United States Environmental Protection Agency
Region 1

Decision Document

J-1 Range Operable Unit

Camp Edwards
Massachusetts Military Reservation
Cape Cod, Massachusetts

May 2011

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PART I: DECLARATION FOR THE SAFE DRINKING WATER ACT DECISION DOCUMENT

A. SITE NAMES

The subject site is the J-1 Range ("the Site"), which is located at Camp Edwards at the Massachusetts Military Reservation (MMR).

B. STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected response actions for the Site. The selected response actions were chosen in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA), 42 USC § 300i(a), as amended, and the Administrative Order (AO) concerning response actions issued thereunder, U.S. Environmental Protection Agency Region 1 (EPA) Administrative Order No. SDWA-1-2000-0014 (AO3). The authority to select the necessary response action(s) has been delegated to EPA Region 1's Regional Administrator pursuant to EPA Delegation No. 9-17 (1200-TN-350) dated May 11, 1994, and further delegated to EPA Region 1's Director, Office of Site Remediation and Restoration, pursuant to a redelegation of authorities dated April 6, 2010.

This decision is based on the Administrative Record, which has been developed in accordance with AO3 and with a previous EPA Administrative Order, SDWA 1-97-1019 (AO1), including consideration of the substantive cleanup standards of the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000. The Index of Key Supporting Documents is available for review at the Impact Area Groundwater Study Program (IAGWSP) office, 1803 West Outer Road, Camp Edwards, MA. Documents included in the Index of Key Supporting Documents are listed in Appendix C.

C. ASSESSMENT OF THE SITE

On July 13, 1982, EPA determined that the Cape Cod Aquifer is the sole or principal source of drinking water for Cape Cod, Massachusetts, and that the Cape Cod Aquifer, if contaminated, would create a significant hazard to public health (47 Fed. Reg. 30282). Contaminants from the Training Ranges and Impact Area at MMR are present in and may enter and migrate in the aquifer. The response actions selected in this Decision Document are necessary to protect the Cape Cod Aquifer, an underground source of

drinking water on which the public relies.

D. DESCRIPTION OF RESPONSE ACTIONS

This Decision Document sets forth the selected response actions taken and to be taken for addressing the source areas contributing to groundwater contamination, and the groundwater contamination at and emanating from the Site. The source areas include both soil contamination and unexploded ordnance (UXO) (or munitions and explosives of concern (MEC)) that may be in or on the soil. There may be additional areas on the site where UXO/MEC and the soil beneath may pose public safety risks, ecological risks, dermal contact risks, and/or soil ingestion risks. These potential UXO/MEC-related risks are not addressed by this Decision Document, which was issued pursuant to Administrative Order No. SDWA-1-2000-0014 and Section 1431(a) of the SDWA, and which focuses on potential endangerment to the health of persons deriving from contaminants present in or likely to enter the underground source of drinking water.

Based on recent sampling results presented in the remedial investigation report for the Site, it was determined that no further action was necessary with regard to the source as a contributor to groundwater contamination associated with the Site. Soil contamination and most of the MEC at the J-1 Range source areas that was contributing to groundwater contamination was adequately removed during historical investigations as well as during response actions conducted from 1997 through 2010. Post-excavation soil samples collected at the Site revealed only low, infrequent detections of explosives compounds. Geophysical investigations suggest it is unlikely that a significant number of MEC which could impact groundwater remain on the range. Since no further contribution of contaminants from soil or MEC to groundwater is expected, the proposed alternatives did not include any further source-area cleanup

However, based on groundwater sampling results, EPA, in consultation with MassDEP deemed it necessary to develop and evaluate a range of potential response actions to address contaminants detected in groundwater associated with the Site. The Remedial Investigation / Feasibility Study (RI/FS) for the Site identified Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) and perchlorate as the contaminants of concern (COCs) for groundwater.

These specific COCs were used to develop and evaluate a range of potential response actions for the Site. Groundwater modeling was used to determine the feasibility of the alternatives and the selected response action was based on the remediation of the RDX and perchlorate plumes. The cleanup objectives for the Site are to restore the useable groundwater to its beneficial use, wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site; to provide a level of protection in the aquifer that takes into account that the Cape Cod Aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent the ingestion and inhalation of groundwater containing the COCs (RDX and perchlorate) in excess of federal Maximum Contaminant Levels (MCLs), Health Advisories (HA), Drinking Water Equivalent Levels (DWELs), applicable State standards or unacceptable excess lifetime cancer risk (ELCR) or non-cancer Hazard Index (HI).

There currently is no federal drinking water standard for perchlorate. However, in December 2008, EPA issued an Interim Drinking Water Health Advisory for exposure to perchlorate in water of 15 µg/L. Also, the Massachusetts Department of Environmental Protection (MassDEP) has promulgated a Massachusetts Maximum Contaminant Level (MMCL) for perchlorate of 2 µg/L.

The lifetime federal Health Advisory for RDX in drinking water is 2 µg/L, the Massachusetts Contingency Plan (MCP) GW-1 standard is 1 µg/L, and the 10^{-6} ELCR risk-based concentration that results in an increased lifetime cancer risk of one in a million is currently 0.6 µg/L.

The EPA, in consultation with MassDEP, has selected a response action for the Site under which the aquifer, which has been designated a Sole Source Aquifer by the EPA and a Potentially Productive Aquifer by the MassDEP, will be restored. The response action will ensure that the groundwater containing RDX at concentrations greater than the 10^{-6} risk-based level and/or perchlorate greater than 2 µg/L is restored to protective levels.

For groundwater investigation and response action purposes, the J-1 Range has been divided into two sub-areas, the northern area and the southern area. The EPA selected response action for the northern area groundwater is Focused Extraction with Two Wells,

Monitored Natural Attenuation, and Land-Use Controls. For the southern area groundwater, the EPA selected response action is Focused Extraction with Two Wells, Monitored Natural Attenuation and Land-Use Controls. These alternatives, as presented in the J-1 Range RI/FS, provide the best balance of the criteria used to evaluate cleanup alternatives.

The selected alternatives achieve cleanup goals in a reasonable timeframe and protect human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the Site are correct and that any residual contamination remains below risk-based levels. Human health will be further protected through the implementation and verification of land use controls. These controls will prevent use of contaminated portions of the aquifer at the Site for drinking water purposes until groundwater data confirm that contamination has been reduced to below risk-based levels.

The major components of the J-1 Range northern area response action are:

- A 250 gallon per minute (gpm) pump and treat system containing two extraction wells and two mobile treatment units (MTUs);
- Development and implementation of a long-term monitoring program that would be optimized as required, as contamination levels are reduced;
- Implementation of land use controls to prevent access to and use of the contaminated portions of the aquifer for drinking water, and maintain the integrity of any current or future groundwater monitoring systems;
- Monitoring to verify actual versus predicted migration and attenuation (i.e., confirmation that cleanup levels have been achieved and to demonstrate that the source removal is adequate);
- Site closeout documentation; and
- Well abandonment after monitoring is complete.

The major components of the J-1 Range southern area response action are:

- A 125 gpm pump and treat system containing two extraction wells and one MTU;
- Development and implementation of a long-term monitoring program that would be optimized as required, as contamination levels are reduced;

- Implementation of land use controls to prevent access to and use of the contaminated portions of the aquifer for drinking water, and maintain the integrity of any current or future groundwater monitoring wells and treatment systems;
- Monitoring to verify actual versus predicted migration and attenuation (i.e., confirmation that cleanup levels have been achieved and to demonstrate that the source removal is adequate);
- Site closeout documentation; and
- Well abandonment after monitoring is complete.

E. DETERMINATIONS

The response actions selected in this Decision Document will protect the public health from any endangerment which may be presented by the presence or potential migration of COCs from the Site into the underlying Sole Source Aquifer. The response action selected in this Decision Document, issued pursuant to AO3 and Section 1431 of the SDWA, addresses the unacceptable threats to the groundwater aquifer from the Site. In this Decision Document, EPA is making no determination regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the Site.

As required by AO3, the selected alternatives for the Site (Focused Extraction, Monitored Natural Attenuation and Land Use Controls for groundwater and no further action for source areas contributing to groundwater contamination) provides a level of protection to the aquifer underlying and downgradient of the Site commensurate with the aquifer's designation as a Sole Source Aquifer and a Potentially Productive Aquifer and is protective of human health.

In addition to annual reports on groundwater monitoring and verification of land-use controls, the selected response actions include periodic reviews at frequencies not to exceed five years. The scope of each review will include, but not be limited to, sampling data, modeling data, and other relevant data. EPA, in consultation with MassDEP, will review this and any other relevant information to determine if additional measures are necessary for the protection of human health. This will include information acquired after implementation of the selected response action (such as new regulatory requirements or changes in the environmental conditions of the Site).

F. SUPPORTING DATA

Detailed information on the Site is included in the Final J-1 Range Remedial Investigation/ Feasibility Study dated July 16, 2010. An overview of the Site, including decision factors that led to selecting the groundwater response actions, is included in the Decision Summary section of this document. The Decision Summary section also includes information on COCs and their respective concentrations, the baseline risk represented by the COCs, cleanup levels established for COCs and the basis for the levels, current and future land and groundwater use assumptions used in the baseline risk screening and Decision Document, land and groundwater use that will be available at the Site as a result of the selected response action, and decision factor(s) that led to selecting the remedy. Additional information can be found in the Index of Key Supporting Documents, which is Appendix C to the Decision Document.

G. AUTHORIZING SIGNATURE

This Decision Document documents EPA's selected response action, under the authority of the SDWA, for remediation of the J-1 Range Operable Unit within Camp Edwards at the MMR. The MassDEP concurs with this decision.

U.S. Environmental Protection Agency

By: _____ FOR JTO **Date:** 5/23/11

James T. Owens, III
Director, Office of Site Remediation and Restoration
Region 1

PART II: THE DECISION SUMMARY

A. SITE DESCRIPTION

The J-1 Range is located on Camp Edwards on the Massachusetts Military reservation on Cape Cod in Massachusetts (Figure 1). It is located southeast of the impact area between the J-2 and J-3 ranges. The J-1 Range is approximately 2,000 meters long and between 50- and 250-meters wide. The range is oriented southeast to northwest, with the southeastern "uprange" end near Greenway Road, and the northwestern "downrange" end extending several hundred meters into the impact area. There are large man-made berms located at various distances along the length of the range. The only structure located on the Range is a concrete bunker located near the 1,000 meter berm. Access to the J-1 Range is currently restricted by a locked gate.

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

The J-1 Range is a multi-purpose range where military training, munitions testing, and munitions disposal occurred. Past munitions use on the range mainly involved contractor testing. Military training, which consisted of anti-tank and small arms training, occurred from 1935 through the mid-1950s. From 1957 through the late 1980s, the J-1 Range was used for weapons testing by defense contractors. The predominant firing positions are believed to have been along the berm located near the entrance to the range, and next to the 1,000-m berm located downrange from Greenway Road (Figure 2). The items fired consisted of various types and sizes of projectiles and ammunition. Although the munitions included practice and high explosive (HE) rounds, available information suggests that the majority of the items fired were inert practice/test rounds.

Testing activities included direct fire to evaluate penetration and round dispersion at various downrange distances, and fuze function and warhead performance testing. The principal round was the 105mm High Explosive Anti-Tank (HEAT) munition and Sabot rounds. Similarly, mortar testing and howitzer projectiles (indirect fired munitions) (principally 60mm and 81mm mortars, and 105mm and 8-inch rounds) were fired to test

fuze performance and spotting round performance. Other testing included hazard classification tests conducted between the 1,000-m and 150-m berms, where fuels were used to ignite munitions during "cook-off" tests. Explosives, propellant and munitions were burned and buried at locations including areas along the range road near the firing points, the cook-off test location, the steel-lined pit, the popper kettle/wastewater disposal area, and numerous burn and burial pits within the interberm area of the range.

2. History of Investigations and Response Actions

Investigations were conducted at the J-1 Range between 1997 and 2010 to identify any contamination in soil and groundwater resulting from past activities. Data collected as part of these investigations were used to characterize the nature and extent of groundwater contamination emanating from the site, any continuing sources of contamination, including soil contamination and potential contamination from MEC, and to provide a basis for the evaluation of risks posed by the site. Investigations included soil sampling, geophysical surveys, groundwater sampling and a robotic technology demonstration. A brief summary of the investigations and response actions performed at the Site is provided below. A more detailed discussion can be found in Sections 3 and 4 of the July 2010 Remedial Investigation/Feasibility Study (RI/FS) Report.

Source Investigations and Results

Source characterization investigations in the J-1 Range commenced in 1997 with soil and groundwater samples collected at areas identified as having the highest probability of contaminant releases. Initial investigations focused on those features identified during a historical aerial photograph analysis of Camp Edwards. Additional range features were included in the investigation as range records became available. Significant information regarding range activities was also obtained through interviews of current and former base employees and range workers and observation noted during site reconnaissance. Soil samples were collected at specific features noted in site records, aerial photographs and during site reconnaissance, at the locations of geophysical anomalies, proposed excavation areas, and from the base of excavations after soil removal activities.

During the period from 1997 through 2007, 1,732 soil samples were collected from 419 locations within the J-1 Range investigation area (Figure 3). The analytical data collected identified volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), pesticides, herbicides, explosives, and metals at various concentrations in J-1 Range soils. Results of soil investigations at the northern or interberm area (IBA) of the range showed soil contamination in and around certain features of the range, in particular the Popper Kettle area, the Steel-lined Pit, the Wastewater Disposal Area, cook-off test location, Polygons 9, 10 and 16 and grids J39, J36 and K36 (Figure 4) that is consistent with explosives and perchlorate found in downgradient groundwater (known as the northern plume area). Soil sampling conducted more recently (2009) identified additional soil contaminated by explosives and perchlorate proximate to the source areas described above. Analytical results indicated elevated levels of RDX and 2,4-DNT from IBA area soils. Additional explosives compounds and perchlorate were detected, but only at levels well below relevant standards. As further discussed below, EPA believes that explosives and perchlorate soil contamination above relevant standards associated with all the various source areas contributing to groundwater contamination in this part of the range have been removed. None of the other contaminants detected from these areas were evaluated in the Feasibility Study because either the contaminant was detected infrequently, the contaminant detected is an essential human nutrient, or the contaminant concentrations were generally below relevant screening levels and/or MCP S-1/GW-1 soil standards, or less than or similar to background (Appendix D).

Results of soil investigations at the southern area of the range showed soil contamination in the vicinity of polygons 2, 3 and 4, multiple disposal pits, and the suspected water saw operation (Figure 5) that is consistent with explosives found in the downgradient groundwater (known as the southern plume area). Soil sampling conducted more recently (2009) identified additional soil contaminated by explosives and perchlorate proximate to the contaminated soils located above polygons 2, 3, and 4. Analytical results indicated elevated levels of RDX and HMX from southern area soils. Additional explosives compounds and perchlorate were detected, but only at levels well below relevant standards. As further discussed below, EPA believes that explosives soil contamination above relevant standards associated with all the various source areas contributing to groundwater contamination in this part of the range have been removed. None of the other contaminants detected from these areas were evaluated in the

Feasibility Study because either the contaminant was detected infrequently, the contaminant detected is an essential human nutrient, or the contaminant concentrations were generally below relevant screening levels and/or MCP S-1/GW-1 soil standards, or less than or similar to background levels.

In 2008, a robotics technology demonstration was conducted in the northern portion of the J-1 Range to evaluate the effectiveness of using remotely operated equipment to safely remove MEC. The technology demonstration involved the removal of soil and munitions from the up range faces of the 1,000-m, 150-m, and 2,000-m (a and b) berms. The 1,000-m and 150-m berms lie in the IBA, and the 2,000-m berms lie within the impact area portion of the Site. A remotely operated excavator equipped with a rotating, two inch slot-screen bucket attachment was used to separate rocks and any munitions from finer soil materials. A total of 9 potentially high explosive items were recovered from the berms. A post-robotics confirmatory geophysical survey and intrusive investigation did not detect additional MEC.

Intrusive investigations identified multiple disposal pits in the southern portion of the range and in the IBA. However, the greatest number of finds consisted of munitions debris or other debris. More than 1,000 projectiles characterized as inert were identified throughout the range during the characterization of the Site. The vast majority of MEC consisted of individual items containing small quantities of energetic material (i.e., fuzes). Greater than 200 fuzes were discovered at a burial pit in the southern area of the range. Each fuze contains approximately 3 grams of RDX. Other encountered MEC items consisted of inert bodies with live fuzes or individual high explosive (HE) projectiles discovered throughout the range. Greater than 50 HE projectiles were documented individually throughout the Site. These projectiles can contain upwards of 1.4 Kg of RDX; however, these projectiles are not believed to be contributors to the known areas of groundwater contamination.

MEC clearance in support of the cumulative investigations and removal actions resulted in the removal of significant quantities of munitions, munitions debris, and range residue debris from those portions of the range responsible for development of the J-1 northern and southern plumes. Other areas of the Site are generally free from large geophysically anomalous areas. Based on the geophysical investigations, remaining geophysical

anomalies are likely munitions debris or other debris. However, there is the potential for residual MEC items, likely consisting of inert projectiles with live fuzes or isolated individual HE items. None of the remaining anomalies are expected to represent disposal pits containing large quantities of MEC or explosives.

J-1 Range Source Removal Actions

The historical geophysical investigations were conducted from 1997 through 2010. Geophysical investigations proceeded in a sequential manner; each of which used information collected during previous investigations to guide the next step of the process. Generally, the largest and/or most densely distributed anomalies were investigated during each investigative phase, which resulted in smaller anomalies being investigated as the phases of the investigation progressed and, ultimately, a thorough evaluation of potential source areas. These activities resulted in the investigation of over 150 geophysically anomalous areas. These investigations also resulted in the excavation and off-site disposal of approximately 1,000 cubic yards of contaminated soil from 19 of the geophysical investigation locations. In addition to the soil removals, these investigations also removed MEC from 39 locations. The locations where contaminated soil and MEC was removed included the Popper Kettle area, the Steel-lined Pit, the Wastewater Disposal Area, cook-off test location, Polygons 9, 10 and 16 and grids J39, J36 and K36. MEC removed from burn pits in these locations primarily consisted of small quantity energetic items including fuzes, cartridge cases with live primers, suspect electronic explosive devices, stab detonators, and propellant. The soils and MEC were removed as a result of the various geophysical survey and investigations conducted at the Site. These materials were disposed of at off-site locations. In addition, approximately 150 cubic yards of screened, contaminated soil generated from the robotics technology demonstration at the 150-m berm was disposed of at a permitted off-site facility.

The recent sampling results identified soils with elevated concentrations of explosives compounds in three areas of the range (J-1 south grids I1-3 and J2-3, J-1 IBA grids L38, J37/38 and K38/39, and J-1 north target 34) (Figures 4 and 5). Soil from these areas with explosives detections were excavated to depths ranging from of 0.5- to 1.5-feet below ground surface and mechanically screened to remove any remaining munitions.

Excavation activities were conducted between September 2009 and April 2010. Approximately 2,400 cubic yards of contaminated soil was excavated. Post-excavation, 100-pt multi-increment soil samples were collected in each of the excavation area units from 0 to 3 inches below the excavation floor. Results from post-excavation sampling indicated no detections of explosives.

The excavated soils were treated beginning in May 2010. The soils were treated using alkaline hydrolysis, which involved raising the pH of the soil by blending it with water and hydrolyzed lime to mineralize the explosives compounds to more elemental compounds of inorganic nitrogen and carbon dioxide. After blending, the soils were staged in a lined treatment cell at the L Range. After treatment, the soils were sampled to determine the effectiveness of treatment. Explosives compounds were detected in some samples from the treated soils but were below relevant standards. The soils will be removed from the treatment cell and utilized on the L Range as backfill. This treatment activity will be documented in a J-1 Range Source Remediation Report.

Groundwater Investigations and Results

More than 150 groundwater monitoring wells were sampled at and downgradient of the J-1 range. Results of this sampling indicated the presence of groundwater plumes of both perchlorate and RDX (Figures 5 and 6). For the purposes of groundwater evaluation the J-1 northern and southern groundwater plume areas are discussed separately. This is due to the diverging flow directions of the two plumes emanating from the J-1 Range. The northern plume is flowing in a north-northwesterly direction and the J-1 southern plume is flowing in a southeasterly direction.

In the northern area, a groundwater contaminant plume consists of perchlorate and RDX. The perchlorate contamination is detached from the source area, has migrated further than the RDX plume and has the highest concentrations in the downgradient portion of the plume. The RDX portion of the plume has the higher concentrations closer to the source. The maximum concentrations in the northern plume as of 2009 are 13 µg/L for RDX and 55 µg/L for perchlorate. The maximum historical detections were 32 µg/L for RDX in 2004 and 78 µg/L for perchlorate in 2008. Based on the nature and extent of contamination, RDX and perchlorate are considered as the groundwater contaminants of

concern for the northern plume.

The primary contaminant of concern in the J-1 Range groundwater southern area is RDX. The southern RDX plume is defined by an on-base portion, which extends from the source area and terminates at the base boundary at an extraction well; and a downgradient portion that extends approximately 1,000 feet beyond the base boundary, beneath a residential area. There is believed to be no exposure to the plume as all residences in the off-base area of the plume are believed to be connected to the municipal water supply. The maximum RDX concentration in the on-base portion of the plume as of 2009 was 14 µg/L. The maximum RDX concentration in the off-base portion of the plume as of 2009 was 20 µg/L. Recent preliminary data obtained during a drive point investigation conducted during the spring of 2010 found RDX at 71 µg/L at one location. The maximum historical concentration in the plume was 130 µg/L in 2006.

Other contaminants detected in the groundwater were not retained as COCs because the contaminant was detected infrequently, the contaminants detected were essential human nutrients, or the contaminant concentrations were generally below relevant screening levels, or less than or similar to background levels. Based on the nature and extent of contamination and the risk-screening process, RDX and perchlorate in the northern area, and RDX in the southern area were retained as COCs since they are detected in a number of wells at concentrations above risk-based standards indicating the presence of a plume of groundwater contamination (Appendix D).

J-1 Range Groundwater Response Action

A 75 gpm (reduced to 45 gpm in September 2009) extraction, treatment and infiltration system consisting of an extraction well, modular treatment unit and infiltration trench was installed at the base boundary in 2007 and has been actively treating the southern RDX plume. Over 81 million gallons of water have been treated through 2009. The objective of the J-1 southern system was to mitigate further migration of the plume by capturing and treating contaminated water at the base boundary until the entire plume extent was determined.

3. History of Relevant Federal and State Enforcement Activities

Federal Enforcement Activities

In February 1997, EPA Region 1 issued SDWA Administrative Order 1-97-1019 (AO1) requiring the investigation of the impact of contamination at or emanating from the training ranges and impact area upon the Sole Source Aquifer.

In May 1997, EPA issued Administrative Order 1-97-1030 (AO2), which prohibited all live firing of mortars and artillery, firing of lead from small arms, planned detonation of ordnance or explosives at or near the Training Ranges and Impact Area except for UXO activities, and certain other training-related activities.

In January 2000, EPA issued SDWA Administrative Order 1-2000-0014 (AO3), which required implementation of Rapid Response Actions (RRAs) and Remedial Actions (RAs) to address contamination from past and present activities and sources at and emanating from the training ranges and impact area. The RRAs specifically required by AO3 addressed elevated concentrations of contaminants in soil and have been completed. The comprehensive response action component of AO3 requires that a feasibility study, remedial design and response action be completed for several areas of concern.

State Enforcement Activities

On May 14, 1998, MassDEP issued Notice of Noncompliance (NON) number NON-SE-98-3F-023 to the Commonwealth of Massachusetts Military Division, Office of the State Quartermaster for failure to manage a cache of over 1000 Unexploded Ordnance (UXO) unearthed at the J-1 Range in compliance with the requirements for the management of remediation waste pursuant to 310 CMR 40.0000, the MCP and to the management requirements at 310 CMR 30.0000, the Massachusetts Hazardous Waste Regulations. The NON required the Office of the State Quartermaster to provide MassDEP by June 1998 a comprehensive plan and an aggressive schedule for implementation of the requirements cited.

On November 8, 1999, MassDEP issued a Notice of Responsibility (NOR) with Release

Tracking Number 4-15035 to Textron Systems Corporation for a release of copper, barium, lead and cadmium at the 'Steel Lined Pit' at the J-1 Range at concentrations greater than the Reportable Concentrations for Soil Category 1 (RCS-1) pursuant to 310 CMR 40.1600, the MCP. The NOR required Textron to perform the necessary response actions required by the MCP.

C. COMMUNITY PARTICIPATION

Throughout the Site's history, the IAGWSP, EPA and MassDEP have kept the community and other interested parties informed and involved with response activities at the J-1 Range through informational meetings, fact sheets, press releases, public comment periods and public meetings. Below is a brief chronology of public involvement efforts.

The Impact Area Review Team (IART) was a citizen advisory committee established in 1997 under AO1. The IART served as a technical advisory resource, allowing the EPA, the National Guard Bureau, the Army, and MassDEP to hear first hand the concerns of the public related to the ongoing investigation and cleanup effort at Camp Edwards. In 2007, this team was merged with the Plume Cleanup Team, the citizens' advisory team for the Air Force Center for Engineering & Environment's MMR Installation Restoration Program, and renamed the MMR Cleanup Team (MMRCT). The combined team meets regularly throughout the year to hear updates and provide public input on the MMR investigations and cleanup efforts.

The IAGWSP also briefs the Senior Management Board (SMB), which advises MMR organizations on environmental programs and policies. Members of the SMB include selectmen or their designated representative from the towns of Bourne, Falmouth, Mashpee, and Sandwich and representatives from the EPA, MassDEP, Massachusetts Department of Public Health, Massachusetts National Guard, U.S. Coast Guard, and a representative from the Mashpee Wampanoag Tribe.

All IART, MMRCT, and SMB meetings related to the Site's investigation and response activities were advertised in the *Cape Cod Times* and the local edition of *The Enterprise* newspapers.

In October 2001, the IAGWSP, EPA and MassDEP released a Public Involvement Plan outlining activities to address community concerns and to keep citizens informed about and involved in response activities.

From the time the initial investigations at the Site began, through the present, the IAGWSP regularly presented updates on the investigation and response activities at the Site. With respect to this Decision Document, the most important updates were:

- On February 10, 2010, an informational meeting was held at Camp Edwards, MA, to present the findings of the RI/FS report for the J-1 Range to the MMR Cleanup Team and the public. A display ad regarding the meeting was placed in the February 5, 2010 editions of the *Cape Cod Times* and *The Enterprise* newspapers and a news release regarding the meeting was sent to the local media on February 8, 2010.

- On March 24, 2010, an informational meeting was held at Camp Edwards, MA, to describe the Remedy Selection Plan for the J-1 Range to the MMR Cleanup Team, Senior Management Board and the public. At the meeting, the IAGWSP gave a presentation on the Site, the Remedy Selection Plan and the proposed response and answered questions from the MMR Cleanup Team and Senior Management Board. The IAGWSP notified the public of the meeting in a display ad placed in the March 18, 2010 editions of the *Cape Cod Times* and *The Enterprise* newspapers.

- From July 19, 2010 through August 17, 2010, a Public Comment Period was held on the Remedy Selection Plan for the J-1 Range. The IAGWSP placed copies of the Remedy Selection Plan in the IAGWSP's information repositories at the Bourne, Falmouth, and Sandwich, MA, public libraries. The repositories contain documents on the J-1 Range investigations and findings supporting selection of the response action including the RI/FS report for the J-1 Range, along with other relevant documents. The Remedy Selection Plan also was made available on the IAGWSP Web site, which also contains the supporting documents and which offered a means of submitting public comments on the Remedy Selection Plan. In addition, the IAGWSP provided copies of the Remedy Selection Plan to MMR Cleanup Team members and distributed it to individuals in attendance at the public meeting and public hearing.

- On August 2, 2010, a Public Information Session and Public Hearing was held on the Remedy Selection Plan for the J-1 Range in Sandwich, MA. The public information session, along with a presentation on the Remedy Selection Plan and EPA's proposed response, was held prior to the opening of the public hearing. Local residents and officials, news media representatives, and members of the public interested in site activities and cleanup decisions were invited to attend both meetings. Representatives from EPA, MassDEP and IAGWSP were available to answer questions. The IAGWSP notified the public of the August 2, 2010 information session and public hearing, and reminded them about the public comment period in a display ad placed in the July 23 and July 30, 2010 editions of the *Cape Cod Times* and *The Enterprise* newspapers. A news release regarding the meeting and the public comment period was sent to the local media on July 16, 2010. In addition, the Remedy Selection Plan and an invitation to the information session was mailed to Forestdale residents on July 22, 2010.

All draft and final reports related to the Sites' investigation and response activities were made available through the Information Repository at the public libraries in Bourne, Falmouth, and Sandwich, MA. These documents also were made available to the public through the IAGWSP Web site: groundwaterprogram.army.mil (formerly www.groundwaterprogram.org) and the Administrative Record located at 1803 West Outer Road, Camp Edwards, MA.

Media releases on presentations and the Public Comment Period for the Site were distributed to the Cape *Cod Times* and other area media including newspapers, radio and television media.

Fact sheets were published and distributed regarding the Site's investigation and response activities. General fact sheets pertaining to the IAGWSP investigations and findings and on related issues, such as the contaminants of concern, were also published and distributed.

The IAGWSP, EPA, and MassDEP also participated in general information sessions, such as open houses, information sessions, community meetings and annual updates to the local Town Managers, Boards of Selectmen, and Boards of Health on MMR investigation

and response activities.

D. SCOPE AND ROLE OF OPERABLE UNIT

The Site consists of source areas contributing to groundwater contamination (i.e., soil and MEC) and groundwater operable units. The source areas contributing to groundwater contamination for the J-1 Range were addressed through the removal of geophysical anomalies (including MEC) and the excavation and removal of contaminated soils. Based on the removal of these contaminated soils and MEC, the EPA, in consultation with MassDEP, determined that no further action with respect to the source area was necessary at this time. Therefore, the analysis of alternatives in the RI/FS was limited to groundwater.

E. SITE CHARACTERISTICS

Site Geology

The surficial geology of western Cape Cod comprises glacial sediments deposited during the retreat of the Wisconsin stage of Holocene glaciation. Three extensive sedimentary units dominate the regional geology: the Buzzards Bay and Sandwich Moraines, and the Mashpee Pitted Plain. The Buzzards Bay Moraine and the Sandwich Moraine are located and visible as hummocky ridges along the western and northern boundaries of Camp Edwards, respectively. The Buzzards Bay Moraine and Sandwich Moraine are composed of ablation till, which is unsorted material ranging from clay to boulder size that was deposited at the leading edge of two lobes of the Wisconsinian glacier at its furthest advance. The Mashpee Pitted Plain is a broad outwash plain that lies between the two moraines and consists of fine to coarse-grained sands and is underlain by fine-grained glaciolacustrine sediments and a basal till layer over bedrock. The Mashpee Pitted Plain underlies most of MMR, including the J-1 Range.

Site Hydrogeology

A single groundwater-flow system underlies western Cape Cod including MMR. Camp Edwards lies over the Sagamore Lens, which is part of the larger, Cape Cod Aquifer. The

primary source of natural fresh water recharge to this groundwater system is rainfall and snow melt-water that averages approximately 48 inches per year. Additional water is returned to the aquifer as wastewater from domestic septic systems. Municipal sewer systems at the MMR and in parts of Falmouth return treated wastewater to the groundwater flow system through infiltration beds at the sewage treatment facilities. Wastewater return flow accounts for approximately 5 percent of the total groundwater recharge in the MMR region.

The high point of the water table within the western Cape Cod groundwater system occurs as a groundwater mound located beneath the east central portion of MMR. Groundwater flows radially outward: north to either the Cape Cod Canal or the Cape Cod Bay, east to the Bass River, south and southeast to Nantucket Sound, and west and southwest to Buzzards Bay.

The height of the water table in and around the MMR can fluctuate up to seven feet annually due to seasonal variations in groundwater recharge and pumping demand. Groundwater levels are highest in the spring when recharge rates are high and pumping demand is low; levels are lowest in the late summer/early autumn when rainfall is minimal and pumping demand is at its maximum. The total thickness of the aquifer varies from approximately 80 feet in the south to approximately 350 feet in the north. The variation in thickness is due to the episodes of glacial advance and retreat, the underlying bedrock geology, and the presence of fine-grained materials in the deeper sediments beneath the southern portion of the aquifer. Within the J-1 Range, the groundwater elevation is typically between 66 and 76 feet national geodetic vertical datum (ngvd) or approximately 100 feet below ground surface.

Surface water is not significantly retained due to the excessively drained sandy soils of Camp Edwards. No large lakes, rivers, or streams exist on the property, only small, marshy wetlands and ponds. Most of the wetlands and surface waters in the Sandwich and Buzzards Bay Moraines on Camp Edwards are considered to be perched. Surface water is present at MMR in a few ponds in kettle holes. The kettle-hole ponds are land-surface depressions that generally extend below the water table. Where these kettle holes do not extend down to the water table, they are merely surface depressions. Larger and deeper ponds have greater effect on slope and direction of the regional water

table near the pond. While horizontal groundwater flow is dominant in the aquifer system, vertical flow is important in areas near ponds and near the top of the groundwater mound for the Sagamore Lens aquifer.

Movement of Contaminants in Groundwater

Contaminated groundwater from the northern J-1 plume flows in a north-northwest direction. Contaminated groundwater from the southern J-1 plume flows in a south-southwesterly direction and crosses the base boundary downgradient of Greenway Road into a residential neighborhood. The groundwater flow rate is approximately one foot/day in an unconfined sandy aquifer comprised of glacial outwash deposits. Groundwater flow is influenced locally by discontinuous fine-grained units, hydraulic gradients, and proximity to the top of the groundwater mound.

Two COCs are present in groundwater at the Site: RDX and perchlorate. RDX and perchlorate readily leach from soil to the groundwater, with perchlorate more readily dissolving than RDX. Movement of RDX is slightly retarded in the soil and the aquifer due to limited sorption to soil particles. Therefore, RDX will generally move at a velocity slightly less than that of normal advective flow, while perchlorate generally will move at the same rate as the advective front. Longitudinal dispersion is a significant transport process for both perchlorate and RDX and a factor in natural attenuation.

Estimate of the Contaminant Volume and Mass

The total volume of the northern plume was estimated to be 318 million gallons as of 2010. The total mass of perchlorate with concentrations greater than 2.0 µg/L was approximately 9.8 kilograms (Kg) and the total mass of RDX with concentrations great than 0.6 µg/L was approximately 3.8 Kg.

The total volume of the southern plume was estimated to be 46 million gallons as of 2010. The total mass of RDX with concentrations greater than 0.6 µg/Lwas approximately 0.8 Kg.

Current Exposure Pathways

There are no known private or public water supplies located within the J-1 Range groundwater study area and no one is currently believed to be drinking water related to the J-1 Range that contains COCs at concentrations that exceed applicable drinking water standards, Health Advisories, and/or risk-based concentrations.

Potential Exposure Pathways

The development of new water supply wells and consumption of groundwater resources in areas contaminated or predicted to be contaminated by the J-1 Range plumes are potential future exposure pathways. As noted above, the Cape Cod Aquifer is the sole or principal source of drinking water for Cape Cod. Portions of Camp Edwards, including the on-base portions of the Site, have been set aside as a drinking water supply reserve by the Massachusetts legislature.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The J-1 Range site northern plume area is located on the MMR and is designated as an active military training area. The J-1 Range site southern plume area originates on base but extends into an adjacent off-base residential neighborhood. It is anticipated that the northern area and the on-base portion of the southern area of the J-1 Range Site will remain under the control and direction of government agencies and will continue to be used for military training and support purposes until at least 2052. The area also is designated as a water and wildlife preserve by Chapter 47 of the Massachusetts Acts of 2002. The source area overlays portions of a sole source aquifer that is a valued water supply for the upper portion of Cape Cod. The land-use controls (described in section K) will prevent the installation of new water supply wells, or use of existing water supply wells (if any), that could provide a pathway for ingestion of drinking water that contains COCs in concentrations that exceed applicable drinking water standards, Health Advisories, and/or risk-based levels, and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.

G. SUMMARY OF SITE RISKS

A Risk Screening was conducted for the J-1 Range. The objective of the risk screening was to identify any contaminants of concern detected at the J-1 Range that required further evaluation in the Feasibility Study.

Constituents detected in soil samples were evaluated by comparing the maximum concentration of each detected constituent to a series of federal and state risk-based criteria. Soil samples collected from the J-1 Range were screened for explosives, perchlorate, metals, SVOCs, pesticides/herbicides/PCBs, VOCs, EDB/MTBE, TOC, phosphate, nitrate/nitrite as nitrogen, ammonia as nitrogen, and cyanide. A number of metals, SVOCs and VOCs exceeded one or more of their respective screening levels. However, on further analysis, it was determined that the detections of metals and SVOCs were below or consistent with background levels or were common laboratory artifacts. VOC detections were sporadic and at low levels, so none of these constituents were carried forward in the feasibility study. Perchlorate was detected, but only at very low levels, throughout the range and well below screening values. Elevated detections of explosives, including RDX, HMX, and 2,4-DNT, were found in the J-1 Range source areas. These explosives-contaminated soils were excavated and treated on site. Post-excavation soil sampling results were all non-detect for explosives. As a result of this screening process and the subsequent analysis of the anticipated leaching behavior of the constituents that were highlighted by the screening, none of the analytes detected in soil were found to pose a risk.

Constituents detected in groundwater samples were evaluated by comparing the maximum concentration of each detected constituent to a series of risk-based criteria including Federal Maximum Contaminant Levels (MCLs), Health Advisory Levels (HAs), EPA Regional Screening Levels for Tapwater (RSL), and the MCP GW-1 standards. The maximum detected concentrations for a few of the explosives compounds and perchlorate exceeded at least one of their respective screening levels. However, with the exception of perchlorate and RDX, these explosives compounds were detected infrequently or were detected at concentrations marginally exceeding the screening values. A number of metals, SVOCs and VOCs exceeded one or more of their respective screening levels. However, on further analysis it was determined that the detections

were infrequent or less than or similar to background levels. The results of this screening identified groundwater containing COCs (RDX and perchlorate) in excess of federal MCLs, Health Advisory Levels, Drinking Water Equivalent Levels (DWELs), applicable State standards or unacceptable ELCR or non-cancer Hazard Index (HI).

The baseline risk screenings revealed that there are believed to be no existing exposure routes for human receptors, and no one is currently believed to be drinking groundwater associated with the J-1 Range site that contains COCs above current drinking water standards, Health Advisories, and/or risk-based levels. A potential future exposure pathway exists through development and consumption of groundwater resources in the area downgradient from the Site. Since groundwater contamination has been detected above drinking water regulatory standards, Health Advisories, and/or risk-based levels, unacceptable human health risks could occur if future exposures occur. However, as noted above, land-use controls will prevent the installation of water wells that could provide a pathway for ingestion of drinking water that contains COCs in concentrations that exceed applicable drinking water standards, Health Advisories, and/or risk-based levels, and maintain the integrity of any current or future groundwater monitoring systems.

H. RESPONSE ACTION OBJECTIVES FOR GROUNDWATER

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives were developed to aid in the development and screening of alternatives. The response action objectives for the selected J-1 Range alternatives are to restore the useable groundwater to its beneficial use wherever practicable within a timeframe that is reasonable given the particular circumstances of the site; to provide a level of protection in the aquifer that takes into account that the Cape Cod Aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent ingestion and inhalation of groundwater containing COCs (RDX and/or perchlorate) in excess of federal maximum contaminant levels, Health Advisories, drinking water equivalent levels (DWELs), applicable State standards and/or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES FOR GROUNDWATER

Pursuant to the AO3 SOW, the following range of remedial alternatives was developed that consider the following objectives: provide an appropriate level of protection to the aquifer underlying the training ranges and impact area, evaluate and address the short-term and long-term potential for human exposure; and consider the potential threat to human health if the remedial alternative proposed were to fail:

- A no-action alternative to serve as a baseline for alternative comparisons.
- An alternative that, throughout the entire groundwater plume, reduces the contaminant concentrations to background conditions.
- An alternative that, throughout the entire groundwater plume, reduces the contaminant concentrations to levels that meet or exceed the MCLs, Health Advisories, DWELS, other relevant standards, and a cumulative 10^{-6} excess cancer risk. It shall achieve the objective as rapidly as possible and must be completed in less than 10 years and shall require no long-term maintenance.
- A limited number of remedial alternatives that attain site-specific remediation levels within different restoration time periods utilizing one or more different technologies if they offer the potential for comparable or superior performance or implementability; fewer or lesser adverse impacts than other available approaches; or lower costs for similar levels of performance than demonstrated treatment technologies.

A range of alternatives from no action to focused extraction were developed specifically for groundwater in consideration of the response action objectives described in Part II.H above. The range of alternatives did not consider further soil remediation or control since no further contribution from soil to groundwater contamination is expected at any of the source areas investigated. Other alternatives utilizing one or more different technologies were not included because, for the circumstances of this operable unit, they would not provide superior performance or implementability, fewer or less adverse impacts, or lower costs for similar levels of performance, than the alternatives evaluated.

Six alternatives were developed to address the response action objectives discussed in Part II.H above and to meet the requirements set forth in AO3. Each of the alternatives

reduces the contaminant concentrations to background conditions. In addition, the focused extraction alternative with the greatest number of extraction wells also reduces the contaminant concentrations to levels that meet or exceed all regulatory and risk-based standards in 10 years or less.

- Alternative 1 - No Further Action
- Alternative 2 - Monitored Natural Attenuation and Land-Use Controls
- Alternative 3 - Focused Extraction with One Well, Monitored Natural Attenuation, and Land-Use Controls
- Alternatives 4 and 5 - Focused Extraction with Two Wells, Monitored Natural Attenuation and Land Use Controls
- Alternative 6 – Focused Extraction with Five Wells, Monitored Natural Attenuation and Land Use Controls

All alternatives except Alternate 1 (No Action) included both long-term groundwater monitoring (to confirm model predictions and achievement of cleanup goals) and monitoring of land-use controls (to ensure their effective implementation until the aquifer achieves risk-based levels and is restored to allow for unrestricted use and exposure). Groundwater monitoring will be performed in accordance with an approved, long-term monitoring plan with periodic and annual summaries of available groundwater monitoring data. Monitoring of land-use controls will be conducted annually by the Army and results will be included in a separate report or as a section of another report, if appropriate, and submitted annually to the regulatory agencies. The annual monitoring report will evaluate the status of the land-use controls and how any land-use control deficiencies or inconsistent uses have been addressed. These reports will be used in preparation of the five-year review to evaluate the effectiveness of the remedy in protecting human health and the sole source aquifer.

A detailed analysis was performed on the alternatives using nine evaluation criteria in order to select the appropriate remedy for each site. These criteria are divided into threshold, balancing, and modifying criteria and are given different weights accordingly, and provide a useful framework for evaluating response alternatives. The threshold criteria include the protection of human health and the environment and compliance with regulations. These criteria must be met by the remedy. The balancing criteria include

the long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short-term effectiveness, implementability, and cost. Modifying criteria include state and community acceptance of the selected remedy. These criteria were modeled on those used under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Contingency Plan (NCP).

In this decision under Section 1431(a) of the SDWA, the Agency is using these criteria, not strictly in accordance with CERCLA and the NCP, but as a way to evaluate and balance a number of relevant factors. The remedy selected through this process is determined to be necessary to protect the health of persons from contaminants present in or likely to enter an underground source of drinking water and that it is otherwise in accordance with existing law or laws. It also reflects the EPA's determination of the appropriate balance of other environmental concerns as reflected by the other criteria. The following are the nine evaluation criteria:

- Overall protection of human health and the environment; this shall include prevention of the movement of contaminants into the aquifer and its preservation as a public drinking water supply.
- Compliance with state and federal regulations.
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume through treatment.
- Short-term effectiveness.
- Implementability.
- Cost.
- State acceptance.
- Community acceptance.

J. DESCRIPTION OF ALTERNATIVES, SUMMARY OF COMPARATIVE ANALYSIS AND THE SELECTED RESPONSE ACTION

J-1 Range Northern Plume Area Description of Alternatives

Alternative 1 – No Further Action: Alternative 1 provides for no further action to address groundwater contamination associated with the Northern J-1 Range plume. Under this alternative:

- **No active groundwater treatment would occur.**
- **Model predictions could not be verified due to discontinued groundwater samplings/analysis and abandonment of existing monitoring wells.**
- **Land-use controls would not be implemented and so would not ensure against exposure until cleanup is achieved.**
- **Contamination within the plume is expected to drop below the 2 µg/L MMCL for perchlorate by 2080 and is expected to reach background levels after 2109. RDX concentrations are expected to decrease below the HA of 2 µg/L by 2053, the 10^{-6} ELCR risk-based level after 2109 and background after 2109.**
- **The total cost of Alternative 1 is estimated at $144,127.**

Alternative 2 – Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs): Alternative 2 would provide long-term monitoring of J-1 Range groundwater until concentrations of contaminants within the plume reach risk-based levels. Under this alternative:

- **A long-term groundwater monitoring would be implemented and optimized as required as the plume attenuates.**
- **Land-use controls would be implemented to prevent use of contaminated portions of the aquifer for drinking water and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.**
- **Monitoring, reporting and site close-out documentation would be completed.**
- **Contamination within the plume is expected to drop below the 2 µg/L MMCL for perchlorate by 2080 and is expected to reach background levels after 2109. RDX**

concentrations are expected to decrease below the HA of 2 µg/L by 2053, the 10^{-6} ELCR risk-based level after 2109 and background after 2109.

- The total cost of Alternative 2 is estimated at $3,441,151.

Alternative 3a and 3b – Focused Extraction with One Well, Monitored Natural Attenuation and Land Use Controls: Alternative 3 would provide for extraction and treatment of the groundwater. Under this alternative:

- A 125-gallon-per-minute (gpm) pump and treat system would be installed that would include one extraction well operating at a rate of 125 gpm, treatment with granular activated carbon and ion-exchange resin at a mobile treatment unit, an infiltration trench, and associated pipeline and power networks.
- A long-term groundwater monitoring plan would be implemented and optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.
- Monitoring, reporting and site-closeout documentation would be completed.
- The alternative was evaluated using two different operational scenarios for the extraction well; in alternative 3a the extraction well operates until the influent concentrations decrease below the method detection limit. In alternative 3b the extraction well operates until 2030 which would clean up the plume by the end of the Army lease in 2051. For alternative 3a, contamination within the plume is expected to drop below the 2 µg/L MMCL for perchlorate by 2042 and is expected to reach background levels after 2109. RDX concentrations would decrease below the HA of 2 µg/L by 2038, the 10^{-6} ELCR risk-based level by 2048 and background by 2057. For alternative 3b, contamination within the plume is expected to drop below the 2 µg/L MMCL for perchlorate by 2043 and is expected to reach background levels after 2109. RDX concentrations would decrease below the HA of 2 µg/L by 2040, the 10^{-6} ELCR risk-based level by 2051, and background by 2061.
- The total cost of Alternative 3a is estimated at $12,439,320. The total cost of Alternative 3b is

  estimated at $11,763,660.

Alternative 4a and 4b – Focused Extraction with Two Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 4 would provide for extraction and treatment of the groundwater. Under this alternative:

- **A 250 gpm pump and treat system would be installed that would include: Two extraction wells operating at a rate of 125 gpm each, treatment with granular activated carbon and ion-exchange resin at two mobile treatment units, infiltration of the treated water via two infiltration trenches, and associated pipeline and power networks.**
- **A long-term groundwater monitoring plan would be implemented and optimized as required.**
- **Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.**
- **Monitoring, reporting and site-closeout documentation would be completed.**
- **The alternative was evaluated using two different operational scenarios for the extraction well. In alternative 4a the extraction wells operate until the influent concentrations decrease below the method detection limit. In alternative 4b the upgradient well would be turned off in 2015 and the downgradient well operates until 2023. For Alternative 4a, contamination is expected to drop below the 2 ug/L MMCL for perchlorate by 2037 and is expected to reach background levels after 2109. RDX concentrations would decrease below the HA of 2 µg/L by 2027, the 10^{-6} ELCR risk-based level by 2035 and background by 2048. For alternative 4b, contamination within the plume is expected to drop below the 2 µg/L MMCL for perchlorate by 2045 and is expected to reach background levels after 2109. RDX concentrations would decrease below the HA of 2 µg/L by 2031, the 10^{-6} ELCR risk-based level by 2050, and background by 2096.**
- **The total cost of Alternative 4a is estimated at $ 13,057,684. The total cost of Alternative 4b is estimated at $11,623,876.**

Alternative 5 – Focused Extraction with Two Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 5 would provide for extraction and treatment of the groundwater. Under this alternative:

- A 250 gpm pump and treat system would be installed that would include two extraction wells
  operating at a rate of 125 gpm each, treatment with granular activated carbon and ion-exchange resin at two mobile treatment units, infiltration of the treated water via two infiltration trenches, and associated pipeline and power networks
- Alternative 5 differs from Alternatives 4a and 4b in the location of the downgradient (northern) extraction well, and hence the location of the pipeline and treatment plant. Under Alternative 5, this well would be located farther downgradient than under Alternatives 4a or 4b.
- A long-term groundwater monitoring plan would be implemented and optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the
  aquifer for drinking water and maintain the integrity of any current or future groundwater
  monitoring wells and treatment systems.
- Monitoring, reporting and site-closeout documentation would be completed.
- Contamination is expected to drop below the 2 µg/L MMCL for perchlorate by 2035 and reach
  background levels by 2048. RDX concentrations would decrease below the HA of 2 µg/L by 2037, the 10^{-6} ELCR risk-based level by 2047, and background by 2059.
- The total cost of Alternative 5 is estimated at $14,935,898.

Alternative 6 – Focused Extraction with Five Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 6 would provide for extraction and treatment of the groundwater. Under this alternative:

- A 625 gpm pump and treat system would be installed that would include: five extraction wells operating at a rate of 125 gpm each, treatment with granular activated carbon and ion-
  exchange resin at five mobile treatment units, infiltration of the treated water via two infiltration trenches, and associated pipeline and power networks.
- A long-term groundwater monitoring plan would be implemented and optimized as required.

- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.
- Monitoring, reporting and site-closeout documentation would be completed.
- Contamination within the plume is expected to drop below the 2 µg/L MMCL for perchlorate by 2020 and reach background by 2035. RDX concentrations would decrease below the HA of 2 µg/L by 2018, the 10^{-6} ELCR risk-based level by 2020, and background by 2026.
- The total cost of Alternative 6 is estimated at $19,752,815.

Summary of the Comparative Analysis of Alternatives

The following discussion summarizes the strengths and weaknesses of each response action alternative identified for the J-1 Range Northern plume area with respect to the nine criteria:

Overall Protection of Human Health and the Environment: Alternative 1 provides the least protection of human health and the environment because it does not contain any land-use controls to ensure that future exposure (use of aquifer as a drinking water source) does not occur, or groundwater monitoring to confirm that RDX and perchlorate concentrations are or will decrease to cleanup levels. Alternative 2 adds provisions for long-term groundwater monitoring to confirm that contaminant concentrations eventually decrease to cleanup levels, and land-use controls to prevent exposure to contaminated groundwater above state and federal drinking water standards, Health Advisories and/or risk-based levels. Alternatives 3 through 6 add increasing degrees of active treatment designed to remove contaminant mass, reduce further movement of contaminants into uncontaminated portions of the aquifer, and reach cleanup levels more quickly (and with greater certainty) than Alternative 2. Alternative 6 involves the most extensive active treatment and therefore provides the most protection of human health and the environment.

Compliance with Regulations: All alternatives are expected to eventually result in compliance with applicable regulations. Alternatives 1 and 2 would meet chemical-specific regulations when contaminant concentrations decrease below the cleanup standards. Alternative 2 includes monitoring to confirm this occurs; Alternative 1 does not. Alternatives 3, 4, 5 and 6 include active treatment to ensure that applicable standards are met. Alternatives 2 through 6 would comply with location- and action-specific regulations. Alternative 1 involves no action; no location- or action-specific requirements apply.

Long-Term Effectiveness and Permanence: All alternatives are expected to provide long-term effectiveness and permanence. The groundwater contaminant concentrations will eventually reach cleanup levels, and the source areas have been removed so residual soil contamination is unlikely to compromise the permanence of the remedial alternatives once completed. Once groundwater cleanup levels are achieved, no containment systems or institutional controls will be needed.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives 1 and 2 are not treatment alternatives and, therefore, do not reduce toxicity, mobility, or volume through treatment. However, the toxicity and volume of the contaminated groundwater would be reduced through natural processes. Based on model predictions, Alternative 3 would remove 6.0 Kg (61%) of perchlorate and 2.1 Kg (55%) of RDX. Alternative 4 would remove 7.1 Kg (72%) of perchlorate and 2.5 Kg (66%) of RDX. Alternative 5 would remove 8.9 Kg (91%) of perchlorate and 2.3 Kg (60%) of RDX. Alternative 6 would reduce the toxicity, mobility and volume of perchlorate and RDX; however, it was not simulated in the groundwater model so mass capture can only be estimated.

Short-Term Effectiveness: Alternative 1 would have the least impact on workers and the environment because construction is minimal. Alternative 6 would have the greatest impact because of the large amount of construction involved. None of the alternatives are anticipated to have significant short-term impacts to the community since work is on-base. The time until protection is achieved would be the longest with Alternative 1. For Alternatives 2 through 6, land use controls would provide an immediate interim level of protection for each of those alternatives, but the time until cleanup levels are attained in groundwater would be longest with Alternative 2 and shortest with Alternative 6.

Implementability: None of the alternatives are limited by administrative feasibility. Alternative 1 is the most easily implemented alternative since it requires no further action other than abandoning groundwater monitoring wells and preparing close out documentation. Alternatives 3, 4, 5, and 6 are the most difficult alternatives to implement since they include the installation of extraction well(s), treatment facilities, new piping/power lines, and infiltration trench(es) in an environment with the potential for munitions and maintenance of systems down range from small arms firing ranges.

Cost: Alternative 1 is the least expensive alternative with a total estimated cost of $144,127, Estimated costs of the other alternatives are: Alternative 2 - $3,441,151, Alternative 3a - $12,439,320, Alternative 3b - $11,763,660, Alternative 4a - $13,057,684, Alternative 4b - $11,623,876, Alternative 5 - $14,935,898, and Alternative 6 - $19,752,815.

State Acceptance: This criterion is continually evaluated as MassDEP participates in all aspects of the evaluation and selection of a remedy. The MassDEP's official concurrence with the selected remedy is set forth in Appendix A.

Community Acceptance: Comments were received from 3 members of the public as part of the public comment period on the Remedy Selection Plan for the J-1 Range. See "Part III Responsiveness Summary" for more details.

<u>The Selected Response Action</u>

For the reasons set forth herein, EPA has identified Focused Extraction with Two Wells, Monitored Natural Attenuation and Land-use Controls as the appropriate response action for the J-1 Range Northern Plume Area (Figure 6). This alternative, as presented in the feasibility study, provides the best balance of the criteria used to evaluate cleanup alternatives.

The selected remedy can be viewed as a variation on Alternatives 4 and 5, with certain details (where wells are located, and when they are turned off) to be determined later. Like Alternatives 4 and 5, the proposed remedy consists of a 250 gpm focused extraction system (two extraction wells operated at a rate of 125 gpm each), treatment with granular

activated carbon and ion exchange resin at two mobile treatment units, and infiltration of the treated water via two infiltration trenches. The exact location of the extraction wells will be determined based on the most recent groundwater sampling data and will be optimized to achieve the best balance between efficiency, cleanup time, cost, implementability and environmental and worker impacts. The location of the treatment systems and pipeline will be based on the well locations.

The selected remedy achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the J-1 Range are correct and that any residual contamination remains below risk-based levels. The response actions taken to date to address soil and MEC are expected to have removed any unacceptable risks currently to groundwater. However, long-term groundwater monitoring will be conducted to verify the effectiveness of the soil and MEC response. Human health will be further protected through the implementation and verification of land-use controls. These controls will prevent use of contaminated portions of the aquifer at the J-1 Range northern plume area for drinking water, and maintain the integrity of any current or future groundwater monitoring wells and treatment systems until it is clear that contamination is reduced to below regulatory standards. In addition to continued groundwater monitoring and use of land-use controls, the Army will review this selected remedy every five years for purpose of evaluating the appropriateness of the remedy in providing adequate protection of human health. The focused extraction (with monitored natural attenuation and land-use controls) remedy includes:

- A 250 gpm pump and treat system would be installed that would include: two extraction wells operating at a rate of 125 gpm each, treatment with granular activated carbon and ion-exchange resin at two mobile treatment units, and infiltration of the treated water via two infiltration trenches.
- A long-term monitoring program that will be optimized as required as the plume attenuates.
- Land-use controls to prevent use of contaminated portions of the aquifer for drinking water, and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.

- Monitoring, reporting, and site close-out documentation.

The remedy is expected to achieve a perchlorate level of 2 µg/L between 2035 and 2037 and an RDX level of 0.6 µg/L between 2035 and 2047 as site contaminants in groundwater are reduced through treatment and natural processes.

J-1 Range Southern Plume Area Description of Alternatives

Alternative 1 – No Further Action: Alternative 1 provides for no further action to address any remaining groundwater contamination associated with the J-1 Range southern plume. Under this alternative:

- No active groundwater treatment would occur.
- Model predictions could not be verified due to discontinued groundwater sampling/analysis and abandonment of existing monitoring wells.
- Land-use controls would not be implemented to ensure against exposure until cleanup is achieved.
- Contamination within the plume is expected to drop below the 2 µg/L HA for RDX by 2032, the 10^{-6} ELCR risk-based level by 2050 and background after 2074.
- The total cost of Alternative 1 is estimated at $111,209.

Alternative 2 – Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs): Alternative 2 would provide long-term monitoring of groundwater until concentrations of contaminants within the plume reach risk-based levels. Under this alternative:

- A long-term monitoring program would be implemented and optimized as required.
- Land-use controls would be implemented to prevent use of contaminated portions of the
  aquifer for drinking water and maintain the integrity of any current or future groundwater
  monitoring wells and treatment systems.
- Monitoring, reporting and site close-out documentation would be completed.

- Contamination within the plume is expected to drop below the 2 µg/L HA for RDX by 2032, the 10^{-6} ELCR risk-based level by 2050, and background by 2074 due to natural processes.
- The total cost of Alternative 2 is estimated at $1,555,596.

Alternative 3 – Focused Extraction with One Well, Monitored Natural Attenuation and Land-Use Controls: Alternative 3 would provide for continued treatment of the plume via the existing extraction system. Under this alternative:

- The existing 45 gallons per minute (gpm) pump and treat system would continue to operate with one extraction well at the base boundary, treatment with granular activated carbon at a mobile treatment unit, and infiltration of the treated water via an infiltration trench.
- Long-term groundwater monitoring would continue and be optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.
- Monitoring, reporting and site-closeout documentation would be completed.
- Contamination within the plume is expected to drop below the 2 µg/L HA for RDX by 2032, the 10^{-6} ELCR risk-based level by 2048, and background levels after 2071.
- The total cost of Alternative 3 is estimated at $2,061,620.

Alternative 4 – Focused Extraction with Two Wells, Monitored Natural Attenuation and Land-Use Controls: Alternative 4 would provide for extraction and treatment of the groundwater. Under this alternative:

- A 125 gpm pump and treat system would be installed that would include continued operation of the existing extraction well located at the MMR boundary operating at a rate of 45 gpm, installation of a downgradient extraction well in the vicinity of Grand Oak Road in Forestdale operating at a rate of 80 gpm, treatment with granular activated carbon at the mobile treatment unit at the base boundary, a pipeline network, and infiltration of the treated water via two infiltration trenches.

- A long-term groundwater monitoring program would be implemented and optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.
- Monitoring, reporting and site-closeout documentation would be completed.
- Contamination is expected to drop below the 2 µg/L HA for RDX by 2019, the 10^{-6} ELCR risk-based level by 2024, and background by 2030.
- The total cost of Alternative 4 is estimated at $4,889,422.

Alternative 5 – Focused Extraction with Three Wells, Monitored Natural Attenuation and Land-Use Controls: Alternative 5 provides for extraction and treatment of the groundwater. Under this alternative:

- A 250 gpm pump and treat system would be installed that would include continued operation of the existing extraction well located at the MMR boundary operating at a rate of 45 gpm, installation of two additional extraction wells in Forestdale operating at a rate of 205 gpm, treatment with granular activated carbon at two mobile treatment units, a pipeline network, and infiltration of the treated water via two infiltration trenches.
- A long-term groundwater monitoring plan would be implemented and optimized as required.
- Land-use controls would be implemented to prevent the use of contaminated portions of the aquifer for drinking water and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.
- Monitoring, reporting and site-closeout documentation would be completed.
- Contamination is expected to drop below the 2 µg/L HA for RDX by 2018, the 10^{-6} ELCR risk-based level by 2022, and background by 2028.
- The total cost of Alternative 5 is estimated at $5,729,427.

Summary of the Comparative Analysis of Alternatives

The following discussion summarizes the strengths and weaknesses of each response action alternative identified for the J-1 Range southern plume area with respect to the nine criteria.

Overall Protection of Human Health and the Environment: Alternative 1 provides the least protection of human health and the aquifer because it does not contain any land-use controls to ensure that future exposure (use of aquifer for drinking water source) does not occur, or groundwater monitoring to confirm that RDX concentrations are or will be below regulatory standards. Alternatives 2 through 5 adds provisions for long-term groundwater monitoring to confirm model predictions and land-use controls to prevent exposure to contaminated groundwater above state and federal drinking water standards, Health Advisories and/or risk-based levels.

Compliance with Regulations: All alternatives are expected to eventually result in compliance with applicable regulations. Alternatives 1 and 2 would meet chemical-specific regulations when contaminant concentrations decrease below the cleanup standards by natural attenuation. Alternative 2 includes monitoring to confirm this occurs; Alternative 1 does not. Alternatives 3, 4 and 5 include active treatment to ensure that applicable standards are met. Alternatives 2 through 5 would comply with location- and action-specific regulations. Alternative 1 involves no action; so no location or action specific regulations apply.

Long-Term Effectiveness and Permanence: All alternatives are expected to provide long-term effectiveness and permanence; however, the timeframes differ. The source area has been removed so residual soil contamination is unlikely to compromise the permanence of the remedial alternatives once completed.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives 1 and 2 are not treatment alternatives and, therefore, do not reduce toxicity, mobility or volume through treatment. However, the toxicity and volume of the contaminated groundwater would be reduced through natural processes. Based on model predictions, Alternative 3

is predicted remove 0.08 Kg (11%) of RDX. Alternative 4 is predicted to remove 0.58 Kg (76%) of RDX. Alternative 5 is predicted to remove 0.56 Kg (73%) of RDX.

Short-Term Effectiveness: Alternative 1 would have the least impact on workers and the environment because construction is minimal. Alternative 5 would have the greatest short-term impact because of the construction involved. The time until protectiveness is achieved is longest under Alternatives 1 and 2 and shortest under Alternative 5, with Alternatives 3 and 4 in between.

Implementability: None of the alternatives are limited by administrative or technical feasibility. Alternative 1 is the most easily implemented alternative since it requires no further action other than abandoning groundwater monitoring wells and preparing close out documentation. Alternatives 2 and 3 are the next most easily implemented alternatives with groundwater monitoring, operations and maintenance of the existing pump and treat system (for Alternative 3) and land-use controls. Alternatives 4 and 5 would be the most difficult to implement since they require installation of extraction wells in a residential neighborhood.

Cost: Alternative 1 is the least expensive alternative with a total estimated cost of $111,209, Estimated costs of the other alternatives are: Alternative 2 - $1,55,596, Alternative 3 - $2,601,620, Alternative 4 - $4,889,422, and Alternative 5- $5,729,427.

State Acceptance: This criterion is continually evaluated as MassDEP participates in all aspects of the evaluation and selection of a remedy. The MassDEP's official concurrence with the selected remedy is set forth in Appendix A.

Community Acceptance: Comments were received from 3 member(s) of the public as part of the public comment period on the Remedy Selection Plan for the J-1 Range. See Part III: Responsiveness Summary for more details.

<u>The Selected Response Action</u>

For the reasons set forth herein, EPA has identified Alternative 4 (Focused Extraction with Two Wells, Monitored Natural Attenuation and Land-use Controls) as the

appropriate response action for the J-1 Range Southern Plume Area (Figure 7). This alternative, as presented in the feasibility study, provides the best balance of the criteria used to evaluate cleanup alternatives.

The selected remedy consists of a 125 gpm focused extraction system (the pre-existing extraction well on the base property and a new off-base extraction well operating at a combined total rate of 125 gpm), treatment with granular activated carbon at a mobile treatment unit, and infiltration of the treated water via two infiltration trenches. The exact location of the off-base extraction well will be determined based on the most recent groundwater sampling data and will be optimized to achieve the best balance between efficiency, cleanup time, cost, implementability and environmental and worker impacts. The location of the pipeline will be based on the well location.

The selected remedy achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the J-1 Range southern plume area are correct and that any residual contamination remains below risk-based levels. The response actions taken to date to address soil and MEC are expected to have removed any unacceptable risks currently to groundwater. However, long-term groundwater monitoring will be conducted to verify the effectiveness of the soil and MEC response. Human health will be further protected through the implementation and verification of land-use controls. These controls will prevent use of contaminated portions of the aquifer at the J-1 Range southern plume area for drinking water, and maintain the integrity of any current or future groundwater monitoring wells and treatment systems until it is clear that contamination is reduced to below regulatory standards. In addition to continued groundwater monitoring and use of land-use controls, the Army will review this selected remedy every five years for purposes of evaluating the appropriateness of the remedy in providing adequate protection of human health. The focused extraction (with monitored natural attenuation and land-use controls) remedy includes:

- A 125 gpm pump and treat system would be installed that would include: the pre-existing extraction well on the base property operating at 45 gpm and a new off-base extraction well operating at 80 gpm, treatment with granular activated carbon

at a mobile treatment unit, and infiltration of the treated water via two infiltration trenches.

- A long-term monitoring program that will be optimized as required as the plume attenuates.
- Land-use controls to prevent use of contaminated portions of the aquifer for drinking water, and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.
- Monitoring, reporting, and site close-out documentation.

K. RESPONSE ACTION IMPLEMENTATION

Plume Treatment and Monitoring

At the J-1 Range, the cleanup goals will be achieved through a combination of focused extraction and natural processes. The success of these processes to achieve regulatory standards will be confirmed through the development and implementation of approved, long-term groundwater monitoring plans. The long-term groundwater monitoring program will also verify that any possible remaining MEC will not pose a threat to groundwater. Optimization of the program will lead to changes that will be documented in the periodic monitoring reports.

If EPA determines, based on groundwater monitoring data, revised modeling, or other relevant information that plume migration is substantially different from the model predictions discussed in the J-1 Range RI/FS, the Army will conduct a detailed analysis to determine, as accurately as possible, the extent of the deviation. If EPA, in consultation with MassDEP, determines based on the results of the detailed analysis, that significant changes to the response action described in this Decision Document are warranted, such changes will be addressed in accordance with the "Modifications" section below.

Cleanup Levels

The cleanup level for RDX is the 10^{-6} risk-based level that results in an increased lifetime cancer risk of one in a million, currently 0.6 µg/L. The cleanup level for perchlorate is the 2 µg/L MMCL.

Land Use Controls

Contaminated groundwater at the J-1 Range currently poses an unacceptable risk to human health if used for drinking water purposes. Administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use, known as "Land Use Controls", must be established to avoid the risk of exposure to contaminated groundwater above regulatory standards, health advisories, and/or risk-based levels, and maintain the integrity of any current or future groundwater monitoring wells and treatment systems. The land use controls are needed until the groundwater contamination no longer poses an unacceptable risk.

The performance objectives of the land use controls are to:

- Prevent access to or use of the groundwater from the J-1 Range plume areas until the groundwater no longer poses an unacceptable risk, and

- Maintain the integrity of any current or future groundwater monitoring wells and treatment systems.

The land use controls will be implemented in the areas encompassing the J-1 Range contaminated groundwater plumes and surrounding areas to prevent risks from exposure to contaminated groundwater (Figure 8). The on-base areas of concern are controlled and operated by the Massachusetts National Guard in conjunction with the US Army (Army) which leases the land from the Commonwealth of Massachusetts. It is expected that these entities will operate and lease, respectively, the J-1 Range and the surrounding areas for the duration of the remedy specified in this Decision Document. As a result, the Army will coordinate with the Commonwealth of Massachusetts as it fulfills its responsibility to establish, monitor, maintain and report on the land use controls for the Site. Although there are no potential receptors in the path of the J-1 range plumes and all homes in the area are believed to have been connected to town water, an additional land use control will be necessary within the Town of Sandwich for the downgradient portion of the J-1 Range Southern Plume Area.

The land use controls will be maintained until either (1) the concentrations of RDX and/or

perchlorate in the groundwater are at levels that allow for unrestricted use and unlimited exposure, or (2) the Army, with the prior approval of the EPA, in consultation with MassDEP, modifies or terminates the land use control in question.

Specific Land Use Controls

The Army is responsible for ensuring that the following land use controls are established, monitored, maintained, reported on, and enforced as part of this final remedy to ensure protection of human health in accordance with SDWA § 1431(a) for the duration of the final remedy selected in this Decision Document. The Town of Sandwich has enforcement authority regarding the first land use control, which is applicable to the off-base portion of the J-1 Range southern plume. The Commonwealth of Massachusetts has enforcement authority regarding the second land use control. The Massachusetts Air National Guard and Massachusetts Army National Guard have enforcement authority regarding the third and fourth land use controls, which are applicable to the on-base portion of the plume. The Air Force has enforcement authority regarding the fifth land use control, which is applicable to the on-base portions of the Site.

1. The Sandwich Board of Health requires a permit for the installation and use of all new wells, including drinking water wells, irrigation wells, and monitoring wells. If a permit to install a drinking water well is approved, the Sandwich Board of Health will not approve the use of that well until its water has been tested and the Board of Health has determined that the water is potable. In addition, the Town of Sandwich has a moratorium on the drilling of new private drinking water and irrigation wells in areas within 200 feet of known groundwater contamination. The Town also prohibits the construction of new potable supply wells for new buildings if Sandwich Water District service is available. (Sandwich Water District service is available in areas downgradient of the J-1 Range and homes in that area are connected to town water.) The Sandwich Board of Health Water Well Regulations do not apply to use of existing drinking water wells and irrigation wells. To assist the Town of Sandwich in the implementation of this land use control, the Army will meet with the Sandwich Board of Health on an annual basis, or more frequently if needed, to provide and discuss

plume maps that document the current and projected location of the J-1 Range plume within the Town of Sandwich. While Figure 7 shows the current area of land use controls in the town, the Sandwich Board of Health may modify the areas where the Board of Health may require additional well testing, and this land use control will apply to such areas even if they differ from the area shown.

2. In addition to the Town of Sandwich Board of Health regulations, which generally apply to small water supply wells, existing land use controls also prevent the possible creation of a large potable water supply well. The MassDEP administers a permitting process for any new drinking water supply wells in Massachusetts that propose to service more than 25 customers or exceed a withdrawal rate of 100,000 gallons per day. This permitting process, which serves to regulate the use of the J-1 Range contaminated groundwater for any new withdrawals of groundwater for drinking water purposes, constitutes an additional land use control for these final remedies. This land-use control applies to both on-post and off-post areas. (Existing public water supply wells will remain subject to permits currently in place).

3. For on-post areas, a prohibition on new drinking water wells serving 25 or fewer customers has been established and placed on file with the planning and facilities offices for the Massachusetts Air and Army National Guard (major tenants at the MMR). The prohibition will be applied to future land-use planning per Massachusetts Air National Guard Instruction (ANGI) 32-1003, Facilities Board and Massachusetts Army National Guard Regulation 210-20, Real Property Development Planning for the Army National Guard.

4. For the on-post areas, the Massachusetts Air National Guard has administrative processes and procedures that require approval for all projects involving construction or digging/subsurface soil disturbance, currently set forth in Massachusetts Air National Guard Instruction 32-1001, Operations Management. This procedure is a requirement of the Massachusetts Army National Guard, by the Massachusetts Air National

Guard, through Installation Support Agreements. The Massachusetts Air National Guard requires a completed AF Form 103, Base Civil Engineer Work Clearance Request (also known as the base digging permit), prior to allowing any construction, digging, or subsurface soil disturbance activity. All such permits are forwarded to the Army for concurrence before issuance. An AF Form 103 will not be processed without a Dig Safe permit number (see next paragraph).

5. The Dig Safe program implemented in Massachusetts provides an added layer of protection to prevent the installation of water supply wells in the J-1 Range plume groundwater areas and to protect monitoring wells. This program requires, by law, anyone conducting digging activities (e.g., well drilling) to request clearance through the Dig Safe network. The Air Force at the MMR is a member utility of Dig Safe. The Camp Edwards Training Range and Impact Area, including the on-post portions of the J-1 Range plume areas, fall within the geographical area identified by the Air Force as a notification region within the Dig Safe program. Through the Dig Safe process, the Air Force will be electronically notified at least 72 hours prior to any digging within this area. The notification will include the name of the party contemplating, and the nature of, the digging activity. Upon receiving Dig Safe notification of any proposed digging activity on Camp Edwards (which includes the Training Range and Impact Area), the Air Force will promptly transmit the Dig Safe notification information to the Army with a copy to the Massachusetts National Guard MMR Environmental & Readiness Center (E&RC). The Army (or its designee) will promptly review each notification and if the digging activity is intended to provide a previously unknown water supply well, the Army (or its designee) will immediately notify the project sponsor (of the well drilling), the EPA, and the MassDEP in order to curtail the digging activity. If the Dig Safe notification indicates proposed work near monitoring wells, the Army (or its designee) will mark its components to prevent damage due to excavation. The extent of the Army's enforcement of this land use control does not address off-base parties failing to file a Dig Safe request or the improper processing of a notification; but if incidents do occur, the Army is

responsible for ensuring remedy integrity and, if necessary, repairing damage caused by third parties to the monitoring wells or treatment systems.

In the event that the Town of Sandwich fails to promptly enforce the first land use control, the Commonwealth of Massachusetts fails to promptly enforce the second land use control, the Massachusetts Air and Army National Guards fail to promptly enforce the third or fourth land use control, or the Air Force fails to promptly enforce the fifth land use control, the Army will act in accordance with the third to last paragraph in this section, headed "*Activities Inconsistent With Land Use Controls.*" Specifically, if the Army discovers that the party responsible for enforcing the identified land use control has failed to promptly enforce that land use control, then, as soon as practicable, but no later than 10 days after the Army becomes aware of this failure to promptly enforce the land use control, the Army will notify the EPA and MassDEP and initiate actions to address such failure. The Army will notify the EPA and MassDEP regarding how the Army has addressed or will address the breach within 10 days of sending the EPA and MassDEP notification of the breach. For purposes of this paragraph, "promptly enforce" means if the violation or potential violation is imminent or on-going, enforce to prevent or terminate the violation within 10 days from the enforcing agency's (i.e., the Town's, Commonwealth's, Massachusetts Air and Army National Guards', or Air Force's) discovery of the violation or potential violation; otherwise, enforce as soon as possible.

Private Wells

The land use controls are intended to prevent exposure to groundwater impacted by the J-1 Range plumes. However, to ensure that the land-use controls achieve the land-use controls performance objectives, the Army will take the following additional action with respect to the J-1 Range Site Southern Plume Area.
Within three years of the signing of this Decision Document, the Army will:

a. Document all private wells (i.e., non-decommissioned wells, including wells not currently in use) that are above or within the projected path of the J-1 Range southern plume.

b. Demonstrate and document that the private well is not capable of drawing contaminated groundwater originating from the southern plume, or test the private well for contamination and demonstrate the private well to be safe for human use. The Army will continue such testing, on an appropriate frequency as determined in coordination with the EPA, until the plume no longer presents a threat to that well as determined in coordination with EPA.

c. If the Army identifies a well containing COCs, the Army shall assess the risk that current and potential future non-drinking uses of such a well pose to human health. The Army shall submit a draft version of any such risk assessment to EPA for review and approval.

d. If neither b nor c is able to confirm that the identified well is safe for human use, the Army will offer the owner decommissioning of the well. If accepted, the Army will document such action with the Sandwich Board of Health. If the decommissioning is not accepted, the Army will take other steps to ensure protectiveness to include, but not be limited to, requesting assistance from the Sandwich Board of Health to issue health warnings to the property owner and any other person with access to the well (such as a lessee or licensee), offering bottled water (if well is used for drinking), or installing treatment systems on affected wells. In each instance, the Army shall submit a schedule subject to EPA concurrence, outlining and including time limitations for the completion of steps sufficient to prevent exposure to concentrations of contaminated groundwater from the Southern Plume Area plume having COCs in excess of cleanup levels.

Monitoring

Monitoring of the land use restrictions and controls will be conducted annually by the Army. The monitoring results will be provided annually in a separate report or as a section of another monitoring report, if appropriate, and provided to the EPA and MassDEP. The reports will be used in preparation of the Five-Year Review to evaluate the effectiveness of the final remedy.

The annual monitoring report, submitted to the regulatory agencies by the Army, will

evaluate the status of the land use controls and how any land use controls deficiencies or inconsistent uses have been addressed. The annual evaluation will address (1) whether the use restrictions and controls referenced above were put in place and effectively communicated, (2) whether the operator, owner, and state and local agencies were notified of the use restrictions and controls affecting the property, and (3) whether use of the property has conformed with such restrictions and controls and, in the event of any violations, summarize what actions have been taken to address the violations. In addition, the Annual Monitoring Report will include a discussion of the efforts undertaken during the past year to complete the tasks outlined in "*Private Wells*" above.

Operational Responsibilities and Liability

Upon approval by EPA, after consultation with MassDEP, the Army may transfer various operational responsibilities for land use controls (i.e., monitoring) to other parties, through agreements. However, the Army acknowledges its ultimate liability under the SDWA § 1431(a) for remedy integrity.

Activities Inconsistent With Land Use Controls

For any proposed land use change(s) that would be inconsistent with the land use control objectives or the final remedy, the Army will seek EPA review and concurrence at least 45 days prior to any proposed land-use change(s). In addition, if the Army discovers a proposed or ongoing activity that would be or is inconsistent with the land-use control objectives or use restrictions, or any other action (or failure to act) that may interfere with the effectiveness of the land use controls, it will address this activity or action as soon as practicable, but in no case will the process be initiated later than 10 days after the Army becomes aware of this breach. The Army will notify the EPA and MassDEP as soon as practicable, but no later than 10 days after the discovery of any activity that is inconsistent with the land use controls objectives or use restrictions, or any other action that may interfere with the effectiveness of the land use controls. The Army will notify the EPA and MassDEP regarding how the Army has addressed or will address the breach within 10 days of sending the EPA and MassDEP notification of the breach.

Ensuring Continued Maintenance of LUCs

The Army will provide notice to the EPA and MassDEP at least six months prior to relinquishing the lease to the J-1 Range Site so the EPA and MassDEP can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective land use controls. If it is not possible for the Army to notify the EPA and MassDEP at least six months prior to any transfer or sale, then the Army will notify the EPA and MassDEP as soon as possible, but no later than 60 days prior to the transfer or sale of any property, subject to land-use controls.

The Army will not modify or terminate land use controls or implementation actions, or modify land use without approval by the EPA, in consultation with MassDEP. The Army, in coordination with other agencies using or controlling the J-1 Range site shall obtain prior approval before taking any anticipated action that may disrupt the effectiveness of the land-use controls or any action that may alter or negate the need for land use controls. The Army will provide EPA and MassDEP 30 days' notice of any changes to the internal procedures for maintaining land-use controls which may affect the site.

Expected Outcomes of the Selected Responses

The response action objectives for groundwater associated with the Site are to restore the useable groundwater to its beneficial use, wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site; to provide a level of protection in the aquifer that takes into account that the Cape Cod Aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent ingestion and inhalation of groundwater containing COCs (perchlorate and RDX) in excess of federal Maximum Contaminant Levels, Health Advisories, DWELs, applicable State standards or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index.

The proposed remedy is expected to achieve permanent cleanup of COCs in groundwater. Specifically, for the Northern plume area, the remedy is expected to achieve a perchlorate level of 2 µg/L between 2035 and 2037 and an RDX level of 0.6 µg/L between 2035 and 2047, the 0.35 ug/L background level for perchlorate after 2050, and

the 0.25 ug/L background level for RDX between 2048 and 2059. For the Southern plume area, RDX is expected to decrease below 2 µg/L by 2019, below 0.6 µg/L by 2024, and below the 0.25 background level by 2030 as site contaminants in groundwater are reduced through treatment and natural processes.

Five-Year Reviews

In addition to annual reports on groundwater monitoring and verification of land-use controls, the groundwater response will be reviewed every five years. The purpose of the review is to revisit the appropriateness of the response in providing adequate protection of human health. The scope of the review will include, but is not limited to the following questions: is the response operating as designed; have any of the cleanup standards changed since finalization of this Decision Document; and is there any new information that would warrant updating the remedy. If appropriate, additional actions (including, if necessary, reopening this decision) may be required as a result of these reviews.

Modifications

Any significant changes to the response action described in this Decision Document will be documented in a technical memorandum in the Administrative Record. If the EPA, in consultation with MassDEP, believes that fundamental changes to the response action are necessary, the EPA will issue a proposed revised Decision Document and accept public comment on it before issuing a final, revised Decision Document.

Response Completion

The Massachusetts Military Reservation (MMR) groundwater plumes, including the J-1 Range plumes, are located within the Cape Cod sole-source aquifer. Subject to EPA approval, in consultation with MassDEP, the following three-step process will be implemented by the Army to achieve site closure.

(1) The plume will be monitored in accordance with an EPA-approved monitoring plan.
(2) In accordance with applicable EPA guidance, a cumulative, residual risk assessment(s) for all contaminants will be performed to determine if additional measures are necessary to achieve acceptable risk levels.
(3) Once acceptable levels have been achieved, the technical feasibility of additional

remediation to approach or achieve background concentrations will be evaluated.

In the event that a dispute arises regarding any of the determinations reached under the process outlined above, such dispute shall be resolved under the dispute resolution procedure of AO3.

L. DETERMINATIONS

The groundwater response actions selected for implementation at the J-1 Range site are consistent with the SDWA Section 1431(a), 42 USC § 300i(a), as amended, and with AO3.

The selected response actions are protective of human health, and will comply with applicable federal and state requirements, standards, MCLs, Health Advisories, and DWELS. The response actions will adequately protect human health and the sole source aquifer which constitutes a current and potential drinking water supply by eliminating, reducing, or controlling exposures to potential human receptors at the site through groundwater monitoring and institutional controls. In addition, the selected response actions includes a periodic review at a frequency not to exceed five years so that relevant data can be provided to EPA for purposes of determining whether additional measures are necessary for the protection of human health.

As required by AO3, the selected alternatives for the Site (Focused Extraction, Monitored Natural Attenuation and Land Use Controls for groundwater and no further action for source areas contributing to groundwater contamination) provides a level of protection to the aquifer underlying and downgradient of the Site commensurate with the aquifer's designation as a Sole Source Aquifer and a Potentially Productive Aquifer and is protective of human health. EPA's determination is related to unacceptable threats to the groundwater aquifer from the Site; however, by this Decision Document EPA is making no determination regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the Site.

M. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a Remedy Selection Plan for the selected alternatives set forth in Part II for the Site on August 2, 2010. EPA reviewed all written and verbal comments submitted during the public comment period. EPA determined that no significant changes to the response action, as originally identified in the Remedy Selection Plan, were necessary.

N. STATE ROLE

The MassDEP has reviewed the various alternatives and has concurred with the selected response actions. See Appendix A.

PART III: THE RESPONSIVENESS SUMMARY

On July 14, 2010, EPA published the remedy selection plan for the J-1 Range site which included the proposed remedies for the site and announced the public comment period on the proposed remedies. The EPA proposed Focused Extraction with Two wells, Monitored Natural Attenuation and land use controls as the remedies for the Northern plume area and Southern plume area of the site.

At the March 24, 2010 public meeting of the MMRCT and the SMB, held at Camp Edwards, MA, the Army gave a presentation on the remedy selection plan and the proposed remedy and answered questions from the teams.

In addition, the Army held a public hearing on the remedy selection plan on August 2, 2010 in Sandwich, MA. A public information session, along with a presentation on the remedy selection plan and EPA's proposed remedies were held prior to the opening of the public hearing. Local residents, officials, and news media representatives interested in site activities and cleanup decisions were invited to attend both meetings. Representatives from EPA, MassDEP, and Army were present.

The Army notified the public of the August 2, 2010 public meeting and announced the public comment period in a display ad placed in the July 23, 2010 editions of the *Cape Cod Times* and *Enterprise* newspapers, and display ads were placed in the July 30 2010 editions of these same newspapers to announce the public hearing and as a reminder of the public comment period.

The Army placed copies of the remedy selection plan for the J-1 Range in the Army's information repositories at the Bourne, Falmouth, and Sandwich, MA public libraries. The repository contains documents on the investigations and findings supporting selection of the response actions including the feasibility study for the sites and other relevant documents upon which EPA relied in selecting the proposed remedies. The remedy selection plan also was made available on the Army web site, which also contains the supporting documents and which offered a means of submitting public comments on the remedy selection plan.

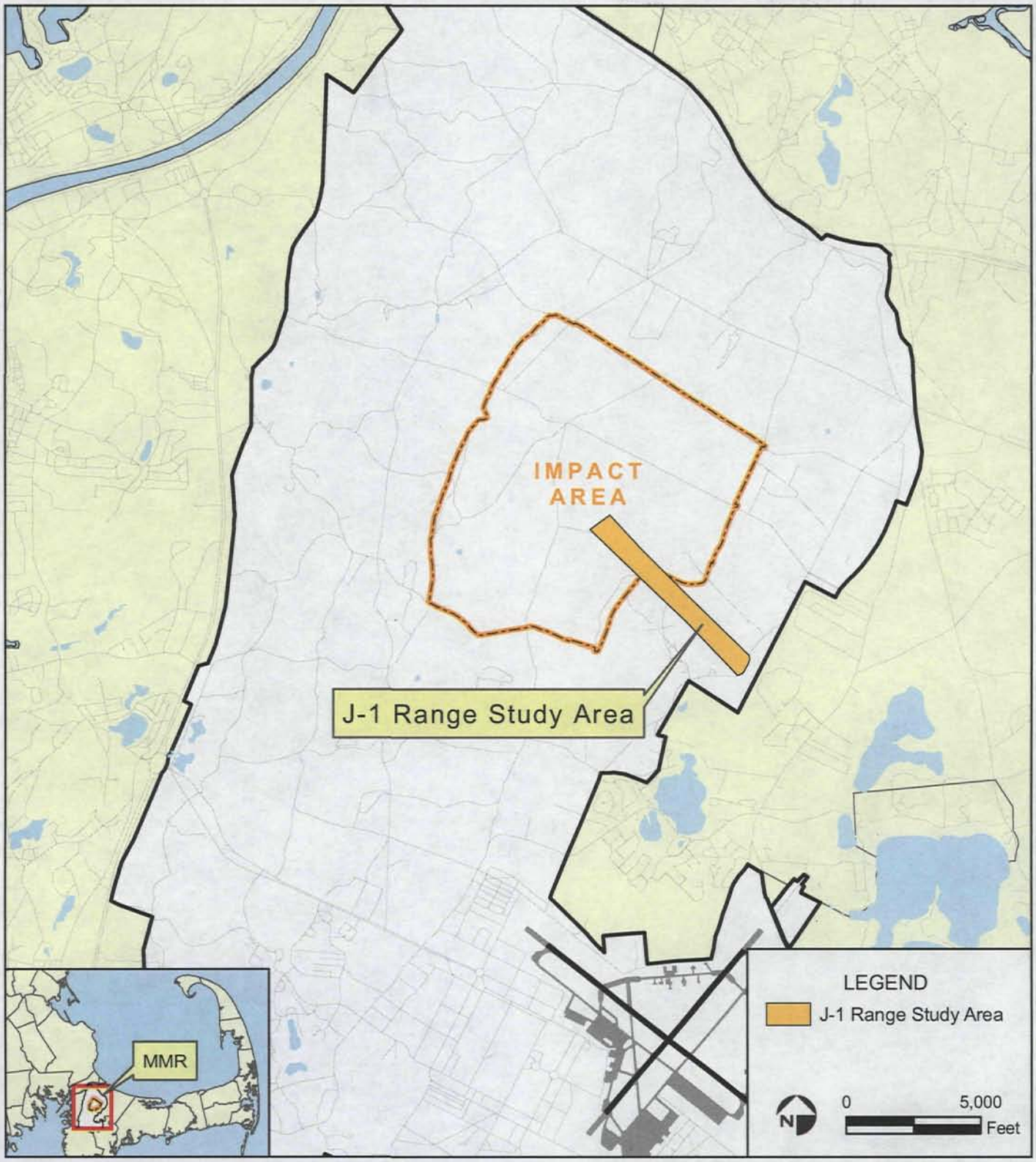
The following table provides a summary of issues and concerns that were raised during and after the public comment period held on the remedy selection plan for the J-1 Range Site from July 19 through August 17, 2010.

Comments:	Responses:
Comments from Ron Reif, P.E., MMRCT Member Dear EPA Region 1, My comments on the draft plan that is dated July 2010 are listed below. 1) Page 2, paragraph 1: 'The groundwater at the J-1 range has been contaminated by RDX and perchlorate.' This sentence should include more information about the levels of contamination relative to the respective standards for RDX and perchlorate. 2) Page 5, left column, 1st paragraph: This section states the RDX concentration 'as of 2009 is 14 ppb' and 'during the winter and spring of 2010 found RDX at 71 ppb.' This data is confusing and it is not clear how this data should be interpreted or compared, as the locations do not appear to be the same. It may be better to list the maximum concentrations obtained and the locations. If more data needs to be presented, a table should be considered that presents dates, maximum results, and sampling locations. 3) Page 5, Response Actions: The statement, 'Exhibited concentrations of explosives', is confusing. What does this mean relative to the soil standard or action level? 4) Page 5, right column: The 'liner' should be described, i.e., material, thickness. 5) Page 5, right column: This section discusses the use of alkaline hydrolysis to treat soil. Hopefully the treated soil was properly tested to ensure adequate treatment. The post-treatment soil results should be described. Where does the treated soil go? This should also be described. 6) Page 5, right column: 'UXO may remain in portions of the range that were not completely cleared.' The administrative controls should be	1) The groundwater cleanup levels are 2 ppb for perchlorate, and the concentration in drinking water that would be expected to cause an increased lifetime cancer risk of one in a million, which is currently 0.6 ppb, for RDX. Current and historic groundwater perchlorate and RDX concentrations exceed these cleanup levels. 2) The J-1 Range southern plume depictions and discussion in the Final J-1 Range RI/FS utilize the most recent validated results from wells sampled or boreholes advanced through 2009. The highest (most recent) RDX concentration in 2009 was 14 ug/L. An additional eight drivepoints were advanced in 2010 to further delineate the high-concentration core, and the eastern, downgradient, and upgradient extent of the plume along Grand Oak Road. Data from these drivepoints (obtained after the data cutoff for the RI/FS for risk screening purposes) encountered concentrations as high as 71 ppb. However, monitoring well data is not available to confirm this drive point finding. 3) The statement "exhibited concentrations of explosives" refers to concentrations detected above relevant cleanup standards. 4) The liner material is HDPE (40-mil), similar to that used to cap landfills. 5) After treatment, the soils were sampled to determine the effectiveness of treatment. Explosives compounds were detected in some samples from the treated soils but below relevant standards. This activity will be documented in a J-1 Range Source Remediation Report. The soils will be removed from the treatment cell and placed on the L Range. 6) EPA's determination is related to

described to address this remaining hazard, e.g., warning signs, access controls, etc. 7) Page 7, right column, Alternative 5: The description is not adequate to differentiate alternative 5 from 4a/b or to explain the $2-3 million dollar increase in costs. 8) Page 12, Implementability: Community noise levels and compliance with public noise standards should be factored into this evaluation, as this involves installation of pumps/motors in a neighborhood.	unacceptable threats to the groundwater aquifer from the Site; however, by this Decision Document EPA is making no determination regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the Site. That said, numerous controls exist on access to MMR in general, and particularly areas where UXO may pose a potential safety hazard, including: guarded gates at the road entrances to the reservation, perimeter fencing, locked gates on roads leading to range areas within the reservation and additional fencing around some ranges. The land lease also precludes the possibility of non-military development in range areas until at least 2051. Range Control signage and access rules strictly constrain access to range areas by military and civilian personnel. 7) Figure 9-1 of the J-1 Range Remedial Investigation/Feasibility Study makes the difference more clear. The primary difference is the location of the downgradient (northern) extraction well and hence the location of the pipeline and treatment plant. Alternative 5 has the well farther downgradient which increases the contaminant travel distance and time. Thus, the treatment system will need to operate longer. The longer the system operates the more it will cost over its operational lifetime. 8) The proposed system makes no audible noise during operation, since the only moving part is the pump which is 200 feet below grade. The only noise issue that arises is that produced during construction of the system, specifically the drilling of the extraction well boring, which will be similar to the noise levels produced during monitoring well installation in the area over the past 5 years. The entire construction phase is estimated to last 12 weeks.
Comment from Phil Goddard, MMRCT Member I support the suggested remedies for both the north and south plumes that install 2 wells. I do encourage the minimum disturbance of habitat and use of mobile treatment units wherever possible Thank you for the opportunity to comment.	The commenter's concurrence with the Remedy Selection Plan's proposed remedies for the site is noted. Habitat disturbance will be limited by flush cutting vegetation to the minimum extent necessary to construct the roadways and wellpads for the treatment systems. Root stock will be preserved. The selected alternatives for the northern and southern plumes include treatment at mobile treatment units.
Comments from Mr. and Mrs. James Janusas, Forestdale Residents	All components would be installed underground within the road right of way,

We are the resident owners of a house located at 24 Grand Oak Road. I am writing today regarding the Remedy Selection Plan for J-1 Range. Currently a monitoring well sits in the street directly in front of our property. We have reviewed the options under consideration and it appears that of the 5 alternatives for the southern plume, several will directly impact our property. If we are reading the information correctly, a pipe route and/or an extraction well area would be located in front of our house. We are very concerned about the implications of what this could mean to the aesthetic appeal of our house, and of course, the property value. Please can you provide us with more information regarding what would be involved in installing a pipe line (i.e. how long would construction take, what would be dug up, etc.) and also what is involved in an extraction well (i.e. is it below ground or above, what does it look like, how long is construction etc.) The investment in our house is of utmost importance to us; therefore, we are in favor of taking measures that correct the water pollution problems, providing that those measures are as unobtrusive as possible. We appreciate you taking time to reply to us. Thank you.	including the extraction well and associated monitoring wells, pipelines and power line. Once construction is complete the only visible sign of the system's presence would be a vault cover in the roadway, similar but slightly larger than a manhole cover, and a few monitoring wells, identical in appearance to the ones that have been installed in several roads in the neighborhood in recent years. Construction would take approximately three months and would likely include temporary closure of portions of Grand Oak Road (for up to a month) while the pipeline is being installed and tested. Any disturbed area will be restored on completion of construction. There will be no audible noise during system operation.

FIGURES



NOTES & SOURCES
Basemap data from US Geological Survey 7 1/2 minute Topographic Maps. Source: MassGIS

Impact Area Groundwater Study Program

Location of J-1 Range Study Area
Massachusetts Military Reservation

FIGURE
1

ECC GIS Server
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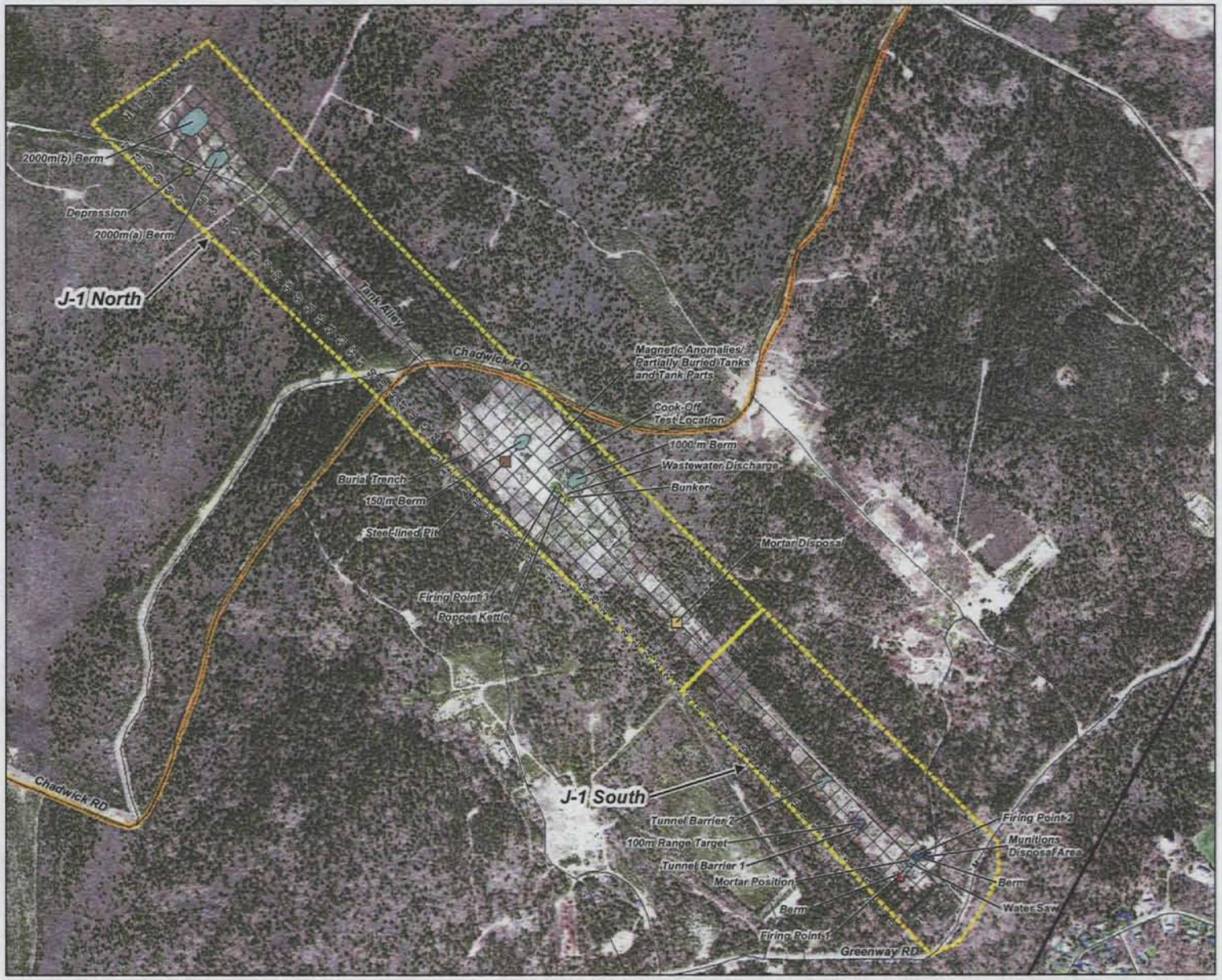
August 2010 REVD: JYK CHKD: PR (IAGWSP)

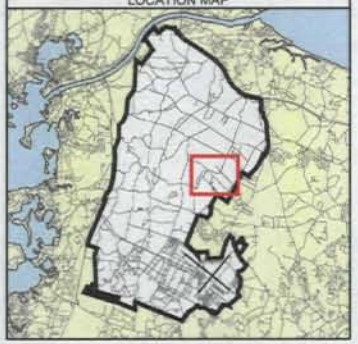


Impact Area Groundwater Study Program

LEGEND

- Depression
- Bunker
- Popper Kettle
- Wastewater Discharge
- Firing Point 3
- Steel-lined Pit
- Mortar Disposal
- 1000 m Range Firing Point
- 100m Range Target
- Firing Point 2
- Mortar Position
- Munitions Disposal Area
- Approx. Location of Water Saw
- Range Tower
- Berms
- Roads
- J-1 Soil RI Study Area Boundaries
- Impact Area Boundary
- J-1 Range Grids

LOCATION MAP



NOTES & SOURCES

Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG.

TITLE

J-1 Range Layout

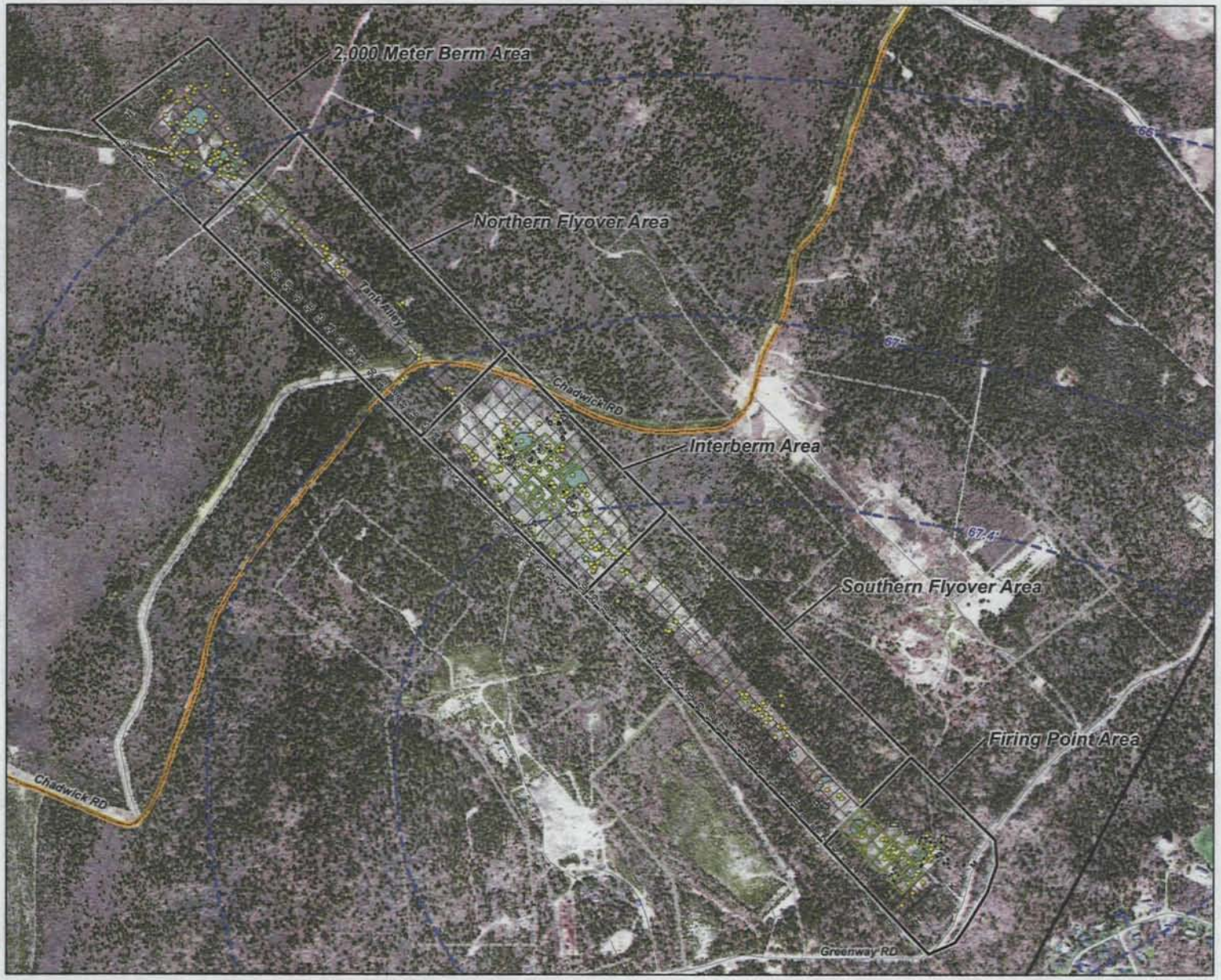
0 800 Feet

FINAL

ECC MMR
Cape Cod, Massachusetts

FIGURE 2

ECC GIS Server
C:\TERC_GIS\ART\J1Range_Fig2.mxd
August 2010 Drawn by JYK Checked by PR (IAGWSP)

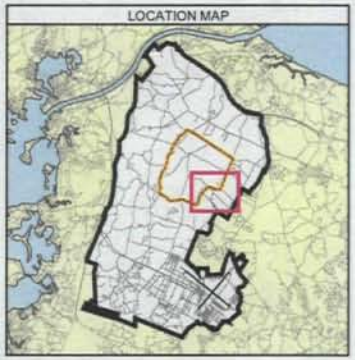


Impact Area Groundwater Study Program

LEGEND

- QC Target Grids
- Multiple Increment Sampling Grid
- Sample Location
- Existing Monitoring Well
- Groundwater Contours (2004)
- Roads
- J-1 Soil RI Study Areas (5)
- MSP Phase III Polygons
- Additional Polygons
- Berms
- Impact Area Boundary
- J-1 Range Grids
- Southeast Ranges Boundaries

LOCATION MAP



NOTES & SOURCES

Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG
Groundwater contours data from JEG

TITLE

J-1 Range Study Areas

0 800 Feet

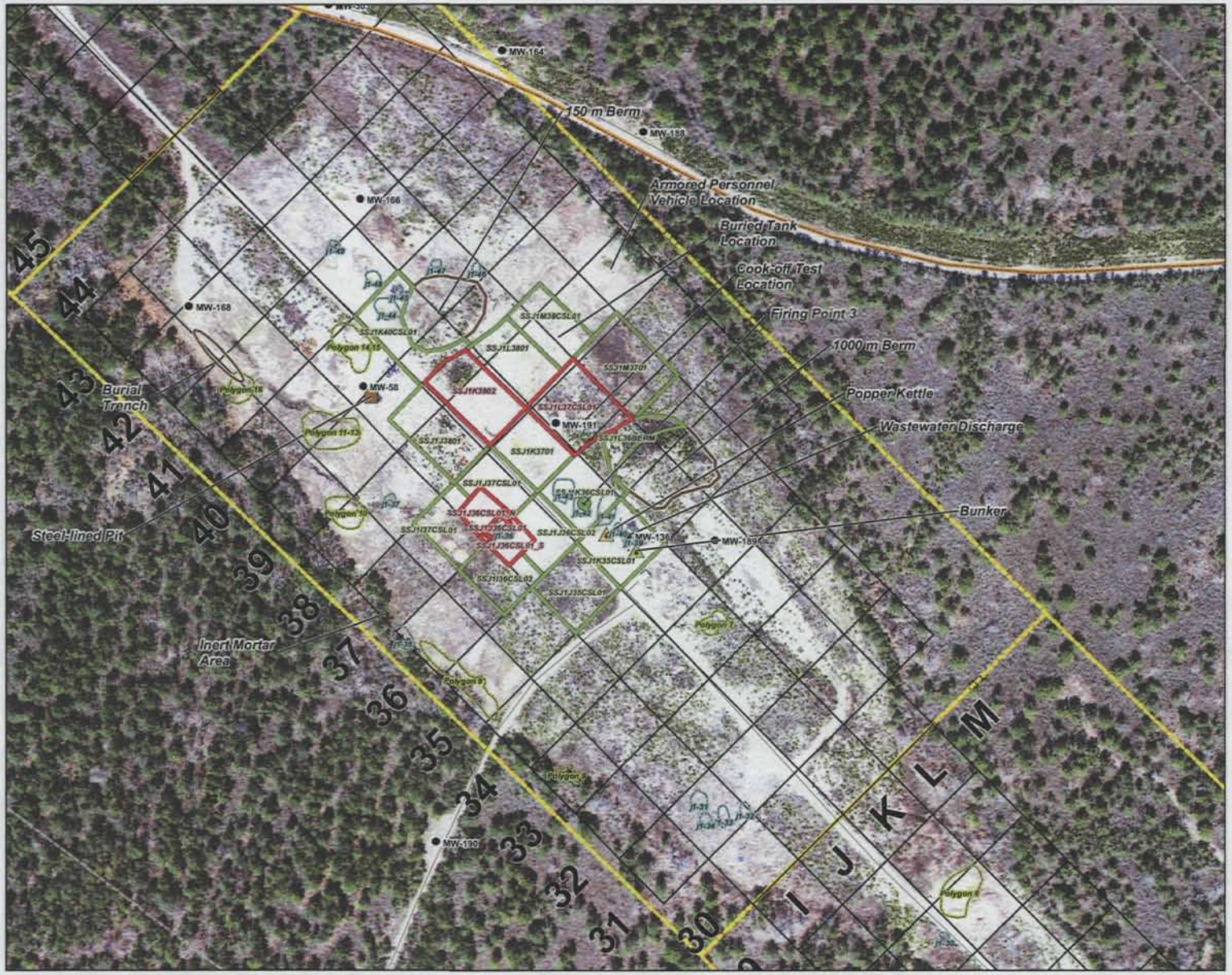
N

FINAL

ECC MMR
Cape Cod, Massachusetts

ECC GIS Server
C:\TERC_GIS\ART\1\Range_Fig3.mxd
August 2010 Drawn By JYK Checked by PR (IAGWSP)

FIGURE 3



Impact Area Groundwater Study Program

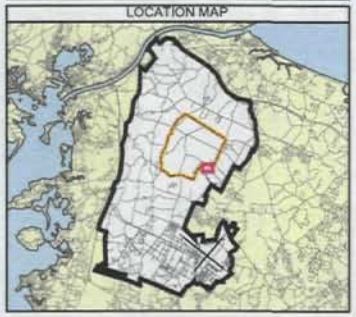
LEGEND

- Existing Monitoring Well

MIS Sampling Grids

- Excavated Grids
- Not Excavated Grids
- Berms
- MSP Phase III Polygons
- Additional Polygons
- Impact Area Boundary
- J-1 Range Grids
- J-1 Soil RI Study Area Boundaries

LOCATION MAP



NOTES & SOURCES

Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG

TITLE

J-1 Range Interberm Area (Rows 30 to 44) MIS Sampling Results

0 200 Feet

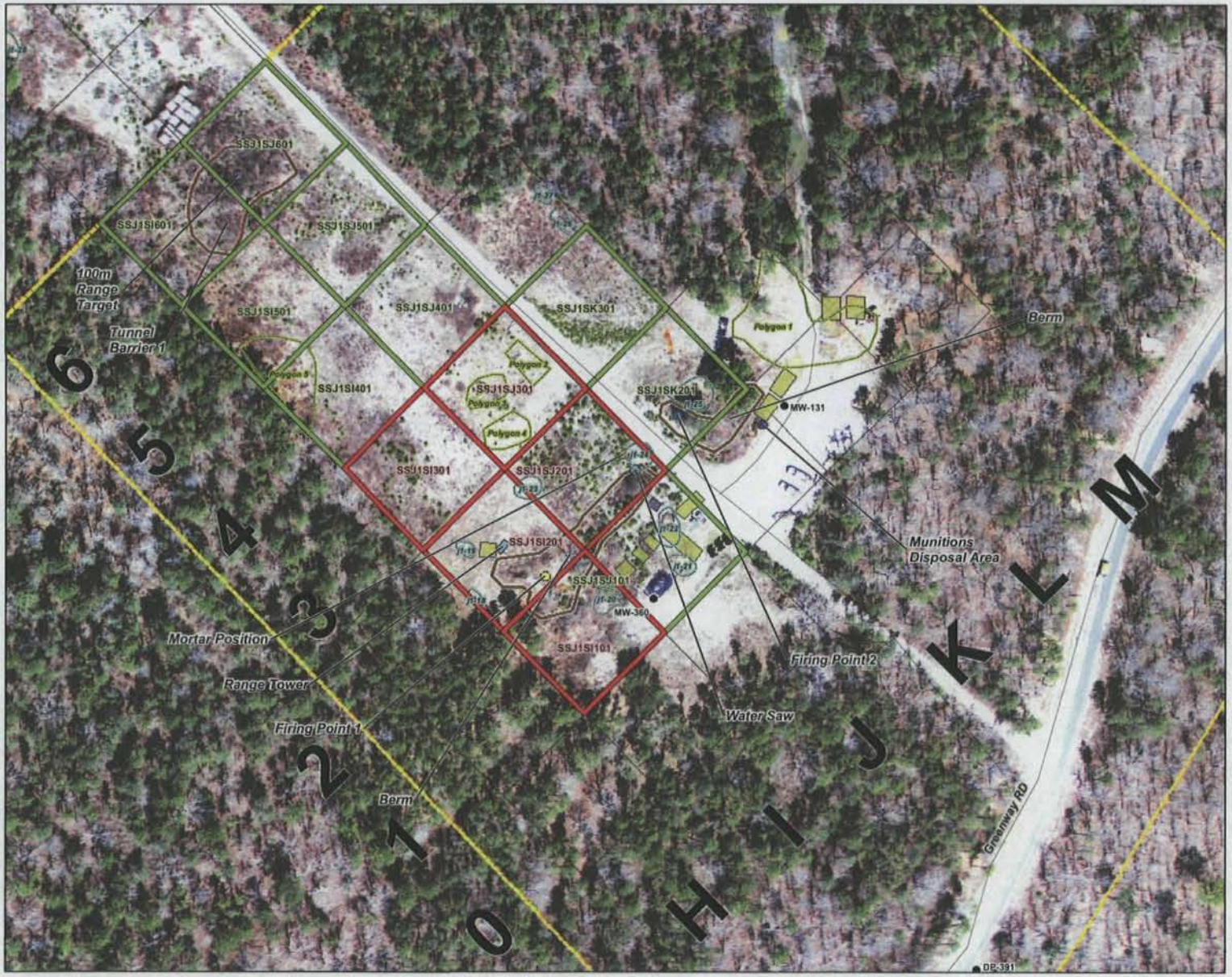
N

FINAL

ECC MMR
Cape Cod, Massachusetts

ECC GIS Server
C:\TERC_GIS\ART\J1DecisionDoc_Fig4.mxd
December 2010 Drawn By JYK Checked by PF

FIGURE 4



Impact Area Groundwater Study Program

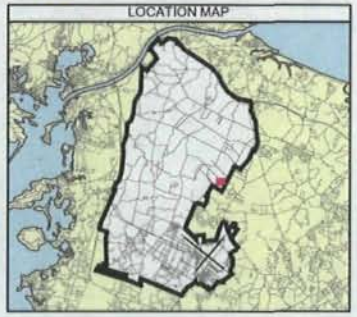
LEGEND

- Existing Monitoring Well

MIS Sampling Grids

- Excavated Grids
- Not Excavated Grids
- MSP Phase III Polygons
- Additional Polygons
- Approx. Location of Water Saw
- 1000 m Range Firing Point
- 100m Range Target
- Firing Point 2
- Mortar Position
- Munitions Disposal Area
- Berms
- Steel Plate
- Range Tower
- Former Buildings
- J-1 Range Grids
- J-1 Soil RI Study Area Boundaries

LOCATION MAP



NOTES & SOURCES

Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG

TITLE

J-1 Range Firing Point Area (Rows 0 to 6) MIS Sampling Results

0 100 Feet

N

FINAL

ECC MMR
Cape Cod, Massachusetts

ECC GIS Server
C:\TERC_GIS\ARTU1\DecisionDoc_Fig5.mxd
December 2010 . Drawn By JYK Checked by PF

FIGURE 5

Legend

- General Extraction Well Location
- Potential Pipe Route
- Alternate Potential Pipe Route
- Potential Infiltration Trench
- Alternate Potential Infiltration Trench
- Likely Location of Mobile Treatment Units
- RDX Plume (shown to 0.6 µg/L)
- Perchlorate Plume (shown to 2 µg/L)

Note: Depending on final locations of extraction wells, groundwater from the northern extraction well will be pumped either to the north or the south for treatment.

Location Map

N

0 700 Feet

Conceptual J-1 Northern Extraction Well Locations and Pipelines

M:\MMR\2010\J-1North\Figures\J-1Northern_PropSyst_120910.pdf
M:\MMR\2010\J-1North\MXDs\J-1Northern_PropSyst_062510.mxd
December 9, 2010 DWN: MTW CHKD: DLH

Impact Area Groundwater Study Program

FIGURE 6

Legend

- Monitoring Well
- Existing Extraction Well
- Existing Treatment System
- Existing Effluent Piping
- Existing Infiltration Trench
- Potential Extraction Well Area
- Potential Pipe Route
- RDX plume > 0.6 µg/L
- Area of highest RDX concentration
- J-1 Range Boundary
- MMR Boundary

Location Map

N

0 600 Feet

Conceptual J-1 Southern Extraction Well Location and Pipelines

M:\MMR\2010\J-1South\Figures\J-1Southern_PropSyst_120910.pdf
M:\MMR\2010\J-1South\MXDs\J-1Southern_PropSyst_062510.mxd
December 9, 2010 DWN: MTW CHKD: DLH

Impact Area Groundwater Study Program

FIGURE 7

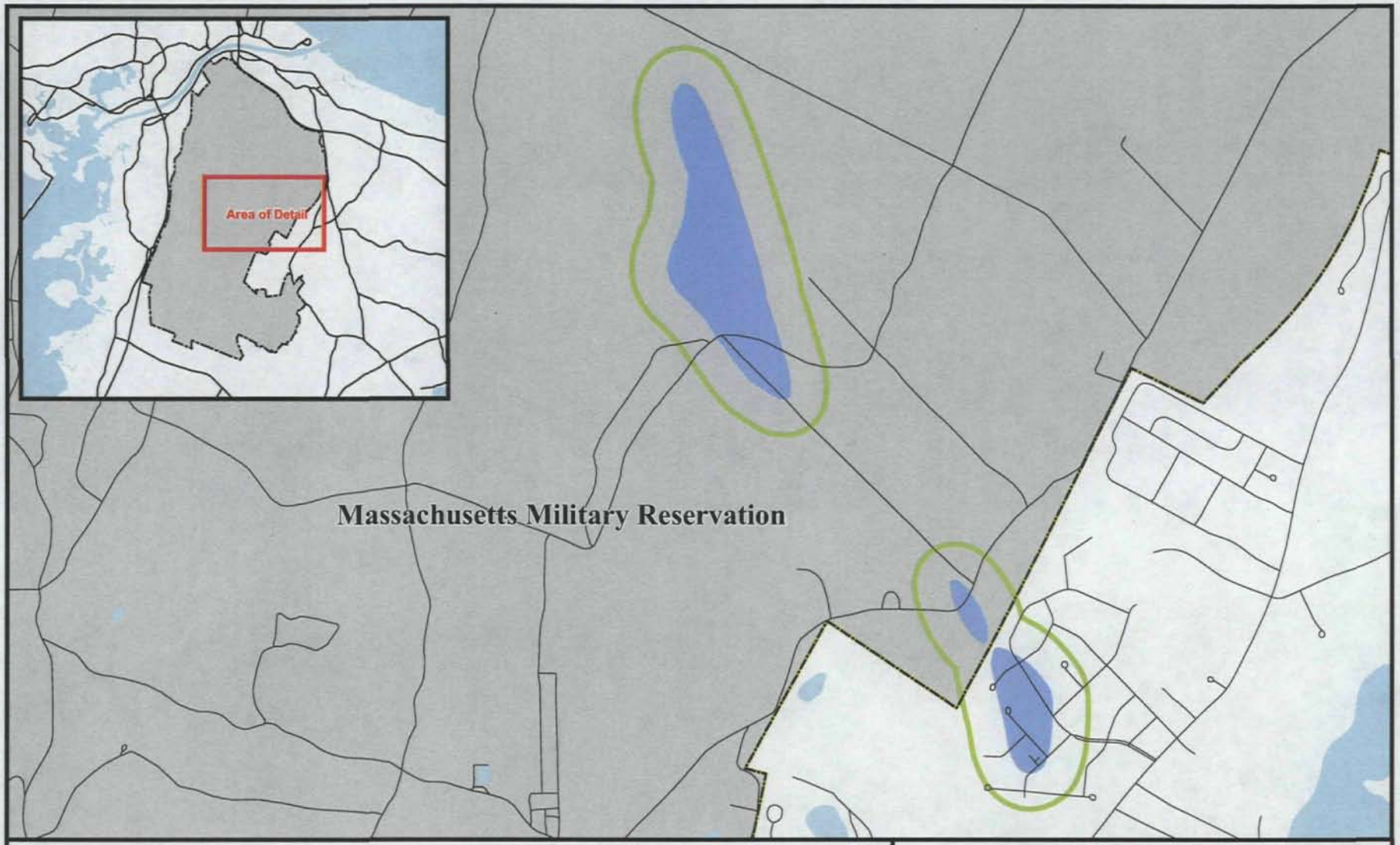


FIGURE 8

J-1 RANGE
2010 LAND USE CONTROL AREA

IAGWSP - Massachusetts Military Reservation

TABLES

TABLE 1
Summary of Alternatives

Northern Area								
Alternative	Design Details		Cleanup Timeframes					Cost
	Number of Extraction Wells	Total Extraction Rate (gpm)	Year Perchlorate Concentrations are Below 2 µg/L	Year Perchlorate Concentrations are Below Nondetect	Year RDX Concentrations are Below 2 µg/L	Year RDX Concentrations are Below 0.6 µg/L	Year RDX Concentrations are Below Nondetect	Total Cost
1	0	0	2080	>2109	2053	>2109	>2109	$144,000
2	0	0	2080	>2109	2053	>2109	>2019	$3,400,000
3a	1	125	2042	>2109	2038	2048	2057	$12,400,000
3b	1	125	2043	>2109	2040	2051	2061	$11,800,000
4a	2	250	2037	>2109	2027	2035	2048	$13,000,000
4b	2	250	2045	>2109	2031	2050	2096	$11,600,000
5	2	250	2035	2048	2037	2047	2059	$14,600,000
6	5	625	2020	2035	2018	2020	2026	$19,800,000

Southern Area						
Alternative	Design Details		Cleanup Timeframes			Cost
	Number of Extraction Wells	Total Extraction Rate (gpm)	Year RDX Concentrations are Below 2 µg/L	Year RDX Concentrations are Below 0.6 µg/L	Year RDX Concentrations are Below Nondetect	Total Cost
1	0	0	2032	2050	2074	$110,000
2	0	0	2032	2050	2074	$1,600,000
3	1	45	2032	2048	2071	$2,600,000
4	2	125	2019	2024	2030	$4,900,000
5	3	250	2018	2022	2028	$5,700,000

µg/L = micrograms per liter
gpm = gallons per minute

Table 2
J-1 Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
Federal/Chemical Specific	SDWA MCLs, 40 CFR 141.61 – 141.63	The EPA has promulgated SDWA MCLs (40 CFR 141-143) that are enforceable standards for public drinking water supplies. The standards protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health.
State/Chemical Specific	MA Drinking Water Regulations, 310 CMR 22.00	These standards establish Massachusetts MCLs (MMCLs) for public drinking water systems (310 CMR 22.00 et seq.).
Federal/Action Specific	SDWA 47 FR 30282 Sole Source Aquifer	Pursuant to Section 1424(e) of the Safe Drinking Water Act, the EPA has determined that the Cape Cod aquifer is the sole or principal source of drinking water for Cape Cod, Massachusetts, and that the Cape Cod aquifer, if contaminated, would create a significant hazard to public health.
Federal/Chemical Specific	Drinking Water Health Advisories, published at http://www.epa.gov/ waterscience/criteria/drinking/	These are exposure concentrations protective of adverse non-cancer effects for a given exposure period. The 1-day and 10-day HA are designed to protect a child; the lifetime HA is designed to protect an adult.
Federal/Chemical Specific	Drinking Water Equivalent Levels (DWELs), published at http://www.epa.gov/ waterscience/criteria/drinking/	DWELs set forth lifetime exposure concentration values protective of adverse, non-cancer health effects, assuming that all of the exposure to a contaminant is from drinking water.
Federal/Chemical Specific	Human Health Reference Doses (RfDs), Reference Concentrations (RfCs), Cancer Slope Factors (CSFs), and 10^{-6} excess lifetime cancer risk level	These risk-based concentrations are considered together with site-specific exposure information to develop concentrations of residual contamination that will not endanger human health.

Table 2
J-1 Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
State/Chemical Specific	Massachusetts Contingency Plan, Method 1, GW-1 Groundwater Standards, 310 CMR 40.0974(2) Table 1	These cleanup standards were developed by MassDEP considering a defined set of exposures considered to be a conservative estimate of the potential exposures at most sites. Groundwater at MMR is classified as GW-1.
State/Chemical Specific	Massachusetts Drinking Water Guidelines, in Standards and Guidelines for Chemicals in Massachusetts Drinking Waters (Spring 2009), available at http://www.mass.gov/dep/water/dwstand.pdf.	This document lists both promulgated Massachusetts MCLs and also MassDEP Office of Research and Standards guidelines for chemicals that do not have Massachusetts MCLs. Standards promulgated by EPA but not yet effective may be included on the Guidelines list. These values are derived based on a review and evaluation of all available data for the chemical of interest.
State/Action Specific	Massachusetts Surface Water Quality Standards, 314 CMR 4.00	These MassDEP standards prescribe the minimum water quality criteria required to sustain the designated uses of Massachusetts waters. The levels are designed to prevent all adverse health effects from ingestion, inhalation or dermal contact.
Federal/Action Specific	Subtitle C Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 CFR Part 264	These requirements establish minimum national standards that define the acceptable management of hazardous waste.
State/Action Specific	MA Hazardous Waste Management Regulations (310 CMR 30.0000)	These requirements specify how a generator of solid waste must determine whether that waste is hazardous. If waste is determined to be hazardous, it must be managed in accordance with these requirements.

Table 2
J-1 Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
Federal/Action Specific	EPA Guidance on "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" (9200.4-17P) (Apr. 21, 1999)	This guidance describes EPA's policy regarding the use of monitored natural attenuation (MNA) for the cleanup of contaminated soil and groundwater. It provides guidance regarding necessary site-specific characterization data and analysis, a methodology for determining a reasonable timeframe for remediation, a preference for remediation of sources, appropriate performance monitoring and evaluation, and a preference for contingency remedies.
Federal/Action Specific	Resource Conservation and Recovery Act (RCRA) [40 CFR 261 - 262]	These regulations govern the identification and listing of hazardous waste under RCRA, and the requirements on generators of hazardous waste.
Federal/Action Specific	RCRA Land Disposal Restrictions [40 CFR 268]	These regulations restrict the disposal of any treatment wastes classified as hazardous waste.
State/Action Specific	Solid Waste Management Regulations (RCRA Subtitle D), 310 CMR 19.000 et seq.	If a waste is determined to be a solid waste, it must be managed in accordance with the state regulations at 310 CMR 19.000 et seq.
Federal/Action Specific	Hazardous Waste Operations and Emergency Response, 29 CFR 1910.120	These regulations describe training, monitoring, planning, and other activities to protect the health of workers performing hazardous waste operations.
Federal/Action Specific	Underground Injection Control Program [40 CFR 114, 144, 146, 147, 148, 1000]	Underground Injection Control Program regulations outline minimum program and performance standards for underground injection wells and prohibit any injection that may cause a violation of any primary drinking water regulation in the aquifer. Infiltration galleries and wells fall within the broad definition of Class V wells. These regulations are administered by the State.

Table 2
J-1 Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
State/Action Specific	MassDEP Stormwater Management Program Policy (Nov. 18, 1996)	Provides policies and guidance on complying with the state's stormwater discharge requirements.
Federal/Action Specific	National Environmental Policy Act, 42 U.S.C. 4321-4370f	"EPA believes that NGB is not required to follow NEPA procedures, as long as the NGB's actions are conducted in accordance with the administrative order, because of the provision in the CEQ regulations exempting enforcement actions from NEPA." (USEPA, 1 March 01)
Federal/Action Specific	CWA NDPES Stormwater Discharge Requirements, 40 CFR 122.26	Establishes requirements for stormwater discharges associated with construction activities that result in a land disturbance of equal to or greater than one acre of land. The requirements include good construction management techniques; phasing of construction projects; minimal clearing; and sediment, erosion, structural, and vegetative controls to mitigate stormwater run-on and runoff.
State/Action Specific	Stormwater Discharge Requirements, 314 CMR 3.04 and 314 CMR 3.19	Requires that stormwater discharges associated with construction activities be managed in accordance with the general permit conditions of 314 CMR 3.19 so as not to cause a violation of Massachusetts surface water quality standards in the receiving surface water body (including wetlands).
State/Chemical Specific	Massachusetts Air Pollution Control Regulations [310 CMR 6.00 – 7.00]	Construction activities could trigger Massachusetts Air Pollution Control Regulations (310 CMR 6.00 – 7.00). These regulations set emission limits necessary to attain ambient air quality standards for fugitive emissions, dust and particulates.

Table 2
J-1 Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
State/Action Specific, Chemical Specific	310 CMR 40.0040 Construction and operation of a groundwater treatment plant	Regulations establish management procedures for remedial wastewater as well as the construction, installation, change, operation and maintenance of treatment works for Remedial Wastewater. Treatment works shall be inspected and the inspections documented. Treatment works shall be protected from vandalism and measures shall be taken to prevent system failure, contaminant pass through, interference, by-pass, upset, and other events likely to result in a discharge of oil and/or hazardous material to the environment.
State/Action Specific, Chemical Specific	Discharge of Groundwater 310 CMR 40.0045	Regulations restrict remedial wastewater discharge to the ground surface or subsurface and/or groundwater. Such a discharge should not erode or impair the functioning of the surficial and subsurface soils, infiltrate underground utilities, building interiors or subsurface structures, result in groundwater mounding within two feet of the ground surface, or result in flooding or breakout to the ground surface. The concentrations of all pollutants discharged must be below the Massachusetts Groundwater Quality Standards established by 314 CMR 6.0. The concentrations must also be below the applicable Reportable Concentrations established by 310 CMR 40.0300 and 40.1600.
State/Action Specific	Discharge of Groundwater 310 CMR 40.0300 and 310 CMR 40.1600	The MCP contains special provisions for the discharge of groundwater containing very low levels of oil or hazardous material. Groundwater containing oil and/or hazardous material in concentrations less than the applicable release notification threshold established by 310 CMR 40.0300 and 40.1600, can be discharged to the ground subsurface and/or groundwater only when following appropriate guidelines.

Table 2
J-1 Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
State/Action Specific	Groundwater Discharge Regulations [314 CMR 5.00]	Recharge of effluent from some treatment works requires a permit under Groundwater Discharge Regulations at 314 CMR 5.00 unless the exemption allowing for actions taken in compliance with MGL C. 21E and regulations at 40 CMR 40.00 applies. The effluent discharged must not exceed any Massachusetts Groundwater Quality Standards and effluent limitations in 314 CMR 5.10(3). For previous projects on MMR, the MassDEP has determined that effluent from any constructed treatment system is "conditionally exempt" from obtaining the permit provided that the applicable or relevant provisions of the MCP 310 CMR 40.0000 are complied with.
State/Action Specific	MassDEP Drinking Water Program, Private Well Guidelines (2008), available at http://www.mass.gov/dep/water/laws/prwellgd.pdf	These are guidelines concerning private well location, design, construction, development, water quality testing, operation, maintenance, and decommissioning.
State/Action Specific	Underground Injection Control [310 CMR 27.00]	These regulations prohibit injection of fluid containing any pollutant into underground sources of drinking water where such pollutant will, or is likely to, cause a violation of any state drinking water standard or adversely affect the health of persons.
State/Action Specific	STATE - MA Erosion and Sediment Control Guidelines for Urban and Suburban Areas (May 2003), available at http://www.mass.gov/dep/water/essec1.pdf	Provides guidance and best management practices regarding erosion and sediment control.

Table 2
J-1 Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
Federal/Action Specific	Archaeological Resources Protection Act, 16 U.S.C. §§ 470aa-ll, 43 CFR Part 7; Native American Graves Protection and Repatriation Act, 25 U.S.C. §§ 3001-3013, 43 CFR Part 10, National Historic Preservation Act, 16 U.S.C. §§ 470 et seq., 36 CFR Part 800; Massachusetts Historic Preservation Act, MGL ch. 9 §§ 26-27C; MGL ch. 7, § 38A; MGL ch. 38, §§ 6B-6C; 950 CMR 70-71.	These statutes and regulations provide for the protection of historical, archaeological, and Native American burial sites, artifacts, and objects that might be lost as a result of a federal construction project.
State/Action Specific	Massachusetts Endangered Species Act.	The Massachusetts Endangered Species Act provides that impacts to state-listed endangered or threatened species, or species of special concern or their habitats from actions are to be avoided, minimized, and/or mitigated.

*Regulations that EPA will either consider or require, as appropriate, in selecting and defining the remedial action as specified in the final decision document.

APPENDIX A
MASSDEP LETTER OF CONCURRENCE

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

One Winter Street Boston, MA 02108 • 617-292-5500

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

May 18, 2011

Mr. James T. Owens III, Director
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency, Region I
5 Post Office Square Suite 100
Boston, MA 02109-3912

RE: **BOURNE**
Release Tracking Number: 4-0015031
Massachusetts Military Reservation (MMR)
J-1 Range Operable Unit, Decision Document, Concurrence

Dear Mr. Owens:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the document entitled **"Decision Document J-1 Range Operable Unit"** (Decision Document), dated March 2011. The Decision Document presents the selected remedy for the source areas contributing to groundwater contamination and the groundwater contamination at and emanating from the J-1 Range Operable Unit, located on Camp Edwards at the Massachusetts Military Reservation (MMR). The J-1 Range is situated on the Sandwich, Massachusetts portion of Camp Edwards. The remedy was selected by the United States Environmental Protection Agency (USEPA) in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA), 42 USC §300i(a), as amended and Administrative Order No. SDWA-1-2000-0014 (AO3), which includes consideration of the substantive cleanup standards set forth under M.G.L. c. 21E and 310 CMR 40.0000, the Massachusetts Contingency Plan (MCP). The U.S. Army (Army) and the National Guard Bureau (NGB) are Respondents under USEPA AO3.

Groundwater

The J-1 Range groundwater contamination has been divided into two sub-areas, the J-1 North groundwater plume and the J-1 South groundwater plume. The selected remedy for both the J-1 North and J-1 South plumes consists of *Focused Extraction with Two Wells, Monitored Natural Attenuation (MNA), and Land-use Controls (LUCs)*. LUCs implemented by the Army/NGB will serve to control access to or use of the groundwater at the J-1 Range Operable Unit until the groundwater no longer poses an unacceptable risk to human health. Monitoring of the LUCs will be conducted annually by the Army/NGB. Additionally, the Army/NGB will submit an annual monitoring report to the regulatory agencies that will evaluate the status of the LUCs and state how any identified deficiencies and/or inconsistent uses have been addressed.

Environmental investigations conducted at the J-1 Range between 1997 and 2010 identified contamination in soil and groundwater resulting from past use as an anti tank and small arms range. From 1957 through the late 1980s, defense contractors used the J-1 Range for weapons testing. Explosives, propellant and munitions were burned and buried by defense contractors at the J-1 Range.

The explosive hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) and the oxidizer perchlorate were identified as the contaminants of concern (COCs) for the J-1 Range groundwater. Under the USEPA SDWA Administrative Orders, the MCP Method 1 GW-1 Standard (and Massachusetts Maximum Contaminant Level (MMCL)) of 2 µg/L is considered a substantive cleanup standard for perchlorate in groundwater used as drinking water. The USEPA RDX risk-based concentration in groundwater that results in an increased lifetime cancer risk of one in a million is 0.6 µg/L.

The J-1 North groundwater plume is defined by concentrations of perchlorate and RDX in the groundwater. There is no off-base exposure to the J-1 North groundwater plume since it is located entirely on and is heading towards the interior of the MMR. The current maximum concentrations in the J-1 North groundwater plume are 16.9 µg/L for RDX and 40.9 µg/L for perchlorate. The maximum historical detections were 32 µg/L for RDX in 2004 and 78 µg/L for perchlorate in 2008. Modeling predicts that the selected remedy will achieve a perchlorate level of 2 µg/L between 2035 and 2045 and an RDX level of 0.6 µg/L between 2047 and 2050 in the J-1 North plume. The J-1 South groundwater plume is defined by concentrations of RDX in the groundwater and has an on-base portion and an off-base portion. The on-base portion of the plume extends from the source area and terminates at the base boundary at an extraction well that was installed in 2007 to prevent further off-base migration of RDX. The off-base portion of the plume is located downgradient of the base boundary beneath a residential area. There is no off-base exposure to the plume since all the residences in the off-base area of the plume are connected to a municipal water supply. The current maximum RDX concentration in the J-1 South groundwater plume is 71 µg/L. The maximum historical concentration in the plume was 130 µg/L in 2006. Modeling predicts that the selected remedy will decrease RDX concentrations in the J-1 South plume to below 2 µg/L by 2019 and below 0.6 µg/L by 2024.

Soil /Source Areas

The selected remedy for the J-1 Range source areas to groundwater contamination is *No Further Action*. Response actions conducted by the Army pursuant to the USEPA Administrative Orders were focused only on the removal of Unexploded Ordnance (UXO), Munitions and Explosives of Concern (MEC) and contaminated soil at areas that were determined to be contributing sources to groundwater, such as at targets and disposal areas. Based on recent sampling results it was determined that no further action was necessary with regard to those source areas contributing to groundwater contamination. Soil contamination and UXO/MEC at the J-1 Range source areas contributing to groundwater contamination were adequately removed during historical investigations as well as during response actions conducted from 1997 through 2010. However, the J-1 Range includes additional areas of soil contaminated with explosives, perchlorate, semi-volatile organic compounds and metals associated with UXO/MEC, as well as areas where UXO/MEC may remain in or on the soil. Munitions fired at the J-1 Range consisted of various types of projectiles and ammunition, including practice and High Explosive (HE) projectiles and inert practice/test projectiles with live fuses. There are HE items currently remaining in areas of the J-1 Operable Unit that were not completely cleared. These items pose a current and potential future risk of injury resulting from an explosion and a release or threat of release to the environment due to corrosion of the munitions. In addition, contaminated soil associated with UXO/MEC remaining at the J-1 Range Operable Unit poses a current and potential future human health risk from dermal contact and ingestion as well as an ecological risk. Therefore, it is necessary to put into place clearly defined LUCs at the J-1 Range until such time that they are no longer needed to mitigate the risk posed by remaining soil contamination and UXO/MEC. On March 18, 2011, MassDEP met with the Camp Edwards Commander to discuss the establishment of LUCs for this purpose at the J-1 Range Operable Unit. MassDEP has provided a letter, dated May 18, 2011, to the Massachusetts

National Guard summarizing this discussion and identifying the additional actions MassDEP believes are necessary to develop LUCs for the J-1 Range Operable Unit. MassDEP will continue to work with the Massachusetts Army National Guard, the Environmental Management Commission and the Department of Fish and Game to establish and implement LUCs at the J-1 Range Operable Unit.

Determination

MassDEP concurs with the remedy proposed in the Decision Document for the J-1 Range Operable Unit which consists of *Focused Extraction with Two Wells, MNA and LUCs* for both the J-1 North and J-1 South plumes and *No Further Action* for the source areas contributing to groundwater. The selected remedy will ensure a sufficient and protective level of control for the J-1 Range Operable Unit such that none of the contamination associated with the J-1 Range groundwater will present a significant risk of harm to health, safety, public welfare or the environment during any foreseeable period of time. Moreover, the groundwater remedy has been designed to reduce the level of contaminants to background levels, consistent with MCP requirements. There may be additional areas associated with UXO/MEC on the J-1 Range Operable Unit which pose public safety risks, ecological risks, dermal contact risks, and/or soil ingestion risks. These potential risks are not addressed by this Decision Document, which was issued by the USEPA pursuant to Administrative Order No. SDWA-1-2000-0014 and Section 1431(a) of the SDWA, and which focuses on potential endangerment to the health of persons deriving from contaminants present in or likely to enter the underground source of drinking water. The USEPA is making no determination in this Decision Document regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the Site.

It is MassDEP's expectation that a robust long term monitoring program for the J-1 Range Operable Unit will be designed and implemented in accordance with the USEPA OSWER Directive 9200.4-17P, April 21, 1999, entitled *"Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites"* ("the OSWER Directive"). The MCP and the OSWER Directive require site-specific documentation to demonstrate that degradation or destruction of contaminants is the primary attenuation process. If it is demonstrated that dispersion and not degradation or destruction is the primary means of contaminant reduction for the groundwater at the J-1 Range Operable Unit, MassDEP will consider *Long-Term Monitoring* to be a component of the selected remedy, rather than MNA. The distinction between MNA and Long Term Monitoring does not affect MassDEP's concurrence with the selected remedy.

MassDEP's concurrence with the remedy selected by the USEPA set forth in the Decision Document is based upon representations made to MassDEP by the Army/NGB and assumes that all information provided is substantially complete and accurate. MassDEP reserves its authority under M.G.L. c. 21E, CERCLA, the MCP, the NCP and any other applicable law or regulation to require further response actions at the J-1 Range Operable Unit including, without limitation, additional investigation, remedial measures, and the implementation of LUCs. MassDEP will review relevant information as it becomes available to determine if additional investigative and/or remedial measures are necessary for the protection of public health, safety, welfare or the environment at the J-1 Range Operable Unit. This includes information acquired after the implementation of the groundwater remedy including, without limitation, new regulatory requirements or changes in the environmental conditions at the Site.

Please incorporate this letter into the Administrative Record for the J-1 Range Operable Unit. If you have any questions regarding this matter, please contact Leonard J. Pinaud, Chief, State & Federal Sites

Management Section at (508) 946-2871 or Millie Garcia-Serrano, Deputy Regional Director of the Bureau of Waste Site Cleanup at (508) 946-2727.

Sincerely,

Janine Commerford
Assistant Commissioner
Bureau of Waste Site Cleanup
Massachusetts Department of Environmental Protection

JC/lp/lm

File : 4-0015031 J-1 Range DD Letter 05-2011

Ec: Gary Moran, Deputy Commissioner
David Johnston, Acting Regional Director
Millie Garcia-Serrano, Deputy Regional Director
Leonard J. Pinaud, Chief, State & Federal Site Management Section
Rebecca Tobin, Regional Counsel
Mark Begley, Environmental Management Commission
Richard Lehan, Department of Fish and Game
Colonel Richard Crivello, Post Commander, HQ Camp Edwards
MassDEP Southeast Region
MMR Senior Management Board
MMR Plume Cleanup Team
Upper Cape Boards of Selectmen
Upper Cape Boards of Health

APPENDIX B
GLOSSARY OF TERMS AND ACRONYMS

2A-DNT	2-amino-4,6-dinitrotoluene, a breakdown product of the explosive TNT
4A-DNT	4-amino-2,6-dinitrotoluene, a breakdown product of the explosive TNT
AFCEE	U.S. Air Force Center for Engineering and the Environment
AO	Administrative Order
Background environmental	A background level is the concentration of a hazardous substance that represents the level of the substance in an undisturbed setting at or near the site.
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	Contaminant of Concern
DWEL	Drinking Water Equivalent Level
EPA	United States Environmental Protection Agency
ELCR	Excess Lifetime Cancer Risk
FS	Feasibility Study
ft	feet
HA	Health Advisory; EPA guidelines that represent the concentration of a chemical in drinking water that, given a lifetime of exposure, is not expected to cause adverse, non-cancerous, effects.
HMX compound	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, an explosives
IAGWSP	Impact Area Groundwater Study Program
IART	Impact Area Review Team
kettle hole	a depression in the ground surface that was formed during the last ice age from the melting of a remnant glacial ice block
LUC	Land Use Control
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level (Federally-promulgated)
MCP	Massachusetts Contingency Plan
MEC	Munitions and Explosives of Concern
mg/Kg	Milligrams per Kilogram
MMCL	Massachusetts Maximum Contaminant Level (State-promulgated)
MMR	Massachusetts Military Reservation

O&M	Operation and Maintenance
perchlorate	A water-soluble salt used as an oxidizer
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine / Royal Demolition Explosive, an explosive compound
RI/FS	Remedial Investigation/Feasibility Study
SDWA	Safe Drinking Water Act
SVOC	semi-volatile organic compound
TNT	Trinitrotoluene (an explosives compound)
ug/Kg	Micrograms per Kilogram
µg/L	Micrograms per Liter, a measure of concentration in liquid, e.g. one part of contaminant in one billion parts of water is 1 µg/L, or 1 microgram per liter
UXO	Unexploded Ordnance
VOC	volatile organic compound

APPENDIX C
INDEX OF KEY SUPPORTING DOCUMENTS

Final J-1, J-3 and L Ranges Interim Data Results Report, #1 3/29/2001

Draft J-1, J-3 and L Ranges Interim Data Results Report, # 2 9/01

Draft J-1, J-3, L Ranges Additional Delineation Report No. 1 5/02

Final J-1 Range North Interim Groundwater Monitoring Plan 4/3/2006

Final J-1 Range South RRA System PME Plan 10/25/2007

Draft J-1 Range Berms AFRL Technology Demonstration Project Note 4/2/2008

Final J-1 South Groundwater RRA Completion of Work Report 5/8/2008

Final J-1 Range North Source Area Sampling Project Note 11/18/2008

Final J-1 Range 2,4-Dinitrotoluene Delineation Project Note 3/19/2009

Final J-1 Range Soil Removal Activities Project Note 8/19/2009

On-Site Transport and Alkaline Hydrolysis Treatment Activities for J-1, J-2 and Former K Ranges Soils Project Note 5/4/2010

Draft J-1 Range Northern and J-1 Range Southern Annual 2009 Environmental Monitoring Report 5/29/2010

J-1 Range Targets 22 and 35 Soil Sample Collection and Grid K4 Anomaly Investigation Project Note 7/2/2010

Final J-1 Range North Plume Proposed Monitoring Wells Project Note 7/29/2010

Final J-1 Range RI/FS 7/2010

Final J-1 Range Remedy Selection Plan 7/2010

Draft Interim J-1 Range Source Remediation Report

APPENDIX D
SOIL AND GROUNDWATER SCREENING

Comparison of Maximum Concentrations in Groundwater to Screening Levels
Northern J-1 Range Plume

Analyte	Maximum Detected Concentration (µg/L)	Location of Maximum Concentration	Detection Frequency	Maximum Contaminant Level (µg/L)	EPA Chronic Health Advisory Level a (µg/L)	EPA Regional Screening Level for Tap Water (µg/L)	MCP GW-1 Standard (µg/L)
Acenaphthene	1.8	MW-187D	14/316	NA	NA	2200	20
Acetone	49	MW-166	296/773	NA	NA	22000	6300
Aldrin	0.044	MW-168M1	1/123	NA	0.2	**0.004**	0.5
C5-C8 Aliphatic Hydrocarbons	3200	MW-187D	2/2	NA	NA	NA	**300**
C9-C10 Aromatic Hydrocarbons	270	MW-187D	2/2	NA	NA	NA	**200**
C9-C12 Aliphatic Hydrocarbons	108	MW-187D	2/2	NA	NA	NA	700
C9-C18 Aliphatic Hydrocarbons	78	MW-187D	1/5	NA	NA	NA	700
Anthracene	0.4	MW-187D	8/316	NA	NA	11000	60
Benzene	1300	MW-187D	27/869	**5**	**100**	**0.41**	**5**
Benzo(a)anthracene	0.34	MW-188M1	1/316	**0.2** [b]	NA	**0.029**	1
Benzoic Acid	0.31	MW-188S	1/266	NA	NA	150000	NA
Benzyl Alcohol	7.3	MW-477M1	1/313	NA	NA	18000	NA
beta-BHC	0.0058	MW-168M1	1/123	NA	NA	0.037	NA
Bis(2-Ethylhexyl) Phthalate	14	MW-477M2	60/316	**6**	300	**4.8**	**6**
Bromodichloromethane	0.56	MW-430	1/869	80 [c]	100	**0.12**	3
Bromoform	0.59	MW-430	1/869	80 [c]	800	8.5	4
Bromomethane	4	MW-187D	3/869	NA	10	8.7	10
Carbon Disulfide	1	MW-477M1	14/869	NA	NA	1000	NA
Chloramben	0.31	MW-166M3	1/106	NA	100	550	NA
gamma-Chlordane	0.029	MW-166M3	1/123	2	10	NA	2
Chlorobenzene	4	MW-187D	10/869	100	NA	91	100
Chloroethane	47	MW-187D	53/869	NA	NA	21000	NA
Chloroform	4	MW-118M1	447/869	80 [c]	70	**0.19**	70
Chloromethane	75	MW-187D	61/869	NA	**30**	190	NA
Chrysene	0.42	MW-188M1	1/316	NA	NA	2.9	2
Dibenzofuran	0.51	MW-166M1	4/316	NA	NA	NA	NA
Dibromochloromethane	1.1	MW-430	7/869	80 [c]	60	**0.15**	2
1,4-Dichlorobenzene	0.2	MW-253M1	3/869	75	75	0.43	5
1,1-Dichloroethane	0.2	MW-187D	1/869	NA	NA	2.4	70
1,2-Dichloroethane	1	MW-187D	1/869	5	40	**0.15**	5
Dieldrin	0.032	MW-244S	3/123	NA	0.2	**0.0042**	0.1
Diethyl Phthalate	2.4	MW-244M1	5/316	NA	NA	29000	2000
Di-n-Butyl Phthalate	1.7	MW-187D	16/316	NA	NA	3700	NA
Di-n-Octylphthalate	0.8	MW-253M1	2/316	NA	NA	NA	NA
2,6-Dinitrotoluene	2.4	MW-326	22/1545	NA	5	**0.099**	NA
4-Amino-2,6-Dinitrotoluene	1.1	MW-191M2	6/1541	NA	NA	73	NA
2-Amino-4,6-Dinitrotoluene	0.8	MW-303	1/1541	NA	NA	73	NA
2,4-Diamino-6-Nitrotoluene	1.9	MW-168	8/1541	NA	NA	73	NA
Ethylbenzene	76	MW-187D	17/869	700	700	**1.5**	700
Fluoranthene	0.28	MW-188M1	1/316	NA	NA	1500	90
Fluorene	5.4	MW-187D	15/316	NA	NA	1500	30
2-Hexanone	8	MW-245	50/869	NA	NA	NA	NA
HMX	110	MW-191M2	202/1541	NA	400	1800	200
Methyl Ethyl Ketone	25	MW-192	243/643	NA	4000	7100	4000
Methyl Isobutyl Ketone	3	MW-192	21/869	NA	NA	2000	350
Methyl Tert-Butyl Ether	2.7	MW-188S	30/474	NA	NA	12	70
Methylene Chloride	0.4	MW-187D	1/869	5	500	4.8	5
2-Methylnaphthalene	20	MW-187D	16/316	NA	NA	150	**10**
2-Methylphenol	21	MW-477M1	3/316	NA	NA	1800	NA
4-Methylphenol	28	MW-477M1	5/316	NA	NA	180	NA

NA - Not Available

ug/L = milligrams per liter

Comparison of Maximum Concentrations in Groundwater to Screening Levels
Northern J-1 Range Plume

Analyte	Maximum Detected Concentration (µg/L)	Location of Maximum Concentration	Detection Frequency	Maximum Contaminant Level (µg/L)	EPA Chronic Health Advisory Level a (µg/L)	EPA Regional Screening Level for Tap Water (µg/L)	MCP GW-1 Standard (µg/L)
Naphthalene	86	MW-187D	22/316	NA	100	**0.14**	140
Nitrobenzene	0.34	MW-06	2/1545	NA	NA	**0.12**	NA
N-Nitrosodiphenylamine	0.76	MW-187D	2/316	NA	NA	14	NA
2-Nitrotoluene	1.5	MW-401	3/1541	NA	NA	**0.31**	NA
3-Nitrotoluene	1.3	MW-349	3/1541	NA	NA	730	NA
Pentachlorophenol	0.13	MW-59M2	1/318	1	30	0.56	1
Perchlorate	66	MW-346	152/947	NA	15	**26**	**2**
Phenanthrene	3.7	MW-187D	14/316	NA	NA	NA	40
Phenol	5.3	MW-477M1	13/316	NA	2000	11000	1000
Picric Acid	3.5	MW-06	1/1535	NA	NA	NA	NA
Pyrene	0.42	MW-188M1	1/316	NA	NA	1100	80
RDX	58	MW-164	384/1539	NA	**2**	**0.61**	**1**
Tetrachloroethene	0.6	MW-126	3/869	5	10	**0.11**	5
Tetryl	0.71	MW-164M2	1/1541	NA	NA	150	NA
Toluene	320	MW-187D	55/869	1000	NA	2300	1000
1,2,4-Trichlorobenzene	0.4	MW-126	3/865	70	70	8.2	70
Trichloroethene	0.5	MW-168M1	7/869	5	300	1.7	5
1,3,5-Trinitrobenzene	0.66	MW-245	4/1541	NA	NA	1100	NA
2,4,6-Trinitrotoluene	47	MW-59	5/1541	NA	**2**	**2.2**	NA
Vinyl Chloride	0.9	MW-192	5/869	2	2	**0.016**	2
m,p-Xylene (Sum Of Isomers)	1.7	MW-187D	2/315	10000	NA	1400	10000
o-Xylene (1,2-Dimethylbenzene)	2.1	MW-187D	1/315	10000	NA	1400	10000
Xylenes, Total	150	MW-187D	19/869	10000	NA	200	10000
Inorganics (Total)							
Aluminum (Total)	5750	MW-168M1	34/135	NA	NA	37000	NA
Antimony (Total)	6.6	MW-253M1	3/140	**6**	**6**	15	**6**
Arsenic (Total)	5.3	MW-187D	4/135	10	**2**	**0.045**	10
Barium (Total)	52	MW-189S	63/135	2000	NA	7300	2000
Beryllium (Total)	1.1	MW-26	6/135	4	NA	73	4
Boron (Total)	121	MW-166M2	79/133	NA	1000	7300	NA
Cadmium (Total)	3.1	MW-26	3/135	5	5	18	5
Calcium (Total)	10000	MW-58S	135/135	NA	NA	NA	NA
Chloride	37700	MW-187D	126/126	NA	NA	NA	NA
Chromium (Total)	3.3	MW-168M1	8/135	100	NA	110	100
Cobalt (Total)	3.8	MW-168M3	15/135	NA	NA	11	NA
Copper (Total)	41.6	MW-168M2	15/135	1300	NA	1500	NA
Cyanide	55.3	MW-164M3	1/123	200	200	730	200
Iron (Total)	8080	MW-187D	45/135	NA	NA	26000	NA
Lead (Total)	3	MW-168M1	6/135	15	NA	NA	15
Magnesium (Total)	5070	MW-187D	135/135	NA	NA	NA	NA
Manganese (Total)	344	MW-126M1	122/135	NA	**300**	880	NA
Molybdenum (Total)	4.6	MW-187D	18/133	NA	40	180	NA
Nickel (Total)	7.8	MW-168M3	42/135	NA	100	730	100
Nitrogen, Nitrate-Nitrite	5200	MW-166M3	90/129	**1000** [d]	NA	58000	NA
Phosphorus, Total Po4	400	MW-168M1	52/129	NA	NA	NA	NA
Potassium (Total)	8660	MW-188S	110/135	NA	NA	NA	NA
Selenium (Total)	5.1	MW-126S	3/135	50	50	180	50
Silver (Total)	2	MW-187D	4/135	NA	100	180	100
Sodium (Total)	27100	MW-187D	133/135	NA	NA	NA	NA
Sulfate	9700	MW-187D	127/127	NA	NA	NA	NA

NA - Not Available

ug/L = milligrams per liter

Comparison of Maximum Concentrations in Groundwater to Screening Levels
Northern J-1 Range Plume

Analyte	Maximum Detected Concentration (µg/L)	Location of Maximum Concentration	Detection Frequency	Maximum Contaminant Level (µg/L)	EPA Chronic Health Advisory Level a (µg/L)	EPA Regional Screening Level for Tap Water (µg/L)	MCP GW-1 Standard (µg/L)
Thallium (Total)	7.3	MW-58S	4/141	**2**	**0.5**	**2.4**	**2**
Tungsten	4	MW-164M2	4/4	NA	NA	NA	NA
Vanadium (Total)	8.2	MW-168M1	7/135	NA	NA	260	30
Zinc (Total)	237	MW-188S	58/135	NA	2000	11000	5000
Radionuclides							
Gross Alpha e	3.2	MW-168M1	4/88	15	15	NA	NA
Gross Beta e	7.1	MW-188S	56/56	15	15	NA	NA

(a) When applicable, the more conservative of the lifetime health advisories or 10^{-4} cancer risk levels was used.

(b) Benzo(a)pyrene (PAHs) value used as a surrogate.

(c) Total trihalomethanes value used as a surrogate.

(d) Nitrite value used as a surrogate.

(e) Units for the radionuclides are in picocuries per liter (pCi/L). The MCL and Health Advisory Level are based on alpha particles.

Highlighting indicates those criteria that have been exceeded and will be discussed further within the report

NA - Not Available

ug/L = milligrams per liter

Comparison of Maximum Concentrations in Groundwater to Screening Levels
Southern J-1 Range Plume

Analyte	Maximum Detected Concentration (µg/L)	Location of Maximum Concentration	Detection Frequency	Maximum Contaminant Level (µg/L)	EPA Chronic Health Advisory Level [a] (µg/L)	EPA Regional Screening Level for Tap Water (µg/L)	MCP GW-1 Standard (µg/L)
Acetone	20	MW-360	24/54	NA	NA	22000	6300
bis(2-ethylhexyl)phthalate	0.36	MW-131M1	2/21	6	300	4.8	6
Carbon disulfide	0.24	MW-398M1	3/61	NA	NA	1000	NA
Chlorobenzene	0.34	MW-360M2	2/61	100	NA	91	100
Chloroethane	2	MW-131	5/61	NA	NA	21000	NA
Chloroform	3	MW-131S	33/61	80 [b]	70	**0.19**	70
P,P'-DDT	0.017	MW-131S	1/9	NA	NA	0.2	0.3
2,6-Dinitrotoluene	0.41	DP-379	1/343	NA	5	37	NA
Ethylbenzene	0.6	MW-131	2/61	700	700	1.5	700
Heptachlor epoxide	0.0059	MW-131M2	1/9	0.2	0.4	0.0074	0.2
HMX	29	DP-384	23/343	NA	400	1800	200
Methyl ethyl ketone	24	MW-131	11/39	NA	4000	7100	4000
Methyl isobutyl ketone	18	MW-131	3/61	NA	NA	2000	350
Methyl tert-butyl ether	0.51	MW-360M1	1/39	NA	NA	12	70
4-Nitotoluene	0.33	MW-398	1/343	NA	NA	4.2	NA
Perchlorate	1.4	MW-403	3/300	NA	15	26	2
RDX	290	DP-384	38/343	NA	**2**	**0.61**	**1**
Toluene	0.24	MW-360M1	1/61	1000	NA	2300	1000
2,4,6-Trinitrotoluene	0.36	MW-360	1/343	NA	2	2.2	NA
Xylenes, total	2	MW-131	3/61	10000	NA	200	10000
Inorganics (Total)							
Aluminum, total	5120	MW-131M1	6/9	NA	NA	37000	NA
Arsenic, total	5	MW-131M2	2/9	10	**2**	**0.045**	10
Barium, total	23.6	MW-131M1	8/9	2000	NA	7300	2000
Beryllium, total	0.12	MW-131M2	1/9	4	NA	73	4
Boron, total	20.1	MW-131S	3/9	NA	1000	7300	NA
Calcium, total	9150	MW-131M2	9/9	NA	NA	NA	NA
Chloride	13100	MW-131S	9/9	NA	NA	NA	NA
Chromium, total	5.1	MW-131M1	2/9	100	NA	110	100
Cobalt, total	2.5	MW-131S	1/9	NA	NA	11	NA
Copper, total	11.2	MW-131M1	2/9	1300	NA	1500	NA
Iron, total	5790	MW-131M1	7/9	NA	NA	26000	NA
Lead, total	4.1	MW-131M1	1/9	15	NA	NA	15
Magnesium, total	3120	MW-131M2	9/9	NA	NA	NA	NA
Manganese, total	180	MW-131M2	9/9	NA	300	880	NA
Nickel, total	7.4	MW-131S	5/9	NA	100	730	100
Nitrogen, Nitrate-Nitrite	17	MW-131M1	1/9	1000	NA	58000	NA
Phosphorus, total	170	MW-131M2	6/9	NA	NA	NA	NA
Potassium, total	2650	MW-131M2	9/9	NA	NA	NA	NA
Selenium, total	3.7	MW-131M1	1/9	50	50	180	50
Sodium, total	9540	MW-131M2	9/9	NA	NA	NA	NA
Sulfate	14800	MW-131M2	9/9	NA	NA	NA	NA
Vanadium, total	12.7	MW-131M1	4/9	NA	NA	260	30
Zinc, total	25.6	MW-131M1	8/9	NA	2000	11000	5000
Radionuclides							
Gross Beta [c]	2	MW-131M2	8/8	15	15	NA	NA

(a) When applicable, the more conservative of the lifetime health advisory or 10^{-4} cancer risk levels was used.

(b) Total trihalomethanes value used as a surrogate.

(c) Units for the radionuclides are in picocuries per liter (pCi/L). The MCL and Health Advisory Level are based on alpha particles.

Highlighting indicates those criteria that have been exceeded and will be discussed further within the report

NA - Not Applicable

ug/L = milligrams per liter

Comparison of Maximum Concentrations in Soil to Screening Levels
Firing Point Area (Rows 0 to 2, Columns H, I, J, and K)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (4) (mg/kg)	MADEP (5) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
Acetone	0.084	SS15147-A	5/10	0.026	Yes	6	6.3	0.11	4.4	NA
Benzo(a)Anthracene	0.056	SS15147-A	1/22	0.048	Yes	7	NA	0.037	**0.014**	2
Benzo(a)Pyrene	0.02	SS05PA	1/22	0.045	No	2	NA	0.20	**0.46**	2
Benzo(b)Fluoranthene	0.066	SS15147-A	4/22	0.057	No	7	NA	0.11	**0.047**	2
Benzo(k)Fluoranthene	0.053	SS15147-A	4/22	0.048	No	70	NA	0.11	0.46	1
Benzoic Acid	0.085	SS05AE	5/19	0.091	Yes	NA	NA	NA	33	NA
Bis(2-Ethylhexyl) Phthalate	0.039	SS05PB	4/22	0.071	Yes	200	NA	72	1.6	NA
Chrysene	0.08	SS15147-A	4/22	0.049	Yes	70	NA	3.4	1.4	2
P,P'-DDE	0.0037	CP05P	2/9	0.0015	No	3	NA	0.88	0.06	NA
P,P'-DDT	0.003	CP05A	2/9	0.0017	Yes	3	NA	0.53	0.087	NA
Di-n-Butyl Phthalate	0.068	SS05PA	1/22	0.055	Yes	NA	NA	151	11	NA
Endrin	0.0049	SS15147-A	1/9	0.0018	No	8	NA	0.19	0.23	NA
Fluoranthene	0.15	SS15147-A	4/22	0.067	Yes	1000	NA	108	210	4
HMX	0.52	SS15137-A	1/51	0.020	Yes	2	**0.34**	**0.32**	7.1	NA
MCPA	6.6	CP04D	1/8	2.59	No	NA	NA	**0.0014**	**0.0047**	NA
Methyl Ethyl Ketone	0.004	SS02830-A	2/7	0.0051	Yes	4	4	0.34	1.5	NA
PCB-1254	0.034	SS15147-A	1/9	0.015	No	2	NA	**0.010**	**0.0051**	NA
Pyrene	0.13	SS15147-A	5/22	0.051	Yes	1000	NA	19	150	4
RDX [3]	3.4	SS15137-A	2/51	0.083	Yes	**1**	**0.0017**	**0.00011**	**0.00036**	NA
Inorganics										
Aluminum	15600	MW-06	25/25	7578	Yes	NA	NA	54006	55000	10000
Antimony	1.7	SS05CK	6/23	0.68	Yes	20	NA	**0.27**	**0.66**	1
Arsenic	5.7	CP05A	23/25	2.9	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	58.3	SS15147-A	25/25	14	Yes	1000	NA	120	300	16
Beryllium	0.38	J1 Polygon	20/25	0.22	Yes	100	NA	2.6	58	0.33
Boron	9.1	SS05A2	12/25	2.2	Yes	NA	NA	9.5	23	17
Cadmium	1.1	CP05A	10/25	0.18	Yes	2	NA	**0.40**	1.4	0.35
Calcium	2040	SS15147-A	25/25	257	Yes	NA	NA	NA	NA	180
Chromium, Total	46.2	SS15147-A	25/25	11	Yes	**30**	NA	**7.0**	NA	15
Cobalt	7.3	SS15147-A	25/25	2.7	Yes	NA	NA	132	**0.5**	2.9
Copper	29.7	SS15147-A	25/25	7.7	Yes	NA	NA	46	51.4	11
Iron	15500	CP05A	25/25	9119	Yes	NA	NA	**2422**	**640**	12000

NA - Not Available
SSL = soil screening level

ug/L = milligrams per liter

Comparison of Maximum Concentrations in Soil to Screening Levels
Firing Point Area (Rows 0 to 2, Columns H, I, J, and K)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (4) (mg/kg)	MADEP (5) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Lead	17.7	CP05A	25/25	8.5	Yes	300	NA	**4.1**	NA	19
Magnesium	6600	SS15147-A	25/25	1378	Yes	NA	NA	NA	NA	1500
Manganese	291	SS05A1	25/25	94	Yes	NA	NA	**44**	**57**	110
Molybdenum	5.7	SS05PA	20/25	0.73	Yes	NA	NA	**0.18**	**3.7**	1.1
Nickel	26	SS15147-A	25/25	6.2	Yes	**20**	NA	292	48	6.9
Nitrogen, Nitrate-Nitrite	0.57	SS15147-A	10/10	0.20	Yes	NA	NA	NA	NA	NA
Phosphorus, Total Po4	338	SS15147-A	10/10	133	Yes	NA	NA	NA	NA	NA
Potassium	2000	SS15147-A	25/25	593	Yes	NA	NA	NA	NA	560
Selenium	1	CP05A	3/25	0.31	Yes	400	NA	2.8	**19**	0.5
Sodium	501	SS15147-A	3/25	65	Yes	NA	NA	NA	NA	160
Thallium	0.79	SSJ1DP1	1/25	0.27	Yes	8	NA	3.0	**NA**	0.6
Vanadium	24.1	SS05PB	25/25	15	Yes	600	NA	260	260	22
Zinc	28.3	CP05A	25/25	16	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

(3) Elevated concentrations of RDX were excavated.

(4) MCP maximum allowable value for human contact

(5) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

FOD = Frequency of detection.

MCP = Massachusetts Contigency Plan.

NA - Not Available
SSL = soil screening level

ug/L = milligrams per liter

Comparison of Maximum Concentrations in Soil to Screening Levels
Firing Point Area (Rows 0 to 2, Columns L and M)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
Acetone	0.096	SS175B	3/3	0.061	Yes	6	6.3	0.11	4.4	NA
Benzo(a)Anthracene	0.022	SSJ1DP1S	1/3	0.039	Yes	7	NA	0.037	**0.014**	2
Benzo(a)Pyrene	0.019	SSJ1DP1S	1/3	0.032	No	2	NA	0.20	**0.46**	2
Benzo(b)Fluoranthene	0.019	SS05CK	1/3	0.035	No	7	NA	0.11	0.047	2
Benzo(k)Fluoranthene	0.024	SSJ1DP1S	1/3	0.038	No	70	NA	0.11	0.46	1
Bis(2-Ethylhexyl) Phthalate	2.3	OG092500-02	1/3	0.81	Yes	200	NA	72	**1.6**	NA
Chrysene	0.022	SS02837-A	2/3	0.029	Yes	70	NA	3.4	1.4	2
P,P'-DDE	0.0049	MW-131	1/2	0.0025	No	3	NA	0.88	0.06	NA
P,P'-DDT	0.0023	MW-131	1/2	0.0012	Yes	3	NA	0.53	0.087	NA
Di-n-Octyl Phthalate	0.022	OG092500-02	1/3	0.044	Yes	NA	NA	0.48	NA	NA
Fluoranthene	0.051	SS05AF	2/3	0.044	Yes	1000	NA	108	210	4
Methyl Ethyl Ketone	0.009	SS02832-A	2/3	0.0060	Yes	4	4	0.34	1.5	NA
Pyrene	0.035	SSJ1DP1S	2/3	0.034	Yes	1000	NA	19	150	4
RDX	0.054	SS08526-A	1/25	0.0062	Yes	1	**0.0017**	**0.00011**	**0.00036**	NA
Toluene	0.002	J1200034	1/3	0.00074	Yes	30	32	0.27	0.0000078	NA
Xylenes, Total	0.002	SSJ1DP1S	0/1	0.00010	Yes	400	360	0.81	1.6	NA
Inorganics										
Aluminum	15000	SS02839-A	12/12	8748	Yes	NA	NA	54006	55000	10000
Antimony	0.94	SS05DA	4/12	0.42	Yes	20	NA	**0.27**	**0.66**	1
Arsenic	4.9	CP04G	8/12	2.6	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	65.2	SS08526-A	12/12	17	Yes	1000	NA	120	300	16
Beryllium	0.41	SS05OA	12/12	0.24	Yes	100	NA	2.6	58	0.33
Boron	5.1	SS05EC	4/12	1.9	Yes	NA	NA	9.5	23	17
Cadmium	0.29	SS02833-A	3/12	0.061	Yes	2	NA	0.40	1.4	0.35
Calcium	2360	SS08526-A	12/12	362	Yes	NA	NA	NA	NA	180
Chromium, Total	47.4	SS08526-A	12/12	14	Yes	**30**	NA	**7.0**	NA	15
Cobalt	9.5	SS08526-A	12/12	3.8	Yes	NA	NA	132	**0.5**	2.9
Copper	102	SS03162-A	15/15	23	Yes	NA	NA	**46**	**51.4**	11
Iron	14500	MW-136	12/12	10213	Yes	NA	NA	**2422**	**640**	12000
Lead	19.8	SS08526-A	15/15	11	Yes	300	NA	**4.1**	NA	19
Magnesium	6550	SS08526-A	12/12	1667	Yes	NA	NA	NA	NA	1500
Manganese	170	SS05EA	12/12	91	Yes	NA	NA	**44**	**57**	110

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Firing Point Area (Rows 0 to 2, Columns L and M)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Molybdenum	0.61	CP05M	1/12	0.25	Yes	NA	NA	**0.18**	3.7	1.1
Nickel	20	SS08526-A	12/12	6.5	Yes	20	NA	292	48	6.9
Nitrogen, Nitrate-Nitrite	0.02	CP04B	2/3	0.012	Yes	NA	NA	NA	NA	NA
Phosphorus, Total Po4	92.1	SSJ1DP1S	3/3	80	Yes	NA	NA	NA	NA	NA
Potassium	2310	SS08526-A	11/12	707	Yes	NA	NA	NA	NA	560
Selenium	1.1	AM030801-01	4/12	0.56	Yes	400	NA	2.8	**19**	0.5
Silver	0.38	MW-131	2/12	0.14	Yes	100	NA	16	1.6	NA
Thallium	1.6	SS04M	4/12	0.58	Yes	8	NA	3.0	**NA**	0.6
Vanadium	27	SS08526-A	12/12	17	Yes	600	NA	260	260	22
Zinc	33.5	SS08526-A	12/12	20	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

(3) MCP maximum allowable value for human contact

FOD = Frequency of detection.

MCP = Massachusetts Contigency Plan.

(4) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Firing Point Area (Rows 3 to 6)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
1,3-Diethyl-1,3-Diphenyl Urea	1.3	SS05AC	6/39	0.087	No	NA	NA	NA	NA	NA
Acenaphthylene	0.036	SSJ1RD019	2/42	0.036	No	1	1.2	0.068	NA	0.5
Acetone	0.28	J1 Polygon	21/24	0.065	Yes	6	6.3	**0.11**	4.4	NA
Anthracene	0.026	SS05AF	1/42	0.032	Yes	1000	NA	54	450	1
Benzo(a)Anthracene	0.28	SS05AF	4/42	0.049	Yes	7	NA	**0.037**	**0.014**	2
Benzo(a)Pyrene	0.22	SS05AF	4/42	0.047	No	2	NA	**0.20**	**0.46**	2
Benzo(b)Fluoranthene	0.73	SS05AF	4/42	0.084	No	7	NA	**0.11**	**0.047**	2
Benzo(g,h,i)Perylene	0.19	SS05AF	4/42	0.049	No	1000	NA	554	NA	1
Benzo(k)Fluoranthene	0.54	SS05AF	4/42	0.066	No	70	NA	**0.11**	**0.46**	1
Benzoic Acid	0.44	SS15226-A	16/39	0.094	Yes	NA	NA	NA	33	NA
Bis(2-Ethylhexyl) Phthalate	0.19	SS05TC	2/42	0.069	Yes	200	NA	72	1.6	NA
Bromoform	0.001	SS05AF	1/24	0.0016	Yes	0.1	0.007	0.0022	0.0023	NA
Carbazole	0.027	SS05AF	1/42	0.050	No	NA	NA	**0.012**	NA	NA
alpha-Chlordane	0.0054	SS05AB	7/21	0.0012	No	1	0.04	**0.00038**	0.033	NA
gamma-Chlordane	0.0064	SS05AD	3/21	0.0010	Yes	1	1.2	**0.000038**	0.033	NA
Chrysene	0.51	SS05AF	4/42	0.062	Yes	70	NA	3.4	1.4	2
P,P'-DDD	0.0032	SS05AE	1/21	0.00067	No	4	NA	0.28	0.086	NA
P,P'-DDE	0.013	SS05AD	12/21	0.0035	No	3	NA	0.88	0.06	NA
P,P'-DDT	0.0077	SS05AE	12/21	0.0029	Yes	3	NA	0.53	0.087	NA
Dibenz(a,h)Anthracene	0.068	SS05AF	2/42	0.049	No	0.7	NA	**0.038**	**0.016**	0.5
Diethyl Phthalate	0.018	SS05AD	1/42	0.032	Yes	10	10	13	13	NA
Di-n-Butyl Phthalate	0.9	SS05AD	6/42	0.070	Yes	NA	NA	151	11	NA
Endosulfan Sulfate	0.0022	SS05AF	1/21	0.00065	No	0.5 (3)	0.54	2.2	9.7	NA
Endrin Aldehyde	0.0047	CP05N	1/21	0.00071	No	8 (4)	NA	0.19	0.00043	NA
Endrin Ketone	0.0043	SS05AF	2/21	0.0010	No	8 (4)	NA	0.19	0.0087	NA
Fluoranthene	0.29	SS05AF	5/42	0.064	Yes	1000	NA	108	210	4
HMX	0.4	SS05AB	3/53	0.025	Yes	2	**0.34**	**0.32**	7.1	NA
Indeno(1,2,3-c,d)Pyrene	0.2	SS05AF	4/42	0.055	No	7	NA	0.32	**0.16**	1
MCPA	6.4	CP05B	1/22	2.6	No	NA	NA	**0.0014**	**0.0047**	NA
Methyl Ethyl Ketone	0.018	J1200034	17/21	0.0068	Yes	4	4	0.34	1.5	NA
Naphthalene	0.051	CP05N	3/42	0.036	Yes	4	4.5	**0.014**	**0.00056**	0.5
N-Nitrosodiphenylamine	0.085	SS05AD	2/42	0.071	Yes	NA	NA	**0.0078**	0.17	NA
Phenanthrene	0.049	SS05AF	3/42	0.034	Yes	10	11	48	NA	3
Pyrene	0.31	SS05AF	7/42	0.056	Yes	1000	NA	19	150	4
RDX [5]	3.6	SS05AD	5/53	0.13	Yes	**1**	**0.0017**	**0.00011**	**0.00036**	NA
Toluene	0.003	AM030801-01	7/24	0.0017	Yes	30	32	0.27	0.0000078	NA

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Firing Point Area (Rows 3 to 6)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Inorganics										
Aluminum	26100	SS05A	60/60	8406	Yes	NA	NA	54006	55000	10000
Antimony	1	SS05AE	17/60	0.41	Yes	20	NA	**0.27**	**0.66**	1
Arsenic	5.4	SS05AB	57/60	3.1	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	66.9	SS05A	60/60	14	Yes	1000	NA	120	300	16
Beryllium	0.36	J1 Polygon	50/60	0.21	Yes	100	NA	2.6	58	0.33
Boron	7.9	SS05TC	20/59	1.7	Yes	NA	NA	9.5	23	17
Cadmium	5.9	SS05A	24/60	0.21	Yes	**2**	NA	**0.40**	**1.4**	0.35
Calcium	1500	SS05A	55/60	252	Yes	NA	NA	NA	NA	180
Chromium, Total	305	SS05A	60/60	15	Yes	**30**	NA	**7.0**	NA	15
Cobalt	12.4	SS05A	59/60	2.7	Yes	NA	NA	132	**0.5**	2.9
Copper	550	SSJ1RD019	65/66	35	Yes	NA	NA	**46**	**51.4**	11
Cyanide	2.2	SSJ1RD019	5/33	0.38	Yes	100	NA	**0.0011**	7.4	NA
Iron	36000	SS05A	60/60	9756	Yes	NA	NA	**2422**	**640**	12000
Lead	166	SSJ1RD019	63/63	18	Yes	300	NA	**4.1**	NA	19
Magnesium	2510	SS15230-A	60/60	1077	Yes	NA	NA	NA	NA	1500
Manganese	290	SS05A	60/60	75	Yes	NA	NA	**44**	**57**	110
Mercury	0.11	CP05B	6/60	0.016	No	20	NA	**0.020**	**NA**	0.1
Molybdenum	2.2	SS05AC	42/59	0.70	Yes	NA	NA	**0.18**	3.7	1.1
Nickel	355	SS05A	60/60	12	Yes	**20**	NA	**292**	**48**	6.9
Nitrogen, Nitrate-Nitrite	0.43	SS05CA	23/23	0.17	Yes	NA	NA	NA	NA	NA
Phosphorus, Total Po4	255	SS05AC	23/23	112	Yes	NA	NA	NA	NA	NA
Potassium	1140	SS05A	60/60	511	Yes	NA	NA	NA	NA	560
Selenium	6.8	SS05A	22/60	0.52	Yes	400	NA	**2.8**	**19**	0.5
Silver	1	SS05AB	7/58	0.17	Yes	100	NA	16	1.6	NA
Sodium	165	SS15230-A	3/60	40	Yes	NA	NA	NA	NA	160
Vanadium	38.9	SS05TA	60/60	17	Yes	600	NA	260	260	22
Zinc	238	SS05A	60/60	22	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

(3) Endosulfan value used as a surrogate.

(4) Endrin value used as a surrogate.

(5) Elevated levels of RDX were excavated

(6) MCP maximum allowable value for human contact

(7) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

FOD = Frequency of detection.

MCP = Massachusetts Contigency Plan.

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Southern Flyover Area
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
Dichloronaphthalene	0.012	SSJ1J15001	1/4	0.0063	No	NA	NA	NA	NA	NA
Trichloronaphthalene	0.13	SSJ1J15001	1/4	0.035	No	NA	NA	NA	NA	NA
Tetrachloronaphthalene	0.095	SSJ1J15001	1/4	0.028	No	NA	NA	NA	NA	NA
Pentachloronaphthalene	0.033	SSJ1J15001	1/4	0.014	No	NA	NA	NA	NA	NA
Acenaphthylene	0.045	SSJRANGED	2/39	0.041	No	1	1.2	0.068	NA	0.5
Acetone	0.11	SS04I	9/22	0.025	Yes	6	6.3	**0.11**	4.4	NA
Benzene	0.003	SS02810-A	3/23	0.0022	Yes	2	1.5	**0.00010**	**0.00023**	NA
Benzo(a)Anthracene	0.049	SSJ1K27001	2/39	0.043	Yes	7	NA	**0.037**	**0.014**	2
Benzo(a)Pyrene	0.035	SSJ1K27001	2/39	0.040	No	2	NA	0.20	**0.46**	2
Benzo(b)Fluoranthene	0.078	SSJ1K27001	2/39	0.049	No	7	NA	0.11	**0.047**	2
Benzo(g,h,i)Perylene	0.042	SS05EB	1/39	0.044	No	1000	NA	554	NA	1
Benzo(k)Fluoranthene	0.076	SSJ1K27001	2/39	0.049	No	70	NA	0.11	0.46	1
Benzoic Acid	0.12	SS05C	2/31	0.15	Yes	NA	NA	NA	33	NA
Bis(2-Ethylhexyl) Phthalate	0.058	SSJ1J24002	7/39	0.060	Yes	200	NA	72	1.6	NA
Bromomethane	0.008	SS02837-A	2/23	0.0027	Yes	0.5	0.05	**0.0018**	**0.0022**	NA
Chlorobenzene	0.002	SSJRANGED	1/23	0.0020	Yes	1	1.2	NA	0.068	NA
2-Chlorobenzoic Acid	0.46	SSJ1J24002	1/24	0.38	No	NA	NA	NA	NA	NA
Chloroform	0.001	CP04D	1/23	0.0019	Yes	0.4	0.35	**0.000036**	**0.000055**	NA
Chloromethane	0.003	AM030801-01	1/23	0.0022	Yes	NA	NA	**0.00040**	0.049	NA
Chrysene	0.11	SSJ1K27001	3/39	0.046	Yes	70	NA	3.4	1.4	2
Dimethyl Phthalate	0.34	SSJ1J15001	1/39	0.048	No	30	33	NA	NA	NA
Di-n-Butyl Phthalate	0.024	SSJ1J24002	2/39	0.042	Yes	NA	NA	151	11	NA
Ethylbenzene	0.002	SSJRANGED	1/23	0.0020	Yes	40	45	1.9	**0.82**	NA
Fluoranthene	0.055	SSJ1K27001	4/39	0.050	Yes	1000	NA	108	210	4
Methyl Ethyl Ketone	0.023	SS02837-A	10/23	0.0053	Yes	4	4	0.34	1.5	NA
Methylene Chloride	0.002	SS60MMWPTANKALL	1/23	0.0019	Yes	0.1	0.01	NA	**0.043**	NA
2-Methylnaphthalene	0.065	SS02837-A	2/39	0.048	Yes	0.7	0.36	0.072	0.9	0.5
Naphthalene	0.068	SS02837-A	6/39	0.045	Yes	4	4.5	**0.014**	**0.00056**	0.5
Perchlorate	0.0024	SS287-A	2/20	0.00089	Yes	0.1	**0.002**	0.0031	NA	NA
Phenanthrene	0.04	SSJ1RD019	3/39	0.039	Yes	10	11	48	NA	3
Phenol	0.062	SSJRANGEB	1/39	0.049	Yes	1	0.95	0.77	8.1	NA
Pyrene	0.11	SSJ1K27001	4/39	0.050	Yes	1000	NA	19	150	4
RDX	0.022	SSJ1I18001	2/64	0.014	Yes	1	**0.0017**	**0.00011**	**0.00036**	NA

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Southern Flyover Area
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Styrene	0.01	SSJRANGED	2/23	0.0024	No	3	2.9	2.3	210	NA
Tetrachloroethene	0.002	SSJRANGED	1/23	0.0020	Yes	1	1.2	**0.00044**	**0.000014**	NA
Tetryl	0.89	SSJRANGED	2/64	0.046	Yes	NA	NA	**0.064**	**0.65**	NA
Toluene	0.012	SS05OB	11/23	0.0032	Yes	30	32	0.27	0.0000078	NA
Trichloroethene	0.002	SSJRANGED	1/23	0.0020	Yes	0.3	0.28	**0.00050**	**9.4**	NA
Xylenes, Total	0.006	SSJRANGED	1/23	0.0029	Yes	400	360	0.81	1.6	NA
Inorganics										
Aluminum	21400	SSJ1RD018	65/65	11401	Yes	NA	NA	54006	55000	10000
Antimony	2.2	SS02837-A	10/65	0.43	Yes	20	NA	**0.27**	**0.66**	1
Arsenic	11.8	SSJ181MM	65/68	4.2	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	37.6	SS02837-A	65/65	15	Yes	1000	NA	120	300	16
Beryllium	0.62	SSJ1RD018	64/68	0.29	Yes	100	NA	2.6	58	0.33
Boron	30.8	SSJ181MM	40/65	3.3	Yes	NA	NA	**9.5**	**23**	17
Cadmium	13.1	SSJRANGEB	29/65	0.46	Yes	**2**	NA	**0.40**	**1.4**	0.35
Calcium	957	SS05S	63/65	216	Yes	NA	NA	NA	NA	180
Chromium, Total	182	SS02837-A	65/65	16	Yes	**30**	NA	**7.0**	NA	15
Cobalt	5.8	SSJ1I30003	64/65	2.9	Yes	NA	NA	132	**0.5**	2.9
Copper	4990	SSJRANGED	63/70	155	Yes	NA	NA	**46**	**51.4**	11
Cyanide	1.9	SS287-A	3/20	0.49	Yes	100	NA	**0.0011**	7.4	NA
Iron	31400	SSJRANGEB	65/65	13202	Yes	NA	NA	**2422**	**640**	12000
Lead	222	SSJ1J24001	72/73	21	Yes	300	NA	**4.1**	NA	19
Magnesium	2930	SS60MMWPTANKALL	65/65	1304	Yes	NA	NA	NA	NA	1500
Manganese	354	SSJRANGEB	65/65	81	Yes	NA	NA	**44**	**57**	110
Mercury	0.15	SS287-A	15/65	0.023	No	20	NA	**0.020**	**NA**	0.1
Molybdenum	37.9	SS02837-A	42/65	1.2	Yes	NA	NA	**0.18**	**3.7**	1.1
Nickel	45.7	SS02837-A	65/65	7.0	Yes	**20**	NA	292	48	6.9
Nitrogen, Nitrate-Nitrite	0.19	SS05CA	12/12	0.092	Yes	NA	NA	NA	NA	NA
Phosphorus, Total Po4	249	CP05P	12/12	121	Yes	NA	NA	NA	NA	NA
Potassium	1850	SSJ1K27001	65/65	577	Yes	NA	NA	NA	NA	560
Selenium	3.9	SSJRANGED	24/65	0.63	Yes	400	NA	**2.8**	**19**	0.5
Silver	0.61	SSJRANGED	5/60	0.16	Yes	100	NA	16	1.6	NA
Sodium	488	SS287-A	4/65	54	Yes	NA	NA	NA	NA	160
Thallium	1.9	CP05E	9/65	0.38	Yes	8	NA	3.0	**NA**	0.6

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Southern Flyover Area
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Vanadium	42.5	SSJ1RD018	65/65	21	Yes	600	NA	260	260	22
Zinc	113	SSJ1K27001	63/65	24	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

(3) MCP maximum allowable value for human contact

(4) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

FOD = Frequency of detection.

MCP = Massachusetts Contigency Plan.

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Interberm Area - (Rows 30 to 33)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
Benzene	0.002	SS02794-A	1/4	0.00065	Yes	2	1.5	**0.00010**	**0.00023**	NA
Bis(2-Ethylhexyl) Phthalate	0.31	SSJ1I30001	4/12	0.076	Yes	200	NA	72	1.6	NA
Fluoranthene	0.021	SS02794-A	1/12	0.035	Yes	1000	NA	108	210	4
HMX	0.014	SSJ1I30003	1/68	0.0076	Yes	2	0.34	0.32	7.1	NA
Methyl Ethyl Ketone	0.011	SS02794-A	1/4	0.0035	Yes	4	4	0.34	1.5	NA
Phenanthrene	0.053	SSJRANGEF	2/12	0.031	Yes	10	11	48	NA	3
Pyrene	0.023	SS02794-A	1/12	0.043	Yes	1000	NA	19	150	4
Toluene	0.002	J1200034	1/4	0.00062	Yes	30	32	0.27	0.0000078	NA
Inorganics										
Aluminum	17700	SS02830-A	34/34	9151	Yes	NA	NA	54006	55000	10000
Antimony	0.78	SSJ1K41001	8/34	0.32	Yes	20	NA	**0.27**	**0.66**	1
Arsenic	6	AM030801-01	33/34	3.6	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	20.3	SS287-A	34/34	11	Yes	1000	NA	120	300	16
Beryllium	0.59	SSJ1I30003	34/34	0.33	Yes	100	NA	2.6	58	0.33
Boron	24.6	SS02794-A	22/34	3.7	Yes	NA	NA	**9.5**	**23**	17
Cadmium	17.6	SSJRANGEF	9/34	0.64	Yes	**2**	NA	**0.40**	**1.4**	0.35
Calcium	423	SSJRANGEF	27/34	113	Yes	NA	NA	NA	NA	180
Chromium, Total	20.3	SSJ1K27003	34/34	11	Yes	30	NA	**7.0**	NA	15
Cobalt	5.8	SSJ1I30003	34/34	3.7	Yes	NA	NA	132	**0.5**	2.9
Copper	535	SSJRANGEF	53/53	34	Yes	NA	NA	**46**	**51**	11
Cyanide	0.82	SSJ1RD013	1/8	0.31	Yes	100	NA	**0.0011**	7.4	NA
Iron	19300	SSJ1IAP003	34/34	11556	Yes	NA	NA	**2422**	**640**	12000
Lead	58.7	SSJ1RD012	47/47	10	Yes	300	NA	**4.1**	NA	19
Magnesium	2530	SSJ1I30003	34/34	1365	Yes	NA	NA	NA	NA	1500
Manganese	251	SS02793-A	34/34	94	Yes	NA	NA	**44**	**57**	110
Mercury	0.028	SSJ1I30003	6/34	0.012	No	20	NA	**0.020**	NA	0.1
Molybdenum	0.78	J1 Polygon	31/34	0.46	Yes	NA	NA	**0.18**	3.7	1.1
Nickel	9.7	SSJ1I30003	34/34	6	Yes	20	NA	292	48	6.9
Potassium	903	SSJ1RD017	34/34	464	Yes	NA	NA	NA	NA	560
Selenium	1	CP05A	9/34	0.35	Yes	400	NA	**2.8**	19	0.5
Sodium	51.4	SSJ1RD012	4/34	28	Yes	NA	NA	NA	NA	160
Thallium	0.94	J1 Polygon	1/34	0.35	Yes	8	NA	3.0	**NA**	0.6

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Interberm Area - (Rows 30 to 33)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Vanadium	28.2	SSJ1RD017	34/34	17	Yes	600	NA	260	260	22
Zinc	136	SSJ1K40002	34/34	23	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

(3) MCP maximum allowable value for human contact

(4) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

FOD = Frequency of detection.

MCP = Massachusetts Contigency Plan.

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Interberm Area (Rows 34 to 42)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
1,2,3,4,6,7,8-HPCDD	0.000102	J1P-15	3/3	0.000058	No	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HPCDF	0.0000042	SSJ1K40BLP001	3/3	0.0000033	No	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HPCDF	0.0000005	SSJ1K40BLP001	1/3	0.00000027	No	NA	NA	NA	NA	NA
1,2,3,4,7,8-HXCDD	0.00000048	J1P-15	2/3	0.00000033	No	NA	NA	NA	NA	NA
1,2,3,4,7,8-HXCDF	0.0000016	SSJ1K40BLP001	3/3	0.00000080	No	NA	NA	NA	NA	NA
1,2,3,6,7,8-HXCDD	0.0000028	J1P-15	2/3	0.0000015	No	NA	NA	NA	NA	NA
1,2,3,7,8,9-HXCDD	0.0000011	J1P-15	2/3	0.00000073	No	NA	NA	NA	NA	NA
2,3,4,6,7,8-HXCDF	0.00000054	SSJ1K40BLP001	3/3	0.00000039	No	NA	NA	NA	NA	NA
2,3,7,8-TCDF	0.0000008	SSJ1K40BLP001	1/3	0.00000030	No	NA	NA	NA	NA	NA
OCDD	0.00521	J1P-15	3/3	0.0029	No	NA	NA	NA	NA	NA
OCDF	0.0000082	J1P-15	3/3	0.0000071	No	NA	NA	NA	NA	NA
2,3,7,8-TCDD TEQ	0.0000033	J1P-15	3/3	0.0000021	No	0.00002	NA	**0.0000005**	**1.5E-07**	NA
C11-C22 Aromatic Hydrocarbons	34	SS05CF	2/43	2.5	No	1000	1258	NA	NA	NA
C9-C10 Aromatic Hydrocarbons	1.7	SS05CI	2/23	0.23	Yes	100	288	NA	NA	NA
C9-C12 Aliphatic Hydrocarbons	0.502	SS05CI	1/23	0.040	Yes	1000	NA	NA	NA	NA
1,3-Diethyl-1,3-Diphenyl Urea	0.54	SS05P1B	18/152	0.046	No	NA	NA	NA	NA	NA
Acenaphthylene	0.033	SS05CF	4/175	0.041	No	1	1.2	0.068	NA	0.5
Acetone	0.64	SS05EA	81/105	0.086	Yes	6	6.3	**0.11**	4.4	NA
Aldrin	0.0018	SS05BB	2/95	0.00024	Yes	0.04	NA	0.0098	**0.00084**	NA
Anthracene	0.74	SS05CF	4/175	0.045	Yes	1000	NA	54	450	1
Benzene	0.0085	J1 Polygon	5/107	0.0048	Yes	2	1.5	**0.00010**	**0.00023**	NA
Benzo(a)Anthracene	1.8	SS05CF	7/175	0.061	Yes	7	NA	**0.037**	**0.014**	2
Benzo(a)Pyrene	0.65	SS05CF	10/175	0.047	No	2	NA	**0.20**	**0.46**	2
Benzo(b)Fluoranthene	1.5	SS05CF	9/175	0.066	No	7	NA	**0.11**	**0.047**	2
Benzo(g,h,i)Perylene	0.19	SS05AF	7/175	0.049	No	1000	NA	554	NA	1
Benzo(k)Fluoranthene	1.2	SS05CF	9/175	0.062	No	70	NA	**0.11**	**0.46**	1
Benzoic Acid	0.48	SS05CF	31/162	0.11	Yes	NA	NA	NA	33	NA
Benzyl Butyl Phthalate	0.029	SSJ1G37002	1/175	0.046	No	NA	NA	491	0.67	NA
alpha-BHC	0.011	SS05BB	3/95	0.00043	No	**0.003** (3)	NA	**0.000062**	**0.000074**	NA
beta-BHC	0.053	SS05BB	5/95	0.0013	Yes	**0.003** (3)	NA	**0.00020**	**0.00026**	NA
delta-BHC	0.0026	SS05BB	3/95	0.00026	No	0.003 (3)	NA	NA	NA	NA
Bis(2-Chloroethyl) Ether	2.5	SS05FA3	1/175	0.051	No	**0.7**	**0.029**	NA	**0.0000027**	NA
Bis(2-Ethylhexyl) Phthalate	0.28	SSJ1RD016	44/175	0.061	Yes	200	NA	72	1.6	NA
Bromoform	0.003	SS05BE	18/105	0.0019	Yes	0.1	0.007	**0.0022**	**0.0023**	NA
Bromomethane	0.065	SS05K	20/105	0.0040	Yes	0.5	**0.05**	**0.0018**	**0.0022**	NA

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Interberm Area (Rows 34 to 42)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Carbazole	0.058	SS05CF	4/175	0.048	No	NA	NA	**0.012**	NA	NA
Carbon Disulfide	0.002	SS05K	1/105	0.0016	Yes	NA	NA	0.41	0.27	NA
gamma-Chlordane	0.0019	SS05CF	2/95	0.00024	Yes	1	1.2	**0.000038**	0.033	NA
Chloroform	0.008	SS05CC	3/105	0.0017	Yes	0.4	0.35	**0.000036**	**0.000055**	NA
Chloromethane	0.053	SS05K	7/105	0.0023	Yes	NA	NA	**0.00040**	**0.049**	NA
Chrysene	3	SS05CF	10/175	0.080	Yes	70	NA	3.4	**1.4**	2
1,4-Dichlorobenzene	0.0035	SSJ1K40BLP001	1/176	0.038	Yes	0.7	0.095	NA	**0.00046**	NA
Dalapon	0.14	SS05EB	1/94	0.059	No	NA	NA	NA	0.23	NA
P,P'-DDD	0.000401	SS02992-A	1/95	0.00041	No	4	NA	0.28	0.086	NA
P,P'-DDE	0.0031	SS05BB	4/95	0.00050	No	3	NA	0.88	0.06	NA
P,P'-DDT	0.0036	SS05AE	5/95	0.00086	Yes	3	NA	0.53	0.087	NA
Dibenz(a,h)Anthracene	0.1	SS05CF	4/175	0.048	No	0.7	NA	**0.038**	**0.016**	0.5
Diethyl Phthalate	0.04	MW-27	1/175	0.045	Yes	10	10	13	13	NA
Dimethyl Phthalate	0.084	SSJ1J40001	1/175	0.045	No	30	33	NA	NA	NA
Di-n-Butyl Phthalate	11	SS05CC	50/175	0.17	Yes	NA	NA	151	11	NA
Di-n-Octyl Phthalate	0.067	SS15152-A	2/175	0.054	Yes	NA	NA	0.48	NA	NA
2,4-Dinitrotoluene	0.55	CP05CP	3/252	0.024	No	0.7	**0.057**	**0.020**	**0.0002**	NA
2-Amino-4,6-Dinitrotoluene	0.14	SS05BA	1/238	0.011	Yes	NA	NA	**0.00038**	**0.029**	NA
alpha-Endosulfan	0.0017	SS05CF	2/95	0.00024	No	0.5 (4)	0.54	1.3	9.7	NA
beta-Endosulfan	0.0024	SS05CF	2/95	0.00045	No	0.5 (4)	0.54	1.3	9.7	NA
Endosulfan Sulfate	0.0086	SS05CF	2/95	0.00056	No	0.5 (4)	0.54	2.2	9.7	NA
Endrin	0.0023	SS05CF	2/95	0.00046	No	8	NA	0.19	0.23	NA
Endrin Aldehyde	0.012	SS05CF	5/95	0.00074	No	8 (5)	NA	0.19	0.00043	NA
Endrin Ketone	0.016	SS05CF	6/95	0.00093	No	8 (5)	NA	0.19	0.0087	NA
Fluoranthene	2.5	SS05CF	12/175	0.082	Yes	1000	NA	108	210	4
Heptachlor	0.013	SS05BB	5/96	0.00051	No	0.2	NA	0.021	**0.51**	NA
Heptachlor Epoxide	0.00535	SS02990-A	3/95	0.00030	Yes	0.09	NA	0.0061	**NA**	NA
2-Hexanone	0.025	J1 Polygon	2/105	0.0024	Yes	NA	NA	NA	NA	NA
HMX	0.06	SSJ1RD016	1/238	0.010	Yes	2	0.34	0.32	7.1	NA
Indeno(1,2,3-c,d)Pyrene	0.25	SS05CF	4/175	0.051	No	7	NA	0.32	**0.16**	1
Methoxychlor	0.018	SS05CF	2/95	0.0064	No	200	NA	4.0	0.022	NA
Methyl Ethyl Ketone	0.02	SS02809-A	52/97	0.0053	Yes	4	4	0.34	1.5	NA
4-Methyl-2-Pentanone	0.026	J1 Polygon	2/105	0.0021	Yes	0.4	0.35	NA	0.44	NA
2-Methylnaphthalene	0.027	SSJ1G36001	1/175	0.050	Yes	0.7	0.36	0.072	0.9	0.5
Naphthalene	0.11	SSJ1G36001	3/177	0.040	Yes	4	4.5	**0.014**	**0.00056**	0.5
2-Nitrodiphenylamine	0.15	SS05CC	2/152	0.045	No	NA	NA	NA	NA	NA

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Interberm Area (Rows 34 to 42)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
N-Nitrosodiphenylamine	0.88	SS05CC	10/175	0.059	Yes	NA	NA	**0.0078**	**0.17**	NA
PCB-1254	0.038	SS05CA	1/95	0.0044	No	2	NA	**0.010**	**0.0051**	NA
Pentachlorophenol	0.018	SS15143-A	1/179	0.041	Yes	3	**0.008**	**0.00043**	**NA**	NA
Perchlorate	0.0048	SS05CK	2/88	0.0010	Yes	0.1	**0.002**	**0.0031**	NA	NA
Phenanthrene	0.091	SS05CF	9/175	0.039	Yes	10	11	48	NA	3
Phenol	0.66	SS05CL	1/175	0.052	Yes	1	0.95	0.77	8.1	NA
Pyrene	4.1	SS05CF	12/175	0.10	Yes	1000	NA	19	150	4
Styrene	0.0012	J1 Polygon	2/105	0.0016	No	3	2.9	2.3	210	NA
Tetrachloroethene	0.0014	J1 Polygon	2/105	0.0016	Yes	1	1.2	**0.00044**	**0.000014**	NA
Tetryl	48	SS05CC	3/238	0.23	Yes	NA	NA	**0.064**	**0.65**	NA
Toluene	0.009	SS04H	23/107	0.0058	Yes	30	32	0.27	0.0000078	NA
1,2,4-Trichlorobenzene	0.0046	SSJ1K40BLP001	1/176	0.041	Yes	2	2.2	NA	0.013	NA
Trichloroethene	0.0029	J1 Polygon	2/105	0.0016	Yes	0.3	0.28	**0.00050**	**9.4**	NA
Inorganics										
Aluminum	25700	SS05EA	167/167	8666	Yes	NA	NA	54006	55000	10000
Antimony	8.3	SS05EB	55/167	0.59	Yes	20	NA	**0.27**	**0.66**	1
Arsenic	8	SS05EA	159/167	3.0	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	456	J1 Polygon	167/167	17	Yes	1000	NA	**120**	**300**	16
Beryllium	0.51	SS05EA	139/167	0.22	Yes	100	NA	2.6	58	0.33
Boron	12.2	J1P-15	65/165	1.7	Yes	NA	NA	**9.5**	23	17
Cadmium	23.4	SSJ1J40001	82/175	0.34	Yes	**2**	NA	**0.40**	**1.4**	0.35
Calcium	3610	SS05C	160/167	183	Yes	NA	NA	NA	NA	180
Chromium, Total	229	SS05CD	167/167	16	Yes	**30**	NA	**7.0**	NA	15
Cobalt	17.9	SS05C	167/167	2.8	Yes	NA	NA	132	**0.5**	2.9
Copper	1630	SS05C	164/173	55	Yes	NA	NA	**46**	**51**	11
Cyanide	1.6	SS15231-A	3/101	0.22	Yes	100	NA	**0.0011**	7.4	NA
Iron	39700	CP05CP	167/167	10519	Yes	NA	NA	**2422**	**640**	12000
Lead	280	SS05EB	164/164	23	Yes	300	NA	**4.1**	NA	19
Magnesium	11900	SS05C	167/167	1180	Yes	NA	NA	NA	NA	1500
Manganese	408	CP05CP	167/167	75	Yes	NA	NA	**44**	**57**	110
Mercury	0.077	AM030801-01	20/167	0.020	No	20	NA	**0.020**	**NA**	0.1
Molybdenum	51.8	CP05CP	110/165	1.8	Yes	NA	NA	**0.18**	**3.7**	1.1
Nickel	326	SS05CD	166/167	14	Yes	**20**	NA	**292**	**48**	6.9
Nitrogen, Nitrate-Nitrite	8.1	SS05B	76/98	0.31	Yes	NA	NA	NA	NA	NA
Phosphorus, Total Po4	706	CP05K	98/98	101	Yes	NA	NA	NA	NA	NA

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Interberm Area (Rows 34 to 42)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Potassium	3260	SS05C	165/167	496	Yes	NA	NA	NA	NA	560
Selenium	1.9	SS15122-A	28/167	0.37	Yes	400	NA	2.8	19	0.5
Silver	5.2	SS05P1A	8/167	0.20	Yes	100	NA	16	1.6	NA
Sodium	813	SS05FA2	18/167	66	Yes	NA	NA	NA	NA	160
Thallium	2.2	MW-126	5/167	0.32	Yes	8	NA	3.0	NA	0.6
Titanium	1150	SS05C	1/1	1150	No	NA	NA	NA	NA	NA
Uranium-234 (units in pCi/g)	0.87	SS05EB	17/17	0.50	No	NA	NA	NA	NA	NA
Uranium-238 (units in pCi/g)	0.76	SS05AA	17/17	0.52	No	NA	NA	NA	NA	NA
Vanadium	48.4	SS05EA	167/167	16	Yes	600	NA	260	260	22
Zinc	249	CP05CP	165/167	21	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

(3) gamma-HCH value used as a surrogate.

(4) Endosulfan value used as a surrogate.

(5) Endrin value used as a surrogate.

(6) MCP maximum allowable value for human contact

(7) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

FOD = Frequency of detection.

mg/kg = Milligrams per kilogram.

MCP = Massachusetts Contigency Plan.

NA = Not available.

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
Interberm Area (Rows 43 and 44)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
Benzo(a)Pyrene	0.039	SSJ1L44BLP01	1/1	0.039	No	2	NA	0.20	**0.46**	2
Bis(2-Ethylhexyl) Phthalate	0.12	SS02793-A	1/1	0.12	Yes	200	NA	72	1.6	NA
Chrysene	0.029	SS05CK	1/1	0.029	Yes	70	NA	3.4	1.4	2
Inorganics										
Aluminum	8960	SSJ1L44BLP01	1/1	8960	Yes	NA	NA	54006	55000	10000
Arsenic	3.7	AM030801-01	1/1	3.7	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	13.7	SSJ1L44BLP01	1/1	13.7	Yes	1000	NA	120	300	16
Beryllium	0.32	CP05D	1/1	0.32	Yes	100	NA	2.6	58	0.33
Boron	1.6	SS02839-A	1/1	1.6	Yes	NA	NA	9.5	23	17
Cadmium	0.36	SS02839-A	1/1	0.36	Yes	2	NA	0.40	1.4	0.35
Calcium	176	SSJ1DP1	1/1	176	Yes	NA	NA	NA	NA	180
Chromium, Total	11.1	SS04M	1/1	11.1	Yes	30	NA	**7.0**	NA	15
Cobalt	2	CP04B	1/1	2	Yes	NA	NA	132	**0.5**	2.9
Copper	6.4	SS04K	1/1	6.4	Yes	NA	NA	46	51	11
Iron	10700	SS04H	1/1	10700	Yes	NA	NA	**2422**	**640**	12000
Lead	10	SS05AC	1/1	10	Yes	300	NA	**4.1**	NA	19
Magnesium	1180	CP05N	1/1	1180	Yes	NA	NA	NA	NA	1500
Manganese	63.3	SSJ1L44BLP01	1/1	63.3	Yes	NA	NA	**44**	**57**	110
Mercury	0.02	J1 Polygon	1/1	0.02	No	20	NA	0.020	NA	0.1
Molybdenum	0.72	SS05PB	1/1	0.72	Yes	NA	NA	**0.18**	3.7	1.1
Nickel	5.7	SS02832-A	1/1	5.7	Yes	20	NA	292	48	6.9
Potassium	445	MW-06	1/1	445	Yes	NA	NA	NA	NA	560
Vanadium	16.6	SS02839-A	1/1	16.6	Yes	600	NA	260	260	22
Zinc	70.5	SSJ1L44BLP01	1/1	70.5	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

(3) MCP maximum allowable value for human contact

(4) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

FOD = Frequency of detection.

MCP = Massachusetts Contigency Plan.

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Concentrations in Soil to Screening Levels
Northern Flyover Area (Rows 45 to 64)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
Dichloronaphthalene	0.078	SSJ1P26003	3/33	0.0090	No	NA	NA	NA	NA	NA
Trichloronaphthalene	1.8	SSJ1P26003	11/33	0.080	No	NA	NA	NA	NA	NA
Tetrachloronaphthalene	2.3	SSJ1P26003	8/33	0.099	No	NA	NA	NA	NA	NA
Pentachloronaphthalene	0.46	SSJ1P26003	6/33	0.031	No	NA	NA	NA	NA	NA
Hexachloronaphthalene	0.041	SSJ1P26003	1/33	0.0068	No	NA	NA	NA	NA	NA
Heptachloronaphthalene	0.016	SSJ1P26003	1/33	0.0059	No	NA	NA	NA	NA	NA
Octachloronaphthalene	0.028	SSJ1IAP001	1/33	0.0064	No	NA	NA	NA	NA	NA
Acetone	0.41	MW-126	2/6	0.080	Yes	6	6.3	**0.11**	4.4	NA
Benzene	0.003	SS02810-A	3/6	0.0025	Yes	2	1.5	**0.00010**	**0.00023**	NA
Benzoic Acid	0.48	SS05CF	4/31	0.16	Yes	NA	NA	NA	33	NA
Bis(2-Ethylhexyl) Phthalate	0.061	SS02809-A	7/32	0.056	Yes	200	NA	72	1.6	NA
Bromomethane	0.013	SS02813-A	4/6	0.0048	Yes	0.5	0.05	**0.0018**	**0.0022**	NA
Carbon Disulfide	0.003	MW-126	1/6	0.0019	Yes	NA	NA	0.41	0.27	NA
Chloromethane	0.001	SS02813-A	2/6	0.0016	Yes	NA	NA	**0.00040**	0.049	NA
Chrysene	0.023	SS05P	2/32	0.042	Yes	70	NA	3.4	1.4	2
P,P'-DDE	0.0022	MW-06	1/2	0.0012	No	3	NA	0.88	0.06	NA
P,P'-DDT	0.003	CP05A	1/2	0.0016	Yes	3	NA	0.53	0.087	NA
Dimethyl Phthalate	0.61	SSJ1P26007	1/32	0.062	No	30	33	NA	NA	NA
Di-n-Butyl Phthalate	0.039	SSJ1P26007	1/32	0.039	Yes	NA	NA	151	11	NA
Fluoranthene	0.024	SS05PB	2/32	0.052	Yes	1000	NA	108	210	4
Methyl Ethyl Ketone	0.03	MW-126	5/6	0.015	Yes	4	4	0.34	1.5	NA
Naphthalene	0.04	SSJ1P26007	5/32	0.040	Yes	4	4.5	**0.014**	**0.00056**	0.5
4-Nitrotoluene	0.013	SS15112-A	1/80	0.011	Yes	NA	NA	0.026	**0.0034**	NA
Phenanthrene	0.023	SS02809-A	2/32	0.037	Yes	10	11	48	NA	3
Phenol	0.083	SSJ1P26007	2/32	0.044	Yes	1	0.95	0.77	8.1	NA
Pyrene	0.032	SSA09230201	5/32	0.059	Yes	1000	NA	19	150	4
RDX	0.042	SS15112-A	2/80	0.01	Yes	1	**0.0017**	**0.00011**	**0.00036**	NA
Toluene	0.003	AM030801-01	5/6	0.0028	Yes	30	32	0.27	0.0000078	NA
Inorganics										
Aluminum	30900	MW-126	42/42	12009	Yes	NA	NA	54006	55000	10000
Antimony	0.69	SS08526-A	2/42	0.34	Yes	20	NA	**0.27**	**0.66**	1
Arsenic	9.8	MW-126	42/42	4.1	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	32.6	MW-126	42/42	14	Yes	1000	NA	120	300	16

NA = Not Available

SSL = soil screening level

mg/Kg = milligram per Kilogram

Concentrations in Soil to Screening Levels
Northern Flyover Area (Rows 45 to 64)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MADEP (4) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Beryllium	0.71	MW-126	34/42	0.25	Yes	100	NA	2.6	58	0.33
Boron	7.5	SS05EB	21/40	2.2	Yes	NA	NA	9.5	23	17
Cadmium	19.1	SSJ1P26005	19/45	1.4	Yes	**2**	NA	**0.40**	**1.4**	0.35
Calcium	543	SSJ1K56002	42/42	190	Yes	NA	NA	NA	NA	180
Chromium, Total	53.2	SSJ1P26007	42/42	15	Yes	**30**	NA	**7.0**	NA	15
Cobalt	8.4	MW-126	42/42	2.9	Yes	NA	NA	132	**0.5**	2.9
Copper	913	SSJ1P26007	59/59	43	Yes	NA	NA	**46**	**51.4**	11
Cyanide	3.4	SSJ1P26007	5/18	0.81	Yes	100	NA	**0.0011**	7.4	NA
Iron	30100	MW-126	42/42	13091	Yes	NA	NA	**2422**	**640**	12000
Lead	113	SSJ1P26006	48/48	16	Yes	300	NA	**4.1**	NA	19
Magnesium	3960	MW-126	42/42	1242	Yes	NA	NA	NA	NA	1500
Manganese	154	MW-126	42/42	69	Yes	NA	NA	**44**	**57**	110
Mercury	0.11	CP05B	18/42	0.031	No	20	NA	**0.020**	**NA**	0.1
Molybdenum	4.1	SSJ1P26007	27/40	0.59	Yes	NA	NA	**0.18**	**3.7**	1.1
Nickel	17.9	MW-126	41/42	6.0	Yes	20	NA	292	48	6.9
Nitrogen, Nitrate-Nitrite	1.1	MW-06	3/4	0.30	Yes	NA	NA	NA	NA	NA
Phosphorus, Total Po4	149	MW-06	4/4	104	Yes	NA	NA	NA	NA	NA
Potassium	1170	MW-126	41/42	526	Yes	NA	NA	NA	NA	560
Selenium	1.8	SSJ1K56002	21/42	0.71	Yes	400	NA	2.8	**19**	0.5
Silver	0.46	SSJ1K56002	2/39	0.13	Yes	100	NA	16	1.6	NA
Thallium	2.2	MW-126	12/42	0.48	Yes	8	NA	3.0	**NA**	0.6
Vanadium	52.1	MW-126	42/42	23	Yes	600	NA	260	260	22
Zinc	151	SSJ1P26007	42/42	29	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

FOD = Frequency of detection.

(3) MCP maximum allowable value for human contact

MCP = Massachusetts Contigency Plan.

(4) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

NA = Not Available

SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
2,000 Meter Berm (Rows 65 to 72)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Organics										
Chloronaphthalene	0.039	SSJ1IAP001	1/5	0.017	No	NA	NA	NA	NA	NA
Dichloronaphthalene	3.5	SSJ1IAP001	1/5	0.71	No	NA	NA	NA	NA	NA
Trichloronaphthalene	64	SSJ1IAP001	1/5	13	No	NA	NA	NA	NA	NA
Tetrachloronaphthalene	71	SSJ1IAP001	1/5	14	No	NA	NA	NA	NA	NA
Pentachloronaphthalene	28	SSJ1IAP001	2/5	5.6	No	NA	NA	NA	NA	NA
Hexachloronaphthalene	5.3	SSJ1IAP001	1/5	1.1	No	NA	NA	NA	NA	NA
Heptachloronaphthalene	0.57	SSJ1IAP001	1/5	0.12	No	NA	NA	NA	NA	NA
Octachloronaphthalene	0.028	SSJ1IAP001	1/4	0.010	No	NA	NA	NA	NA	NA
Acetone	0.99	SS175B	59/69	0.19	Yes	6	6.3	**0.11**	4.4	NA
Acifluorfen	0.031	SS04M	8/47	0.0042	No	NA	NA	**0.00011**	NA	NA
Benzene	0.003	SS02810-A	2/68	0.0015	Yes	2	1.5	**0.00010**	**0.00023**	NA
Benzo(b)Fluoranthene	0.033	SS175B	2/67	0.059	No	7	NA	0.11	0.047	2
Benzo(k)Fluoranthene	0.031	SS175B	2/67	0.059	No	70	NA	0.11	0.46	1
Benzoic Acid	1	SSJ1IAP001	16/59	0.13	Yes	NA	NA	NA	33	NA
Bentazon	0.19	CP04D	2/50	0.023	No	NA	NA	**0.037**	0.3	NA
alpha-BHC	0.0011	SS112A	1/59	0.00018	No	0.003 (3)	NA	**0.000062**	**0.000074**	NA
Bis(2-Ethylhexyl) Phthalate	1.1	SS04M	18/66	0.088	Yes	200	NA	72	1.6	NA
Chloramben	0.042	SS113A	3/51	0.0070	Yes	NA	NA	0.12	0.12	NA
alpha-Chlordane	0.0015	SS04M	1/59	0.00018	No	1	0.04	**0.00038**	0.033	NA
2-Chlorobenzoic Acid	1.8	SSJ1IAP001	1/16	0.65	No	NA	NA	NA	NA	NA
Chloroform	0.001	CP04D	3/68	0.0014	Yes	0.4	0.35	**0.000036**	**0.000055**	NA
Chrysene	0.027	SS175B	4/67	0.059	Yes	70	NA	3.4	1.4	2
3,5-Dichlorobenzoic Acid	0.14	CP04B	2/67	0.016	No	NA	NA	NA	NA	NA
Dalapon	0.16	SS112B	2/67	0.064	No	NA	NA	NA	0.23	NA
P,P'-DDE	0.0074	SS174A	10/59	0.0011	No	3	NA	0.88	0.06	NA
P,P'-DDT	0.016	SS175A	16/59	0.0020	Yes	3	NA	0.53	0.087	NA
Dicamba	0.007	SS113B	1/67	0.0014	No	NA	NA	0.26	0.28	NA
Dieldrin	0.004	SS175A	2/59	0.00041	Yes	0.05	NA	**0.00080**	**0.00009**	NA
Diethyl Phthalate	0.04	MW-27	1/67	0.059	Yes	10	10	13	13	NA
Dimethyl Phthalate	1	SSJ1IAP001	1/67	0.071	No	30	33	NA	NA	NA
Di-n-Butyl Phthalate	0.08	CP05N	4/67	0.060	Yes	NA	NA	151	11	NA
2,4-Dinitrotoluene	0.255	J1200182R	1/317	0.014	No	0.7	**0.057**	**0.020**	**0.0002**	NA
2,6-Dinitrotoluene	0.043	SS174B	1/317	0.019	Yes	NA	NA	**0.0088**	**0.034**	NA

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
2,000 Meter Berm (Rows 65 to 72)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
2-Amino-4,6-Dinitrotoluene	0.3	SS113A	3/316	0.012	Yes	NA	NA	**0.00038**	**0.029**	NA
4-Amino-2,6-Dinitrotoluene	0.22	SS113A	2/316	0.011	Yes	NA	NA	**0.00038**	**0.029**	NA
Endrin	0.0041	SS175A	2/59	0.00044	No	8	NA	0.19	0.23	NA
Endrin Aldehyde	0.0049	SS119A	2/59	0.00042	No	8 (4)	NA	0.19	0.00043	NA
Fluoranthene	0.039	SS175B	2/67	0.062	Yes	1000	NA	108	210	4
Heptachlor	0.0013	SS112A	1/59	0.00018	No	0.2	NA	0.021	0.51	NA
Heptachlor Epoxide	0.0011	SS175A	1/59	0.00019	Yes	0.09	NA	0.0061	**NA**	NA
2-Hexanone	0.0411	SS02984-A	1/66	0.0028	Yes	NA	NA	NA	NA	NA
HMX	2	SS02893-A	10/316	0.034	Yes	2	**0.34**	**0.32**	7.1	NA
MCPA	35	SS112B	3/67	1.9	No	NA	NA	**0.0014**	**0.0047**	NA
MCPP	35	SS04H	5/66	3.1	No	NA	NA	**0.050**	**0.011**	NA
Methoxychlor	0.065	SS04L	1/59	0.0030	No	200	NA	4.0	0.022	NA
Methyl Ethyl Ketone	0.035	SS04M	44/68	0.0098	Yes	4	4	0.34	1.5	NA
2-Nitrotoluene	0.036	SS175A	1/316	0.016	Yes	NA	NA	**0.0022**	**0.00025**	NA
3-Nitrotoluene	0.03	SS174B	1/316	0.012	Yes	NA	NA	NA	0.6	NA
PCB-1260	0.25	SS175A	6/59	0.014	No	2	NA	**0.010**	**0.014**	NA
Pentachlorophenol	0.025	SS112B	1/73	0.049	Yes	3	**0.008**	**0.00043**	**NA**	NA
Perchlorate	0.0606	SS118A	2/10	0.0074	Yes	0.1	**0.002**	**0.0031**	NA	NA
Phenanthrene	0.018	SS02794-A	1/67	0.053	Yes	10	11	48	NA	3
Phenol	0.15	SSJ1IAP003	4/67	0.065	Yes	1	0.95	0.77	8.1	NA
Picloram	0.016	SS112B	13/45	0.0038	No	NA	NA	0.088	0.17	NA
Pyrene	0.031	SS05CK	2/67	0.056	Yes	1000	NA	19	150	4
RDX [5]	3.5	SS118A	16/316	0.055	Yes	**1**	**0.0017**	**0.00011**	**0.00036**	NA
Toluene	0.015	SS174A	38/69	0.0029	Yes	30	32	0.27	0.0000078	NA
Trichloroethene	0.003	CP04D	1/68	0.0014	Yes	0.3	0.28	**0.00050**	**9.4**	NA
2,4,5-T	0.024	CP04B	3/67	0.0017	No	NA	NA	0.49	0.11	NA
Inorganics										
Aluminum	16500	SS05OA	74/74	7866	Yes	NA	NA	54006	55000	10000
Antimony	1.2	CP05D	4/74	0.32	Yes	20	NA	**0.27**	**0.66**	1
Arsenic	5.9	SSJ1IAP003	67/74	2.6	Yes	20	NA	**0.0090**	**0.0013**	3.9
Barium	58.8	SS113A	74/74	12	Yes	1000	NA	120	300	16
Beryllium	1.4	SS04J	65/74	0.18	Yes	100	NA	2.6	58	0.33
Boron	9	SS118A	17/66	1.8	Yes	NA	NA	9.5	23	17

NA = Not Available
SSL = soil screening level

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
2,000 Meter Berm (Rows 65 to 72)
J-1 Range

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Frequency of Detection	Average Concentration (1) (mg/kg)	Detected in Groundwater	MCP S-1/GW-1 Standard (6) (mg/kg)	MADEP (7) Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Cadmium	3.3	SSJ1IAP001	35/105	0.19	Yes	**2**	NA	**0.40**	**1.4**	0.35
Calcium	848	SSJ1IAP001	67/74	116	Yes	NA	NA	NA	NA	180
Chromium, Total	66.9	SSJ1IAP001	70/74	9.7	Yes	**30**	NA	**7.0**	NA	15
Cobalt	6.6	SS04J	71/74	2.1	Yes	NA	NA	132	**0.5**	2.9
Copper	1550	SSJ1IAP001	75/80	34	Yes	NA	NA	**46**	**51.4**	11
Iron	47100	SS04J	74/74	9772	Yes	NA	NA	**2422**	**640**	12000
Lead	62.7	SS113A	74/74	10	Yes	300	NA	**4.1**	NA	19
Magnesium	2300	SSJ1IAP003	74/74	841	Yes	NA	NA	NA	NA	1500
Manganese	1590	SS04J	74/74	75	Yes	NA	NA	**44**	**57**	110
Mercury	0.028	SSJ1I30003	3/74	0.025	No	20	NA	**0.020**	NA	0.1
Molybdenum	11.5	SS04J	29/66	0.81	Yes	NA	NA	**0.18**	**3.7**	1.1
Nickel	19.2	SSJ1IAP001	74/74	4.5	Yes	20	NA	292	48	6.9
Nitrogen, Nitrate-Nitrite	0.71	SS04M	44/69	0.063	Yes	NA	NA	NA	NA	NA
Phosphorus, Total Po4	147	SS174A	69/69	97	Yes	NA	NA	NA	NA	NA
Potassium	1750	SS04J	69/74	378	Yes	NA	NA	NA	NA	560
Selenium	1.6	SS04H	18/74	0.45	Yes	400	NA	2.8	**19**	0.5
Silver	0.59	SS112A	3/74	0.13	Yes	100	NA	16	1.6	NA
Sodium	357	SS119B	3/74	38	Yes	NA	NA	NA	NA	160
Thallium	5.2	SS04J	21/74	0.62	Yes	8	NA	**3.0**	**NA**	0.6
Vanadium	25.3	SSJ1IAP003	74/74	15	Yes	600	NA	260	260	22
Zinc	218	SS113B	74/74	26	Yes	2500	NA	2202	680	26

(1) Non-detects were included at one-half the detection limit.

(2) The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

(3) gamma-HCH value used as a surrogate.

(4) Endrin value used as a surrogate.

(5) Elevated concentrations of RDX in the vicinity of the tank targets was excavated

(6) MCP maximum allowable value for human contact

(7) MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

FOD = Frequency of detection.

mg/kg = Milligrams per kilogram.

MCP = Massachusetts Contigency Plan.

NA = Not available.