DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, NORTH ATLANTIC DIVISION
FORT HAMILTON MILITARY COMMUNITY
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CENAD-PD-I

JUN 13 2017

MEMORANDUM FOR Commander, U.S. Army Corps of Engineers, New England District, (CENAE-PP-M/Mr. Gary P. Morin), 696 Virginia Road, Concord, MA 01742

SUBJECT: Final Decision Document (DD) for the Former Bucks Harbor Air Force Radar Tracking Station (AFRTS) and Ground-to-Air Transmitter and Receiver (GATR) Site, Machiasport, Maine

1. Reference Memorandum, CENAE-PP-E, dated 25 May 2017, subject as above, (enclosed).

2. I concur with the conclusions and approve the Final DD for the Former Bucks Harbor Air Force Radar Tracking Station and Ground-to-Air Transmitter and Receiver FUDS Projects (D01ME0486 02 and DO1ME0509 03).

3. The point of contact for this action is Ms. Heather Sullivan, FUDS Program Manager, (978) 505-7985, Heather.L.Sullivan@usace.army.mil.

Encl

WILLIAM H. GRAHAM
Brigadier General, USA
Commanding

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
696 VIRGINIA ROAD
CONCORD MA 01742-2751

CENAE-PP-E 25 May 2017

MEMORANDUM FOR Commander, U.S. Army Corps of Engineers, North Atlantic Division, (CENAD-PD-IIS-P/Mr. Ravi Ajodah), Fort Hamilton Military Community, 302 General Lee Ave, Brooklyn, New York 11252

SUBJECT: Request for Approval of the Final Decision Document (DD) for the Former Bucks Harbor Air Force Radar Tracking Station (AFRTS) and Ground-to-Air Transmitter and Receiver (GATR) Site, Machiasport, Maine

1. Enclosed with this memorandum is the Final DD for the Former Bucks Harbor Air Force Radar Tracking Station and Ground-to-Air Transmitter and Receiver FUDS Projects (D01ME0486 02 and D01ME0509 03).

2. The former Bucks Harbor facility is located in Machiasport, Maine, approximately 25 miles from the Canadian border. Machiasport is a small coastal town that includes the communities of Larrabee, Bucks Harbor, and Starboard Cove. The former Bucks Harbor facility consists of two properties within the FUDS program. One property is located on a spur ridge of Howard Mountain and is called the Bucks Harbor Former Air Force Radar Tracking Station (AFRTS). The other property is located on Miller Mountain and is referred to as the Ground-to-Air Transmitter and Receiver (GATR) Site.

3. The Remedial Investigation concluded that there is unacceptable risk to current and potential future receptors due to elevated concentrations of TCE in groundwater. The selected decision provides a long term solution by continuing to monitor the natural decreases in groundwater TCE concentrations while protecting the public from exposure to TCE. The key components of this alternative are monitored natural attenuation, long term monitoring of groundwater; alternate water supply or point of entry treatment system for impacted residents, monitoring of indoor air; and land use controls. The total estimated cost for implementing the selected remedy is approximately $4.6 Million.

4. The Final Remedial Investigation, Proposed Plan, and DD have all been fully coordinated with the lead regulator for the site, Maine Department of Environmental Protection (MEDEP) and Office of Counsel. MEDEP provided their concurrence on the final decision via correspondence dated 23 May 2017. Also, during the public comment period and public meeting, no disapproval of the decision presented in the Proposed Plan was expressed by the community or other stakeholders.

5. I recommend NAD approval of the Final DD for the Former Bucks Harbor Air Force Radar Tracking Station (AFRTS) and Ground-to-Air Transmitter and Receiver (GATR) Site. Pursuant to USACE Interim Guidance Document on FUDS Decision Documents dated 9 February 2017, the Division Commander for any Division with an assigned FUDS mission execution responsibility is the approval authority for DDs that have a selected remedy with total cost of less than or equal to $5 million.

6. Please contact me directly, if I can be of further assistance. Detailed information desired by your staff can be obtained by contacting Gary P. Morin, (978) 318-8232.

CHRISTOPHER J. BARRON
COL, EN
Commanding

Enclosure

U.S. Army Corps of Engineers
New England District

Final Decision Document

Former Bucks Harbor Air Force Radar Tracking Station (AFRTS) [D01ME0486 02] and Ground-to-Air Transmitter and Receiver (GATR) Site [D01ME0509 03], Machiasport, Maine

May 2017

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PART 1: DECLARATION

1.0 SITE NAME AND LOCATION

The former Bucks Harbor facility consists of two properties within the FUDS program. One property is located on a spur ridge of Howard Mountain and is called the Bucks Harbor Former Air Force Radar Tracking Station (AFRTS) and consists of: radar operations, the Cantonment Area, the Housing Area, and the Transmitter Site. This property includes the Howard Mountain and Transmitter Sites, and is identified as FUDS project D01ME0486 02. The other property is located on Miller Mountain and is referred to as the Ground-to-Air Transmitter and Receiver (GATR) Site. The Miller Mountain Site is identified as FUDS project D01ME0509 03. This Decision Document covers both FUDS projects, collectively identified as the Bucks Harbor facility in this Decision Document.

2.0 STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedy for the former Bucks Harbor AFRTS and GATR Site, located in Machiasport, Maine. The selected remedial alternative is **Monitored Natural Attenuation (MNA), long-term groundwater monitoring, alternate water supply or Point of Entry Treatment (POET) for impacted water supply wells, monitoring of indoor air, and land use controls**. This decision has been made, and this document has been prepared, under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS). As required by the DERP-FUDS program, the process and documentation for the environmental investigations and actions are conducted using the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, as amended. This Decision Document was prepared in accordance with the following guidance documents:

- *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents,* EPA 540-R-98-031, July 1999; and
- *Environmental Quality, Formerly Used Defense Sites (FUDS) Program Policy*, ER 200-3-1, U.S. Army Corps of Engineers, May 10, 2004.

This decision is based on the Administrative Record (AR), which is catalogued in an Administrative Record index. The AR and associated AR index were developed in accordance with Section 113 (k) of CERCLA, with key documents available for review at the US Army Corps of Engineers (USACE) New England District office, located in Concord, Massachusetts. The Administrative Record is available at the public information repositories at the Machiasport Town Hall in Machiasport, Maine, and at the Maine Department of Environmental Protection (MEDEP) headquarters in Augusta, Maine.

3.0 ASSESSMENT OF THE SITE

The response action selected in this Decision Document is necessary to protect public health or welfare and the environment from actual or threatened releases of pollutants or contaminants from this site which may present an endangerment to public health and welfare.

Based on the history of AFRTS activities and 1993 reports of trichloroethylene (TCE) in groundwater (Weston, 2005), USACE issued an Inventory Project Report (INPR) amendment (USACE, 1995a) under the DERP-FUDS program to initiate funding for investigating and responding to the TCE. This INPR was issued for the former AFRTS, which included the Federal Aviation Administration (FAA) Station, Maine Downeast Correctional Facility (DCF) at Howard Mountain, and the former Transmitter Site adjacent to Howard

Mountain (USACE, 1995a). Additionally, an INPR was issued for the ground-to-air transmitter and receiver (GATR) site at Miller Mountain (USACE, 1995b).

4.0 DESCRIPTION OF THE SELECTED REMEDY

This Decision Document sets forth the Long Term Monitoring with Enhanced Site Controls and Alternate Water Supply remedy for the Bucks Harbor site. The remedy provides a long term solution for all three areas (Howard Mountain, Miller Mountain and the Transmitter Site) by continuing to monitor the natural decreases in groundwater TCE concentrations while protecting the public from exposure to TCE. The key components of this alternative are:

- Monitored Natural Attenuation;
- Long term monitoring of groundwater;
- Alternate water supply or Point of Entry Treatment (POET) system for impacted residents.
- Monitoring of indoor air; and
- Land Use Controls.

The total estimated cost for implementing the selected remedy is approximately $4.6 Million.

5.0 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment. It complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action.

The enhanced site controls will provide interim measures that reduce the risks of exposure/ingestion of contaminated groundwater and the alternate water supply or POET system will provide treated water to affected residents. However, since treatment of the principal threats of the site is not considered a practical alternative, it does not satisfy the statutory preference for treatment as a principal element.

Until the remedy is complete, hazardous contaminants will remain in groundwater above levels that allow for Unlimited Use and Unrestricted Exposure (UU/UE). A review will be conducted no less often than each five years after initiation of remedial action until remedial action objectives have been attained to ensure that the remedy is protective of human health and the environment.

6.0 DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section (Part 2) of this Decision Document. More specific references for each item in the checklist below are provided in Part 2 of this document. See also Part 2,Section 3.1 for information regarding the availability of the AR.

- Discussion of the chemicals of concern and their respective concentrations at the site;
- Baseline potential risks represented by the chemicals of concern;
- Cleanup levels established for chemicals of concern and the basis for these levels;
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater, as used in the baseline risk assessment;
- Potential uses of land and groundwater at the site as a result of the selected remedy;
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected; and

- Key factors that led to selecting the remedy (i.e., a discussion of balancing and tradeoffs with respect to the modifying criteria).

7.0 AUTHORIZING SIGNATURES

This Decision Document (DD) presents the selected remedy of Long Term Monitoring with Enhanced Site Controls and Alternate Water Supply remedy for the Bucks Harbor site. The USACE is the lead agency under the DERP for response actions for DOD's hazardous substances at FUDS and has developed this DD consistent with CERCLA, as amended, and the NCP. This DD will be incorporated into the administrative record, which is available for public view. The selected remedy is protective of human health and the environment. This decision is approved by the undersigned, pursuant to USACE Interim Guidance Document on FUDS Decision Documents dated 9 February 2017, and to Engineer Regulation 200-3-1, FUDS Program Policy, dated 10 May 2004.

Signed by: Date:

David J. Leach 26 Jun 17

DAVID J. LEACH, P.E., SES
Director of Programs

PART 2: DECISION SUMMARY

1.0 SITE NAME, LOCATION AND DESCRIPTION

The former Bucks Harbor facility is located in Machiasport, Maine, approximately 25 miles from the Canadian border. Machiasport is a small coastal town that includes the communities of Larrabee, Bucks Harbor, and Starboard Cove (Weston, 2005). The Bucks Harbor study areas were grouped into three separate sites based on their locations, individual geologic and hydrogeologic characteristics, and the distribution of groundwater impacts. These areas are Howard Mountain, Miller Mountain, and the Transmitter Site, as shown in Figure 1. The study areas are located on mountains overlooking the harbor.

The USACE is the lead Federal agency for this site, and the Maine DEP is the support agency. This project is funded through the DERP-FUDS program.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 Site History

The Bucks Harbor Air Force Radar Tracking Station (AFRTS), consisting of Howard Mountain and the Transmitter Site was acquired by the US government between 1955 and 1963. The site consisted of 3.11 acres lease, 43.2 acres fee and 6.49 acres easement. Approximately 25 acres fee were obtained by condemnation, the rest were obtained by purchase (USACE, 2009).

The Bucks Harbor facility was used by the USAF as a radar tracking station until 1984 and had three major functional areas: Radar Operations, the Cantonment Area, and the Housing Area. Other site features include a sanitary sewer filter bed and a sanitary wastewater treatment plant (WWTP), located east of Base Road. Three outpost facilities were associated with the former AFRTS: the Receiver site and the Transmitter Site, which were located on a spur ridge at Howard Mountain (and the GATR site at Miller Mountain; see below). With the advent of more sophisticated satellite-based tracking systems, the USAF ceased operations at the facility in 1984 (Weston, 2005). See operational areas and features for the AFRTS, Transmitter Site, and GATR Site, shown on Figures 2, 3, and 4, respectively.

The radar operations facility, located near the Howard Mountain summit, was transferred to the Federal Aviation Administration (FAA) for use in tracking commercial air traffic, and the Cantonment Area was transferred to the State of Maine Department of Corrections for use as a minimum-security prison. The former Housing Area and the Transmitter Site were also transferred to the State of Maine and are used by the Downeast Correctional Facility (DCF). The former DCF Housing Area consisted of 27 housing units, which historically were used as rental units and/or for storage by the DCF and its employees. The units are currently unoccupied, and seven of the housing units were demolished in 2016. Inmates and DCF employees currently use the Transmitter Site as a carpentry shop. The adjacent Receiver site was sold to a private party and is currently used as a residence (Weston, 2005).

The GATR property (5.55 acres fee and 33.51 acres easement) was acquired by the US government via purchase between 1962 and 1963 (USACE, 2009). The USAF used the GATR site as an antennae field in conjunction with the AFRTS a few miles away. The USAF maintained ownership of the GATR site, before transferring the property to the FAA sometime around 1984. The language of this transfer document is not known. The property was identified as surplus government property in 1990. In 1992, The US Department of the Interior (DOI), National Park Service (NPS) transferred the property, on behalf of FAA, to its current owner, the Town of Machiasport. Due to environmental condition of the site, the property has not been used since its transfer to the Town of Machiasport.

2.2 History of Investigations

Environmental study began at the FAA-owned portion of the AFRTS in 1991. During that investigation, four areas were identified that required further investigation, including three former above-ground storage tank (AST) locations and one area of stained soil caused by the release of lubricating oil during the operation of a cooling tower. USACE issued an INPR in 1992 under the DERP-FUDS Program to initiate a project (D01ME0486 01) for the investigation of the tank locations (USACE, 1992). These four areas were addressed in a Site Assessment (SA) Report (equivalent to a Site Inspection Report in the CERCLA process) prepared in February 1995 (ABB, 1995a). The SA Report recommended preparation of a Corrective Action Plan (CAP) for soil removal at each of the four areas, demolition of the former fuel pump house and its foundation, and removal of the remains of the underground fuel distribution system in the FAA portion of the facility. The CAP (equivalent to a Remedial Action Plan in the CERCLA process) was prepared in June 1995 (ABB, 1995b), and the work was completed in the summer of 1996 (ABB, 1997a).

Based on the history of AFRTS activities and 1993 reports of TCE in groundwater, USACE issued an INPR amendment in 1995 (USACE, 1995a) under the DERP- FUDS program to initiate investigating and responding to the reported TCE contamination (D01ME0486 02). An INPR was also issued for the ground-to-air transmitter and receiver (GATR) site at Miller Mountain (USACE, 1995b) (D01ME0509 03)

USACE contracted Franklin Environmental Services, Inc. (Franklin) to remove 27 fuel oil underground storage tanks (USTs) associated with the DCF Housing Area and formerly used for home heating oil. Franklin also removed two diesel fuel above ground Storage tanks (ASTs), two 55-gallon drums, and three electrical switches. Franklin excavated approximately 2 cubic yards of soil from each of the former UST locations and collected soil samples for off-site laboratory analysis that indicated the presence of total petroleum hydrocarbons (TPH) at concentrations as high as 14,200 milligrams per kilogram (mg/kg) and low levels of chlorinated volatile organic compounds (VOCs). The chlorinated VOCs were detected in samples from the excavations near Buildings 2, 11, 17 and 21. In 1995, Franklin prepared a Tank Closure Report (Franklin, 1995).

The Maine DEP began sampling groundwater from a limited number of residential wells along Machias Road in May 1995 (Weston, 2005). USACE subsequently began a quarterly domestic well Groundwater Monitoring (GWM) program for impacted and potentially-impacted residential water supply wells. The results of the initial sampling events indicated the presence of fuel oil at concentrations up to 470 µg/L and TCE concentrations up to 80 µg/L. This prompted the MEDEP to issue a Notice of Violation to FAA stating that two diesel fuel USTs were out of compliance with State regulations. The FAA complied by removing the two tanks in March 1995. The FAA also conducted limited soil sampling in the vicinity of Buildings 113 and 114 during the demolition of these buildings, which occurred as part of a facility upgrade (Environmental Transportation Consultants, 1995). The results of the soil sampling indicated the presence of fuel, solvents, pesticides and metals in site soils (ABB, 1997b).

The GWM program that began in May 1995 has continued with specific wells added or deleted as data and supporting information become available. The program samples a variety of residential/domestic wells (DW), public water supply wells (WY), and selected test wells (TW) and environmental groundwater monitoring wells (MW) and focuses primarily on TCE.

USACE initiated a tank and soil removal program that focused on removing impacted soils associated with the ASTs and USTs and several other spill sites identified in the 1995 ABB SA Report (ABB, 1995a). Following completion of the tank and soil removal program, USACE conducted two additional studies: a Hydrogeological Investigation (ABB, 1997c) and an Engineering Evaluation of Contamination (EEC) (ABB, 1997b).

The purpose of the Hydrogeological Investigation (ABB, 1997c) was to characterize the geology and hydrogeology at the DCF Housing Area and to evaluate potential groundwater impacts associated with the USTs that supplied heating oil to the 27 housing units. The sampling program included the collection of soil borings and installing overburden monitoring wells, and the collection of soil, groundwater, surface water and sediment samples. The results of the investigation identified fuel oil contamination exceeding the MEDEP cleanup goal of 10 mg/kg in soil near five of the 27 housing units. The contamination was reportedly confined to the vadose zone at three of the five locations, and extended to a zone of groundwater-saturated soils at the other two locations (Weston, 2005).

The Remedial Investigation (RI) Report completed in 2005 describes a continuous glacio-marine clay layer throughout the DCF Housing Area, which varies in thickness from 20 to 28 feet (Weston, 2005). The layer was deemed to be “of sufficient thickness and consistency to act as a confining layer, thus creating a perched overburden aquifer and preventing the downward migration of contaminants at the site” (ABB 1997c). No further action (NFA) was recommended for the contaminants detected, in large part because of the amount of soil excavated and removed from the contaminated areas, the limited receptors of perched groundwater, and the absence of potential migration pathways that could result in future risks (ABB 1997c).

The EEC document (ABB, 1997b) reported the potential for soil and groundwater contamination at 6 locations listed below (see Figures 2, 3, and 4).

- Grease trap/utility trench associated with an automotive maintenance building in the former Cantonment Area (now the DCF);
- FAA filter bed and outlet that received sanitary waste from many portions of the facility since 1954;
- Transmitter Site leach field and Burn Pit No. 2, where chlorinated solvents used to clean the radio transmitters may have been spilled;
- GATR Site, where chlorinated solvents used to clean electrical equipment may have been spilled;
- Receiver Site, where chlorinated solvents used to clean electrical equipment may have been spilled; and
- Burn Pit No. 1, where chlorinated solvents and fuels were reportedly burned as a disposal method and to facilitate fire-fighter training.

In 1998, USACE began working with the Restoration Advisory Board (RAB) to evaluate next steps for the site. While the FAA was responding to the petroleum-related impacts, USACE performed the supplemental EEC, which included a soil-gas survey, four test pit excavations, installation of three shallow bedrock monitoring wells, and soil and groundwater sampling to further investigate the extent of TCE in the vicinity of the Transmitter Site. Results of the Transmitter Site investigation indicated that groundwater is contaminated with TCE and that it flows away radially from the Transmitter Site.

In 2001, a preliminary draft water supply evaluation (also referred to at that time as an “FS”) was prepared to determine if that alternative was feasible for supplying a safe and adequate drinking water supply to residents whose wells had been affected by site contaminants (Weston 2001). The evaluation focused exclusively on the potential for supplying an alternate water supply to affected residents. In 2003, a water supply test well (TW-1) was installed to assess the potential for an alternative water source.

Ultimately USACE and the MEDEP decided that it was premature and inconsistent with CERCLA to proceed with a focused alternate water supply evaluation rather than an evaluation of overall site remediation. It was determined that additional remedial investigation was warranted to address identified data gaps, including the evaluation of water quality in the deeper bedrock water-bearing zones.

Between 2003 and 2005, the following field investigations were conducted by USACE, Weston, and others:

- Installation and sampling of bedrock monitoring wells MW-04, MW-05, MW-06 and MW-07 at the Transmitter Site (Weston, 2005);

- Installation and sampling of bedrock monitoring wells MW-8B, MW-09, MW-10, MW-11 and MW-12 at Howard Mountain (Weston, 2005);
- Installation and sampling of bedrock monitoring wells MW-13 and MW-14 at Miller Mountain (Weston, 2005);
- Surface geophysical surveys by ANL and USGS (ANL, 2005; USGS, 2005);
- Borehole geophysical surveys (Weston, 2005) and USGS (USGS, 2004);
- Fracture and air photogrammetric studies (USACE, 2004);
- Packer sampling of selected wells (Weston, 2005); and
- Site plan surveying (USACE, various dates).

The results of these investigations are summarized in the RI Report (Weston, 2005). The additional information/data listed below has been collected since the RI and was used in completing the Feasibility Study (ENSR, 2007) and the Feasibility Study Addendum (Watermark, 2011).

- Surface and borehole geophysics (ANL, 2005; USGS, 2005; ENSR; and Hager-Richter, 2006 (JCO/ENSR, 2006));
- Continuation of domestic GWM (Weston, Woods Hole Group);
- Hydrophysics and wire-line straddle packer sampling (RAS, 2006);
- Installation of transducers and data loggers and analysis of water level trends in selected wells (USACE/Weston);
- Hydrogeochemical analysis (CLP);
- Location and sampling of springs and seeps on Howard and Miller Mountains (ENSR);
- Geologic mapping and outcrop fracture measurement (ENSR);
- Test pit excavation; soil sampling at Howard Mountain and Transmitter Site (JCO/ENSR, 2006);
- Air photogrammetric analysis (USACE TEC);
- Site plan updates by USACE;
- Installation of two angled core holes at Howard Mountain (JCO/ENSR, 2006);
- Installation of new monitoring wells MW-15, MW-16, MW-17 and MW-501 (JCO/ENSR, 2006); and
- Clean-out of WY-GATR and WY-3C and installation of a packer at about 211 feet in WY-GATR (JCO/ENSR, 2006).

A groundwater monitoring program for monitoring wells and residential wells has been on-going since 1995. The most recent sampling event occurred in October 2016 (Absolute Resource Associates (ARA), 2016). Results from each sampling event are evaluated to determine trends and to assess natural attenuation.

Indoor air quality testing (also known as Vapor Intrusion testing) has been performed at the most likely impacted residential and commercial properties in the Howard Mountain and Miller Mountain areas. Indoor air and sub-slab soil vapor samples were collected during two sampling events, one in April and one in August/September 2012. Results of indoor air samples collected from residential properties did not exceed guidelines for safe levels, as established by EPA (Woods Hole Group (WHG), 2013). It was determined that a complete vapor intrusion pathway may exist between the groundwater and indoor air at two commercial buildings in the Howard Mountain and Transmitter Site areas. The two buildings are the FAA Building, which is used for tracking commercial air traffic, and the DCF Building 300, which is used as a carpentry workshop by the correctional facility inmates. Building 300 contained levels of TCE in the indoor air which exceeded

EPA Regional Screening Levels (RSLs) for Chemical Contaminants. These RSLs represent conservative chemical-specific levels in air below which no health risks are expected. Risk estimates show the cancer and non-cancer hazards associated with contaminants which have a complete VI pathway from the groundwater to indoor air do not reach a level of concern that requires a response.

2.3 History of Enforcement Activities

There have been no CERCLA enforcement activities at this site. In May 1995, the MEDEP issued a Notice of Violation to FAA stating that two diesel fuel USTs were out of compliance with State regulations. FAA complied by removing the two tanks.

3.0 COMMUNITY PARTICIPATION

Throughout the site's history, community involvement has been ongoing. USACE has kept the community and other interested parties apprised of site activities through informational meetings, fact sheets, press releases, public meetings, and regular contact with local officials. USACE has also met routinely with the MEDEP and the RAB. There have been two formal technical project planning (TPP) sessions – August 2004 and June 2007 – as well as several less formal meetings to discuss recent findings and upcoming deliverables and milestones, and for the formation of a water association. Representatives from USACE, the MEDEP, RAB and/or other community members have attended these public meetings. A public meeting was also convened for the Proposed Plan presentation on May 5, 2016 (see Section 3.2).

3.1 Administrative Record (AR) and Document Repositories

USACE maintains two document repositories. The official AR contains all relevant documents and is located in USACE's office in Concord, Massachusetts. A local document repository containing the Administrative Record has been supplied for community reference and review is located at the Town Hall in Machiasport, Maine. The MEDEP also maintains key documents from the official AR for their review and participation in the site investigation, and has made those documents available to the community, if requested.

3.2 Public Availability of Proposed Plan

The Proposed Plan, outlining USACE's recommendation for this site, was distributed to the community on April 13, 2016. Because of the rural nature of the site area, the Proposed Plan was mailed to all of the residents within the Land Use Control Institutional Control Zones, as well as other project stakeholders. Additionally, copies were sent to the Town Hall for distribution. The public comment period was from April 20, 2016 through May 27, 2016. Notification of the Proposed Plan and public meeting were made in the following newspapers on the indicated dates: Bangor Daily News (April 16, April 23, April 29, and May 11, 2016), Machias Valley News Observer (April 20 and April 27, 2016), and The Quoddy Tides (April 22, 2016). See Appendix E for content of the public notification.

A public meeting presenting the Proposed Plan was held on May 5, 2016 at the Fort O'Brien Elementary School. Stakeholders in attendance at the meeting included community members, representatives from the MEDEP, and representative from the Department of Corrections. Verbal comments were offered and recorded during the May 5, 2016 public meeting. Written comments were received during the public comment period. The Responsiveness Summary, which compiles the verbal and written comments, as well as the USACE responses to those comments, is provided in Part 3 of this Decision Document.

4.0 SCOPE AND ROLE OF SITE OR RESPONSE ACTION

This Decision Document presents a comprehensive response action that addresses the Bucks Harbor study areas. The overall "site" consists of three study areas at which former USAF activities were conducted (Howard Mountain, Miller Mountain, and the Transmitter Site). These areas have been studied individually to the extent warranted, but they were not split into separate operable units. There are no other Decision Documents anticipated for this site. All three study areas are incorporated into this decision.

5.0 SITE CHARACTERISTICS

Groundwater underlying the Bucks Harbor facility is impacted with variable levels of VOCs, primarily TCE (with TCE concentrations ranging from non-detect (ND) to approximately 5,000 ug/L) (see Figures 5 and 6). Groundwater flow at all three areas is dominated by flow through fractures in bedrock that vary in size, orientation and a virtually unpredictable interconnectivity. These complex geologic and hydrogeologic conditions make it difficult to characterize, model and/or map groundwater flow and contaminant distribution and migration. Consequently, the cost-effective design and implementation of a remedy including an active treatment technology for aquifer restoration to the TCE MCL (5 ug/L) would be difficult without additional investigations and pilot studies.

5.1 Overview of Conceptual Site Model

There has been a significant amount of geophysical investigations at the Bucks Harbor site that are documented in the Remedial Investigation (Weston, 2005) and the Feasibility Study (ENSR, 2007) and in several other investigation reports (ANL 2005; USGS 2009; USGS 2005 and USGS 2004). Generally there is little unconsolidated overburden in the Bucks Harbor study areas. Bedrock is exposed in many locations and has low primary porosity and hydraulic conductivity. Bedrock fractures, measured at outcrops in the study areas and interpreted from boreholes, are oriented in a variety of directions, with some of the major fractures reflecting the regional geologic patterns. Many fractures are not hydraulically active. Contamination within the study areas is sporadically present within some of the water-bearing fractures. Large-scale features such as the Howard Mountain Fault Zone define some site-specific geologic structures that may control some primary groundwater transport. However, an adequate characterization of the moderately-sized and smaller-scale fractures that control the fate and transport of contaminants within the aquifer has not been fully achieved to the point where the migration of contaminant can be understood to the extent needed to implement the successful application of an in-situ remediation technique. If five-year reviews indicate that the selected remedy is no longer protective of human health and the environment, USACE may elect to perform further characterization. The slow migration of contamination through highly connected fractures (USGS, 2009) provides a long-term secondary source of contaminants in the groundwater. This conceptual site model is based on current and past data and will be revised as necessary.

At the Bucks Harbor site, some individual wells and fractures that are adjacent to one another are essentially isolated from each other hydraulically. In such cases, significant local hydraulic gradients do not necessarily result or contribute to groundwater flow or contaminant transport. The following highlights provide an indication of the geologic complexity and unpredictability of groundwater flow in the bedrock at the Bucks Harbor site.

- Volcanic rock formations with very little porosity dominate the subsurface. On a larger scale, groundwater flow generally occurs through the highly fractured bedrock aquifer and interfaces among the various rock types; however, on a smaller scale the fate and transport of contaminant within the aquifer is controlled by a tortuous and less well understood network of fractures. Howard Mountain and Transmitter Site bedrock consists of flow-banded rhyolite, vitrophyre, and autobreccia, while Miller Mountain bedrock consists of gabbro, diabase, granodiorite, and basalt.
- Hydraulic conductivity estimates for measured bedrock fracture zones vary substantially from <0.001 to 0.487 feet per day (ft/day), with associated bedrock fracture zone transmissivity values widely ranging from 0.6 to 150 square feet per day (ft^2/day) (ENSR, 2007). Discrete-interval transmissivities of 0.16 to 330 ft^2/day and flowmeter-derived open-hole transmissivities of 1 to 511 ft^2/day have also been reported (USGS, 2009).
- Some shallow water-bearing bedrock fractures are not connected to nearby deeper bedrock fractures. An example of this is given by the measured water levels at MW-15, which is a shallow bedrock well and MW-10, which is a deep bedrock well; both located within 32 feet of each other at the radar site.

- MW-10 (200 feet deep) is 32 feet from MW-15 (50 feet deep), and exhibits a static water level measuring 100 feet deeper than MW-15.
- At MW-15 concentrations of TCE ranging from approximately 2.5 to 46 ug/L have been detected, while at well MW-10, only 32 feet away, TCE has been measured at levels ranging from approximately 570 to 3,630 µg/L.

- Conditions at Miller Mountain and the Transmitter Site reveal a similar discontinuity and lack of interconnectivity between bedrock fractures, throughout the bedrock depths assessed.
  - WY-GATR has two separate intervals. The upper interval is sealed off from the bottom one with a packer and concrete plug at 190.3-212.5 feet. The difference in elevations between MW-13 (219 feet deep) and the upper interval (190 feet deep) of WY-GATR is approximately 25-30 feet. The deeper interval at WY-GATR has groundwater elevations that are approximately 100 feet lower than those in the shallower wells, indicating that the upper and lower bedrock zones in this area are probably isolated.
  - Pumping tests at WY-GATR induced no influence on MW-13.
  - At WY-GATR, TCE concentrations are in the 2,000 µg/L range with a variety of associated lesser-chlorinated compounds detected, whereas MW-13 TCE concentrations are in the approximately 5 µg/L range with fewer associated compounds detected.

Throughout the site, the concentration of TCE in groundwater ranges from below the MCL (5 µg/L) to levels in the vicinity of 2,000 to 3,000 µg/L adjacent to former operational areas. With few exceptions, the concentrations have been relatively constant during the GWM program.

A summary of the maximum groundwater TCE concentrations follows (see also Figures 5 and 6):

- At the Howard Mountain site, the maximum TCE detection reported in monitoring wells was MW-16 at 4,850 ug/L (detected in November 2006). The maximum TCE detection reported in water supply wells was DW-04 at 93 ug/L (detected in September 2002).
- At the Miller Mountain site, the maximum TCE detection reported in monitoring wells was WY-GATR at 2,900 ug/L (detected in September 2013). The maximum TCE detection reported in water supply wells was DW-23 at 2.9 ug/L (detected in September 2002).

5.1.1 Conceptual Site Model – Howard Mountain

The highest concentrations of TCE at the Bucks Harbor facility have been detected in the vicinity of Howard Mountain. The most likely primary source of TCE at Howard Mountain is Building 114 (see Figure 2). The building has been removed, but the foundation remains. Based on the historical and investigatory information compiled for the study area, it is likely that TCE from Building 114 migrated through the subsurface into soil, shallow bedrock, deep bedrock, and/or the nearby gravel pit. The following is the CSM for Howard Mountain and describes the geology, bedrock structure, hydrogeology, contaminant distribution and geochemistry. For a more detailed overview, see the Bucks Harbor Feasibility Study (FS) (ENSR, 2007).

<u>Howard Mountain Geology</u>: The most prominent topographic features of Howard Mountain are the cliffs and steep slopes on its eastern and northeastern flanks. Smaller cliffs are also present on the northern and northwestern slopes. The southern slopes of Howard Mountain are characterized by gentler slopes and fewer outcrops. Topography in the gravel pit and DCF Housing area east of Howard Mountain has been altered by excavation and filling, with a significant portion of the glaciofluvial sand and gravel that was originally present removed by excavation. Also, topography near the summit of Howard Mountain may have been altered (i.e. filled) during construction and subsequent demolition of former onsite Buildings.

Over much of the higher portions of Howard Mountain, overburden is mostly unsaturated or only intermittently saturated. Boreholes commonly reach bedrock without encountering water. However, in the gravel pit and DCF Housing areas east of Howard Mountain, significant thicknesses (as much as 40 feet) of saturated overburden occur in some locations. In the summit area, the water levels in well MW-10 and MW-16 are approximately 120 feet below the ground, and many unsaturated rock fractures are inferred to be present above that depth. However, water-bearing fractures have been encountered at shallower depths than the water level observed in wells MW-10 and MW-16. For example, the water level is less than 20 feet below ground in shallow bedrock monitoring well MW-15, which is located approximately 32 feet from MW-10.

Howard Mountain Bedrock Structure and Fracture Network: The most prominent geologic structure in the area is the Howard Mountain Fault, which occurs along the eastern edge of Howard Mountain and trends NNW/SSE. The down-thrown side of the fault is to the east and the fault is likely steeply-dipping. The fault is high-angle, but could be either normal or reverse (high-angle thrust), depending on its dip. Photolineaments and topography suggest that a fault zone associated with the Howard Mountain Fault may extend from the cliffs on Howard Mountain, eastward through the DCF Housing area. West of the fault zone, many different fracture strikes are present. In the vicinity of former Buildings 114 and 501, located near the Howard Mountain summit, NNW-striking fractures with steep dips are common. Transmissive fractures occur near former Building 114 that generally trend NE and dip SE/NW.

A study of fracture spacing and length on the southwest flank of Howard Mountain indicates that the mean fracture length ranges from 0.48 to 0.81 m, while the mean fracture spacing ranges from 0.09 to 0.27 m. In both cases, the statistical distribution (of length and spacing) is log normal or exponential, so a few fractures that are much longer can be expected. Likewise, occasional blocks of rock with greater fracture spacing (less fracture density) can also be expected. Borehole radar surveys of Howard Mountain wells reveal that a significant number of radar reflectors that may represent fractures are present in the rock mass. Moderate to steeply-dipping radar reflections with a variety of strikes are prevalent throughout the area.

Howard Mountain Hydrogeology and Interconnectivity: The higher portions of Howard Mountain, where fractured rock outcrops and unsaturated soils are present, are generally groundwater recharge areas, while springs on the flanks of Howard Mountain, pumping wells, and Howard Cove are groundwater discharge areas and potential contaminant receptors. Groundwater flows through permeable overburden and open fractures from areas of higher head to areas of lower head. However, flow will not occur in bedrock fractures unless they are connected to permeable overburden, the earth's surface or another water-bearing feature. Shallow, water-bearing fractures that do not connect with other, deeper fractures exist at Howard Mountain at depths considerably shallower than the depth to water in deeper bedrock wells. The discrepancy in water levels suggests that an observed deep water level does not necessarily indicate that rock fractures above the observed water level are dry. Shallower fractures can still be water-bearing. Such shallow fractures may be of limited extent, receive their recharge from very close to the wellhead, may terminate in the rock mass and can be considered analogous to perched aquifers.

Howard Mountain Contaminant Distribution: The distribution of TCE contamination at the site is indicative of residual TCE in poorly connected or small aperture-width bedrock fractures, likely in the fully saturated portion of the bedrock aquifer, based on the higher concentrations detected in deep wells than shallow wells at Howard Mountain. While no discrete source of TCE has been located in the area of Howard Mountain, elevated TCE concentrations are indicative of residual source material in or upgradient of the area and TCE concentrations in Howard Mountain wells vary with both location and depth. The extent of this area has not been delineated to the northwest or southeast, although it is apparent that the highest concentrations do not extend to the Building 501 area. The distribution of TCE believed to be associated with this source area, extends east, south and southeast from Howard Mountain toward Howard Cove. Off-site concentrations are greatest immediately south of Howard Mountain. The Howard Mountain Fault may dilute impacted groundwater, may direct contaminant migration toward Howard Cove along the fault, or may pose a barrier to contaminant migration toward the southeast. The detection of only trace concentrations of TCE southeast of the fault suggests that the influence of the fault in this regard may be sufficient to prevent significant migration of the TCE further to the southeast, despite the operation of water supply well WY-03

Domestic wells south, southeast, and east of the Howard Mountain summit are the primary potential receptors in the Howard Mountain area. TCE is absent or occurs only in low concentrations in available wells located in other directions from the source area. Because the TCE in groundwater is not uniformly distributed, TCE migration in other directions is possible, as hydraulic gradients at Howard Mountain have been demonstrated to be widely varied. The variable distribution of TCE in three dimensions at Howard Mountain suggests that discrete fracture pathways (as opposed to an effectively porous medium) are responsible for the flow of either contaminated or uncontaminated groundwater at the scale of investigation.

Howard Mountain Geochemistry: The aquifer in the vicinity of Howard Mountain is generally well oxygenated with a low potential for anaerobic degradation of TCE.

5.1.2 Conceptual Site Model – Transmitter Site

The primary source of TCE at the Transmitter Site appears to be Building 300, historic operational areas, and the septic tank (cesspool) area (see Figure 3). The building and septic tank are still intact and operational. It is likely that TCE from these areas migrated through the subsurface into soil, shallow bedrock, and deep bedrock. These three areas are considered to be the most likely secondary sources of TCE, which may continue to impact groundwater. Only the on-site groundwater monitoring well network exists for site characterization.

Transmitter Site Geology: Overburden deposits are generally thicker (2 to 12 feet at well sites and thicker at the small gravel pit) at the Transmitter Site than they are on the higher portions of Howard Mountain, although outcrops are present in some locations in the Transmitter Site area. Topography generally slopes downward in all directions from the fenced area of the Transmitter Site. Slopes are gentle compared to the rest of Howard Mountain and to Miller Mountain. Most of the area outside the fence is wooded.

Overburden generally consists of fill or glacial till; however, a small gravel pit located just northeast of the fenced area contains stratified sand and gravel deposits that may represent a kame (glacial meltwater deposit). At some portions of the Transmitter Site, overburden is saturated, at least for a few feet above bedrock. However, in the small gravel pit northeast of the Transmitter Site fence, sand and gravel exposed in the pit to an estimated depth of 15 feet is unsaturated.

The conductivities measured in Transmitter Site well MW-07 are slightly lower than those measured in Howard Mountain wells, which range from less than 0.005 to 0.5 feet/day.

Transmitter Site Bedrock Structure and Fracture Network: The most prominent geologic structure in the Bucks Harbor study areas is the NNW-striking Howard Mountain Fault, which occurs along the eastern edge of Howard Mountain. The Transmitter Site is about one-half mile west of the fault zone, and the fault probably has little effect on fracturing, groundwater flow or contaminant transport at the Transmitter Site.

A compilation of bedrock fracture measurements from outcrops indicate that west of the fault zone, many different fracture strikes are present. NNW-striking fractures are present, but not predominant, as is the case closer to the fault zone. Most fractures observed are steeply-dipping.

A study of fracture spacing and length on the southwest flank of Howard Mountain indicates that the mean fracture length ranges from 0.48 to 0.81 m, while the mean fracture spacing ranges from 0.09 to 0.27 m. In both cases, the statistical distribution (of length and spacing) is log normal or exponential, so a few fractures that are much longer can be expected. Likewise, occasional blocks of rock with greater fracture spacing (less fracture density) can also be expected.

Photolineaments compiled from a variety of sources occur to the northeast, north, west, and south of the Transmitter Site, but are not mapped across fenced portion of the site. The lineaments in the vicinity generally strike either NW or NE.

Transmitter Site Hydrogeology and Interconnectivity: The higher portions of Howard Mountain, where fractured rock outcrops and unsaturated soils are present, are generally groundwater recharge areas, while springs on the flanks of Howard Mountain, pumping wells, and Howard Cove are groundwater discharge areas and potential contaminant receptors. The same may be true, but to a lesser extent at the Transmitter Site, which is a broad shoulder of Howard Mountain.

Groundwater flows through permeable overburden and open fractures from areas of higher head to areas of lower head. However, flow will not occur in bedrock fractures unless they are connected to other fractures, permeable overburden, the earth's surface, or another water-bearing feature. Data that could be used to assess hydraulic interconnectivity (or lack thereof) are not available for the Transmitter Site. Regional groundwater flow is inferred to be generally to the south and southwest from Transmitter Site, although some northwesterly flow off the elevated shoulder of Howard Mountain may occur.

Transmitter Site Contaminant Distribution: The limited data available suggests that TCE concentrations are highest to the south and southwest of Building 300. The lower concentrations are inside the perimeter fence, which theoretically would be closer to the historic source areas from site operations. While this may be merely the result of greater interconnection between fractures impacted by secondary source material and the more distant wells than the nearby wells, or it may be indicative of a source outside of the perimeter fence.

Elevated concentrations of TCE have not been detected to the west, north, or southeast of the Transmitter Site operational areas. This suggests that either a shallow secondary source of TCE is present, or that increased recharge generated by precipitation produces flow from a shallower, more heavily impacted fracture than provides water to the well under drier conditions. The extent of groundwater contamination has not been fully delineated to the south and southwest of the Transmitter Site. However, sampling results from the closest downgradient receptors (Starboard Cove) indicated that there are no site-related contaminants in the groundwater in that vicinity, therefore there is no complete exposure pathway. This area is included in the Land Use Control Institutional Control Zone (see Section 12.5) to ensure notification and protectiveness of any future receptors.

Transmitter Site Geochemistry: The aquifer in the vicinity of the Transmitter Site is generally well oxygenated with a low potential for anaerobic degradation of TCE. The lack of microbial degradation at the Transmitter Site could be primarily attributable to the lack of sufficient organic material

5.1.3 Conceptual Site Model – Miller Mountain

The likely primary source of TCE at Miller Mountain is the leach field and building area on the mountain summit (see Figure 4). Both the building and leach field are still intact, but no longer operational. Based on available information, it is likely that TCE from these areas migrated through the subsurface into soil, shallow bedrock, and deep bedrock. These three areas are considered to be the most likely secondary sources of TCE, which may continue to impact groundwater.

Miller Mountain Geology: The topography of Miller Mountain is generally broad and moderate on the southern and western slopes and in the summit area. However, the summit (GATR) area features bedrock troughs and ridges that trend NW/SE (about 330 degrees). Relief between ridges and troughs is estimated to be 4 to 15 feet. The troughs and ridges are clearly bedrock features, but they may have been glacially enhanced. Northeast of the GATR fence is a linear trough (trending 330 degrees), located between two linear outcrops. The trough and the outcrops extend for several hundred feet and contain several small seeps and seasonal springs. The outcrops consist of very coarse-grained greenish gabbro. The northern and northeastern slopes of Miller Mountain are steep, with a stair-step topography created by a series of small gabbroic cliffs. At one location, a smoothly-eroded overhang in the rock at the base of a cliff near Route 92 is very smoothly eroded, suggesting wave or stream action.

Overburden deposits are generally thin (about 10 feet or less) or absent over most of the higher portions of Miller Mountain. Much of the GATR area near the Miller Mountain summit is outcrop, and ledges and small cliffs are present on the steep northeastern and eastern slopes of Miller Mountain. Where present on Miller Mountain, overburden generally consists of glacial till and artificial fill. In most of the Miller Mountain summit (GATR) area, overburden, where it exists, is mostly unsaturated or only seasonally saturated. Within a few hundred feet of the GATR fence, springs, seeps and boggy areas underlain by soil or overburden are present, indicating locally saturated, but thin overburden. A large difference in water levels in open bedrock wells MW-13 and WY-GATR, both located in the GATR area, indicates that there may not be strong interconnections between shallow and deep bedrock.

Transmissivity estimates for the WY-GATR well range from less than 1 foot squared per day for a specific zone to more than 150 square feet per day for the whole well.

Miller Mountain Bedrock Structure and Fracture Network: The most prominent geologic structure in the study areas is the NNW-trending Howard Mountain Fault, which occurs along the eastern edge of Howard Mountain, more than one mile south of Miller Mountain. Due to its distance, the fault probably has little or no effect on bedrock fracturing, groundwater flow, or contaminant transport in the Miller Mountain area. No comparable geologic structures have been mapped or observed in the Miller Mountain area. Miller Mountain area transmissive fractures strike NW and SE, and dip moderately-steeply towards the NE and SW, respectively.

Fractures measured at Miller Mountain outcrops show a range of strikes, with NNW/SSE-striking fractures common at almost all outcrops and the dominant fracture strike at a majority of outcrops. Considerable local variability is present within Miller Mountain, and E/W, N/S, and NE/SW-striking fractures are also common. Outcrops in the GATR area generally have a massive, blocky appearance, with most fractures moderately-to-steeply dipping, and NW-striking bedrock troughs coinciding with fractures of the same strike. In basalt and diabase outcrops along Route 92 (eastern base of Miller Mountain), fracturing appears more chaotic. In general, both average fracture length and average fracture spacing are greater than at Howard Mountain.

Miller Mountain Hydrogeology and Interconnectivity: The higher portions of Miller Mountain, where fractured rock outcrops and unsaturated soils are present, are generally groundwater recharge areas, while springs on the flanks of Miller Mountain, pumping wells and Bucks Harbor are groundwater discharge areas and potential contaminant receptors. Groundwater flows through permeable overburden and open fractures from areas of higher head to areas of lower head. However, flow will not occur in bedrock fractures unless they are connected to permeable overburden, the earth's surface or another water-bearing feature. Thus, a shallow, water-bearing fracture that does not connect with other, deeper fractures may exist at Miller Mountain at a depth considerably shallower than the depth to water in a well such as WY-GATR. Also, the observed discrepancy in water levels suggests that an observed deep water level, such as 140 feet below ground in WY-GATR, does not necessarily indicate that the rock mass and fractures above the observed water level are dry. Shallower fractures can still be water-bearing. Such shallow fractures may be of limited extent, receive their recharge from very close to the wellhead, may terminate in the rock mass and may be analogous to perched aquifers. For deep, open bedrock boreholes that intersect multiple water bearing fracture zones, the observed water level in the well is a weighted average of the head and flow in the specific fractures.

Disparities in water levels exist in adjacent wells and indicate that the wells are not hydraulically connected. The disparity in water levels between the shallow and deep zones in WY-GATR illustrates the varying hydraulic conditions and hydraulic isolation that can exist between fracture zones at different depths in the same location. Understanding the nature of hydraulic connectivity between individual fractures or wells at Miller Mountain is necessary to select the proper depth and spacing for injection or extraction wells. However, the complexity of the hydrogeologic regime at Miller Mountain makes such understanding elusive. The hydrogeology and the interconnectivity between wells is constrained by having only two monitoring wells at this site.

Miller Mountain Contaminant Distribution: TCE has been detected above MCLs at both onsite wells with TCE typically detected at WY-GATR at concentrations of 2,000 to 3,000 ug/L. The WY-GATR well is 416 feet deep. Straddle (dual) packer sampling indicates that TCE concentrations are generally higher at depths of less than 200 feet than near the bottom of the WY-GATR well.

Similar to the Howard Mountain CSM, data collected for the Miller Mountain area indicate that the TCE in groundwater is most likely attributable to TCE remaining in poorly connected fractures, which could provide a persistent source of TCE in the aquifer underlying the WY-GATR area.

Four residential wells, which are located south-southeast of Miller Mountain, are the only residential wells impacted with TCE. However, detections have been intermittent, and TCE concentrations are below MCLs. TCE has not been delineated to the northwest and west of well WY-GATR; however as described in the FS, given the dominant NNW-SSE fracture orientation at Miller Mountain and a south-southwesterly regional hydraulic gradient (i.e., towards Bucks Harbor), TCE migration would not be expected to be significant in any of those directions (ENSR, 2007). However, the source is on the top of Miller Mountain, so it is possible that groundwater flow could be radial. The area to the north and northwest of well WY-GATR is undeveloped. Therefore, there are no receptors in that direction, and no complete exposure pathway. However, this area is included in the Land Use Control Institutional Control Zone (see Section 12.5) to ensure notification and protectiveness of any future receptors.

Miller Mountain Geochemistry: The aquifer in the vicinity of Miller Mountain is less oxygenated than Howard Mountain and thus, has a slightly higher potential for anaerobic degradation of TCE. These findings are consistent with a prior monitored natural attenuation (MNA) analysis conducted for WY-GATR at Miller Mountain. A review of the operational history of the Miller Mountain area suggests that a source of organic carbon (such as the wastewater leach field at the mountain summit) may have been sufficient to stimulate anaerobic metabolism and reductive dechlorination of TCE historically. However, there is insufficient information to conclude that reductive dechlorination at Miller Mountain would be a primary factor in natural attenuation processes over time.

5.2 Aquifer Restoration Potential

It would be difficult to access a sufficient quantity of TCE in the low-connectivity, fractured bedrock network to restore the Bucks Harbor aquifer to a steady state condition that is below the MCL, using an active remediation technology. As presented in the FS (ENSR, 2007), the following limitations would prevent effectively restoring the aquifer using active remediation techniques.

- *In-situ* treatment technologies such as chemical oxidation are not likely to be able to reach a sufficient percentage of bedrock fractures to induce a meaningful reduction in TCE given the irregularity and complexity of the fracture network. Designing an effective injection well network that distributes oxidant to a sufficient fraction of the contaminated bedrock fractures may prove to be an intractable problem.
- Induced bioremediation techniques such as enhanced reductive dechlorination (ERD) are not likely to be able to influence a sufficient percentage of bedrock fractures to promote a meaningful reduction of TCE in the bedrock. There are many challenges for successful in-situ bioremediation in bedrock, including: lack of specific knowledge of the location (in three dimensions) of the contaminant; delivery of necessary nutrients to the proximity of the contaminants given the irregularity and complexity of the fracture network; and the likely absence of TCE-specific degrading microbes (i.e., *Dehalococoides*) in the aerobic conditions in the bedrock. Bench-scale and pilot testing would be required to evaluate whether suitable conditions can be developed within the bedrock to effect remediation. However, in the event such testing was successful, designing an effective injection well network that distributes nutrients and bacteria to a sufficient fraction of the contaminated bedrock fractures may prove to be an intractable problem.

- Pumping technologies such as extraction wells would not induce sufficient flow from the poorly connected bedrock fractures that are thought to contain the residual TCE; and the maximum sustainable pumping rate at most of the locations would be less than 5 gallons per minute (gpm); only Miller Mountain has shown the potential for slightly higher pumping rates, possibly approaching 15 gpm, which is still relatively low for the design of a comprehensive extraction system.
- The application of treatment agents in general may be limited to a gravity-fed batch process which would not likely influence TCE in poorly connected bedrock fractures; and the treatment agents would become overly diluted at the depths requiring treatment (some at over 300 feet). Gravity feed was cited in the FS report to theoretically mimic the initial pathway of TCE migration from the suspected primary source areas. This approach was considered in the FS in order to try and avoid short-circuiting of injected treatment agents due to flow along preferential pathways when using higher flowrates and pressures than experienced during the TCE release and during dissolved TCE transport from infiltrating precipitation.

Geochemical trends in the aquifer indicate that the conditions are primarily aerobic and generally not conducive to large scale microbial degradation. In addition, the volcanic bedrock formation and absence of other (non-TCE) organic matter limits the substrate necessary for microbial degradation. There are some possible exceptions where microbial degradation could be occurring, such as portions of the Miller Mountain subsurface and in the immediate vicinity of the FLUTe-lined MW-16. However, the general absence of widespread anaerobic conditions and organic carbon does not necessarily preclude *non-biologic* (abiotic) natural attenuation from occurring. Abiotic transformation processes are evident from the natural limited dissipation of TCE away from the former operational areas. The MNA component of the selected remedy for Bucks Harbor is intended to measure the natural dissipation of TCE, whether microbial or abiotic. Given the relatively constant levels of TCE throughout the GWM program, it is likely that the natural dissipation of TCE to the 5 µg/L MCL could take a significant amount of time.

6.0 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The Bucks Harbor facility and nearby areas are currently used for the following purposes:

- FAA radar operations near the Howard Mountain summit, used for tracking commercial air traffic;
- DCF minimum-security prison complex at the base of Howard Mountain, operated by the State of Maine;
- DCF carpentry shop at the former Transmitter Site location near the summit of Howard Mountain; and
- Private, rural, residential homes with a few commercial operations near and/or around the area of Howard and Miller Mountains.

The potential for additional residential development exists in the area, but there are no known plans for formal infrastructure development. All homes and commercial facilities are served by private wells. Most of the private wells are drilled wells completed in the fractured bedrock aquifer. Groundwater at and near the Bucks Harbor site is currently used as drinking water by individual residential properties, and the DCF has one well that supplies drinking water to the staff and inmates. Groundwater at five properties is filtered through an engineered system to remove TCE prior to consumption.

There is no indication that the current use of groundwater will significantly change in the foreseeable future. There has been some discussion and evaluation by the community regarding establishing a local, public water supply. During the first Proposed Plan public meeting on June 9, 2008, and through written comments during the Proposed Plan public comment period, some of the community members expressed an interest in developing a public water supply in the area, as an alternative to the selected remedy. Based on this feedback, a revised Feasibility Study Addendum (Watermark, 2011) was prepared to assess the feasibility of provision of an alternate water supply to impacted residents in the Howard Mountain vicinity. Howard Mountain is the area where some water supply wells exceed the MCL.

As documented in the FS Addendum Report (Watermark, 2011), the DCF well (WY-03) has been identified as a suitable water supply well that can guarantee a sustainable volume of water. It contains low level TCE contamination (less than 1 ug/L). Therefore, the alternate water supply remedy will also include upgrades to the water supply, including treatment using GAC. The CSM developed for the Bucks Harbor study areas show a highly variable and unpredictable bedrock fracture network, with relatively unpredictable areas of TCE impacts. Given the complexity of the CSM and because of the multiple sources of groundwater impacts in the area, the search for another suitable water supply could be difficult and costly and may not be feasible and/or reliably protective.

7.0 SUMMARY OF POTENTIAL SITE RISKS

As part of the 2005 RI, a baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the site if no remedial actions were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action, if necessary. A summary of the human health risk assessment is presented in Section 7.1, followed by a summary of the environmental (ecological) risk assessment in Section 7.2.

7.1 Potential Human Health Risks

The concentration of TCE in groundwater in some drinking water wells and in groundwater at some of the sampled locations is above human health based risk levels. Use of groundwater extracted from these locations, if not treated, could expose residents to unacceptable risks from the inhalation and/or ingestion of TCE. The human health risk assessment provided estimates of potential risks that could result from exposure to untreated groundwater.

As presented in the RI Report (Weston, 2005), the Baseline Human Health Risk Assessment (BHHRA) followed EPA Risk Assessment Guidance for Superfund (EPA, 2001):

1) Hazard identification, which identified hazardous substances that were identified as being a potential concern;
2) Exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations and determined the extent of possible exposure;
3) Toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances; and
4) Risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential risks posed by hazardous substances at the site, including potential carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates.

The BHHRA compiled data from 35 drinking water wells, one DCF Housing Area Supply well, and 35 groundwater monitoring wells. Of the 35 drinking water wells, the analyses for 11 wells did not have any detected chemicals and were therefore not further evaluated in the BHHRA. So, data from a total of 60 wells were used in the BBHRA. Chemicals of Potential Concern (COPCs) were then selected based on toxicity. The maximum detected concentration for each chemical was compared to its EPA risk-based screening concentration (RBC) available at the time of the risk assessment (Weston, 2005), and any chemical with a maximum concentration greater than its RBC was included as a COPC. Six chemicals were selected for evaluation in the human health risk assessment as COPCs, and are summarized in Table 1. The two of the COPCs contributing the most to total risk identified as Contaminants of Concern (COCs) are TCE and PCE.

Several exposure pathways were developed consistent with EPA guidance. These exposure pathways were based on present uses, potential future uses, and location in relation to the site. The current land use near the Bucks Harbor study areas is primarily rural residential with groundwater supplied by private wells. On Howard Mountain, one drinking water well provides water for inmates and employees at the DCF. The risk evaluation included both current site use (on-site prison inmate and off-site resident), and hypothetical future site use (on-site resident in the Howard Mountain area or the Miller Mountain area). Future residential use of groundwater is a possibility at both Howard Mountain and Miller Mountain. The exposure assessment identified the potentially exposed populations to be adult and child residents. Potential exposure pathways included ingestion of untreated groundwater and inhalation of vapors during bathing/showering. Dermal contact while bathing was evaluated semi-quantitatively in the Uncertainty Analysis.

Average daily doses of COPCs were estimated using conservative assumptions relative to the rates of potential ingestion of tap water, the frequency and duration of contact during bathing, and other parameters. Many of the exposure parameters used were standard default values recommended by EPA guidance (EPA, 1997) and MEDEP guidance (MEDEP, 1994).

Incremental lifetime cancer risks (ILCRs) were determined for each receptor and each exposure scenario and area by multiplying a daily dose with the chemical-specific cancer potency factor. In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) was calculated by dividing the daily dose by the reference dose (RfD) or other suitable benchmark for each COPC. The total of HQs with for a receptor is called a hazard index (HI). If the HI is greater than1, then the HQs are segregated and totaled for specific toxic endpoints. Refer to Section 6.0 of the RI Report (Weston, 2005) for a more comprehensive risk summary. In general, if cumulative (i.e., all COPCs in all media for an exposure scenario) carcinogenic risk is less than 1×10^{-4}, the non-carcinogenic HI is less than or equal to 1, and any groundwater contaminant concentrations are less than their Maximum Contaminant Levels (i.e., Safe Drinking Water Act), then remedial action is not warranted (EPA, 1991a). EPA guidance recommends that remedial action be determined with a site-specific decision based on the ILCR range of 10^{-4} to 10^{-6}. The MEDEP Remedial Action Guidelines are established based on exposure to a single contaminant in a single media, and at the lower of the Incremental Lifetime Cancer Risk (ILCR) of 10^{-5} or a Hazard Quotient of 1 (MEDEP, 2016). The DERP-FUDS program follows CERCLA guidance and uses Federal (EPA guidance) for risk management and decision making purposes (USACE, 1999).

The 2005 Baseline Human Health Risk Assessment concluded that:

- The total cancer risks and total non-cancer risks for current Howard and Miller Mountain residents using private wells were at acceptable levels;
- The total cancer risk and total non-cancer risk for current prison inmates were at acceptable levels;
- The total cancer risks and total non-cancer risks for future Howard Mountain residents based on monitoring wells were at unacceptable levels;
- The total cancer risk was at an acceptable level, but the total non-cancer risk was at an unacceptable level for future Miller Mountain residents based on monitoring wells.

Since the BHHRA was completed more than a decade ago, several toxicity factors and several exposure factors have changed. Therefore, a re-evaluation of risk was completed using the EPA RSL Calculator (EPA, 2017). The EPA RSL Calculator is a risk calculator and includes the most recent EPA toxicity factors and exposure factors.

The 2017 EPA RSL Calculator results concluded that:

- The total cancer risks and total non-cancer risks for current Howard Mountain residents using private wells were at unacceptable levels;

- The total cancer risks for current Miller Mountain residents using private wells were at acceptable levels, and the total non-cancer risks for current Miller Mountain residents using private wells were at unacceptable levels;
- The total cancer risk and total non-cancer risk for current prison inmates were at acceptable levels;
- The total cancer risk and total non-cancer risks were at unacceptable levels for future Howard and Miller Mountain residents based on monitoring wells.

Table 2 presents a comparison of the current and future risks for residential groundwater exposure results of the human health risk from the 2005 BHHRA and the updated EPA RSL Calculator risk results, using the data that was used for the 2005 BHHRA. The re-evaluation EPA RSL Calculator input and output are included in this DD as Appendix F. As shown in Table 2, the updated risk results are higher than the 2005 risk results. These results support the selection of a remedial action. An interim remedial action has been implemented and is currently maintained with the use of GAC filtration for drinking water wells to protect residents from ingestion of TCE and other COPCs. Additionally, there are some monitoring well locations at the site that have higher concentrations than those used in the 2005 BHHRA (see Section 5.1). Nonetheless, the remedial action objectives (RAOs) for this site (see Section 8.0) are based on MCLs for chlorinated volatile organic compounds (CVOCs), which are protective of human health in accordance with the NCP. MCLs are the primary drinking water standards that are legally enforceable standards applicable to public water systems.

In addition to the above evaluation, the vapor intrusion pathway was evaluated by comparing the maximum groundwater concentrations in site monitoring wells and drinking water wells to EPA draft screening levels protective of residential indoor air, assuming a groundwater to indoor air attenuation factor of 0.001 (EPA, 2002). The maximum detected value of tetrachloroethene (PCE) at Howard Mountain exceeded its screening value. The maximum detected values of TCE in wells at the current residence at DW-04, Howard Mountain, and Miller Mountain exceeded the screening value. It was concluded that the vapor intrusion pathway may pose a potential risk to the current residence at DW-04, and future residences at Howard Mountain and Miller Mountain.

Vapor Intrusion testing was performed at the most likely impacted residential and commercial properties in the Howard Mountain and Miller Mountain areas in 2012. Indoor air and sub-slab soil vapor samples were collected during two sampling events, one in April and one in August/September 2012. Results of indoor air samples collected from residential properties (DW-01, DW-02, DW-03, DW-04, DW-12, and DW-23) did not exceed guidelines for safe levels, as established by EPA. It was determined that a complete vapor intrusion pathway may exist between the groundwater and indoor air at two commercial buildings in the Howard Mountain and Transmitter Site areas. The two buildings are the FAA Building, which is used for tracking commercial air traffic, and the DCF Building 300, which is used as a carpentry workshop by the correctional facility inmates. Building 300 contained levels of TCE in the indoor air which exceeded EPA Regional Screening Levels (RSLs) for Chemical Contaminants. These RSLs represent conservative chemical-specific levels in air below which no health risks are expected. Risk estimates show the cancer and non-cancer hazards associated with contaminants which have a complete VI pathway from the groundwater to indoor air do not reach a level of concern that requires a response. Results from VI testing at residential and commercial properties have determined that risks from vapor intrusion are acceptable at properties in the vicinity of the former Bucks Harbor facility. However, contamination in groundwater will remain on site which may lead to risks from VI. Therefore, continued VI sampling is necessary to insure that risks from VI remain at acceptable levels. Sampling and Quality Assurance Project Plans will be developed for VI testing at the site.

7.2 Potential ecological risks

In addition to the human health risk assessment described above, a screening-level ecological risk assessment was also performed. The ecological assessment is provided in Section 7.0 of the RI Report.

The ecological risk assessment evaluated potential risks to ecological receptors that may occur in the presence of chemical stressors in environmental media.

Habitat reconnaissance was conducted to identify potential ecological receptors, habitat types, and potential receptor pathways at the site. Three habitat areas were identified:

- Forested upland habitat/high gradient stream (headwaters of the stream, north of the AFRTS site);
- Forested upland habitat/low gradient stream (from the northernmost part of the stream to the northern property boundary of the DCF Housing Area); and
- Emergent scrub/shrub wetland/low gradient stream (from the property boundary of the DCF Housing Area in the north to approximately Route 92 in the south).

Sediment and surface water samples were collected from four locations in the wetland area and unnamed stream to the northeast of the DCF Housing Area. Sediment samples were collected from a depth of 0-0.5 feet. Samples were analyzed for TCE, PCE, cis-1,2-dichloroethene, chloroform, toluene, and xylenes. None of these compounds were detected in the sediment or surface water samples. Sample limits of quantitation (LOQs) for the compounds were compared to the appropriate surface water (freshwater and marine) benchmarks. None of the LOQs exceeded the benchmarks. No sediment benchmarks are available for the analytes.

The screening-level ecological assessment concluded that the current concentrations of compounds in sediment and surface water (non-detect) do not pose a significant risk to ecological receptors and that further sampling and assessment are not necessary.

7.3 Summary

In accordance with the 2017 EPA RSL Calculator results, a future adult resident at the Howard and Miller Mountain areas has an unacceptable ILCR of 1.34×10^{-3} and 1.27×10^{-4}, respectively. These values exceed EPA's upper bound risk level of 1×10^{-4}. Additionally, the hazard indices for non-cancer risk for Howard and Miller Mountain adult residents are 210 and 21, respectively, which exceed the EPA's ceiling of 1.0. There is no significant risk to any ecological receptors at the site.

The response action selected in this Decision Document is necessary to protect public health or welfare and the environment from actual or threatened releases of pollutants or contaminants from the site which may present an endangerment to public health or welfare. The primary objective identified from the risk assessment was to eliminate or reduce the potential human exposure to TCE in groundwater.

8.0 REMEDIAL ACTION OBJECTIVES

RAOs were established in the FS Report to provide the framework for identifying applicable remedial technologies and developing candidate remedial alternatives:

- Prevent ingestion of drinking water that contains TCE greater than 5 ug/L, which is the Federal Safe Drinking Water Act MCL. [Note: This Remedial Action Objective also applies to other chlorinated VOCs historically or currently detected at the Site, including: 1,2-Dichlorethene (MCL = 70 ug/L), Vinyl Chloride (MCL = 2 ug/L), PCE (MCL = 5 ug/L), 1,1,1-Trichloroethane (MCL = 200 ug/L), and 1,1-Dichloroethene (MCL =7 ug/L), 1,4,-Dichlorobenzene (MCL = 5), 1,2,4-Trichlorobenzene (MCL=70)].
- Restore the groundwater within the Site to MCLs.
- If present, prevent inhalation of vapors from TCE in groundwater that could pose potential risks in excess of EPA recommended thresholds (EPA, 2015; MEDEP 2016).

As of the May 2016, the EPA Regional Screening Levels (RSLs) provided a screening level of 2.1 µg/m^3 (based on a non-cancer HQ of 1) for the residential concentration of TCE in indoor air under a residential scenario and 8.8 µg/m^3 for an indoor worker. Since the TCE toxicity factor and possibly other RAO listed VOC toxicities changed since 2005, they were reviewed and a residential risk scenario for drinking water wells (2005 BHHRA) with the highest TCE and PCE concentrations at Howard and Miller Mountains as well as the highest monitoring wells in those two areas and the prison well were re-evaluated using the EPA RSL Calculator tool (EPA, 2017). The EPA RSL Calculator includes the updated EPA 2014 exposure factors and the May 2016 EPA RSL toxicity factors. The EPA RSL Calculator results support the selection of a remedial action for the site. An interim remedial action has been implemented and is currently maintained with the use of GAC filtration for drinking water wells to protect residents from ingestion of TCE and other COPCs. A summary table of this information and the EPA RSL Calculator output is included as Appendix F.

A variety of approaches were identified and evaluated in the FS to achieve these RAOs. These approaches ranged from focusing on potential receptors (i.e., treating or otherwise controlling the ingestion of TCE-impacted groundwater) to focusing on the aquifer itself (i.e., reducing the concentration of TCE in groundwater or source control). The evaluation of source control options revealed that accelerating the restoration of the groundwater using active remediation technologies to achieve the TCE MCL compared to natural restoration rates is not considered possible with current technology. This conclusion is based on professional judgement due to inability to locate a source and an active treatment process that would effectively reduce contaminant concentrations. As such, the RAOs for the Bucks Harbor facility ultimately focus on protecting potentially exposed individuals rather than removing source contamination from groundwater using an active treatment technology.

9.0 DESCRIPTION OF ALTERNATIVES

The NCP requires that a range of remedial alternatives be considered in an FS. To accomplish this, a range of remedial technologies and process options were considered. This was done in the original FS (ENSR, 2007) and in the FS Addendum (Watermark, 2011), where the addendum presented alternate water supply alternatives to the treatment of drinking water at affected residences which currently use POET systems for water treatment. As the technologies and processes were defined and researched, they were also compared (screened) against each other to select representative candidates for subsequent remedial alternative development. Using the results of the technology screening, a systematic approach to evaluation and comparison resulted in four potentially comprehensive remedial alternatives, which are summarized in the Remedial Alternative Matrix shown in Table 3. Consistent with EPA guidance, the cost estimates provided in the following sections are based on the best available information regarding the anticipated scope of the remedial alternative and an assumed remediation timeframe of 30 years; however, remedial alternatives are expected to continue until RAOs have been met. These are order-of-magnitude engineering cost estimates that are expected to be within +50 to -30 percent of the actual project cost. Note that the descriptions of the alternatives below are as described in the FS (ENSR, 2007) and FS Addendum (Watermark, 2011) to develop the cost estimates.

Sections 9.1 through 9.5 and include a description of each alternative (identified as Alternatives 0, 1, 2, 3, and 4) developed in the FS Report (ENSR, 2007). Section 9.6 includes a description of the Alternate Water Supply Alternatives developed in the FS Addendum Report (Watermark, 2011). The Alternate Water Supply considers the substitution of the GAC Domestic Well Treatment component of the FS Alternatives, and are intended to be presented only as alternatives to the that element of the FS alternatives.

9.1 Alternative 0 – No Action

The No Action Alternative is required under CERCLA as a baseline with which to compare other alternatives. In a No Action Alternative there are no institutional, administrative, monitoring, or remedial actions implemented at the site. The costs associated with Alternative 0 are presented in Table 4A. It is noted that a true “no action” alternative was not included in the FS report (ENSR, 2007), and is included in the discussion below for comparative purposes.

9.2 Alternative 1 – Long Term Monitoring and Wellhead Treatment

As presented in Section 5.1 of the FS, Alternative 1 consists of the following elements, but would not include institutional controls (ICs), such as annual notifications:

- Continuing the domestic well treatment and management program that USACE initiated in 1995; and
- Converting the ongoing GWM program into a long-term monitoring (LTM) program for site groundwater.

The current operating procedure entails annual sampling. One untreated sample is collected prior to the GAC vessels and one is collected between them. Parameters which will be analyzed as part of the LTM program will include VOCs (including TCE). As a precautionary measure to reduce the potential for biological solids buildup or carbon breakthrough over time, the filters are changed approximately every year. The first filter is removed from service and replaced with the second, and the second is replaced with a new GAC filter.

Under this alternative, GAC treatment will continue for an assumed period of 30 years, which is the CERCLA default duration. After 30 years, a determination will be made as to whether additional treatment and monitoring is necessary, depending on TCE residual concentrations in the aquifer. During the 30-year period at each requisite five-year review and/or following each groundwater collection event, re-evaluation and/or modification of the number of wells within the LTM sampling network will occur. Currently (as of the 2016 sampling program), there are 17 domestic wells (including the five domestic wells with GAC systems), one public water supply well, and 14 groundwater monitoring locations (including 13 wells with 26 individual well screens) and one seep included in the annual GWM program.

The costs associated with Alternative 1 include: 1) the cost of managing the point-of-entry treatment (POET) systems at the existing five private water supply wells; 2) the cost of conducting the LTM program; and 3) the cost of conducting five-year site reviews. The total present value costs for Alternative 1 are estimated to be 2.1 million dollars ($2.1M), as presented in Table 4A.

9.3 Alternative 2 – Long Term Monitoring, Wellhead Treatment and Enhanced Site Controls

This alternative includes all components of Alternative 1 (LTM and Wellhead Treatment) with the addition of the following:

- Where necessary, mitigation measures to prevent vapor intrusion potentially resulting in inhalation of contaminated air at residential properties. The vapor intrusion mitigation would be implemented by sub-slab depressurization (SSD);
- Implementation of ICs for properties that are potentially within the institutional control zone (ICZ); and
- Monitored natural attenuation (MNA) to evaluate the anticipated attenuation of TCE over time.

SSD involves the installation of a foundation vapor control system, similar to those commonly used for radon gas mitigation. To date, no residences or commercial properties at the DCF have been identified as needing an SSD system. This engineering control is vapor intrusion mitigation measure to be installed only if necessary. The FS included the installation of an SSD system for homes where domestic well TCE concentrations are above the MCL. This is a highly conservative assumption because vapor transport from bedrock groundwater is expected to be considerably less significant than typical vapor intrusion scenarios. Additionally, based on vapor intrusion investigations performed in 2012 (Woods Hole Group, 2013) which indicated that there was currently no actionable risk at the properties investigated (commercial and residential properties with impacted groundwater concentrations greater than the MCL). Consistent with EPA Guidance (EPA, 2002), if groundwater concentrations above generic groundwater screening levels (i.e., the MCL for TCE and PCE) are measured, vapor intrusion investigations will be conducted in the area(s) of interest (residential and/or commercial properties). If potential risks exceed EPA target levels, SSD (or appropriate mitigation system) will be implemented at the particular property. Since CVOCs will remain in groundwater, USACE plans to monitor VI regularly (every five years) and/or if changes in site conditions dictate (e.g., increase in groundwater concentrations, changes in building conditions) that the sampling frequency be re-evaluated. Note that the vapor intrusion mitigation element of the remedy has been revised from that stated the FS report (ENSR, 2007) based on the 2012 VI investigation results (Woods Hole Group, 2013), and elimination of deed restrictions (with change to annual notifications) as the institutional control mechanism.

Land use controls will include annual notification letters to the property owners within the institutional control zone (ICZ) to ensure that they are aware of the potential contaminated groundwater under their property; and to indicate that USACE will test any new drinking water well for VOCs, and connect to an alternate water supply (DCF water supply) or install and maintain GAC filters, if MCLs are exceeded (due to DOD contamination) or if concentrations are trending toward an MCL exceedance. USACE will work with the Town of Machiasport to include notices with building permits issued by the town. If the Town does not agree to providing notices with the building permits, USACE will contact the Code Enforcement Officer (or local town official) on a semi-annual basis to determine if any new homes are planned to be constructed in the ICZ. If so, a notification (as described above) will be provided to the building permit applicant.

Parameters analyzed for MNA assessment will include VOCs (including TCE)) and MNA geochemical parameters including metals (ferrous iron and manganese), anions (chloride, nitrate, and sulfate), alkalinity, gasses (methane, ethane, and ethene) and total organic carbon. The concentration of TCE in groundwater has the potential to decrease over time due to natural attenuation mechanisms in the subsurface at the site. There is little evidence of microbial degradation of TCE in the Howard Mountain and Transmitter site areas, and the dissipation observed may be predominantly the result of natural abiotic (i.e., non-microbial) attenuation. Although data at the Miller Mountain Site are limited, there is evidence that some microbial transformation is occurring that contributes to natural attenuation. The MNA program would initially expand the LTM program to include periodic evaluation of LTM data to assess and project TCE distribution patterns and potential reduction rates. The expanded LTM program would include an assessment of data and trend analysis to evaluate how effective natural processes (whether abiotic or microbial) are in degrading TCE. Alternative 2 includes these assessments, which will help refine the selection of wells to be sampled within the LTM network as well as provide predictions of TCE attenuation rates. Specific wells, sampling frequencies and parameters to support an MNA evaluation will be considered during the LTM planning process, which will occur during the design phase of this project.

In this alternative, the POET systems, SSD systems, and MNA assessment would continue until RAOs have been met. For cost estimating purposes a 30-year duration has been assumed. The annual notification would be created immediately and would remain in-place until the LTM program confirms that the concentration of TCE in the aquifer is below the MCL (and/or below vapor intrusion screening levels for areas with SSD). As part of each five-year review, a determination would be made as to whether additional treatment and monitoring is necessary to demonstrate that TCE concentrations have been sufficiently reduced to mitigate risk.

In addition to the costs associated with Alternative 1, the additional costs associated with this alternative include: 1) installation of SSD systems; 2) securing annual notifications for all properties within the ICZ; and 3) implementing LTM and preparing MNA assessments of data to quantify the progress of naturally-occurring attenuation of TCE. The total present value costs for Alternative 2 are estimated to be $3.3M, as shown in Table 4A.

9.4 Alternative 3 – Long Term Monitoring, Wellhead Treatment, Enhanced Site Controls, and Source Removal

This alternative includes all components of Alternatives 1 and 2 with the addition of the excavation of selected soil and debris from potential TCE source areas. A general depiction of the conceptual remediation areas that would be targeted for excavation is presented in the FS, along with the associated geologic cross-sectional detail. A more precise extent of excavation will be developed through a pre-design investigation (PDI).

Through prior USACE and FAA investigations and response actions, previous soil removal actions primarily focused on removal of petroleum contaminated media. Remaining soil areas that may contain TCE have been sampled and very little overburden TCE has been detected (Weston, 2005; JCO, 2006). As such, it is unlikely (but possible) that TCE contamination still exists in shallow soil.

The conceptual remediation areas were sketched to approximate the areas most likely associated with primary TCE sources, based on: 1) the distribution of the maximum concentrations of TCE in groundwater; 2) an overlay of the historic operational areas that were the most likely sources of TCE contamination; and 3) review of the CSM to better define the shallow areas that are most likely to contain residual TCE, including overburden deposits (i.e., soil) and deposited materials, storage piles, concrete foundation pads, and other heterogeneous disruptions to natural infiltration and groundwater flow (i.e., debris). Historic unused piping, apparatus, leachfield components, or other structures within these excavation areas will also be removed as part of the excavation operation.

In contrast to the other alternatives introduced this far (Alternatives 1 and 2), this alternative would include the active remediation of residual TCE in shallow horizons (assuming it exists). Removal of shallow areas of TCE has the potential to reduce contaminant concentrations in the aquifer over time. However, elevated concentrations of contaminants would likely remain in the aquifer for the foreseeable future. Therefore, the POET systems, SSD systems, and MNA assessment would continue for a period of 30 years, which is the CERCLA default duration, as discussed for Alternative 2.

For the purposes of establishing a baseline level of costs for this remedial component, the volumes estimated for removal are summarized below. It is likely that these volumes will change during design and implementation, as further data is collected. It is also likely that only portions of material within these areas will require excavation, rather than implementing a contiguous excavation event for each of these areas.

- Howard Mountain: 8,745 cubic yards (26,234 square feet x 9-foot average thickness)
- Miller Mountain: 5,615 cubic yards (18,951 square feet x 8-foot average thickness)
- Transmitter Site: 1,000 cubic yards (3,374 square feet x 12-foot average thickness)

In addition to the costs associated with Alternative 2, the costs associated with this remedy include soil excavation. The total present value costs for Alternative 3 are estimated to be $6.7M, as shown in Table 4A.

9.5 Alternative 4 – Long Term Monitoring, Wellhead Treatment, Enhanced Site Controls, Source Removal, and In-situ Treatment

This alternative includes all components of Alternatives 1, 2, and 3 with the addition of applying *in-situ* chemical oxidation (ISCO) to the surface of exposed bedrock, after excavating overburden material from the potential primary source areas (as discussed in Section 9.4).

Because residual TCE could persist in the shallow subsurface in the proposed potential primary source excavation areas (e.g., within the weathered bedrock horizon), this alternative includes the application of an oxidant to the top of competent bedrock with the excavation areas. The oxidant selected for this alternative is potassium permanganate ($KMnO_4$), based on its typically larger sweep efficiency than other oxidants. The oxidant would be applied to the shallow zones via a gravity-feed batch process on the surface. This would theoretically mimic the initial pathway of TCE migration from the suspected primary source areas.

The success of this alternative is primarily dependent upon the ability to sufficiently deliver oxidant to the target areas and destroy residual TCE. Specific treatment volumes for ISCO application at each site encompass larger zones beyond each of the excavation boundaries.

Because the treatment zone for the proposed ISCO is the shallow subsurface, the targeted depth for each of the study areas will be limited to the uppermost 20 feet for cost estimation. Based on this depth, the treatment volumes were estimated as follows (refer to Appendix B of the FS):

- Howard Mountain: 260,000 cubic feet
- Miller Mountain: 180,000 cubic feet
- Transmitter Site: 30,000 cubic feet

Similarly to Alternative 3, this alternative would include the active remediation of residual TCE in shallow horizons (assuming it exists). Treatment of shallow areas of TCE has the potential to reduce contaminant concentrations in the aquifer over time. However, elevated concentrations of contaminants would likely remain in the aquifer for the foreseeable future. Therefore, the POET systems, SSD systems, and MNA assessment would continue for a period of 30 years, which is the CERCLA default duration, as discussed for Alternatives 2 and 3.

In addition to the costs associated with Alternative 3, the costs associated with this remedy include the application of oxidants within the excavated areas. For cost estimating purposes, it is assumed that ISCO treatment would be applied in a single batch event at each excavation area. Additional applications could be field-determined based on the initial application results. In addition, the supplemental application of ISCO via deep bedrock injectors is not included in the base cost estimate for this alternative. The total present value costs for Alternative 4 are estimated to be $8.0M, as presented in Table 4A.

9.6 Alternate Water Supply Alternatives

9.6.1 Addendum Alternative 0: Continue POET Systems

At the Bucks Harbor facility, five domestic wells (four in the Howard Mountain area) that currently have POET systems and the ongoing domestic well LTM program, must be maintained until an alternate remedy (if selected) is implemented. The continuation of these systems is necessary to ensure protection from ingestion. Similarly, the associated domestic well LTM program must be maintained in parallel with the POET systems to assess system performance and plume stability. As such, continued implementation of these existing site controls is the minimum action that is being considered. The total present value costs for Addendum Alternative 0 is estimated to be $247,358, as presented in Table 4B.

9.6.2 Addendum Alternative 1 and 1A: Site New Well for Water Supply

This alternative (Addendum Alternative 1) involves finding a non-contaminated location to install and develop a new water supply well to serve up to ten homes residences in the immediate vicinity of Howard Mountain. As an additional option (Addendum Alternative 1A) for this alternative, a pretreatment system will be evaluated to provide a level of insurance if VOCs (e.g., PCE or TCE) become present in the discharge from the well. The total present value costs for Addendum Alternative 1 and 1A are estimated to be $1.6M and 2.3M, respectively, as presented in Table 4B.

9.6.3 Addendum Alternative 2 and 2A: Connection to Existing DCF Water Supply

This alternative will utilize the existing water supply well that services the DCF. This alternative, as outlined in the FS Addendum (Watermark, 2011) includes the installation of water lines, establishing a water association for operation and maintenance of the water line, periodic monitoring of private drinking water wells, and continued monitoring of the TCE in bedrock wells. The DCF water supply well (WY-03) serves 148 inmates and 68 staff at the prison. The water is also used for food preparation in the kitchen and feeds all other typical utilities at the prison. Subsequent to the publication of the FS Addendum, USACE agreed to install, operate and maintain the public water supply connection from the DCF instead of having this function performed by a water association.

The DCF water supply well had previously serviced 27 local housing units. Between 1985 and 2002 approximately 12 to 15 of these housing units were occupied by prison employee families. The main pipeline that ran to the former DCF housing complex is a 4-inch steel (most likely ductile iron) pipe that runs from the storage tanks south down to “A” Street (see Figure 7). Transmission lines would be installed from this existing pipe to both affected and potentially affected homes. As an additional option (Addendum Alternative 2A) for this alternative, a pretreatment system will be evaluated to provide a level of insurance if VOCs (e.g., PCE or TCE) become present in the discharge from the well. The total present value costs for Addendum Alternative 2 and 2A are estimated to be $0.5M and 1.32M, respectively, as presented in Table 4B.

9.6.4 Addendum Alternative 3: Desalination – Reverse Osmosis

Desalination is a separation process used to reduce the dissolved salt content of brackish or sea water to a usable level, in this case, for potable water. All desalination processes involve three liquid streams: the saline feed water (seawater), low-salinity product water (potable water), and very saline concentrate (reject water). The saline feed water is drawn from the ocean. It is separated by the desalination process into the two output streams: the low-salinity product water and very saline concentrate streams.

Although some substances dissolved in water, such as calcium carbonate, can be removed by chemical treatment, other common constituents, like sodium chloride, require more technically sophisticated methods, collectively known as desalination. In the past, the difficulty and expense of removing various dissolved salts from water made saline waters an impractical source of potable water; however, starting in the 1950s, desalination began to appear to be economically practical for ordinary use, under certain circumstances.

The product water of the seawater desalination process is generally water with less than 500 mg/l dissolved solids, which is suitable for most domestic, industrial, and agricultural uses.

A by-product of desalination is brine (high salt reject water). Brine is a concentrated salt solution (with more than 35,000 mg/l dissolved solid) that must be disposed of, generally by discharging back to the ocean. Brine disposal methodology is dependent on environmental regulation, cost, or proximity concerns.

This alternative requires water pipe lines to be installed from the desalination system to the affected residences. Water supply tanks will also be needed. An operator will be responsible for monitoring the desalination system.

Desalination overcomes the common concern of the other two alternatives being evaluated, which is the possibility of eventually drawing TCE to the water source (groundwater well). Since this alternative uses ocean water, there is no possibility of TCE eventually becoming present in the water source.

The total present value cost for Addendum Alternative 3 is estimated to be $2.3, as presented in Table 5B.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The NCP recommends nine criteria for evaluating and comparing the remedial alternatives, as listed below. Per CERCLA guidance (EPA, 1988), the FS and FS Addendum included an evaluation of the first seven criteria. Tables 4A and 4B summarize the comparison of alternatives to these criteria, and this Decision Document includes discussions relative to the last two criteria (State and community acceptance).

- Overall protection of human health and the environment;
- Compliance with ARARs;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume of contaminants through treatment;
- Short-term effectiveness;
- Implementability;
- Cost;
- State acceptance; and
- Community acceptance.

10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment requires that each alternative provide adequate protection of human health and the environment and describe how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs..

Alternative 0, the No Action alternative, would not be protective of human health because it would not provide treatment prior to ingestion of water which potentially contains contaminant concentrations above the MCL.

Alternative 1 which includes Long Term Monitoring and domestic Well Head Treatment would also not be protective of human health. It would provide continued drinking water treatment at the existing network of domestic wells in the area, groundwater monitoring, and periodic reviews of remedy performance. However, this alternative does not include additional ICs (such as annual notifications); therefore, it could be possible for a new domestic well to be installed in an area of the aquifer that is impacted by VOC contamination which could pose a potential risk to human health if left untreated.

Alternative 2 expands on the protection provided by Alternative 1 by implementing ICs to provide notification of potential exposure of future residents to TCE-impacted groundwater. In addition, Alternative 2 would include the construction of SSD systems (if necessary), which would provide an increased level of protection by mitigating potential risks that could be posed by the inhalation of TCE or related organic vapors via vapor intrusion. Alternative 2 provides overall protection of human health and the environment.

Alternatives 3 and 4 both include all of the elements of Alternative 2. Alternatives 3 and 4 include removal of possible source-area TCE impacts, and Alternative 4 includes *in-situ* treatment of possible source-area TCE impacts. Alternatives 3 and 4 provide overall protection of human health and the environment

The alternatives included in the FS Addendum provide alternatives to the GAC domestic well treatment systems, so that more permanent system is in place for water treatment and the means to provide long term drinking water to affected residents. These options are all intended to replace the current approach of treating groundwater at each residential location using POET systems. The addendum alternatives include the installation and potential treatment of a drinking water supply well, the connection to and potential treatment of an existing water supply well, and treatment of ocean water to provide water to affected residents. All FS Addendum Alternatives for an alternate water supply are protective of human health and the environment, if operated as intended.

10.2 Compliance with ARARs

Applicable or relevant and appropriate requirements (ARARs) are Federal and State environmental requirements used to define the appropriate extent of site cleanup, identify sensitive land areas or land uses, develop remedial alternatives, and direct site remediation. CERCLA and the NCP require that remedial actions comply with State ARARs that are more stringent than Federal ARARs, if they are legally enforceable (promulgated), generally applicable, and consistently enforced Statewide. Once a requirement is identified as an ARAR, the selected remedy must comply with that ARAR, even if the ARAR is not related to health or environmental protectiveness.

For an alternative to be eligible for selection it must comply with its ARARs or a waiver should be identified and the justification provided for invoking it. An alternative that cannot comply with ARARs, or for which a waiver cannot be justified, should be eliminated from consideration. Consistent with EPA guidance, the FS provides a detailed discussion of ARARs for this site.

The RAO for protection of drinking water is based on chemical-specific ARARs (i.e., drinking water standards, including consideration of Federal MCLs and non-zero MCLGs, and State MCLs). Specifically, the established RAO is to prevent ingestion of drinking water that contains TCE (or other related contaminants) to levels above their respective MCL [Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) 40 CFR Part 141 Subpart B (141.11 – 141.16)]. FS alternatives 1-4 would achieve this RAO immediately, primarily through the GAC filtration of potentially impacted domestic wells, and are compliant with ARARs.

All FS Addendum Alternatives comply with ARARs by provision of POET system (Addendum Alternative 0) or an alternate water supply (Addendum Alternatives 1-3) which would provide water at concentrations less than the MCL.

10.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

FS Alternative 0 would not achieve long-term effectiveness or permanence. The use of the POET and SSD systems (components of FS Alternatives 1, 2, 3, and 4) at residential properties would have long-term effectiveness and permanence with proper maintenance. Alternative 1 provides a lesser degree of long-term effectiveness and permanence than Alternatives 2, 3, and 4 because it does not include the implementation of annual notifications, which would provide notification to future residents of potential exposure to TCE in their drinking water or through soil vapor intrusion. The application of ICs (included in FS Alternatives 2, 3, and 4) would be an adequate and reliable method of notifying residents of future potential exposure to TCE.

Although contaminant concentrations may naturally be reduced over time under each alternative, elevated concentrations of TCE would likely persist for several decades. The more aggressive actions included within Alternatives 3 and 4 could theoretically reduce the concentration of TCE within a shorter timeframe than the other alternatives; however, the added degree of permanence induced via excavation and/or ISCO as part of Alternatives 3 and/or 4 is unclear. Ultimately, none of the alternatives would decrease the timeframe in providing a permanent solution for reducing contaminant concentrations. The LTM programs included for all FS alternatives (with the exception of Alternative 0), as well as the additional MNA monitoring included for Alternatives 2, 3, and 4, will assist in refining the CSM for the study areas and adjusting the treatment systems, groundwater sampling approach, and ICZ as necessary to maximize the remedy effectiveness. Therefore, FS Alternatives 2, 3, and 4 are considered to be fully effective and permanent.

FS Addendum Alternatives 0, 1A, 2A, and 3 achieve long term effectiveness and permanence. Addendum Alternatives 1 and 2 do not provide for treatment of TCE if TCE becomes present in the discharge from the alternate water supply well. Therefore Alternatives 1 and 2 are considered to be only moderately favorable with respect to long term effectiveness and permanence.

10.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Reduction of toxicity, mobility, or volume (TMV) through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

There is no reduction of TMV through treatment with Alternative 0. Alternatives 1, 2, and 3 would have a minor impact on the reduction of TMV due to the GAC domestic well treatment at impacted water supply locations. These alternatives would not enhance the rate of natural transformation processes that reduce contaminant concentrations over time. Although Alternatives 2 and 3 would include a program to quantify the rate of TCE dissipation, it would not increase the dissipation rate via a reduction of toxicity, mobility or volume.

Alternative 4 includes more aggressive treatment technology that is intended to reduce the contaminant volume. However, this would only be effective if TCE is encountered and/or affected by the excavation and ISCO application. This alternative would not decrease the mobility or toxicity of TCE in deep bedrock, however, it could possibly reduce the mass of TCE to some extent if it is encountered in the shallow areas targeted for action. Significant additional data would be needed to adequately design deep bedrock injectors given the complexity of bedrock fracturing and hydraulic interconnectedness.

The FS Addendum Alternatives that include GAC treatment (Addendum Alternatives 0, 1A, and 2A) would result in minor reduction in TMV due to the GAC domestic or water supply well head treatment. The other FS Addendum Alternatives (Alternatives 1, 2, and 3) do not include any treatment technologies.

10.5 Short-term effectiveness

The short-term effectiveness criterion addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community or the environment during construction and operation of the remedy until cleanup levels are achieved.

No short-term risks would be created through the implementation of Alternatives 1 or 2, which would be immediately effective. Under Alternatives 1 and 2, the current POET systems and groundwater monitoring programs would continue. There would be short-term exposure to contaminated media created by GAC maintenance activities and groundwater monitoring activities. However, adherence to site specific health and safety plans and use of personnel protective equipment during these activities will eliminate exposure and potential health effects. Alternatives 3 and 4 have the potential to create short-term risks if remedial activities are not properly managed. For example, volatile emissions could be generated during excavation. However, perimeter air monitoring could be performed and corrective measures could be implemented, as necessary. Alternative 3 could be implemented in approximately one year and Alternative 4 could be implemented in approximately two years.

There is minimal construction proposed in Alternatives 1 and 2, therefore, there are minimal potential environmental effects associated with implementation of either alternative. Both Alternatives 3 and 4 would involve construction activities, which could have the potential to create environmental wastes that require onsite management and potentially offsite transport and disposal. Standard worker safety would be ensured through the development and implementation of a site-specific health and safety plan.

All FS Alternatives, except the No Action Alternative 0, would be expected to be immediately effective in the short-term in preventing the potential ingestion groundwater which exceeds MCLs or inhalation of vapors above risk thresholds.

All Addendum Alternatives (except Addendum Alternative 0) have the potential to create short-term risks if remedial activities are not properly managed. For example, alternate water supply lines and treatment systems need to be constructed properly. Construction activities should be accomplished in accordance with health and safety plans to protect worker and community risks. Other short-term impacts would include increased local truck traffic during mobilization/demobilization activities, during installation of the transmission line and service connections.

All FS Addendum Alternatives would be expected to be immediately effective in the short-term in preventing the potential ingestion groundwater which exceeds MCLs, since Addendum Alternative 0 (POET systems) are currently in place, and wouldn't be removed until another addendum alternative is implemented. FS Addendum Alternatives 1 and 1A would take approximately 2-3 years to implement. Addendum Alternative 2 and 2A would take approximately 14 months to implement. Addendum Alternative 3 would take 2-3 years to implement.

10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternatives 0, 1 and 2 require minimal remedial construction for implementation, and could be implemented within a short timeframe. Alternatives 1 and 2 would continue the POET and groundwater monitoring programs currently ongoing; no additional POET installation or monitoring well construction would be included. Alternative 2 requires implementation of an ICZ and vapor controls through SSD, if needed. Coordination with legal services and local governmental authorities would be necessary to successfully implement annual notifications. Overall, Alternatives 0, 1, and 2 are considered easily implementable.

Alternatives 3 and 4 would require services, materials, equipment, and personnel necessary to pilot test, design, construct, operate, and maintain the selected remedial systems. Alternatives 3 and 4 would require the additional services, materials, equipment and personnel necessary to design and successfully implement three focused and targeted excavations. In Alternative 4, the design of the ISCO application must carefully consider site-specific hydrogeological and geochemical processes to ensure the proper selection of oxidant, dosage rate, distribution network, performance monitoring, and other key factors. All required services, materials and equipment are readily available and should not pose any significant time constraints. The implementation of Alternative 4 would be the most challenging of the four alternatives, primarily because of the complexity in designing and implementing *in-situ* remedial systems that sufficiently influence TCE residuals in a relatively complex bedrock fracture network. Alternative 3 is considered implementable but requires logistical planning; and Alternative 4 is considered to be implementable, but requires specialized expertise for successful implementation.

Addendum Alternatives 1 and 1A are considered technically feasible and implementable, as the technology for this alternative currently exists and has been widely implemented in the fractured crystalline rock of Maine and elsewhere. However, these alternatives require a long-term pump test for the new water supply well, and requires a water district to be setup (which requires town approval).

Addendum Alternatives 2 and 2A are considered technically feasible and implementable, as the technology for this alternative currently exists and has been implemented at the DCF. Representatives of the DCF well have expressed a willingness to allow a connection to their system. An agreement between the Department of Corrections and USACE has been drafted and will be finalized before the water line construction begins. If the DCF was to close down within the 30-year monitoring program, another mechanism for operation O&M of the DCF water well supply will be sought.

For Addendum Alternative 3, the technology for this alternative currently exists in Maine and is successful in providing clean water to homes. Materials and services needed for the installation of the transmission lines and service connections necessary for the implementation of this alternative are well defined, and readily available. Desalination systems are readily available and implementable. However, this alternative may be complicated by processes that need to be followed to allow water withdrawal from the ocean and brine discharge back to the ocean. Additionally, it may require that a water district be set up, which requires town approval.

Overall, Addendum Alternative 0 is considered easily implementable, as it is currently in implemented at the site. Addendum Alternatives 1, 1A, 2, and 2A are considered easily implementable, but will require design plans and specifications and/or the set up of a water district, which requires town approval. Alternative 3 is not easily implementable, requiring design plans, specifications, specialized expertise, and development of a water district (requiring town approval).

10.7 Cost

The estimated net present value (NPV) of each alternative is summarized in Tables 5A and 5B. Cost estimate details for major alternative components are provided in Appendix B of the FS and Appendix A of the FS Addendum, and a cost sensitivity analysis is presented in Section 7.0 of the FS. The estimated NPV costs are:

- Alternative 0: $0
- Alternative 1: $2.1M
- Alternative 2: $3.3M
- Alternative 3: $6.7M
- Alternative 4: $8.0M

  - Addendum Alternative 0: $247 K (0.25 M)
  - Addendum Alternative 1: $1.6 M
  - Addendum Alternative 1A: $2.3M
  - Addendum Alternative 2: $0.5 M
  - Addendum Alternative 2A: $1.3M
  - Addendum Alternative 3: $2.3M

10.8 State Acceptance

Written comments regarding the Proposed Plan were offered by the MEDEP. Part 3 of this Decision Document presents the Responsiveness Summary, which compiles these and other comments, followed by USACE responses.

The State of Maine has offered some comments on the selected remedy (Alternative 2 with Addendum Alternative 2A) described in the Proposed Plan, as summarized below:

> *The alternate water supply is the best long-term option for providing clean water to residents whose wells are impacted with site-related contaminants in the Howard Mountain area. We are also encouraged by the Corps' commitment to maintain the water line with no cost to the users of the system. Granular activated carbon treatment is a proven effective technology for removing site-related contaminants from impacted water supply wells in the Miller Mountain area since an alternate water supply is not practical in that area.*

Long-term monitoring is necessary to evaluate any changes in contaminant concentration and migration in the aquifer that may occur over time. The Corps will need to prepare a MEDEP-approved robust long-term monitoring plan in order to effectively track any such changes and to ensure that any potential impacts to currently clean wells due to those changes are detected well ahead of time. Such a monitoring plan will also help us to determine whether or not natural attenuation is effectively reducing contaminant concentrations over time.

The State of Maine does not have the authority to record deed restrictions or notifications on private property without the cooperation and permission of the land owner.

Below are the major topics that the MEDEP has discussed with USACE and has documented in their comments. Other comments and discussion topics are included in Part 3 of this Decision Document.

Monitored Natural Attenuation – The MEDEP does not agree that natural attenuation is occurring at a rate that will result in attaining the second Remedial Action Objective of restoring the groundwater to MCLs within a reasonable time frame. Nevertheless, MEDEP recognizes that the complicated fracture network at the site makes the success of any active remediation attempts very doubtful.

Development of a Public Water Supply – The MEDEP agrees that FS Addendum Alternative 2A (alternate water supply) is the best option for providing clean water to residents around Howard Mountain.

Expansion of the ICZs – The notification letters will be educational in nature with the intent to inform and advise the homeowner, as well as collect samples from any newly installed water supply wells. USACE's position is that the Land Use Controls are an important component of the remedy in terms of communication and transparency. USACE is implementing similar LUCs at the Glenburn Ground to Air Transmitter Facility FUDS. MEDEP has provided concurrence on that Decision Document. To date, USACE has not had significant public opposition when educational institutional controls have been proposed for FUDS projects.

10.9 Community Acceptance

Verbal and written comments were offered by the stakeholders during the public meeting (May 5, 2016) and during the public comment period (April 20, 2016 through May 27, 2016). Part 3 of this Decision Document presents the Responsiveness Summary, which compiles the verbal and written comments and USACE responses. Stakeholders in attendance at the meeting included community members, representatives from the MEDEP, and representatives from the State of Maine Department of Corrections.

The comments from the community predominantly focused on questions regarding the implementation of the land use controls and concerns with groundwater monitoring.

11.0 PRINCIPAL THREAT WASTES

According to *A Guide to Principal Threat and Low Level Threat Wastes* (EPA, 1991b), principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Principal threat wastes generally include, but are not limited to: 1) liquid source material (e.g., waste in drums, non-aqueous phase liquid [NAPL] in the subsurface); 2) mobile source material (e.g., highly impacted soil that is mobile or potential mobile, such as through volatilization, runoff or leaching); and 3) highly toxic source material (e.g., buried non-liquid wastes or soils with high concentrations of toxic materials).

Conversely, non-principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Non-principal threat wastes generally include, but are not limited to: 1) Non-mobile contaminated source material of low to moderate toxicity (e.g., surface soil containing chemicals of concern that generally are relatively immobile in air or groundwater in the specific environmental setting; and 2) low toxicity source material (e.g., soil and subsurface soil concentrations that present an excess cancer risk near the acceptable risk range were exposure to occur).

Principal threat wastes do not currently exist at the Bucks Harbor site. Through prior USACE and FAA investigations and response actions, the majority of the petroleum contaminated soil at the Bucks Harbor facility (primarily at Howard Mountain) has been removed. Remaining soil areas that may contain TCE have been sampled and very little overburden TCE has been detected (Weston, 2005; JCO, 2006). As such, it is unlikely (but possible) that TCE contamination still exists in shallow overburden. Potential areas where shallow soils are most likely to contain residual TCE were identified through examination of the CSM, the distribution of the maximum concentrations of TCE in groundwater, and the locations of the historic operational areas that were the most likely sources of TCE contamination (refer to the FS for a general depiction of these potential source areas). Based on analytical data collected to date, it is possible that TCE will be present in these potential areas, but concentrations may not exceed prior results (e.g., low part-per-billion levels). However, PCE was recently detected in shallow soil at the septic tank area during the April/May 2006 post-RI investigation (refer to the FS for more detail).

Primary sources of TCE impacts to groundwater have not been identified. Dissolved TCE in groundwater likely results from secondary sources (residual TCE) in near-surface or subsurface areas within each of the study areas. As discussed in the FS, it is likely that residual TCE may also be persistent in poorly connected bedrock fractures, providing a continuing source of dissolved TCE in groundwater. The presence of residual TCE is inferred from groundwater with TCE concentrations in the vicinity of 2,000 µg/L. However, pure-phase NAPL has not been detected at the Bucks Harbor site.

12.0 SELECTED REMEDY

This Decision Document sets forth the Long Term Monitoring and Enhanced Site Controls remedy (Alternative 2) and Connection to Existing Downeast Correctional Facility Water Supply and Pretreatment (Addendum Alternative 2A) or point of entry well head treatment for Bucks Harbor. The following paragraphs describe the key components of this alternative, as presented in the FS. A general depiction of the areas that are described by this selected remedy are presented in Figures 5 and 6. The selected remedy includes the following components:

- Monitored natural attenuation (MNA);
- Long-term monitoring (LTM) of groundwater;
- Alternate water supply or point of entry well head treatment for impacted water supply wells;
- Monitoring of indoor air; and
- Land Use Controls.

This remedy was selected because it achieves the RAOs for the site in a cost-effective manner. It will continue to protect current residents from exposure to TCE in groundwater above the MCL by providing an alternate water supply or well head treatment to affected residents. This remedy will also protect residents from potential indoor air exposure to TCE or other VOCs. The possibility of exposure through soil vapor intrusion is present when volatile chemicals exist in the shallow subsurface. This potential exposure will be remedied by first identifying areas with subsurface VOCs, then identifying residences with unacceptable levels of VOCs, and following up with appropriate mitigation actions, such as the installation and operation of SSD systems to the extent warranted for those residences. The selected remedy will also maintain awareness of current and future residents by providing annual notifications to properties within the ICZs (the extent of which will be determined in concert with the Town and MEDEP). These notifications will inform residents regarding potential exposure to TCE through drinking water and/or vapor intrusion within the defined ICZs.

The total present value cost for FS Alternative 2 is estimated to be $3.3M, which encompasses upfront capital costs, annual O&M costs, and periodic costs (refer to Table 5A). The total present value cost for FS Addendum Alternative 2A is estimated to be $1.3M, which encompasses upfront capital costs, annual O&M costs, and periodic costs (refer to Table 5B). A detailed presentation of the estimated cost components is presented in Appendix B of the FS and Appendix A of the FS Addendum. This cost estimate is based on the best available information regarding the anticipated scope of the selected remedy. Major changes may be documented in the form of a memorandum in the AR file, an explanation of significant differences (ESD), or a Decision Document amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. Per EPA guidance, the estimated cost will increase in accuracy as the remedial process evolves.

12.1 Monitored Natural Attenuation

The concentration of TCE in groundwater should naturally attenuate over time, albeit very slowly. There is little evidence of microbial degradation of TCE in the Howard Mountain and Transmitter site areas, and the minor degree of attenuation observed may be predominantly the result of natural abiotic (i.e., non-microbial) attenuation. Although information from the Miller Mountain Site is limited, there is evidence that some microbial transformation may have occurred based on the presence of DCE and other less-chlorinated compounds. The monitoring well network currently in place for the domestic and monitoring well program will be evaluated for its sufficiency to monitor progress towards achieving the MCL and for evaluation of natural attenuation progress. The sampling program currently includes an annual assessment of data and trend analysis to evaluate how effective natural processes (whether abiotic or microbial) is in the attenuation of TCE concentrations. This selected remedy will continue with this assessment. The specific wells, sampling frequencies, and analytical parameters to support an MNA evaluation will be developed (in coordination with MEDEP and stakeholders) during the LTM planning process in the design phase of this remedy. Under EPA guidance, this would typically include the development of a Long-term Monitoring Plan (LTMP). Sampling and Quality Assurance Project Plans will be developed for long term monitoring at the site.

12.2 Long-term monitoring (LTM) of groundwater

To ensure the protection of human health, USACE has been conducting a groundwater and residential well monitoring program. The program is primarily designed to evaluate the concentration of TCE in those wells that have GAC systems in place, as well as to collect data from other domestic and monitoring wells near TCE-impacted areas. Currently, there are 19 domestic wells (including the five wells with GAC systems and public water supply well) and 26 monitoring well screens included in the monitoring program.

As also described above, multiple samples are collected from domestic wells on properties that have GAC filtration systems, to assess the continued performance of the treatment system during each event. Parameters currently analyzed as part of the GWM program include VOCs (including TCE) and MNA parameters including dissolved and total metals (including ferrous iron and manganese), anions (nitrate, sulfate, chloride) and gasses (methane, ethane, and ethene), and total organic carbon.

This component of the selected remedy consists of converting the current “GWM” program into a long term “LTM” program. The difference is essentially in nomenclature only. The precise LTM network, sampling frequency and other details will be continually optimized, at a minimum to coincide with required five year reviews. The data from the LTM will be used to evaluate the ongoing MNA processes at the site, as discussed in Section 12.1.

Over time, as the TCE distribution and concentrations dissipates (as expected based on the evaluation presented in the FS), the network of monitoring points should continue to be reduced. For planning purposes, the LTM program is anticipated to include an average of 15 domestic wells and 26 monitoring wells to be sampled annually over a 30-year period, which is the EPA-required default duration in an FS.

12.3 Alternate water supply or point of entry well head treatment for impacted water supply wells

Based on community and MEDEP comments generated on the Proposed Plan and public presentation for the former Bucks Harbor facility in June 2008, USACE investigated the feasibility of providing an alternate water supply for impacted residents in the vicinity of the former Bucks Harbor facility. Of the alternatives evaluated in the Feasibility Study Addendum, connection to the existing DCF water supply was the preferred alternative for provision of potable drinking water to impacted residents. USACE will install the water line to the impacted residents in the Howard Mountain vicinity. Maintenance of the water line shall be performed by the USACE or its agents. This alternative can include the formation of a Water Association which could ultimately assume responsibility for maintenance of the water line extension from the DCF water supply. Agreements between all parties involved will be put in place to establish a mutual framework governing the respective parties for the supply of potable drinking water. No additional land in Machiasport, other than that already used as a water supply (and any required easements) will be needed to enact this component of the remedy. Water supply wells at residences where an alternate water supply is provided will be capped and locked from further usage as a water supply. These wells will likely continue to be used as monitoring points, so they are not planned for abandonment at this stage of the remedy implementation.

If the DCF ceases operation of the water supply well, USACE will investigate alternatives for continuing its operation to supply potable water to impacted residents. This may be accomplished by another entity which would be responsible for O&M of the public water supply.

The selected remedy includes the contingency for the continued operation and maintenance of POET systems that treat drinking water wells with TCE contamination that currently exceed the MCL in the Howard Mountain vicinity. The GAC filtration systems are currently installed at four domestic wells (DW-02, DW-03, DW-04, and DW-12) at Howard Mountain and one domestic well (DW-23) near Miller Mountain. Each system includes an in-line sedimentation pre-filter, followed by GAC filters. The systems typically consist of two GAC treatment units in series. The GAC filters are 10-inch diameter vertical cylindrical vessels, each approximately 54 inches high. They are connected by standard water supply piping, with either a spigot-port or saddle-valve for sampling. One system has additional redundancy built in consisting of four GAC treatment units, two parallel sets of two vessels in series (DW-03). If the alternate water supply is not feasible due to a residential location (e.g., Miller Mountain vicinity), the POET system will be used to ensure potable water for residents. However, the priority will be to sustain the public water supply operation, if feasible.

12.4 Monitoring of indoor air

Indoor air quality testing (also known as Vapor Intrusion testing) has been performed at the most likely impacted residential and commercial properties in the Howard Mountain and Miller Mountain areas. Risk estimates show the cancer and non-cancer hazards associated with contaminants which have a complete VI pathway from the groundwater to indoor air do not reach a level of concern that requires a response. However, site characteristics (e.g., increasing groundwater contaminant concentrations) which may lead to vapor intrusion will continue to be evaluated to determine if further investigation and/or mitigation of vapors in indoor air is necessary.

12.5 Land Use Controls

The USACE will provide annual notification letters to the property owners within the institutional control zone (ICZ) to ensure that they are aware of the potential contaminated groundwater under their property; and to indicate that USACE will test any new drinking water well for VOCs, and connect to an alternate water supply (DCF water supply) or install and maintain a POET system, if MCLs are exceeded (due to DOD contamination) or if concentrations are trending toward an MCL exceedance. Additionally, site characteristics (e.g., increasing groundwater contaminant concentrations) which may lead to vapor intrusion will continue to be evaluated to determine if investigation and/or mitigation of vapors in indoor air is necessary. These letters will be sent by USACE and will be based on Town tax records to ensure that current owners of the property are notified.

The properties designated in the ICZ are those which have historically had detections of TCE or those that may become impacted due to their proximity to impacted properties. Annual notification letters will also be sent to property owners within the ICZ even if there is no well currently on their property. Figures 8 and 9 show the ICZ area for the Howard Mountain and Miller Mountain areas, respectively. Note that the ICZ may change as the TCE impacted groundwater areas change over time. Also, the potential for groundwater usage within and immediately outside of the ICZ will be re-evaluated each year to identify any changes.

In addition to annual notifications to property owners, USACE is working with the Town of Machiasport to develop notices that will be provided with each building permit issued by the town. The notice will provide information on the areas which contain groundwater contamination and advise the public of the potential need for water treatment. It is noted that the Town does not have a well installation permit process in place, so that is not a viable notification vehicle. If the Town does not agree to providing notices with the building permits, USACE will contact the Code Enforcement Officer (or local town official) on a semi-annual basis to determine if any new homes are planned to be constructed in the ICZ. If so, a notification (as described above) will be provided to the building permit applicant.

The Land Use Control plan for this site will not include any deed restrictions or notifications on properties. Language in the Proposed Plan that said that the state or local officials may do this was in error. There is no intent to encumber property in any way by the USACE, the State of Maine, or the Town of Machiasport.

12.6 Five-year Reviews

Because contamination will remain in the groundwater at concentrations which do not allow unlimited use and unrestricted exposure (UU/UE) within 5 years, CERCLA five-year reviews will be performed at this site until the site's contamination falls below levels safe for UU/UE.

CERCLA §121(c) states the following:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remailing 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 judgement of the President that action is appropriate at such site in accordance with the section [104] or [106], the President shall take or require such action.

13.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the selected remedy must be protective of human health and the environment, comply with ARARs (unless a statutory waiver is granted), be cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the selected remedy meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedy will be protective of human health and the environment. The continuation of the POET systems or the connection of impacted residents to the DCF water supply at the existing network of domestic wells in the area will prevent exposure of residents to TCE in groundwater above the MCL. The implementation of ICs will prevent potential exposure of future residents to TCE impacted groundwater. The construction of SSD systems (if necessary) would provide protection for residents by mitigating potential risks from the inhalation of TCE or related organic vapors via vapor intrusion. The LTM program with the associated MNA evaluation will assist in determining if adjustments are needed to maximize the remedy effectiveness. The five-year reviews will provide an opportunity to re-evaluate the remedy, as necessary, to maintain protection of human health and the environment.

13.2 Compliance with ARARs

The ARARs associated with the selected remedy, along with a brief discussion of how they will be achieved, are presented in Table 6. For the Bucks Harbor facility, the driving ARAR is the Federal MCL for TCE in drinking water (5 µg/L). [Safe Drinking Water Act (SDWA), Maximum Contaminant Levels (MCLs); 40 CFR 141, Subpart B (141.11-141.16)] This value is categorized by EPA as a primary MCL based on the potential health risks from ingestion of water. The alternate water supply or continued operation of the POET systems for existing and future residential properties where groundwater may exceed the TCE MCL will protect human health.

While the domestic well treatment will continue to ensure the protection of human health, it is anticipated that residual levels of TCE greater than 5 µg/L will persist in groundwater until the TCE naturally attenuates. As concluded in the FS and prior evaluations, even if TCE source areas could be identified, the implementation of an effective and successful active remedial technology for TCE treatment or removal in this deep, fractured bedrock aquifer is not practical.

13.3 Cost-effectiveness

The selected remedy is cost-effective in meeting the RAOs for the site. The NPV of capital costs for monitored natural attenuation, long term groundwater monitoring, alternate water supply (or treatment with POET systems) for impacted water supply wells, monitoring of indoor air, and land use controls is estimated at $4.6M.

The various components included in this remedy are cost-effective means of ensuring continued human health protection. The LTM program will continue to be optimized over time as chemical data is collected and MNA indicator parameters are evaluated. Adjustments in the well network, sampling frequencies, and analytical parameters will be continually adjusted to respond to evolving site conditions.

13.4 Use of Permanent Solutions and Preference for Treatment

CERCLA's requirement for permanence typically refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. MNA is considered a permanent solution since the contamination would not be anticipated to rebound after cleanup levels are attained.

MNA does not effectively reduce the toxicity, mobility, or volume (TMV) through treatment. MNA does not enhance the natural transformation process that reduce contaminant concentrations over time. There is a minor impact in the reduction of TMV through the GAC treatment systems (DCF public water supply and/or residential POET systems).

The development of an alternate supply of drinking water for affected residents is a key component of the selected remedy. Groundwater used by residents in the impacted areas (currently five well locations) will be replaced with groundwater extracted and treated by the DCF at an existing supply well. This element of the remedy will have long-term effectiveness provided proper operation and maintenance of the systems.

The use of POET systems for water treatment would not offer as much permanence as the alternate water supply connection since it requires monitoring and maintenance at individual homes, and could be subject to failure or re-configuration without USACE knowledge.

In addition, implementation of ICs through annual notifications, which may lead to additional sampling and treatment and/or connection to the DCF water supply, will protect current or future residents who might otherwise be potentially be exposed to impacted groundwater or soil vapor.

13.5 Compliance with Five-Year Review Requirements

This remedy will result in hazardous substances being reduced to a level that will allow for unlimited use and unrestricted exposure, however it will take more than five years for the remedy to be fully effective. As such, a five-year review will be conducted at least every five years until the remedy is complete and hazardous substances on site fall below the levels that would allow for unlimited use and unrestricted exposure.

14.0 DOCUMENTATION OF NO SIGNIFICANT CHANGES

The Proposed Plan for the Bucks Harbor AFRTS site was released for public comment in April 2016 and a public meeting was held on May 5, 2016. The Proposed Plan identified Alternative 2 (long term monitoring and enhanced site controls) and Addendum Alternative 2A (connection to existing Downeast Correctional Facility water supply and pretreatment) as the Preferred Alternative. All verbal and written comments regarding the USACE recommendation were reviewed and considered, but did not result in any significant changes to the recommended alternative

PART 3: RESPONSIVENESS SUMMARY

1.0 STAKEHOLDER ISSUES AND USACE RESPONSES

Verbal comments were offered by the stakeholders during the public meeting conducted on May 5, 2016 to present the Bucks Harbor Proposed Plan. Stakeholders in attendance at the meeting included community members, representatives from the Maine DEP, and representatives from the State of Maine Department of Corrections. The public comment period was from April 20, 2016 through May 27, 2016.

2.0 TECHNICAL AND LEGAL ISSUES

Based on community and MEDEP comments generated on the Proposed Plan and public presentation for the former Bucks Harbor facility in June 2008, USACE investigated the feasibility of providing an alternate water supply for impacted residents in the vicinity of the former Bucks Harbor facility. Of the alternatives evaluated in the Feasibility Study Addendum, connection to the existing DCF water supply was the preferred alternative for provision of potable drinking water to impacted residents. USACE will install the water line to the impacted residents in the Howard Mountain vicinity. Maintenance of the water shall be performed by the USACE. Agreements between all parties involved will be put in place to establish a mutual framework governing the respective parties for the supply of potable drinking water. No additional land in Machiasport, other than that already used as a water supply (and any required easements) will be needed to enact this component of the remedy. The provision of the alternate water supply appears to be an acceptable addition to the remedy at Bucks Harbor.

Other comments primarily focused on the groundwater monitoring program and the land use controls.

Specific comments and responses related to this and other issues are provided in Section 3.0 below.

3.0 COMMENT RESPONSES

Section 3.1 presents a compilation of verbal comments offered at the public meeting on May 5, 2016. Section 3.2 presents written comments received during the public comment period from April 20, 2016 through May 27, 2016. (The specific syntax and format of the verbal comments are slightly paraphrased.) Refer to Appendix D for copies of the written comments received. Comments are provided in normal font, with associated responses provided in *italics* font.

3.1 Verbal comments and USACE responses

<u>Comment on May 5, 2016 from Shirley Erickson, representing the community</u>
I appreciate you addressing head on the lengthy study, the 20 plus years of this particular problem. My question is that have there been similar projects with similar challenges throughout the country that you have been able to benefit from the work that they have done as you ' re addressing our problem here in Bucks Harbor?

Yes, we have a project in Glenburn, Maine. We have done investigations for both Glenburn and Bucks Harbor. Glenburn also took a long time to complete investigations. USACE has learned a lot from both of these projects. There are other projects across the country that have similar issues. The Corps has a center of expertise in Omaha, Nebraska, with specialists who have expertise in various disciplines relating to contamination in bedrock, and they also see issues from a national perspective. So we have tapped into their knowledge. MEDEP has also assisted us. So, yes, there are other projects out there that we have learned from. *We have also kept involved through industry in terms of our contacts to industry.*

<u>Comment on May 5, 2016 from Shirley Erickson, representing the community</u>
I know that the nature of the bedrock in this area is more unique than some of the other sites around the country. So that is why I wondered if there was somebody that had some of the same issues that we had

that went before us and have been able to achieve a full resolution but I appreciate that comment and the benefits that your agency has been able to obtain so far.

The one thing about New England sites that have this issue with bedrock, is that it's not going to be the same for every site. In general, bedrock is much shallower than some of the other FUDS sites that we are aware of that have this problem. For example, more often in the Midwest, bedrock is present, but much deeper. So you have a much thicker layer of soil to deal with that also is contaminated; and that can help expedite your cleanup by dealing with that soil portion. But at Bucks Harbor, as witnessed by the hilly terrain, we don't have that situation. That's one thing that makes this site a little bit unique (that there is very little soil), so there is very little remaining source of contamination hung up in that soil layer. It has already migrated to the bedrock.

In general, fractured bedrock sites are extremely difficult to resolve and comparisons from one site to another are often not reliable because of the differences in fracture characteristics. At Bucks Harbor, there are added complexities associated with remediating the fractured bedrock aquifer, including: the lack of a definable source area, the possibility of rebound from matrix diffusion from the bedrock, and the presence of downgradient receptors that might be negatively impacted by in situ remedial efforts. The following reference is provided for more information on fractured bedrock remedial efforts:

> *National Academies Press publication Characterization, Modeling, Monitoring, and Remediation of Fractured Rock, 2015 (https://www.nap.edu/21742).*

Comment on May 5, 2016 from Shirley Erickson, representing the community
You mentioned that there would be no deed restrictions in this land use control statement that you made. However, the proposed plan does have a paragraph on Page 13 about the possibility of recording deed restrictions.

The language regarding the Town doing deed restrictions was in error and that language will be corrected in the decision document. Deed restrictions are not part of our remedial plan. It is noted by the State of Maine representatives that the state does not have authority to record deed restrictions unilaterally.

Comment on May 5, 2016 from Shirley Erickson, representing the community
I just wanted to make the statement because, based on what Mr. Anderson said, there would be no deed restrictions. However, it was noted in the proposed plan. So I think it's important to bring that to the public's attention, because land use control should not be taken lightly.

See response above.

Comment on May 5, 2016 from Shirley Erickson, representing the community
Another statement I would like to make is that every few years there is talk at the state level about closing the Downeast Correctional Facility. And my question is, If it closes, what happens with that alternate water supply?

The bottom line is that the Army and the Corps of Engineers have an absolute responsibility to provide clean drinking water to people that have impacted water above the MCL If the Downeast Correctional Facility were to close for some reason, then it would be our responsibility to determine the best solution under those circumstances. It could involve taking over operation of the public supply well and keeping the waterline in place. Another alternative may be to go back to point-of-entry treatment systems, like we have in place currently, as an interim solution. But the absolute bottom line is USACE has an obligation to provide that clean water, and we have to do whatever it takes to accomplish that.

Currently, the Corps and DOC have established an agreement. It's a written formal agreement, which is not yet signed, however, the agreement discusses what DOC would do in terms of identifying to the Corps that they plan to close the facility. We have agreed that they would give us as much notice as possible if that *situation were to occur. The DOC and USACE are committed to making sure that the solution that we are developing now endures, even if the DCF closes.*

Comment on May 5, 2016 from Shirley Erickson, representing the community
Perhaps when the Decision Document is written, you could include some language in there, instead of always referring to the Downeast Correctional Facility as being this alternate water supply, perhaps making some type of a statement in there about contingency if the DCF closes. Otherwise, it appears that the alternate water supply will stop if the DCF closes.

The USACE is responsible for implementation of this remedy, including the protection of residents for their drinking water. We have no information that the DCF is planning to close. If they were to close, the USACE has a number of alternatives available to them and will modify this remedy to ensure the protection of human health and the environment as the law requires.

Comment on May 5, 2016 from Iver McLeod, representing the MEDEP
It has been pointed out that the Proposed Plan does say Town of Machiasport or Maine DEP may decide to record deed restrictions. The State does not have authority to record deed restrictions. MEDEP can't place restrictions on your property without the complete cooperation with the property owner.

This is noted by USACE and will be corrected in the Decision Document. The Land Use Control plan for this site will not include any deed restrictions or notifications on properties. Language in the Proposed Plan that said that the state or local officials may do this was in error. There is no intent to encumber property in any way by the USACE, the State of Maine, or the Town of Machiasport.

Comment on May 5, 2016 from Shirley Erickson, representing the community
I would just like to say that I' m very thankful that this alternative is the two-pronged approach: The long-term monitoring, coupled with the alternative water supply. It took a number of years to come to this point, but I believe it's in the best interest of everybody to move forward with that resolution.

Comment acknowledged.

Comment on May 5, 2016 from Lynn Gibson, representing the community
I live in the Miller Mountain industrial zone, and I'm inside the black line shown on the figure in the Proposed Plan. My well has not been tested in several years. Is that going to resume?

The monitoring program has been reduced based on the information we've gathered previously. USACE will re-establish a baseline during the Decision Document timeframe, and likely re-test homes in this area to verify previous data to make certain that conditions haven't changed and that everything is as we expect it to be.

Comment on May 5, 2016 from Lynn Gibson, representing the community
So if something changed, say, for my neighbor, would I be notified that their levels increased? Because our wells might be in proximity to one another.

There wouldn't be a notification, necessarily, that their levels increased. However, USACE will make certain that any location that may be impacted will be tested. Part of our analysis of the data that we're looking at is: What changes are happening in the vicinity of all these places that are or are not impacted? What else is going on around there that might be impacted to cause us to look at this? Have you been pumping more water? There are lots of questions we might ask at that point.

Comment on May 5, 2016 from Mr. Almendinger, representing the community
Since the last round of water testing on Miller Mountain at the GATR site, that's been blasted out since the last round of water monitoring that I'm aware of. They built a cell phone tower on the top of Miller Mountain. They blasted every day for three weeks. I just can't believe that that didn't have some effect on the

contaminants in the area.

That's a great point. The last sample event occurred in October 2015, after the cell tower blasting. USACE will make sure to take this into account when developing the sampling program for 2016.

Comment on May 5, 2016 from Shirley Erickson, representing the community
That was one of the issues I was trying to raise about the land use controls and the restrictions. Currently, the Planning Board has been under no direction to take a look at any of these maps and notifications for property owners that want to get a building permit. This Proposed Plan just came out with this information that identifies the institutional control zone. I'm not sure how long it has been available, but the Planning Board is planning on talking about this subject at our meeting next Thursday. It's on our agenda, but we are just becoming familiar with it, along with the rest of the community.

To date, USACE has communicated with the Town of Machiasport Code Enforcement Officer, Planning Board and Board of Selectmen about the possibility of providing notices with each new building permit issued in the ICZ. However, the specifics have not been determined at this time. USACE will continue to work with the town Planning Board and Board of Selectmen to pursue this form of notification to property owners.

Comment on May 5, 2016 from Susan Almendinger, representing the community
My concern would be, because Miller Mountain, the very top of it, was a serious site, and then to have dynamite. I mean, that's all exposed bedrock. So that's a concern, specifically, when you're looking down the road at land use controls. And when something of that magnitude takes place and we're a landowner abutting that property, we are concerned about that.

I understand why you would be concerned. That's the type of information we're trying to find out as part of our notification process every year. If you see things like that or if you hear things, and even if you think we already know about it, those are things to notify USACE about so that we can consider changes to the groundwater monitoring program to make sure that the remedy is protective.

3.2 Written comments and USACE responses

Comment letter dated May 27, 2016 from Iver McLeod, representing the MEDEP

The alternate water supply is the best long-term option for providing clean water to residents whose wells are impacted with site-related contaminants in the Howard Mountain area. We are also encouraged by the Corps' commitment to maintain the water line with no cost to the users of the system. Granular activated carbon treatment is a proven effective technology for removing site-related contaminants from impacted water supply wells in the Miller Mountain area since an alternate water supply is not practical in that area.

Comment acknowledged.

Comment letter dated May 27, 2016 from Iver McLeod, representing the MEDEP

Long-term monitoring is necessary to evaluate any changes in contaminant concentration and migration in the aquifer that may occur over time. The Corps will need to prepare a MEDEP-approved robust long-term monitoring plan in order to effectively track any such changes and to ensure that any potential impacts to currently clean wells due to those changes are detected well ahead of time. Such a monitoring plan will also help us to determine whether or not natural attenuation is effectively reducing contaminant concentrations over time.

USACE agrees and will provide a Long Term Monitoring Plan, including monitored natural attenuation assessment, for the site, and make adjustments based on results of the on-going monitoring program.

Comment letter dated May 27, 2016 from Iver McLeod, representing the MEDEP

Page 13 of the Proposed Plan states, "...MEDEP may decide to record deed restrictions or notifications on properties within an ICZ." Please note that, as stated at the May 5, 2016 public meeting in Machiasport, the State of Maine does not have the authority to record deed restrictions or notifications on private property without the cooperation and permission of the land owner.

Comment acknowledged. This will be clarified in the Decision Document.

Comment letter dated April 27, 2016 from Shirley M. Erickson, representing the community

This letter is to acknowledge receipt of your correspondence dated April 14, 2016 regarding the Proposed Plan for the Bucks Harbor Former Air Force Radar Tracking Station and Former Ground/Air/Transmitter/Receiver (GATR) Formerly Used Defense Sites (Bucks Harbor site) in Machiasport, Maine. In the aforementioned correspondence you state "You are receiving this letter and a copy of the Proposed Plan because your property [Lot no. 12-070-100) is in an institutional control zone (ICZ) ...However, we will request that you notify us if you install a drinking water supply well so that we can test it to ensure it does not contain contaminants related to historic Department of Defense activities at the Site..."

If the US Army Corps of Engineers (USACE) and the Maine Department of Environmental Protection would review their records related to the Bucks Harbor site spanning the past two decades, you will find that a drinking water supply well currently exists on my property located at 248 Yoho Head Road (Property Tax Map 12, Lot 70-100) in Machiasport and was tested by the USACE for a number of years (before being withdrawn from the testing program by the USACE) for the contaminants of concern identified as volatile organic compounds. For file reference purposes, my drinking water supply well was identified as sample location DW-30.

With the above in mind, this letter will serve as formal notification to the USACE that a drinking water supply well has been installed on my property. In addition, this letter is to formally request that the USACE include my drinking water supply well in the regular testing program related to the Bucks Harbor site.

USACE acknowledges that your drinking water supply, identified as DW-30 in our records, has been historically sampled. It was discontinued from the groundwater monitoring program in 2011 because it had no historical detections and is not believed to be impacted by the groundwater contamination from the site. The letter sent with the Proposed Plan was intended to ask for notification if a new water supply well is installed on your property. USACE has conducted a robust groundwater sampling event in October 2016, and will include your residence at that time to verify our previous findings.

Comment letter dated May 16, 2016 from Shirley M. Erickson, representing the community

The purpose of this letter is provide written comments regarding the Proposed Plan for the Bucks Harbor Former Air Force Radar Tracking Station and Former Ground/Air/Transmitter/Receiver (GATR) Formerly Used Defense Sites (Bucks Harbor site) in Machiasport, Maine, dated April 13, 2016. These written comments are in addition to the verbal comments I made during the Public Meeting held on May 5, 2016 at the Fort O'Brien Elementary School in Machiasport, Maine.

My comments relate to the need for clarification on the Land Use Controls section of the aforementioned Proposed Plan for the Bucks Harbor site on pages 12 and 13. On these pages, it states "...USACE is working with the Town of Machiasport to develop notices that will be provided with each building permit issued by the town ...The Town of Machiasport or MEDEP may decide to record deed restrictions or notifications on properties within an ICZ (Institutional Control Zone) ..."

During the public hearing on May 5, 2016, there appeared to be some uncertainty and a lack of clarity with respect to which governmental entity had the authority to record deed restrictions or notifications on properties within an !CZ as referenced on page 13 of the Proposed Plan for the Bucks Harbor site. With this in mind, please describe the legal framework or precedent for municipalities and/or states to record deed restrictions or notifications on properties the USACE identifies as being within an ICZ. In addition, please provide a summary of the work to date that the USACE and Town of Machiasport has completed with respect to the development and proposed content of the notices to be provided with the issuance of building permits as referenced on page 12 of the Proposed Plan for the Bucks Harbor Site.

Response: The language regarding the Town recording deed restrictions was in error and that language will be corrected in the Decision Document. Deed restrictions are not part of our remedial plan. It is noted by the State of Maine representatives that the state does not have authority to record deed restrictions unilaterally.

To date, USACE has communicated with the Town of Machiasport Code Enforcement Officer, Planning Board and Board of Selectmen about the possibility of providing notices with each new building permit issued in the ICZ. However, the specifics have not been determined at this time. USACE will work with the town Planning Board and Board of Selectmen to pursue this form of notification to property owners.

<u>Comment letter dated May 26, 2016 from Vincent W. Dinan, Jr., Secretary and Treasurer, Jasper Beach Water Association</u>

Set forth below are my observations and comments regarding the referenced plan. It should be noted that the comments presented were also endorsed by the membership at the April 12, 2016 meeting of the Jasper Beach Water Association (JBWA).

The issues listed below are seen by me and the other members of the JBWA as critical to the establishment of equitable rights and responsibilities between the U. S. Army Corps of Engineers (USACE) and the JBWA, preliminary to the installation of an alternate water supply at the homes of Association members in the Howard Mountain area. Our concerns are as follows:

More specificity regarding costs related to the alternate clean water supply to be provided by the State of Maine Department of Corrections, and the installation, maintenance, and operation of facilities installed by the U. S. Army Corps of Engineers (USACE) to provide a clean water supply to households affected by the contamination of drinking water by the former Air Force Radar Tracking Station in Machiasport, Maine. NOTE: In a status update forwarded by Marie Wojtas of USACE on April 13, 2016, the following new information was provided regarding the O & M cost issue: "Currently, the Proposed Plan states that installation and maintenance of the water line shall be performed by USACE. Responsibility for the maintenance of the water line by USACE was included in an effort to alleviate the concerns that the Jasper Beach Water Association had regarding financial support for maintaining the water line." This represents a significant change from the Corp's past position, and may mean that any potential responsibility by JBWA for O & M financing goes away.

USACE plans to install, operate and maintain the public water supply connection from the DCF. Therefore, the Jasper Beach Water Association will not be responsible for the financial support of the water line connection.

A more complete explanation concerning expansion of the clean water supply provided by the State of Maine Department of Corrections to homes beyond the current five households, either currently in existence of to be built in the future in the area affected by water contamination. Details involved should include homeowner eligibility and limitations.

USACE plans to connect five homes in the vicinity of the groundwater contamination. Future connections will be established based on conditions such as the concentration of contamination and the vicinity of the home to the water line.

Provisions for funding for legal fees (if any) incurred by JBWA in connection with resolving the water contamination issue.

USACE cannot pay for legal fees.

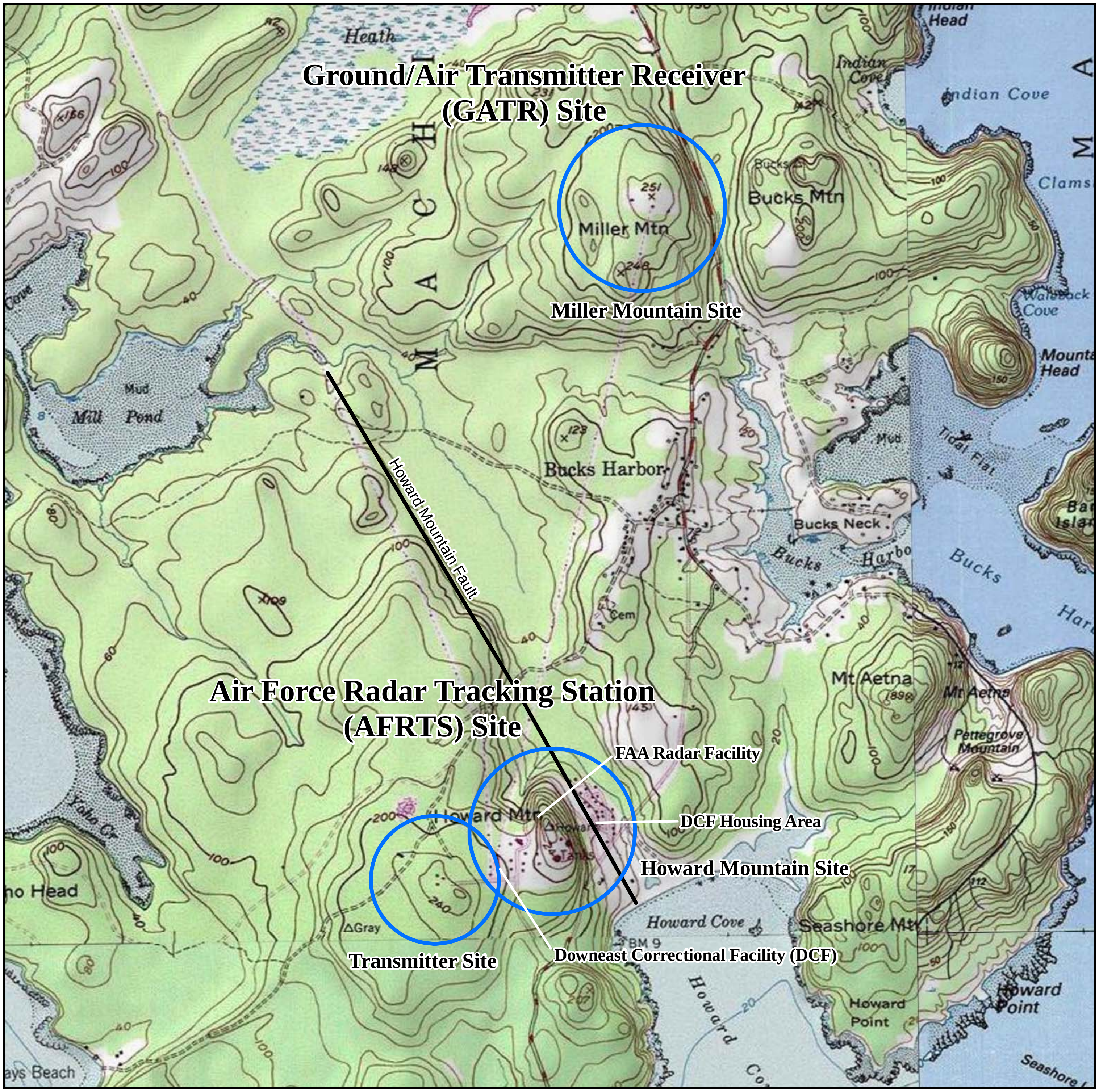
Consideration of dissolution of the JBWA in the event that USACE assumes responsibility for all operating and maintenance costs associated with the new water system.

USACE agrees that the JBWA is not a necessary entity considering the current plan for operation and maintenance of the water line connection by USACE.

Recourse available to affected homeowners in the event that the State of Maine Department of Corrections abandons the Downeast Correctional Facility and its water supply.

The USACE is responsible for implementation of this remedy, including the protection of residents for their drinking water. We have no information that the DCF is planning to close. If they were to close, the USACE has a number of alternatives available to them and will modify this remedy to ensure the protection of human health and the environment as the law requires.

Figures



LEGEND

Approximate site locations

HowardMountainFault

LOCATION MAP

NOTES & SOURCES

Map Coordinate System:
Maine Stateplane East NAD83 Feet

TITLE

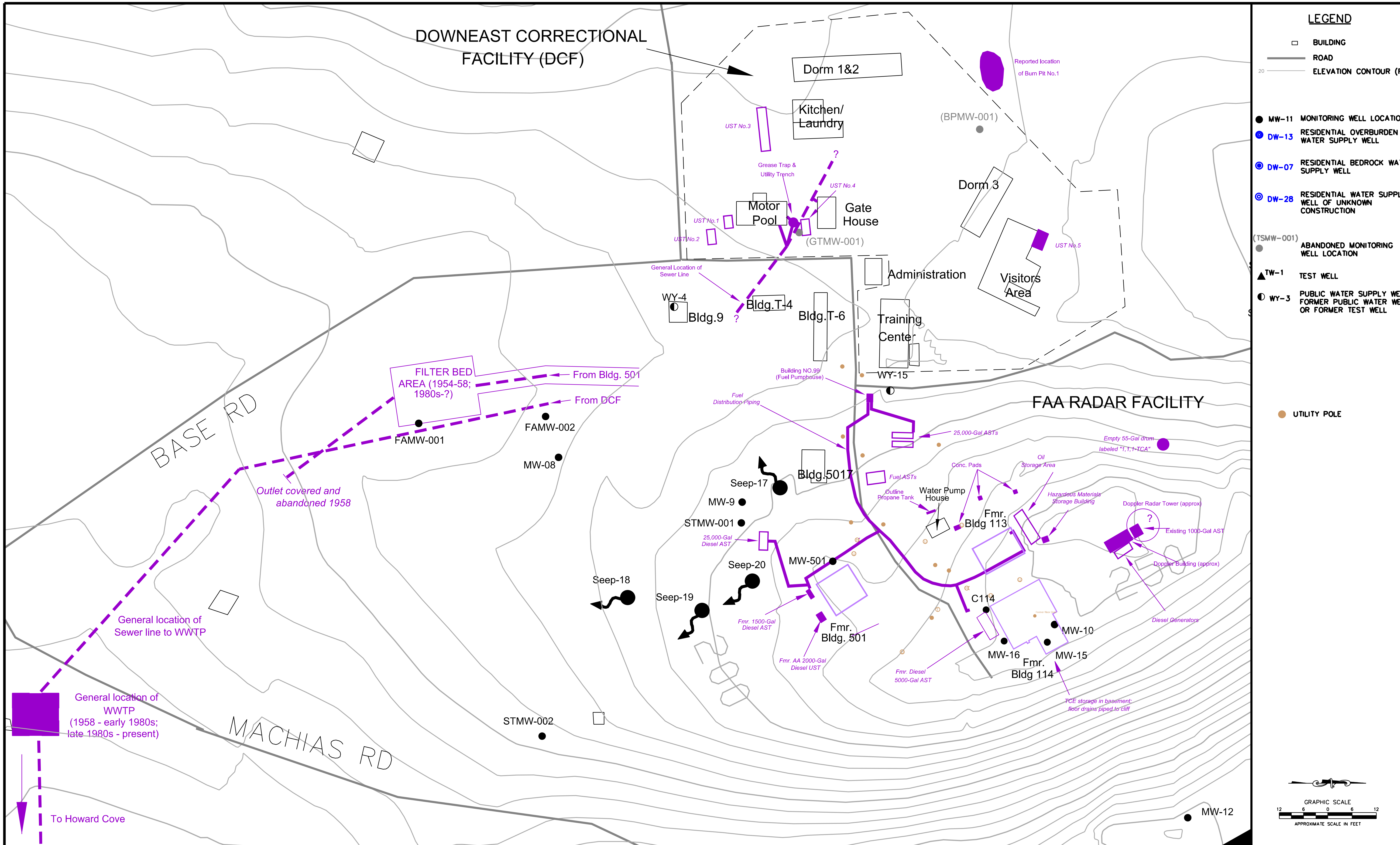
Location Map Showing
Bucks Harbor Sites

0 2,000
Feet

US Army Corps of Engineers
New England District

FIGURE
1

M:\Projects\FUDS\BucksHarbor\2016\Figures\Fig1_021716.pdf
M:\Projects\FUDS\BucksHarbor\2016\MXDs\Fig1_021716.pdf
February 17, 2016 DWN: MTW CHKD: MAW



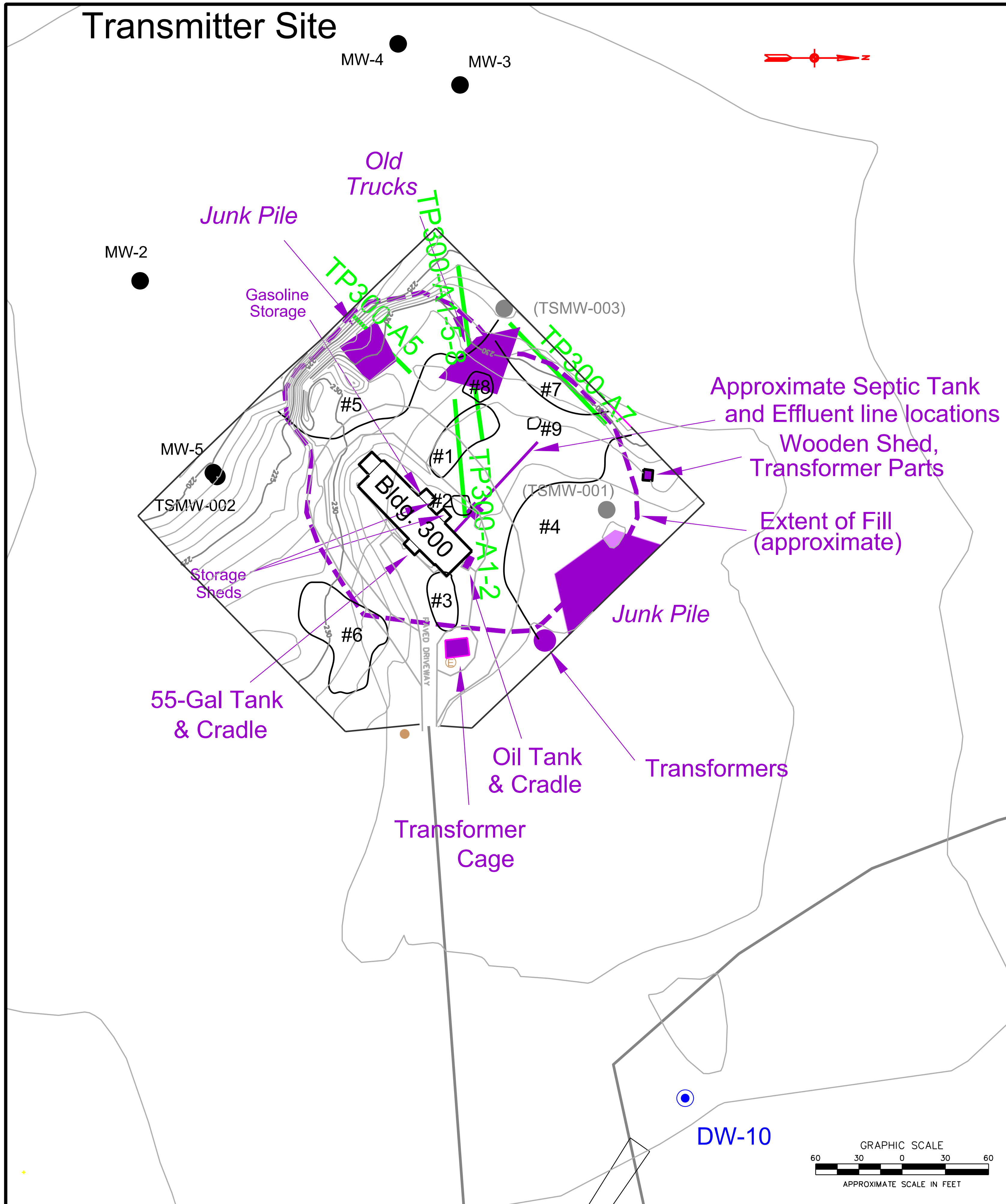
Notes:
1. Base map adapted from USACE, 2003. Photogrammetric Map and Orthophoto, Bucks Harbor, Maine. Produced for USACE New England District by USACE Topographic Engineering Center.
2. Coordinate system Maine State Plane, NAD 83, US feet.
3. All wells from USACE survey map (July 2004) except DW-5 through DW-40 from USACE 2003 referenced in note 1 above.
4. Test pits and soil trenches shown in green from The Johnson Company "Field Report for Spring 2006 Activities", December 2006.
5. Potential contamination sources from USACE 2003 (note 1 above), ABB Inc. report entitled "Engineering Evaluation of Contamination Report, Bucks Harbor, Former Air Force Radar Tracking Station" (July 1997), and ENSR field observations.
6. Location of potential contamination sources from the ABB report and ENSR observations are approximate and not the result of a survey.

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

Howard Mountain
Operational Areas

FILE: BH1_C-101.DWG
DATE: 20 APRIL 2017

FIG
2



LEGEND

▭	BUILDING
——	ROAD
20 ——	ELEVATION CONTOUR (FT)
●	UTILITY POLE
● MW-11	MONITORING WELL LOCATION
◎ DW-10	RESIDENTIAL BEDROCK WATER SUPPLY WELL
TP-A-2	SOIL TRENCH (JCO, 2006)
#6 ◯	EM ANOMALY (ARGONNE, 2005)

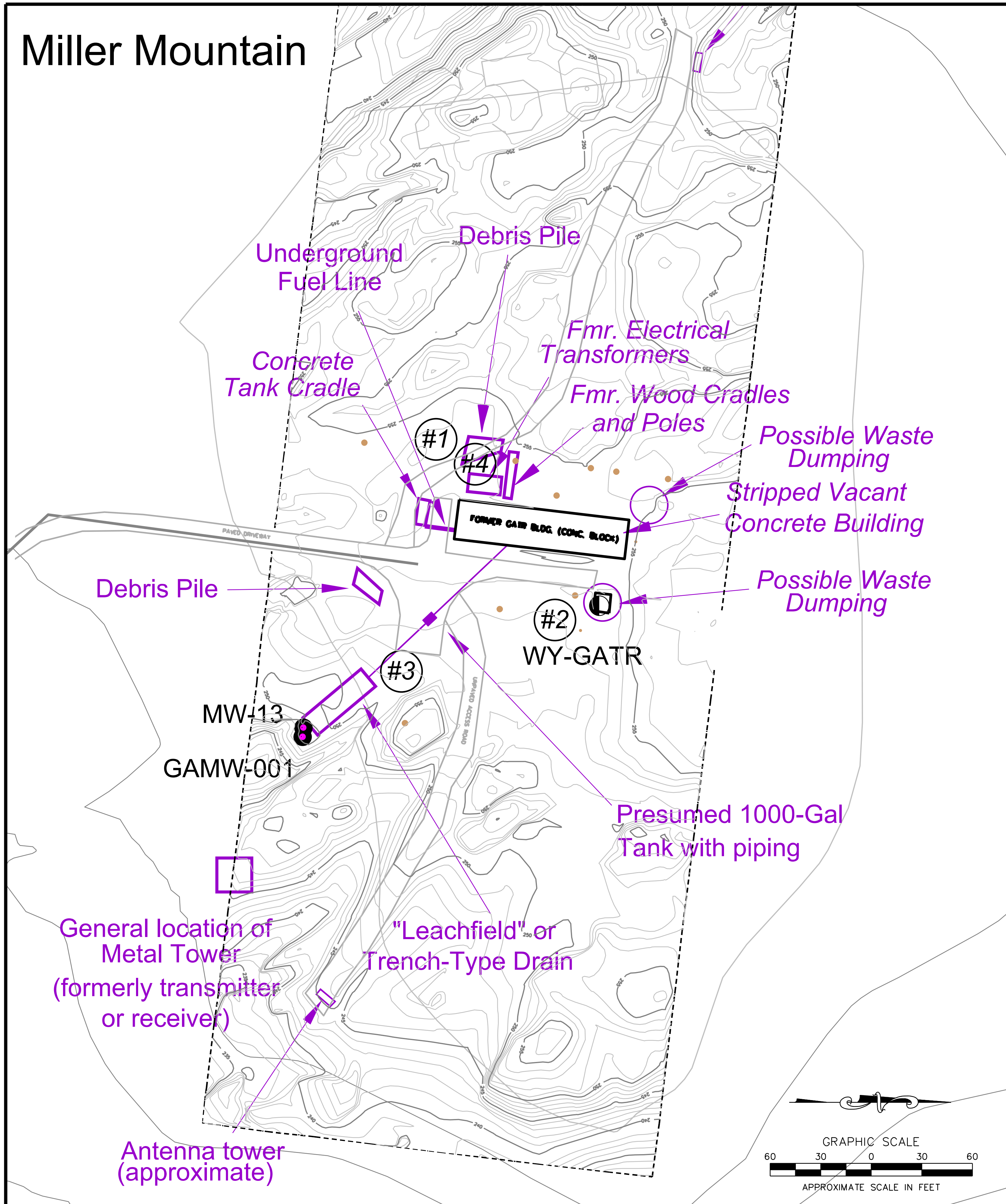
Notes:

1. Base map adapted from USACE, 2003. Photogrammetric Map and Orthophoto, Bucks Harbor, Maine. Produced for USACE New England District by USACE Topographic Engineering Center.
2. Coordinate system Maine State Plane, NAD 83, US feet.
3. All wells from USACE survey map (July 2004) except DW-5 through DW-40 from USACE 2003 referenced in note 1 above.
4. Soil trenches shown in green from The Johnson Company "Field Report for Spring 2006 Activities", December 2006.
5. Interval of detailed contours 1 foot (USACE, 2003).

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

BUCKS HARBOR MACHIASPORT MAINE
TRANSMITTER SITE OPERATIONAL AREAS
FILE NAME: BH1_C-103_fig 5.dgn
DATE: 4/21/2017

FIG 3



LEGEND

▭	BUILDING
——	ROAD
20 ——	ELEVATION CONTOUR (FT)
●	UTILITY POLE
● MW-11	MONITORING WELL LOCATION
#6 ◯	EM ANOMALY (ARGONNE, 2005)
◐ WY-3	PUBLIC WATER SUPPLY WELL, FORMER PUBLIC WATER WELL, OR FORMER TEST WELL

Notes:

1. Base map adapted from USACE, 2003. Photogrammetric Map and Orthophoto, Bucks Harbor, Maine. Produced for USACE New England District by USACE Topographic Engineering Center.
2. Coordinate system Maine State Plane, NAD 83, US feet.
3. All wells from USACE survey map (July 2004) except DW-5 through DW-40 from USACE 2003 referenced in note 1 above.
4. Soil trenches shown in green from The Johnson Company "Field Report for Spring 2006 Activities", December 2006.
5. Interval of detailed contours 1 foot (USACE, 2003).

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

BUCKS HARBOR MACHIASPORT MAINE
MILLER MOUNTAIN OPERATIONAL AREAS
FILE NAME: BH1_C-104_fig 6.dgn
DATE: 4/21/2017

FIG
4

LEGEND

Monitoring Wells not in Program

TCE Distribution (µg/L)

Wells currently in Groundwater Monitoring Program. Data from 2013 or 2014.

- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

Wells not currently in Groundwater Monitoring Program. Data from 2003 - 2011.

- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

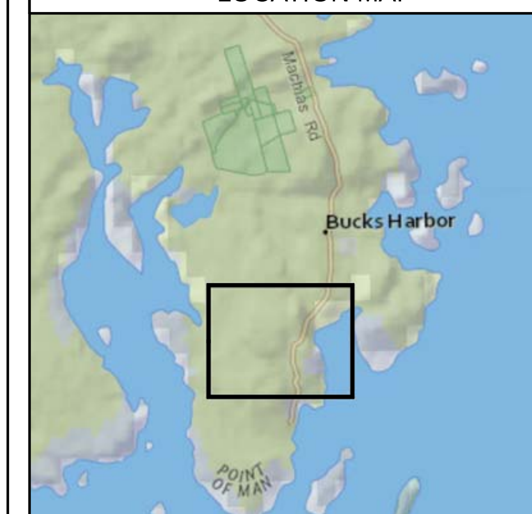
Approximate extent of TCE impacted groundwater

Machiasport Parcels

Easements

Roads

LOCATION MAP



NOTES & SOURCES

Machisaport Parcels data from Maine Office of GIS
Map Coordinate System: Maine Stateplane East NAD83 Feet

TITLE

Trichloroethylene (TCE) Distribution
Howard Mountain and Transmitter Sites
Bucks Harbor

0 650 Feet

N

US Army Corps of Engineers New England District

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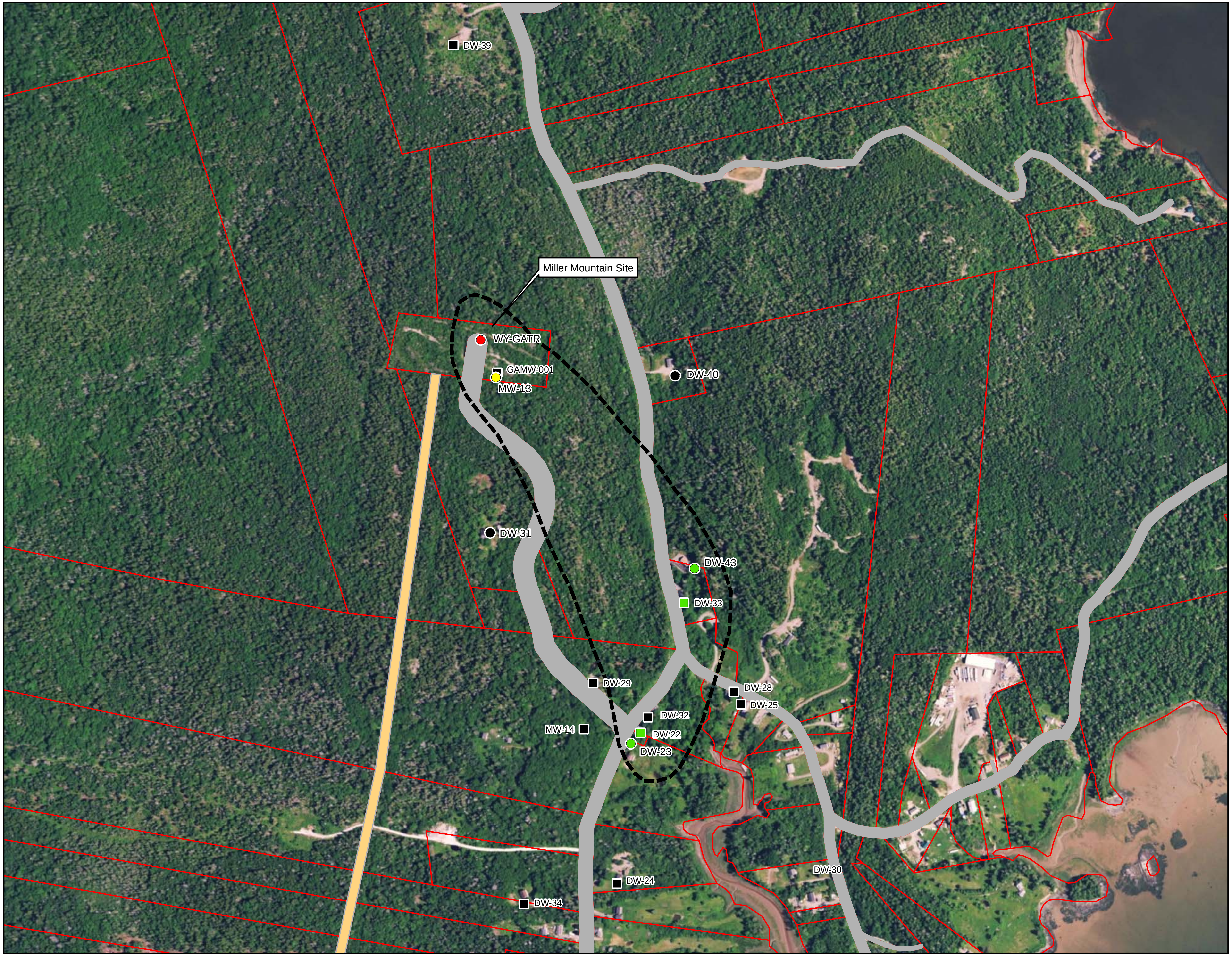
May 2, 2017 DWN: MTW CHKD: MAW

FIGURE 5



LEGEND

TCE Distribution (µg/L)

Wells currently in Groundwater Monitoring Program. Data from 2013 or 2014.

- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

Wells not currently in Groundwater Monitoring Program. Data from 2003 - 2011.

- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

Approximate extent of TCE impacted groundwater

Machiasport Parcels

Easements

Roads

LOCATION MAP

NOTES & SOURCES

Machisaport Parcels data from Maine Office of GIS
Map Coordinate System: Maine Stateplane East NAD83 Feet

TITLE

Trichloroethylene (TCE) Distribution
Miller Mountain Site
Bucks Harbor

0 500 Feet

N

US Army Corps of Engineers New England District

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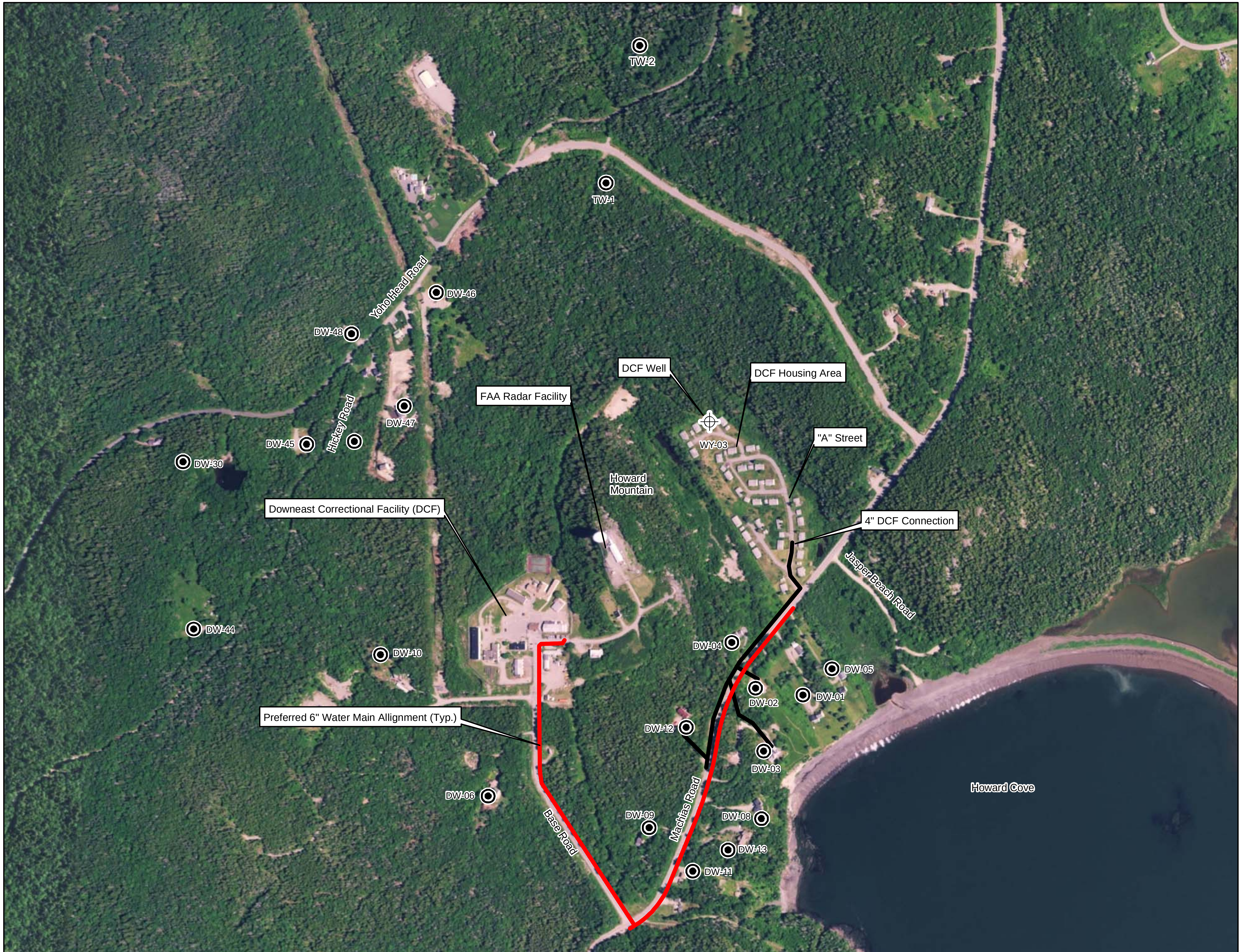
M:\Projects\FUDS\BucksHarbor\2016\MXDs\Fig6_021716.pdf
May 2, 2017 DWN: MTW CHKD: MAW

FIGURE 6

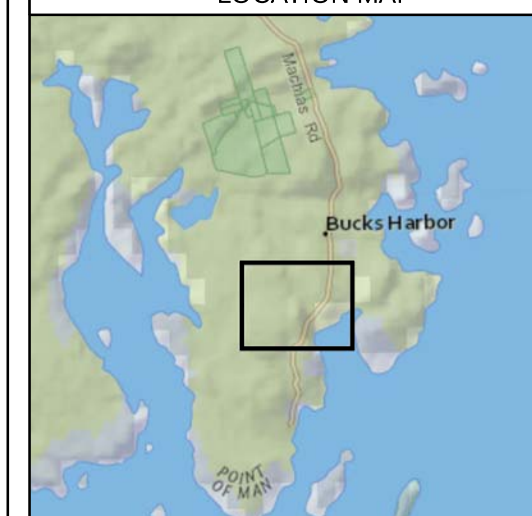


LEGEND

Piping Network

- Feasibility Study Addendum, 2011
- Design Build RFP, 2017
- Domestic Well (DW-01)
- Production Well (WY-3)
- Test Well (TW-1)

LOCATION MAP



NOTES & SOURCES

Machisaport Parcels data from Maine Office of GIS
Map Coordinate System: Maine Stateplane East NAD83 Feet

TITLE

Connection to Existing DCF Water Supply
Howard Mountain and Transmitter Sites
Bucks Harbor

0 500 Feet

N

US Army Corps of Engineers New England District

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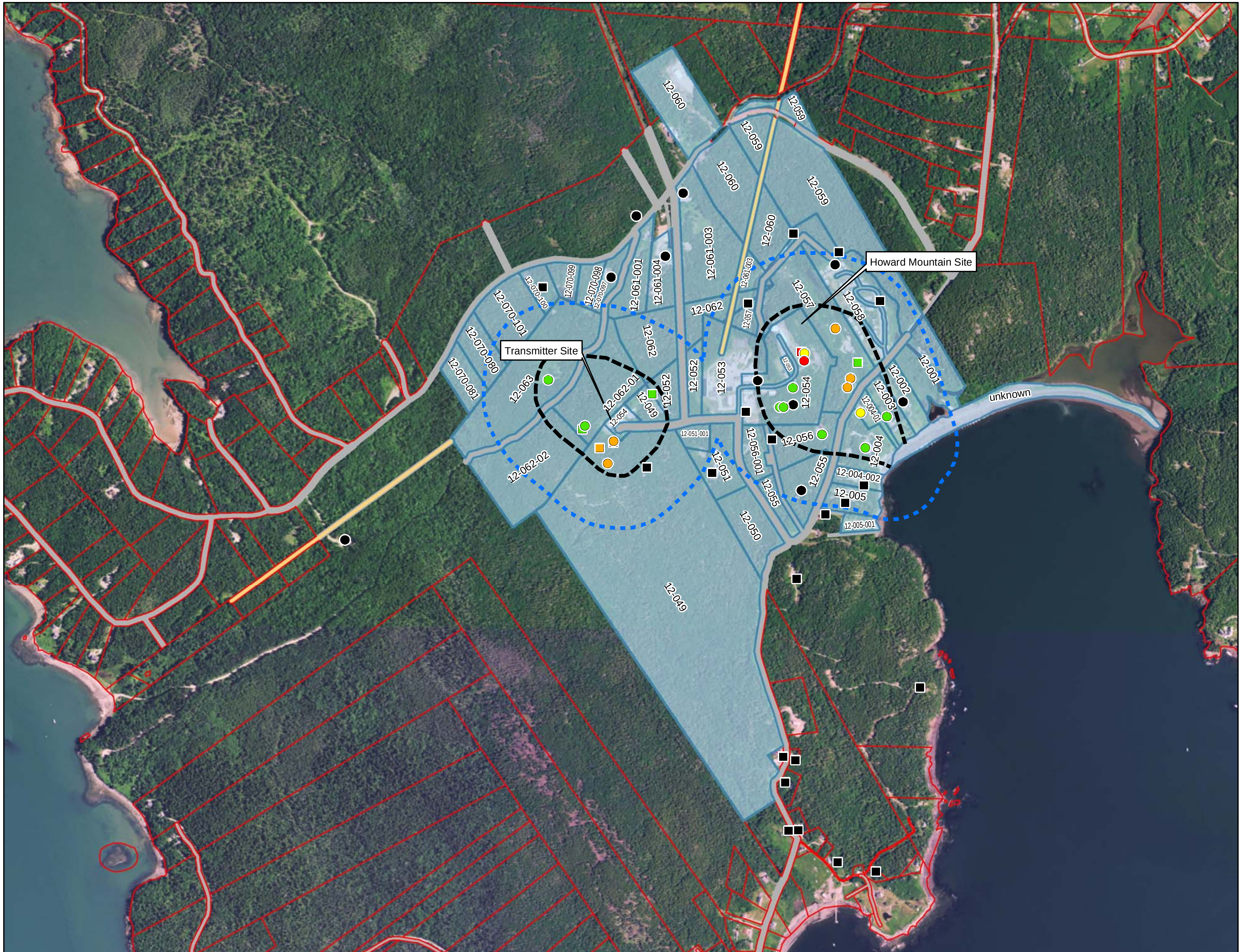
May 2, 2017 DWN: MTW CHKD: KJH MAW

FIGURE 7



LEGEND

TCE Distribution (µg/L)

Wells currently in Groundwater Monitoring Program. Data from 2013 or 2014.

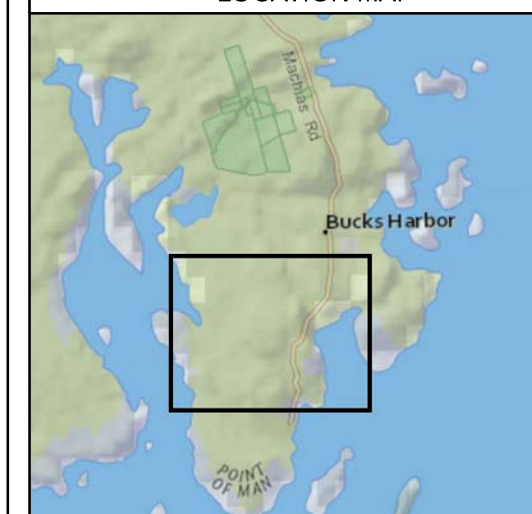
- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

Wells not currently in Groundwater Monitoring Program. Data from 2003 - 2011.

- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

- Approximate extent of TCE impacted groundwater
- 500 foot buffer zone surrounding extent of TCE impacted groundwater
- Machiasport Parcels
- Institutional Control Zone
- Easements
- Roads

LOCATION MAP



NOTES & SOURCES

Machisaport Parcels data from Maine Office of GIS
Map Coordinate System: Maine Stateplane East NAD83 Feet

TITLE

Institutional Control Zone for
Howard Mountain and Transmitter Sites
Bucks Harbor

0 900
Feet

US Army Corps of Engineers
New England District

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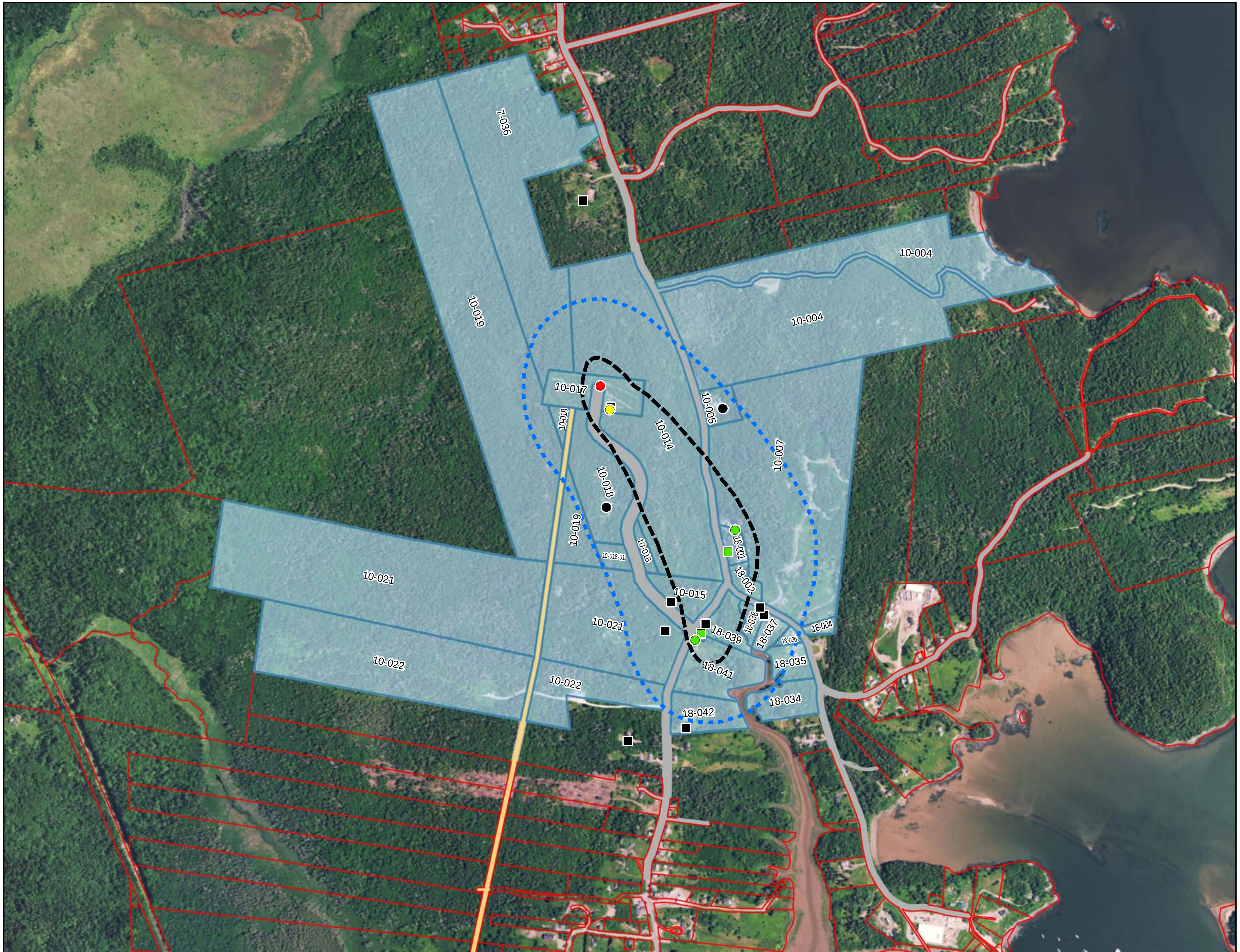
M:\Projects\FUDS\BucksHarbor\2016\MXDs\Fig8_030716.pdf
May 2, 2017 DWN: MTW CHKD: MAW

FIGURE
8



LEGEND

TCE Distribution (µg/L)

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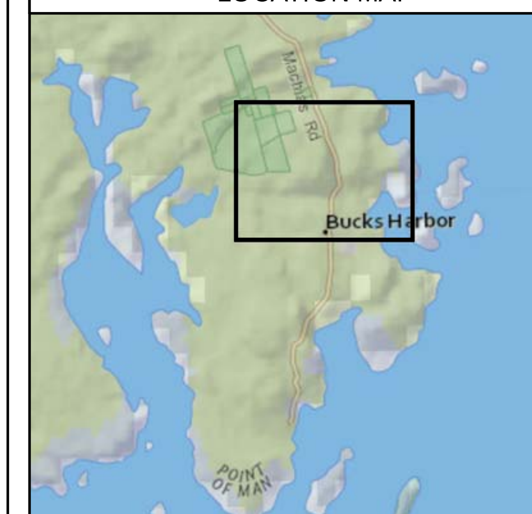
- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

Wells not currently in Groundwater Monitoring Program. Data from 2003 - 2011.

- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

- Approximate extent of TCE impacted groundwater
- 500 foot buffer zone surrounding extent of TCE impacted groundwater
- Machiasport Parcels
- Institutional Control Zone
- Easements
- Roads

LOCATION MAP



NOTES & SOURCES

Machisaport Parcels data from Maine Office of GIS
Map Coordinate System: Maine Stateplane East NAD83 Feet

TITLE

Institutional Control Zone
for Miller Mountain Site
Bucks Harbor

0 800
Feet

US Army Corps of Engineers New England District

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May 2, 2017 DWN: MTW CHKD: MAW

FIGURE
9

Tables

Table 1
Contaminants of Potential Concern Evaluated in Human Health Risk Assessment

Chemicals of Potential Concern Used in Human Health Risk Assessment
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,2,4-Trichlorobenzene
Tetrachloroethene
Trichloroethene
cis-1,2-Dichloroethene

Note: COPCs listed in this table were identified in the 2005 Remedial Investigation Report (Weston, 2005).

Table 2
Summary of Human Health Risk Assessment for Exposure to Groundwater

Exposure Area	Total Cancer Risk		Total Noncancer Risk*	
	2005 BHHRA	2017 EPA RSL Calculator	2005 BHHRA	2017 EPA RSL Calculator
Current				
Howard Mountain Area	3.03E-05	1.44E-04	0.35	22
Miller Mountain Area	1.97E-06	7.45E-06	0.05	1
Howard Mountain Prison	6.76E-07	1.32E-06	0.004	0.21
Future				
Howard Mountain Area	3.08E-04	1.34E-03	10	210
Miller Mountain Area	2.55E-05	1.27E-04	2	21

Notes:

* Results less than 1 are reported to 2 or 3 decimal places for comparison purposes only

2005 BHHRA - Baseline Human Health Risk Assessment (Weston, 2005)
2017 EPA RSL Calculator - 2017 re-evaluation using the EPA Regional Screening Level Calculator (EPA, 2017); see Appendix F of this Decision Document

Table 3 Remedial Alternative Matrix

Technology/Process	Alternative 0	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Addendum Alternative 0	Addendum Alternative 1	Addendum Alternative 1A	Addendum Alternative 2	Addendum Alternative 2A	Addendum Alternative 3
	No Action	Long Term Monitoring (LTM) and Wellhead Treatment	LTM, Wellhead Treatment, MNA, and Enhanced Site Controls	LTM, Wellhead Treatment, MNA, Enhanced Site Controls, and Source Removal	LTM, Wellhead Treatment, MNA, Enhanced Site Controls, Source Removal, and in-situ Treatment	No Action (Continue Wellhead treatment (POET Systems))	Site New Well for Water Supply	Site New Well for Water Supply and Pretreatment	Connection to Existing Downeast Correctional Facility Water Supply	Connection to Existing Downeast Correctional Facility Water Supply and Pretreatment	Desalination – Reverse Osmosis
LTM program		x	x	x	x						
GAC domestic well treatment		x	x	x	x	x					
New Supply Well							x				
New Supply Well with Pretreatment								x			
Connection to Existing DCF Supply									x		
Connection to Existing DCF Supply with Pretreatment										x	
Desalination Reverse Osmosis											x
MNA			x	x	x						
Notification within ICZs			x	x	x						
Sub-slab depressurization			x	x	x						
Excavation of potential source areas				x	x						
ISCO application					x						

DCF = Downeast Correctional Facility
GAC = granular activated carbon
ICZ = institutional control zone
ISCO = in-situ chemical oxidation
LTM = long term monitoring
MNA = monitored natural attenuation
POET = point of entry treatment

Table 4A Remedial Alternative Comparison Summary from Feasibility Study (ENSR, 2007)

FS Alternative Component Details	Alternative 0 No Action	Alternative 1 LTM and wellhead treatment	Alternative 2 Enhanced Site Controls	Alternative 3 Source Removal and Enhanced Site Controls	Alternative 4 Source Removal, *In-situ* Treatment, and Enhanced Site Controls
GAC domestic well treatment		x	x	x	x
LTM program		x	x	x	x
Sub-slab depressurization			x	x	x
Land Use Control			x	x	x
MNA			x	x	x
Excavation of potential source areas				x	x
ISCO application					x
Five year review		x	x	x	x

Criteria Evaluation Summary

Overall Protection of Human Health and the Environment	Does Not Provide Overall Protection Not protective of currently impacted production wells or future potentially impacted production wells. Users will be unaware of potential risks.	Does Not Provide Overall Protection Protective of currently impacted production wells through well-head treatment; but may not be protective of future impacted production wells if users are unaware of potential risks	Provides Overall Protection Same protectiveness as Alternative 1, with the additional protection of providing current and future users with notifications that provide precautions for production wells in the immediate site vicinity	Provides Overall Protection Same protectiveness of Alternative 2, with possible additional risk reduction if the potential source areas targeted for excavation still contain residual impacts	Provides Overall Protection Same protectiveness of Alternative 3, with further possible risk reduction if the shallow subsurface underlying the potential source areas still contain residual impacts
Compliance with ARARs	Not compliant with all ARARs Not compliant with MCLs and relevant procedural ARARs	Compliant with ARARs Compliant with MCLs and relevant procedural ARARs	Compliant with ARARs Same as Alternative 1	Compliant with ARARs Same as Alternative 1	Compliant with ARARs Same as Alternative 1
Long-term Effectiveness and Permanence	Not Effective/Permanent There is risk for current and future residents and no controls to prevent exposure	Partially Effective/Permanent May not be effective in the long-term if future impacted production well users are unaware of potential risks; rate of natural attenuation of impacted groundwater would not be increased	Fully Effective/Permanent Effective long-term with notifications that recommend well-head treatment for future impacted production wells; rate of natural attenuation of impacted groundwater would not be increased	Fully Effective/Permanent Same as Alternative 2; source area excavations would not likely increase the rate of impacted groundwater attenuation	Fully Effective/Permanent Same as Alternative 2; source area excavations and shallow ISCO application would not likely increase the rate of impacted groundwater attenuation
Reduction of Toxicity, Moblity, and Volume (TMV) Through Treatment	No Reduction of TMV Through Treatment There is no reduction of TMV through Treatment since there is no treatment included with this Altnernative	Some Reduction of TMV Through Treatment There is a minor reduction of TMV through Treatment since there is Well head treatment on domestic wells.	Some Reduction of TMV Through Treatment There is a minor reduction of TMV through Treatment since there is Well head treatment on domestic wells.	Some Reduction of TMV Through Treatment There is a minor reduction of TMV through Treatment since there is Well head treatment on domestic wells.	Reduction of TMV Through Treatment The ISCO treatment technology is anticipated to reduce the volume of contaminants. This alternative would not decrease the mobility or toxicity of TCE in deep bedrock, however, it could possibly reduce the mass of TCE to some extent if it is encountered in the shallow areas targeted for action. and reasched by the ISCO application
Short-term Effectiveness	Not Effective There is risk for current and future residents and no controls to prevent exposure	Fully effective Currently effective through well-head treatment	Fully effective Same as Alternative 1	Fully effective Same as Alternative 1; removal of potential source areas could minimize risks if those areas still contain impacted media. Risks to remedial action workers and the community will be minimized with the use and adherence to safety plans.	Fully effective Same as Alternative 1; removal of potential source areas and shallow ISCO application could minimize risks if those areas still contain impacted media. Risks to remedial action workers and the community will be minimized with the use and adherence to safety plans.
Implementability	Easily implemented Easily implementable; no additional site controls are required	Easily implemented Easily implementable; no additional site controls are required	Easily implemented Maintainance of existing well-head treatment systems and administration of notifications are common and generally easy to implement	Implementable with logistical planning Additional planning and logistics are necessary to perform excavations; remnants of building foundations in targeted areas will require specialized excavation equipment	Implementable but requires ISCO expertise In addition to implementing excavations, ISCO will require bench and pilot testing, as well as performance monitoring during and after oxidant application
Cost	Estimated cost = $0, but some costs may be associated with removal of exisitng POET systems (although the homeowner may opt to retain the system at their own cost). The cost to remove the five existing POET systems is estimated to be less than $10,000	Estimated cost is approximately $2.1 million over a projected 30-year period; essentially equal to the cost currently being incurred	Estimated cost is approximately $3.3 million over a projected 30-year period	Estimated cost is approximately $6.7 million over a projected 30-year period	Estimated cost is approximately $8.0 million over a projected 30 year period
Cost Sensitivity	Cost predictable (no cost) Some costs may be associated with removal of exisitng POET systems (although the homeowner may opt to retain the system at their own cost. The cost to remove the five existing POET systems is estimated to be less than $10,000	Cost most predictable; tightest range Estimated cost range could vary from $1.4 million to $2.3 million, by varying well-head treatment and LTM program assumed in the baseline cost estimate	Cost generally predictable; moderate range Estimated cost range could vary from $2.4 million to $3.6 million, by varying well-head treatment and LTM program assumed in the baseline cost estimate	Unknown subsurface conditions could impact cost Estimated cost range could vary from $5.2 million to $10.9 million, by varying well-head treatment, LTM program, and size of potential source areas assumed in the baseline cost estimate	Degree of ISCO application could impact cost Estimated cost range could vary from $6.4 million to $31.8 million, by varying well-head treatment, LTM program, size of potential source areas, and depth of ISCO application

Notes:
ARAR = Applicable or Relevant and Appropriate Requirment
CERCLA = Comprehensive Environmental Response, Compensation and Liability Act
GAC = granular activated carbon
ICZ = institutional control zone
ISCO = *in-situ* chemical oxidation
LTM = long-term monitoring
MCL = Maximum Contaminant Level
MNA = monitored natural attenuation
POET = point of entry treatment
TMV = Toxicity, Mobility and Volume

Table 4B Remedial Alternative Comparison Summary from Feasibility Study Addendum (Watermark, 2011)

FS Addendum Alternative Component Details	Addendum Alternative 0	Addendum Alternative 1	Addendum Alternative 1A	Addendum Alternative 2	Addendum Alternative 2A	Addendum Alternative 3
Continue POET Systems	x					
Installation of a New Water Supply Well		x	x			
Pretreatment for TCE and Other VOCs			x		x	
Connection to Existing DCF Well				x	x	
Installation of a Desalinization Treatment System						x

Criteria Evaluation Summary

Criteria	Addendum Alternative 0	Addendum Alternative 1	Addendum Alternative 1A	Addendum Alternative 2	Addendum Alternative 2A	Addendum Alternative 3
Overall Protection of Human Health and the Environment	Provides Overall Protection	Provides Overall Protection	Provides Overall Protection	Provides Overall Protection	Provides Overall Protection	Provides Overall Protection
	Protective of users by providing a clean water supply	Protective of users by providing a clean water supply May not be protective if well eventual becomes impacted with TCE or other VOCs	Same as Addendum Alternative 1 with the addition of a pretreatment system, which eliminates the risk if TCE becomes present in the well	Same as Addendum Alternative 1, with the exception that the DCF well has trace levels of TCE below MCL and MEG limits	Same as Addendum Alternative 2 with the addition of a pretreatment system, which eliminates the risk if TCE exceeds MCL in the well	Protective of users by providing a clean water supply
Compliance with ARARs	Compliant with ARARs	Compliant with ARARs	Compliant with ARARs	Compliant with ARARs	Compliant with ARARs	Compliant with ARARs
	Compliant with MCL and MEG limits	Compliant with MCL and MEG limits	Same as Addendum Alternative 1	Same as Addendum Alternative 1	Same as Addendum Alternative 1	Same as Addendum Alternative 1
Long-term Effectiveness and Permanence	Fully Effective/Permanent	Partially Effective/Permanent	Fully Effective/Permanent	Partially Effective/Permanent	Fully Effective/Permanent	Fully Effective/Permanent
	With implementaion of POET systems on water supply wells, there would be no risk of ingestion if TCE or other VOCs became present in the well above MCL or MEG limits	May not be effective if TCE is eventually drawn toward the well and becomes present above MCL or MEG limits	With the addition of the pretreatment system there would be no risk if TCE or other VOCs became present in the well above MCL or MEG limits	Same as Alternative 1	Same as Alternative 1A	Since ocean water and not groundwater is the source, there is not risk of TCE or other VOC affecting the water source
Reduction of Toxicity, Mobliity, and Volume (TMV) Through Treatment	Some Reduction of TMV Through Treatment	No Reduction of TMV Through Treatment	Some Reduction of TMV Through Treatment	No Reduction of TMV Through Treatment	Some Reduction of TMV Through Treatment	No Reduction of TMV Through Treatment
	There is a minor reduction of TMV through Treatment since there is Well head treatment on domestic wells.	There is no reduction of TMV through Treatment since there is no treatment included with this Altnernative	There is a minor reduction of TMV through Treatment since there is Well head treatment on domestic wells.	There is no reduction of TMV through Treatment since there is no treatment included with this Altnernative	There is a minor reduction of TMV through Treatment since there is Well head treatment on domestic wells.	There is no reduction of TMV through Treatment since there is no treatment included with this Altnernative
Short-term Effectiveness	Fully Effective	Fully Effective	Fully Effective	Fully Effective	Fully Effective	Fully Effective
	Effective by providing a clean source of water to the users	Same as Alternative 0; risks to remedial action workers and the community will be minimized with the use and adherence to safety plans during water line construction activities.	Same as Addendum Alternative 1	Same as Addendum Alternative 1	Same as Addendum Alternative 1	Same as Addendum Alternative 1
Implementability	Easily Implemented	Easily Implemented but Must Get Water District Approved and Setup	Easily Implemented but Must Get Water District Approved and Setup	Easily Implemented	Easily Implemented	Difficult to Implement, Requires Additional Permitting
	Currently implemented at the site. No additional site controls are required	Requires a long-term pump test for either TW-1 or TW-2 Requires a water district to be setup, which requires town approval	Same as Alternative 1	The DCF well is already a public supply well The pump has an established pumping rate	Same as Alternative 2	Will require additional permitting for water withdrawal from the ocean and brine discharge back to the ocean Requires a water district to be setup, which requires town approval
Cost	Estimated cost is approximately $247,000 over a 30-year period	Estimated cost is approximately $1.6 million over a 30-year period	Estimated cost is approximately $2.3 million over a 30-year period	Estimated cost is approximately $491,000 over a 30-year period	Estimated cost is approximately $1.3 million over a 30-year period	Estimated cost is approximately $2.3 million over a 30-year period

Notes:
DCF = Downeast Correctional Facility
POET = point of entry treatment
TCE = Trichloroethene
VOC = Volatile Organic Compound
TMV = Toxicity, Mobility and Volume

Table 5A Net Present Value Cost Summary for Alternatives from Feasibility Study (ENSR, 2007)

Cost Component	Alternative 0	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	No Action	LTM and domestic wellhead treatement	Enhanced Site Controls	Source Removal and Enhanced Site Controls	Source Removal, In-situ Treatment, and Enhanced Site Controls
Capital Costs	$0	$0	$86,234	$3,419,412	$4,795,755
Annual O&M Costs(1)	$0	$1,729,248	$2,318,579	$2,318,579	$2,318,579
Periodic Costs(1)	$0	$377,037	$922,713	$922,713	$922,713
Total Net Present Value	**$0**	**$2,106,285**	**$3,327,526**	**$6,660,703**	**$8,037,047**

Notes:
(1) = Net present value over 30-year operating period
O&M = operation and maintanance

Table 5B Net Present Value Cost Summary for Alternatives from Feasibility Study Addendum (Watermark, 2011)

Cost Component	Addendum Alternative 0	Addendum Alternative 1/1A		Addendum Alternative 2/2A		Addendum Alternative 3
	No Action (Continue POET Systems)	Site New Well for Water Supply	Site New Well for Water Supply with Treatment	Connection to Existing DCF Water Supply	Connection to Existing DCF Water Supply with Treatment	Desalination – Reverse Osmosis
		1	1A	2	2A	
Capital Costs	$0	$570,504	$705,434	$232,675	$367,605	$537,756
Annual O&M Costs(1)	$0	$376,533	$465,587	$169,853	$268,352	$381,807
Periodic Costs(1)	$247,358	$629,810	$1,124,730	$88,939	$646,415	$1,404,306
Total Net Present Value	**$247,358**	**$1,576,847**	**$2,295,751**	**$491,467**	**$1,282,372**	**$2,323,869**

Notes:
(1) = Net present value over 30-year operating period
O&M = operation and maintanance

Table 6 Chemical-Specific ARARs and TBCs for the Selected Remedy

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Federal				
Groundwater	Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) 40 CFR Part 141 Subpart B (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. The MCL for trichloroethylene (TCE) is 5 micrograms per liter (µg/L).	Groundwater in the area is projected to be of "high use and value," under the context of CERCLA. Therefore, MCLs will be used as the basis for developing remedial action objectives (RAOs) for site groundwater. RAOs will be established to prevent the ingestion of groundwater that exceeds the MCL for TCE.	Applicable
Air	USEPA OSWER Publication 9200.2-154. Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor to Indoor Air (or most current)	Technical recommendations by USEPA base on current understanding of vapor intrusion into indoor air from subsurface vapor sources.	Alternative 2 includes on-going assessment of vapor intrusion at the FUDS property and impacted properties for possible VI impacts.	TBC
Air	Regional Screening Levels for Chemical Contamination at Superfund Sites, June 2015 (or most current)	The Region 9 PRGs have been harmonized with similar risk-based screening levels used by Regions 3-6 into a single table: "Regional Screening Levels (RSL) for Chemical Contaminants at Superfunds Sites". The updated screening levels, along with a detailed user's guide and supplementary tables, can be accessed directly on-line or downloaded to a computer. The web site contains a Screening Level Calculator to assist in calculating site-specific screening levels.	Alternative 2 includes on-going assessment of vapor intrusion at the FUDS property and impacted properties for possible VI impacts.	TBC

Appendix A: Maine Letter of Concurrence

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PAUL R. LEPAGE
GOVERNOR

PAUL MERCER
COMMISSIONER

May 30, 2017

Marie Wojtas
US Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Re: Decision Document, Former Bucks Harbor Air Force Radar Tracking Station (AFRTS) and Ground-to-Air Transmitter and Receiver (GATR) Site, Machiasport, ME, May 2017

Dear Ms. Wojtas,

The Maine Department of Environmental Protection (MEDEP) has reviewed the US Army Corps of Engineers' (Corps) Decision Document (DD) for the Former Bucks Harbor Air Force Radar Tracking Station (AFRTS) and Ground-to-Air Transmitter and Receiver (GATR) Site in Machiasport, Maine dated May 2017. The DD summarizes the results from the investigations and actions conducted at the site between 1991 and 2016 to, among other things, remove underground storage tanks and petroleum-contaminated soil, monitor and filter residential water supplies, investigate geology and hydrogeology, determine contaminant distribution in the subsurface of the Howard Mountain and Miller Mountain areas and perform indoor air quality testing. The DD also documents the Corps' rationale for selecting as the remedy for this site: alternate water supply or Point of Entry Treatment (POET) for impacted water supply wells, monitoring of indoor air, land use controls, long-term groundwater monitoring, and Monitored Natural Attenuation (MNA). The MEDEP concurs with this remedy. We believe the alternate water supply is the best long-term solution to replace impacted water supply wells at Howard Mountain. In addition, we concur with long-term groundwater monitoring, POET systems at Miller Mountain, monitoring of indoor air, and land use controls in the form of notices to property owners. As indicated in prior correspondence, the MEDEP does not believe there is enough evidence to show that natural attenuation is occurring at the site at a meaningful rate and therefore we do not believe that MNA will restore the aquifer. However, at this time we do not know of a feasible alternative to MNA, and rather than attempting remediation, resources should instead be directed at water-line development. During 5-year reviews, USACE should assess whether technologies have become available to induce a meaningful reduction in contaminants that remain in bedrock aquifers.

The State's concurrence of the selected decision, as described above, should not be construed as the State's concurrence with any conclusion of law or finding of fact, which may be set forth in the Decision Document or supporting documents for the site listed above. The State reserves any and all rights to challenge any such finding of fact or conclusion of law in any other context.

This concurrence is based on the State's understanding that the Corps will continue to solicit MEDEP's review and concurrence with implementing the remedy described above. MEDEP looks forward to working with the Army Corps of Engineers to resolve the environmental issues remaining at the former Bucks Harbor AFRTS and GATR site.

If you have any questions or comments, please contact Iver McLeod at iver.j.mcleod@maine.gov or 207-592-2981.

Sincerely,

David Wright

Digitally signed by David Wright
DN: cn=David Wright, o=Maine Dept Environmental Protection, ou=Director, Division of Remediation, email=david.w.wright@maine.gov, c=US
Date: 2017.05.23 10:40:24 -04'00'

David Wright, Director
Division of Remediation, BRWM

pc: I. McLeod, MEDEP
C. Swain, MEDEP
G. Lipfert, MEDEP

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Appendix C: Glossary of Terms and Acronyms

Glossary of Terms

Bedrock: The native rock underlying the Earth's surface. At Bucks Harbor, the rock is primarily igneous in origin and ranges from very hard and dense to highly fractured. Groundwater meanders through fractures within the rock masses.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A Federal law passed in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA), commonly known as Superfund. The Corps' characterization and remediation at sites is conducted under the framework of CERCLA/SARA, while funded by the Defense Environmental Restoration Program (DERP).

Corps of Engineers: The U.S. Army Corps of Engineers (USACE) provides comprehensive environmental restoration services for the Army, Department of Defense (DOD), Environmental Protection Agency (EPA), Department of Energy (DOE), and other Federal agencies. The DOD has designated the Corps to oversee the environmental program at the Former Bucks Harbor site, under the Formerly Used Defense Site (FUDS) program.

Decision Document: A legal, technical and public document that explains the rationale and remedy decision for a given site. It also summarizes the public's involvement in the decision.

Feasibility Study (FS): An engineering study of the potential remedies for a site.

Granular Activated Carbon (GAC): Specially formulated carbon used to filter organic contaminants out of drinking water. One pound of carbon contains a surface area of approximately 500,000 square meters. The *activation* process adds a positive charge to the carbon, which enables the carbon to more effectively attract (and filter out) negatively charged water contaminants.

Groundwater: Groundwater is the water found beneath the earth's surface that fills pores between such materials as sand, soil or gravel. In the case of the former Bucks Harbor site, groundwater is predominantly found within bedrock fractures.

Groundwater Water Monitoring (GWM) Program: USACE has been implementing a sampling program at the former Bucks Harbor area since 1995. Currently (2015 sampling program), there are 19 domestic wells (including the five domestic wells with GAC systems and one public water supply well) and 14 groundwater monitoring locations including 13 wells with 26 individual well screens and 1 seep included in the GWM program.

Information Repository: A public file containing site/project information and documents of onsite investigation and remedial activities in either hard copy or electronic form.

***In-situ* Chemical Oxidation (ISCO):** A chemical treatment process by which a strong oxidant (such as potassium permanganate) is injected into groundwater to destroy organic compounds, such as TCE.

Institutional Control Zone (ICZ): Area in which notifications are recommended to advise property owners that their property may be potentially impacted by the presence of site contaminants.

Maximum Contaminant Level (MCL): Enforceable drinking water standard developed by EPA. The MCL for TCE is 5 μg/L.

Monitored Natural Attenuation (MNA): MNA is the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods.

Remedial Investigation (RI): The collection of data and information necessary to characterize the nature and extent of contamination at a site. The RI Report summarizes the site characterization data, and include an evaluation of whether or not the contamination poses a significant risk to human health or the environment.

Acronyms

µg	Micrograms
µg/kg	microgram per kilogram
µg/L	micro grams per liter
µg/m3	micrograms per cubic meter
AFRTS	Air Force Radar Tracking Station
ANL	Argonne National Laboratory
AR	Administrative Record
ARA	Absolute Resource Associates
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Above-ground Storage Tank
BHHRA	Baseline Human Health Risk Assessment
CDC	Center for Disease Control
CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cis-1,2-DCE	*Cis*-1,2 dichloroethene
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
CVOC	Chlorinated volatile organic compound
DCF	Downeast Correctional Facility
DERP	Defense Environmental Restoration Program
DNAPL	Dense Non Aqueous Phase Liquid
DoD	Department of Defense
EC	Environmental Covenant
DW	Domestic Well
ELCR	Excess Lifetime Cancer Risk
EPC	Exposure Point Concentration
ESD	Explanation of Significant Difference
FAA	Federal Aviation Administration
fbgs	Feet below ground surface
FLUTe	Flexible Liner Underground Technology
FS	Feasibility Study
Ft	Feet
fbgs	Feet below ground surface
FUDS	Formerly Used Defense Site
GAC	Granular Activated Carbon
GAI	Geophysical Applications Incorporated
GATR	Ground-to-Air Transmitter and Receiver
GIS	Geographic Information System
GPM	Gallons per Minute
GSA	General Services Administration
GWM	Groundwater Monitoring
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
HTRW	Hazardous, Toxic, and Radioactive Waste
IAT	Indoor Air Target
IC	Institutional Control
ICZ	Institutional Control Zone
ILCR	Incremental Lifetime Cancer Risk
In	Inch

INPR	Inventory Project Report
J&E	Johnson & Ettinger
JCO	The Johnson Company
LTM	Long Term Monitoring
LTMP	Long Term Monitoring Plan
LUC	Land Use Control
M	Meters
MCL	Maximum Contaminant Level
ME	Maine
MEDEP	Maine Department of Environmental Protection
MEDHHS	Maine Department of Health and Human Services
MEG	Maximum Exposure Guidelines
MEGIS	Maine Geographic Information System
MNA	Monitored Natural Attenuation
MW	Monitoring Well
NAPL	Non Aqueous Phase Liquid
NAVD88	North American Vertical Datum of 1988
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NE	Northeast
NFA	No Further Action
NGS	Northeast Geophysical Services
NPL	National Priorities List
NPV	Net Present Value
NRCS	Natural Resource Conservation Service
NW	Northwest
O&M	Operation & Maintenance
OSHA	Occupational Safety and Health Administration
PCE	Tetrachloroethene
POET	Point of Entry Treatment
POTW	Publicly Owned Treatment Works
ppbV	parts per billion by volume
RA	Remedial Alternative
RAB	Restoration Advisory Board
RAG	Remedial Action Guideline
RAO	Remedial Action Objective
RAS	Radon Abatement Systems Integrated Subsurface Evaluation
RBC	Risk Based Concentration
RBSC	Risk Based Screening Concentration
RfC	Reference Concentration
RfD	Reference Dose
RG	Remedial Goal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RSL	Regional Screening Level
SA	Site Assessment
SARA	Superfund Amendments and Reauthorization Act
SE	Southeast
SLERA	Screening Level Ecological Risk Assessment
SSD	Sub-slab Depressurization
SW	Southwest
TBC	To Be Considered
TCE	Trichloroethene (also known as Trichloroethylene)
TEC	Topographic Engineering Center
TPH	Total Petroleum Hydrocarbon
TPP	Technical Project Planning

TW	Test Well
UCL	Upper Confidence Limit
UMO	University of Maine at Orono
USACE	United States Army Corps of Engineers
USAF	United States Air Force
US DoD	United States Department of Defense
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
UU/UE	Unlimited Use and Unrestricted Exposure
VC	Vinyl Chloride
VISL	Vapor Intrusion Screening Level
VOC	Volatile Organic Compound
WHG	Woods Hole Group
WWTP	Wastewater Treatment Plant
WY	Water Supply Well

Appendix D: Written Comments Received on the Proposed Plan

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PAUL R. LEPAGE
GOVERNOR

PAUL MERCER
COMMISSIONER

May 27, 2016

Marie Wojtas
US Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Re: Final US Army Corps of Engineers Bucks Harbor Proposed Plan, Former Air Force Radar Tracking Station, Machiasport, Maine, April 13, 2016.

Dear Marie,

The Maine Department of Environmental Protection has completed its review of the subject document. MEDEP supports the Corps' recommendation of Alternative 2, Long-Term Monitoring with Enhanced Site Controls, and Alternative 2A, Alternate Water Supply. We have the following comments.

1. The alternate water supply is the best long-term option for providing clean water to residents whose wells are impacted with site-related contaminants in the Howard Mountain area. We are also encouraged by the Corps' commitment to maintain the water line with no cost to the users of the system. Granular activated carbon treatment is a proven effective technology for removing site-related contaminants from impacted water supply wells in the Miller Mountain area since an alternate water supply is not practical in that area.

2. Long-term monitoring is necessary to evaluate any changes in contaminant concentration and migration in the aquifer that may occur over time. The Corps will need to prepare a MEDEP-approved robust long-term monitoring plan in order to effectively track any such changes and to ensure that any potential impacts to currently clean wells due to those changes are detected well ahead of time. Such a monitoring plan will also help us to determine whether or not natural attenuation is effectively reducing contaminant concentrations over time.

3. Page 13 of the Proposed Plan states, "…MEDEP may decide to record deed restrictions or notifications on properties within an ICZ." Please note that, as stated at the May 5, 2016 public meeting in Machiasport, the State of Maine does not have the authority to record deed restrictions or notifications on private property without the cooperation and permission of the land owner.

AUGUSTA
17 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0017
(207) 287-7688 FAX: (207) 287-7826

BANGOR
106 HOGAN ROAD, SUITE 6
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYWAY PARK
PRESQUE ISLE, MAINE 04769
(207) 764-0477 FAX: (207) 760-3143

website: www.maine.gov/dep

Please feel free to contact me at (207) 287-8010 if you have any questions.

Sincerely,

Iver McLeod
Project Manager
Bureau of Remediation and Waste Management

pc: Gail Lipfert, MEDEP
Chris Swain, MEDEP
Vince Dinan, Machiasport
Robert Dean, Machiasport
Jeff and Deb Huntley, Machiasport
Town of Machiasport

April 27, 2016

Mr. Scott E. Acone, P.E.
Chief, Engineering/Planning Division
US Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Re: USACE Bucks Harbor Proposed Plan

Dear Mr. Acone:

This letter is to acknowledge receipt of your correspondence dated April 14, 2016 regarding the Proposed Plan for the Bucks Harbor Former Air Force Radar Tracking Station and Former Ground/Air/Transmitter/Receiver (GATR) Formerly Used Defense Sites (Bucks Harbor site) in Machiasport, Maine. In the aforementioned correspondence you state "You are receiving this letter and a copy of the Proposed Plan because your property [Lot no. 12-070-100] is in an institutional control zone (ICZ)...However, we will request that you notify us if you install a drinking water supply well so that we can test it to ensure it does not contain contaminants related to historic Department of Defense activities at the Site..."

If the US Army Corps of Engineers (USACE) and the Maine Department of Environmental Protection would review their records related to the Bucks Harbor site spanning the past two decades, you will find that a drinking water supply well currently exists on my property located at 248 Yoho Head Road (Property Tax Map 12, Lot 70-100) in Machiasport and was tested by the USACE for a number of years (before being withdrawn from the testing program by the USACE) for the contaminants of concern identified as volatile organic compounds. For file reference purposes, my drinking water supply well was identified as sample location DW-30.

With the above in mind, this letter will serve as formal notification to the USACE that a drinking water supply well has been installed on my property. In addition, this letter is to formally request that the USACE include my drinking water supply well in the regular testing program related to the Bucks Harbor site.

Please inform me of the future testing schedule for my drinking water supply well to ensure that it does not contain contaminants related to the Bucks Harbor site. Your attention to this matter of critical importance to me is greatly appreciated.

Sincerely,

Shirley M. Erickson
248 Yoho Head Road
Machiasport, ME 04655

cc: Ms. Marie Wojtas, Project Manager
Mr. Iver McLeod, Project Manager

May 16, 2016

Ms. Marie Wojtas, Project Manager
US Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Re: Public Comments-USACE Bucks Harbor Proposed Plan

Dear Ms. Wojtas:

The purpose of this letter is provide written comments regarding the Proposed Plan for the Bucks Harbor Former Air Force Radar Tracking Station and Former Ground/Air/Transmitter/Receiver (GATR) Formerly Used Defense Sites (Bucks Harbor site) in Machiasport, Maine, dated April 13, 2016. These written comments are in addition to the verbal comments I made during the Public Meeting held on May 5, 2016 at the Fort O'Brien Elementary School in Machiasport, Maine.

My comments relate to the need for clarification on the Land Use Controls section of the aforementioned Proposed Plan for the Bucks Harbor site on pages 12 and 13. On these pages, it states "...USACE is working with the Town of Machiasport to develop notices that will be provided with each building permit issued by the town...The Town of Machiasport or MEDEP may decide to record deed restrictions or notifications on properties within an ICZ (Institutional Control Zone)..."

During the public hearing on May 5, 2016, there appeared to be some uncertainty and a lack of clarity with respect to which governmental entity had the authority to record deed restrictions or notifications on properties within an ICZ as referenced on page 13 of the Proposed Plan for the Bucks Harbor site. With this in mind, please describe the legal framework or precedent for municipalities and/or states to record deed restrictions or notifications on properties the USACE identifies as being within an ICZ. In addition, please provide a summary of the work to date that the USACE and Town of Machiasport has completed with respect to the development and proposed content of the notices to be provided with the issuance of building permits as referenced on page 12 of the Proposed Plan for the Bucks Harbor Site.

Thank you in advance for your response to my comments regarding clarification on the Land Use Controls section of the Proposed Plan for the Bucks Harbor site.

Sincerely,

Shirley M. Erickson
248 Yoho Head Road
Machiasport, ME 04655

PO Box 336
1527 Port Road
Machiasport, ME 04655
May 26, 2016

Marie Wojtas, Project Manager
U. S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Re: Comments on Proposed Plan, Bucks Harbor Former Air Force Radar Tracking Station

Dear Ms. Wojtas:

Set forth below are my observations and comments regarding the referenced plan. It should be noted that the comments presented were also endorsed by the membership at the April 12, 2016 meeting of the Jasper Beach Water Association (JBWA).

The issues listed below are seen by me and the other members of the JBWA as critical to the establishment of equitable rights and responsibilities between the U. S. Army Corps of Engineers (USACE) and the JBWA, preliminary to the installation of an alternate water supply at the homes of Association members in the Howard Mountain area. Our concerns are as follows:

1. More specificity regarding costs related to the alternate clean water supply to be provided by the State of Maine Department of Corrections, and the installation, maintenance, and operation of facilities installed by the U. S. Army Corps of Engineers (USACE) to provide a clean water supply to households affected by the contamination of drinking water by the former Air Force Radar Tracking Station in Machiasport, Maine. **NOTE:** In a status update forwarded by Marie Wojtas of USACE on April 13, 2016, the following new information was provided regarding the O & M cost issue: "**Currently, the Proposed Plan states that installation and maintenance of the water line shall be performed by USACE. Responsibility for the maintenance of the water line by USACE was included in an effort to alleviate the concerns that the Jasper Beach Water Association had regarding financial support for maintaining the water line." This represents a significant change from the Corp's past position, and may mean that any potential responsibility by JBWA for O & M financing goes away.**

2. A more complete explanation concerning expansion of the clean water supply provided by the State of Maine Department of Corrections to homes beyond the current five households, either currently in existence of to be built in the future in the area affected by water contamination. Details involved should include homeowner eligibility and limitations.

3. Provisions for funding for legal fees (if any) incurred by JBWA in connection with resolving the water contamination issue.

4. Consideration of dissolution of the JBWA in the event that USACE assumes responsibility for all operating and maintenance costs associated with the new water system.

5. Recourse available to affected homeowners in the event that the State of Maine Department of Corrections abandons the Downeast Correctional Facility and its water supply.

The comments discussed above should not be viewed in any way limiting my future input, or the input of other members of the JBWA as the corrective action plan evolves.

Please contact me at (207) 255-6618 or by e-mail at dinan.downeast2@gmail.com if you have any questions or concerns regarding the information provided in this document.

Sincerely yours,

Vincent W. Dinan, Jr.
Secretary and Treasurer
Jasper Beach Water Association

Appendix E: Proposed Plan Public Notice

PUBLIC MEETING: May 5, 2016 - 6:30pm to 8:00pm
at the Fort O'Brien Elementary School, 492 Port Road, Machiasport, ME to present the Proposed Plan to address environmental issues at the Bucks Harbor Former Air Force Radar Tracking Station Site and the Former Ground/Air/Transmitter/Receiver (GATR) Site in Machiasport, Maine

PUBLIC COMMENT PERIOD: Public comments on the Proposed Plan will be accepted between April 20 and May 27, 2016

A Proposed Plan has been prepared to provide information to the public on the US Army Corps of Engineers (USACE), New England District recommended remedial action to address groundwater contamination at the site of the Bucks Harbor Former Air Force Radar Tracking Station Site and the Former Ground/Air/Transmitter/Receiver (GATR) Site in Machiasport, Maine. The Proposed Plan and associated public meeting are intended to inform the community of the rationale for the selection of the preferred alternative and to encourage and facilitate community participation.

The Proposed Plan includes the following components:

- Monitored Natural Attenuation
- Long term monitoring of groundwater
- Alternate water supply or Point of Entry Water Treatment for impacted water supply wells
- Monitoring of indoor air; and
- Land Use Controls.

The USACE and Maine Department of Environmental Protection (MEDEP) will hold a public meeting from 6:30 pm to approximately 8:00 pm at the Fort O'Brien Elementary School, 492 Port Road, Machiasport, Maine. This meeting will include a presentation describing the project and the recommended remedy. This will also be an opportunity for public comments to be submitted – either verbally or in writing.

Copies of the Proposed Plan can be obtained by contacting Marie Wojtas, Project Manager, US Army Corps of Engineers, phone: 978-318-8788; email: marie.a.wojtas@usace.army.mil.

Supporting document relating to the Proposed Plan can be found at the project information repositories at:

Machiasport Town Hall
8 Unity Square
Machiasport, Maine 04655
(207)-255-4516

US Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751
(978)-318-8788

Appendix F: Decision Document 2017 Risk Re-Evaluation

Summary of Tables:

Table F-1: Howard Mountain current risk – using data from BHHRA, Table 6-58

Table F-2: Miller Mountain current risk – using data from BHHRA, Table 6-65

Table F-3: Howard Mountain Prisoner current risk – using data from BHHRA, Table 6-91

Table F-4: Howard Mountain Area future risk – using data from BHHRA, Table 6-92

Table F-5: Miller Mountain Area future risk – using data from BHHRA, Table 6-94

BHHRA – Baseline Human Health Risk Assessment (Weston, 2005)

Regional Screening Levels for Chemical Contaminants at Superfund Sites, RSL Calculator [accessed February 2017]
https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

Site-specific Risk
Resident Equation Inputs for Tapwater

TABLE F-1

Variable	Value
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

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Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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
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

Output generated 03FEB2017:15:35:08

Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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

Output generated 03FEB2017:15:35:08

Site-specific Risk
Resident RISK for Tapwater

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m³)	RfC Ref	Ingestion SF (mg/kg-day)⁻¹	SFO Ref	Inhalation Unit Risk (ug/m³)⁻¹	IUR Ref	ABS_{gi}	K_p (cm/hr)	FA	In EPD?	Carcinogenic Absorbed dose per event (mg/cm²-event)
Chloroform	No	Yes	1.00E-02	I	9.77E-02	A	3.10E-02	C	2.30E-05	I	1	0.00683	1	Yes	2.81E-06
Tetrachloroethylene	No	Yes	6.00E-03	I	4.00E-02	I	2.10E-03	I	2.60E-07	I	1	0.0334	1	Yes	5.64E-05
Trichloroethylene	Yes	Yes	5.00E-04	I	2.00E-03	I	4.60E-02	I	4.10E-06	I	1	0.0116	1	Yes	1.40E-03
**Total Risk/HI*			-		-		-		-		-	-	-		-

Noncancer-child Absorbed dose per event (mg/cm²-event)	Noncancer-adult Absorbed dose per event (mg/cm²-event)	Noncancer-adjusted Absorbed dose per event (mg/cm²-event)	Tap Concentration (ug/L)	Child Ingestion HQ	Child Inhalation HQ	Child Dermal HQ	Child Total HI	Adult Ingestion HQ	Adult Inhalation HQ	Adult Dermal HQ
2.53E-06	2.90E-06	2.81E-06	0.26	1.30E-03	1.28E-03	1.03E-04	2.68E-03	7.79E-04	1.28E-03	6.82E-05
5.06E-05	5.80E-05	5.64E-05	0.79	6.57E-03	9.47E-03	3.43E-03	1.95E-02	3.95E-03	9.47E-03	2.28E-03
1.25E-03	1.44E-03	1.40E-03	70.4	**7.02E+00**	**1.69E+01**	**1.02E+00**	**2.49E+01**	**4.22E+00**	**1.69E+01**	**6.78E-01**
-	-	-	-	***7.03E+00***	***1.69E+01***	***1.02E+00***	***2.49E+01***	***4.22E+00***	***1.69E+01***	***6.80E-01***

Adult Total HI	Adjusted Ingestion HQ	Adjusted Inhalation HQ	Adjusted Dermal HQ	Adjusted Total HI	Ingestion Risk	Inhalation Risk	Dermal Risk	Total Risk
2.12E-03	8.98E-04	1.28E-03	7.74E-05	2.25E-03	1.03E-07	1.06E-06	8.91E-09	1.18E-06
1.57E-02	4.55E-03	9.47E-03	2.59E-03	1.66E-02	2.13E-08	3.66E-08	1.21E-08	7.00E-08
2.18E+01	**4.87E+00**	**1.69E+01**	**7.69E-01**	**2.25E+01**	5.95E-05	7.36E-05	9.45E-06	**1.43E-04**
2.18E+01	***4.87E+00***	***1.69E+01***	***7.72E-01***	***2.25E+01***	*5.97E-05*	*7.47E-05*	*9.47E-06*	***1.44E-04***

Output generated 03FEB2017:15:35:08

Site-specific Risk
Resident Equation Inputs for Tapwater

TABLE F-2

Variable	Value
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

Output generated 03FEB2017:15:23:04

Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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
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

Output generated 03FEB2017:15:23:04

Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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

Output generated 03FEB2017:15:23:04

Site-specific Risk
Resident RISK for Tapwater

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m³)	RfC Ref	Ingestion SF (mg/kg-day)$^{-1}$	SFO Ref	Inhalation Unit Risk (ug/m³)$^{-1}$	IUR Ref	ABS_{gi}	K_p (cm/hr)	FA	In EPD?	Carcinogenic Absorbed dose per event (mg/cm²-event)
Dichloroethane, 1,2-	No	Yes	6.00E-03	P	7.00E-03	P	9.10E-02	I	2.60E-05	I	1	0.0042	1	Yes	1.58E-06
Dichloroethylene, 1,2-cis-	No	Yes	2.00E-03	I	-		-		-		1	0.011	1	Yes	1.12E-04
Trichloroethylene	Yes	Yes	5.00E-04	I	2.00E-03	I	4.60E-02	I	4.10E-06	I	1	0.0116	1	Yes	5.76E-05
**Total Risk/HI*			-		-		-		-		-	-	-		-

Noncancer-child Absorbed dose per event (mg/cm²-event)	Noncancer-adult Absorbed dose per event (mg/cm²-event)	Noncancer-adjusted Absorbed dose per event (mg/cm²-event)	Tap Concentration (ug/L)	Child Ingestion HQ	Child Inhalation HQ	Child Dermal HQ	Child Total HI	Adult Ingestion HQ	Adult Inhalation HQ	Adult Dermal HQ
1.41E-06	1.62E-06	1.58E-06	0.27	2.24E-03	1.85E-02	9.59E-05	2.08E-02	1.35E-03	1.85E-02	6.36E-05
1.00E-04	1.15E-04	1.12E-04	7.4	**1.84E-01**	-	2.04E-02	**2.05E-01**	**1.11E-01**	-	1.35E-02
5.17E-05	5.93E-05	5.76E-05	2.9	**2.89E-01**	**6.95E-01**	4.21E-02	**1.03E+00**	**1.74E-01**	**6.95E-01**	2.79E-02
-	-	-	-	***4.76E-01***	***7.14E-01***	*6.25E-02*	***1.25E+00***	***2.86E-01***	***7.14E-01***	*4.15E-02*

Adult Total HI	Adjusted Ingestion HQ	Adjusted Inhalation HQ	Adjusted Dermal HQ	Adjusted Total HI	Ingestion Risk	Inhalation Risk	Dermal Risk	Total Risk
1.99E-02	1.56E-03	1.85E-02	7.22E-05	2.01E-02	3.15E-07	1.25E-06	1.47E-08	1.58E-06
1.24E-01	**1.28E-01**	-	1.54E-02	**1.43E-01**	-	-	-	-
8.97E-01	**2.00E-01**	**6.95E-01**	3.17E-02	**9.27E-01**	2.45E-06	3.03E-06	3.89E-07	5.87E-06
1.04E+00	***3.30E-01***	***7.14E-01***	*4.71E-02*	***1.09E+00***	*2.77E-06*	*4.28E-06*	*4.04E-07*	*7.45E-06*

Output generated 03FEB2017:15:23:04

Site-specific Risk
Resident Equation Inputs for Tapwater

TABLE F-3

Variable	Value
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

Output generated 03FEB2017:16:08:17

Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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
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

Output generated 03FEB2017:16:08:17

Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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

Output generated 03FEB2017:16:08:17

Site-specific Risk
Resident RISK for Tapwater

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m³)	RfC Ref	Ingestion SF (mg/kg-day)⁻¹	SFO Ref	Inhalation Unit Risk (ug/m³)⁻¹	IUR Ref	ABS_{gi}	K_p (cm/hr)	FA	In EPD?
Dibromodichloromethane	No	Yes	-		-		-		-		1	0.00376	1	Yes
Trichloroethylene	Yes	Yes	5.00E-04	I	2.00E-03	I	4.60E-02	I	4.10E-06	I	1	0.0116	1	Yes
**Total Risk/HI*			*-*		*-*		*-*		*-*		*-*	*-*	*-*	

Carcinogenic Absorbed dose per event (mg/cm²-event)	Noncancer-child Absorbed dose per event (mg/cm²-event)	Noncancer-adult Absorbed dose per event (mg/cm²-event)	Noncancer-adjusted Absorbed dose per event (mg/cm²-event)	Tap Concentration (ug/L)	Child Ingestion HQ	Child Inhalation HQ	Child Dermal HQ	Child Total HI	Adult Ingestion HQ
5.68E-06	5.09E-06	5.84E-06	5.68E-06	0.43	-	-	-	-	-
1.29E-05	1.16E-05	1.33E-05	1.29E-05	0.65	6.48E-02	**1.56E-01**	9.43E-03	**2.30E-01**	3.90E-02
-	*-*	*-*	*-*	*-*	*6.48E-02*	***1.56E-01***	*9.43E-03*	***2.30E-01***	*3.90E-02*

Adult Inhalation HQ	Adult Dermal HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Inhalation HQ	Adjusted Dermal HQ	Adjusted Total HI	Ingestion Risk	Inhalation Risk	Dermal Risk	Total Risk
-	-	-	-	-	-	-	-	-	-	-
1.56E-01	6.26E-03	**2.01E-01**	4.49E-02	**1.56E-01**	7.10E-03	**2.08E-01**	5.50E-07	6.79E-07	8.73E-08	1.32E-06
1.56E-01	*6.26E-03*	***2.01E-01***	*4.49E-02*	***1.56E-01***	*7.10E-03*	***2.08E-01***	*5.50E-07*	*6.79E-07*	*8.73E-08*	*1.32E-06*

Output generated 03FEB2017:16:08:17

Site-specific Risk
Resident Equation Inputs for Tapwater

TABLE F-4

Variable	Value
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

Output generated 03FEB2017:15:39:05

Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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
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

Output generated 03FEB2017:15:39:05

Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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

Site-specific Risk

Resident RISK for Tapwater

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m³)	RfC Ref	Ingestion SF (mg/kg-day)⁻¹	SFO Ref	Inhalation Unit Risk (ug/m³)⁻¹	IUR Ref	ABS_{gi}	K_p (cm/hr)	FA	In EPD?	Carcinogenic Absorbed dose per event (mg/cm²-event)
Dichlorobenzene, 1,3-	No	Yes	-		-		-		-		1	0.052	1	Yes	1.04E-04
Dichlorobenzene, 1,4-	No	Yes	7.00E-02	A	8.00E-01	I	5.40E-03	C	1.10E-05	C	1	0.0453	1	Yes	9.78E-05
Dichloroethylene, 1,2-cis-	No	Yes	2.00E-03	I	-		-		-		1	0.011	1	Yes	1.46E-04
Tetrachloroethylene	No	Yes	6.00E-03	I	4.00E-02	I	2.10E-03	I	2.60E-07	I	1	0.0334	1	Yes	2.32E-04
Trichloroethylene	Yes	Yes	5.00E-04	I	2.00E-03	I	4.60E-02	I	4.10E-06	I	1	0.0116	1	Yes	1.31E-02
**Total Risk/HI*			-		-		-		-		-	-	-		-

Noncancer-child Absorbed dose per event (mg/cm²-event)	Noncancer-adult Absorbed dose per event (mg/cm²-event)	Noncancer-adjusted Absorbed dose per event (mg/cm²-event)	Tap Concentration (ug/L)	Child Ingestion HQ	Child Inhalation HQ	Child Dermal HQ	Child Total HI	Adult Ingestion HQ	Adult Inhalation HQ	Adult Dermal HQ
9.37E-05	1.07E-04	1.04E-04	1.06	-	-	-	-	-	-	-
8.78E-05	1.01E-04	9.78E-05	1.14	8.12E-04	6.83E-04	5.10E-04	2.01E-03	4.88E-04	6.83E-04	3.39E-04
1.31E-04	1.50E-04	1.46E-04	9.67	2.41E-01	-	2.66E-02	2.68E-01	1.45E-01	-	1.77E-02
2.08E-04	2.39E-04	2.32E-04	3.25	2.70E-02	3.90E-02	1.41E-02	8.01E-02	1.62E-02	3.90E-02	9.38E-03
1.18E-02	1.35E-02	1.31E-02	660	6.58E+01	1.58E+02	9.57E+00	2.34E+02	3.96E+01	1.58E+02	6.35E+00
-	-	-	-	*6.61E+01*	*1.58E+02*	*9.61E+00*	*2.34E+02*	*3.97E+01*	*1.58E+02*	*6.38E+00*

Adult Total HI	Adjusted Ingestion HQ	Adjusted Inhalation HQ	Adjusted Dermal HQ	Adjusted Total HI	Ingestion Risk	Inhalation Risk	Dermal Risk	Total Risk
-	-	-	-	-	-	-	-	-
1.51E-03	5.63E-04	6.83E-04	3.84E-04	1.63E-03	7.90E-08	2.23E-06	5.40E-08	2.37E-06
1.63E-01	1.67E-01	-	2.01E-02	1.87E-01	-	-	-	-
6.46E-02	1.87E-02	3.90E-02	1.06E-02	6.83E-02	8.76E-08	1.50E-07	4.98E-08	2.88E-07
2.04E+02	4.56E+01	1.58E+02	7.21E+00	2.11E+02	5.58E-04	6.90E-04	8.86E-05	1.34E-03
2.04E+02	*4.58E+01*	*1.58E+02*	*7.24E+00*	*2.11E+02*	*5.58E-04*	*6.92E-04*	*8.87E-05*	*1.34E-03*

Output generated 03FEB2017:15:39:05

Site-specific Risk
Resident Equation Inputs for Tapwater

TABLE F-5

Variable	Value
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

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Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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
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

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Site-specific Risk
Resident Equation Inputs for Tapwater

Variable	Value
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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Site-specific Risk
Resident RISK for Tapwater

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m ^{3})	RfC Ref	Ingestion SF (mg/kg-day) $^{-1}$	SFO Ref	Inhalation Unit Risk (ug/m ^{3}) $^{-1}$	IUR Ref	ABS_{gi}	K_p (cm/hr)	FA	In EPD?	Carcinogenic Absorbed dose per event (mg/cm ^{2}-event)
Dichloroethylene, 1,2-cis-	No	Yes	2.00E-03	I	-		-		-		1	0.011	1	Yes	3.47E-04
Trichlorobenzene, 1,2,4-	No	Yes	1.00E-02	I	2.00E-03	P	2.90E-02	P	-		1	0.0705	1	Yes	6.67E-04
Trichloroethylene	Yes	Yes	5.00E-04	I	2.00E-03	I	4.60E-02	I	4.10E-06	I	1	0.0116	1	Yes	1.21E-03
**Total Risk/HI*			-		-		-		-		-	-	-		-

Noncancer-child Absorbed dose per event (mg/cm ^{2}-event)	Noncancer-adult Absorbed dose per event (mg/cm ^{2}-event)	Noncancer-adjusted Absorbed dose per event (mg/cm ^{2}-event)	Tap Concentration (ug/L)	Child Ingestion HQ	Child Inhalation HQ	Child Dermal HQ	Child Total HI	Adult Ingestion HQ	Adult Inhalation HQ	Adult Dermal HQ
3.11E-04	3.57E-04	3.47E-04	23	5.73E-01	-	6.33E-02	6.37E-01	3.45E-01	-	4.20E-02
5.98E-04	6.86E-04	6.67E-04	4	1.99E-02	9.59E-01	2.43E-02	1.00E+00	1.20E-02	9.59E-01	1.62E-02
1.09E-03	1.25E-03	1.21E-03	61	6.08E+00	1.46E+01	8.85E-01	2.16E+01	3.66E+00	1.46E+01	5.87E-01
-	-	-	-	*6.68E+00*	*1.56E+01*	*9.72E-01*	*2.32E+01*	*4.01E+00*	*1.56E+01*	*6.46E-01*

Adult Total HI	Adjusted Ingestion HQ	Adjusted Inhalation HQ	Adjusted Dermal HQ	Adjusted Total HI	Ingestion Risk	Inhalation Risk	Dermal Risk	Total Risk
3.87E-01	3.97E-01	-	4.77E-02	4.45E-01	-	-	-	-
9.87E-01	1.38E-02	9.59E-01	1.83E-02	9.91E-01	1.49E-06	-	1.98E-06	3.47E-06
1.89E+01	4.22E+00	1.46E+01	6.67E-01	1.95E+01	5.16E-05	6.38E-05	8.19E-06	1.24E-04
2.02E+01	*4.63E+00*	*1.56E+01*	*7.33E-01*	*2.09E+01*	*5.31E-05*	*6.38E-05*	*1.02E-05*	*1.27E-04*

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