UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND - REGION I
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September 27, 2017

Mr. Jonathan S. Davis, P.E.
Section Chief, McGuire Installation Support Section (ISS)
U.S. Air Force Civil Engineer Center (AFCEC/CZO)
322 East Inner Rd.
Otis ANG Base, MA 02542

Re: Fifth Five-Year Review Report (2012-2017)
Hanscom Field/Hanscom Air Force Base Superfund Site

Dear Mr. Davis:

This office is in receipt of the Air Force's Final Fifth Five-Year Review Report for Hanscom Field/Hanscom Air Force Base Superfund Site, dated September 26, 2017. EPA reviewed the report for compliance with EPA's *Comprehensive Five-Year Review Guidance* (OSWER Directive No. 9355.7-03B-P dated June 2001). The report discusses all three operable units (OUs) and the corresponding Installation Restoration Program (IRP) sites for each OU.

The report makes a site-wide determination of short-term protective. Remedial actions taken are currently protective of human health and the environment, but follow-up actions need to be completed for OU1/IRP Sites 1, 2, and 3 to ensure long-term protectiveness.

OU1 includes: IRP Site 1, a former fire training area; IRP Site 2, a Paint Waste Disposal Area; and IRP Site 3, Jet Fuel Residue/Tank Sludge Disposal Area. An Interim Record of Decision (ROD) was signed in 2001, and a final ROD in 2007. The final remedy components for OU1 are: operating the existing groundwater remediation system; a vacuum enhanced recovery system; molasses and/or permanganate injections (in-situ treatment methods); maintaining and enforcing LUCs, including institutional controls to prevent exposure to hazardous substances above unlimited use levels; continuing an environmental sampling program, including groundwater and surface water, to monitor performance of the groundwater remediation system and to monitor progress towards achievement of the Remedial Action Objectives; and conducting Five-Year Reviews.

Follow-up actions identified in the report include the following:

- Prepare a Land Use Control (LUC) Implementation Plan that includes a requirement to evaluate the potential for vapor intrusion risks if new construction in the area of groundwater and residual subsurface soil contamination is proposed.

- Conduct the Site Investigation (SI) for PFOS, PFOA, and PFBS with sampling of groundwater, surface water, and soil-sediment in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling.
    - The SI is currently in progress, with sampling for PFOS, PFOA, and PFBS planned for Fall 2017. The SI is expected to be complete by June 2018.
    - The CERCLA process will be continued for 1,4-dioxane and PFOS, PFOA, and PFBS, and any changes to the current remedy will be incorporated into a future decision document.

EPA concurs with the Air Force's determination that the OU1 remedy is protective in the short term, since the groundwater is not being used as a drinking water source and the Air Force is conducting a site investigation for PFOS, PFOA, and PFBS. The EPA and Air Force agree that further investigations are needed for emerging contaminants 1,4-dioxane, PFOS, PFOA, and PFBS to ensure long-term protectiveness at OU1.

This Fifth Five-Year review was triggered by the Fourth Five-Year Review, completed September 27, 2012. Consistent with Section 121(c) of CERCLA, the next Five-Year Review must be finalized by September 29, 2022.

Sincerely,

Bryan Olson, Director
Office of Site Remediation and Restoration

cc: Ginny Lombardo, EPA
Anni Loughlin, EPA
Lisa Thuot, EPA
Monica McEaddy, EPA HQ
Brian Roden, MassDEP

FINAL
FIFTH FIVE-YEAR REVIEW REPORT FOR HANSCOM FIELD/HANSCOM AIR FORCE BASE SUPERFUND SITE BEDFORD, CONCORD, LEXINGTON, LINCOLN MIDDLESEX COUNTY, MASSACHUSETTS

Prepared for:

Department of the Air Force
Air Force Civil Engineer Center

Prepared by:

URS/AECOM

SEPTEMBER 2017

FINAL
FIFTH FIVE-YEAR REVIEW REPORT FOR HANSCOM FIELD/HANSCOM AIR FORCE BASE SUPERFUND SITE BEDFORD, CONCORD, LEXINGTON, LINCOLN MIDDLESEX COUNTY, MASSACHUSETTS

Approval signature:

Suzanne W Bilbrey

SUZANNE W. BILBREY, P.E., GS-15, DAF
Director, Environmental Management Directorate

26 Sep 2017

Date

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ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

1,2-DCE	1,2-dichloroethene
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFCEE	Air Force Center for Environmental Excellence
ARAR	Applicable or Relevant and Appropriate Requirement
BIW	Boundary Interceptor Well
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Cis-1,2-DCE	cis-1,2-dichloroethene
COC	Contaminant of Concern
CoE	U.S. Army Corps of Engineers
DEA	Debris Excavation Area
DD	Decision Document
DNAPL	Dense Non-Aqueous Phase Liquid
DoD	Department of Defense
ESC	Electronic Systems Center
EWRA	East Wetland Remediation Area
FS	Feasibility Study
GAC	Granular Activated Carbon
GC	Gas Chromatograph
gpm	gallons per minute
H&A	Haley & Aldrich, Inc.
HI	Hazard Index
IC	Institutional Controls
IROD	Interim Record of Decision
IRP	Installation Restoration Program
IW	Interceptor Well
LNAPL	Light Non-Aqueous Phase Liquid
LTM	Long Term Management
LUC	Land Use Controls
MassDEP	Massachusetts Department of Environmental Protection
Massport	Massachusetts Port Authority
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MCP	Massachusetts Contingency Plan
MSL	mean sea level
NCP	National Oil and Hazardous Substances Contingency Plan
NFRAP	No Further Response Action Planned
NPL	National Priorities List
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
ORC	Oxygen Release Compound
OU	Operable Unit
OW	Observation Well
PAH	Polynuclear Aromatic Hydrocarbon
PFCs	Perfluorinated Chemicals
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
ppb	Parts per billion
ppm	Parts per million

PSG	Professional Services Group, Inc.
RA	Remedial Action
RAB	Restoration Advisory Board
RBRGs	Risk Base Remediation Goals
RAO	Remedial Action Objectives
RAO (MCP)	Response Action Outcome
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCADA	Supervisory control and data acquisition system
SVE	Soil Vapor Extraction
SVOC	Semi-volatile organic compound
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbon
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VER	Vapor Enhanced Recovery
VOC	Volatile organic compound
WWRA	West Wetland Remediation Area

EXECUTIVE SUMMARY

This is the Fifth Five-Year Review for the Hanscom Field/Hanscom AFB Superfund Site. The review is required by statute for the implemented remedial actions under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as long as hazardous substances, pollutants, or contaminants remain on site above levels that allow for unlimited use and unrestricted exposure. The triggering action for this review is the date of the Fourth Five-Year Review Report as shown in EPA's WasteLAN database: September 26, 2012.

The Department of Defense (DoD) initiated its Installation Restoration Program (IRP) concurrently with CERCLA with the overall goal of cleaning up contamination on DoD installations. The USAF began implementing the IRP at Hanscom AFB during the early 1980s with records reviews, interviews and field investigations to identify potentially contaminated sites. Subsequently Hanscom AFB, including Hanscom Field, was listed on the USEPA National Priorities List (NPL) in 1994. Of the 22 individual Hanscom AFB IRP sites with known or suspected contamination, 6 with on-going remedial actions have been designated as CERCLA sites and fall under jurisdiction of the United States Environmental Protection Agency (USEPA) and are the subject of this review. These CERCLA sites were grouped into the following three Operable Units (OUs):

Operable Unit 1

IRP Site 1	Fire Training Area II
IRP Site 2	Paint Waste Disposal Area
IRP Site 3	Jet Fuel Residue/Tank Sludge Disposal Area

Operable Unit 2

IRP Site 4	Sanitary Landfill

Operable Unit 3

IRP Site 6	Landfill/Former Filter Beds
IRP Site 21	Unit 1 Petroleum Release Site

Pre-NPL Remedial Action Plans for Hanscom Field Sites (IRP Sites 1, 2, 3/5 and 4): In 1985 Haley & Aldrich, Inc. (H&A) was retained to conduct investigations and prepare Remedial Action Plans for IRP Sites 1 through 5 on Hanscom Field. Field investigation of the sites was conducted by H&A in 1985 and 1986. The results of this field work were documented in Appendix F of the report entitled Installation Restoration Program, Phase IV-A, Hanscom AFB Area I. Based on the results of the field investigation H&A prepared a "Remedial Action Plan" for each site. Following public review of the plans, Hanscom AFB documented selection of each site's Remedial Action Plan in a Decision Paper, Area 1 (Sites 1-5) dated April 6, 1988. This Decision Paper was approved by the Base Commander on April 20, 1988. Please note that the Remedial Action Plan entitled IRP Sites 3/5 noted that "… field investigations have failed to indicate that fire training activities or any contamination associated with those activities can be attributed to Site 5." Subsequently a Decision Document for Close-Out for Site 5 was signed by the Base Commander on 27 September 1991. This Decision Document included the determination "… that there is no basis for the existence of this site" and included the declaration that "… the selected remedy is no action and the site is hereby closed-out." Regulatory confirmation of the close out of IRP Site 5 was later documented in the Interim Record of Decision, Operable Unit 1 dated November 2000.

The Remedial Action Plans for IRP Sites 1, 2 and 3 included the removal of drums and/or visibly contaminated soil in 1988; construction of a groundwater collection, treatment and recharge

system which commenced operation in 1991; and a long term groundwater and surface water monitoring program. The groundwater collection system included collection trenches at each of the three sites and four (4) boundary interceptor wells along the Hanscom Field/Hanscom AFB northern property boundary with the Town of Bedford's Hartwell Forest and George Gordon Conservation Area. The purpose of these wells is to intercept any contamination migrating off the airfield complex through the lower/glacial till and/or bedrock aquifers.

The Remedial Action Plan for IRP Site 4, the former Hanscom AFB municipal landfill, included a low permeability cap, drainage measures and a compensatory wetland. Construction of this remedy was completed in 1988 and a long-term monitoring program was conducted between December 1989 and September 1992.

Post-NPL Actions

OU-1/IRP Sites 1, 2 & 3: Following designation of Hanscom Field/Hanscom AFB as a NPL site in May 1994, USEPA became the lead regulatory agency and IRP Sites 1, 2 and 3 which are located on Hanscom Field were grouped into Operable Unit 1 to facilitate further response actions. These three sites are confirmed groundwater contamination source areas. Contaminants of Concern (COCs) at OU-1 consist of chlorinated and aromatic volatile organic compounds (VOCs) and the VOCs with the highest concentrations are trichloroethene (TCE), 1,2-dichlorothene (1,2-DCE) and vinyl chloride. Dense non-aqueous phase liquid (DNAPL) is known to be present at Site 1 and is suspected to be present in other areas within OU-1. While the extent of the DNAPL is not fully known it is believed to be fully contained and within the capture zone of the existing collection system. This conclusion is supported by long-term monitoring data which has not found dissolved-phase contaminant concentrations in groundwater which are indicative of nearby DNAPL in monitoring wells down-gradient of the existing collection system.

IRP Site 1: This site is located at the north end of the airfield and was reportedly used from the late 1960s through 1973 for fire training exercises. It is situated in the town of Bedford. Two (2) burn pits were used at this site. Waste oils, solvents, paint thinners, and degreasers were collected from around the base, dumped into pits, ignited, and then extinguished. Occasionally, aircraft wrecks and fuselages were burned in the pits. The size of each of the two pits was estimated to be 15 feet by 20 feet. There is no information indicating that a liner or containment was used at these pits.

IRP Site 2: This site located in the northeast portion of the airfield, was used for disposing of waste solvents and paint from 1966 to 1972. It is situated in the town of Bedford. Metal plating wastes may also have been disposed in this area from the early 1960s through 1972. During the 1988 removal action four (4) drum burial pits of various sizes were found and excavated. There is no information indicating whether any type of liner or containment was used at these pits.

IRP Site 3: This site is located in a triangular area in the western portion of the airfield bounded by Taxiway "Whiskey" to the north, Taxiway "Mike" to the southwest and Runway 5-23 to the southeast. It is situated in the town of Concord. According to the IRP Phase I Records Search, several hundred drums of waste oils and paint wastes were buried at the Jet Fuel Residue Area during the period of 1959 to 1969. Disposal at the Tank Sludge Area, which is located within the same triangular area and to the northwest of the Jet Fuel Residue Area, reportedly occurred during the early 1960's. Because of the close proximity of this site to the Jet Fuel Residue Area, they were discussed and evaluated as one site. During the 1988 removal action ten (10) drum burial pits of various sizes were found and excavated. There is no information indicating whether any type of liner or containment was used at these pits.

As stated above, Remedial Action Plans for IRP Sites 1, 2 and 3 were developed and implemented prior to the NPL designation. Subsequently, in 1995, USEPA advised that additional studies were necessary to ensure that these earlier actions fully addressed CERCLA requirements. Using the results of all previous investigations a Final Ecological Risk Assessment, OU1 (dated January 1999) and a Focused Feasibility Study, OU1 (dated May 2000) were completed. This effort included groundwater flow and solute transport models, and an evaluation of the soil-to-groundwater contaminant transport pathway for human health risk assessment. Based on these reports and the presence of DNAPL in the bedrock fractures, the Project Team concluded that it was not prudent to select a final remedy at that time since there was a moderate to high degree of uncertainty regarding attainment of Applicable or Relevant and Appropriate Requirements (ARARs) within all of the OU-1 area. At that time it was determined that an Interim Record of Decision (IROD) would be appropriate and an Interim Proposed Plan for Hanscom AFB Operable Unit 1 (dated June 2000) was prepared. The public review of this plan, to include a Public Information Meeting and Public Hearing on June 28, 2000, was completed in July 2000 without comment.

Subsequently an Interim Record of Decision, dated November 2000, selecting an interim remedy for OU1 was signed by the Air Force on January 24, 2001 and by USEPA on February 6, 2001. The Commonwealth of Massachusetts formally concurred with this IROD by letter dated December 27, 2000. The selected interim remedial action for cleaning up OU-1/IRP Sites 1, 2 and 3 included continued operation of the existing dynamic groundwater remediation system, implementation of institutional controls, and monitoring of groundwater and surface water. This course of action was selected to provide time to collect additional information to support a final remedy.

By 2006 progress had been made (since the IROD was issued in 2000) towards the cleanup of OU-1 and additional information was gathered that supported the selection of a final remedy. Therefore, in 2007, a Focused Groundwater Flow and Transport Model (May 2007), a Revised Focused Feasibility Study of OU-1 (May 2007), and a Proposed Plan (May 2007) were prepared to support a Final Record of Decision (ROD) for OU-1. The public comment period for the OU-1 Proposed Plan was from June 8, 2007 to July 9, 2007. In addition, a public meeting and a public hearing were conducted on June 20, 2007 in Bedford, MA to discuss the OU-1 Proposed Plan and to accept oral comments. No written comments were received during the comment period, including the public hearing. During the public hearing on June 20, 2007 oral comments were accepted from the public. Comments received during the hearing were positive and required no changes to the Proposed Plan. Based on the above a ROD selecting the final remedy for OU-1 was signed by the Air Force on September 14, 2007 and by USEPA on September 28, 2007. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated September 28, 2007. The final remedy selected by the 2007 ROD was the Continued Operation of the Existing Dynamic Groundwater Remediation System, Land Use Controls (LUCs), and Monitoring.

According to the data review, site inspections, and interview conducted in late 2016 and 2017, this Fifth Five-Year Review finds that the **remedy at OU-1 currently protects human health and the environment** because long-term monitoring confirms that operation of the pump and treat system, in conjunction with supplemental in-situ treatment measures, is working to prevent further migration of dissolved-phase COCs in groundwater and to prevent discharge to surface water bodies and wetlands of groundwater containing COC concentrations above ARARs. Recent supplemental in-situ treatment has been conducted and will continue along with other optimization measures with the goal of reducing the time to reduce groundwater concentrations to meet ARARs, including EPA Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and Massachusetts Contingency Plan (MCP) GW-1 and GW-2 Standards. LUCs identified in

the ROD have been implemented and routine monitoring and inspections have confirmed that objectives of preventing exposure to and use of contaminated groundwater, ensuring that excavation is controlled in the three source areas in which excavations took place, and preventing exposure to vapors that could accumulate in buildings affected by the contaminated groundwater plume are currently being met. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness:

(1) a LUC Implementation Plan should be prepared for OU-1 and should include a requirement to evaluate the potential for vapor intrusion risks if new construction in the area of groundwater and residual subsurface soil contamination is proposed; and

(2) a Site Investigation (SI) for PFOS and PFOA is currently in progress. Groundwater, surface water, and soil-sediment sampling for PFOS and PFOA at HAFB is planned for Fall 2017 in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling. The SI is expected to be complete by June 2018. The CERCLA process will continue for 1,4-dioxane and perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS) and any changes to the current remedy will be incorporated into a future decision document.

OU-2/IRP Site 4: IRP Site 4 was used as the Hanscom AFB municipal waste landfill from December 1964 until December 1974. The site covers 10.5 acres and is located approximately 1,800 feet southeast of the approach end of Runway 5-23 on Hanscom Field. The landfill is situated predominantly in the town of Lincoln, with a small portion protruding into the bordering town of Concord. Pre-1964 topographic maps of the area indicate that the site was a wetland area associated with Elm Brook. During its active life, the landfill was intended to be primarily for the disposal of solid waste. However, the IRP Phase I – Records Search report states that interviews with Base personnel confirmed that dumpsters containing waste from all shops and research laboratories were emptied into the landfill during its 10-year operation. No attempt was made to segregate hazardous materials from non-hazardous materials. The landfill ranges from 10 to 15 feet deep and is estimated to have a volume of 210,000 cubic yards. A remedial action constructed in 1988 placed an impervious cap over the area. The area is also bermed with drainage ditches to channel runoff from the capped area to the wetlands. Today the area is grassed open space with a softball field in the southern half.

Following the listing of Hanscom Field/Hanscom AFB on the NPL, USEPA requested that CERCLA Human Health and Ecological Risk Assessments, to include Supplemental Sampling and Analysis, be completed for IRP Site 4. The site was also designated Operable Unit 2 at this time. The additional monitoring was conducted and the CERCLA risk assessments were completed. The human health risk assessment concluded that there are “no unacceptable risks associated with exposure to Site 4 media” and “no remedial action is warranted.” The Ecological Risk Assessment concluded that “there are no significant ecological risks associated with Site 4.” Subsequently USEPA determined that the Remedial Action completed in 1988 was acceptable as a final remedial action. The Project Team (Remedial Project Managers for Hanscom AFB, USEPA & MassDEP) concluded that additional long-term groundwater monitoring data was not required but, since the landfill waste remains on-site and requires the protective landfill cap to reduce leaching and potential exposure to waste, Five-Year Reviews of the remedial action were appropriate.

USEPA and Hanscom AFB completed a site inspection in May 1997 and USEPA issued Five-Year Review Report #1, Hanscom Air Force Base Superfund Site, Middlesex County, Massachusetts dated September 1997. This review concluded “based on the field inspection,

and human health and ecological risk assessment, protectiveness of the landfill cap at Site 4 has been demonstrated;" however, the review did identify a requirement to remove scrub brush growing in the drainage ditches and on sections of the cap and berms and for a long-term inspection/ maintenance program to be instituted. The field work to remove the scrub brush was completed in the spring of 1998 and a long-term inspection and maintenance program was instituted and continues to the present.

According to the data review, site inspections, and interview conducted in late 2016 and 2017, this Fifth Five-Year Review finds that the **remedy at OU-2/IRP Site 4 is protective of human health and the environment**. The remedy is functioning as intended by the 1988 Remedial Action Plan, in that the integrity of the low permeability landfill cap is being maintained and a long-term inspection and maintenance program is in place to ensure continued protectiveness.

OU-3/IRP Site 6: OU-3/IRP Site 6 is approximately 15 acres in area and is located in the northeast portion of Hanscom AFB. It is situated in both the town of Bedford and the town of Lexington. The site is bounded to the north by a former railroad spur, to the northeast by a wetland area and small pond, to the east by a commercial industrial park, to the south by a service road (Hunter Street), and to the west by IRP Site 21 (the former aviation fuel facility). IRP Site 6 consists of three distinct areas: the former filter beds (including the former sludge beds) and two (2) hillside landfill areas; the south landfill (including a suspected ash disposal area and Building 1855 Underground Storage Tank (UST) site); and the west landfill. The former filter bed area is higher than the wetlands to the north and was the location of the original sanitary waste treatment system (used from 1947 until the mid 1950's) for Hanscom AFB. This system, which was abandoned in place when the Base connected to a municipal sanitary waste system, consisted of an Immoff Tank, Dosing Tank, Filter Beds (six (6) sand filled cells with a concrete berm surrounding each cell) and two (2) sludge beds. Following the abandonment of the treatment system, this area became a disposal site for municipal wastes, construction debris, and clean fill. As a result the filter beds were overlain by approximately 5 to 15 feet of solid waste material. Immediately adjacent to, and to the south of the filter bed area are two (2) hillside landfill areas (south and west). Disposal in these two areas was mainly clean fill and/or construction debris. The south landfill was originally graded into terraces, however, these were obliterated by dumping of clean fill from a building foundation excavation and construction debris in the late 80's/early 90's. The southernmost portion of the south landfill includes a suspected ash disposal area and the former location of a 1,000-gallon No. 2 fuel oil UST on the west side of Building 1855. When the UST tank was removed in 1990, evidence of a petroleum release was found. Building 1855 formerly housed an incinerator and is currently a licensed solid waste transfer station for Hanscom AFB.

The RI of the site was completed in 1998 and Human Health and Ecological Risk Assessments were completed in 1999. The human health risk assessment identified that future industrial site workers could potentially be exposed to COCs in surface soil. Also, the hypothetical scenario identified that future hypothetical residential groundwater users living in houses built on OU-1 may be exposed to an unacceptable human health risk that exceeds 10-4 (carcinogenic) and HI>1 (noncarcinogenic). Although this is not a likely scenario, it must be considered under the CERCLA regulation, the NCP. In addition, the ecological risk assessment identified an unacceptable risk to soil invertebrates and animals feeding 100% of the time at the landfill areas (especially the suspected Ash Disposal Area), to benthic and water column organisms in the wetlands, and to the black-crowned night heron from DDT in the wetlands. Based on the RI and risk assessments a Focused Feasibility Study, Operable Unit 3, Site 6 – Landfill and a Proposed Plan for Hanscom AFB Operable Unit 3/Site 6 were prepared. The public review of the Proposed Plan, including an Information Meeting and Public Hearing on June 20, 2000, was completed in July 2000 without comment. Subsequently, a Record of Decision, dated

September 2000, selecting the final remedy for OU3/IRP Site 6 was signed by the Air Force on November 14, 2000 and by USEPA on December 5, 2000. The Commonwealth of Massachusetts formally concurred with this Record of Decision (ROD) by letter dated October 16, 2000.

The construction of the final remedy in accordance with the IRP Site 6 ROD was substantially completed in September 2001 and review of the Remedial Action Report confirmed that the remedy was constructed in accordance with the Remedial Design. The remedial action for cleaning up OU-3/IRP Site 6 included containment/pervious capping of three landfill areas, removal of contaminated sediments and landfill debris from adjacent private property and placing of this material within the capped landfill area, long-term monitoring, and institutional controls. In addition, the remedy included establishment of a Groundwater Compliance Boundary and a Contingency Groundwater Remedy in the event monitoring results show that the remedy is not effective in maintaining groundwater quality outside the compliance boundary. Immediately following construction of the remedy a long-term inspection, maintenance and monitoring program commenced to ensure the continued protectiveness of the remedy.

A Five/Thirty Year Monitoring Plan was specified by the Remedial Design for the wetland areas remediated during the construction phase of the Site 6 Remedial Action. The initial 5-year wetland mitigation monitoring program was successfully completed in 2006 and the Annual Wetland Mitigation Monitoring Reports for this monitoring indicated that the wetlands had exceeded the design goal for vegetative cover, and provided ample evidence that wildlife habitat has been restored. The Remedial Design also specified that the initial Five-Year Monitoring should be followed by a Long-Term Monitoring Plan for the continuing evaluation of the restoration five-year ecosystem evaluations for a total of thirty years. In compliance with this RD requirement wetland mitigation and ecosystem evaluation events were successfully completed in 2011 and 2016. Overall, the data collected during the 2016 monitoring event document that the objectives of the initial five-year monitoring plan and long-term operation and maintenance plan have been achieved and that the East Wetland Remediation Area (EWRA) and West Wetland Remediation Area (WWRA) are established, maturing, and appear to be functioning similarly to adjacent wetlands. The Five-Year Wetlands Ecosystem Evaluations are being discontinued as recommended in the 2016 wetland report.

The long-term monitoring data continues to indicate that the surface water quality in the adjacent wetlands and the Shawsheen River are not being threatened and that natural flushing and natural attenuation are reducing the size and strength of residual groundwater contamination. A Downgradient Investigation was conducted in 2014 and 2015 to determine the source of arsenic detected at and north of the compliance boundary at concentrations above the MCL. The evaluation determined that arsenic concentrations that exceed the MCL beyond the compliance boundary are naturally occurring and the compliance boundary is protective and adequate as currently defined.

Although not expected to impact the current or future protectiveness of the remedy, it cannot be absolutely confirmed based on recent PCP results for well MW-112U, which have been non-detect with reporting limits above the MCL/MCP GW-1 Standard, that PCP does not exceed the cleanup standards at that location. Therefore, it is recommended that the well be sampled for PCP using an analytical method that is sensitive enough to achieve a reporting limit below the MCL/MCP GW-1 Standard.

According to the data review, site inspections, and interviews conducted in late 2016 and 2017, this Fifth Five-Year Review finds that the **remedy at OU-3/IRP Site 6 is protective of human health and the environment**. The capping of contaminated soils and removal of contaminated wetland soil and subsequent wetland restoration is preventing direct contact with contaminants

in surface soils, reducing exposure of ecological receptors to contamination to acceptable levels, and minimizing erosion of contaminants from the site to the adjacent wetlands and pond. A long-term inspection and maintenance program is in place to ensure the continued integrity of the capped landfill areas. The existing Groundwater Compliance Boundary is appropriate and protective as currently defined and will continue to be monitored through long-term groundwater and surface water sampling. LUCs/ICs prevent exposure to and use of contaminated groundwater and ensure that excavation at the three capped landfill areas is controlled to prevent exposure to any residual contamination in the subsurface soil.

OU-3/IRP Site 21: IRP Site 21 is an area with groundwater contamination and three separate areas of petroleum products floating on the water table that were identified by the Remedial Investigation. These areas are technically referred to as light non-aqueous phase liquid (LNAPL) pools. The site is approximately 5 acres in area, situated in the town of Bedford in the northeast portion of Hanscom AFB and adjacent to IRP Site 6. IRP Site 21 is the area of a former aviation fueling facility that was used for storage, off-loading, and dispensing of jet fuel and aviation gasoline from at least 1945 through 1973, and to store and distribute No. 2 fuel oil during the early 1970s. Fuel was stored in aboveground and underground storage tanks, which had associated pump houses and a network of underground piping. This area was also used for the storage of cleaning solvents and other petroleum products (oils and lubricants) associated with aircraft and vehicle maintenance.

Following the discovery of IRP Site 21 in 1990 several interim remedial actions were conducted prior to 2001, to include a RI and risk assessments which were completed in July 2000. Based on these documents and data gathered during the interim remedial actions, a Feasibility Study, Operable Unit 3/ Site 21 dated June 2001 and a Proposed Plan for Hanscom AFB Operable Unit 3/Site 21 dated July 2001 were prepared. The public review of the Proposed Plan, including a Public Information Meeting and Public Hearing on August 1, 2001, was completed in August 2001 without comment. Subsequently, a Record of Decision, dated October 2001 selecting the remedy for OU3/IRP Site 21 was signed by the Air Force on August 20, 2002 and by the USEPA on August 29, 2002. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated January 22, 2002.

The construction of the final remedy in accordance with the IRP Site 21 ROD commenced in June 2003 and was substantially completed in September 2003. The selected remedial action for cleaning up OU-3/IRP Site 21 includes interceptor trenches with passive recovery wells; removal and disposal of petroleum saturated soil encountered during trench construction; enhancement of biodegradation of groundwater contamination by ORC® application in all trenches; a network of ten active recovery wells connected to an existing treatment system; monitoring; land use controls/institutional controls; and groundwater containment/treatment and vacuum enhanced recovery (VER) contingencies. Following construction there was a 6-month shakedown/assessment period for the 10-well LNAPL/groundwater recovery and treatment system which commenced 15-September 2003. Review of the Remedial Action Report confirmed that the remedy was constructed in accordance with the Environmental Cleanup Plan and is being operated in accordance with the Operation and Maintenance Plan.

Immediately following the shakedown/assessment period the Remedial Action-Operation (RA-O) phase commenced. This included operation and maintenance of a small scale (less than 1 gpm) LNAPL/groundwater recovery and treatment system and a long-term LNAPL and groundwater/surface water monitoring program. The post-RA monitoring of the site commenced with a baseline monitoring round in October 2003 to document post-RA LNAPL, to identify contaminants of concern in the groundwater and surface water, and to provide a baseline to monitor changes over time in the contaminant concentration levels. The RA-O phase also includes the monitoring and enforcing of the LUCs/ICs specified in the ROD.

According to the data review, site inspections, and interviews conducted in late 2016 and 2017, this Fifth Five-Year Review finds that the **remedy at OU-3/IRP Site 21 is protective of human health and the environment**. The construction of the interceptor trenches and operation of the LNAPL/groundwater recovery (and treatment) system has been effective in reducing LNAPL to trace detections and preventing further migration of the contaminant plume (dissolved-phase COCs), minimizing further migration of contaminants from source materials (VOCs/LNAPL) to groundwater, and preventing discharge of groundwater containing COCs that exceed standards to the Shawsheen River. While the active recovery system had made progress towards the response action outcome (RAO) to return groundwater to federal and state drinking water standards and state groundwater risk characterization standards within an acceptable time period (<100 years), the recent focus has changed from active remedial efforts to passive in-situ treatment methods, with a goal of achieving a higher rate of contaminant mass destruction. LUCs/ICs prevent exposure to and use of contaminated groundwater, ensure that excavation at the Site is controlled to prevent exposure to any residual contamination in the subsurface soil or groundwater, and that future land use does not increase the risk of exposure to contaminants remaining on-site.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Hanscom Field/Hanscom AFB		
EPA ID: MA 8570024424		
Region: 1	**State:** MA	**City/County:** Bedford-Concord-Lexington-Lincoln/Middlesex County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** U.S. Air Force
Author name (Federal or State Project Manager): Mr. William Gooden
Author affiliation: U.S. Air Force, Hanscom AFB Restoration Program Manager
Review period: 11/9/2016 – 8/8/2017
Date of site inspection: 12/6/2016
Type of review: Statutory
Review number: 5
Triggering action date: 9/26/2012
Due date *(five years after triggering action date)*: 9/26/2017

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU2

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 1	**Issue Category:** Institutional Controls			
	Issue: The Town of Bedford has expressed a need for formal documentation of areas where emerging contaminants are a concern with respect to installation of new wells. Similarly, Hanscom Field Airport is looking to understand what areas may be available for future development, including possible use for occupied buildings. Because of the age of the site, a LUC Implementation Plan was not prepared during remedial design.			
	Recommendation: Prepare a LUC Implementation Plan for OU-1. Include a requirement to evaluate the potential for vapor intrusion risks if new construction in the area of groundwater and residual subsurface soil contamination is proposed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
N	Y	U.S. Air Force	EPA/MassDEP	2022
OU(s): 1	**Issue Category:** Changed Site Conditions			
	Issue: Two emerging contaminants (1,4-dioxane and PFCs) were recently sampled for and detected in OU-1 groundwater. 1,4-dioxane was detected above the MCP GW-1 Standard in some wells at IRP Sites 1 and 2. PFOS and PFOA were detected above EPA lifetime drinking water health advisory levels in groundwater from some wells at IRP Site 1 and also in the GWTP effluent and in a surface water sample downstream of the effluent discharge location. The GWTP is not designed to and does not remove these compounds.			
	Recommendation: 1) Conduct groundwater, surface water, and soil-sediment sampling for PFOS and PFOA as part of Site Investigation (SI) in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling. 2) Complete SI for PFOS and PFOA. 3) Proceed through the CERCLA process for 1,4-dioxane and PFOS, PFOA, and PFBS, and incorporate any changes to the current remedy into a future decision document.			

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
N	Y	U.S. Air Force	EPA/MassDEP	1) Fall 2017 2) June 2018 3) 2022
OU(s): 3/ IRP Site 6	**Issue Category:** Monitoring			
	Issue: The extent of pentachlorophenol (PCP) above the MCL/MCP GW-1 Standard downgradient of well MW6-106 cannot be confirmed using recent data because the reporting limit for the analytical method used is above the MCL/MCP GW-1 Standard (1 ppb). PCP results for downgradient well MW6-112U have ben non-detect with reporting limits ranging from 19 to 57 ppb over the past five years.			
	Recommendation: Sample for PCP at well MW6-112U using an analytical method that is sensitive enough to achieve a reporting limit below the MCL/MCP GW-1 Standard of 1 ppb.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
N	N	U.S. Air Force	EPA/MassDEP	December 2018

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU1/IRP Sites 1, 2, and 3	Short-Term Protective	

Protectiveness Statement:

The remedy at OU-1 currently protects human health and the environment because long-term monitoring confirms that operation of the pump and treat system, in conjunction with supplemental in-situ treatment measures, is working to prevent further migration of dissolved-phase COCs in groundwater and to prevent discharge to surface water bodies and wetlands of groundwater containing COC concentrations above ARARs. Recent supplemental in-situ treatment has been conducted and will continue along with other optimization measures with the goal of reducing the time to reduce groundwater concentrations to meet ARARs, including MCLs and MCP GW-1 and GW-2 Standards. LUCs/ICs identified in the ROD have been implemented and routine monitoring and inspections have confirmed that objectives of preventing exposure to and use of contaminated groundwater, ensuring that excavation at the three source areas is controlled to prevent exposure to any residual contamination in the subsurface soil, and preventing exposure to vapors that could accumulate in buildings affected by the contaminated groundwater plume are currently being met. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: 1) a LUC Implementation Plan should be prepared for OU-1 and should include a requirement to evaluate the potential for vapor intrusion risks if new construction in the area of groundwater and residual subsurface soil contamination is proposed; and 2) a Site Investigation (SI) for PFOS and PFOA is currently in progress. Groundwater, surface water, and soil-sediment sampling for PFOS and PFOA at HAFB is planned for Fall 2017 in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling. The SI is expected to be complete by June 2018. The CERCLA process will continue for 1,4-dioxane and PFOS, PFAS, and PFBS, and any changes to the current remedy will be incorporated into a future decision document.

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU2/IRP Site 4	Protective	

Protectiveness Statement:
The remedy at OU-2/IRP Site 4 is protective of human health and the environment. The remedy is functioning as intended by the 1988 Remedial Action Plan, in that the integrity of the low permeability landfill cap is being maintained and a long-term inspection and maintenance program is in place to ensure continued protectiveness.

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU3/IRP Site 6	Protective	

Protectiveness Statement:
The remedy at OU-3/IRP Site 6 is protective of human health and the environment. The capping of contaminated soils and removal of contaminated wetland soil and subsequent wetland restoration is preventing direct contact with contaminants in surface soils, reducing exposure of ecological receptors to contamination to acceptable levels, and minimizing erosion of contaminants from the site to the adjacent wetlands and pond. A long-term inspection and maintenance program is in place to ensure the continued integrity of the capped landfill areas. The existing Groundwater Compliance Boundary is appropriate and protective as currently defined and will continue to be monitored through long-term groundwater and surface water sampling. LUCs/ICs prevent exposure to and use of contaminated groundwater and ensure that excavation at the three capped landfill areas is controlled to prevent exposure to any residual contamination in the subsurface soil.

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU3/IRP Site 21	Protective	

Protectiveness Statement:
The remedy at OU-3/IRP Site 21 is protective of human health and the environment. The construction of the interceptor trenches and operation of the LNAPL/groundwater recovery (and treatment) system has been effective in reducing LNAPL to trace detections and preventing further migration of the contaminant plume (dissolved-phase COCs), minimizing further migration of contaminants from source materials (VOCs/LNAPL) to groundwater, and preventing discharge of groundwater containing COCs that exceed standards to the Shawsheen River. While the active recovery system had made progress towards the RAO to return groundwater to federal and state drinking water standards and state groundwater risk characterization standards within an acceptable time period (<100 years), the recent focus has changed from active remedial efforts to passive in-situ treatment methods, with a goal of achieving a higher rate of contaminant mass destruction. LUCs/ICs prevent exposure to and use of contaminated groundwater, ensure that excavation at the Site is controlled to prevent exposure to any residual contamination in the subsurface soil or groundwater, and that future land use does not increase the risk of exposure to contaminants remaining on-site.

Sitewide Protectiveness Statement (if applicable)

Protectiveness Determination:	*Addendum Due Date (if applicable):*
Short-Term Protective	

Protectiveness Statement:
The remedial actions taken are currently protective of human health and the environment; however, the follow-up actions for OU-1/IRP Sites 1, 2, and 3 need to be completed to ensure long-term protectiveness.

SECTION 1.0
INTRODUCTION

The United States Air Force has conducted a five-year review of the remedial actions implemented at the Hanscom Field/Hanscom AFB Superfund Site in Bedford, Concord, Lexington and Lincoln, Massachusetts. This is the Fifth Five-Year Review for the Hanscom Field/Hanscom AFB Superfund Site. The triggering action for this review is the date of the Fourth Five-Year Review Report, as shown in USEPA's WasteLAN database: September 26, 2012. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants are or will be left on site above levels that allow for unlimited use and unrestricted exposure.

The purpose of five-year reviews is to determine whether the remedies at a site are protective of human health and the environment or are expected to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

The United States Air Force has conducted this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). CERCLA §121(c) states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The United States Air Force interpreted this requirement further in the NCP; Section 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

SECTION 2.0
SITE CHRONOLOGY

The chronology of the site, including all significant site events and dates is included in Table 1.

Table 1
Chronology of Site Events

Event	Date
Initial discovery of problem or contamination	
– IRP Sites 4 & 6	5 June 1981
– IRP Site 2 & 3	25 June 1982
– IRP Site 1	April 1983
– IRP Site 21	14 June 1990
Pre-NPL responses	
– Hydrogeologic Investigation of Hanscom Field	June 1982 – September 1984
– Remedial Action Plans for IRP Sites 1 thru 5	September 1985 – May 1988
– Design of IRP Site 1 Soil Removal	December 1986 – August 1987
– Design of IRP Sites 2 & 3 Drum Removal	December 1986 – August 1987
– Design of IRP Site 4 Soil Cap Old Landfill	December 1986 – August 1987
– IRP Phase II-Confirmation/Quantification-Stage 1 for IRP Sites 6 through 13	November 1986 – August 1988
– Design of pump & treat system for Sites 1, 2 & 3	February 1987 – May 1988
– IRP Site 1 Soil Removal	September 1987 – August 1988
– IRP Sites 2 & 3 Soil & Drum Removal	September 1987 – June 1988
– Construction of IRP Site 4 Soil Cap	September 1987 – September 1988
– RI/FS for IRP Sites 6, 8 & 13	September 1987 – June 1992
– Construction of groundwater collection, treatment and recharge system for IRP Sites 1, 2 & 3	September 1988 – January 1991
– Long-term Monitoring of IRP Site 4 (7 Rounds)	November 1989 –November 1992
– Long-term Monitoring of IRP Sites 1, 2 and 3/5	November 1990; February – March 1991; August 1991
– IRP Site 21 Pilot Product Recovery	December 1990 – February 1991
– Operation of groundwater collection, treatment and recharge system for IRP Sites 1, 2 & 3	23 April 1991 – present
– Preliminary RI, IRP Site 21	October 1992 – March 1994
– IRP Site 21 SVE & Groundwater/Product Recovery	March 1993 – December 1993
NPL listing	31 May 1994
Removal Actions - OU-3/IRP Site 21	September 1995 - September 2003
Remedial Investigation/Feasibility Study completed	
– OU-2/IRP Site 4 Supplemental Sampling	February 1996
– OU-2/IRP Site 4 Risk Assessments	April 1997
– OU-3/IRP Site 6 Supplemental RI	July 1998
– OU-1 Ecological Risk Assessment	January 1999
– OU-3/IRP Site 21 Remedial Investigation	April 1999
– OU-3/IRP Site 6 Risk Assessments	July 1999
– OU-3/IRP Site 6 Focused Feasibility Study	May 2000
– OU-3/IRP Site 6 Proposed Plan	May 2000

Event	Date
– OU-1 Focused Feasibility Study	May 2000
– OU-1 Interim Proposed Plan	June 2000
– OU-3/IRP Site 21 Supp. RI & Risk Assessments	July 2000
– OU-3/IRP Site 21 Feasibility Study	June 2001
– OU-3/IRP Site 21 Proposed Plan	July 2001
– OU-1 Revised Focused Feasibility Study	May 2007
– OU-1 Proposed Plan	May 2007
ROD signature	
– OU-3/IRP Site 6 ROD dated September 2000	Air Force - 14 November 2000 EPA - 5 December 2000
– OU-1 IROD dated November 2000	Air Force - 24 January 2001 EPA - 6 February 2001
– OU-3/IRP Site 21 ROD dated October 2001	Air Force - 20 August 2002 EPA - 29 August 2002
– OU-1 ROD dated September 2007	Air Force – 14 September 2007 EPA – 28 September 2007
ROD Amendments or ESDs	None
Enforcement documents (CD, AOC, Unilateral AO)	None
Remedial design start	
– OU-1/IRP Sites 1, 2 & 3 & OU-2/IRP Site 4	Pre-NPL
– OU-3/IRP Site 6	27 September 1999
– OU-3/IRP Site 21	3 December 2002
Remedial design complete	
– OU-1/IRP Sites 1, 2 & 3	Pre-NPL
– OU-2/IRP Site 4	Pre-NPL
– OU-3/IRP Site 6	13 April 2001
– OU-3/IRP Site 21	10 June 2003
Superfund Federal Facility Agreement	Air Force – 14 September 2007 EPA – 28 September 2007
Construction dates (start, finish)	
– OU-1/IRP Sites 1, 2 & 3 & OU-2/IRP Site 4	Pre-NPL
– OU-3/IRP Site 6	29 March 2001 - 17 September 2001
– OU-3/IRP Site 21	2 June 2003 – 15 September 2003
Construction completion date [1]	28 September 2007
Actual remedial action start	
– OU-1/IRP Sites 1, 2 & 3	Pre-NPL
– OU-2/IRP Site 4	Pre-NPL
– OU-3/IRP Site 6	18 September 2001
– OU-3/IRP Site 21	15 September 2003
Previous five-year reviews	September 1997, September 2002, September 2007, September 2012

1. The Construction Completion date refers to EPA's signature date on the Preliminary Closeout Report, Hanscom Air Force Base.

SECTION 3.0
BACKGROUND

3.1 PHYSICAL CHARACTERISTICS

Hanscom Field/Hanscom AFB is located in the central part of Middlesex County, Massachusetts, approximately 14 miles northwest of downtown Boston and 11.5 miles south of downtown Lowell, Massachusetts. The complex occupies land in the towns of Bedford, Concord, Lexington, and Lincoln (**Figure 1**). Topographically the Hanscom Field/Hanscom AFB area is located in a low-lying basin surrounded by hills. The relatively flat runway portion of Hanscom Field lies in the ancient lake bed of glacial Lake Concord. The ground surface elevation on this former lake bed ranges from 120 to 130 feet above mean sea level (MSL). The hills south of the air base, and Pine Hill to the west, rise to more than 200 feet MSL. Hills north of the airfield area are more subdued, but still rise above 150 feet MSL. Former glacial Lake Concord and Hanscom AFB on its southern edge, drain to the Shawsheen River, which flows north-northeast from the site to join the Merrimack River approximately 15 miles downstream. The topography and surficial geology of the Hanscom Field/Hanscom AFB area is illustrated in **Figure 2**.

The Department of Defense (DoD) initiated its Installation Restoration Program (IRP) concurrently with CERCLA with the overall goal of cleaning up contamination on DoD installations. The USAF began implementing the IRP at Hanscom AFB during the early 1980s with records reviews, interviews and field investigations to identify potentially contaminated sites. Subsequently Hanscom AFB, including Hanscom Field, was listed on the USEPA National Priorities List (NPL) in 1994. Of the 22 individual Hanscom AFB IRP sites with known or suspected contamination, 6 with on-going remedial actions have been designated as CERCLA sites and fall under jurisdiction of the USEPA and are the subject of this review.

These CERCLA sites were grouped into the following three Operable Units (OUs):

Operable Unit 1(OU-1)

- IRP Site 1 Fire Training Area II
- IRP Site 2 Paint Waste Disposal Area
- IRP Site 3 Jet Fuel Residue/Tank Sludge Disposal Area

Operable Unit 2 (OU-2)

- IRP Site 4 Sanitary Landfill

Operable Unit 3 (OU-3)

- IRP Site 6 Landfill/Former Filter Beds
- IRP Site 21 Unit 1 Petroleum Release Site

The location of these three Operable Units is shown in **Figure 1**.

Upon the designation of Hanscom Field/Hanscom AFB as a NPL Site in 1994, USEPA reviewed the listing of all of the IRP sites to identify those not subject to CERCLA because of the

CERCLA petroleum exclusion clause. IRP sites identified at this time as non-CERCLA sites included IRP Sites 9, 11, 12, 14, 15, 16, 17, and 18. Subsequently, following additional review of site investigation data, IRP Sites 13 and 22 were also determined to be non-CERCLA sites.

Please note that non-CERCLA/petroleum sites are regulated by the Massachusetts Contingency Plan (MCP) with regulatory oversight by the Massachusetts Department of Environmental Protection (MassDEP).

There are 16 IRP Sites not covered by this Five-Year Review because they have either been closed-out with regulatory concurrence or are non-CERCLA sites being regulated by the MCP. The status of these 16 sites is as follows:

IRP Site	Name	Status	Date	Document
5	Fire Training Area I	Closed-out	9/27/1991	AF DD (note 1)
7	Industrial Wastewater Treatment System	Closed-out	1/22/1991	AF DD (note 2)
8	Scott Circle Landfill	Closed-out	12/23/1991	AF DD (note 3)
9	Administration Building Jet Fuel Spill	Closed-out	1/22/1991	AD DD
10	Mercury Spill at Building 1128	Closed-out	12/19/1989	AF DD (note 2)
11	Various Fuel Spills on Runways & Taxiways	Closed-out	1/22/1991	AF DD
12	AAFES Service Station Gasoline Leak	Closed-out	1/22/1991	AF DD
13	Motor Pool Gasoline Leak	MCP LTM	1/19/1999	Class C RAO
14	Multi-site UST Investigation	Closed-out	10/19/2000	AF DD
15	Multi-site UST Removal	Closed-out	10/19/2000	AF DD
16	Contamination at Building T-860	Closed-out	9/30/1994	AF DD
17	Contamination at Building 1103	Closed-out	9/30/1993	AF DD
18	Contamination at Building 1102-C	Closed-out	9/30/1993	AF DD
19	Suspected Dump Site	Closed-out	9/30/1994	AF DD (note 2)
20	Suspected Fire Training Area	Closed-out	2/6/2001	OU1 IROD
22	AAFES Service Station Petroleum Leaks	MCP LTM	8/26/1997	Class C RAO
Note 1 – Close-out reconfirmed by OU-1 IROD dated November 2002 Note 2 – Close-out reconfirmed by USEPA letter dated July 5, 2000 Note 3 – Close-out reconfirmed by USEPA letter dated September 28, 2001				

3.2 LAND AND RESOURCE USE

Hanscom AFB is an active base, owned and operated by the Federal government through the Department of the USAF. Hanscom AFB is home to the 66th Air Base Group, which provides worldwide support for the Air Force Life Cycle Management Center (AFLCMC). AFLCMC is one of five centers under the Air Force Materiel Command and is the single center responsible for total life cycle management of Air Force weapon systems. Hanscom AFB is also home to two major Air Force Program Executive Offices (PEOs), the PEO for Command, Control, Communications, Intelligence and Networks (C3I&N) and the PEO for Battle Management. In addition, Hanscom hosts other units, including the Massachusetts National Guard Joint Force Headquarters and services others throughout the region (http://www.hanscom.af.mil; accessed January 2017).

Hanscom Field, located adjacent to, and north of the Base, is a full-service General Aviation airport owned by the Commonwealth of Massachusetts and operated by the Massachusetts Port Authority (Massport) and the Federal Aviation Administration. However, prior to 1973, the USAF leased the runways and flight line (that are now part of Hanscom Field) from the Commonwealth and the primary mission of Hanscom AFB was the operational maintenance of fighter aircraft and research and development support.

Massport's 2012 L.G. Hanscom Field Environmental Status and Planning Report (ESPR) indicates that there are currently no plans to change the existing land use of Hanscom Field in the future. Similarly, the 2017 Installation Development Plan for Hanscom AFB indicates that future land use patterns will generally resemble the Installation's existing land use pattern, with certain exceptions that do not impact the IRP sites.

Groundwater beneath Hanscom Field/Hanscom AFB is not currently used as a drinking water supply, and it is not expected to be so used in the future. Potable water for Hanscom Field and Hanscom AFB are obtained from local municipal suppliers (Lexington and Concord). Massport's most recent L. G. Hanscom Field Environmental Status and Planning Report (ESPR) (Massport, December 2013) states that the USAF purchases its water for Hanscom AFB from the Town of Lexington, which in turn is supplied by the Massachusetts Water Resources Authority (MWRA). Massport's water supply for Hanscom Field is provided primarily by the adjacent Hanscom AFB water distribution system, except for one line coming from the Town of Concord for the Pine Hill Area facilities.

However, MassDEP has classified groundwater in Hanscom Field/Hanscom AFB as Class I "high use and value" and the groundwater in the Town of Bedford has been designated as GW-1 (i.e., as a potential future drinking water supply) under state law by means of a Town of Bedford Aquifer Protection District by-law that was enacted through a process authorized by the MCP and implemented through the state regulations. Bedford's Aquifer Protection Districts are shown on **Figure 3**. In addition MassDEP has classified sections of the area as a Non-Potential Drinking Water Source (Medium Yield). The MCP defines "Non-Potential Drinking Water Source" as "Those portions of high and medium yield aquifers which may not be considered as areas of groundwater conducive to the locations of public water supplies." The MassDEP groundwater classification maps for each of the source (IRP Site) areas are included as **Figures 4 through 8**. The Town of Bedford's Hartwell Road Wellfield, which is inactive, is shown on **Figure 4**. The Town of Bedford's primary drinking water source is the Massachusetts Water Resource Authority (MWRA) and the secondary source is from the Shawsheen Road Wellfield, which is located approximately 2.3 miles northeast of the northeastern corner of Hanscom AFB.

A well inventory was conducted for Hanscom AFB by Metcalf & Eddy (M&E) as part of the Remedial Investigation of IRP Site 6 (M&E, 1992). The objective of the well inventory was to identify and locate all public water supply wells, private drinking water wells, and industrial, irrigation, and monitoring wells within a three-mile radius of Hanscom AFB. Subsequently, in October 2000, officials from Hanscom AFB met with the Director of the Board of Health in the Town of Bedford to review the locations of any wells installed after the M&E survey. These surveys revealed that there are five private wells located within 1.4 miles of the northeastern corner of Hanscom AFB, in Bedford. The two nearest private wells are located 1.2 miles north-northeast, and 1.3 miles northeast of the northeastern corner of Hanscom AFB, respectively. The private drinking water well locations are not downgradient of groundwater plumes associated with the Hanscom AFB IRP sites.

OU-1/IRP Sites 1, 2 & 3: OU-1 is an area with groundwater contamination that includes three distinct areas of concern, known as IRP Sites 1, 2, and 3, which are all located on Hanscom Field. OU-1 includes parts of Hanscom Field and the wetland areas/former beaver ponded area to the north/northeast of the airfield known as the Jordan Conservation Area and the Hartwell Town Forest which are owned by the Town of Bedford. There are deed restrictions on the Bedford property which limit use to passive and/or active recreation use. There is also a small section of OU-1 which is leased from the Commonwealth by Hanscom AFB and used as a campground and as the site of the central groundwater treatment facility for OU-1. The 2017 Installation Development Plan identifies this area as part of the Community District for planning purposes. The Plan indicates that the area is not developable and the only planned project for this area is to install a utility metering system at the FamCamp in the next 1 to 5 years. The area of the campground and treatment facility is identified with minor operation constraints due to its location adjacent to Hanscom Field. The Installation Development Plan also shows the plume source areas (IRP Sites 1, 2, and 3) on Hanscom Field as having minor environmental constraints because they are IRP sites with LUCs in place.

The wetland area to the north/northeast of the airfield was delineated and named Wetland B during the Air Force Comprehensive Ecological Analysis by LEC in 1992-1995 (LEC, 1997). Wetland B is a mature forested swamp associated with a tributary of the Shawsheen River. Subsequent to the LEC investigations, beavers dammed the drainage channel resulting in a significant portion of the former wetland becoming inundated killing off most of the tress. Therefore, the nomenclature of Wetland B/beaver pond has been adopted to represent this mixed habitat in documents issued prior to 2011. However, in May 2011, Massport removed 10 beavers from this area, installed a beaver deceiver in the stream and breeched the beaver dam at end of Runway 23-5. Since then water levels have been significantly lower in the drainage ditch that receives the groundwater treatment system's discharge and most of the ponded water has disappeared.

IRP Site 1, situated in the town of Bedford, is a former Air Force fire training area located on a relatively flat plateau on the southeast side of Hartwell Hill and northwest of Hanscom Field Runway 5-23. The area is slightly higher than the runways and the wetlands to the northeast. This area was reportedly used for fire training from the late 1960s through 1973. Today the area is fenced open space.

IRP Site 2, situated in the town of Bedford, is the site of drum burial pits located on Hanscom Field north of Runway 11-29 and east of Runway 5-23 which were used for disposing of waste solvents and paint from 1966 to 1972. The area is the same elevation as the runways and is slightly higher than the wetlands to the north. Prior to the remedial activities discussed below the site was devoid of most vegetation, possibly because of

the sand cap placed over the site following the burial of the drums. Today the area is grassed open space covering a groundwater recharge system within the security fence perimeter of Hanscom Field.

IRP Site 3, situated in the town of Concord, is the site of drum burial pits located on Hanscom Field in a triangular area bounded by Taxiway "Whiskey" to the north, Taxiway "Mike" to southwest and Runway 5-23 to the southeast. The area is the same elevation as the runways. Today the area is grassed open space covering a groundwater recharge system within the security fence perimeter of Hanscom Field.

OU-2/IRP Site 4: IRP Site 4 is a municipal waste landfill which covers 10.5 acres and is located approximately 1,800 feet southwest off the approach end of Runway 5-23 on Hanscom Field. Pre-1964 topographic maps of the area indicate that the site was a wetland area associated with Elm Brook. As discussed below the Remedial Action constructed in 1988 placed an impervious cap over the area. The area is also bermed with drainage ditches to channel runoff from the capped area to the wetlands. Today the area is grassed open space with a softball field in the southern half. The landfill is situated predominantly in the town of Lincoln, with a small portion protruding into the bordering town of Concord. Although outside of the installation boundary, the 2017 Installation Development Plan identifies this airfield site as having minor environmental constraints because it is an IRP site undergoing long-term monitoring and with LUCs in place.

OU-3/IRP Site 6: OU-3/IRP Site 6 is approximately 15 acres in area and is located in the northeast portion of Hanscom AFB and is situated in both the town of Bedford and the town of Lexington. The site is bounded to the north by a former railroad spur, to the northeast by a wetland area and small pond, to the east by a commercial industrial park, to the south by a service road (Hunter Street), and to the west by IRP Site 21, the former aviation fuel facility. IRP Site 6 consists of three distinct areas: the former filter beds (including the former sludge beds) and two (2) hillside landfill areas (south and west). The former filter bed area is higher than the wetlands to the north. As discussed below, the Remedial Action constructed in 2001 re-graded and placed a pervious cap over the three landfill areas of the site.

Today IRP Site 6 is a grassed area which is fenced and locked with “No Digging, No Dumping” signs posted. The South Landfill Area of Site 6 is periodically used by Air Force personnel for readiness training that does not require digging. The 2017 Installation Development Plan identifies the area of IRP Site 6 as part of the Base Support District for planning purposes. IRP Site 6 is identified as having minor operational constraints due to its location in proximity to Hanscom Field. The three landfill areas are identified as having minor environmental constraints because they are IRP sites undergoing long-term monitoring and with LUCs in place and there are also minor environmental constraints associated with the wetlands and Shawsheen River to the north of the former filter bed area. The 2017 Installation Development Plan identifies the Former Filter Bed Area and West Landfill Area as developable land that may serve as a potential location for renewable energy generation (PV arrays) as part of an alternative future course of action. Because of the IRP site status, any future renewable energy generation project would require the review and approval of the Hanscom AFB Environmental Office. Through these measures the use of the site is well controlled and managed.

An area adjacent to the southeast portion of the site is used as a municipal waste transfer station for all municipal waste produced at Hanscom AFB and a sand and salt storage dome is located adjacent to the southwest corner of the site. Land use in adjacent and surrounding areas in close proximity to the site currently includes an occupied industrial park located east of

the site, unoccupied wetland areas just north and northeast of the filter bed area, a former railroad spur to the north of the site, and an industrial area of the base to the west of the site.

OU-3/IRP Site 21: OU-3/IRP Site 21 is approximately 5 acres in area, situated in the town of Bedford, in the northeast portion of Hanscom AFB and adjacent to IRP Site 6. The northern site boundary is on or near the Hanscom AFB fence. The Shawsheen River is on Hanscom Field, just north of the fence. IRP Site 21 is the area of a former aviation fueling facility that was used for storage, off-loading, and dispensing of jet fuel and aviation gasoline from at least 1945 through 1973, and to store and distribute No. 2 fuel oil during the early 1970s. Fuel was stored in aboveground and underground storage tanks, which had associated pump houses and a network of underground piping. This area was also used for the storage of cleaning solvents and other petroleum products (oils and lubricants) associated with aircraft and vehicle maintenance.

Today the northern half of the site is a controlled/fenced parking area for privately owned recreational vehicles. The southern half of the site includes Building 1823, which is currently used as the base entomology facility; the former aboveground storage tank (AST) area which is currently used by the Base roads and grounds maintenance organization for equipment and materials storage, wood/brush chipping, and composting; and Buildings 1833 and 1834 used for the base's maintenance material receiving and storage.

The area of IRP Site 21 is identified in the 2017 Installation Development Plan as part of the Base Support District for planning purposes; however, the Plan indicates that the area is not developable and no future projects are identified for the area. IRP Site 21 is identified as having minor operational constraints due to its location in proximity to Hanscom Field. IRP Site 21 is identified as having minor environmental constraints because it is an IRP site with LUCs in place and there are also minor environmental constraints associated with the Shawsheen River to the north of the site. There are currently no plans to change the existing use of IRP Site 21 in the future.

3.3 HISTORY OF CONTAMINATION

Hanscom AFB's initial action in implementing CERCLA was the submission of Notification of Hazardous Waste Site forms to USEPA on 5 June 1981, which identified IRP Sites 4 and 6 as land-filled areas where hazardous waste may have been disposed. Following discussions with long-time employees, this initial notification was amended with the submission of additional Notification of Hazardous Waste Site forms to USEPA on 25 June 1982, which identified IRP Sites 2 and 3 as areas where hazardous waste may have been disposed. Also, in 1982 IRP actions at Hanscom Field/Hanscom AFB commenced with the conduct of a preliminary investigation of IRP Site 3. Subsequently, Roy F. Weston, Inc. was retained by Hanscom AFB to conduct a hydrogeologic investigation at Hanscom Field to assess the potential for past waste disposal activities at Hanscom Field to impact the water quality at the Town of Bedford's Hartwell Road wellfield. This investigation confirmed the existence of contamination at IRP Sites 2 and 3 and also identified contamination in the area designated as IRP Site 1.

In 1984, JRB Associates, Inc. was retained by Hanscom AFB to complete an Installation Assessment/Records Search. The purpose of this investigation was to identify the potential for environmental contamination from past waste management practices, evaluate the probability of contaminant migration, and assess the potential hazard posed by past disposal activities. Five of the 6 specific sites covered by this Five-Year Review (IRP Sites 1, 2, 3, 4, & 6) were documented in this report.

In June 1990, petroleum product identified as jet fuel (JP-4) was found in a foundation investigation boring for an addition to Building 1823 and in September 1990, during the cleaning of the abandoned fuel transfer pipeline, No. 2 fuel oil was released from the end of the former rail tank car unloading header. Also, in December 1990 during the removal of abandoned underground storage tanks (USTs) connected to the floor drains of out-of-commission pump houses (Buildings 1818 and 1828), LNAPL was found in both of the UST excavations. Subsequently, the former fuels area was designated IRP Site 21.

OU-1/IRP Sites 1, 2 & 3: OU-1 is an area with groundwater contamination that includes three distinct areas of concern, known as IRP Sites 1, 2, and 3, which are all located on Hanscom Field. These three sites are confirmed groundwater contamination source areas. Contaminants of Concern (COCs) at OU-1 consist of chlorinated and aromatic volatile organic compounds (VOCs). The VOCs with the highest concentrations are trichloroethene (TCE), 1,2-dichlorothene (1,2-DCE) and vinyl chloride. Dense non-aqueous phase liquid (DNAPL) is known to have been present at Site 1 and is suspected to have been present in other areas within OU-1; however, monitoring data in recent years suggests that most of the DNAPL has been remediated. While the extent of any residual DNAPL is not fully known, it is believed to be fully contained and within the capture zone of the existing collection system. This conclusion is supported by long-term monitoring data which has not found dissolved-phase contaminant concentrations in groundwater which are indicative of nearby DNAPL in monitoring wells down-gradient of the existing collection system.

IRP Site 1, located at the north end of the airfield was reportedly used from the late 1960s through 1973 for fire training exercises. Two (2) burn pits were used at this site. There is also an area designated as Burn Pit #1 Runoff Area adjacent to Burn Pit #1 where visible contaminant staining was noted in the RI. Waste oils, solvents, paint thinners, and degreasers were collected from around the base, dumped into pits, ignited, and then extinguished. Occasionally, aircraft wrecks and fuselages were burned in the pits. The size of the pits was estimated to be 15 feet by 20 feet each (**Figure 9**). There is no information indicating that a liner or containment was used at these pits.

IRP Site 2, located in the northeast portion of the airfield, was used for disposing of waste solvents and paint from 1966 to 1972. Metal plating wastes may also have been disposed in this area from the early 1960s through 1972. During the 1988 removal action four (4) drum burial pits of various sizes were found and excavated (**Figure 10**). There is no information indicating whether any type of liner or containment was used at these pits.

IRP Site 3, is located in a triangular area in the western portion of the airfield bounded by Taxiway "Whiskey" to the north, Taxiway "Mike" to the southwest and Runway 5-23 to the southeast. According to the Phase I Records Search several hundred drums of waste oils and paint wastes were buried at the Jet Fuel Residue Area during the period of 1959 to 1969. Disposal at the Tank Sludge Area, which is located within the same triangular area and to the northwest of the Jet Fuel Residue Area, reportedly occurred during the early 1960's. Because of the close proximity of this site to the Jet Fuel Residue Area, both areas were discussed and evaluated as one site (**Figure 11**). During the 1988 removal action, ten (10) drum burial pits of various sizes were found and excavated. There is no information indicating whether any type of liner or containment was used at these pits.

OU-2/IRP Site 4: IRP Site 4, located on the southwestern corner of Hanscom Field, was used as the Hanscom AFB municipal waste landfill from December 1964 until December 1974 (**Figure 12**). During its active life, the landfill was intended to be used primarily for the disposal of solid waste, however, the IRP Phase I – Records Search report states that interviews with Base personnel confirmed that dumpsters containing waste from all shops and research laboratories were emptied into the landfill during its 10-year operation. No attempt was made to segregate hazardous materials from non-hazardous materials. A review of the 1980 chemical inventory and waste management practices of Hanscom AFB revealed that the following types of compounds and associated empty containers were routinely discarded into dumpsters and disposed of in the landfill: battery acid; bonding compounds; fuels; medical wastes; inks and paints; mercury; photographic chemicals (developers, fixers, toners); spent acids (HF, H2SO4, HCl, HNO3); and TCE and other cleaning solvents. The landfill ranges from 10 to 15 feet deep and is estimated to have a volume of 210,000 cubic yards.

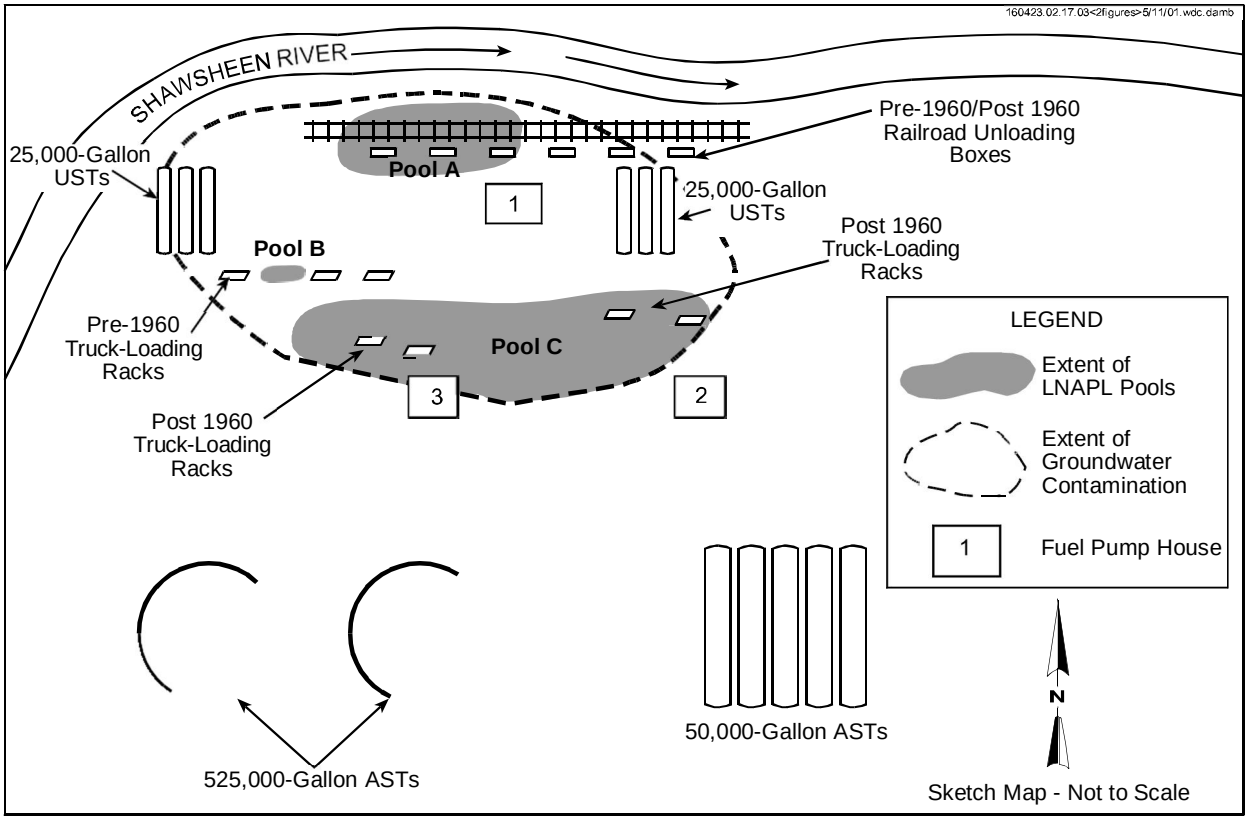
OU-3/IRP Site 6: IRP Site 6, located on the northeastern corner of Hanscom AFB, consists of three distinct areas: the former filter beds (including the former sludge beds); the south landfill (including a suspected ash disposal area and Building 1855 UST site); and the west landfill **(Figure 13).** The former filter bed area was the location of the original sanitary waste treatment system (used from 1947 until the mid-1950's) for Hanscom AFB. This system, which was abandoned in place when the Base connected to a municipal sanitary waste system, consisted of an Immoff Tank, Dosing Tank, Filter Beds (six (6) sand filled cells with a concrete berm surrounding each cell) and two (2) sludge beds. Following the abandonment of the treatment system, this area became a disposal site for municipal wastes, construction debris, and clean fill. The filter beds were overlain by approximately 5 to 15 feet of solid waste material. The Installation Restoration Program Phase I - Records Search reports an unauthorized release of 10 gallons of "Bar Kleen" and 80 gallons of "Inhibitor N-101" in the filter bed area in April 1983. These substances are boiler water treatment chemicals. Also reported were two (2) truckloads of No. 2 fuel oil-soaked soil being dried on polyethylene sheets and 10-15 empty drums labeled as foaming grease. One drum was on its side and leaking rust-colored liquid. Other documented releases included the burying of approximately 200 canisters of DDT in the late 1940's with about three-fourths of these canisters excavated in the early 1970s and transferred off-site. The remaining one-fourth of these canisters was deteriorated and could not be removed. Power line insulators, sod piles, and construction debris were reportedly stored on an abandoned concrete pad. A sign in the southeast corner of the filter bed area indicated that "leaded tank sludge buried here, do not excavate."

Immediately adjacent to, and to the south of the filter bed area are two (2) hillside landfill areas (south and west). Disposal in these two areas was mainly clean fill and/or construction debris. The south landfill was originally graded into terraces at 160 to 180-foot MSL elevations; however, these were obliterated by dumping of clean fill from a building foundation excavation and construction debris in the late 80's/early 90's. The southernmost portion of the south landfill includes a suspected ash disposal area and the former UST location that was located on the west side of Building 1855. Building 1855 formerly housed an incinerator and is currently a licensed solid waste transfer station for Hanscom AFB. The UST was a 1,000-gallon steel tank used to store No. 2 fuel oil for Building 1855. This tank was installed in 1958 and removed in 1990. When the tank was removed, evidence of a petroleum release was found.

OU-3/IRP Site 21: IRP Site 21 is an area with groundwater contamination and, prior to the RA, had three separate areas with petroleum products floating on the water table. These areas are technically referred to as light non-aqueous phase liquid (LNAPL) pools. Several investigations

were conducted to determine what contamination exists, exactly where the contamination is located, and whether or how the contamination is moving. Concentrations of chlorinated VOCs, benzene, toluene, ethylbenzene, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH) have been detected in various media at the site. Fortunately, it appears that the LNAPL pools and the groundwater contamination have not migrated and have not adversely impacted the Shawsheen River which is adjacent to the northern edge of the site. The stable nature of the pre-RA product and dissolved-phase contamination is the result of the fine grained soils at the site which have high adsorptive qualities, and the natural biodegradation of the contaminants. In addition, the vertical migration of the dissolved-phase contamination is confined by a lacustrine layer that underlies the upper (fill/sand and gravel) water table aquifer.

Today's (post-RA) layout of the area is shown on **Figure 14** and the sketch below shows the historical layout of the area. Prior to 1960, the fuel distribution and storage system at IRP Site 21 consisted of a railroad tank car siding where the fuel was unloaded, six 25,000-gallon USTs, and truck loading/unloading stations located on the northern portion of the site. Post-1960, the USTs and the truck loading/unloading stations were replaced by two 525,000-gallon jet fuel and five 50,000-gallon aviation gasoline above-ground storage tanks (ASTs) and new truck loading/unloading stations located on the south side of the site. This post-1960 system also included three pump houses (#1, #2 & #3 in diagram below).



3.4 INITIAL RESPONSE

All of the following actions were conducted under the Air Force initiated CERCLA-based IRP, with the MassDEP as the lead regulatory agency.

Remedial Action Plans for Hanscom Field Area 1 (IRP Sites 1, 2, 3/5 and 4): In 1985, Haley & Aldrich, Inc. (H&A) was retained to conduct investigations and prepare Remedial Action Plans for Area 1 on Hanscom Field which included IRP Sites 1 through 5 (**Figure 15**). Field investigation of the sites was conducted by H&A in 1985 and 1986. The results of this field work are included in Appendix F of the report entitled *Installation Restoration Program, Phase IV-A, Hanscom AFB Area I.* Based on the results of the field investigation, H&A prepared a Remedial Action Plan for each site. Following public review of these plans, Hanscom AFB documented selection of each site's Remedial Action Plan in a *Decision Paper, Area 1 (Sites 1-5),* dated April 6, 1988. This Decision Paper was approved by the Base Commander on April 20, 1988. Please note that the Remedial Action Plan entitled IRP Sites 3/5 noted that "… field investigations have failed to indicate that fire training activities or any contamination associated with those activities can be attributed to Site 5." Thus this Remedial Action Plan did not address Site 5 and a *Decision Document for Close-Out* for Site 5, was signed by the Base Commander on 27 September 1991. This Decision Document included the determination "… that there is no basis for the existence of this site." and the declaration that "… the selected remedy is no action and the site is hereby closed-out." Regulatory confirmation of the close out of IRP Site 5 was also subsequently documented in the OU-1 Interim Record of Decision (IROD).

Remedial Action Plans for IRP Sites 1, 2 and 3: The remedy for these sites included the removal of drums and/or visibly contaminated soil; construction of a groundwater collection, treatment and recharge system; and a long term monitoring program. Also included were four Boundary Interceptor Wells along the Hanscom AFB/Massport northern property boundary with the Town of Bedford's property. The purpose of these wells is to intercept any contamination migrating off the airfield complex through the lower/glacial till and/or bedrock aquifers.

Remedial Action Plan for IRP Site 4: The remedy for this former Hanscom AFB municipal landfill included a low permeability cap, drainage measures, a compensatory wetland and long-term monitoring.

Remedial Action Design for Hanscom Field Area 1 (IRP Sites 1, 2, 3/5 and 4): H&A was also retained to design the remedial actions for IRP Sites 1, 2, 3/5 and 4. This effort commenced in December 1986 and was completed in August 1987.

Remedial Action Construction - IRP Site 1: In September 1987, Enroserv Inc. was awarded a contract for Soil Removal and Site Improvements at IRP Site 1. Field work commenced in the spring of 1988 and was completed in August 1988. There were three areas where visibly contaminated soils were excavated: Burn Pit #1, Burn Pit #1 Runoff Area, and Burn Pit #2 (**Figure 9**). A total of 2,160 tons of visibly contaminated soil was removed and transported to disposal facilities. Post-excavation survey data indicate that excavation depths averaged three to four feet in the two Burn Pits, and one to two feet in the Burn Pit #1 Runoff Area. These areas were backfilled with clean fill material.

Remedial Action Construction - IRP Sites 2 and 3: In September 1987, Hydro-dredge Corporation was awarded a contract for Drum Removal at IRP Sites 2 and 3. Field work commenced in October 1987 and was completed in June 1988. Buried drums were excavated from Sites 2 and 3 in January and February 1988. The majority of the drums were empty and only 660 gallons of liquids were recovered. Site 2 contained 4 drum excavation pits (**Figure 10**)

and Site 3 contained 10 drum excavation pits (**Figure 11**). A total of 1,896 tons of visibly contaminated soil was removed from the pits along with the drums and transported to licensed off-site disposal facilities. The pits were backfilled with the remaining excavated soil and 1,617 tons of clean fill with the intent that any residual contamination would be captured by the groundwater collection trench installed around the perimeter of the site.

Remedial Action Construction - IRP Site 4: In September 1987, WES Construction Corporation was awarded a contract for Soil Cap Old Landfill which included a low permeable cap, drainage measures, and a compensatory wetland. Field work commenced in April 1988 and was completed in September 1988 (**Figure 12**).

Remedial Action Construction – Groundwater Collection, Treatment and Recharge System for IRP Sites 1, 2 and 3: In September 1988, R. Zoppo Co., Inc. was awarded a contract to construct a groundwater collection, treatment and recharge system for IRP Sites 1, 2 and 3.

Components of the system (see **Figure 16**) included:

- Central groundwater treatment facility
- Underground piping and electrical to and from the treatment facility and remote groundwater collection points
- Upper (surface/unconfined) aquifer groundwater collection trenches with pump station at each site
- Groundwater recharge basins at IRP Sites 2 and 3
- Four boundary interceptor wells (BIWs) aligned along the Hanscom Field/Massport northern property boundary with the Town of Bedford's property. These wells are constructed to collect groundwater from both the lower and bedrock aquifers.

The contractor received a Notice to Proceed in December 1988 and startup testing of the completed project was conducted between November 1990 and April 1991.

Long-Term Monitoring of IRP Site 4: In 1989, Environmental Resources Management, Inc. was awarded a contract to conduct long-term monitoring of groundwater and surface water at IRP Site 4. A total of seven rounds of sampling were completed between December 1989 and September 1992. Environmental Resources Management's final report for this long-term monitoring was issued in November 1992.

Technical Document to Support No Further Action Planned, IRP Site 4: This document, which was signed by the Electronic System Center Commander on 30 September 1993, states that "A permanent response action solution has been achieved (landfill cap). Groundwater and surface water monitoring has determined that a condition of no significant risk of harm to health, safety, public welfare and the environment for the foreseeable future exists at the site. ……. thus the selected remedy is the No further Action alternative and the site is hereby closed-out."

Remedial Action Operation – Groundwater Collection, Treatment and Recharge System for IRP Sites 1, 2 and 3: In January 1991, Metcalf & Eddy Services was awarded a contract for the operation and maintenance of the Groundwater Collection, Treatment and Recharge System for IRP Sites 1, 2 and 3. The locations of the components of the Groundwater Collection, Treatment and Recharge System for IRP Sites 1, 2 and 3 are shown in **Figure 16.**

Regular/daily operation of the system was started on 23 April 1991 and on 6 May 1991 the system went to around-the-clock operation (and has continued around-the clock ever since). The maximum flow capacity of the treatment facility is approximately 320 gallons per minute (gpm). Initially, groundwater was collected via the collection trenches at IRP Sites 1, 2 and 3 and from the four boundary interceptor wells (BIW-1, BIW-2, BIW-3 & BIW-4) and pumped to the central treatment facility. The collected groundwater is pumped to a 40,000-gallon equalization tank at the treatment facility and then from the equalization tank it is pumped through two air stripping towers connected in series to remove the contaminants of concern (VOCs). The water cascades downward through materials (similar to whiffle balls) within the towers while air is blown upward. Contaminants are removed from the groundwater in this process and go into a gaseous phase. The water that leaves the towers, called effluent, is sampled and analyzed to ensure that it meets regulatory discharge parameters. The treated effluent can be pumped to, and recharged (returned to the groundwater) at Sites 1, 2 and/or 3 and/or discharged to a drainage channel between the treatment plant and the northeast-southwest runway of Hanscom Field. This drainage channel flows to the Wetland B/beaver pond north of Hanscom Field. The treatment facility also has an off-gas treatment system consisting of 2 granular activated carbon units connected in series which removes the VOCs from the air from the stripping towers before the air is discharged into the atmosphere.

IRP Site 1, 2 & 3 Decision Document No Further Response Action Planned: This document, which was signed by the Base Commander on 9 April 1992, states that "…… This determination is protective of human health and the environment, and attains Federal and State requirements that are applicable or relevant and appropriate, and cost effective. This declaration is to continue operation of a pump and treat system until the groundwater meets acceptable levels."

Long-Term Monitoring of IRP Sites 1, 2 and 3: H&A was also retained to conduct the long term monitoring of IRP Sites 1, 2 and 3. Between January 1986 and October 1988, H&A completed 3 rounds of groundwater monitoring in OU-1. Round 1 (January & March 1986), Round 2 (September-October 1987), and Round 3 (September-October 1988) were associated with the development of the Remedial Action Plans, the design of the Remedial Actions and to establish a baseline prior to commencement of groundwater treatment. Round 4 (November 1990), Round 5 (February-March 1991) and Round 6 (August 1991) were designed to provide long term monitoring information on the performance of the groundwater treatment facility and the potential off-site migration of groundwater contaminants from Hanscom Field. Upon review of the Round 6 data, MassDEP requested that the monitoring network be expanded to better access the effectiveness of the pump & treat system. 30 additional monitoring wells were installed prior to further sampling. Subsequently, Round 7 (June-July 1994) and Round 8 (November 1994) were completed.

OU-3/IRP Site 21: The initial response actions conducted at IRP Site 21 are summarized **Table 2** below.

Table 2
IRP Site 21 Remedial Actions

Date	Authority	Action	Results
1990-1991	MCP Interim Measure/DEP Case No. 3-3315	Passive Recovery System (1 recovery well) for 8 weeks in the vicinity of Building 1823. Contractor: GZA Remediation, Inc.	25 gallons of jet fuel recovered
1993	MCP Interim Measure/ DEP Case No. 3-3315	200 Linear Feet of Horizontal Recovery Trench. Operation of Soil Vapor Extraction (SVE) system for 4 months, and Groundwater Recovery/Treatment System for 8 months. Contractor: Zenone, Inc.	1,400 tons of petroleum contaminated soil removed 226,420 gallons of groundwater recovered/treated 62 gallons of petroleum product recovered 185 gallons of SVE solvent recovered
1995 thru Oct 1998	CERCLA Removal Action	9 to 13 Recovery Wells & Zenone's Recovery Trenches. Operation of Soil Vapor Extraction (SVE) and Groundwater Recovery/Treatment System Sep 95 thru Oct 98. Contractor: Kestrel Drilling and Remediation, Inc.	3,191,356 gallons of groundwater recovered/treated 1,451 gallons of petroleum product recovered 1,679 gallons of SVE solvent recovered
1999-2000	CERCLA Removal Action	3 Recovery Wells. Operation Vacuum Enhanced Recovery (VER) System Sep 99 thru Jul 00 Contractor: Arcadis Geraghty & Miller, Inc.	67,730 gallons of groundwater recovered/treated
2000-2003	CERCLA Removal Action	Continued Operation of Vacuum Enhanced Recovery (VER) System and groundwater monitoring Contractor: IT Corp	231,408 gallons of groundwater recovered/treated

Long-Term Monitoring of IRP Site 21: A component of the Removal Action which commenced in September 1995 was the long-term monitoring of groundwater contaminant concentrations and the thickness of the LNAPL in selected IRP Site 21 monitoring and recovery wells. Long-term groundwater sampling rounds were conducted in April 1996, June 1996, December 1996, March 1997, June 1997, December 1997, April 1998, June 1998, September 1998, April 1999, July 1999, May 2000, October 2000, January 2001, May 2001, October 2001, May 2002 and October 2002.

3.5 BASIS FOR TAKING ACTION

OU-1/IRP Sites 1, 2 and 3 Groundwater Contamination: COC concentrations in OU-1 groundwater exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards) at many locations. As a result, there is an unacceptable risk to human health from the hypothetical future ingestion of this groundwater. The nature and extent of groundwater contamination in the three aquifers in the OU-1 area (upper, lower, and bedrock) have been evaluated in detail through the OU-1 Long-Term Monitoring Program. Following Hanscom's designation as a NPL site in 1994, USEPA reviewed H&A's Long-term Monitoring Rounds 7 and 8 data and requested that the monitoring network be expanded again to better access the effectiveness of the pump & treat system and to better define the nature and extent of contamination from the airfield (OU-1) sites. 22 additional monitoring wells were installed prior to further sampling.

Subsequently Round 9 (June-July 1996) and Round 10 (May 1997) were completed. During this period CH2M Hill was retained to complete CERCLA Risk Assessments, a Focused Feasibility Study and an Interim Record of Decision (IROD) for OU1. As part of this effort, groundwater flow and solute transport models were developed. These indicated a need for an additional cluster (3) of monitoring wells in the Bedford forest northeast of the boundary interceptor wells to confirm the models' projection of the contaminated groundwater plume. The additional well cluster was installed prior to H&A's Round 11 (May 1998). The Round 11 (and subsequent monitoring) results for the additional cluster are consistent with what was projected by the model. The results of Sampling Round 11 and a summary of all earlier H&A sampling rounds are presented in the Round 11 Sampling Report (H&A, 1998). Following H&A's Round 11, the focus of the Long-Term Monitoring Program changed to the monitoring of the effectiveness of the on-going remedial actions and progress towards attainment of RAOs and the complete cleanup of OU-1. In 1999, Hanscom AFB issued a long-term monitoring plan for OU-1 which reflected the changed focus. Also, at this time the responsibility for the long-term monitoring of OU-1 (in accordance with the Long-Term Monitoring Program) was shifted to the contractor responsible for the operation and maintenance (O&M) of the OU-1 remedial actions. Also, since 1999, the Long-Term Monitoring Program has been subject to the Remedial Process Optimization (RPO) process in that sampling points and frequency are re-evaluated after each round for changes necessary to more effectively accomplish the objectives of the Long-Term Monitoring Program. Twenty-nine (29) major/formal rounds of sampling and analysis in OU-1 have been performed to date, at the dates listed in Table 3 below.

Table 3
Schedule of Past Long-Term Monitoring Rounds

Round No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Date (Mo/Yr)	2/86	10/87	9/88	11/90	2/91	8/91	6/94	11/94	7/96	5/97	5/98	5/99	11/99
Round No.	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
Date (Mo/Yr	11/00	11/01	11/02	11/03	11/05	11/05	11/06	11/07	11/08	11/09	11/10	11/11	5/13
Round No.	**27**	**28**	**29**										
Date (Mo/Yr	11/13	4/15-5/15	11/15										

Long-Term Monitoring Reports have been issued for each OU-1 major/formal round of sampling and analysis. Based on the historical Long-Term Monitoring data, COCs at OU-1 consist of chlorinated and aromatic VOCs, with the compounds with highest concentrations being TCE, cis-1,2-dichlorothene (cis-1,2-DCE) and vinyl chloride.

OU-2/IRP Site 4: As stated above, a *Technical Document to Support No Further Action Planned* for Site 4 was signed by the Commander on 30 September 1993. MassDEP subsequently requested that a risk assessment be completed in order to close-out the site. O'Brien & Gere was retained to complete a MCP Risk Assessment which included supplemental sampling and analysis at IRP Site 4. However, prior to completion of this effort, Hanscom Field/Hanscom AFB was added to the NPL and USEPA requested that CERCLA Human Health and Ecological Risk Assessments be completed instead of the MCP Risk Assessment. The site was also designated Operable Unit 2 (OU-2) at this time. O'Brien & Gere's scope of work was then modified to only include sampling and analysis. Field work was conducted by O'Brien & Gere between December 1994 and April 1995. The results of this field work are included in O'Brien & Gere's Report entitled *Supplemental Sampling and Environmental Update, Site 4 – Sanitary Landfill* dated February 1996.

CH2M Hill was retained to complete the CERCLA Human Health and Ecological Risk Assessments. In the process, it was determined that some data gaps existed and CH2M Hill conducted additional sampling and analysis. This field work was completed in 1996 and the results provided in CH2M Hill's *Operable Unit 2 Sampling Report* dated August 1996. The CERCLA risk assessments were then completed and are found in CH2M Hill's *Baseline Human Health Risk Assessment for Operable Unit 2 (Site 4)* and *Baseline Ecological Risk Assessment for Operable Unit 2 (Site 4)*, both dated April 1997. The human health risk assessment concluded that there are "no unacceptable risks associated with exposure to Site 4 media" and "no remedial action is warranted." The Ecological Risk Assessment concluded that "there are no significant ecological risks associated with Site 4." Upon review of the Risk Assessments, USEPA determined that the Remedial Action completed in 1988 was acceptable as a final remedial action. The Project Team (Remedial Project Managers for Hanscom AFB, USEPA & Mass DEP) concluded that additional long-term groundwater monitoring data was not required but, since the landfill waste remains on-site, Five-Year Reviews of the remedial action were appropriate.

USEPA and Hanscom AFB completed a site inspection in May 1997 and USEPA issued the *Five-Year Review Report #1, Hanscom Air Force Base Superfund Site, Middlesex County, Massachusetts* dated September 1997. This review concluded "based on the field inspection, and human health and ecological risk assessment, protectiveness of the landfill cap at Site 4 has been demonstrated"; however, the review did identify a requirement to remove scrub brush growing in the drainage ditches and on sections of the cap and berms and for a long-term inspection/maintenance program to be instituted. The field work to remove the scrub brush was completed in the spring of 1998 and a long-term inspection and maintenance program instituted.

OU-3/IRP Site 6: The baseline human health risk assessment revealed that future industrial site workers potentially exposed to compounds of concern in surface soil, and hypothetical future residential groundwater users may be exposed to an unacceptable human health risk that exceeds 10-4 (carcinogenic) and HI>1 (noncarcinogenic). In addition, the ecological risk assessment revealed an unacceptable risk to soil invertebrates and animals feeding 100% of the time at the landfill areas (especially the suspected Ash Disposal Area), to benthic and water column organisms in the Wetland Z area, and to the black-crowned night heron from DDT in wetland Z. The media that were sampled during field investigations include subsurface soil,

surface soil, sediments (wetland and stream), surface water, and groundwater. The following **Table 4** summarizes the results of these investigations.

Table 4
OU-3/IRP Site 6 RI Results

Contaminant Type	Medium Affected	Concentration Range	Approximate Areal Extent	Suspected Source
VOCs*	Groundwater – Upper aquifer Groundwater – Lower aquifer	3.0 - 100 ug/L 0.5 – 130 ug/L	Former Filter Beds	Flushing of landfill areas
Pesticides**	Wetland sediment	0.01 – 920 ug/kg	Wetland Z sediment/north of Former Filter Beds	Landfill surface soil erosion, surface water draining from the landfill areas
SVOCs** (including PAHs)	Wetland sediment	10 - 55,000 ug/kg	Wetland Z sediment/north of Former Filter Beds	Landfill surface soil erosion, surface water draining from the landfill areas
SVOCs** (including PAHs)	Groundwater – Upper aquifer	0.27 – 180 ug/L	Former Filter Beds	Flushing of landfill areas
SVOCs** (including PAHs)	Surface soil	0.0035 – 330 mg/kg	Suspected Ash Disposal Area	Landfill debris (source area)
SVOCs** (including PAHs)	Subsurface soil	0.00084 – 12 mg/kg	South Landfill	Landfill debris (source area)
Metals*	Groundwater – Upper aquifer Groundwater – Lower aquifer	14.3 – 117,000 ug/L 22 – 14,400 ug/L	Former Filter Beds	Flushing of landfill areas
Metals*	Surface water	ND – 0.11mg/L	Ponded wetland areas	Flushing of landfill areas, surface water draining from the landfill areas

Notes:

*Human Health Risk Assessment (CH2M HILL, 1999a) exposure concentration data was used for concentration ranges.

**Ecological Risk Assessment (CH2M HILL, 1999b) exposure concentration data was used for concentration ranges. ND – Non Detect

OU-3/IRP Site 21: COC concentrations in OU-3/IRP Site 21 groundwater exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards), and the human health risk assessment revealed that future construction workers potentially exposed to LNAPL and contaminated groundwater, and future residential groundwater users may be exposed to an unacceptable human health risk that exceeds 10-4 (carcinogenic) and HI>1 (noncarcinogenic). Contaminants detected above MCLs in groundwater during the 1999 Supplemental RI are presented by sample location, i.e., beneath LNAPL Pools A, B or C or from the dissolved-phase plume; in the following **Table 5**.

Table 5
Contaminants of Concern in Groundwater – OU-3/IRP Site 21

Contaminant (exceeding MCL)	Sample Id/ Location	Maximum Concentration	MCL (Drinking Water Standard)
Source Area (LNAPL Pool A)			
Benzene	MW-10	150 ug/L	5 ug/L
Toluene	MW-10	1,800 ug/L	1,000 ug/L
Naphthalene	MW-10	170 ug/L	20 ug/L[1]
Source Area (LNAPL Pool B)			
Naphthalene	ECS-33	73 ug/L	20 ug/L[1]
Source Area (LNAPL Pool C)			
Naphthalene	MWZ-20	120 ug/L	20 ug/L[1]
Groundwater Plume			
1,4-Dichlorobenzene	CH-102	390 ug/L	75 ug/L
1,2-Dichlorobenzene	CH-102	1,400 ug/L	600 ug/L
1,2,4-Trichlorobenzene	ECS-31	84 ug/L	70 ug/L
vinyl chloride	ECS-28	37 ug/L	2 ug/L
cis-1,2-Dichloroethene	ECS-28	100 ug/L	70 ug/L
Trichloroethylene	MWZ-7	6 ug/L	5 ug/L
Naphthalene	MWZ-23	33 ug/L	20 ug/L[1]
Benzene	ECS-14R	73 ug/L	5 ug/L
TPH	CH-102	2,900 ug/L	200 ug/L[1]

Notes:

[1] MCP Method 1 GW-1 standard used because no MCL exists. Note that the Method 1 GW-1 standard at the time of the ROD is shown for naphthalene and has since been increased to 140 ug/L.

The ecological risk assessment revealed that, although a risk could not be ruled out for the Shawsheen River, the contamination detected in the river (non site-related concentrations of PAHs in the sediments and metals in the surface water) was most likely from surface water runoff from the paved areas of Hanscom Field and/or Hanscom AFB and not related to the releases regulated under CERCLA. Therefore actions to address this contamination detected in the river were not included in the Remedial Action; however, actions to ensure that the site's contaminants are not impacting the Shawsheen River are subject to CERCLA and are included in the remedial action. Refer to Section 4.1, Remedy Selection – OU-3/IRP Site 21, for the specific Remedial Action Objectives and elements of the remedial action. Also, it should also be noted, that the headwaters of the Shawsheen River, which includes Hanscom AFB and Hanscom Field, are the subject of intensive study through the Massachusetts Watershed Initiative established to ensure Clean Water Act compliance.

SECTION 4.0
REMEDIAL ACTIONS

4.1 REMEDY SELECTION

Remedy Selection - OU-1/IRP Sites 1, 2 and 3

As stated above, Remedial Action Plans for IRP Sites 1, 2 and 3 were developed and implemented prior to the NPL designation. Subsequently, in 1995, USEPA advised that additional studies were necessary to ensure that these earlier actions fully addressed risk. Using the results of all previous investigations, CH2M Hill completed a *Final Ecological Risk Assessment, OU-1* (dated January 1999) and a *Focused Feasibility Study, OU-1* (dated May 2000). This effort included groundwater flow and solute transport models (based on 1996 and 1997 Long-Term Monitoring results), and an evaluation of the soil-to-groundwater contaminant transport pathway for human health risk assessment. Based on these reports and the apparent presence of DNAPL in the bedrock fractures, the Project Team concluded that it was not prudent to select a final remedy at the time (2000) since compliance with ARARs would not be attained in the existing groundwater contaminant plume in the short-term. It was determined that an Interim Remedial Action should be selected/implemented. Subsequently, CH2M Hill prepared an *Interim Proposed Plan for Hanscom AFB Operable Unit 1*, dated June 2000. The public review of this plan, including a Public Meeting on June 28, 2000, was completed in July 2000 without comment. Following the public review/comment period, an Interim Record of Decision, dated November 2000 (also prepared by CH2M Hill) selecting the remedy for OU-1 was signed by the Air Force on January 24, 2001 and by USEPA on February 6, 2001. The Commonwealth of Massachusetts formally concurred with this IROD by letter dated December 27, 2000.

Charts of all actual Long-Term Monitoring results to date were presented in the 2002 Five-Year Review Report, which indicated that both the contaminant mass at the Site 1 and Site 2 source areas and the contaminant concentrations in the plumes flowing from these source areas were being reduced at a rate much faster than predicted by the solute transport model. Long-Term Monitoring results since the initiation of active groundwater remediation in 1991 demonstrated that the groundwater remediation system is effective at removing contaminant mass in the source areas and within the contaminant plumes. In addition, the water quality and groundwater flow data collected at the boundary wells and wells in both the source areas and the downgradient plumes (Town of Bedford conservation lands) indicated that the remedial system was effective in both containing contaminant migration in each of the surface, lower and bedrock aquifers and in pulling back the plumes towards their source areas. Long-Term Monitoring results since 1997 also appeared to not support assumptions used in CH2M Hill's solute transport model that was constructed using 1996 and 1997 Long-Term Monitoring results. That model could not predict when, if ever, RAOs would be achieved and resulted in the selection of an interim action to provide time to gather additional data.

In 2006, the Project Team concluded that the existing system appeared to be a feasible technology to achieve RAOs in a reasonable period of time and that Hanscom AFB should start the process of converting the 2000 IROD to a final ROD. Because of the apparent reduction of CVOC contaminant concentrations in site ground water that was observed in the Long-Term Monitoring data set, in 2006 EPA Region I and Hanscom AFB partnered in preparing a "focused" solute transport model based on the Long-Term Monitoring results and the adjusted ground water extraction rates through 2005. During a January 2007 Project Team meeting, the

draft model which had been prepared by EPA's consultant, CDW Consultants, Inc. was reviewed and evaluated. The focused solute transport model conservatively indicated that the existing interim remedy (dynamic groundwater remediation system) could achieve RAOs within a reasonable (30-50 years) time frame. It was concurred that the "focused" model more likely reflected actual solute transport conditions for the area modeled and those results should be incorporated into a revised focused feasibility study. The final report for the Focused Groundwater Flow and Transport Model was issued in May 2007 and a *Revised Focused Feasibility Study for OU-1*, prepared by Hanscom AFB, was also issued in May 2007.

Subsequently Hanscom AFB prepared a *Proposed Plan for Hanscom AFB Operable Unit 1*, dated May 2007. The public review of this plan, including a Public Information Meeting and Public Hearing on June 20, 2007, was completed in July 2007 without comment. Following the public review/comment period, a Record of Decision (ROD), dated September 2007 was prepared by Hanscom AFB. This ROD was signed by the Air Force on September 14, 2007 and by USEPA on September 28, 2007. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated September 28, 2007.

The remedy for OU-1 selected by the ROD is basically the same as that selected by the 2000 IROD. This 2007 ROD sets forth the final remedy for OU-1 at the Hanscom Field/Hanscom AFB NPL Site as the continued operation of the existing dynamic groundwater remediation system, land use controls including institutional controls, and the monitoring of groundwater and surface water. This remedy is expected to remove/destroy the sources of groundwater contamination, effectively contain the migration of groundwater contaminants, and is expected to reduce the overall extent of the groundwater plume via a reduction in contaminant mass.

The following are the major components of the selected remedy:

- Continuing to operate the existing dynamic groundwater remediation system (groundwater collection, treatment and recharge system; vacuum enhanced recovery (VER) system; molasses and/or permanganate injections).
- Continuing to maintain and enforce Land Use Controls (LUCs), including Institutional Controls (ICs), to prevent exposure to hazardous substances above unlimited use levels.
- Continuing an environmental sampling program (including groundwater and surface water) to monitor the performance of the groundwater remediation system and to monitor progress towards achievement of the Remedial Action Objectives (RAOs).
- Conducting Five-Year Reviews as long as any hazardous substances, pollutants or contaminants remain at the site above levels that allow for unrestricted exposure and unlimited use to assure that the cleanup remedy continues to protect human health and the environment.

The remedial action objectives (RAOs) for OU-1 groundwater are to:

- Prevent exposure (via ingestion, inhalation and/or dermal contact) to groundwater containing COC concentrations that exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs, state drinking water standards (i.e., MCLs), and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards);
- Prevent further migration of dissolved-phase COCs in groundwater;

- Prevent discharge to surface-water bodies and wetlands of groundwater containing COC concentrations that exceed federal drinking water standards, state drinking water standards, and state groundwater risk characterization standards; and
- Within an acceptable time period (<30 - 50 years), return groundwaters to federal drinking water standards, state drinking water standards, and state groundwater risk characterization standards.

Secondary objectives are to ensure that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil and to prevent exposure to vapors that could accumulate in buildings affected by the contaminated groundwater plume.

Remedy Selection - OU-2/IRP Site 4

A discussed above, a remedy for OU-2/IRP Site 4 was selected prior to the listing of Hanscom Field/Hanscom AFB on the NPL with the MassDEP as the lead regulatory agency. The selected remedy (impermeable cap) was documented in the Remedial Action Plan for the former Hanscom AFB municipal landfill. The Remedial Action Plan met the Massachusetts Contingency Plan requirements for remedy selection at the time of the decision (1988).

Remedy Selection - OU-3/IRP Site 6

Using the results of all previous investigations, CH2M Hill completed a *Human Health Risk Assessment, Site 6 of OU3* and the *Ecological Risk Assessment, Site 6 of OU3,* both dated July 1999. In addition to finalizing the risk assessments, CH2M Hill also prepared a *Focused Feasibility Study, Operable Unit 3, Site 6 – Landfill* and *Proposed Plan for Hanscom AFB Operable Unit 3/Site 6* both dated May 2000. The public review of Proposed Plan, including a Public Information Meeting and Public Hearing on June 20, 2000, was completed in July 2000 without comment.

A Record of Decision, dated September 2000 (also prepared by CH2M Hill) selecting the remedy for OU3/IRP Site 6, was signed by the Air Force on November 14, 2000 and by USEPA on December 5, 2000. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated October 16, 2000.

Remedial action objectives (RAOs) based on the types of contaminants, environmental media of concern, and potential exposure pathways, 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. The RAOs for the selected remedy for OU-3/ Site 6 are:

- Prevent exposure to groundwater above health-based criteria (via ingestion, inhalation, and dermal contact) within the landfill and filter bed area.
- Reduce exposure of ecological receptors to Wetland Z sediment contamination.
- Reduce potential exposure of ecological receptors to contaminated surface soils in the landfill/former filter bed area, south landfill, and west landfill.
- Prevent direct contact to surface soils within the landfill source areas (former filter bed area, south landfill, former ash disposal area, and west landfill).
- Minimize erosion of potentially contaminated soil from the former filter bed area into the

adjacent pond and wetlands.

The RAOs are meant to reduce the potential exposure of future industrial site workers to PAHs in surface soil at the landfill areas via dermal contact, ingestion, and inhalation that may present a human health risk in excess of 10-4 (carcinogenic) and HI >1 (noncarcinogenic), such that the risk attributable to this medium is below 10-4 to 10-6 (carcinogenic) and has a HI which does not exceed one (noncarcinogenic) and complies with ARARs for the protection of human health and the environment. In addition, the RAOs are meant to reduce the potential exposure of children and adults to VOCs and inorganics in groundwater via ingestion, dermal contact, and inhalation that may present a human health risk in excess of 10-4 (carcinogenic) and HI >1 (noncarcinogenic) such that the risk attributable to this medium is below 10-4 to 10-6 (carcinogenic) and has a HI which does not exceed one (noncarcinogenic) and complies with ARARs for the protection of human health and the environment.

The RAOs are also meant to reduce the potential exposure of soil invertebrates and higher trophic level omnivorous animals to PAHs and inorganics in the landfill soil that are present in concentrations that may result in adverse effects for these receptors. In addition, the RAOs are meant to reduce the potential exposure of benthic organisms and the black-crowned night heron to pesticides in the wetland sediments.

The selected remedy for OU-3/IRP Site 6 consists of:

- Containment (permeable caps) of three landfill areas,
- Removal of contaminated sediments and landfill debris and placing of this material within the capped landfill area,
- Long-term monitoring, and
- Institutional controls.

In addition, the remedy includes establishment of a groundwater compliance boundary and a Contingency Groundwater Remedy in the event monitoring results show that the remedy is not effective in maintaining groundwater quality outside the compliance boundary. A full range of options from extending the boundary, to more sampling, to active remedial measures may be considered depending on the site conditions at the time.

An expected outcome of the selected remedy is that the landfill soils and wetland sediments will no longer present an unacceptable risk to future industrial site workers and ecological receptors via dermal contact, ingestion, and inhalation. In combination with natural flushing and natural attenuation, this alternative can be expected to achieve a reduction in the size and contaminant concentrations of the contaminant plume within the compliance boundary. The selected remedy will also provide environmental and ecological benefits such as restoration of the wetlands areas where contaminated sediments are removed.

Remedy Selection - OU-3/IRP Site 21

Using the results of all previous investigations, CH2M Hill prepared a *Feasibility Study, Operable Unit 3/ Site 21,* dated June 2001, and *Proposed Plan for Hanscom AFB Operable Unit 3/Site 21,* dated July 2001. The public review of Proposed Plan, including a Public Information Meeting and Public Hearing on August 1, 2001, was completed in August 2001 without comment. A Record of Decision, dated October 2001 (also prepared by CH2M Hill) selecting

the remedy for OU3/IRP Site 21, was signed by the Air Force on August 20, 2002 and by the USEPA on August 29, 2002. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated January 22, 2002.

Remedial action objectives (RAOs) based on the types of contaminants, environmental media of concern, and potential exposure pathways, 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. The RAOs for the selected remedy for OU-3/ Site 21 are:

- Prevent exposure (via ingestion, inhalation and/or dermal contact) to groundwater containing COC concentrations that exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards);
- Prevent discharge to the Shawsheen River of groundwater containing COC concentrations that exceed federal drinking water standards, state drinking water standards and state groundwater risk characterization standards;
- Prevent or minimize further migration of the contaminant plume (dissolved-phase COCs);
- Prevent or minimize further migration of contaminants from source materials (VOCs/LNAPL) to groundwater; and
- Within an acceptable time period (< 100 years), return groundwaters to federal drinking water standards (i.e., MCLs and non-zero MCL goals (MCLGs)), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards).

The physical details of the selected remedial action for cleaning up OU-3/IRP Site 21 are graphically shown on **Figure 17** and the principal components include:

- Three (3) interceptor trenches with passive recovery wells, one main trench covering LNAPL Pools A and B near northern boundary of the site and two smaller trenches at hotspot areas within LNAPL Pool C;
- Network of active recovery wells in non-hotspot areas of LNAPL Pool C;
- Enhancement of biodegradation of dissolved-phased contaminants (VOCs and fuel compounds) by ORC® application in all trenches;
- Monitoring;
- Land Use Controls/Institutional Controls;
- Groundwater Containment/Treatment and VER Contingencies; and
- Five-year Reviews (until contaminant levels allowing unlimited use and unrestricted exposure are attained).

The primary expected outcome of the selected remedy is that the human health risks associated with the contaminated groundwater and LNAPL will be eliminated through the implementation of the selected remedy described above. Petroleum saturated soils will be removed during the

installation of the trenches. Residual LNAPL not removed during construction will be contained, captured and removed through a network of active and passive recovery wells. Short term exposure to contaminants will be controlled through the use of the land use controls (LUCs)/Institutional Controls (ICs). Groundwater monitoring will confirm the effectiveness of the remedy in containing the LNAPL pools and dissolved-phase (VOCs/fuel compounds) groundwater contaminated plume from migrating to the Shawsheen River.

4.2 REMEDY IMPLEMENTATION

Remedy Implementation - OU-1/IRP Sites 1, 2 and 3

Remedial Action-Operation/Continued Operation of the Existing Dynamic Groundwater Remediation System: As discussed earlier in this document, the remedy for OU-1/IRP Sites 1, 2 and 3 was constructed/implemented (**Figure 16**) prior to the listing of Hanscom Field/Hanscom AFB on the NPL and appropriateness of the remedy was re-confirmed by the 2000 OU-1 Interim ROD and 2007 OU-1 ROD. The term "dynamic" was included in the remedy designation and in the 2007 ROD to include the Remedial Process Optimization (RPO) as a component of the selected Remedy. This process has been on-going since the initial Groundwater Collection, Treatment and Recharge system was placed in operation in April 1991. A listing of key dates/milestones for the OU-1 Remedy prior to completion of the prior five-year review are included in attachments to the Fourth Five-Year Review Report. Significant RPO changes for the OU-1 Remedy conducted prior to the Fourth Five-Year Review include:

- In 1996, the system was automated which allowed for the reduction in operating staff/unmanned operation and the pump stations at IRP Sites 1, 2 and 3 were upgraded with larger pumps. Subsequently in 1997 variable speed drives were added to these pumps.
- In 1997, an experimental vacuum enhanced recovery (VER) system consisting of four recovery wells was placed in operation in the immediate vicinity of Burn Pit #1 and Burn Pit #1 Runoff Area at Site 1 to accelerate the removal of contaminant mass from the bedrock aquifer at Site 1. Following a successful Demonstration Project, this system was incorporated in the OU-1 remedy.
- In 1997, two additional conventional interceptor wells were placed in operation, one downgradient (southeast) of Site 1(IW-6) and the other downgradient (north) of Site 2 (IW-5). Also, the pump in BIW #1 was replaced with a larger pump.
- In 1999, an additional conventional interceptor well was installed at Site 1 (IW-10) in the center of Burn Pit #2 and the VER system at Site 1 was augmented by the conversion of 3 monitoring wells in the immediate area to conventional interceptor wells (IW-7, IW-8 & IW-9). The groundwater collected by these wells is pumped to the central treatment facility.
- In 2000, an Environmental Security Technology Certification Program (ESTCP) project entitled: In-situ Substrate Addition to Create Reactive Zones for Treatment of Chlorinated Aliphatic Hydrocarbons: Hanscom Air Force Base commenced in the vicinity of the RAP1-6 monitoring well cluster which is considered to be in the heart of the on-site plume emanating from Site 1. This project involved multiple injections of a substrate (molasses) into the lower aquifer slightly upgradient of the existing RAP1-6 monitoring well cluster. A total of forty-seven injections were made between October 2000 and October 2002. Over this time 1,250 gallons of raw blackstrap molasses was injected (average of 139 lbs molasses/week).

- In 2001, the pumps in BIW #3 and BIW #4 were replaced with larger pumps to take advantage of available well yield to increase the amount of contaminant mass being recovered and to enhance the BIWs capability to contain the plume on-site and also to draw it back toward the source areas.
- In June 2001, a permanganate injection pilot study commenced in the vicinity of existing monitoring wells RAP1-3S and RAP1-3R which is also the area being remediated by the Site 1 VER system. VER system operation and recovery from IW-7, IW-8 and IW-9 were suspended for the duration of pilot study.
- In August 2001, because the TCE and cis-1,2-DCE concentrations had declined to near drinking water standards the collection and treatment of groundwater from Site 3 was suspended.
- In October 2002, the VER system was restarted following conclusion of the permanganate injection pilot study. However, due to iron fouling of well, pumps and discharge line IW-7, IW-8 and IW-9 were not re-activated.
- In 2003, the pump in BIW #1 was replaced with a larger pump to take advantage of available well yield to increase the amount of contaminant mass being recovered.
- In June 2006, an existing monitoring well (IRZ-2) located in the on-site plume emanating from Site 1 and downgradient of the molasses injection well was converted to a conventional interceptor well (IW-11).
- In August 2006, the operation of the Site 1 VER system was again suspended for the duration of a permanganate treatment of the Site 1 source area in the vicinity of existing monitoring wells RAP1-3S and RAP1-3R.
- In August 2006, fouled/nearly worn out pumps in BIW No. 2 and IW No. 5 were replaced with larger size pumps.
- In August 2007, restarted VER system (shut down 31 Jul 06 for permanganate injection).
- In September 2007, converted monitoring well RAP1-3R to a vacuum enhanced extraction well and included it in the operational scheme for the IRP Site 1 VER System**.**
- In July 2009, installed a hydrant stub-up tapped off the Site 2 recharge piping to provide an alternate or additional recharge capability at Site 2.
- In September 2009, installed a hydrant stub-up tapped off the Site 3 recharge piping to provide a recharge capability at Site 1.

Since the Fourth Five-Year Review, significant RPO changes to the OU-1 remedy include:

- In July 2013, the VER system operation at Site 1 was suspended following the Fourth Five-Year Review Report recommendation (see Section 5.0 for the specific recommendation and how it has been addressed).
- In late 2013, groundwater pumping and surface recharge operations at Site 3 were temporarily re-initiated and then terminated following a pumping and recharge test period that was conducted from August to November 2013, which showed that concentrations of COCs in groundwater from the Site 3 collection trench were far below cleanup criteria.

- Between September 19, 2014 and January 23, 2015, remedial action construction (RA-C) activities were conducted to supplement the existing remedial activities at OU-1 Sites 1, 2, and 3. Specifically, the following activities were conducted:
  - At Site 1, in-situ chemical oxidation reagents were injected near the historical Site 1 source area (near monitoring well RAP1-3R/Burn Pit #1 Runoff Area) with a goal of reducing TCE concentrations by 80 percent in the vicinity of monitoring well RAP1-3R. Injection of reagents (sodium permanganate/water mixture) at well GM-97-EW-2 (screened in the lower/till and bedrock aquifers) occurred on October 27, 2014. **Figure 18** shows the injection well and surrounding area.
  - At Sites 2 and 3, BioTrap® installation and sampling was conducted to determine the presence of VOC-degrading bacteria (i.e., Dehalococcoides spp. [DHC]). BioTrap® results indicated that additional DHC injections were required to improve the microbe population for effective implementation of enhanced reductive dechlorination (ERD). In September 2014, 2 lower/till aquifer injection wells were installed at Site 2 and in October 2014, 11 surface aquifer wells were installed at Sites 2 and 3 (**Figures 19, 20, and 21**). In October 2014, emulsified vegetable oil (EVO) injections were conducted at Sites 2 and 3. EVO mixtures were injected at the existing injection well (IW-5), newly installed injection wells (INJ-01 through INJ-13), and direct injection points (DIPs) (DIP-01 through DIP-12). All DIPs were abandoned following completion of injections. To aid in biodegradation, BAC-9 (containing DHC microbes) was injected in October 2014 following the EVO injections. The ERD substrates were injected with a goal of achieving MCLs and MCP GW-1 and GW-2 standards in the vicinity of surface aquifer monitoring wells P02-1S and OW2-6 at Site 2, lower aquifer monitoring wells B114-MW, B115-MW, and IW-5 at Site 2, and surface aquifer monitoring wells OW3-14 and RAP 3-3S at Site 3.
  - Performance monitoring was conducted to evaluate the effectiveness of the ISCO and ERD injections and to determine if additional remedial treatments are needed and/or trigger changes in the manner in which the OU-1 GWTP is being operated. At Site 1, a baseline groundwater sampling event was performed prior to ISCO injections in September 2014 and post-injection events occurred on December 4, 2014 (Round 1), December 30, 2014 (Round 2), and January 23, 2015 (Round 3). At Sites 2 and 3, a baseline groundwater sampling event was performed prior to EVO injections in October 2014 and post-injection events occurred on April 28 and 29, 2015 (Round 1), July 28 to 30, 2015 (Round 2), and November 4 and 5, 2015 (Round 3). Evaluation of the performance monitoring data was conducted in the *Remedial Action Construction (RA-C) Completion and Performance Monitoring Report* (Versar, 2016) and is discussed in the Data Review section of this report.

Monitoring of Groundwater and Surface Water: As discussed above, the Long-Term Monitoring of OU-1 has been on-going since the RI commenced in 1986 and an extensive network (see **Figure 22**) of interceptor, recovery and monitoring wells and surface water monitoring points has been developed over time to monitor contaminant levels/trends in the surface water and groundwater in each of the 3 aquifers of concern within OU-1. The implemented remedy includes the continuation of groundwater and surface water monitoring at

OU-1, which initially commenced in 1986. Long-Term Monitoring events are conducted in accordance with the *Basewide Quality Assurance Project Plan for Long Term Monitoring at NPL Operable Unit 1, NPL Operable Unit 3/IRP Site 6, NPL Operable Unit 3/IRP Site 21and MCP Sites (IRP Sites 13 & 22, and the FAFSUST Site)*.

The post-1998 and pre-2007 ROD Long-Term Monitoring for OU-1 was 2-phased: (1) the annual sampling of selected monitoring wells and a surface water sampling point for analysis of VOCs by an off-site commercial laboratory, and (2) the monthly/quarterly/semi-annual/annual sampling of collection points, selected monitoring wells and the surface water sampling point for analysis by the O&M staff using an on-site gas chromatograph (GC). The on-site GC only quantified the two principal contaminants of concern, TCE and cis-1,2-DCE. The Long-Term Monitoring Program has also been subject to the RPO process in that sampling points and frequency are re-evaluated after each round for changes necessary to more effectively accomplish the objectives of the Long-Term Monitoring Program.

The monitoring component of the 2007 ROD remedy continues the two-phase approach. Phase 1 is the annual sampling of selected wells to confirm established Long-Term Monitoring trends within the OU-1 source areas and plumes and to monitor progress towards achievement of RAOs. Analysis of these samples is for VOCs by an off-site commercial laboratory. The Phase 1 sampling and analysis is documented in a formal Long-Term Monitoring Report. In 2013, quarterly groundwater elevation monitoring events have also been performed to supplement groundwater elevation data collected during sampling events and the results of this monitoring are included in the formal Long-Term Monitoring Reports. The second phase of the Long-Term Monitoring Program is the monthly sampling and monitoring focused on the operational and compliance aspects of the groundwater treatment plant. Until 2013, this sampling included screening of collection sources and monitoring wells by the O&M staff using an on-site GC; however, this was discontinued and water samples are now all analyzed by an off-site laboratory. Results of the Long-Term Monitoring Program Phase 2 sampling and analysis is documented in the Monthly OU-1 Remedial Action Report which is submitted to USEPA Region I, MassDEP and stakeholders.

Land Use Controls: Due to the nature and extent of the contaminants, the current and future land use, and since OU-1/IRP Sites 1, 2 & 3 are on an active/full-service General Aviation airport; LUCs/ICs which include non-engineered instruments such as legal and/or administrative controls, will prevent exposure to, and use of, contaminated groundwater; ensure that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil; and prevent exposure to vapors that could accumulate in buildings affected by the contaminated groundwater plume. ICs are considered acceptable measures to be used as part of a balanced cleanup when treatment is also being used to address principal waste threats. LUCs/ICs that are being maintained, monitored and enforced under this remedy to control access to the three source areas on Hanscom Field and to ensure that the OU-1 groundwater is not used for drinking water purposes include:

- Since the early 1980's, Massport has granted the Air Force access to Hanscom Field for activities associated with the Hanscom AFB IRP. This access is formalized by License Agreements.
- Massport is kept up-to-date on the status of the Hanscom AFB IRP. Both the Airport Director and Massport's Environmental Unit are on the distribution list for IRP Reports concerning OU-1 (and other IRP Reports concerning/affecting Hanscom Field). Also Massport is a chartered member of the Hanscom AFB Restoration Advisory Board (RAB).

- To alert Massport's operational personnel, planners, and decision makers of their presence, OU-1 and the locations of IRP Sites 1, 2 and 3 are noted on Figure 9-5 of Massport's *2012 L.G. Hanscom Field Environmental Status and Planning Report (ESPR)* and Chapter 9 of the document includes a discussion of the Hanscom AFB IRP. Massport personnel review site information and notify Hanscom personnel if any work is anticipated near the IRP sites.
- Massport's 2012 ESPR included forecasts for 2020 and 2030 scenarios which indicate that Hanscom Field will continue to be a full-service General Aviation airport for the foreseeable future.
- Hanscom Field has a perimeter fence and all areas of Hanscom Field are patrolled by security forces. Access to the field is controlled and restricted to authorized personnel. In addition, IRP Site 1 is separately fenced.
- Construction of the OU-1 recharge basins placed 6-8 feet of clean soil over the original ground surface of the waste burial pits at IRP Sites 2 and 3. Also, all visually contaminated soil at IRP sites 1, 2 and 3 was removed by the 1988 removal actions and replaced by clean backfill. Thus access to any residual subsurface soil contamination is physically restricted.
- Massport's 2012 ESPR states "The ESPR does not replace the MEPA review of projects at the site which exceed regulatory thresholds."
- IRP Sites 1, 2 and 3 are immediately adjacent to the runways, within the restrictive airfield area, and the only potential construction would be for utility services. Further, in place remedial system piping and recharge basins at Site 2 and 3 would necessitate routing of new utility services around the area with any residual subsurface soil contamination. If construction activities are planned for the airfield area in the future, appropriate health and safety procedures will be followed, including the preparation of a site specific health and safety plan, in accordance with OSHA (29 CFR 1910.120) and all other applicable federal, state, and local requirements.
- Groundwater beneath Hanscom Field/OU-1 is not used, not expected to ever be used, as a public water supply. The public water supply for Hanscom Field is provided primarily by Hanscom AFB, which purchases its water from the Town of Lexington (served by MWRA). Figure 2-3 of Massport's 2012 ESPR shows the existing water lines for Hanscom Field and Figure 9-3 shows locations of public water supply facilities within Bedford, Concord, Lexington and Lincoln (some of which are inactive). Table 9-5 shows the approximate distance of each from Hanscom Field which vary from 0.9 to 7.3 miles.
- Figure 9-4 of Massport's 2012 ESPR delineates an approved Zone II Wellhead Protection Area that overlaps Hanscom Field and includes IRP Site 3. These areas are approved under the MassDEP's Drinking Water Program to protect the recharge area around public water supply groundwater sources.

In addition to the Hanscom Field area, OU-1 contaminated groundwater also flows through a section of an active Air Force Installation (Hanscom AFB's Family Campground) and into conservation lands owned by the Town of Bedford. The below listed LUCs/ICs are already in-placed/instituted for that the portion of OU-1 which the Air Force leases from the

Commonwealth of Massachusetts for the Hanscom AFB Family Campground and central groundwater treatment system.

The 2017 Installation Development Plan identifies the area of the Hanscom AFB Family Campground and central treatment system as part of the Community District for planning purposes. The Plan indicates that the area is not developable and the only planned project for this area is to install a utility metering system at the FamCamp in the next 1 to 5 years. The area of the campground and treatment facility is identified with minor operational constraints due to its location adjacent to Hanscom Field.

The 2017 Installation Development Plan for Hanscom AFB identifies the plume source areas (IRP Site 1, 2, and 3) on Hanscom Field as having minor environmental constraints that could limit development/redevelopment due to the LUCs in place and requires that any disturbance on these sites must be reviewed and approved by the HAFB Environmental Office.

Key excerpts from the 2017 Installation Development Plan that relate to IRP site LUCs/ICs and current and future land use are included as **Attachment G-1** of this Fifth Five-Year Review Report.

Hanscom AFB operating procedures, as defined by Air Force Instructions (AFIs), requires that project planning documents (for both new construction and repair projects, including utility repairs) be coordinated with the environmental office. There is also a Base Dig Safe process that requires sign-off by the environmental office before intrusive activities can occur. Also, Hanscom AFB contractors performing IRP work are required by OSHA to have Site Specific Health and Safety Plans and properly trained workers.

For those portions of OU-1 located on conservation lands owned by the Town of Bedford, a legal mechanism is in place (deed restrictions on these lands) which limit use to passive and/or active recreation use. This area of OU-1 includes undeveloped wetlands, beaver ponds and forest areas known as the Jordan Conservation Area and Hartwell Town Forest. A letter to the Hanscom AFB RPM from the Town of Bedford Conservation Commission which summarizes the management and land use status of these areas is included as **Attachment G-2** of this Fifth Five-Year Review Report. Additional administrative mechanisms to ensure that the groundwater under this off-base area is not used for drinking water purposes include:

- Town of Bedford officials are kept up-to-date on the status of the Hanscom AFB IRP and levels of contaminants in the groundwater beneath the town owned land. The Board of Health is furnished a copy of all OU-1 Long-Term Monitoring Reports and both the Board of Health and Conservation Commission are on the distribution list for the monthly Remedial Action Report. Also, the Board of Health Director is a chartered member of the Hanscom AFB Restoration Advisory Board (RAB) and the Chair/CoChair of the Board of Health usually attends RAB meetings.
- Also, the OU-1 ROD required the Air Force, in consultation with the EPA and MassDEP, to establish restrictions prohibiting the construction of wells and the use of groundwater in any documented or anticipated area of groundwater contamination. These restrictions shall be in place within 1 year of the ROD's signature. In retrospect, these restrictions were already in place, specifically Section 8 of the Bedford Board of Health Code of Health Regulations requires that any landowner obtain a permit for the installation of wells anywhere in the Town of Bedford. While this does not specifically “prohibit” wells in the Jordan Conservation Area and Hartwell Town Forest, it does ensure that the Board of Health would be involved in the decision.

A 4 September 2008 Memorandum from the Hanscom AFB Environmental Office to the USEPA, Region I, which summarizes the implementation of LUCs/ICs for OU-1, is included as **Attachment G-3** of this Fifth Five-Year Review Report. An **enclosure to Attachment G-3** is a copy of the 24 July 2008 letter to the Hanscom AFB Environmental Director from the Bedford Town Manager which discusses restrictions on the land use and the use of groundwater by the Town of Bedford in off-base areas of contamination.

The on- and off-base LUCs will be maintained until the concentrations of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and unlimited exposure. The Air Force is responsible for ensuring that the LUCs described above, as components of the selected remedy, continue to be in place, are reported on, and enforced to ensure that the LUCs and are effective and protective of human health and the environment. In this regard, the Hanscom AFB environmental office formally monitors and documents the results in normal operations, maintenance, and/or monitoring reports for the remedial action. This monitoring is accomplished by:

- Frequent inspections (almost daily) of the OU-1 area by the Hanscom AFB's remedial action-operations contractor's on-site staff in the course of their OU-1 system operation, maintenance and monitoring duties, and
- Discussions at least annually, or more often if warranted between Massport and Bedford officials by the Hanscom AFB IRP Manager to verify that untreated groundwater within OU-1 is not being used for any purpose and that there is no unauthorized digging at IRP Sites 1, 2 and 3.

The LUC monitoring results will be included in a separate annual report or as a section of another annual environmental report, if appropriate, and provided to the EPA and the MassDEP. The LUC monitoring reports will be used in preparation of the Five Year Reviews to evaluate the effectiveness of the OU-1 remedy.

Should the Air Force plan on transferring or leasing any property affected by OU-1, whether or not as a result of base closure, the Air Force will consult with USEPA and MassDEP on the specific wording on groundwater and land use restrictions to be included in the documents evidencing the transfer or lease. If the property is transferred, or the lease allows capital improvements, a technical evaluation of the continued effectiveness and appropriateness of the remedy will be undertaken considering long-term monitoring results to date, the proposed land use, and the fact that the Air Force may no longer actively own or operate the property.

Remedy Implementation - OU-2/IRP Site 4

As discussed earlier in this document, the remedy for OU-2/IRP 4 was constructed/ implemented prior (1988) to the listing of Hanscom Field/Hanscom AFB on the NPL and the protectiveness of the remedy was documented in the 1st Five-Year Review Report and the Site entered the Long-Term Management Phase on 16 September 1997.

Land Use Controls (LUCs): LUCs to ensure that future land use and/or groundwater use does not increase the risk of exposure to the waste/contaminated soils and groundwater remaining on the site were **not** specified in the 1988 Remedial Action Plan for Site 4. However, inspections are made by Hanscom AFB's remedial action- operations contractor's on-site staff in the course of their IRP Site 4 maintenance duties to verify the integrity of the cap and to ensure that drinking water wells are not being installed and that there is no unauthorized digging at the site. Site 4 is also on Hanscom Field within the area formally designated as a buffer area (Runway 5

Approach Area) and most of the discussion of Hanscom Field's LUCs/ICs above in the OU-1 section also applies to Site 4. Vehicle access to the Runway 5 Approach Area is restricted by a locked gate. As with OU-1, access by Air Force personnel/contractors to Hanscom Field to conduct IRP activities is by License Agreements. In addition, Figure 1-3 (Planning Areas) and Table 1-3 (Potential Planning Concepts under 2020 and 2030 scenarios) in Massport's 2012 ESPR reflects that nothing is/will be planned for the Runway 5 Approach Area.

Remedy Implementation - OU-3/IRP Site 6

Remedial Design/Remedial Construction: The Remedial Design (RD) in conformance with the ROD is dated April 2001. This RD was prepared for Hanscom AFB by CH2M Hill.

Construction of the remedy was completed via an Air Force Center for Environmental Excellence (AFCEE) contract with IT Corporation. IT Corporation mobilized on-site on 29 May 2001 and field work was substantially complete on September 17, 2001. The *Remedial Action Report for Landfill Capping Project at Operable Unit 3-Site 6*; prepared by IT Corporation, April 2002, describes the construction of the RA.

The major components of IT's scope of work included:

- Conducting a property line survey to verify the location of the Base property line to the north and east of the Former Filter Bed Area,
- Excavation of the contaminated sediments from two wetland hotspot areas and the placement of this material under the Former Filter Bed Area cap,
- Excavation of the debris extending off the Base property and the placement of this material under the Former Filter Bed Area cap,
- Constructing a permeable cap at the Former Filter Bed Area, South Landfill, and West Landfill,
- Restoring the wetlands in the wetland remediation areas,
- Re-establishment of perimeter and security fencing with signs on each gate, and
- As-built surveys and drawings.

The installation of three monitoring well couplets down gradient from Site 6 on adjacent landowner's property to help define a groundwater compliance boundary was also included in the scope of the construction contract. Delays in negotiating a Right-of-Entry for the Kiln Brook Spur property precluded installation of the wells during the major construction period in 2001. The Right-of-Entry was subsequently established and the wells installed in September 2002. The *Site 6 Compliance Boundary Monitoring Well Installation Report*; prepared by IT Corporation and dated January 2003 describes the installation of the wells.

Quarterly inspections and annual maintenance of the capped areas commenced in 2002.

Wetland Mitigation Monitoring: The Remedial Design included a 30-year post-RA Monitoring Plan for the wetland areas remediated during the construction phase of the Site 6 Remedial Action. The "baseline" vegetative monitoring event for the wetland restoration areas (East Wetland Remediation Area (EWRA) and West Wetland Remediation Area (WWRA)) was included in the construction contract scope/costs and was accomplished by IT Corporation in September 2001. The baseline vegetative monitoring was performed by a qualified wetlands

scientist and included the establishment of a transect line through each wetland remediation area, the placement of a 1 m x 1 m quadrant at a reproducible location, an ocular estimation of the ratio of growth to area, photographs of the wetland remediation areas from a reproducible location, and the assessment of the remedial progress. This vegetative monitoring (which established the baseline conditions for future inspections and assessments) was documented in the *Remedial Action Report for Landfill Capping Project at Operable Unit 3-Site 6*; prepared by IT Corporation, April 2002. Subsequently the initial Five-Year Monitoring Plan included in the Remedial Design for the wetland areas remediated was completed in the fall of 2006 with follow-up wetland mitigation monitoring and ecosystem evaluation required every five years thereafter. As documented in the *Final 2016 Wetland Mitigation Monitoring and Ecosystem Evaluation Report for Operable Unit 3, IRP Site 6*; prepared by Versar, March 2017, it was agreed that long-term ecosystem monitoring would be discontinued. The rationale for discontinuing long-term ecosystem monitoring is described in Section 6.3 Data Review under Data Review OU-3/IRP Site 6.

Monitoring of Groundwater and Surface Water: An extensive network of groundwater monitoring wells and surface water monitoring points (see **Figure 13**) has been developed over time to monitor contaminant levels/trends in the surface water and groundwater in each of the 2 aquifers of concern within IRP Site 6. The monitoring of the IRP Site 6 remedy commenced in 2001 with a "baseline" groundwater and surface water sampling and analysis event that was included in the construction contract scope/costs. The purpose of this initial post-RA monitoring of the site was to identify contaminants of concern in the groundwater and surface water and to provide a baseline to monitor changes over time in the contaminant concentration levels. It was accomplished by IT Corporation in December 2001and documented in the *Baseline Groundwater Monitoring Report for Post-RA Monitoring of Operable Unit 3 Site 6 (December 2001 Samples);* prepared by IT Corporation, May 2002. Subsequent post-RA Long-Term Monitoring events have been conducted at least annually. Also, seasonal dissolved arsenic analysis of groundwater from selected wells was conducted from July 2005 through July 2015.

Groundwater Compliance Boundary: Figure 7.0 of the Site 6 ROD shows the Groundwater Compliance Boundary and associated monitoring wells to include 3 additional well couplets (surface and lower aquifers). The initial sampling and analysis of groundwater at the existing monitoring wells was included in the 2001 baseline Long-Term Monitoring event. However, as stated above, the installation of three additional monitoring well couplets down gradient from Site 6 (and on an adjacent Massport or privately owned property) to better define the groundwater compliance boundary was delayed and not completed until September 2002. The initial sampling and analysis of groundwater from these wells was included in the October 2002 Long-Term Monitoring event for Site 6. As noted in the 2007 Five-Year Review, additional monitoring wells were installed and the initial boundary was revised in 2006. More recently, additional monitoring wells were installed, groundwater monitoring was conducted at an increased frequency to evaluate seasonal trends, and an assessment of the source of dissolved arsenic was conducted in 2014 and 2015, at an in the vicinity of Site 6. The results of the detailed investigation are provided in the Downgradient Investigation Report (Versar, 2015). It was determined that the compliance boundary, as revised in 2006, is still appropriate and protective and that the dissolved arsenic present above the MCL beyond the compliance boundary is naturally occurring and not site related. The revised Groundwater Compliance Boundary and additional wells are shown on the current Site Plan (**Figure 13**). This determination along with USEPA and MassDEP's approval of the findings, was documented in a letter report entitled Final Compliance Boundary Confirmation for DP007 (Site 6) at Hanscom Air Force Base (Versar, March 2016). Based on the findings, an Explanation of Significant

Differences or ROD Amendment was determined not to be needed. The additional monitoring and determination address a recommendation made for Site 6 in the previous 2012 Five-Year Review.

Land Use Controls (LUCs)/Institutional Controls (ICs): LUCs/ICs instituted to ensure that future land use and/or /groundwater use does not increase the risk of exposure to the waste/contaminated soils and groundwater remaining on the site are listed below. LUCs/ICs are formally monitored and results documented by the base environmental office in the recurring Remedial Action Reports issued for this site.

- Fencing with locked gates
- Signs at each of the 2 vehicle access gates stating:

  IRP Site 6
  No Digging, No Dumping
  Per Order of the Installation Commander
  For Additional Information Contact the Environmental Office
  781-377-4495/8207/4667

- Inspections are conducted by Hanscom AFB's remedial action-operations contractor's on-site staff in the course of their IRP Site 6 maintenance and monitoring duties to verify the integrity of the cap and to ensure that there is no unauthorized digging at the site and that drinking water wells are not being installed at the site or in adjacent Massport and private property (Debris Excavation Area 1, the off-base wetlands, and the former railroad spur to Hanscom AFB) which may have groundwater with dissolved arsenic levels above the arsenic MCL.
- Much of the off-base area downgradient from Site 6 is on Hanscom Field within the Runway 29 approach area and most of the discussion of Hanscom Field's LUCs/ICs above in the OU-1 section also applies to this section of Hanscom Field which may contain groundwater with dissolved arsenic levels above the arsenic MCL. As with OU-1 and OU-2, access to Hanscom Field by Air Force personnel/contractors to conduct IRP activities is formalized by License Agreements. Massport is also on the distribution list for Long-Term Monitoring Reports concerning OU-3/IRP Site 6.
- Rights-of-Entry are formalized with the private property owners (Debris Excavation Area 1, the off-base wetlands, and the former railroad spur to Hanscom AFB) which may contain groundwater with dissolved arsenic levels above the arsenic MCL. Each owner has been formally provided with the analytical results of groundwater and surface water samples collected at these off-base locations. Sampling is not currently conducted on the private properties.
- IRP Site 6 is identified in the 2017 Installation Development Plan as having minor operational constraints due to its location in proximity to Hanscom Field. The three landfill areas are identified as having minor environmental constraints that could limit development/redevelopment because they are IRP sites undergoing long-term monitoring and with LUCs in place and there are also minor environmental constraints associated with the wetlands and Shawsheen River to the north of the former filter bed area. The 2017 Installation Development Plan identifies the area of IRP Site 6 as part of the Base Support District for planning purposes. The Former Filter Bed Area and West Landfill Area are identified as developable land that may serve as a potential location for renewable

energy generation (PV arrays) as part of an alternative future course of action. Because of the IRP site status, the 2016 Installation Development Plan states that any disturbance on IRP Site 6 must be reviewed and approved by the HAFB Environmental Office. Also, base operating procedures (as established by Air Force Instructions) requires that project planning documents (for both new construction and repair projects) be coordinated with the environmental office. Through these measures, the use of the site is well controlled and managed. Key excerpts from the 2017 Installation Development Plan that relate to IRP site LUCs/ICs and current and future land use are included as **Attachment G-1** of this Fifth Five-Year Review Report.

Contingency Groundwater Remedy: Not required at this time.

Remedy Implementation - OU-3/IRP Site 21

Remedial Design/Remedial Construction: The design and construction of the selected Remedial Action for IRP Site 21 was completed via an Air Force Center for Environmental Excellence (AFCEE) contract with Shaw Environmental, Inc. (formerly IT Corporation). The remedial design for the selected remedy was included in the *Environmental Cleanup Plan, Remedial Action at Operable Unit 3- Site 21, Hanscom AFB, MA*; prepared by Shaw Environmental, Inc. and dated May 2003. Shaw mobilized on-site on June 2, 2003, field work was substantially complete in September 2003, and the LNAPL recovery/groundwater treatment system officially commenced around-the-clock operation on September 15, 2003. The *Final Remedial Action Report for the Remedial Action at Operable Unit 3 - Site 21, Hanscom AFB, MA;* prepared by Shaw Environmental, Inc. and dated March 2004, describes the construction of the RA.

The major construction components of the RA for this Site were:

- Removal of petroleum contaminated soils from various hotspot locations – a total of 2,763 tons of contaminated soil was transported to Eastern Soil Management Inc. for thermal treatment and reuse;
- Construction of four trenches with passive recovery wells – one main trench covering LNAPL Pool A with three passive wells, one trench covering LNAPL Pool B with two passive wells, and two smaller trenches at hotspot areas within LNAPL Pool C, each with a passive well;
- Application of ORC® in each trench to enhance the biodegradation of dissolved-phased contaminants (VOCs and fuel compounds) - a total of 1,170 pounds was applied during construction;
- Installation of a network of ten active recovery wells in non-hotspot areas within LNAPL Pool C connected to a retrofitted LNAPL recovery and treatment system that had been used at the site for previous removal actions;
- Installation of provisions to implement groundwater containment/treatment and/or vapor enhanced recovery (VER) contingencies in the future (i.e., the capability for future pump and treat was built into the interceptor trenches and the former VER system was removed and equipment was salvaged for potential future use if the VER contingency is implemented);
- Surveying and as-built drawings; and
- A six-month start-up and prove-out period for the LNAPL/groundwater recovery and

treatment system. This O&M period was included in the construction contract scope/costs. The construction contract also included preparation of the *Operation and Maintenance Plan, Remedial Action at Operable Unit 3 - IRP Site 21* which was prepared by Shaw Environmental, Inc. in 2003. Upon completion of the start-up and prove-out period the responsibility for the operation, maintenance, and monitoring of the Site 21 remedy in accordance with the O&M Plan was transferred to the Basewide Remedial Action-Operation (RA-O)/Long-Term Management (LTM) contractor.

Monitoring of LNAPL, Groundwater and Surface Water: An extensive network of groundwater monitoring wells and surface water monitoring points (see **Figure 24**) has been developed over time to monitor LNAPL levels and contaminant levels/trends in the surface water and groundwater in each of the 2 aquifers of concern within IRP Site 21. The monitoring of the IRP Site 21 remedy commenced in 2003 with a "baseline" groundwater and surface water sampling and analysis event that was included in the construction contract scope/costs. This event also included the measurement of LNAPL thickness in monitoring and recovery wells at Site 21 which had discernable LNAPL in pre-RA monitoring events. The purpose of this initial post- RA monitoring of the site was to document the residual LNAPL; to identify contaminants of concern in the groundwater and surface water; and to provide a baseline to monitor changes over time in the contaminant concentration levels. It was accomplished by Shaw Environmental, Inc. in October 2003 and documented in the *October 2003 Stage 2 Post-RA Baseline Long Term Monitoring Report for Operable Unit 3 – IRP Site 21*; prepared by Shaw Environmental, Inc. and dated March 2004. Subsequent post-RA Long-Term Monitoring events were conducted semi-annually until 2014, when the frequency was reduced to annual spring sampling events.

Land Use Controls (LUCs)/Institutional Controls (ICs): LUCs/ICs instituted to ensure that future land use or groundwater use does not increase the risk of exposure to the contaminated soils and groundwater remaining on the site are listed below. LUCs/ICs are formally monitored and results documented by the base environmental office in the recurring Remedial Action Reports issued for this site.

- Frequent inspections by Hanscom AFB's remedial action-operations contractor's on-site staff in the course of their OU-1 system operation, maintenance and monitoring duties are conducted to verify that untreated groundwater within OU-3/IRP Site 21 is not being used for any purpose and that there is no unauthorized digging at the site.
- The area of IRP Site 21 is identified in the 2017 Installation Development Plan as part of the Base Support District for planning purposes; however, the Plan indicates that the area is not developable and no future projects are identified for the area. IRP Site 21 is identified as having minor operational constraints due to its location in proximity to Hanscom Field. IRP Site 21 is identified as having minor environmental constraints because it is an IRP site with LUCs in place and there are also minor environmental constraints associated with the Shawsheen River to the north of the site. There are currently no plans to change the existing use of IRP Site 21 in the future.
- Because of the IRP site status, the 2017 Installation Development Plan states that any disturbance on IRP Site 6 must be reviewed and approved by the HAFB Environmental Office. Key excerpts from the 2017 Installation Development Plan that relate to IRP LUCs/ICs and current and future land use are included as **Attachment G-1** of this Fifth Five-Year Review Report.

Groundwater Containment/Treatment and VER Contingencies: Not envisioned at this time.

Remedy Implementation Summary

OU-1/IRP Sites 1, 2 & 3

- Continued operation of the existing dynamic groundwater collection and treatment system – implemented
- Monitoring of groundwater and surface water – implemented
- Land Use Controls/Institutional controls – implemented

OU-4/IRP Site 4

- Inspection and Maintenance of cap – implemented
- Monitoring of groundwater and surface water – no longer required
- Land Use Controls/Institutional controls – Not formally included in the 1988 RAP, however, they have been implemented

OU-3/IRP Site 6

- Containment of three landfill areas - completed
- Removal of contaminated sediments and landfill debris and placing of this material within the capped landfill area - completed
- Inspection and Maintenance of capped areas – implemented
- Wetland mitigation monitoring – completed
- Monitoring of groundwater and surface water – implemented
- Groundwater compliance boundary – implemented
- Land Use Controls/Institutional controls – implemented
- Contingency Groundwater Remedy – not envisioned at this time

OU-3/IRP Site 21

- Construction of interceptor trenches with passive recovery wells and removal of petroleum contaminated soils - completed
- Application of ORC® in interceptor trenches – completed
- Installation of LNAPL/groundwater recovery and treatment system – completed
- Operation of LNAPL/groundwater recovery and treatment system - completed
- Monitoring of groundwater and surface water – implemented
- Land Use Controls/Institutional controls – implemented
- Groundwater Containment/Treatment and VER Contingencies – not envisioned at this time

4.3 REMEDIAL ACTION – OPERATION/LONG-TERM MANAGEMENT

OU-1/IRP Sites 1, 2 and 3 Remedial Action – Operation

Remediation System Operations, Maintenance and Monitoring (OM&M):

Monitoring of the remediation systems is conducted in accordance with the Basewide Quality Assurance Project Plan for Long Term Monitoring at NPL Operable Unit 1, NPL Operable Unit 3/IRP Site 6, NPL Operable Unit 3/IRP Site 21and MCP Sites (IRP Sites 13 & 22, and the FAFSUST Site). Operation and maintenance (O&M) of the original Groundwater Collection, Treatment and Recharge System is conducted in accordance with the O&M Manual entitled Recovered Groundwater Treatment System O&M Manual. The O&M Manual was initially prepared by Engineer-Science, Inc., a subcontractor to H&A, in 1991. In 1998, the manual was revised by IT Corp, a subcontractor to PSG Inc., following completion of the system automation and upgrade contract. Under this contract, a supervisory control and data acquisition (SCADA) system was installed to control and monitor system operation. The SCADA system includes remote terminal units at the pump stations at IRP Sites 1, 2 and 3 for two-way radio communication with the central control unit at the central treatment facility. It also includes an auto-dialer to notify the operating contractor of major failures during non-duty hours/periods of unattended operation.

O&M of the VER System, prior to its termination in November 2013, was based on Standard Operating Procedures established since the VER Demonstration Project commenced in 1997.

The primary activities associated with OM&M of the OU-1 Groundwater Collection, Treatment and Recharge System include the following:

- Visual checks of doors, gates, and system components to include remote sites for signs of vandalism and/or other unauthorized activity.
- Visual and computer checks of all operational equipment to include remote collection points (VER system [no longer operating], pump stations and interceptor wells). Repairs as necessary for proper operation.
- Adjustment of controls and computer set points necessary for efficient system operation.
- Off-site commercial laboratory analysis of treatment systems (central & historically, the Site 1 VER) water quality and air quality parameters to ensure compliance with discharge standards (Note that until 2013, this also included some on-site analysis).
- Response to major alarms during non-duty/unattended periods of operation. Major alarms include steam boiler failure, security alert, process down, high equalization tank level, or fire alarm.
- Scheduled/routine maintenance of equipment.
- On-site re-generation of central system's granular activated carbon units when continuous monitoring device indicates need for such.
- Major maintenance tasks as needed for efficient system operation. Includes replacement of failed pumps, replacement of "consumed" activated carbon in Site 1 VER system (no longer operating) and in the central system (when it can no longer be regenerated on-site), pigging of collection system piping, acid cleaning of stripping towers, and cleaning/repacking of stripping towers.

- Disposal of recovered solvent, spent activated carbon from the Site 1 VER system (no longer operating) and other generated hazardous waste at a licensed off-site disposal facility.
- Monthly Remedial Action Report

As noted above the Air Force's RPO process has been on-going since the initial Groundwater Collection, Treatment and Recharge system was placed in operation in April 1991. Significant RPO changes for the OU-1 Remedy conducted prior to and since the Fourth Five-Year Review were described in Section 4.2 Remedy Implementation.

Groundwater and Surface Water Monitoring: Long-Term Monitoring events are conducted in accordance with the Basewide Quality Assurance Project Plan for Long Term Monitoring at NPL Operable Unit 1, NPL Operable Unit 3/IRP Site 6, NPL Operable Unit 3/IRP Site 21 and MCP Sites (IRP Sites 13 & 22, and the FAFSUST Site). Long-Term Monitoring Reports are issued for each formal/annual event and the results for the GWTP influent and effluent analysis are reported in the Remedial Action Reports submitted monthly for OU-1. The primary activities associated with OU-1's Long-Term Monitoring include the following:

- Annual sampling of selected monitoring wells and one surface water sampling point with analysis for VOCs by an off-site commercial laboratory to confirm the containment and possible reduction of the OU-1 plumes.
- Piezometric levels to monitor changes in groundwater elevations. The Long-Term Monitoring Program was updated in August 2013 to include quarterly groundwater elevation monitoring events to supplement elevation data collected during sampling events.
- Monthly influent and effluent pH monitoring and sampling with off-site analysis for VOCs by the O&M staff. Note that until mid-2013, screening of collection points and selected monitoring wells was conducted using an onsite gas chromatograph (GC); however, this practice was discontinued as part of several optimization efforts. Also, the frequency of pH monitoring was reduced from daily to monthly. Monthly influent and effluent sampling is consistent with the substantive requirements for NPDES General Permits in Massachusetts. The RPO process documented as a component of the selected Remedy in the 2007 ROD is applicable to both the Dynamic Groundwater Remediation System and the Long-Term Monitoring Program.

The following is a listing of OU-1 Long-Term Monitoring Reports that have been issued since the 2012 Five-Year Review:

- *Long-Term Monitoring Report for NPL Operable Unit 1 - May 2013 Samples*; prepared by Versar, Inc., October 2013
- *Long-Term Monitoring Report for NPL Operable Unit 1, November 2013 Samples;* prepared by Versar, Inc., April 2014
- *Long-Term Monitoring Report for NPL Operable Unit 1, April/May 2015 Samples*; prepared by Versar, Inc., February 2017
- *Long-Term Monitoring Report for NPL Operable Unit 1, November 2015 Samples*; prepared by Versar, Inc., February 2017
- *Long-Term Monitoring Report for NPL Operable Unit 1, November 2016 Samples*; prepared by Versar, Inc., July 2017

Remedial Action-Operation Costs: The previous five-year review report for Hanscom AFB included actual annual operation, maintenance and monitoring costs for OU-1/IRP Sites 1, 2, & 3 that had been incurred since the remedial action-operation phase commenced in 1991. Since then, the Air Force has moved to a Firm Fixed-Price performance based contract for conducting this work and costs are not tracked in the same manner. Although actual costs are not available for this five-year period, the Air Force reports no unusual expenditures under their new contract structure that would indicate problems with the remedy.

OU-2/IRP Site 4 Long-Term Management

The RA-O phase ended with the 1st Five-Year Review which documented that the Long-Term Monitoring of the Site's ground water and surface water was no longer necessary to confirm the protectiveness of the remedy. However, the 1st Five-Year Review identified a requirement to remove scrub brush growing in the drainage ditches and on sections of the cap and berms and recommended that a long-term inspection/maintenance program be instituted. The initial field work to remove the scrub brush was completed in the spring of 1998 by PSG, Inc., via a modification to the contract providing operation, maintenance and monitoring support for the on-going OU-1 remedial action. Subsequently, since 1999, the recurring inspection and maintenance of IRP Site 4 has been included in the scope of the Basewide RA-O/LTM contract. OU-2/IRP Site 4 LTM requirements include:

Inspection and Maintenance: Recurring requirements include:

- Periodic inspections to verify integrity of the cap and to monitor for settlement and slope instability
- Fill and/or seed low and bare areas of landfill cap
- Fill animal burrows on landfill cap
- Annually cut grass and brush on the capped area and berms to include the capped northwest lobe outside the bermed landfill capped (main) area
- Remove debris from drainage swales
- Monitoring of LUCs

Note: The grass on the main cap is cut periodically by Massport and a softball league at no cost to Hanscom AFB.

Annual Remedial Action Report: The following is a listing of OU-2/IRP Site 4 Annual Remedial Action Reports that have been issued since the 2012 Five-Year Review. Each report includes a summary of activities for the calendar year and inspection reports with photo documentation. Inspections were performed quarterly through 2013 and annually beginning with calendar year 2014.

- *Calendar Year 2012 Remedial Action Report for NPL OU-2/IRP Site 4*; prepared by Versar, Inc.
- *2013 Annual Remedial Action Report for LF004 – (IRP Site 4);* prepared by Versar, Inc.
- *2014 Annual Remedial Action Report for LF004 – (IRP Site 4);* prepared by Versar, Inc.
- *2015 Annual Remedial Action Report for LF004 (IRP Site 4);* prepared by Versar, Inc.
- *2016 Annual Remedial Action Report for Operable Unit 2, Installation Restoration Program Site 4 (LF004),* prepared by Versar, Inc.

Long-Term Management Costs: The previous five-year review report for Hanscom AFB included actual annual long-term management costs for IRP Site 4 that had been incurred since the 1st Five-Year Review. Since then, the Air Force has moved to a Firm Fixed-Price performance based contract for conducting this work and costs are not tracked in the same manner. Although actual costs are not available for this five-year period, the Air Force reports no unusual expenditures under their new contract structure that would indicate problems with the remedy.

OU-3/IRP Site 6 Remedial Action-Operation

The RA-O phase commenced in September 2001 following completion of the Remedial Action-Construction phase. OU-3/IRP Site 6 RA-O requirements include:

Inspection and Maintenance: Recurring requirements include:

- Periodic (usually quarterly) inspections of fences, gates, signs and permanent survey benchmarks for integrity.
- Periodic (usually quarterly) inspections to verify integrity of the cap and to monitor for settlement, erosion and slope instability
- Mowing of grassed areas of the landfill caps at least once per year prior to the fall inspection.
- Fertilizing, seeding, and mulching as required to establish and maintain grass cover.
- Periodic inspections of groundwater monitoring wells for proper functioning.
- Repairs as necessary if an inspection of the site indicates that corrective action is needed to repair or restore a component of the remedy.
- Monitoring of LUCs

Annual Remedial Action Report: The following is a listing of OU-3/IRP Site 6 Annual Remedial Action Reports that have been issued since the 2012 Five-Year Review. Beginning with the calendar year 2013 activities, the results of Long-Term Monitoring and reporting of inspection and maintenance activities were combined into Long-Term Monitoring/Remedial Action reports. Each report includes a summary of activities for the calendar year and the inspection reports with photo documentation. The frequency of inspections was reduced from quarterly to annually in 2014.

- *Calendar Year 2012 Remedial Action Report for NPL OU-3/IRP Site 6*; prepared by Versar, Inc.
- *2013 Annual Long-Term Monitoring/Remedial Action Report for DP007 – (IRP Site 6);* prepared by Versar, Inc.
- *2014 Annual Long-Term Monitoring/Remedial Action Report for DP007 – (IRP Site 6);* prepared by Versar, Inc.
- *2015 Annual Long-Term Monitoring/Remedial Action Report for Operable Unit 3, IRP Site 6 (DP007);* prepared by Versar, Inc.
- *2016 Annual Long*-Term Monitoring/Remedial Action Report for Operable Unit 3, IRP Site 6 (DP007), prepared by Versar, Inc.

Wetland Mitigation Monitoring: Per the Remedial Design Wetland Mitigation Monitoring & Ecosystem Evaluation is required every five years commencing 2011 until 2031. The following is a listing of OU-3/IRP Site 6 Wetland Mitigation Monitoring Reports that have been issued since the 2012 Five-Year Review.

- *2016 Wetland Mitigation Monitoring & Ecosystem Evaluation Report, Operable Unit 3, Installation Restoration Program (IRP) Site 6;* prepared by Versar, Inc., March 2017

Note: The semi-annual and/or annual monitoring of wetland ecosystem development in the West and East Wetland Restoration Areas, supervised by a Wetlands Scientist, at the beginning (May) and/or end (September) of the growing season for five years was completed in 2006.

Groundwater/Surface Water Monitoring to include Groundwater Compliance Boundary Monitoring: Long-Term Monitoring events are conducted in accordance with the *Basewide Quality Assurance Project Plan for Long Term Monitoring at NPL Operable Unit 1, NPL Operable Unit 3/IRP Site 6, NPL Operable Unit 3/IRP Site 21and MCP Sites (IRP Sites 13 & 22, and the FAFSUST Site)*. The most recent updates to the Long-Term Monitoring Program for OU-3/IRP Site 6 were documented in a *Memorandum – Update to the Long-Term Monitoring Program for DP007/IRP Site 6 at Hanscom Air Force Base (AFB), Massachusetts* (Versar, July 2016). The results of the Long-Term Monitoring events at IRP Site 6 are documented in formal Annual Long-Term Monitoring Reports.

Sampling and analysis of groundwater and surface water are required as part of the remedy selected in the Record of Decision (ROD) for OU-3/IRP Site 6. The primary objective of this effort is to monitor the compliance boundary and the continued natural flushing of residual contaminants in the land filled areas in order to assess the effectiveness of the remedy. The primary activities associated with OU-3/IRP Site 6's Long-Term Monitoring Program include the following:

- Annual sampling of selected monitoring wells and surface water sampling points with analysis for COCs by an off-site commercial laboratory. Also included the sampling and analysis of additional wells on Hanscom Field for dissolved arsenic through 2015.
- Piezometric levels to monitor changes in groundwater elevations.

As noted above the "baseline" groundwater and surface water sampling and analysis was conducted in December 2001 to identify contaminants of concern (COCs) in the groundwater water and surface water and to provide a baseline to monitor changes over time in the contaminant concentration levels. Since then the OU-3/IRP Site 6's Long-Term Monitoring Program has been subjected to the Air Force's Remedial Process Optimization (RPO) which has included the installation of additional monitoring wells and inclusion of additional surface water sampling points to better define the groundwater compliance boundary, refinement of COCs, changes in the frequency of events, and the refinement of monitoring points based on the analysis of each year's results.

The initial sampling and analysis of groundwater at existing monitoring wells selected to help define the groundwater compliance boundary was included in the 2001 baseline monitoring event. The wells selected to help define the compliance boundary have also been included in the post-RA Long-Term Monitoring events that have been conducted at least annually. However, as stated above, the installation of three additional monitoring well couplets down gradient from Site 6 (and on an adjacent Massport or privately owned property) to better define the groundwater compliance boundary was delayed and not completed until September 2002. The initial sampling and analysis of groundwater from these wells was included in the October 2002 Long-Term Monitoring event for Site 6.

Based on the Long-Term Monitoring results through 2005 it was concluded that there was dissolved arsenic in the surface aquifer further downgradient of the site than anticipated and that the compliance boundary should be moved further to the north, near the Shawsheen River. Three additional surface aquifer monitoring wells, all on Massport property north of the site, were installed in 2006 to better define a revised/expanded compliance boundary. These additional wells were initially sampled in July 2006 and were then included in the seasonal (quarterly or spring, summer & fall) Long-Term Monitoring events that were conducted to evaluate seasonal changes/impacts in the downgradient dissolved arsenic.

At a 2006 Project Team meeting, the RPMs from USEPA and MassDEP recommended that the Air Force sample the groundwater in the former off-base Debris Excavation Area 1 east of the site to confirm that the groundwater in this area (which is cross gradient to the normal groundwater flow and also on privately owned property) is not being impacted by Site 6. A three well cluster (surface aquifer/lacustrine layer/lower aquifer) was installed in 2006 and the wells were initially sampled in July 2006 and again in the annual Long-Term Monitoring event in October 2006. Analysis of the samples was for all of Site 6's COCs (VOCs, SVOCs, pesticides, PCBs, and dissolved metals). With the exception of one questionable estimated result for thallium (a metal) the initial sampling and analysis did not identify any COC in the former Debris Excavation Area (DEA) No. 1. In regard to the thallium analysis it was determined that EPA Method 6010B, the method used by the laboratory for the initial metal analysis, was not the best method to quantify low levels of thallium since false positive results are sometimes reported. Since the 2006 DEA No. 1 Baseline Monitoring, the Long-Term Monitoring analysis of DEA No.1's groundwater has been limited to SVOCs and dissolved arsenic which are the principal

COCs for Site 6 plus some additional analysis via Method 7841 or 6020 to confirm that thallium is not a COC.

The installation of the additional monitoring wells installed in 2006 is documented in the *Monitoring Well Installation Report for Additional Compliance Boundary Monitoring Wells*; prepared by Shaw Environmental, Inc., July 2006. The locations of these wells (MW6-119, MW6-120, and MW6-121) relative to the revised compliance boundary are shown on **Figure 23**.

Three (3) additional wells (MW6-123U, MW6-124U, and MW6-125U) were installed in October 2008 on the downgradient side of the compliance boundary. Two of these were on the west side of the Shawsheen River and the 3rd was on the north side of the Shawsheen River. The purpose of these wells is to further define and/or revise the current Groundwater compliance boundary for the Site. These well installations were documented in a letter report dated January 2009 (Metcalf & Eddy, 2009). Also in 2008, the Long-Term Monitoring Program was revised to include three additional surface water sampling points. The locations of these wells and surface monitoring points relative to the revised compliance boundary are shown on **Figure 23**.

In 2014 and Spring 2015, additional wells were installed and sampling activities were conducted for the purpose of confirming the downgradient groundwater compliance boundary and determining whether the source of dissolved arsenic found on Hanscom Field is from IRP Site 6 or not. Three pairs of groundwater monitoring wells were installed at locations west of the Shawsheen River. Each pair was comprised of one well screened in the shallow saturated zone and one well screened in the deep saturated zone. Shallow wells included MW6-126U, MW6-127U, and MW6-128U and deep wells included MW6-126T, MW6-127T, and MW6-128T as shown on **Figure 23**. The well installation was documented in the *Downgradient Investigation Report, DP007 (IRP Site 6)* (Versar, 2015).

The following is a listing of OU-3/IRP Site 6 Long-Term Monitoring Reports that have been issued since the 2012 Five-Year Review:

- *2012 Annual Long-Term Monitoring Report, NPL Operable Unit 3, IRP Site 6 (April, July and October/December 2012 Samples);* prepared by Shaw Environmental, Inc.
- *2013 Annual Long-Term Monitoring/Remedial Action Report for DP007 – (IRP Site 6);* prepared by Versar, Inc.
- *2014 Annual Long-Term Monitoring/Remedial Action Report for DP007 – (IRP Site 6);* prepared by Versar, Inc.
- *2015 Annual Long-Term Monitoring/Remedial Action Report for Operable Unit 3, IRP Site 6 (DP007);* prepared by Versar, Inc.

Remedial Action-Operation Costs: The previous five-year review report for Hanscom AFB included actual annual inspection, maintenance and monitoring costs for IRP Site 6 that had been incurred since the remedial action was constructed in 2001. Since then, the Air Force has moved to a Firm Fixed-Price performance based contract for conducting this work and costs are not tracked in the same manner. Although actual costs are not available for this five-year period, the Air Force reports no unusual expenditures under their new contract structure that would indicate problems with the remedy.

Remedial Action-Operation OU-3/IRP Site 21

Remedial Action-Operation: The RA-O phase at IRP Site 21 commenced on September 15, 2003 following the completion of the Remedial Action-Construction phase. OU-3/IRP Site 21 RA-O requirements include:

Remediation System Operations, Maintenance and Monitoring (OM&M): Prior to shutdown of the Groundwater Treatment System in July 2015, operation and maintenance (O&M) was conducted in accordance with the *Operation and Maintenance Plan, Remedial Action at Operable Unit 3- IRP Site 21*, prepared by Shaw Environmental, Inc. in December 2003. Monitoring of the remediation system was conducted in accordance with the *Basewide Quality Assurance Project Plan for Long Term Monitoring at NPL Operable Unit 1, NPL Operable Unit 3/IRP Site 6, NPL Operable Unit 3/IRP Site 21and MCP Sites (IRP Sites 13 & 22, and the FAFSUST Site)*.

The primary activities associated with OM&M of the OU-3/IRP Site 21 LNAPL/Groundwater Recovery and Treatment System included the following:

- Periodic (at least weekly) visual checks of all operational equipment associated with the LNAPL/groundwater recovery and treatment system and adjustment of controls as necessary for efficient system operation.
- Visual checks of doors and system components for signs of vandalism and/or other unauthorized activity.
- Periodic (normally monthly) off-site commercial analysis of the groundwater treatment system water quality parameters to ensure compliance with discharge standards.
- Backwashing of the groundwater treatment system GAC units and/or the sand filter when operational pressures dictate such.
- Routine maintenance and/or repair of equipment. Includes removing sludge and biomass from the oil-water separator, transfer tank, and backwash water recovery tank.
- Major maintenance tasks as needed for efficient system operation. Includes replacement of failed pumps; replacement of “consumed” activated carbon in groundwater treatment system; replacement of sand filter media; and
- Disposal of recovered LNAPL, spent carbon and other generated wastes.
- Monthly Remedial Action Report

The Air Force’s RPO process has been on-going since the initial LNAPL/Groundwater Recovery and Treatment system was placed in operation in December 2003. A listing of key dates/milestones for the OU-3/IRP Site 21 Remedy through 2011 was included as an attachment to the 2012 Five-Year Review Report. Significant RPO changes for the IRP Site 21 Remedy conducted prior to the Fourth Five-Year Review include:

- Post-RA data documented that the “small scale” enhanced product recovery system within Former LNAPL Pool C was not recovering LNAPL and after the Third Five-Year Review in 2007, the objective of the active recovery system was revised to remediate the localized TCE hotspot centered on RW-6A and RW-7A.

- Recovery well RW-11A was installed and activated in October 2010 with the objective of expanding the remediation system to remediate a developing petroleum contaminated groundwater hotspot in the vicinity of monitoring well ECS-31.

Since the Fourth Five-Year Review, Supplemental Remedial Activities were conducted at Site 21 to enhance the pre-existing remedy and accelerate the rate of destruction of site contaminants. The supplemental remedial activities were intended to comply with the approved remedy in the Site 21 ROD. On July 6, 2015, the groundwater treatment system was turned off to minimize interference with the application of remedial products and also to monitor the behavior of TCE in the aquifer when not under the influence of the pump and treat system. The treatment system has remained off since then.

Supplemental remedial activities, including injections of a chemical oxidant (RegenOx^{TM}) in two wells and installation of filter socks containing a more concentrated oxygen release compound (ORC Advanced®) in twelve wells, were conducted in 2015 as described in the *Final Supplemental Remedial Activities Report for Site 21* (Versar, 2016). More details regarding these activities and the results of performance monitoring are described in Section 6.3 Data Review.

Groundwater and Surface Water Monitoring: Annual (previously Semi-Annual through 2013) Long-Term Monitoring events are conducted in accordance with the *Basewide Quality Assurance Project Plan for Long Term Monitoring at NPL Operable Unit 1, NPL Operable Unit 3/IRP Site 6, NPL Operable Unit 3/IRP Site 21 and MCP Sites (IRP Sites 13 & 22, and the FAFSUST Site)*. The results of these Long- Term Monitoring events at IRP Site 21 are documented in formal Annual Long-Term Monitoring Reports.

The primary objective of the Site 21 Long-Term Monitoring Program is to monitor the natural attenuation and/or the natural containment of the dissolved-phase contaminant plumes and to monitor progress towards achievement of Remedial Action Objectives (RAOs) in order to assess the effectiveness of the RA. The primary activities associated with OU-3/IRP Site 21's Long-Term Monitoring Program include the following:

- Semi-Annual (spring & fall) sampling, which was reduced to Annual (spring) sampling in 2014, of selected monitoring wells and surface water sampling points with analysis for VOCs by an off-site commercial laboratory. Also includes the sampling and analysis for SVOCs and/or TPH (DRO) if determined to be necessary.
- Piezometric levels to monitor changes in groundwater elevations.

As noted above the "baseline" groundwater and surface water sampling and analysis was conducted in October 2003 to document the post-RA extent of the LNAPL Pools and dissolved phase VOCs. Since then, the OU-3/IRP Site 21's Long-Term Monitoring Program has been subjected to the Air Force's RPO process in that the frequency of monitoring specific wells is adjusted and the monitoring points for each event are refined based on the analysis of each year's results. Also, as noted above, the frequency of sampling events was reduced from semi-annual to annual beginning in 2014 as an optimization measure.

The following is a listing of OU-3/IRP Site 21 Long-Term Monitoring Reports that have been issued since the 2012 five-year review:

- *2012 Post RA Long-Term Monitoring Report for Operable Unit 3 – Site 21 (April 2012 and*

December 2012 Samples); prepared by Shaw Environmental, Inc., April 2013

- *Post-Remedial Action Long-Term Monitoring Report, April 2013 for Operable Unit 3 – Site 21;* prepared by Versar, Inc., April 14, 2014.
- *Post-Remedial Action Long-Term Monitoring Report, April 2013 and October 2013 for Operable Unit 3 – Site 21;* prepared by Versar, Inc., May 5, 2014.
- *Post-Remedial Action Long-Term Monitoring Report, Spring 2014 for Operable Unit 3 – Site 21*; prepared by Versar, Inc., October 16, 2014.
- *Post-Remedial Action Long-Term Monitoring Report, Spring 2015 for Operable Unit 3 – Site 21;* prepared by Versar, Inc., December 15, 2015.
- *Post-Remedial Action Long-Term Monitoring Report for Operable Unit 3 – Site 21, Spring 2016;* prepared by Versar, Inc., March 2017.

LNAPL Monitoring: LNAPL monitoring is a component of the Long-Term Monitoring Program for OU-3/IRP Site 21. The site's recovery (active and passive) and groundwater monitoring wells with a post-RA history of LNAPL are periodically checked for the presence of LNAPL with an oil-water interface probe. In 2014, site operations were optimized and the LNAPL monitoring frequency was reduced from monthly to annually. The results of the LNAPL monitoring are reported in the Long-Term Monitoring Reports. Historically, LNAPL measurements were also reported in monthly RA Reports.

Remedial Action-Operation Costs: The previous five-year review report for Hanscom AFB included actual annual operation, maintenance and monitoring costs for IRP Site 21 that had been incurred since the remedial action-operation phase commenced in 2003. Since then, the Air Force has moved to a Firm Fixed-Price performance based contract for conducting this work and costs are not tracked in the same manner. Although actual costs are not available for this five-year period, the Air Force reports no unusual expenditures under their new contract structure that would indicate problems with the remedy.

SECTION 5.0
PROGRESS SINCE THE LAST REVIEW

This is the fifth five-year review for Hanscom Field/Hanscom AFB. This section presents the recommendations and follow-up actions identified in the fourth five-year review, followed by a summary of efforts since 2012 to address the recommendations and follow-up actions. The Fourth Five-Year Review stated that there are no issues related to current site operations, conditions, or activities that affect current and/or future protectiveness of any of the Hanscom Field/Hanscom AFB remedies; however, recommendations and follow-up actions were identified to improve site operations, activities, remedies, or conditions.

5.1 OU-1/IRP SITES 1, 2, & 3 PROTECTIVENESS STATEMENT AND RECOMMENDATIONS FROM PRIOR FIVE-YEAR REVIEW

Protectiveness Statement from Fourth Five-Year Review:

The remedy at OU-1 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Recommendation 1

Continue to implement Remedial Process Optimization initiatives as suggested by operational experience, monitoring and the evolution of new applicable remediation technologies to complete the cleanup in the most cost effective and timely manner possible

Progress: Updates to the long-term monitoring program (LTMP) were prepared and submitted to USEPA and MassDEP in an August 1, 2013 letter, which was approved on August 30, 2013. Changes in the revised LTMP included:

(1) discontinuation of the use of the on-site gas chromatograph (GC), with water samples now all analyzed by off-site laboratory;
(2) reduction in sample frequency from quarterly to annually at all monitoring well locations where quarterly sampling was being conducted;
(3) implementation of groundwater elevation monitoring events to supplement groundwater elevation data collected during sampling events;
(4) suspension of select remediation system operational wells from the sampling program;
(5) corrections to site assignments of select monitoring wells; and
(6) removal of abandoned wells from the LTMP tables.

Additionally, monthly remedial action reports for OU-1 have been streamlined to focus on key information and daily O&M tasks have been reduced where the tasks performed or data generated are not supporting the progression of IRP Site 1 to achieving site closure (i.e. reduced frequency of pH monitoring) as documented in the *Interim Optimized Exit Strategy Implementation Report for FT001 – Fire Training Area II (IRP Site 1)* (Versar, 2016).

As discussed under Recommendation 3, the VER system at Site 1 was suspended in November 2013 due to diminishing recovery and the high cost of its operation.

In addition to the updates and activities described above, additional remedial activities were performed at IRP Sites 1, 2, and 3 for September 19, 2014 through January 23, 2015 in order to supplement existing remedial measures and maintain compliance with

the OU-1 ROD. These supplemental remedial activities and associated performance monitoring are summarized in Section 6.3.

Recommendation 2

Re-survey the In-situ Reactive Zone (IRZ) Area monitoring wells and re-validate or revise the Conceptual Site Model for this area to more fully evaluate the impact of the change of the surface water elevation since the beaver dam was breeched by Massport in 2010. This should be accomplished as soon as possible and an analysis of the current vertical hydraulic gradients should be included in the 2012 Annual Long-Term Monitoring Report.

Progress: In approximately May 2010, Massport removed beavers from the wetland area north/northeast of the airfield (in the vicinity of the IRZ Area, installed a "beaver deceiver" in the stream to prevent future beaver dams from retaining water, and breeched the beaver dam at the end of Runway 23-5. Since then, water levels have been significantly lower in the drainage ditch that receives the groundwater treatment system's discharge and most of the ponded water has disappeared. Due to well modifications made by Massport in 2009, subsequent depth to water measurements in the IRZ Area could not be accurately converted to groundwater elevations; therefore, the impact of the change in surface water conditions due to removal of beavers from the area could not be assessed. On April 24, 2013, Massport re-surveyed the modified wells and an assessment of groundwater elevation and vertical hydraulic gradients in the IRZ Area was presented in the OU-1 Long-Term Monitoring Report for May 2013 Samples (Versar, 2013). The groundwater elevation assessment did not change the conceptual site model for Site 1 or OU-1.

Recommendation 3

Conduct surface recharge for 3 to 6 months in the areas of the Burn Pits and the Burn Pit #1 Runoff Area and evaluate the effect of recharging on remedy. Also re-evaluate cost effectiveness of continuing VER at Site 1.

Progress: Surface recharge was conducted from August 29, 2012 until November 28, 2012. The effectiveness of the VER system was evaluated following the period of surface recharge and a recommendation was made to discontinue VER system operations at Site 1. The evaluation and request to discontinue VER system operations were documented in a July 9, 2013 letter to EPA and MassDEP and VER system operations were terminated on November 30, 2013 (Versar, 2016).

Recommendation 4

Suspend operation of BIW-2 for 12-18 months and evaluate the impact of this suspension and the necessity for continued operation in the 2012 and/or 2013 Annual Long-Term Monitoring Reports.

Progress: Termination of groundwater recovery from BIW-2 was scheduled to begin in 2014; however, to support successful operation of the wet well (i.e., not losing suction and thereby shutting down), it was determined that continued operation of BIW-2 is required and groundwater recovery will continue indefinitely. The impacts of the continued operation will be evaluated through the continued implementation of the LTMP (Versar, 2016).

Recommendation 5

Re-initiate groundwater collection and recharging at Site 3 for 3-6 months to confirm that no further active cleanup is required for the IRP Site 3 source areas.

Progress: Groundwater collection and recharge was re-initiated in late 2013 and it was concluded that groundwater collection from the Site 3 trench was not contributing significantly to the contaminant mass removal from Site 3 groundwater. Groundwater collection from and surface water recharge into the area was terminated in November 2013; however, monitoring well OW3-14, located adjacent to the collection trench, indicated fluctuating concentrations of COCs above and below cleanup criteria in November 2013. Subsequently, the well OW3-14 was added to the treatment area for enhanced reductive dechlorination treatment and performance monitoring. Enhanced reductive dechlorination was performed in late 2014 (Versar, 2016). Performance evaluation of the in-situ treatment at well OW3-14 is documented in the *OU-1 Remedial Action-Completion and Performance Monitoring Report* (Versar, 2016) and is discussed in Section 6.3 of this report.

5.2 OU-2/IRP SITE 4 PROTECTIVENESS STATEMENT AND RECOMMENDATIONS FROM PRIOR FIVE- YEAR REVIEW AND PROGRESS SINCE PRIOR FIVE-YEAR REVIEW

Protectiveness Statement from Fourth Five-Year Review:

The remedy at OU-2 continues to be protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

No specific recommendations were identified.

5.3 OU-3/IRP SITE 6 PROTECTIVENESS STATEMENT AND RECOMMENDATIONS FROM PRIOR FIVE- YEAR REVIEW AND PROGRESS SINCE PRIOR FIVE-YEAR REVIEW

Protectiveness Statement from Fourth Five-Year Review:

The remedy at OU-3/IRP Site 6 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Recommendation 1

Determine whether or not the groundwater compliance boundary is adequately defined by the current network of monitoring wells and provide a satisfactory/acceptable explanation for the dissolved arsenic that has been found on Hanscom Field. If this is not accomplished in the next 3-5 years then a ROD Amendment or Explanation of Significant Difference will be required to address the Groundwater Compliance Boundary component of the ROD.

Progress: Since the previous five-year review, it was determined that the existing groundwater compliance boundary for IRP Site 6 is serving its intended purpose to prevent human or ecological exposure to site-derived contamination. It was determined that arsenic concentrations observed at and north of the compliance boundary, including concentrations that exceed the MCL, are naturally occurring. This determination along with USEPA and MassDEP's approval of the findings, was documented in a letter report entitled Final Compliance Boundary Confirmation for DP007 (Site 6) at Hanscom Air Force Base (Versar, March 2016). Activities conducted that contributed to this

determination included expansion of the Site 6 monitoring well network, increased groundwater monitoring frequency to evaluate seasonal trends, and most recently, a detailed investigation in 2014 and 2015 to evaluate the source of arsenic observed at and in the vicinity of Site 6. The results of the detailed investigation are provided in the Downgradient Investigation Report (Versar, 2015). To maintain the compliance boundary, it was determined that arsenic will remain a COC and will continue to be sampled for in the compliance boundary wells only.

5.4 OU-3/IRP SITE 21 PROTECTIVENESS STATEMENT AND RECOMMENDATIONS FROM PRIOR FIVE- YEAR REVIEW AND PROGRESS SINCE PRIOR FIVE-YEAR REVIEW

Protectiveness Statement from Fourth Five-Year Review:

The remedy at OU-3/IRP Site 21 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Recommendation 1

Continue to implement Remedial Process Optimization initiatives as suggested by operational experience, monitoring and the evolution of new applicable remediation technologies to complete the cleanup in the most cost effective and timely manner possible.

Progress: A number of measures have been taken since the previous five-year review to further optimize the remedy as follows:

1) The frequency of long-term groundwater and surface water monitoring events was reduced from semi-annual to annual events in 2014. Also, the frequency of LNAPL monitoring was reduced from monthly to annually in 2014.

2) The frequency of monitoring specific wells has continued to be refined based on analysis of each year's results.

3) The groundwater collection and treatment system continued to operate during this five-year review period until July 2015, when Supplemental Remedial Activities were conducted at Site 21 to enhance the pre-existing remedy and accelerate the rate of destruction of site contaminants. On July 6, 2015, the groundwater treatment system was turned off to minimize interference with the application of remedial products and also to monitor the behavior of TCE in the aquifer when not under the influence of the pump and treat system. Two types of remedial amendments were applied to separately target petroleum hydrocarbons and chlorinated solvent-related contaminants, including Oxygen Release Compound (ORC) Advanced® and RegenOx™. The details of the remedial activities and subsequent performance monitoring are provided in the Final Supplemental Remedial Activities Report for Site 21 (Versar, 2016). More details regarding these activities and the results of performance monitoring are described in Section 6.3 Data Review.

Recommendation 2

Install additional monitoring wells in Zone 2 of Site 21 to evaluate whether or not expansion of the active recovery network to cover more of this Zone would be beneficial in expediting the cleanup of Zone's 2 groundwater.

Progress: Since the previous five-year review, the focus of efforts to remediate Site 21 groundwater have changed from active remedial efforts (i.e. pump and treat) in the Zone

2 area to passive in-situ treatment methods, with a goal of achieving a higher rate of contaminant mass destruction. To date, additional monitoring wells have not been installed in Zone 2, since they were intended for evaluation of the active recovery network. Rather, in July 2015, the active groundwater collection and treatment system was shut down and supplemental remedial activities were conducted. The active groundwater collection and treatment system was turned off to minimize interference with the application of remedial products and also to monitor the behavior of TCE in the aquifer when not under the influence of the pump and treat system. ORC Advanced® filter socks were placed in 12 wells at Site 21, including wells ECS-31, RW-1, and RW-11A within the Zone 2 area. The effectiveness of the treatment was evaluated during the May 2016 LTM event. While VOC concentrations in May 2016 at well ECS-31 did not indicate a positive impact on VOC concentrations that are present above regulatory standards and RBRGs, May 2016 results for wells RW-1 and RW-11A did appear to show downward trends as compared to previous rounds. More detailed discussion is included in the Data Review section of this report. Following the May 2016 LTM event, the filter socks were replaced in the same wells in late June 2016. The treatment effectiveness will continue to be evaluated as part of the upcoming 2017 LTM event.

Recommendation 3

Since Buildings 1823, 1833 and 1834 are either on or adjacent to OU-3/IRP Site 21 and VOC contamination occurs in the unsaturated zone and/or the uppermost saturated zone at this site, the subsurface vapor intrusion to indoor air exposure pathway needs to be evaluated in accordance with EPA's 2002 draft guidance. This evaluation should be completed within 6 months using the Long-Term Monitoring data scheduled to be collected in the fall of 2012.

Progress: Since the previous five-year review, a vapor intrusion investigation was conducted and the results were documented in the July 31, 2014 Final Vapor Intrusion Investigation Report, Operable Unit 3/IRP Site 21, prepared by Versar, Inc. The investigation was conducted in accordance with MassDEP Interim Final Vapor Intrusion Guidance (WSC-11-435) and evaluated Building 1823 (Entomology/Pest Control), Building 1833 (COCESS/MaraTech), and Building 1834 (Material Control). An analysis of historical groundwater COC concentrations in the vicinity of these buildings was conducted following procedures in the MassDEP guidance. Based on the review of groundwater data, it was concluded that 1,2-dichlorobenzene, 1,4-dichlorobenzene, and carbon tetrachloride for Building 1833 and TCE for Building 1823 should be evaluated further for potential vapor intrusion by collecting and analyzing sub-slab vapor samples. Sub-slab vapor samples were collected in February 2014 and locations were selected based on potential vapor intrusion points such as cracks in the slab, utility penetrations, floor drains, etc. Soil vapor samples were analyzed for TO-15/APH (Air-phase petroleum hydrocarbons). While several VOCs were detected in the samples, none of the detections exceeded the commercial/industrial sub-slab soil gas screening criteria presented in the MassDEP guidance. The overall conclusion of the evaluation was that the vapor intrusion pathway is not a concern.

SECTION 6.0
FIVE-YEAR REVIEW PROCESS

This section describes the activities performed during the five-year review process and provides a summary of findings.

6.1 ADMINISTRATIVE COMPONENTS AND COMMUNITY INVOLVEMENT

Administrative Components

The Fifth Five-Year Review of Hanscom Field/Hanscom AFB Superfund Site was kicked-off between the Air Force and its five-year review contractor, URS/AECOM, on November 9, 2016. A schedule was subsequently established to allow for Air Force and regulatory agency reviews and finalization of the five-year review report by September 26, 2017 (the signature date of the prior five-year review). Site inspections and interviews were conducted in early December 2016 with review team members and other stakeholders. Team members who participated in the five-year review process included the Hanscom AFB Remedial Project Manager, AFCEC Section Chief, USEPA Region 1 RPM, and MassDEP Interim RPM. The O&M Manager for the Air Force's Remedial Action-Operations Contractor (Versar, Inc.) participated in the site inspection and was interviewed as discussed further below.

Community Involvement

The Hanscom AFB Restoration Advisory Board (RAB) has been kept up-to-date as to the status of all of Hanscom AFB's on-going remedial actions. Also, minutes from meetings are sent to RAB members and others on the RAB mailing list who did not attend the meeting. Meetings since the 2012 Five-Year review to present IRP status updates were held on:

September 18, 2012
November 13, 2013
September 24, 2014
October 27, 2015
October 26, 2016

Specific to this Fifth Five-Year Review, the Air Force plans to send the Executive Summary of the Fifth Five-Year Review Report to RAB members and others who attended the October 26, 2016 RAB meeting.

6.2 DOCUMENT REVIEW

The five-year review consisted of a review of relevant documents, including OM&M records (see **Attachment A – List of Documents Reviewed/References**). In addition, applicable groundwater cleanup standards, as listed in the RODs for OU-1, OU-3/IRP Site 6, and OU-3/IRP Site 21 were reviewed (see **Attachment B**).

6.3 DATA REVIEW

Data Review OU-1/IRP Sites 1, 2, and 3

OU-1 Operational Data for Groundwater Remediation System: Key operational data associated with the groundwater remediation system are summarized below. Note that the GWTP treats VOCs to below detectable levels.

	2012	2013	2014	2015	2016
Average Monthly Total VOCs Influent (ug/L)	221.6	185.1	282.2	229.3	270.8
Plant Influent Total Gallons	62,893,136	53,723,305	42,461,494	27,030,007	28,993,970
Pounds of VOCs Removed	116	83	100	51.7	65.5
Average gpm	119.3	108.7	102.6	56.6	58.5
VER Contribution - gpm	0.4	VER operations discontinued	0	0	0
On-site Recharge - gpm	8.53	15.3	6.4	0	0
Percent of Time GWTP Operating	96.4%	94.48%	78.76% [1]	90.87%	94.05%
Percent of Time VER System Operating	38.5%	VER operations discontinued	0%	0%	0%

1. Between September 24 to November 10, 2014, the GWTP was shut down for field activities associated with implementation of the in-situ remedial treatments at OU-1.

OU-1 Supplemental Remedial Activities and Performance Monitoring Data: Between September 19, 2014 and January 23, 2015, remedial action construction (RA-C) activities were conducted to supplement the existing remedial activities at OU-1 Sites 1, 2, and 3. Specifically, the following activities were conducted:

- At Site 1, in-situ chemical oxidation (ISCO) reagents were injected near the historical Site 1 source area (near monitoring well RAP1-3R/Burn Pit #1 Runoff Area) with a goal of

reducing TCE concentrations by 80 percent in the vicinity of monitoring well RAP1-3R. Injection of reagents (sodium permanganate/water mixture) at well GM-97-EW-2 (screened in the lower/till and bedrock aquifers) occurred on October 27, 2014. **Figure 18** shows the injection well and surrounding area.

- At Sites 2 and 3, BioTrap® installation and sampling was conducted to determine the presence of VOC-degrading bacteria (i.e., Dehalococcoides spp. [DHC]). BioTrap® results indicated that additional DHC injections were required to improve the microbe population for effective implementation of enhanced reductive dechlorination (ERD). In September 2014, 2 lower/till aquifer injection wells were installed at Site 2 and in October 2014, 11 surface aquifer wells were installed at Sites 2 and 3 (**Figures 19, 20, and 21**). In October 2014, emulsified vegetable oil (EVO) injections were conducted at Sites 2 and 3. EVO mixtures were injected at existing injection well (IW-5), newly installed injection wells (INJ-01 through INJ-13), and direct injection points (DIPs) (DIP-01 through DIP-12). All DIPs were abandoned following completion of injections. To aid in biodegradation, BAC-9 (containing DHC microbes) was injected in October 2014 following the EVO injections. The ERD substrates were injected with a goal of achieving MCLs and MCP GW-1 and GW-2 standards in the vicinity of surface aquifer monitoring wells P02-1S and OW2-6 at Site 2, lower aquifer monitoring wells B114-MW, B115-MW, and IW-5 at Site 2, and surface aquifer monitoring wells OW3-14 and RAP 3-3S at Site 3.

Performance monitoring was conducted to evaluate the effectiveness of the ISCO and ERD injections and to determine if additional remedial treatments are needed and/or if the results of the injections would trigger changes in the manner in which the OU-1 GWTP is being operated. At Site 1, a baseline groundwater sampling event was performed prior to ISCO injections in September 2014 and post-injection events occurred on December 4, 2014 (Round 1), December 30, 2014 (Round 2), and January 23, 2015 (Round 3). At Sites 2 and 3, a baseline groundwater sampling event was performed prior to EVO injections in October 2014 and post-injection events occurred on April 28 and 29, 2015 (Round 1), July 28 to 30, 2015 (Round 2), and November 4 and 5, 2015 (Round 3). Evaluation of the performance monitoring data was conducted in the *Remedial Action Construction (RA-C) Completion and Performance Monitoring Report* (Versar, 2016).

Site 1 Groundwater Monitoring Results

At Site 1, the overall conclusion of the performance evaluation monitoring was that there was no indication of chemical oxidant reaching the target performance monitoring well. The TCE concentration in monitoring well RAP1-3R actually increased from 160 ug/L (baseline event) to 640 ug/L during the final (Round 3) performance monitoring event. Baseline sampling was conducted at six well locations (CW-4, GM-97-EW-4, GM-97-M3, GM-97-EW-3, RAP1-3R, and GM-97-EW-2). Post-injection sampling included the same wells, with the exception of GM-97-EW-2, where the injection occurred, which did not have any analytes detected above project action limits during the baseline sampling. The wells were tested for sodium permanganate and no indication of ISCO reagent breakthrough was observed. With the exception of the injection well, groundwater samples showed no significant changes in ORP, DO, specific conductance, and pH values post-injection as would be expected. Groundwater samples were also analyzed for dissolved phase metals and no significant changes were noted following the injection events, as would have been expected with a change in redox conditions. Monitoring of TCE will be continued in well RAP1-3R to determine the need for additional injections or alternative approaches.

Site 2 and Site 3 Groundwater Monitoring Results

As stated above, the goal of ERD substrate injections at Site 2 was to achieve MCLs and MCP GW-1 and GW-2 standards in the vicinity of surface aquifer monitoring wells P02-1S and OW2-6 and lower aquifer monitoring wells B114-MW, B115-MW, and IW-5. The goal of ERD substrate injections at Site 3 was to achieve MCLs and MCP GW-1 and GW-2 standards in the vicinity of surface aquifer monitoring wells OW3-14 and RAP 3-3S. During performance monitoring, total organic carbon (TOC) results showed that the TOC concentrations in all monitoring wells, with the exception of well B115-MW at Site 2, were inadequate for ERD. ORP measurements indicated that reducing conditions were not established, as is favorable for ERD treatment. Methane data showed a significant increase at well B115-MW only, indicating that reducing conditions were developing at that location only. Concentrations of chlorinated VOCs were reduced in B114-MW, B115-MW, and RAP2-3T following the EVO injections; however, VOC concentrations were not reduced to below MCLs and MCP GW-1 and GW-2 standards in all wells. Additional treatment will be needed to achieve NFA for groundwater in these areas.

OU-1 Long-Term Monitoring Data: The groundwater collection, treatment (GWTP) and recharge system began operating in 1991 and has operated continuously since that time. The system was designed to achieve mass reduction of source materials and hydraulic containment of OU-1 groundwater contamination. The collection system consists of interceptor wells and/or collection trenches at each of the three sites. Four boundary interceptors wells (i.e., IW-1, IW-2, IW-3, and IW-4) are aligned along a transect near Sites 1 and 2 and the northern Hanscom Field/Hascom AFB boundary with Bedford's Hartwell Town Forest. Collection trenches are used to recover groundwater from the surface aquifer while interceptor wells recover groundwater from the lower/till and bedrock aquifers. A vacuum-enhanced recovery system was operational adjacent to Burn Pit #1 Runoff area at Site 1 from 1997 to 2013. In July 2013, the VER system was suspended following the Fourth Five-Year Review Report recommendation. Consistent groundwater collection and recharge was terminated in 2001 at Site 3 following reported groundwater concentrations well below cleanup criteria. Groundwater collection and recharge at Site 3 was re-initiated in late 2013 to confirm that no further active cleanup is required for the Site 3 source areas and it was confirmed that groundwater collection from the Site 3 trench was not contributing significantly to contaminant mass removal from Site 3 groundwater. Groundwater from Sites 1 and 2 is still actively treated using the GWTP.

Contaminants of concern at OU1 consist of chlorinated VOCs and aromatic VOCs. The VOCs with the highest concentrations are the CVOCs trichloroethylene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride.

Due to the complexity of the OU1 groundwater and surface water contamination, the analysis of results is presented in the following sections:

- Surface Water
- Site 1
- Site 2
- Site 3
- Additional OU-1 Groundwater Locations

Surface Water

The Long-Term Monitoring surface water monitoring point, RAP1-4SW, is located in the Hanscom Field storm water discharge ditch between Sites 1 and 2 which empties into Wetland B/beaver pond north of Hanscom Field (see **Figure 22**). This ditch also receives groundwater treatment effluent that is not recharged on-site. The surface water monitoring point is located downstream of the treated effluent discharge point. In 1991, the TCE concentration at this monitoring point prior to the startup of the groundwater collection, treatment, and recharge system was 91 micrograms per liter (µg/L). By the June 1996 Long-Term Monitoring Event, the TCE concentration had fallen below the TCE MCL. No subsequent TCE concentrations have been reported over the MCL. This is true for all other VOCs. Reductions were attributed to: (1) the Site 1 collection trench successfully contains any residual surface aquifer contamination at the source area precluding its migration to downgradient locations; (2) prior to the operation of the BIW's the drainage ditch received both surface runoff and the discharge from the surface aquifer because the natural vertical gradient was up (from the bedrock, lower and surface aquifers to the surface water); (3) beaver activity in the area which resulted in a significant rise in the elevation of the surface water which may have changed the vertical gradients. Operation of the BIWs and IW and/or the change in the surface water elevation reversed the natural vertical hydraulic gradients to the point that the surface water was recharging the surface aquifer with uncontaminated water.

The 2002 Five-Year Review reported that TCE concentrations had declined by 1999 to below 1.0 µg/L. The 2012 Five-Year Review reported a TCE concentration collected in November 2011 of 1.5 µg/L. Since 2011, samples were collected in May and November 2013, May and November 2015, and November 2016. TCE concentrations ranged from 0.67J ug/L to 3.9 ug/L and while elevated compared to the several years of historical data showing TCE below a 1 ug/L reporting limit, they do not exceed the 5 ug/L MCL and GW-1 Standard. Other VOCs detected during one or more sampling events in the past five years with their maximum concentration include: cis-1,2-dichloroethene (6.3 ug/L), 1,1,1-trichloroethane (0.19J ug/L), 1,1,-dichloroethane (0.84J ug/L), acetone (4.1J ug/L), 1,1-dichloroethene (0.19J ug/L), toluene (0.36J ug/L), and vinyl chloride (0.34J ug/L). All of these detections were below MCLs and MCP GW-1 and GW-2 Standards.

Site 1

Site 1 source areas are Burn Pit #1 (with an associated runoff area) and Burn Pit #2. These areas plateau on the southeast side of Hartwells Hill. Burn Pit #1 is considered the major source of contaminated groundwater migrating away from the site. There is no lacustrine layer at this location and it appears that waste liquids poured into the pit, or flowing onto the runoff area, were able to make their way through the surficial glacial till and into the bedrock fractures underlying the site.

The Site 1 plume originally extended in a southeasterly direction from the source areas (burn pits) on Hanscom Field to the vicinity of BIW-3 and BIW-4 in the Hanscom AFB Campground area. The Site 1 plume comingles with the Site 2 plume in the Campground area and changes direction to flow northeast into the Hartwell Town Forest. It is assumed that the Site 1 plume generally follows a natural trough in the surface of the bedrock. Groundwater flow also follows a similar path; the remedial investigation of OU-1 included modeling which predicted that groundwater exits OU-1 via discharge to the surface water which flows into the Shawsheen River.

Exceedances of TCE, TCE degradation products, and/or additional VOCs were reported in all aquifers of interest (surface, lower/glacial till, and bedrock) with the highest concentrations reported in the bedrock. Data have indicated a continued, but diminishing source of chlorinated solvents in the vicinity of bedrock well RAP1-3R. Historical concentrations suggested the presence of dense non-aqueous phase liquid in the vicinity of RAP1-3R; however, concentrations of TCE have decreased since 2009 and degradation products, cis-1,2-DCE and vinyl chloride have remained at concentrations less than historical values.

Monitoring wells located downgradient of RAP1-3R have exhibited persistent, yet slowly decreasing concentrations of COCs. Several wells reported significant decreases in COC concentrations in the April/May 2015 sampling event to levels below cleanup criteria. However, many wells reported increases in concentrations during the November 2015 sampling event above cleanup criteria: B237 (vinyl chloride), B239 (TCE, cis-1,2-DCE, vinyl chloride), RAP1-6T (TCE, cis-1,2-DCE, vinyl chloride), and RAP2-2T (vinyl chloride). One well (B239, a lower/till aquifer well) reported TCE, cis-1,2-DCE, and vinyl chloride at concentrations higher than historical data. An additional well (B237, a bedrock aquifer well) reported COCs greater than historical values during the November 2016 sampling event. Additional wells indicated increases of TCE, cis-1,2-DCE, and vinyl chloride; however, increases were within historical trends.

The table below provides a summary of the highest reported concentrations of TCE, cis-1,2-DCE, and vinyl chloride in each aquifer zone for 2011 through 2016 sample data.

Table 6
Recent Maximum Concentrations in IRP Site 1 Groundwater

	Trichloroethene		Cis-1,2-dichloroethene		Vinyl Chloride	
Date	**Well**	**Result**	**Well**	**Result**	**Well**	**Result**
Surface Wells						
2011	RAP1-3S	13	RAP1-3S	240	RAP1-6S	38
2012	RAP1-3S	3	RAP1-6S	410	NA	NS
2013	RAP1-3S	12	RAP1-6S	230	RAP1-6S	98
2014	RAP1-3S	30	RAP1-3S	13	RAP1-3S	ND
2015	RAP1-3S	13*	RAP1-6S	380	RAP1-6S	110
2016	RAP1-6S	0.38J	RAP1-6S	9.0	RAP1-6S	74
Lower/Till Wells						
2011	V-1	3100	IRZ-4	3100	RAP2-2T	170
2012	V-1	3100	IRZ-5	2000	NA	NS
2013	V-1	1700	IRZ-5	2400	IRZ-5	170
2014	CW-4	6.9	B108-MW	56	B108-MW	0.66J
2015	IRZ-4	110	IRZ-4	500	IRZ-5	180
2016	IRZ-4	150J	IRZ-4	680J	IRZ-5	170J
Bedrock Wells						
2011	RAP1-3R	14000	RAP1-3R	8600	RAP1-6R	590

Date	Trichloroethene		Cis-1,2-dichloroethene		Vinyl Chloride	
	Well	Result	Well	Result	Well	Result
2012	RAP1-3R	4600	RAP1-3R	6500	NA	NS
2013	RAP1-3R	790	RAP1-3R	4800	RAP1-6R	590
2014	RAP1-3R	560	RAP1-3R	3700	RAP1-3R	280
2015	RAP1-3R	430	RAP1-3R	3600	RAP1-3R	280
2016	RAP1-3R	330J	RAP1-3R	2600J	RAP1-6R	550J

Notes:
Concentrations are reported in units of ug/L
* - Sample collected May 2015, well was dry November 2015
J - estimated value
NA - Not applicable
ND - Not detected
NS - Not sampled

Concentrations are either decreasing or stable in the lower/till and bedrock aquifers. Minor fluctuations are observed in concentrations from the surface aquifer. Concentrations in wells downgradient of RAP1-3R have decreased and remained relatively stable since 2012. The eastern edge of the TCE plume remains stable within the Boundary/Forest and plume recession in the western area of the site is occurring. For the lower/till aquifer, the upgradient TCE plume boundary has recessed, as indicated by the concentrations in V-1 and IW-10. The bedrock aquifer TCE plume remains stable, with a slight increase of TCE noted in cross-gradient well B-237; however, TCE concentrations in downgradient bedrock hotspots RAP1-6R and RAP1-7 continue to fluctuate. Concentrations in these two wells are at or below concentrations noted in 2011. In the surface aquifer, the TCE plume is only present near the source area.

Site 2

Site 2 Source Areas include drum burial pits within the area defined by the rectangular surface aquifer collection trench. A lacustrine layer is present and appears to have prevented waste liquids from escaping buried containers and entering the glacial till and bedrock fractures underlying the site. Groundwater contamination has been found in the surface and lower/till aquifers (not the bedrock aquifer).

In November 2016, exceedances of one or more VOCs were observed in two surface aquifer monitoring wells (OW2-6, P02-1S) and one lower/till aquifer monitoring well (B114). In May and November 2015, exceedances of one or more VOCs were observed in four surface aquifer monitoring wells (OW2-3, OW2-6, PO2-1S, and RFW-11) and both lower/till aquifer monitoring wells (B114 and B115). In the previous May and November 2013 LTM events, exceedances of one or more VOCs were observed in two surface aquifer monitoring wells (PO2-1S and OW2-6) and in lower/till aquifer wells B114 and B115. Recent results are relatively consistent with historical data. The vinyl chloride concentration in B114 was at a historical high concentration in November 2015, possibly due to natural attenuation of TCE,; however, concentrations of TCE, cis-1,2-DCE, and/or vinyl chloride (B115 only) decreased in both lower/till aquifer monitoring wells. Concentrations of TCE in B114 and cis-1,2-DCE in B115 have been reported as nondetect. Injection of ERD substrate was performed in August 2014 in Site 2 areas where

COCs were present above cleanup criteria as discussed above. While concentrations of some chlorinated VOCs were reduced in B114-MW, B115-MW, and RAP2-3T following the EVO injections, VOC concentrations were not reduced to below MCLs and MCP GW-1 and GW-2 standards in all wells. Additional treatment will be needed to achieve NFA for groundwater in these areas.

Site 3

Exceedances of the cleanup criteria for TCE were observed from 2013 through 2016 in surface aquifer monitoring well RAP3-3S. Well OW3-14 has seen fluctuating levels of cis-1,2-DCE and vinyl chloride above and below the cleanup criteria. This is consistent with historical data and indicates continued decreases of TCE and/or daughter products in the surface aquifer. No contamination has been identified in the lower/till or bedrock aquifers. Injection of ERD substrate was performed in August 2014 in surface aquifer monitoring wells OW3-14 and RAP 3-3S as discussed above. Performance monitoring did not show a reduction in VOC concentrations to below MCLs and MCP GW-1 and GW-2 standards and additional treatment will be needed to achieve NFA for groundwater in that area.

Additional OU-1 Groundwater Locations

Monitoring is conducted downgradient of plume source areas (Sites 1, 2, and 3) and their immediate vicinity at locations referred to as the Remediation System, the Boundary Forest Area, and the Airfield Area. Remediation System wells capture lower/till and bedrock groundwater contamination originating from Sites 1 and 2. Boundary Forest Area wells monitor potential migration of contaminant plumes originating from Sites 1 and 2. Airfield wells monitor potential downgradient migration of contaminants originating from Site 3.

Remediation System

Groundwater is currently being pumped from several interceptor wells (IW-1, IW-2, IW-6, IW-10, and IW-11) and the collection trench in the vicinity of Site 1 and interceptor wells IW-3 and IW-4 and the collection trench at Site 2 and delivered to the GWTP for treatment. IW-1 and IW-4 are located at the Hanscom Field/Hanscom AFB boundary with the Town of Bedford conservation lands and continue to capture TCE, cis-1,2-DCE, and/or vinyl chloride concentrations in excess of cleanup criteria. These wells draw back contaminants that have migrated from the Sites 1 and 2 plume source areas, including bedrock monitoring well P02-2R near IW-4 where TCE and cis-1,2-DCE concentrations are present above cleanup criteria at 210 and 260 µg/L, respectively. RAP1-7T (lower/till) and RAP1-7 (bedrock) are located near the Community Gardens in the George Jordan Conservation Area. TCE is present in these wells in relatively stable concentrations in excess of cleanup criteria with the higher concentrations continuing to be found in the bedrock aquifer.

Remediation wells IW-6 and IW-11 continue to capture TCE, cis-1,2-DCE, and vinyl chloride concentrations in excess of cleanup criteria at Site 1 and IW-5 and IW-10 have had non-detected or trace contaminant concentrations during the most recent sampling events. Well IW-3 was last sampled in 2012 and had shown no detections of TCE during the previous few years of sampling at that location.

Boundary/Forest

Wells located near the boundary between Hanscom Field and the Bedford Town Forest, as well as wells located within the Bedford Town Forest, are collectively identified as “Boundary/Forest” wells in recent LTM reports. The Bedford Town Forest is comprised of the Hartwell Town

Forest, Hartwell Brook Conservation Area, George Jordan Conservation Area, South Road Soccer Fields, and the Community Gardens. No contamination above cleanup criteria has been identified in the surface aquifer in the Boundary/Forest area. During the most recent November 2016 LTM event, one or more VOCs were reported in the four lower/till aquifer monitoring wells above cleanup criteria: B126 (TCE), B248 (cis-1,2-DCE, TCE), P02-1T (cis-1,2-DCE, vinyl chloride), and P02-2T (cis-1,2-DCE, TCE). Five bedrock aquifer monitoring wells reported one or more VOCs above cleanup criteria: B244A (TCE), P02-2R (TCE and cis-1,2-DCE), PT2-RA (TCE, cis-1,2-DCE, and vinyl chloride), RAP1-7 (TCE), and RAP2-1R (TCE and cis-1,2-DCE). Results from November 2016 were relatively consistent with historical data with excess concentrations relatively stable or decreased. Three wells reported nondetect concentrations of vinyl chloride, including B254, B126, RAP1-7, RAP1-7T, RAP2-1T, and RAP2-3T.

Airfield

No exceedances of COCs above cleanup criteria were reported for wells within the Airfield area in any of the three aquifer zones. Results are consistent with historical data and indicate potential contaminants originating from Site 3 have not migrated downgradient in excess of cleanup criteria. Note that concentrations of cis-1,2-dichloroethene frequently exceed the current GW-2 Standard of 20 ug/L at surficial well RAP3-4S; however, there are no buildings located in proximity to this location on Hanscom Field.

1,4-Dioxane Assessment: In May 2016, 1,4-dioxane sampling was conducted at OU-1 and Site 21 for the purpose of determining whether 1,4-dioxane was present above the MCP GW-1 standard of 0.3 ug/L. Results for Site 21 are discussed separately under the Data Review section for OU-1. The field activities and analytical results were documented in a Final – Technical Memorandum for May 2016 1,4-Dioxane Sampling at OU-1 and IRP Site 21 (Versar, July 2016). 1,4-dioxane is an emerging contaminant that had not been sampled for at Hanscom AFB prior to the May 2016 event. Because 1,1,1-TCA and 1,1-DCE have been observed in groundwater at OU-1, it was considered possible that 1,4-dioxane may be present as a co-contaminant. 1,4-dioxane has been used as a stabilizer for chlorinated solvents and is associated with 1,1,1-TCA and 1,1-DCE, in particular.

At Site 1, groundwater samples were collected from the following locations:

- six monitoring wells (B114-MW, B115-MW, B240, RAP1-3R, RAP16T, and RAP1-6R)
- two of five active extraction (interceptor) wells (IW-6 and IW-11)
- GWTP influent and effluent

Additionally, a surface water sample was collected from one location (RAP1-SW4).

Extraction wells IW-6 and IW-11 were shut down 1 hour prior to sampling to allow groundwater to recharge and then turned on again so that a grab sample could be collected from the discharge line during the normal cycle of the dedicated pump. At the time of collection of the GWTP influent and effluent samples, five extraction wells (IW-1, IW-2, IW-3, IW-6, and IW-11) were operating and the groundwater from the wells was pumped to an equalization tank at the GWTP, where it mixed and homogenized along with any rainwater that is captured, likely resulting in dilution.

Results are summarized in the table below and detections that are above the MCP GW-1 Standard of 0.3 ug/L are bolded. Note that there is no federal MCL and the MCP GW-2 and GW-3 Standards (6,000 ug/L and 50,000 ug/L, respectively) were not exceeded.

Table 7
1,4-Dioxane Results for OU-1 Samples

Location	Aquifer	1,4-Dioxane Concentration (ug/L)
GWTP Influent	N/A	0.17 J
GWTP Effluent	N/A	0.13 J
RAP1-SW4	N/A (surface water)	0.057 U
B114-MW	Lower/Till	**12**
B115-MW	Lower/Till	0.057 U
IW-11	Lower/Till	**4**
RAP1-6T	Lower/Till	**0.43**
B240	Bedrock	**3.3**
IW-6	Bedrock	**2.9**
RAP1-3R	Bedrock	**0.54**
RAP1-6R	Bedrock	**14**

Notes:
U = Not detected above method detection limit (MDL)
J = Concentration is approximate (less than reporting limit, but above MDL)

While 1,4-dioxane was not detected in surface water or above the MCP GW-1 Standard in the GWTP influent and effluent samples, it was detected above the MCP GW-1 Standard in groundwater from seven of the eight wells sampled. The wells sampled are located in the Site 1 and Site 2 source and on-site plume areas.

Based on the results of this initial assessment, additional investigation is needed to define the extent of 1,4-dioxane in groundwater that exceeds the MCP GW-1 Standard. Note also that the Air Force sampled 2 private off-base irrigation wells in June 2017 for both 1,4-dioxane and perfluorinated compounds (PFCs) (see discussion below), although these wells are not used to supply drinking water, which is the primary exposure pathway of concern.

Perfluorinated Compound Preliminary Assessment Report and Sampling at IRP Site 1: In May 2015, a Final Preliminary Assessment (PA) Report for PFCs at Hanscom Air Force Base was completed by HydroGeoLogic, Inc. PFCs have been used in the formulation of Aqueous Film Forming Foam (AFFF), which the Air Force has used in fire training exercises, suppressing aircraft and other vehicle fires, and in aircraft hangar fire suppression systems. The purpose of the PA was to identify areas at Hanscom AFB where PFCs may have been released into the environment, including known fire training areas, as well as other areas such as hangars, fire stations, emergency response areas, etc., where the potential exists for AFFF to have been released into the environment. With respect to IRP Site 1 (Former Fire Training Area II), the PA concluded that AFFF may have been released between 1970 and 1973 in an unknown amount and it was recommended that the Air Force initiate a Site Inspection.

In August 2016, groundwater sampling was conducted at IRP Site 1 for PFC analysis. The results of this sampling and analysis were documented in the 15 February 2017 Revised Draft Letter Report on Perfluorinated Compound (PFC) Sampling at Operable Unit (OU)-1, FT001 – Fire Training Area II (IRP Site 1), which was completed by Versar, Inc. Samples were collected

at ten locations and included surface water, groundwater treatment process water, and groundwater. Samples were analyzed for the basic suite of 18 PFCs, consistent with the Final Quality Assurance Project Plan for Site Inspections of Fire Fighting Foam Usage at Various Air Force Bases in the Eastern United States (U.S. Army Corps of Engineers, 2016). Sampling locations included seven monitoring wells (B102-MW, B127-MW, B241, P01-3S, RAP2-1S, RAP1-6T, RAP1-6R), GWTP influent and effluent, and one surface water sample (RAP1-SW4). Surface water location RAP1-SW4 is located downstream of the GWTP discharge. Three wells initially proposed for sampling (B247, B250, and RAP1-3S) were found to be dry during the sampling event and were replaced by B127-MW, B241, and P01-3S. Seven extraction wells (IW-1, IW-2, IW-3, IW-4, IW-6, IW-10, and IW-11) were operating when the GWTP influent and effluent samples were collected. Because groundwater from these wells is pumped to an equalization tank at the GWTP and mixed along with any rainwater that is captured, there is likely a diluting effect on any contaminant concentrations in the influent sample.

Eight PFCs were detected at concentrations ranging from 0.0034 ug/L to 8 ug/L. Detected compounds include perfluorobutane sulfonate, perfluorobutanoic acid, perfluoroheptanoic acid, perfluorohexane sulfonate, perfluorohexanoic acid, perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), and perfluoropentanoic acid.

In May 2016, EPA issued lifetime drinking water health advisory (HA) levels that replaced the previous provisional HA values for two PFCs (PFOA and PFOS). The HA levels are:

- PFOS: 0.07 ug/L
- PFOA: 0.07 ug/L
- PFOA and PFOS (combined): 0.07 ug/L

The full analytical results for all 18 PFCs analyzed can be found in the letter report referenced above. A summary of the PFOS and PFOA results with comparison to the EPA HA levels is provided below:

Table 8
PFOA/PFOS Results for OU-1 Samples

Location	Aquifer	PFOA (ug/L)	PFOS (ug/L	Sum of PFOA & PFOS (ug/L)
GWTP Influent	N/A	**0.18**	0.025	**0.21**
GWTP Effluent	N/A	**0.18**	0.023	**0.20**
RAP1-SW4	N/A (surface water)	**0.14**	0.021	**0.16**
B102-MW	Surface	0.0053 U	0.0038 J	0.0038
B127-MW	Surface	0.0053 U	0.0033 U	ND
B241	Surface	0.0053 U	0.0034 J	0.0034
P01-3S	Surface	0.020	0.0075 J	0.028
RAP2-1S	Surface	0.0053 U	0.027	0.027
RAP1-6T	Lower/Till	**2.9(1)**	**0.51**	**0.5**
RAP1-6R	Bedrock	**2.7(1)/2.8(1)**	**0.075/0.076**	**0.01/0.1**

Notes:
(1) Due to high concentration of the target analyte, sample required high level analysis. Detection limit was adjusted accordingly.
J = Estimated concentration between the method detection limit and reportable detection limit
U = Not detected; limit of quantitation is shown
ND = Not detections of PFOA or PFOS, sum not applicable

As can be seen from the table above, no HA exceedances were found for wells screened in the surface aquifer; however HA exceedances were reported for PFOA and for the sum of PFOA and PFOS in the GWTP Influent and Effluent, the surface water location RAP1-SW4, and groundwater from the lower/till (RAP1-6T) and bedrock (RAP1-6R) aquifers. The PFOS results for groundwater from the lower/till (RAP1-6T) and bedrock (RAP1-6R) aquifers also exceeded the HA.

Following receipt of this data which indicated the potential for off-base PFC migration, the Air Force contacted three private well owners to request permission to sample their private wells. Two of the owners granted permission and one declined. The off-base wells are used for irrigation and because they had been winterized for the season when permission was granted, sampling was completed in June 2017. EPA had also requested sampling of a public well located at the Community Gardens in Bedford; however, the Bedford Conservation Commission indicated that the public well at the Community Gardens had been replaced by a connection to Bedford's municipal water system.

Based on the results of the Final PA and subsequent sampling for PFCs, the CERCLA process will need to be continued and any changes to the current remedy incorporated into a future decision document.

Data Review OU-2/IRP Site 4

Since the first Five-Year Review conducted in 1997, OU2/IRP Site 4 has been in the Long-Term Management phase with no requirement for groundwater or surface water monitoring. The first Five-Year Review did identify a requirement for recurring maintenance of the site to remove scrub brush growing in the drainage ditches and on sections of the cap. This maintenance was initiated in the spring of 1998. Subsequently, since 1999, quarterly inspections (reduced to annual inspections in 2014) have been routinely performed and maintenance/repairs identified in the inspection have been completed. Review of the routine inspection reports for the current reporting period confirms that the integrity of the cap is being maintained and that there are no physical changes at the site.

Data Review OU-3/IRP Site 6

Long-Term Maintenance and Inspection: As a result of the RA construction activities, the RAOs for this site have been substantially achieved and in September 2001, the Site entered the RA-O (long-term maintenance and monitoring) phase. Since the previous five-year review, landfill inspections were conducted quarterly through the spring of 2014 and annually beginning in the fall of 2014. Maintenance (cutting of vegetation and brush on the landfill surfaces and slopes) is conducted annually at the end of the growing season. Review of the inspection and maintenance reporting for the current five-year period confirms that the integrity of the cap is being maintained and that there are no physical changes at the site.

Wetland Mitigation Monitoring: As noted earlier, the initial Five-Year Wetland Mitigation Monitoring for the wetland areas remediated during the construction phase of the Site 6 Remedial Action concluded in 2006 and the Wetland Mitigation Monitoring Reports for this monitoring indicated that the wetlands had exceeded the design goal for vegetative cover, and provided ample evidence that wildlife habitat had been restored. The Remedial Design also specified that that initial Five-Year Monitoring should be followed be a Long-Term Monitoring Plan for continuing evaluation of the restoration every 5 years for a total of thirty years. The first follow-up wetland mitigation and ecosystem evaluation event was completed in 2011 and

documented in the OU-3/Site 6, 2011 Wetland Mitigation Monitoring & Ecosystem Evaluation Report (Shaw, November 2011). The second long-term assessment was conducted in 2016 and documented in the 2016 Wetland Mitigation Monitoring and Ecosystem Evaluation Report for OU-3, IRP Site 6 (Versar, March 2017). Overall, the data collected during the 2016 monitoring event suggest that the objectives of the initial five-year monitoring plan and long-term operation and maintenance plan have been achieved and that the East Wetland Remediation Area (EWRA) and West Wetland Remediation Area (WWRA) are established, maturing, and appear to be functioning similarly to adjacent wetlands. As documented in the 2016 report, it was agreed that long-term ecosystem monitoring could be discontinued. More specific conclusions drawn relative to the specific objectives of the Long-Term Operation & Maintenance Plan and that support the decision to discontinue further monitoring include the following:

1. Groundwater levels at the EWRA and WWRA have demonstrated sufficient hydrology for wetland development over the course of the monitoring and both sites are dominated by hydrophytic plant communities.
2. The EWRA appears to be following a typical set of steps in succeeding towards a normal climax ecosystem for a typical wetland system in Massachusetts in this landscape position. Although the groundwater elevations at the WWRA are similar to the EWRA, the EWRA is succeeding in a very different trajectory, which may be caused by the design presence of the open water pond habitat and migration of common reed from the adjacent, natural wetlands. The 2016 evaluation concludes that tall perennials (common reed, bulrushes, sweet flag, and cattails) will likely continue to dominate; however, as organic matter aggrades in the site and microhabitat is created by downed woody debris, opportunities for a change in the vegetation will occur.
3. The EWRA and WWRA are not easily distinguished from the adjacent, natural wetland habitats.
4. Both sites are dominated by hydrophytic plant communities and have developed a well-established fringe of woody species. Use of the sites by a wide variety of wildlife species has been documented and the benthic macroinvertebrate community in the EWRA is as expected for the environment.

Groundwater/Surface Water and Compliance Boundary Monitoring: The long-term monitoring program for OU-3/IRP Site 6 was initiated with baseline sampling in 2001 and long-term monitoring reports have been produced annually since then to document the results of groundwater and surface water sampling. The most recent annual sampling round for which results are available was conducted in November 2015. In addition to the annual monitoring required by the ROD, sampling (three to four events per year) was conducted from July 2005 through July 2015 to provide seasonal data for further evaluation of arsenic in groundwater and surface water. The current network of monitoring points (which has been developed over time) is shown on **Figure 23**. Tables from the 2015 LTM Report (Versar, 2016) that summarize historical groundwater and surface water monitoring data are included as **Attachment E**.

Since the landfill waste has been left in place, it is not expected that the groundwater beneath the wastes would meeting drinking water standards and the primary objectives of the monitoring component of the RA are:

- To identify the on and off site's post-RA COCs,
- To monitor changes in on-site contaminant concentrations over time (i.e. monitor the "flushing" of COCs from the landfilled areas,

- To monitor concentrations of COCs in surface water flowing from the site, and
- To monitor concentrations of COCs at the site's groundwater compliance boundary.

Groundwater COCs Other Than Dissolved Arsenic: In addition to dissolved arsenic, the other COCs identified in the 2001 Baseline and/or subsequent monitoring events include:

Dissolved Metals: Antimony, Barium, Cadmium, Nickel, Lead, Thallium, and Vanadium
PCBs: Aroclor 1016, 1232, 1242, or 1248
Pesticides: 4-4'-DDD, Dieldrin, and Heptachlor epoxide
SVOCs: 1,4-Dichlorobenzene, 2,4-Dichlorophenol, 2,4,5-Trichlorophenol, bis(2-ethylhexyl)phthalate, Naphthalene, Pentachlorophenol (PCP)
VOCs: Benzene and Trichloroethene

Over time, several COCs have been eliminated as sufficient Long-Term Monitoring data has been available to conclude that they should no longer be considered a Site 6 COC. The 2012 Five-Year Review concluded that other than dissolved arsenic, which was still being assessed, the only residual COCs for Site 6 groundwater include:

Dissolved Metals: Barium in MW-112U; Nickel in MW6-110U
PCBs: Aroclor 1232, 1242, or 1016 in MW6-110U
Pesticides: 4-4'-DDD in MW6-114T
SVOCs: 1,4-Dichlorobenzene in MW6-106 and MW6-112U; 2,4-Dichlorophenol, 2,4,5-Trichlorophenol, and PCP in MW6-106

The annual groundwater sampling conducted in October/December 2012, October 2013, November /December 2014, and November 2015 generally included the locations and analytes identified above as residual COCs. The groundwater results (excluding dissolved arsenic), including comparison to ARARs and to historical data, are discussed below. The wells that continue to show exceedances of MCLs and/or MCP GW-1 standards are located well within the compliance boundary and do not call into question the protectiveness of the current compliance boundary.

Barium: Dissolved barium was analyzed in groundwater from well MW6-112U (surface aquifer) in 2012 through 2015 and concentrations ranged from 610 to 2,100 ug/L. The 2012 concentration of 2,100 ug/L was above the MCL/GW-1 standard (2,000 ug/L). Overall barium concentrations appeared similar to historic results from 2001 through 2011, which ranged from 321.6 to 3,500 ug/L.

Cadmium: Dissolved cadmium was analyzed in groundwater from well MW6-113T (lower aquifer) in 2012 in order to confirm that it is not a COC at this location. Concentrations in well MW6-113T in 2007, 2008, 2010, 2011, and 2012 were all less than the MCL/GW-1 standard (5 ug/L) and based on those results, cadmium was subsequently dropped as a COC.

Nickel: Dissolved nickel was analyzed in groundwater from well MW6-110U (surface aquifer) in 2012 through 2015 and concentrations ranged from 100 to 720 ug/L. The results for this period were equal to or exceeded the MCP GW-1 standard of 100 ug/L. While the 2012 and 2013 results were consistent with concentrations from the previous nine years, the 2014 and 2015 concentrations (720 and 550 ug/L, respectively) were the highest detected in this well since 2003.

PCBs: PCBs (Aroclors 1016, 1232, 1242, and 1248) were analyzed in groundwater from well MW-110U (surface aquifer) in 2012 through 2015 and no PCBs were detected in any of the four

rounds. In previous years, PCBs had been detected periodically at concentrations slightly above the MCL/MCP GW-1 standard of 0.5 ug/L total PCBs. The data shows that PCB concentrations have declined since the historical peak of 0.984/1.05 ug/L in 2005.

Pesticides (4,4'-DDD): Organochlorine pesticides were analyzed in groundwater from well MW6-114T (lower aquifer) in 2012 through 2015 and 4,4'-DDD was detected at concentrations ranging from 0.43 to 0.67 ug/L. The results for this period exceeded the MCL/MCP GW-1 standard of 0.2 ug/L. Overall, the 4,4'-DDD concentrations were similar to historical concentrations and do not indicate an upward or downward trend.

SVOCs: SVOCs were analyzed in groundwater from well MW6-117U (upper aquifer) in 2012 to confirm that SVOCs are not COCs at this location. Based on the lack of detection of SVOCs, SVOCs are no longer considered COCs at well MW6-117U.

SVOCs were analyzed in groundwater from well MW6-112U (upper aquifer) in 2012 through 2015. 1,4-dichlorobenzene concentrations in MW6-112U ranged from 9.2 to 16 ug/L and exceeded the MCP GW-1 standard of 5 ug/L during all four rounds, which is consistent with historical results. Naphthalene concentrations in MW6-112U ranged from 6.2 to 49 ug/L and were below the MCP GW-1 standard of 140 ug/L. PCP was analyzed for but not detected during the past four monitoring rounds; however, the reporting limit is more than an order of magnitude higher than the MCL/MCP GW-1 standard of 1 ug/L, so PCP cannot be ruled out as a COC based on the available data.

SVOCs were analyzed in groundwater from well MW6-106 (upper aquifer) in 2012. The well was planned for sampling in 2014 and 2015, but was dry. Naphthalene, PCP, 1,3-dichlorobenzene, and 2,4,5-trichlorophenol were detected in 2012. The PCP concentration (690 ug/L) was well above the MCL/MCP GW-1 standard, but is lower than previous detections, with the exception of the non-detect result in 2011. Concentrations of naphthalene, 1,3-dichlorobenzene, 2,4,5-trichlorophenol, and 2,4-dichlorophenol (non-detect in 2011 and 2012) appear to be showing a downward trend.

Surface Water COCs Other Than Dissolved Arsenic: Historical data is included in **Attachment E** for pesticides, PCBs, and metals at EWRA-01 (East Wetlands Remediation Area), WWRA-01 (West Wetlands Remediation Area), SWW6-05 and SWW6-06 (Wetlands Surface Water Monitoring Points), SG #3 (Shawsheen River Stream Gauging Station #3), and SWR6-02 (Shawsheen River Monitoring Point). Data collected prior to 2012 ruled out all COCs in surface water. Only dissolved arsenic has continued to be monitored as part of investigation of seasonal trends. None of the results exceed the current National Recommended Water Quality Criteria (Freshwater Chronic Standards), indicating that surface water is not adversely impacted by IRP Site 6 groundwater.

Dissolved Arsenic in Groundwater and Results of Downgradient Investigation for Arsenic: Historical data is included in **Attachment E** for dissolved arsenic in groundwater from 2001 through July 2015. In 2014 and 2015, a Downgradient Investigation was conducted to determine the source of arsenic detected at and north of IRP Site 6, which has included detections above the current MCL (10 ug/L) at locations beyond the current compliance boundary. Six new monitoring wells were installed, the entire groundwater monitoring well network was surveyed to produce accurate groundwater contour maps, and a comprehensive field investigation was conducted including groundwater monitoring and sampling in the spring, summer and fall seasons. Seasonal data (spring, summer, and fall) collected over the prior ten (10) years were compiled and evaluated, and current literature related to arsenic in groundwater was also searched and reviewed. In short, the evaluation determined that arsenic

concentrations observed at and north of the IRP Site 6 compliance boundary, including concentrations that exceed the MCL, are naturally occurring and the compliance boundary is protective and adequate as currently defined.

A summary of the findings, as presented in the Downgradient Investigation Report (Versar, 2015), include the following:

- The groundwater flow direction in the area northwest of the Shawsheen River is towards the river. Hypothetical groundwater contamination (if any) originating from Site 6 would not reach monitoring wells located on the opposite (northwest) side of the Shawsheen River; therefore this line of evidence does not support the conclusion that arsenic observed northwest of the Shawsheen River is related to Site 6.
- Surface water quality in the Shawsheen River was reviewed for samples collected upstream and downstream of Site 6. Groundwater elevation was also evaluated and the river was found to be a gaining water body. No negative impact on surface water quality is observed in this gaining river. This provides an additional line of evidence that arsenic originating from either Site 6 (if any), or arsenic originating from the northwest (airfield) side of the Shawsheen River, or from any other source is not impacting water quality in the Shawsheen River.
- No long-term trend in dissolved arsenic is evident. This condition would be expected for naturally occurring arsenic.
- A slight seasonal trend is apparent, with lowest arsenic concentrations typically observed in the spring, and with higher arsenic concentrations observed in the summer and/or fall. This pattern is believed to be related to geochemical conditions in the subsurface related to variations in temperature and/or the timing of snowmelt and rain infiltration, and the effects these variables have on other geochemical parameters that impact the solubility of arsenic in water (see next bullet).
- Peak arsenic concentrations were observed to generally coincide with periods of low dissolved oxygen (DO) and oxidation reduction potential (ORP) between -250 millivolts (mV) and +100 mV. The values of DO and ORP observed across the Site 6 monitoring well network do not indicate any direct influence from landfill leachate. Instead, conditions observed across the entire site indicate the DO and ORP values observed in wells close to Site 6 are the same as those in areas now known to be hydraulically separated from Site 6. This line of evidence supports the conclusion that arsenic observed across the site is naturally occurring.
- Collaborative investigation by the United States Geological Survey (USGS), the Massachusetts Department of Environmental Protection (MassDEP), and the Massachusetts Department of Public Health (MassDPH) has documented that elevated arsenic in groundwater is observed across large portions of Massachusetts as a result of the presence of significant quantities of arsenic in regional bedrock which in turn also influences arsenic in unconsolidated aquifers via soil forming processes. These investigations have shown the town of Bedford, MA and Hanscom AFB are located in the area known to exhibit elevated arsenic in groundwater. No equally plausible anthropogenic sources of arsenic have been identified for the area, particularly potential sources that would have influenced the geographical area over which arsenic is observed in Site 6 monitoring wells.

Data Review OU-3/IRP Site 21

LNAPL/Groundwater Collection and Treatment System and Supplemental Remedial Activities Performance Data: IRP Site 21 entered the RA-O (long-term operation, maintenance, and monitoring) phase in September 2003. See **Figure 24** for the layout of Site 21, including recovery and monitoring wells, locations of the former (pre-RA) LNAPL Pools, and RI Zone designations. The Fourth Five-Year Review completed in 2012 indicated that continued operation of the groundwater collection and treatment system to include active recovery wells RW-1A, RW-6A, RW-7A, and RW-11A was warranted to expedite cleanup within their capture zone. The report also recommended additional investigation in Zone 2 within the area bounded by monitoring wells ECS-14R, RW-6A, RW-7A, ECS-35, ECS-31, and CH102 to determine whether or not further expansion of the active recovery system would be beneficial.

The groundwater collection and treatment system continued to operate during this five-year review period until July 2015, when Supplemental Remedial Activities were conducted at Site 21 to enhance the pre-existing remedy and accelerate the rate of destruction of on-site contaminants. On July 6, 2015, the groundwater treatment system was turned off to minimize interference with the application of remedial products and also to monitor the behavior of TCE in the aquifer when not under the influence of the pump and treat system. Two types of remedial amendments were applied to separately target petroleum hydrocarbons and chlorinated solvent-related contaminants, including Oxygen Release Compound (ORC) Advanced® and RegenOx™. The details of the remedial activities and subsequent performance monitoring are provided in the Final Supplemental Remedial Activities Report for Site 21 (Versar, 2016).

ORC Advanced® filter socks were placed in 12 wells at Site 21, including ECS-28, ECS-30L, ECS-31, MWZ-3, MWZ-12, MWZ-13, MWZ-20, PW-4, RW-1, RW-1A, RW-11A, and ECS-38. These locations were selected because hydrocarbon-related contaminants had been detected above applicable regulatory standards during two or more sampling events since 2012. Well ECS-14R was originally intended to receive ORC Advanced® filter socks, but socks could not be installed due to a bent casing. ORC Advanced® is engineered to treat contaminants such as BTEX, naphthalene, chlorobenzenes, trimethylbenzene, and propylbenzene. ORC Advanced® treats contaminants with a controlled release of oxygen and therefore, no performance monitoring samples were collected. Effectiveness of the treatment was evaluated in the Spring 2016 LTM report (Versar, 2016).

RegenOx™, a chemical oxidant, was injected in wells RW-6A and RW-7A in August and September 2015 to treat chlorinated VOCs. Injection of RegenOx™ was also planned at well ECS-35; however, pre-injection testing indicated concerns about comprising the integrity of the well and it was removed from the treatment program. Less RegenOx™ was injected than planned at RW-6A and RW-7A due issues with daylighting occurring. Performance monitoring of the RegenOx® treatment included one event during the period after shutting down the treatment system and before the first application of RegenOx™ (August 13, 2015) and three post-injection monthly performance monitoring events (September, October, and November 2015). During the first three performance monitoring events, groundwater samples were collected from wells RW-3A, RW-4A, and RW-5A, which are located along the sewer line conduit. During the fourth event (November 2015), the same three wells were sampled along with three additional wells (RW-6A, RW-7A, and ECS-35) that were targeted for RegenOx™ injections. Samples were analyzed for VOCs and results were compared to MCLs, MCP GW-1 and GW-2 Standards, and Risk-Based Remedial Goals (RBRGs) from the October 2001 ROD. The May 2015 LTM sampling event was chosen as the pre-injection baseline for comparison to the performance monitoring results. TCE was the only COC detected during the baseline May

2015 event above regulatory standards. Note that no RBRG was defined for TCE in the October 2001 ROD.

A summary of TCE concentrations in the wells selected for performance monitoring, during the baseline (May 2015) event, four performance monitoring events, and subsequent May 2016 LTM event is provided below. The May 2016 results were not available for evaluation at the time of completion of the Supplemental Remedial Activities Report, but were provided in the more recent Annual LTM Report for May 2016 samples.

Table 9
TCE Concentrations in Wells Selected for Performance Monitoring – IRP Site 21

Date	5/20/15	8/12/15	9/18/15	10/7/15	11/9/15	5/11-5/12/16
RW-3A	NS	1.8	1.3	1.2	1.1	NS
RW-4A	NS	1.2	1.2	1.1	1	NS
RW-5A	NS	0.28J	0.24J	<0.4	<0.4	<0.4
RW-6A	**17**	NS	NS	NS	3.9	**22**
RW-7A	**200**	NS	NS	NS	3.5J/4J	**56**
ECS-35	**7/7.1**	NS	NS	NS	**11**	**16/15**

Notes:
Results are micrograms per liter (ug/L).
Bold concentrations exceed the MCL and MCP GW-1 and GW-2 Standards (all 5 ug/L).
J – Indicates result is approximate.
NS – Not sampled.

The three main objectives of the performance monitoring are provided below followed by a summary of the outcome:

1. **Monitor reductions in TCE concentration near the hotspot at RW-7A.** Despite applying less oxidant than planned, RegenOx^{TM} injections effectively reduced the concentration of TCE in hotspot well RW-7A by 98 percent and nearby hotspot well RW-6A by 77 percent, when comparing the May 2015 pre-injection results to the results from the last round of performance monitoring in November 2015 (see table above). However, subsequent TCE results from the May 2016 LTM event show that concentrations in both wells have re-bounded. No other VOCs exceeded regulatory standards or RBRGs during these events. While TCE persists above regulatory standards at well ECS-35 (where injections were not possible), the detections are similar to results reported since 2006. It is also worth noting that TCE was not detected at RW-5A (the well closest to the injection locations to the west) during October and November 2015 and May 2016 sampling events.
2. **Gauge whether or not TCE is hydraulically contained by the groundwater treatment system.** Comparison of baseline (May 2015) groundwater elevation monitoring results to the potentiometric surface from the subsequent performance monitoring events showed that the groundwater treatment system did not contribute to hydraulic containment of TCE at Site 21. It was concluded that the treatment system should remain off-line, but left in place so that it may be brought online in the future and that monitoring should continue during annual LTM events.
3. **Determine if the sewer line conduit provides a preferential pathway for**

contaminant migration. RW-3A, RW-4A, and RW-5A are arranged in a roughly east-west trending orientation, parallel to the sewer line conduit. These wells had been removed from the LTM program after the 2008 sampling event because for several years, VOC concentrations were consistently non-detect or below regulatory standards. TCE concentrations remained low or non-detect during the performance monitoring, consistent with historical results with a possible slight downward trend. It was concluded that the sewer line conduit is not serving as a preferential pathway for contaminant migration.

Long-Term Monitoring Data and Results of ORC Advanced® Treatment at Twelve Wells: Monitoring is a component of the selected remedy with the objectives of monitoring progress towards achievement of RAOs and monitoring the reduction in the volume of LNAPL and the natural attenuation/natural containment of the LNAPL and dissolved-phase contaminant plumes (including the former tetrachloroethene (PCE) hot spot). The Long-Term Monitoring Program for Site 21 is documented in the Hanscom AFB *Basewide Quality Assurance Project Plan (QAPP) for Long-Term Monitoring at NPL Operable Unit 1, NPL Operable Unit 3/IRP Site 6, Operable Unit 3/IRP Site 21, and MCP Sites (IRP Sites 13 and 22 and the FAFSUST Site)*. The Long-Term Monitoring Program for Site 21 initially included 2 stages. Stage 1 was the pre-remedial action monitoring and Stage 2 is the post-RA monitoring which commenced on 15 September 2003. Stage 2 includes the following:

- October 2003 Post-RA Baseline sampling of selected wells
- Semi-annual/annual sampling of selected monitoring wells and the Shawsheen River for laboratory analysis to confirm the containment and anticipated reduction and degradation of the dissolved-phase plumes
- Periodic (currently annual) measurement of LNAPL levels during water level measurements using an oil/water interface probe to monitor the effectiveness of the remedial action and/or natural attenuation
- Treatment system monitoring (not conducted since treatment system shutdown in July 2015)

The May 2016 LTM event also included evaluation of the effectiveness of ORC Advanced® filter socks that were placed in 12 wells at Site 21 in 2015. These wells include ECS-28, ECS-30L, ECS-31, MWZ-3, MWZ-12, MWZ-13, MWZ-20, PW-4, RW-1, RW-1A, RW-11A, and ECS-38. Note that the filter socks were removed from these wells two weeks prior to the May 2016 groundwater sampling and replaced in these same wells in late-June 2016.

The data presented in this section cover the post-RA Long-Term Monitoring events at Site 21 from April 2012 through May 2016. These events are documented in Annual Long-Term Monitoring Reports. The network of monitoring points established at IRP Site 21 is shown on **Figure 24**. **Attachment F** provides a table extracted from the 2016 LTM Report that contains a summary of all groundwater and surface water results following the 2003 remedial action with comparison to MCLs, MCP GW-1 and GW-2 Standards, and RBRGs.

Due to the complexity of the IRP Site 21 groundwater and surface water contamination, the analysis of results is best presented by using the RI's subdivision of the Site into the following areas, which are shown of **Figure 24**:

- Former Above Ground Storage Tank Area
- Former Railroad Tracks Right of Way
- Zone 1 (Jet Fuel Loading and Unloading Area)
- Zone 2 (Aviation Fuel Loading and Unloading Area, also gasoline and diesel service station setup for Civil Engineering Vehicles)
- Zone 3 (Eastern Half of Railroad Fuel Delivery Siding with Underground Unloading Header)
- Zone 4 (Western Half of Railroad Fuel Delivery Siding with Underground Unloading Header)
- Zone 5 (Buffer/Sentry Area between Site and the Shawsheen River) and
- The Shawsheen River

Former Above Ground Storage Tank Area: The RI did not identify any residual contamination in this area, thus there has been no Post-RA Long-Term Monitoring of this area. No further sampling and analysis is planned for ECS-26, ECS-27, ECS-45, and ECS-46, which are in the Former Above Ground Storage Tank Area.

Former Railroad Tracks Right of Way: The investigation phase did not identify any residual surface aquifer contamination in the western half of this area, which was confirmed by Post-RA Baseline monitoring event. No further sampling and analysis is planned for CH-104 and OW-2, which are in the western half of the Former Railroad Tracks Right of Way. Both of these wells were decommissioned in 2012 along with several other wells at Site 21. Long-Term Monitoring results are included in **Attachment F** for wells CH-102 (lower aquifer) and ECS-30L (lower aquifer).

CH-102 – This well was sampled during all LTM events between April 2012 and May 2016. In April and December 2012, concentrations of 1,2-Dichlorobenzene and 1,4-Dichlorobenzene exceeded the respective RBRGs. The 1,4-Dichlorobenzene concentrations in April and December 2012 also exceeded the MCL and MCP GW-1 and GW-2 standards. These concentrations were comparable to the Baseline 2003 data. Subsequently, the results for 2013 through 2016 showed much lower detections of these two compounds and other VOCs and no exceedances of regulatory standards or RBRGs.

ECS-30L – Over the past five years, this well was sampled in December 2012, October 2013, and May 2015. Subsequently, an ORC Advanced® filter sock was installed in June 2015 and the well was sampled again in May 2016. In 2012, 2013, and 2015, 1,2-Dichlorobenzene was detected above the RBRG, but below regulatory standards, and concentrations were similar to or slightly higher than historical concentrations for that compound. In 2012, 2013, and 2015, 1,4-dichlorobenzene was detected at or above the RBRG and above the MCP GW-1 Standard and was similar to or slightly higher than historical concentrations. No other VOCs exceeded regulatory standards or RBRGs. Following placement of the ORC Advanced® filter sock, VOC concentrations in May 2016 were much lower for 1,2-Dichlorobenzene and 1,4-Dichlorobenzene and no regulatory standards or RBRGs were exceeded.

Historical data for wells **ECS-30U** and **ECS-34** are not included in **Attachment F**, since these wells were eliminated from the LTM program after the December 2012 LTM event. These wells

were sampled in April and December 2012 to assess migration from petroleum hot spot ECS-31 and no detections exceeded standards and there were no signs of migration.

Zone 1 (Jet Fuel Loading and Unloading Area/Former LNAPL Pool C): The previous five-year review noted that monitoring of the following Zone 1 wells had been suspended because their long-term monitoring results had been consistently below regulatory standards and RBRGs: ECS-37, MWZ-19, MWZ-23, MWZ-24, MWZ-25, PW-1, PW-2, RT-S2, RT-S3, RW-2, RW-2A, RW-3A, RW-4A, RW-5A, RW-8A, RW-9A, and RW-10A. Sampling of location RW-5A resumed in 2016 as discussed below. Long-Term Monitoring results are included in **Attachment F** for wells ECS-35, MWZ-13, MWZ-15, MWZ-17, MWZ-20, RW-1A, RW-5A, RW-6A, and RW-7A.

ECS-35 – Over the past five years, this well was sampled in December 2012, October 2013, May 2015, and May 2016. As discussed above, RegenOx^{TM} injections were planned at this location in 2015, but were not possible due to concerns with damaging the well. While TCE persists above regulatory standards (MCL and MCP GW-1 and GW-2 Standards) at well ECS-35, the detections are similar to results reported since 2006.

MWZ-13 – Over the past five years, this well was sampled in December 2012, October 2013, and May 2015. Subsequently, an ORC Advanced® filter sock was installed in June 2015 and the well was sampled again in May 2016. Similar to historical events, the 2012, 2013, and 2015 results showed several VOCs detected at concentrations above RBRGs, although the 2015 results did appear to indicate a downward trend from previous years. In contrast, following placement of the ORC Advanced® filter sock, VOC concentrations in May 2016 did not exceed RBRGs and were generally lower than the 2015 results.

MWZ-15 - Over the past five years, this well was sampled in December 2012, October 2013, and May 2016. Regulatory standards have not been exceeded in the post-RA data set and RBRGs have not been exceeded at this location since 2010. Overall, decreasing trends have been seen at this location. The 2016 LTM Report indicates that MWZ-15 will be removed from the LTM sampling program.

MWZ-17 – This well is located west of Former LNAPL Pool C and was most recently sampled in 2012, 2013, 2015, and 2016. No VOCs have been detected above regulatory standards or RBRGs since 2010. The 2016 LTM Report indicates that MWZ-15 will be removed from the LTM sampling program.

MWZ-20 - Over the past five years, this well was sampled in December 2012, October 2013, and May 2015. Subsequently, an ORC Advanced® filter sock was installed in June 2015 and the well was sampled again in May 2016. Naphthalene, n-propylbenzene, and ethylbenzene exceeded RBRGs in recent events through 2015. In contrast, following placement of the ORC Advanced® filter sock, VOC concentrations in May 2016 did not exceed RBRGs and were generally lower than the 2015 results.

RW-1A - Over the past five years, this well was sampled in December 2012, October 2013, and May 2015. Subsequently, an ORC Advanced® filter sock was installed in June 2015 and the well was sampled again in May 2016. Unlike the other locations within Zone 1 where ORC Advanced® filter socks have been placed, treatment at RW-1A appears to have had little effect on VOC concentrations. 1,2,4-Trimethylbenzene, naphthalene, and n-Propylbenzene were detected above RBRGs in May 2016, which is consistent with historical data.

RW-5A – This well was added to the LTM sampling program in May 2016 to monitor for potential migration of TCE downgradient of RW-6A and RW-7A. No VOCs were detected in this well above regulatory standards or RBRGs.

RW-6A and RW-7A – Over the past five years, these wells were sampled in April and December 2012, April and October 2013, April 2014, May 2015, November 2015 (for performance monitoring), and May 2016. RegenOx^{TM}, a chemical oxidant, was injected in wells RW-6A and RW-7A in August and September 2015 to treat chlorinated VOCs. Despite applying less oxidant than planned, RegenOx^{TM} injections were initially effective at reducing the concentration of TCE in hotspot well RW-7A by 98 percent and nearby hotspot well RW-6A by 77 percent, when comparing the May 2015 pre-injection results to the results from the last round of performance monitoring in November 2015. However, subsequent TCE results from the May 2016 LTM event show that concentrations in both wells have re-bounded. Aside from TCE, cis-1,2-dichloroethene had been detected at RW-6A above the RBRG during the 2012 and 2013 events, but concentrations subsequently decreased to trace levels well below the RBRG in 2014 through 2016. No other VOCs exceeded regulatory standards or RBRGs during these events. Cis-1,2-dichloroethene was also detected above the RBRG in April 2014 and May 2015 at RW-7A, but subsequent results were non-detect in 2015 and 2016.

Historical data for well **MWZ-22** is not included in **Attachment F**, since this well was eliminated from the LTM program after the April 2012 event. Regulatory standards and RBRGs had been met for four consecutive years.

Zone 2 (Aviation Fuel Loading and Unloading Area, also Gasoline and Diesel Service Station Setup for Civil Engineering Vehicles): A Pre-RI (November 1992) investigation found significant BTEX in monitoring well MWZ-14 with a benzene concentration of 599 ug/L. Subsequently, MWZ-14 was destroyed and was replaced by ECS-14R in the October 1997 RI at which time the BTEX had dropped significantly with a benzene concentration of 9.9 ug/L. The MWZ-14/ECS-14R location is downgradient from the five former above ground 50,000-gallon aviation gas storage tanks and is in the immediate vicinity of the former truck loading/unloading facilities. Thus it is concluded that there had been a historic release of aviation gas in this area prior to 1972 when the Air Force flying activities at Hanscom AFB were terminated. The previous five-year review noted that no further sampling and analysis was planned for CH-101 and ECS-43, which are in Zone 2. In this area, benzene and 1,4-dichlorobenzene, are the principal COCs. Long-Term Monitoring results are included in **Attachment F** for ECS-14R, ECS-31, RW-1, and RW-11A.

ECS-14R – Over the past five years, this well was sampled in December 2012, April and October 2013, April 2014, May 2015, and May 2016. ECS-14R was originally intended to receive ORC Advanced® filter socks in 2015, but socks could not be installed due to a bent casing. Benzene has been consistently detected at this location at concentrations above the RBRG (2 ug/L) and often also exceeds the MCL and MCP GW-1 Standard (5 ug/L). TCE concentrations show no apparent trend. No other VOCs exceeded regulatory standards or RBRGs over the past five years of monitoring.

ECS-31 - Over the past five years, this well was sampled in April and December 2012, April and October 2013, April 2014, May 2015, and May 2016. In June 2015, an ORC Advanced® filter sock was installed in this well. Overall, the treatment does not appear to have had a significant impact on COCs that are present above regulatory standards and RBRGs. 1,2-Dichlorobenzene was consistently detected above the RBRG during the 2012 through May 2016 LTM events. 1,2,4-Trichlorobenzene concentrations exceeded the RBRG from 2012 through 2015, but decreased to slightly below the RBRG during the May 2016 event. 1,4-Dichlorobenzene concentrations consistently exceeded RBRGs during the 2012 through May 2016 monitoring events. 1,4-Dichlorobenzene results also exceeded the MCL and MCP GW-1 and GW-2 Standards during multiple events between 2012 and May 2016.

RW-1 – Over the past five years, this well was sampled in December 2012, April and October 2013, April 2014, May 2015, and May 2016. In June 2015, an ORC Advanced® filter sock was installed in this well. At this location, VOC concentrations appeared to decrease in 2014 and 2015 compared to previous years and appeared to further decrease in May 2016, following treatment. December 2012 and October 2013 results had shown multiple VOCs (benzene, ethylbenzene, 1,2-dichlorobenzene, and 1,4-dichlorobenzene) present above RBRGs and the MCP GW-1 standard for 1,4-dichlorobenzene. No regulatory standards or RBRGs were exceeded in 2014 through 2016.

RW-11A – Over the past five years, this well was sampled in April and December 2012, April and October 2013, April 2014, May 2015, and May 2016. In June 2015, an ORC Advanced® filter sock was installed in this well. While a few VOCs (1,2-dichlorobenzene, 1,2,4-trichlorobenzene, and 1,4-dichlorobenzene) continued to be detected above RBRGs and/or regulatory standards in May 2016 following treatment, concentrations did appear lower than previous LTM events and few VOCs exceeded standards.

Zone 3 (Eastern Half of Railroad Fuel Delivery Siding with Underground Unloading Header): There was a documented release of Number 2 Heating Oil from the western end of the underground fuel unloading header in the early 1990s. At that time, the pipe was being cleaned out, unfortunately pressure instead of vacuum was applied to the pipe and the oil inside the pipe blew out of the end cap. The release (which was in the immediate vicinity of MW-12) was immediately cleaned up. The prior five-year review noted that no further sampling and analysis is planned for MWZ-6, MWZ-7, RW-3, RW-4A, and RW-5, which are in Zone 3. Well RW-5 was abandoned in 2012. Long-Term Monitoring results are included in **Attachment F** for wells ECS-28, MWZ-11, and MWZ-12.

ECS-28 - Over the past five years, this well was sampled in December 2012, April and October 2013, April 2014, May 2015, and May 2016. In June 2015, an ORC Advanced® filter sock was installed in this well. At this location, vinyl chloride was detected above the MCL and MCP GW-1 and GW-2 standards in December 2012 and then again in May 2015, but the most recent May 2016 result (which followed placement of the filter sock) was below standards. Sec-butylbenzene was detected just above the RBRG in May 2015, but subsequently decreased in May 2016 to below the RBRG.

MWZ-11 - Over the past five years, this well was sampled in December 2012, October 2013, May 2015, and May 2016. Concentrations of n-propylbenzene were at or slightly above the RBRG in 2013, 2015, and 2016. No other VOCs have exceeded regulatory standards or RBRGs. No trends are apparent in the VOC data for this location.

MWZ-12 - Over the past five years, this well was sampled in December 2012, October 2013, May 2015, and May 2016. In June 2015, an ORC Advanced® filter sock was installed in this well. In general, VOCs in this well appear to be on a decreasing trend. Levels of 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and sec-butylbenzene dropped to below the RBRGs following the December 2012 LTM event. Concentrations of n-propylbenzene have continued to indicate exceedance of the RBRG, but only slightly exceeded the RBRG during the most recent May 2016 event, which followed placement of the ORC Advanced® filter sock.

Zone 4 (Western Half of Railroad Fuel Delivery Siding with Underground Unloading Header/Former LNAPL Pools A & B): LNAPL Pool A was the most significant pre-RA COC and, as discussed earlier, the LNAPL was effectively eliminated by the removal of the petroleum contaminated soil in order to construct the RA's east-west interceptor trench. LNAPL Pool B was not as significant as Pool A or Pool C; however, as with LNAPL Pool A, the construction of

the RA's northeast-southwest interceptor trench effectively eliminated the LNAPL. Post-RA COCs within the former LNAPL Pool A and Pool B areas include benzene and the four compounds with RBRGs, but no applicable regulatory standards. The prior five-year review noted that no further sampling and analysis was planned for wells MWS-108, PW-6, PW-7, and RW-8, as well as CH-105, ECS-32, MWZ-4, and MWZ-5. Wells ECS-32 and MWZ-5 were abandoned in 2012. Long-Term Monitoring results are included in **Attachment F** for wells MWZ-3, PW-3, and PW-4.

MWZ-3 – This well is located west of former LNAPL Pool A. Over the past five years, this well was sampled in April and December 2012, April and October 2013, April 2014, May 2015, and May 2016. In June 2015, an ORC Advanced® filter sock was installed in this well. Overall, this well has seen decreasing trends in VOCs concentrations over time. During the May 2015 and May 2016 rounds, no regulatory standards or RBRGs were exceeded. VOC concentrations continued to decline following placement of the ORC Advanced® filter sock. Prior to 2015, n-propylbenzene had been detected above the RBRG in 2013 and 2014 and additional VOCs exceeded regulatory standards and/or RBRGs during previous LTM events.

PW-3 – Over the past five years, this well was sampled in December 2012, October 2013, May 2015, and May 2016. VOC concentrations in 2012 appear atypically low compared to earlier and more recent LTM events and no regulatory standards or RBRGs were exceeded. During the three most recent LTM events, benzene, 1,2,4-trimethylbenzene, naphthalene, and n-propylbenzene were detected above the RBRGs during one or more rounds. No MCLs or GW-1 or GW-2 standards were exceeded over the past five years.

PW-4 – Over the past five years, this well was sampled in April and December 2012, April and October 2013, April 2014, May 2015, and May 2016. In June 2015, an ORC Advanced® filter sock was installed in this well. In the past five years, n-propylbenzene was detected above the RBRG during two rounds in 2012 and 2013. Otherwise, there have been no exceedances of regulatory standards or RBRGs and the most recent May 2016 results, following ORC Advanced® filter sock placement, showed no detections of VOCs.

Historical data for well **PW-5** is not included in **Attachment F**, since this well was eliminated from the LTM program after the October 2013 event. Regulatory standards and RBRGs had been met for four consecutive years.

Zone 5 (Buffer/Sentry Area between Site and the Shawsheen River): Of primary concern in the post-RA Long-Term Monitoring Program is confirmation that there is a natural containment of the LNAPL and a natural containment and/or natural attenuation of the dissolved-phase plume and that water quality of the adjacent Shawsheen River is not being threatened by the groundwater contamination and any residual LNAPL at Site 21. Six monitoring wells are located in Zone 5 downgradient from the Former LNAPL Pools and the dissolved phase plumes. These sentry wells are CH-103, ECS-38, ECS-39, ECS-40, ECS-41, and ECS-42. The previous five-year review noted that no further sampling and analysis was planned for these wells, with the exception of ECS-38, due to consistent low to non-detect levels of VOCs. Long-Term Monitoring results are included in **Attachment F** for well ECS-38 and stream gauge SG-3.

ECS-38 - Over the past five years, this well was sampled in April and December 2012, April and October 2013, April 2014, May 2015, and May 2016. In June 2015, an ORC Advanced® filter sock was installed in this well. Over the past five years, 1,2-Dichlorobenzene and 1,4-Dichlorobenzene were detected above RBRGs during multiple rounds. 1,4-Dichlorobenzene concentrations also exceeded the MCP GW-1 Standard, but did not exceed the MCL or MCP GW-2 Standard in the past five years. Following placement of the ORC

Advanced® filter sock in 2015, there did appear to be a decrease in concentrations of these two VOCs. Note also that comparison of data from the past five years to the MCP GW-3 standards shows no exceedances, indicating that ecological impacts from migration of groundwater from Site 21 to surface water in the Shawsheen River are unlikely.

Shawsheen River Stream Gauge (SG-3) – VOC detections in SG-3 continue to remain well below regulatory standards and RBRGs. The data set indicates that the water quality of the Shawsheen River is not adversely impacted by the site. As noted in the previous five-year review, VOCs detected in the river could actually be from the surface water runoff from the paved areas of Hanscom AFB and Hanscom Field, which make up the majority of the flow in the river at this monitoring point. Note also that comparison of the surface water data from the past five years to EPA Region III BTAG Freshwater Screening Benchmarks shows no exceedances, indicating that ecological impacts from the low level VOC detections are unlikely.

LNAPL Monitoring/Passive LNAPL Collection: A component of the Site 21 Remedial Action is a monitoring program to track levels of residual LNAPL floating on the surface aquifer groundwater. This monitoring was initiated following the 2003 RA construction activities (removal of petroleum contaminated soil, construction of interceptor trenches, and installation of active and passive recovery wells) at the site. Initially, all wells with a historical LNAPL presence and those within the perimeter of the former LNAPL Pools (A, B, & C) were monitored monthly. Subsequently, after the November 2004 LNAPL monitoring event, the monitoring frequency of those wells with more than one year of no LNAPL detections was changed to semi-annually. In 2014, site operations were optimized and the LNAPL monitoring frequency was reduced to annually. Currently, wells are checked for LNAPL using an oil/water interface probe as part of the annual groundwater elevation measurements. Wells that have had a post-RA detection of LNAPL include ECS-29, ECS-31, ECS-35, MWZ-13, MWZ-15, MWZ-17, MWZ-20, and MWZ-22.

Recent annual LTM reports have noted that LNAPL was last detected at a measureable amount in September 2010 (0.04 feet in ECS-31) within Zone 2, to the east of Former LNAPL Pool C. During the October 2013 monitoring event, traces of LNAPL were detected in wells MWZ-13 and MWZ-20 and heavy traces were detected in RW-1A and RW-11A. During the December 2012 monitoring event, a slight trace of LNAPL was noted at MWZ-20 and a heavy trace of LNAPL was noted at MWZ-22. These wells are located either within the perimeter of Former LNAPL Pool C or to the east within Zone 2.

Overall, the post-RA LNAPL monitoring to date indicates that the 2003 RA's removal and disposal of petroleum contaminated soil effectively removed most of the residual LNAPL, especially in the former LNAPL Pool A and B areas of the site.

1,4-Dioxane Assessment: In May 2016, 1,4-dioxane sampling was conducted at OU-1 and Site 21 for the purpose of determining whether 1,4-dioxane was present above the MCP GW-1 standard of 0.3 ug/L. Results for OU-1 are discussed separately under the Data Review section for OU-1. The field activities and analytical results were documented in a Final – Technical Memorandum for May 2016 1,4-Dioxane Sampling at OU-1 and IRP Site 21 (Versar, July 2016). 1,4-dioxane is an emerging contaminant that had not been sampled for at Hanscom AFB prior to the May 2016 event. Because 1,1,1-TCA had recently been detected in groundwater at Site 21, it was considered possible that 1,4-dioxane might be present as a co-contaminant. 1,4-dioxane has been used as a stabilizer for chlorinated solvents and is associated with 1,1,1-TCA and 1,1-DCE, in particular. At Site 21, 1,4-dioxane was detected in one of four samples collected. Sample locations included wells ECS-35, RW-6A, RW-7A and Shawsheen River

gauge SG-3. 1,4-dioxane was detected at 0.065 ug/L in groundwater from off-line extraction well RW-7A, which is below the MCP GW-1 standard.

Vapor Intrusion Investigation: Since the previous five-year review, a vapor intrusion investigation was conducted and the results were documented in the July 31, 2014 Final Vapor Intrusion Investigation Report, Operable Unit 3/IRP Site 21, prepared by Versar, Inc. The investigation was conducted in accordance with MassDEP Interim Final Vapor Intrusion Guidance (WSC-11-435) and evaluated Building 1823 (Entomology/Pest Control), Building 1833 (COCESS/MaraTech), and Building 1834 (Material Control). An analysis of historical groundwater COC concentrations in the vicinity of these buildings was conducted following procedures in the MassDEP guidance. Based on the review of groundwater data, it was concluded that 1,2-dichlorobenzene, 1,4-dichlorobenzene, and carbon tetrachloride for Building 1833 and TCE for Building 1823 should be evaluated further for potential vapor intrusion through collecting and analyzing sub-slab vapor samples. Sub-slab vapor samples were collected in February 2014 and locations were selected based on potential vapor intrusion points such as cracks in the slab, utility perforations, floor drains, etc. Soil vapor samples were analyzed for TO-15/APH (air-phase petroleum hydrocarbons). While several VOCs were detected in the samples, none of the detections exceeded the commercial/industrial sub-slab soil gas screening criteria presented in the MassDEP guidance. The overall conclusion of the evaluation was that the vapor intrusion pathway is not a concern.

Since the Vapor Intrusion Investigation Report was drafted, the Massachusetts Contingency Plan was amended in April and May 2014 and new MassDEP Vapor Intrusion Guidance: Site Assessment, Mitigation, and Closure (Policy #WSC-16-435) was issued in October 2016. GW-2 Standards for those VOCs evaluated in groundwater that were lowered in 2014 are as follows:

Table 10
Groundwater COCs with GW-2 Standards Lowered in 2014 – IRP Site 21

Groundwater COC	Previous GW-2 Standard (ppb)	Current GW-2 Standard (Effective 4/25/14) (ppb)
Benzene	2,000	1,000
1,4-Dichlorobenzene	200	60
Cis-1,2-Dichloroethylene	100	20
Trans-1,2-Dichloroethylene	90	80
Dichloromethane (Methylene Chloride)	10,000	2,000
Naphthalene	1,000	700
1,2,4-Trichlorobenzene	2,000	200
Trichloroethylene	30	5
Xylenes	9,000	3,000

In addition to these GW-2 Standard revisions, the Vapor Intrusion Investigation Report did not consider the existence of GW-2 Standards for 2-Butanone (50,000 ppb) and 4-Methyl-2-Pentanone (50,000 ppb). These revised (and not previously considered) GW-2 Standards were compared to the historical groundwater data evaluated in the Vapor Intrusion Investigation Report and it was confirmed that the revised standards do not change the overall results and conclusions.

In the 2016 MassDEP vapor intrusion guidance, several of the commercial/industrial sub-slab soil gas screening values were changed from the screening values used in the Vapor Intrusion Investigation Report. The following criteria were lowered in the most recent guidance:

Table 11
Sub-Slab Soil Vapor Analytes with Lowered MassDEP Screening Criteria – IRP Site 21

Sub-Slab Soil Vapor Analyte	Previous Sub-Slab Commercial/Industrial Screening Criteria (ug/m^3)	Current Sub-Slab Commercial/Industrial Screening Criteria (ug/m^3)
1,1-Dichloroethene	13,000	12,000
Cis-1,2-Dichloroethylene	2,200	370
Trans-1,2-Dichloroethylene	4,300	3,700
1,2,4-Trichlorobenzene	13,000	240
1,1,1-Trichloroethane	320,000	310,000
Trichloroethylene	130	120

These new sub-slab screening values were compared to the sub-slab soil vapor data in the Vapor Intrusion Investigation Report and it was confirmed that the revised standards do not change the overall results and conclusions.

6.4 SITE INSPECTION

An inspection of the Site was conducted on December 6, 2016 by staff members from URS/AECOM, who were accompanied by Mr. William Gooden, Hanscom AFB RPM and Mr. Richard Landry, Versar, Inc.'s On-site Manager for the Basewide Remedial Action-Operations Contract.

The purpose of the inspection was to confirm current land use and to assess the protectiveness of the remedies for OU-1/IRP Sites 1, 2, and 3, OU-2/IRP Site 4, OU-3/IRP Site 6, and OU-3/IRP Site 21. No significant issues were identified and there was no evidence of unauthorized digging or use of groundwater for potable/non-potable purposes. There were no signs of vandalism or trespassing around the treatment systems and capped areas. A photo log was prepared to document the inspection and is included as **Attachment C**.

OU-1/IRP Sites 1, 2, and 3: These sites are located within the restricted/fenced perimeter of Hanscom Field. Access to the OU-1 central treatment facility is further restricted with fenced/locked gates. Additionally, IRP Site 1, including the inactive VER system, is fenced to segregate the area from the active airfield and adjacent US Navy property. The central treatment system was fully operational at the time of the inspection. The location of discharge of treated water from OU-1 on Hanscom Field was observed. The water level in the storm drain ditch continues to be lower since Massport's breaching of a beaver dam. The O&M Manager indicated that a "beaver deceiver" has been in place to keep beavers away.

OU-2/IRP Site 4: The capped former sanitary landfill site is part of Hanscom Field in the Runway 5 Approach, but is outside the perimeter fencing of the active part of the airfield. Vehicle access to this area is restricted by locked gates and physical barriers; however, the area is accessible on foot. The grass cover on the landfill surface, berms, and side slopes, and the paved perimeter drains appeared in good condition. Although the O&M manager indicated

that minor ponding occurs at times after heavy rain in one portion of the softball field, no ponding was observed during the inspection and the grass cover did not appear to be impacted. A beaver dam was observed in a wet area off of the southwest corner of the landfill, but did not appear to be impacting drainage from the landfill.

OU-3/IRP Site 6: Each of the three capped areas is fenced with locked gates. The South Landfill Area and Former Filter Bed Area/West Landfill Area gates have signage that reads "IRP Site 6, No Digging, No Dumping…" Some subsidence was observed around some of the monitoring wells in the northeast portion of cap (see photo #16 in **Attachment C**). This observation was consistent with recent annual inspection reports and there did not appear to be any potential for ponding or other concerns as a result.

OU-3/IRP Site 21: This site is within Hanscom AFB with access limited to those with access to the base. The northern portion of IRP Site 21 is a controlled/fenced parking area for privately-owned recreational vehicles.

6.5 INTERVIEWS

Interviews were conducted with the following parties connected to the site as part of the five-year review process:

- Mr. William Gooden (Hanscom AFB RPM)
- Mr. Richard Landry (Versar, Inc., Hanscom AFB's RA-O contractor's On-site Manager)
- Mr. Jonathan Davis (AFCEC Section Chief)
- Ms. Sharon Williams (Airport Director, Hanscom Field, Massport)
- Ms. Keith Leonhardt (Operations Manager, Hanscom Field, Massport)
- Mr. Mathew Audet (USEPA Region 1 RPM)
- Ms. Anne Malewicz (MassDEP Interim RPM)
- Ms. Heidi Porter (Director of Public Health, Town of Bedford)

Interview records are included as **Attachment D** and key discussion items are summarized below. Mr. Gooden and Mr. Landry were interviewed in person during the December 6, 2016 site inspection and the other interviews were conducted over the phone or via email, during or within the week following the site inspection. All parties had an overall positive impression of the Installation Restoration Program at Hanscom AFB and the level of communication that occurs. There was also an appreciation for the efforts to optimize and further progress the remedies for each site.

Both Mr. Audet (USEPA Region 1 RPM) and Ms. Malewicz (MassDEP Interim RPM) participate in regular conference calls, site visits, and RAB meetings and feel well informed about the IRP site activities and progress.

Ms. Porter (Director of Public Health, Bedford) indicated that the recent focus on emerging contaminants has sparked more involved discussion regarding well permits and the need to have something more formal in place to tell the town where the areas of concern are that wells should not be installed. She also indicated that there have not been any issues thus far.

Ms. Williams and Mr. Leonhardt (Hanscom Field Airport Director and Operations Manager) indicated that the relationship between Massport and Air Force is good. They would like an update on the status of when the airfield sites can be returned for Massport use and what future land uses could be allowed. The question comes up occasionally related to possible future development. They are interested in potentially using areas for future occupied buildings – in particular, the site on the west side near taxiway Mike.

Mr. Gooden (Hanscom RPM) and Mr. Landry (On-site O&M Manager for Versar, Inc.) noted that the current performance-based remediation contract for remedial action operations at the IRP sites has added more incentive to make progress towards aggressive cleanup goals. At OU-1, more innovative technologies are being used to augment the pump and treat system, which can run for a long time. The effectiveness of recent vegetable oil injections is still being evaluated. At OU-1, the VER system has been shut down because it was very labor intensive and not recovering enough contamination. With respect to the OU-1 treatment plant, there have been some changes such as reducing the frequency of pH measurements and abandonment of on-site GC analysis and replacement with off-site analysis at a lesser frequency. The sampling frequency and number of wells sampled is reviewed regularly for opportunities to optimize and reduce the collection of data that is not very useful. At Site 21, the pump and treat system has been shut down for the past year and instead, they have been performing ORC injections. Vapor enhanced recovery was performed many years ago. Within OU-1, Mr. Gooden notes that Site 2 seems to be meeting its goals, but Site 3 has a TCE hot spot that is not being affected as well.

Both Mr. Gooden and Mr. Landry expressed concerns with aging equipment and software associated with the OU-1 treatment system and high propane costs for the boiler. Mr. Landry explained that there was a lightning strike that hit the Site 1 pump and treat system about a year ago and that it was difficult to get some replacement parts because of the age of the equipment. Mr. Landry also indicated that the boiler and feed water tank at OU-1 are getting old. One improvement to the OU-1 treatment system was the replacement of the motor and VFD for the air stripper blower, which has resulted in a 40-50% reduction in electricity use. Mr. Gooden noted that the existing pump and treat system is probably not doing a great job at removing the emerging contaminants and that if more funding is made available to address that, perhaps some of the older equipment/systems could be upgraded at the same time. Mr. Gooden also noted the need to understand the source of TCE in the Hartwell Town Forest/Jordan Conservation Area and he mentioned that the groundwater flow direction is opposite if it was coming from the IRP sites.

Mr. Davis (AFCEC Section Chief) noted the need for development of land use control implementation plans for the IR sites before the next five-year review. At the time the decision documents for these sites were completed, he indicated that preparation of LUC implementation plans was not a standard process as it is now for newer AF sites. Mr. Davis also mentioned the need to conduct the RI/FS process specifically for 1,4-dioxane, as an emerging contaminant. The extent in groundwater, particularly in the Bedford Town Forest/Conservation Area is not known. More work is also needed with regard to PFAS/PFOS, although it was noted that there are no promulgated standards for those emerging contaminants.

SECTION 7.0
TECHNICAL ASSESSMENT

This section discusses the technical assessment of the remedy and provides answers to the three questions posed in EPA's Comprehensive Five-Year Review Guidance (June 2001).

7.1 OU-1/IRP Sites 1, 2, and 3

Question A: Is the remedy functioning as intended by the decision documents?

Remedial Action Performance: The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD. Surface water and groundwater sampling as part of the Long-Term Monitoring program confirms that operation of the pump and treat system, in conjunction with supplemental in-situ treatment measures, is working to prevent further migration of dissolved-phase COCs in groundwater and prevent discharge to surface water bodies and wetlands of groundwater containing COC concentrations that exceed federal drinking water standards, state drinking water standards, and state groundwater risk characterization standards (MCP GW-1 and GW-2).

At Site 1, chlorinated VOC concentrations have decreased in all three aquifers (surface, lower/till, and bedrock); however, TCE and its degradation products (cis-1,2-DCE and vinyl chloride) continue to be detected in all three aquifers above MCLs and MCP GW-1 and GW-2 Standards. Since the last five-year review, VOC concentrations at Site 1 have been either stable or decreasing. Groundwater contamination extends from Hanscom Field to the forested area owned by the Town of Bedford to the northeast. At Site 2, groundwater contamination is found in the surface and lower/till aquifers (not the bedrock aquifer). Recent groundwater data is relatively consistent with historical data since the last five-year review and VOCs remain above MCLs and MCP GW-1 and GW-2 Standards in some wells. At Site 3, groundwater contamination is found in the surface aquifer only and recent data indicates continued decreases of TCE and/or daughter products, with TCE and fluctuating levels of cis-1,2-DCE and vinyl chloride above MCLs and GW-1 and GW-2 Standards. Since the last five-year review, VOC concentrations at Site 3 have generally been stable.

In 2013, the VER system located adjacent to the Burn Pit #1 Runoff area at Site 1 was suspended due to diminishing performance and the substantial costs of operating the VER system. Also in 2013, groundwater collection and recharge at Site 3 was re-initiated for a brief period (3-4 months) and it was confirmed that groundwater collection from the Site 3 trench was not contributing significantly to contaminant mass removal from Site 3 groundwater. Groundwater from Sites 1 and 2 is still actively treated using the GWTP. In 2014, supplemental remedial activities consisting of in-situ remedial treatments at Sites 1, 2, and 3 were performed to improve the overall effectiveness of remedial treatment at OU-1 beyond the recent performance of the groundwater pump and treat system alone. The goal of the supplemental treatment along with other optimization measures has been to reduce the time to achieve RAOs and reduce project life-cycle costs. ISCO injections at Site 1 in 2014 were not effective and monitoring will continue to determine the need for additional injections or alternate treatment approaches. At Site 2, chlorinated VOCs were reduced in some Site 2 monitoring wells following EVO injections for enhanced reductive dechlorination, but for the most part, performance monitoring results for Sites 2 and 3 suggested that EVO was not effectively distributed and effective reducing conditions were not established. Additional treatments will be needed to achieve the goal of reducing groundwater contamination to below MCLs and MCP GW-1 and GW-2 Standards in these source areas. Remedial process optimization should

continue to work toward achieving the RAO of returning groundwater to federal and state drinking water standards and state groundwater risk characterization standards within an acceptable period.

The RAOs to prevent exposure to groundwater containing COC concentrations that exceed federal and state drinking water standards and state groundwater risk characterization standards continues to be met through containment of the groundwater plume and implementation of LUCs/ICs to prevent installation of groundwater wells.

Secondary RAOs identified in the ROD include ensuring that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil and to prevent exposure to vapors that could accumulate in buildings affected by the contaminated groundwater plume. LUCs/ICs have been implemented and routine monitoring and inspections have confirmed that no unauthorized activities have occurred and land use has not changed.

System Operations/O&M: Operation and maintenance of the groundwater collection, treatment, and recharge system has, on the whole, been effective. There has been a high rate of operation over the past five years. Excluding 2014, the percent of time operating ranged from 90.87% to 96.4% of possible hours each year during this review period. In 2014, the plant operated nearly continuously, except for a period of time in the fall when the GWTP was shut down for field activities associated with implementation of the in-situ remedial treatments at OU-1.

Opportunities for Optimization: Several optimization measures have been implemented during this review period and additional opportunities will continue to be investigated. Significant optimization actions since the previous five-year review are outlined in Section 5.0. Also, the Long-Term Monitoring Program is adjusted between events and wells are added or removed from the sampling plan to optimize the monitoring.

Implementation of Land Use Controls/Institutional Controls and Other Measures: The LUCs/ICs included in the ROD have been fully implemented, monitored, and enforced. Routine inspections include ensuring that drinking water wells are not being installed and that there is no unauthorized digging at the three source areas (IRP Site 1, 2, and 3) on Hanscom Field. Also, Massport's 2012 L.G. Hanscom Field Environmental Status and Planning Report includes information on IRP Sites 1, 2, and 3 and other sites addressed in this five-year review and it reflects that nothing is/will be planned for the areas of Sites 1, 2, and 3 that are located on Hanscom Field. However, based on interviews conducted with the Hanscom Field Airport Director and Operations Manager, Massport is interested in understanding the status of the sites and potential for future development, potentially including use of the areas for occupied buildings. The Town of Bedford Board of Health continues to be kept up-to-date on the status of the sites and receives copies of OU-1 Long-Term Monitoring Reports. Also, the Town regulations require that any landowner obtain a permit for the installation of wells anywhere in the Town of Bedford, which does not specifically "prohibit" wells in the Jordan Conservation Area and Hartwell Town Forest, but does ensure that the Board of Health be involved in the decision. Based on an interview conducted with the Bedford Director of Public Health, she indicated that although there have not been any issues thus far, there is a need to have formal documentation to inform the town of areas where emerging contaminants are a concern with respect to installation of new wells.

Further, the current LUC/IC measures that are in place do not specifically address the RAO to prevent exposure to vapors that could accumulate in buildings affected by the contaminated

groundwater plume, although there are measures in place that make building construction "unlikely." A deed restriction limits land use in the Jordan Conservation Area and Hartwell Town Forest to recreational and passive use. Additionally, construction of occupied buildings would constitute a change in land use and necessitate prior evaluation of the potential for vapor intrusion.

Note that the current DoD Defense Environmental Restoration Program Manual (4715.20) includes the development of a LUC Implementation Plan as part of the remedial design phase, if LUCs/ICs are a required element of the selected remedial action. Because of the age of this site, a LUC Implementation Plan was not prepared as is done for Air Force IRP sites with more recent RODs. It is recommended that a LUC Implementation Plan be prepared for OU-1 in order to provide clarity on what additional LUCs/ICs are needed in order for the remedy to continue to be protective and where the LUCs/ICs apply, particularly on off-base properties.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Changes in Standards and To Be Considered: Chemical-specific ARARs listed in the OU-1 ROD as relevant and appropriate for OU-1 groundwater include federal and state drinking water standards (i.e., MCLs and non-zero MCLGs) and state groundwater risk characterization standards (i.e. MCP Method 1 GW-1 and GW-2 Standards). The Massachusetts Groundwater Quality Standards (314 CMR 6.00) were also listed as applicable, but the regulations were later rescinded in 2009. No changes have been made to the Federal or State MCLs and non-zero MCLGs since the previous five-year review. Minor changes since the ROD are shown in the next subsection below.

The MCP was last amended in April 24, 2014 and May 23, 2014 and GW-1 and GW-2 Standards were revised for some groundwater COCs identified either in the ROD or from the Long-Term Monitoring data set. GW-2 Standards for several analytes were either increased or decreased in 2014. GW-2 Standards were lowered for benzene, 1,4-dichlorobenzene, trans-1,2-dichloroethene, naphthalene, and xylenes, which are VOCs that are currently analyzed; however, these changes have no impact since recent groundwater data does not exceed these standards. The GW-2 Standards for TCE and cis-1,2-dichloroethene, which are two of the main COCs in groundwater at OU-1 were both lowered in 2014. The GW-2 Standard for TCE was lowered from 30 to 5 ug/L and is now the same as the MCL and GW-1 Standard. The GW-2 Standard for cis-1,2-dichlorethene was lowered from 100 to 20 ug/L and is now lower than the MCL and GW-1 Standard of 70 ug/L. Based on review of the most recent November 2015 LTM data, TCE and/or cis-1,2-dichloroethene concentrations in surficial aquifer samples were noted for 3 well locations at or downgradient of Site 3, 2 well locations at Site 2, and 1 well location (RAP1-6S) located at Site 1. All of these locations are on Hanscom Field and none are in areas where the GW-2 Standards would be applicable. The GW-2 Standard applies if contamination is found within 30 feet of an existing or planned occupied building or structure that is or will be occupied, and the average annual depth to groundwater in that area is 15 feet or less. Note that groundwater contamination above GW-2 Standards has been detected in the lower/till and bedrock aquifers both on-base and on Hanscom Field and Town of Bedford-owned conservation land.

Other ARARs and TBCs relate to the site's location (surface water and wetlands) and to the groundwater and treatment system's monitoring. No changes in these requirements and no new standards or TBCs have been identified that affect the protectiveness of the OU-1 remedy.

The 2007 Final ROD for OU-1 includes Executive Order 11988 and Appendix A of 40 CFR 6 as an applicable floodplain management requirement. This provision of the CFR no longer exists and the current provision is a FEMA regulation codified at 44 CFR 9. Since the remedy has been constructed and no activities are anticipated that would impact the 100-year floodplain, there are no concerns with the protectiveness of the remedy.

Changes in Risk Assessment Methods, Exposure Pathways, Toxicity, and Other Contaminant Characteristics: Based on agreement between USEPA Region I, MassDEP, and Hanscom AFB, a full baseline HHRA was not conducted for OU1. It was determined that COC concentrations in groundwater exceeded federal and state drinking water standards (MCLs and non-zero MCLs), and state groundwater risk characterization standards (MCP GW-1) at many locations and as a result, unacceptable risks and hazards are present to receptors (i.e., future groundwater users) from groundwater ingestion. The remedial system was designed to prevent exposure to groundwater, to prevent further migration of dissolved phase COCs in groundwater, and to prevent discharge to surface water.

As noted above, the ARARs listed in the OU1 ROD include federal and state drinking water standards (MCLs and non-zero MCLs) and state groundwater risk characterization standards related to the site's location (surface water and wetlands) and the groundwater and treatment system monitoring. LUCs/ICs have been implemented to prevent exposure to, and use of, contaminated groundwater and ensure that excavation at the three source areas is controlled to prevent exposure to any residual contamination in subsurface soil and prevent the accumulation of vapors in buildings overlying or in the proximity of the groundwater plume.

Remediation Goals identified in the ROD and updated values (if applicable) are presented in the table below:

		EPA MCL		MCP GW-1	
COC	Units	ROD Value	Current	ROD Value	Current
1,1-dichloroethane	µg/l			70	70
1,1-dichloroethene	µg/l	7	7	7	7
1,1,1-trichloroethane	µg/l	200	200	200	200
1,2-dichlorobenzene	µg/l	600	600	600	600
1,2-dichloroethane	µg/l	5	5	5	5
Acetone	µg/l	NA	NA	3000	6300
Benzene	µg/l	5	5	5	5
Chloroethane	µg/l	NA	NA	NA	NA
Chloroform	µg/l	100	70*	5	70
cis-1,2-dichloroethene	µg/l	70	70	70	70
Methyl-tert-butyl-ether	µg/l	NA	NA	70	70
Toluene	µg/l	1000	1000	1000	1000
trans-1,2-dichloroethene	µg/l	100	100	100	100
Trichloroethene	µg/l	5	5	5	5
Vinyl chloride	µg/l	2	2	2	2

* MCLG

NA – not available

There have been no changes to USEPA MCLs or MassDEP MCP GW-1 standards that would

affect the protectiveness of the remedy. The MCP GW-1 standard for acetone has increased from 3,000 to 6,300 µg/l and the MCP GW-1 standard for chloroform has increased from 5 to 70 ug/L.

Soil contamination was determined to be related to potential degradation of groundwater quality beneath OU1. Direct contact exposure for construction workers to contaminated soils was not evaluated as construction activities other than remedial efforts were not envisioned on the active airfield. LUCs/ICs are maintained to prevent direct contact with residual soil contamination. Future construction activities at the site will be conducted in accordance of site-specific health and safety procedures to minimize and prevent potential exposures.

COCs include chlorinated VOCs and aromatic VOCs. The 2012 Five-Year Review stated that a qualitative screening of maximum concentrations in groundwater showed exceedances of risk-based screening levels. However, vapor intrusion was determined to not be a relevant exposure pathway due to no permanent residential dwellings in the contaminant footprint, receptors are limited to site workers and periodic/short-term official visitors, and the pathway to Hanscom AFB Campground area and conservation lands is not complete. Should any building construction be considered at OU1, a vapor intrusion assessment should be performed because of changes in site conditions (land use, source remediation, or plume migration). Intrinsically safe building design may be necessary to reduce potential vapor intrusion risks.

In terms of emerging contaminants, sampling was conducted in May 2016 for 1,4-dioxane (see Section 6.3). 1,4-dioxane was detected in seven of 11 samples with a maximum concentration of 14 µg/l, greater than the MassDEP MCP GW-1 standard of 0.3 µg/l. In addition, in August 2016, eight PFCs were detected at concentrations ranging from 0.0034 ug/L to 8 ug/L (see Section 6.3). Detected compounds include perfluorobutane sulfonate, perfluorobutanoic acid, perfluoroheptanoic acid, perfluorohexane sulfonate, perfluorohexanoic acid, perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), and perfluoropentanoic acid. No MCL, Regional Screening Level (RSL), or MassDEP MCP GW-1 standard has been developed for these compounds. However, the USEPA RSL Calculator contains provisional toxicity values for PFOA (0.00002 mg/kg/day; USEPA, May 2016) and PFOS (0.00002 mg/kg/day; USEPA, May 2016). Risk-based screening levels were calculated for PFOA (0.0401 ug/l) and PFOS (0.0401 ug/l) using the provisional toxicity values and a default residential scenario. Detections are greater than the calculated risk-based screening level of 0.0401 µg/l and the USEPA drinking water health advisory (HA) level of 0.07 µg/l for PFOS/PFOA.

Exceedances of the PFOS/PFOA HA were reported in August 2016 at the GWTP Influent and Effluent, the surface water location RAP1-SW4, and groundwater from the lower/till (RAP1-6T) and bedrock (RAP1-6R) aquifers. The PFOS results for groundwater from the lower/till (RAP1-6T) and bedrock (RAP1-6R) aquifers also exceeded the HA. GWTP treatment processes are known to be ineffective for PFOS/PFOA.

A Site Investigation (SI) for PFOS and PFOA is currently in progress. Groundwater, surface water, and soil-sediment sampling for PFOS and PFOA at HAFB is planned for Fall 2017 in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling. The SI is expected to be complete by June 2018. The CERCLA process will continue for 1,4-dioxane and PFOS, PFAS, and PFBS, and any changes to the current remedy will be incorporated into a future decision document.

Expected Progress Towards Meeting RAOs: Overall, the remedy is progressing as expected.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

With the exception of the identification of two emerging contaminants (1,4-dioxane and PFCs) in groundwater at OU-1 as discussed in Question B, no other information has come to light that could call into question the protectiveness of the remedy. The presence of these emerging contaminants does not affect current protectiveness, because there is no current exposure, as the groundwater is not being used.

Technical Assessment Summary: According to the data reviewed, site inspection, and interviews, the remedy is functioning as intended by the ROD and there have been no changes in the physical conditions of the site that would affect the current protectiveness of the remedy. Based on the results of initial sampling conducted for two emerging contaminants (1,4-dioxane and PFCs) in 2016, 1,4-dioxane is present in site groundwater above the state risk-based standard (MCP GW-1 Standard) and PFOS and PFOA are present in site groundwater above the risk-based screening levels calculated using USEPA provisional toxicity values and recently issued EPA lifetime drinking water health advisory levels (note that there are currently no promulgated standards for any PFCs). The RI/FS process needs to be conducted for these contaminants and any changes to the current remedy should be incorporated into a future decision document. Additionally, modifications to the existing groundwater treatment system may be needed to remove PFCs.

While the LUCs/ICs have been implemented as described in the ROD, the Town of Bedford has expressed a need to have more formal documentation in place to tell the town where areas of concern are that wells should not be installed. Similarly, Hanscom Field Airport is looking to understand what areas may be available for future development, including possible use for occupied buildings. Because of the age of the site, a LUC Implementation Plan was not prepared during remedial design. It is recommended that a LUC Implementation Plan be prepared to provide greater clarity on where LUCs/ICs are needed, particularly on off-base properties, and the plan should include a requirement to evaluate the potential for vapor intrusion risks if new construction in the area of groundwater and residual soil contamination is proposed.

7.2 OU-2/IRP Site 4

Question A: Is the remedy functioning as intended by the decision documents?

Remedial Action Performance: The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the 1988 Remedial Action Plan. The integrity of the low permeability landfill cap is being maintained. Since the 4th Five-Year Review, the physical site conditions or the understanding of these conditions have not changed in a way that could affect the protectiveness of the remedy. The protectiveness of the landfill cap had previously been confirmed by the long term monitoring conducted between December 1989 and September 1992, Supplemental Sampling and Analysis conducted in 1995 and 1996, the Human Health and Ecological Risk Assessments completed in 1997, and Five-Year Reviews conducted in 1997, 2002, 2007, and 2012. The assessment of this Five-Year Review finds that the recommendations of the 1st Five-Year

Review continue to be implemented and that a long-term inspection and maintenance program is in place to ensure continued protectiveness of the remedy. Routine inspections confirm that there have been no changes of any kind since the 4th Five-Year Review that could affect the protectiveness of the remedy.

Opportunities for Optimization: Since routine inspections and periodic maintenance of the low-permeability landfill cover, along with five-year reviews, are the only ongoing requirements associated with IRP Site 4, there are little opportunities for optimization. The frequency of routine site inspections was reduced from quarterly to annually beginning with calendar year 2014. No further optimization opportunities have been identified.

Implementation of Land Use Controls/Institutional Controls and Other Measures: While LUCs/ICs were not specifically included in the 1988 Remedial Action Plan, they have been voluntarily implemented, monitored, and enforced. Routine inspections include ensuring that the integrity of the landfill cap is maintained, that drinking water wells are not being installed, and that there is no unauthorized digging at the site. Since IRP Site 4 is located on Hanscom Field, within the Runway 5 Approach Area, Massport restricts vehicle access with a locked gate. Also, Massport's 2012 L.G. Hanscom Field Environmental Status and Planning Report includes information on IRP Site 4 and other sites addressed in this five-year review and it reflects that nothing is/will be planned for the Runway 5 Approach Area.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

CERCLA Human Health and Ecological Risk Assessments were completed in 1997 following construction of the low-permeability landfill cap and completion of several years of environmental monitoring. The Human Health Risk Assessment concluded that "there are no unacceptable risks associated with exposure to Site 4 media" and the Ecological Risk Assessment concluded that "there are no significant ecological risks associated with Site 4". While methodologies, exposure assumptions, and toxicity values applied during the previous risk assessments may have changed, the remedy for the site (a cap with land use controls) remains protective of the receptors evaluated since the cap prevents exposure to contaminants.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No newly identified human health or ecological risks have been found and no other information has come to light that could call into question the protectiveness of the remedy.

Technical Assessment Summary: Based on the documents reviewed, the site inspection, and the interviews, the remedy is functioning as intended by the 1988 Remedial Action Plan. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

7.3 OU-3/IRP Site 6

Question A: Is the remedy functioning as intended by the decision documents?

Remedial Action Performance: The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that remedy is functioning as intended by the ROD. The capping of contaminated soils and removal of contaminated wetland soil has achieved the Remedial Action Objectives to prevent direct contact with contaminants in surface soils, to reduce exposure of ecological receptors to contamination, and to minimize erosion of contaminants from the site to the adjacent wetlands and pond. A formal inspection and maintenance program is in place to ensure that the physical site conditions or the understanding of these conditions have not changed in a way that could affect the protectiveness of the remedy. Review of the inspection and maintenance reporting for the current five-year period confirms that the integrity of the cap is being maintained and that there are no physical changes at the site.

The results of the second round of wetland mitigation monitoring and ecosystem evaluation conducted in 2016 documents that the objectives of the initial five-year monitoring plan and long-term operation and maintenance plan have been achieved and that the wetland restoration areas (EWRA and WWRA) are established, maturing, and appear to be functioning similarly to adjacent wetlands. It was agreed that long-term ecosystem monitoring would be discontinued based on the 2016 evaluation.

Long-Term Monitoring data confirms that the existing Groundwater Compliance Boundary is serving its intended purpose to prevent human or ecological exposure to site-derived contamination. Since the previous five-year review, it was determined that arsenic concentrations observed at and north of the compliance boundary, including concentrations that exceed the MCL, are naturally occurring. Activities conducted that contributed to this determination included expansion of the Site 6 monitoring well network, increased groundwater monitoring frequency to evaluate seasonal trends, and most recently, a detailed investigation in 2014 and 2015 to evaluate the source of arsenic observed at and in the vicinity of Site 6.

Long-Term Monitoring data confirms that Site 6 contaminants are not leaving the site via surface water flowing from the wetlands. The on-going groundwater and surface water sampling confirms that natural flushing and natural attenuation are reducing strength of the on-site contaminants.

PCP is routinely detected in well MW6-106, located within the limits of the Former Filter Bed Area cap, at concentrations above the MCL/MCP GW-1 Standard. PCP results for downgradient well MW6-112U have been non-detect with reporting limits ranging from 19 to 57 ppb over the past five years; therefore, it cannot be absolutely concluded that PCP is not present above the MCL/MCP GW-1 Standard at well MW6-112U. Historic data from 2006 for well MW6-112U showed a PCP concentration of 1.06 ppb and it is unlikely that PCP concentrations would have increased since then. Also, well MW6-112U is located more than 400 feet upgradient of the compliance boundary and within the limits of the Former Filter Bed Area cap. However, in order to absolutely confirm that the extent of PCP above the MCL/MCP GW-1 Standard is limited and does not extend beyond well MW6-112U, it is recommended that the well be sampled for PCP using an analytical method that is sensitive enough to achieve a reporting limit below the MCL/MCP GW-1 Standard of 1 ppb.

Opportunities for Optimization: The long-term groundwater and surface water monitoring program should continue to be optimized, as appropriate, including refinement of COCs and

refinement of monitoring programs based on the analysis of each year's results, which are documented in annual long-term monitoring reports.

Implementation of Land Use Controls/Institutional Controls and Other Measures: The LUCs/ICs included in the ROD have been fully implemented, monitored, and enforced. Site inspection has confirmed the presence of fencing and signage. Routine inspections include checks to verify the integrity of the cap, that there is no unauthorized digging at the site, and that drinking water wells are not being installed at the site. Also, Massport's 2012 L.G. Hanscom Field Environmental Status and Planning Report includes information on IRP Site 6 and other sites addressed in this five-year review. It reflects that nothing is/will be planned for the area of Site 6 that is located on Hanscom Field.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Changes in Standards and To Be Considered: The ARARs listed in the ROD that must be met and that have been evaluated are included in Attachment B. As the cap construction and wetlands remediation and restoration work have been completed, many of the ARARs cited in the ROD have been met. The Federal Safe Drinking Water MCLs and MCP GW-1 Standards were both identified as ARARs for the long-term monitoring of groundwater and must be met at the groundwater compliance boundary. No changes have been made to the Federal MCLs since the previous five-year review. The MCP was last amended in April 24, 2014 and May 23, 2014 and while GW-1 Standards were modified for a small number of analytes, no GW-1 Standards have changed for the groundwater COCs identified either in the ROD or from the Long-Term Monitoring data set. As noted in previous reviews, the arsenic MCL was lowered from 50 ug/L to 10 ug/L, which prompted additional investigation into arsenic trends and source and the adequacy of the groundwater compliance boundary; however, it was determined that the dissolved arsenic present in groundwater above the current MCL, downgradient of the groundwater compliance boundary, is naturally occurring and not site-related. See further discussion of changes in MCLs and MCP GW-1 Standards since the ROD below.

The ROD for OU-3/IRP Site 6 includes Executive Order 11988 and Appendix A of 40 CFR 6 as an applicable floodplain management requirement. This provision of the CFR no longer exists and the current provision is a FEMA regulation codified at 44 CFR 9. Since the Wetland Z sediment removal and restoration work has been completed, the permeable caps are in place, and no activities are anticipated that would impact the 100-year floodplain, there are no concerns with the protectiveness of the remedy.

Changes in Risk Assessment Methods, Exposure Pathways, Toxicity, and Other Contaminant Characteristics: Only potentially complete exposure pathways were evaluated in the 1999 HHRA. The Site is fenced and locked, and no site workers are present on a regular basis. Exposure to surface soil by a hypothetical future site worker and exposure to surface and subsurface soil by a construction worker were evaluated. Exposure to surface water and sediment in the wetland area and the Shawsheen River by recreational users was evaluated. Groundwater beneath the site is not used as a source of potable water; however, hypothetical use of groundwater by future residents was evaluated. There have been no changes in exposure pathways since the remedy has been implemented.

The results of the HHRA showed that risks and hazards were greater than the target risk level for surface soil exposure in the suspected ash disposal area for future site workers (1×10^{-4}).

This risk is associated with PAHs detected in surface soil (benzo(a)pyrene) primarily from one sample with detected concentrations two orders of magnitude higher than other samples. The remedy (cap and institutional controls) is protective of future site worker exposures as long as it is maintained properly.

Risks of future use of groundwater beneath the filter beds and at the northern edge of the site between the site and the Shawsheen River was also greater than the USEPA target risk level. Groundwater is not used as a potable water supply and is not anticipated for use in the future (refer to Section 4.2 for the specific LUCs/ICs that are in place for IRP Site 6). Based on evaluations performed to date, it is unlikely that groundwater concentrations at a potential downgradient receptor are or will be at unacceptable levels.

Groundwater is monitored to ensure remedy effectiveness of the compliance boundary. Site groundwater is not currently used for potable water and will not be used in the future. Primary COCs include VOCs, PAHs, and arsenic. Long-term monitoring data has supported the removal of several COCs from further monitoring.

ARARs listed in the ROD applicable to Site 6 include federal drinking water standards (MCLs), state drinking water standards (MCLs), and state groundwater risk-based standards (MCP GW-1 standards). Groundwater cleanup levels identified in the 2000 ROD and updated (if applicable) values are presented in the table below (note that there were no risk-based cleanup levels):

		EPA MCL		MCP GW-1	
	Units	ROD Value	Current	ROD Value	Current
Benzene	µg/l	5	5	5	5
Chlorobenzene	µg/l	100	100	100	100
1,4-dichlorobenzene	µg/l	75	75	5	5
Trichloroethene	µg/l	5	5	5	5
1,2,4-Trimethylbenzene	µg/l	NA	NA	NA	NA
Vinyl chloride	µg/l	2	2	2	2
2,4-dichlorophenol	µg/l	NA	NA	10	10
4-methylphenol	µg/l	NA	NA	NA	NA
Naphthalene	µg/l	NA	NA	20	140
Pentachlorophenol	µg/l	1	1	1	1
Arsenic	µg/l	50	10	50	10
Barium	µg/l	2000	2000	2000	2000
Cadmium	µg/l	5	5	5	5
Manganese	µg/l	NA	NA	NA	NA
Nickel	µg/l	100	NA	100	100

NA – not applicable/available

The MassDEP MCP GW-1 standard for naphthalene has increased from 20 to 140 µg/l. Since the standard has increased, there is no impact to the protectiveness of the remedy. The MCL and MassDEP MCP GW-1 for arsenic has decreased from 50 to 10 µg/l (see discussion on

arsenic above in Changes in Standards).

Wells reporting exceedances of MCLs and/or MCP GW-1 standards, except arsenic, are located well within the compliance boundary. Arsenic has been determined as naturally occurring downgradient of the Site 6 compliance boundary (not a site-related contaminant). An institutional control is in place preventing the use of groundwater within the compliance zone from human consumption.

As stated in the 2012 Five-Year Review, vapor intrusion was not evaluated in the 1999 HHRA. Per EPA guidance, this pathway should be evaluated if potential receptors are present within 100 feet of contaminant boundaries. No buildings are within or near the footprint of groundwater contamination; thus, this exposure pathway does not need to be evaluated at this time. Should future development of the site be considered, the potential for vapor intrusion should be reevaluated.

From an ecological standpoint, no new ecological pathways have been identified and there have been no changes to ecological risk assessment methods or standards that impact the protectiveness of the remedy.

Overall, site conditions and the understanding of these conditions have not changed in a way that could affect the protectiveness of the remedy. Land use on and near the site remains unchanged. No new contaminants or sources have been identified. While methodologies, exposure assumptions, and toxicity values applied during the previous risk assessment may have changed, the remedy for the site remains protective of the receptors evaluated.

Expected Progress Towards Meeting RAOs: The remedy is progressing as expected.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No newly identified human health or ecological risks have been found and no other information has come to light that could call into question the protectiveness of the remedy.

Technical Assessment Summary: According to the data reviewed, site inspections, and interviews, the remedy is functioning as intended by the ROD for IRP Site 6. There are no known changes in the physical conditions of the site that would affect the protectiveness of the remedy. The existing Groundwater Compliance Boundary is appropriate and protective as currently defined and will continue to be monitored through long-term groundwater and surface water sampling.

PCP is routinely detected in well MW6-106, located within the limits of the Former Filter Bed Area cap, at concentrations above the MCL/MCP GW-1 Standard. PCP results for downgradient well MW6-112U have been non-detect with reporting limits ranging from 19 to 57 ppb over the past five years; therefore, it cannot be absolutely concluded that PCP is not present above the MCL/MCP GW-1 Standard at well MW6-112U. Historic data from 2006 for well MW6-112U showed a PCP concentration of 1.06 ppb and it is unlikely that PCP concentrations would have increased since then. Also, well MW6-112U is located more than 400 feet upgradient of the compliance boundary and within the limits of the Former Filter Bed Area cap. However, in order to absolutely confirm that the extent of PCP above the MCL/MCP GW-1 Standard is limited and does not extend beyond well MW6-112U, it is recommended that the well be sampled using an analytical method that is sensitive enough to achieve a reporting limit below the MCL/MCP GW-1 Standard of 1 ppb.

7.3 OU-3/IRP Site 21

Question A: Is the remedy functioning as intended by the decision documents?

Remedial Action Performance: The review of documents, ARARs, risk assumptions, and the results of the site inspection indicated that the remedy is functioning as intended by the ROD. Surface water and groundwater sampling and analysis as part of the Long-Term Monitoring Program confirms that construction of the interceptor trenches and operation of the LNAPL/groundwater recovery (and treatment) system has achieved the remedial objectives to prevent or minimize further migration of the contaminant plume (dissolved-phase COCs) and to prevent or minimize further migration of contaminants from source materials (VOCs/LNAPL) to groundwater. Long-term monitoring confirms that groundwater containing COC concentrations that exceed standards is not discharging into the Shawsheen River. While the active recovery system has made progress towards the RAO to return groundwater to federal and state drinking water standards and state groundwater risk characterization standards within an acceptable time period (<100 years), the recent focus has changed from active remedial efforts to passive in-situ treatment methods, with a goal of achieving a higher rate of contaminant mass destruction. In-situ treatment is anticipated to continue and the effectiveness will continue to be monitored during long-term monitoring events.

The RAO to prevent exposure (via ingestion, inhalation, and/or dermal contact) to groundwater containing COC concentrations that exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs), and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards) are being met by the monitoring and enforcement of LUCs/ICs.

System Operations/O&M: The LNAPL/groundwater recovery system operated well and several measures were implemented during its operation to optimize the system and recovery of groundwater contaminants. However, because the pace of contaminant recovery was slow, supplemental remedial activities have been conducted more recently, beginning in 2015, to enhance the existing remedy and accelerate the rate of destruction of site contaminants. At that time, the active recovery and treatment system was shut off and has remained off since July 2015 to minimize interference with application of in-situ remedial products and to monitor the behavior of TCE in the aquifer when not under the influence of the recovery system.

Opportunities for Optimization: As discussed in detail in earlier sections of this report, the initial implementation of in-situ treatment measures appears to have had positive impacts on VOC concentrations in some locations, but not in others. It recommended that in-situ treatment measures continue and that treatment effectiveness continue to be evaluated and used to optimize the wells targeted for treatment and also to determine if additional wells may be needed. The long-term groundwater and surface water monitoring program should continue to be optimized, as appropriate, including refinement of COCs and refinement of monitoring reports based on the analysis of each year's results, which are documented in annual long-term monitoring reports.

Early Indicators of Potential Issues: There are no known issues or problems associated with the OU-3/IRP Site 21 Remedial Action that could place protectiveness at risk.

Implementation of Land Use Controls/Institutional Controls and Other Measures: The LUCs/ICs included in the ROD have been fully implemented, monitored, and enforced.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Changes in Standards and To Be Considered: The ARARs listed in the ROD that must be met and that have been evaluated are included in Attachment B. Chemical-specific ARARs identified as relevant and appropriate for groundwater in the 2001 ROD include Federal MCLs and non-zero MCLGs, Massachusetts Drinking Water Standards, and MCP Method 1 GW-1 Standards. Although not specifically called out in the ARARs tables, MCP Method 1 GW-2 Standards were also evaluated in selecting Interim Remedial Goals for groundwater and long-term monitoring data are compared to the current GW-2 Standards. No changes have been made to the Federal or State MCLs since the previous five-year review.

The MCP was last amended in April 24, 2014 and May 23, 2014 and GW-1 and GW-2 Standards were revised for some groundwater COCs identified either in the ROD or from the Long-Term Monitoring data set. The GW-1 Standard for 1,3-Dichlorobenzene increased from 40 to 100 ug/L, which has resulted in the elimination of this VOC as a COC. The GW-1 Standard for 1,4-dioxane was reduced from 3 to 0.3 ug/L in 2014. Since 1,4-dioxane was first sampled for at Site 21 in 2016, the current GW-1 Standard was used for evaluation and there were no exceedances. GW-2 Standards for several analytes were either increased or decreased in 2014. Section 6.2, Data Review for OU-3/IRP Site 21 includes a table showing those GW-2 Standards that were lowered in 2014. These revised standards were reviewed with respect to the results and conclusions of the Vapor Intrusion Investigation that was conducted in 2014 to evaluate three existing buildings (1823, 1833, & 1835) located in the area of Site 21 groundwater. The lowered GW-2 Standards did not impact the conclusion that the vapor intrusion pathway is incomplete and is not a concern. Several GW-2 Standards continue to be exceeded in groundwater within Site 21.

The ROD for OU-3/IRP Site 21 includes Executive Order 11988 and Appendix A of 40 CFR 6 as an applicable floodplain management requirement. This provision of the CFR no longer exists and the current provision is a FEMA regulation codified at 44 CFR 9. Since the remedial action construction has been completed and no activities are anticipated that would impact the 100-year floodplain, there are no concerns with the protectiveness of the remedy.

Changes in Risk Asssessment Methods, Exposure Pathways, Toxicity, and Other Contaminant Characteristics: The HHRA was completed in 2000 and a supplemental vapor intrusion assessment was performed in 2014. The HHRA evaluated potential exposures to construction workers (subsurface soil and groundwater) and future offsite residents (groundwater). The land use on and near the site has remained unchanged and physical site conditions have not changed in a way that could affect the protectiveness of the remedy.

The HHRA reported no exceedances of the USEPA target risk level of one in ten thousand (10^{-4}) to one in one million (10^{-6}) or the noncancer benchmark value of one for exposure to surface soil, subsurface soil, or offsite groundwater. Slightly elevated noncancer hazards (1.2) were calculated for construction workers potentially exposed to subsurface soil and groundwater. Risks to the construction worker can be abated through the use of a health and safety program and appropriate personal protective equipment (PPE). Unacceptable risks were calculated for future residents exposed to groundwater beneath the site.

The remedy includes monitoring groundwater as an early warning system to prevent unacceptable short-term risks and cross media impacts. Groundwater remedial goals provided

in the ROD and updated values (as applicable) are presented in the table below:

		EPA MCL		MCP GW-1	
COC	Units	ROD Value	Current	ROD Value	Current
1,4-dichlorobenzene	µg/l	75	75	5	5
1,2-dichlorobenzene	µg/l	600	600	600	600
1,2,4-trichlorobenzene	µg/l	70	70	70	70
Vinyl chloride	µg/l	2	2	2	2
cis-1,2-dichloroethene	µg/l	70	70	70	70
1,2-dichloropropane	µg/l	5	5	5	5
trans-1,3-dichloropropene	µg/l	NA	NA	1	0.4
Tetrachloroethene	µg/l	5	5	5	5
Trichloroethene	µg/l	5	5	5	5
Benzene	µg/l	5	5	5	5
Toluene	µg/l	1000	1000	1000	1000
Ethylbenzene	µg/l	700	700	700	700
n-propylbenzene	µg/l	NA	NA	NA	NA
1,3,5-trimethylbenzene	µg/l	NA	NA	NA	NA
1,2,4-trimethylbenzene	µg/l	NA	NA	NA	NA
sec-butylbenzene	µg/l	NA	NA	NA	NA
Naphthalene	µg/l	NA	NA	20	140
Benzo(a)anthracene	µg/l	NA	NA	1	1
Benzo(b)fluoranthene	µg/l	NA	NA	1	1
Benzo(a)pyrene	µg/l	0	0.2	0	0.2

NA – not applicable/available

MCP GW-1 standards have decreased for trans-1,3-dichloropropene and increased for naphthalene. Trans-1,3-dichloropropene has not been detected in Site 21 wells from 2012 to present.

Four COCs do not have ARARs-based cleanup levels (n-propylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and sec-butylbenzene). Risk-based cleanup levels were calculated for these four noncarcinogens based on a child resident's exposure to groundwater through ingestion, inhalation, and dermal contact. Because there were 14 noncarcinogenic COCs contributing to hazards due to exposure to groundwater, cleanup goals were based on a target hazard index of 0.07 for each COC. Since the time of the ROD, both exposure parameters and toxicity values have been updated relative to the calculation of these cleanup levels.

Updated toxicity values for the four COCs without ARAR based cleanup levels are presented in the following table.

Analyte	RfDo mg/kg-day		GIabs	RfCi mg/m^3	
	HHRA	Current		HHRA	Current
n-propylbenzene	1.00E-02	1.00E-01	1.00E+00	1.0E+00	1.00E+00
1,3,5-trimethylbenzene	5.00E-02	1.00E-02	1.00E+00	7.0E-03	6.00E-02
1,2,4-trimethylbenzene	5.00E-02	1.00E-02	1.00E+00	7.0E-03	6.00E-02
sec-butylbenzene	1.00E-02	1.00E-01	1.00E+00	1.0E+00	-

GIabs - Fraction of contaminant absorbed in gastrointestinal tract.
mg/kg-day - Milligrams per kilogram per day.
mg/m^3 - Milligrams per cubic meter.
RfCi - Inhalation reference concentration.
RfDo - Oral reference dose.

Default exposure assumptions for child residents have been updated since the 1999 HHRA. The default ingestion rate has decreased from 1 liter per day (L/day) to 0.78 L/day. Skin surface area has decreased from 6,500 cm^2 to 6,365 cm^2. Exposure time bathing has increased from 0.25 to 0.54 hours/event. The previous cleanup goals calculated in the 2002 Supplemental Remedial Investigation Report also assumed that the inhalation component for risks and hazards was equal to the ingestion component.

To determine impacts to the risk-based cleanup levels, the USEPA Regional Screening Level (RSL) Calculator (2017) was used to recalculate cleanup goals for the four COCs. The calculator uses a reference concentration that is an estimate of continuous inhalation exposure that is likely to be without deleterious effects during a lifetime and the Andelman volatilization factor to determine potential concentrations of volatiles in air during bathing. The results of the calculations are presented in the following table. RSL Calculator inputs and resulting screening levels are presented in Attachment H, Tables 1 and 2, respectively.

Analyte	Previous Cleanup Goal	Potential Cleanup Goal Revision
n-propylbenzene	4.20+00	4.59E+01
1,3,5-trimethylbenzene	2.2E+01	4.22E+00
1,2,4-trimethylbenzene	2.1E+01	3.90E+00
sec-butylbenzene	3.7E+00	1.40E+02

The cleanup goals calculated using current toxicity values and exposure parameters for n-propylbenzene and sec-butylbenzene have increased while cleanup goals for 1,3,5-trimethylbenezene and 1,2,4-trimethylbenzene have decreased. The most recent Long-Term Monitoring Report shows historical and recent concentrations greater than the existing cleanup goals. However, the majority of recent exceedances (2015 to present) are limited to the former suspected LNAPL plumes (n-propylbenzene: MWZ-13, MWZ-20, PW-3, and RW-1A; 1,2,4-trimethylbenzene: MWZ-13, PW-3, and RW-1A; and 1,3,5-trimethylbenzene: RW-1A) or upgradient of the LNAPL plume (sec-butylbenzene, ECS-28; and n-propylbenzene, MWZ-11

and MWZ-12). The remedy is designed to minimize migration of the plume and to treat the contaminated groundwater. Long-term monitoring confirms that groundwater containing COC concentrations that exceed standards is not discharging to the Shawsheen River. The current understanding of the extent of the contaminant plume is not impacted by the changes and LUCs/ICs prevent exposure to impacted groundwater while the remedy is operating.

As stated in the 2012 Five-Year Review, vapor intrusion was not evaluated in the 1999 HHRA. In 2014, a vapor intrusion assessment was performed for the site following Mass DEP Interim Final Vapor Intrusion Guidance (WSC-11-435). In accordance with the guidance, if concentrations of constituents in groundwater were less than twice the GW-2 standard and concentrations in soil vapor do not exceed the sub-slab soil gas criteria, the vapor intrusion pathway is determined to be incomplete and no further investigation or remediation is warranted. The investigation did not find concentrations exceeding these criteria; therefore, the vapor intrusion pathway is not a current concern for Site 21. Should future redevelopment occur at the site, the vapor intrusion pathway may need to be reevaluated because of changes in site conditions, such as land use, source remediation, or plume migration. Since the 2014 assessment, additional updates to screening values have been released. The following table shows COCs with GW-2 Standards that were lowered in 2014.

Groundwater COC	Units	Previous GW-2 Standard	Updated GW-2 Standard[1]
Benzene	ppb	2,000	1,000
1,4-Dichlorobenzene	ppb	200	60
Cis-1,2-Dichloroethylene	ppb	100	20
Trans-1,2-Dichloroethylene	ppb	90	80
Dichloromethane (Methylene Chloride)	ppb	10,000	2,000
Naphthalene	ppb	1,000	700
1,2,4-Trichlorobenzene	ppb	2,000	200
Trichloroethylene	ppb	30	5
Xylenes	ppb	9,000	3,000

1 –GW-2 Standard effective 25 April 2014

2-Butanone and 4-methyl-2-pentanone were not considered in the 2014 assessment. A review of the groundwater data presented in the 2014 assessment and updated screening values confirmed that updated standards do not affect the report's overall conclusion that the vapor intrusion pathway is incomplete.

MassDEP commercial/industrial sub-slab screening values were lowered for some COCs in 2016.

Soil Vapor COC (sub-slab)	Units	Previous Commercial/Industrial Sub-Slab Screening Criteria	Updated Commercial/Industrial Sub-Slab Screening Criteria
1,1-Dichloroethene	$\mu g/m^3$	13,000	12,000
Cis-1,2-Dichloroethylene	$\mu g/m^3$	2,200	370
Trans-1,2-Dichloroethylene	$\mu g/m^3$	4,300	3,700
1,2,4-Trichlorobenzene	$\mu g/m^3$	13,000	240
1,1,1-Trichloroethane	$\mu g/m^3$	320,000	310,000
Trichloroethylene	$\mu g/m^3$	130	120

Updated screening confirms that revised screening criteria do not affect the report's overall conclusions that the vapor intrusion pathway is not a concern. Updated MassDEP vapor intrusion screening is provided in Attachment H, Table 3.

In June 2015, EPA finalized the Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air and updated the vapor intrusion screening levels (VISLs) electronic calculator to develop media-specific risk-based VISLs for groundwater, soil gas, and indoor air. As part of this five-year review, the sub-slab soil vapor results were compared to current VISLs as presented in Attachment H, Table 3. The data comparison shows that the VISLs were not exceeded and that consideration of EPA guidance and VISLs do not affect the report's overall conclusions that the vapor intrusion pathway is not a concern.

1,4-dioxane sampling was conducted in May 2016. 1,4-dioxane was detected in one of four samples at a concentration of 0.065 micrograms per liter (µg/l) which is below the MassDEP MCP GW-1 standard of 0.3 µg/l (note that there is no MCL for 1,4-dioxane).

Expected Progress Towards Meeting RAOs: The remedy is progressing as expected.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary: According to the data reviewed, site inspections, and interviews, the remedy is functioning as intended by the ROD and there have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

SECTION 8.0
ISSUES

Based on the activities conducted during this Five-Year Review, the issues identified in Table 12 have been noted.

Table 12
Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
OU-1 The Town of Bedford has expressed a need for formal documentation of areas where emerging contaminants are a concern with respect to installation of new wells. Similarly, Hanscom Field Airport is looking to understand what areas may be available for future development, including possible use for occupied buildings. Because of the age of the site, a LUC Implementation Plan was not prepared during remedial design.	N	Y
Two emerging contaminants (1,4-dioxane and PFCs) were recently sampled for and detected in OU-1 groundwater. 1,4-dioxane was detected above the MCP GW-1 Standard in some wells at IRP Sites 1 and 2. PFOS and PFOA were detected above EPA lifetime drinking water health advisory levels in groundwater from some wells at IRP Site 1 and also in the GWTP effluent and in a surface water sample from downstream of the effluent discharge location. The GWTP is not designed to and does not remove these compounds.	N	Y
OU-3/IRP Site 6 The extent of PCP above the MCL/MCP GW-1 Standard downgradient of well MW6-106 cannot be confirmed using recent data because the reporting limit for the analytical method used is above the MCL/MCP GW-1 Standard (1 ppb). PCP results for downgradient well MW6-112U have been non-detect with reporting limits ranging from 19 to 57 ppb over the past five years.	N	N

SECTION 9.0
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

In response to the issues noted above, it is recommended that the actions listed in Table 13 be taken:

Table 13
Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
OU-1 The Town of Bedford has expressed a need to have more formal documentation in place to tell the town where areas of concern are that wells should not be installed. Similarly, Hanscom Field is looking to understand what areas may be available for future development, including possible use for occupied buildings. Because of the age of the site, a LUC Implementation Plan was not prepared during remedial design.	Prepare a LUC Implementation Plan for OU-1. Include a requirement to evaluate the potential for vapor intrusion risks if new construction in the area of groundwater and residual subsurface soil contamination is proposed.	U.S. Air Force	EPA/ MassDEP	2022	N	Y
Two emerging contaminants (1,4-dioxane and PFCs) were recently sampled for and detected in OU-1 groundwater. 1,4-dioxane was detected above the MCP GW-1 Standard in some wells at IRP Sites 1 and 2. PFOS and PFOA were detected above EPA lifetime drinking water health advisory levels in groundwater from some wells at IRP Site 1 and also in the	Conduct groundwater, surface water, and soil-sediment sampling for PFOS and PFOA as part of Site Investigation (SI) in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling.	U.S. Air Force	EPA/ MassDEP	Fall 2017	N	Y

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
GWTP effluent and in a surface water sample from downstream of the effluent discharge location. The GWTP is not designed to and does not remove these compounds.	Complete SI for PFOS and PFOA.	U.S. Air Force	EPA/ MassDEP	June 2018	N	Y
	Proceed through the CERCLA process for 1,4-dioxane and PFOS and PFOA and incorporate any changes to the current remedy into a future decision document.	U.S. Air Force	EPA/ MassDEP	2022	N	Y
<u>OU-3/IRP Site 6</u> The extent of PCP above the MCL/MCP GW-1 Standard downgradient of well MW6-106 cannot be confirmed using recent data because the reporting limit for the analytical method used is above the MCL/MCP GW-1 Standard (1 ppb). PCP results for downgradient well MW6-112U have been non-detect with reporting limits ranging from 19 to 57 ppb over the past five years.	Sample for PCP at well MW6-112U using an analytical method that is sensitive enough to achieve a reporting limit below the MCL/MCP GW-1 Standard of 1 ppb.	U.S. Air Force	EPA/ MassDEP	December 2018	N	N

SECTION 10.0
PROTECTIVENESS STATEMENT

OU-1/IRP Sites 1, 2, and 3

The remedy at OU-1 currently protects human health and the environment because long-term monitoring confirms that operation of the pump and treat system, in conjunction with supplemental in-situ treatment measures, is working to prevent further migration of dissolved-phase COCs in groundwater and to prevent discharge to surface water bodies and wetlands of groundwater containing COC concentrations above ARARs. Recent supplemental in-situ treatment has been conducted and will continue along with other optimization measures with the goal of reducing the time to reduce groundwater concentrations to meet ARARs, including MCLs and MCP GW-1 and GW-2 Standards. LUCs/ICs identified in the ROD have been implemented and routine monitoring and inspections have confirmed that objectives of preventing exposure to and use of contaminated groundwater, ensuring that excavation at the three source areas is controlled to prevent exposure to any residual contamination in the subsurface soil, and preventing exposure to vapors that could accumulate in buildings affected by the contaminated groundwater plume are currently being met. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: 1) a LUC Implementation Plan should be prepared for OU-1 and should include a requirement to evaluate the potential for vapor intrusion risks if new construction in the area of groundwater and residual subsurface soil contamination is proposed; and 2) a Site Investigation (SI) for PFOS and PFOA is currently in progress. Groundwater, surface water, and soil-sediment sampling for PFOS and PFOA at HAFB is planned for Fall 2017 in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling. The SI is expected to be complete by June 2018. The CERCLA process will be continue for 1,4-dioxane and PFOS, PFAS, and PFBS, and any changes to the current remedy will be incorporated into a future decision document.

OU-2/IRP Site 4

The remedy at OU-2/IRP Site 4 is protective of human health and the environment. The remedy is functioning as intended by the 1988 Remedial Action Plan, in that the integrity of the low permeability landfill cap is being maintained and a long-term inspection and maintenance program is in place to ensure continued protectiveness.

OU-3/IRP Site 6

The remedy at OU-3/IRP Site 6 is protective of human health and the environment. The capping of contaminated soils and removal of contaminated wetland soil and subsequent wetland restoration is preventing direct contact with contaminants in surface soils, reducing exposure of ecological receptors to contamination to acceptable levels, and minimizing erosion of contaminants from the site to the adjacent wetlands and pond. A long-term inspection and maintenance program is in place to ensure the continued integrity of the capped landfill areas. The existing Groundwater Compliance Boundary is appropriate and protective as currently defined and will continue to be monitored through long-term groundwater and surface water sampling. LUCs/ICs prevent exposure to and use of contaminated groundwater and ensure that excavation at the three capped landfill areas is controlled to prevent exposure to any residual contamination in the subsurface soil.

OU-3/IRP Site 21

The remedy at OU-3/IRP Site 21 is protective of human health and the environment. The construction of the interceptor trenches and operation of the LNAPL/groundwater recovery (and treatment) system has been effective in reducing LNAPL to trace detections and preventing further migration of the contaminant plume (dissolved-phase COCs), minimizing further migration of contaminants (VOCs/LNAPL) from source materials to groundwater, and preventing discharge of groundwater containing COCs that exceed standards to the Shawsheen River. While the active recovery system has made progress towards the RAO to return groundwater to federal and state drinking water standards and state groundwater risk characterization standards within an acceptable time period (<100 years), the recent focus has changed from active remedial efforts to passive in-situ treatment methods, with a goal of achieving a higher rate of contaminant mass destruction. LUCs/ICs prevent exposure to and use of contaminated groundwater, ensure that excavation at the Site is controlled to prevent exposure to any residual contamination in the subsurface soil or groundwater, and that future land use does not increase the risk of exposure to contaminants (VOCs/LNAPL) remaining on-site.

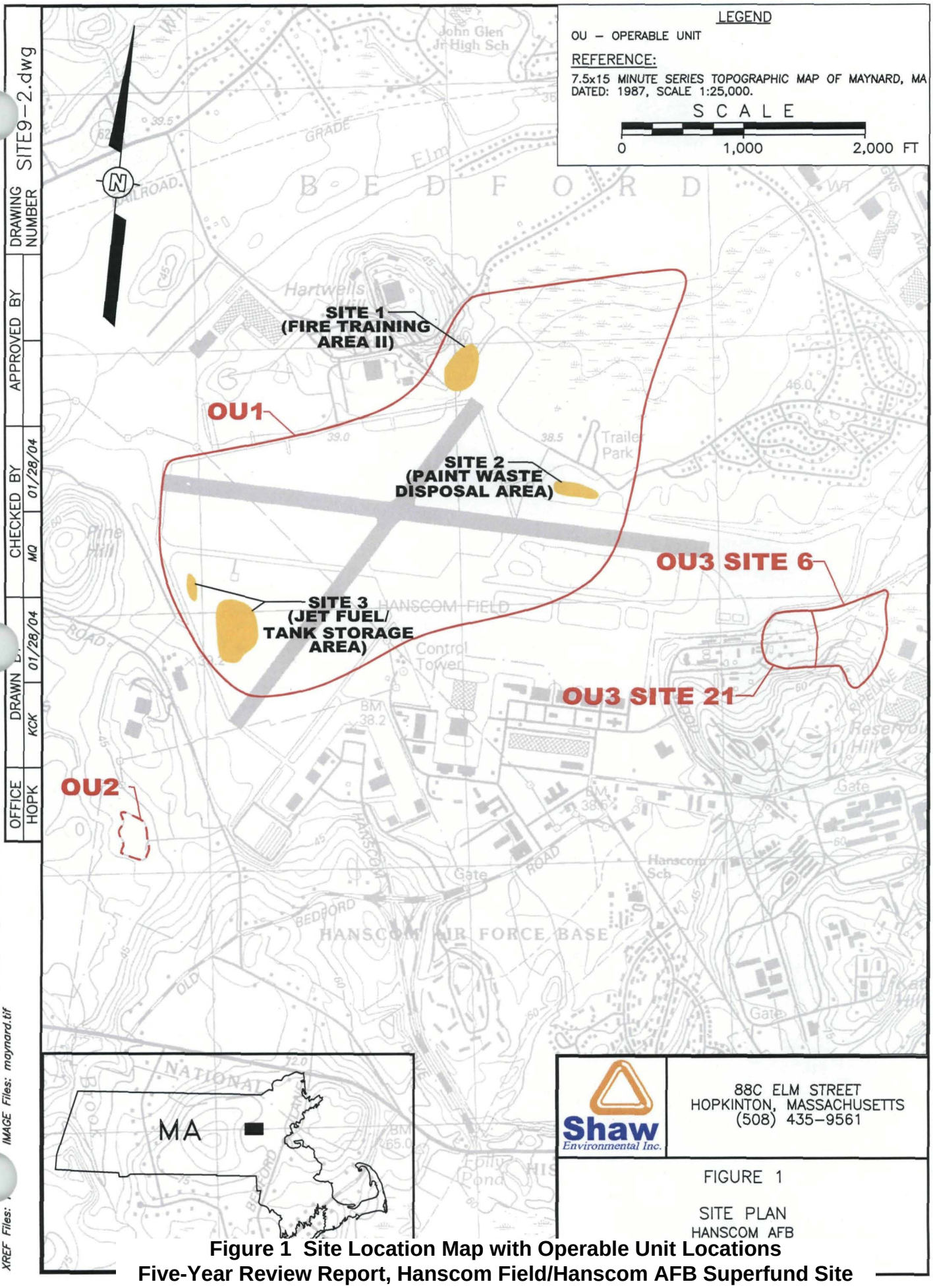
Site-Wide Protectiveness Statement

The remedial actions taken are currently protective of human health and the environment; however, the follow-up actions for OU-1/IRP Sites 1, 2, and 3 need to be completed to ensure long-term protectiveness.

SECTION 11.0
NEXT REVIEW

The next five-year review for the Hanscom Field/Hanscom AFB Superfund Site should be completed no later than five years following the signature date of this Five-Year Review Report, which is anticipated to occur on or before September 26, 2022.

FIGURES



File: N:\MIS...m AFB\2004\OU1\SITE 9-3jb.dwg Layout: O.U. LOC FIG 1-1 User: chris.desig... 4, 2007 - 4:30pm
XREF Files: ... IMAGE Files: maynard.tif

Figure 1 Site Location Map with Operable Unit Locations
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

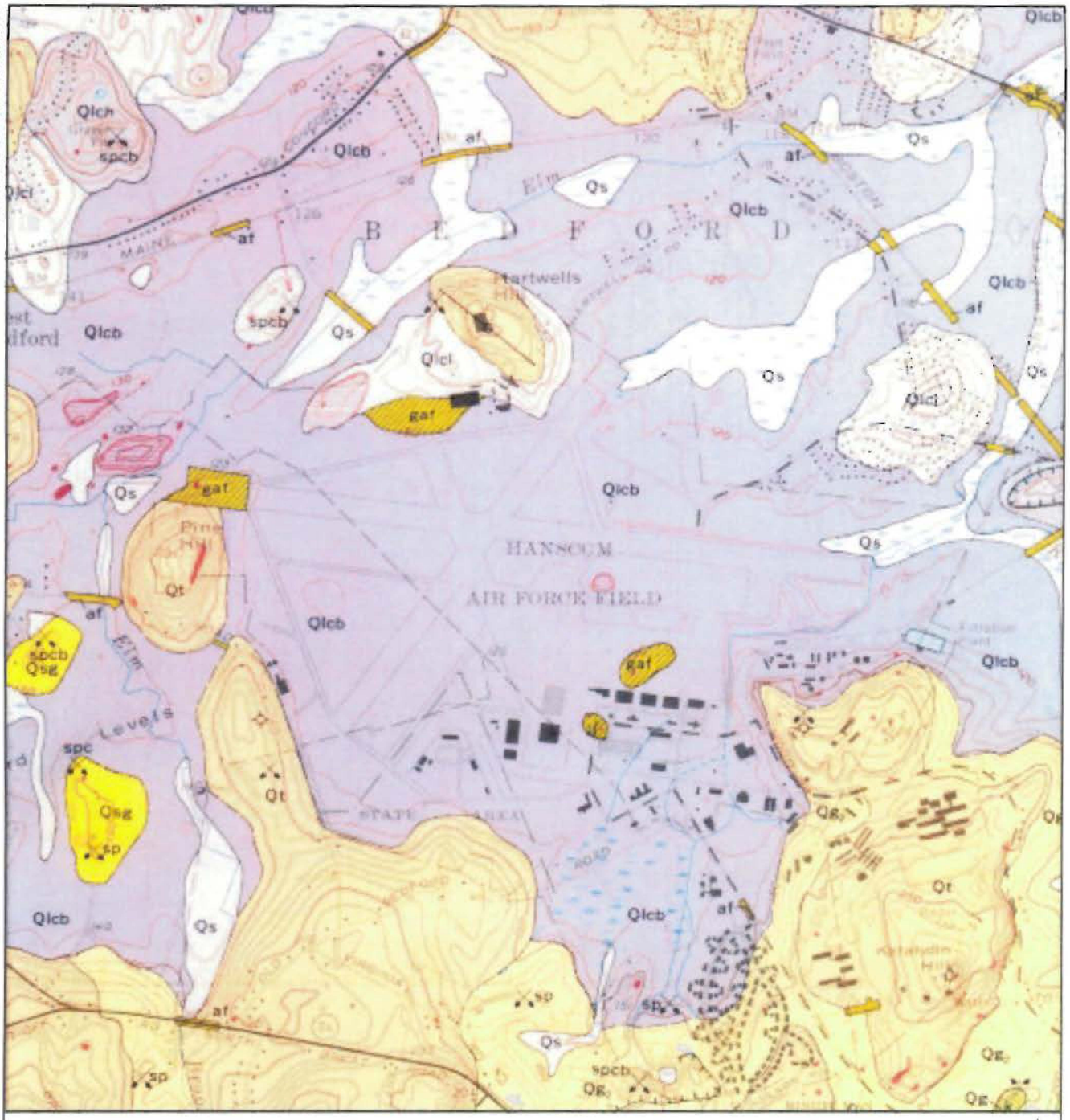


Figure 2 Topography and Surficial Geology
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

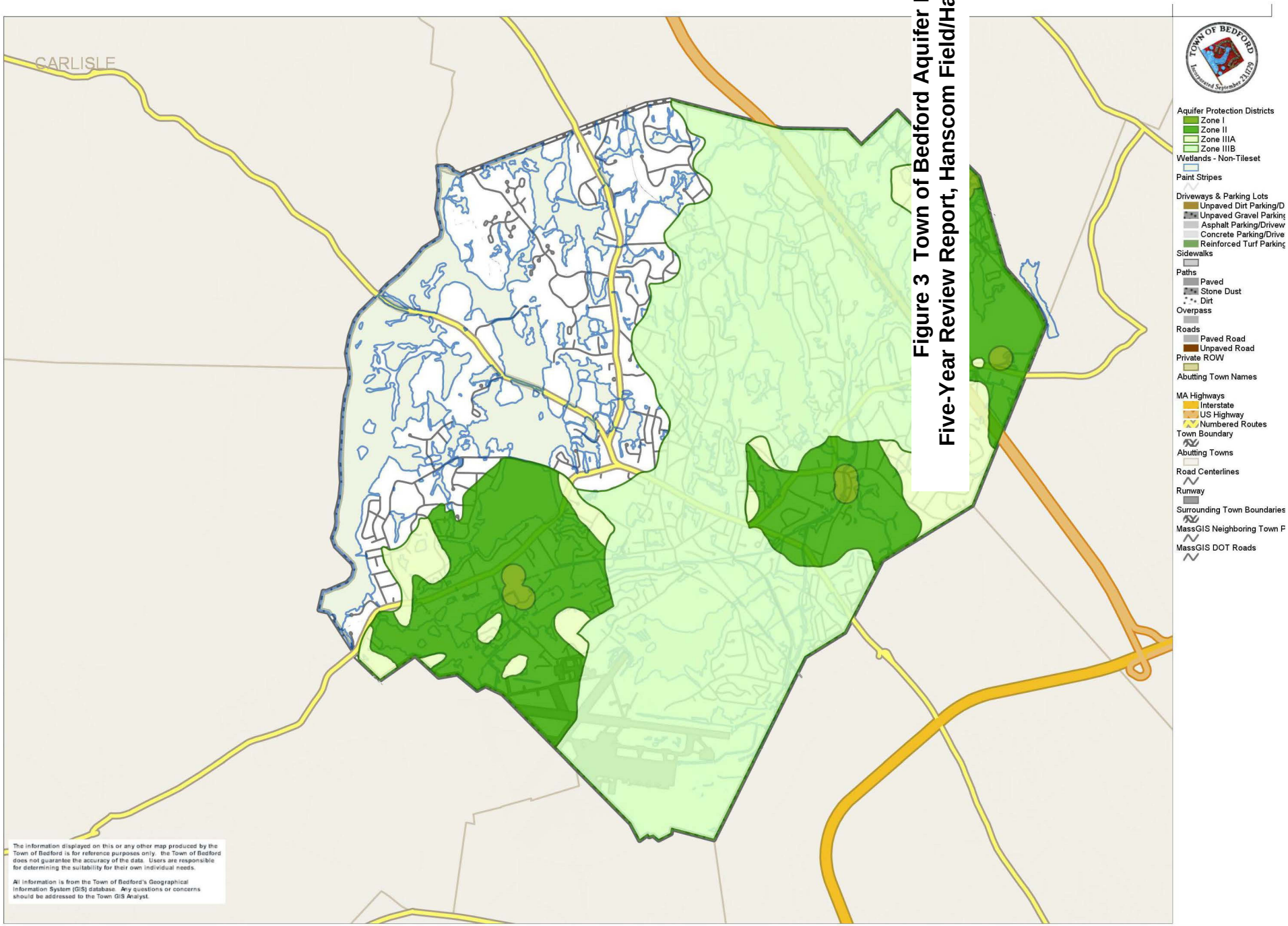


Figure 3 Town of Bedford Aquifer Protec
Five-Year Review Report, Hanscom Field/Hanscom

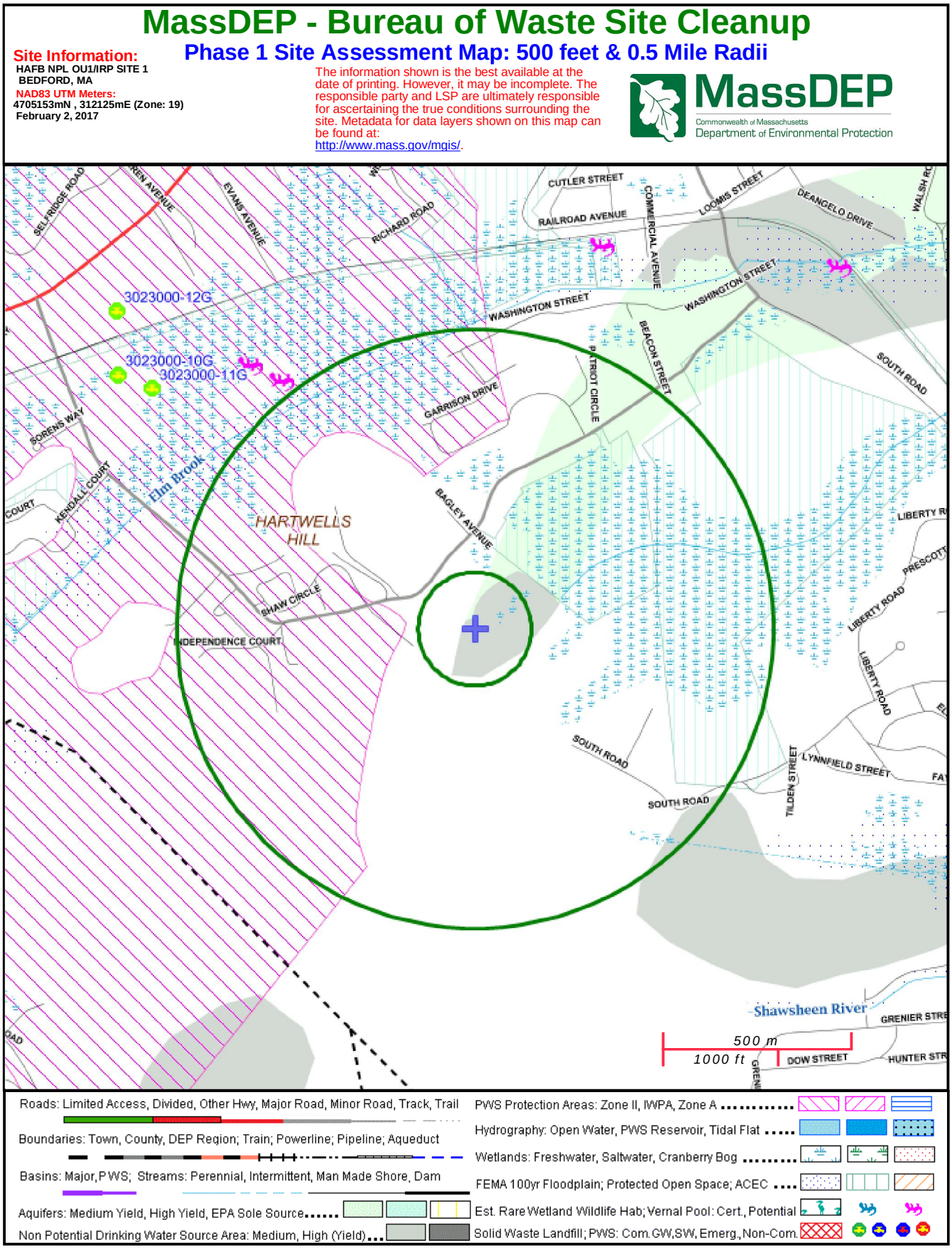


Figure 4 MassDEP Bureau of Waste Site Cleanup Groundwater Classification Map for IRP Site 1
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

MassDEP - Bureau of Waste Site Cleanup

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

Site Information:
HAFB NPL OU1/IRP SITE 2
BEDFORD, MA
NAD83 UTM Meters:
5231914mN , -7934932mE (Zone: 18)
February 2, 2017

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

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

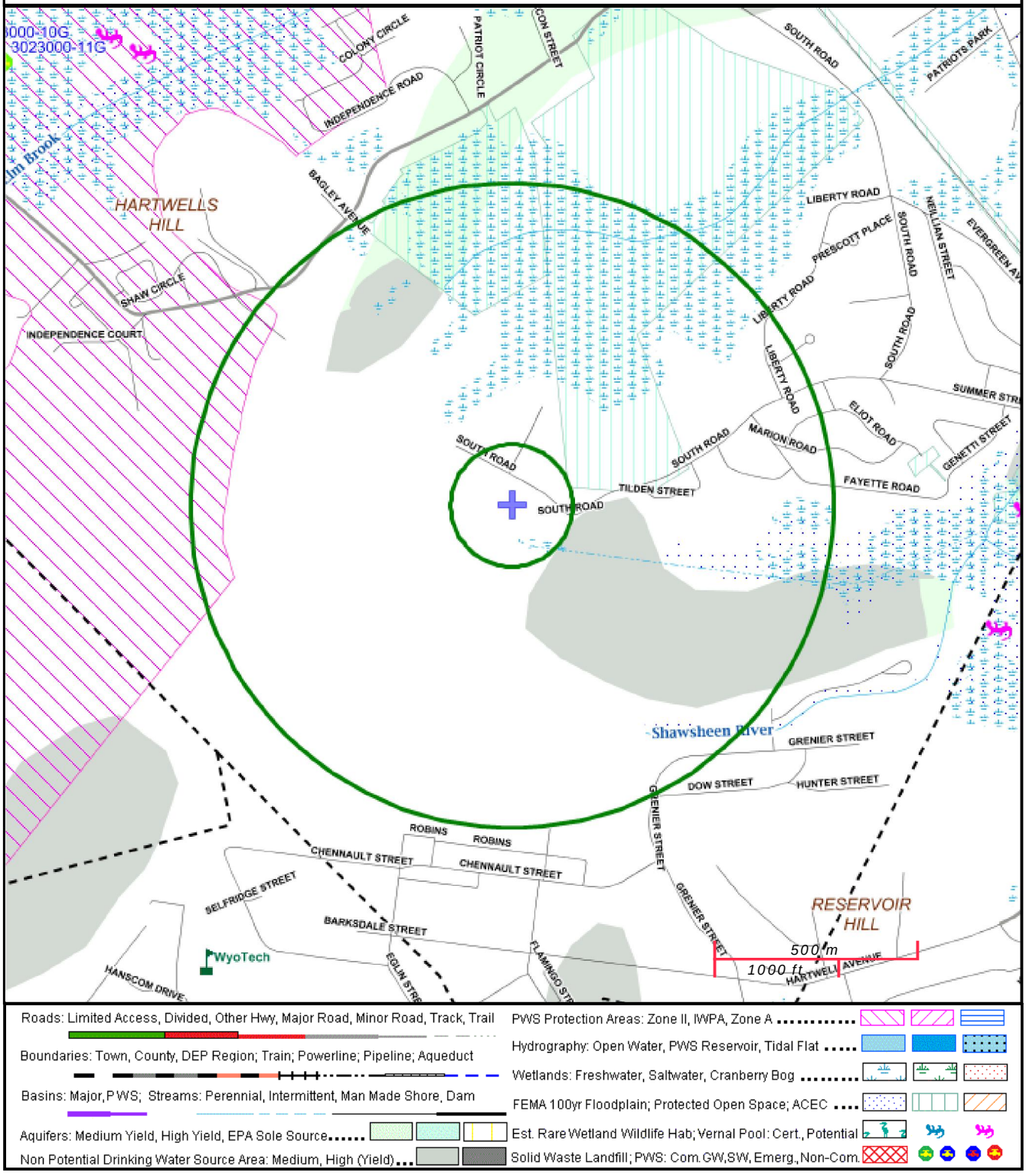


Figure 5 MassDEP Bureau of Waste Site Cleanup Groundwater Classification Map for IRP Site 2
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

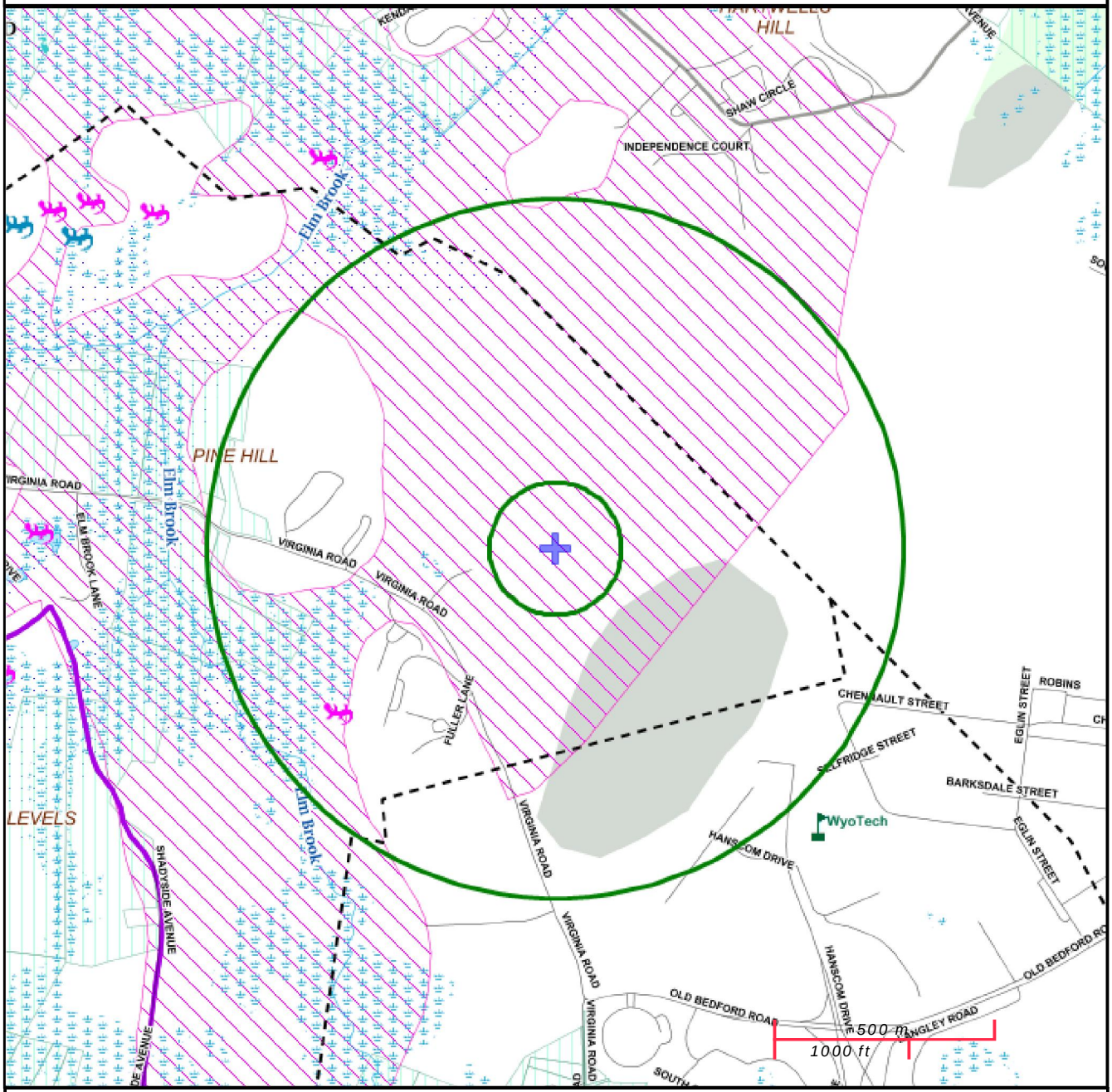
MassDEP - Bureau of Waste Site Cleanup

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

Site Information:
HAFB NPL OU1/IRP SITE 3
BEDFORD, MA
NAD83 UTM Meters:
5231238mN , -7936793mE (Zone: 18)
February 2, 2017

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

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection



Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail
Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct
Basins: Major,PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam
Aquifers: Medium Yield, High Yield, EPA Sole Source
Non Potential Drinking Water Source Area: Medium, High (Yield)
PWS Protection Areas: Zone II, IWPA, Zone A
Hydrography: Open Water, PWS Reservoir, Tidal Flat
Wetlands: Freshwater, Saltwater, Cranberry Bog
FEMA 100yr Floodplain; Protected Open Space; ACEC
Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential
Solid Waste Landfill; PWS: Com.GW,SW, Emerg.,Non-Com.

Figure 6 MassDEP Bureau of Waste Site Cleanup Groundwater Classification Map for IRP Site 3
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

MassDEP - Bureau of Waste Site Cleanup

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

Site Information:
HAFB NPL OU3/IRP SITE 6
BEDFORD, MA
NAD83 UTM Meters:
5231100mN , -7933504mE (Zone: 18)
February 2, 2017

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

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

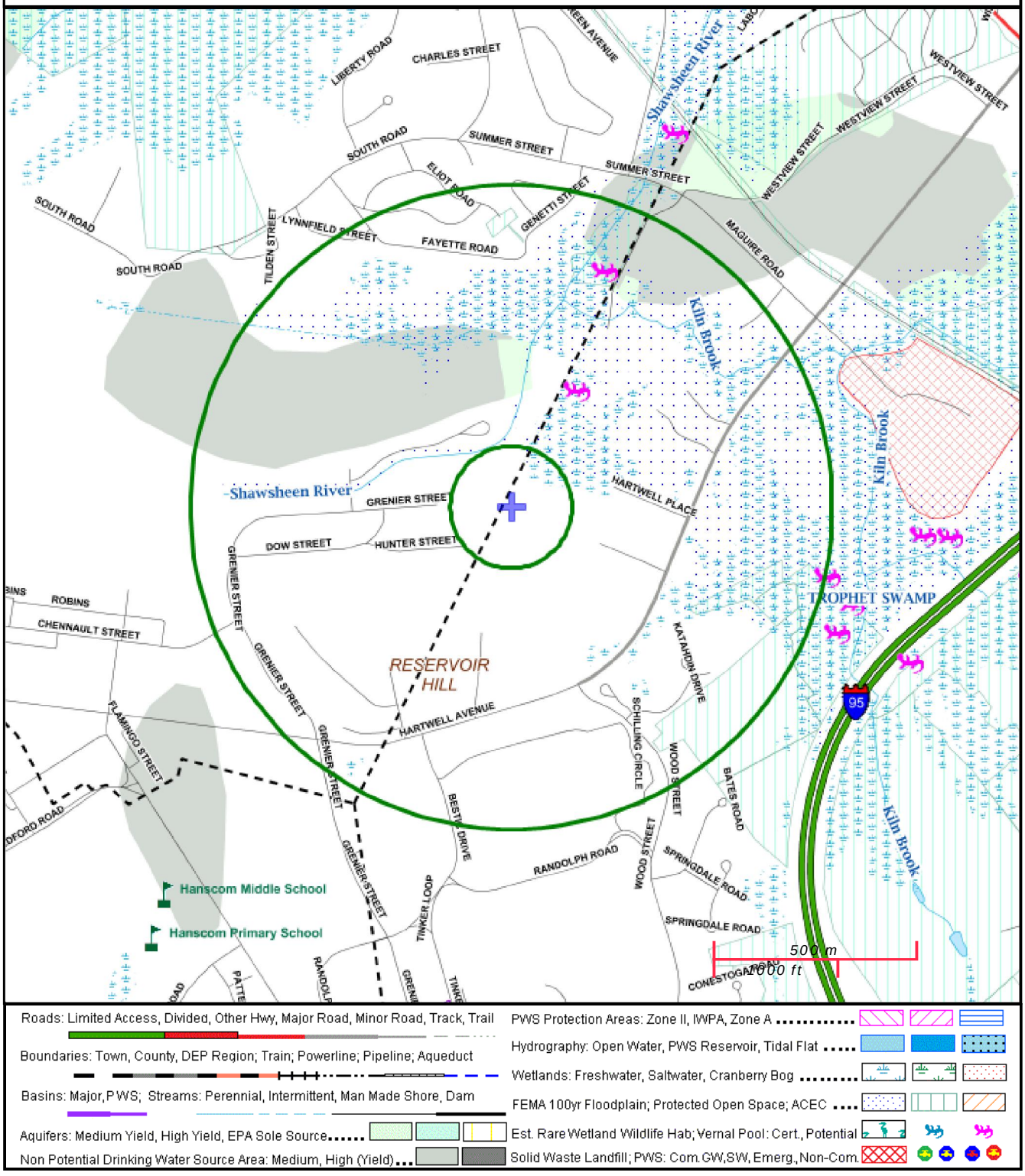


Figure 7 MassDEP Bureau of Waste Site Cleanup Groundwater Classification Map for IRP Site 6
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

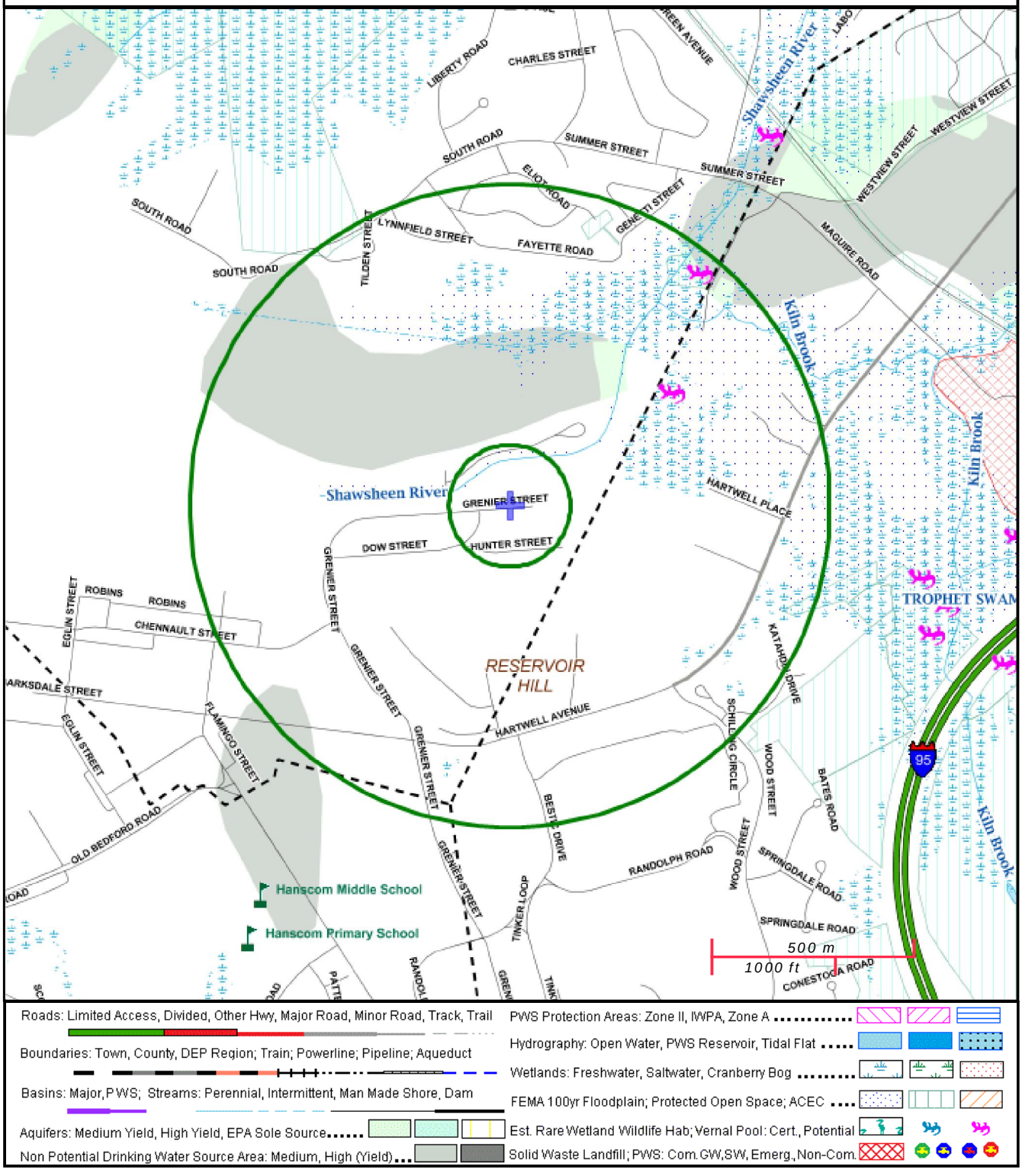
MassDEP - Bureau of Waste Site Cleanup

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

Site Information:
HAFB NPL OU3/IRP SITE 21
BEDFORD, MA
NAD83 UTM Meters:
5231109mN , -7933833mE (Zone: 18)
February 2, 2017

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

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection



Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail
Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct
Basins: Major, PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam
Aquifers: Medium Yield, High Yield, EPA Sole Source
Non Potential Drinking Water Source Area: Medium, High (Yield)
PWS Protection Areas: Zone II, IWPA, Zone A
Hydrography: Open Water, PWS Reservoir, Tidal Flat
Wetlands: Freshwater, Saltwater, Cranberry Bog
FEMA 100yr Floodplain; Protected Open Space; ACEC
Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential
Solid Waste Landfill; PWS: Com.GW,SW, Emerg., Non-Com.

Figure 8 MassDEP Bureau of Waste Site Cleanup Groundwater Classification Map for IRP Site 21
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

Figure 9 IRP Site 1 Plan
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

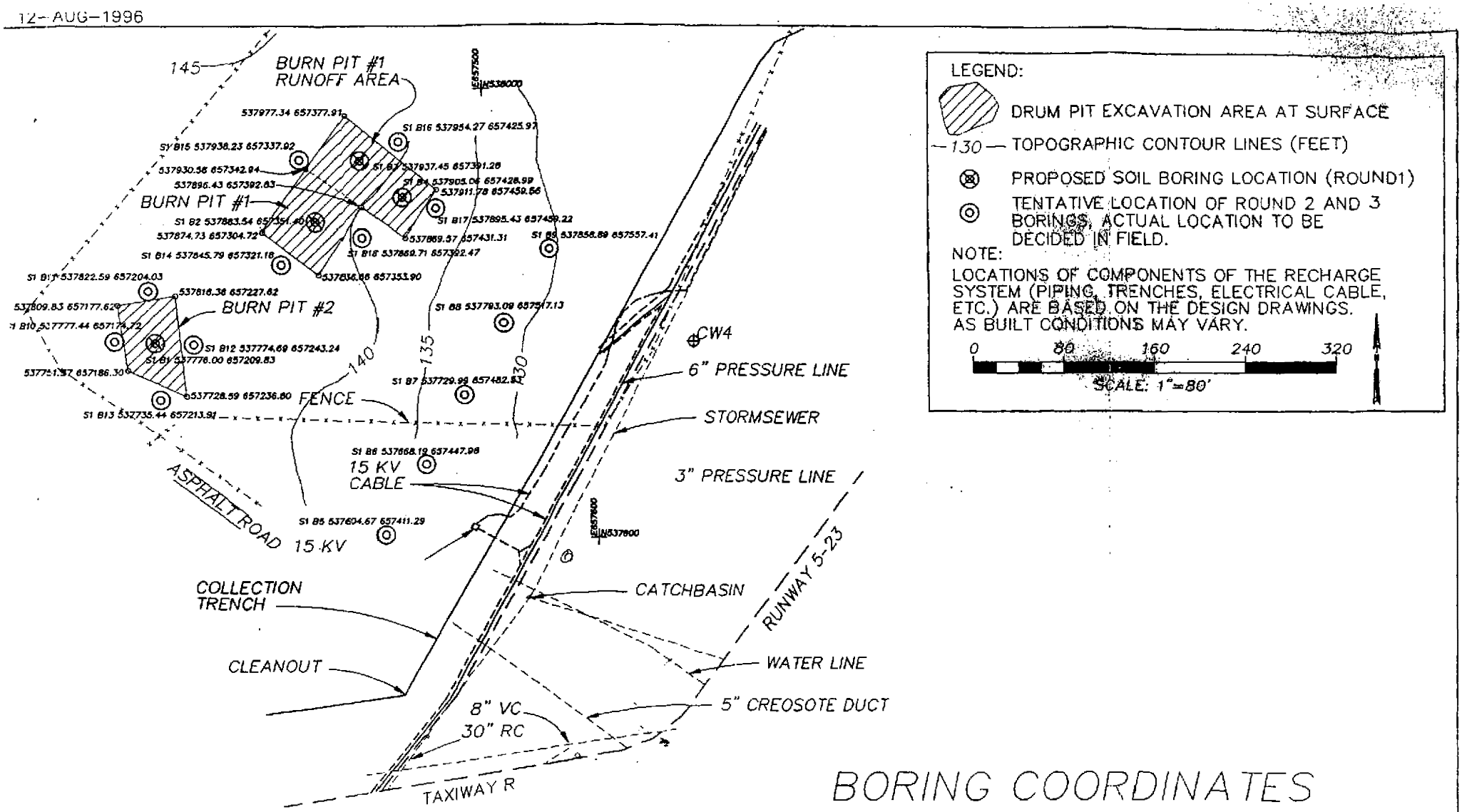


Figure 2:
SOIL BORING LOCATIONS
SITE 1
HANSCOM AFB

Figure 10 IRP Site 2 Plan
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

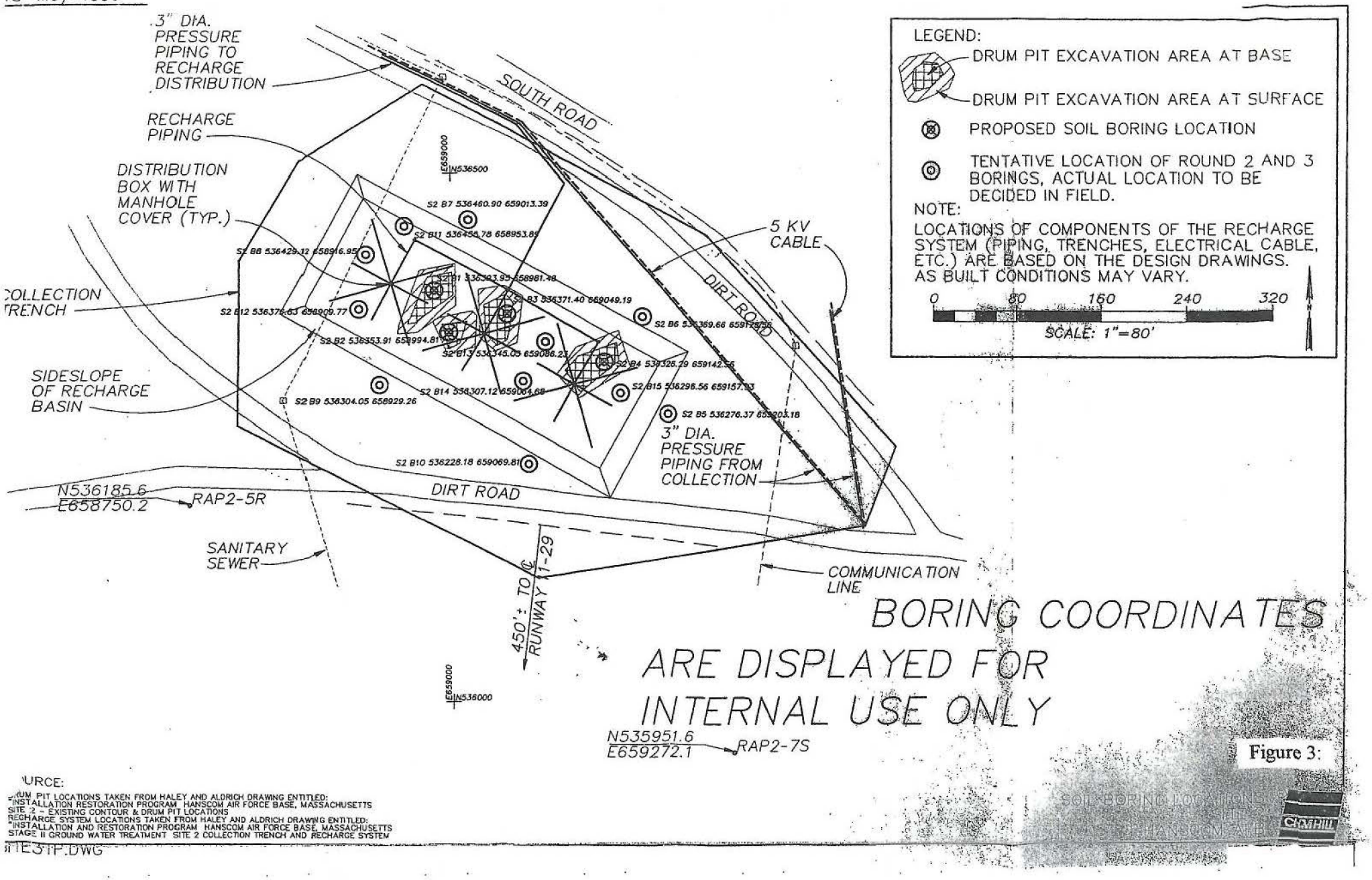


Figure 11 IRP Site 3 Plan
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

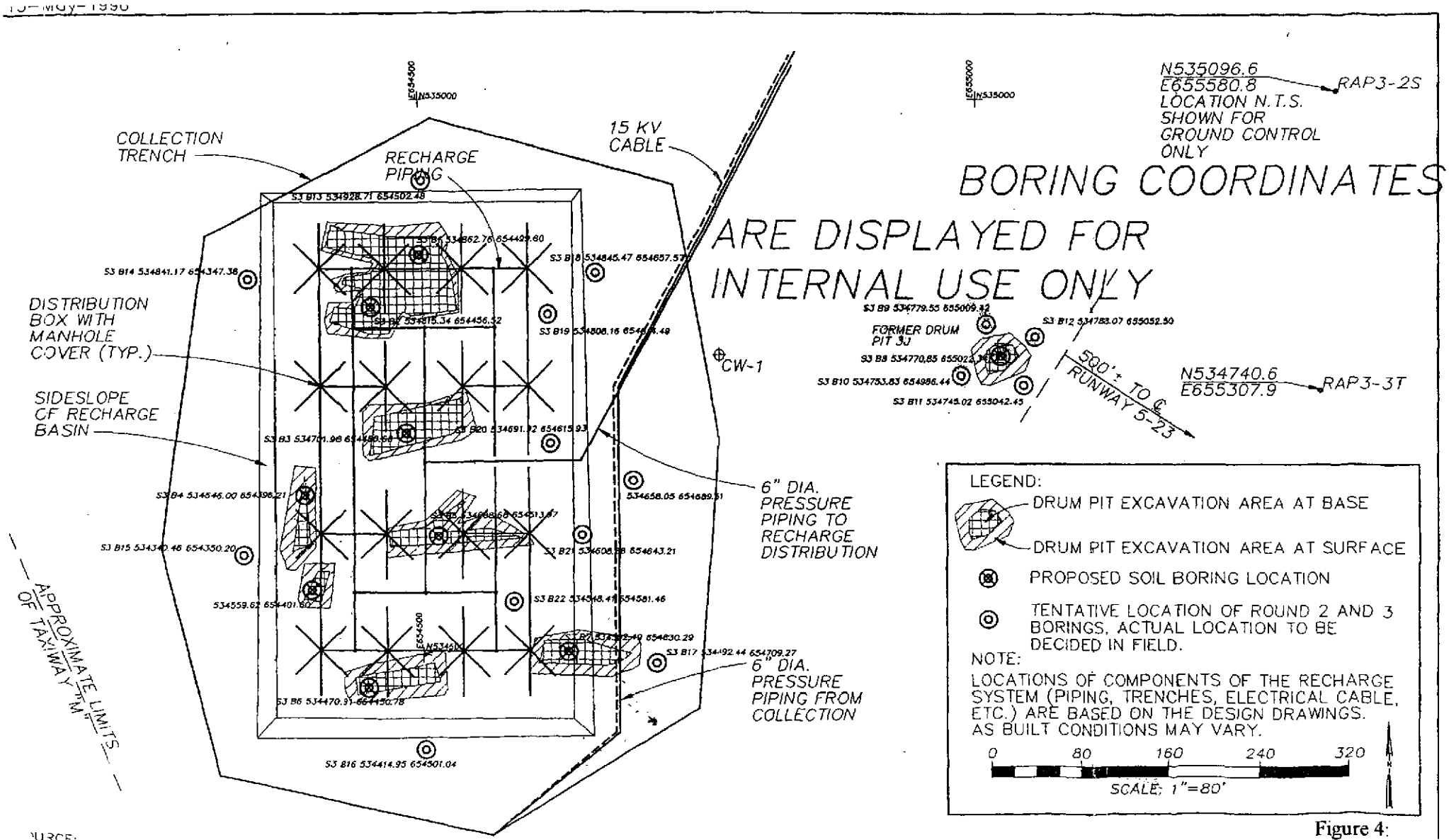


Figure 4:
SOIL BORING LOCATIONS
SITE 3
HANSCOM AFB

Figure 12 IRP Site 4 Plan
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

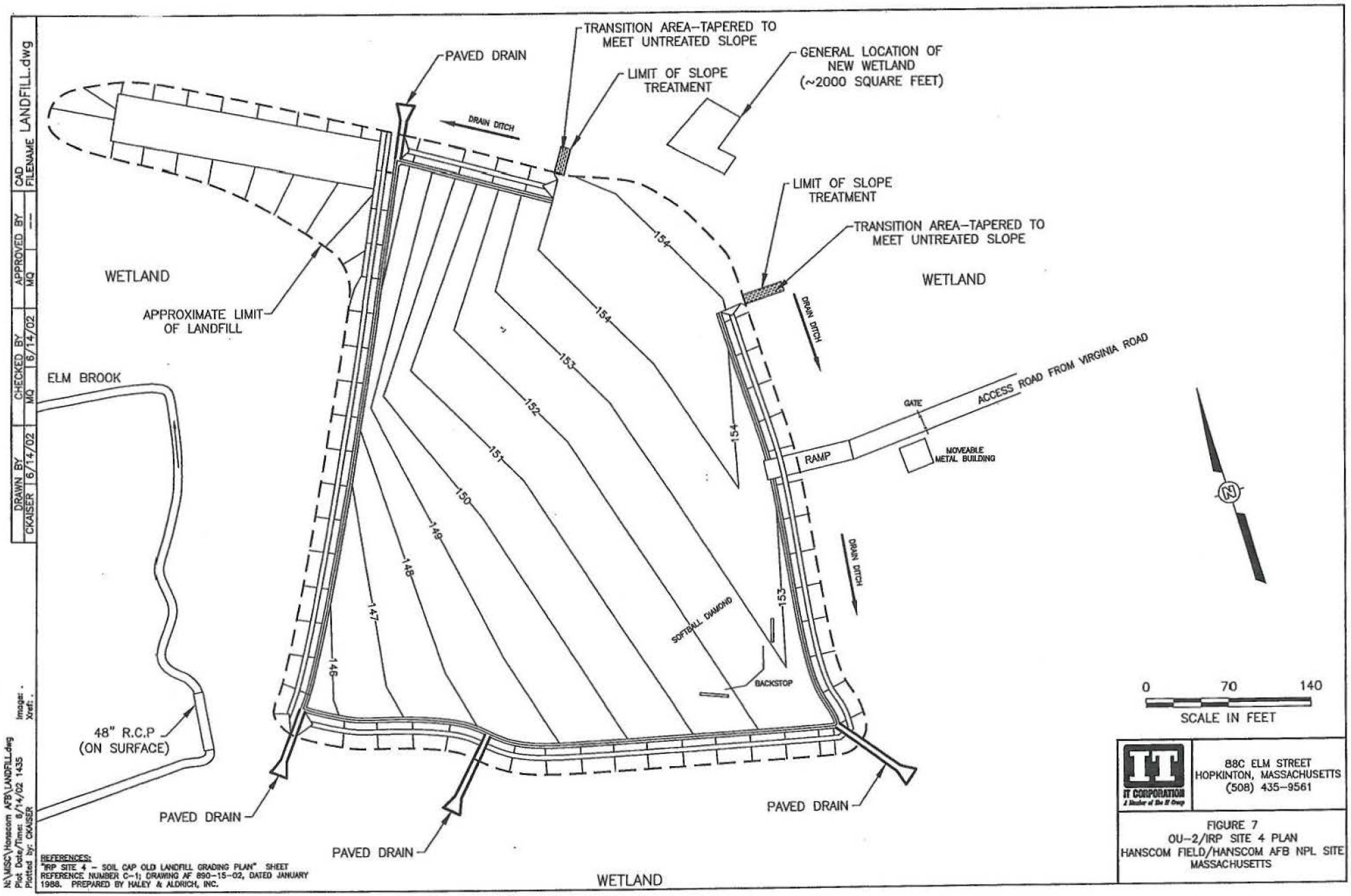


Figure 13 IRP Site 6 Plan
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

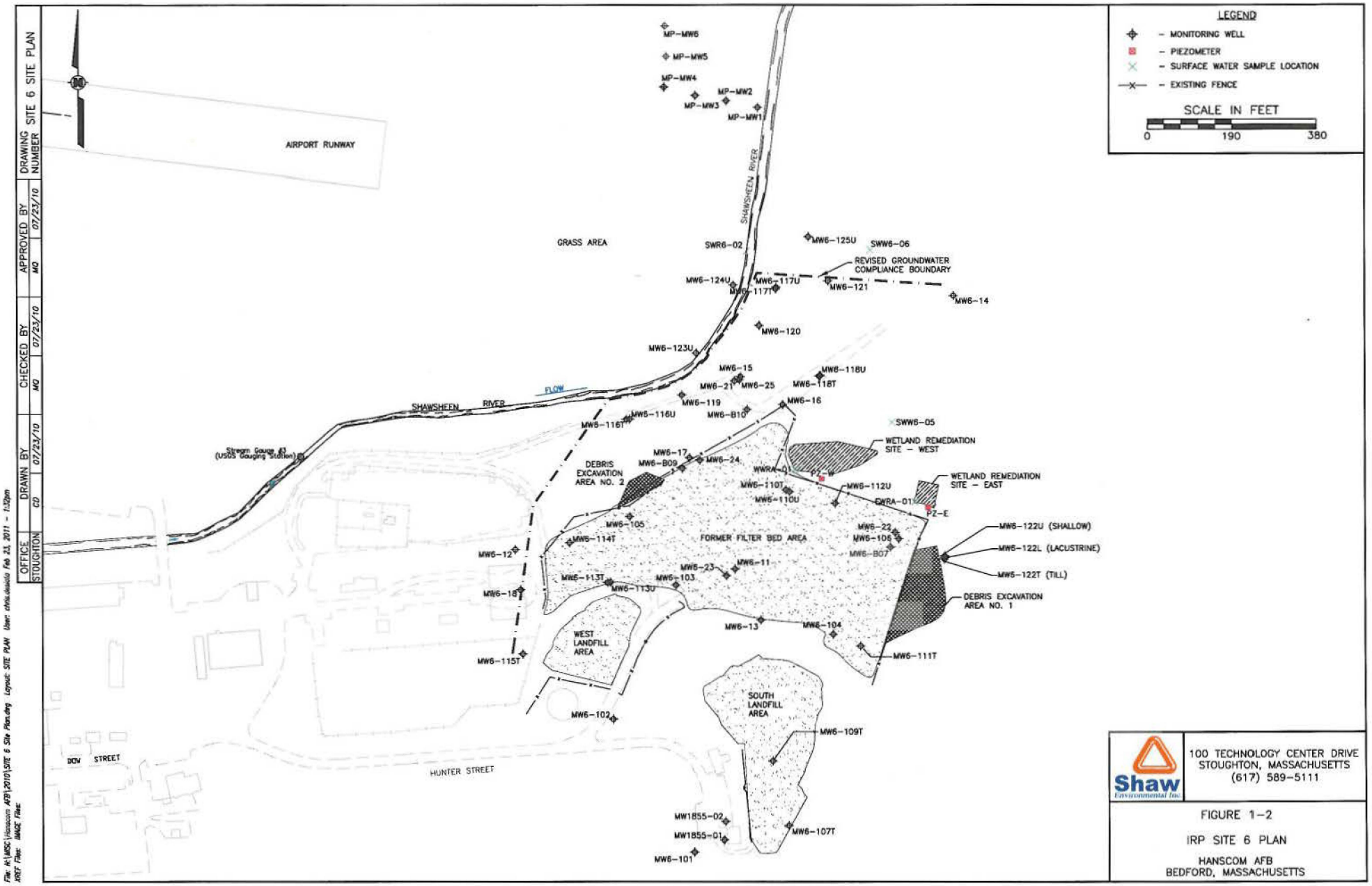
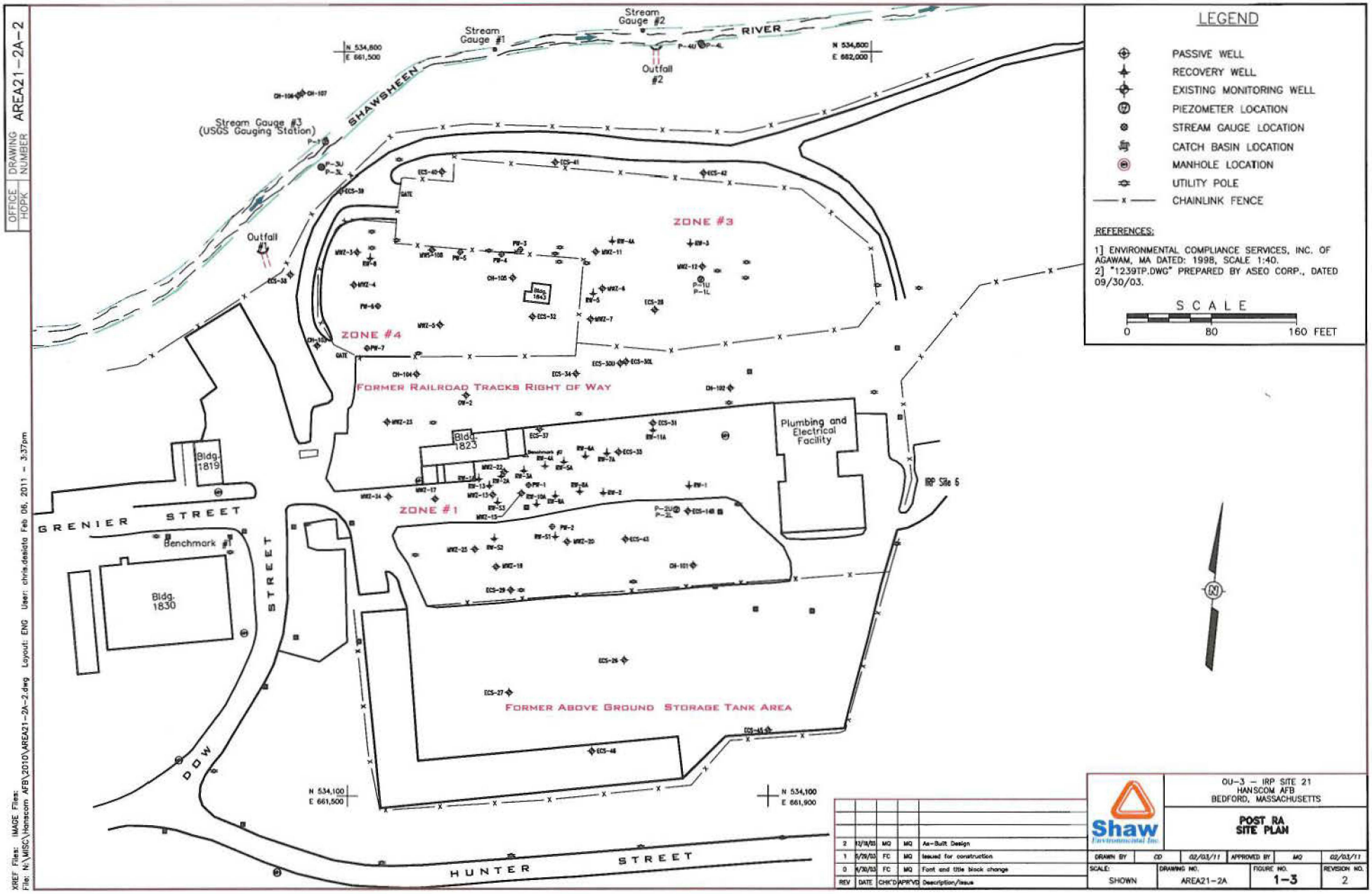
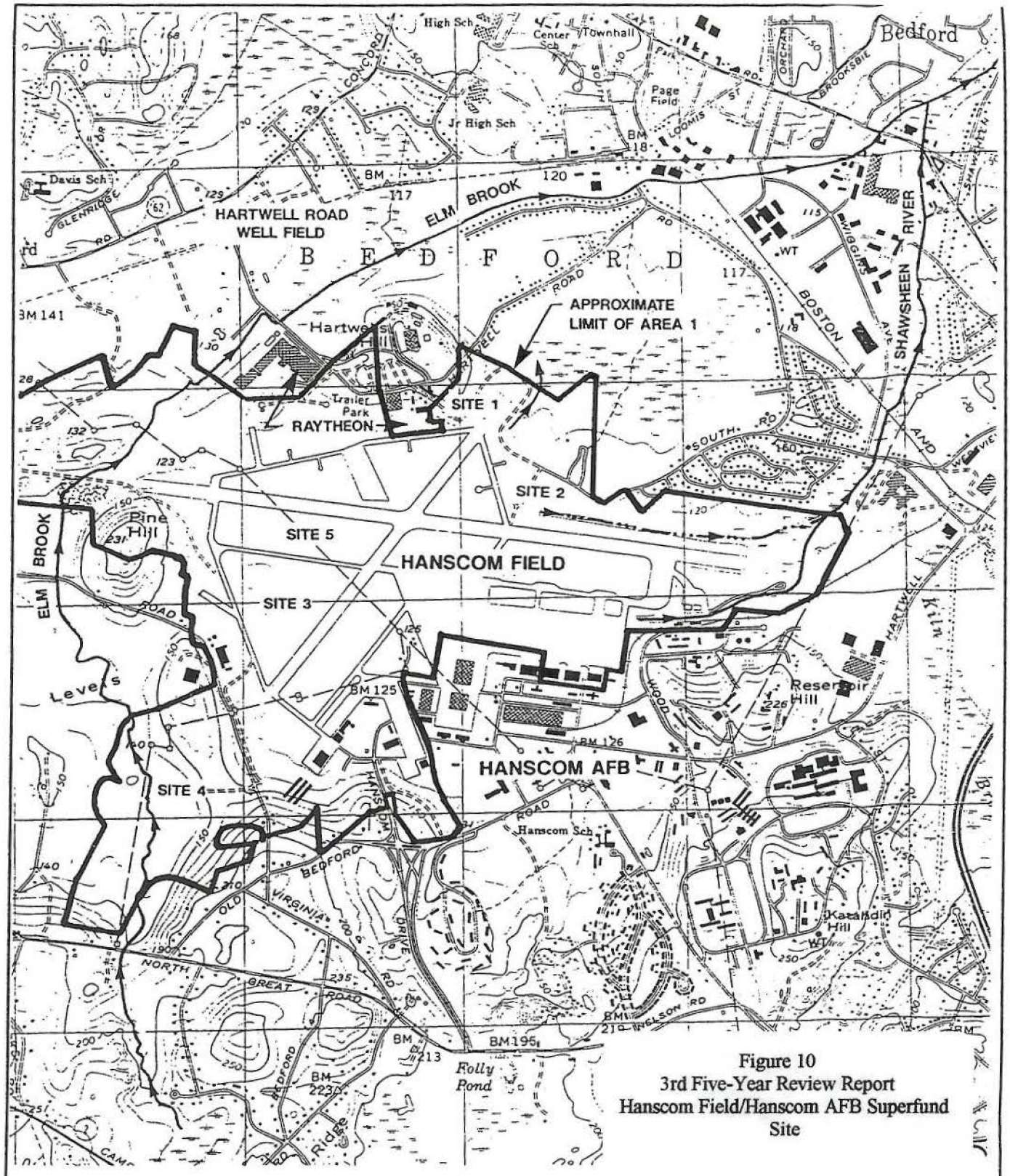


Figure 14 IRP Site 21 Plan
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site





05833-065 A161

Figure 15 Hanscom Field Area 1 Project Locus Plan
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

Figure 16 OU-1 Plan of the Components of the Groundwater Remediation System
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

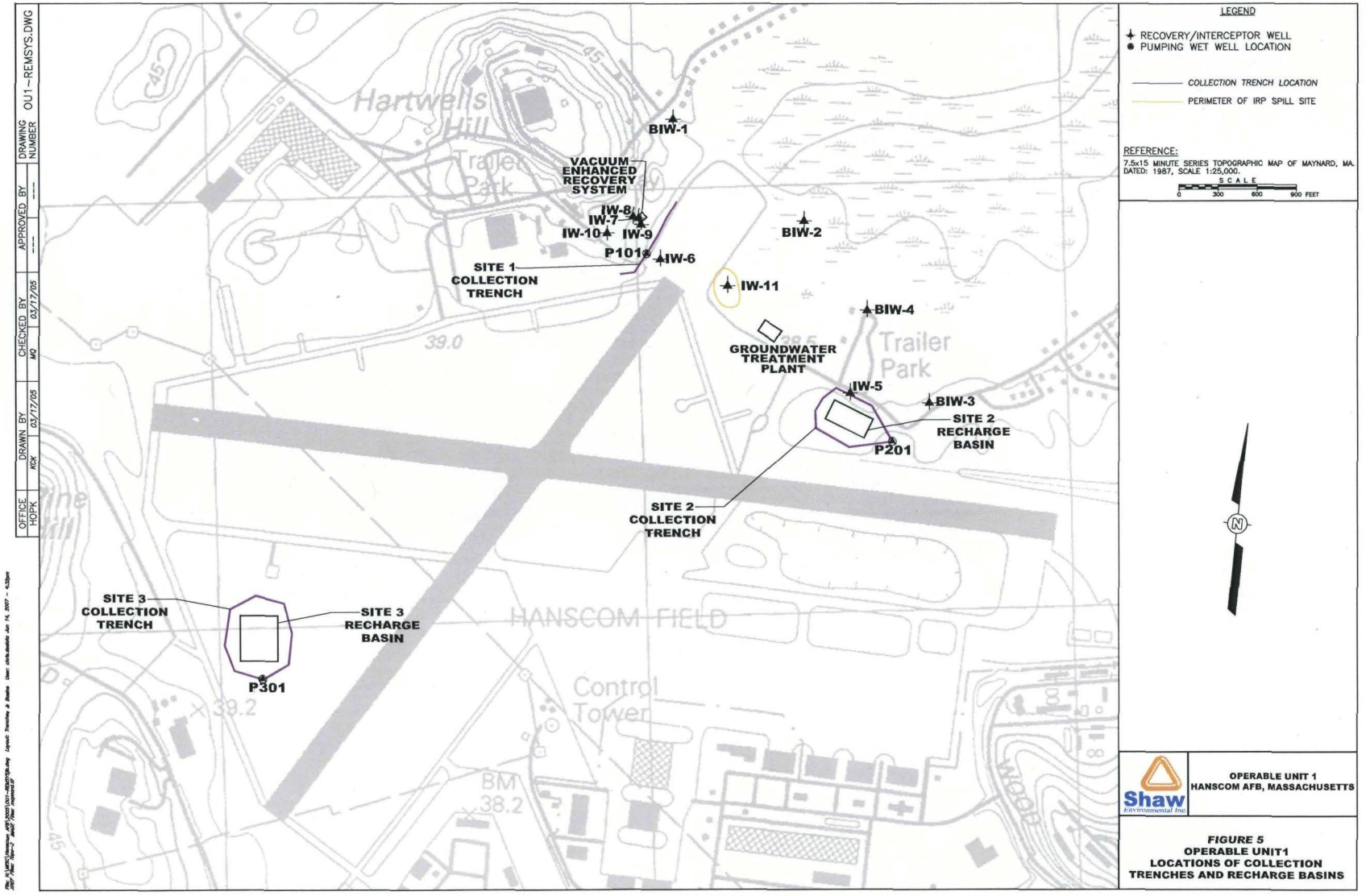


Figure 17 OU-3/IRP Site 21 Plan of the Physical Components of the Selected Remedial Action
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

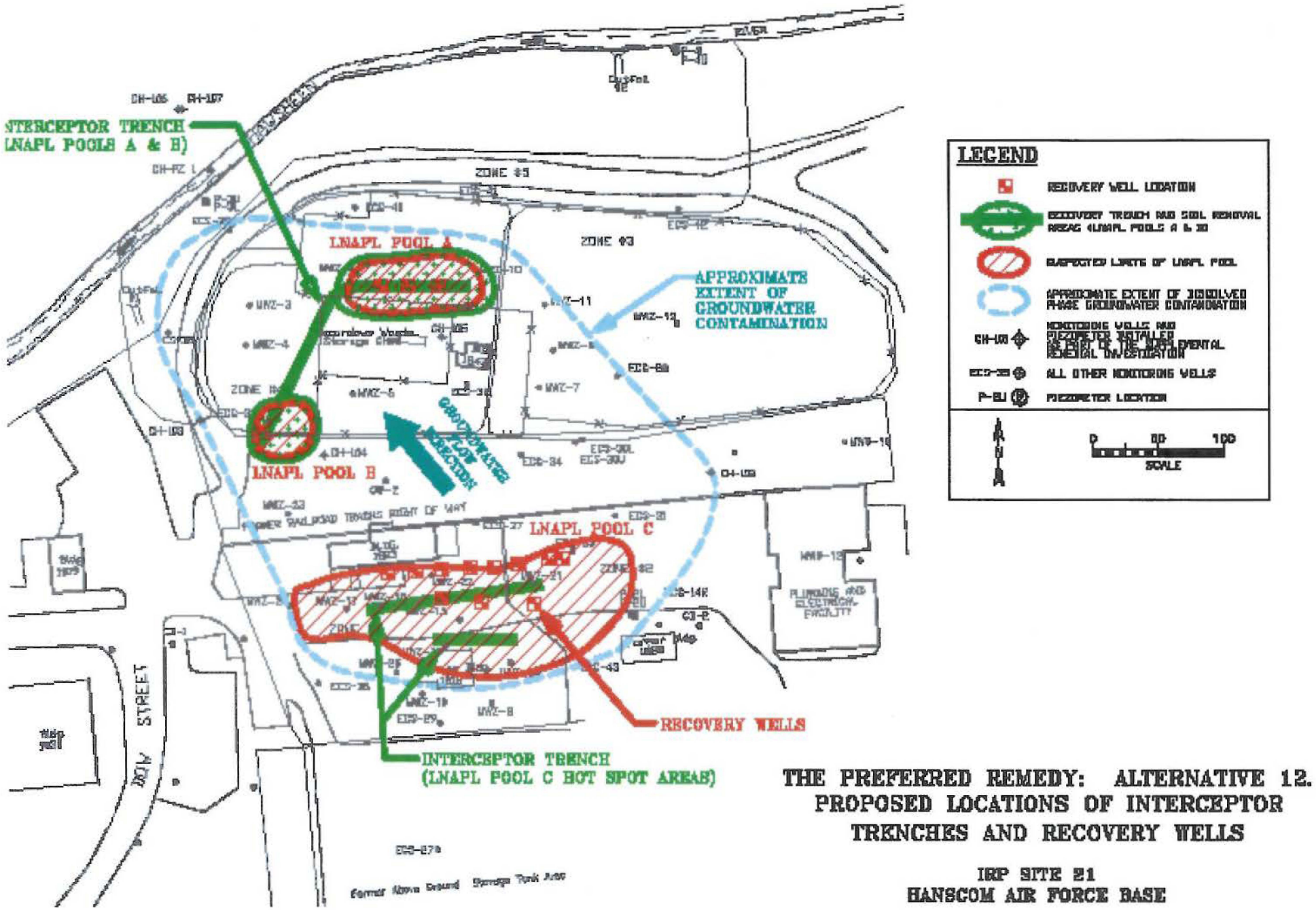
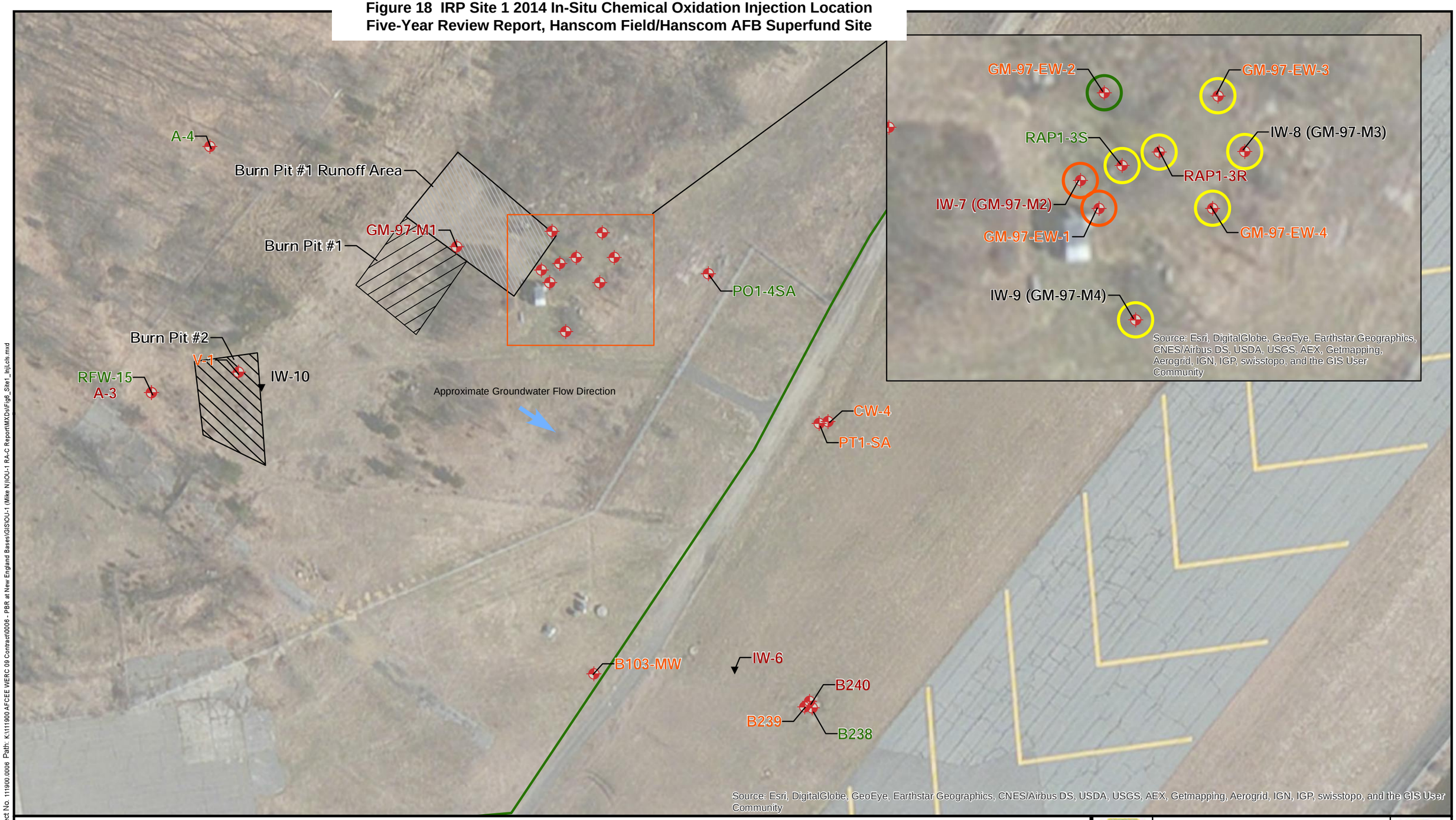


Figure 18 IRP Site 1 2014 In-Situ Chemical Oxidation Injection Location
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site



Legend

- Groundwater Extraction Well
- Monitoring Well
- Operable Unit 1 Groundwater Collection Trench
- Primary planned injection well
- Contingent injection well
- Well previously exhibited limited ability to receive injections

Note:

Lacustrine Sand	Surface Aquifer*	
Sandy Glacial Till	Till/Lower Aquifer*	Till/Lower & Bedrock Aquifers
Granite (Fractured)	Bedrock Aquifer*	

*Label color corresponds to aquifer where well is screened.

0 25 50 100 Feet

N

Coordinate System: WGS 1984 UTM Zone 19N

Hanscom AFB - 66th Air Base Group

AFCEC

Operable Unit 1
Hanscom Air Force Base, Massachusetts

Site 1 Injection Locations

FIGURE: 6

VERSAR

Author: J. King Date Saved: 8/24/2016 Project No. 111900.0006 Path: K:\111900 AFCEE WERC 09 Contract\0006 - PBR at New England Bases\GIS\OU-1 (Mike N)\OU-1 RA-C Report\MXDs\Fig6_Site1_InjLcls.mxd

Figure 19 IRP Site 2 Lower/Till Aquifer Injection, Soil Boring, and Monitoring Well Locations
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

RAP2-4S
ND (2001)

B107-MW
ND (2013)

B101-MW
ND (2011)

OW2-2
0.26J (2013)

OW2-1
ND (2011)

B130-MW
ND (2002)

OW2-3
0.28J (2013)

C201

B105-MW
ND (2013)

OW2-4
1.2 (2013)

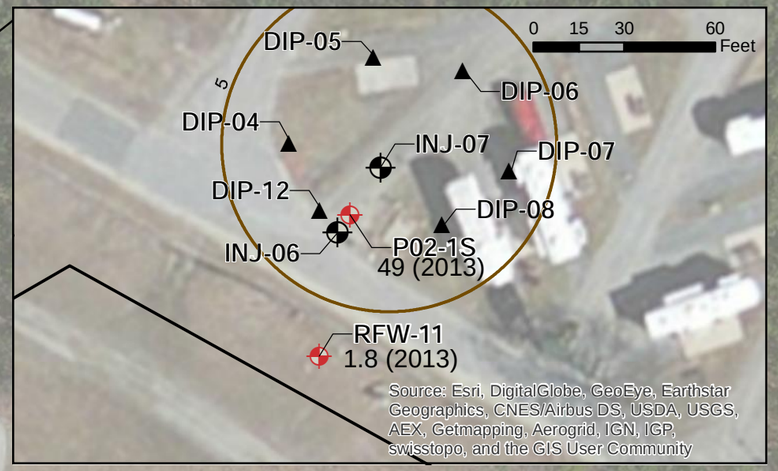
RAP2-5S
ND (2002)

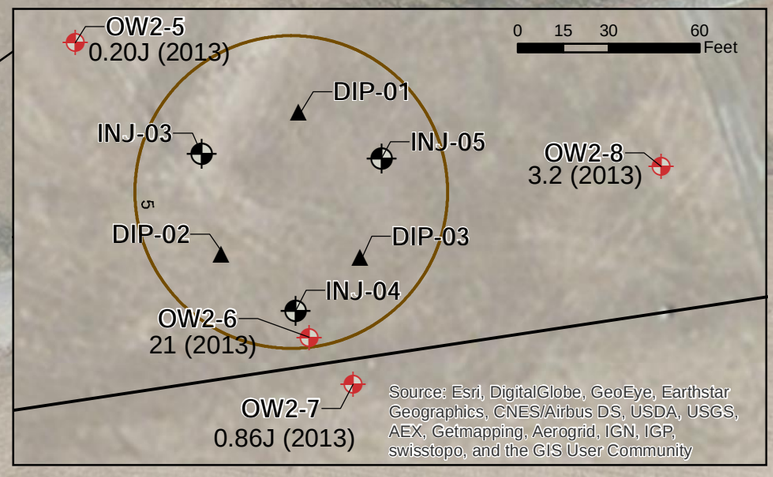
OW2-8
3.2 (2013)

P201

B106-MW
ND (2013)

Approximate Groundwater Flow Direction





Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ERD Injection Point (Well)
- ERD Direct Injection Point
- Groundwater Monitoring Well Currently in Sampling Program
- Groundwater Monitoring Well Suspended from Sampling Program
- Collection Trench Point
- Trichloroethene (TCE) 5 µg/L Contour
- Operable Unit 1 Groundwater Collection Trench

Note: All units in µg/L (micrograms per liter).
The most recent concentrations presented, year of data shown in parentheses.

N

0 50 100 200 Feet

Coordinate System: WGS 1984 UTM Zone 19N

Hanscom AFB - 66th Air Base Group

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Operable Unit 1
Hanscom Air Force Base, Massachusetts

Site 2 Surface Aquifer Injection, Soil Boring, and Monitoring Well Locations

FIGURE: 7

VERSAR

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Figure 20 IRP Site 2 Lower/Till Aquifer Injection and Monitoring Well Locations
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

IW-4
18 (2013)

RAP2-1T
1.0 (2013)

P02-2T
30 (2013)

B251
0.96J (2013)

RAP2-2T
29* (2013)

RAP2-4T
ND (2002)

B113-MW
14 (2013)

B108-MW
1.1 (2013)

RAP2-3T
2.9 (2013)

B114-MW
7.5 (2013)

IW-5

INJ-02

B115-MW
2,000 (2013)

INJ-01

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

IW-3
ND (2011)

B112-MW
ND (2002)

B109-MW
2.6 (2013)

RAP2-5T
ND (2001)

Approximate Groundwater Flow Direction

B110-MW
0.40J (2013)

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Groundwater Extraction Well
- ERD Injection Point
- Groundwater Monitoring Well Currently in Sampling Program
- Groundwater Monitoring Well Suspended from Sampling Program

Tricholoroethene (TCE) Contour (ug/L)

- 5
- 50
- 500

Note: All units in µg/L (micrograms per liter). The most recent concentrations presented (through November 2013), year of data shown in parentheses.

*November 2011 data presented due to fallen tree that damaged well (discovered December 2012) raising uncertainty in more recent data.
**Not used in contouring due to sporadic data.

N

0 125 250 500 Feet

Coordinate System: WGS 1984 UTM Zone 19N

Hanscom AFB - 66th Air Base Group

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Operable Unit 1
Hanscom Air Force Base, Massachusetts

Site 2 Lower/Till Aquifer Injection and Monitoring Well Locations

FIGURE: 8

VERSAR

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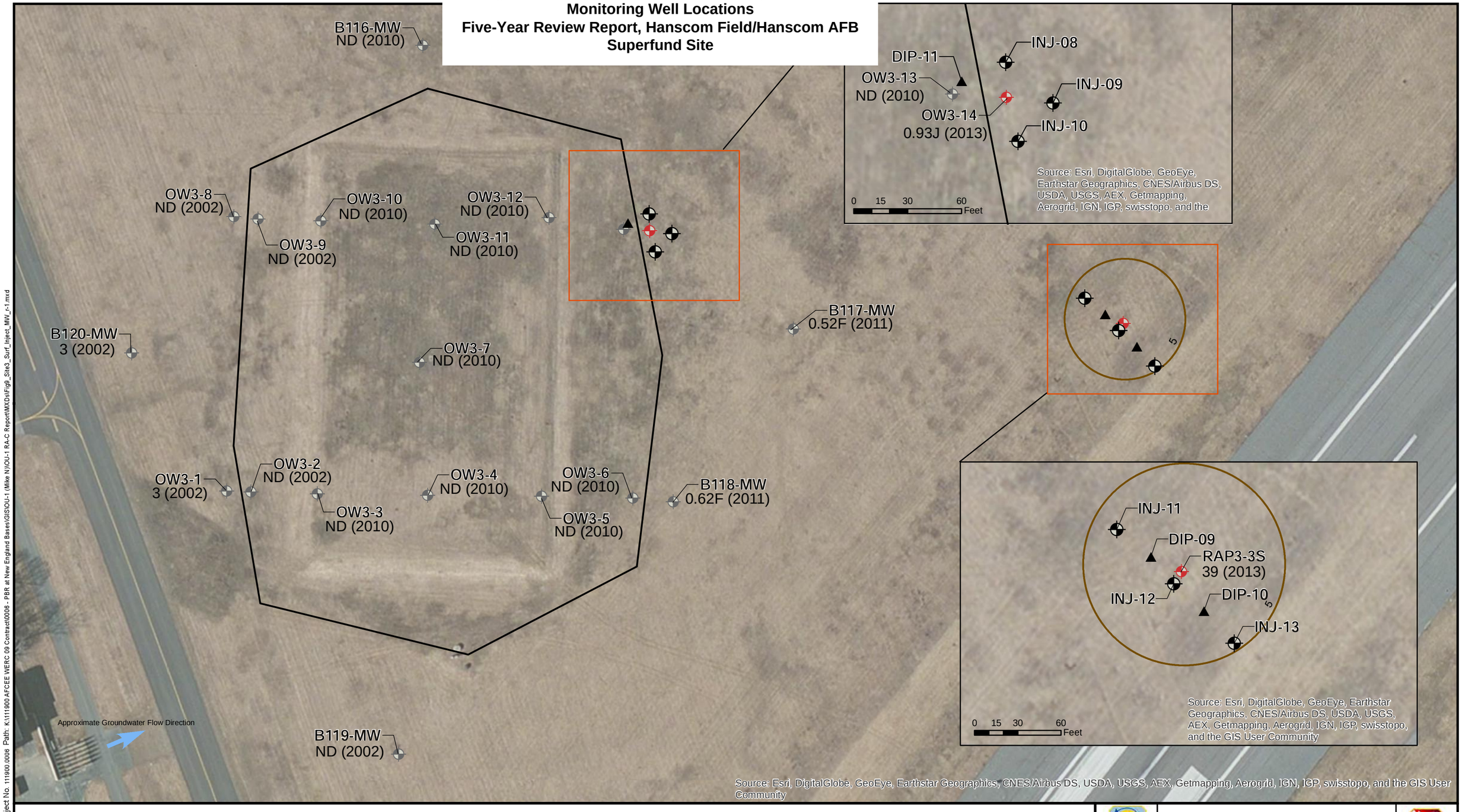
Figure 21 IRP Site 3 Surface Aquifer Injection and Monitoring Well Locations
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site



Legend

- ERD Injection Well
- ERD Injection Point
- Groundwater Monitoring Well Currently in Sampling Program
- Groundwater Monitoring Well Suspended from Sampling Program
- Trichloroethene (TCE) 5 µg/L Contour
- Operable Unit 1 Groundwater Collection Trench

Note: All units in ug/L (micrograms per liter).
The most recent concentrations presented (through November 2013), year of data shown in parentheses.
(Revision date: 29 July 2016)

0 50 100 200 Feet

N

Coordinate System: WGS 1984 UTM Zone 19N

Hanscom AFB - 66th Air Base Group

AFCEC

Operable Unit 1
Hanscom Air Force Base, Massachusetts

Site 3 Surface Aquifer Injection and Monitoring Well Locations

FIGURE: 9

VERSAR

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Figure 22 OU-1 Surface Water and Groundwater Monitoring Well Locations
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

N

Coordinate System: WGS 1984 UTM Zone 19N

RAP1-8
RAP1-7S
RAP1-7
RAP1-7T
RAP1-1T
RAP1-1R
IW-1
VER-4
IW-8
B104-MW
VER-3
P01-2S
RAP1-3R
PT1-RA
RAP1-3S
P01-2R
VER-2
RAP1-4S
B244A
VER-1
RAP1-4RA
B245
GMMW1
RAP1-2R
B246
A-4
P01-4SA
IW 2
V-1
CW-4
B102-MW
A-3
PT1-SA
B126-MW
RFW-15
IRZ-1
B129-MW
IW-10
IRZ-4
B247
IW-7
RAP1-SW4
B111-MW
B248
IW-9
B238
B128-MW
B127-MW
B249
B103-MW
B239
B241
P02-1R
RAP1-5S
B240
R242
P02-1RA
B243
P02-1T
RAP1-5R
IRZ-5
RAP2-1S
PT2-RA
IRZ-Inj
IW-4
RAP1-6R
IRZ-3
P02-2T
RAP2-1R
B237
RAP1-6S
IW-11
RAP2-1T
IW-6
RAP1-6T
B250
P02-2R
B251
RAP2-4R
RAP2-2R
B252
RAP2-4S
RAP2-2S
B101-MW
RAP2-4T
RAP2-2T
B108-MW
B107-MW
RAP2-3S
B113-MW
P02-1S
RAP2-3T
OW2-1
B114-MW
RAP2-3R
OW2-2
RFW-11
B112-MW
IW 5
IW 3
B130-MW
B105-MW
OW2-3
B109-MW
RAP2-5S
OW2-8
RAP2-6T
RAP2-5T
OW2-5
RAP2-6R
RAP2-5R
OW2-6
B115-MW
OW2-7
OW2-4
B110-MW
B106-MW
B253
B254
B255
B233
RAP5-1R
RAP5-1T
Approximate Groundwater Flow Direction
RAP3-1S
RAP3-1T
RAP5-2R
RAP5-2T
RAP5-2S
B231
B236
82-3
B116-MW
B121-MW
OW3-10
OW3-11
OW3-9
OW3-12
OW3-8
OW3-13
OW3-14
82-2
B117-MW
B234
B122-MW
B120-MW
B124-MW
RAP3-3S
B232
RAP3-3T
B125-MW
B118-MW
OW3-1
OW3-6
OW3-2
OW3-5
OW3-3
OW3-7
OW3-4
B119-MW
B123-MW
A-5
RAP3-4S
B235
RAP3-4T

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Groundwater Extraction Well
- Monitoring Well
- Surface Water Monitoring Point
- Operable Unit 1 Groundwater Collection Trench
- Bedford Town Forest and Jordan Conservation Area**

Well Assignments[1]

- Site 1 Wells
- Site 2 Wells
- Site 3 Wells
- Airfield Wells

Note:

Lacustrine Sand	Surface Aquifer*	Lower/Till & Bedrock Aquifers
Sandy Glacial Till	Lower/Till Aquifer*	
Granite (Fractured)	Bedrock Aquifer*	

0 625 1,250 2,500 Feet

*Label color corresponds to aquifer where well is screened.
**This area includes the Hartwell Town Forest, the Hartwell Brook Conservation Area, the South Road Soccer Fields, and the George Jordan Conservation and Community Garden areas.
1 - Boundary lines drawn based upon well location and aquifer zone, and are not representative of actual Sites 1, 2, 3 site boundaries, or the airfield boundary.

Hanscom AFB - 66th Air Base Group

AFCEC

Operable Unit 1
Hanscom Air Force Base, Massachusetts

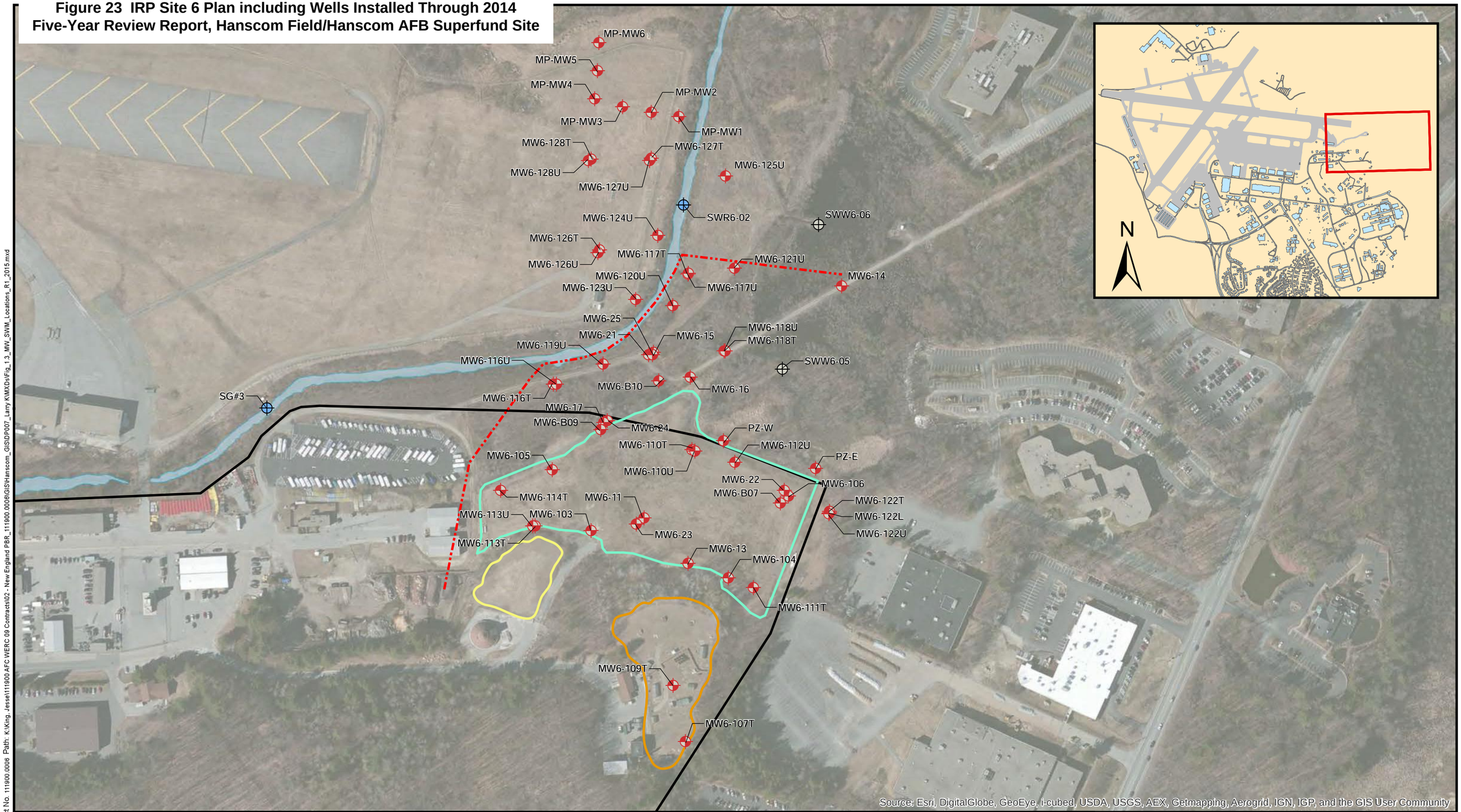
VERSAR

Surface Water and Monitoring Well Locations

FIGURE: 3

Author: J. King Date Saved: 12/20/2016 Project No. 111900.0006 Path: K:\111900 AFCEE WERC 09 Contract\0006 - PBR at New England Bases\GIS\OU-1 (Mike N)\LTM Reports\LTM_MWs_Fig3_OU1_r-2.mxd

Figure 23 IRP Site 6 Plan including Wells Installed Through 2014
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site



Legend

- Monitoring Well
- Shawsheen River Monitoring Point
- Surface Water Monitoring Point
- Former Filter Bed Area
- South Landfill Area
- West Landfill Area
- Hanscom AFB Boundary
- Shawsheen River
- Current Groundwater Compliance Boundary

0 125 250 500 Feet

N

Coordinate System: WGS 1984 UTM Zone 19N
Aerial Imagery: ESRI World Imagery

Hanscom AFB - 66th Air Base Group

AFCEC

Monitoring Wells and
Surface Water Monitoring Locations
DP007 - IRP Site 6

FIGURE:
1-3

VERSAR

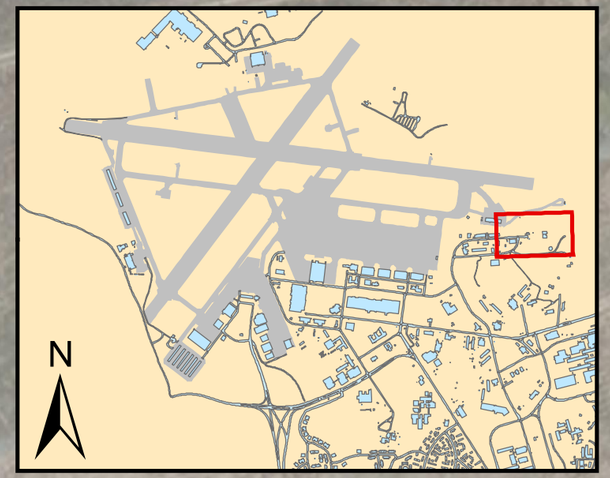
Author: J. King Date Saved: 8/24/2015 Project No.: 111900.0006 Path: K:\King_Jesse\111900 AFC WERC 09 Contracts\02 - New England PBR_111900.0006\GIS\Hanscom_GIS\DP007_Larry KMXDs\Fig_1-3_MW_SWM_Locations_R1_2015.mxd

Figure 24 OU-3/IRP Site 21 Plan and May 2016 Groundwater Contours
Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site

Shawsheen River

114 115 116 117 118 119 120 121 122 123

Zone #5
ECS-40 (116.06)
ECS-41 115.60
ECS-42 116.85
SG-3
ECS-39 NM
PW-4 116.29
PW-3 116.76
MWS-108 116.56
MWZ-3* (114.46)
RW-8 115.21
ECS-38* (113.57)
MWZ-4* (114.65)
PW-5 NM
Pool A
CH-105* (115.86)
PW-6 115.86
CH-103* (114.56)
Pool B
Zone #4
PW-7 115.33
Former Bldg. 1819
Former Railroad Right-of-Way
MWZ-23 115.10
MWZ-23
ECS-37 119.80
RW-3A 120.20
Bldg. 1823
RW-5A (122.17)
RW-2A (119.31)
RW-1A 117.83
RW-13 117.84
MWZ-24 NM
MWZ-17 116.20
MWZ-13 (116.78)
MWZ-15 118.76
Pool C
PW-1 119.62
RW-2 121.58
RW-8A (120.47)
RW-9A (119.23)
Bldg. 1830
RT-S3 (116.33)
Zone #1
RW-10A 119.21
MWZ-25 116.26
PW-2 120.28
MWZ-19* (116.60)
RT-S2 116.65
ECS-29 (118.47)
MWZ-20 120.25
Former Bldg. 1818
Zone #3
RW-3 118.71
MWZ-11 119.34
Former Bldg. 1843
MWZ-6 119.20
MWZ-12 119.40
PZ-1L 120.04
ECS-28 (121.24)
PZ-1U (119.62)
MWZ-7 121.75
ECS-30L* (118.48)
ECS-34 NM
ECS-30U 120.39
RW-6A 121.99
RW-7A 122.91
CH-102* (120.08)
ECS-31 123.31
Zone #2
RW-11A (122.57)
ECS-35 (121.05)
RW-1 123.51
ECS-14R NM
Plumbing and Electrical Facility
Former Bldg. 1828
Former Above Ground Storage Tank (AST) Area



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Monitoring Well
- Shawsheen River Monitoring Point
- Groundwater Elevation Contour
- 118.00 Measured Groundwater Elevation
- (118.00) Measured Groundwater Elevation Not Used in Contouring
- Former Suspected LNAPL Pool
- Approximate IRP Site 21 Boundary
- Building
- Shawsheen River

*Wells screened in the till (lower) aquifer were not used for groundwater contouring.
COCs above regulatory standards occur mainly within the upper aquifer.
NM - Not Measured
Black arrows signify general groundwater flow direction.

0 75 150 300 Feet

N

Coordinate System: WGS 1984 UTM Zone 19N
Aerial Imagery: ESRI World Imagery

Hanscom AFB - 66th Air Base Group
AFCEC

Groundwater Contour Map (May 2016)
ST021 - IRP Site 21

FIGURE: 2-2

VERSAR

Author: J. King Date Saved: 9/22/2016 Project No. 111900.0006 Path: K:\111900 AFCEE WERC 09 Contract\0006 - PBR at New England Bases\GIS\Site21 (Corinne)\LTM Reports\Site 21 May 2016\Fig2-2_Site21 Groundwater Elevations_R3.mxd

ATTACHMENT A

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ATTACHMENT B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

APPENDIX D - ARARs Table Hanscom AFB OU-1 - Selected Remedy (Alternative G-3) - *Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring*

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	These standards limit the concentration of certain materials allowed in classified Massachusetts water. The groundwater at the site has been designated as GW-1 (i.e., as a potential future drinking water supply) under state law by means of a Town of Bedford Aquifer Protection District by-law that was enacted through a process authorized by and implementing the MCP. In addition, MADEP has classified the eastern side of OU-1, east of Runway 5-23, as an approved Zone II; under the state drinking water regulations (310 CMR 22.02), a Zone II is "that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated." Further in addition, the northeastern portion of the site at the northern end of Runway 5-23 is classified as a Potentially Productive Aquifer; the MCP defines "Potentially Productive Aquifer" in part as "all aquifers delineated by the U.S. Geological Survey (USGS) as a high or medium yield aquifer."	Alternative G-3's groundwater remediation system will treat extracted groundwater to attain GW-1 standards unless a more restrictive state standard has been promulagated in which case the more stringent state standard will be met. GW-1 standards will not be attained in groundwater at the source ares or within the contaminated plumes in the short-term, however, all RAOs are expected to be achieved in a reasonable (<50-years) period of time. In the interim LUCs will serve to control the potential access and exposure to contaminated media within the OU-1.The selected remedy also includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. GW-1 standards are listed in Table 2-1 for compounds of concern at OU-1.	Applicable
Location Specific ARARs				
Surface water and wetlands	***Federal***			
	Fish and Wildlife Coordination Act (16 USC 661 et seq.)	This act requires consultation with the Fish and Wildlife Service and the state wildlife resource agency if alteration of a body of water, including discharge of pollutants into a wetland, will occur as a result of off-site remedial activities. Consultation is strongly recommended for on-site actions. This provides protection for actions that would affect streams, wetlands, other water bodies or protected habitats. Any action taken should protect fish or wildlife, and include measures developed to prevent, mitigate, or compensate for project-related losses to fish and wildlife.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system which discharges treated groundwation into a drainage ditch which emptys into in the Wetland B/Beaver Pond Area surface water. The selected remedy includes monitoring of the treatment system effluent and the long-term monitoring of groundwater and surface water. Precautions will be taken to minimize the potential effect on fish and wildlife during these activities and any future remediation system alterations.	Relevant and Appropriate
Wetland sediment and surface water	***Federal***			
	Protection of Wetlands - Executive Order 11990 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Wetlands Executive Order. Under this order, federal agencies are required to minimize the degradation, loss, or destruction of wetlands, and to preserve the natural and beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. If no alternative is available, effects from implementing the chosen alternative must be mitigated.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system and the long-term monitoring of groundwater and surface water. No additional actions, other than monitoring, are proposed in the wetlands until RAOs are achieved and existing wells in the Wetland B/Beaver Pond Area are decommissioned. There is no practicable alternative these remedy components located in or near the Wetland B/Beaver Pond Area. Precautions will be taken to minimize the potential effect on wetlands during these activities.	Applicable
	State			
	Massachusetts Wetlands Regulations (310 CMR 10.51-10.60, MGL c. 131, Section 40: Wetlands Protection Act)	These regulations protect inland wetlands such as those found at the site from activities that may alter the resource area by establishing buffer zone areas. The loss may be permitted with replication of the lost area within two growing seasons.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system and the long-term monitoring of groundwater and surface water. No additional actions, other than monitoring, are proposed in the wetlands until RAOs are achieved and existing wells in the Wetland B/Beaver Pond Area are decommissioned. There is no practicable alternative these remedy components located in or near to the Wetland B/Beaver Pond Area. Activities at the site will be performed in compliance with the buffer zone requirements for these resource areas. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
Other Natural Resources	***Federal***			
	Protection of Floodplains, Executive Order 11988 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Floodplains Executive Order. Under this order, federal agencies are required to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the floodplain.	According to the Comprehensive Ecological Analysis (LEC, August 1997), portions of OU-1 are located within a 100-year floodplain. Alternative G-3 includes continued operation and optimization of the existing groundwater remediation system, and the long-term monitoring of groundwater and surface water. No practicable alternative to these remedy components exists. The floodplain storage capacity and hydraulics will not be changed by this remedy.	Applicable

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Action Specific ARARs				
Surface water	*Federal*			
	Clean Water Act National Pollutant Discharge Elimination System (NPDES) Regulations (40 CFR 122-125 and 131)	These regulations establish discharge limitations, monitoring requirements and best management practices for any direct discharge from a point source into surface water.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the discharge of effluent from the treatment plant to a drainage channel which emptys into in the Wetland B/Beaver Pond Area surface water.. The effluent will be sampled and analyzed to ensure compliance with regulatory discharge parameters.	Applicable
	State			
	Clean Waters Act - Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)	This act and program establish the requirements intended to maintain the quality of surface waters by controlling the direct discharge of pollutants to surface waters. Direct discharges of wastewater to surface waters must meet effluent discharge limits established by this program.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the discharge of effluent from the treatment plant to a drainage channel which emptys into in the Wetland B/Beaver Pond Area surface water.. The effluent will be sampled and analyzed to ensure compliance with regulatory discharge parameters. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
Groundwater	*Federal*			
	Resource Conservation and Recovery Act (RCRA) 40 CFR Part 264, Subpart F-Releases from Solid Waste Management Units (40 CFR 264.90-264.101 and 265.90-265.94)	General facilities requirements for groundwater monitoring at affected facilities and general requirements for corrective action programs, if required, at the affected facilities.	This program has been delegated to the state. Groundwater monitoring will be conducted in accordance with Massachusetts requirements.	Applicable
	Underground Injection Control Program (UIC) (40 CFR 141 148)	These regulations outline minimum program and performance standards for underground injection wells and prohibit any injection that may cause a violation of any primary drinking water regulation in the aquifer.	This program has been delegated to the state and takes effect through the State requirements listed below.	Applicable
	State			
	MA Hazardous Waste Management Rules (HWMR) Groundwater Protection (310 CMR 30.660-30.679)	These regulations require groundwater monitoring at specified regulated units that treat, store or dipose of hazardous waste. Maximum concentration limits for the hazardous constituents are specified in 310 CMR 30.668.	Groundwater monitoring under Alternative G-3 will be conducted in accordance with these requirements.	Applicable
	MA Standards for Analytical Data for Remedial Response Action, Bureau of Waste Site Cleanup Policy 300-89.	This policy decribes the minimum standards for analytical data submitted to the MADEP.	All sampling plans for Alternative G-3 will be designed with consideration of the analytical methods provided in this policy.	To Be Considered
	Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00; MGL c.21 Sections 26-53; 310 CMR 27.01 - 27.11)	This program is designed to protect state groundwaters for their highest potential use by regulating discharges of pollutants to state groundwaters and requiring the MADEP to regulate the outlets for groundwater discharges and associated treatment works. These regulations set effluent limits for the discharge of pollutants to groundwater. Recharge wells used exclusively to replenish an aquifer with uncontaminated water are exempt from this requirement. Uncontaminated water is water which upon discharge could not cause a violation of applicable water quality standards.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the option to discharge of treated water to the ground via recharge basins. The treatment system's effluent will be sampled and analyzed to ensure the discharge of treated water to groundwater would comply with the substantive requirements of these regulations. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	MA Underground Injection Control (UIC) Program (310 CMR 23.01-23.11)	These regulations require acquiring a permit in order to inject wastes, chemicals or other substances into the subsurface.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which may include the injection of permanganate, molasses or other substances for in-situ remediation of on-site groundwater contaminants. To ensure that these injections complies with the substantive requirements of these regulations the proposed quantities to be injected will be included in the work plan/design that will be submitted to EPA and MA DEP for comment and concurrence prior to an injection and injections will only be considered for on-site locations that are upgradient of the boundary interceptor wells. Also the groundwater monitoring program will reviewed/revised to ensure adequacy for the assessment of the impact of any injections. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable

APPENDIX D - ARARs Table Hanscom AFB OU-1 - Selected Remedy (Alternative G-3) - *Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring*

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Miscellaneous Actions	*State*			
	Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas (May 2003)	Provides guidance and best management practices regarding erosion and sediment control.	Construction of any new wells (if needed) will be performed in accordance with *this guidance as appropriate.*	To Be Considered
	Massachusetts Well Decommissioning Requirements (313 CMR 3.03)	These regulations provide for certain notification requirements upon well abandonment.	The decommissioning or abandonment of wells (when no longer needed) will be performed in accordance with these requirements.	Applicable
Waste	*Federal*			
	RCRA Identification and Listing of Hazardous Wastes (40 CFR 261.24)	These requirements establish the maximum concentrations of contaminants for which the waste would be a RCRA-characteristic hazardous waste for toxicity.	Alternative G-3 ncludes continued operation and optimization of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. These materials include the recovered solvent from the groundwater treatment system, the activated carbon from the air/vapor treatments systems associated with the groundwater treatment and vacuum enhanced recovery systems, groundwater samples, and soil borings that may result from the installation of new wells. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	RCRA Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations.	Alternative G-3 ncludes continued operation and optimization of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. These materials include the recovered solvent from the groundwater treatment system, the activated carbon from the air/vapor treatments systems associated with the groundwater treatment and vacuum enhanced recovery systems, groundwater samples, and soil borings that may result from the installation of new wells. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	State			
	MA HWMR, Use and Management of Containers, 310 CMR 30.689; Storage and Treatment in Tanks, 310 CMR 30.699	These regulations set forth requirements for use and management of containers and tanks at hazardous waste facilities.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	Massachusetts Hazardous Waste Management Rules (HWMR), 310 CMR 30.300-30.371, Requirements for Generators	Establishes requirements and standards for generators of hazardous waste that address general waste management measures, including the accumulation of hazardous waste prior to off-site disposal, preparing the hazardous wastes for shipment, and preparing appropriate waste manifests.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
Air	*Federal*			
	RCRA - Air Emission Standards for Process Vents, 40 CFR Part 264, Subpart AA	These regulations establish requirements for controlling emmisions from process vents associated with treatment processes that manage hazardous wastes with organic concentrations of 10 ppm or more.	If operation of the groundwater remediation system under Alternative G-3 involves management of hazardous waste with organic concentrations of at least 10 ppm, equipment used in remedial activies will meet the requirements and be monitored for compliance.	Relevant and Appropriate
	RCRA, Air Emission Standards for Equipment Leaks 40 CFR 264, Subpart BB	Contains air pollutant emission standards for equipment leaks at hazardous waste TSD facilities. Contains design specifications and requirements for monitoring for leak detection. It is applicable to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10% by weight.	If operation of the groundwater remediation system under Alternative G-3 involves management of hazardous waste with organics of at least 10 ppm, equipment will meet the design specifications, and will be monitored for leaks.	Relevant and Appropriate

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
	RCRA, Air Emission Standards for Tanks, Surface Impoundments and Containers (40 CFR 264, Subpart CC	Contains air pollutant emission standards for owners and operators of TSD facilities using tanks, surface impoundments, and containers to manage hazardous waste. Specific organic emissions controls have to be installed if the average volatile organic concentantions are equal or greater than 100 ppmw.	If operation of the groundwater remediation system under Alternative G-3 involves management of hazardous waste with organics of at least 10 ppm, equipment used in in remediation activities will meet the requirement to be monitored for compliance.	Relevant and Appropriate
	USEPA Policy on Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites, Office of Solid Waste and Emergency Response (OSWER) *Directive* 9355.0-28	Provides guidance on the control of air emissions from air strippers used at Superfund sites and distinguishes between requirements for attainment and nonattainment areas for ozone.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes an off-gas treatment system for the air strippers. This off-gas treatment system will be monitored and maintained to ensure air emissions meet discharge standards.	To Be Considered
	USEPA New England Region Memorandum, 12 July 1989 from Louis Gitto to Merril S. Hohman	States that Superfund air strippers in ozone nonattainment areas generally merit controls on all VOC emissions.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which already includes an off-gas treatment system for the air strippers.	To Be Considered
	State			
	MADEP Off-Gas Treatment of Point Source Remedial Air Emissions (Policy No. WSC-94-150)	This policy establishes permitting requirements for air stripper installations.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which already includes off-gas treatment systems for the air strippers and the vacuum enhanced recovery system that were designed to meet air discharge standards. These off-gas treatment systems are/will be monitored and maintained to ensure air emissions continue meet discharge standards. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	To Be Considered
	Massachusetts Air Pollution Control Regulations (310 CMR 7.18)	These regulations establish the standards and requirements for air pollution control in the Commonwealth. Section 7.18 details requirements for air pollution controls for volatile organic compounds.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which already includes off-gas treatment systems for the air strippers and the vacuum enhanced recovery system that were designed to meet air discharge standards. These off-gas treatment systems are/will be monitored and maintained to ensure air emissions continue meet discharge standards. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	Massachusetts Rules for Remedial Air Emissions (310 CMR 40.0049)	The Massachusetts rules set forth standards for emissions from remedial activities, including a general requirement for 95% control over emissions from the remedial system.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which already includes off-gas treatment systems for the air strippers and the vacuum enhanced recovery system that were designed to meet air discharge standards. These off-gas treatment systems are/will be monitored and maintained to ensure air emissions continue meet discharge standards. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Relevant and Appropriate
	Massachusetts Threshold Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air	The Massachusetts Department of Environmental Protection has issued guidance setting out permissible concentations of air toxics in ambient air. The TELs and AALs are used to guide permitting decisions for sources of air toxics.	Remedial activities under Alternative G-3 will be monitored to ensure remedial air emissions do not cause any exceedances of TELs and AALs. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	To Be Considered

AALs - Allowable Ambient Limits
ARARs - Applicable or relevant and appropriate requirements.
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act.
CFR - Code of Federal Regulations.
CMR - Code of Massachusetts Regulations
COCs - Contaminants of Concern
CSFs - Cancer Slope Factors
CWA- Clean Water Act.
EPA - Environmental Protection Agency.
GAC - Granular Activated Carbon
GWQS - Groundwater Quality Standards
LUCs - Land Use Controls
MGL - Massachusetts General Laws
NPDES-National Pollutant discharge elimination system.
ppm - parts per million
ppmv - parts per million by wieght
RCRA - Resource Conservation and Recovery Act.
RfDs - Risk Reference Doses
SDWA - Safe Drinking Water Act.
TELs - Threshold Exposure Limits
TSD - Treatment, Storage and Disposal
USC - United States Code.
VOC - Volatile Organic Compounds

APPENDIX G. Table G-1

Hanscom AFB OU-3 Alternative 3 - *Permeable Cap, Wetlands Hotspot Removal and Replication, Institutional Controls, Groundwater Compliance Boundary, and Monitoring* **ARARs**

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Chemical Specific ARARs				
Surface Soil	***Site Specific***			
	Federal-EPA Risk Reference Doses (RfDs)[(a)]	RfDs are dose levels developed based on noncarcinogenic effects and are used to develop Hazard indices. A Hazard index of less than or equal to 0.1 is considered acceptable. Primary COCs for surface soil include PAHs and inorganics.	This alternative includes installation of permeable caps over the landfill areas, implementation of institutional controls controlling future land use, and excavation of contaminated wetland sediments to prevent exposure to contaminated soils.	To Be Considered
	Federal-EPA Human Health Assessment Group Cancer Slope Factors[(a)]	Cancer slope factors are developed by the EPA from Health Effects Assessments and are used to develop excess cancer risks. The only COCs for the surface soil were carcinogens, a carcinogenic risk of less than or equal to 1×10^{-6} is acceptable. Primary COCs for surface soil including PAHs and inorganics.	This alternative includes installation of permeable caps over the landfill areas, implementation of institutional controls controlling future land use, and excavation of contaminated wetland sediments to prevent exposure to contaminated soils.	To Be Considered
Groundwater	***Federal***			
	Federal Safe Drinking Water Act MCLs (40 CFR 141.11-141.16)	This act consists of promulgated standards or levels (concentrations) for a broad range of contaminants of concern (COCs) in public drinking water supplies. It may be considered relevant and appropriate for groundwater aquifers used for drinking water. The site groundwater is not currently being used and will not be used in the future. The applicability of the ARARs will be at the compliance boundary. Primary threat COCs include VOCs, PAHs, and arsenic.	This alternative includes annual groundwater monitoring in order to track changes in contaminant concentrations over time as natural flushing continues to occur.	Relevant & Appropriate
	Federal-EPA Risk Reference Doses (RfDs)[(a)]	RfDs are dose levels developed based on noncarcinogenic effects and are used to develop Hazard indices. A Hazard index of less than or equal to 0.1 is considered acceptable. Primary threat COCs include VOCs, PAHs, and arsenic.	This alternative includes annual groundwater monitoring in order to track changes in contaminant concentrations over time as natural flushing continues to occur.	To Be Considered
	Federal-EPA Human Health Assessment Group Cancer Slope Factors[(a)]	Cancer slope factors are developed by the EPA from Health Effects Assessments and are used to develop excess cancer risks. A carcinogenic risk of less than or equal to 1×10^{-6} is acceptable. Primary threat COCs include VOCs, PAHs and arsenic.	This alternative includes annual groundwater monitoring in order to track changes in contaminant concentrations over time as natural flushing continues to occur.	To Be Considered
	State			
	Massachusetts Contingency Plan GW 1 Standards (310 CMR 40.0974)	This act consists of promulgated standards or levels (concentrations) for COCs in groundwater under Massachusetts DEP Method 1 standards. The MCP GW-1 standards will only apply for compounds where the state standard is more restrictive than the federal MCL and/or MCLGs or for which no MCL and/or MCLG currently exists. The site groundwater is not currently being used and will not be used in the future. The applicability of the ARARs will be at the compliance boundary. Primary threat COCs include VOCs, PAHs, and arsenic.	This alternative includes annual groundwater monitoring in order to track changes in contaminant concentrations over time as natural flushing continues to occur.	Applicable
Location Specific ARARs				
Wetlands Surface water	***Federal***			
	Fish and Wildlife Coordination Act (16 USC 661 et seq)	This act provides protection for fish and wildlife and consultation with the U.S. Fish and Wildlife Service and the State counterpart for actions that would affect streams, wetlands, other water bodies or protected habitats. Any action taken should protect fish and wildlife and include measures developed to prevent, mitigate, or compensate for project-related losses to fish and wildlife	Alternative #3 - *Permeable Cap* includes excavation of contaminated wetland sediments, placement of clean sediment that will support the existing ecological wetlands system, and the planting of submerged and bordering species as appropriate. Standard good engineering practices and precautions will be taken to minimize or eliminate the potential effects of these actions on fish and wildlife, and efforts will be made to enhance the overall condition of the wetlands through replication. Consultation with Natural Resource agencies will be performed.	Applicable

APPENDIX G. Table G-1

Hanscom AFB OU-3 Alternative 3 - *Permeable Cap, Wetlands Hotspot Removal and Replication, Institutional Controls, Groundwater Compliance Boundary, and Monitoring* **ARARs**

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Wetland soil and surface water	***Federal***			
	Protection of Wetlands - Executive Order 11990 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Wetlands Executive Order. Under this order, federal agencies are required to minimize the degradation, loss, or destruction of wetlands, and to preserve the natural and beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. If no alternative is available, effects from implementing the chosen alternative must be mitigated. Public notice and review of activities involving wetlands is required.	COCs have been detected in wetlands soils at the site, therefore, those areas have already been impacted. Alternative #3 - *Permeable Cap* includes excavation and removal of contaminated wetland sediments, followed by the placement of clean sediment and planting of submerged and bordering plant species that will support the existing ecological wetlands system in the excavated areas. The permeable cap over the Former Filter Bed Area will prevent soil erosion that might transport contaminated soil into the wetland areas. During cap construction and wetland sediment excavation, drainage controls will be constructed and standard engineering practices will be implemented to minimize or eliminate the potential effects of these actions on the surrounding wetlands. There is no practicable alternative to this action and it is the least invasive protective action. Public review will be accomplished through the Proposed Plan.	Applicable
	Clean Water Act, (Section 404(b)(1), 40 CFR 230) Guidelines for Specification of Disposal Sites for Dredged or Fill Material	The purpose of this act is to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of disharges of dredged or fill material. Dredged or fill material should not be discharged into the aquatic ecosystem unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern. Public notice is required.	Alternative #3 - *Permeable Cap* includes excavation of contaminated wetland sediments, placement of clean sediment that will support the existing ecological wetlands system, followed by the planting of submerged and bordering species as appropriate. Standard engineering practices and precautions will be taken to minimize the potential effect on surface waters through erosion and drainage controls, and efforts will be made to enhance the overall condition of the wetlands through replication. There is no practicable alternative to this action and it is the least invasive protective action. Public review will be accomplished through the Proposed Plan.	Applicable
	State			
	Massachusetts Wetlands Regulations, (310 CMR 10.51-10.60, MGL c. 131, Section 40, Wetlands Protection Act)	These regulations protect inland wetlands such as those found at the site from activities that may alter the resource area. The loss may be permitted with replication of the lost area within two growing seasons.	Alternative #3 - *Permeable Cap* includes excavation and replication of contaminated wetland sediments. Clean sediment that will support the existing ecological wetlands system will be placed in the excavated areas, followed by the planting of submerged and bordering species as appropriate. Activities at the site will be performed in compliance with the performance standards of these regulations.	Applicable
All forms of media at the site	***Federal***			
	Migratory Bird Treaty Act of 1972, (16 USC Section 703)	This act protects almost all species of native birds in the U.S. from unregulated "taking" which can include poisoning at contaminated or hazardous waste sites.	According to the Comprehensive Ecological Analysis (LEC, August 1997), migratory birds have been observed in Wetland Z. Alternative #3 - *Permeable Cap* includes the removal of contaminated sediments and the enhanced replication of the wetland. Standard engineering practices and precautions will be taken to minimize the potential effect on migratory birds, and efforts will be made to enhance the overall condition of the wetlands through the replication.	Applicable
	Protection of Floodplains, Executive Order 11988 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Floodplains Executive Order. Under this order, federal agencies are required to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the floodplain. Agencies are also required to circulate a notice explaining why action within the floodplain is proposed.	According to the Comprehensive Ecological Analysis (LEC, August 1997), wetland Z is located within a 100-year floodplain. Alternative #3 - *Permeable Cap* includes the removal of contaminated sediments, followed by the planting of submerged and bordering plant species and the enhanced replication of the wetland. Efforts will be made to conduct the work during the dry season to avoid potential flooding. The floodplain storage capacity and hydraulics will not be changed significantly by this alternative. There is no practical alternative to this action and it is the least invasive protective action. Public notice and review of proposed activities will be accomplished through the Proposed Plan.	Applicable
	State			
	Massachusetts Endangered Species Act, 321 CMR 10.00. (MGL c. 131A)	The Commonwealth of Massachusetts has authority to research, list, and protect any species deemed endangered, threatened, or of other special concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.	According to the Comprehensive Ecological Analysis (LEC, August 1997), the spotted turtle (a species of Special Concern, as listed by Massachusetts), has been observed in Wetland Z. Alternative #3 - *Permeable Cap* includes excavation and replication of contaminated wetland sediments. These activities will be designed to minimize the potential effect on this species and to enhance the overall status of the wetlands.	Applicable

APPENDIX G. Table G-1

Hanscom AFB OU-3 Alternative 3 - *Permeable Cap, Wetlands Hotspot Removal and Replication, Institutional Controls, Groundwater Compliance Boundary, and Monitoring* **ARARs**

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Action Specific ARARs				
Surface water	***Federal***			
	National Pollutant Discharge Elimination System (NPDES) (40 CFR 122-125 and 131), Clean Water Act	Establishes discharge limitations, monitoring requirements and best management practices for any direct discharge from a point source into surface water.	Under Alternative #3 - *Permeable Cap*, during cap construction drainage controls will be constructed and standard engineering precautions will be taken to minimize/eliminate potential effects of these activities.	Applicable
	State			
	Clean Water Act - Surface Water Discharge Permit Program (314 CMR 3.00, MGL c. 21 Sections 26-53)	This act and program regulate the requirements intended to maintain the quality of surface waters by controlling the direct discharge of pollutants to surface waters. Direct discharges of wastewater to surface waters must meet effluent discharge limits established by this section. These limits are established on a case-by-case basis.	Under Alternative #3 - *Permeable Cap* construction of the cap will prevent the erosion of contaminated soils into surface waters. During cap construction drainage controls will be constructed and standard engineering precautions will be taken to minimize/eliminate potential effects of the action.	Applicable
	Massachusetts Surface Water Quality Standards (314 CMR 4.05(3)(b)5-8, MGL c.21 Sections 26-53	These regulations limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained or attained. Discharges may be limited or prohibited to protect existing uses and not interfere with the attainment of designated uses in downstream and adjacent segments. This may pertain to both discharges to surface water as a result of remediation and any onsite surface waters affected by site conditions.	Under Alternative #3 - *Permeable Cap*, during cap construction (and after if permanent point drainage structures are constructed) drainage controls will be constructed and standard engineering precautions will be taken to minimize/eliminate potential effects of the action.	Applicable
Waste	***Federal***			
	RCRA Subtitle C, 40 CFR Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	These standards, which regulate the operation of facilities which treat, store, or dispose of hazardous waste, take effect through authorized state RCRA programs cited below (Massachusetts HWMR/Hazardous Waste Management Regulations).	See Massachusetts hazardous waste regulations cited below.	Relevant & Appropriate
	RCRA Subtitle D, 40 CFR Part 258 - Criteria for Municipal Solid Waste Landfills	These standards, which regulate the operation of facilities which treat, store, or dispose of solid waste, take effect through authorized state RCRA programs cited below (Massachusetts Solid Waste Disposal Laws).	See Massachusetts solid waste regulations cited below.	Relevant & Appropriate
	State			
	Solid Waste Disposal Laws (MGL c. 21H, MGL c. 111, 150A-150A ½) 310 CMR 19 100-151	These regulations specify general design and performance standards for the South and West landfill cover systems, potential gas control, storm water control, closure, monitoring, corrective action, and post-closure care. These regulations apply to all solid waste management activities and facilities including landfills and dumping grounds.	Under Alternative 3 - *Permeable Cap*, the action includes the excavation of waste material from the area east of the former filter bed area and removal of contaminated wetlands sediment. These materials will be placed within the OU 3/Site 6 filter bed area prior to installation of the permeable cap. The alternative will address the relevant and appropriate performance requirements of these regulations for the South and West landfills. A monitoring program will be developed to monitor and maintain the South and West landfill areas after construction.	Relevant & Appropriate
	Hazardous Waste disposal Laws (MGL c.21C), 310 CMR 30.001-009, 30.590-593, 30.663, 30.660-666.	These regulations specify general design and performance standards for the filter bed cover system, potential gas control, storm water control, closure, monitoring, corrective action, and post-closure care. These regulations apply to all hazardous waste management facilities.	Under alternative 3 - *Permeable Cap*, the action includes the excavation of waste material from the area east of the former filter bed area and removal of contaminated wetlands sediment. These materials will be placed within the OU3/Site 6 filter bed area prior to installation of the permeable cap. The alternative will address the relevant and appropriate performance requirements of these regulations for the former filter bed area. A monitoring program will be developed to monitor and maintain the filter bed area after construction.	Relevant & Appropriate
Air	***State***			
	Massachusetts Air Pollution Control Regulations (310 CMR 7.09)	These regulations establish the standards and requirements for air pollution control in the Commonwealth. Section 7.09 details requirements for ambient air quality standards (dust, odor) during construction and demolition activities.	Under Alternative #3 - *Permeable Cap*, excavation and material handling operations associated with capping activities could generate ambient air quality issues. Remedial actions will be conducted with air monitoring equipment, and engineering controls will be implemented during construction, as required, to meet the regulations.	Applicable

APPENDIX G. Table G-1

Hanscom AFB OU-3 Alternative 3 - *Permeable Cap, Wetlands Hotspot Removal and Replication, Institutional Controls, Groundwater Compliance Boundary, and Monitoring* **ARARs**

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirements	Status

ARARs - Applicable or relevant and appropriate requirements
RCRA - Resource Conservation and Recovery Act.
CFR - Code of Federal Regulations.
CWA - Clean Water Act.
EO - Executive Order
EPA - Environmental Protection Agency
FR - Federal Register.
USC - Unites States Code.
NPDES - National Pollutant discharge elimination system.
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act.
SDWA - Safe Drinking Water Act.
[a] Toxicity information obtained from U.S. Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS) 1999, and Health Effects Assessment Summary Tables (HEAST) FY1998

APPENDIX F Table F-2
Hanscom AFB OU-3/IRP Site 21
Alternative 12 ARARs

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Chemical Specific ARARs				
Groundwater	***Federal***			
	Federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs) (40 CFR 141 11-141.16)	MCLs are enforceable standards that regulate the concentration of specific organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supplies They also may be considered relevant and appropriate for groundwater aquifers potentially used for drinking water Primary threat COCs in groundwater are VOCs.	Alternative 12 includes excavation of petroleum-saturated soil from LNAPL Pools A and B and "hot spots" in LNAPL Pool C and decreases in the dissolved concentrations of both the LNAPL associated contaminants and the chlorinated VOCs through natural attenuation Following removal of the contaminant source ORC will be added to the excavation for an initial treatment of groundwater Following the initial ORC treatment the dissolved-phase contaminant concentrations will continue to decrease through natural attenuation. Alternative 12 also includes contingencies for pumping and/or treating the groundwater in order to contain migration and/or reduce dissolved-phase concentrations. This alternative includes annual groundwater monitoring in order to track decreases in LNAPL volume and dissolved-phase contaminant concentrations over time MCLs are listed in Table 2-15 for compounds of concern at OU-3/ IRP Site 21	Relevant and Appropriate
	Federal Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs) (40 CFR 141.50-141.51)	Non-zero MCLGs are nonenforceable health goals for public water systems. MCLGs are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety Non-zero MCLGs are to be used as goals when MCLs have not been established for a particular compound of concern	Alternative 12 includes excavation of petroleum-saturated soil from LNAPL Pools A and B and "hot spots" in LNAPL Pool C and decreases in the dissolved concentrations of both the LNAPL associated contaminants and the chlorinated VOCs through natural attenuation Following removal of the contaminant source ORC will be added to the excavation for an initial treatment of groundwater Following the initial ORC treatment the dissolved-phase contaminant concentrations will continue to decrease through natural attenuation Alternative 12 also includes contingencies for pumping and/or treating the groundwater in order to contain migration and/or reduce dissolved-phase concentrations. This alternative includes annual groundwater monitoring in order to track decreases in LNAPL volume and dissolved-phase contaminant concentrations over time	Relevant and Appropriate
	State			
	Massachusetts Drinking Water Standards (310 CMR 22.00)	These standards establish State MCLs for organic and inorganic contaminants that have been determined to adversely effect human health in public drinking water systems. They are to be used where they are more stringent than Federal MCLs.	Alternative 12 includes excavation of petroleum-saturated soil from LNAPL Pools A and B and "hot spots" in LNAPL Pool C and decreases in the dissolved concentrations of both the LNAPL associated contaminants and the chlorinated VOCs through natural attenuation. Following removal of the contaminant source ORC will be added to the excavation for an initial treatment of groundwater. Following the initial ORC treatment the dissolved-phase contaminant concentrations will continue to decrease through natural attenuation Alternative 12 also includes contingencies for pumping and/or treating the groundwater in order to contain migration and/or reduce dissolved-phase concentrations. This alternative includes annual groundwater monitoring in order to track decreases in LNAPL volume and dissolved-phase contaminant concentrations over time	Relevant and Appropriate
	Massachusetts Contingency Plan Method 1 GW-1 Standards (310 CMR 40 0974)	These are promulgated standards for characterizing the risk posed by COCs in groundwater under MCP. The MCP Method 1 GW-1 standards will only apply for compounds where the state standard is more restrictive than the federal MCL or MCLG, or for which no MCL or MCLG currently exists Primary threat COCs in groundwater are VOCs	Alternative 12 includes excavation of petroleum-saturated soil from LNAPL Pools A and B and "hot spots" in LNAPL Pool C and decreases in the dissolved concentrations of both the LNAPL associated contaminants and the chlorinated VOCs through natural attenuation Following removal of the contaminant source ORC will be added to the excavation for an initial treatment of groundwater Following the initial ORC treatment the dissolved-phase contaminant concentrations will continue to decrease through natural attenuation Alternative 12 also includes contingencies for pumping and/or treating the groundwater in order to contain migration and/or reduce dissolved-phase concentrations. This alternative includes annual groundwater monitoring in order to track decreases in LNAPL volume and dissolved-phase contaminant concentrations over time MCP Method 1 GW-1, GW-2 and GW-3 standards are listed in Table 2-15 for compounds of concern at OU-3/ IRP Site 21	Relevant and Appropriate
Location Specific ARARs				
Surface water and wetlands	***Federal***			
	Fish and Wildlife Coordination Act (16 USC 661 et seq.)	This act requires consultation with the Fish and Wildlife Service and the state wildlife resource agency if alteration of a body of water, including discharge of pollutants into a wetland, will occur as a result of off-site remedial activities Consultation is strongly recommended for on-site actions This provides protection for actions that would affect streams, wetlands, other water bodies or protected habitats. Any action taken should protect fish or wildlife, and include measures developed to prevent, mitigate, or compensate for project-related losses to fish and wildlife	According to the Comprehensive Ecological Analysis (LEC, August 1997), the Shawsheen River and it's banks are part of the Wetland Z System, however, Alternative 12 does not alter the river or discharge pollutants into a wetland Since Alternative 12 includes excavating a trench approximately 120 to 200 feet south of the Shawsheen River and the discharge of treated groundwater into the base storm drainage system which discharges into the river, precautions will be taken to ensure that this alternative does not alter the river or discharge pollutants into a wetland. These include the installation of hay bales and/or silt fencing between the site and the river to ensure that surface runoff from the open excavation area does not transport silt into the the river and/or wetland Also the the effluent from the groundwater treatment system will be sampled and analyzed to ensure compliance with regulatory discharge parameters	Applicable
Other Natural Resources	***Federal***			
	Protection of Floodplains, Executive Order 11988 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Floodplains Executive Order. Under this order, federal agencies are required to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the floodplain.	According to the Comprehensive Ecological Analysis (LEC, August 1997), the Shawsheen River and it's banks (Zone 5) are located within a 100-year floodplain, however, Alternative 12 does not include any activities within the 100-year floodplain. Also the floodplain storage capacity and hydraulics will not be changed by this alternative. Since Alternative 12 includes excavating a trench approximately 120 to 200 feet south of the Shawsheen River, precautions will be taken to ensure that this alternative has no effect on the natural and beneficial values of the floodplain. These include the installation of hay bales and/or silt fencing between the site and the 100-year floodplain to ensure that surface runoff from the open excavation area does not transport silt into the floodplain.	Applicable

APPENDIX F Table F-2
Hanscom AFB OU-3/IRP Site 21
Alternative 12 ARARs

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Other Natural Resources			*State*	
	Massachusetts Endangered Species Act, 321 CMR 10.00, (MGL c. 131A)	The Commonwealth of Massachusetts has authority to research, list, and protect any species deemed endangered, threatened, or of other special concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.	According to the Comprehensive Ecological Analysis (LEC, August 1997), the spotted turtle (a species of Special Concern, as listed by Massachusetts), has been observed in the Wetland Z System, however, Alternative 12 does not include any activities within the wetland. Since Alternative 12 includes excavating a trench approximately 120 to 200 feet south of the Shawsheen River and long-term monitoring of groundwater including some wells adjacent to the river, precautions will be taken to minimize the potential effect on endangered species. These include the briefing of site workers that if the spotted turtle is observed in the area of site work then actions (stop work or relocate turtle out of danger) are to be taken to preclude threatening or endangering the turtle. The requirement for this briefing will be included in the construction work plan and operation, maintenance, and monitoring plan	Applicable
Action Specific ARARs				
Surface water			*Federal*	
	Clean Water Act National Pollutant Discharge Elimination System (NPDES) Regulations (40 CFR 122-125 and 131)	These regulations establish discharge limitations, monitoring requirements and best management practices for any direct discharge from a point source into surface water	Alternative 12 includes recovery, treatment, and discharge of groundwater to the base storm drainage system which has outfalls in the Shawsheen River. The effluent from the groundwater treatment system will be sampled and analyzed to ensure compliance with regulatory discharge parameters	Relevant and Appropriate
	Federal Ambient Water Quality Criteria (AWQC), 33 U.S.C 1314(a); (40 CFR Part 122.44)	Federal AWQC include (1) criteria for protection of human health from toxic properties of contaminants ingested through drinking water and aquatic organisms, and (2) criteria for protection of aquatic life	Contaminant concentrations in monitoring wells adjacent to the Shawsheen River will continue to be monitored to determine whether river water quality is being impacted by contaminated groundwater, and to assure that AWQC are being met.	Relevant and Appropriate
			State	
	Clean Waters Act - Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)	This act and program establish the requirements intended to maintain the quality of surface waters by controlling the direct discharge of pollutants to surface waters. Direct discharges of wastewater to surface waters must meet effluent discharge limits established by this program.	Alternative 12 includes recovery, treatment, and discharge of groundwater to the base storm drainage system which has outfalls in the Shawsheen River. The effluent from the groundwater treatment system will be sampled and analyzed to ensure compliance with regulatory discharge parameters.	Relevant and Appropriate
	Massachusetts Surface Water Quality Standards (314 CMR 4.05(3)(b)5-8; MGL c.21 Sections 26-53)	These regulations limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained or attained. Discharges may be limited or prohibited to protect existing uses and not interfere with the attainment of designated uses in downstream and adjacent segments. This may pertain to both discharges to surface water as a result of remediation and any onsite surface waters affected by site conditions	Contaminant concentrations in monitoring wells adjacent to the Shawsheen River will continue to be monitored to determine whether river water quality is being impacted by contaminated groundwater, and to assure that MA standards are being met.	Relevant and Appropriate
Groundwater	*Federal*			
	RCRA 40 CFR Part 264, Subpart F-Releases from Solid Waste Management Units (40 CFR 264 90-264.101 and 265.90-265.94)	General facilities requirements for groundwater monitoring at affected facilities and general requirements for corrective action programs, if required, at the affected facilities	Groundwater monitoring will be conducted in accordance with these requirements.	Relevant and Appropriate
	Federal Safe Drinking Water Act Underground Injection Control Program (UIC) Subparts C,D and E (40 CFR 144.21-144.55)	These regulations require acquiring a permit in order to inject wastes, chemicals or other substances into the subsurface	Alternative 12 includes injection of ORC into the groundwater. To ensure that the ORC injection complies with the substantive requirements of these regulations the proposed quantities to be injected will be included in the design and submitted to EPA and MA DEP for comment and concurrence and the groundwater monitoring program will assess the impact of the ORC. Also the contigency for groudnwater recovery from the trenches receiving the ORC can be implemented to remove the ORC if determined to be necessary	Relevant and Appropriate
	State			
	MA HWMR Groundwater Protection (310 CMR 30.660-30.679)	These regulations require groundwater monitoring at specified regulated units that treat, store or dipose of hazardous waste. Maximum concentration limits for the hazardous constituents are specified in 310 CMR 30.668	Groundwater monitoring will be conducted in accordance with these requirements	Relevant and Appropriate
	Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00, MGL c.21 Sections 26-53)	This program is designed to protect state groundwaters for their highest potential use by regulating discharges of pollutants to state groundwater and requiring the MADEP to regulate the outlets for groundwater discharges and associated treatment works. These regulations set effluent limits for the discharge of pollutants to groundwater. Recharge wells used exclusively to replenish an aquifer with uncontaminated water are exempt from this requirement. Uncontaminated water is water which upon discharge could not cause a violation of applicable water quality standards.	Alternation 12 does not include any discharge to groundwater. However, Alternative 12 does includes injection of ORC into the groundwater. To ensure that the ORC injection complies with the substantive requirements of these regulations the proposed quantities to be injected will be included in the design and submitted to EPA and MA DEP for comment and concurrence and the groundwater monitoring program will assess the impact of the ORC. Also the contigency for groudwater recovery from the trenches receiving the ORC can be implemented to remove the ORC if determined to be necessary	Relevant and Appropriate
	MA Application of Remedial Additives (310 CMR 40.0046)	These regulations consist of requirements for the application of remedial additives to the subsurface	Alternative 12 includes injection of ORC into the groundwater. To ensure that the ORC injection complies with the substantive requirements of these regulations the proposed quantities to be injected will be included in the design and submitted to EPA and MA DEP for comment and concurrence and the groundwater monitoring program will assess the impact of the ORC. Also the contingency for groundwater recovery from the trenches receiving the ORC can be implemented to remove the ORC if determined to be necessary	Relevant and Appropriate
	MA Standards for Analytical Data for Remedial Response Action, Bureau of Waste Site Cleanup Policy 300-89	This policy decribes the minimum standards for analytical data submitted to the MADEP	All sampling plans will be designed with consideration of the analytical methods provided in this policy.	To Be Considered
	MA Underground Injection Control (UIC) Program (310 CMR 23.01-23.11)	These regulations require acquiring a permit in order to inject wastes, chemicals or other substances into the subsurface.	Alternative 12 includes injection of ORC into the groundwater. To ensure that the ORC injection complies with the substantive requirements of these regulations the proposed quantities to be injected will be included in the design and submitted to EPA and MA DEP for comment and concurrence and the groundwater monitoring program will assess the impact of the ORC. Also the contingency for groundwater recovery from the trenches receiving the ORC can be implemented to remove the ORC if determined to be necessary.	Relevant and Appropriate

APPENDIX F Table F-2
Hanscom AFB OU-3/IRP Site 21
Alternative 12 ARARs

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Action Specific ARARs				
Waste	*Federal*			
	Resource Conservation and Recovery Act (RCRA) Identification and Listing of Hazardous Wastes (40 CFR 261.24)	These requirements establish the maximum concentrations of contaminants for which the waste would be a RCRA-characteristic hazardous waste for toxicity	Alternative 12 includes the disposal of recovered petroleum product and petroleum-saturated soil which may be classified as hazardous. Also this alternative includes groundwater treatment. The treatment method would have the potential to generate hazardous wastes such as activated carbon used to treat groundwater. Disposal of these wastes will comply with the substantive requirements of these regulations.	Applicable
	RCRA Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations.	Alternative 12 includes the disposal of recovered petroleum product and petroleum-saturated soil which may be classified as hazardous. Also this alternative includes groundwater treatment. The treatment method would have the potential to generate hazardous wastes such as activated carbon used to treat groundwater. Disposal of these wastes will comply with the substantive requirements of these regulations	Applicable
	State			
	MA HWMR, Use and Management of Containers, 310 CMR 30.689; Storage and Treatment in Tanks, 310 CMR 30.699	These regulations set forth requirements for use and management of containers and tanks at hazardous waste facilities	Packing and accumulation of recovered product, treatment sludges, and other material will adhere to these standards.	Relevant and Appropriate
	Massachusetts Hazardous Waste Management Rules (HWMR), 310 CMR 30.300-30.371, Requirements for Generators	Establishes requirements and standards for generators of hazardous waste that address general waste management measures, including the accumulation of hazardous waste prior to off-site disposal, preparing the hazardous wastes for shipment, and preparing appropriate waste manifests.	Alternative 12 includes the disposal of recovered petroleum product and petroleum-saturated soil which may be classified as hazardous. Also this alternative includes groundwater treatment. The treatment method would have the potential to generate hazardous wastes such as activated carbon used to treat groundwater. Disposal of these wastes will comply with the substantive requirements of these regulations.	Applicable
	Solid Waste Disposal Laws (MGL c. 21H, MGL c. 111, Sections 150A-150A 1/2) 310 CMR 19.100-151	These regulations govern the disposal of solid waste in Massachusetts	Disposal of solid waste resulting from remedial activities associated with this alternative will have to be disposed of properly in accordance with these laws.	Relevant and Appropriate
Air	*Federal*			
	RCRA, - Air Emission Standards for Equipment Leaks (42 USC 6924, 40 CFR 264, Subpart BB	Contains air pollutant emission standards for equipment leaks at hazardous waste TSD facilities. Contains design specifications and requirements for monitoring for leak detection. It is applicable to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10% by weight.	If petroleum product recovery or groundwater treatment involves management of hazardous waste with organics of at least 10 ppm, equipment will meet the design specifications, and will be monitored for leaks.	Relevant and Appropriate
	State			
	Massachusetts Air Pollution Control Regulations (MGL c.111 Sections 142A-142M, 310 CMR 7.09 and 7.18)	These regulations establish the standards and requirements for air pollution control in the Commonwealth. Section 7.09 details requirements for ambient air quality standards (dust, odor) during construction and demolition activities. Section 7.18 details requirements for air pollution controls for volatile organic compounds	Alternative 12 includes excavation of petroleum-saturated soils and the excavation and material handling operations could generate ambient air quality issues. Air monitoring will be conducted during excavation and soil management activities such as the potential use of landfarming to treat petroleum contaminated soil on-site. Remedial actions will be conducted with air monitoring equipment, and engineering controls will be implemented as required to meet the regulations. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative	Applicable

ARARs - Applicable or relevant and appropriate requirements.
RCRA - Resource Conservation and Recovery Act.
CFR - Code of Federal Regulations.
CMR - Code of Massachusetts Regulations.
CWA- Clean Water Act.
EPA - Environmental Protection Agency.
MGL - Massachusetts General Laws
USC - United States Code.

NPDES-National Pollutant discharge elimination system.
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act.
SDWA - Safe Drinking Water Act.
GAC - Granular Activated Carbon.
VOC - Volatile Organic Compounds

ATTACHMENT C

SITE INSPECTION PHOTO LOG

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 1	Date: December 6, 2016

Direction Photo Taken:

Northwest.

Description:

Vapor-phase carbon vessel for the treatment of off-gas from stripping tower; OU1 groundwater treatment plant.

Photo No. 2	Date: December 6, 2016

Direction Photo Taken:

West.

Description:

Stripping tower; OU1 groundwater treatment plant.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 3	Date: December 6, 2016

Direction Photo Taken:

North.

Description:

Pipe galley with process pumps; OU1 groundwater treatment plant.

Photo No. 4	Date: December 6, 2016

Direction Photo Taken:

Northwest.

Description:

New variable-frequency drive motor for process blower; OU1 groundwater treatment plant.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 5	Date: December 6, 2016

Direction Photo Taken:

West.

Description:

Pump station #2.

Photo No. 6	Date: December 6, 2016

Direction Photo Taken:

West.

Description:

Site #2 recharge gallery.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 7	Date: December 6, 2016

Direction Photo Taken:

Northeast.

Description:

Off-site discharge of treated water from OU1 to the Shawsheen basin.

Photo No. 8	Date: December 6, 2016

Direction Photo Taken:

Southwest.

Description:

Pump station #1.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 9	Date: December 6, 2016

Direction Photo Taken:

Southeast.

Description:

Entrance gate into the OU1 groundwater treatment plant property (from inside the treatment plant property). MassPort construction activities (installation of new fence) was underway at time photograph was taken.

Photo No. 10	Date: December 6, 2016

Direction Photo Taken:

Northwest.

Description:

OU1 groundwater treatment plant. The plant is surrounded by a chain link fence and access is controlled by O&M staff.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 11	Date: December 6, 2016

Direction Photo Taken:

Southwest.

Description:

Site #21 treatment shed, which houses oil/water separator and liquid ring pump. Defunct catalytic oxidizer unit in the foreground to the left.

Photo No. 12	Date: December 6, 2016

Direction Photo Taken:

West.

Description:

Second treatment shed at Site #21 that houses pump controls, and sand and carbon filters.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 13	Date: December 6, 2016

Direction Photo Taken:

North.

Description:

Site #6 entrance; west landfill. Note the warning sign affixed to the fence that states “No Digging” and “No Dumping”.

Photo No. 14	Date: December 6, 2016

Direction Photo Taken:

Northeast.

Description:

Site #6; Former Filter bed Area.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 15	Date: December 6, 2016

Direction Photo Taken:

Northeast.

Description:

Site #6; Former Filter Bed Area – looking towards wetlands at toe of slope.

Photo No. 16	Date: December 6, 2016

Direction Photo Taken:

Northeast.

Description:

Site #6; Former Filter Bed Area: monitoring well showing subsidence of landfill.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 17	Date: December 6, 2016

Direction Photo Taken:

East/northeast.

Description:

Site #6; Camp Patriot.

Photo No. 18	Date: December 6, 2016

Direction Photo Taken:

Southwest.

Description:

Landfill LF-04 aka "Hanscom Field".

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 19	Date: December 6, 2016

Direction Photo Taken:

Southeast.

Description:

Drainage swale at the southeast corner of landfill LF-04.

Photo No. 20	Date: December 6, 2016

Direction Photo Taken:

West.

Description:

Berm located on the south edge of landfill LF-04.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 21	Date: December 6, 2016

Direction Photo Taken:

West

Description:

Landfill LF-04 aka "Hanscom Field".

Photo No. 22	Date: December 6, 2016

Direction Photo Taken:

South.

Description:

Drainage swale at the midpoint of the southern edge of landfill LF-04.

AECOM

PHOTOGRAPHIC LOG

Client Name: U.S. Air Force	Site Location: Hanscom AFB	Project No. 60520125

Photo No. 23	Date: December 6, 2016

Direction Photo Taken:

Southwest.

Description:

Drainage swale at the southwest corner of landfill LF-04. Beaver dam in background does not appear to be impacting drainage from the landfill.

Photo No. 24	Date: December 6, 2016

Direction Photo Taken:

Southwest.

Description:

Entrance to landfill LF-04 aka “Hanscom Field”..

ATTACHMENT D

INTERVIEW RECORDS

INTERVIEW RECORD

Site Name: Hanscom Field/ Hanscom Air Force Base	**EPA ID No.:** MA 8570024424	
Subject: Five Year Review	**Time:**	**Date:** 12/6/2016
Type: ☐ Telephone X Visit ☐ Other **Location of Visit:** Call made from Hanscom AFB Environmental Office	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Cindy Castleberry-Lee	**Title:** Project Engineer	**Organization:** URS/AECOM

Individual Contacted:

Name: Bill Gooden and Richard Landry	**Title:** Hanscom AFB RPM and RA-O Contractor's Field/On-Site Manager	**Organization:** United States Air Force and Versar, Inc.
Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:**	

1. What is your overall impression of the IRP at Hanscom Air Force Base? (general sentiment)

Mr. Gooden stated that it's a good program – some facilities are getting old, but the work is progressing. He noted that performance-based remediation (PBR) shifts more of the responsibility to the contractor.

Mr. Landry stated that he is working for the 9th contractor conducting operations at the IRP sites and that the current goals are aggressive; Versar's PBR has added more incentive to make progress; Prior to Tom Best's retirement, the base was very aggressive.

2. Are the remedies for each IRP site functioning as expected? How well are the remedies performing?

Mr. Landry discussed how at OU1, they are trying more innovative technologies to augment the pump and treat system, which can run for a long time. They are still evaluating the effectiveness of vegetable oil injections.

Also, Site 21 has a pump and treat system that has been shut down for the past year and instead they have been performing ORC injections. Vapor enhanced recovery was performed many years ago. At OU1, the VER system has been shut down because it was very labor intensive and not recovering enough contamination.

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

Mr. Gooden noted that Site 2 seems to be meeting its goals, but Site 3 has a TCE hot spot that is not being affected as well.

4. For each IRP site, is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

Mr. Landry worked full-time mainly at the OU1 groundwater treatment plant and has a pager that notifies him of issues with the treatment plant at night/on weekends. Mr. Landry checks on OU3 Site 21 every few weeks. Site 4 has annual inspections, but he checks on it more frequently. Site 6 is also inspected annually, but others are present for LTM events and base training activities.

5. For each IRP site, have there been any significant changes in the O&M requirements, maintenance schedules or sampling routines in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

At OU1, there have been some changes such as reducing the frequency of pH measurements and the abandonment of on-site GC analysis and replacement with off-site sampling at a lesser frequency. The sampling frequency and number of wells sampled is regularly looked at for opportunities to optimize and reduce the collection of data that is not useful.

6. Have there been any unexpected O&M difficulties or costs at the IRP sites in the last five-years? If so, please give details.

At OU1, they need to downsize some pumps, motors, VFDs to be able to run at lower flow rates. There was a lightning strike that hit the Site 1 pump area and destroyed electronics (SCADA system) about a year ago. Mr. Landry noted that it was difficult to get some parts because of the age of the equipment and they ended up pulling parts from Site 3. Mr. Landry also indicated that the boiler and feed water tank at OU1 are getting old.

Mr. Gooden that the existing pump and treat system is probably not doing a great job at removing the emerging contaminants and that if more funding is made available to address that, perhaps some of older equipment/systems could be upgraded at the same time.

Mr. Landry also mentioned that the stripper towers foul about every 8 years.

Propane for the boiler costs $500/week in the winter.

7. For each IRP site, describe any changes that have been made within the past five years to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

The blower for the air stripper was replaced with a new motor and VFD, which has resulted in a 40-50% reduction in electricity use.

8. Do you have any comments, suggestions, or recommendations regarding the IRP sites?

Mr. Landry noted that he thinks keeping software updated is important. He is concerned about keeping software updated and concern over running into problems with proprietary software and companies not producing certain software any longer.

Mr. Gooden noted the need to understand the source of emerging contaminants in the Hartwell Town Forest/Jordan Conservation Area and he mentioned that the groundwater direction is opposite if it was coming from the IRP sites.

INTERVIEW RECORD

Site Name: Hanscom Field/ Hanscom Air Force Base	**EPA ID No.:** MA 8570024424	
Subject: Five Year Review	**Time:**	**Date:** 12/6/2016
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:** Call made from Hanscom AFB Environmental Office	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Cindy Castleberry-Lee (William Gooden, Hanscom AFB RPM also present)	**Title:** Project Engineer	**Organization:** URS/AECOM

Individual Contacted:

Name: Jonathan Davis	**Title:** AFCEC Section Chief	**Organization:** United States Air Force
Telephone No: **Fax No:** **E-Mail Address:** jonathan.davis.2@us.af.mil	**Street Address:**	

1. What is your overall impression of the IRP at Hanscom Air Force Base? (general sentiment)
Mr. Davis' overall sentiment is that it is a protective, comprehensive program that is working to accelerate cleanup efforts beyond regulatory requirements.

2. Are the remedies for each IRP site functioning as expected? How well are the remedies performing?
Yes, the remedies are performing well, in part due to adjustments that have been made (i.e., at Site 21) and the dynamic approach.

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?
Mr. Davis was not knowledgeable of the details of the monitoring data. Mr. Gooden added that the monitoring data trends vary by site and specific locations, in that some locations are on track to meet the exit strategy, while other specific locations/areas are not responding to targeted treatment.

4. For each IRP site, is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.
It was agreed that this question had been adequately answered during the interview with the Mr. Richard Landry, the RA-O contractor's field/on-site manager.

5. For each IRP site, have there been any significant changes in the O&M

requirements, maintenance schedules or sampling routines in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.
It was agreed that this question had been adequately answered during the interview with the Mr. Richard Landry, the RA-O contractor's field/on-site manager.

6. Have there been any unexpected O&M difficulties or costs at the IRP sites in the last five-years? If so, please give details.
Mr. Davis briefly mentioned a historical issue with propane delivery.

7. For each IRP site, describe any changes that have been made within the past five years to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
It was discussed that due to the age of the remedial systems, the Air Force needs to start planning for some infrastructure upgrades. Also, there have been changes made that toward optimizing the remedies, including shutdown of the vapor enhanced recovery system at IRP Site 1 and other changes since the start of the performance-based remediation contract. The remedies are continually being optimized such as eliminating sampling that isn't providing useful data.

8. Do you have any comments, suggestions, or recommendations regarding the IRP sites?
Mr. Davis noted the need for development of land use control implementation plans for the IR sites before the next five-year review. At the time the decision documents for these sites were completed, preparation of LUC implementation plans was not a standard process as it is now for newer AF sites.

Also mentioned was the need to conduct the RI/FS process specifically for 1,4-dioxane, as an emerging contaminant. The extent in groundwater, particularly in the Bedford Town Forest/Conservation Area is not known. More work is also needed with regard to PFAS/PFOS, although it was noted that there are no promulgated standards for those emerging contaminants.

INTERVIEW RECORD

Site Name: Hanscom Field/ Hanscom Air Force Base	**EPA ID No.:** MA 8570024424	
Subject: Five Year Review	**Time:**	**Date:** 12/6/2016
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Cindy Castleberry-Lee (William Gooden, Hanscom AFB RPM also present)	**Title:** Project Engineer	**Organization:** URS/AECOM

Individual Contacted:

Name: Sharon Williams and Keith Leonhardt	**Title:** Airport Director and Operations Manager	**Organization:** MassPort
Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:**	

1. What is your overall impression of the IRP at Hanscom Air Force Base? (general sentiment)
Mr. Leonhardt overall impression is good – there is a good relationship with the Air Force.

2. What effects have IRP site operations had on Hanscom Field?
Mr. Leonhardt noted that the process operates quietly with minimal impacts. He indicated that the ability of MassPort to use the site areas occasionally comes up related to possible future development and it would be helpful to know when certain areas would be remediated such that they can be made available for MassPort development.

3. Are you aware of any events, incidents, or activities at the IRP sites within the past five years, such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
None.

4. Do you feel well informed about the IRP site activities and progress and land use controls that are in-place?
Mr. Leonhardt indicated that Rich Landry has been very communicative regarding the IRP sites and how they may impact the airport operations.

5. Do you have any comments, suggestions, or recommendations regarding the management or operation of any of the IRP sites?
Ms. Williams and Mr. Leonhardt would like an update on the status of when the airfield sites can be returned for MassPort use and what future land uses could be allowed. They

are interested in potentially using areas for future occupied buildings – in particular, the site on the west side near taxiway Mike.

INTERVIEW RECORD

Site Name: Hanscom Field/ Hanscom Air Force Base	**EPA ID No.:** MA 8570024424	
Subject: Five Year Review	**Time:**	**Date:** 12/7/2016
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Cindy Castleberry-Lee	**Title:** Project Engineer	**Organization:** URS/AECOM

Individual Contacted:

Name: Heidi Porter	**Title:** Director of Public Health	**Organization:** Town of Bedford, Massachusetts
Telephone No: **Fax No:** **E-Mail Address:** hporter@bedfordma.gov	**Street Address:**	

1. What is your overall impression of the IRP at Hanscom Air Force Base? (general sentiment)
Overall impression is good. Ms. Porter likes the change that occurred 4 or 5 years ago with the performance-based remediation contract and how that is being implemented.

2. Have there been routine communications or activities (site visits, inspections, reporting, etc.) conducted by your office regarding the IRP sites at Hanscom Air Force Base? If so, please give purpose and results.
There are annual discussions with the base regarding wells and Ms. Porter attends the annual Restoration Advisory Board meetings.

3. Have there been any complaints, violations, or other incidents related to the IRP sites requiring response by your office within the past five years? If so, please give details of the events and results of the responses.
No. However, the recent focus on emerging contaminants has sparked more involved discussion regarding well permits and the need to have something more formal in place to indicate a specific land use control area within which well permits should not be issued.

4. Do you feel well informed about the IRP site activities and progress?
Yes, monthly updates are provided.

5. Do you have any comments, suggestions, or recommendations regarding the management or operation of any of the IRP sites?
Ms. Porter referred back to her response to question #3 and the need to have something more formal in place to tell the town where the areas of concern are that wells should not be installed. She also indicated that there haven't been any issues thus far.

INTERVIEW RECORD

Site Name: Hanscom Field/ Hanscom Air Force Base	**EPA ID No.:** MA 8570024424	
Subject: Five Year Review	**Time:**	**Date:** 12/8/2016
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Cindy Castleberry-Lee (William Gooden, Hanscom AFB RPM also on conference call)	**Title:** Project Engineer	**Organization:** URS/AECOM

Individual Contacted:

Name: Mathew Audet	**Title:** RPM	**Organization:** U.S. Environmental Protection Agency, Region 1
Telephone No: **Fax No:** **E-Mail Address:** audet.matthew@epa.gov	**Street Address:**	

1. What is your overall impression of the IRP at Hanscom Air Force Base? (general sentiment)
Mr. Audet's overall impression is positive; a lot has been accomplished and optimization efforts have been helping progress the remedies. Mr. Audet is pleased with the Air Force's responsiveness.

2. Have there been routine communications or activities (site visits, inspections, reporting, etc.) conducted by your office regarding the IRP sites at Hanscom Air Force Base? If so, please give purpose and results.
Mr. Audet communicates with the Air Force on a regular basis on conference calls and also frequently performs site visits (4-5 times per year).

3. Have there been any complaints, violations, or other incidents related to the IRP sites requiring response by your office within the past five years? If so, please give details of the events and results of the responses.
None.

4. Do you feel well informed about the IRP site activities and progress?
Yes.

5. Do you have any comments, suggestions, or recommendations regarding the management or operation of any of the IRP sites?
Mr. Audet had no comments, but indicated that the remedies are in place and on-going work to optimize the remedies will save money and reduce remediation timeframes.

INTERVIEW RECORD

Site Name: Hanscom Field/ Hanscom Air Force Base	**EPA ID No.:** MA 8570024424	
Subject: Five Year Review	**Time:**	**Date:** 12/5/2016
Type: ☐ Telephone ☐ Visit X Other **Location of Visit:** Responses provided via email	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Cindy Castleberry-Lee	**Title:** Project Engineer	**Organization:** URS/AECOM

Individual Contacted:

Name: Anne Malewicz	**Title:** RPM	**Organization:** Massachusetts Department of Environmental Protection
Telephone No: **Fax No:** **E-Mail Address:** anne.malewicz@state.ma.gov	**Street Address:**	

1. What is your overall impression of the IRP at Hanscom Air Force Base? (general sentiment)
The IRP program is managed by a group of dedicated professionals with willingness for open communications. They have sound technical ability and suggest changes to improve the remediation systems when necessary.

2. Have there been routine communications or activities (site visits, inspections, reporting, etc.) conducted by your office regarding the IRP sites at Hanscom Air Force Base? If so, please give purpose and results.
There are regular conference calls, site visits, and RAB meetings with the community.

3. Have there been any complaints, violations, or other incidents related to the IRP sites requiring response by your office within the past five years? If so, please give details of the events and results of the responses.
No complaints or violations noted in my fed fac office, boston.

4. Do you feel well informed about the IRP site activities and progress?
We feel well informed about the IRP as we have open communications and regular conference/meetings with base staffing and their cleanup contractors.

5. Do you have any comments, suggestions, or recommendations regarding the management or operation of any of the IRP sites?
No, keep the same openness in communication and dedicated core of technical expertise.

ATTACHMENT E

HISTORICAL LONG-TERM MONITORING DATA FOR IRP SITE 6

TABLE 2-9
HISTORIC AND CURRENT METALS, PESTICIDES, AND PCBs IN SURFACE WATER
(OCTOBER 2002 - JULY 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

Well ID	Date	Metals**										Pesticides					PCBs
		Arsenic (ug/L)	Iron (ug/L)	Aluminum (ug/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)	Nickel (ug/L)	Selenium (ug/L)	Zinc (ug/L)	4,4'-DDD (ug/L)	alpha-BHC (ug/L)	beta-BHC (ug/L)	Endrin (ug/L)	Endosulfan I (ug/L)	PCBs (ug/L)
AWQC Standards*		**150**	**1000**	**87**	**0.72**	**74**	**-**	**2.5**	**52**	**-**	**120**	**NS**	**NS**	**NS**	**0.036**	**0.056**	**0.014**
EWRA-01	**Apr-03**	0.002F/ND	4.378/0.523	0.03F/0.06F	ND/0.0006F	0.001F/ 0.005F	0.001F/ND	ND/ND	0.0013F/ 0.0046F	ND/ND	0.0052F/ 0.0034F	ND	0.051F	0.06F	0.01F	ND	ND
	Oct-04	0.099	215.54	0.02F	ND	ND	ND	ND	ND	0.007F	0.099	R	R	R	R	R	ND
	Apr-05	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-05	0.0025F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-06	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WWRA-01	**Apr-03**	ND/ND	27.277/ 18.085	0.05F/0.06F	ND/0.0007F	0.002F/ 0.006F	ND/ND	ND/ND	0.0042F/ 0.0083F	0.0027F/N D	ND/ 0.0044F	ND	ND	0.04F	ND	0.01F	ND
	Oct-04	ND	40.581	ND	ND	ND	ND	0.0013F	0.004F	0.003F	0.045	ND	ND	ND	ND	ND	ND
	Apr-05	0.004F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SWW6-05	**Oct-02**	ND/ND	2.726/1.486	0.84J/0.13F	0.0002F/ND	0.002F/ 0.002F	0.006F/ 0.009F	0.0046F/ 0.0014F	0.0052F/ 0.0049F	ND/ND	0.0973/ 0.0855	0.018F	ND	ND	ND	ND	ND
	Apr-03	ND/ND	1.442/0.632	0.04F/0.03F	ND/ND	ND/ND	0.003F/ 0.001F	ND/ND	ND/ 0.0019F	ND/ND	0.0806/ 0.0545	ND	0.013F	0.029F	ND	ND	ND
	Apr-05:Jul-06	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-06	ND	0.816M	0.046F	ND	ND	ND	ND	0.00163F	ND/ND	0.0124F	--	--	--	--	--	--
	Apr-08	0.67F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-08	1.5F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-08	1.0F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-09	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-09	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-09	<4.4	3.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-10	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-10	0.97F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-11	0.6F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	1.5F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-13	1.4J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-14	1.6J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-14	3.0J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-14	1.0J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-15	5.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SG #3	**Apr-08**	3.4F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-08	3.0F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-08	3.8F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-09	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-09	5.8F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-09	<4.4	0.71	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 2-9
HISTORIC AND CURRENT METALS, PESTICIDES, AND PCBs IN SURFACE WATER
(OCTOBER 2002 - JULY 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

Well ID	Date	Metals**										Pesticides					PCBs
		Arsenic (ug/L)	Iron (ug/L)	Aluminum (ug/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)	Nickel (ug/L)	Selenium (ug/L)	Zinc (ug/L)	4,4'-DDD (ug/L)	alpha-BHC (ug/L)	beta-BHC (ug/L)	Endrin (ug/L)	Endosulfan I (ug/L)	PCBs (ug/L)
AWQC Standards*		**150**	**1000**	**87**	**0.72**	**74**	**-**	**2.5**	**52**	**-**	**120**	**NS**	**NS**	**NS**	**0.036**	**0.056**	**0.014**
SG #3 (Continued)	Apr-10	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-10	2.2F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-10	2.3F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-11	2.9F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-11	2.1F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	3.6F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-12	1.9F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-13	3.7J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-13	2.4J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-13	2.7J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-14	2.5J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-14	3.2J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-14	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-15	5.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-15	4.6J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SWR6-02	Apr-08	3.2F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-08	2.8F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-08	3.1F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-09	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-09	4.9F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-09	<4.4	1.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-10	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-10	1.4F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-10	2.0F/ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-11	3.1F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-11	1.5F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	3.7F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-12	1.4F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SWR6-02	Apr-13	3.1J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-13	3.1J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-13	1.7J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-14	2.3J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Aug-14	1.4J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-14	2.8J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 2-9
HISTORIC AND CURRENT METALS, PESTICIDES, AND PCBs IN SURFACE WATER
(OCTOBER 2002 - JULY 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

Well ID	Date	Metals**										Pesticides					PCBs
		Arsenic (ug/L)	Iron (ug/L)	Aluminum (ug/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)	Nickel (ug/L)	Selenium (ug/L)	Zinc (ug/L)	4,4'-DDD (ug/L)	alpha-BHC (ug/L)	beta-BHC (ug/L)	Endrin (ug/L)	Endosulfan I (ug/L)	PCBs (ug/L)
AWQC Standards*		**150**	**1000**	**87**	**0.72**	**74**	**-**	**2.5**	**52**	**-**	**120**	**NS**	**NS**	**NS**	**0.036**	**0.056**	**0.014**
SWR6-02 (Continued)	**Apr-15**	5.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-15	2.3J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SWW6-06	**Apr-08**	0.59F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-08	1.6F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-08	0.65F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-09	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-09	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-09	<4.4	0.63	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-10	<4.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-10	1.5F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-11	0.72F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-11	1.3F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	1.2F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-12	1.1F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-13	0.62J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-13	1.1J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-14	0.72J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Aug-14	1.2J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-14	1.2J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-15	0.94J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-15	1.3J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
AWQC - Ambient Water Quality Criteria (national Recommended Water Quality Criteria for Priory Toxic Pollutants and non-Priority Pollutants - Freshwater Chronic Standards)
* AWQC criteria is based on dissolved metals in the water column
**Results for metals presented in total/dissolved concentrations; if only one concentration is listed it is dissolved
EWRA-01 - East Wetlands Remediation Area
WWRA-01 - West Wetlands Remediation Area
SWW6-05 - Wetlands Surface Water Monitoring Point
SG#3 - Shawsheen River Stream Gauging Station #3
SWR6-02 - Shawsheen River Monitoring Point
SWW6-06 - Wetlands Surface Water Monitoring Point
ug/L - micrograms per liter

BOLD -Indicates exceedance of one or more standards
-- not analyzed
NS - No standard
ND - not detected
F - Value between MDL and RDL
J - Estimated value.
R - Rejected data following data validation
U - Non-detect at associated detection limit.

TABLE 2-10
HISTORIC AND CURRENT DISSOLVED ARSENIC IN GROUNDWATER AND SURFACE WATER (2001 - 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

DISSOLVED ARSENIC																
Well ID	**MW6-B07**	**MW6-B09**	**MW6-B10**	**MW6-11**	**MW6-12**	**MW6-13**	**MW6-14**	**MW6-15**	**MW6-16**	**MW6-17**	**MW6-18**	**MW6-21**	**MW6-22**	**MW6-23**	**MW6-25**	**MW6-103**
Aquifer	**Lower Till**	**Lower Till**	**Lower Till**	**Lower Till**	**Lower Till**	**Lower Till**	**Lower Till**	**Lower Till**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**
Dec-01	--	26 F	21 F	45	< 2.7/< 2.7	12 F	--	< 2.7	< 2.7	6 F	< 2.7	6 F	48	62	123/90	Dry
Oct-02	--	15 F	40/35	50	--	--	<1.6	18 F	<1.6	60	3 F	32	--	11 F	<1.6	Dry
Apr-03	--	42	--	--	--	20 F	--	<1.6	--	--	--	<1.6	46	--	2 F	6 F
Sep-03	--	36	43	< 2.9	--	<2.9	<2.9	<2.9	66	122	--	5 F	50	15 F	4 F	--
Oct-04	--	46	51	<2.5	--	23 F	<2.5	4 F	18 F	105	--	35	44/45	8 F	20 F	13 F
Apr-05	--	54	--	--	--	--	--	<2.5	<2.5	--	--	<2.5	--	--	3 F	--
Jul-05	--	51	51	--	--	--	--	<2.5	<2.5/<2.5	72	--	80	--	--	<2.5	--
Oct-05	--	34	48	<1.9	--	9.6	--	<1.9	2.0 F/2.4 F	35/19	--	170	43/43	10	3.4 F	27
Jan-06	--	52	52	--	--	--	--	<1.9	<1.9	6.6	--	2.8 F	--	--	<1.9	--
Apr-06	--	50	55	--	--	--	--	<1.9	<1.9	22	--	<1.9	--	--	<1.9	--
Jul-06	63.4	--	--	--	--	--	--	--	--	--	--	35	5.67	--	--	--
Oct-06	55	52	55	<4	--	7.4	--	<4	<4	86	--	99	--	6.6	<4	--
Jan-07	61/61	54	62	--	--	--	--	<4	<4	4.6	--	7.1	--	--	<4	9.7
Apr-07	89	46	54	--	--	--	--	<4	<4	37	--	<4	--	--	<4	5.2
Aug-07	54/55	40	52	--	--	--	--	<4	<4	35	--	100	--	--	<4	<4
Oct-07	53	40/40	66	<4	--	<4	--	<4	<4	37	--	150	--	4.2	<4	Dry
Apr-07	78	42	59	--	--	--	--	1.0 F	0.30 F	7.6	--	2.4 F/2.2 F	--	--	--	20
Jul-08	64	39	63	--	--	--	--	0.83 F	0.98 F	32	--	48	--	--	--	9.4
Oct-08	66	46	77	--	--	--	--	10	0.69 F	41	--	91	--	5.4	--	5.8
Apr-09	78	42	58	--	--	--	--	<4.4	<4.4	27	--	<4.4	--	--	--	<4.4
Jul-09	76	40	69	--	--	--	--	7.1 F	<4.4	43	--	33	--	--	--	<4.4
Nov-09	48	38	56	--	--	--	--	<4.4	<4.4	18	--	11	--	<4.4	--	--
Apr-10	77	36	54	--	--	--	--	<4.4	<4.4	21 F	--	<4.4	--	--	--	9.8 F
Jul-10	65	44	56	--	--	--	--	2.5 F	0.45 F	38	--	28	--	--	--	2.3 F
Nov-10	58	31/29	53	--	--	--	--	2.5 F	0.48 F	20	--	3.1/3.3 F	--	--	--	Dry
Apr-11	--	--	--	--	--	--	--	--	--	--	--	1 F	--	--	--	40
Jul-11	--	--	--	--	--	--	--	--	--	--	--	14	--	--	--	18
Oct/Nov-11	61	43	51	--	--	--	--	1.7 F	0.28F	32	--	24/24	--	--	--	2.9 F
Apr-12	--	--	--	--	--	--	--	--	--	--	--	4.8 F	--	--	--	1.9 F
Jul-12	--	--	--	--	--	--	--	--	--	--	--	10	--	--	--	4.1 F
Oct/Dec-12	63	53	44	--	--	--	--	0.53 F	0.57 F	29	--	47	--	--	--	--
Apr-13	--	--	--	--	--	--	--	--	--	--	--	0.67J	--	--	--	7.3
Jul-13	--	--	--	--	--	--	--	--	--	--	--	1.8J	--	--	--	3.1
Oct-13	66	39	49	--	--	--	--	0.53J	0.37J	31	--	24	--	--	--	--
Apr-14	--	--	--	--	--	--	--	--	--	--	--	3J/3.1J	--	--	--	5.6
Jul-14	--	--	--	--	--	--	--	--	--	--	--	0.98J	--	--	--	2.5J
Nov/Dec-14	40	34	46	--	--	--	--	<1	<1	27	--	16	--	--	--	--
Apr-15	--	--	--	--	--	--	--	--	--	--	--	1.3J/1J	--	--	--	2.8J
Jul-15	--	--	--	--	--	--	--	--	--	--	--	0.41J	--	--	--	2J

TABLE 2-10
HISTORIC AND CURRENT DISSOLVED ARSENIC IN GROUNDWATER AND SURFACE WATER (2001 - 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

DISSOLVED ARSENIC																	
Well ID	**MW6-104**	**MW6-105**	**MW6-106**	**MW6-110T**	**MW6-110U**	**MW6-111T**	**MW6-112U**	**MW6-113T**	**MW6-113U**	**MW6-114T**	**MW6-115T**	**MW6-116T**	**MW6-116U**	**MW6-117T**	**MW6-117U**	**MW6-118T**	**MW6-118U**
Aquifer	**Surface/ Lower Till**	**Surface**	**Surface**	**Lower Till**	**Surface**	**Lower Till**	**Surface**	**Lower Till**	**Surface**	**Lower Till**	**Lower Till**	**Lower Till**	**Surface**	**Lower Till**	**Surface**	**Lower Till**	**Surface**
Dec-01	Dry	Dry	Dry	22 F	< 2.7	< 2.7	< 2.7	< 2.7	Dry	< 2.7	--	--	--	--	--	--	--
Oct-02	Dry	27 F	<1.6	23 F	--	--	<1.6	<1.6	Dry	<1.6	<1.6	<1.6	<1.6	<1.6	5 F	<1.6	24 F
Apr-03	10 F/14 F	--	--	--	<1.6	--	<1.6	2 F	11 F	--	--	<1.6	<1.6	<1.6	4 F	<1.6	23 F
Sep-03	--	12 F	< 2.9	21 F/23 F	<2.9	--	<2.9	<2.9	9 F	<2.9	<2.9	<2.9	<2.9	<2.9	6 F	<2.9/<2.9	108
Oct-04	Dry	30/30	<2.5	10 F	<2.5	25 F	<2.5	<2.5	3 F	--	<2.5	<2.5	<2.5	<2.5	8 F	<2.5	179
Apr-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3 F	--	14/20
Jul-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--	90
Oct-05	18	37	<1.9	22	2.74	72	<1.86/<1.86	<1.86	2.41 F	--	--	<1.9	<1.9	<1.9	16	<1.9	39
Jan-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<1.9/<1.9	--	2.8 F/<1.9
Apr-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.5 F/2.5 F	--	28
Jul-06	--	--	<1.2/<1.2	--	--	--	--	--	--	--	--	--	<1.2	--	3.0 F	--	48
Oct-06	--	10	<4	18/18	<4	76	<4	<20/<20	<20	--	--	<4/<4	<4	<4	9.9	<4	200/200
Jan-07	6.9	--	<4	--	--	--	--	<4	4.7	--	--	--	--	--	<4	--	28
Apr-07	7.2	<4	--	17/18	--	64	--	--	--	--	--	--	--	<4	<4	<4	32
Aug-07	--	8.7	--	11	--	--	--	--	--	--	--	--	--	<4	10/9.7	--	--
Oct-07	Dry	6.2	Dry	11	<4	66	<4	<4	Dry	--	--	<4	<4	<4/<4	30	--	--
Apr-07	7.0/7.4	8.9	--	13	--	57	--	--	--	--	--	--	--	<0.021	0.93 F	--	18
Jul-08	Dry	4.2 F	--	12	--	61	--	--	--	--	--	--	--	8.1	12	--	150/150
Oct-08	2.5 F	2.6 F/2.8 F	0.55F/0.63F	12	--	74	--	--	--	--	--	<0.42	1.5 F	2.1 F	4.0 F	<0.42/<0.42	130
Apr-09	<4.4	<4.4	--	9.2 F/11	--	46	--	--	--	--	--	--	--	<4.4	<4.4	--	23
Jul-09	8.2 F	8.6 F	<4.4	17	--	66	--	--	--	--	--	--	--	<4.4/<4.4	<4.4	--	17
Nov-09	--	<4.4	--	16/14	--	64	--	--	--	--	--	<4.4	<4.4	4.7 F	<4.4	<4.4/<4.4	<4.4
Apr-10	--	--	--	6.2 F	--	40	--	--	--	--	--	--	--	<4.4	4.6 F	--	<4.4/<4.4
Jul-10	--	--	--	15/15	--	52	--	--	--	--	--	--	--	<0.21	17	--	17
Nov-10	--	--	--	16	--	18	--	--	Dry	--	--	3.8 F	<0.21	<0.21	2.5 F	0.22 F	11
Apr-11	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.21	0.51 F	--	0.29F/0.31F
Jul-11	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.21	0.77F/0.89F	--	16
Oct/Nov-11	--	--	--	14	--	49	--	--	--	--	--	<0.21	0.27 F	<0.21	0.48F/0.48F	<0.21	39
Apr-12	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.33/<0.33	0.51 F	--	6.4/4.1F
Jul-12	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.33	1.1 F	--	71 F
Oct/Dec-12	--	--	--	15/16	--	48	--	--	--	--	--	0.66 F	<0.33	<0.33	31	<0.33	140
Apr-13	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.33	0.63F	--	15
Jul-13	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.33	2.7J	--	15
Oct-13	--	--	--	16	--	44	--	--	--	--	--	<0.33	<0.33	<0.33	13	<0.33	140/140
Apr-14	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.33	0.44J/0.57J	--	5.1
Jul-14	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.33	4.3J	--	160
Nov/Dec-14	--	--	--	14	--	30	--	--	--	--	--	<1	<1	<1	1.4J	<1	44
Apr-15	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.33	0.54J	--	27
Jul-15	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.33	0.61J/0.71J	--	120/120

TABLE 2-10
HISTORIC AND CURRENT DISSOLVED ARSENIC IN GROUNDWATER AND SURFACE WATER (2001 - 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

DISSOLVED ARSENIC																	
Well ID	**MW6-119U**	**MW6-120U**	**MW6-121U**	**MW6-122L**	**MW6-122T**	**MW6-122U**	**MW6-123**	**MW6-124U**	**MW6-125**	**MW6-126U**	**MW6-126T**	**MW6-127U**	**MW6-127T**	**MW6-128U**	**MW6-128T**	**PZ-E**	**PZ-W**
Aquifer	**Surface**	**Surface**	**Surface**	**Surface**	**Lower Till**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**Lower Till**	**Surface**	**Lower Till**	**Surface**	**Lower Till**	**Surface**	**Surface**
Dec-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oct-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Apr-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sep-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oct-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Apr-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Jul-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	16	19
Oct-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	59.4	20.7
Jan-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.5	22
Apr-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	9.8
Jul-06	8	11-Nov	<1.2	<1.2	<1.2	<1.2	--	--	--	--	--	--	--	--	--	19.1	
Oct-06	33	9	6.7	<4	<4	<4	--	--	--	--	--	--	--	--	--	47.2	13.3
Jan-07	<4/<4	<4	<4	--	--	--	--	--	--	--	--	--	--	--	--	32	6.3
Apr-07	<4	<4/<4	<4	--	--	--	--	--	--	--	--	--	--	--	--	15	9.1
Aug-07	44	12	<4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oct-07	76	7.2	15	<4	<4	Dry	--	--	--	--	--	--	--	--	--	--	--
Apr-07	0.22 F	0.33 F	2.0 F	--	--	--	--	--	--	--	--	--	--	--	--	4.9	7.2
Jul-08	34/38	0.90 F	8.1	--	--	--	--	--	--	--	--	--	--	--	--	15	35
Oct-08	6.9 F	4.0 F	9.1/9.1	0.74 F	1.1 F	0.46 F	4.4 F	38	20	--	--	--	--	--	--	3.1 F	36
Apr-09	<4.4	<4.4	<4.4	--	--	--	<4.4	19	16	--	--	--	--	--	--	13	14
Jul-09	4.7 F	<4.4	15	--	--	--	17	34/43	35	--	--	--	--	--	--	14	17
Nov-09	<4.4	<4.4	<4.4/<4.4	<4.4	27 *	<4.4	5.7 F	<4.4	<4.4	--	--	--	--	--	--	26 *	14 *
Apr-10	<4.4	<4.4	<4.4	--	--	--	<4.4	<4.4/<4.4	18 F	--	--	--	--	--	--	<4.4	<4.4
Jul-10	39	3.9 F	1.8 F	--	--	--	14	39/35	20/19	--	--	--	--	--	--	Dry	Dry
Nov-10	31	1.8 F	0.88 F	--	--	--	8	11/8.2	16	--	--	--	--	--	--	3.8 F	1.3 F
Apr-11	0.36 F	0.62 F	0.95 F	--	--	--	5.2	0.45F/0.58F	11	--	--	--	--	--	--	15	2.6 F
Jul-11	35	0.66 F	18	--	--	--	7.1	40/41	13	--	--	--	--	--	--	--	--
Oct/Nov-11	3.3 F	3.4 F	1.1 F	--	2.9 F	--	2.3F/2.3F	0.51 F	14	--	--	--	--	--	--	1.3 F	25
Apr-12	11	4.9 F	0.7 F	--	--	--	19	11	8.8	--	--	--	--	--	--	1.6 F	7
Jul-12	12	12	8.3	--	--	--	17/14	26	9.2/10	--	--	--	--	--	--	--	--
Oct/Dec-12	57	2.6 F	1.3 F	--	0.51F	--	27/19	14	7.7/8.8	--	--	--	--	--	--	18	8.5
Apr-13	7.2	4.7F	0.8F	--	--	--	1.8J	0.57J	5.9	--	--	--	--	--	--	--	--
Jul-13	19	17	13-Dec	--	--	--	5.2/4.7J	3.1J	16	--	--	--	--	--	--	26	41
Oct-13	26	24/22	3J	--	--	--	11	32	12	--	--	--	--	--	--	--	--
Apr-14	<0.33	0.74J	1.1J	--	--	--	0.62J	<0.33	6.5	--	--	--	--	--	--	8.5	9.4
Jul-14	52	1.9J	8.3	--	--	--	4.4J	3.0J	15/15	17/17	5.1J	0.36J	0.86J	0.34J	2.0J	19	--
Nov/Dec-14	40	2.1J	1.8J	--	<1	--	9.6	6.7	7.3	8.9	2.3J	<1	1.5J	<1	2.7J	--	11
Apr-15	0.64J	0.52J	1.2J	--	--	--	<0.33	<0.33	3.4J	12	1.8J	0.38J/0.45J	1.9J	<0.33	11	17	27
Jul-15	1.8J	12	3.1J	--	--	--	3.5J	3.2J	5.1	--	--	--	--	--	--	--	--

TABLE 2-10
HISTORIC AND CURRENT DISSOLVED ARSENIC IN GROUNDWATER AND SURFACE WATER (2001 - 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

DISSOLVED ARSENIC										
Well ID	**SWR6-02**	**SWW6-05**	**SWW6-06**	**SG #3**	**MP-MW-01**	**MP-MW-02**	**MP-MW-03**	**MP-MW-04**	**MP-MW-05**	**MP-MW-06**
Aquifer	**Surface H2O**				**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**
Dec-01	--	< 2.7	--	--	--	--	--	--	--	--
Oct-02	--	<1.6	--	--	--	--	--	--	--	--
Apr-03	--	<1.6	--	--	--	--	--	--	--	--
Sep-03	--	<2.9/<2.9	--	--	--	--	--	--	--	--
Oct-04	--	--	--	--	--	--	--	--	--	--
Apr-05	--	<2.5	--	--	--	--	--	--	--	--
Jul-05	--	<2.5	--	--	--	--	--	--	--	--
Oct-05	--	<1.9	--	--	--	--	--	--	--	--
Jan-06	--	<1.9	--	--	--	--	--	--	--	--
Apr-06	--	<1.9	--	--	--	--	--	--	--	--
Jul-06	--	<1.2	--	--	--	--	--	--	--	--
Oct-06	--	<4	--	--	--	--	--	--	--	--
Jan-07	--	--	--	--	--	--	--	--	--	--
Apr-07	--	--	--	--	--	--	--	--	--	--
Aug-07	--	--	--	--	--	--	--	--	--	--
Oct-07	--	--	--	--	--	--	--	--	--	--
Apr-07	3.2 F	0.67 F	0.59 F	3.4 F	--	--	--	--	--	--
Jul-08	2.8 F	1.5 F	1.6 F	3.0 F	--	--	--	--	--	--
Oct-08	3.1 F	1.0 F	0.65 F	3.8 F	--	--	--	--	--	--
Apr-09	<4.4/<4.4	<4.4	<4.4	<4.4	--	--	--	--	--	--
Jul-09	4.9 F	<4.4	<4.4	5.8 F	--	--	--	--	--	--
Nov-09	<4.4	<4.4	<4.4	<4.4	--	--	--	--	--	--
Apr-10	<4.4	<4.4	<4.4	<4.4	--	--	--	--	--	--
Jul-10	1.4 F	Dry	Dry	2.2 F	**2.6 F**	**24**	**11**	**32**	**72**	**17**
Nov-10	2 F	0.97 F	1.5 F	2.3 F	**3.6 F**	**48**	**10**	**40**	**110**	**18**
Apr-11	3.1 F	0.6 F	0.72 F	2.9 F	**3.5 F**	--	--	--	**78**	--
Jul-11	1.5 F	--	1.3 F	2.1 F	**5.1**	--	--	--	**90**	--
Oct/Nov-11	3.7 F	1.5 F	1.2 F	3.6 F	**3.7 F**	--	--	--	**82**	--
Apr-12	3.5 F	0.92F	0.52 F	3 F	**2.8 F**	--	--	--	**74 J**	--
Jul-12	1.5 F	--	1.3 F	2.4 F	**2.3 F**	--	--	--	**90 J**	--
Oct/Dec-12	1.4 F	--	1.1 F	1.9 F	**3.8 F**	--	--	--	**91**	--
Apr-13	3.1J	--	0.62J	3.7J	**3.0J**	--	--	--	**68/69**	--
Jul-13	3.1J	1.4J	1.1J	2.4J	**2.3J**	--	--	--	**69**	--
Oct-13	1.7J	--	--	2.7J	**3.2J**	--	--	--	**85**	--
Apr-14	2.3J	1.6J	0.72J	2.5J	**2.4J**	--	--	--	**67**	--
Jul-14	1.4J	3.0J	1.2J	3.2J	**2.0J**	--	--	--	**82**	--
Nov/Dec-14	2.8J	1.0J	1.2J	5	**2.6J**	--	--	--	**84**	--
Apr-15	5.7	5.6	0.94J	5.2	**1.6J**	--	--	--	**80**	--
Jul-15	2.3J	--	1.3J	4.6J	**1.6J**	--	--	--	**77**	--

Compliance boundary wells MW6-116U and MW6-116T were inadvertently not sampled for arsenic in 2015.
All results are in ug/L (ppb).
'-- Not Sampled
n method detection limit
Exceeds MCL of 10-ug/L (ppb)
F – Estimated concentration between method detection limit & the reporting limit
J – Estimated concentration
Primary/Duplicate
* - MW6-122T, PZ-E & PZ-W Nov-09 samples were not filtered thus results are total arsenic

TABLE 2-11
HISTORIC AND CURRENT CHEMICALS OF CONCERN LESS ARSENIC IN GROUNDWATER (2001 - 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

Well ID	Date	Metals							Volatile Organic Compounds																	PCBs			
		Antimony (Filtered) ug/L	Barium (Filtered) ug/L	Cadmium (Filtered) ug/L	Nickel (Filtered) ug/L	Lead ug/L	Thallium (Filtered) ug/L	Vanadium (Filtered) ug/L	Benzene ug/L	Benzo(a)-anthracene ug/L	Benzo(a)-pyrene ug/L	Benzo(b)-fluoranthene ug/L	Benzo(k)-fluoranthene ug/L	bis (2-Ethylhexyl) phthalate ug/L	Dibenzo(a,h)-anthracene ug/L	Dieldrin ug/L	Heptachlor epoxide ug/L	Hexachloro-benzene ug/L	Indeno (1,2,3-cd)pyrene ug/L	Naphthalene ug/L	Pentachloro-phenol (PCP) ug/L	Trichloro-ethene ug/L	1,4-Dichloro-benzene ug/L	2,4-Dichloro-phenol ug/L	2,4,5-Trichloro-phenol ug/L	4,4'-DDD ug/L	Aroclor 1016 ug/L	Aroclor 1232 ug/L	Aroclor 1242 ug/L	Aroclor 1248 ug/L
MCL/MCP-GW-1		6	2,000	5	100	15	2	50	5	1	0.2	1	1	6	0.5	0.1	0.2	1	0.5	140	1	5	5	10	200	0.1	0.5 (total)	0.5 (total)	0.5 (total)	0.5 (total)
MW6-B07 (Till)	**Dec-01**	--	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--	**5.41-5F**	--	--	--	--	--	--	--
	Apr-03	--	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--	**5.36-3.7F**	--	--	--	--	--	--	--
	Sep-03	--	--	--	--	--	--	--	--		--	**4.39**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-04	--	--	--	--	--	--	--	--		--	**4.44/4.48**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-05	--	--	--	--	--	--	--	--		--	**4.55/4.71**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-06	--	--	--	--	--	--	--	--	**1.31F**	**1.15F**	**1.21F**	**1.14F**	--	**1.02F**	--	--	**1.03F**	**1.10F**	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	--	--	--	--	--	--	--	--	<0.33	<0.29	<0.50	<0.44	--	<0.48	--	--	<0.63	<62	--	--	--	--	--	--	--	--	--	--	--
MW6-23 (Lacustrine)	**Dec-01**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**6.1**	--	--	--	--	--	--	--	--
	Oct-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.04	--	--	--	--	--	--	--	--
	Sep-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.2F	--	--	--	--	--	--	--	--
	Oct-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.031	--	--	--	--	--	--	--	--
MW6-104 (Surface/Lacustrine /Till) *Dry in years: Dec-01, Oct-02, Sep-03, Oct-04, Oct-06*	**Apr-03**	--	--	--	--	--	--	--	2.97/**5.79**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-05	--	--	--	--	--	--	--	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-07	--	--	--	--	--	--	--	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW6-105 (Surface/Lacustrine /Till) *Dry in years: Dec-01*	**Oct-02**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0073	**0.819**	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.418F**	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--
	Sep-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.058F	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01F/0.01F	<0.0067/ <0.0067	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0094/ <0.0094	<0.14/ 0.014	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0094/ <0.0094	<0.14/ 0.014	--	--	--	--	--	--	--	--	--	--	--	--	--
MW6-106 (Surface) *Dry in years: Oct-07*	**Oct-02**	--	--	--	--	--	--	--	**5.17**	--	--	--	--	--	--	--	--	--	--	16.6-15.7	4,507.90	--	**14.1-9.7F**	**58**	**1,681.60**	**0.166R**	--	--	--	--
	Apr-03	--	--	--	--	--	--	--	1.5	--	--	--	--	--	--	--	--	--	--	12.4-10.5	6,025.70	--	**10.99-8.1F**	**21.7**	**1,576.8F**	--	--	--	--	--
	Sep-03	--	--	--	--	--	--	--	3.6	--	--	--	--	--	--	--	--	--	--	24.1-<0.08	**3,105.3**	--	**10.29-7.8F**	**24.1**	**918.4F**	<0.066R	--	--	--	--
	Oct-04	--	--	--	--	--	--	--	2.89	--	--	--	--	--	--	--	--	--	--	15.86-11.4M	**2,320.9F**	--	**13.83-8.9F**	**20.4**	**616.6F**	**0.03J**	--	--	--	--
	Oct-05	--	--	--	--	--	--	--	1.18	--	--	--	--	--	--	--	--	--	--	4.3-5.32F/ 5.28F	**1,200M/ 1,040**	--	**9.1-7.24F/7.15F**	**21.8/21.6**	**368M/304F**	--	--	--	--	--
	Jul-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.02F/8.49F	**2,720/2,980**	--	**8.47F/8.54F**	**16/17.1**	**526F/550**	--	--	--	--	--
	Oct-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.6	**3,980**	--	**10.6**	**25.1**	**530F**	<0.46R Dilution = 50	--	--	--	--
	Oct-08	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.3FJ	**1,900J**	--	**7.8FJ**	**25**	**460**	<0.0077	--	--	--	--
	Nov-09	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.9F/3.2F	**1,600M/ 1,700M**	--	**6.0F/6.2F**	NR	**370M/410M**	--	--	--	--	--
	Nov-10	--	--	--	--	--	--	--	4.1F/4.5F	--	--	--	--	--	--	--	--	--	--	3.6F/4F	**1,600/200**	--	--	--	**400F/530F**	--	--	--	--	--
	Oct-11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.28/<0.28	<19/<19	--	<0.30/<0.31	<0.61/<0.61	<0.43/<0.43	--	--	--	--	--
	Oct-12/Dec-12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.6F	**690**	--	3.1F	<0.61	190F	--	--	--	--	--
MW6-110T	**Dec-01**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**6.01-4.5F**	--	--	--	--	--	--	--
	Oct-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.48F-2.5F	--	--	--	--	--	--	--
	Sep-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.5-1.2F/ 1.41-1.3F	--	--	--	--	--	--	--
	Oct-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.42	--	--	--	--	--	--	--
MW6-112U	**Dec-01**	--	1,142.8	<0.33	30.7	1.2F	<0.76M	3.0F	--	--	--	--	--	<2.09	--	--	--	--	--	25.3-15.3	<0.73	--	**6.98-3.3F**	--	--	--	--	--	--	<0.0531J
	Apr-03	--	**2,983.3**	**5.6F**	**1,055.90**	9.9F	<0.63	**55**	**6.34**	--	--	--	--	<3.05	--	--	--	--	--	3.6-3.2F	<0.59	--	4.9-4.1F	--	--	--	--	**0.73F**	--	--
	Sep-03	--	**2,262.5**	<0.25	**177.2**	<0.7	<0.63M	29	1.49	--	--	--	--	**6.6F**	--	--	--	--	--	8.7-8.7F	<0.31	--	4.41-4.7F	--	--	--	--	**0.61F**	--	--
	Oct-04	--	**2,105**	<0.17	**292**	1.7F	<0.63	30	3.34	--	--	--	--	1.2F	--	--	--	--	--	8.96-8.4M	**2.7F**	--	**6.61-5.1F**	--	--	--	--	--	--	**0.59J**
	Oct-05	--	1,680	<0.27	**257**	2.55F	**6.15F**	19.4	4.6	--	--	--	--	1.30F	--	--	--	--	--	10.4-11.8	<6.29	--	**7.6-6.69F**	--	--	--	--	**0.984/1.05**	--	--
	Oct-06	--	1,610M	4.22F	**108**	4.17F	<5.87	27.1	3.86	--	--	--	--	1.12F/1.21F	--	--	--	--	--	9.27F/9.74F	<0.23/<0.23	--	4.40F/2.44F	--	--	--	--	--	--	0.411J
	Oct-07	--	1,450	3.20F	**192**	**23F**	<0.83	21.6	--	--	--	--	--	0.92M/0.73J	--	--	--	--	--	11.7/8.91F	<1.2/<1.2	--	3.32F/2.94F	--	--	--	--	**0.686**	--	--
	Oct-08	--	--	--	**180J**	--	<0.36	--	--	--	--	--	--	1.37/0.96F	--	--	--	--	--	7.3FMJ/5.9MJ	<20/<20	--	0.57J/0.46FJ	--	--	--	--	--	--	<0.1J
	Nov-09	--	--	--	**150***	--	**4.7***	0.03F*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.5J
	Nov-10	--	--	--	**430**	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.56J**	--	--	--
	Oct-11	--	--	--	**190**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.12J	**0.54J**	--	--
	Oct-12/Dec-12	--	--	--	**100J**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.12	<0.16	--	--
	Oct-13	--	--	--	**170**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.12	<0.16	<0.099	<0.087
	Dec-14	--	--	--	**720**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.29	<0.38	<0.29	<0.19
	Nov-15	--	--	--	**550**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.38	<0.57	<0.28	<0.28
MW-6-112U	**Dec-01**	2.0F	**2,028.7**	--	74.7	--	<0.76M	--	**6.24**	--	--	--	--	--	--	--	--	--	--	**155-151**	--	--	**17.1-11.4**	--	--	--	--	--	--	--
	Oct-02	2.0F	321.6	--	**162.7**	--	<0.63	--	**5.55**	--	--	--	--	--	--	--	--	--	--	22.6-35.1	--	--	**15.9-9.5F**	--	--	--	--	--	--	--
	Apr-03	**22F**	1,416.6	--	85.3	--	<0.63	--	1.12	--	--	--	--	--	--	--	--	--	--	11.5-7 F	--	--	**14.65-11.4**	--	--	--	--	--	--	--
	Sep-03	**6.0F**	1,839.7	--	31.2	--	<0.63M	--	3.65	--	--	--	--	--	--	--	--	--	--	30.7-38.6	--	--	**16.29-15.6**	--	--	--	--	--	--	--
	Oct-04	3.0F	**3,154.6**	--	36	--	<0.63	--	4.43	--	--	--	--	--	--	--	--	--	--	45.12-43.8 M	--	--	**23.69-19.5**	--	--	--	--	--	--	--
	Oct-05	3.93F/3.65F	**2,750M/ 2,770**	--	55.2/54.6	--	<4.63/<4.63	--	3.22	--	--	--	--	--	--	--	--	--	--	64.1 - 83.6	--	--	**22.1-18.3**	--	--	--	--	--	--	--
	Oct-06	<1.52	**3,500M**	--	40.4	--	<5.87	--	--	--	--	--	--	--	--	--	--	--	--	57	**1.06F**	--	**17.5**	--	--	--	--	--	--	--
	Oct-07	<1.52	**2,520**	--	84.7	--	<5.87	--	--	--	--	--	--	--	--	--	--	--	--	49.3	<1.20	--	**12.3**	--	--	--	--	--	--	--
	Oct-08	--	**2,500**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15 MJ	<20	--	**13J**	--	--	--	--	--	--	--
	Nov-09	--	**2,200***	--	--	--	0.025F*	--	--	--	--	--	--	--	--	--	--	--	--	69	<19M	--	**12**	--	--	--	--	--	--	--
	Nov-10	--	1,200	--	--	--	0.03F	--	--	--	--	--	--	--	--	--	--	--	--	47	--	--	**12**	--	--	--	--	--	--	--
	Oct-11	--	1,900	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	58	<19	--	**13**	--	--	--	--	--	--	--
	Oct-12/Dec-12	--	**2,100J**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	49	<19	--	**16**	--	--	--	--	--	--	--
	Oct-13	--	**1600**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	<19U	--	**11**	--	--	--	--	--	--	--
	Dec-14	--	610	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	<19U	--	**11**	--	--	--	--	--	--	--
	Nov-15	--	**1400/1200**	--	--	--	--	--	--	--	<0.95	<1.9	<0.95	<1.3	<1.9	--	--	<1.9	<1.9	6.2J	<57U	--	**9.2J**	<1.9	<0.95	--	--	--	--	--

TABLE 2-11
HISTORIC AND CURRENT CHEMICALS OF CONCERN LESS ARSENIC IN GROUNDWATER (2001 - 2015)
Long-Term Monitoring/Remedial Action Report for
Operable Unit 3/IRP Site 6, Hanscom Air Force Base, Massachusetts

Well ID	Date	Metals							Volatile Organic Compounds																	PCBs			
		Antimony (Filtered) ug/L	Barium (Filtered) ug/L	Cadmium (Filtered) ug/L	Nickel (Filtered) ug/L	Lead ug/L	Thallium (Filtered) ug/L	Vanadium (Filtered) ug/L	Benzene ug/L	Benzo(a)-anthracene ug/L	Benzo(a)-pyrene ug/L	Benzo(b)-fluoranthene ug/L	Benzo(k)-fluoranthene ug/L	bis (2-Ethylhexyl) phthalate ug/L	Dibenzo(a,h)-anthracene ug/L	Dieldrin ug/L	Heptachlor epoxide ug/L	Hexachloro-benzene ug/L	Indeno (1,2,3-cd)pyrene ug/L	Naphthalene ug/L	Pentachloro-phenol (PCP) ug/L	Trichloro-ethene ug/L	1,4-Dichloro-benzene ug/L	2,4-Dichloro-phenol ug/L	2,4,5-Trichloro-phenol ug/L	4,4'-DDD ug/L	Aroclor 1016 ug/L	Aroclor 1232 ug/L	Aroclor 1242 ug/L	Aroclor 1248 ug/L
MCL/MCP-GW-1		**6**	**2,000**	**5**	**100**	**15**	**2**	**50**	**5**	**1**	**0.2**	**1**	**1**	**6**	**0.5**	**0.1**	**0.2**	**1**	**0.5**	**140**	**1**	**5**	**5**	**10**	**200**	**0.1**	**0.5 (total)**	**0.5 (total)**	**0.5 (total)**	**0.5 (total)**
MW-6-113T	**Dec-01**	--	--	**18.1**	**135.7**	--	<0.76M	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-02	--	--	**9.3**	57.6	--	<0.63	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Apr-03	--	--	**15.7**	**125.2**	--	<0.63	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Sep-03	--	--	**11.6**	80.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-05	--	--	3.86F	--	--	<4.63	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-06	--	--	**9.18F/9.57F**	47.7/50.9	--	<29.4/<29.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-07	--	--	2.74F	18.3F	--	**19.7F**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-08	--	--	1.5F	--	--	1.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-09	--	--	**8.6 ***	--	--	1.4*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-10	--	--	0.31F	--	--	0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	--	--	0.31F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-12/Dec-12	--	--	0.14F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-6-113U *Dry in years: Oct-07 & Nov-10*	**Apr-03**	--	--	**5.6F**	**120.4**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Sep-03	--	--	**7.5**	77.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-05	--	--	<0.27	20.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-06	--	--	3.16F	**158**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-08	--	--	0.16FJ	17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-09	--	--	**20***	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	--	--	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-6-114T	**Dec-01**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0099	--	--	--	--	--	--	--	--	--	**0.277F**	--	--	--	--
	Oct-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0073	--	--	--	--	--	--	--	--	--	**0.563**	--	--	--	--
	Apr-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.105F**	--	--	--	--	--	--	--	--	--	**0.467F**	--	--	--	--
	Sep-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0084	--	--	--	--	--	--	--	--	--	**0.498F**	--	--	--	--
	Oct-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.002	--	--	--	--	--	--	--	--	--	**0.8J**	--	--	--	--
	Oct-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0094	--	--	--	--	--	--	--	--	--	**0.94**	--	--	--	--
	Oct-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0092	--	--	--	--	--	--	--	--	--	**0.95R**	--	--	--	--
	Oct-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.64 (0.44)**	--	--	--	--
	Oct-08	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0063	--	--	--	--	--	--	--	--	--	<0.0077	--	--	--	--
	Nov-09	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0063	--	--	--	--	--	--	--	--	--	<0.0077	--	--	--	--
	Nov-10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.73**	--	--	--	--
	Oct-11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.48**	--	--	--	--
	Oct-12/Dec-12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.67**	--	--	--	--
	Oct-13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.63**	--	--	--	--
	Dec-14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.61**	--	--	--	--
	Nov-15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.019	<0.019	--	--	--	--	--	--	--	--	**0.43J**	--	--	--	--
MW-6-117U	**Oct-02**	--	--	--	--	--	--	--	--	--	--	--	--	<3.05R	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Sep-03	--	--	--	--	--	--	--	--	--	--	--	--	**14.9**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-04	--	--	--	--	--	--	--	--	--	--	--	--	1.9F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-05	--	--	--	--	--	--	--	--	--	--	--	--	3.78F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-06	--	--	--	--	--	--	--	--	--	--	--	--	0.65F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-6-122T *Dry in years: Oct-07 & Nov-10*	**Jul-06**	--	--	--	--	--	**6.5F**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-07	--	--	--	--	--	<0.83	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-08	--	--	--	--	--	0.14F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-09	--	--	--	--	--	0.17F*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	--	--	--	--	--	0.12F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PZ-E	**Oct-05**	--	--	--	--	--	**8.36 F**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Jul-06	--	--	--	--	--	<5.87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-06	--	--	--	--	--	<5.87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-08	--	--	--	--	--	<0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-09	--	--	--	--	--	0.053F*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-10	--	--	--	--	--	<0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PZ-W	**Oct-05**	--	--	--	--	--	**5.43F**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**5.9-4.2F**	--	--	--	--	--	--	--
	Oct-06	--	--	--	--	--	<5.87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.5F	--	--	--	--	--	--	--
	Oct-08	--	--	--	--	--	<0.04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.2FJ	--	--	--	--	--	--	--
	Nov-09	--	--	--	--	--	<0.020*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Nov-10	--	--	--	--	--	0.029F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Oct-11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.2F	--	--	--	--	--	--	--

Notes:
MCL/*MCP-GW-1* : United States Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL), or if none is available the Massachusetts Contingency Plan (MCP) MCL GW-1 (listed in italics).
ug/L - micrograms per liter
-- Not Analyzed
< - Concentration less than detection limit
- Exceeds MCL for MCP-GW-1
F - Between MDL and RL
J - Estimated
M - May be biased high or low
NR - Not reported
*Nov-09 samples not filtered

ATTACHMENT F

HISTORICAL LONG-TERM MONITORING DATA FOR IRP SITE 21

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well CH-102

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/16/03	04/16/12	12/14/12	04/25/13	10/14/13	04/14/14	05/18/15	05/11/16
Total BTEX	NS	NS	NS	NS	**-**	ND	**0.54F**	-	-	-	**2**	**0.91J**
Toluene	1,000	1,000	50,000	99	**-**	-	-	-	**5.8**	-	**2**	**0.91J**
Ethylbenzene	700	700	20,000	46	<0.1	<0.099	**0.31F**	-	-	-	**-**	**-**
Xylenes	10,000	10,000	3,000	NS	<0.23	<0.11	**0.23F**	-	-	-	**-**	**-**
1,2,4-Trichlorobenzene	70	70	200	4	<0.175	**0.75F**	**2.8**	**0.16F**	-	-	**-**	**-**
1,2,4-Trimethylbenzene	NS	NS	NS	21	<0.08	<0.081	**0.35F**	-	-	-	**-**	**-**
1,2-Dichlorobenzene	600	600	8,000	41	**122.27**	**83**	**520**	**0.97F**	**3.8J**	**0.22JF**	**0.61J**	**0.4J**
1,3-Dichlorobenzene	NS	100	6,000	NS	**1.67F**	**2.9**	**6.7**	**0.21F**	**0.18J**	-	**-**	**-**
1,4-Dichlorobenzene	75	5	60	14	**28.76**	**82**	**160**	**0.58**	**2.6J**	**0.19JF**	**0.51J**	**0.38J**
Acetone	NS	6,300	50,000	NS	-	**4.3F**	<1.6		**1.9J**	**2.3JF**	**-**	**-**
Chlorobenzene	100	100	200	NS	<0.165	**7.2**	**3.1**	-	**3.1J**	-	**0.54J**	**0.42J**
cis-1,2-Dichloroethene	70	70	20	5	<0.105	<0.098	**1.4**	**-**	-	-	-	**-**
Naphthalene	NS	140	700	16	<0.24	<0.25	**1.8**	-	-	-	-	**-**
Trichloroethene	5	5	5	NS	**0.7F**	**0.8F**	**3.6**	-	-	-	-	**-**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-14R (replaced MWZ-14)

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					RA-C BL 10/16/03	10/10/06	10/23/07	10/15/08	11/16/09	11/08/10	11/02/11
Total BTEX	NS	NS	NS	NS	**82.34F**	**64**	**72.66**	**126.1**	**33.24**	**16.56F**	**73.3**
Benzene	5	5	1,000	2	**25.36**	**4.83**	**11.1J**	**25**	**7.4**	**5.1**	**15**
Toluene	1,000	1,000	50,000	99	**0.99F**	<0.018	<0.036R	**1.1**	**0.19F**	**0.27F**	**1.3**
Ethylbenzene	700	700	20,000	46	**52.87**	**52.8**	**60.6**	**56**	**25**	**11**	**45**
Xylenes	10,000	10,000	3,000	NS	**3.12F**	**6.8M**	**0.96J**	**44M**	**0.65F**	**0.19F**	**12**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**6.31**	**7.21**	**2.68**	**5.6M**	**0.81F**	**0.17F**	**3.1**
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-	-	-
1,3-Dichlorobenzene	NS	100	6,000	22	**0.55F**	**0.5F**	<0.026	**1.5**	<0.083M	**0.15F**	**0.21F**
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	**0.16F**	-
Acetone	NS	6,300	50,000	NS	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**2.8**	**1.67**	**1J**	**1.4**	**0.59F**	**0.59F**	**0.86F**
Naphthalene	NS	140	700	16	**9.2**	**16.7**	**12.2**	**20**	**6.3**	**1.2**	**18**
n-Propylbenzene	NS	NS	NS	4	**2.73**	**2.08**	**1.1F**	**1.6**	<0.13	**0.53F**	**0.97F**
sec-Butylbenzene	NS	NS	NS	4	-	-	-	-	-	-	**0.5F**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	**0.2F**	**0.15F**

Note: See last page of Table 4-1For table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-14R (replaced MWZ-14)

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results					
					12/13/12	04/25/13	10/14/13	4/14/14	5/21/15	05/11/16
Total BTEX	NS	NS	NS	NS	**16.53FJ**	-	**20.88**	**-**	**39.51**	**81.8**
Benzene	5	5	1,000	2	**5.5J**	**7.5**	**4.6**	**4.9**	**6.6**	**13**
Toluene	1,000	1,000	50,000	99	**0.17FJ**	**0.56F**	**0.28J**	**0.67JF**	**0.51J**	**1.4**
Ethylbenzene	700	700	20,000	46	**10**	**23**	**16**	**9.6**	**24**	**40**
Xylenes	10,000	10,000	3,000	NS	**0.86F**	**11**	**0.8R**	**8.4R**	**8.4**	**27.4**
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	**1.5**	**0.25J**	**0.46JF**	**1.3**	**3.2**
1,2-Dichlorobenzene	600	600	8,000	41	**1**	-	-	**-**	**-**	**-**
1,3-Dichlorobenzene	NS	100	6,000	22	-	**0.46F**	**-**	**0.17JF**	**0.23J**	**0.71J**
1,4-Dichlorobenzene	75	5	60	14	**0.28F**	-	-	**-**	**-**	**-**
4-Isopropyltoluene	NS	NS	NS	NS	**0.16F**	-	-	**-**	**-**	**-**
Acetone	NS	6,300	50,000	NS	-	-	-	**24**	**-**	**14J**
Isopropylbenzene	NS	NS	NS	NS	**0.61F**	**0.30F**	**0.5J**	**-**	**0.33J**	**0.34J**
Naphthalene	NS	140	700	16	**1.8**	**3.7**	**1.3**	**1.8**	**4.3**	**10**
n-Propylbenzene	NS	NS	NS	4	**0.76F**	**0.24F**	**0.43J**	**-**	**0.32J**	**0.34J**
sec-Butylbenzene	NS	NS	NS	4	**0.28F**	-	-	**-**	**-**	**-**
tert-Butylbenzene	NS	NS	NS	NS	**0.2F**	-	**0.18J**	**-**	**-**	**-**

Note: See last page of Table 4-1For table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-28

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/16/03	11/04/04	04/26/05	10/19/05	04/21/06	10/12/06	05/14/07	11/17/09
Total BTEX	NS	NS	NS	NS	**0.76F**	**1.6M**	**1.29F**	**2.49F**	**21/22F**	**2.1/1.8**	**3.32F**	**0.13F/0.12F**
Benzene	5	5	1,000	2	**0.28F**	**0.35F**	**1.29F**	**2.3**	**20.6/21.4**	**1.85/1.48**	**2.36**	-
Toluene	1,000	1,000	50,000	99	-	-	-	-	-	-	-	-
Xylenes	10,000	10,000	3,000	NS	**0.33F**	**1.0M**	-	**0.19F**	-	-	**0.76F**	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	na	**2.3F**	-	**3.9M**	**5.08F/<2.06**	-	-	-
Ethylbenzene	700	700	20,000	46	-	-	-	-	-	-	-	-
Chloroethane	NS	NS	NS	NS	**1**	**1.01F**	-	-	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	**2.5**	**1.12F**	-	**8.7**	**0.3F/0.325F**	**0.9F/0.775F**	**0.37F**	**-**
Dichloromethane (Methylene Chloride)	5	5	2000	NS	-	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Methyl Tert-butyl Ether	NS	NS	NS	NS	-	**334.2**	**260.28**	**130.0 F**	**40.2/42.8**	**47.6/47**	**4.8F**	**0.50F/0.57F**
Naphthalene	NS	140	700	16	-	-	-	-	-	-	-	-
n-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
n-Propylbenzene	NS	NS	NS	4	-	-	-	-	-	-	-	-
sec-Butylbenzene	NS	NS	NS	4	**1.24F**	**2.61**	**1.12F**	**1.5**	**0.725F/0.8F**	**1.72F/1.82F**	**2.05**	**<0.18/0.21F**
tert-Butylbenzene	NS	NS	NS	NS	**2.41**	**3.16**	**1.55F**	**1.7**	**1.75F/1.85F**	**1.88F/2F**	**1.74**	**0.28FM/0.32FM**
trans-1,2-Dichloroethene	100	100	80	NS	-	-	-	**-**	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	**-**	-	-	-	-
Vinyl Chloride	2	2	2	NS	**12.75**	**16.69**	**1.59F**	**18**	**6.85/7.33**	**5.72/4.45**	**1.32**	**0.63F/0.72F**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-28

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					04/22/10	11/10/10	10/28/11	12/12/12	04/24/13	10/15/13	04/14/14
Total BTEX	NS	NS	NS	NS	**0.63F/0.36F**	**0.87**	**0.57**	**0.23F**	-	-	**-**
Benzene	5	5	1,000	2	**0.35F/0.36F**	**0.79**	**0.57**	**0.23F**	**0.17F**	**-**	**-**
Toluene	1,000	1,000	50,000	99	-	**0.08F**	-	-	-	-	**-**
Xylenes	10,000	10,000	3,000	NS	**0.28J/<0.087UJ**	-	-	-	-	**0.11R**	**-**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**0.57F/0.2F**	**0.14F**	**0.43F**	**0.15F**	-	-	**-**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	**4.6F**	-	-	-	-	**8.4JF/5JF**
Ethylbenzene	700	700	20,000	46	-	-	-	-	-	-	-
Chloroethane	NS	NS	NS	NS	-	-	-	-	-	-	**-**
cis-1,2-Dichloroethene	70	70	20	5	**0.28F/0.25F**	**8.7**	**0.22F**	**2.2**	**0.29F**	**0.32J**	**0.19JF/0.22JF**
Dichloromethane (Methylene Chloride)	5	5	2000	NS	-	**1.2F**	-	**0.32F**	-	-	**-**
Isopropylbenzene	NS	NS	NS	NS	**0.24J/<0.12UJ**	**0.18F**	**1.4**	**0.42F**	**0.36F**	**-**	**0.39JF/0.42JF**
Methyl Tert-butyl Ether	NS	NS	NS	NS	**0.18F/0.18F**	**2.4F**	-	**0.54F**	-	-	**-**
Naphthalene	NS	140	700	16	-	-	**0.69F**	**0.27F**	**0.41F**	**-**	**-**
n-Butylbenzene	NS	NS	NS	NS	-	-	**0.36F**	**0.23F**	**0.18F**	**-**	**-**
n-Propylbenzene	NS	NS	NS	4	**0.18J/<0.13UJ**	-	**0.28F**	-	-	-	**-**
sec-Butylbenzene	NS	NS	NS	4	**0.67F/0.58F**	**0.58F**	**5.3**	**1.8**	**1.3**	**-**	**0.28JF/0.32JF**
tert-Butylbenzene	NS	NS	NS	NS	**0.63F/0.53F**	**1.2F**	**3.6**	**1.6**	**0.74F**	**0.21J**	**0.43JF/0.46JF**
trans-1,2-Dichloroethene	100	100	80	NS	-	**0.11F**	**0.06F**	-	-	-	**-**
Trichloroethene	5	5	5	NS	**<0.1/0.13F**	**2.7**	-	**0.61F**	-	-	**-**
Vinyl Chloride	2	2	2	NS	**1J/0.85J**	**3.7**	**4.5**	**2.5**	**0.68F**	**0.32J**	**1.3J/1.6J**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-28

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results	
					05/18/15	05/10/16
Total BTEX	NS	NS	NS	NS	**0.74J/0.74J**	**0.94**
Benzene	5	5	1,000	2	**0.47J/0.46J**	**-**
Toluene	1,000	1,000	50,000	99	**-**	**-**
Xylenes	10,000	10,000	3,000	NS	**0.27J/0.28J**	**0.47J**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**1.7/1.9**	**5.8**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**2.4**
Acetone	NS	6,300	50,000	NS	**-**	**-**
Ethylbenzene	700	700	20,000	46	-	**0.47 J**
Chloroethane	NS	NS	NS	NS	**-**	**-**
cis-1,2-Dichloroethene	70	70	20	5	**0.82J/0.77J**	**0.24J**
Dichloromethane (Methylene Chloride)	5	5	2000	NS	**-**	**-**
Isopropylbenzene	NS	NS	NS	NS	**3.0/2.9**	**0.66J**
Methyl Tert-butyl Ether	NS	NS	NS	NS	**-**	**-**
Naphthalene	NS	140	700	16	**1.2/1.0**	**2**
n-Butylbenzene	NS	NS	NS	NS	**0.73J/0.74J**	**-**
n-Propylbenzene	NS	NS	NS	4	**-**	**0.34J**
sec-Butylbenzene	NS	NS	NS	4	**5.5/5.4**	**0.51J**
tert-Butylbenzene	NS	NS	NS	NS	**3.0/3.0**	**0.7J**
trans-1,2-Dichloroethene	100	100	80	NS	**-**	**-**
Trichloroethene	5	5	5	NS	**-**	**-**
Vinyl Chloride	2	2	2	NS	**5.2/5.3**	**0.88J**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-30L

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					RA-C BL 10/14/03	10/16/05	10/11/06	10/23/07	10/15/08	11/16/09	11/09/10
Total BTEX	NS	NS	NS	NS	**0.13F**	-	-	-	-	-	-
Benzene	5	5	1,000	2	-	-	-	-	-	-	-
Toluene	1,000	1,000	50,000	99	-	-	-	-	-	-	-
Xylenes	10,000	10,000	3,000	NS	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**13.54**	**45**	**30.6**	**14.7**	**34 M**	**18**	**18**
1,3-Dichlorobenzene	NS	100	6,000	NS			-	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	**4.2**	**13**	**11.4**	**5.44**	**8.6**	**4.5**	**4.4**
2-Butanone	NS	NS	NS	NS	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	**na**	-	**1.17M**	**1.95F**	**<1.6**	-	**3.6F**
Chlorobenzene	100	100	200	NS	**2.55**	**6.3**	**3.99**	**1.67**	**3.7**	**1.2**	**1.7**
Chloroform	NS	70	50	NS	-	-	-	-	-	-	-
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	-	**0.65F**
cis-1,2-Dichloroethene	70	70	20	5	-	-	-	-	-	-	**0.24F**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	-
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	-	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	**0.12F**
Vinyl Chloride	2	2	2	NS	-	-	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-30L

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results				
					11/02/11	12/12/12	10/14/13	05/18/15	05/11/16
Total BTEX	NS	NS	NS	NS	**0.39 J**	**0.22F**	-	**0.2J**	**-**
Benzene	5	5	1,000	2	**0.27 J**	**0.22F**	-	**-**	**-**
Toluene	1,000	1,000	50,000	99	-	-	-	**0.20J**	**-**
Xylenes	10,000	10,000	3,000	NS	**0.12 J**	-	**0.11R**	**-**	**-**
1,2,4-Trichlorobenzene	70	70	200	4	-	**0.61F**	**0.39J**	**0.4J**	**-**
1,2-Dichlorobenzene	600	600	8,000	41	**37 J**	**44**	**56**	**47**	**4.3J**
1,3-Dichlorobenzene	NS	100	6,000	NS	**0.43 J**	**0.57F**	**0.52J**	**0.54J**	**-**
1,4-Dichlorobenzene	75	5	60	14	**11J**	**14**	**16**	**16**	**0.99J**
2-Butanone	NS	NS	NS	NS	-	-	-	-	**8.4 J**
Acetone	NS	6,300	50,000	NS	**-**	**6.3**	-	**-**	**69J**
Chlorobenzene	100	100	200	NS	**5.3J**	**5.3**	**6.5**	**5.5**	**0.88J**
Chloroform	NS	70	50	NS	**0.073J**	-	-	**-**	**-**
Chloromethane	NS	NS	NS	NS	-	-	-	**-**	**-**
cis-1,2-Dichloroethene	70	70	20	5	**0.5J**	**0.41F**	-	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**0.34F**	-	**-**	**0.41 J**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	**0.88F**	**0.37J**	**2.8J**	**4.1J**
Trichloroethene	5	5	5	NS	**0.3J**	**0.27F**	-	**-**	**-**
Vinyl Chloride	2	2	2	NS	**0.19J**	-	-	**-**	**-**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-31

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					RAC 10/16/03	10/10/06	05/14/07	10/23/07	04/09/08	10/16/08	04/16/09
Total BTEX	NS	NS	NS	NS	**1.19F**	**23FM**	**40.25F**	**22F**	**29.8**	**21.6**	**14.05**
Benzene	5	5	1,000	2	-	-	-	-	-	-	-
Toluene	1,000	1,000	50,000	99	**0.24F**	**3F**	-	-	**1.5F**	**1.1F**	**0.49F**
Ethylbenzene	700	700	20,000	46	**0.57F**	**11F**	**7.25F**	**9F**	**13**	**11**	**7.3**
Xylenes	10,000	10,000	3,000	NS	**0.38F**	**9.3 M**	**33F**	**13F**	**15.3F**	**9.5FM**	**6.26**
1,1-Dichloroethene	7	7	80	NS	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**38.71**	**872**	**792M**	**958**	**1,200**	**1,200M**	**710**
1,3-Dichlorobenzene	NS	100	6,000	NS	**1.1F**	**9F**	-	**11.2F**	**13**	**11**	**7.3**
1,2,3-Trichlorobenzene	NS	NS	NS	NS	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	**19.57**	**13.2F**	**27**	**20F**	**22**	**21**	**20**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**0.22F**	-	**2.75F**	-	**7.1**	**5.4M**	**3.4**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	-	-	-	**42F**	**2.4**
1,4-Dichlorobenzene	75	5	60	14	**17.72**	**276**	**259**	**358**	**370**	**320**	**200**
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	-	-	-	-	-
Carbon Tetrachloride	5	5	2	NS	-	-	-	-	-	-	-
Chlorobenzene	100	100	200	NS	**21.8**	**55.5**	**80**	**79**	**79M**	**120**	**130**
Chloroform	NS	70	50	NS	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	**0.37F**	-	-	-	**0.89G**	**1.6F**	**2.2**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**0.2F**	-	**2.75F**	-	**5.4**	**4.3F**	**3.3**
Naphthalene	NS	140	700	16	-	-	-	-	-	-	-
n-Propylbenzene	NS	NS	NS	4	-	-	-	-	-	-	-
sec-Butylbenzene	NS	NS	NS	4	-	-	-	-	-	-	-
Tetrachloroethene	5	5	50	NS	**0.96F**	-	**3.25F**	-	**2.7F**	**2.3F**	**2.1**
trans-1,2-Dichloroethene	100	100	80	NS	-	-	-	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	-
Vinyl Chloride	2	2	2	NS	-	-	-	-	-	-	-

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Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-31

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					11/16/09	04/22/10	11/09/10	04/25/11	11/02/11	04/16/12	12/12/12
Total BTEX	NS	NS	NS	NS	**121.45**	**54.99F**	**31.5F**	**5.93F**	**6.09F**	**2.78F**	**0.96F**
Benzene	5	5	1,000	2	**0.45**	**0.29F**	-	-	-	-	-
Toluene	1,000	1,000	50,000	99	**17**	**2.7**	**1.5F**	**0.53F**	**0.29F**	**0.18F**	-
Ethylbenzene	700	700	20,000	46	**39**	**19**	**10**	**2.2F**	**2.5F**	**1.2**	**0.39F**
Xylenes	10,000	10,000	3,000	NS	**65**	**33**	**20**	**3.2F**	**3.3F**	**1.4F**	**0.57F**
1,1-Dichloroethene	7	7	80	NS	-	**0.14F**	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**3,200**	**1,800J**	**1,700**	**650**	**800**	**310**	**140**
1,3-Dichlorobenzene	NS	100	6,000	NS	**24**	**19**	**19**	**6**	**9.2**	**3.7**	**3.1**
1,2,3-Trichlorobenzene	NS	NS	NS	NS	**1.5**	**0.83F**	-	-	-	**0.36F**	**0.56F**
1,2,4-Trichlorobenzene	70	70	200	4	**28**	**26**	**41**	**18**	**21**	**9.2**	**11**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**11**	**10**	**12**	**1.9F**	**0.94F**	**0.23F**	**0.32F**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**7.2**	**6.6**	**10**	**1.8F**	**0.4F**	**0.88F**	-
1,4-Dichlorobenzene	75	5	60	14	**740**	**490J**	**490**	**200**	**240**	**100**	**71**
4-Isopropyltoluene	NS	NS	NS	NS	-	-	**2.7F**	**1F**	-	-	-
Acetone	NS	6,300	50,000	NS	-	**68**	**75F**	-	-	-	**3.2F**
Carbon Tetrachloride	5	5	2	NS	-	**0.41F**	-	-	-	-	-
Chlorobenzene	100	100	200	NS	**290**	**210J**	**210**	**120**	**63**	**52**	**24**
Chloroform	NS	70	50	NS	**2.3**	**0.66**	-	**0.82F**	**1.2**	**0.34**	-
cis-1,2-Dichloroethene	70	70	20	5	**3.8**	**3.4**	**3.1F**	**2.2F**	**1.9F**	**2.1**	**0.52F**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	**2.9F**	-	-	**0.44F**	**0.43F**
Isopropylbenzene	NS	NS	NS	NS	**6.8**	**5.6**	**3.5F**	**1F**	**0.77F**	-	-
Naphthalene	NS	140	700	16	**5.3**	**3.3**	-	-	-	**0.33F**	**1.5**
n-Propylbenzene	NS	NS	NS	4	**2.1**	**2.2**	-	**0.58F**	-	**0.18F**	**0.3F**
sec-Butylbenzene	NS	NS	NS	4	-	**0.74F**	-	-	-	**0.24F**	**0.21F**
Tetrachloroethene	5	5	50	NS	**2.3**	**1.7**	-	-	**0.69F**	**0.52F**	**0.32F**
trans-1,2-Dichloroethene	100	100	80	NS	-	**0.25F**	-	-	-	**0.17F**	-
Trichloroethene	5	5	5	NS	**1.5**	**1**	**1.4F**	**1.6F**	**0.71F**	**0.69F**	**0.32F**
Vinyl Chloride	2	2	2	NS	**2.3**	**2.1**	**1.5F**	**1.4F**	-	**1.6**	**0.63F**

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Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-31

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results				
					04/25/13	10/15/13	04/14/14	05/20/15	05/11/16
Total BTEX	NS	NS	NS	NS	-	-		0.60J	2.08/2.77
Benzene	5	5	1,000	2	0.14F	0.22J	0.15JF	-	0.17/0.17J
Toluene	1,000	1,000	50,000	99	0.25F	0.27J	0.19JF	0.22	-
Ethylbenzene	700	700	20,000	46	0.77F	1	0.68JF	0.38J	1.1/1.4
Xylenes	10,000	10,000	3,000	NS	0.99F	1.3R	0.63R	-	0.81/1.2J
1,1-Dichloroethene	7	7	80	NS	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	350	200	110	86	86/100
1,3-Dichlorobenzene	NS	100	6,000	NS	4.9	3.3	2.1	2.0	1.6/1.7
1,2,3-Trichlorobenzene	NS	NS	NS	NS	-	0.24J	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	7.7	5.9	4	4.2	2.7/2.8
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	0.24J	-	-	-
1,3,5-Trimethylbenzene	NS	NS	NS	22	0.15F	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	110	68	43	34	53/58
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	2.4J	-	11	-/3.1J
Carbon Tetrachloride	5	5	2	NS	-	-	-	-	-
Chlorobenzene	100	100	200	NS	25	58	41	35	90/89
Chloroform	NS	70	50	NS	0.53	0.3	0.21JF	-	-
cis-1,2-Dichloroethene	70	70	20	5	0.98F	1.3	0.72JF	0.39J	0.66/0.68J
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	0.25F	-	0.34JF	0.30J	0.5/0.46J
Naphthalene	NS	140	700	16	0.40F	0.29J	-	-	-
n-Propylbenzene	NS	NS	NS	4	0.17F	-	0.21JF	0.18J	0.17/0.16J
sec-Butylbenzene	NS	NS	NS	4	0.42F	-	0.46JF	0.45J	-
Tetrachloroethene	5	5	50	NS	0.39F	0.27J	0.17JF	-	-
trans-1,2-Dichloroethene	100	100	80	NS	-	-	-	-	-
Trichloroethene	5	5	5	NS	0.38F	0.32J	0.22JF	0.20J	-
Vinyl Chloride	2	2	2	NS	0.76F	1.5	0.69JF	0.28J	0.5/0.5J

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Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-35

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					RA-C BL 10/13/03	10/10/06	10/23/07	10/15/08	11/16/09	11/09/10	11/02/11
Total BTEX	NS	NS	NS	NS	**0.21F**	**0.17F**	-	-	-	-	**0.23J**
Ethylbenzene	700	700	20,000	46	-	-	-	-	-	-	**0.12J**
Xylenes	10,000	10,000	3,000	NS	-	-	-	-	-	-	**0.11J**
1,1-Dichloroethane	NS	70	2,000	NS	-	-	-	-	-	**0.11F**	-
1,1-Dichloroethene	7	7	80	NS	-	-	-	-	-	**0.13F**	**0.1J**
1,2-Dichlorobenzene	600	600	8,000	41	**0.39**	**0.51F**	**0.94F**	**2.1M/ 2.2M**	**0.5/1.4**	**1.6**	**0.59J**
1,3-Dichlorobenzene	NS	100	6,000	NS	**0.22F**	-	-	**1.1 /<0.14**	-	-	-
1,4-Dichlorobenzene	75	5	60	14	**0.47**	**0.41F**	**0.67**	**0.84/0.83**	**0.52/0.51**	**0.6**	**0.34J**
Acetone	NS	6,300	50,000	NS	**-**	**-**	**-**	**-**	**-**	**-**	**-**
cis-1,2-Dichloroethene	70	70	20	5	**0.31F**	**1.2**	**12.6**	**0.61F / 0.68F**	**0.89F/0.92F**	**1.8**	**1.3J**
Chloroform	NS	70	50	NS	-	-	-	-	-	**0.39**	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**0.82**	**0.49F**	**0.23F**	**0.31F/0.32F**	**0.30FM/0.29FM**	**0.3F**	-
n-Propylbenzene	NS	NS	NS	4	**1.27**	**0.51F**	**0.29F**	**0.31F/0.31F**	**<0.13/0.27F**	**0.21F**	-
Naphthalene	NS	140	700	16	-	-	-	-	-	**1.2**	**1.4J**
p-Isopropyltoluene	NS	NS	NS	NS	**1.95**	**0.63F**	**1.35**	**0.57F/0.58F**	-	-	-
sec-Butylbenzene	NS	NS	NS	4	**4.54**	**1.65**	**1.76**	**1.5/1.4**	**1.9 M/1.8M**	**2.2**	**1.2J**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	**0.18F**	-
Trichloroethene	5	5	5	NS	**3.7**	**18.8**	**5.78R**	**13/13**	**14/13**	**17**	**16J**

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Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-35

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results			
					12/13/12	10/14/2013	05/20/15	05/11/16
Total BTEX	NS	NS	NS	NS	-	-	-	-
Ethylbenzene	700	700	20,000	46	-	-	-	-
Xylenes	10,000	10,000	3,000	NS	-	**0.11R**	-	-
1,1-Dichloroethane	NS	70	2,000	NS	-	-	-	-
1,1-Dichloroethene	7	7	80	NS	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**1/1.1**	**0.98J**	**0.56J/0.56J**	**0.32J/1.2J**
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	**0.56/0.57**	**0.53**	**0.34J/0.34J**	**0.24J/0.36J**
Acetone	NS	6,300	50,000	NS	**-**	**10**	**ND/24**	**-**
cis-1,2-Dichloroethene	70	70	20	5	**2.6/2.5**	**1.4**	**0.23J/0.24J**	**0.4J/0.4J**
Chloroform	NS	70	50	NS	-	-	-	**<0.4/0.18J**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**0.35F/0.35F**	-	-	**<0.8/0.39J**
Isopropylbenzene	NS	NS	NS	NS	-	-	-	-
n-Propylbenzene	NS	NS	NS	4	-	-	-	-
Naphthalene	NS	140	700	16	-	-	-	**0.45J/0.74J**
p-Isopropyltoluene	NS	NS	NS	NS	**0.18F/<0.1**	-	-	-
sec-Butylbenzene	NS	NS	NS	4	**1.5/1.8**	-	**1.4/1.5**	**1J/2.2J**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-
Trichloroethene	5	5	5	NS	**15/17**	**7.4**	**7.1/7.0**	**16/15**

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Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-38

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/14/03	01/05/04	04/21/04	11/03/04	04/26/05	10/19/05	04/21/06	05/14/07
Total BTEX	NS	NS	NS	NS	-	-	-	**0.34F**	**0.56**	**0.34F/0.27F**	**0.275F**	**1.96F/0.78F**
Benzene	5	5	1,000	2	-	-	-	**0.34F**	**0.56**	**0.34F/0.27F**	**0.275F**	**0.66/0.68**
Ethylbenzene	700	700	20,000	46	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**188.76**	**170**	**77.75**	**112.16**	**2.21**	**53/55**	**48**	**27.9M/29.5M**
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	**48.9**	**52**	**22.34**	**31.92**	**2.05**	**13/13**	**12.9**	**10.7/11.2**
Chlorobenzene	100	100	200	NS	**5.8**	**6J**	**1.89**	**4.44**	**0.3F**	**2.2/2.3**	**1.92**	**1.77/1.79**
cis-1,2-Dichloroethene	70	70	20	5	-	-	-	-	-	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	-	-
Hexachlorobutadiene	NS	0.6	50	NS	-	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	-	-	-	-	-	-
sec-Butylbenzene	NS	NS	NS	4	-	-	-	-	-	-	-	-
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	-	-

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Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-38

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					10/22/07	04/09/08	10/14/08	04/16/09	11/17/09	04/22/10	11/10/10	04/25/11
Total BTEX	NS	NS	NS	NS	-	**0.48**	**0.27F**	**0.27F**	**0.228F**	-	-	**0.15F**
Benzene	5	5	1,000	2	**0.32R**	**0.48**	**0.27F**	**0.29F**	**0.15F**	-	-	-
Ethylbenzene	700	700	20,000	46	-	-	-	-	-	-	-	**0.15F**
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-	-	**0.68F**	**0.46F**	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	-	-	-	-	**0.095F**
1,2-Dichlorobenzene	600	600	8,000	41	**14R**	**24**	**35**	**32**	**130**	**45**	**54**	**24**
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	-	-	-	**0.44F**	**0.41F**	-
1,4-Dichlorobenzene	75	5	60	14	**5.56R**	**6.1**	**6.8**	**7.9**	**26**	**11**	**12**	**6.2**
Chlorobenzene	100	100	200	NS	**2.27R**	-	**1.5**	-	**5.1**	**1.5**	**2.9**	**1.1**
cis-1,2-Dichloroethene	70	70	20	5	-	-	-	-	-	**0.11F**	**0.24F**	**0.35F**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	**0.35F**	-
Hexachlorobutadiene	NS	0.6	50	NS	-	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	-	-	-	-	-	**0.16**	-	**0.25**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	-	-	-	**0.2F**	-	-
sec-Butylbenzene	NS	NS	NS	4	-	-	-	-	-	**0.26F**	**0.23F**	-
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	**0.33F**	**0.2F**	-
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	-	**0.11F**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well ECS-38

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					10/28/11	04/16/12	12/12/12	04/24/13	10/15/13	04/14/14	05/20/15	05/10/16
Total BTEX	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Benzene	5	5	1,000	2	-	-	-	-	-	-	-	-
Ethylbenzene	700	700	20,000	46	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	**0.39F**	**0.95F**	**0.25F**	**0.21J**	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	**0.21F**	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**57**	**68**	**53**	**34**	**31**	**9.5**	**83**	**18**
1,3-Dichlorobenzene	NS	100	6,000	NS	**0.47F**	**0.57F**	**0.6F**	**0.41F**	**0.4J**	**0.15JF**	-	**0.2J**
1,4-Dichlorobenzene	75	5	60	14	**14**	**19**	**16**	**11**	**10**	**3.3**	**16**	**5.6**
Chlorobenzene	100	100	200	NS	**2.3**	**3.6**	**8.4**	**2.8**	**11**	**0.69**	**4.1**	**0.82J**
cis-1,2-Dichloroethene	70	70	20	5	**0.1F**	**0.31F**	-	-	**0.29J**	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**0.37F**	**0.32FJ**	-	-	-	-	-
Hexachlorobutadiene	NS	0.6	50	NS	-	-	**0.27F**	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**0.13F**	-	-	**0.24F**	-	**0.15JF**	-	-
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	-	-	-	-	-	**0.49J**
sec-Butylbenzene	NS	NS	NS	4	**0.35F**	**0.21F**	**0.39F**	-	**0.21J**	-	**0.35J**	-
tert-Butylbenzene	NS	NS	NS	NS	**0.13F**	**0.15F**	-	**0.11F**	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-3

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/15/03	12/01/03	01/05/04	02/02/04	03/03/04	04/21/04	11/04/04	04/26/05
Total BTEX	NS	NS	NS	NS	**591.04F**	**511J**	**391J**	**236J**	**236J**	**10.45**	**170M**	**39.79F**
Benzene	5	5	1,000	2	**6.08F**	**8J**	**9J**	**8J**	**9.1J**	**0.57F**	**5.42**	**1.73F**
Toluene	1,000	1,000	50,000	99	-	-	-	-	-	-	-	-
Ethylbenzene	700	700	20,000	46	**25.54**	**27**	**36**	**33**	**31**	**3.16**	**20.99**	**22.49**
Xylenes	10,000	10,000	3,000	NS	**559.42F**	**476J**	**346J**	**195J**	**130**	**6.72**	**140.88M**	**15.75**
1,1,1-Trichloroethane	200	200	4,000	NS	-	-	-	**20**	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-	**5.64**	**1.95F**	**3.92F**
1,2,3-Trichlorobenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**148.48**	**170**	**180**	**150**	**170**	**56.24**	**217.29**	**51.97**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**47.63**	**44**	**32**	**15**	**<10**	**0.83F**	**7.74F**	**0.93**
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	**1.54**	-	**1.27F**
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Chlorobenzene	100	100	200	NS	-	-	-	-	-	**0.92F**	-	-
Chloroform	NS	70	50	NS	-	-	-	-	-	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**14.9F**	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**20.28**	**31**	**32**	**28**	**27**	**11.34**	**31.38**	**21.77**
Hexachlorobutadiene	NS	0.6	50	NS	-	-	-	-	-	-	-	-
Naphthalene	NS	140	700	16	**26.5**	**27J**	**39J**	**39J**	**38J**	**8.37**	**53.1**	**9.83**
n-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
n-Propylbenzene	NS	NS	NS	4	**15.47**	**21**	**24**	**19**	**21**	**9.71**	**24.43**	**17.04**
p-Isopropyltoluene	NS	NS	NS	NS	**3.75F**	**6J**	**7J**	**6J**	-	**4.17**	**7.52F**	**4.57F**
sec-Butylbenzene	NS	NS	NS	4	-	-	-	-	-	**1.81F**	-	**2.09F**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	**1.3F**	**1.13F**	**0.85F**
Tetrachloroethene	5	5	50	NS	-	-	-	**13**	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	**97**	-	**0.27F**	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-3

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					10/19/05	04/21/06	10/12/06	05/14/07	10/22/07	04/09/08	10/14/08	04/16/09
Total BTEX	NS	NS	NS	NS	**73.7**	**606.2**	**150**	**156F**	**131.1F**	**95.6**	**65.8F**	**40.79**
Benzene	5	5	1,000	2	**2.4**	-	**1.8F**	**1.2F**	**1.1F**	**0.97**	**1.2**	**0.85**
Toluene	1,000	1,000	50,000	99	-	-	-	-	-	**0.44F**	**0.47F**	**0.24F**
Ethylbenzene	700	700	20,000	46	**9.3**	**36.2**	**4.55F**	**14.8**	-	**13**	**0.87F**	**4.5**
Xylenes	10,000	10,000	3,000	NS	**62**	**570**	**140**	**140**	**130**	**81.2**	**63.3**	**35.2**
1,1,1-Trichloroethane	200	200	4,000	NS	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**2.1**	**4.5F**	**2.3F**	**13.3M**	**1.1F**	**1.4**	**1.2**	**1.2**
1,2,3-Trichlorobenzene	NS	NS	NS	NS	-	**3.75F**	-	-	-	-	**-**	-
1,2,4-Trichlorobenzene	70	70	200	4	-	**3.25F**	**0.13**	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**150**	**259**	**234**	**171**	**195**	**140**	**220**	**170**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**22**	**56.5**	**42.3**	**35.4**	**28.4**	**39**	**19**	**25**
1,4-Dichlorobenzene	75	5	60	14	**0.45F**	-	-	**4.3F**	-	**0.6**	**0.58**	**0.59**
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Chlorobenzene	100	100	200	NS	-	-	-	-	-	-	-	-
Chloroform	NS	70	50	NS	-	-	-	-	-	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**0.33F**	-	-	-	**2F**	-	**0.6**	-
Isopropylbenzene	NS	NS	NS	NS	-	-	-	**2.7F**	-	**1.2F**	**0.42F**	-
Hexachlorobutadiene	NS	0.6	50	NS	-	-	-	-	-	-	-	-
Naphthalene	NS	140	700	16	**25**	**29.2**	**30.6**	**22.9**	**27.6**	**26**	**28**	**27**
n-Butylbenzene	NS	NS	NS	NS	**33**	**72.5**	**58.8**	**29.1**	**46**	**28**	**36**	**21**
n-Propylbenzene	NS	NS	NS	4	-	-	-	-	**1.1F**	**0.71F**	-	**0.51F**
p-Isopropyltoluene	NS	NS	NS	NS	**17**	**20.8F**	**26.7**	**19.9**	**22.2**	**18**	**21**	**20**
sec-Butylbenzene	NS	NS	NS	4	**6.1**	-	**5.8**	**7.4F**	**7.2F**	**6.2**	**5.9**	**6**
tert-Butylbenzene	NS	NS	NS	NS	**2.9**	-	-	**1.9F**	**1.9F**	**2.8**	-	**3.3**
Tetrachloroethene	5	5	50	NS	-	-	-	-	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-3

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					11/17/09	04/22/10	11/10/10	04/25/11	10/28/11	04/16/12	12/12/12	04/24/13
Total BTEX	NS	NS	NS	NS	**53.31**	**28.42F**	**2.7F**	**4.62F**	**1.36**	**3.76F**	**3.5F/3.35FJ**	**-**
Benzene	5	5	1,000	2	**1**	**1.1**	**0.54**	**0.82**	**1.1**	-	**1.2 /1.2J**	**0.35F**
Toluene	1,000	1,000	50,000	99	**0.20F**	**0.42F**	**0.14F**	**0.2F**	**0.073F**	**0.45F**	**0.53F/0.5FJ**	-
Ethylbenzene	700	700	20,000	46	**0.71F**	**4.9**	**0.22F**	**1.1F**	**0.19F**	**0.31F**	**0.47F/0.45F**	-
Xylenes	10,000	10,000	3,000	NS	**51.4**	**22**	**1.8F**	**2.5F**	-	**3**	**1.3F/1.2F**	-
1,1,1-Trichloroethane	200	200	4,000	NS	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**0.61F**	**6.6**	**1.1**	**0.25F**	**0.37F**	**0.31F**	**0.54 /0.53F**	-
1,2,3-Trichlorobenzene	NS	NS	NS	NS	-	-	-	-	-	-	**<0.27/0.49F**	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-	-	-	**1.3/0.3F**	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**250**	**220**	**54**	**18**	**4.2**	**56**	**25/25**	**3.6**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**53**	**23**	**2.1**	**3.2**	-	-	**0.2F/0.2F**	-
1,4-Dichlorobenzene	75	5	60	14	**0.33F**	**2**	**0.5**	**0.24F**	-	-	**0.35F/<0.12**	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	**0.37F**
Chlorobenzene	100	100	200	NS	-	**0.77F**	**1.2**	**0.16F**	-	**0.12F**	**0.2F/0.2F**	-
Chloroform	NS	70	50	NS	-	-	**0.084F**	-	-	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	**0.61F/0.64FJ**	-
Isopropylbenzene	NS	NS	NS	NS	**29**	**37**	**19**	**17**	**24**	**26**	**28/28**	**10**
Hexachlorobutadiene	NS	0.6	50	NS	-	-	-	-	-	-	**0.69/<0.17**	-
Naphthalene	NS	140	700	16	**32**	**19**	**3**	**3.1**	**2.4**	**11**	**15/15**	**1.2**
n-Butylbenzene	NS	NS	NS	NS	-	**0.68F**	-	-	-	-	**0.72F/0.72F**	**0.89F**
n-Propylbenzene	NS	NS	NS	4	**22**	**30**	**14**	**14**	**20**	**20**	**25/25**	**10**
p-Isopropyltoluene	NS	NS	NS	NS	**5.5**	**7.7**	**3.1**	**2.4**	**1.3**	**1.3**	**1/1**	-
sec-Butylbenzene	NS	NS	NS	4	-	**4.5**	**2.2**	**1.6F**	**3.1**	**2.1**	**3.8/3.8**	**1.4**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	**0.73F**	**0.73F**	**1.1/0.99F**	**0.53F**
Tetrachloroethene	5	5	50	NS	-	-	-	-	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-3

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results			
					10/15/13	04/14/14	05/18/15	05/10/16
Total BTEX	NS	NS	NS	NS	**0.96**	-	**0.57J**	-
Benzene	5	5	1,000	2	**0.96**	**0.13JF**	**0.40J**	-
Toluene	1,000	1,000	50,000	99	-	-	**0.17J**	-
Ethylbenzene	700	700	20,000	46	-	-	-	-
Xylenes	10,000	10,000	3,000	NS	**0.11R**	-	-	-
1,1,1-Trichloroethane	200	200	4,000	NS	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**0.45J**	-	-	-
1,2,3-Trichlorobenzene	NS	NS	NS	NS	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**1**	-	**0.28J**	**0.24J**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	**0.18J**	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	**0.51J**	-	-	-
Chlorobenzene	100	100	200	NS	-	-	-	-
Chloroform	NS	70	50	NS	-	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	**0.45J**
Isopropylbenzene	NS	NS	NS	NS	**16**	**4.8**	**4.1**	**0.64J**
Hexachlorobutadiene	NS	0.6	50	NS	-	-	-	-
Naphthalene	NS	140	700	16	**1.1**	**0.47JF**	**0.65J**	**0.27J**
n-Butylbenzene	NS	NS	NS	NS	**1.5**	**0.5JF**	-	-
n-Propylbenzene	NS	NS	NS	4	**15**	**4.2**	**2.5**	**0.35J**
p-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-
sec-Butylbenzene	NS	NS	NS	4	-	**0.7JF**	**1.5**	**0.18J**
tert-Butylbenzene	NS	NS	NS	NS	**0.86J**	**0.26JF**	**0.43J**	-
Tetrachloroethene	5	5	50	NS	-	-	-	-
Trichloroethene	5	5	5	NS	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-11

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/15/03	10/19/05	10/12/06	10/22/07	10/14/08	11/17/09	11/10/10	10/28/11
Total BTEX	NS	NS	NS	NS	**0.93F**	**1.18**	**1.7F**	-	**0.21F**	-	-	**0.71F/0.70F**
Benzene	5	5	1,000	2	**0.5**	**0.32F**	**0.25F**	-	-	-	-	**0.19F/0.19F**
Toluene	1,000	1,000	50,000	99	-	-	-	-	-	-	-	-
Ethylbenzene	700	700	20,000	46	**0.28F**	**0.17F**	**0.71F**	-	**0.21F**	-	-	**0.52F/0.51F**
Xylenes	10,000	10,000	3,000	NS	**0.15F**	**0.69F**	**0.76F**	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**0.12F**	**3.2**	**3.05**	-	**0.58F**	-	**0.23F**	**2.9/3.2**
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	**0.51F**	-	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	**1.62F**	**1.73F**	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	**0.13F**	-	-	-	**0.15F**	**0.13F**	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**0.2F**	**0.31F**	-	**0.38F**	-	**0.48FB**	**1.5F**	-
Isopropylbenzene	NS	NS	NS	NS	**3.65**	**4.2**	**5.56**	**0.88F**	**4.8**	**2.4**	**0.16F**	**11/11**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	**0.29F**	**0.85F**	-	-	-	-
Naphthalene	NS	140	700	16	-	-	**1.01**	**0.19F**	**1.4**	**0.48FB**	-	**1.8/1.5**
n-Butylbenzene	NS	NS	NS	NS	**0.19F**	-	**0.25F**	**0.15F**	-	-	-	**0.52F/0.52F**
n-Propylbenzene	NS	NS	NS	4	**1.8**	**2.7**	**5.11**	**0.86F**	**5.6**	**2.8**	-	**12/11**
p-Isopropyltoluene	NS	NS	NS	NS	-	-	**0.15F**	**0.32F**	**1.5**	-	-	**3.7/3.7**
sec-Butylbenzene	NS	NS	NS	4	**1.72**	**1.2**	**1.43**	**0.67F**	**2.2**	**1.7**	**0.22F**	**2.9/2.9**
tert-Butylbenzene	NS	NS	NS	NS	**0.49F**	**0.81F**	**0.25F**	**0.18F**	**0.3F**	**0.27F**	-	-
Trichloroethene	5	5	5	NS	-	-	-	**0.1F**	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-11

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results			
					12/12/12	10/15/13	05/18/15	05/10/16
Total BTEX	NS	NS	NS	NS	-	-	**0.33J**	**0.53**
Benzene	5	5	1,000	2	-	-	**-**	**0.16J**
Toluene	1,000	1,000	50,000	99	-	-	**-**	**-**
Ethylbenzene	700	700	20,000	46	-	-	**0.33J**	**0.37J**
Xylenes	10,000	10,000	3,000	NS	-	**0.11R**	**-**	**-**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**0.41F**	-	**3.7**	**4.3**
1,2-Dichlorobenzene	600	600	8,000	41	**0.18F**	-	**-**	**-**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**0.21F**	-	**0.57J**	**-**
1,4-Dichlorobenzene	75	5	60	14	**0.19F**	-	**-**	**-**
4-Isopropyltoluene	NS	NS	NS	NS	**0.37F**	-	**-**	**-**
Acetone	NS	6,300	50,000	NS	-	-	**-**	**-**
cis-1,2-Dichloroethene	70	70	20	5	**0.17F**	**0.19J**	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**0.3F**	-	**-**	**-**
Isopropylbenzene	NS	NS	NS	NS	**2.6**	**3.1**	**8.5**	**9.3**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	**-**	**-**
Naphthalene	NS	140	700	16	**0.47F**	-	**0.56J**	**0.65J**
n-Butylbenzene	NS	NS	NS	NS	**0.31F**	**0.37J**	**-**	**-**
n-Propylbenzene	NS	NS	NS	4	**2.8**	**4**	**8.4**	**9.6**
p-Isopropyltoluene	NS	NS	NS	NS	**0.54F**	-	**-**	**-**
sec-Butylbenzene	NS	NS	NS	4	**2.8**	-	**3.2M**	**2.4**
tert-Butylbenzene	NS	NS	NS	NS	**0.42F**	**0.31J**	**0.35J**	**0.34J**
Trichloroethene	5	5	5	NS	-	-	**-**	**0**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-12

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/15/03	10/19/05	10/12/06	10/22/07	10/14/08	11/17/09	11/10/10	10/28/11
Total BTEX	NS	NS	NS	NS	**9.90F**	**1.03F**	**11F**	**4.2F**	**3.63F**	**1.604F**	**0.79F**	**2.19F**
Benzene	5	5	1,000	2	**-**	-	-	-	-	-	-	-
Toluene	1,000	1,000	50,000	99	**-**	-	-	-	-	**0.24F**	-	**0.085F**
Ethylbenzene	700	700	20,000	46	**3.42F**	**0.52F**	**3.5F**	**1.2F**	**1.2**	**1.1**	**0.28F**	**0.6F**
Xylenes	10,000	10,000	3,000	NS	**6.48F**	**0.51F**	**7.2F**	**3.0F**	**2.43F**	**0.264F**	**0.51F**	**1.5F**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**195**	**40**	**339**	**124**	**150**	**200**	**37**	**63**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**66.55**	**4.2**	**130**	**24**	**3**	**130**	**18**	**56**
4-Isopropyltoluene	NS	NS	NS	NS	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**0.53F**	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**28.43**	**8.4**	**50.8**	**17.6**	**21**	**25**	**6.3**	**15**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	**0.52F**	-	-	-	-	-	-
Naphthalene	NS	140	700	16	**11.2**	-	**2.6F**	**1.9F**	**1.1**	**1.5**	**0.84F**	**1.7**
n-Butylbenzene	NS	NS	NS	NS	**2.62F**	-	**2.8F**	**1.7F**	-	**3.5**	**1.3**	**3.8**
n-Propylbenzene	NS	NS	NS	4	**36.49**	**11**	**74.2**	**25.5**	**38**	**46**	**14**	**34**
p-Isopropyltoluene	NS	NS	NS	NS	**8.44F**	**2.4**	**7.1F**	**4.4F**	**15**	**17**	**12**	**13**
sec-Butylbenzene	NS	NS	NS	4	**4.88F**	**2.6**	**6.9F**	**2.6F**	**6.6**	**7.6**	**3.8**	**9.9**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-12

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results			
					12/12/12	10/15/13	05/18/15	05/10/16
Total BTEX	NS	NS	NS	NS	**2.17F**	**0.34J**	**0.48J**	**0.35**
Benzene	5	5	1,000	2	-	**-**	**-**	**-**
Toluene	1,000	1,000	50,000	99	**0.47F**	**-**	**-**	**-**
Ethylbenzene	700	700	20,000	46	**0.47F**	**0.34J**	**0.27J**	**0.35J**
Xylenes	10,000	10,000	3,000	NS	**1.7F**	**0.59R**	**0.21J**	**-**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**70**	**18**	**1.6**	**12**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**61**	**21**	**-**	**8.4**
4-Isopropyltoluene	NS	NS	NS	NS	**-**	**3.3**	**5.2**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**-**	**-**	**1.1J**
Isopropylbenzene	NS	NS	NS	NS	**8.4**	**5.3**	**3.9**	**2.6**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	**-**	**-**	**-**
Naphthalene	NS	140	700	16	**1.3**	**0.48J**	**-**	**0.73J**
n-Butylbenzene	NS	NS	NS	NS	**4.6**	**0.91J**	**-**	**-**
n-Propylbenzene	NS	NS	NS	4	**21**	**15**	**12**	**5.1**
p-Isopropyltoluene	NS	NS	NS	NS	**22M**	**-**	**-**	**4.8**
sec-Butylbenzene	NS	NS	NS	4	**7.7**	**-**	**3.5**	**2.4**
tert-Butylbenzene	NS	NS	NS	NS	**0.86F**	**-**	**0.50J**	**1.5J**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-13

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/15/03	10/10/06	10/23/07	10/15/08	11/16/09	11/09/10	11/02/11	12/14/12
Total BTEX	NS	NS	NS	NS	LNAPL	**1,400FM**	**1,482**	**849 F**	**956 F**	**706**	**303.37 F**	**136.79J**
Benzene	5	5	1,000	2	-	-	-	**0.40 F**	-	**0.49**	-	**0.59J**
Toluene	1,000	1,000	50,000	99	-	**2.1F**	-	**0.23 F**	**0.25 F**	**5.5**	**0.37 F**	**4.2J**
Ethylbenzene	700	700	20,000	46	-	**248**	**282**	**160**	**180**	**110**	**53**	**100**
Xylenes	10,000	10,000	3,000	NS	-	**1,100M**	**1,200**	**688**	**776**	**590**	**250**	**32**
2-Butanone (MEK)	NS	NS	NS	NS	-	**5.6F**	-	-	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-	-	-	-	**0.17F**
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	**295**	**353**	**250**	**290**	**260**	**86**	**200**
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-	-	-	-
1,2-Dichloropropane	5	5	3	NS	-	-	-	-	-	-	-	**0.48FJ**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**114**	**133**	**140**	**170**	**200**	**55**	**87**
4-Isopropyltoluene	NS	NS	NS	NS	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	**0.26F**	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	-	**0.67FJ**
Isopropylbenzene	NS	NS	NS	NS	-	**34.1**	**34.4J**	**27**	**31**	**25**	**9.6**	**22**
n-Butylbenzene	NS	NS	NS	NS	-	**55**	**13.8F**	-	-	**8.8**	**4.4**	**9**
n-Propylbenzene	NS	NS	NS	4	-	**39.1**	**39**	**29**	**30**	**20**	**9.2**	**24**
p-Isopropyltoluene	NS	NS	NS	NS	-	**9.3**	**10J**	**23**	**21**	**28**	**11**	**27**
sec-Butylbenzene	NS	NS	NS	4	-	**6.75**	**6.4F**	**9.1**	-	**9.3**	**3.2**	**9**
tert-Butylbenzene	NS	NS	NS	NS	-	**1.5F**	-	-	-	-	-	-
Naphthalene	NS	140	700	16	-	**100**	**125**	**110**	**100**	**160**	**59**	**100**
Tetrachloroethene	5	5	50	NS	-	-	-	-	-	**0.85F**	**0.41F**	**0.37F**
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	-	**0.29FJ**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-13

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results		
					10/14/13	05/20/15	05/12/16
Total BTEX	NS	NS	NS	NS	**86.35**	**17J**	**42.8**
Benzene	5	5	1,000	2	**0.25J**	-	-
Toluene	1,000	1,000	50,000	99	**2.1J**	-	-
Ethylbenzene	700	700	20,000	46	**84**	**17J**	**15**
Xylenes	10,000	10,000	3,000	NS	**350R**	**29J**	**27.8**
2-Butanone (MEK)	NS	NS	NS	NS	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**160**	**43**	**19**
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-
1,2-Dichloropropane	5	5	3	NS	-	-	-
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	**6J**	**3.7J**	-
Chloromethane	NS	NS	NS	NS	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	**0.51J**
Isopropylbenzene	NS	NS	NS	NS	**14J**	**4.5J**	**2.6**
n-Butylbenzene	NS	NS	NS	NS	**4.7J**	-	-
n-Propylbenzene	NS	NS	NS	4	**18J**	**5.4J**	**2.3**
p-Isopropyltoluene	NS	NS	NS	NS	-	-	**2**
sec-Butylbenzene	NS	NS	NS	4	-	-	**0.76J**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-
Naphthalene	NS	140	700	16	**83**	**15J**	**11J**
Tetrachloroethene	5	5	50	NS	-	-	-
Trichloroethene	5	5	5	NS	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-15

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					RA-C BL 10/15/03	10/10/06	10/23/07	10/16/08	11/16/09	11/09/10	11/02/11
Total BTEX	NS	NS	NS	NS	LNAPL	**150M/140M**	**126**	**12.7F/13.1F**	**16.1**	**20.35F**	**1.25F/1.33F**
Benzene	5	5	1,000	2	-	-	-	-	-	**0.15F**	-
Toluene	1,000	1,000	50,000	99	-	-	-	**0.074F/0.11F**	**<0.068/0.12F**	-	**0.27F/0.29F**
Ethylbenzene	700	700	20,000	46	-	**16.4/16.2**	**16**	**2.9/2.9**	**2.7/2.4**	**3.2**	**0.42F/0.47F**
Xylenes	10,000	10,000	3,000	NS	-	**130M/120M**	**110**	**9.7/10.1**	**13.4/12.2**	**17**	**0.56F/0.57F**
2-Butanone (MEK)	NS	NS	NS	NS	-	**3.77F/<1.62**	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	**59.6/58**	**69.4**	**24/25**	**38/38**	**52**	**3.2/3.2**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**39.2/.8.8**	**38.6**	**17/17**	**37/36**	**51**	**2/2**
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-	-	**0.53F/0.52F**
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	-	**0.27F/0.26F**
Acetone	NS	6,300	50,000	NS	-	-	-	-	-	-	-
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	**0.25F**	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	-	**5.81/5.85**	**7J**	**2.6/2.6**	**3.4/3.2**	**4.4**	**0.7F/0.74F**
n-Butylbenzene	NS	NS	NS	NS	-	**1.73/1.6F**	**5.52**	-	**1.1/MD**	**1.2**	-
n-Propylbenzene	NS	NS	NS	4	-	**5.62/5.58**	**7.45**	**2.1/2.1**	**2.6/2.4**	**3.8**	**0.45F/0.4F**
sec-Butylbenzene	NS	NS	NS	4	-	**2.68/2.68**	**2.52**	**1.2/1.3**	**2.7/2.4**	**2.9**	**0.46F/0.46F**
tert-Butylbenzene	NS	NS	NS	NS	-	**1.13/1.1F**	-	-	-	-	**0.23F/0.26F**
4-Isopropyltoluene	NS	NS	NS	NS	-	**5.8/5.45**	**4.65J**	**10/12**	**9.8/8.5**	**9.4**	**0.78F/0.7F**
Naphthalene	NS	140	700	16	-	**23.1/19.9**	**19.2**	**9.1/9.7**	**4.0/4.8**	**5.7**	**<0.25UJ/1.5J**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-15

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results		
					12/13/12	10/14/13	05/12/16
Total BTEX	NS	NS	NS	NS	**2.82F**	**0.57J**	**0.17**
Benzene	5	5	1,000	2	-	-	-
Toluene	1,000	1,000	50,000	99	**0.28F**	-	-
Ethylbenzene	700	700	20,000	46	**0.84F**	**0.57J**	**0.17J**
Xylenes	10,000	10,000	3,000	NS	**1.7F**	**1.3R**	-
2-Butanone (MEK)	NS	NS	NS	NS	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**16**	**8.7**	**0.55J**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**0.94F**	-	-
1,4-Dichlorobenzene	75	5	60	14	**0.43F**	-	-
Acetone	NS	6,300	50,000	NS	**70**	-	**29**
Chloromethane	NS	NS	NS	NS	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**0.42F**	-	-
Isopropylbenzene	NS	NS	NS	NS	**1.1**	**0.6J**	**0.46J**
n-Butylbenzene	NS	NS	NS	NS	**1**	**1.1**	-
n-Propylbenzene	NS	NS	NS	4	**1.5**	-	**0.43J**
sec-Butylbenzene	NS	NS	NS	4	**2.3**	-	**0.48J**
tert-Butylbenzene	NS	NS	NS	NS	**0.49F**	-	**0.31J**
4-Isopropyltoluene	NS	NS	NS	NS	**5.3 M**	**2**	**0.82J**
Naphthalene	NS	140	700	16	**1.4**	**0.92J**	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-17

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results					
					RA-C BL 10/13/03	04/21/04	10/24/07	10/15/08	11/16/09	11/09/10
Total BTEX	NS	NS	NS	NS	**7.99F**	**4.68M**	**1.6F**	**1.8F**	**0.24F**	**1.2F**
Benzene	5	5	1,000	2	-	-	-	-	-	-
Toluene	1,000	1,000	50,000	99	**0.71F**	-	-	**0.16F**	**0.12F**	-
Ethylbenzene	700	700	20,000	46	**1.52**	**0.77M**	**0.3F**	**0.35F**	-	**0.28F**
Xylenes	10,000	10,000	3,000	NS	**5.76F**	**3.91**	**1.3F**	**1.29F**	**0.12F**	**0.92F**
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**37.23**	**29.06M**	**16**	**23**	**14**	**34**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**12.51**	**15.6**	**8**	**15**	**5.7**	**14**
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	**1.9F**	**7.67F**	-	-	-
Chloroethane	NS	NS	NS	NS	-	-	-	-	-	-
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	-	-	-	-	**0.11F**	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	**0.18F**	-	**0.52FB**	-
Isopropylbenzene	NS	NS	NS	NS	**8.58**	**2.43M**	**1.69**	**2.5**	**1.4**	**3.7**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	**4.9F**	-	-	-	**0.51F**
Naphthalene	NS	140	700	16	**1.1**	-	**0.55F**	-	-	**0.82F**
n-Butylbenzene	NS	NS	NS	NS	**1.13**	**2.67**	**1.41**	-	**0.86F**	**1.5**
n-Propylbenzene	NS	NS	NS	4	**7.34**	**2.86**	**1.98**	**2.6**	**1.5**	**3.7**
p-Isopropyltoluene	NS	NS	NS	NS	**3.38**	**6.2**	**1.73**	**7.7**	**5.8**	**9**
sec-Butylbenzene	NS	NS	NS	4	**2.83**	**2.53**	**1.18**	**1.7**	**1.5**	**2.8**
tert-Butylbenzene	NS	NS	NS	NS	**0.84F**	**0.9F**	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-17

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results				
					11/02/11	12/13/12	10/14/13	05/20/15	05/10/16
Total BTEX	NS	NS	NS	NS	**0.12F**	**0.16F**	**-**	-	**-**
Benzene	5	5	1,000	2	-	-	**-**	**-**	**-**
Toluene	1,000	1,000	50,000	99	-	-	**-**	**-**	**-**
Ethylbenzene	700	700	20,000	46	-	-	**-**	**-**	**-**
Xylenes	10,000	10,000	3,000	NS	**0.12F**	**0.16F**	**0.11R**	**-**	**-**
1,2-Dichlorobenzene	600	600	8,000	41	**1.4**	**0.56F**	**0.27F**	**-**	**-**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**13**	**16**	**14**	**-**	**2.1**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**5**	**5.2**	**4.1**	**-**	**-**
1,4-Dichlorobenzene	75	5	60	14	**0.99**	**0.39F**	**-**	**-**	**-**
4-Isopropyltoluene	NS	NS	NS	NS	**-**	**-**	**3.7**	**-**	**-**
Acetone	NS	6,300	50,000	NS	-	**8.7F**	**4.3J**	**-**	**-**
Chloroethane	NS	NS	NS	NS	-	-	**-**	**-**	**-**
Chloromethane	NS	NS	NS	NS	-	-	**-**	**-**	**-**
cis-1,2-Dichloroethene	70	70	20	5	-	-	**-**	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**0.31F**	**-**	**-**	**-**
Isopropylbenzene	NS	NS	NS	NS	**1.5**	**1.9**	**1.6**	**-**	**-**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	**-**	**-**	**-**
Naphthalene	NS	140	700	16	-	-	**-**	**-**	**-**
n-Butylbenzene	NS	NS	NS	NS	**2.3**	**1.6**	**0.87J**	**-**	**-**
n-Propylbenzene	NS	NS	NS	4	**1.7**	**2.6**	**1.9**	**0.17J**	**0.26J**
p-Isopropyltoluene	NS	NS	NS	NS	**8.8**	**3.9**	**-**	**-**	**2.5**
sec-Butylbenzene	NS	NS	NS	4	**3.3**	**3.1**	**-**	**-**	**0.43J**
tert-Butylbenzene	NS	NS	NS	NS	-	**0.6F**	**-**	**0.16J**	**0.57J**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-20

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					RA-C BL 10/15/03	10/11/06	10/23/07	10/15/08	11/16/09	11/08/10	11/02/11
Total BTEX	NS	NS	NS	NS	**LNAPL**	**140M/140M**	**151.55J/181.55J**	**107.1**	**129.5**	**169**	**55.13J**
Benzene	5	5	1,000	2	-	**1.08/1.08**	**0.55J/0.55J**	**0.27F**	**-**	**-**	**-**
Toluene	1,000	1,000	50,000	99	-	-	-	**0.18F**	**-**	**-**	**0.13J**
Ethylbenzene	700	700	20,000	46	-	**106M/103M**	**134/157**	**92**	**110**	**140**	**43J**
Xylenes	10,000	10,000	3,000	NS	-	**32/34**	**17/24**	**14.6**	**19.5**	**29**	**12J**
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-	-	-	**0.95J**
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	**56.1/63.8**	**26/47**	**24**	**23**	**45**	**16J**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**35.1/43.8**	**7.45/23**	**13**	**13**	**37**	**10J**
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-	-	**4.2J**
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	-	**1.4J**
2-Butanone	NS	NS	NS	NS	-	-	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	-	-	-	**110**	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	**1.2F**	-
Isopropylbenzene	NS	NS	NS	NS	-	**13.2/13.5**	**12.9J/14.8J**	**9.6**	**14**	**22**	**9.1J**
Naphthalene	NS	140	700	16	-	**37/38.2**	**32.8/38.1**	**27**	**35**	**49**	**28J**
n-Butylbenzene	NS	NS	NS	NS	-	**1.16F/1.22F**	**3.8F/7.8**	-	-	**4.2F**	**1.4J**
n-Propylbenzene	NS	NS	NS	4	-	**9.76/9.96**	**8.35/9.5**	**6.7**	**8.5**	**12**	**5.5J**
p-Isopropyltoluene	NS	NS	NS	NS	-	**8.46/9.2**	**7.85J /10.8J**	**1.3**	**12**	**23**	**5.9JM**
sec-Butylbenzene	NS	NS	NS	4	-	**2.06/2.14**	**1.8F/2.5F**	**1.3**	**1.4**	**3.2F**	**1.5J**
tert-Butylbenzene	NS	NS	NS	NS	-	**1.14F/1.16F**	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well MWZ-20

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results			
					12/13/12	10/14/13	05/21/15	05/11/16
Total BTEX	NS	NS	NS	NS	**14.71FJ**	**5.63**	**96.27J**	**45.71**
Benzene	5	5	1,000	2	**-**	**-**	**-**	**-**
Toluene	1,000	1,000	50,000	99	**0.21FJ**	**0.17J**	**0.35J**	**0.29J**
Ethylbenzene	700	700	20,000	46	**3.5**	**5.8**	**70**	**32**
Xylenes	10,000	10,000	3,000	NS	**11**	**10R**	**25.92J**	**13.42J**
1,2,4-Trichlorobenzene	70	70	200	4	**0.25FJ**	**-**	**-**	**-**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**17J**	**12**	**11**	**5.7**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**11J**	**10**	**12**	**4.2**
1,2-Dichlorobenzene	600	600	8,000	41	**0.91FJ**	**-**	**-**	**-**
1,4-Dichlorobenzene	75	5	60	14	**0.32FJ**	**-**	**-**	**-**
2-Butanone	NS	NS	NS	NS	-	-	-	**6.3**
4-Isopropyltoluene	NS	NS	NS	NS	-	**3.6**	**2.0**	**-**
Acetone	NS	6,300	50,000	NS	**57JM**	**-**	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**-**	**-**	**-**
Isopropylbenzene	NS	NS	NS	NS	**11J**	**7.8**	**8.4**	**2.9**
Naphthalene	NS	140	700	16	**27J**	**31**	**38**	**15**
n-Butylbenzene	NS	NS	NS	NS	**2.3J**	**-**	**1.5**	**-**
n-Propylbenzene	NS	NS	NS	4	**7.4J**	**6.2**	**6.2**	**1.5**
p-Isopropyltoluene	NS	NS	NS	NS	**6J**	**-**	**-**	**0.61J**
sec-Butylbenzene	NS	NS	NS	4	**2.1J**	**1.1**	**1.1**	**0.19J**
tert-Butylbenzene	NS	NS	NS	NS	**0.76FJ**	**-**	**0.47J**	**0.25J**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well PW-3

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/15/03	11/04/04	10/19/05	10/12/06	10/22/07	10/14/08	11/17/09	11/10/10
Total BTEX	NS	NS	NS	NS	**602.84F**	**250**	**296.7**	**120**	**175.2F**	**145.1**	**42.7**	**103.26**
Benzene	5	5	1,000	2	**3.37F**	**1.39**	**2.7**	**1.3F**	**1.95F**	**2.8**	**0.21F**	**0.96**
Toluene	1,000	1,000	50,000	99	**9.75F**	**5.64**	**11**	**2.65F**	**5.65**	**9.3**	**0.39F**	**1.3**
Ethylbenzene	700	700	20,000	46	**110.37**	**56.9**	**23**	**13.2**	**27.6**	**49**	**4.1**	**21**
Xylenes	10,000	10,000	3,000	NS	**479.35**	**188.08M**	**260**	**100**	**140**	**84**	**38**	**80**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**89.84**	**51.43**	**94**	**76.3**	**57.8**	**98**	**30**	**49**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**34.34**	**17.03**	**30**	**18.2**	**23.7**	**49**	**18**	**29**
4-Isopropyltoluene	NS	NS	NS	NS	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**10.88**	**6.98**	**8.8**	**10.1**	**8.55**	**17**	**2**	**12**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	-	-	-	-	-	**0.47F**
Naphthalene	NS	140	700	16	**27.8**	**17.16**	**16**	**15.3**	**16.4**	**29**	**7.4**	**22**
n-Butylbenzene	NS	NS	NS	NS	**1.63F**	**1.18**	-	**0.82F**	**1.8F**	-	-	-
n-Propylbenzene	NS	NS	NS	4	**9.68**	**6.2**	**7.2**	**8.3**	**7.25**	**13**	**1.2**	**8.5**
p-Isopropyltoluene	NS	NS	NS	NS	**7.86F**	**3.4**	**6.5**	**2.55F**	**2.5F**	**7**	**2.9**	**4.1M**
sec-Butylbenzene	NS	NS	NS	4	**2.95F**	**1.88**	**2.6**	**1.8F**	**1.4F**	**3.9**	-	**2.1**
Tetrachloroethene	5	5	50	NS	-	-	-	-	-	-	-	**1.3**
Trichloroethene	5	5	5	NS	-	-	-	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well PW-3

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results				
					10/28/11	12/12/12	10/15/13	05/18/15	05/10/16
Total BTEX	NS	NS	NS	NS	**70.62F**	**8F**	**72.17**	**82.4**	**63**
Benzene	5	5	1,000	2	**0.74**	**-**	**0.77**	**2.8**	**3.6**
Toluene	1,000	1,000	50,000	99	**0.88F**	**-**	**0.4J**	**9.0**	**10**
Ethylbenzene	700	700	20,000	46	**16**	**0.38F**	**7.1M**	**8.6**	**16**
Xylenes	10,000	10,000	3,000	NS	**53**	**7.7**	**13R**	**62**	**33.4**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**43**	**7.4**	**29M**	**43**	**45**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**22**	**7.2**	**21M**	**19**	**18**
4-Isopropyltoluene	NS	NS	NS	NS	**-**	**-**	**1.4**	**1.4**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**0.45F**	**-**	**-**	**-**
Isopropylbenzene	NS	NS	NS	NS	**8.9**	**0.58F**	**7.4M**	**1.8**	**6**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	**-**	**-**	**-**
Naphthalene	NS	140	700	16	**19**	**4.4**	**14M**	**17**	**14**
n-Butylbenzene	NS	NS	NS	NS	**1.4**	**0.39F**	**1.2**	**-**	**-**
n-Propylbenzene	NS	NS	NS	4	**6.7**	**0.43F**	**6.4**	**1.3**	**4.3**
p-Isopropyltoluene	NS	NS	NS	NS	**-**	**0.71F**	**-**	**-**	**1.3**
sec-Butylbenzene	NS	NS	NS	4	**1.9**	**0.27**	**-**	**0.67J**	**1.1**
Tetrachloroethene	5	5	50	NS	**0.46F**	-	**-**	**-**	**-**
Trichloroethene	5	5	5	NS	**0.14F**	-	**-**	**-**	**-**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well PW-4

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results								
					RA-C BL 10/14/03	11/04/04	10/19/05	04/21/06	10/12/06	05/14/07	10/22/07	04/09/08	10/14/08
Total BTEX	NS	NS	NS	NS	**328.11F**	**690**	**435.1**	**844.3**	**700**	**190**	**42.1JF**	**99.5F**	**262.3**
Benzene	5	5	1,000	2	**2.97**	**5.19**	**2.1**	**7.5F**	**7.25F**	**4F**	**2.3J**	**3.8**	**11**
Toluene	1,000	1,000	50,000	99	**0.83F**	**3.95**	**23**	**3.75F**	-	-	-	**0.74F**	**1.9**
Ethylbenzene	700	700	20,000	46	**162.76**	**235.86**	**130**	**243**	**113**	**113**	**12.8**	**67**	**54**
Xylenes	10,000	10,000	3,000	NS	**161.55**	**446.96M**	**280**	**590**	**73F**	**73F**	**27F**	**28**	**195.4**
1,1,2-Trichloroethane	5	5	900	NS	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	**3.25F**	**3.25F**	-	-	-
1,2,3-Trichloropropane	NS	NS	NS	NS	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**93.41**	**134.83**	**180**	**244**	**233**	**203**	**130**	**150**	**180**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**19.27**	**25.28**	**39**	**42**	**39.2**	**5F**	**3.7F**	**1.5**	**45**
2-Butanone (MEK)	NS	NS	NS	NS	-	**1.5F**	-	-	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	-	-
4-Methyl-2-pentanone	NS	NS	NS	NS	-	-	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**17.99**	**30.17**	**27**	**32.2**	**37**	**28.3**	**25.7J**	**37**	**38**
Naphthalene	NS	140	700	16	**43.4**	**73.06**	**40**	**65.8**	**56.2**	**36.2**	**15**	**30**	**49**
n-Butylbenzene	NS	NS	NS	NS	**0.83F**	**1.84**	-	-	-	**5.25F**	**1.7F**	**1.6**	-
n-Propylbenzene	NS	NS	NS	4	**13.47**	**25.27**	**18**	**26.2**	**33.5**	**23.5F**	**22**	**31**	**29**
p-Isopropyltoluene	NS	NS	NS	NS	**3.61F**	**4.9**	**10**	-	**3.5F**	**15.8F**	**4.8J**	**8.8**	**9.7**
sec-Butylbenzene	NS	NS	NS	4	**1.93F**	**4.02**	**5**	-	**5.5F**	**7.5F**	**3.8F**	**7.1**	**7.9**
tert-Butylbenzene	NS	NS	NS	NS	**0.76F**	**1**	-	-	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well PW-4

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					04/16/09	11/17/09	04/22/10	11/10/10	04/25/11	10/28/11	04/16/12	12/12/12
Total BTEX	NS	NS	NS	NS	**76**	**2.96**	**90F**	**27.65F**	**126.9/127.9**	**2.29F**	**0.72**	**3.96**
Benzene	5	5	1,000	2	**4.1**	**0.67**	**0.61**	**1.1**	**2/2**	**0.32F**	**0.72**	**0.46**
Toluene	1,000	1,000	50,000	99	**4.5**	**0.14F**	**0.35F**	**0.25F**	**1.9/1.9**	-	-	-
Ethylbenzene	700	700	20,000	46	**36**	**0.32F**	**33**	**5.3**	**80/78**	**0.87F**	-	**1.4**
Xylenes	10,000	10,000	3,000	NS	**31.4**	**1.83F**	**56**	**21**	**43/46**	**1.1F**	-	**2.1**
1,1,2-Trichloroethane	5	5	900	NS	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**0.12F**	-	**0.15F**	-	**0.18J/<0.11UJ**	-	-	-
1,2,3-Trichloropropane	NS	NS	NS	NS	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**150**	**130**	**57**	**59**	**100/99**	**8.7M**	**0.55F**	**11**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**9.1**	**1.9**	-	**9.3**	**5.5/5.9**	**1.2**	-	**0.51F**
2-Butanone (MEK)	NS	NS	NS	NS	-	-	-	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
4-Methyl-2-pentanone	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**37**	**20**	**23**	**18**	**24/23**	**1.1**	**4.5**	**10**
Naphthalene	NS	140	700	16	**25**	**25**	**4.5**	**14**	**24/27**	**2.2**	**0.32F**	**2.8**
n-Butylbenzene	NS	NS	NS	NS	**1.4**	**0.98F**	**0.77F**	**0.86F**	**1/0.96F**	-	-	**0.4F**
n-Propylbenzene	NS	NS	NS	4	**28**	**18**	**18**	**14**	**18/17**	**0.43F**	**0.96F**	**4.6**
p-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	**1.3**
sec-Butylbenzene	NS	NS	NS	4	**6.7**	**5.5**	**4.5**	**4.4**	**4.3/4**	**0.24F**	**0.88F**	**2.9**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	**0.3F**	**0.48F**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well PW-4

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results				
					04/24/13	10/15/13	04/14/14	05/18/15	05/10/16
Total BTEX	NS	NS	NS	NS	-	**0.56**	-	**4.6J**	-
Benzene	5	5	1,000	2	**1.4**	**0.23J**	**0.68**	**0.77J**	-
Toluene	1,000	1,000	50,000	99	-	-	**0.21JF**	**0.20J**	-
Ethylbenzene	700	700	20,000	46	**4.8**	**0.33J**	**3.6**	**0.63J**	-
Xylenes	10,000	10,000	3,000	NS	**0.41F**	**0.27R**	**7.9R**	**3.0**	-
1,1,2-Trichloroethane	5	5	900	NS	-	**13**	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-
1,2,3-Trichloropropane	NS	NS	NS	NS	-	**0.32J**	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**0.43F**	**10**	**0.96JF**	**0.69J**	-
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**0.27J**	**0.17JF**	-	-
2-Butanone (MEK)	NS	NS	NS	NS	-	**44**	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	**0.18J**	-	-	-
4-Methyl-2-pentanone	NS	NS	NS	NS	-	**1.9J**	-	-	-
Acetone	NS	6,300	50,000	NS	-	**31**	-	-	-
Isopropylbenzene	NS	NS	NS	NS	**14**	**7.6**	**9**	**8.2**	-
Naphthalene	NS	140	700	16	**0.49F**	**1.8**	**0.48JF**	**0.69J**	-
n-Butylbenzene	NS	NS	NS	NS	-	**0.49J**	-	-	-
n-Propylbenzene	NS	NS	NS	4	-	**4.2**	**2.00**	**1.3**	-
p-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-
sec-Butylbenzene	NS	NS	NS	4	**2.2**	**2.4**	**1.8**	**1.2**	-
tert-Butylbenzene	NS	NS	NS	NS	**0.45F**	**1.5**	**0.41JF**	**0.31J**	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-1

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/14/03	10/20/05	10/10/06	10/23/07	10/15/08	11/16/09	11/08/10	11/02/11
Total BTEX	NS	NS	NS	NS	-	**53.72F**	**190**	**86.1**	**100.6**	**189**	**339.7/339.8**	**4.02F**
Benzene	5	5	1,000	2	-	**1.1**	**5.11**	**5.6J**	**3**	-	**7.7/7.8**	-
Toluene	1,000	1,000	50,000	99	-	**0.62F**	**2.38**	**2.7J**	**1.4**	**2**	**12/12**	**0.12F**
Ethylbenzene	700	700	20,000	46	-	**26**	**124**	**50.8**	**77**	**130**	**160/160**	**2.3**
Xylenes	10,000	10,000	3,000	NS	-	**26**	**59M**	**27**	**19.2**	**57**	**160/160**	**1.6F**
1,2-Dichlorobenzene	600	600	8,000	41	-	**350**	**284**	**85**	**120**	**1.0F**	**250/250**	**4.1**
1,2,3-Trichlorobenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	**3.2**	**2.53**	**1.7F**	**2.6**	**3.9**	**<1.4/3**	**0.67F**
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	**3.3**	**5.54**	**1.7F**	**4**	**12**	**10/9.4**	**0.14F**
1,3-Dichlorobenzene	NS	100	6,000	NS	-	**3.7**	**3.96**	**1.3F**	**1.7**	-	**3.1F/2.8**	-
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**2**	**0.81F**	**<0.13**	**1.3**	**2.9**	**3.3F/3.1**	-
1,4-Dichlorobenzene	75	5	60	14	-	**110**	**95.3**	**32.7**	**35**	**99**	**65/65**	**4.1**
2-Chlorotoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
4-Chlorotoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	**66**	**<0.823M**	**17.7F**	-	-	-	-
Carbon Tetrachloride	5	5	2	NS	-	-	-	-	-	-	-	-
Chlorobenzene	100	100	200	NS	-	**0.4F**	**<0.011**	**3.1J**	**0.81**	**2.3**	**8.5/11**	**4.1**
cis-1,2-Dichloroethene	70	70	20	5	-	-	-	-	-	-	-	-
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	-	**2.1J/<0.083UJ**	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**4F**	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	-	**0.59F**	**2.03**	-	**1.1**	**3.3**	**2F/2.1**	-
Naphthalene	NS	140	700	16	-	**4.2**	**15.9**	**4F**	**9.9**	**18**	**17/14**	-
n-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
p-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	**<1UJ/0.27J**	-
n-Propylbenzene	NS	NS	NS	4	-	**0.31F**	**1.2**	-	**0.76F**	**2.1**	**2.1J/1.5J**	-

Note: See last page of Table 4-1For table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-1

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results					
					12/13/12	04/25/13	10/14/13	04/14/14	05/20/15	05/11/16
Total BTEX	NS	NS	NS	NS	**352J**	-	-	-	**13.69J**	**2.22**
Benzene	5	5	1,000	2	**5.3J**	**0.16F**	**4.7**	-	**0.24J**	**-**
Toluene	1,000	1,000	50,000	99	**17J**	**0.25F**	**7**	**0.13JF**	**0.25J**	**-**
Ethylbenzene	700	700	20,000	46	**150**	**4.8**	**120**	**2.5**	**7.9**	**0.83J**
Xylenes	10,000	10,000	3,000	NS	**180**	**3.9**	**79R**	**1.8R**	**5.3**	**1.39J**
1,2-Dichlorobenzene	600	600	8,000	41	**170**	**11**	**94**	**5.1**	**6.7**	**3.8**
1,2,3-Trichlorobenzene	NS	NS	NS	NS	**0.24F**	-	-	-	**-**	**-**
1,2,4-Trichlorobenzene	70	70	200	4	**3.4**	**1**	**2.4**	**0.62JF**	**0.47J**	**-**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**8.7**	**0.34F**	**5**	-	**0.39J**	**-**
1,3-Dichlorobenzene	NS	100	6,000	NS	**3.1**	**0.46F**	**1.6**	**0.27JF**	**0.23J**	**-**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**2.7**	**0.12F**	**1.5**	-	**-**	**-**
1,4-Dichlorobenzene	75	5	60	14	**51**	**6.5**	**36**	**2.5**	**3.5**	**1.4**
2-Chlorotoluene	NS	NS	NS	NS	-	**0.16F**	**-**	-	**-**	**-**
4-Chlorotoluene	NS	NS	NS	NS	-	**0.18F**	**-**	-	**-**	**-**
4-Isopropyltoluene	NS	NS	NS	NS	-	**-**	**-**	-	**-**	**-**
Acetone	NS	6,300	50,000	NS	-	-	-	-	**9.1J**	**-**
Carbon Tetrachloride	5	5	2	NS	-	**0.19F**	**-**	-	**-**	**-**
Chlorobenzene	100	100	200	NS	**5.6**	**1.2**	**-**	**0.62**	**0.66J**	**-**
cis-1,2-Dichloroethene	70	70	20	5	-	-	-	-	**-**	**-**
Chloromethane	NS	NS	NS	NS	-	-	-	-	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	**-**	**0.42J**
Isopropylbenzene	NS	NS	NS	NS	**2**	**0.12F**	**1.5**	-	**-**	**-**
Naphthalene	NS	140	700	16	**12**	**0.72F**	**6.7**	-	**0.63J**	**-**
n-Butylbenzene	NS	NS	NS	NS	**-**	**-**	**-**	-	**-**	**-**
p-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	**-**	**-**
n-Propylbenzene	NS	NS	NS	4	**1.9**	-	**1.1**	-	**-**	**-**

Note: See last page of Table 4-1For table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-1A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/14/03	12/01/03	11/03/04	10/20/05	10/10/06	10/24/07	10/16/08	11/16/09
Total BTEX	NS	NS	NS	NS	-	**1500**	**210**	**172.5**	**21M**	**109.3/106.3**	**214.6**	**135.2FM**
Benzene	5	5	1,000	2	-	-	**0.24F**	**0.6**	**0.22F**	**0.3F/0.32F**	**0.32F**	**0.35F**
Toluene	1,000	1,000	50,000	99	-	**16**	**0.76F**	**4.9**	-	-	**0.11F**	**0.11F**
Ethylbenzene	700	700	20,000	46	-	**260**	**28.75**	**57**	**7.93**	**29/28**	**45**	**32M**
Xylenes	10,000	10,000	3,000	NS	-	**1200**	**182.4**	**110**	**13M**	**80/78**	**169.2**	**102.7**
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	**220**	**76.78**	**48**	**12.1**	**42.4/41.8**	**80**	**110**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**110**	**33.77**	**32**	**6.12**	**14.5/14**	**28**	**31M**
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	-	-	-
2-Butanone (MEK)	NS	NS	NS	NS	-	-	**4F**	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	**-**	**-**	**-**	-	-	-
4-Methyl-2-pentanone	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS								
Carbontetrachloride	5	NS	NS	NS	-	-	-	-	-	-	-	-
Chlorobenzene	100	100	200	NS	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	-	-	**0.23F**	-	-	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	**0.49F**	-	**0.22F/<0.068**	-	**-**
Isopropylbenzene	NS	NS	NS	NS	-	**26**	**3.35**	**8.5**	**2.63**	**5.78 / 5.7**	**10**	**19M**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	-	**1.8F**	**3.39F**	-	-	-
Naphthalene	NS	140	700	16	-	**50**	**30.82**	**19**	**6.88**	**22.2/22.9**	**34**	**57M**
n-Butylbenzene	NS	NS	NS	NS	-	-	**0.62F**	-	**0.16F**	**1.26F/1.22F**	-	-
n-Propylbenzene	NS	NS	NS	4	-	**19**	**2.79**	**7**	**2.08**	**5.12 / 5.16**	**9.6**	**14**
p-Isopropyltoluene	NS	NS	NS	NS	-	**13**	**5.04**	**9.6**	**0.58F**	**1.14F/1.04F**	**4.3**	**3.9**
sec-Butylbenzene	NS	NS	NS	4	-	**6J**	-	**1.5**	**0.44F**	**0.76F/0.76F**	**2.4**	-
tert-Butylbenzene	NS	NS	NS	NS	-	-	**0.71F**	-	**0.23F**	-	-	-
Trichloroethene	5	5	5	NS	-	-	**4.37**	**0.2F**	-	-	**0.13F**	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-1A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results					
					11/09/10	11/02/11	12/14/12	10/14/13	05/20/15	05/12/16
Total BTEX	NS	NS	NS	NS	**20.6J/20.95J**	**125.27J**	**1.57F**	**1.9**	**89J**	**48.8**
Benzene	5	5	1,000	2	**<0.53UJ/0.19J**	**0.15J**	-	-	**-**	**0.25J**
Toluene	1,000	1,000	50,000	99	**<0.27UJ/0.26J**	**0.12J**	-	-	**-**	**0.45J**
Ethylbenzene	700	700	20,000	46	**3.6F/3.5**	**31J**	**0.37F**	**1.9**	**14J**	**20**
Xylenes	10,000	10,000	3,000	NS	**17/17**	**94J**	**1.2F**	**0.69R**	**75**	**28.1J**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**21/19**	**110J**	**32**	**12**	**38**	**32**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**5.9/5.3**	**30J**	**1.2**	**0.86J**	**42**	**16**
1,2-Dichlorobenzene	600	600	8,000	41	-	**0.25J**	-	-	**-**	**-**
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	-	-	**-**	**-**
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	**-**	**-**
2-Butanone (MEK)	NS	NS	NS	NS	-	-	-	-	**-**	**-**
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	0.37J	**4.1J**	**-**
4-Methyl-2-pentanone	NS	NS	NS	NS	-	-	**2.3F**	**-**	**-**	**-**
Acetone	NS	6,300	50,000	NS						**62**
Carbontetrachloride	5	NS	NS	NS	-	-	-	-	**-**	**-**
Chlorobenzene	100	100	200	NS	-	-	-	-	**-**	**-**
cis-1,2-Dichloroethene	70	70	20	5	-	-	-	-	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**1.2J/<0.083UJ**	-	-	-	**-**	**0.46J**
Isopropylbenzene	NS	NS	NS	NS	-	-	**0.36F**	**4.1**	**5.1J**	**7.8**
Methyl Tert-butyl Ether	NS	70	50,000	NS	**11J/7.4J**	**18J**	**11**	**-**	**-**	**-**
Naphthalene	NS	140	700	16	-	-	-	9.7	**33**	**25J**
n-Butylbenzene	NS	NS	NS	NS	**18J/12J**	**53J**	**35**	**0.6J**		**1.1**
n-Propylbenzene	NS	NS	NS	4	**<0.5UJ/1.3J**	**2.5J**	**0.74F**	**3.6**	**3.5J**	**7.5**
p-Isopropyltoluene	NS	NS	NS	NS	**7.1J/4.7J**	**14J**	**10**	**-**	**-**	**3**
sec-Butylbenzene	NS	NS	NS	4	**<0.42UJ/4.1J**	**2.7J**	**0.53F**	**0.66J**	**3.4J**	**2**
tert-Butylbenzene	NS	NS	NS	NS	**5.5J/2.6J**	**3.8J**	**2**	**-**	**-**	**-**
Trichloroethene	5	5	5	NS	-	**0.11J**	**0.36F**		**-**	**-**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-5A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results				
					12/01/03	11/03/04	10/10/06	11/09/15	05/12/16
Total BTEX	NS	NS	NS	NS	-	-	-	-	-
Benzene	5	5	1,000	2	-	-	-	-	-
Toluene	1,000	1,000	50,000	99	-	-	-	-	-
Ethylbenzene	700	700	20,000	46	-	-	-	-	-
Xylenes	10,000	10,000	3,000	NS	-	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	-	**0.16J**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	-	-	-	-	-
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-
2-Butanone (MEK)	NS	NS	NS	NS	-	-	-	-	-
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-
4-Methyl-2-pentanone	NS	NS	NS	NS	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	**1.33M**	-	
Carbontetrachloride	5	NS	NS	NS	-	-	-	-	-
Chlorobenzene	100	100	200	NS	-	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	-	**0.24**	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**4**	-	-	-	**0.34J**
Isopropylbenzene	NS	NS	NS	NS	-	-	-	-	-
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	**0.11F**	-	-	-
Naphthalene	NS	140	700	16	-	-	-	-	**0.77J**
n-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-
n-Propylbenzene	NS	NS	NS	4	-	-	-	-	-
p-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-
sec-Butylbenzene	NS	NS	NS	4	-	-	-	-	-
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-
Trichloroethene	5	5	5	NS	**2**	**3.4**	**1.23**	**-**	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-6A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/14/2003	12/01/03	11/03/04	10/20/05	10/10/06	04/22/10	04/25/11	11/02/11
Total BTEX	NS	NS	NS	NS	-	-	-	-	-	-	**0.23F**	**0.15J**
1,1,2,2-Tetrachloroethane	NS	2	9	NS	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	5	5	900	NS	-	-	-	-	-	-	-	-
Trichloroethene	5	5	5	NS	-	**50**	**65.5**	**48**	**100**	**76J**	**0.23F**	**77J**
1,1-Dichloroethane	NS	70	2,000	NS	-	-	**0.23F**	-	**0.26F**	**0.11F**	-	**0.11J**
1,1-Dichloroethene	7	7	80	NS	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	NS	NS	NS	NS	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	-	-	**5.58**	**4.8**	**1.34F**	**8.1J**	-	**0.36J**
1,2-Dichloroethane	5	5	5	NS	-	-	**0.14F**	-	**0.2F**	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	**0.12F**	-	-	**0.47F**	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	**0.21F**	-	-	**0.12F**	-
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	**0.1F**	-	**0.26F**	-	-	-
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**0.5J**	-	-	-	**2.0J**	-	-
1,4-Dichlorobenzene	75	5	60	14	-	-	**1.98**	**1.1**	**0.98F**	**7.6F**	**-**	**-**
4-Methyl-2-pentanone	NS	NS	NS	NS	-	-	-	-	-	-	**-**	**-**
Acetone	NS	6,300	50,000	NS	-	-	-	-	**6.14 M**	**0.77**	-	**0.79J**
Chloroform	NS	70	50	NS	-	-	**0.22F**	**0.53**	**0.58F**	**0.26F**	-	-
Chlorobenzene	100	100	200	NS	-	-	**0.23F**	-	-	**9.4**	-	**5.3J**
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	-	**1**	**1.93**	**2.6**	**5.22**	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	**0.73F**	-	-	-	-
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	**0.2F**	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Naphthalene	NS	140	700	16	-	-	-	**0.77F**	-	**0.062F**	-	-
n-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
sec-Butylbenzene	NS	NS	NS	4	-	-	-	-	-	-	-	-
tert-Butylbenzene	NS	NS	NS	NS	-	**0.6 J**	-	-	-	-	-	-
trans-1,2-Dichloroethene	100	100	80	NS	-	-	-	-	**0.54F**	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-6A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					04/17/12	12/14/12	04/25/13	04/25/13	04/14/14	05/20/15	11/09/15	05/12/16
Total BTEX	NS	NS	NS	NS	-	-	-	-	-	**0.41J**	-	-
1,1,2,2-Tetrachloroethane	NS	2	9	NS	-	-	**0.16F**	-	-	-	-	-
1,1,2-Trichloroethane	5	5	900	NS	-	-	**29**	-	-	-	-	-
Trichloroethene	5	5	5	NS	**140**	**340**	**160**	**180**	**31**	**17**	**3.9**	**22**
1,1-Dichloroethane	NS	70	2,000	NS	**0.22F**	**0.39F**	**0.19F**	**0.22J**	-	-	-	-
1,1-Dichloroethene	7	7	80	NS	**0.12F**	**0.18F**	**0.12F**	-	-	-	-	-
1,2,3-Trichloropropane	NS	NS	NS	NS	-	-	**0.53F**	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**5.4**	**3.6**	**2.7**	**1.9**	**2.3**	**0.82J**	-	-
1,2-Dichloroethane	5	5	5	NS	-	**1.3**	**0.49F**	-	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	**0.29F**	**0.48F**	**0.26F**	**0.18J**	-	-	-	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	**1.2**	-	-	-	-	-
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	**2.2**	**1.5**	**1.2**	**0.94**	-	**0.38J**	-	-
4-Methyl-2-pentanone	NS	NS	NS	NS	-	-	**5.0F**	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	-	-	-	**6.8J**	**6J**	-
Chloroform	NS	70	50	NS	**0.69**	**0.98**	**0.64**	**0.58**	**0.36**	**7.2**	**0.19J**	**0.61J**
Chlorobenzene	100	100	200	NS	**0.21F**	**0.16F**	**0.11F**	-	-	-	-	-
Chloromethane	NS	NS	NS	NS	-	**0.16F**	-	-	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	**15**	**18**	**11**	**13**	**0.93JF**	**0.50J**	**0.26J**	**0.24J**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**0.47F**	-	-	-	-	-	**0.38J**
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	-	-	-	-	-	-	-
Isopropylbenzene	NS	NS	NS	NS	-	-	**0.21F**	-	-	-	-	-
Naphthalene	NS	140	700	16	-	**1.3**	**0.26F**	-	-	-	-	-
n-Butylbenzene	NS	NS	NS	NS	-	-	**0.21F**	-	-	-	-	-
sec-Butylbenzene	NS	NS	NS	4	**0.27F**	**0.85F**	**0.95F**	-	-	-	-	-
tert-Butylbenzene	NS	NS	NS	NS	**0.26F**	**0.22F**	**0.33F**	**0.2J**	-	-	-	-
trans-1,2-Dichloroethene	100	100	80	NS	-	**0.17F**	-	-	-	-	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-7A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					RA-C BL 10/14/03	12/01/03	11/03/04	10/20/05	10/10/06	04/17/12	12/13/12
Total BTEX	NS	NS	NS	NS	-	-	-	-	-	-	-
1,1,1-Trichloroethane	200	200	4,000	NS	-	-	**0.13F**	**0.21F/0.21F**	-	**0.08F**	-
1,1-Dichloroethane	NS	70	2,000	NS	-	-	**0.51F**	**0.31F/0.3F**	**0.28F**	**0.4F**	**0.29F**
1,2-Dichlorobenzene	600	600	8,000	41	-	**1J**	**2.3**	**2.2/2.4**	**0.3F**	**3.4**	**0.37F**
1,2-Dichloroethane	5	5	5	NS	-	-	**0.24F**	-	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	**0.16F**	**0.26F/<0.26**	-	-	**0.22F**
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	**0.26F**	-	**0.38F**	**0.87**	**0.14F**
1,4-Dichlorobenzene	75	5	60	14	-	**0.7J**	**0.32F**	**0.39F/0.46F**	-	**6.3F**	-
2-Butanone (MEK)	NS	NS	NS	NS	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	**1.2F**	**27/26**	**2.44M**	-	-
Chlorobenzene	100	100	200	NS	-	-	**0.33F**	-	-	**1.6**	**1.8**
Chloroform	NS	70	50	NS	-	-	**1.02**	**0.72/0.7**	**1.18**	**6.6**	**5.6**
cis-1,2-Dichloroethene	70	70	20	5	-	**1**	**2.74**	**2/2.1**	**4.02**	**0.58F**	**0.33F**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	**0.6F/0.55F**	-	-	-
Tetrachloroethene	5	5	50	NS	-	-	-	-	-	-	-
Trichloroethene	5	5	5	NS	-	**20**	**50.46**	**46/45**	**76.6**	**120**	**110**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-7A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results					
					04/25/13	10/14/13	04/14/14	05/20/15	11/09/15	05/12/16
Total BTEX	NS	NS	NS	NS	-	-	-	-	-	-
1,1,1-Trichloroethane	200	200	4,000	NS	**0.13F**	-	**0.53JF**	-	-	**0.77J**
1,1-Dichloroethane	NS	70	2,000	NS	**0.25F**	**0.27J**	**0.45JF**	**0.36J**	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**0.71F**	**0.21F**	**1.7**	**0.20J**	**0.26J/0.3J**	-
1,2-Dichloroethane	5	5	5	NS	**0.18F**	-	**0.4JF**	-	-	-
1,2,4-Trichlorobenzene	70	70	200	4	-	-	-	-	-	-
1,3-Dichlorobenzene	NS	100	6,000	NS	-	-	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	**0.22F**	-	**0.64**	**0.21J**	-	-
2-Butanone (MEK)	NS	NS	NS	NS	-	-	-	-	**9J/12J**	-
Acetone	NS	6,300	50,000	NS	-	-	-	**7.1J**	**47J/61J**	-
Chlorobenzene	100	100	200	NS	-	-	-	-	-	-
Chloroform	NS	70	50	NS	**1.1**	**1.6**	**1.9**	**1.6**	**0.83J/0.93J**	**0.81J**
cis-1,2-Dichloroethene	70	70	20	5	**2.5**	**4.8**	**5.6**	**7.3**	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	-	-	**0.34J**
Tetrachloroethene	5	5	50	NS	-	-	-	-	**0.43J/0.53J**	**1.9**
Trichloroethene	5	5	5	NS	**95**	**130**	**160**	**200**	**4J/3.5J**	**56**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-11A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results						
					RA-C BL 10/14/03	11/08/10	04/25/11	11/02/11	04/17/12	12/13/12	04/25/13
Total BTEX	NS	NS	NS	NS	-	**102.5F**	**195**	**152F**	**154**	**117**	-
Benzene	5	5	1,000	2	-	-	-	-	-	-	**0.35F**
Toluene	1,000	1,000	50,000	99	-	**7.5F**	**40**	**18F**	**14**	**12F**	**4.7**
Ethylbenzene	700	700	20,000	46	-	**45**	**56**	**55**	**57**	**47F**	**12**
Xylenes	10,000	10,000	3,000	NS	-	**50F**	**99**	**79F**	**83**	**58F**	**18**
1,1-Dichloroethene	7	7	80	NS	-	-	-	-	-	-	**0.15F**
1,2-Dichlorobenzene	600	600	8,000	41	-	**5,300**	**8,400**	**8,000**	**8,300**	**9,600**	**2,500**
1,2,3-Trichlorobenzene	NS	NS	NS	NS	-	-	-	-	**2.5**	-	**1.7**
1,2,4-Trichlorobenzene	70	70	200	4	-	**63**	**97**	**64**	**66**	**80**	**73**
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	**11F**	**11F**	**12F**	**12**	**16F**	**5.2**
1,3-Dichlorobenzene	NS	100	6,000	NS	-	**42**	**69**	**71**	**66**	**84**	**29**
1,3,5-Trimethylbenzene	NS	NS	NS	22	-	**9F**	**9.1F**	**7.6F**	**5.7**	**9.8F**	**4**
1,4-Dichlorobenzene	75	5	60	14	-	**1,200**	**2,100**	**2,100**	**2,200**	**2,200**	**830**
4-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	-	-	**0.21F**
4-Methyl-2-pentanone	NS	NS	NS	NS	-	-	-	-	-	-	-
Acetone	NS	6,300	50,000	NS	-	-	-	-	-	-	**4.8F**
Carbon Tetrachloride	5	5	2	NS	-	-	**14F**	-	-	-	**2.2**
Chlorobenzene	100	100	200	NS	-	**300**	**260**	**200**	**180**	**180**	**95**
Chloroform	NS	70	50	NS	-	**24**	**47**	**63**	**65**	**48**	**4.7**
cis-1,2-Dichloroethene	70	70	20	5	-	-	-	-	**0.96F**	-	**1.5**
Chloroethane	NS	NS	NS	NS	-	-	-	-	**2.4**	-	**0.15F**
Chloromethane	NS	NS	NS	NS	-	**3.5F**	-	-	-	-	-
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**12F**	-	-	-	**65F**	-
Isopropylbenzene	NS	NS	NS	NS	-	**5.5F**	**6.8F**	**5F**	**6**	-	**1.9**
n-Butylbenzene	NS	NS	NS	NS	-	-	-	-	-	-	**0.57F**
Naphthalene	NS	140	700	16	-	-	-	-	**16**	**47F**	**3.7**
p-Isopropyltoluene	NS	NS	NS	NS	-	-	-	-	**0.23F**	-	-
n-Propylbenzene	NS	NS	NS	4	-	-	-	-	**2**	-	**0.76F**
sec-Butylbenzene	NS	NS	NS	4	-	-	-	-	**0.65F**	-	**0.51F**
tert-Butylbenzene	NS	NS	NS	NS	-	-	-	-	**0.14F**	-	-
Tetrachloroethene	5	5	50	NS	-	-	-	-	**1.4**	-	**0.74F**
Trichloroethene	5	5	5	NS	-	-	-	-	**1.9**	-	**0.77F**
Vinyl chloride	2	2	2	NS	-	-	-	-	-	-	**1.3**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Monitoring Well RW-11A

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results			
					10/14/13	04/14/14	05/20/15	05/11/16
Total BTEX	NS	NS	NS	NS	**10.4**	**-**	**43.4J**	**2.54**
Benzene	5	5	1,000	2	**-**	**-**	**-**	**-**
Toluene	1,000	1,000	50,000	99	**2J**	**16**	**3.8J**	**-**
Ethylbenzene	700	700	20,000	46	**8.4J**	**51**	**19J**	**0.96J**
Xylenes	10,000	10,000	3,000	NS	**17R**	**55R**	**20.6J**	**1.58J**
1,1-Dichloroethene	7	7	80	NS	**-**	**-**	**-**	**-**
1,2-Dichlorobenzene	600	600	8,000	41	**2,100**	**6,800**	**3,200**	**560**
1,2,3-Trichlorobenzene	NS	NS	NS	NS	**1.9J**	**2.6JF**	**-**	**1.1J**
1,2,4-Trichlorobenzene	70	70	200	4	**45**	**79**	**70**	**25**
1,2,4-Trimethylbenzene	NS	NS	NS	21	**4.6J**	**13**	**5.8J**	**1.2J**
1,3-Dichlorobenzene	NS	100	6,000	NS	**29**	**69**	**37**	**8.8**
1,3,5-Trimethylbenzene	NS	NS	NS	22	**3.7J**	**7.3JF**	**4.0J**	**0.82J**
1,4-Dichlorobenzene	75	5	60	14	**710**	**2,000**	**1,100**	**120**
4-Isopropyltoluene	NS	NS	NS	NS	**-**	**-**	**-**	**-**
4-Methyl-2-pentanone	NS	NS	NS	NS	-	**13JF**	**-**	**-**
Acetone	NS	6,300	50,000	NS	**-**	**-**	**-**	**15J**
Carbon Tetrachloride	5	5	2	NS	**-**	**5.2JF**	**-**	**-**
Chlorobenzene	100	100	200	NS	**110**	**180**	**140**	**45**
Chloroform	NS	70	50	NS	**8.0**	**35.0**	**8.1J**	**-**
cis-1,2-Dichloroethene	70	70	20	5	**1.7J**	**-**	**-**	**0.47J**
Chloroethane	NS	NS	NS	NS	**-**	**-**	**-**	**-**
Chloromethane	NS	NS	NS	NS	**-**	**-**	**-**	**-**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**-**	**-**	**-**	**1.2J**
Isopropylbenzene	NS	NS	NS	NS	**-**	**5.6JF**	**-**	**-**
n-Butylbenzene	NS	NS	NS	NS	**-**	**-**	**-**	**-**
Naphthalene	NS	140	700	16	**4.9J**	**13**	**5.3J**	**0.7J**
p-Isopropyltoluene	NS	NS	NS	NS	**-**	**-**	**-**	**-**
n-Propylbenzene	NS	NS	NS	4	**-**	**2.1JF**	**-**	**-**
sec-Butylbenzene	NS	NS	NS	4	**6.0J**	**-**	**-**	**-**
tert-Butylbenzene	NS	NS	NS	NS	**-**	**1.8JF**	**-**	**-**
Tetrachloroethene	5	5	50	NS	**-**	**-**	**-**	**-**
Trichloroethene	5	5	5	NS	**-**	**1.6JF**	**-**	**-**
Vinyl chloride	2	2	2	NS	**3.0J**	**-**	**-**	**0.32J**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Shawsheen River Stream Gauge (SG-3)

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					RA-C BL 10/16/03	01/05/04	04/21/04	11/04/04	04/26/05	10/20/05	04/21/06	10/11/06
Total BTEX	NS	NS	NS	NS	-	-	-	-	**0.2F**	-	-	-
Toluene	1,000	1,000	50,000	99	-	-	-	-	-	-	-	-
Xylenes	10,000	10,000	3,000	NS	-	-	-	-	**0.2F**	-	-	-
1,1-Dichloroethene	7	7	80	NS	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	-	-	**0.022F**	**0.34F**	-	-	**0.12F**	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	75	5	60	14	-	-	**0.13F**	**0.14F**	-	**2.3F**	-	-
2-Butanone (MEK)	NS	NS	NS	NS	-	-	**0.3F**	**5.4F**	**6.0F**	**8.7F**	-	**1.22F**
Acetone	NS	6,300	50,000	NS	-	-	**8.4F**	**9.1F**	**10.3**	**0.78F**	**18.3**	**3.16M**
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	70	70	20	5	**0.7F**	**0.8J**	**0.77F**	**0.88F**	**0.67F**	**0.48F**	**0.86F**	**0.9F**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**0.1F**	-	-	-	-	**0.62F**	-	-
Methyl Tert-butyl Ether	NS	70	50,000	NS	-	**1J**	**2.11F**	**2.28F**	**0.7F**	**0.3F**	**0.58F**	**0.76F**
m/p-Xylene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Naphthalene	NS	140	700	16	-	-	-	-	-	-	-	-
Trichloroethene	5	5	5	NS	**0.3F**	-	**0.34F**	**0.44F**	**0.25F**	-	**0.5F**	**0.29F**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Shawsheen River Stream Gauge (SG-3)

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					05/14/07	10/22/07	04/09/08	10/14/08	04/16/09	11/17/09	04/22/10	11/09/10
Total BTEX	NS	NS	NS	NS	-	-	-	-	-	**0.15F**	**0.071F**	**0.258F**
Toluene	1,000	1,000	50,000	99	-	-	-	-	-	**0.15F**	**0.071F**	**0.088F**
Xylenes	10,000	10,000	3,000	NS	-	-	-	-	-	-	-	**0.17F**
1,1-Dichloroethene	7	7	80	NS	-	-	-	-	**0.19F**	-	-	-
1,2-Dichlorobenzene	600	600	8,000	41	**0.1F**	-	-	**0.11F**	-	**0.26F**	**0.13F**	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	-	**0.20F**	-	-	**0.21F**
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	-	-	-
2-Butanone (MEK)	NS	NS	NS	NS	-	-	**5F**	**4.6F**	**57**	-	-	-
Acetone	NS	6,300	50,000	NS	**4.69F**	**3.94F**	-	**34**	**8.7F**	-	**4.2F**	**5.6F**
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	-	-	**0.13F**
cis-1,2-Dichloroethene	70	70	20	5	**0.8F**	**0.73F**	**0.8F**	**0.84F**	**0.82F**	**0.60F**	**0.54F**	**0.18F**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	**0.22F**	-	-	-	**0.44FB**	-	-
Methyl Tert-butyl Ether	NS	70	50,000	NS	**0.95F**	**0.45F**	**0.27F**	**0.27F**	-	-	-	-
m/p-Xylene	NS	NS	NS	NS	-	-	-	-	-	-	-	-
Naphthalene	NS	140	700	16	**0.26F**	-		-	-	-	-	**0.78F**
Trichloroethene	5	5	5	NS	**0.24F**	**0.19R**	-	-	**0.018F**	**0.11F**	-	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Shawsheen River Stream Gauge (SG-3)

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results							
					04/25/11	11/02/11	04/16/12	12/14/12	Date Unknown	04/24/13	10/14/13	04/14/14
Total BTEX	NS	NS	NS	NS	-	**0.35F**	**0.39F**	**0.32F**	-	-	-	**-**
Toluene	1,000	1,000	50,000	99	-	**0.19F**	**0.26F**	**0.18F**	-	-	-	**-**
Xylenes	10,000	10,000	3,000	NS	-	**0.16F**	**0.13F**	**0.14F**	-	**0.11F**	**0.11R**	**0.16R**
1,1-Dichloroethene	7	7	80	NS	**0.1F**	-	**0.16F**	-	**0.15F**	-	-	**-**
1,2-Dichlorobenzene	600	600	8,000	41	-	**0.16F**	-	**0.13F**	-	-	-	**-**
1,2,4-Trimethylbenzene	NS	NS	NS	21	-	-	-	-	-	-	-	**-**
1,4-Dichlorobenzene	75	5	60	14	-	-	-	-	-	-	-	**-**
2-Butanone (MEK)	NS	NS	NS	NS	-	-	-	**2.6F**	-	-	-	**1.9JF**
Acetone	NS	6,300	50,000	NS	**4.69F**	-	**5.1F**	**8.9F**	**10**	-	-	**8.8JF**
Chloromethane	NS	NS	NS	NS	-	-	-	-	-	-	-	**-**
cis-1,2-Dichloroethene	70	70	20	5	**0.8F**	**0.75F**	**0.46F**	**0.55F**	**0.64F**	**0.47F**	**1.4**	**0.57JF**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	-	-	-	**0.32F**	**0.31F**	-	-	**-**
Methyl Tert-butyl Ether	NS	70	50,000	NS	**0.95F**	-	-	-	-	-	-	**-**
m/p-Xylene	NS	NS	NS	NS	-	-	-	-		-	-	**0.16JF**
Naphthalene	NS	140	700	16	**0.26F**	**1.4**	-	-	-	-	-	**-**
Trichloroethene	5	5	5	NS	**0.24F**	**0.28F**	-	-	-	-	-	**-**

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

Shawsheen River Stream Gauge (SG-3)

Analyte (µg/L)	USEPA MCLs[1] (µg/L)	MCP GW-1 Standards[2] (µg/L)	MCP GW-2 Standards[2] (µg/L)	RBRGs[3] (µg/L)	Analytical Results	
					05/21/15	05/10/16
Total BTEX	NS	NS	NS	NS	**-**	**-**
Toluene	1,000	1,000	50,000	99	**-**	-
Xylenes	10,000	10,000	3,000	NS	**-**	**-**
1,1-Dichloroethene	7	7	80	NS	**-**	-
1,2-Dichlorobenzene	600	600	8,000	41	**-**	-
1,2,4-Trimethylbenzene	NS	NS	NS	21	**-**	-
1,4-Dichlorobenzene	75	5	60	14	**-**	-
2-Butanone (MEK)	NS	NS	NS	NS	**-**	-
Acetone	NS	6,300	50,000	NS	**15**	**5.6J**
Chloromethane	NS	NS	NS	NS	**-**	-
cis-1,2-Dichloroethene	70	70	20	5	**0.63J**	**0.59J**
Dichloromethane (Methylene Chloride)	5	5	2,000	NS	**-**	-
Methyl Tert-butyl Ether	NS	70	50,000	NS	**-**	-
m/p-Xylene	NS	NS	NS	NS	**-**	-
Naphthalene	NS	140	700	16	**-**	-
Trichloroethene	5	5	5	NS	**-**	-

Note: See last page of Table 4-1 for table notes, qualifier definitions and acronyms.

Table 4-1
SUMMARY OF HISTORICAL AND CURRENT VOLATILE ORGANIC COMPOUND ANALYTICAL DATA
Site 21, Hanscom Air Force Base, Massachusetts
May 2016 Long-Term Monitoring Event

TABLE NOTES:

[1] National Primary Drinking Water Standards, United States Enironmental Protection Agency Maximum Contaminant Levels, May 2016.

[2] Current Massachusetts Contingency Plan Method 1 Groundwater Standards 310 CMR 40.0974(2): Table 1++, GW-1 & GW-2 Standards (Accessed at http://www.mass.gov/eea/agencies/massdep/cleanup/regulations/mcp-method-1-groundwater-standards.html, on 15 August 2016).

[3] Risk-based Site Remediation Goals (RBRG) from the Record of Decision (ROD), Operable Unit 3 (OU-3)/Installation Restoration Program Site 21, October 2001.

1. Summary tables only include compounds with concentrations above the approximate sample quantification or detection limit.
2. Detections noted in bold.
3. Results shaded in gray indicate an exceedance of one or more of the groundwater standards. Gray shading for historical data represents exceedances of one or more groundwater standards at the time the data were reported. Historical exceedances are shaded in accordance with the standards applicable at the time the data were reported.
4. If no result indicated, either the sample was below the detection level or not analyzed.
5. Since 2000, groundwater samples have been collected using a modified low-flow sampling method with a peristaltic pump. Post-1999 analytical results reported above should be considered "minimum" concentrations and non-detect data considered "estimated".
6. For samples where a field duplicate was analyzed, both detected values are shown separated with a slash.

DATA QUALIFIERS:

B: Compound was detected in an associate laboratory and/or field blank. Reported concentration not substantially above level reported in laboratory or field blanks and may be due to laboratory contamination
E: Estimated (value exceeds the calibration range)
F: Result between method detection limit (MDL) and reporting limit (RL)
J: Estimated value
L: Estimated value is below the calibration range
M: A matrix effect is present
R: Rejected

ACRONYMS/ABBREVIATIONS:

BTEX = Combined total of benzene, toluene, ethylbenzene, and xylenes; USEPA = United States Environmental Protection Agency; GW-1/GW-2 = Massachusetts Contingency Plan Groundwater Classifications; IRA = Interim Remedial Action; LNAPL = Light Non-Aqueous Phase Liquid; LTM/LTMP = Long-term Monitoring/Long-term Monitoring Plan; MCL = Maximum Contaminant Level; MCP = Massachusetts Contingency Plan; NA = not analyzed; ND = not detected; NS = no regulatory standard; O&M = Operation and Maintenance; RA-C BL = Remedial Action-Construction Baseline Sampling Event; RBRG = Risk-based Remediation Goal; RI/SRI = Remedial Investigation/Supplemental Remedial Investigation; vic. = vicinity; VOC = volatile organic compound; < = compound not detected at specified limit

ATTACHMENT G

LAND USE CONTROLS/INSTITUTIONAL CONTROLS (LUCs/ICs) DOCUMENTATION

G-1 – Key excerpts from the March 2017 Installation Development Plan for Hanscom AFB that pertain to LUCs/ICs.

G-2 – Town of Bedford Conservation Commission's letter to the Hanscom AFB IRP Manager dated July 27, 2007, Subject: Hartwell Town Forest and Jordan Conservation Area

G-3 – Hanscom AFB Environmental Office Memorandum to the USEPA, Region I dated 4 September 2008, Subject: Land Use Controls including Institutional Controls (LUCs/ICs) for Operable Unit 1 (OU-1) at the Hanscom Field/Hanscom AFB NPL Site

G-3-1 – Enclosure to Attachment G-3 - Bedford Town Manager Letter to the Hanscom AFB Environmental Director dated 24 July 2008, which discusses restrictions on the land use and the use of groundwater by the Town of Bedford in off-base areas of contamination

3.3 PLANNING CONSTRAINTS

Table 3.2 // HAFB Development Impacts

(RED) Major constraint: Certain types of development prohibited in affected areas	Total: 0
(YELLOW) Minor constraint: Development permitted in affected areas with consideration/mitigation	Total: 9
(GREEN) No constraint: Development permitted in affected areas with consideration/mitigation	Total: 3
Operational	Rating
Air Installation Compatible Use Zones	
Airfield and Airspace Clearance	
Operational Constraints	
Environmental	Rating
Cultural Resources	
Natural Resources	
Environmental Restoration, Quality & Munitions Response Programs	
Hazard and Non Hazardous Waste and Material	
Flood Analysis and Management	
Built	Rating
Electromagnetic Radiation Sources	
AT/FP (Force Protection Siting Criteria)	
Explosive Safety Quantity-Distance Arcs	
Fuel and Chemical Storage Tanks	

ON-BASE PLANNING CONSTRAINTS

Minor constraints to future development include:

- Airfield Clearance and Noise Contours
- Antiterrorism/Force Protection (AT/FP) Standards
- Natural Resources
- Cultural Resources (Archaeological sites and historic building areas)
- Explosive Safety Quantity-Distance Arcs
- Environmental Restoration, Quality & Munitions Response Programs (ERP Sites)
- Hazard and Non Hazardous Waste and Material
- Fuel and Chemical Storage Tanks

Constraints that do not impact future development include:

- Operational Constraints (Surface Danger Zones)
- Flood Analysis Management
- Electromagnetic Radiation Safety Zones

Planning constraints are man-made or natural elements that may create significant limitations on the operation or construction of buildings, roadways, utility systems, airfields, training ranges, and other facilities. These constraints, when considered collectively with the Installation's capacity opportunities, will identify areas open for development and those areas that can be redeveloped to support future growth or mission expansion.

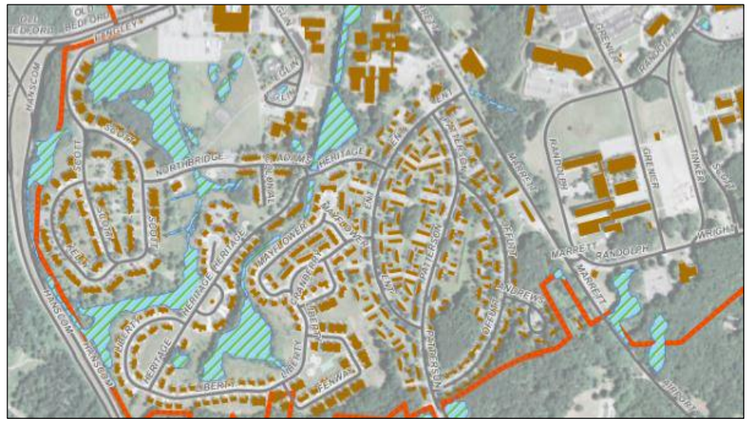
The identification of planning constraints at HAFB integrates a multitude of considerations, such as natural and cultural resources information, environmental quality issues, airspace restrictions, operational safety requirements, the built environment, and other factors that influence facility site planning on the Installation. This information is critical when beginning to identify land for mission redevelopment, expansion, or new mission acceptance.

There are minor constraints to future development at the Installation that limit the location, intensity, or form of future development. These constraints can be an influential factor in establishing the future pattern of development at HAFB.

Figure 3.5
Operational Constraints Snapshot

For greater detail, see contraints maps in Chapter 6, Planning Constraints

Figure 3.6
Natural Resource Constraints Snapshot



For greater detail, see contraints maps in Chapter 6, Planning Constraints

3.7 PLAN IMPLEMENTATION

Plan implementation outlines proposed unit moves, facility consolidation opportunities, and new construction projects identified during interviews with the 66 ABG and specific units, facility tours, and from other resources. All approved and proposed projects contained within this IDP are listed based on their current status, funding, and urgency as it is understood today. Until each project has been approved and assigned a priority rating by the Installation, the plan cannot be implemented. Table 3.7 summarizes the short-, mid-, and long-range projects of the Capital Improvements Plan.

3.7.1 SHORT-RANGE DEVELOPMENT PLAN (1-5 YEARS)

The Short-Range Development Plan focuses primarily on those projects currently being pursued by the Installation with limited Military Construction (MILCON) funds within the upcoming five years. Many of the projects are related to space or mission optimization and/or consolidation. Projects in the Short-Range Plan may potentially slip into the Mid-Range Plan based on mission requirements and/or available funding. Short-Range projects are identified with green dots in Figure 3.12.

3.7.2 MID-RANGE DEVELOPMENT PLAN (6-10 YEARS)

The Mid-Range Development Plan consists primarily of projects being pursued by the Installation within the next 6-10 years. These projects are likely to receive funding based on their identified requirements. Use of limited MILCON, Unspecified Minor Military Construction (UMMC), or Sustainment, Restoration, and Modernization (SRM) dollars is anticipated, although this IDP focuses attention on identified MILCON projects. Mid-Range projects are identified with yellos dots in Figure 3.12.

3.7.3 LONG-RANGE DEVELOPMENT PLAN (11+ YEARS)

The Long-Range Development Plan consists primarily of projects to be pursued by the Installation 11+ years out. The use of MILCON funding is specifically targeted for these projects. Long-Range Projects are identified with orange dots in Figure 3.12.

Table 3.7 // Capital Improvements Plan – Short-, Mid-, and Long-Range

Map ID	Type of Project	Plan Range	Project #	Description	Planning District	Alignment
A1	Airfield Pavement	Short-Range	N/A	Repave section of airfield pavement inside HAFB boundary, around Hangar B1715	Base Support	G4, O4.4
E1	Energy	Short-Range	N/A	Construct Combined Heat and Power (CHP) facility (addition to B201)	Base Support	G1, O1.3
E2	Energy	Short-Range	N/A	Install Photovotaic Arrays	Base Support	G1, O1.1 G1, O1.2
F1	Facility	Short-Range	MXRD 07-3000	Construct System Management Engineering Facility (SMEF) (addition to B1604). Demolish B1600 & B1729 and construct new parking lot	Acquisition	G2, O2.1 G3, O3.3
F2	Facility	Short-Range	MXRD 06-3004	Add/Alt to Fire Station (B1721)	Base Support	G4, O4.1 G4, O4.2
F3	Facility	Short-Range	MXRD 15-3006	Construct MIT/LL Compound Semiconductor Laboratory Microsystems Integration Facility (CSL-MIF)	MIT/LL	G3, O3.3
F4	Facility	Short-Range	MXRD 08-3002	Construct new dormitory. Demolish B1511 and 1510 and relocate billeting to new dorm	Acquisition	G2, O2.1 G3, O3.3 G3, O3.4
F5	Facility	Short-Range	MXRD 13-3000 MXRD 14-3000	Relocate all children to permanent elementary and middle schools. Remove temporary school	Education	G3, O3.1 G3, O3.3
F6	Facility	Short-Range	N/A	Upgrade MIT/LL Hangar B1720	MIT/LL	G3, O3.3
F7	Facillity	Mid-Range	MXRD 15-3007	Construct MIT LL Engineering Prototyping Facility (EPF) and Parking Lot	MIT/LL	G1, O1.1 G4, O4.1
F8	Facility	Long-Range	MXRD 06-3001	Construct new Education & Training Center. Demolish B1535, B1538, & B1543 and relocate personnel to new building	Acquisition	G3, O3.3
F9	Facility	TBD	N/A	Demolish and Rebuild obosolete MIT enclave buildings (as per MIT/LL ADP)	MIT/LL	G3, O3.2 G4, O4.1 G4, O4.2
T1	Transportation	Short-Range	MXRD 15-0038	Upgrade Perimeter Flightline Security Fence and construct access road to B1729	Base Support	G4, O4.2 G4, O4.3
T2	Transportation	Short-Range	MXRD 08-3000	Build new UFC-compliant Vandenberg Gate Complex	N/A (Housing)	G4, O4.2 G4, O4.3
T3	Transportation	Mid-Range	MXRD 15-3004	Re-alignment of Bestic Drive	Base Support	G3, O3.1
T4	Transportation	Mid-Range	MXRD 15-3005	Build new UFC-compliant Hartwell Gate Complex	Base Support	G4, O4.2 G4, O4.3
T5	Transportation	Mid-Range	MXRD 13-3005	Demolish B1426 and connect Kirtland and Hamilton Road	Base Support	G3, O3.1
U1	Utilities	Short-Range	N/A	Install new natural gas tie-in to Kinder Morgan line	Base Support	G1, O1.1 G4, O4.2
U2	Utilities	Short-Range	N/A	Extend natural gas distribution to Lodging area. Remove buildings from steam and fuel oil fired boilers	Lodging	G1, O1.1 G4, O4.2
U3	Utilities	Short-Range	N/A	Extend natural gas distribution to Civeil Engineering buildings. Remove buildings from steam and fuel oil fired boilers.	Base Support	G1, O1.1 G4, O4.2
U4	Utilities	Short-Range	N/A	Install utility metering system at FamCamp	Community	G1, O1.1

In the "Alignment" column, G = IDP goal number and 0 = IDP objective number. These are found in Table 3.1 and described in more detail in Chapter 4 Strategic Vision Alignment.

Figure 3.12
Plan Implementation

MINOR CONSTRAINT: AIR INSTALLATION COMPATIBLE USE ZONES (AICUZ)

The AICUZ program was initially established by DoD in response to the Noise Control Act of 1972 to promote an environment free from noise that jeopardizes public health or welfare. The AICUZ is the means to inform and protect everyone from noise and minimize the risk of accident potential. At Hanscom AFB, where no flying mission exists and the airfield is owned and operated my Massport, AICUZ do not apply. In place of AICUZ, FAA Standards do apply.

To protect quality-of-life and human health, noise contours have their own list of permissible uses, as identified in DODI 4165.57. Inclusion of noise level reduction (NLR) in the design of new buildings at the airfield can help mitigate development restrictions; however, those designs typically come at a higher cost of construction. The only area of HAFB impacted by Noise Contours is located in the northeast corner of the base.

Main Installation
20.5 acres = amount of installation land that is inside the existing 65-decibel (DB) contours (light green)

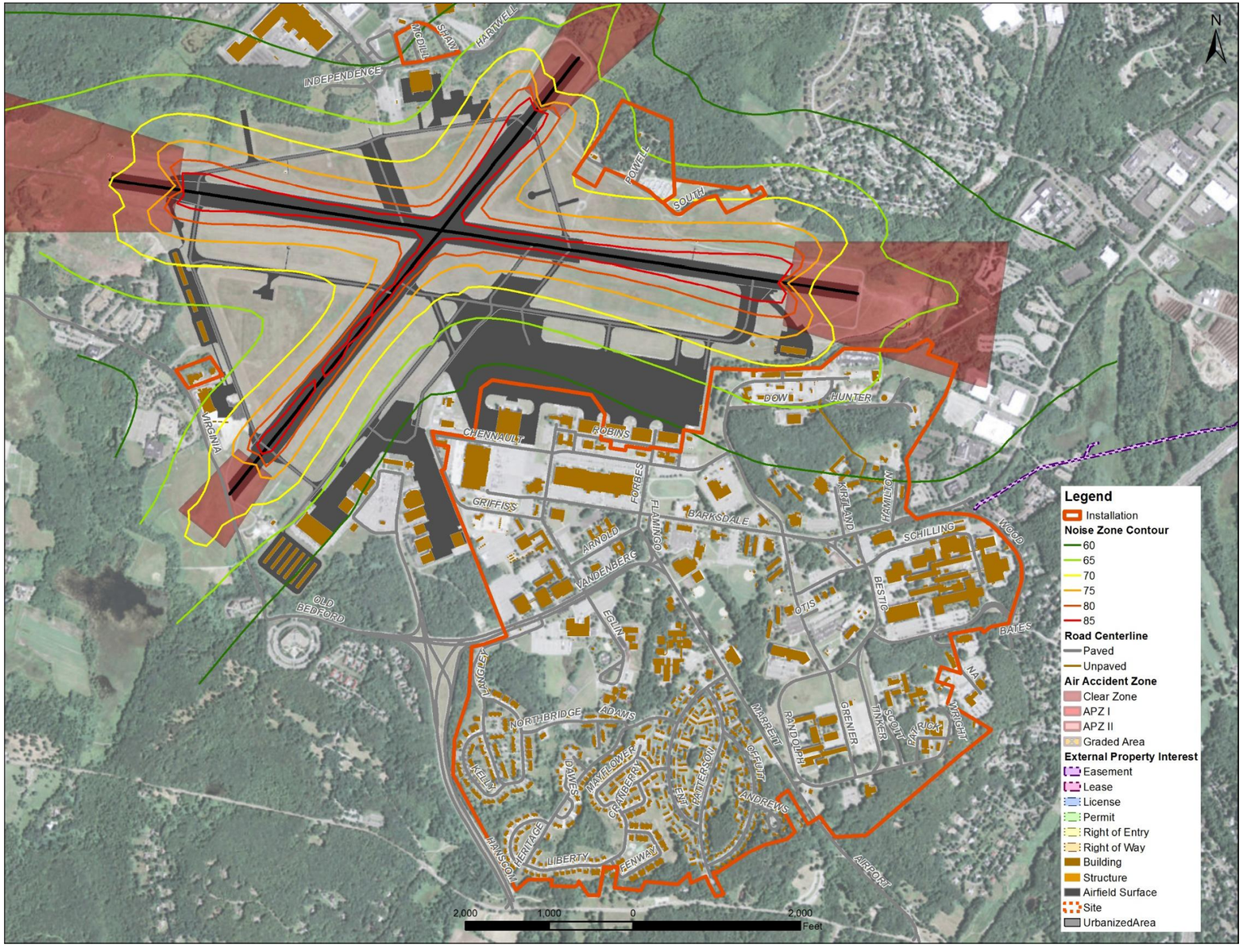
80.4 acres = amount of installation land that is inside the existing 60-decibel (DB) contours (dark green)

Outlying Parcels
20.1 acres = amount of installation land of the outlying parcels that is inside the existing 65-decibel (DB) AICUZ contours (light green)

32 acres = amount of installation land of the outlying parcels that is inside the existing 60-decibel (DB) AICUZ contours (dark green)

Source: 2003 HAFB General Plan; Hanscom Air Force Base Geographic Information System Data 2016

Figure 6.1
F.1 Air Installation Compatible Use Zones



MINOR CONSTRAINT: AIRFIELD AND AIRSPACE CLEARANCE

Installations that support fixed and rotary winged aircraft are required to comply with criteria established in UFC 3-260-01, Airfield and Heliport Planning and Design. Clear Zones are off-limits for future planning purposes because development is prohibited. Accident Potential Zones I and II have their own density development requirements that create their own development challenges.

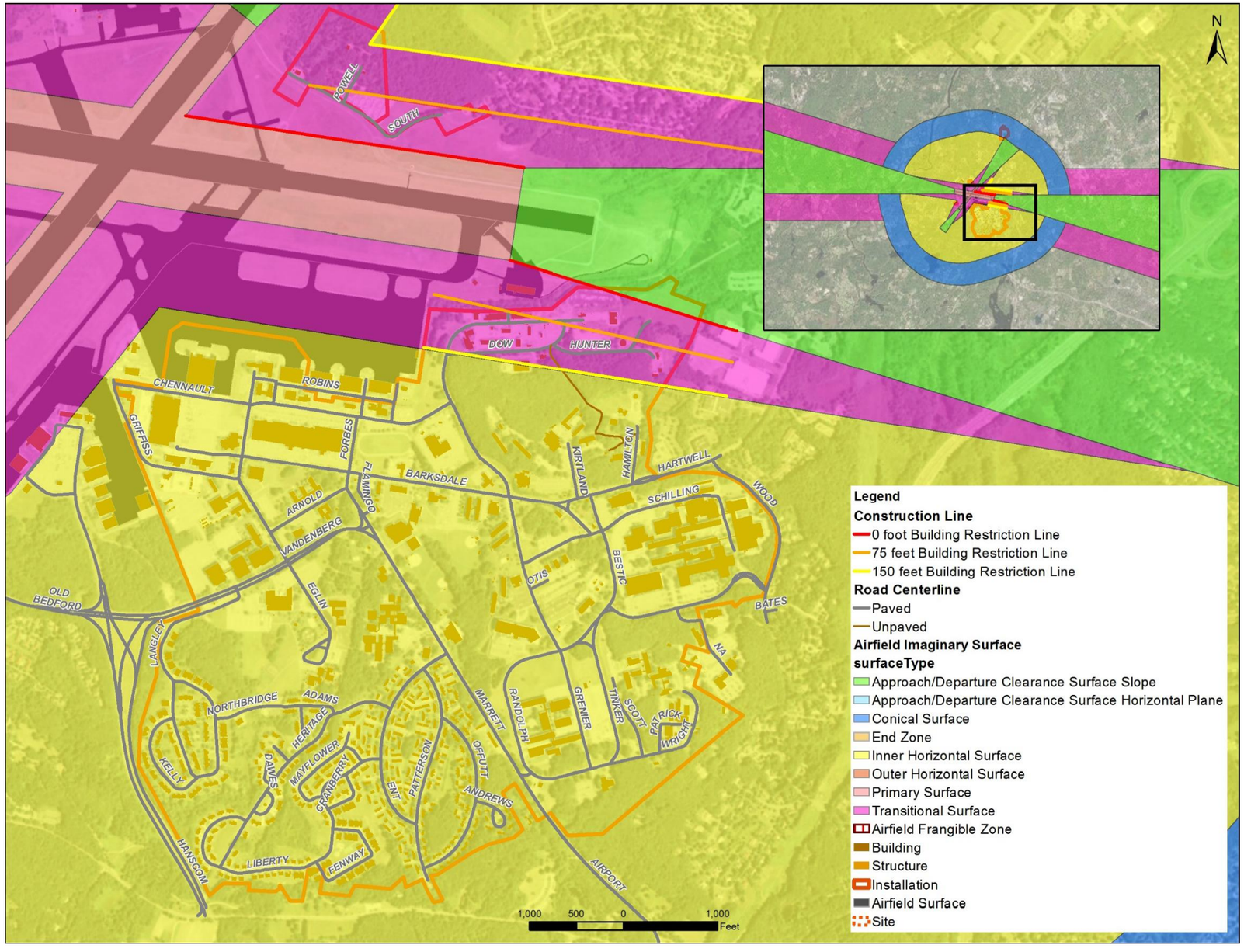
Though HAFB is does not have flying mission, nor does it operate or maintain an airfield, the base's proximity to Hanscom field will have an impact on development. A small portion of land in the northeast quadrant is located within a Transitional Surface Area (pink polygon). An even smaller sliver of a land, located along in the northeast corner is located within the Approach and Departure Clearance Zone (green polygon). These areas are subject to building height limits and certain land use restrictions. See Figure 6.2 for the location of these areas.

43.9 acres = total acres of Transitional Surface Area that falls inside of HAFB's boundary

3.8 acres = total acres of Approach and Departure Clearance Zone that falls inside of HAFB's boundary

Source: Hanscom Air Force Base General Plan, 200; Hanscom Air Force Base Geographic Information System Data 2016. Unified Facilities Criteria (UFC) 3-260-01, Airfield and Heliport Planning and Design, 17 November 2008

Figure 6.2
F.2 Airfield and Airspace Clearance Criteria



MINOR CONSTRAINT: NATURAL RESOURCES

HAFB currently falls within the potential habitat area of the Northern Long-Eared Bat, a species of bat identified as "Threatened" by The U.S. Fish and Wildlife Service under the Endangered Species Act (ESA). Since this bat was added to the list of Threatened species in January of 2016, all cutting of trees on base has become restricted in the months between April and August. A survey of the Eastern Coast is planned for next year to further determine the extent of the bat's habitat. It is recommended that all on-base polices regarding the habitat of the Northern Long-Eared Bat be re-evaluated when this survey is completed.

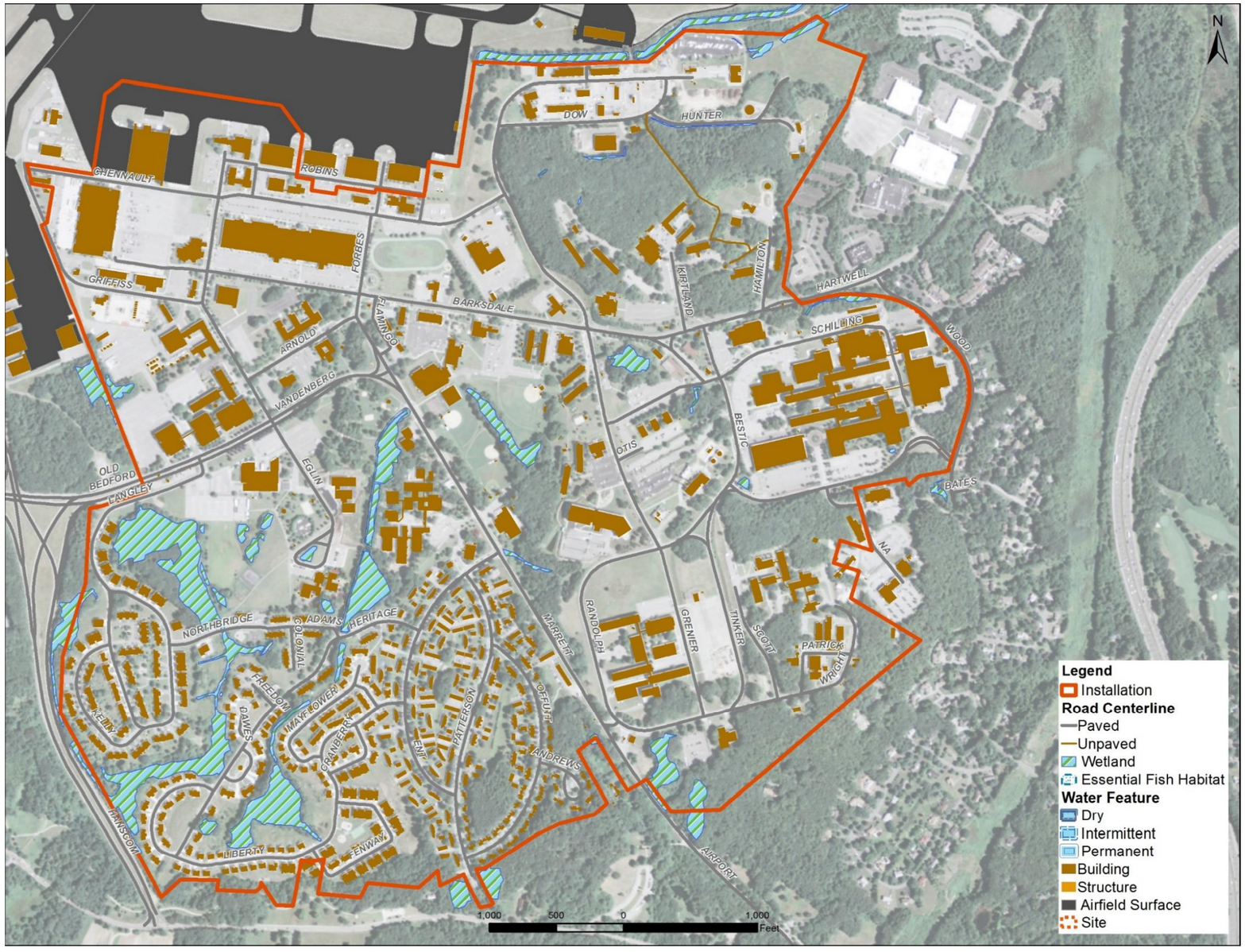
Recreational use of nearly two-thirds of the Fourth Cliff Recreational Annex is restricted from mid-April to late August in order to safeguard nesting habitat for state and federally protected shorebird species during nesting season. HAFB prohibits recreational activities in nesting habitat and coordinates with Massachusetts Audubon for monitoring and habitat protection during nesting season.

Areas that are classified as wetlands or jurisdictional Waters of the US (WoUS) require protection from destruction or degradation. Approximately 31 acres of jurisdictional wetlands are located in various sites at HAFB. If a jurisdictional wetland must be altered or damaged, a permit from the US Army Corps of Engineers is required. If future development impedes upon an existing wetland, mitigation factors must take place to compensate for its replacement. Avoidance of wetland impact should be considered in every future development circumstance.

HAFB's location straddles the jurisdiction of multiple towns and thus is subject to different local wetland protection by-laws. Depending where on base the wetland is located, development setback criteria may range from 50 to 100 feet. In addition, there exists a 200' setback from the Shawsheen River. The wetlands are in various stages of succession, ranging from wet meadows to more mature forested areas; these areas are considered a constraint to development.

The base is located almost entirely within the watershed of the Shawsheen River. Two perennial stream systems originate along the western and southern boundaries of the base and flow northeasterly through two wetlands systems.

Figure 6.5
F.5 Natural Resources



MINOR CONSTRAINT: ENVIRONMENTAL RESTORATION, QUALITY & MUNITIONS RESPONSE PROGRAMS

In an effort to clean up and control contamination created from past waste disposal activities and practices at military installations, the USAF developed a comprehensive program designed to identify, investigate, and remediate contamination sites. The Installation Restoration Program (IRP) is designed to protect human health and ensure that natural resources are restored for future use. Since implementation in 1988, 22 Installation IRP sites have been identified within the larger Hanscom AFB/Hanscom Field Area. Of these, 14 sites require no further action and are considered closed. Of the six sites that are undergoing remedial action operations (RAO) only **three** are within the installation boundary. These are **IRP Sites 21, 13, and 22**.

In addition, **two IRP sites (Sites 6 and 4) are undergoing long-term monitoring (LTM),** and **8 sites (Sites 1, 2, 3, 4, 6, 13, 21, and 22) have land use controls (LUC)** in place. Any disturbance on these sites must be reviewed an approved by the HAFB Environmental Office.

Also, an additional IRP site is located on land at the former Ipswtich Antenna Test Facility, but this land is currently being cleaned for return to the property owner.

Potential pollution areas on base are found in two general areas, one in the northeast corner and one to the north of the housing area. The northeast corner of the base is the location of a noted petroleum release site and a former filter bed and land fill area. Pollution is a concern in this area and in groundwater extending off-base to the north. The other area of concern is **IRP Site 8**, a closed landfill located to the north of the housing area with soil lead concentrations higher than normal. Though testing has revealed levels to be below the state limit and the site is capped with 6 inches of clean fill, this area is very close to housing and school age children facilities.

Source: Hanscom Air Force Base General Plan, 2003; Hanscom Air Force Base Geographic

Figure 6.6

F.6 Environmental Restoration, Quality & Munitions Response Programs

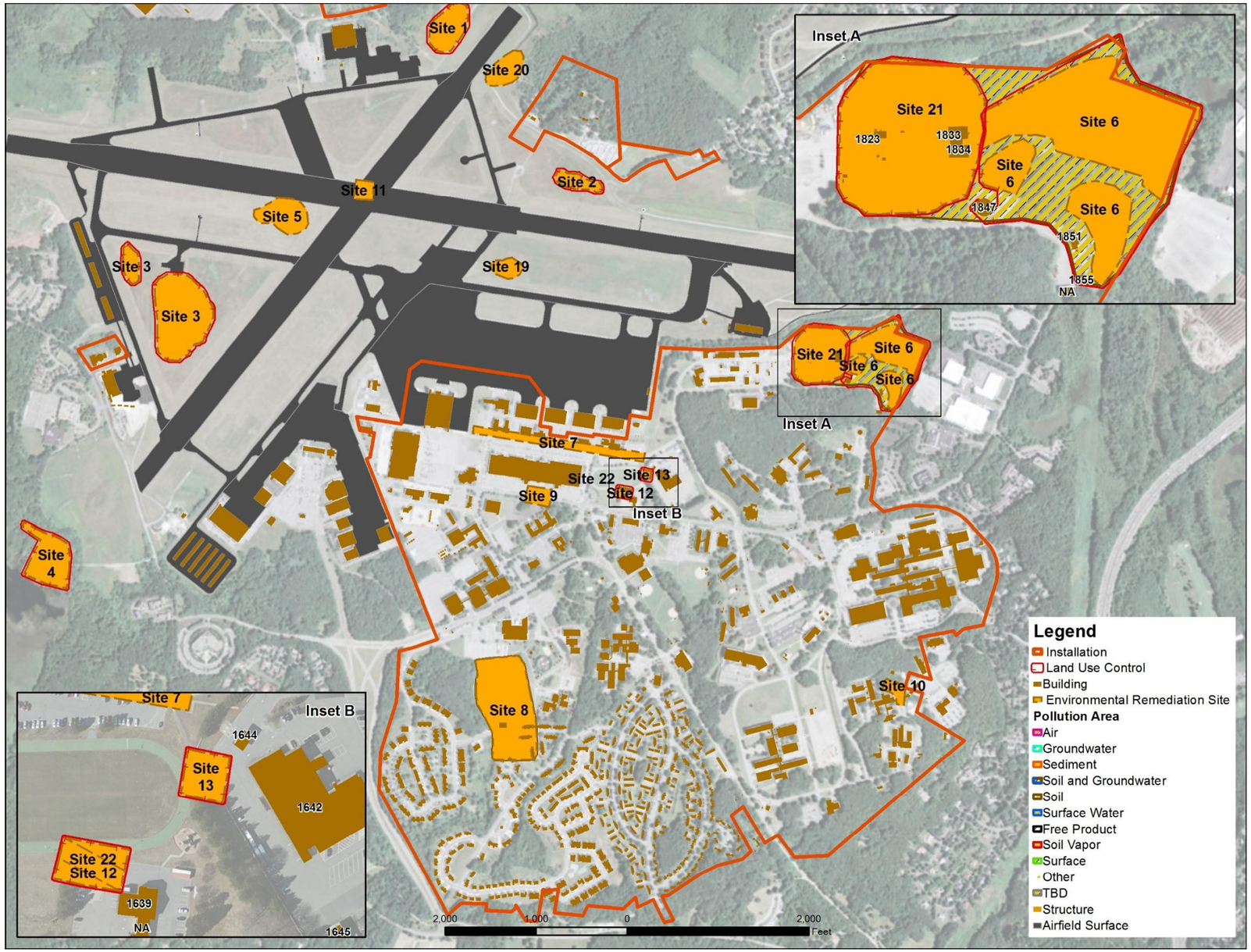
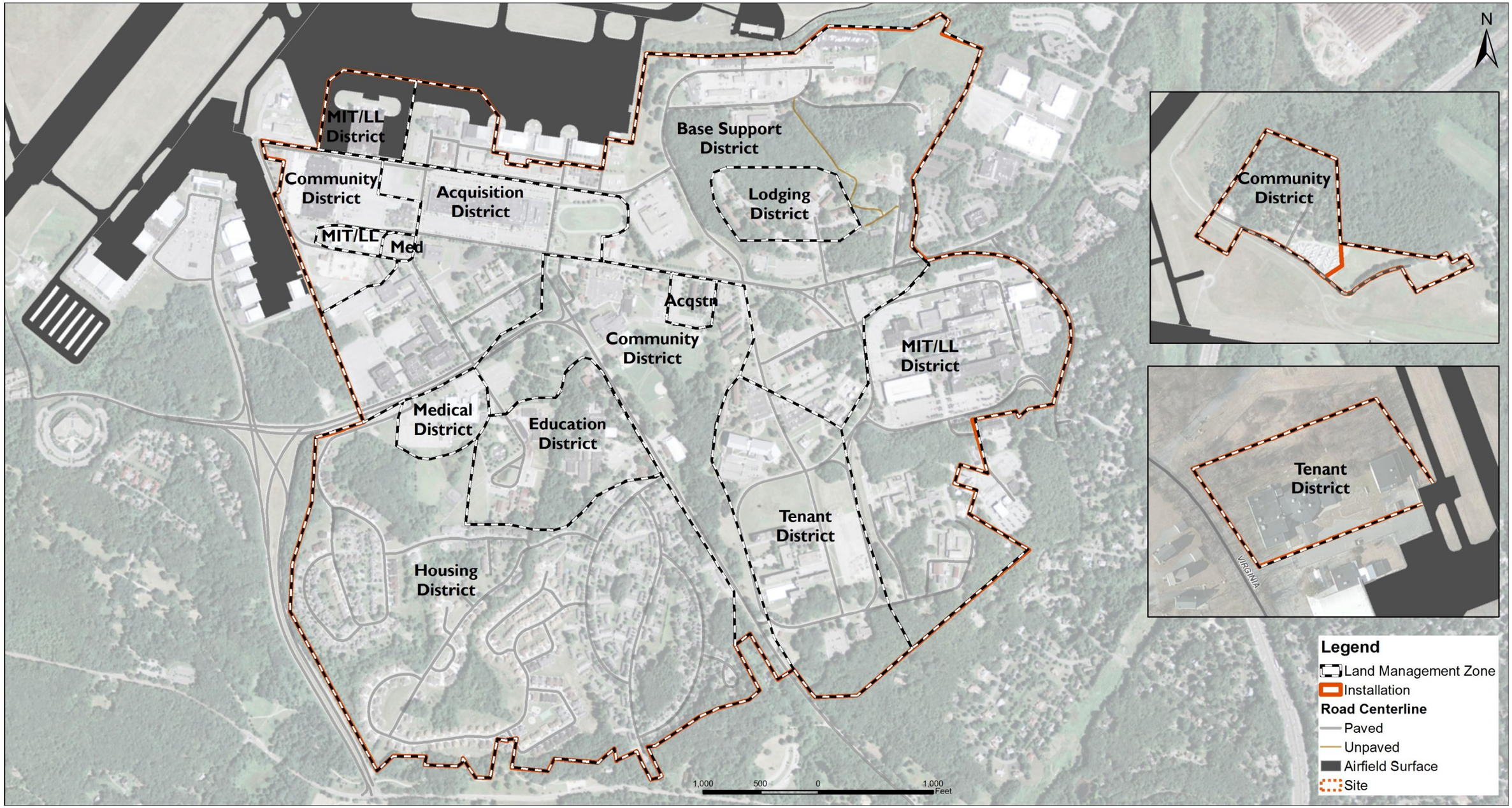


Figure 5.24
E.2 Planning Districts



9 Future Development Planning

The IDP is the foundation for future development planning and programming decisions at Hanscom Air Force Base. It summarizes and compiles past planning efforts, resource management plans, and other special plans and studies, supported with graphics and maps.

Chapter 9 identifies district-specific development opportunity areas with potential capacity for development alternatives. This chapter also defines district-specific land use and form-based development standards. These development scenarios and standards align with HAFB's IDP vision, goals, and objectives, and the vision, goals, and objectives of the higher-level organizations as defined in Chapter 4, Strategic Vision Alignment. The development scenarios address environmental sustainability, energy use, space and facility optimization, mission needs, and tenant plans. These scenarios can be used as the framework of an Area Development Plan (ADP) when more specific planning guidance is needed to determine the future of a particular district. These future development scenarios are integral to the IDP, as a dynamic, though-out master planning document.

The plans presented in Chapter 9 present future development recommendations that will promote HAFB's mission efficiency and effectiveness. The timeframe for the plans and proposals for capital improvements in this chapter may be more than 20 years. These long-range projects include facility modernization and replacing facility and infrastructure components that have reached the end of their useful life.

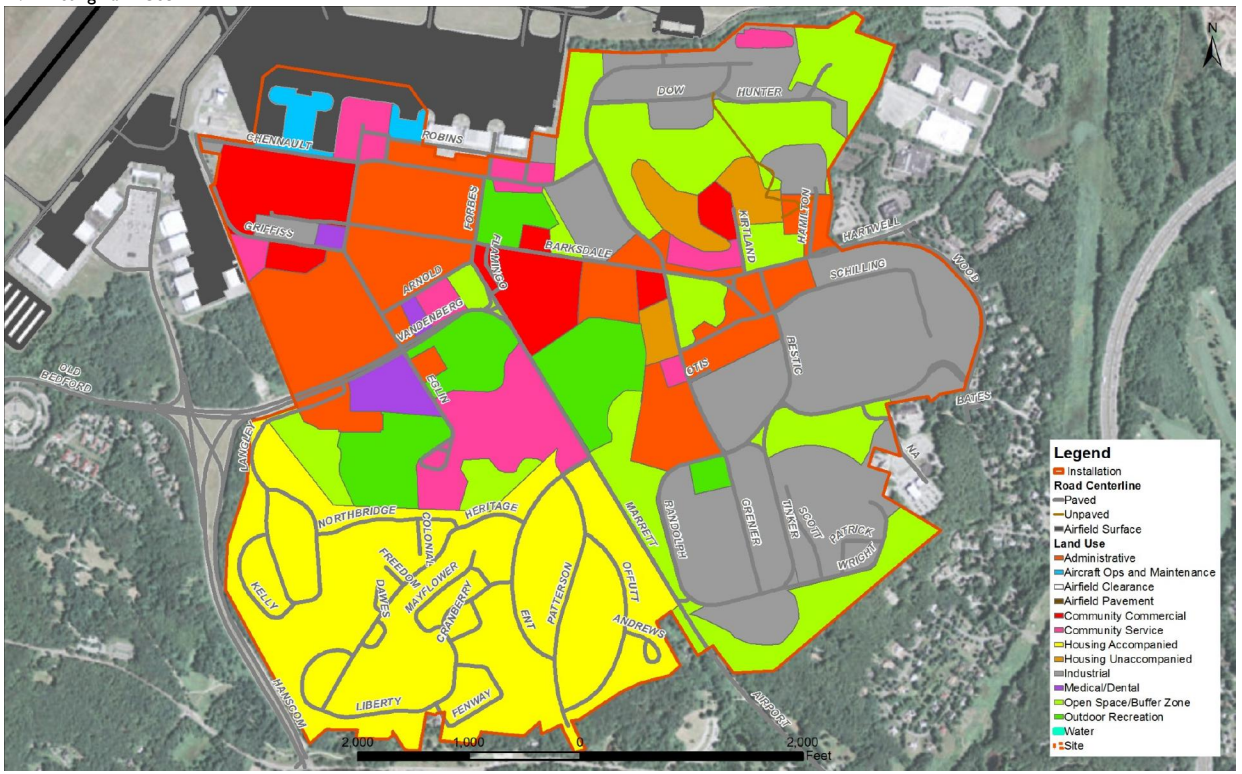
The development scenarios also address transportation networks and required improvements, including personal vehicles, government vehicles, pedestrians, parking, access control, and traffic.

9.1 EXISTING LAND USE PLAN

Existing land uses at HAFB, as illustrated in Figure 9.1, describe typical functional uses in generalized parcels. At just 846 acres, HAFB is geographically small compared to most other air force bases. This compact footprint results in a rather dense development pattern. There is not a large amount of undeveloped area at HAFB and a good portion of what open space is available is strategically being used as buffered space.

The existing land use pattern clusters compatible uses and separates incompatible uses, resulting in efficiencies and few conflicts between dissimilar land uses. Most of the development along Hanscom's major corridors (Barksdale

Figure 9.1
H.1 Existing Land Use



Street and Vandenberg Drive), such as acquisition management, administrative activities, and community support functions are low intensity and have few negative impacts on neighboring parcels. As such, these parcels are clustered together and allowed to function alongside one another.

The more industrial base operations, such as civil engineering, the steam plant, and logistics are found either on the periphery of the base or are buffered by open space. Research and Development facilities, such as those in the MIT Lincoln Laboratory area are also located on the edge of the base and are buffered by open space.

In much the same way, the residential area is distinctively separate from the rest of base operations. Its location in the southwest corner is fittingly situated in close proximity to educational, medical and recreational areas. Continued adherence to this strategic and logical separation of land uses will help support mission operations and maintain a high quality of life for base residents.

9.2 FUTURE LAND USE PLAN

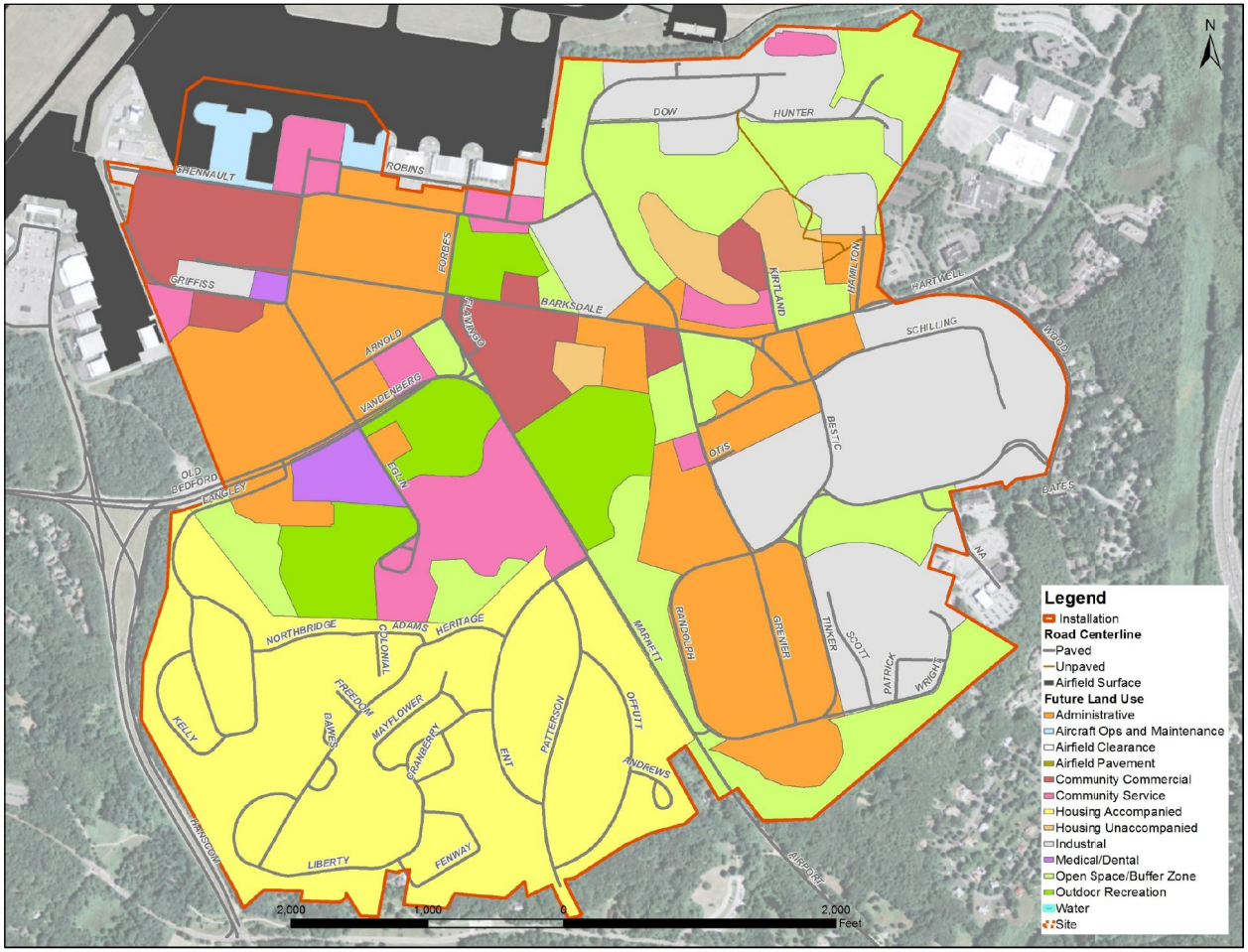
The Future Land Use Plan for HAFB is based on the future planning vision and existing land use analysis conducted throughout the development of the IDP. The IDP carefully considers land use compatibility, facility consolidation, mission sustainability, quality of life, safety and security.

Land uses at HAFB are already well consolidated and similar functions are collocated. Maintaining this compact development will contribute to energy conservation and reduced infrastructure investment. Emphasis will be given to protecting available land within the main cantonment area for future potential mission change or growth, and maintaining safe traffic flow and accessibility with this future development.

The future land use pattern will generally resemble the Installation's existing land use pattern. Exceptions include the following:

- The demolition of Buildings 1510 and 1511 along the north end of Grenier Street will create an open space. There are currently no plans for this parcel.
- The vacant parcel between Grenier and Randolph, previously categorized as outdoor recreation, will be repurposed as administrative and could potentially be used as a site for PV systems.
- With the demolition of Building 1605, the use of a parcel between Vandenberg and Arnold will change from Medical to Community Service.
- A small area of open space south of the Civil Engineering area will be lost to make way for the new road extension rerouting access to Hamilton via Kirtland Street.
- Since the area is no longer geared toward research and development, the old AFRL area, previously designated as an Industrial Area, will be reassigned the land use category of an Administrative Area.

Figure 9.2
H.2 Future Land Use

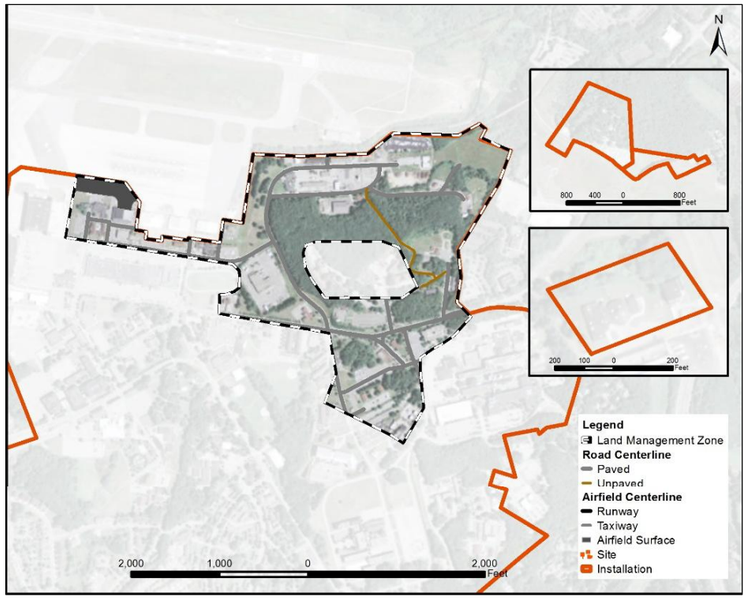


HAFB Planning District 5
BASE SUPPORT DISTRICT

Planning District 5—the Base Support District—includes the 66th ABG Headquarters, Security Forces, Logistics Readiness, Base Civil Engineering, and an assortment of industrial functions. The district occupies a large section of land in the northeast corner of the installation, with one parcel being omitted due to its role as the Lodging District. The Base Support District is bordered on the north by the airfield, on the east (outside base) by private businesses, on the southeast by the MIT enclave, and on the south and southwest by the Community and Acquisition Districts, respectively. Figure 9.7 identifies the general boundaries of the Base Support District.

The Base Support District contains a variety of different land uses and provides the necessary space for some of the base's more intense land uses. Though a large amount of land within the district is open space, much of this land is not feasible for development. One of the largest constraints to development consists of an ERP site in the northeastern corner of the base. This site, the location of a large petroleum release and covered landfill, has land use controls and will restrict certain types of development. Another large constraint pertains to the forested land in the center. Development in much of this area is inadvisable, as it is the site of three archeologically sensitive areas. One last constraint includes a small wetland area northwest of Building 1217, along the Southside of Barksdale Street. Refer to Figures 6.4, 6.5, and 6.6 in Chapter 6 for more information on these constraints.

Figure 9.7
E.2-5 Planning Districts – Base Support District



Relationship to Overall Future Development

Future development is likely to adhere to existing land use patterns. The district's location, along the flight line and away from community and residential functions, lends itself to more intense industrial uses.

Existing Planning Studies

The following references or completed planning studies may serve as a foundation to build upon during the course of follow-on planning efforts:

- General Plan, Hanscom AFB, 2003
- Hanscom 20/20 Plan, 2012
- The State of Hanscom, Massport, 2015
- Internal Installation Complex Encroachment Management Action Plan (ICEMAP), Hanscom AFB 2015
- Clean Energy Assessment and Strategic Plan for Massachusetts Military Installations, 2014
- Final Environmental Assessment for Solar Photovoltaics Installation, Hanscom Air Force Base, 2015

Issues

A number of planning-based issues have been identified through stakeholder interviews and during the course of the Vision Workshop. Identified issues are listed below; site analysis and key development opportunities are presented in Illustration 9.5 on the following page.

- There is a shortage of parking available for employees working in the ABG Headquarters building.
- The land west of Bestic Drive and directly to the south of Vandenberg Drive is not being utilized efficiently. Buildings 1217 and 1218, both in poor condition, are past their useful facility life span.
- The existing intersection of Bestic Drive with Hartwell Avenue is poorly configured. This area, in the heart of the base, could be redeveloped to improve traffic circulation and provide additional parking for employees working in neighboring facilities.
- The Hartwell Gate is currently non-compliant with established AT/FP engineering standards.
- The boundary fence along the flighline is porous. There is a need for the fence to be repaired along the flight line. Additionally, MassPort does not provide the necessary level of access control.
- The AeroClub, located in a hanger along the flightline, is poor condition.
- The area in the northeast corner of the site is an ERP site but may serve as a potential location for renewable energy generation.
- Facility upgrade and expansion is necessary for continued operations at the Fire Station.
- The steam system is nearing capacity, and because of this, new buildings are not tied into the steam system when brought online. The steam plan would greatly benefit from a tie-in to the existing Kinder Morgan gas pipeline. Having access to the Kinder Morgan line would increase the plant's capabilities, allowing the construction of for an on-site CHP.
- In addition, many of the buildings in the Civil Engineering (CE) buildings (the northern edge of district) are still on steam heating and would benefit from a natural gas connection.

Recommendations

- Demolish Buildings 1217, 1218, and 1219 and relocate personnel to Building 1240. Realign Bestic Drive, improve pedestrian circulation, and construct additional parking lot on available land.
- Construct new UFC-compliant entry control complex. This will require a partial demolition of Hamilton Street and will close off access to Barksdale. To provide the necessary access, Kirtland Street will need to be rerouted.
- Upgrade Hanscom AFB boundary fence along flightline.
- Demolish Building 1728 and relocate Education Training to a new facility in the Community District.
- Upgrade and expand Fire Station (Building 1721).
- Route natural gas distribution system to the CE area and remove oil fired boilers
- Construct new combined heat and power (CHP) plant located at Building 1201.

HAFB Planning District 5

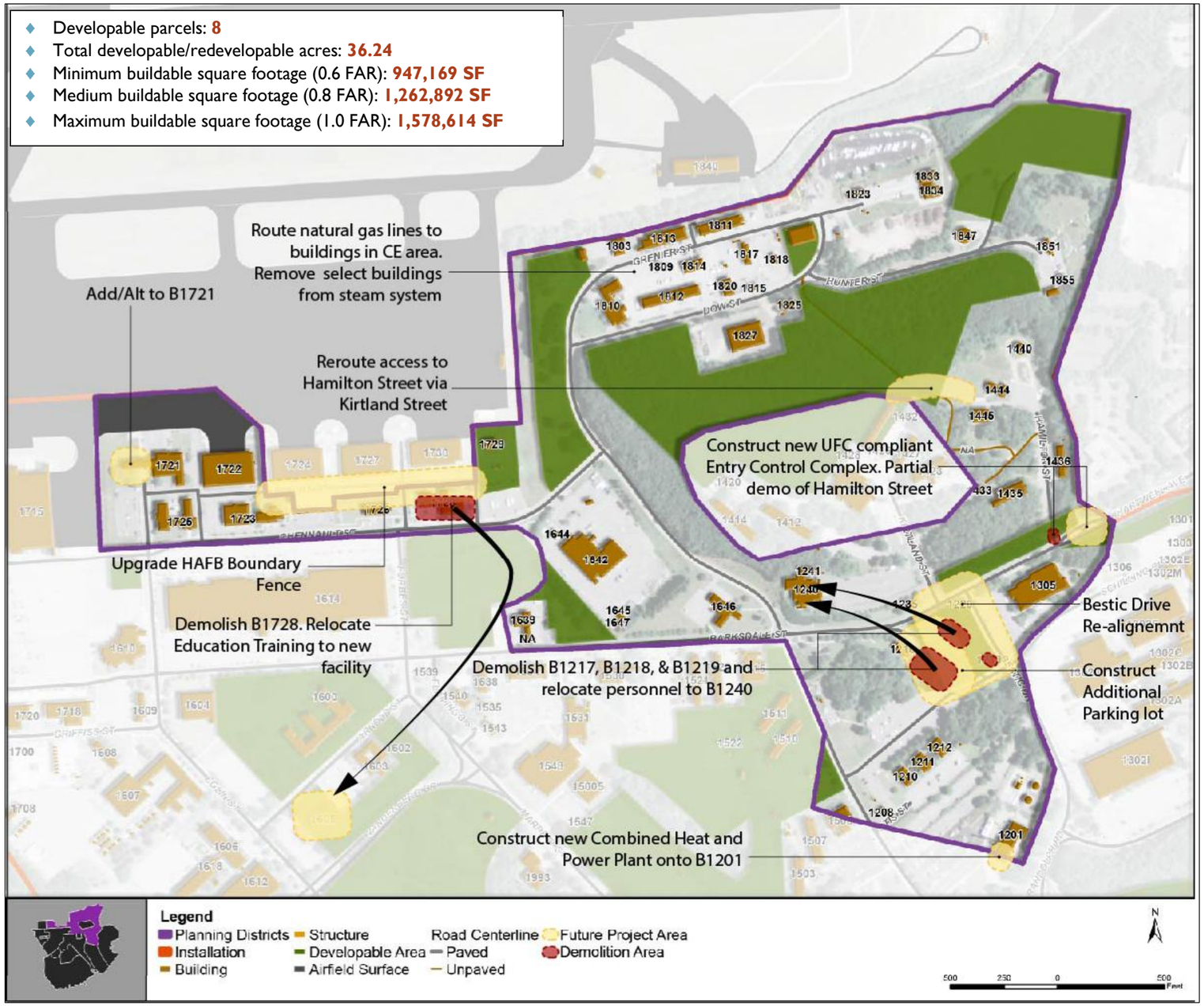
BASE SUPPORT DISTRICT

Table 9.8 // Base Support District – Permitted Uses

Permitted Uses within the Base Support District	
Airfield Operations and Maintenance: squadron operations, hangars, aircraft maintenance units, control towers, and passenger terminal	
Industrial: warehouse, liquid fuel systems, maintenance, vehicle maintenance, and/or storage	
Light Industrial: warehouse, maintenance, storage	
Administrative: headquarters, office, operations, research, testing, warehouse, training, educational	
Small-Scale Administrative: less than 50,000 square feet	
Munitions Storage	
Medical: installation hospital, clinic, dental services, flight medicine, pharmacy	
Community Service: fitness center, child development center, recreation and community center, youth center	
Lodging: hotel, temporary lodging facilities, visitors quarters	
Community Commercial: base exchange, commissary	
Small-Scale Retail and Service: less than 50,000 square feet	
Unaccompanied Housing: multistory and dormitories	
Accompanied Housing: single-family homes, townhomes	
Outdoor Recreation: Outdoor courts, outdoor fields, stable, swimming pool, and/or golf course	
Open Space: Undeveloped	
Military Training Area	

Restricted *Permitted with restrictions* *Permitted*

Illustration 9.5
Base Support District Planning Analysis



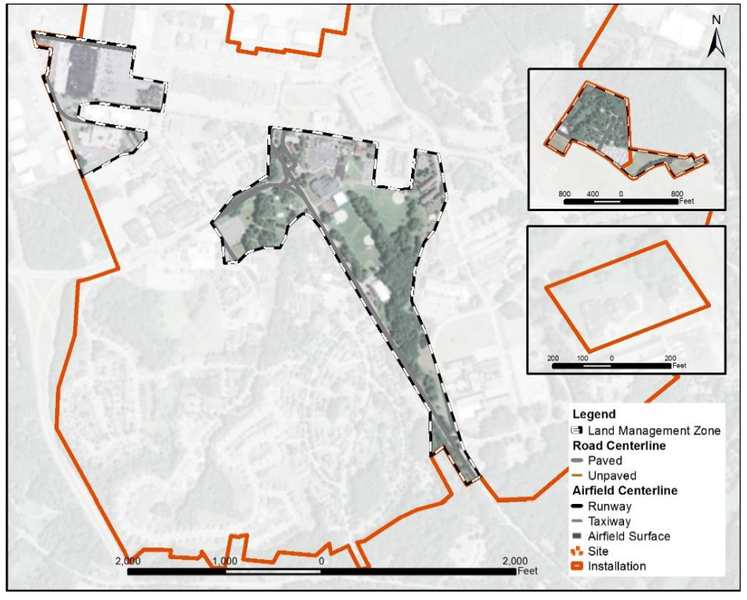
HAFB Planning District 8
COMMUNITY DISTRICT

Planning District 8—the Community District—includes all space on base that provides a community function. The heart of this district runs up the middle of the base, along Marrett, and includes most the base's indoor and outdoor recreational facilities as well as commercial services. Outlying parcels include the area surrounding the Base Exchange and Commissary and the FamCamp parcel to the north of the runway. Also included as part of the Community District (not shown below) is the off-site Fourth Cliff Family Recreation Area, located in Scituate, MA. Figure 9.10 identifies the general boundaries of the Community District.

A significant amount of the Community District is either undeveloped or developed specifically for recreational activity. This low intensity development pattern aligns with the district's role as a community focal point. The district's fitness center, baseball fields, tennis courts, playground, volleyball court, swimming pool, pedestrian trails, and picnic and forested areas offer convenient options for recreational and outdoor activity.

Concerning constraints to development, the district has a few areas of concern. The first is a thin strip of wetland area in the forested area between the baseball fields. Two zones of archaeological potential also exist within the district, on the south side, behind the swimming pool. Refer to Figures 6.4 and 6.5 in Chapter 6 for more information regarding these planning constraints.

Figure 9.10
E.2-8 Planning Districts – Community District



Relationship to Overall Future Development

Development within the district should continue to provide community oriented recreational activities as well as key community commercial services. Areas identified as buildable include the land around the existing dormitories (Buildings 1510 and 1511), land north of the temporary school, and a couple strips of land on the south end of the district, to the northwest of the Tenant District. Additionally, the land currently dedicated to the ball fields may not be offering the highest and best use and has been identified by the base as offering potential for redevelopment.

Existing Planning Studies

The following references or completed planning studies may serve as a foundation to build upon during the course of follow-on planning efforts:

- General Plan, Hanscom AFB, 2003
- Hanscom 20/20 Plan, 2012
- Internal Installation Complex Encroachment Management Action Plan (ICEMAP), Hanscom AFB 2015

Issues

A number of planning-based issues have been identified through stakeholder interviews and during the course of the Vision Workshop. Identified issues are listed below; site analysis and key development opportunities are presented in Illustration 9.8 on the following page.

- Buildings 1510 and 1511 are in poor condition and are nearing the end of their usable lifecycle. Both buildings have been identified as candidates for demolition.
- Currently at the Fourth Cliff location, there are development restrictions due to erosion concerns and wetlands and erosion.
- Multiple MWR facilities in the district are aging and require infrastructure updates. Major issues have been reported with building envelopes, HVAC systems, bathrooms, and lighting systems in the bowling center and the pool.
- The FamCamp area is in need of a utility metering system. This would allow the base to better track energy usage at the camp throughout the year.

Recommendations

- Construct new dormitory on land east of Building 1531. Demolish Buildings 1510 and 1511 and relocate occupants to new dorm.
- Install utility metering system in the FamCamp area.
- Continue with erosion control project at Fourth Cliff Recreation Area.
- Pursue funding for MWR facility upgrades.

HAFB Planning District 8
COMMUNITY DISTRICT

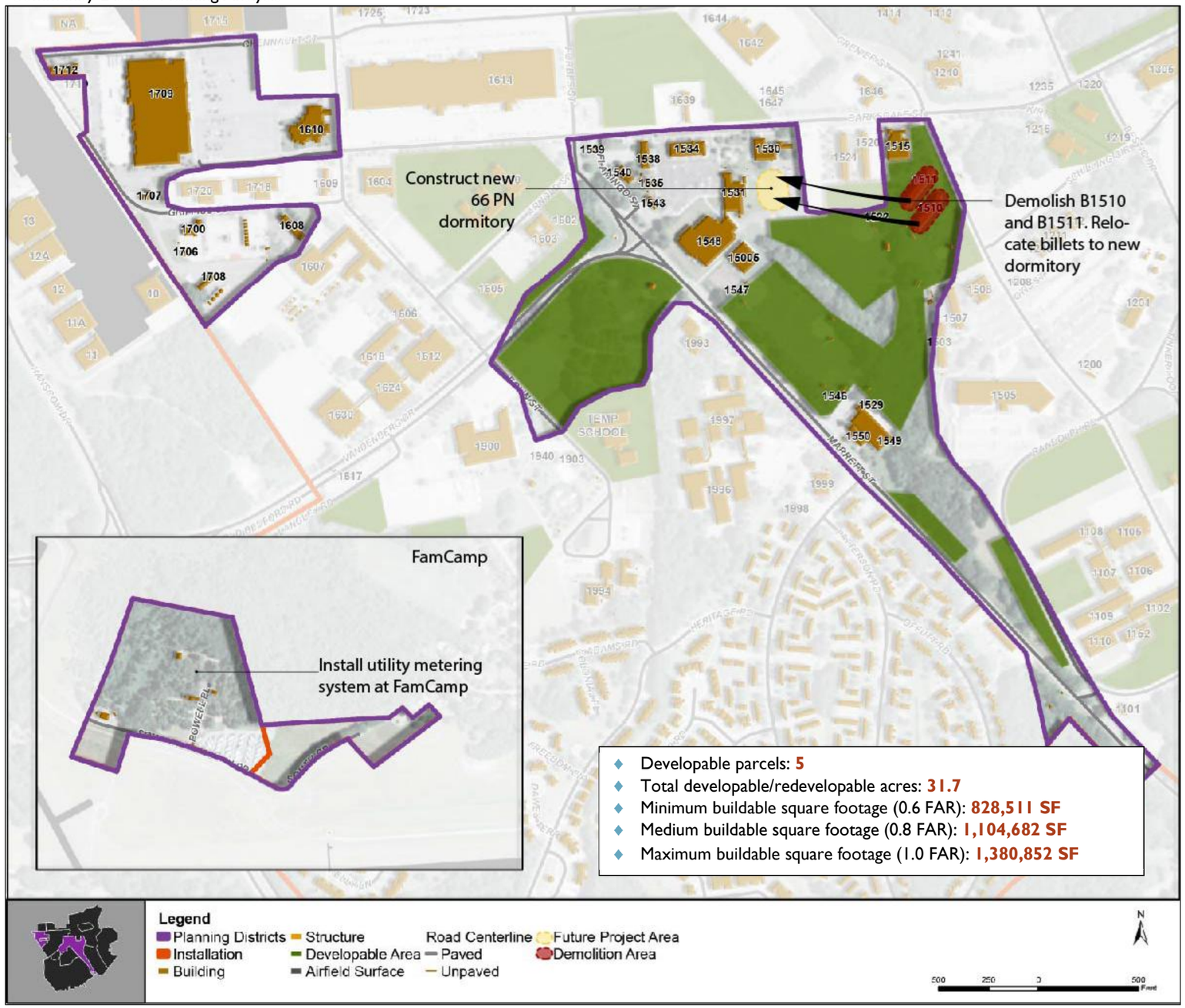
Table 9.11 // Community District – Permitted Uses

Permitted Uses within the Community District	
Airfield Operations and Maintenance: squadron operations, hangars, aircraft maintenance units, control towers, and passenger terminal	
Industrial: warehouse, liquid fuel systems, maintenance, vehicle maintenance, and/or storage	
Light Industrial: warehouse, maintenance, storage	
Administrative: headquarters, office, operations, research, testing, warehouse, training, educational	
Small-Scale Administrative: less than 50,000 square feet	
Munitions Storage	
Medical: installation hospital, clinic, dental services, flight medicine, pharmacy	
Community Service: fitness center, child development center, recreation and community center, youth center	
Lodging: hotel, temporary lodging facilities, visitors quarters	
Community Commercial: base exchange, commissary	
Small-Scale Retail and Service: less than 50,000 square feet	
Unaccompanied Housing: multistory and dormitories	
Accompanied Housing: single-family homes, townhomes	
Outdoor Recreation: Outdoor courts, outdoor fields, stable, swimming pool, and/or golf course	
Open Space: Undeveloped	
Military Training Area	

Restricted *Permitted with restrictions* *Permitted*

Illustration 9.8

Community District Planning Analysis



10.8 ALTERNATIVE DEVELOPMENT SCENARIOS

A coordinated planning effort is required in order to make best use of the remaining developable parcels of the Hanscom AFB cantonment area and to effectively prepare for potential future redevelopment of the existing built environment to properly support the mission. This map explores development and redevelopment beyond current planned and programmed actions and seeks to provide alternative solutions to the issues presented to the planning team in the data collection site visit and the Vision Workshop.

Alternative Future Courses of Action

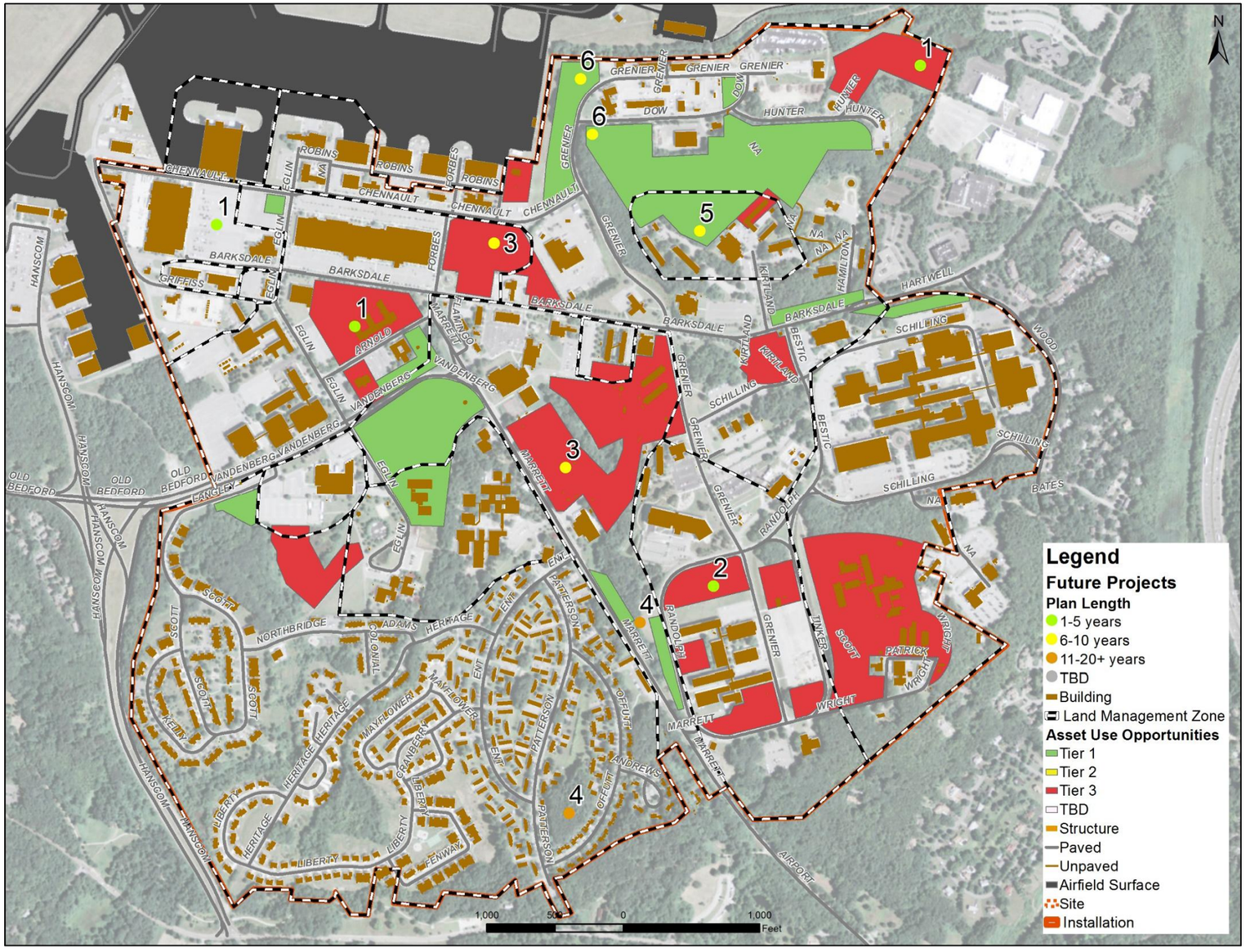
Map ID	Planning Actions	Alignment[1]
1	With the abundance of new and existing parking lots at HAFB, there are other potential locations for car-port mounted PV arrays. The alternative course of action identities three possible sites for PV.	G1, O1.1 G1, O1.2
2	With PV arrays constructed elsewhere, the land to the north of the older lower AFRL could be developed for new buildings to increase the capacity of the Tenant District.	G2, O2.2
3	Though sited centrally, along Barksdale, the running track may be better suited near other recreational activities, such as the baseball fields and swimming pool. This scenario sees the relocation of the track to the community district, thereby leaving a large parcel of land in the acquisition district for development. The Education and Training Center could be located here in a central location.	G3, O3.3 G3, O3.4
4	If housing demand continues to increase, base planners may need to identify areas for housing previously overlooked. This scenario identifies two such areas.	G3, O3.3 G2, O2.1
5	There exists substantial space for development in the northern half of the Lodging District. This area could be used to site additional lodging or storage facilities	G3, O3.3 G2, O2.1
6	There exists substantial space for development in the Base Support District. This area could be used to site additional CE structures.	G3, O3.3 G2, O2.1

[1] *G = IDP goal number; see Chapter 4 Strategic Vision Alignment*

[1] *O = IDP objective number; see Chapter 4 Strategic Vision Alignment*

Figure 10.8

I.8 Alternative Development Scenarios



G-2 - Town of Bedford Conservation Commission's letter to the Hanscom AFB IRP Manager dated July 27, 2007, Subject: Hartwell Town Forest and Jordan Conservation Area

TOWN OF BEDFORD

BEDFORD, MASSACHUSETTS 01730

TTD/TTY: 781-687-6124

CONSERVATION COMMISSION

Robert Kenyon
Chair
Elizabeth Bagdonas
Conservation Administrator

Town Hall
10 Mudge Way
Bedford, MA 01730-2144
Phone 781-275-6211
Fax 781-275-1334
Email elizabeth@town.bedford.ma.us

July 27, 2007

Mr. Thomas Best, IRP Manager
66 MSG/CEG, 120 Grenier Street
Hanscom Air Force Base, MA 01731

Re: Hartwell Town Forest and Jordan Conservation Area

Dear Mr. Best:

The attached correspondence from Joseph O'Keefe requests information on the management and land use status of two Bedford conservation areas, the Hartwell Town Forest and George Jordan Conservation Area.

In 1940, the Hartwell Town Forest was accepted by the Town as a gift, "to be placed under the Town Forest Act". *[Reference: History of Hartwell Town Forest]*

The 1957 Conservation Commission Act (Massachusetts General Laws Chapter 40 section 8C) authorized the establishment of a locally appointed municipal agency (the Commission), whose role was to protect natural resources, acquire important land and water areas, and manage these properties for conservation and passive recreation. *[Reference: MACC Environmental Handbook, p. 1]*

At the 1977 Annual Town Meeting, the Town voted to assign jurisdiction over Hartwell Town Forest to the Conservation Commission. According to a 1997 opinion from Town Counsel, a town forest is part of the "public domain" under section 19 of C. 45 of the General Laws. Section 19 says in relevant part that "such public domain shall be devoted to the culture of forest trees, or to the preservation of the water supply of such city or town…"

TOWN OF BEDFORD
BEDFORD, MASSACHUSETTS 01730

TTD/TTY: 781-687-6124

Chapter 40, section 15A requires the Conservation Commission to approve change in use and/or transfer of control, but this law does not entirely override the forest's public trust status since it was a gift to the town. For that matter, town meeting must also agree to a change in both use and control. The potential change in use and the nature of the change in legal or physical control would also need to be analyzed in light of Article 97 which protects the public right to freedom from excessive and unnecessary noise, among others. Article 49 of the Articles of Amendment to the Massachusetts Constitution (inserted in its present form by the 97th Article of Amendment in 1972) says in relevant part:

> "The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic, and aesthetic qualities of their environment; and the protection of the people in their right to the conservation, development and utilization of the agricultural, mineral, forest, water, air and other natural resources is hereby declared to be a public purpose." *[Reference: 1997 Town Counsel Report]*

The George Jordan Conservation Area was conveyed to the Town in 1971 "through its Conservation Commission, for administration, control and maintenance", under the provisions of Massachusetts General Laws, Chapter 40, section 8C – the "Conservation Commission Act". The option to purchase, further states that the land shall be "managed and controlled by the Conservation Commission of the Town of Bedford for the promotion and development of the natural resources and for the protection of the watershed resources of said Town."

Please do not hesitate to contact the Commission if you would like more information on the Hartwell or Jordan conservation areas.

Sincerely,

Elizabeth J. Bagdonas

Elizabeth J. Bagdonas
Conservation Administrator

G-3 - Hanscom AFB Environmental Office Memorandum to the USEPA, Region I dated 4 September 2008, Subject: Land Use Controls including Institution Controls (LUCs/ICs) for Operable Unit 1 (OU-1) at the Hanscom Field/Hanscom AFB NPL Site

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 66th MISSION SUPPORT GROUP (AFMC)
HANSCOM AIR FORCE BASE MASSACHUSETTS

U.S. AIR. FORCE

4 September 2008

MEMORANDUM FOR: Mr. Matthew Audet
U.S. Environmental Protection Agency, Region I
1 Congress St., Suite 1100 (HBT)
Boston, MA 02114-2023

FROM: 66 MSG/CEV, 120 Grenier Street, Hanscom AFB, MA 01731-1910

SUBJECT: Land Use Controls including Institution Controls (LUCs/ICs) for Operable Unit 1 (OU-1) at the Hanscom Field/Hanscom AFB NPL Site

Reference: July 24, 2008 letter to the undersigned from the Bedford Town Manager, Mr. Richard T. Reed, concerning restrictions on land use and the use of groundwater in Bedford's Jordan Conservation Area and the Hartwell Town Forest.

1. LUCs/ICs are components of the remedy selected by the 2007 Record of Decision (ROD) for OU-1. The LUCs/ICs that are being maintained, monitored and enforced to control access to the three source areas on Hanscom Field and OU-1 contaminated groundwater are documented in Section 2.13.3, Description of Remedial Action of the ROD. These LUCs/ICs were also discussed in the OU-1 Remedy Implementation paragraphs in Section IV of the 2007 Third Five-Year Review Report for the Hanscom Field/Hanscom AFB Superfund Site.

2. The subject letter was requested by this office to fulfill the specific requirement listed in Section 2.13.3 of the ROD concerning the town establishing restrictions prohibiting the construction of wells and the use of groundwater in any documented or anticipated area of groundwater contamination. As noted in the reference letter the town already has a previously unreported/undocumented IC in place concerning the installation of wells. Specifically Section 8 of Bedford Board of Health Code of Health Regulations requires that any landowner obtain a permit for the installation of wells anywhere in the Town of Bedford. While this does not specifically "prohibit" wells in the referenced conservation lands it does ensure that the Board of Health would be involved in the decision. This permit requirement in conjunction with the Land Use restrictions documented both in the ROD and in the referenced letter and with the Board of Health's knowledge of the groundwater contamination in the reference conservation lands should ensure that wells are not installed in any documented or anticipated area of groundwater contamination.

3. As stated in the ROD the Air Force is responsible for ensuring that the LUCs /ICs described in the ROD continue to be in place, are reported on, and enforced to ensure that the LUCs are effective and protective of human health and the environment. In this regard, the Hanscom AFB environmental office has been monitoring activities on Hanscom Field and in the Bedford

conservation lands for several years to ensure that these activities did not impact the on-going remedial action or threaten human health or the environment. The formal reporting of this monitoring was initiated in June 2002 by including the statement in the monthly OU-1 Remedial Action Report that "there continues to be no evidence of unauthorized activities at Sites 1, 2 and 3 and no evidence that the OU-1 groundwater is being used for drinking water purposes". Please note that this statement is based both on observations by this office and on observations by our remedial action-operations contractor's on-site staff in the course of their OU-1 system operation, maintenance and monitoring duties.

4. This office also maintains a good working relationship with key Hanscom Field and Town of Bedford personnel in regards to activities on Hanscom Field and Hanscom AFB that could impact Bedford, Massport and/or the Air Force. This relationship includes written communications/reports and periodic discussions meetings concerning operational, safety and environmental compliance requirement in addition to Hanscom AFB remedial actions. Hanscom AFB has been furnished the opportunity to review and comment on Massport's L.G. Hanscom Field Environmental Status and Planning Report (ESPR) which is issued every five years. Massport also includes Hanscom AFB in the planning stages of their activities which have an environmental impact, e.g., in 2007 Massport coordinated with this office during the planning stage for new storm water detention/infiltration facilities and also on the design of a Runway Safety Area (RSA) project.

5. In the OU-1 ROD Hanscom AFB committed to have "discussions at least annually, or more often if warranted between Massport and Bedford officials and the Hanscom AFB IRP Manager to verify that untreated groundwater within OU-1 is not being used for any purpose, and that there is no unauthorized digging at IRP Sites 1, 2 and 3". As noted in paragraph 4 above there have been periodic discussions/meetings over the years. In 2008 both the undersigned and our IRP Manager, Mr. Thomas Best have had several discussions and/or meetings with Ms Elizabeth Bagdonas, Bedford's Conservation Administrator, Mr. David Black, Bedford's Director of Public Health, Mr. James Mathieu, Hanscom Field Manager of Operations and Mr. Erik Bankey, Massport's Environmental Unit in which the Hanscom AFB IRP has been the central issue. Mr. Best also coordinated with Mr. Don Corey, former Bedford Selectman/member of both the Hanscom AFB and NWIRP RABs, to obtain the referenced letter from Mr. Reed.

6. In view of the information contained in this Memorandum and the OU-1 ROD Hanscom AFB is of the opinion that the selected remedy is fully in-place. We will continue to formally report on the status of the remedial action to include LUCs/ICs via the monthly Remedial Action Report and annual LTM Report. Also this office and our environmental support contractor will continue to be ever vigilant in monitoring activities on Hanscom Field and in the Bedford

conservation lands to ensure that these activities did not impact the on-going remedial action or threaten human health or the environment.

DONALD C. MORRIS, P.E.
Environmental Director, Civil Engineering

Attachment: Referenced letter from the Bedford Town Manager

CF: Ms Jennifer Roberge, Remedial Project Manager, MADEP
Ms Elizabeth Bagdonas, Bedford Conservation Administrator
Mr. David Black, Bedford Director of Public Health
Mr. Donald Corey, Hanscom AFB RAB Member
Mr. James Mathieu, Operations Manager, L.G. Hanscom Field
Mr. Mark Pearson, Community Co-Chair, Hanscom AFB RAB
Mr. Ed Conroy, Environmental Services Project Manager, Metcalf & Eddy, Inc.

G-3-1 - Enclosure **to Attachment J-3** - Bedford Town Manage letter to the Hanscom AFB Environmental Director dated 24 July 2008 which discusses restrictions on the land use and the use of groundwater by the Town of Bedford in off-base areas of contamination

TOWN OF BEDFORD

BEDFORD, MASSACHUSETTS 01730

TTD/TTY: 781-687-6124

Richard T. Reed, *Town Manager*

Town Hall
Bedford, MA 01730
781-275-1111

July 24, 2008

Mr. Donald C. Morris, P.E,
Environmental Director, Civil Engineering
66th MSG/CEGV
120 Grenier Street
Hanscom AFB, MA 01731

Dear Mr. Morris:

The purpose of this letter is to address concerns of the US EPA and Mass DEP regarding restrictions on land use and the use of groundwater by the Town of Bedford in off-base areas of contamination.

Please be advised of the following:

1. Representatives of the Town of Bedford were given the opportunity to review and comment on Hanscom AFB's 2007 Record of Decision (ROD) for NPL Operable Unit 1 at Hanscom Field/Hanscom AFB, MA. While no formal comments were offered by my office, we noted that this ROD continues the commitment that Hanscom AFB made in the mid-1980's to fast track the investigation and cleanup of the groundwater contamination which was originating from three (3) source areas on Hanscom Field for which the Air Force accepted responsibility.

The Town of Bedford has been kept informed as to each step in the CERCLA process to reach the current on-going remedial action stage. The Monthly Remedial Actions Reports provided to the Conservation Administrator and Director of Public Health, together with the Long-Term Monitoring Reports provided to the Director of Public Health, document the continued progress towards complete aquifer restoration. Also, key members of the Town are kept up-to-date as to the status of the remedial action by periodic meetings with representatives of the Hanscom AFB Environmental Office and by attending the Hanscom AFB Restoration Advisory Board (RAB) meetings or by review of minutes and handouts from the RAB meetings.

2. In regards to the Town's conservation lands known as the Hartwell Town Forest and the Jordan Conservation Area (where Community Gardens are located), we have been asked by your office to outline the current use restrictions and the basis for those restrictions. The management and land use for these areas are outlined in the Conservation Commission's July 27, 2007, letter, which has been incorporated as Appendix G to the September 2007 ROD for NPL Operable Unit 1 at Hanscom Field/Hanscom AFB, MA. As noted in that letter, the bases for the restrictions of these lands are the Massachusetts General Laws and the Massachusetts Constitution. While it may be possible to change the land use, it would be a difficult process that would require public and regulatory involvement.

When the Town was accepted in MWRA's Water Division, one of the mandatory requirements was that Bedford would maintain its currently active municipal drinking water wells and would attempt to reactivate other wells that were shut down due to contamination whenever public health considerations

permit and/or economic feasibility allows. This would include the Hartwell Road Wellfield, although the Hartwell Town Forest and Jordan Conservation Area are too far downgradient to impact those wells.

The Town has also adopted an Aquifer Protection District Bylaw, found at Section 13 of the Bedford Zoning Bylaws. It was developed based on DEP's model ordinance and has rigorous use regulations for properties located within any Aquifer Protection District. The Aquifer Protection Districts are delineated on a map entitled "Hydrogeologic Zones for Bedford Water Supply Wells", which was developed by the town's consultant and is a part of the Zoning Bylaw. All of Hanscom AFB's and Mass. Port Authority's land located in Bedford is either in the Hartwell Road Wellfield Zone II or the currently operational Shawsheen Road Wellfield Zone III. Both Hartwell Town Forest and Jordan Conservation Area, which are drained to the Shawsheen River via Hartwell Brook, are also in the Shawsheen Road Wellfield Zone III. No evidence of contamination has been found in the groundwater from the Shawsheen Wells, and the Town would not consider changes in its upgradient land or groundwater usage that might compromise those wells.

Additional institutional controls that are in-place include the requirement for any landowner to obtain a permit from the Board of Health to install wells anywhere in the Town of Bedford. This requirement is documented within Section 8 of Bedford Board of Health Code of Health Regulations (Private Wells) adopted under authority of Chapter 111, Section 31 of Massachusetts General Laws. Please note that to the best of our knowledge the Board of Health has never issued a drinking water well permit in the immediate vicinity of the Hartwell Town Forest or the Jordan Conservation Area. Also both the Conservation Administrator and representatives of the Hanscom AFB Environmental Office frequently visit these areas and have never reported an unauthorized well in these areas.

3. At this time we cannot envision a scenario that would require the Town to attempt changes in the land use of the Hartwell Town Forest and/or the Jordan Conservation Area. Any proposed change in land use or use of the groundwater as a drinking water source would also initially have to be reviewed and approved by the Conservation Commission, which, as noted above, is well aware of the potential for groundwater contamination in these areas. However, by a copy of this letter, I am requesting that both the Board of Health and the Conservation Commission ensure that the Hanscom AFB Environmental Office is immediately notified in case any changes are proposed in the land and/or groundwater use in the Hartwell Town Forest and/or the Jordan Conservation Area.

Finally, please continue to use our Director of Public Health, Mr. David Black, and our Conservation Administrator, Ms Elizabeth Bagdonas, as the points of contact for matters concerning the groundwater contamination within the Hartwell Town Forest and/or the Jordan Conservation Area.

Very truly yours,

Richard T. Reed
Town Manager

cc: Matthew Audet, Remedial Project Manager, EPA
Jennifer Roberge, Remedial Project Manager, EPA
Tom Best, Project Manager, HAFB
Mark Pearson, HAFB-RAB Community Co-Chair
Donald Corey
Richard Warrington, DPW Director
David Black, Health Director
Elizabeth Bagdonas, Conservation Administrator

ATTACHMENT H

SUPPORTING INFORMATION FOR IRP SITE 21 QUESTION B RESPONSE

Attachment H Table 1
Hanscom AFB
OU-3 Site 21
RSL Calculator Inputs

Site-specific	
Resident Equation Inputs for Tap Water	
Variable	**Value**
THQ (target hazard quotient) unitless	0.07
TR (target risk) unitless	0.000001
LT (lifetime) year	70
K (volatilization factor of Andelman) L/m^3	0.5
l_{sc} (apparent thickness of stratum corneum) cm	0.001
ED_{res} (exposure duration - resident) year	26
ED_{res-c} (exposure duration - child) year	6
ED_{res-a} (exposure duration - adult) year	20
ED_{0-2} (mutagenic exposure duration first phase) year	2
ED_{2-6} (mutagenic exposure duration second phase) year	4
ED_{6-16} (mutagenic exposure duration third phase) year	10
ED_{16-26} (mutagenic exposure duration fourth phase) year	10
EF_{res} (exposure frequency) day/year	350
EF_{res-c} (exposure frequency - child) day/year	350
EF_{res-a} (exposure frequency - adult) day/year	350
EF_{0-2} (mutagenic exposure frequency first phase) day/year	350
EF_{2-6} (mutagenic exposure frequency second phase) day/year	350
EF_{6-16} (mutagenic exposure frequency third phase) day/year	350
EF_{16-26} (mutagenic exposure frequency fourth phase) day/year	350
$ET_{res-adj}$ (age-adjusted exposure time) hour/event	0.67077
$ET_{res-madj}$ (mutagenic age-adjusted exposure time) hour/event	0.67077
ET_{res} (exposure time) hour/day	24
ET_{res-c} (dermal exposure time - child) hour/event	0.54
ET_{res-a} (dermal exposure time - adult) hour/event	0.71
ET_{res-c} (inhalation exposure time - child) hour/day	24
ET_{res-a} (inhalation exposure time - adult) hour/day	24
ET_{0-2} (mutagenic inhalation exposure time first phase) hour/day	24
ET_{2-6} (mutagenic inhalation exposure time second phase) hour/day	24
ET_{6-16} (mutagenic inhalation exposure time third phase) hour/day	24
ET_{16-26} (mutagenic inhalation exposure time fourth phase) hour/day	24
ET_{0-2} (mutagenic dermal exposure time first phase) hour/event	0.54
ET_{2-6} (mutagenic dermal exposure time second phase) hour/event	0.54
ET_{6-16} (mutagenic dermal exposure time third phase) hour/event	0.71
ET_{16-26} (mutagenic dermal exposure time fourth phase) hour/event	0.71
BW_{res-a} (body weight - adult) kg	80
BW_{res-c} (body weight - child) kg	15

Attachment H Table 1
Hanscom AFB
OU-3 Site 21
RSL Calculator Inputs

Site-specific	
Resident Equation Inputs for Tap Water	
Variable	**Value**
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	80
BW_{16-26} (mutagenic body weight) kg	80
$IFW_{res-adj}$ (adjusted intake factor) L/kg	327.95
$IFW_{res-adj}$ (adjusted intake factor) L/kg	327.95
$IFWM_{res-adj}$ (mutagenic adjusted intake factor) L/kg	1019.9
$IFWM_{res-adj}$ (mutagenic adjusted intake factor) L/kg	1019.9
IRW_{res-c} (water intake rate - child) L/day	0.78
IRW_{res-a} (water intake rate - adult) L/day	2.5
IRW_{0-2} (mutagenic water intake rate) L/day	0.78
IRW_{2-6} (mutagenic water intake rate) L/day	0.78
IRW_{6-16} (mutagenic water intake rate) L/day	2.5
IRW_{16-26} (mutagenic water intake rate) L/day	2.5
EV_{res-a} (events - adult) per day	1
EV_{res-c} (events - child) per day	1
EV_{0-2} (mutagenic events) per day	1
EV_{2-6} (mutagenic events) per day	1
EV_{6-16} (mutagenic events) per day	1
EV_{16-26} (mutagenic events) per day	1
$DFW_{res-adj}$ (age-adjusted dermal factor) cm^2-event/kg	2610650
$DFWM_{res-adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	8191633
$DFW_{res-adj}$ (age-adjusted dermal factor) cm^2-event/kg	2610650
$DFWM_{res-adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	8191633
SA_{res-c} (skin surface area - child) cm^2	6365
SA_{res-a} (skin surface area - adult) cm^2	19652
SA_{0-2} (mutagenic skin surface area) cm^2	6365
SA_{2-6} (mutagenic skin surface area) cm^2	6365
SA_{6-16} (mutagenic skin surface area) cm^2	19652
SA_{16-26} (mutagenic skin surface area) cm^2	19652

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Attachment H Table 2
RSL Calculator Output
Hanscom AFB
OU-3 Site 21

Site-specific
Resident Screening Levels (RSL) for Tap Water
Key: I = IRIS; P = PPRTV; D = DWSHA; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; E = see user guid

Chemical	CAS Number	Mutagen?	VOC ?	Chemical Type	Ingestion SF (mg/kg-day)$^{-1}$	SFO Ref	Inhalation Unit Risk (ug/m^3)$^{-1}$	IUR Ref	Chronic RfD (mg/kg-day)	Chronic RfD Ref	Chronic RfC (mg/m^3)	Chronic RfC Ref	GIABS
Butylbenzene, sec-	135-98-8	No	Yes	Organics	-		-		1.00E-01	SC	-		1
Propyl benzene	103-65-1	No	Yes	Organics	-		-		1.00E-01	SC	1.00E+00	SC	1
Trimethylbenzene, 1,2,4-	95-63-6	No	Yes	Organics	-		-		1.00E-02	IR	6.00E-02	IR	1
Trimethylbenzene, 1,3,5-	108-67-8	No	Yes	Organics	-		-		1.00E-02	IR	6.00E-02	IR	1

Output generated 31MAR2017:10:28:32

Attachment H Table 2
RSL Calculator Output
Hanscom AFB
OU-3 Site 21

Site-specific
Resident Screening Levels (RSL) for Ta
Key: I = IRIS; P = PPRTV; D = DWSHA; O = Ce Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Gu

Chemical	CAS Number	K_p (cm/hr)	MW	B (unitless)	t (hr)	T_{event} (hr/event)	FA (unitless)	In EPD?	$DA_{event\ (ca)}$	$DA_{event\ (nc\ child)}$	$DA_{event\ (nc\ adult)}$	MCL (ug/L)
Butylbenzene, sec-	135-98-8	0.301	134.22	1.3412254	2.3358545	0.593582	1	No	-	-	-	-
Propyl benzene	103-65-1	0.0939	120.2	0.3959538	1.1889949	0.4954145	1	Yes	-	0.0172035	0.0297171	-
Trimethylbenzene, 1,2,4-	95-63-6	0.0857	120.2	0.3613763	1.1889949	0.4954145	1	Yes	-	0.0017203	0.0029717	-
Trimethylbenzene, 1,3,5-	108-67-8	0.0621	120.2	0.2618608	1.1889949	0.4954145	1	Yes	-	0.0017203	0.0029717	-

Output generated 31MAR2017:10:28:32

Attachment H Table 2
RSL Calculator Output
Hanscom AFB
OU-3 Site 21

Site-specific
Resident Screening Levels (RSL) for Ta
Key: I = IRIS; P = PPRTV; D = DWSHA; O = Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL value

Chemical	CAS Number	Ingestion SL TR=1.0E-6 (ug/L)	Dermal SL TR=1.0E-6 (ug/L)	Inhalation SL TR=1.0E-6 (ug/L)	Carcinogenic SL TR=1.0E-6 (ug/L)	Ingestion SL Child THQ=0.07 (ug/L)	Dermal SL Child THQ=0.07 (ug/L)	Inhalation SL Child THQ=0.07 (ug/L)
Butylbenzene, sec-	135-98-8	-	-	-	-	1.40E+02	-	-
Propyl benzene	103-65-1	-	-	-	-	1.40E+02	1.28E+02	1.46E+02
Trimethylbenzene, 1,2,4-	95-63-6	-	-	-	-	1.40E+01	1.40E+01	8.76E+00
Trimethylbenzene, 1,3,5-	108-67-8	-	-	-	-	1.40E+01	1.94E+01	8.76E+00

Output generated 31MAR2017:10:28:32

Attachment H Table 2
RSL Calculator Output
Hanscom AFB
OU-3 Site 21

Site-specific
Resident Screening Levels (RSL) for Ta
Key: I = IRIS; P = PPRTV; D = DWSHA; O = Cs are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Chemical	CAS Number	Noncarcinogenic SL Child THI=0.07 (ug/L)	Ingestion SL Adult THQ=0.07 (ug/L)	Dermal SL Adult THQ=0.07 (ug/L)	Inhalation SL Adult THQ=0.07 (ug/L)	Noncarcinogenic SL Adult THI=0.07 (ug/L)	Screening Level (ug/L)
Butylbenzene, sec-	135-98-8	1.40E+02	2.34E+02	-	-	2.34E+02	1.40E+02 nc
Propyl benzene	103-65-1	4.59E+01	2.34E+02	1.93E+02	1.46E+02	6.13E+01	4.59E+01 nc
Trimethylbenzene, 1,2,4-	95-63-6	3.90E+00	2.34E+01	2.12E+01	8.76E+00	4.90E+00	3.90E+00 nc
Trimethylbenzene, 1,3,5-	108-67-8	4.22E+00	2.34E+01	2.92E+01	8.76E+00	5.23E+00	4.22E+00 nc

Output generated 31MAR2017:10:28:32

Attachment H Table 3
Vapor Intrusion Screening
Hanscom Air Force Base
Operable Unit 3 - Site 21

Constituent	Units	USEPA Commercial Target Sub-Slab Soil Gas Concentration @ TCR = 1E-06 or THQ = 0.1	MassDEP Sub-slab Criteria (Commercial/ Industrial)	1833-A-20140226*	2833-A-20140226	1823-B-20140227	1833-C-20140226	1834-A-20140227	1834-B-20140227	1834-C-20140227	1823-C-20140227	1823-B-20140227	1823-A-20140227
		µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3
Acetone	µg/m3	452600	50,000	220J	120	47	50	37	62	180J	99	97	290J
Benzene	µg/m3	52.41025641	770	6.3	0.62J	0.66J	0.92J	0.39J	0.37J	0.60J	0.84J	1.5	0.59J
Methyl Ethyl Ketone (2-butanone)	µg/m3	73000	310,000	23	9.8	9.1	9.3	9.6	7.2	15	19	18	17
Carbon Tetrachloride	µg/m3	68.13333333	130	12	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	µg/m3	730	1,300	8.6	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	µg/m3	17.77391304	210	9.7	0.72J	ND	0.61J	ND	ND	ND	ND	ND	ND
Dichlorobenzene, 1,2-	µg/m3	2920	13,000	12	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobenzene, 1,3-	µg/m3	N/A	13,000	12	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobenzene, 1,4-	µg/m3	37.16363636	120	12	ND	ND	ND	ND	ND	ND	0.99J	ND	1.7J
Dichloroethane, 1,1-	µg/m3	255.5	31,000	7.3	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichloroethylene, 1,1-	µg/m3	2920	12,000	6.4	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethylene	µg/m3	N/A	370	7.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	µg/m3	N/A	3,700	7.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	µg/m3	163.52	62,000	9.7	ND	ND	0.96J	ND	ND	0.53J	1.8	2.5	0.60J
Hexachlorobutadiene	µg/m3	18.58181818	320	18J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Tert-Butyl Ether (MTBE)	µg/m3	1572.307692	190,000	8.6	1.6J	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Isobutyl Ketone (4-methyl-2	µg/m3	43800	46,000	3.1	0.3JM	0.17J	ND	0.16J	0.15J	0.20J	0.82	0.53	0.53M
Methylene chloride	µg/m3	8760	37,000	5.9	0.30J	ND	0.73J	ND	0.74J	ND	0.30J	ND	ND
Naphthalene	µg/m3	12.02352941	190	8.9J	ND	ND	ND	ND	ND	ND	ND	5.0J	ND
Tetrachloroethylene	µg/m3	584	290	13	0.51J	0.49J	2.2J	ND	ND	0.91J	1.3J	5.8	0.75J
Toluene	µg/m3	73000	310,000	8.8	2.7	1.5J	2	1.3J	0.99J	1.1J	5.2	140	12
Trichlorobenzene, 1,2,4-	µg/m3	29.2	240	12J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethane, 1,1,1-	µg/m3	73000	310,000	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	µg/m3	29.2	120	9.9	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	µg/m3	92.90909091	91	4.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	µg/m3	1460	6,200	30	1.3J	0.96J	3.9J	0.97J	ND	2.0J	9.2	11	2.6J

Notes:
1. USEPA Target Sub-Slab Soil Gas Concentrations were obtained from the USEPA Vapor Intrusion Screening Level (VISL) Calculator Version 3.5.1 (based on May 2016 Regional Screening Levels [RSLs]).
2. MassDEP Sub-Slab Criteria were obtained from the MassDEP Vapor Intrusion Guidance: Site Assessment, Mitigation and Closure, Policy #WSC-16-435, October 14, 2016.

ATTACHMENT I

AIR FORCE RESPONSES TO USEPA AND MASSDEP COMMENTS

Comment and Response Worksheet

	Surveillance Activity Number	Hanscom AFB 5th Five Year Review - Regulatory Comments		Date:

Item	Commenter	Section	Page	Para	Line	Class	Comment	Response	Concurrence with Response	
1	EPA	4.2 - Remedy Implementation	pg. 4-14 (53)	3	(No specific line)	M	Groundwater Compliance Boundary - Please specify whether the recent additional monitoring and determination described on pg. 53 is addressing the prior FYR recommended actions. (Note: please add more detail here, similar to what is summarzied on Pg. 5-3 (70) of the FYR, about the dates and summary of findings per the 2016 downgradient investigation report & compliance Boundary memo for OU3/IRP Site 6. Please also note whether or not an amended ROD or ESD is needed based on findings).	The latter portion of the paragraph was expanded as follows to include more detail similar to that provided on p. 5-3: "More recently, additional monitoring wells were installed, groundwater monitoring was conducted at an increased frequency to evaluate seasonal trends, and an assessment of the source of dissolved arsenic was conducted in 2014 and 2015, at an in the vicinity of Site 6. The results of the detailed investigation are provided in the Downgradient Investigation Report (Versar, 2015). It was determined that the compliance boundary, as revised in 2006, is still appropriate and protective and that the dissolved arsenic present above the MCL beyond the compliance boundary is naturally occurring and not site related. The revised Groundwater Compliance Boundary and additional wells are shown on the current Site Plan (Figure 13). This determination along with USEPA and MassDEP's approval of the findings, was documented in a letter report entitled Final Compliance Boundary Confirmation for DP007 (Site 6) at Hanscom Air Force Base (Versar, March 2016). Based on the findings, an Explanation of Significant Differences or ROD Amendment was determined not to be needed. The additional monitoring and determination address a recommendation made for Site 6 in the previous 2012 Five-Year Review."	9/19/2017	EPA concurs with response. (*Note : Pls. ensure the Aug. 2015 draft DGI Final report [doc # NER0006CK.02] is finalized and the Summary and Recommendations - section 4.0 - reflects the same info./conclusions as the FYR. During the last monthly Partnering call, AF confirmed some of the DGI report needed to be revised due to some incorrectly written info .*).
2	EPA	5.4 - Protectiveness & Recommendations for OU3/Site 21	Pg. 5-5 (72)	1 (under Recomm. #2)	1	F	Under Recommendation #2 - please better clarify and describe the reason why the wells were not installed and the groundwater treatment in zone 2 was halted, e.g. so that remedial optimization remedies such as in-situ treatment could be employed and monitored in this area. [Note: As written now, to someone reading the FYR but who's not familiar with technical details for OU3/Site 21, not installing the wells could appear as a negative or not following a prior FYR recommendation. Could use wording similar to that on pg. 5-4 (71)].	Under Progress for Recommendation #2, the beginning of the paragraph was edited and expanded as follows for additional clarification: "Since the previous five-year review, the focus of efforts to remediate Site 21 groundwater have changed from active remedial efforts (i.e. pump and treat) in the Zone 2 area to passive in-situ treatment methods, with a goal of achieving a higher rate of contaminant mass destruction. To date, additional monitoring wells have not been installed in Zone 2, since they were intended for evaluation of the active recovery network. Rather, in July 2015, the active groundwater collection and treatment system was shut down and supplemental remedial activities were conducted. The active groundwater collection and treatment system was turned off to minimize interference with the application of remedial products and also to monitor the behavior of TCE in the aquifer when not under the influence of the pump and treat system. ORC Advanced® filter socks were placed..."	9/19/2017	EPA concurs with response and expanded wording.
3	EPA	6.3 - Data Review for OU3/Site 6	pg. 6-15 (87)	4	4	C	For OU-3/IRP Site 6: it mentions that pentachlorophenol (PCP) was not detected but the detection limit was higher than the MCL/GW-1 standard of 1 ug/L; therefore, PCP cannot be ruled out as a COC based on available data. To rule out PCP, representative future samples should be analyzed using methods with a detection limit lower than the standard.	To address this comment, the following text has been added to Section 7.3 under Remdial Action Performance and at the end of the Technical Asseessment Summary: "PCP is routinely detected in well MW6-106, located within the limits of the Former Filter Bed Area cap, at concentrations above the MCL/MCP GW-1 Standard. PCP results for downgradient well MW6-112U have been non-detect with reporting limits ranging from 19 to 57 ppb over the past five years; therefore, it cannot be absolutely concluded that PCP is not present above the MCL/MCP GW-1 Standard at well MW6-112U. Historic data from 2006 for well MW6-112U showed a PCP concentration of 1.06 ppb and it is unlikely that PCP concentrations would have increased since then. Also, well MW6-112U is located more than 400 feet upgradient of the compliance boundary and within the limits of the Former Filter Bed Area cap. However, in order to absolutely confirm that the extent of PCP above the MCL/MCP GW-1 Standard is limited and does not extend beyond well MW6-112U, it is recommended that the well be sampled for PCP using an analytical method that is sensitive enough to achieve a reporting limit below the MCL/MCP GW-1 Standard of 1 ppb." In Sections 8.0 and 9.0 and on the Summary Form, and Issue and Recommendation has been added. The issue states "The extent of PCP above the MCL/MCP GW-1 Standard downgradient of well MW6-106 cannot be confirmed using recent data because the reporting limit for the analytical method used is above the MCL/MCP GW-1 Standard (1 ppb). PCP results for downgradient well MW6-112U have been non-detect with reporting limits ranging from 19 to 57 ppb over the past five years." The recommendation/follow-up action states: "Sample for PCP at well MW6-112U using an analytical method that is sensitive enough to achieve a reporting limit below the MCL/MCP GW-1 Standard of 1 ppb." The milestone date is shown as December 2018 and it is indicated that neither current or future protectiveness are impacted. In the Executive Summary, the following text has been added as the 2nd to last paragraph under OU-3/IRP Site 6: "Although not expected to impact the current or future protectiveness of the remedy, it cannot be absolutely confirmed based on recent PCP results for well MW-112U, which have been non-detect with reporting limits above the MCL/MCP GW-1 Standard, that PCP does not exceed the cleanup standards at that location. Therefore, it is recommended that the well be sampled for PCP using an analytical method that is sensitive enough to achieve a reporting limit below the MCL/MCP GW-1 Standard."	9/19/2017	EPA concurs with response and the recommendation & follow-up action added to the FYR for PCP sampling at a lower detection limit.
4	EPA	6.3 - Data Review for OU3/Site 21	Pg. 6-24 (96)	6	(No specific line)	C	Subsection "Zone 5 (Buffer/Sentry Area between the Site and the Shawsheen River)", indicates there is consistent low to non-detect levels of VOCs in sentry well ECS-38, and long-term monitoring results are included in Attachment F for well ECS-38 and stream gauge SG-3. Please add a brief discussion of these results in the context of whether or not there could be ecological impacts in the river after dilution/attenuation of the groundwater into surface water, (perhaps by comparison of groundwater concentrations with MCP GW-3 standards or available aquatic toxicity benchmarks for the detected chemicals).	The following text has been added to the end of the paragraph that discusses well ECS-38 data; "Note also that comparison of data from the past five years to the MCP GW-3 standards shows no exceedances, indicating that ecological impacts from migration of groundwater from Site 21 to surface water in the Shawsheen River are unlikely." Additionally, the following text has been added to the end of the paragraph that discusses stream gauge SG-3: "Note also that comparison of the surface water data from the past five years to EPA Region III BTAG Freshwater Screening Benchmarks shows no exceedances, indicating that ecological impacts from the low level VOC detections are unlikely."	9/19/2017	EPA concurs with response and expanded wording.

Item	Commenter	Section	Page	Para	Line	Class	Comment	Response	Concurrence with Response	
5	EPA	7.1 - Technical Assessment for OU1	pg. 7-5 (106)	5	1	C	In reference to the statement "The CERCLA process needs to be continued for these contaminants and any changes to the current remedy should be incorporated into a future decision document." Please add additional text that refers more specifically to recommended actions that would satisfy such CERCLA process (as are described in Section 9.0 Recommendations).	The paragraph has been expanded as follows: "A Site Investigation (SI) for PFOS and PFOA is currently in progress. Groundwater, surface water, and soil-sediment sampling for PFOS and PFOA at HAFB is planned for Fall 2017 in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling. The SI is expected to be complete by June 2018. The CERCLA process should continue for 1,4-dioxane and PFOS and PFAS and any changes to the current remedy should be incorporated into a future decision document."	9/19/2017	EPA concurs with response, except for the following wording change: "The CERCLA process will continue for 1,4-dioxane and PFOS and PFAS and any changes to the current remedy should be incorporated into a future decision document." (*Note: "will" replaces "should"*).
6	EPA	7.1 - Technical Assessment for OU1	pg. 7-3 (104)	(See comment)	(See comment)	R	Please note that the ARARs tables for OU1 and 3 include 40 C.F.R. § 6 as an applicable requirement. However, this regulation no longer exists. Instead, FEMA regulation 44 C.F.R. § 9, is now in effect and addresses the Floodplain issues. Since the Floodplains regulations have changed, EPA requests that the Air Force therefore include some text or discussion in the FYR that addresses this change, and describes whether or not this change affects protectiveness at each relevant operable unit. Please include a discussion of this issue on the following pages: i. p. 7-3 (104) in sub-section, "Changes in Standards and To Be Considered"; ii. p. 7-8 (110) in sub-section, "Changes in Standards and To Be Considered"; and iii. p. 7-12 (113) in sub-section, "Changes in Standards and To Be Considered" b. This affects the ARARs tables included in Attachment B – ARARs Tables.	For OU-1, the following text has been added at the end of the "Changes in Standards and To Be Considered" subsection: "The 2007 Final ROD for OU-1 includes Executive Order 11988 and Appendix A of 40 CFR 6 as an applicable floodplain management requirement. This provision of the CFR no longer exists and the current provision is a FEMA regulation codified at 44 CFR 9. Since the remedy has been constructed and no activities are anticipated that would impact the 100-year floodplain, there are no concerns with the protectiveness of the remedy." For OU-3/IRP Site 6, the following text has been added at the end of the "Changes in Standards and To Be Considered" subsection: "The ROD for OU-3/IRP Site 6 includes Executive Order 11988 and Appendix A of 40 CFR 6 as an applicable floodplain management requirement. This provision of the CFR no longer exists and the current provision is a FEMA regulation codified at 44 CFR 9. Since the Wetland Z sediment removal and restoration work has been completed, the permeable caps are in place, and no activities are anticipated that would impact the 100-year floodplain, there are no concerns with the protectiveness of the remedy." For OU-3/IRP Site 21, the following text has been added at the end of the "Changes in Standards and To Be Considered" subsection: "The ROD for OU-3/IRP Site 21 includes Executive Order 11988 and Appendix A of 40 CFR 6 as an applicable floodplain management requirement. This provision of the CFR no longer exists and the current provision is a FEMA regulation codified at 44 CFR 9. Since the remedial action construction has been completed and no activities are anticipated that would impact the 100-year floodplain, there are no concerns with the protectiveness of the remedy."	9/19/2017	EPA concurs with response and revised wording.
7	EPA	7.1 - Technical Assessment for OU1	pg. 7-3 (104)	(See comment for row 18)	(See comment for row 18)	R	(See comment for row 18)	It is assumed that this was meant to refer to row 10 and the floodplain regulation change. See response for row 10 above for additional text that has been added.	9/19/2017	EPA concurs with response.
8	EPA	7.3 - Technical Assessment for OU3/Site 6	pg. 7-8 (110)	(See comment for row 18)	(See comment for row 18)	R	(See comment for row 18)	It is assumed that this was meant to refer to row 10 and the floodplain regulation change. See response for row 10 above for additional text that has been added.	9/19/2017	EPA concurs with response.
9	EPA	Attachment B - ARARs	Table G-1, Pg. 2 (161)	(See comment for row 18)	(See comment for row 18)	R	(See comment for row 18)	It is assumed that this was meant to refer to the ROD ARARs table included in Appendix B for OU-3/IRP Site 6 and to row 10 and the floodplain regulation change. Since Appendix B includes the ROD ARARs tables (exactly as presented in the RODs) and the discussion of changes to ARARs is included in the text, no edits have been made to Appendix B. See the response under row 10 above for text that has been added to page 7-8 for OU-3/IRP Site 6.	9/19/2017	EPA concurs with response.
10	EPA	7.3 - Technical Assessment for OU3/IRP 6	Pg. 7-13 to 7-14 (114-115)	4 (extends to top of pg. 7-14)	all	C/M	Changes in Risk Asssessment Methods, Exposure Pathways, Toxicity, and Other Contaminant Characteristics: Potential cleanup Goals for 4 chemicals that lack MCLs or GW-1 standards are calculated, each for hazard quotients of 0.07, based on the assumption that cleanup levels for 14 non-carcinogenic COCs would contribute equally and additively to a total hazard index of 1. This approach is conservative (protective), but uncustomary, because the summation of HQs should be done only for chemicals with the same target tissue for calculation of a target tissue-specific hazard index. These new potential cleanup goals should be documented in an ESD or amended ROD.	While risk-based cleanup levels for the 4 chemicals would be different if calculated now as documented in the text, an ESD does not seem warranted at this point because the changes do not appear to impact the current understanding of the extent of the contaminant plume, LUCs are in place to prevent exposure to impacted groundwater while the remedy is operating, and remedy operation would not change at this point if new cleanup levels were adopted. As stated in the comment, a conservative approach was used to evaluate the impact of the toxicity value and default exposure assumption changes. The Air Force will continue to evaluate the cleanup levels in future five-year reviews.	9/19/2017	EPA concurs with response and determination, and future evaluation of cleanup levels in future FYRs.
11	EPA	7.3 - Technical Assessment for OU3/Site 6	pg. 7-10 (113)	1st (after Table)	1	F	Please state that the change in MassDEP MCP GW-1 standard for naphthalene from 20 to 140 µg/l does not affect protectiveness and briefly explain why.	The following text has been added to the referenced paragraph following the sentence the describes the change to the GW-1 standard for naphthalene: "Since the standard has increased, there is no impact to the protectiveness of the remedy. "	9/19/2017	EPA concurs with response and revised wording.
12	EPA	7.3 - Technical Assessment for OU3/Site 21	pgs. 7-14 to 7-15 (115-116)	5 (starting at bottom of pg. 7-14)	(No specific line)	F	In the description of the revised risk-based cleanup levels/goals for the 4 COCs listed, please expand wording/explain how these new goals affect protectiveness. The existing text is not completely clear, and it appears as if the LTM data suggests exceedances of the new risk-based goals.	The text has been modified to reflect the following: "The cleanup goals calculated using current toxicity values and exposure parameters for n-propylbenzene and sec-butylbenzene have increased while cleanup goals for 1,3,5-trimethylbenezene and 1,2,4-trimethylbenzene have decreased. The most recent Long-Term Monitoring Report shows historical and recent concentrations greater than existing cleanup goals. However, the majority of recent exceedances (2015 to present) are limited to the former suspected LNAPL plumes (n-propylbenzene: MWZ-13, MWZ-20, PW-3, and RW-1A; 1,2,4-trimethylbenzene: MWZ-13, PW-3, and RW-1A; and 1,3,5-trimethylbenzene: RW-1A) or upgradient of the LNAPL plume (sec-butylbenzene, ECS-28; and n-propylbenzene, MWZ-11 and MWZ-12). The remedy is designed to minimize migration of the plume and to treat the contaminated groundwater. Long-term monitoring confirms that groundwater containing COC concentrations that exceed standards is not discharging to the Shawsheen River. The current understanding of the extent of the contaminant plume is not impacted by the changes and LUCs/ICs prevent exposure to impacted groundwater while the remedy is operating."	9/19/2017	EPA concurs with response and modified wording.
13	EPA	7.3 - Technical Assessment for OU3/IRP 6	Pg. 7-9 (110)	5	1	E	Under "Changes in Risk Assessment Methods, Exposure Pathways, Toxicity and Other Contaminant Characteristics": Change "Future residential use of groundwater…" to "Risks of future use of groundwater…"	Edit made as requested.	9/19/2017	EPA concurs with response.

Item	Commenter	Section	Page	Para	Line	Class	Comment	Response	Concurrence with Response	
14	EPA	7.3 - Technical Assessment for OU3/IRP 6	Pg. 7-10 (111)	5 (last on pg.)	3	F	It is stated that no new contaminants have been identified. Please confirm in the response to these comments that neither PFAS nor 1,4-dioxane has been detected in OU3/IRP Site 6; otherwise, please revise.	Neither PFAS nor 1,4-dioxane have been sampled for at IRP Site 6, so the existing text is correct that no new contaminants have been identified. 1,4-dioxane was sampled for in 2016 and 2017 only at those sites where it's presence was considered possible due to the presence of indicator compounds such as 1,1,1-TCA and 1,1-DCE. A Preliminary Assessment conducted for PFCs at Hanscom AFB did not identify any potential sources at Site 6.	9/19/2017	EPA concurs with response.
15	EPA	9 - Table 13: Recommendations & Follow-up Actions	Pg. 9-1 (119)	2nd row	Columns 1, 2, & 5	C	Please include a description and dates of the SI work for PFAS planned for Fall 2017 and 2018. [Note: Specific dates of known PFAS-related work were requested to be added to this table (rather than only including the 2022 milestone date)]. Also, please include a description and dates of any 1,4-dioxane work planned for any operable unit(s).	The Recommendations and Follow-up Action column for the emerging contaminants issue has been expanded to include three rows. The first row states "Conduct groundwater, surface water, and soil-sediment sampling for PFOS and PFOA as part of Site Investigation (SI) in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling." The Milestone Date for that row is included as Fall 2017. The second row states "Complete SI for PFOS and PFOA." The Milestone Date for the row is included as June 2018. The third row is unchanged from the original text and states "Proceed through the CERCLA process for 1,4-dioxane and PFOS and PFOA and incorporate any changes to the current remedy into a future decision document." with a Milestone Date of 2022.	9/19/2017	EPA concurs with response and these revisions.
16	EPA	9 - Table 13: Recommendations & Follow-up Actions	Pg. 9-2 (120)	2nd row	Column 1	C	Will the AF be investigating/researching water treatment technologies that are available/exist now (or are being developed) to remove PFAS compounds that could be used for effluent that is discharged from the HAFB GWTP to surface water? (e.g. feasibility, cost, etc. of best available technologies).	The Air Force's approach and policy for managing PFOS/PFOA contamination beyond addressing current exposures is still being developed. As such, specific plans for a technology analysis are not in place.	9/19/2017	EPA concurs with response.
17	EPA	10 - Protectiveness statement	Pg. 10-1 (124); (please also see pgs. xi, xvii, xviii, & 7-5).	1	(No specific line)	C/M	Under OU-1/IRP Sites 1, 2, & 3: Please include additional wording about the upcoming Site Investigation (SI) work planned for Fall 2017 and 2018, and next steps in the CERCLA process. Suggested wording for this section was drafted by EPA management and legal staff as follows: "A Site Investigation (SI) for PFAS is currently in progress. Groundwater, surface water, and soil-sediment sampling for PFAS at HAFB is planned for Fall 2017 in areas that were identified for further PFAS investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling. The SI is expected to be completed by June 2018. The SI will be followed by a Remedial Investigation (RI) to more fully delineate the nature and extent of PFAS contamination, including determining whether PFAS is migrating off the HAFB site onto adjacent property. Depending on the results of the RI, an additional CERCLA decision document may be required to modify the existing ROD remedy."	The latter portion of the paragraph has been expanded as follows: "...2) a Site Investigation (SI) for PFOS and PFOA is currently in progress. Groundwater, surface water, and soil-sediment sampling for PFOS and PFOA at HAFB is planned for Fall 2017 in areas that were identified for further investigation during the 2015 Preliminary Assessment, and based on the presence and elevated levels of PFOA/PFOS during August 2016 sampling. The SI is expected to be complete by June 2018. the The CERCLA process should be continued for 1,4-dioxane and PFOS and PFAS and any changes to the current remedy should be incorporated into a future decision document."	9/19/2017	EPA concurs with response, except for the following wording changes: "The CERCLA process will continue for 1,4-dioxane and PFOS, PFOA, and PFBS, and any changes to the current remedy will be incorporated into a future decision document." (*Note: "will" replaces "should"*). This wording was located on these pages of the FYR: pg. xi, xvii, xviii, 7-5, and 10-1.
18	EPA	Several sections (see comment field)	(See comment)	(See comment)	(See comment)	F	Please clarify the FYR triggering action and due dates, noted by our legal staff as being cited inconsistently in the FYR report as either Sept. 26th or Sept. 27th. Please see these sections: Executive summary (P. viii/pg. 8) Introduction: pg. 1-1 (20) Summary form: pg. xvi (16) Section 6.0: pg. 6-1 (73) Section 11.0: pg. 11-1 (126) Please clarify correct date(s) and ensure the date is consistently cited throughout.	The text has been modified to consistently refer to September 26th, which is the Air Force signature date on the previous five-year review. The Executive Summary, Introduction, and Summary Form have been updated.	9/19/2017	EPA concurs with response and the date revisions.
Note: Page numbers in (##) refer to the PDF file page, e.g. ## of 287.									AFCEC Concurrence	

Comment Classifications

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Comment and Response Worksheet

		Surveillance Activity Number					Hanscom AFB 5th Five Year Review - Regulatory Comments			
										Date:
Item	Commenter	Section	Page	Para	Line	Class	Comment	Response	Concurrence with Response	
1	MassDEP	Executive Summary	xiii	3	6		Suggest adding "beyond the compliance boundary" after "exceed the MCL" to clarify that only arsenic outside the compliance boundary has determined to be naturally occurring. Similar language is used on page 4-14.	Edit made as suggested.		
2	MassDEP	4.2	4-12	3	3		Change "Commonwealth" to MassDEP	Edit made as suggested.		
3	MassDEP	4.2	4-14	1	10		Add a rational was the long-term ecosystem monitoring was discontinued or a reference to a section in the document which describes why the monitoring was discontinued.	The following text has been added to the end of the referenced paragraph: "The rationale for discontinuing long-term ecosystem monitoring is described in Section 6.3 Data Review under Data Review OU-3/IRP Site 6."		
4	MassDEP	4.3	4-21	1			Change the dates for the LTM Reports for April/May2015 and November 2015 from "December 2016" to "February 2017" to reflect the final document	The dates have been changed as requested on this page and in Attachment A.		
5	MassDEP	4.3	4-23	1			Add 2016 Annual LTM for OU3 to the bulleted list of documents	The following bullet has been added: "• 2016 Annual Long-Term Monitoring/Remedial Action Report for Operable Unit 3, IRP Site 6 (DP007), prepared by Versar, Inc."		
6	MassDEP	4.3	4-23	2	4		In the Wetland Mitigation Monitoring section should "the 2007 Five-Year Review" be "the 2012 Five-Year Review"	Yes, date has been updated.		
7	MassDEP	4.3	4-25	2	5		Add a reference for the letter report dated January 2009	The text was edited to add "(Metcalf & Eddy, 2009)" at the end of the sentence that mentions the letter report. Attachment A was updated to add "Letter Regarding Installation of Monitoring Wells at Operable Unit 3 Site 6, Hanscom AFB, Massachusetts. Prepared by Metcalf & Eddy, Inc., January 23, 2009."		
8	MassDEP	5.4	5-5	3	16		Please specify which sub-slab soil screening values data were compared to, commercial/industrial or residential.	The words "commercial/industrial" have been added before "...sub-slab soil gas screening criteria..."		
9	MassDEP	6.3	6-10	2	3		Can this be updated to state that the Air Force has collected samples from 2 private off-base irrigation wells and add the sample dates?	The sentence has been updated to state: "Note also that the Air Force sampled 2 private off-base irrigation wells in June 2017 for both 1,4-dioxane and perfluorinated compounds (PFCs) (see discussion below), although these wells are not used to supply drinking water, which is the primary exposure pathway of concern."		
10	MassDEP	6.3	6-12	2			Similar comment to above, can this be updated to reflect that the Air Force has collected samples from 2 private irrigation wells	The words "has been scheduled for spring" have been updated to "was completed in June".		
11	MassDEP	6.3	6-19	4	4		The reference to Figure 23 should be changed to Figure 24	Edit made as suggested.		
12	MassDEP	6.3	6-26	1	13		Same comment as #8 please specify which sub-slab screening values were used	The words "commercial/industrial" have been added before "...sub-slab soil gas screening criteria..."		
13	MassDEP	6.3	6-27	Table 11			Add "Commercial/Industrial" to headers for sub-slab screening criteria	Edit made as suggested.		
14	MassDEP	7.1	7-6	1	7		There is not a EPA RSL for PFOS or PFOA, unclear what value this statement is referencing	Text on page 7-5 has been edited to reflect the use of the USEPA RSL calculator and provisional toxicity values for PFOA and PFOS to obtain risk-based screening levels. "No MCL, Regional Screening Level (RSL), or MassDEP MCP GW-1 standard has been developed for these compounds. However, the USEPA RSL Calculator contains provisional toxicity values for PFOA (0.00002 mg/kg/day; USEPA, May 2016) and PFOS (0.00002 mg/kg/day; USEPA, May 2016). Risk-based screening levels were calculated for PFOA (0.0401 ug/l) and PFOS (0.0401 ug/l) using the provisional toxicity values and a default residential exposure scenario. Detections are greater than the calculated risk-based screening level of 0.0401 µg/l and the USEPA drinking water health advisory (HA) level of 0.07 µg/l for PFOS/PFOA." On page 7-6, the words "current EPA Regional Screening Level" have been replaced with "risk-based screening levels calculated using USEPA provisional toxicity values".		
15	MassDEP	7.3	7-15	4			Specify that sub-slab soil screening values were commercial/industrial values	The text was clarified to add "Commercial/Industrial" before the mentions of sub-slab soil screening values.		
									AFCEC Concurrence	

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