United States Environmental Protection Agency
Region 1

Decision Document

J-2 Range Operable Unit

Camp Edwards
Joint Base Cape Cod
Cape Cod, Massachusetts

September 2013

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

A. SITE NAME

The subject site is the J-2 Range (also referred to as "the Site"), which is located at Camp Edwards at the Joint Base Cape Cod (JBCC) (formerly Massachusetts Military Reservation (MMR)).

B. STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected response actions for the J-2 Range. 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 Administrative Record is available for review by appointment at the Impact Area Groundwater Study Program (IAGWSP) office, PB0516 West Outer Road, Camp Edwards, MA.

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 JBCC 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. The J-2 Range is also located within the Upper Cape Water Supply Reserve established pursuant to Chapter 47 of the Massachusetts Acts of 2002 and designated as conservation land under the care and control of the Massachusetts Division of Fisheries and Wildlife.

D. DESCRIPTION OF COMPREHENSIVE 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), also referred to in this Declaration and Decision Document as unexploded ordnance/discarded military munitions/munitions constituents, or UXO/DMM/MC, or UXO that may be in or on the soil. There may be additional areas on the Site where UXO and the soil beneath may pose public safety risks, ecological risks, dermal contact risks, and/or soil ingestion risks. These potential UXO-related risks are not addressed by this Decision Document, which is being 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.

During the investigations of the Site, several response actions were taken to remove the sources of groundwater contamination. Disposal pits containing UXO and contaminated soil are believed to be the cause of much of the groundwater contamination. Soil contamination and UXO were also discovered in other areas of the range including areas believed to be targets, firing points and areas used for burning propellants. It is believed that most of these source areas were identified and removed during the previous investigations. However, there are a few areas on the range located up-gradient of the plume that require additional investigation to confirm that potential sources have been completely addressed. Confirmatory soil sampling and UXO clearance in select areas of the range will be conducted as part of the remedy to verify source removal is complete. Work plans describing this work have been approved by EPA and MassDEP (Appendix E). Soil contamination and munitions posing a threat to groundwater will be removed.

Based on groundwater sampling results, EPA, in consultation with the Massachusetts Department of Environmental Protection (MassDEP), deemed it necessary to develop and evaluate a range of potential response actions to address contaminants detected in groundwater associated with the J-2 Range. 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 COCs were used to develop and evaluate a range of potential response actions for the Site. The Site contains two distinct and separate groundwater plumes identified as the J-2 Northern groundwater plume and the J-2 Eastern groundwater plume. Groundwater modeling was used to determine the feasibility of the alternatives for each of these plumes. The cleanup objectives for the J-2 Range groundwater plumes 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 and 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; to prevent ingestion and inhalation of groundwater containing the contaminants of concern (COCs) (RDX and perchlorate), in excess of federal maximum contaminant levels (MCLs), Health Advisories (HA), drinking water equivalent levels (DWELs),

applicable State standards or an unacceptable excess lifetime cancer risk (ELCR) or non-cancer Hazard Index (HI); and, for the J-2 Northern groundwater plume, to protect the current water supply by preventing groundwater in excess of Health Advisories, drinking water equivalent levels (DWELs), applicable State standards or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index from migrating past Gibbs Road located on Camp Edwards.

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, MassDEP promulgated a Massachusetts Maximum Contaminant Level (MMCL) for perchlorate of 2 µg/L in July 2006.

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 in the J-2 Range groundwater plumes 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 groundwater response actions 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.

The selected response action consisting of Focused Extraction with Monitored Natural Attenuation with Land-Use Controls (LUCs), and confirmatory soil sampling and UXO clearance to verify all sources have been addressed provides the best balance of the criteria used to evaluate cleanup alternatives.

The selected response action achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater extraction and treatment and groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination are valid and that contamination levels continue to decline. The groundwater extraction and treatment system will be designed and operated to protect the public water supply located down gradient. Human health will be further protected through the implementation and verification of LUCs. These LUCs will prevent use of contaminated portions of the aquifer at the Site for drinking water purposes until groundwater data confirms that contamination has been reduced to below risk-based levels. The LUCs will also prevent activities that may interfere with the treatment and monitoring systems.

The major components of the source and groundwater response actions for the J-2 Range Northern groundwater plume are:

- Extraction and treatment of groundwater by shifting pumping stress between the three existing extraction wells within the current system design and expanding the system if necessary to ensure complete containment of the plume at each extraction well; treatment with granular activated carbon and ion exchange resin at the existing or expanded treatment units; and infiltration of the treated water at a minimum of four infiltration trenches. A work plan (J-2 Range Priority 2 Data Gap Drilling Project Note, dated 08/28/2013) which has been approved by EPA and MassDEP, will be implemented as part of the remedy and includes the installation of additional monitoring wells to determine if each extraction well is achieving containment (Appendix E). If containment is not achieved, a work plan will be developed to explain how the extraction and treatment system will be altered and augmented to insure that containment at each extraction well is achieved. This work plan will be implemented as part of the selected remedy after approval by EPA and MassDEP.

- A contingency for additional active treatment in the area of Gibbs Road on Camp Edwards, and modifying the system to optimize the system performance to ensure protection of the Upper Cape Water Supply. A work plan (J-2 Range Northern Plume Priority 1 Data Gap Drilling Project Note, dated 07/11/2013) describing the monitoring program necessary to verify that contamination has not migrated past Gibbs Road has been approved by EPA and MassDEP and will be implemented as part of the remedy (Appendix E). A second work plan will be developed that will include the groundwater monitoring and modeling work necessary to make this demonstration periodically. If groundwater monitoring data or modeling suggests that contamination above federal or state regulatory or risk-based levels for COCs will likely migrate past Gibbs Road, additional extraction wells will be installed and begin operation within 12 months of that determination.
- An investigation including soil sampling and removal of additional geophysical anomalies in select areas of the range to verify source removal is complete. A work plan (Confirmatory Soil Sampling for Areas 1, 2 and 3 at the J-2 Range Project Note, dated 08/29/2013, and Confirmatory Intrusive Geophysical Investigations at the J-2 Range Project Note, dated 08/28/2013) describing the soil sampling and geophysical investigations has been approved by EPA and MassDEP and will be implemented as part of the remedy (Appendix E). Soil contamination and munitions posing a threat to groundwater shall be removed.
- Long-term groundwater monitoring at existing and new monitoring wells to verify the effectiveness of the source response action; to ensure that groundwater modeling predictions regarding the reduction and migration of contamination are valid; and to ensure that any remaining contamination remains below risk-based levels.
- Implementation and verification of Land Use Controls to prevent use of contaminated portions of the aquifer for drinking water until contamination is reduced to below risk-based levels and to prevent actions that would interfere with the remedy.

- Five year reviews to determine if the groundwater treatment system is still protective and achieving the goals established and to determine if source response actions continue to protect groundwater.

The major components of the source and groundwater response actions for the J-2 Range Eastern groundwater plume are:

- Optimization and continued long-term operation of the current J-2 Range Eastern groundwater extraction treatment and injection system. The J-2 Range eastern groundwater plume system consists of three extraction wells and three infiltration trenches located to the northeast, southeast, and southwest of the plume.
- An investigation including soil sampling and removal of additional geophysical anomalies in select areas of the range to verify source response is complete. A work plan (Confirmatory Soil Sampling for Areas 1, 2 and 3 at the J-2 Range Project Note, dated 08/29/2013, and Confirmatory Intrusive Geophysical Investigations for the J-2 Range Project Note, dated 08/28/2013) describing the soil sampling and geophysical investigations has been approved by EPA and MassDEP and will be implemented as part of the remedy (Appendix E). Soil contamination and munitions posing a threat to groundwater shall be removed.
- Long-term groundwater monitoring at existing and new monitoring wells to verify the effectiveness of the source response action; to ensure that groundwater modeling predictions regarding the reduction and migration of contamination are valid; and to ensure that any remaining contamination remains below risk-based levels.
- Implementation and verification of Land Use Controls to prevent use of contaminated portions of the aquifer for drinking water until contamination is reduced to below risk-based levels and to prevent actions that would interfere with the remedy.
- Five year reviews to determine if the groundwater treatment system is still protective and achieving the goals established and to determine if source response actions continue to protect groundwater.

E. DETERMINATIONS

The following determinations apply to both the J-2 Range Northern area and the J-2 Range Eastern area. 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 confirmatory soil sampling and UXO clearance) 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 the 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-2 Range Remedial Investigation/ Feasibility Study dated July 2013. An overview of the Site, including decision factor(s) 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 RDX and perchlorate, their respective concentrations, the baseline risk, the cleanup levels established 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 the selected response actions for remediation of the J-2 Range within Camp Edwards at the JBCC. The response actions were selected by EPA under the authority of the SDWA. The MassDEP concurs with this decision.

U.S. Environmental Protection Agency

By: Nancy Barmakian for Date: 09/30/13

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

PART II: THE DECISION SUMMARY

A. SITE DESCRIPTION

The J-2 Range is located on Camp Edwards on the JBCC on Cape Cod in Massachusetts (Figure 1). It is located southeast of the impact area, and north of the J-1 range. The J-2 Range is approximately 1,200 meters long and between 100- and 180-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 beyond Chadwick Road into the impact area. There were five man-made berms located at various areas within the range. The only remaining structures located on the range are a concrete/earthen wall, a former ammunition bunker surrounded by fencing, a wooden subsurface vault that housed valves/well, and the foundations of a small concrete melt/pour facility, and concrete pad. Access to the J-2 Range is currently restricted by a locked gate at Greenway Road.

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

The J-2 Range was a multi-purpose range where military training, munitions testing, and munitions disposal occurred. Military training, which consisted of small arms training, occurred from 1935 to the 1980s. From 1953 through the late 1980s, the J-2 Range was used for weapons testing by defense contractors. The predominant firing positions are believed to have been in the southern area of the range. The items fired consisted of various types and sizes of projectiles and ammunition.

Testing activities included fuzes for the 30mm High Explosive Incendiary (HEI) round, propellants and fuzes in 81mm mortars, fuzes in 105mm and 155mm projectiles and 8-inch rounds. Other testing included fin assemblies for wax-filled 60mm mortars, 105mm High Explosive Anti-Tank munitions and discarding sabot rounds, over-pressure testing on the 105mm tank barrels, and other miscellaneous tests. An on-site, melt/pour facility was used at the range to melt, mix, and mold explosives for use in various munitions. Testing for development of the LAW rocket was conducted at the range between 1971 and 1974. Disposal activities conducted at the range consisted of propellant and waste burning in pits and along the range road near the firing points. Munitions and other items, including fireworks, were disposed of at various locations throughout the range, including a significant disposal area identified as Disposal Area 2 near the Impact Area boundary.

2. History of Investigations and Response Actions

Investigations were conducted at the J-2 Range between 1997 and 2012 to identify the nature and extent of contamination in soil and groundwater resulting from past military 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 future contamination from UXO, and to provide a basis for the evaluation of risk(s) posed by the Site.

During response actions conducted from 2004 to 2006, approximately 6,474 cubic yards of soil contaminated with explosives and perchlorate were excavated from the central and southern portions of the J-2 Range and treated on-site by thermal desorption. In 2009 and 2010, approximately 1,100 cubic yards of contaminated soil was removed from the J-2 extension area and treated by alkaline hydrolysis. Finally, approximately 1,110 additional cubic yards of contaminated soil generated as a result of various intrusive investigations of geophysical anomalies were disposed of off-site at permitted facilities.

Geophysical investigations were conducted from 1997 through 2009 in several different phases utilizing several approaches to identify and remove munitions. Many of the investigations focused on identifying and removing disposal pits. Over the course of these ongoing removal actions, approximately 21,600 munitions containing high explosives (HE) were removed. In addition, approximately 11,100 munitions containing small quantities of explosives were removed along with 114,000 pounds of range debris.

These targeted removals of soil and munitions have likely removed most of the items posing as active sources of groundwater contamination. A brief summary of the investigations and response actions performed at the Site is provided below. To simplify the discussion, the range has been divided into four subareas (Areas 1 through 4) (Figure 2). The areas were chosen based on historical range use, range features and the conceptual site model of the range. A more detailed discussion can be found in Sections 3 and 4 of the July 2013 Remedial Investigation/Feasibility Study (RI/FS) Report.

Source Investigations and Results

Source characterization investigations on or at the J-2 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 observations 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, before and after blow-in-place (BIP) events, proposed excavation areas, and from the base of excavations after soil removal activities.

During the period from 1997 through 2009, 3,178 soil samples were collected from 753 locations within the J-2 Range investigation area (Figure 3).

Area 1

Area 1 is located in the southernmost portion of the J-2 Range. This area of the range had multiple features, including firing points from which munitions were fired downrange, a building used to melt, mix, and mold explosives for use in various munitions, an area where propellant was loaded into cartridges, and a staging and administrative area for the munitions testing that occurred on the range. Results of soil investigations and geophysical investigations in Area 1 indicated no widespread surface soil contamination. Area 1 had the lowest number of UXO items of the J-2 Range. Approximately 340 HE items were removed from Area 1. The majority of UXO items removed were from the burial pits that were discovered in five grid locations in the northern portion of Area 1. The majority of UXO found in these pits contained small quantities of explosives (e.g. 20mm and 40mm, 60mm). None of the disposal locations were identified as burn pits and there are no known impact or target locations within Area 1. While there is a potential for residual single UXO items, the investigation findings suggest that there is a low likelihood of the presence of uninvestigated UXO burials or the potential for widespread distribution of UXO items. Items that could remain in Area 1 containing HE or a small quantity of energetic include 20mm projectiles, 66mm LAW rockets, 60mm mortars, 81mm mortars, 3.5-inch rockets, 37mm projectiles, 30mm projectiles, and fuses. Large residual anomalies are associated with cultural features and metallic structures from contractor testing. Isolated medium to small sized geophysical anomalies still remain on the range and it is likely that they are due to fragmentation, metallic debris, or individual intact munitions that could be either inert or HE.

Area 2

Area 2 is the largest of the four J-2 Range areas and is situated in the central portion of the J-2 Range. This area of the range had multiple features including firing points, target areas, and areas along the range road where propellant was allegedly burned. Thirteen burial locations containing UXO were identified. Approximately 2,400 munitions containing HE were removed from Area 2. Individual projectiles have been identified throughout Area 2. Significant quantities of 30mm high explosive incendiary (HEI) projectiles were identified in the southwestern portion of Area 2 centered on grids M19/M20. Many of the projectiles within grids M19 and M20 were determined to be cracked and/or leaking (see Table 5 of Appendix G of the RI/FS). In addition to these individual projectiles, found at depths ranging from 0 to greater than 12 inches below ground surface, two munitions burial pits containing mostly 30mm HEI projectiles were identified within grids M19 and M20. These features are considered the primary contributors to the J-2 Eastern groundwater plume.

All large geophysical anomalies in Area 2 have been investigated. Large anomalies that still remain are associated with concrete structures. Some small to medium-size anomalies still remain, and it is likely that additional single 30mm HEI projectiles, 57mm projectiles and 66mm HE rockets could be found within this area. Some single 60mm or 81mm mortars also likely remain on the range that could have inert bodies with live fuses. Surface soil contamination was identified in the area around the firing locations and at certain impact locations. Soil contamination was also associated with certain burial locations that contained UXO. Soil removal activities were conducted in this area, as discussed below in J-2 Range Response Actions (Figure 4). The UXO and soil contamination associated with Areas 1 and 2 likely contributed to the generation of the J-2 Eastern groundwater plume.

Area 3

Area 3 is located in the north-central portion of the J-2 Range. The primary activity conducted in the area was burning and burial of munitions and fireworks. Investigations in Area 3 included a quality control survey with an intrusive investigation of residual anomalies over most of the area. Approximately 18,760 UXO items were removed during Area 3 investigations including a rapid response action. Soils contaminated with significant levels of explosives and/or perchlorate were found at Disposal Area 2, which contained thirty-two burn/burial pits. Note that Area 3 is the only area on J-2 Range in which burn pits were found. These areas were addressed during soil removal actions, and with a few exceptions, no significant soil contamination remains. The highest percentage of UXO items were recovered during the burial investigations. No known burials remain. Single UXO items were also discovered in Area 3 and it is possible that some may remain at isolated medium-sized to small geophysical anomaly locations. It is likely that these anomalies are fragmentation, metallic debris or individual intact munitions, both inert and HE. As a result of former disposal operations in Disposal Area 2, kick-outs are possible. Area 3 also lies within the down-range portion of the J-2 Range and could contain residual munitions from testing and training. These residual munitions may include single UXO items such as 20mm projectiles, 30mm projectiles, 37mm projectiles, 40mm projectiles, and/or 57mm projectiles. It is unlikely that any subsurface burials still remain in the Area 3. This area was subsequently targeted for excavation of the highest levels of TNT, nitroglycerin, RDX and HMX during the removal activities discussed below in J-2 Range Response Actions (Figure 5). This area has been identified as the primary source of the J-2 Range Northern groundwater plume.

Area 4

Area 4 is located at the northern end of the range, north of Barlow Road (the Impact Area boundary) . Area 4 was presumed to be a demolition area as this area lacked surface features indicative of historical contractor use and testing. Soil sampling activities around the demolition area indicated elevated levels of RDX and HMX in the north central portion of Area 4. No significant groundwater contamination has been detected down gradient of Area 4. This area was subsequently targeted for excavation (Figure 6). Large anomalous areas identified

throughout the geophysical survey were excavated. Approximately 175 HE items were removed from Area 4. Isolated medium to small sized geophysical anomalies still remain on the range and it is possible that they represent fragmentation, metallic debris, or individual munitions that could be either inert or HE.

Groundwater Investigations and Results

Two large-scale plumes of comingled RDX and perchlorate contaminated groundwater have been found to be migrating from sources at the J-2 Range. The J-2 Range Northern groundwater plume is thought to be derived from Disposal Area 2 located near Barlow Road and is migrating in a northerly direction. The J-2 Eastern groundwater plume is more fan-shaped and consists of a main lobe, which migrates in a northeasterly direction and several smaller lobes that migrate in both an easterly and northerly direction.

In the Northern area, the groundwater 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 detected concentrations in the up gradient portion of the plume. The RDX portion of the plume is enveloped within the perchlorate groundwater plume. The extent of the perchlorate plume, as defined by detections above 2 µg/L, is approximately 8,100 feet long and 850 feet wide. Prior to the start up of the rapid response action, the RDX plume was approximately 2,400 feet long and 900 feet wide but has since diminished to the point where concentrations of RDX above 0.6 µg/L have only been detected in two well samples collected in 2012. The maximum historical detections were 16.1 µg/L for RDX and 198 µg/L for perchlorate and the current maximum detected are 2.9 µg/L for RDX and 115 µg/L for perchlorate.

Monitoring data collected in 2012 indicates that significant perchlorate concentrations exist at MW-588 and MW-589 which are located outside of the simulated capture zones of extraction well J2EW001. This extraction well had been pumping at 75 gpm since the startup of the RRA system in September 2006. In March 2013, the pumping rate at J2EW0001 was increased to 150 gpm in order to expand the capture zone enough to encompass these two monitoring wells. In addition, the pumping rate at J2EW0002 was also reduced from 175 to 100 gpm to accommodate the flow rate capacity in the treatment system. Further investigations are needed to verify the extent of contamination beyond the two monitoring wells and to determine whether these changes are sufficient to capture contamination in this area. The treatment system design capacity for extraction wells J2EW001 and J2EW0002 is currently 250 gpm. In August 2013, the pumping rate at J2EW0003 was increased to 190 gpm (to be increased to 225 gpm) in order to expand the capture zone enough to encompass contamination recently seen at MW-296.

In the Eastern area, the groundwater plume consists of perchlorate and RDX. Since there were multiple sources of contamination for the J-2 Range eastern plume, this plume is more heterogeneous in nature. The perchlorate plume is detached from the source area and has the

highest detected concentrations in the middle portion of the plume. The extent of the J-2 Range eastern perchlorate plume (above 2 µg/L) is approximately 4,200 feet long and 1,700 feet wide. The RDX plume extends slightly further down gradient than the perchlorate plume. The main body of the J-2 Range eastern RDX plume (above 0.6 µg/L), is approximately 5,800 feet long and up to approximately 1,150 feet wide. There are also three smaller lateral plumes. The maximum historical detections were 17 µg/L for RDX and 88 µg/L for perchlorate and are currently 14 µg/L for RDX and 44 µg/L for perchlorate.

Perchlorate was detected in the groundwater from MW-519M1 located downgradient of the J-2 Extension area at 0.21 µg/L. RDX was not detected from this location.

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 were retained as COCs for both the northern and eastern groundwater plumes. (Appendix D).

J-2 Range Response Actions

Several soil response actions have been undertaken in the J-2 Range to reduce levels of contamination from certain areas. These include soil and UXO removals at the following areas:

Area 1
Approximately 215 cubic yards of soil was removed from Area 1, primarily associated with two munitions burial pits.

Area 2 and Area 3
During response actions conducted from 2004 to 2006, approximately 6,474 cubic yards of soil contaminated with explosives and perchlorate were excavated from 15 locations in Areas 2 and 3 of the J-2 Range and treated onsite by thermal desorption. In addition, approximately 300 cubic yards of contaminated soil was excavated from Area 2 in 2006 and disposed of off-site.

Area 4
Approximately 1,100 cubic yards of contaminated soil was removed in 2009 and 2010 and treated by alkaline hydrolysis at the on-site treatment cell located at the L Range.

Locations throughout Areas 1, 2 and 3

Geophysical investigation of 271 anomalies from 1997 through 2010 resulted in the removal of UXO from 62 locations. These investigations also resulted in the excavation and off-site

disposal or on-site thermal treatment of approximately 1,110 cubic yards of contaminated soil from 34 investigation locations.

In summary, soil removal actions have been conducted at numerous locations and approximately 9,000 cubic yards of contaminated soil has been excavated and treated on-site, or disposed of off-site. Cumulatively, approximately 21,600 munitions containing high explosives were removed as a result of the soil and UXO removal actions. In addition, approximately 11,100 munitions containing small quantities of explosives were removed along with 114,000 pounds of range debris.

A Rapid Response Action (RRA) was initiated at the J-2 Northern groundwater plume in 2006. The objective of the RRA system was to provide accelerated protection of the water supply wells and aquifer restoration by capturing and treating contaminated groundwater until the long-term remedy could be selected for the plume. The Extraction, Treatment, and Infiltration (ETI) system consisted of three axial extraction wells pumping at a combined rate of 375 gpm and four infiltration trenches located to the northeast, southeast, southwest, and northwest of the northern J-2 plume. Since the start of the system, approximately 1.2 billion gallons of groundwater have been treated. The plume appears to be becoming segmented into four lobes due to the operation of the ETI system and natural attenuation. However, additional characterization of groundwater is necessary to determine whether any contamination lies beyond and down gradient of the existing capture zones and to provide continued protection of the water supply wells.

A RRA was initiated at the J-2 Eastern plume in 2008. The objective of this RRA system was to prevent further off base migration of the plume and to protect the down gradient water supply wells. The ETI system consisted of three axial extraction wells pumping at a combined rate of 425 gpm and three infiltration trenches located to the northeast, southeast, and southwest of the Eastern J-2 plume. Since the start of the system, approximately 1 billion gallons of groundwater have been treated. The J-2 Eastern plume also appears to be becoming segmented due to the operation of the ETI system and natural attenuation.

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 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.

C. COMMUNITY PARTICIPATION

Throughout the Site's history, the Impact Area Groundwater Study Program (IAGWSP), EPA and MassDEP have kept the community and other interested parties informed and involved with response activities at the J-2 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 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 JBCC investigations and cleanup efforts.

The IAGWSP has briefed the Senior Management Board (SMB), which had advised JBCC organizations on environmental programs and policies. Members of the SMB included 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 March 14, 2012, an informational meeting was held at Camp Edwards, MA, to present the findings of the RI/FS report for the J-2 Range to the MMRCT and the public. A display ad regarding the meeting was placed in the editions of the *Cape Cod Times* and *The Enterprise* newspapers and a news release regarding the meeting was sent to the local media on March 7, 2012

- On July 24, 2013, a Public Information Session was held on the Remedy Selection Plan for the J-2 Range at Camp Edwards. At the meeting, the IAGWSP gave a presentation on the findings of the investigations and the alternatives evaluated and EPA presented the proposed response for the Site. The MMRCT, local residents and officials, news media representatives, and members of the public interested in site activities and cleanup decisions were invited to attend the meeting. Representatives from EPA, MassDEP and IAGWSP were available to answer questions. The IAGWSP notified the public of the information session, and reminded them about the public comment period in a display ad placed in the 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 17, 2013. In addition, the Remedy Selection Plan and an invitation to the information session were mailed to Forestdale residents on July 17, 2013.

- From July 17 through August 16, 2013, a Public Comment Period was held on the Remedy Selection Plan for the J-2 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-2 Range investigations and findings supporting selection of the response action including the RI/FS report for the J-2 Range, along with other relevant documents. The Remedy Selection Plan also was made available on the both the EPA and IAGWSP Web sites, which also contains the supporting documents and offered a means of submitting public comments on the Remedy Selection Plan. In addition, the IAGWSP provided copies of the Remedy Selection Plan to the MMRCT members and distributed it to individuals in attendance at the public meeting.

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), the EPA Web site (www.epa.gov/region1/mmr) and the Administrative Record located at PB0516 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 JBCC investigation and response activities.

D. SCOPE AND ROLE OF OPERABLE UNIT

The Site consists of source areas contributing to groundwater contamination (i.e., contaminated soil and the areas known or suspected to contain UXO, DMM or MC) and two distinct groundwater plumes. Several source areas contributing to groundwater contamination for the J-2 Range were addressed through the removal of geophysical anomalies and the excavation and removal of contaminated soils. The effectiveness of the source removal will be evaluated as part of the selected remedy. The selected remedy also includes a groundwater response action for each groundwater plume. Since complete range clearance has not been conducted, UXO items may remain. In addition, these remaining munitions, and the soil beneath, may also pose public safety risks, ecological risks, dermal contact risks, and/or soil ingestion risks. However, 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.

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 the JBCC, including the J-2 Range.

Site Hydrogeology

A single groundwater-flow system underlies Western Cape Cod including JBCC. Camp Edwards lays 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 JBCC 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 JBCC 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 JBCC. 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 JBCC 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-2 Range, the groundwater elevation is typically between 67 and 69 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 JBCC 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 J-2 Northern groundwater plume flows in a northerly

direction. Contaminated groundwater from the J-2 Eastern groundwater plume flows in a northeasterly direction. The groundwater flow rate is approximately one foot/day in the sandy portions of the unconfined aquifer which is comprised of glacial outwash deposits. Groundwater flow rates generally decrease with depth in the aquifer, where silty deposits prevail. 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 J-2 Range Northern plume (based on concentrations of perchlorate greater than 2.0 µg/L as of 2013) is estimated to be 293 million gallons. The total mass of perchlorate in this plume is 17.4 pounds and the total mass of RDX in this plume is less than 1 pound.

The total volume of the J-2 Range Eastern plume (based on concentrations of perchlorate greater than 2.0 µg/L as of 2013) is estimated to be 307 million gallons. The total mass of perchlorate is approximately 16.8 pounds and the total mass of RDX is approximately 1.8 pounds.

Current Exposure Pathways

There are two public water supplies located within the J-2 Range groundwater study area. An Upper Cape Cod Regional Water Supply Cooperative Well (WS-2) is located approximately 0.6 mile down gradient of the J-2 Range Northern groundwater plume; WS-1 is located approximately 0.55 mile down gradient of the J-2 Range Eastern groundwater plume. There are no known private water supplies and no one is currently believed to be drinking water related to the J-2 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-2 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-2 Range is located on the JBCC and is designated as an active military training area. The J-2 Range Eastern groundwater plume area originates on base but extends slightly into an adjacent off-base residential neighborhood. It is anticipated that the northern area and the on-base portion of the eastern area of the J-2 Range Site will remain under the control and direction of government agencies and will continue to be used for military training and support purposes at least until the current lease expires in 2052. The J-2 Range is also located within the Upper Cape Water Supply Reserve established pursuant to Chapter 47 of the Massachusetts Acts of 2002 and designated as conservation land under the care and control of the Massachusetts Division of Fisheries and Wildlife. The source area overlays portions of a sole source aquifer that is designated 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-2 Range to identify any contaminants of concern (COCs) detected in J-2 Range soil or groundwater that required further evaluation in the Feasibility Study.

The soil risk screening was conducted to evaluate the risk to human health and the potential for detected constituents in soil to leach from the soil and migrate through the subsurface to the groundwater. The constituents detected in the soil were initially evaluated by comparing their maximum detected concentrations to a series of federal and state risk-based criteria. The screening values included the constituent's MCP Method 1 S-1/GW-1 Standard, the MassDEP leaching based soil concentration, the site specific SSL (MMR SSL), and the EPA risk-based SSL. The risk screening identified specific locations where the maximum concentrations of several constituents (including 2,4 DNT, HMX, RDX and perchlorate) exceeded their screening criteria. However, when averaged with other samples from within the same area (e.g., within a 10,000 sf grid), the averages did not exceed the respective MCP Method 1 S-1/GW-1 Standards. In addition, the soil at many of these locations was associated with blown in place (BIP) activities and were either allowed to remain in-place under BIP protocols or have been removed under this program. Other constituents were occasionally detected above their screening levels, but only at low frequencies. A confirmatory soil sampling program for explosives, perchlorate, cadmium, and polychlorinated naphthalenes is to be conducted to verify

the overall findings of the RI/FS and the extent of residual contamination (if any) remaining at several locations within Areas 1, 2, and 3 of the J-2 Range. These confirmatory results also will be used to identify any areas where additional soil removal may be needed. The J-2 Range groundwater risk screening was conducted using the results for groundwater samples collected from 185 monitoring wells associated with the J-2 Range eastern and northern plumes. The maximum concentration of each detected constituent was compared to its federal and state (where available) Maximum Contaminant Level (MCL or MMCL), EPA Drinking Water Health Advisory (HA), EPA Regional Screening Level (RSL) for Tapwater, and MCP Method 1 GW-1 Standard. The groundwater screening identified RDX and perchlorate as exceeding their respective screening criteria and they were, therefore, recommended for further evaluation in the Feasibility Study. Several other constituents also were identified at concentrations exceeding the risk screening criteria, but these constituents were either no longer detected at concentrations exceeding their screening criteria in the most recent sampling, are associated with naturally occurring background conditions, or are laboratory-related contaminants. Consequently, they were not recommended for further consideration in the groundwater Feasibility Study. Based on the J-2 Range groundwater screening analysis, perchlorate and RDX were identified as COCs in both the J-2 northern and eastern groundwater plumes and were further evaluated in the Feasibility Study.

Given the location of the J-2 Range within a restricted area surrounded by fencing and guarded gates (i.e., the land is controlled by the U.S. Army under a lease with the Commonwealth of Massachusetts until at least 2052), the potential for human exposure to on-site soil contaminants is limited to occasional trespassers, site workers, and military personnel. Therefore, it is anticipated that the land use at the J-2 Range will not significantly change over time. The risk screening revealed that there are believed to be no current significant exposure routes associated with soil and groundwater for human receptors, and no one is currently believed to be drinking groundwater associated with the J-2 Range containing COCs above current drinking water standards, Health Advisories, or risk based levels. An Upper Cape Cod Regional Water Supply Cooperative operates two water supply wells down-gradient of the J-2 Range. Water supply well WS-2 is located approximately 0.6 mile down-gradient of the J-2 Range Northern plume. Water supply well WS-1 is located approximately 0.55 mile down-gradient of the J-2 Range Eastern plume. Since groundwater contamination has been detected above the noted screening criteria, unacceptable human health risks could result from drinking the groundwater associated with the J-2 Range (if that were to occur). However, the groundwater extraction and treatment remedy is designed to intercept and capture the northern and eastern groundwater plumes and maintain the integrity and quality of the down-gradient water supplies.

H. RESPONSE ACTION OBJECTIVES

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-2 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; 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, and, for the J-2 Northern groundwater plume, to protect the current water supply by preventing groundwater in excess of Health Advisories, drinking water equivalent levels (DWELs), applicable State standards or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index from migrating past Gibbs Road located on Camp Edwards.

I. DEVELOPMENT 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 less 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 in consideration of the response action objectives described in Part II.H above. 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.

Five alternatives were developed for each area of groundwater contamination 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 Three Wells, Monitored Natural Attenuation, and Land-Use Controls (Continued Operation of Current System)
- Alternative 4 - Focused Extraction with Three Wells, Monitored Natural Attenuation and Land Use Controls (Optimization of Current System)
- Alternative 5 – Focused Extraction with Five Wells, Monitored Natural Attenuation and Land Use Controls

All alternatives except Alternate 1 (No Action) include 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. Although this decision is being made under the SDWA, these criteria were modeled on those used under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Contingency Plan (NCP), 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.

In this decision under Section 1431(a) of the SDWA, the EPA 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, and 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-2 Range Northern Groundwater Plume Description of Alternatives

Alternative 1 – No Further Action: Alternative 1 provides for no further action to address groundwater contamination associated with the J-2 Range Northern groundwater plume. Under this alternative:

- No active groundwater treatment would occur.
- Model predictions could not be verified due to abandonment of existing treatment systems and monitoring wells.
- Land-use controls would not be implemented and so would not ensure against exposure until cleanup is achieved.
- Site close-out documentation would be completed.
- Contamination within the plume is predicted to drop below the 2 µg/L MMCL for perchlorate by 2065 and is predicted to reach background levels after 2113.
- The total cost of Alternative 1 is estimated at $213,000.

Alternative 2 – Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs): Alternative 2 would provide long-term monitoring of the J-2 Range Northern groundwater plume 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 closeout documentation would be completed.
- Contamination within the plume is predicted to drop below the 2 µg/L MMCL for perchlorate by 2065 and is predicted to reach background levels after 2113.
- The total cost of Alternative 2 is estimated at $2,783,000.

Alternative 3 – Focused Extraction with Three Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 3 would provide for extraction and treatment of the groundwater. Under this alternative: Contamination would be remediated through the long term operation of the current extraction system consisting of: a flow rate of 75 gpm at J2EW0001, 175 gpm at J2EW0002, and 125 gpm at J2EW0003 for a total combined pumping rate of 375 gpm; treatment with granular activated carbon and ion exchange resin at two treatment units and one treatment facility/infiltration of the treated water via four 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.
- Perchlorate is predicted to drop below the 2 µg/L MMCL for perchlorate by 2029 and is predicted to reach background levels by 2071.
- The total cost of Alternative 3 is estimated at $5,825,000.

Alternative 4 – Focused Extraction with Three Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 4 would provide for extraction and treatment of the groundwater by enhancing the existing groundwater extraction system. Under this alternative: Contamination would be remediated through the optimization and long term operation of the current extraction system consisting of: a flow rate of 150 gpm at J2EW0001, 100 gpm at J2EW0002, and 225 gpm at J2EW0003 for a total combined pumping rate of 440 gpm; treatment with granular activated carbon and ion-exchange resin at two mobile treatment units and one treatment

facility; infiltration of the treated water via four 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.
- Perchlorate is predicted to drop below the 2 µg/L MMCL by 2027 and is predicted to reach background levels by 2071.
- The total cost of Alternative 4 is estimated at $5,346,000.

Alternative 5 – Focused Extraction with Five Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 5 would provide for extraction and treatment of the groundwater by enhancing the current groundwater extraction system. Under this alternative: The pump and treat system would include: a flow rate of 150 gpm at J2EW0001, 200 gpm at J2EW0002, 225 gpm at J2EW0003, and the addition of two extraction wells near J2EW0001 (100 gpm at a shallow well and 50 gpm at a deep well) for a total combined pumping rate of 625 gpm, treatment with granular activated carbon and ion exchange resin by expanding the treatment units.; infiltration of the treated water by expanding the 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 is predicted to drop below the 2 µg/L MMCL for perchlorate by 2024 and reach background levels by 2059.
- The total cost of Alternative 5 is estimated at $10,690,000.

Summary of the Comparative Analysis of Alternatives

The following discussion summarizes the strengths and weaknesses of each response action alternative identified for the J-2 Range Northern groundwater plume with respect to the nine criteria: Overall Protection of Human Health and the Environment: Alternatives 2 through 5 would be protective of human health and the environment. Alternative 1, however, offers no monitoring or confirmation of existing land-use controls to ensure that future exposures do not occur. Alternative 2 adds provisions for plume monitoring and land-use controls to help prevent future exposure to contaminated groundwater. Alternatives 3 through 5 add extraction and

treatment components and achieve risk-based concentrations earlier than Alternatives 1 and 2.

Compliance with Regulations: All alternatives are expected to eventually result in compliance with applicable regulations. Alternatives 1 and 2 allow for continued migration of the plume. Because these alternatives involve no active remediation, chemical-specific regulations would be met only 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.

Long-Term Effectiveness and Permanence: Additional soil sampling and UXO clearance shall be performed to confirm that the source area has been removed so residual soil contamination is unlikely to compromise the permanence of the remedial alternatives once completed. All of the alternatives would permanently achieve the cleanup goals; however, time to cleanup would vary. Moreover, Alternatives 3 through 5, which include active treatment of the plume, may result in fewer uncertainties over the long term regarding the fate and transport of the plume.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives 3 through 5 reduce the toxicity, mobility, and volume of contaminated groundwater through treatment. Based on model predictions, Alternatives 3, 4 and 5 would remove 13.9, 13.2, and 11.6 kg of perchlorate, respectively.

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 impact because of the large amount of construction involved. Alternatives 3 and 4 would also have some environmental impacts due to construction. Alternatives 2 through 5 would have environmental impacts from monitoring well installation, monitoring, and well abandonment. The only environmental impact of Alternative 1 would be from abandonment of the current extraction system, and monitoring well system.

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 the existing groundwater extraction system, groundwater monitoring wells and preparing close out documentation. Alternative 2 is the next most easily implemented alternative with groundwater monitoring and land-use controls implemented. Alternatives 3, 4, and 5 are somewhat more difficult alternatives to implement, since they include the installation of groundwater monitoring wells and/or extraction well(s), treatment facilities, new piping/power lines, and infiltration trench(es).

Cost: Alternative 1 and Alternative 2 would be the least costly, with most of the Alternative 2 cost associated with long-term monitoring. Costs for Alternative 3 and Alternative 4 are similar. Alternative 5 would be significantly more costly than either Alternative 3 or Alternative 4. The primary driver of the costs for Alternative 5 is the capital cost for the additional extraction,

treatment and discharge. Alternative 1 is the least expensive alternative with a total estimated cost of $213,000. Estimated costs of the other alternatives are: Alternative 2 - $2,783,000, Alternative 3 - $5,825,000, Alternative 4 - $5,346,000, and Alternative 5 - $10,690,000,.

These cost estimates (except for Alternative 1) are exclusive of the costs associated with the removal of any soil contamination and munitions determined to pose a threat to groundwater.

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 the Upper Cape Cod Regional Water Supply Cooperative as part of the public comment period on the Remedy Selection Plan for the J-2 Range. See "Part III Responsiveness Summary" for more details.

The Selected Response Action for the J-2 Northern Groundwater Plume

For the reasons set forth herein, EPA has identified Alternative 4 - Focused Extraction with Monitored Natural Attenuation, and Land-use Controls for ground water, and confirmatory soil sampling and UXO clearance, as the appropriate response action for the J-2 Range Northern Groundwater Plume (Figure 7). This alternative, as presented in the feasibility study, provides the best balance of the criteria used to evaluate cleanup alternatives. However, to strengthen this alternative, EPA has selected Alternative 4 with certain enhancements to ensure the remedy remains protective. This Enhanced Alternative 4 includes:

- Extraction and treatment of groundwater by shifting pumping stress between the existing extraction wells within the current system design or expanding the system to ensure complete containment of the plume up-gradient of each extraction well; treatment with granular activated carbon and ion exchange resin at the existing or expanded treatment units; and infiltration of the treated water at a minimum of four infiltration trenches. Currently, the system is pumping at 150 gpm at J2EW001, 100 gpm at J2EW0002 and 190 gpm at J2EW0003 for a total combined flow rate of 440 gpm. A work plan, which has been approved by EPA and MassDEP, will be implemented as part of the remedy. The work plan (J-2 Range Priority 2 Data Gap Drilling Project Note, dated 08/28/2013) includes the installation of additional monitoring wells to determine if each extraction well is achieving containment. If containment is not achieved, an additional work plan will be developed to explain how the extraction and treatment system will be altered and augmented to insure that containment at each extraction well is achieved. This work plan will be implemented as part of the selected remedy after approval by EPA and MassDEP.
- A contingency for additional active treatment in the area of Gibbs Road on Camp Edwards, and modifying the system to optimize the system performance to ensure

protection of the Upper Cape Water Supply. A work plan, which has been approved by EPA and MassDEP, will be implemented as part of the remedy. The work plan (J-2 Range Northern Plume Priority 1 Data Gap Drilling Project Note, dated 07/11/2013) includes the installation of monitoring wells to verify that contamination has not migrated past Gibbs Road. A second work plan will be developed to include the monitoring and modeling work necessary to make this demonstration periodically. If monitoring data or modeling suggests that contamination above federal or state regulatory or risk-based levels for COCs will likely migrate past Gibbs Road, a work plan shall be developed and submitted to EPA and MassDEP for approval requiring additional extraction wells be installed and begin operation within 12 months of that determination.

- Confirmatory soil sampling and UXO clearance in select areas of the range to verify source removal is complete. A work plan, which has been approved by EPA and MassDEP, will be implemented as part of the remedy. The work plan (Confirmatory Soil Sampling for Areas 1, 2 and 3 at the J-2 Range Project Note, dated 08/29/2013, and Confirmatory Intrusive Geophysical Investigations for the J-2 Range Project Note, dated 08/28/2013) includes soil sampling and geophysical investigations in areas of the range known to have contributed to groundwater contamination. Soil contamination and munitions posing a threat to groundwater will also be removed as part of the selected remedy.
- Long-term groundwater monitoring at existing and new monitoring wells to verify the effectiveness of the soil and UXO removal; to ensure that groundwater modeling predictions regarding the reduction and migration of contamination are valid; and to ensure that any remaining contamination remains below risk-based levels.
- Implementation and verification of Land Use Controls to prevent the use of contaminated portions of the aquifer for drinking water until contamination is reduced to below risk-based levels and to prevent actions that would interfere with the remedy.
- Five year reviews will be conducted to ensure that the remedy remains protective and is achieving the goals established in the decision document.

The selected remedy is predicted to achieve a perchlorate level of 2 µg/L by 2027 and a RDX level of 0.6 µg/L by 2020. The estimated cost of the selected remedy is approximately $5,346,000.

This alternative is selected because it achieves permanent cleanup of RDX and perchlorate in the J-2 Range Northern groundwater plume in a reasonable timeframe without excessive environmental and worker impacts. The remedy ensures protection of human health and the environment through continued monitoring and enforcement of land-use controls that will prevent exposure to contaminated groundwater. The remedy includes additional contingencies to protect the public water supply by requiring complete containment at each extraction well in the current system and requiring further treatment of the contaminated plume if found near

Gibbs Road. In this decision, 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.

J-2 Range Eastern Groundwater Plume Description of Alternatives

Alternative 1 – No Further Action: Alternative 1 provides for no further action to address groundwater contamination associated with the J-2 Range Eastern groundwater plume. Under this alternative:

- No active groundwater treatment would occur.
- Model predictions could not be verified due to abandonment of existing treatment systems and monitoring wells.
- Land-use controls would not be implemented and so would not ensure against exposure until cleanup is achieved.
- Site close-out documentation would be completed.
- Contamination within the plume is predicted to drop below the 2 µg/L MMCL for perchlorate by 2104 and is predicted to reach background levels after 2113. RDX concentrations are predicted to decrease below the 10^{-6} risk-based level of 0.6 µg/L by 2055 and background after 2113.
- The total cost of Alternative 1 is estimated at $246,000.

Alternative 2 – Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs): Alternative 2 would provide long-term monitoring of the J-2 Range Eastern groundwater plume 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 closeout documentation would be completed.
- Contamination within the plume is predicted to drop below the 2 µg/L MMCL for perchlorate by 2104 and is predicted to reach background levels after 2113. RDX concentrations are predicted to decrease below the 10^{-6} risk-based level of 0.6 µg/L by 2055 and background after 2113.
- The total cost of Alternative 2 is estimated at $3,231,000

Alternative 3 – Focused Extraction with Three Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 3 would provide for extraction and treatment of the groundwater. Under this alternative: Contamination would be remediated through the long term operation of

the current extraction system consisting of: a flow rate of 90 gpm at J2EW0004, 210 gpm atJ2EW0005, and 125 gpm at J2EW0006 for a total combined pumping rate of 425 gpm; treatment with granular activated carbon and ion exchange resin at 4 treatment units; infiltration of the treated water via three 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 predicted to drop below the 2 µg/L MMCL for perchlorate by 2027 and is predicted to reach background levels by 2058. RDX concentrations are predicted to decrease below the 10^{-6} risk-based level of 0.6 µg/L by 2023 and background by 2031.
- The total cost of Alternative 3 is estimated at $5,526,000.

Alternative 4 – Focused Extraction with Three Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 4 would provide for extraction and treatment of the groundwater by enhancing the existing groundwater extraction system. Under this alternative: The pump and treat system would include: a flow rate of 120 gpm at J2EW0004, 250 gpm at J2EW0005, and 125 gpm at J2EW0006 for a total combined pumping rate of 495 gpm; treatment with granular activated carbon and ion exchange resin by expanding the treatment units; infiltration of the treated water by expanding the 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 predicted to drop below the 2 µg/L MMCL for perchlorate by 2027 and is predicted to reach background levels by 2066. RDX concentrations are predicted to decrease below the 10^{-6} risk-based level of 0.6 µg/L by 2022 and background by 2030.
- The total cost of Alternative 4 is estimated at $5,980,000.

Alternative 5 – Focused Extraction with Five Wells, Monitored Natural Attenuation and Land Use Controls: Alternative 5 would provide for extraction and treatment of the groundwater by enhancing the current groundwater extraction system. Under this alternative: The pump and

treat system would include: a flow rate of 150 gpm at J2EW0004, 250 gpm at J2EW0005, 125 gpm at J2EW0006 and installation of two new extraction wells (up gradient of J2EW0005) operating at 175 and 150 gpm for a total combined pumping rate of 850 gpm; treatment with granular activated carbon and ion exchange resin by expanding the treatment units; infiltration of the treated water by expanding the 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 predicted to drop below the 2 µg/L MMCL for perchlorate by 2022 and is predicted to reach background levels by 2035. RDX concentrations are predicted to decrease below the 10^{-6} risk-based level of 0.6 µg/L by 2021 and background by 2026.
- The total cost of Alternative 5 is estimated at $9,486,000.

Summary of the Comparative Analysis of Alternatives

The following discussion summarizes the strengths and weaknesses of each response action alternative identified for the J-2 Range Eastern groundwater plume with respect to the nine criteria: Overall Protection of Human Health and the Environment: Alternatives 2 through 5 would be protective of human health and the environment. Alternative 1, however, offers no monitoring or confirmation of existing land-use controls to ensure that future exposures do not occur. Alternative 2 adds provisions for plume monitoring and land-use controls to help prevent future exposure to contaminated groundwater. Alternatives 3 through 5 add extraction and treatment components and achieve risk-based concentrations earlier than Alternatives 1 and 2.

Compliance with Regulations: All alternatives are expected to eventually result in compliance with applicable regulations. Alternatives 1 and 2 allow for continued migration of the plume. Because these alternatives involve no active remediation, chemical-specific regulations would be met only 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.

Long-Term Effectiveness and Permanence: Additional soil sampling and UXO clearance shall be performed to confirm that the source area has been removed so residual soil contamination is unlikely to compromise the permanence of the remedial alternatives once completed. All of the alternatives would permanently achieve the cleanup goals; however, time to cleanup would vary. Moreover, Alternatives 3 through 5, which include active treatment of the plume, may result in fewer uncertainties over the long term regarding the fate and transport of the plume.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives 3 through 5 reduce the toxicity, mobility, and volume of contaminated groundwater through treatment. Based on model predictions, Alternative 3 would remove 2.9 pounds of RDX and 13 pounds of perchlorate, Alternative 4 would remove 2.8 pounds of RDX and 13.5 pounds of perchlorate, and Alternative 5 would remove 3.1 pounds of RDX and 11.6 pounds of perchlorate.

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 impact because of the large amount of construction involved. Alternatives 3 and 4 would also have some environmental impacts due to construction. Alternatives 2 through 5 would have environmental impacts from monitoring well installation, monitoring, and well abandonment. The only environmental impact of Alternative 1 would be from abandonment of the current extraction system, and monitoring well system.

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 the existing groundwater extraction system, groundwater monitoring wells and preparing close out documentation. Alternative 2 is the next most easily implemented alternative with groundwater monitoring and land-use controls implemented. Alternatives 3, 4, and 5 are somewhat more difficult alternatives to implement, since they include the installation of groundwater monitoring wells and/or extraction well(s), treatment facilities, new piping/power lines, and infiltration trench(es).

Cost: Alternative 1 and Alternative 2 would be the least costly, with most of the Alternative 2 cost associated with long-term monitoring. Costs for Alternative 3 and Alternative 4 are similar. Alternative 5 would be significantly more costly than either Alternative 3 or Alternative 4. The primary driver of the costs for Alternative 5 is the capital cost for the additional extraction, treatment and discharge. Alternative 1 is the least expensive alternative with a total estimated cost of $246,000. Estimated costs of the other alternatives are: Alternative 2 - $3,231,000, Alternative 3 - $5,526,000, Alternative 4 - $5,980,000, and Alternative 5 - $9,486,000.

These cost estimates (except for Alternative 1) are exclusive of the costs associated with the removal of any soil contamination and munitions determined to pose a threat to groundwater.

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 the Upper Cape Cod Regional Water Supply Cooperative as part of the public comment period on the Remedy Selection Plan for the J-2 Range. See "Part III Responsiveness Summary" for more details.

The Selected Response Action for the J-2 Eastern Groundwater Plume

For the reasons set forth herein, EPA has identified Alternative 4 - Focused Extraction with Monitored Natural Attenuation and Land-use Controls for groundwater, and confirmatory soil sampling and UXO clearance, as the appropriate response action for the J-2 Range Eastern Groundwater Plume (Figure 8). 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 the following:

- Optimization and continued long-term operation of the current J-2 Range Eastern groundwater extraction, treatment and injection system. The J-2 Range Eastern groundwater plume ETI system consists of three extraction wells and three infiltration trenches located to the northeast, southeast, and southwest of the plume. Currently, the system is pumping at a flow rate of 90 gpm at J2EW0004, 210 gpm at J2EW005, and 125 gpm at J2EW006 for a total combined flow rate of 495 gpm. The selected response action would enhance the existing system by increasing the flow rates to 120 gpm at J2EW0004, 250 gpm at J2EW0005, and maintaining a flow of 125 gpm at J2EW0006. This alternative includes modifying the system to optimize the system performance.
- Confirmatory soil sampling and UXO clearance in select areas of the range to verify source removal is complete. A work plan, which has been approved by EPA and MassDEP, will be implemented as part of the remedy. The work plan (Confirmatory Soil Sampling for Areas 1, 2 and 3 at the J-2 Range Project Note, dated 08/29/2013, and Confirmatory Intrusive Geophysical Investigations for the J-2 Range Project Note, dated 08/28/2013) includes soil sampling and geophysical investigations in areas of the range known to have contributed to groundwater contamination. Soil contamination and munitions posing a threat to groundwater shall be removed.
- Long-term groundwater monitoring at existing and new monitoring wells to verify the effectiveness of the soil and UXO removal; to ensure that groundwater modeling predictions regarding the reduction and migration of contamination are valid; and to ensure that any remaining contamination remains below risk-based levels.
- Implementation and verification of Land Use Controls to prevent use of contaminated portions of the aquifer for drinking water until contamination is reduced to below risk-based levels and to prevent actions that would interfere with the remedy.
- Five Year Reviews will be conducted to ensure that the remedy remains protective and is achieving the goals established in the decision document.

RDX is predicted to decrease below 0.6 µg/L by 2022 and perchlorate is predicted to decrease below 2 µg/L by 2027. The estimated cost of the selected remedy is approximately $5,980,000.

This alternative is selected because it achieves permanent cleanup of RDX and perchlorate in groundwater in the J-2 Range Eastern groundwater plume in a reasonable timeframe without excessive environmental and worker impacts. The remedy ensures protection of human health and the environment through continued monitoring and enforcement of land-use controls that will prevent exposure to contaminated groundwater. In this decision, 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.

K. RESPONSE ACTION IMPLEMENTATION

Plume Treatment and Monitoring

At the J-2 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 UXO 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-2 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-2 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-2 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-2 Range contaminated groundwater plumes and surrounding areas to prevent risks from exposure to contaminated groundwater (Figure 9). 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-2 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-2 range plumes and all homes in the area 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-2 Range Eastern Groundwater Plume Area.

The land use controls will be maintained until either (1) the concentrations of RDX and 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-2 Range Eastern 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. Before a permit to install a drinking water well is approved, the Sandwich Board of Health requires the water to be tested so that the Board of Health can determine if 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 down gradient of the J-2 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-2 Range plume within the Town of Sandwich. While Figure 9 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 residential water supply wells, existing land use controls also prevent the possible creation of a public 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-2 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 JBCC). 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-2 Range groundwater plume 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 JBCC is a member utility of Dig Safe. The Camp Edwards Training Range and Impact Area, including the on-post portions of the J-2 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 JBCC 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-2 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-2 Range Site Eastern Groundwater 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-2 Range Eastern groundwater 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 and MassDEP, until the plume no longer presents a threat to that well as determined in coordination with EPA and MassDEP.

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 and MasssDEP for review and EPA 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, EPA and MassDEP. 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 Eastern 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 and MassDEP review and EPA 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-2 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-2 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 and, for the J-2 Northern groundwater plume, to protect the current water supply by preventing groundwater in excess of Health Advisories, drinking water equivalent levels (DWELs), applicable State standards or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index from migrating past Gibbs

Road located on Camp Edwards.

The selected remedy is expected to achieve permanent cleanup of COCs in groundwater. The selected remedy for the J-2 Range Northern groundwater plume is expected to achieve a perchlorate level of 2 µg/L by 2027 and the 0.35 µg/L background level for perchlorate by 2071. For the J-2 Range Eastern groundwater plume, the selected remedy is expected to achieve a perchlorate level of 2 µg/L by 2027 and the 0.35 µg/L background level by 2066. RDX is expected to decrease below 0.6 µg/L by 2022 and below the 0.25 µg/L 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 remedy 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 JBCC groundwater plumes, including the J-2 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-2 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 with Monitored Natural Attenuation, and Land Use Controls for groundwater, and confirmatory soil sampling and UXO clearance) 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 July 24, 2013. 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 17, 2013, EPA published the remedy selection plan for the J-2 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 Three Wells, Monitored Natural Attenuation, Source Controls and Land Use Controls as the remedies for the Northern groundwater plume and Eastern groundwater plume of the Site.

At the July 24, 2013 public meeting of the MMRCT, held at Camp Edwards, MA, the US EPA gave a presentation on the remedy selection plan and the proposed remedy and answered questions from the teams. Local residents, officials, and news media representatives interested in site activities and cleanup decisions were invited to attend the meeting. Representatives from MassDEP and Army were present.

The Army notified the public of the July 24, 2013 public meeting and announced the public comment period in display advertisements placed in the July 12th and 19th editions of the Cape Cod Times and Enterprise newspapers.

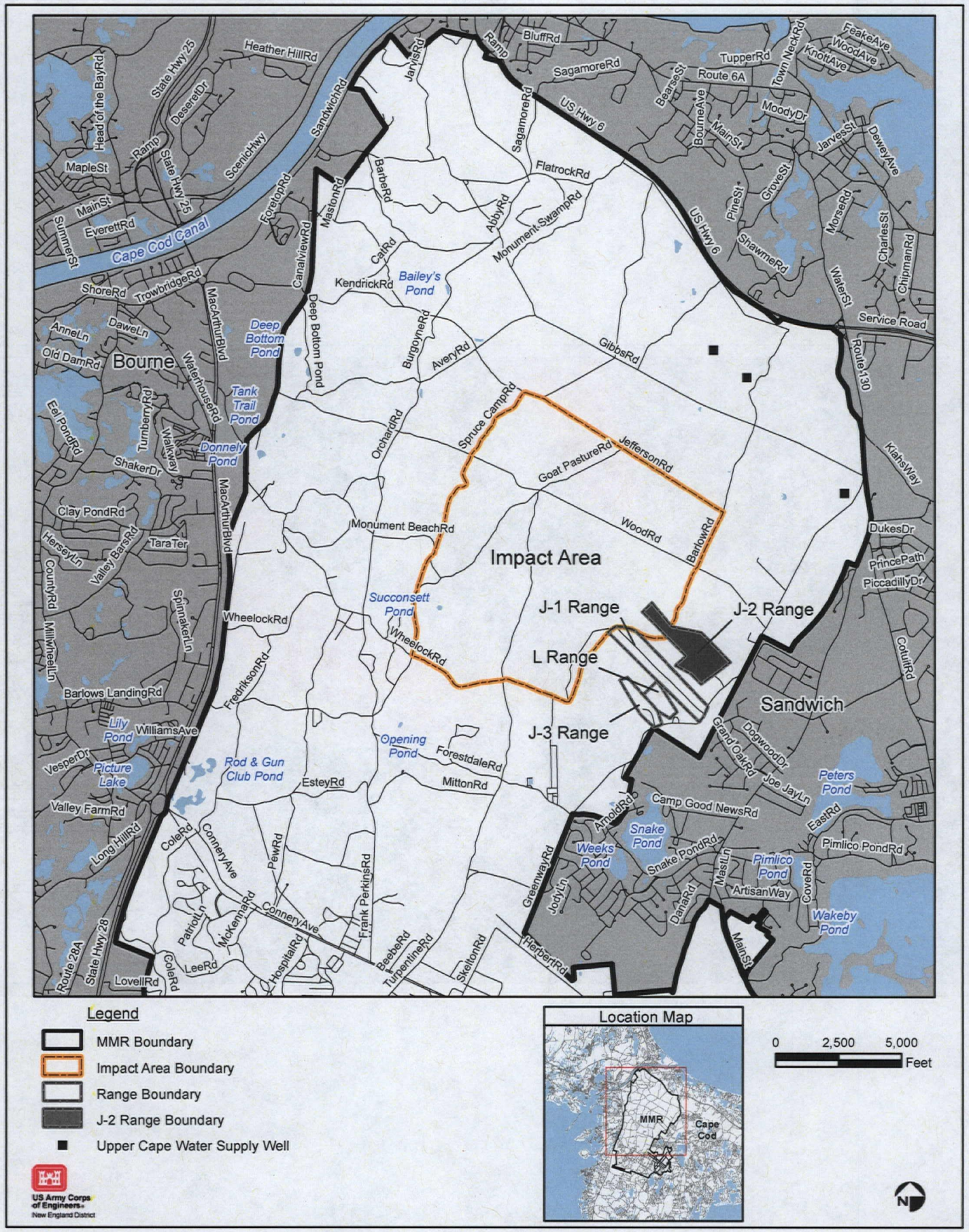
The Army placed copies of the remedy selection plan for the J-2 Range in the Army's information repositories at the Bourne, Falmouth, and Sandwich, MA public libraries. The repository contains documents on the investigations and findings supporting selection of the response actions including the feasibility study for theSsite 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-2 Range Site from July 17 through August 16, 2013.

Comments:	Responses:
Comments from the Upper Cape Cod Regional Water Supply Cooperative We recommend that the Cooperative receive advance copies of all Work Plans to allow for comments prior to EPA approval and implementation.	EPA will provide advance copies of all Work Plans to the UCCWSC to allow for comments prior to EPA approval and implementation.

We recommend that the Cooperative request a more discrete time frame for completion of *periodic* verification modeling work stipulated in EPA;s Enhanced Alternative 4 for the J-2 Range northern plume.	Groundwater monitoring reports containing the results of the following activities are submitted to EPA and MassDEP annually. An assessment of treatment system operations; an assessment of the treatment system's effectiveness at removing perchlorate and RDX from groundwater; an evaluation of hydraulic conditions to assess aquifer response to pumping; an assessment of the chemical monitoring results; a comparison of model-predicted and observed results; and recommendations for future monitoring activities in the plant, chemical, and/or hydraulic monitoring networks. Annual environmental monitoring reports containing the periodic verification modeling will continue to be submitted to EPA annually. More frequent reviews may be conducted as necessary.
We recommend the Cooperative request a stipulation be added to allow for additional modeling if changes in the Cooperative's withdrawal volumes change. Groundwater modeling would need to be completed to demonstrate that proposed changes in withdrawals would not interfere with the effectiveness of the treatment system.	Modeling that incorporates changes in the Cooperative's withdrawal volumes will be included in the annual reports.

FIGURES

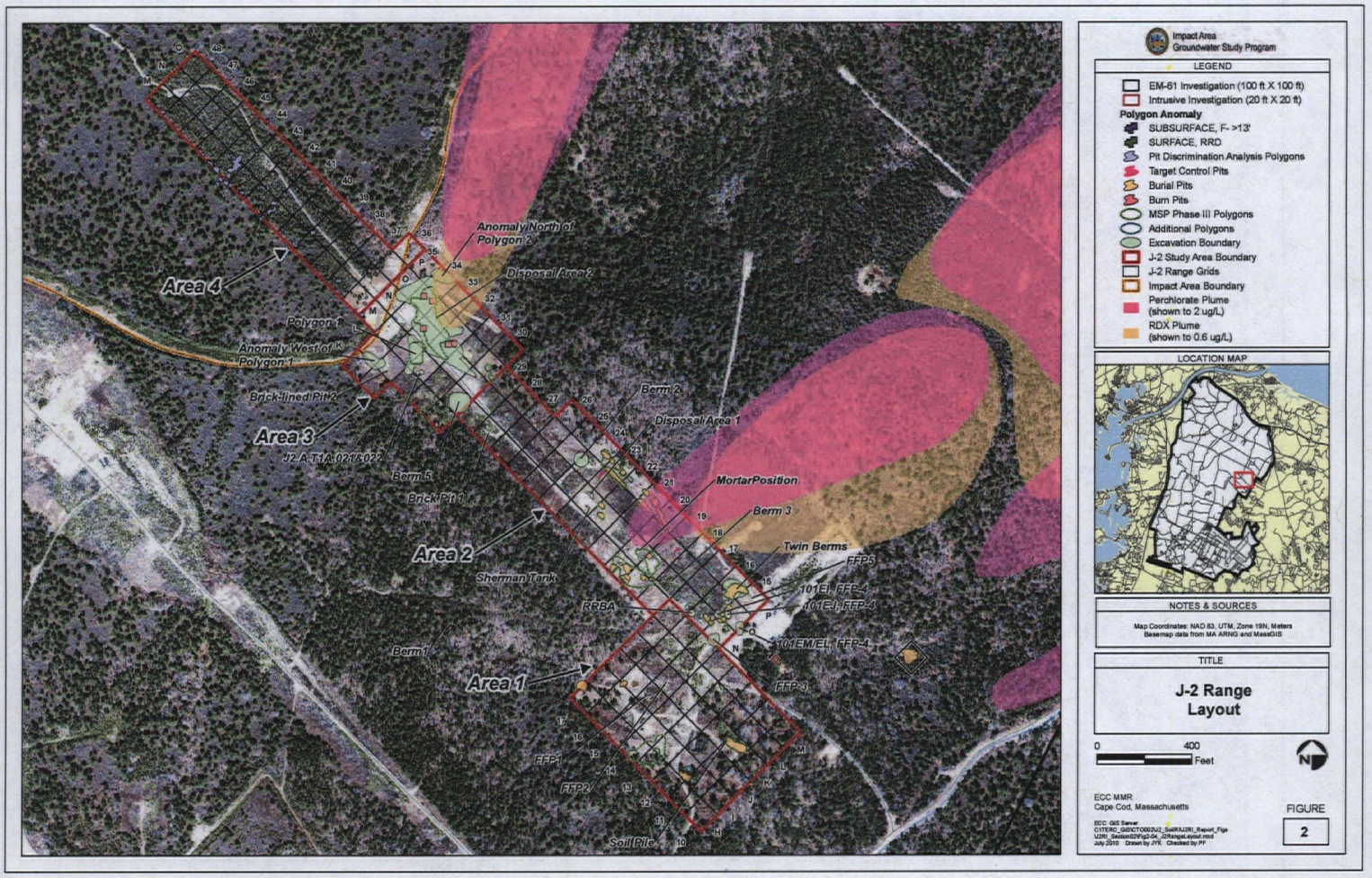


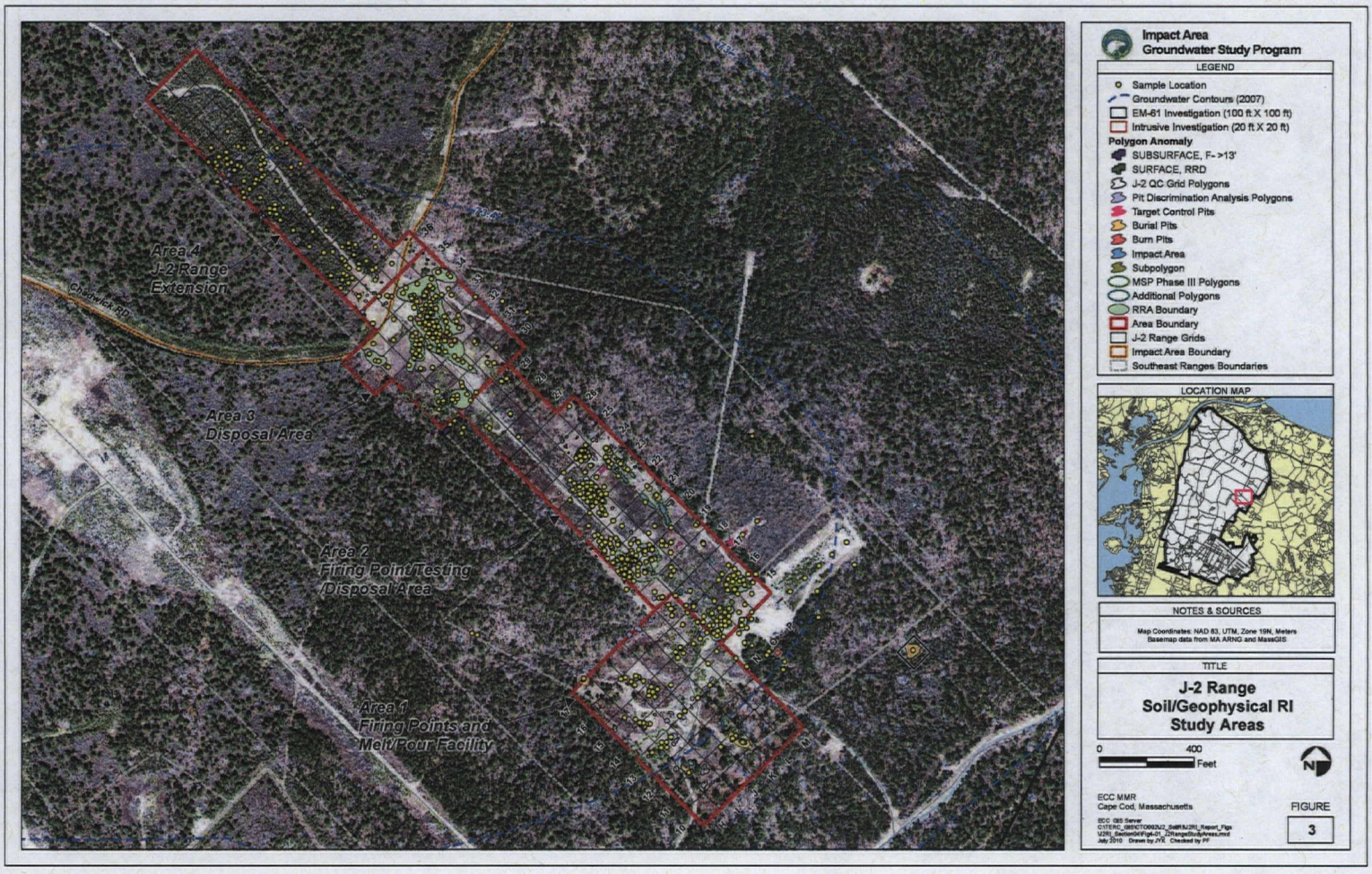
MMR J-2 Range Location Map

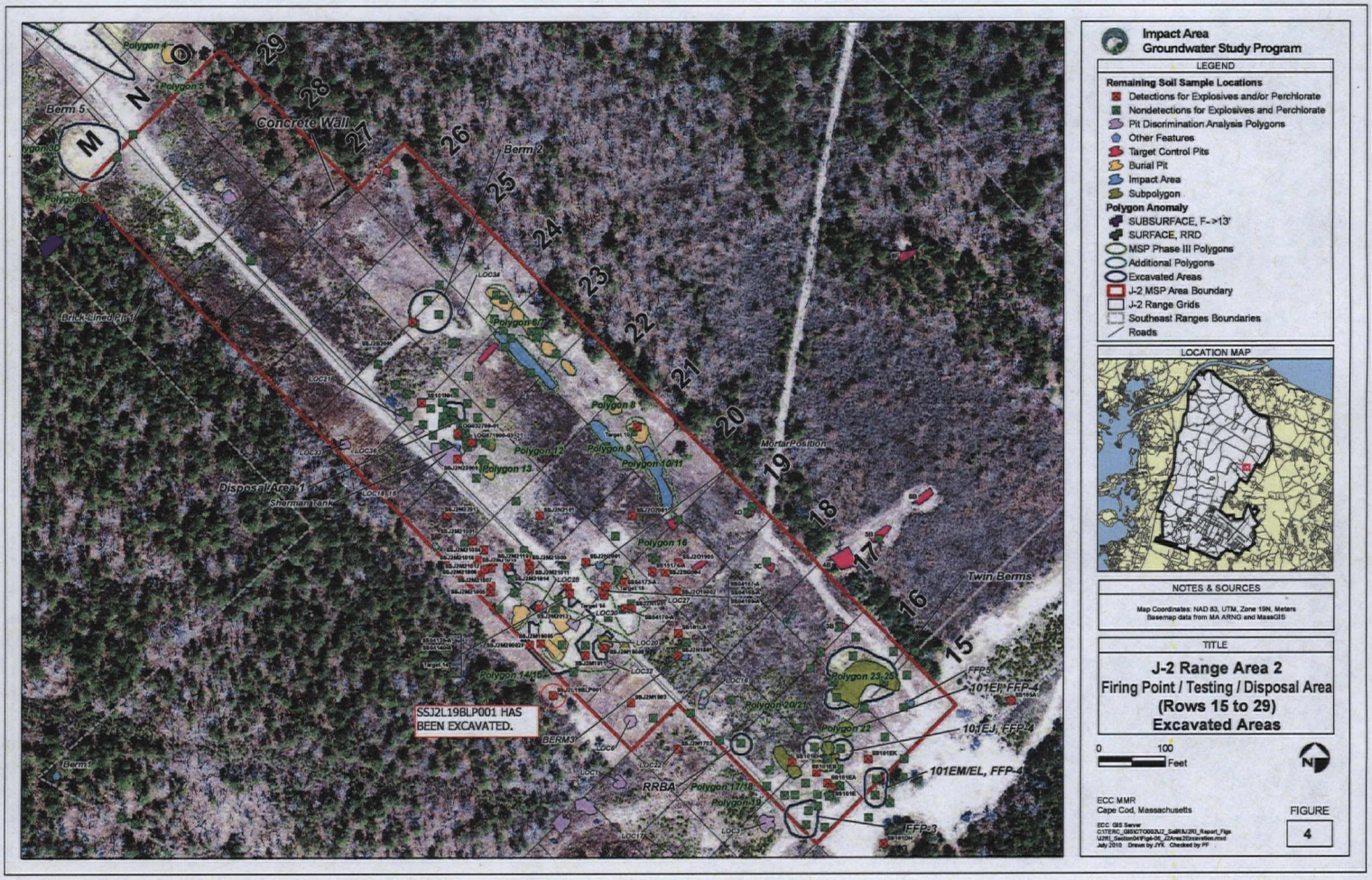
FIGURE 1

M:\MMR\2013\J2\DecisionDoc\Figures\Fig1_090913.pdf
M:\MMR\2013\J2N\DecisionDoc\MXDs\Fig1_090913.mxd
September 9, 2013 DWN: MTW CHKD: PJR

Impact Area Groundwater Study Program


Area 4
Area 3
Area 2
Area 1
Anomaly North of Polygon 2
Disposal Area 2
Polygon 1
Anomaly West of K Polygon 1
Brick-lined Pit 2
J2 A T1A 021&022
Berm 5
Brick Pit 1
Berm 1
Sherman Tank
RRBA
Berm 2
Disposal Area 1
MortarPosition
Berm 3
Twin Berms
FFP5
101EM/EL, FFP-4
101EM/EL, FFP-4
101EM/EL, FFP-4
FFP-3
FFP1
FFP2
Soil Pile
Impact Area Groundwater Study Program
LEGEND
EM-61 Investigation (100 ft X 100 ft)
Intrusive Investigation (20 ft X 20 ft)
Polygon Anomaly
SUBSURFACE, F- >13'
SURFACE, RRD
Pit Discrimination Analysis Polygons
Target Control Pits
Burial Pits
Burn Pits
MSP Phase III Polygons
Additional Polygons
Excavation Boundary
J-2 Study Area Boundary
J-2 Range Grids
Impact Area Boundary
Perchlorate Plume (shown to 2 ug/L)
RDX Plume (shown to 0.6 ug/L)
LOCATION MAP
NOTES & SOURCES
Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG and MassGIS
TITLE
J-2 Range Layout
0
400
Feet
N
ECC MMR
Cape Cod, Massachusetts
ECC GIS Server
C:\TERC_GIS\CTO002\J2_Soil\RAJ2RI_Report_Figs
\J2RI_Section2\Fig2-04_J2RangeLayout.mxd
July 2010 Drawn by JYK Checked by PF
FIGURE
2


Area 4
J-2 Range
Extension
Chemwick Rd
Area 3
Disposal Area
Area 2
Firing Point/Testing
Disposal Area
Area 1
Firing Points and
Melt/Pour Facility
Impact Area
Groundwater Study Program
LEGEND
Sample Location
Groundwater Contours (2007)
EM-61 Investigation (100 ft X 100 ft)
Intrusive Investigation (20 ft X 20 ft)
Polygon Anomaly
SUBSURFACE, F->13'
SURFACE, RRD
J-2 QC Grid Polygons
Pit Discrimination Analysis Polygons
Target Control Pits
Burial Pits
Burn Pits
Impact Area
Subpolygon
MSP Phase III Polygons
Additional Polygons
RRA Boundary
Area Boundary
J-2 Range Grids
Impact Area Boundary
Southeast Ranges Boundaries
LOCATION MAP
NOTES & SOURCES
Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG and MassGIS
TITLE
J-2 Range
Soil/Geophysical RI
Study Areas
0
400
Feet
N
ECC MMR
Cape Cod, Massachusetts
FIGURE
3


Impact Area
Groundwater Study Program
LEGEND
Remaining Soil Sample Locations
Detections for Explosives and/or Perchlorate
Nondetections for Explosives and Perchlorate
Pit Discrimination Analysis Polygons
Other Features
Target Control Pits
Burial Pit
Impact Area
Subpolygon
Polygon Anomaly
SUBSURFACE, F->13'
SURFACE, RRD
MSP Phase III Polygons
Additional Polygons
Excavated Areas
J-2 MSP Area Boundary
J-2 Range Grids
Southeast Ranges Boundaries
Roads
LOCATION MAP
NOTES & SOURCES
Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG and MassGIS
TITLE
J-2 Range Area 2
Firing Point / Testing / Disposal Area
(Rows 15 to 29)
Excavated Areas
0
100
Feet
ECC MMR
Cape Cod, Massachusetts
FIGURE
4
SSJ2L19BLP001 HAS BEEN EXCAVATED.
Concrete Wall
Berm 1
Berm 2
Berm 3
Berm 5
Brick-lined Pit 1
Disposal Area 1
Sherman Tank
Mortar Position
Twin Berms
RRBA
101EJ, FFP-4
101EM/EL, FFP-4
FFP-3
Polygon 1
Polygon 2
Polygon 3
Polygon 6/7
Polygon 8
Polygon 9
Polygon 10/11
Polygon 12
Polygon 13
Polygon 16
Polygon 17/18
Polygon 20/21
Polygon 22
Polygon 23/25
Polygon 14/15
29
28
27
26
25
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23
22
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20
19
18
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16
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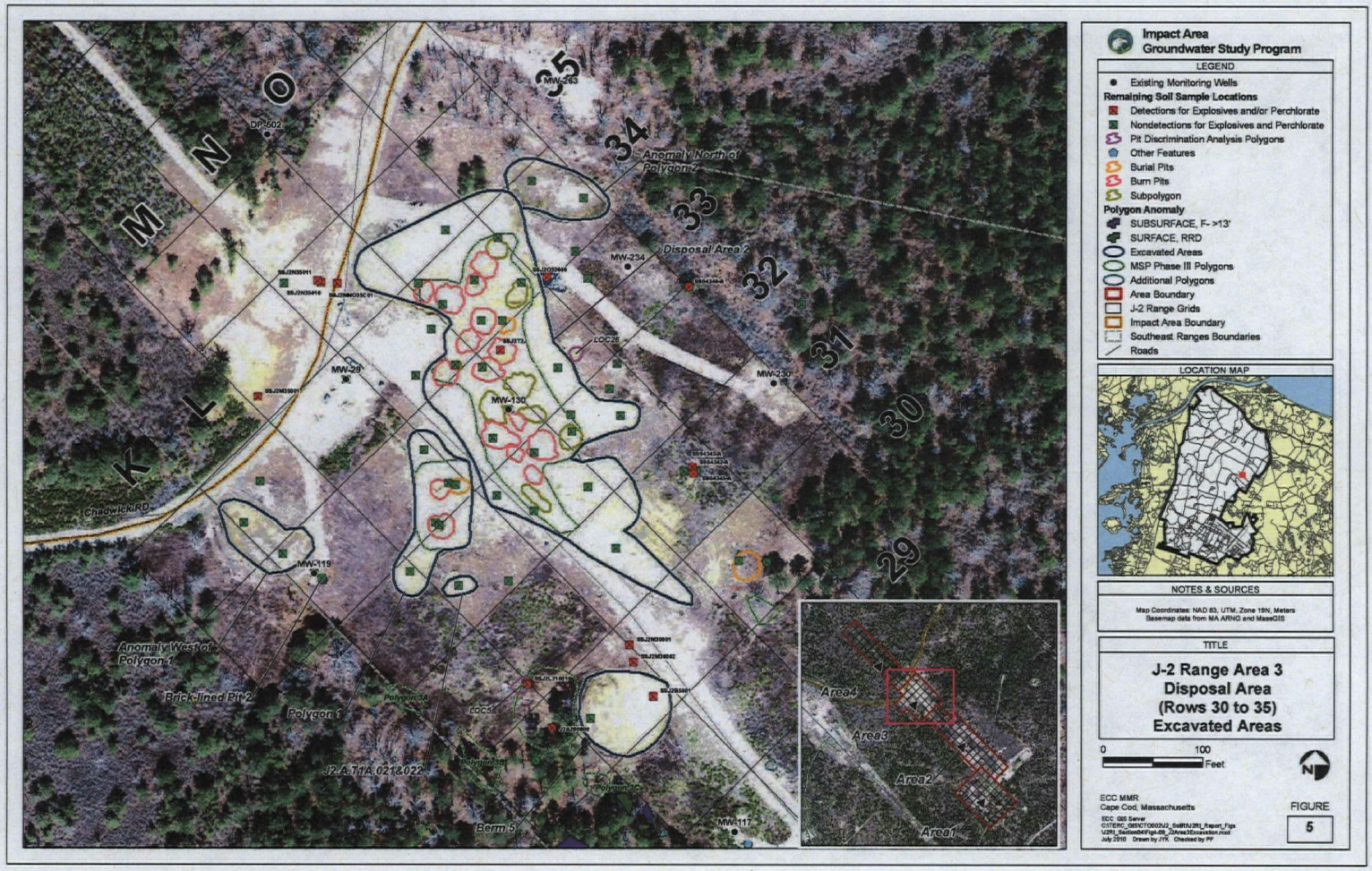
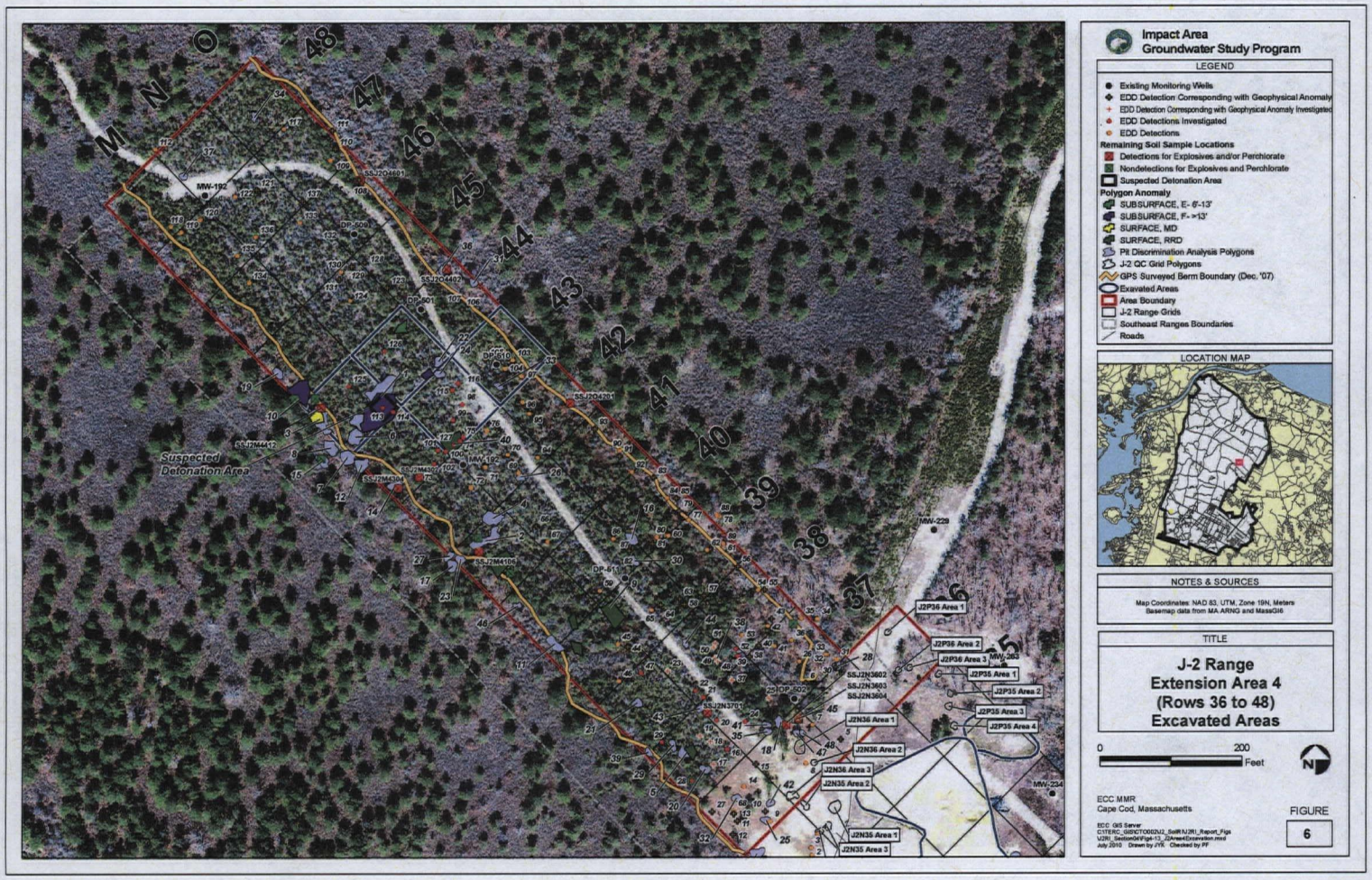
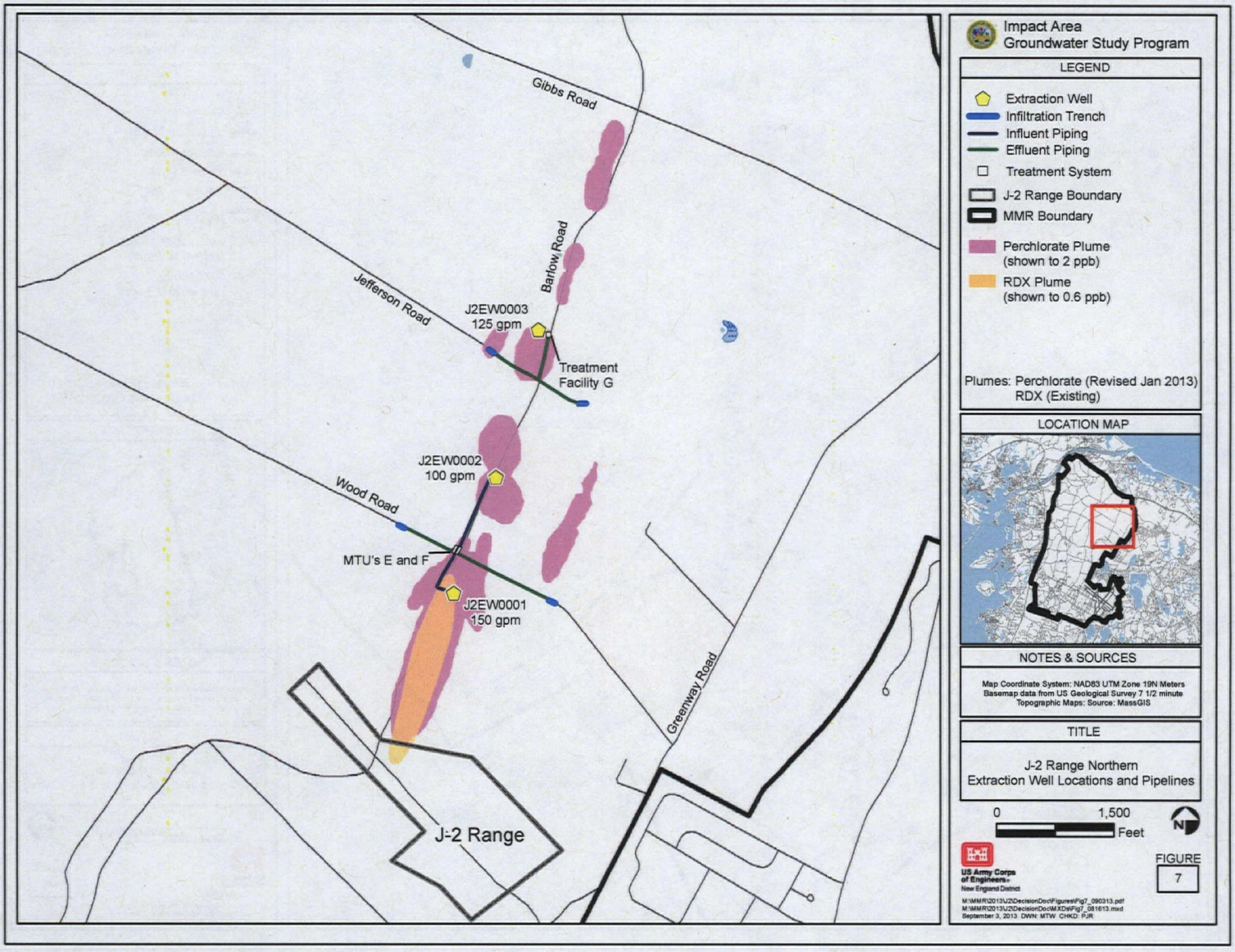

Impact Area
Groundwater Study Program
LEGEND
Existing Monitoring Wells
Remaining Soil Sample Locations
Detections for Explosives and/or Perchlorate
Nondetections for Explosives and Perchlorate
Pit Discrimination Analysis Polygons
Other Features
Burial Pits
Burn Pits
Subpolygon
Polygon Anomaly
SUBSURFACE, F- >13'
SURFACE, RRD
Excavated Areas
MSP Phase III Polygons
Additional Polygons
Area Boundary
J-2 Range Grids
Impact Area Boundary
Southeast Ranges Boundaries
Roads
LOCATION MAP
NOTES & SOURCES
Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG and MassGIS
TITLE
J-2 Range Area 3
Disposal Area
(Rows 30 to 35)
Excavated Areas
0
100
Feet
ECC MMR
Cape Cod, Massachusetts
FIGURE
5
Anomaly North of Polygon 2
Disposal Area 2
Anomaly West of Polygon 1
Brick-lined Pit 2
Polygon 1
J-2 A T1A 021&022
Berm 5
Chadwick Rd
MW-263
MW-234
MW-29
MW-130
MW-230
MW-119
MW-117
DP-502
LOC26
LOC24
Area4
Area3
Area2
Area1


Impact Area
Groundwater Study Program
LEGEND
Existing Monitoring Wells
EDD Detection Corresponding with Geophysical Anomaly
EDD Detection Corresponding with Geophysical Anomaly Investigated
EDD Detections Investigated
EDD Detections
Remaining Soil Sample Locations
Detections for Explosives and/or Perchlorate
Nondetections for Explosives and Perchlorate
Suspected Detonation Area
Polygon Anomaly
SUBSURFACE, E- 6'-13'
SUBSURFACE, F- >13'
SURFACE, MD
SURFACE, RRD
Pit Discrimination Analysis Polygons
J-2 QC Grid Polygons
GPS Surveyed Berm Boundary (Dec. '07)
Exavated Areas
Area Boundary
J-2 Range Grids
Southeast Ranges Boundaries
Roads
LOCATION MAP
NOTES & SOURCES
Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG and MassGIS
TITLE
J-2 Range
Extension Area 4
(Rows 36 to 48)
Excavated Areas
0
200
Feet
N
ECC MMR
Cape Cod, Massachusetts
FIGURE
6
Suspected Detonation Area
MW-192
MW-229
MW-234
MW-265
DP-506
DP-501
DP-510
DP-511
DP-502
SSJ2O4402
SSJ2O4401
SSJ2M4106
SSJ2M4104
SSJ2N3701
SSJ2N3602
SSJ2N3603
SSJ2N3604
J2P36 Area 1
J2P36 Area 2
J2P36 Area 3
J2P35 Area 1
J2P35 Area 2
J2P35 Area 3
J2P35 Area 4
J2N36 Area 1
J2N36 Area 2
J2N36 Area 3
J2N35 Area 2
J2N36 Area 4
J2N35 Area 3


Gibbs Road
Barlow Road
Jefferson Road
J2EW0003
125 gpm
Treatment
Facility G
J2EW0002
100 gpm
Wood Road
MTU's E and F
J2EW0001
150 gpm
Greenway Road
J-2 Range
Impact Area
Groundwater Study Program
LEGEND
Extraction Well
Infiltration Trench
Influent Piping
Effluent Piping
Treatment System
J-2 Range Boundary
MMR Boundary
Perchlorate Plume
(shown to 2 ppb)
RDX Plume
(shown to 0.6 ppb)
Plumes: Perchlorate (Revised Jan 2013)
RDX (Existing)
LOCATION MAP
NOTES & SOURCES
Map Coordinate System: NAD83 UTM Zone 19N Meters
Basemap data from US Geological Survey 7 1/2 minute
Topographic Maps: Source: MassGIS
TITLE
J-2 Range Northern
Extraction Well Locations and Pipelines
0
1,500
Feet
N
US Army Corps
of Engineers
New England District
M:\MMR\2013\U2\DecisionDoc\Figures\Fig7_090313.pdf
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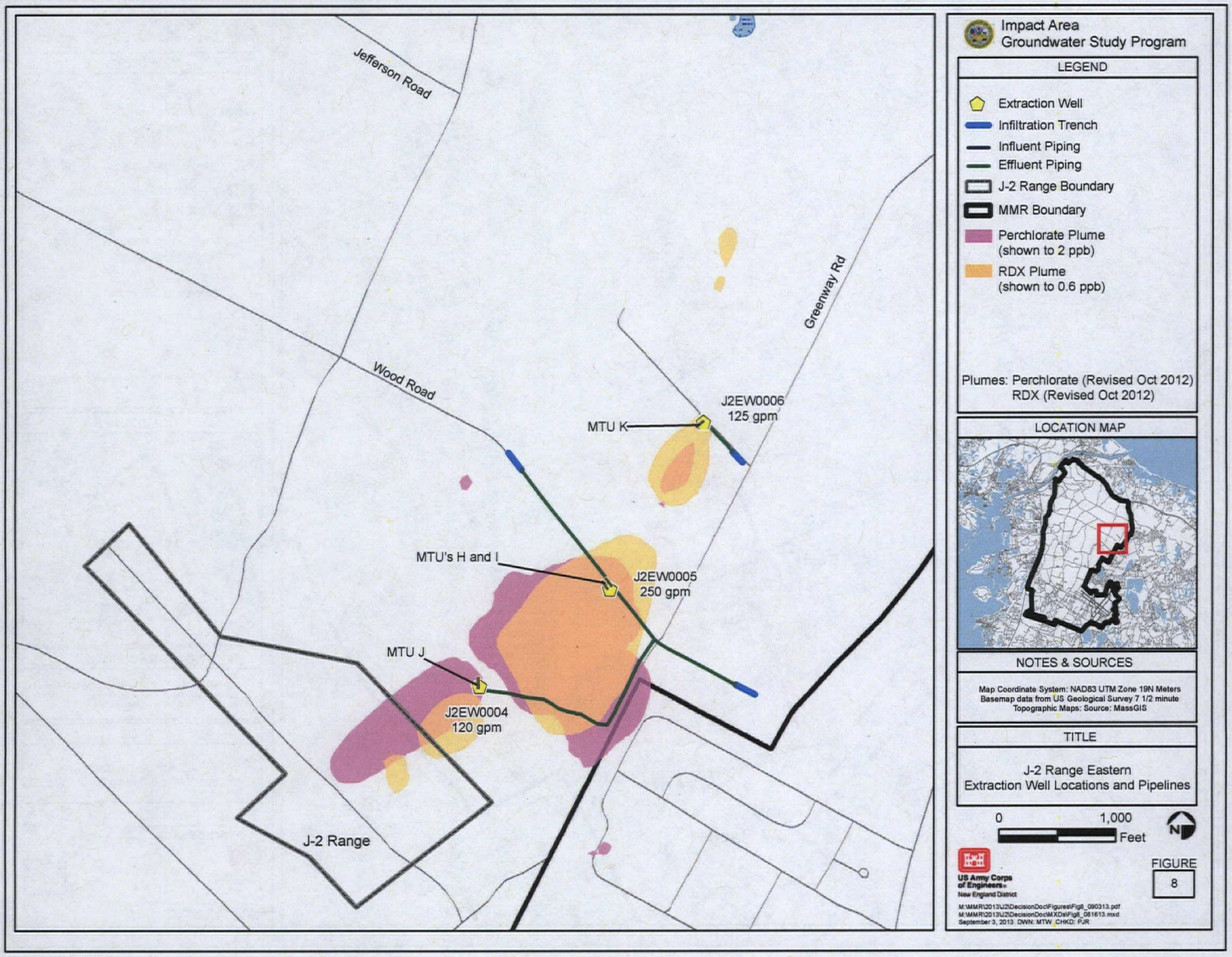
September 3, 2013 DWN: MTW CHKD: PJR
FIGURE
7


Jefferson Road
Wood Road
Greenway Rd
J2EW0006
125 gpm
MTU K
MTU's H and I
J2EW0005
250 gpm
MTU J
J2EW0004
120 gpm
J-2 Range
Impact Area
Groundwater Study Program
LEGEND
Extraction Well
Infiltration Trench
Influent Piping
Effluent Piping
J-2 Range Boundary
MMR Boundary
Perchlorate Plume
(shown to 2 ppb)
RDX Plume
(shown to 0.6 ppb)
Plumes: Perchlorate (Revised Oct 2012)
RDX (Revised Oct 2012)
LOCATION MAP
NOTES & SOURCES
Map Coordinate System: NAD83 UTM Zone 19N Meters
Basemap data from US Geological Survey 7 1/2 minute
Topographic Maps: Source: MassGIS
TITLE
J-2 Range Eastern
Extraction Well Locations and Pipelines
0
1,000
Feet
N
US Army Corps
of Engineers
New England District
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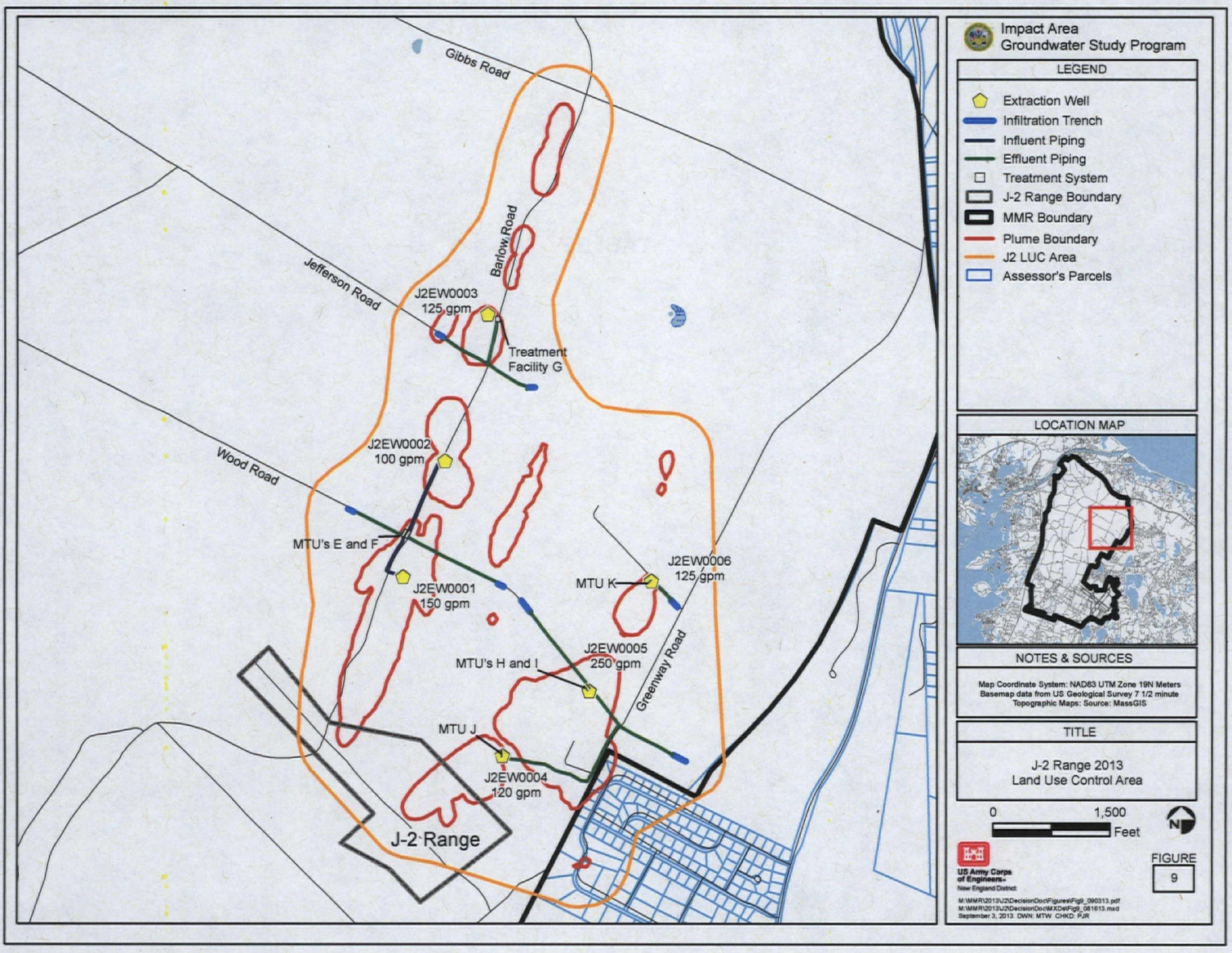
September 3, 2013 DWN: MTW CHKD: PJR
FIGURE
8


Gibbs Road
Barlow Road
Jefferson Road
Wood Road
Greenway Road
J2EW0003
125 gpm
Treatment
Facility G
J2EW0002
100 gpm
MTU's E and F
J2EW0001
150 gpm
MTU K
J2EW0006
125 gpm
MTU's H and I
J2EW0005
250 gpm
MTU J
J2EW0004
120 gpm
J-2 Range
Impact Area
Groundwater Study Program
LEGEND
Extraction Well
Infiltration Trench
Influent Piping
Effluent Piping
Treatment System
J-2 Range Boundary
MMR Boundary
Plume Boundary
J2 LUC Area
Assessor's Parcels
LOCATION MAP
NOTES & SOURCES
Map Coordinate System: NAD83 UTM Zone 19N Meters
Basemap data from US Geological Survey 7.1/2 minute
Topographic Maps; Source: MassGIS
TITLE
J-2 Range 2013
Land Use Control Area
0
1,500
Feet
US Army Corps
of Engineers
New England District
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M:\MMR\2013\J2\DecisionDoc\MXD\Fig9_081613.mxd
September 3, 2013 DWN: MTW CHKD: PJR
FIGURE
9

TABLES

Table 1 Summary of Alternatives

Alt. #	Design Details		Perchlorate Remediation[1]				RDX Remediation								
	Number of Extraction Wells	Total Extraction Rate (gpm)	Estimate Year Perchlorate Concentrations Decrease Below 15 µg/L	Estimate Year Perchlorate Concentrations Decrease Below 2 µg/L[2]	Estimate Year Perchlorate Concentrations Decrease Below ND	Mass Removed (Pounds)	Estimate Year RDX Concentrations Decrease Below 6 µg/L	Estimate Year RDX Concentrations Decrease Below 2 µg/L	Estimate Year RDX Concentrations Decrease Below 0.6 µg/L[2]	Estimate Year RDX Concentrations Decrease Below ND	Mass Removed (Pounds)	Extraction Well ND Date[3]	Capital Cost	O&M	Site Closeout Report	Total Present Value
J-2 Range Northern Area																
Alt. 1	0	0	2022	2065	>2113	0	NA	NA	NA	NA	NA	NA	$0.1M	$0.0	$0.08M	$0.2M
Alt. 2	0	0	2022	2065	>2113	0	NA	NA	NA	NA	NA	NA	$0.4M	$2.4M	$0.05M	$2.8M
Alt. 3	3	375	2017	2029	2071	13.9	NA	NA	NA	NA	NA	2029	$0.5M	$5.2M	$0.07M	$5.8M
Alt. 4	3	375	2016	2027	2065	13.2	NA	NA	NA	NA	NA	2025	$0.5M	$4.7M	$0.07M	$5.3M
Alt. 5	5	625	2016	2024	2059	11.6	NA	NA	NA	NA	NA	2023	$3.7M	$6.9M	$0.08M	$10.7M
J-2 Range Eastern Area																
Alt. 1	0	0	2026	2104	>2113	0	2014	2028	2055	>2113	0	NA	$0.2M	$0.0	$0.08M	$0.2M
Alt. 2	0	0	2026	2104	>2113	0	2014	2028	2055	>2113	0.0	NA	$0.4M	$2.8M	$0.03M	$3.2M
Alt. 3	3	425	2018	2027[4]	2058	13	2014	2018	2023[7]	2031	2.9	2027/2018	$0.7M	$4.7M	$0.07M	$5.5M
Alt. 4	3	495	2018	2027[5]	2066	13.5	2014	2017	2022[8]	2030	2.8	2025/2018	$0.7M	$5.2M	$0.07M	$6.0M
Alt. 5	5	850	2016	2022[6]	2035	14.2	2014	2016	2021[9]	2026	3.1	2021/2015	$3.7M	$5.7M	$0.08M	$9.5M

Notes:

[1] Contaminant transport modeling for permeable portions of the aquifer.

[2] Cleanup timeframes based on contaminant transport modeling animations according to site achieving concentrations below 2 µg/L for Perchlorate; 0.6 µg/L for RDX.

[3] Extraction well shut off year corresponds to first year when extraction well influent concentration decreases below method detection limit (RDX = 0.25 ug/L and perchlorate = 0.35 ug/L).

[4] Perchlorate concentrations remaining beyond 2027 are in low conductivity, non-productive portions of the aquifer (Remaining pechlorate mass >2 ug/L in low K zone at 2027 = 0.36 lbs; Percent of initial perchlorate mass > 2 ug/Lin low K zone at 2027 = 2.1%).

[5] Perchlorate concentrations remaining beyond 2027 are in low conductivity, non-productive portions of the aquifer (Remaining pechlorate mass >2 ug/L in low K zone at 2027 = 0.32 lbs; Percent of initial perchlorate mass > 2 ug/Lin low K zone at 2027 = 1.9%).

[6] Perchlorate concentrations remaining beyond 2022 are in low conductivity, non-productive portions of the aquifer (Remaining pechlorate mass >2 ug/L in low K zone at 2022 = 0.01 lbs; Percent of initial perchlorate mass > 2 ug/Lin low K zone at 2022 = 0.1%).

[7] RDX concentrations remaining beyond 2023 are in low conductivity, non-productive portions of the aquifer (Remaining RDX mass >0.6 ug/L in low K zone at 2023 = 0.02 lbs; Percent of initial RDX mass > 0.6 ug/L in low K zone at 2023 = 1.1%).

[8] RDX concentrations remaining beyond 2022 are in low conductivity, non-productive portions of the aquifer (Remaining RDX mass >0.6 ug/L in low K zone at 2022 = 0.02 lbs; Percent of initial RDX mass > 0.6 ug/L in low K zone at 2023 = 1.1%).

[9] RDX concentrations remaining beyond 2021 are in low conductivity, non-productive portions of the aquifer (Remaining RDX mass >0.6 ug/L in low K zone at 2021 = 0.004 lbs; Percent of initial RDX mass > 0.6 ug/L in low K zone at 2021 = 0.2%).

Alt. = Alternative
M = million
NA = not applicable
ND = nondetect
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
µg/L = micrograms per liter

TABLE 2
J-2 Range 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.
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.

TABLE 2
J-2 Range Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
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.
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.
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)

TABLE 2
J-2 Range Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
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.
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 5.10(3). 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-2 Range 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.
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

Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

DEVAL L. PATRICK
Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

September 30, 2013

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
Joint Base Cape Cod (JBCC)
Decision Document J-2 Range Operable Unit, Concurrence

Dear Mr. Owens:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the document entitled **"Decision Document J-2 Range Operable Unit"** (Decision Document), dated September 2013. The Decision Document presents the selected remedy for the J-2 Range Operable Unit (J-2 Range), located at Camp Edwards on the Joint Base Cape Cod (JBCC), formerly the Massachusetts Military Reservation (MMR), situated in Bourne, Cape Cod, Massachusetts. The Decision Document sets forth response actions required to address the source areas within the J-2 Range contributing to groundwater contamination, and the groundwater contamination at and emanating from the J-2 Range. The remedy was selected by the U.S. Environmental Protection Agency Region 1 (EPA) in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA), 42 USC §300i (a), as amended, and EPA Administrative Order No. SDWA-1-2000-0014 (AO3), which includes consideration of the substantive cleanup standards set forth under Massachusetts General Law 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 AO3.

Groundwater

Environmental investigation activities at the J-2 Range have been ongoing since 1999. These investigations have identified contamination in soil and groundwater resulting from the past use of the J-2 Range for military training and as a defense contractor test 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-2 Range groundwater operable unit. The Massachusetts Maximum Contaminant Level (MMCL) for perchlorate in drinking water is 2 µg/L and is considered an Applicable or Relevant and Appropriate Requirement (ARAR). The USEPA RDX risk-based concentration (RBC) in groundwater that results in an increased lifetime cancer risk of one in a million is 0.6 µg/L.

The J-2 Range groundwater operable unit has been divided into two sub-areas, the J-2 North groundwater plume and the J-2 East groundwater plume. All of the J-2 North plume and most of the J-2

East plume are located on JBCC. Two Upper Cape Cod Water Supply Cooperative wells on JBCC are located downgradient from the J-2 North and East plumes. Interim groundwater treatment systems were installed for the J-2 North and East plumes as rapid response actions to provide accelerated aquifer restoration and protection of the water supply wells by capturing and treating contaminated groundwater until a long-term remedy could be selected for each plume.

The J-2 Range groundwater plumes are defined by concentrations of perchlorate exceeding the MMCL of 2 µg/L and concentrations of RDX exceeding the RBC of 0.6 µg/L. The current maximum detected concentrations in the J-2 North groundwater plume are 115 µg/L for perchlorate and 2.9 µg/L for RDX. The maximum historical detections were 198 µg/L for perchlorate and 16.1 for RDX. The current maximum detected concentrations in the J-2 East groundwater plume are 44 µg/L for perchlorate and 14 µg/L for RDX. The maximum historical detections were 88 µg/L for perchlorate and 17 µg/L for RDX.

The selected remedy for both the J-2 North and J-2 East groundwater plumes consists of *Focused Extraction with Three Wells, Monitored Natural Attenuation (MNA), Land-use Controls (LUCs), and Optimization of Current System*. The remedy for the J-2 North plume contains a contingency remedy for additional active treatment in the area of Gibbs Road on Camp Edwards, and for modifying the treatment system to optimize performance to ensure protection of the Upper Cape Water Supply. A work plan describing the monitoring program necessary to verify that contamination has not migrated past Gibbs Road has been approved by EPA and MassDEP and will be implemented as part of the remedy. A second work plan will be developed that will include the groundwater monitoring and modeling work necessary to make this demonstration. If groundwater monitoring data or modeling suggests that contamination above federal or state regulatory or risk-based levels for COCs will likely migrate past Gibbs Road, additional extraction wells will be installed and begin operation within 12 months of that determination.

The selected remedy for both the J-2 North and J-2 East groundwater plumes also includes long-term groundwater monitoring at existing and new monitoring wells to verify the effectiveness of the source response action, to ensure that groundwater modeling predictions regarding the reduction and migration of contamination are valid, and to ensure that any remaining contamination remains below risk-based levels. The remedy includes implementation and verification of LUCs to prevent use of contaminated portions of the aquifer for drinking water until contamination is reduced to below risk based levels and to prevent actions that would interfere with the remedy; and five year reviews to determine if the groundwater treatment system is still protective and achieving the established goals and to determine if source response actions continue to protect groundwater.

Modeling predicts that the selected remedy for J-2 North groundwater will achieve a perchlorate level of 2 µg/L by 2027. Modeling was not performed for RDX since operation of the existing treatment system has substantially reduced the volume of RDX in the aquifer. Modeling predicts that the selected remedy for J-2 East groundwater will decrease RDX concentrations to below 0.6 µg/L by 2022 and will decrease perchlorate concentrations to below 2 µg/L by 2027.

Soil/Source Areas

The J-2 Range includes soil contaminated with explosives and perchlorate and unexploded ordnance (UXO) (or Munitions and Explosives of Concern (MEC)). Military activities conducted in the area of the J-2 Range primarily involved small arms training from the 1930s to the late 1980s. Defense contractor

testing activities conducted from the 1950s to late 1980s included propellant and fuze testing, testing of mortar fin assemblies, penetration testing for various munitions, including rockets, and other miscellaneous testing activities. Excess explosives, propellant, and munitions were burned and buried on the J-2 Range.

Investigation activities at the J-2 Range have been ongoing since 1999 and included soil sampling, geophysical surveys, intrusive investigations and groundwater sampling. Former target areas have been documented by the presence of UXO and soil contamination at target berms and at various other locations throughout the J-2 Range. The conceptual site model, based on known range use, activities and the distribution of UXO and soil contaminants, suggests that explosives, propellant, and munitions burning and disposal activities are the primary source of the J-2 North groundwater plume, and firing, munitions testing and disposal activities are the primary source of the J-2 East groundwater plume.

Soil removal actions have been conducted at numerous locations and approximately 9,000 cubic yards of contaminated soil has been excavated and either treated on-site or disposed of off-site. These targeted soil removal actions have likely removed most of the soil contamination that were active sources of groundwater contamination. However, additional soil sampling is necessary to confirm whether all potential sources have been addressed.

Geophysical investigations were conducted in several phases from 1997 through 2009, which used various approaches to identify and remove munitions. Many of the investigations focused on identifying and removing disposal pits. Approximately 21,600 munitions containing high explosives were removed and approximately 11,100 munitions containing small quantities of explosives were removed along with 114,000 pounds of range debris. These removal actions have likely removed most of the UXO items that were active sources of groundwater contamination. However, additional geophysical work is necessary to confirm that all sources have been addressed.

The selected remedy for the J-2 Range includes an investigation including soil sampling and removal of additional geophysical anomalies in select areas of the range to verify if source removal is complete. A work plan and Project Note describing the soil sampling and geophysical investigations has been approved by EPA and MassDEP and will be implemented as part of the remedy. Soil contamination and munitions posing a threat to groundwater will be removed.

Determination

MassDEP concurs with the remedy proposed in the Decision Document for the J-2 Range. The selected remedy will ensure a sufficient and protective level of control for the J-2 Range groundwater such that none of the contamination associated with the J-2 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 areas on the J-2 Range which pose public safety risk, ecological risk, dermal contact risk and/or soil ingestion risk. These potential risks are not specifically 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 potential public

safety risk, ecological risk, dermal contact risk and/or soil ingestion risk posed by any remaining contamination at the J-2 Range. MassDEP's concurrence is limited to the Decision Document and MassDEP makes no determination regarding any potential public health, safety, welfare or environmental risk posed by any remaining contamination at the J-2 Range. It is MassDEP's understanding that the Massachusetts Army National Guard (MANG) will develop an action plan detailing measures to be implemented at Camp Edwards to mitigate any remaining public safety risk, ecological risk, dermal contact risk and/or soil ingestion risk posed by contamination and UXO/MEC remaining at the J-2 Range. MassDEP will continue to work with the MANG, the Environmental Management Commission (EMC) and the Department of Fish and Game (DFG) to mitigate the risk posed by soil contamination and remaining UXO by establishing and implementing LUCs and other measures at the J-2 Range.

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. Without limitation, if MassDEP determines that any material omissions or misstatements exist, if new information becomes available, if LUCs are not properly implemented, monitored and/or maintained or if conditions within the J-2 Range changes, resulting in potential or actual human exposure or threats to the environment, 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. 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-2 Range. This includes information acquired after the implementation of the groundwater remedy, such as new regulatory requirements or changes in the environmental conditions at the J-2 Range.

Please incorporate this letter into the Administrative Record for the J-2 Range. 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,

Benjamin J. Ericson
Assistant Commissioner
Bureau of Waste Site Cleanup

BE/lp/

File : 4-0015031 J-2DD Concurrence Letter 09-2013

Ec: Gary Moran, Deputy Commissioner

Philip Weinberg, Regional Director
Millie Garcia-Serrano, Deputy Regional Director
Leonard J. Pinaud, Chief, State & Federal Site Management
Dawn Stolfi Stalenhoef, Regional Counsel
Mark Begley, Environmental Management Commission
Richard Lehan, Department of Fish and Game
Colonel Gregory McDonald, Post Commander, HQ Camp Edwards
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
AFCEC	U.S. Air Force Civil Engineer Center
AO	Administrative Order
Background	A background level is the concentration of a hazardous substance that represents the level of the substance in an undisturbed environmental 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	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, an explosives compound
IAGWSP	Impact Area Groundwater Study Program
IART	Impact Area Review Team
JBCC	Joint Base Cape Cod
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)
MMRCT	Massachusetts Military Reservation Cleanup Team
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-2 Range Work Plan for the Camp Edwards Impact Area Groundwater Quality Study 08/01/2000

J-2 Range Additional Delineation Work Plan 01/23/2001

Draft J-2 Range Interim Data Report 03/16/2001

Final J-2 Range Additional Delineation Work Plan No. 2 03/08/2002

Draft J-2 Range Polygon Investigation Report 04/29/2003

Final J-2 Range Supplemental Groundwater Work Plan 12/02/2003

Final Revised J-2 Range Supplemental Soil Work Plan 04/27/2004

Draft J-2 Range Rapid Response Action (RRA) Completion of Work Report 11/21/2005

Final J-2 Range North Groundwater Rapid Response Action (RRA) Plan 12/19/2005

Final J-2 Range Supplemental Geophy sical Anomaly Investigation Report – J-2 Range Priority 1 Grids Technical Memorandum 12/19/2005

Final J-2 Range East Interim Groundwater Monitoring Plan 04/14/2006

Final J-2 Range North Rapid Response Action (RRA) Performance and Monitoring Evaluation Plan 04/20/2006

Revised Reconnaissance for Assessment of Potential Data Gaps at J-1 and J-2 Ranges Project Note 01/12/2007

J-2 Range Detailed Reconnaissance, EM61 Survey and Aerial Photo Assessment Summary and Recommendations Project Note 02/23/2007

Final Completion of Work Report, J-2 Range North Groundwater Rapid Response Action, Groundwater Extraction, Treatment, and Infiltration System 07/01/2007

Final Design Criteria J-2 Range East Groundwater Extraction, Treatment, and Infiltration System 07/10/2007

Final J-2 Extension Area Revised Field Investigation Project Note 07/25/2007

Draft J-2 Extension Soil Characterization Plan Project Note 01/22/2008

Final J-2 Range East System Performance Monitoring Plan 02/13/2008

Final J-2 Range North Groundwater Rapid Response Action (RRA) 6-month System Performance Monitoring Report 07/31/2008

Final J-2 Extension Additional Supplemental Soil and Groundwater Investigation 11/26/2008

Final J-2 Range North Groundwater Rapid Response Action 2007 Annual System Performance Monitoring Report 02/18/2009

Groundwater Remedial Construction Close-Out Report J-2 Range East Groundwater Remedial Action – Groundwater Extraction, Treatment and Infiltration System 08/21/2009

Final J-2 Range Soil Removal Project Note 08/24/2009

Final J-2 Range Eastern Plume 6-Month Interim Environmental Monitoring Report 04/07/2010

On-Site Transport and Alkaline Hydrolysis Treatment Activities for J-1, J-2 and Former K Ranges Soils Project Note 05/04/2010

Final J-2 Range Eastern Interim Environmental Monitoring Report March 2009 through July 2010, J-2 Range Northern, September 2008 through July 2010 9/16/2011

Final J-1, J-2 and Former K Ranges Batch #2 Soil Treatment Report 02/07/2012

Final J-1, J-2, Former A and L Ranges Soil Removal Activities Completion of Work Report 02/01/2013

J-2 Range Northern Plume Evaluation Project Note 07/16/2012

Final J-2 Range Eastern and J-2 Range Northern Interim Environmental Monitoring Report, August 2010 through July 2011, 07/30/2012

Final J-2 Range Eastern and J-2 Range Northern Interim Environmental Monitoring Report, August 2011 through May 2012 03/07/2013

J-2 Range Northern Extraction Rate Optimization Project Note 3/28/2013

Final J-2 Range Remedial Investigation/Feasibility Study July 2013

Final J-2 Range Remedy Selection Plan 07/11/2013

J-2 Range Northern Plume Priority 1 Data Gap Drilling Project Note 07/11/2013

J-2 Range Priority 2 Data Gap Drilling Project Note 08/28/2013

Confirmatory Soil Sampling for Areas 1, 2 and 3 at the J-2 Range Project Note

Confirmatory Intrusive Geophysical Investigations for Area 2 at the J-2 Range Project Note

APPENDIX D
SOIL AND GROUNDWATER SCREENING

Comparison of Maximum Concentrations in Groundwater to Screening Levels
J-2 Range

Analyte	Maximum Detected Concentration (ug/L)	Location of Maximum Detected Concentration	Date of Maximum Detected Concentration	Eastern or Northern Plume	Detection Frequency	Maximum Contaminant Level * (ug/L)	EPA Health Advisory (HA) for Drinking Water [b] (ug/L)	EPA Regional Screening Level for Tapwater [c] (ug/L)	MCP GW-1 Standard [d] (ug/L)
PEP Compounds									
1,3-DINITROBENZENE	0.255	MW-234M2	14-Aug-09	NORTHERN	5 / 1573	-	1	1.5	-
1,4-DIAMINO-2,3-ANTHRAQUINONE	0.74 J	MW-130S	14-Jun-01	NORTHERN	4 / 33	-	-	-	-
2,4,6-TRINITROTOLUENE (TNT)	2.44	MW-234M2	14-Sep-11	NORTHERN	17 / 1573	-	2	2.2	-
2,4-DINITROTOLUENE by 8330 (2,4-DNT)	0.397	MW-234M1	14-Sep-11	NORTHERN	8 / 1573	-	0.05	0.20	30
2-AMINO-4,6-DINITROTOLUENE by 8330	7.1	MW-234M2	14-Aug-09	NORTHERN	42 / 1573	-	-	30	-
2-AMINO-4,6-DINITROTOLUENE by 8270	1.5 NJ	MW-234M1	30-Jun-03	NORTHERN	1 / 1	-	-	30	-
2-NITROTOLUENE	0.42 J	MW-388M1	01-Sep-05	EASTERN	1 / 1573	-	-	0.27	-
3-NITROTOLUENE	0.29	MW-292M1	01-Apr-04	NORTHERN	1 / 1573	-	-	1.3	-
4-AMINO-2,6-DINITROTOLUENE	9.2 J	MW-234M2	14-Aug-09	NORTHERN	74 / 1573	-	-	30	-
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX)	16.1	MW-234M1	22-Sep-08	NORTHERN	348 / 1573	-	0.3	0.61	1
TETRAZOCINE	38	MW-228S	16-May-05	EASTERN	204 / 1573	-	-	780	200
PICRIC ACID	0.56 J	MW-18D	22-Oct-97	EASTERN	1 / 1537	-	-	-	-
PERCHLORATE [e]	198	J2EW1-MW1-C	01-Apr-11	NORTHERN	722 / 1781	15 / 2	15	11	2
PAHs									
NAPHTHALENE	0.38 J	MW-154M1	24-Jul-01	EASTERN	5 / 292	-	100	0.14	140
VOCs/SVOCs									
BENZOIC ACID	13 J	MW-57S	21-Dec-99	EASTERN	2 / 250	-	-	58,000	-
bis(2-ETHYLHEXYL) PHTHALATE	3300 J	MW-57S	21-Dec-99	EASTERN	62 / 292	6	3	0.07	6
CARBON DISULFIDE	0.3 J	MW-120M1	15-Feb-01	EASTERN	5 / 439	-	-	720	-
DIETHYL PHTHALATE	2 J	MW-63D	22-Sep-99	NORTHERN	3 / 292	-	30,000	11,000	2,000
DI-n-BUTYL PHTHALATE	0.42 J	MW-170M1	21-Jun-01	EASTERN	2 / 292	-	4,000	670	-
DI-n-OCTYLPHTHALATE	0.82 J	MW-63D	07-Oct-02	NORTHERN	2 / 292	-	-	-	-
1,2,4-TRICHLOROBENZENE	0.8 J	MW-18M2	16-Mar-99	EASTERN	4 / 433	70	70	0.99	70
1,1,1-TRICHLOROETHANE	0.3 J	MW-57M1	18-Oct-05	EASTERN	3 / 439	200	70,000	7,500	200
2-BUTANONE (MEK)	0.4 J	MW-18M1 / MW-18M2	30-Sep-02	EASTERN	2 / 344	-	4,000	4,900	4,000
ACETONE	3 J	MW-170M1 / MW-18D	21-Jun-01 / 16-Mar-99	EASTERN	6 / 372	-	-	12,000	6,300
CHLOROFORM [m]	4.1	MW-335M3	14-Apr-05	EASTERN	340 / 439	80	70	0.19	70
CHLOROMETHANE	2 J	MW-263M1	22-May-03	NORTHERN	20 / 439	-	400	190	-
tert-BUTYL METHYL ETHER (MTBE)	1.3	MW-170M1	21-Jun-01	EASTERN	9 / 356	-	-	12	70
TETRACHLOROETHYLENE(PCE)	2.1	MW-358M2	29-Jul05 / 01-Apr-05	EASTERN	34 / 439	5	10	9.7	5
TOLUENE	0.4 J	MW-63M3	21-Sep-99	NORTHERN	9 / 439	1,000	3,000	860	1,000
TRICHLOROETHENE (TCE)	4	MW-18M1	multiple dates 1998-2003	EASTERN	19 / 439	5	3	0.44	5
XYLENES, TOTAL	0.7 J	MW-18S	10-Oct-97	EASTERN	2 / 439	10,000	7,000	190	10,000
Pesticides/Herbicides									
2,4 DB	1.3 NJ	MW-57D	06-Jul-00	EASTERN	1 / 236	-	-	91	-
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0.54 J	MW-57D	06-Jul-00	EASTERN	2 / 236	-	70	120	-
ACIFLUORFEN	0.18 J	MW-57M3	30-Aug-00	EASTERN	1 / 223	-	1	-	-
BENTAZON	1.5 NJ	MW-63S	21-Sep-99	NORTHERN	1 / 181	-	200	440	-
CHLORAMBEN	0.98	MW-57D	06-Jul-00	EASTERN	3 / 174	-	100	230	-
DCPA (DACTHAL)	0.31 J	MW-57D	06-Jul-00	EASTERN	1 / 225	-	70	93	-
DICHLOROPROP	1.2 J	MW-63S	21-Sep-99	NORTHERN	1 / 236	-	-	-	-
MCPP [k]	280	MW-120S	20-Oct-00	EASTERN	1 / 236	-	30	12	-
PENTACHLOROPHENOL	0.2	MW-170M2	25-Jun-01	EASTERN	2 / 206	1	0.09	0.17	1
PICLORAM	0.16 NJ	MW-57D	06-Jul-00	EASTERN	2 / 170	500	700	1,100	-
SILVEX (2,4,5-TP)	0.27 NJ	MW-57D	06-Jul-00	EASTERN	1 / 236	50	50	84	-
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.017	MW-234M1	16-Oct-02	NORTHERN	3 / 215	-	-	0.022	-
ENDRIN ALDEHYDE [l]	0.035	MW-63D	25-Aug-00	NORTHERN	2 / 215	2	2	1.7	2
METHOXYCHLOR	0.074 J	MW-215M1	28-Oct-02	EASTERN	1 / 215	40	40	27	40
PCBs									
PCB-1254 (AROCHLOR 1254)	0.12 J	MW-228S	05-Sep-02	EASTERN	2 / 215	0.5	0.1	0.03	0.5
Metals									
ALUMINUM	4650	MW-120M1	20-Oct-00	EASTERN	73 / 277	-	-	16,000	-
ANTIMONY	3.4 J	MW-57S	21-Dec-99	EASTERN	1 / 272	6	6	6	6
ARSENIC	5.6 J	MW-63M1	26-Jul-05	NORTHERN	7 / 277	10	0.02	0.05	10
BARIUM	125 J	MW-57M3	18-Oct-05	EASTERN	151 / 277	2,000	7,000	2,900	2,000
BERYLLIUM	0.42 J	MW-63S	21-Sep-99	NORTHERN	9 / 277	4	70	16	4
BORON	129	MW-57M3	07-Oct-02	EASTERN	158 / 269	-	7,000	3,100	-
CADMIUM	1.6	MW-12	04-Mar-99	NORTHERN	5 / 277	5	5	6.9	5
CALCIUM	10700	MW-57M1	14-Sep-04	EASTERN	271 / 277	-	-	-	-
CHLORIDE (AS CL)	23.2	MW-57M1	05-Jul-00	EASTERN	196 / 196	-	-	-	-
CHROMIUM, TOTAL [f]	12.1	MW-63S	21-Sep-99	NORTHERN	19 / 277	100	100	0.03	100
COBALT	9	MW-18S	10-Oct-97	EASTERN	22 / 277	-	-	4.7	-
COPPER	146	MW-63D	04-Apr-00	NORTHERN	49 / 277	1,300	-	620	-
IRON	5120	MW-229M1	05-Sep-02	NORTHERN	104 / 277	-	-	11,000	-
LEAD	5	MW-63M2	05-Oct-04	NORTHERN	10 / 277	15	-	-	15
MAGNESIUM	10700	MW-57M3	07-Oct-02	EASTERN	264 / 277	-	-	-	-
MANGANESE	1880	MW-18S	10-Oct-97	EASTERN	253 / 277	-	300	320	-
MERCURY [g]	0.64	MW-63M3	04-Jan-00	NORTHERN	6 / 276	2	2	0.63	2
MOLYBDENUM	21.9	MW-57M3	13-Dec-99	EASTERN	62 / 269	-	40	78	-
NICKEL	11.4	MW-120S	15-Feb-01	EASTERN	56 / 277	-	100	300	100
POTASSIUM	9000 J	MW-57M1	14-Dec-99	EASTERN	226 / 277	-	-	-	-
SELENIUM	3.8 J	MW-63M3	01-Oct-04	NORTHERN	4 / 277	50	50	78	50
SILVER	2.5 J	MW-229M4	13-Feb-03	NORTHERN	5 / 263	-	100	71	100
SODIUM	25900	MW-57M2	30-Jun-00	EASTERN	277 / 277	-	-	-	-
SULFATE (AS SO4)	38	MW-120M1	15-Feb-01	EASTERN	196 / 196	-	-	-	-
THALLIUM	4.7 J	MW-49S / MW-48D	19-Nov-99 / 26-Jun-00	EASTERN	7 / 277	2	7	0.16	2
TUNGSTEN [i]	0.83 J	MW-357M1	25-Apr-07	EASTERN	2 / 8	-	-	11,000	20
VANADIUM [j]	9	MW-229M1	05-Sep-02	NORTHERN	16 / 277	-	-	78	30
ZINC	70.7	MW-63M2	05-Oct-04	NORTHERN	121 / 277	-	2,000	4,700	5,000
Inorganics									
NITROGEN, AMMONIA (AS N)	0.16 J	MW-228M2	19-Jun-03	EASTERN	95 / 202	-	30,000	-	-
NITROGEN, NITRATE-NITRITE [h]	3300	MW-57M1 / MW-57M2	29-Aug-00 / 05-Jul-00 / 30-Jun-00	EASTERN	173 / 202	1,000	10,000	1,600	-
PO4)	0.37	MW-229M1	05-Sep-02	NORTHERN	114 / 201	-	-	-	-

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

NA = Not Available.

Notes:

Data set consists of all sampling events for the monitoring wells presented in Appendix D-1 and D-2 for the J-2 Range Eastern and Northern plumes, respectively.

The following 109 monitoring wells are within the J-2 Eastern plume: 84MW0005, 90WT0009, J2MW-01M1, J2MW-01M2, J2MW-04M1, J2MW-04M2, J2MW-05M1, J2MW-05M2, MW-116S, MW-120M1, MW-120S, MW-121S, MW-122S, MW-137S, MW-154M1, MW-154S, MW-158M1, MW-158M2, MW-158S, MW-170M1, MW-170M2, MW-170M3, MW-18D, MW-18M1, MW-18M2, MW-18S, MW-215M1, MW-215M2, MW-215S, MW-228M1, MW-228M2, MW-228S, MW-254M1, MW-254M2, MW-307M1, MW-307M2, MW-307M3, MW-310M1, MW-319M1, MW-319M2, MW-319S, MW-321M1, MW-321M2, MW-324M1, MW-324M2, MW-334M1, MW-334M2, MW-335M1, MW-335M2, MW-335M3, MW-336D, MW-336M1, MW-339M1, MW-339M2, MW-342M1, MW-342M2, MW-342S, MW-351M1, MW-351M2, MW-354M1, MW-354M2, MW-355M1, MW-355S, MW-357M1, MW-357M2, MW-358M1, MW-358M2, MW-362M1, MW-362M2, MW-365M1, MW-365M2, MW-365S, MW-366M1, MW-366M2, MW-366M3, MW-367M1, MW-367M2, MW-368M1, MW-368M2, MW-368M3, MW-372D, MW-372M1, MW-381M1, MW-381M2, MW-388M1, MW-388M2, MW-388M3, MW-393D, MW-393M1, MW-393M2, MW-399M1, MW-399M2, MW-436M1, MW-436M2, MW-48D, MW-48M1, MW-48M2, MW-48M3, MW-48S, MW-49D, MW-49M1, MW-49M2, MW-49M3, MW-49S, MW-57D, MW-57M1, MW-57M2, MW-57M3 and MW-57S.

The following 76 monitoring wells are within the J-2 Northern plume: J2EW1-MW1-A, J2EW1-MW1-B, J2EW1-MW1-C, J2EW2-MW1-A, J2EW2-MW2-A, J2EW2-MW2-B, J2EW2-MW2-C, J2EW2-MW3-A, J2EW2-MW3-B, J2EW2-MW3-C, J2EW3-MW-2-A, J2EW3-MW-2-B, J2EW3-MW-2-C, MW-117S, MW-119S, MW-12, MW-130D, MW-130M1, MW-130S, MW-229M1, MW-229M2, MW-229M3, MW-229M4, MW-230M1, MW-230M2, MW-234M1, MW-234M2, MW-263M1, MW-263M2, MW-289M1, MW-289M2, MW-289S, MW-29, MW-292M1, MW-292M2, MW-293M1, MW-293M2, MW-293S, MW-296M1, MW-296M2, MW-300M1, MW-300M2, MW-300M3, MW-302M1, MW-302M2, MW-305M1, MW-313M1, MW-313M2, MW-313M3, MW-318M1, MW-318M2, MW-318S, MW-322M1, MW-322S, MW-327M1, MW-327M2, MW-327M3, MW-330M1, MW-330M2, MW-330M3, MW-331M1, MW-331M2, MW-337D, MW-337M1, MW-340D, MW-340M1, MW-340M2, MW-345M1, MW-345M2, MW-348M1, MW-348M2, MW-63D, MW-63M1, MW-63M2, MW-63M3, and MW-63S.

Laboratory data validation qualifier codes used for the "Maximum Concentration" are as follows:
J = Detected Concentration
NJ = Estimated Concentration
"-" = No listed value.
* = Value is also the Massachusetts Maximum Contaminant Level
(a) Federal Maximum Contaminant Level
(b) HA is the Federal EPA Lifetime Health Advisory value (Spring, 2012) (http://water.epa.gov/action/advisories/drinking/upload/dwstandards2012.pdf).
The HA shown is the Lifetime value. If no Lifetime value was available, the lower of the Drinking Water Equivalent Level (DWEL) or the $1x10^{-6}$ Cancer Risk level. If neither of these values was available, then the 10-Day acute concentration is
(c) The USEPA Regional Screening Level (RSL), May, 2012. (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm)
(d) MCP Method 1 GW-1 Standards, May 2009 (http://www.mass.gov/dep/service/compliance/riskasmt.htm)
(e) Federal MCL for perchlorate is 15 ug/L. The MCP GW-1 Standard for perchlorate is also the Massachusetts MCL.
(f) Chromium VI used as a surrogate for the RSL value for Chromium, Total.
(g) The Tapwater RSL for mercuric chloride (and other mercury salts) is used for mercury.
(h) The MCL for nitrate is 10,000 ug/L. The Tapwater RSL for nitrate is 25,000 ug/L. Values shown are for nitrite which was conservatively chosen for screening purposes. The HA shown is the 10-day HA for nitrate + nitrite. (http://www.epa.gov/ogwdw000/pdfs/facts/soc/fsochnitrates.pdf)
(i) The Tapwater RSL value presented was not published in the EPA RSL Table, but was calculated using that approach and assumed exposure parameters along with the CHPPM oral RfD toxicity value. The MCP GW-1 value shown for tungsten is an Interim Drinking Water Guideline from MassDEP/ORS (MassDEP, 2006).
(j) The Tapwater RSL for metallic vanadium and compounds is 2.6 ug/L. Value shown is for vanadium and compounds.
(k) MCPA used as a surrogate for the HA value for MCPP
(l) The Tapwater RSL for Endrin is used for Endrin Aldhyde.
(m) The MCL for total trihalomethanes is used for chloroform.

Comparison of Maximum Concentrations in Soil to Screening Levels
J-2 Range - Area 1

Analyte	Frequency of Detection	FOD	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detected in J-2 East Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MassDEP Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
PEP Compounds										
1,3-Diethyl-1,3-Diphenyl Urea	12 / 161	7%	2.5	SS101BA	No	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	19 / 377	5%	1.2	SS101Q	No	0.7	0.057	0.020	0.00028	NA
2,6-Dinitrotoluene	3 / 377	1%	0.15	SS101Q	No	NA	NA	0.009	0.02000	NA
4-Amino-2,6-Dinitrotoluene	1 / 192	1%	0.019	SS294-A	No	NA	NA	0.00038	0.023	NA
Nitroglycerin	1 / 186	1%	0.55	SS04381-A	No	NA	NA	0.0010	0.00066	NA
Perchlorate	9 / 89	10%	0.0122	SSJ2H13001	Yes	0.1	0.002	0.0031	NA	NA
RDX	3 / 192	2%	0.22	SS101A1	Yes	1.0	0.0017	0.00011	0.00023	NA
2,4,6-Trinitrotoluene	3 / 192	2%	0.36	SS101A1	No	NA	NA	0.00021	0.013	NA
Tetryl	1 / 192	1%	0.322	Target 32	No	NA	NA	0.06366	0.590	
Polychlorinated Naphthalenes										
Dichloronaphthalene	3 / 57	5%	4.4	SS101PJ	Not analyzed	NA	NA	NA	NA	NA
Trichloronaphthalene	17 / 57	30%	370	SS101PJ	Not analyzed	NA	NA	NA	NA	NA
Tetrachloronaphthalene	18 / 57	32%	540	SS101PJ	Not analyzed	NA	NA	NA	NA	NA
Pentachloronaphthalene	13 / 57	23%	150	SS101PJ	Not analyzed	NA	NA	NA	NA	NA
Hexachloronaphthalene	4 / 57	7%	9.6	SS101PJ	Not analyzed	NA	NA	NA	NA	NA
Heptachloronaphthalene	2 / 57	4%	1	SS101PJ	Not analyzed	NA	NA	NA	NA	NA
Octachloronaphthalene	2 / 57	4%	0.23	SS101PJ	Not analyzed	NA	NA	NA	NA	NA
PAHs										
Acenaphthene	7 / 185	4%	0.31	SS101Q	No	4	3.9	2.706	4.1	NA
Acenaphthylene	7 / 185	4%	0.23	SS101Q	No	1	1.2	0.068	NA	NA
Anthracene	19 / 185	10%	0.71	SS101Q	No	1000	NA	54	42	NA
Benzo(a)anthracene	67 / 185	36%	2.6	SS101Q	No	7	NA	0.037	0.010	NA
Benzo(a)pyrene	69 / 185	37%	1.7	SS101Q	No	2	NA	0.20	0.0035	NA
Benzo(b)fluoranthene	70 / 185	38%	3	SS101Q	No	7	NA	0.11	0.035	NA
Benzo(e)pyrene	1 / 1	NA	0.86	SSJ2H12BLP001	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	51 / 185	28%	0.97	SS101Q	No	1000	NA	554	NA	NA
Benzo(k)fluoranthene	69 / 185	37%	2.2	SS101Q	No	70	NA	0.11	0.35	NA
Chrysene	81 / 185	44%	3.1	SS101Q	No	70	NA	3.4	1.1	NA
Dibenz(a,h)anthracene	19 / 185	10%	0.41	SS101Q	No	0.7	NA	0.038	0.011	NA
Fluoranthene	91 / 185	49%	5.6	SS101Q	No	1000	NA	108	70	NA
Fluorene	9 / 185	5%	0.35	SS101Q	No	1000	NA	14	4	NA
Indeno(1,2,3-cd)pyrene	56 / 185	30%	0.96	SS101Q	No	7	NA	0.32	0.12	NA
2-Methylnaphthalene	7 / 185	4%	0.1	SS101Q	No	0.7	0.36	0.072	0.14	NA
Naphthalene	8 / 185	4%	0.309	Target 32	Yes	4	4.5	0.014	0.00047	NA
Phenanthrene	63 / 185	34%	2.9	SS101Q	No	10	10.9	48	NA	NA
Pyrene	90 / 185	49%	5.1	SS101Q	No	1000	NA	19	9.5	NA
VOCs/SVOCs										
Acetone	63 / 80	79%	0.49	SS101UD	Yes	6	6.3	0.11	2.4	NA
Acetophenone	2 / 2	NA	0.16	SSJ2J13NRTH	NA	NA	NA	NA	0.5	NA
Benzanthrone	5 / 2	NA	0.04	SS101A2	No	NA	NA	NA	NA	NA
Benzene	2 / 80	3%	0.017	Target 32	No	2	1.5	0.00010	0.00020	NA
Benzoic Acid	39 / 184	21%	1.9	SS101BA	Yes	NA	NA	NA	14	NA
Benzyl Butyl Phthalate	7 / 185	4%	0.86	SS101UB	No	NA	NA	491	0.20	NA
Bis(2-Ethylhexyl) Phthalate	73 / 185	39%	10	OG071100-02	Yes	200	NA	72	0.017	NA
Bromoform	22 / 80	28%	0.004	BH-29	No	0.1	0.007	0.0022	0.0021	NA
Bromomethane	7 / 80	9%	0.002	SS101UD	No	0.5	0.05	0.0018	0.0018	NA
Carbazole	9 / 185	5%	0.45	SS101Q	No	NA	NA	0.012	NA	NA
Carbon Disulfide	1 / 80	1%	0.0008	SS101T	Yes	NA	NA	0.41	0.21	NA
Chloroform	6 / 80	8%	0.067	SS101Q	Yes	0.4	0.35	0.00004	0.000053	NA
Chloromethane	3 / 80	4%	0.007	SS101Q	Yes	NA	NA	0.00040	0.049	NA
p-Cymene (p-Isopropyltoluene)	1 / 1	NA	0.12	SS15195-A	NA	NA	NA	NA	NA	NA
Dibenzofuran	6 / 185	3%	0.23	SS101Q	No	NA	NA	0.26	0.11	NA
3,5-Dichlorobenzoic Acid	1 / 61	2%	0.11	SS101Q	No	NA	NA	NA	NA	NA
1,2-Dichloropropane	1 / 80	1%	0.022	SS101TD	No	0.1	0.015	NA	0.099	NA
Diethyl Phthalate	3 / 185	2%	0.023	SS101PF	Yes	10	10.0	13	4.7	NA
2,4-Dimethylphenol	1 / 185	1%	0.85	SS101Q	No	0.7	0.18	0.30	0.32	NA
Di-N-Butyl Phthalate	48 / 185	26%	1.4	SS165B	Yes	NA	NA	151	1.7	NA
Di-N-Octyl Phthalate	3 / 185	2%	1.3	SS101PG	Yes	NA	NA	0.48	NA	NA
Ethylbenzene	1 / 80	1%	0.002	SS101AA	No	40	44.8	1.9	0.0015	NA
Methyl Ethyl Ketone	51 / 80	64%	0.046	SS101Q	Yes	4	4	0.34	1.0	NA
Methyl Isobutyl Ketone (4-Methyl-2-Pentanon	1 / 80	1%	0.002	SS04752-A		0.4	0.35	NA	0.2	NA
2-Methylphenol	1 / 185	1%	0.14	SS101Q	No	NA	NA	0.47	0.58	NA
4-Methylphenol	2 / 185	1%	0.36	SS101Q	No	NA	NA	0.04	1.1	NA
N-Nitrosodiphenylamine	39 / 185	21%	1.6	SS101Q	No	NA	NA	0.0078	0.057	NA
2-Nitrodiphenylamine	19 / 161	12%	0.87	SS165B	No	NA	NA	NA	NA	NA
Pentachlorophenol	6 / 185	3%	0.11	SS101A1	Yes	3	0.008	0.0004	0.0017	NA
Phenol	4 / 185	2%	0.17	SS101PL	No	1	0.95	0.77	2.6	NA
Styrene	1 / 80	1%	0.002	Target 32		3	2.90	2.34	1.2	NA
Toluene	20 / 80	25%	0.01	SS101UD	Yes	30	32	0.27	0.59	NA
2,4,6-Trichlorophenol	1 / 185	1%	0.35	SS101Q	No	0.7	0.04	NA	0.013	NA
Xylenes	2 / 80	3%	0.006	SS101AA	Yes	400	360	0.81	0.19	NA
Pesticides/Herbicides										
Acifluorfen	5 / 70	7%	0.046	SS101R	Yes	NA	NA	0.00011	NA	NA
Aldrin	14 / 89	16%	4.9	SS101PJ	No	0.04	NA	0.010	0.00003	NA
Bentazon	1 / 57	2%	0.21	SS101Q	No	NA	NA	0.037	0.096	NA
alpha-BHC	24 / 89	27%	32	SS101PJ	No	NA	NA	0.000062	0.000036	NA
beta-BHC	30 / 89	34%	120	SS101PJ	Yes	NA	NA	0.00020	0.00013	NA
delta-BHC	16 / 89	18%	4	SS101PJ	No	NA	NA	NA	NA	NA
gamma-BHC	2 / 89	2%	0.15	SS101Q	No	0.003	0.0028	0.00073	0.00021	NA
Chloramben	5 / 71	7%	0.026	SS101Q	Yes	NA	NA	0.12	0.057	NA
alpha-Chlordane	1 / 89	1%	0.0016	SS101R	No	0.7	NA	0.00038	0.0018	NA
gamma-Chlordane	12 / 89	13%	0.64	SS101PJ	No	0.7	NA	0.000038	0.0018	NA
Dalapon	3 / 72	4%	0.48	SS101Q	No	NA	NA	NA	0.097	NA
2,4-DB	1 / 72	1%	0.1	SS101Q	Yes	NA	NA	0.052	0.036	NA
DCPA (Dacthal)	1 / 72	1%	0.008	SS101Q	Yes	NA	NA	4.9	0.11	NA
P,P'-DDD	5 / 89	6%	0.28	SS101Q	No	4	NA	0.28	0.066	NA
P,P'-DDE	46 / 89	52%	5.5	SS101PJ	No	3	NA	0.88	0.046	NA
P,P'-DDT	56 / 89	63%	3.7	SS101Q	No	3	NA	0.53	0.067	NA
Dicamba	1 / 72	1%	0.026	SS101Q	No	NA	NA	0.26	0.11	NA
Dieldrin	5 / 89	6%	0.012	SS101UB	No	0.05	NA	0.00080	0.000061	NA
alpha-Endosulfan	1 / 89	1%	0.0017	SS101UB	No	0.5	0.54	1.32	1.1	NA
beta-Endosulfan	3 / 89	3%	0.0033	SS101A4	No	0.5	0.54	1.32	1.1	NA
Endosulfan Sulfate	2 / 89	2%	0.054	SS101Q	No	8	NA	0.19	0.068	NA
Endrin	4 / 89	4%	0.0087	SS101PN	No	8	NA	0.19	0.068	NA
Endrin Aldehyde	10 / 89	11%	0.067	SS101PG	No	8	NA	0.19	0.068	NA
Endrin Ketone	12 / 89	13%	0.073	SS101Q	No	8	NA	0.19	0.068	NA
Heptachlor	28 / 89	31%	30	SS101PJ	No	0.2	NA	0.021	0.00014	NA
Heptachlor Epoxide	28 / 89	31%	3.4	SS101PJ	No	0.09	NA	0.0061	0.000068	NA
MCPP	1 / 72	1%	91	SS101Q	Yes	NA	NA	0.050	0.0035	NA
Methoxychlor	1 / 89	1%	0.012	SS101UB	Yes	200	NA	4.0	1.5	NA
4-Nitrophenol	1 / 72	1%	0.18	SS101Q	No	NA	NA	NA	NA	NA
Picloram	3 / 48	6%	0.0084	SS101R	Yes	NA	NA	0.088	0.29	NA
Silvex (2,4,5-TP)	1 / 72	1%	0.044	SS101Q	Yes	NA	NA	NA	0.046	NA
2,4,5-T (Trichlorophenoxyacetic Acid)	1 / 72	1%	0.011	SS101Q	Yes	NA	NA	0.49	0.052	NA
PCBs										
PCB-1260	7 / 89	8%	0.082	SS101A4	No	2	NA	0.01	0.024	NA
PCB-1254	8 / 89	9%	0.46	SS101UB	Yes	2	NA	0.01	0.0088	NA
Metals										
Aluminum	165 / 166	99%	19700	SS04381-A	Yes	NA	NA	54006	23000	16000
Antimony	26 / 166	16%	2.8	SS165B	Yes	20	NA	0.27	0.27	1.9
Arsenic	148 / 166	89%	6.7	SS101UB	Yes	20	NA	0.0090	0.0013	5.5
Barium	166 / 166	100%	131	SS101UA	Yes	1000	NA	120	120	24
Beryllium	157 / 166	95%	0.71	SS101UB	Yes	100	NA	2.6	13	0.38
Boron	29 / 166	17%	4.9	OG071100-02	Yes	NA	NA	9.5	9.9	9.6
Cadmium	88 / 166	53%	38.5	OG071100-02	Yes	2	NA	0.40	0.52	0.94
Calcium	148 / 166	89%	62100	SS101Q	Yes	NA	NA	NA	NA	NA
Chromium	163 / 166	98%	53.9	SS101A1	Yes	30	NA	7.0	0.00059	19
Cobalt	164 / 166	99%	8.4	SS101A4	Yes	NA	NA	132	0.21	4
Copper	152 / 166	92%	1810	Target 32	Yes	NA	NA	46	22	11
Iron	166 / 166	100%	64600	SS101Q	Yes	NA	NA	2422	270	17800
Lead	166 / 166	100%	423	Target 32	Yes	300	NA	4.1	NA	19

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
J-2 Range - Area 1

Analyte	Frequency of Detection	FOD	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detected in J-2 East Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MassDEP Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Magnesium	166 / 166	100%	4930	SS101Q	Yes	NA	NA	NA	NA	2010
Manganese	166 / 166	100%	709	SSJ2LOC14001	Yes	NA	NA	44	21	134
Mercury	35 / 166	21%	3.4	SS101Q	Yes	20	NA	0.020	0.033	0.12
Molybdenum	95 / 166	57%	4.1	SS101Q	Yes	NA	NA	0.18	1.6	1.2
Nickel	160 / 166	96%	28.7	SS101Q	Yes	20	NA	292	20	10
Potassium	164 / 166	99%	5360	SS101Q	Yes	NA	NA	NA	NA	766
Selenium	57 / 166	34%	2.8	SS101Q	Yes	400	NA	2.76	0.40	1.7
Silver	16 / 166	10%	2.9	SS101Q	Yes	100	NA	16	0.6	0.74
Sodium	14 / 166	8%	2990	SS101Q	Yes	NA	NA	NA	NA	NA
Thallium	15 / 166	9%	4.2	SS101Q	Yes	8	NA	3.0	0.011	1.6
Vanadium	166 / 166	100%	35.3	SS04381-A	Yes	600	NA	260	78	28.8
Zinc	166 / 166	100%	1320	SS101Q	Yes	2500	NA	2202	290	25.6
Inorganics										
Cyanide	2 / 90	2%	10.3	SS101Q	No	100	NA	0.0011	0.094	NA
Nitrogen, Ammonia (as N)	85 / 90	94%	860	SS101Q	Yes	NA	NA	NA	NA	NA
Nitrogen, Nitrate-Nitrite	73 / 90	81%	3260	SS101Q	Yes	NA	NA	NA	NA	0.5
Phosphorus, Total PO4 (as PO4)	90 / 90	100%	15600	SS101Q	Yes	NA	NA	NA	NA	291

(1) Non-detects were included at one-half the detection limit.
(2) Site-specific background level for outwash (AMEC 2001).
(3) Maximum value allowable for human contact

Shading indicates that the screening level was exceeded by the maximum detected concentration.
NA = Not Available.

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
J-2 Range - Area 2

Analyte	Frequency of Detection	FOD	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detected in J-2 East Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MassDEP Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
PEP Compounds										
1,3-Diethyl-1,3-Diphenyl Urea	35 / 301	12%	25	SS101NN	No	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	7 / 1040	1%	0.59	SS165A	No	0.7	0.057	0.020	0.00028	NA
2,6-Dinitrotoluene	3 / 1041	0.3%	0.042	SS04173-A	No	NA	NA	0.0088	0.020	NA
2-Amino-4,6-Dinitrotoluene	2 / 689	0.3%	0.32	SSJ2O19002	No	NA	NA	0.00036	0.023	NA
4-Amino-2,6-Dinitrotoluene	2 / 689	0.3%	0.33	SSJ2O19002	No	NA	NA	0.00036	0.023	NA
HMX	8 / 689	1%	10	SSJ2SG004	Yes	2	0.34	0.32	0.99	NA
Nitroglycerin	2 / 657	0.3%	7.5	SS101EB	No	NA	NA	0.0010	0.00066	NA
Pentaerythritol Tetranitrate	1 / 689	0.1%	6.3	SS101NH	No	NA	NA	NA	0.024	NA
Perchlorate	84 / 270	31%	0.153	SSJ2M19005	Yes	0.1	0.0020	0.0031	NA	NA
RDX	27 / 48	56%	5.6	OG071900-03_21	Yes	1	0.0017	0.00011	0.00023	NA
2,4,6-Trinitrotoluene	4 / 691	0.6%	0.47	SSJ2M19005	No	NA	NA	0.00021	0.013	NA
Polychlorinated Naphthalenes										
2-Chloronaphthalene	1 / 376	0%	0.04	SS101LF	Not analyzed	NA	NA	NA	2.9	NA
Chloronaphthalene	6 / 164	4%	6.9	SS101NR	Not analyzed	NA	NA	NA	NA	NA
Dichloronaphthalene	39 / 164	24%	150	SS101NR	Not analyzed	NA	NA	NA	NA	NA
1,4-Dichloronaphthalene	3 / 24	13%	70.6	Target 14C	Not analyzed	NA	NA	NA	NA	NA
Trichloronaphthalene	88 / 164	54%	1700	SS101NR	Not analyzed	NA	NA	NA	NA	NA
1,2,3-Trichloronaphthalene	3 / 24	13%	23.1	Target 14C	Not analyzed	NA	NA	NA	NA	NA
1,2,3,4-Tetrachloronaphthalene	5 / 24	21%	39.8	Target 14C	Not analyzed	NA	NA	NA	NA	NA
Tetrachloronaphthalene	93 / 164	57%	1600	SS101NR	Not analyzed	NA	NA	NA	NA	NA
Pentachloronaphthalene	86 / 164	52%	550	SS101NR	Not analyzed	NA	NA	NA	NA	NA
1,2,3,5,8-Pentachloronaphthalene	4 / 24	17%	69	Target 14C	Not analyzed	NA	NA	NA	NA	NA
Hexachloronaphthalene	35 / 162	22%	25	SS101NR	Not analyzed	NA	NA	NA	NA	NA
1,2,3,4,6,7-Hexchloronaphthalene	1 / 24	4%	0.771	Target 14C	Not analyzed	NA	NA	NA	NA	NA
Heptachloronaphthalene	16 / 162	10%	1	SS101NR	Not analyzed	NA	NA	NA	NA	NA
1,2,3,4,5,6,7-Heptachloronaphthalene	1 / 24	4%	3.12	Target 14C	Not analyzed	NA	NA	NA	NA	NA
Octachloronaphthalene (total)	7 / 162	4%	0.087	SS101NR	Not analyzed	NA	NA	NA	NA	NA
Octachloronaphthalene	1 24	4%	0.342	Target 14C	Not analyzed	NA	NA	NA	NA	NA
Dioxins/Furans										
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	13 / 20	65%	0.00000095	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	17 / 20	85%	0.0000018	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	16 / 20	80%	0.000004	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	16 / 20	80%	0.0000036	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	20 / 20	100%	0.000133	SS101DE	No	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	20 / 20	100%	0.0151	SS101NK	No	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	11 / 20	55%	0.0000026	SS101NK	No	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	11 / 20	55%	0.00000069	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	13 / 20	65%	0.00000052	SS101NK	No	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	13 / 20	65%	0.0000011	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	18 / 20	90%	0.0000012	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	10 / 20	50%	0.00000057	SS101ND	No	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	14 / 20	70%	0.0000013	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	4 / 20	20%	0.0000012	SS101DE	No	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzofuran	12 / 20	60%	0.0000196	SS101DE	No	NA	NA	NA	NA	NA
Octachlorodibenzofuran	19 / 20	95%	0.0000954	SS101NE	No	NA	NA	NA	NA	NA
2,3,7,8-TCDD TEQ	20 / 20	100%	0.000006	SS101DE	No	0.00002	NA	5.00E-13	0.00000026	NA
Tetrachlorinated Dibenzo-p-dioxins, (Total)	20 / 20	100%	0.000001	SS101NK	No	NA	NA	NA	NA	NA
Pentachlorinated Dibenzo-p-dioxins, (Total)	20 / 20	100%	0.000005	SS101DE	No	NA	NA	NA	NA	NA
Hexachlorinated Dibenzo-p-dioxins, (Total)	20 / 20	100%	0.0000392	SS101DE	No	NA	NA	NA	NA	NA
Heptachlorinated Dibenzo-p-dioxins, (Total)	20 / 20	100%	0.000285	SS101DE	No	NA	NA	NA	NA	NA
Tetrachlorinated Dibenzofurans, (Total)	20 / 20	100%	0.0000339	SS101NE	No	NA	NA	NA	NA	NA
Pentachlorinated Dibenzofurans, (Total)	18 / 20	90%	0.0000169	SS101NE	No	NA	NA	NA	NA	NA
Hexachlorinated Dibenzofurans, (Total)	19 / 20	95%	0.000052	SS101NE	No	NA	NA	NA	NA	NA
Heptachlorinated Dibenzofurans, (Total)	18 / 20	90%	0.000068	SS101NE	No	NA	NA	NA	NA	NA
PAHs										
Acenaphthene	2 / 352	1%	0.032	SS101PQ	No	4	3.9	2.7	4.1	NA
Acenaphthylene	14 / 35	40%	0.091	SSJ2TCP001	No	1	1.2	0.068	NA	NA
Anthracene	15 / 352	4%	0.19	SSJ2TCP001	No	1000	NA	54	42	NA
Benzo(a)anthracene	100 / 352	28%	3	SSJ2TCP001	No	7	NA	0.037	0.01	NA
Benzo(a)pyrene	92 / 352	26%	1.9	SSJ2TCP001	No	2	NA	0.20	0.0035	NA
Benzo(b)fluoranthene	107 / 352	30%	2.5	SSJ2TCP001	No	7	NA	0.11	0.035	NA
Benzo(e)pyrene	2 / 2	NA	0.13	SSJ2M19005	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	60 / 352	17%	0.95	SSJ2TCP001	No	1000	NA	554	NA	NA
Benzo(k)fluoranthene	98 / 344	28%	2.7	SSJ2TCP001	No	70	NA	0.11	0.35	NA
Chrysene	127 / 352	36%	3.5	SSJ2TCP001	No	70	NA	3.4	1.1	NA
Dibenz(a,h)anthracene	19 / 352	5%	0.53	SSJ2TCP001	No	0.7	NA	0.038	0.011	NA
Fluoranthene	128 / 351	36%	4.6	SSJ2TCP001	No	1000	NA	108	70	NA
Fluorene	6 / 352	2%	0.064	SS101LA	No	1000	NA	14	4	NA
Indeno(1,2,3-cd)pyrene	57 / 352	16%	1	SSJ2TCP001	No	7	NA	0.32	0.12	NA
2-Methylnaphthalene	6 / 352	2%	0.049	SSJ2_30MM	No	0.7	0.36	0.072	0.14	NA
Naphthalene	14 / 352	4%	0.121	Target 6A	Yes	4	4.5	0.014	0.00047	NA
Phenanthrene	74 / 352	21%	0.45	SS101PH	No	10	10.9	48	NA	NA
Pyrene	136 / 352	39%	6.3	SSJ2TCP001	No	1000	NA	19	9.5	NA
VOCs/SVOCs										
Acetone	137 / 153	90%	1.7	SS03992-A	Yes	6	6.3	0.11	2.4	NA
Benzene	20 / 153	13%	0.035	SS03992-A	No	2	1.5	0.00010	0.00020	NA
Benzoic Acid	36 / 325	11%	0.4	SSJ2M29001	Yes	NA	NA	NA	14	NA
1,4-Bis(P-Toluidino)Anthraquinone	2 / 14	14%	1.3	SS101NA	No	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl) Phthalate	88 / 35	251%	66	SS101LG	Yes	200	NA	72	0.017	NA
Bromoform	8 / 153	5%	0.001	SS101KH	No	0.1	0.007	0.0022	0.0021	NA
Bromomethane	20 / 153	13%	0.1	Target 10	No	0.5	0.05	0.0018	0.0018	NA
Carbazole	7 / 352	2%	0.031	SS101GB	No	NA	NA	0.012	NA	NA
Carbon Disulfide	11 / 153	7%	0.004	OG071800-02	Yes	NA	NA	0.41	0.21	NA
Chloroform	1 / 153	1%	0.012	SS03992-A	Yes	0.4	0.35	0.000036	0.000053	NA
Chloromethane	16 / 153	10%	0.019	Target 10	Yes	NA	NA	0.0004	0.049	NA
Dibenzofuran	2 / 352	1%	0.028	SS101LA	No	NA	NA	0.26	0.11	NA
Diethyl Phthalate	1 / 352	0%	0.049	SSJ2_30MM	Yes	10	10	13	4.7	NA
Di-N-Butyl Phthalate	36 / 352	10%	0.7	SS165A	Yes	NA	NA	151	1.7	NA
Di-N-Octyl Phthalate	2 / 352	1%	0.083	SS101EC	Yes	NA	NA	0.48	NA	NA
1,1-Dichloroethene	1 / 153	1%	0.002	SS101GB	No	3	3.4	NA	0.093	NA
Dipropyl Adipate	1 / 301	0%	0.32	SS101DF	No	NA	NA	NA	NA	NA
Ethylbenzene	7 / 153	5%	0.009	SS03992-A	No	40	45	1.9	0.0015	NA
Hexachlorobenzene	2 / 352	1%	0.07	SS101HA	No	0.7	NA	0.007	0.00053	NA
Methyl Ethyl Ketone	100 / 153	65%	0.11	SS03992-A	No	4	0.34	4	1	NA
Methylene Chloride	1 / 153	1%	0.04	OG072000-04	No	0.1	0.01	NA	0.0025	NA
N-Nitrosodiphenylamine	22 / 352	6%	0.85	SS165A	No	NA	NA	0.0078	0.057	NA
2-Nitrodiphenylamine	12 / 301	4%	0.63	SS101DF	No	NA	NA	NA	NA	NA
PCE	1 / 152	1%	0.0006	SS101N	Yes	1	1.24	0.00044	0.0044	NA
Styrene	9 / 153	6%	0.01	SS03992-A	No	3	2.9	2.3	1.2	NA
Toluene	70 / 153	46%	0.047	SS03992-A	Yes	30	32	0.27	0.59	NA
TCE	2 / 153	1%	0.003	SS03992-A	Yes	0.3	0.28	0.0005	0.00016	NA
Xylenes	15 / 153	10%	0.013	SS03992-A	Yes	400	360	0.81	0.19	NA
Pesticides/Herbicides										
Acifluorfen	2 / 98	2%	0.051	SS101GB	Yes	NA	NA	0.00011	NA	NA
Aldrin	58 / 141	41%	23	SS101NE	No	0.04	NA	0.010	0.000034	NA
Bentazon	1 / 86	1%	1.8	SS101NG	No	NA	NA	0.037	0.096	NA
alpha-BHC	93 / 141	66%	140	SS101NE	No	NA	NA	0.000062	0.000036	NA
beta-BHC	57 / 141	40%	5.4	SS101PB	Yes	NA	NA	0.00020	0.00013	NA
delta-BHC	58 / 141	41%	24	SS101NE	No	NA	NA	NA	NA	NA
Chloramben	10 / 90	11%	0.13	SS101NG	Yes	NA	NA	0.12	0.057	NA
alpha-Chlordane	1 / 141	1%	0.0026	SS101GB	No	0.7	NA	0.00038	0.0018	NA
gamma-Chlordane	31 / 141	22%	0.29	SS101NN	No	0.7	NA	0.000038	0.0018	NA
P,P'-DDD	5 / 141	4%	0.0028	SS101LG	No	4	NA	0.28	0.066	NA
P,P'-DDE	87 / 141	62%	30	SS101NE	No	3	NA	0.88	0.046	NA
P,P'-DDT	90 / 141	64%	11	SS101NE	No	3	NA	0.53	0.067	NA
Dieldrin	8 / 141	6%	0.43	SS101PB	No	0.05	NA	0.0008	0.000061	NA
beta-Endosulfan	1 / 141	1%	0.0021	SS101NI	No	0.5	0.54	1.3	1.1	NA
Endrin Aldehyde	37 / 134	28%	19	SS101NE	No	8	NA	0.19	0.068	NA
Endrin Ketone	11 / 141	8%	0.006	SS101NA	No	8	NA	0.19	0.068	NA
Heptachlor	95 / 141	67%	130	SS101NE	No	0.2	NA	0.021	0.00014	NA
Heptachlor Epoxide	68 / 141	48%	19	SS101NE	No	0.09	NA	0.0061	0.00007	NA
MCPA	1 / 115	1%	11	MW-120	No	NA	NA	0.0014	0.0015	NA
Picloram	2 / 85	2%	0.012	MW-120	Yes	NA	NA	0.088	0.29	NA
2,4,5-T (Trichlorophenoxyacetic Acid)	1 / 115	1%	0.006	SS101IA	Yes	NA	NA	0.49	0.052	NA
PCBs										
PCB-1260	2 / 133	2%	0.1	SS101GP	No	2	NA	0.010	0.024	NA
PCB-1254	1 / 133	1%	0.096	SS101GP	Yes	2	NA	0.010	0.0088	NA
Metals										

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
J-2 Range - Area 2

Analyte	Frequency of Detection	FOD	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detected in J-2 East Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MassDEP Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
Aluminum	365 / 365	100%	26400	SS101N	Yes	NA	NA	54006	23000	16000
Antimony	56 / 365	15%	2.2	OG071800-03	Yes	20	NA	0.27	0.27	1.9
Arsenic	331 / 365	91%	16	SS101NI	Yes	20	NA	0.0090	0.0013	5.5
Barium	365 / 365	100%	110	SS101NG	Yes	1000	NA	120	120	24
Beryllium	306 / 365	84%	0.71	SS101KI	Yes	100	NA	2.6	13	0.38
Boron	142 / 365	39%	65.7	SS101NG	Yes	NA	NA	9.5	9.9	9.6
Cadmium	137 / 369	37%	12.2	Target 6D	Yes	2	NA	0.40	0.52	0.94
Calcium	348 / 365	95%	9070	SS101NG	Yes	NA	NA	NA	NA	NA
Chromium	366 / 365	100%	792	SS101NG	Yes	30	NA	7.0	0.00059	19
Cobalt	357 / 365	98%	41.4	SS101NG	Yes	NA	NA	132	0.21	4
Copper	354 / 372	95%	8940	SS101NC	Yes	NA	NA	46	22	11
Iron	366 / 365	100%	133000	Target 10	Yes	NA	NA	2422	270	17800
Lead	369 / 375	98%	1040	SS101NC	Yes	300	NA	4.1	NA	19
Magnesium	366 / 365	100%	107000	SS101NG	Yes	NA	NA	NA	NA	2010
Manganese	366 / 365	100%	1310	Target 10	Yes	NA	NA	44	21	134
Mercury	50 / 365	14%	0.18	SSJ2M21018	Yes	20	NA	0.020	0.033	0.12
Molybdenum	181 / 365	50%	19	MW-120	Yes	NA	NA	0.18	1.6	1.2
Nickel	354 / 365	97%	853	SS101NG	Yes	20	NA	292	20	10
Potassium	366 / 365	100%	1330	SS101NM	Yes	NA	NA	NA	NA	766
Selenium	134 / 365	37%	2.7	OG071700-01	Yes	400	NA	2.76	0.4	1.7
Silver	13 / 351	4%	22.7	OG071900-03_21	Yes	100	NA	16	0.6	0.74
Sodium	54 / 365	15%	469	OG072000-02	Yes	NA	NA	NA	NA	NA
Thallium	38 / 365	10%	1.7	SS101NA	Yes	8	NA	3.0	0.011	1.6
Vanadium	366 / 365	100%	42.1	SS101NG	Yes	600	NA	260	78	28.8
Zinc	365 / 365	100%	1930	SS101NC	Yes	2500	NA	2202	290	25.6
Inorganics										
Chloride (as Cl)	3 / 3	100%	3.8	SSBP01	Yes	NA	NA	NA	NA	NA
Cyanide	4 / 163	2%	4.4	SSJ2M21013	No	100	NA	0.001	0.094	NA
Nitrogen, Ammonia (as N)	112 / 133	84%	76.5	SS101PH	Yes	NA	NA	NA	NA	NA
Nitrogen, Nitrate-Nitrite	110 / 134	82%	1.6	MW-116	Yes	NA	NA	NA	NA	0.5
Phosphorus, Total PO4 (as PO4)	133 / 134	99%	416	MW-228	Yes	NA	NA	NA	NA	291
Sulfate (as SO4)	2 / 3	67%	96	SSBP01	Yes	NA	NA	NA	NA	NA

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

(2) Site-specific background level for outwash (AMEC 2001).

(3) Maximum value allowable for human contact

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

NA = Not Available.

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
J-2 Range - Area 3

Analyte	Frequency of Detection	FOD	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detected in J-2 North Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MassDEP Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
PEP Compounds										
2,4-Dinitrotoluene	4 / 232	2%	0.087	SS04345-A	Yes	0.7	0.057	0.020	0.00028	NA
2-Amino-4,6-Dinitrotoluene	6 / 186	3%	0.45	SSJ2O32006	Yes	NA	NA	0.00038	0.023	NA
4-Amino-2,6-Dinitrotoluene	3 / 186	2%	0.4	SSJ2O32006	Yes	NA	NA	0.00038	0.023	NA
HMX	4 / 186	2%	0.049	SS04343-A	Yes	2	0.34	0.32	0.99	NA
Nitroglycerin	1 / 184	0.5%	0.27	SS04343-A	No	NA	NA	0.0010	0.00066	NA
2-Nitrotoluene	1 / 186	0.5%	0.02	SSJ2M30001	No	NA	NA	0.0022	0.00025	NA
Perchlorate	5 / 82	6%	0.0164	SSJ2N35010	Yes	0.1	0.002	0.0031	NA	NA
RDX	9 / 186	5%	0.56	J2A200600	Yes	1.0	0.0017	0.00011	0.00023	NA
Tetryl	2 / 186	1%	0.12	SS04343-A	No	NA	NA	0.064	0.59	NA
2,4,6-Trinitrotoluene	3 / 186	2%	0.51	SSJ2B5001	Yes	NA	NA	0.00021	0.013	NA
Polychlorinated Naphthalenes										
1-Chloronaphthalene	2 / 7	29%	0.31	SS04342-A	Not analyzed	NA	NA	NA	NA	NA
2-Chloronaphthalene	3 / 53	6%	0.267	SS04342-A	Not analyzed	NA	NA	NA	2.9	NA
Dichloronaphthalene, (Total)	6 / 31	19%	0.26	SSJ2AT2U004	Not analyzed	NA	NA	NA	NA	NA
Trichloronaphthalene, (Total)	12 / 31	39%	6.6	SSJ2AT2U004	Not analyzed	NA	NA	NA	NA	NA
Tetrachloronaphthalene, (Total)	12 / 31	39%	8.7	SSJ2AT2U006	Not analyzed	NA	NA	NA	NA	NA
Pentachloronaphthalene, (Total)	8 / 31	26%	2.8	SSJ2AT2U006	Not analyzed	NA	NA	NA	NA	NA
Heptachloronaphthalene, (Total)	3 / 31	10%	0.086	SSJ2AT2U006	Not analyzed	NA	NA	NA	NA	NA
1,2,3,4,5,6,7-Heptachloronaphthalene	2 / 7	29%	0.929	SS04342-A	Not analyzed	NA	NA	NA	NA	NA
Hexachloronaphthalene, (Total)	5 / 31	16%	0.35	SSJ2AT2U006	Not analyzed	NA	NA	NA	NA	NA
1,2,3,4,6,7-Hexachloronaphthalene	1 / 7	14%	0.142	SS04342-A	Not analyzed	NA	NA	NA	NA	NA
Octachloronaphthalene, (Total)	1 / 31	3%	0.012	SSJ2AT2U006	Not analyzed	NA	NA	NA	NA	NA
Octachloronaphthalene	1 / 7	14%	0.0802	SS04342-A	Not analyzed	NA	NA	NA	NA	NA
PAHs										
Acenaphthylene	2 / 46	4%	0.095	SSJ2N35010	No	1	1.2	0.068	NA	NA
Anthracene	1 / 46	2%	0.022	SSJ2O30001	No	1000	NA	54	42	NA
Benzo(a)anthracene	2 / 46	4%	0.19	SSJ2O30001	No	7	NA	0.037	0.010	NA
Benzo(a)pyrene	2 / 46	4%	0.26	SSJ2O30001	No	2	NA	0.20	0.0035	NA
Benzo(b)fluoranthene	2 / 46	4%	0.5	SSJ2O30001	No	7	NA	0.11	0.035	NA
Benzo(e)pyrene	1 / 1	NA	0.26	SSJ2O30001	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	1 / 46	2%	0.15	SSJ2O30001	No	1000	NA	554	NA	NA
Benzo(k)Fluoranthene	1 / 46	2%	0.049	SSJ2M30002	No	70	NA	0.11	0.35	NA
Chrysene	2 / 46	4%	0.23	SSJ2O30001	No	70	NA	3.4	1.1	NA
Fluoranthene	3 / 46	7%	0.28	SSJ2O30001	No	1000	NA	108	70	NA
Fluorene	1 / 46	2%	0.031	SSJ2N35010	No	1000	NA	14	4	NA
Indeno(1,2,3-cd)pyrene	1 / 46	2%	0.15	SSJ2O30001	No	7	NA	0.32	0.12	NA
2-Methylnaphthalene	1 / 46	2%	0.032	SSJ2N35010	No	0.7	0.36	0.072	0.14	NA
Naphthalene	4 / 46	9%	0.371	SS04342-A	No	4	4.5	0.014	0.00047	NA
Phenanthrene	2 / 46	4%	0.1	SSJ2O30001	No	10	10.9	48	NA	NA
Pyrene	3 / 46	7%	0.33	SSJ2O30001	No	1000	NA	19	9.5	NA
VOCs/SVOCs										
Acetone	11 / 16	69%	0.28	AM061102-01	Yes	6	6.3	0.11	2.4	NA
Acetophenone	1 / 1	NA	0.19	SSJ2_81MM1	NA	NA	NA	NA	NA	NA
Benzene	1 / 16	6%	0.002	SSJ2CB	No	2	1.5	0.00010	0.00020	NA
Benzaldehyde	1 / 1	NA	0.29	SSJ2CB	NA	NA	NA	NA	0.33	NA
Benzoic Acid	3 / 38	8%	0.16	SS15189-A	No	NA	NA	NA	14	NA
Benzyl Butyl Phthalate	1 / 46	2%	0.038	SSJ2N35012	No	NA	NA	491	0.20	NA
Bis(2-Ethylhexyl) Phthalate	7 / 46	15%	0.23	MW-130	Yes	200	NA	72	0.017	NA
Bromoform	3 / 16	19%	0.003	SS101OM	No	0.1	0.007	0.0022	0.0021	NA
Bromomethane	3 / 16	19%	0.009	AM061102-01	No	0.5	0.05	0.0018	0.0018	NA
Chloromethane	1 / 16	6%	0.002	AM061102-01	Yes	NA	NA	0.00040	0.049	NA
p-Cymene (p-Isopropyltoluene)	1 / 1	NA	0.11	SSJ2M30001	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	14 / 46	30%	1.6	SSJ2N35010	No	NA	NA	151	1.7	NA
Hexachlorobenzene	2 / 46	4%	0.063	SS15189-A	No	0.7	NA	0.0070	0.00053	NA
Methyl Ethyl Ketone	7 / 16	44%	0.012	AM061102-01	No	4	4	0.34	1.0	NA
N-Nitrosodiphenylamine	4 / 46	9%	0.17	SSJ2N35010	No	NA	NA	0.0078	0.057	NA
Toluene	7 / 16	44%	0.002	SSJ2_81MM1	Yes	30	32	0.27	0.6	NA
Xylenes, Total	1 / 16	6%	0.001	MW-119	Yes	400	360	0.81	0.19	NA
Metals										
Aluminum	121 / 121	100%	22700	SS15162-A	Yes	NA	NA	54006	23000	16000
Antimony	29 / 121	24%	1.3	SSJ2N35011	No	20	NA	0.27	0.27	1.9
Arsenic	108 / 121	89%	20.1	SSJ2N35010	Yes	20	NA	0.0090	0.0013	5.5
Barium	120 / 121	99%	125	AM061102-01	Yes	1000	NA	120	120	24
Beryllium	101 / 121	83%	0.79	SS15188-A	Yes	100	NA	2.6	13	0.38
Boron	35 / 109	32%	14	MW-119	Yes	NA	NA	9.5	10	9.6
Cadmium	51 / 121	42%	16.1	SSJ2M30002	Yes	2	NA	0.40	0.52	0.94
Calcium	107 / 121	88%	927	SS04431-A	Yes	NA	NA	NA	NA	NA
Chromium	117 / 121	97%	26.4	SS15188-A	Yes	30	NA	7.0	0.00059	19
Cobalt	118 / 121	98%	7.5	MW-29	Yes	NA	NA	132	0.21	4
Copper	139 / 143	97%	2860	SSJ2N35011	Yes	NA	NA	46	22	11
Iron	121 / 121	100%	36100	SSJ2N35010	Yes	NA	NA	2422	270	17800
Lead	141 / 143	99%	942	SSJ2N35011	Yes	300	NA	4.1	NA	19
Magnesium	120 / 121	99%	2620	SS15188-A	Yes	NA	NA	NA	NA	2010
Manganese	119 / 121	98%	914	SSJ2N35011	Yes	NA	NA	44	21	134
Mercury	30 / 121	25%	0.12	SS04346-A	Yes	20	NA	0.020	0.033	0.12
Molybdenum	71 / 109	65%	2.5	SSJ2N35010	Yes	NA	NA	0.18	1.6	1.2
Nickel	114 / 121	94%	14.9	SSJ2N35010	Yes	20	NA	292	20	10
Potassium	119 / 121	98%	1310	SS04345-A	Yes	NA	NA	NA	NA	766
Selenium	56 / 121	46%	11.1	SSJ2N35011	Yes	400	NA	2.76	0.40	1.7
Silver	2 / 121	2%	0.89	SSJ2M30002	Yes	100	NA	16	0.6	0.74
Sodium	7 / 121	6%	3590	SSJ2M30002	Yes	NA	NA	NA	NA	NA
Thallium	33 / 121	27%	1.7	SS04346-A	No	8	NA	3.0	0.011	1.6
Vanadium	120 / 121	99%	38.8	SS04346-A	Yes	600	NA	260	78	28.8
Zinc	112 / 121	93%	23800	SSJ2M30002	Yes	2500	NA	2202	290	25.6
Inorganics										
Chloride (as Cl)	3 / 3	100%	1.6	SSBP02	Yes	NA	NA	NA	NA	NA
Cyanide	1 / 69	1%	0.66	SSJ2L34001	No	100	NA	0.0011	0.094	NA
Nitrogen, Ammonia (as N)	26 / 41	63%	37.3	MW-130	Yes	NA	NA	NA	NA	NA
Nitrogen, Nitrate-Nitrite	35 / 41	85%	1	MW-119	Yes	NA	NA	NA	NA	0.5
Phosphorus, Total PO4 (as PO4)	41 / 41	100%	135	SSBP02	Yes	NA	NA	NA	NA	291
Sulfate (as SO4)	2 / 3	67%	13.5	SSBP02	Yes	NA	NA	NA	NA	NA

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

(2) Site-specific background level for outwash (AMEC 2001).

(3) Maximum value allowable for human contact

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

NA = Not Available.

mg/Kg = milligram per Kilogram

Comparison of Maximum Concentrations in Soil to Screening Levels
J-2 Range - Area 4

Analyte	Frequency of Detection	FOD	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detected in J-2 North Groundwater	MCP S-1/GW-1 Standard (3) (mg/kg)	MassDEP Leaching Based Soil Concentration (mg/kg)	MMR SSL (mg/kg)	EPA Risk-Based SSL (mg/kg)	Background Value (2) (mg/kg)
PEP Compounds										
4-Amino-2,6-Dinitrotoluene	3 / 146	2%	0.32	SSJ2M4304	Yes	NA	NA	0.00038	0.023	NA
2-Amino-4,6-Dinitrotoluene	3 / 146	2%	0.25	SSJ2M4304	Yes	NA	NA	0.00038	0.023	NA
2,4-Dinitrotoluene	2 / 146	1%	0.046	SSJ2M4304	Yes	0.7	0.057	0.020	0.00028	NA
HMX	11 / 146	8%	14	SSJ2M4304	Yes	2	0.34	0.32	0.99	NA
2-Nitrotoluene	1 / 146	1%	0.12	SSJ2O4601	No	NA	NA	0.0022	0.00025	NA
3-Nitrotoluene	1 / 146	1%	0.056	SSJ2O4601	Yes	NA	NA	NA	0.0012	NA
Perchlorate	45 / 119	38%	3.98	SSJ2O4402	Yes	0.1	0.002	0.0031	NA	NA
RDX	7 / 146	5%	130	SSJ2M4304	Yes	1.0	0.0017	0.00011	0.00023	NA
Tetryl	1 / 146	1%	0.025	SSJ2N4101	No	NA	NA	0.06366	0.59	NA
1,3,5-Trinitrobenzene	2 / 146	1%	0.033	SSJ2M4304	No	NA	NA	NA	1.7	NA
2,4,6-Trinitrotoluene	8 / 148	5%	69	SSJ2M4304	Yes	NA	NA	0.00021	0.013	NA
PAHs										
Acenaphthylene	3 / 26	12%	0.085	SSJ2O4601	No	1	1.2	0.068	NA	NA
Benzo(b)fluoranthene	1 / 26	4%	0.064	SSJ2O4601	No	7	NA	0.11	0.035	NA
Fluoranthene	5 / 26	19%	0.034	SSJ2O4601	No	1000	NA	108	70	NA
Fluorene	1 / 26	4%	0.024	SSJ2N3701	No	1000	NA	14	4	NA
2-Methylnaphthalene	2 / 26	8%	0.042	SSJ2O4601	No	0.7	0.36	0.072	0.14	NA
Naphthalene	7 / 26	27%	1	SSJ2O4201	No	4	4.5	0.014	0.00047	NA
Phenanthrene	2 / 26	8%	0.044	SSJ2O4601	No	10	10.9	48	NA	NA
VOCs/SVOCs										
Acetophenone	4 / 4	NA	0.7	SSJ2O4402	No	NA	NA	NA	0.45	NA
Benzoic Acid	2 / 26	8%	0.45	SSJ2O4402	No	NA	NA	NA	14	NA
Benzyl Butyl Phthalate	1 / 26	4%	0.033	SSJ2O4201	No	NA	NA	491	0.20	NA
Bis(2-Ethylhexyl) Phthalate	5 / 26	19%	0.077	SSJ2N3701	Yes	200	NA	72	0.017	NA
2-Chloronaphthalene	2 / 26	8%	2.2	SSJ2O4201	No	NA	NA	NA	2.9	NA
Chloronaphthalene, (Total)	2 / 2	NA	17	SSJ2O4201	No	NA	NA	NA	NA	NA
p-Cymene	1 / 1	NA	0.33	SSJ2N3602	No	NA	NA	NA	NA	NA
1,2-Dichloroethane	1 / 1	NA	2.4	SSJ2O4601	No	0.1	0.01	NA	0.000042	NA
Di-N-Butyl Phthalate	1 / 26	4%	0.17	SSJ2N3602	No	NA	NA	151	1.7	NA
Di-N-Octyl Phthalate	1 / 26	4%	0.037	SSJ2M4104	Yes	NA	NA	0.48	NA	NA
Hexachlorobenzene	1 / 26	4%	0.35	SSJ2N3701	No	0.7	NA	0.007	0.00053	NA
N-Nitrosodiphenylamine	1 / 26	4%	0.047	SSJ2N3602	No	NA	NA	0.0078	0.057	NA
Phenol	2 / 26	8%	0.13	SSJ2O4402	No	1	0.95	0.77	2.6	NA
Metals										
Aluminum	24 / 24	100%	16900	SSJ2N3701	Yes	NA	NA	54006	23000	16000
Antimony	7 / 24	29%	0.97	SSJ2O4402	No	20	NA	0.27	0.27	1.9
Arsenic	24 / 24	100%	6.7	SSJ2N3602	Yes	20	NA	0.0090	0.0013	5.5
Barium	24 / 24	100%	78.6	SSJ2N3602	Yes	1000	NA	120	120	24
Beryllium	22 / 24	92%	0.81	SSJ2M4106	Yes	100	NA	2.6	13	0.38
Boron	16 / 24	67%	3.5	SSJ2N4101	Yes	NA	NA	9.5	10	9.6
Cadmium	20 / 24	83%	17	SSJ2O3701	Yes	2	NA	0.40	0.52	0.94
Calcium	24 / 24	100%	333	SSJ2O4201	Yes	NA	NA	NA	NA	NA
Chromium	24 / 24	100%	122	SSJ2O4402	Yes	30	NA	7.0	0.00059	19
Cobalt	24 / 24	100%	6.5	SSJ2N4101	Yes	NA	NA	132	0.21	4
Copper	24 / 24	100%	23500	SSJ2O4201	Yes	NA	NA	46	22	11
Iron	24 / 24	100%	17600	SSJ2N3701	Yes	NA	NA	2422	270	17800
Lead	24 / 24	100%	5030	SSJ2O4201	Yes	300	NA	4.1	NA	19
Magnesium	24 / 24	100%	2870	SSJ2N4101	Yes	NA	NA	NA	NA	2010
Manganese	24 / 24	100%	103	SSJ2N4101	Yes	NA	NA	44	21	134
Mercury	14 / 24	58%	0.064	SSJ2O4201	Yes	20	NA	0.020	0.033	0.12
Molybdenum	24 / 24	100%	4	SSJ2O4402	Yes	NA	NA	0.18	1.6	1.2
Nickel	24 / 24	100%	67.6	SSJ2O4402	Yes	20	NA	292	20	10
Potassium	24 / 24	100%	1010	SSJ2N4101	Yes	NA	NA	NA	NA	766
Selenium	14 / 24	58%	3.7	SSJ2M4101	Yes	400	NA	2.76	0.40	1.7
Silver	2 / 24	8%	2.4	SSJ2M4302	Yes	100	NA	16	0.6	0.74
Sodium	10 / 24	42%	50.1	SSJ2N4101	Yes	NA	NA	NA	NA	NA
Thallium	5 / 24	21%	0.22	SSJ2N3701	No	8	NA	3.0	0.011	1.6
Vanadium	24 / 24	100%	32.9	SSJ2O4201	Yes	600	NA	260	78	28.8
Zinc	24 / 24	100%	276	SSJ2N3701	Yes	2500	NA	2202	290	25.6

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

(2) Site-specific background level for outwash (AMEC 2001).

(3) Maximum value allowable for human contact

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

NA = Not Available.

APPENDIX E
WORK PLAN PROJECT NOTES

PROJECT NOTE

Client, Project and Location:
Impact Area Groundwater Study Program
Army National Guard
J-2 Range Northern Plume Evaluation
Camp Edwards, MA

Subject: J-2 Range Northern Plume Priority 1 Data Gap Drilling

Date: July 11 , 2013

PURPOSE

The purpose of this Project Note is to document regulatory agency concurrence with proposed aquifer profile sampling at four locations in peripheral areas of the J-2 Northern plume. EPA has indentified areas where aquifer profile information is needed before a decision can be made regarding the final remedy for the J-2 northern plume. Specifically, EPA has requested that additional data gap drilling be conducted in certain areas that lie either outside the recently optimized capture zone or are beyond the maximum capabilities of current J-2 northern ETR system infrastructure.

PROPOSED AQUIFER PROFILE LOCATIONS

The aquifer profiling proposed below is intended to determine the presence and magnitude of perchlorate contamination in areas outside the recently optimized capture zones of the existing ETR system. This information is needed so a determination can be made regarding the need for further optimization, within the design capabilities of the existing RRA system, or whether the existing infrastructure needs to be augmented to meet the remediation goals of a final remedy for the J-2 northern plume.

The following four profile borings will be completed as part of this investigation (Figure 1):

1. **(J2N-EPA-1) between MW-340 and MW-330** - Profile sampling at this location will determine the presence and magnitude of any contamination that lies in the immediate area of Gibbs Road, which is upgradient from COOP water supply well WS-2.

2. **(J2N- EPA-2) East of MW-327** - Profile sampling at this location will determine the presence and magnitude of any contamination that lies approximately mid way between J2EW0003 and Gibbs Road. This location is east of Barlow Road will complete a well fence along with MW-327 and MW-337

3. **(J2N- EPA-3) East of J2EW0002 Outside ETR System Capture Zone** - Profile sampling at this location will determine the presence and magnitude of any contamination that lies to the east of J2EW0002, downgradient along a pathline from a point on Wood Road mid way between MW-305 and MW-322. This location is outside the capture zone of the existing ETR system.

4. **(Vicinity of MW-330)**– Additional profile sampling conducted in the vicinity of MW-330 to determine the presence and magnitude of any contamination between the existing well screens.

All profile borings will be completed to refusal depth, unless otherwise agreed by the regulatory agencies, and water samples will be collected starting approximately 70 feet below the water table and then every 10 feet. Samples will be analyzed for perchlorate. Monitoring well screens will be installed based on the profile results in consultation with the regulatory agencies.

PLUME SHELL REFINEMENT

If necessary, the newly collected data will be used to make appropriate refinements to the J-2 northern perchlorate plume shell. However, any such refinements to the J-2 Northern plume shell will be used only to guide activities associated with the ongoing groundwater monitoring program for the J-2 Northern plume, including any additional capture zone simulations/optimizations and will not be available for incorporation in the upcoming J-2 Northern feasibility study.

CONCURRENCE

Concurrence with the recommendations presented in this project note is represented by the signatures below:

11 July 2013

USEPA Representative

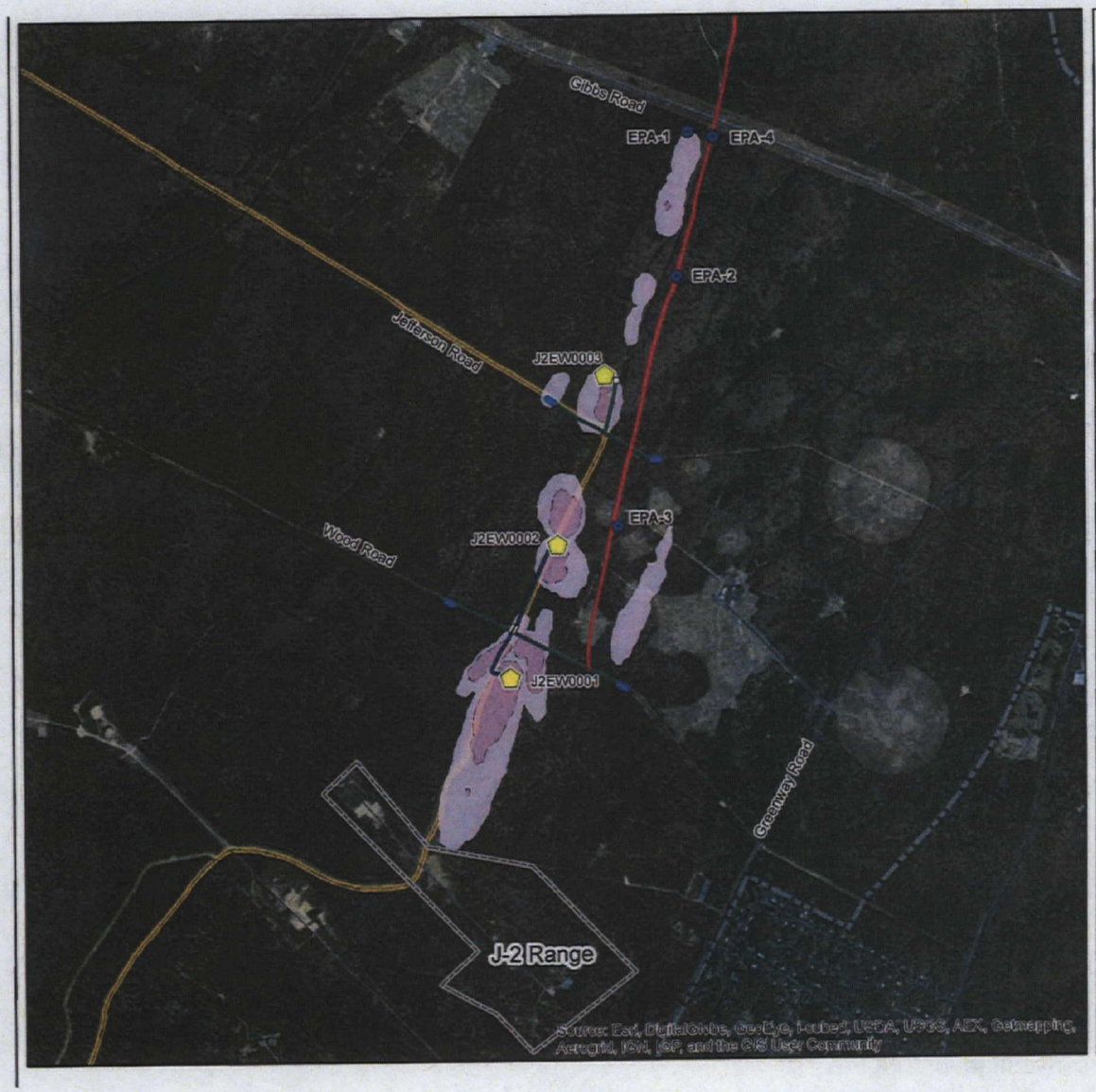
7/11/13

MassDEP Representative

7/11/2013

IAGWSP Representative

FIGURES



Impact Area Groundwater Study Program

LEGEND

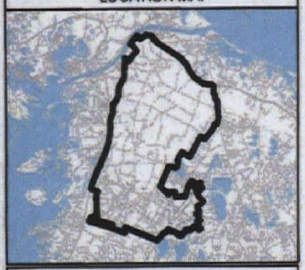
- Proposed Drive Point
- Extraction Well
- Infiltration Trench
- Influent Piping
- Effluent Piping
- Treatment System
- J-2 Range Boundary
- Impact Area Boundary
- MMR Boundary
- EPA-3 Particle Paths

Perchlorate Detections

- 2-15 µg/L
- 15-200 µg/L

Perchlorate Plume: Revised Jan 2013

LOCATION MAP



NOTES & SOURCES

Map Coordinate System: NAD83 UTM Zone 19N Meters
Basemap data from US Geological Survey 7 1/2 minute Topographic Maps. Source: MassGIS

TITLE

J-2 Range Northern
Priotiry 1 Monitoring Wells

N

US Army Corps of Engineers
New England District

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July 16, 2013 DWN: MTW CHKD: KJH

FIGURE
1

PROJECT NOTE

Client, Project and Location:
Impact Area Groundwater Study Program
Army National Guard
Camp Edwards, MA

Subject: J-2 Range Priority 2 Data Gap Drilling

Date: August 29, 2013

PURPOSE

The purpose of this Project Note is to document regulatory agency concurrence with proposed aquifer profile sampling at six locations in areas of the J-2 northern and eastern plumes. EPA has requested that additional data gap drilling be conducted for characterization purposes at two locations, one in the core of the J-2 northern plume and one in a suitable location to monitor a small, uncaptured lobe of the J-2 eastern plume. In addition, four borings are proposed in areas that lie outside the plausible maximum/minimum capture zones of the existing J-2 northern extraction, treatment and recharge (ETR) system infrastructure to determine the adequacy of the existing system to achieve optimal capture of the plume.

PROPOSED AQUIFER PROFILE LOCATIONS

The aquifer profiling proposed below is intended to determine the presence and magnitude of perchlorate contamination in areas outside the plausible maximum/minimum capture zones of the existing J-2 northern ETR system. The existing RRA ETR system design has flexibility to expand/reduce the capture zones of J2EW0001 and J2EW0002 by increasing/decreasing pumping rates at these two extraction wells. However, since the combined pumping rates of these two extraction wells use the entire 250 gpm flow capacity of their dedicated treatment system, any increase in the pumping rate at J2EW0001 must be balanced by an equal reduction in the pumping rate at J2EW0002 and vice versa. Therefore, the focus of this evaluation is to determine whether the capture zones can be adequately manipulated within the current system design capabilities, or whether the existing infrastructure needs to be augmented to meet the remediation goals for the J-2 northern plume.

The following four profile borings will be completed as part of the maximum/minimum capture zones investigation (Figure 1):

1. **(J2N-7) East of MW-589, Side-gradient of J2EW0001** - Profile sampling at this location will determine the presence and magnitude of any contamination that lies outside the simulated capture zone of J2EW0001 at a plausible maximum pumping rate of 200 gpm. If no significant contamination (>2 ug/L) is observed at this location

then sufficient flexibility exists within the design capabilities of the existing ETR system to capture the eastern portion of the J-2 northern plume.

2. **(J2N-8) West of MW-588, Side-gradient of J2EW0001** - Profile sampling at this location will determine the presence and magnitude of any contamination that lies outside the simulated capture zone of J2EW0001 at a plausible maximum pumping rate of 200 gpm. If no significant contamination (>2 ug/L) is observed at this location then sufficient flexibility exists within the design capabilities of the existing ETR system to capture the western portion of the J-2 northern plume.

3. **(J2N-9) East of MW-587, Outside Plausible Minimum Capture Zone of J2EW0002** - Profile sampling at this location will determine the presence and magnitude of any contamination that lies outside the simulated capture zone of J2EW0002 at a plausible minimum pumping rate of 50 gpm. If no significant contamination (>2 ug/L) is observed at this location then sufficient flexibility exists within the design capabilities of the existing ETR system to capture the eastern portion of the J-2 northern plume.

4. **(J2N-10) West of MW-587, Outside Plausible Minimum Capture Zone of J2EW0002** – Profile sampling at this location will determine the presence and magnitude of any contamination that lies outside the simulated capture zone of J2EW0002 at a plausible minimum pumping rate of 50 gpm. If no significant contamination (>2 ug/L) is observed at this location then sufficient flexibility exists within the design capabilities of the existing ETR system to capture the western portion of the J-2 northern plume.

The following additional priority 2 data gap borings will be also be completed for long term monitoring purposes:

5. **(J2EPA-5) Midway between MW-289 and J2EW0001** - Profile sampling at this location will determine the presence and magnitude of contamination in the core of the J-2 northern plume, including any migrated contamination in the deeper portion of the aquifer, as was previously observed at MW-289M1.

6. **(J2EPA-6) Downgradient of Uncaptured Lobe of J-2 Eastern Perchlorate Plume** - An additional screen will be installed at MW-57 at an elevation suitable to monitor the small, uncaptured lobe of perchlorate contamination previously observed at off base monitoring well MW-367.

7. **(J2EPA-11) Downgradient of MW-296** – An additional well screen will be installed at the location of MW-337, at a suitable depth interval to provide future monitoring of contamination recently observed in MW-296M1.

8. **(J2EPA-12) Upgradient of MW-296** – This boring will be conducted upgradient, along the flow path of origin of contamination recently observed in MW-296M1, to determine if the western edge of the perchlorate plume, which was outside the

capture zone of J2EW0002 at the startup of the RRA system, has migrated through the area as expected.

9. **(J2EPA-13) Downgradient of J-2 Eastern RDX Plume** – this well will be installed to provide future monitoring of the uncaptured portion of the J-2 eastern RDX plume.

All profile borings will be completed to refusal depth, unless otherwise agreed by the regulatory agencies, and water samples will be collected starting approximately 70 feet below the water table and then every 10 feet. Samples will be analyzed for perchlorate, except for J2EPA-5, J2EPA-6 and J2EPA-13, which will also be analyzed for explosives. Monitoring well screens will be installed based on the profile results in consultation with the regulatory agencies.

PLUME SHELL REFINEMENT

If appropriate, the newly collected data will be used to make appropriate refinements to the J-2 northern and/or J-2 eastern perchlorate/RDX plume shells.

CONCURRENCE

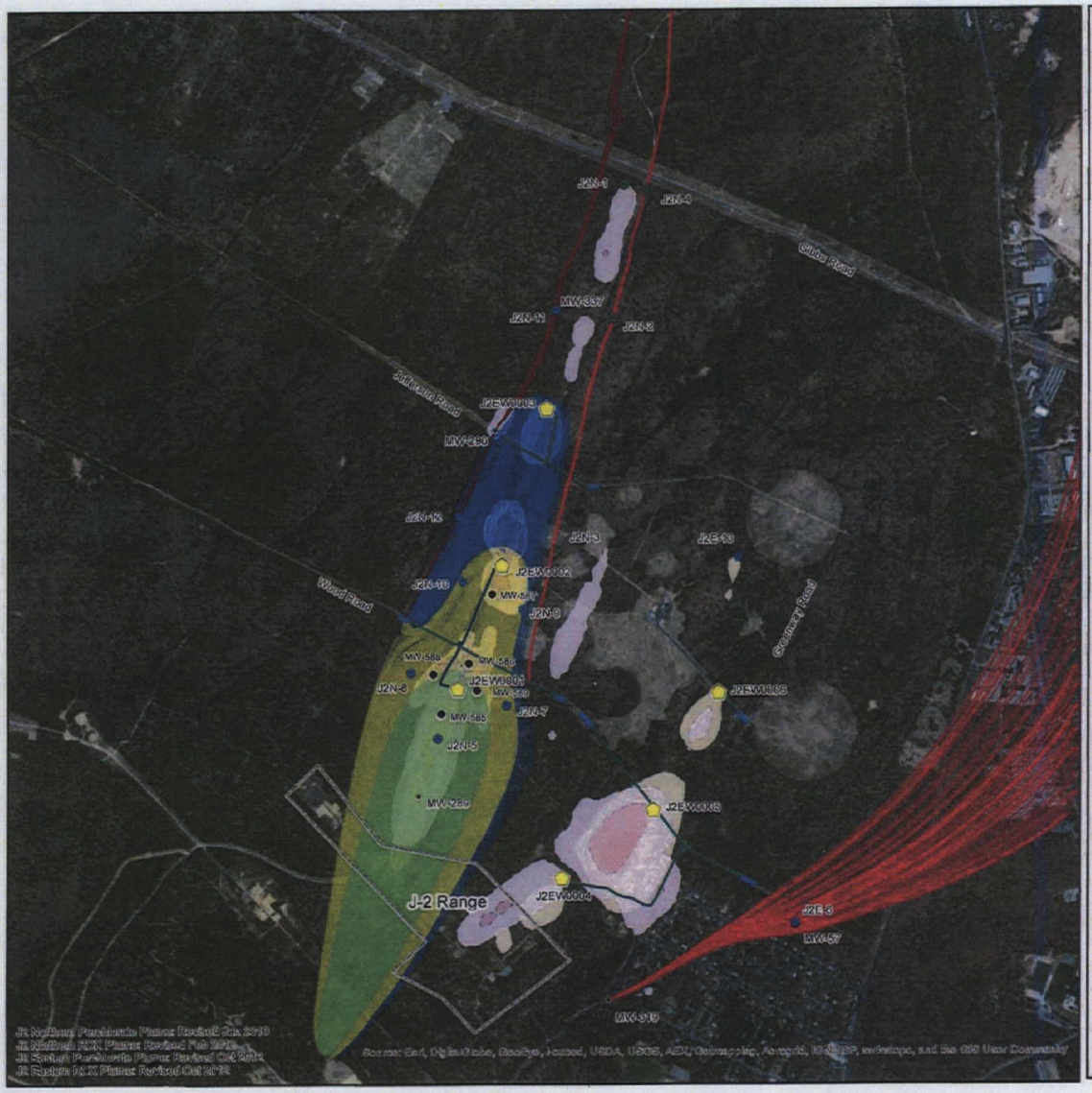
Concurrence with the recommendations presented in this project note is represented by the signatures below:

Jane Nolan 8/29/13
USEPA Representative

8-29-2013
MassDEP Representative

Benjamin D. Gregson 8/29/13
IAGWSP Representative

FIGURES



Impact Area Groundwater Study Program

LEGEND

- Priority 2 Proposed Drive Points
- Priority 1 Drive Points
- Extraction Well
- Monitoring Well
- Infiltration Trench
- Influent Piping
- Effluent Piping
- Treatment System
- J-2 Range Boundary
- Impact Area Boundary
- MMR Boundary
- MW-319 Particle Paths
- MW-296 Particle Paths
- J2EW0001 Capture Zone
- J2EW0002 Capture Zone
- J2EW0003 Capture Zone
- 2-15 µg/L Perchlorate
- 15-200 µg/L Perchlorate
- 0.6-2 µg/L RDX
- 2-6 µg/L RDX
- 6-20 µg/L RDX

J2E-6: Deeper screen (-115 to -125 ft msl) at well MW-57.
J2N-11: Middle screen (-90 to -100 ft msl) at well MW-337.

LOCATION MAP

NOTES & SOURCES

Map Coordinate System: NAD83 UTM Zone 19N Meters
Basemap data from US Geological Survey 7 1/2 minute Topographic Maps. Source: MassGIS

TITLE

Priority 2 Well Locations

J2EW0001	J2EW0002	J2EW0003
150 gpm	100 gpm	225 gpm

0 1,250 Feet

US Army Corps of Engineers
New England District

M:\MMR\2013\J2RI\Figures\Fig1p2_082813.pdf
M:\MMR\2013\J2RI\SMX\txt\Fig1p2_082813.mxd
August 28, 2013 DWN: MTW CHKD: KJH

FIGURE 1

PROJECT NOTE

Impact Area Groundwater Study Program
J-2 Range Confirmatory Sampling Program
Camp Edwards, MA

Subject: Confirmatory soil sampling for Areas 1, 2 and 3 at the J-2 Range

Date: August 29, 2013

1.0 PURPOSE

The purpose of this project note is to provide a soil sampling approach for Areas 1, 2 and 3 at the J-2 Range to confirm existing conditions and conclusions in the J-2 Range Remedial Investigation/Feasibility Study (RI/FS) regarding the extent of any residual soil contamination at the range.

2.0 BACKGROUND

The J-2 Range is located adjacent to (and partially within) the Impact Area and is the northernmost of the four former military training, and defense contractor, test ranges that operated from the 1930s until the 1990s. The range is approximately 1,100 meters long and between 100 and 180 meters wide.

Soil characterization activities at the J-2 Range commenced in 1999. During the period from February 1999 to September 2009, approximately 3,160 soil samples were collected at various depths from 695 locations within the J-2 Range study area. Soil samples collected at the J-2 Range have included a large number of discrete and composite samples as well as multiple increment samples. Soil samples have primarily been analyzed for explosives and perchlorate, although many samples have also been analyzed for other contaminants including metals, semivolatiles, dioxins and furans, and polychlorinated naphthalenes (PCNs).

The results of the soil sampling investigations conducted to date at the J-2 Range have been compiled and evaluated in support of the RI/FS for the range and to support numerous soil excavation Rapid Response Actions (RRAs) that have been undertaken at the range.

Overall, the soil sampling results for the J-2 Range have indicated the presence of explosives, perchlorate and some other contaminants at certain range locations. At many locations, sampling results have indicated little or no soil contamination. At some locations, soil samples indicating minimal contamination have been collected in close proximity to samples indicating substantive levels of contamination. Much of the existing sampling data has been focused on areas in the immediate vicinity of historical features of possible concern from a soil contamination perspective. As such, some areas of the J-2 Range have undergone somewhat limited sampling due to the absence of any distinctive features or clear evidence of past use.

As the J-2 Range Decision Document is developed and implemented, a focused confirmatory soil sampling program has been developed to verify the overall findings of the RI/FS with respect to the extent of residual contamination (if any) and adequacy of RRAs conducted to date.

3.0 PROPOSED ACTIONS

As discussed above, a focused supplemental soil sampling program is being proposed for the J-2 Range to confirm the findings of the RI/FS and the associated sampling programs that have been conducted to date.

To optimize flexibility, a two-phase Sampling Program is proposed. Phase 1 is detailed below and will consist of a surface soil multiple increment sampling program to be implemented across Areas 1, 2 and 3. Given the extensive existing subsurface database for the J-2 Range, additional subsurface multiple increment soil samples will not be collected during the Phase 1 sampling effort. Following evaluation of the Phase 1 results, recommendations regarding potential Phase 2 soil sampling (including possible subsurface sampling) will be considered. If required, Phase 2 sampling will be focused toward grids/areas contaminant levels that exceed Range Action Levels based on Phase 1 sampling results. Phase 1 and Phase 2 results will be used to identify areas where soil removal actions are required.

The principal objectives of the proposed Phase 1 sampling effort for explosives and perchlorate are as follows:

- To provide confirmatory data regarding existing soil conditions at multiple locations within the J-2 Range including:
  - Area 1 – Loading/Conditioning Building, the Melt/Pour Building, and Loading Building and Latrine Area
  - Area 2 – FFP-3, FFP-4, Disposal Area 1 and Berm 2
  - Area 3 – Berm 5 and Disposal Area 3
- To provide supplemental data to document existing soil conditions in grids proximate and adjacent to some of the locations noted above. Certain grids have not been previously sampled.
- To provide supplemental data documenting existing conditions at selected downrange grids or grids along the perimeter of a given area that in some cases have had minimal sampling. This includes certain grids that may have had past BIP activity, geophysical anomalies, and/or disposal pits.

As such, for each Area (Areas 1, Area 2 and Area 3), a suite of sampling grids has been selected to confirm existing conditions at locations of concern, document conditions in adjacent less sampled locations, and confirm conditions in selected downrange and peripheral areas.

In addition to confirmation of explosives and perchlorate concentrations in surface soils at the J-2 Range, focused surface soil sampling will also be conducted at certain grid locations for metals (cadmium) and PCNs. The objectives of this component of the sampling effort are as follows:

- To provide additional data for cadmium where current conditions data indicates that the average concentration of cadmium in that grid may exceed its MCP Method 1 S-1/GW-1 Standard.
- To provide current data for grid locations where previous data indicated that the concentration of polychlorinated naphthalenes may exceed the Relative Experimental

Potency (REP) adjusted screening level based on the MCP Method 1 S-1/GW-1 Standard for 2,3,7,8-TCDD.

The results of Risk Screening related evaluation of average metals concentrations in grids at the J-2 Range (Attachment 1) indicated that while the maximum soil concentrations of several metals exceeded their respective S-1/GW-1 Standards, cadmium was the only metal whose average concentration exceeded its S-1/GW-1 Standard in any grid.

Multiple increment sampling is proposed for PCNs in certain grids because some historical soil results for the J-2 Range exceed screening levels based on the REP adjusted S-1/GW-1 Standards.

3.1 Approach

The Phase 1 Sampling Program will involve the collection of 100-point multiple increment surface soil samples at individual grids within Areas 1, 2 and 3. All multiple increment samples will encompass the entire grid in which they are collected and will be collected at surface depths of 0 to 3 inches below ground surface. Some proposed sampling grids partially overlap previously excavated areas.

Proposed sampling locations are summarized in Table 1 and presented on Figures PS-1, PS-2 and PS-3 (red shaded grids). The proposed sampling program has emphasized consideration of general areas of concern identified by EPA. In selecting specific grid locations for sampling, consideration has been given to available analytical results regarding individual grids potentially appropriate for sampling. Information considered in selecting sampling grids included the following:

- Proximity of specific grids to former area features and/or past range activities;
- The extent of existing explosives and perchlorate data previously collected within the grid;
- Explosives and perchlorate data trends with respect to past detects and non-detects within a grid;
- The current conditions average concentration of metals as compared to soil S-1/GW-1 Standards;
- Historical results for PCNs; and
- The extent of past soil remediation/excavations (if any) in a given grid.

Overall, sample location selection has been qualitatively biased towards grids that had not been extensively sampled or excavated in order to assess the issue of possible data gaps at the range. However, for overall evaluation purposes and to provide balance to the sampling effort, certain grids having significant past sampling and/or that have been previously excavated are also included in the sampling program.

Details of the evaluation of current conditions concentrations of metals are provided in Attachment 1. Information on the basis for evaluation of PCNs is provided in Attachment 2.

3.2 Area Specific Sampling

This section describes the proposed sampling on an area by area basis.

Area 1

As indicated in Table 1, Area 1 multiple increment sampling is proposed for 19 grids. Grid locations are identified in Figure PS-1. Grids J13/K13 will be combined into one multiple increment sampling area. Grids have been selected to provide confirmatory sampling at multiple locations, including in the vicinity of the propellant Loading/Conditioning Building, the Melt/Pour Building and disposal pits and the latrine. In addition to sampling in the vicinity of these facilities, sampling is also proposed for several grids in perimeter areas of Area 1.

Multiple increment sampling for cadmium is proposed for grid J16 because the current conditions average concentration of cadmium may exceed the Method 1 S-1/GW-1 Standard. Multiple increment sampling for PCNs is proposed for grid M16 because based on 2001 data, certain PCNs may exceed the REP adjusted screening criteria.

Area 2

Multiple increment sampling is proposed for 26 grids in Area 2 (Table 1). Grid locations are identified in Figure PS-2. Proposed sampling locations in Area 2 are primarily focused on explosives and perchlorate in the vicinity of FFP-3 and FFP-4, Disposal Area 1 and Berm 2. As discussed above, in selecting grids in Area 2, emphasis has been placed on sampling grids near or adjacent to locations that have not been heavily sampled in the past. Several grid locations that have previously undergone significant sampling (including N15 and N23) are not proposed for further explosives investigation. It should also be noted that multiple increment samples have previously been collected from 13 grids in Area 2 with no explosives detections and generally low-level perchlorate detections (Figure PS-2). No additional multiple increment sampling is proposed for explosives or perchlorate for these previously sampled grids.

In addition to explosives and perchlorate sampling, multiple increment sampling for cadmium is proposed for grid P23 because the current conditions average concentration of cadmium may exceed the Method 1 S-1/GW-1 Standard. Multiple increment sampling for PCNs is proposed for grids M19, M20, M22, M23, N15, N16, N22, N23, N24 and P26 because based on 2001-2006 data, certain PCNs may exceed the REP adjusted screening criteria. A PCN exceedance was also observed in grid N19. However, this location was within Target 16 and has been excavated.

Area 3

Multiple increment sampling is proposed for 17 grids in Area 3 (Table 1). Grid locations are identified in Figure PS-3. Grids O32/O33 and K34/L34 will each be combined into single multiple increment sampling areas. The majority of the proposed grid locations are near Berm 5 and/or along the outer boundaries of past excavations associated with Disposal Area 2. Sampling grids are also proposed in downrange areas near Brick-lined Pit 2. Extensive additional multiple increment sampling is not proposed at the center of Disposal Area 2, given the extent of past sampling (including grids N32, N33 and O34) and soil excavation in these areas. As indicated in Figure PS-3, numerous non-detect sample results have been previously reported for grids in this area.

Multiple increment sampling for PCNs will also be conducted in grids O31/32, M31 and M/N33 if excavation and BIP Supplemental data are insufficient to demonstrate that soils containing certain PCNs that exceeded the REP adjusted screening criteria have been removed.

Supplemental Sampling

In addition to the grids identified above, sampling may be conducted at up to five additional grids. The additional grids may be located in Area 1, Area 2 and/or Area 3 and will be selected based upon initial field observations during Phase 1 sampling. EPA has indicated that the majority of these grids will be located in the vicinity of FFP-3 and FFP-4.

3.3 Analysis Program

Most multiple increment samples will be analyzed for explosives (Method 8330B) and perchlorate (Method 6850) following established procedures previously used for multiple increment samples at MMR. Certain samples will also be analyzed for metals (Method 6010) and/or dioxins/furans (Method 8290). Several samples are proposed for analysis of PCNs. However, as a standard laboratory method is not available for PCNs, specialized non-routine analyses will be required.

4.0 PHASE 1 RESULTS AND PHASE 2

Following analysis, all Phase 1 sampling data will be reviewed with respect to any contaminant detections. Positive detections will be evaluated with respect to grid location, sampling objective and any potential Action Levels. Based upon the Phase 1 results, additional Phase 2 sampling may be proposed following discussions between EPA, MassDEP and the IAGWSP. Ultimately, the results of the Phase 1 and Phase 2 sampling will be used to identify any areas where soil removal actions are required.

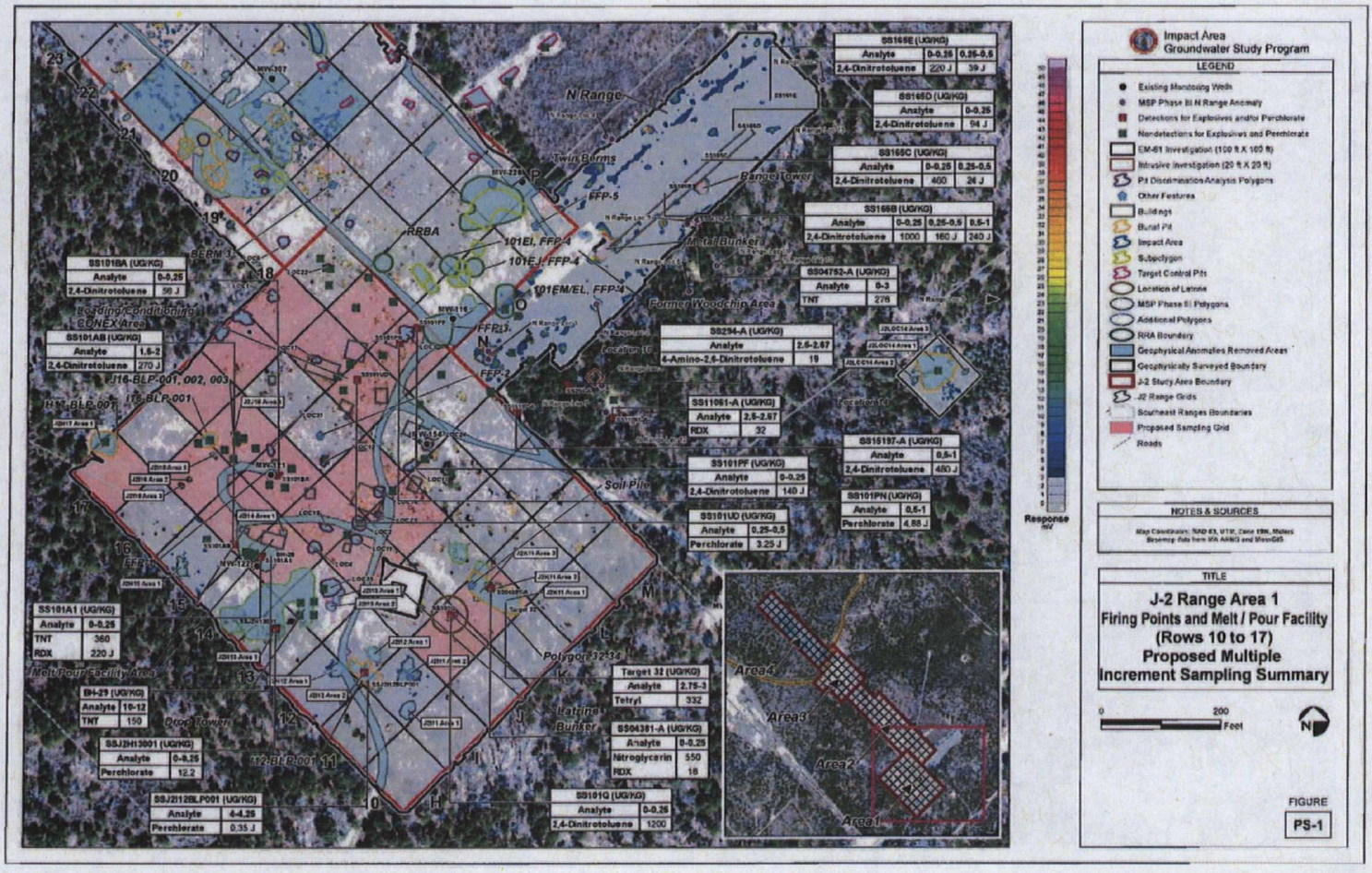
5.0 CONCURRENCE

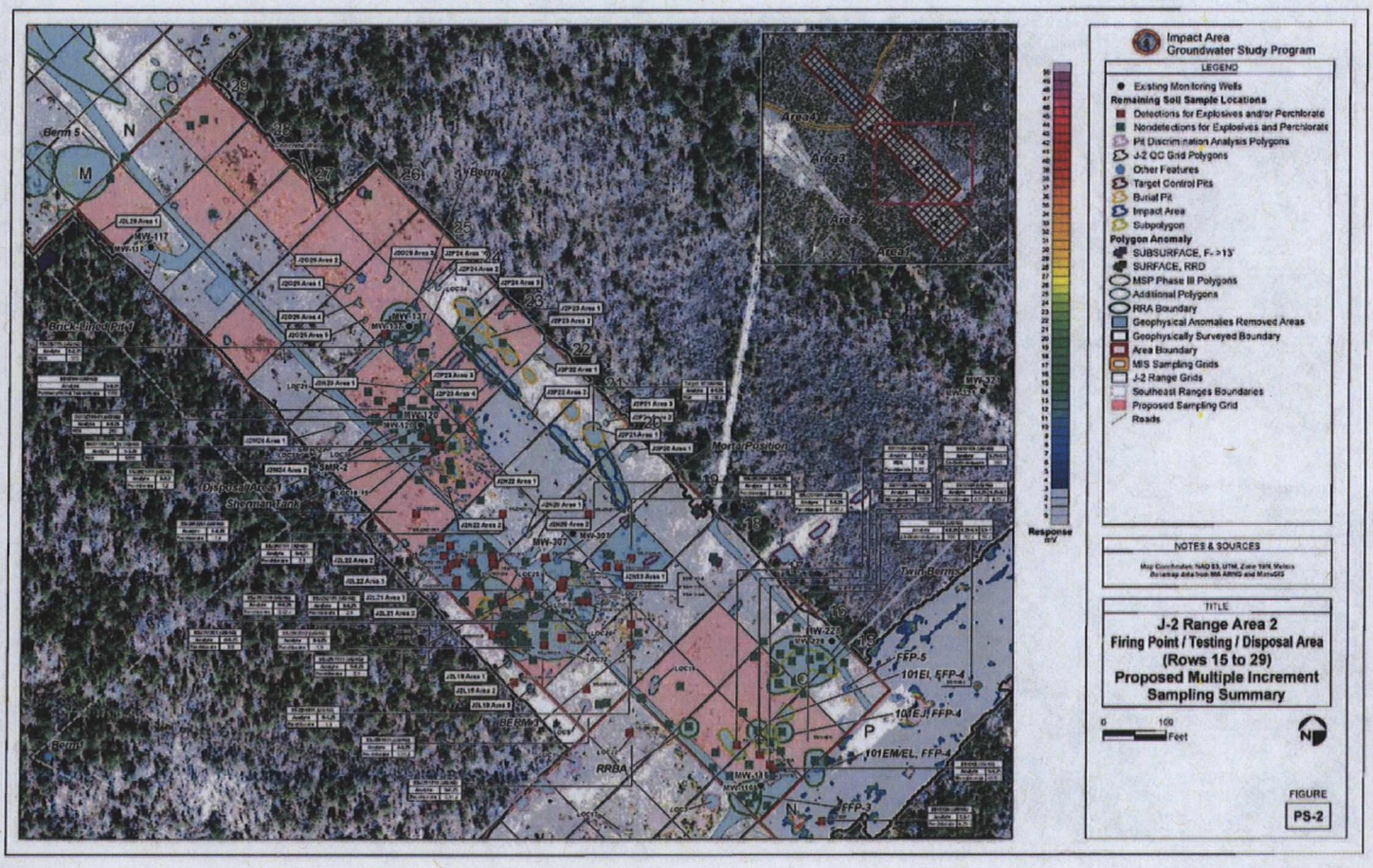
Concurrence with the recommendations presented in this project note is represented by the signatures below:

Jane Downey 8/29/13
EPA Representative

Henry Cue 8/29/13
MassDEP Representative

Benjamin P. Simpson 9/3/13
IAGWSP Representative


N Range
Twin Berms
Range Tower
FFP-5
RRBA
101EI, FFP-4
101EJ, FFP-4
101EM/EL, FFP-4
Former Woodchip Area
FFP-3
FFP-2
Soil Pile
Polygon 32434
Latrine
Bunker
Area4
Area3
Area2
Area1
SS165E (UG/KG)
Analyte | 0-0.25 | 0.25-0.5
2,4-Dinitrotoluene | 220 J | 39 J
SS165D (UG/KG)
Analyte | 0-0.25
2,4-Dinitrotoluene | 94 J
SS165C (UG/KG)
Analyte | 0-0.25 | 0.25-0.5
2,4-Dinitrotoluene | 400 | 36 J
SS165B (UG/KG)
Analyte | 0-0.25 | 0.25-0.5 | 0.5-1
2,4-Dinitrotoluene | 1000 | 160 J | 240 J
SS101BA (UG/KG)
Analyte | 0-0.25
2,4-Dinitrotoluene | 50 J
SS101AB (UG/KG)
Analyte | 1.5-2
2,4-Dinitrotoluene | 270 J
SS04752-A (UG/KG)
Analyte | 0-3
TNT | 276
SS294-A (UG/KG)
Analyte | 2.5-2.67
4-Amino-2,6-Dinitrotoluene | 19
SS11061-A (UG/KG)
Analyte | 2.5-2.67
RDX | 32
SS101PF (UG/KG)
Analyte | 0-0.25
2,4-Dinitrotoluene | 140 J
SS101UD (UG/KG)
Analyte | 0.25-0.5
Perchlorate | 3.25 J
SS15197-A (UG/KG)
Analyte | 0.5-1
2,4-Dinitrotoluene | 450 J
SS101PN (UG/KG)
Analyte | 0.5-1
Perchlorate | 4.85 J
SS101A1 (UG/KG)
Analyte | 0-0.25
TNT | 360
RDX | 220 J
BH-29 (UG/KG)
Analyte | 10-12
TNT | 150
SSJ2H13001 (UG/KG)
Analyte | 0-0.25
Perchlorate | 12.2
SSJ2I12BLP001 (UG/KG)
Analyte | 4-4.25
Perchlorate | 0.35 J
Target 32 (UG/KG)
Analyte | 2.75-3
Tetryl | 332
SS04381-A (UG/KG)
Analyte | 0-0.25
Nitroglycerin | 550
RDX | 18
SS101Q (UG/KG)
Analyte | 0-0.25
2,4-Dinitrotoluene | 1200
Response mV
Impact Area Groundwater Study Program
LEGEND
Existing Monitoring Wells
MSP Phase III N Range Anomaly
Detections for Explosives and/or Perchlorate
Nondetections for Explosives and Perchlorate
EM-61 Investigation (100 ft X 100 ft)
Intrusive Investigation (20 ft X 20 ft)
Pit Discrimination Analysis Polygons
Other Features
Buildings
Burial Pit
Impact Area
Subpolygon
Target Control Pits
Location of Latrine
MSP Phase III Polygons
Additional Polygons
RRA Boundary
Geophysical Anomalies Removed Areas
Geophysically Surveyed Boundary
J-2 Study Area Boundary
J-2 Range Grids
Southeast Ranges Boundaries
Proposed Sampling Grid
Roads
NOTES & SOURCES
Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from WA ARNG and MassGIS
TITLE
J-2 Range Area 1
Firing Points and Melt / Pour Facility
(Rows 10 to 17)
Proposed Multiple
Increment Sampling Summary
0
200
Feet
N
FIGURE
PS-1


Impact Area
Groundwater Study Program
LEGEND
Existing Monitoring Wells
Remaining Soil Sample Locations
Detections for Explosives and/or Perchlorate
Nondetections for Explosives and Perchlorate
Pit Discrimination Analysis Polygons
J-2 QC Grid Polygons
Other Features
Target Control Pits
Burial Pit
Impact Area
Subpolygon
Polygon Anomaly
SUBSURFACE, F- >13'
SURFACE, RRD
MSP Phase III Polygons
Additional Polygons
RRA Boundary
Geophysical Anomalies Removed Areas
Geophysically Surveyed Boundary
Area Boundary
MIS Sampling Grids
J-2 Range Grids
Southeast Ranges Boundaries
Proposed Sampling Grid
Roads
NOTES & SOURCES
TITLE
J-2 Range Area 2
Firing Point / Testing / Disposal Area
(Rows 15 to 29)
Proposed Multiple Increment
Sampling Summary
0
100
Feet
FIGURE
PS-2
Response MV
Area 4
Area 3
Area 2
Area 1
Berm 5
Berm 4
Berm 3
Berm 2
Brick-Lined Pit
Disposal Area 1
Sherman Tank
Mortar Position
Twin Berms
RRBA
FFP-5
101EI, FFP-4
101EJ, FFP-4
101EM/EL, FFP-4
FFP-3
MW-117
MW-137
MW-138
MW-307
MW-301
MW-228
MW-326
MW-118
SMR-2

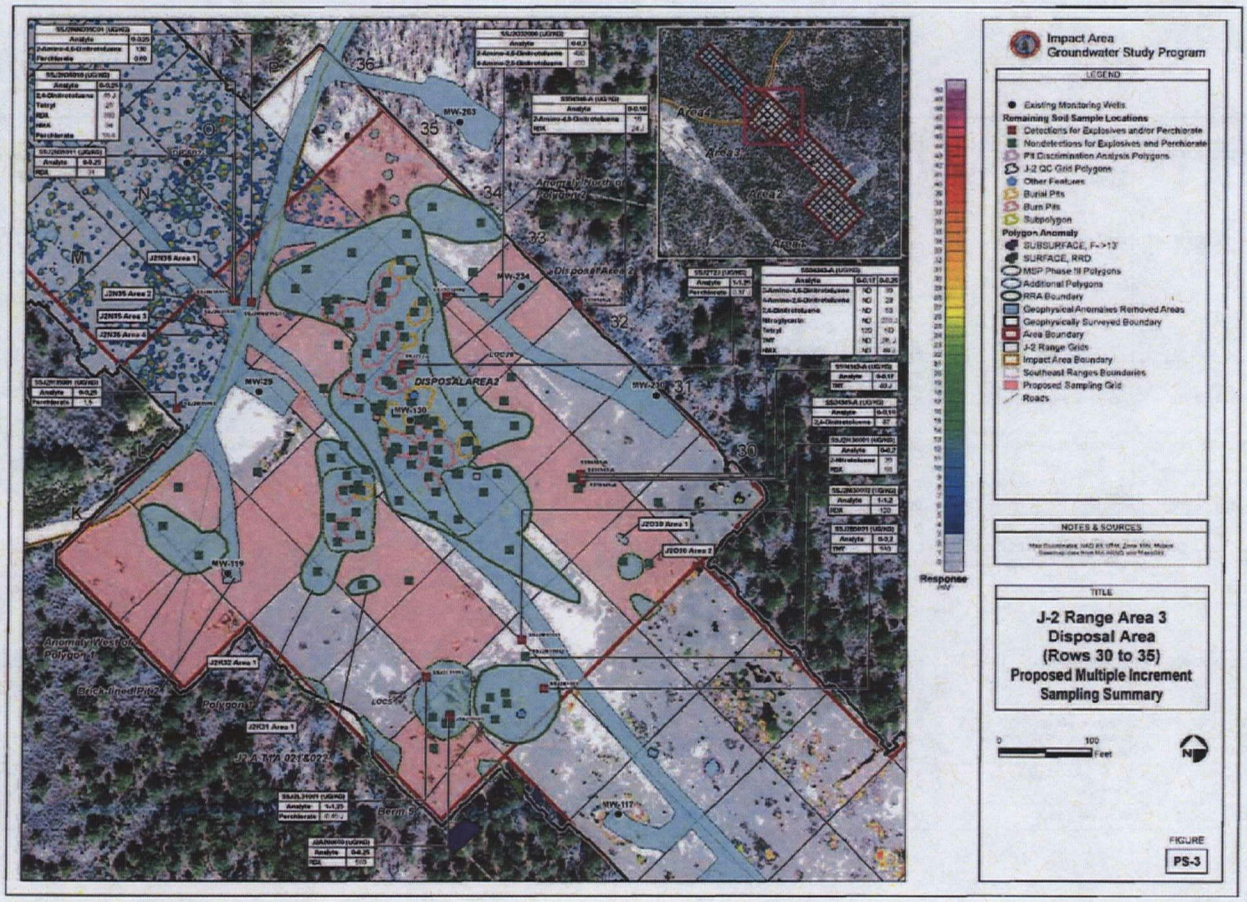

Impact Area
Groundwater Study Program
LEGEND
Existing Monitoring Wells
Remaining Soil Sample Locations
Detections for Explosives and/or Perchlorate
Nondetections for Explosives and Perchlorate
PS Discrimination Analysis Polygons
J-2 QC Grid Polygons
Other Features
Burial Pits
Burn Pits
Subpolygon
Polygon Anomaly
SUBSURFACE, F->13'
SURFACE, RRD
MSP Phase III Polygons
Additional Polygons
RRA Boundary
Geophysical Anomalies Removed Areas
Geophysically Surveyed Boundary
Area Boundary
J-2 Range Grids
Impact Area Boundary
Southeast Ranges Boundaries
Proposed Sampling Grid
Roads
NOTES & SOURCES
TITLE
J-2 Range Area 3
Disposal Area
(Rows 30 to 35)
Proposed Multiple Increment
Sampling Summary
0
100
Feet
FIGURE
PS-3
Response
DISPOSALAREA3
MW-263
MW-234
MW-29
MW-130
MW-119
MW-117
Area 4
Area 3
Area 2
Area 1
Anomaly West of Polygon 1
Polygon 1
Brick-lined Pit 24
Berm 5
J2N35 Area 1
J2N35 Area 2
J2N35 Area 3
J2N35 Area 4
J2N32 Area 1
J2N31 Area 1
J2O39 Area 1
J2O36 Area 1
J-2 RTA 021&022

Table 1
Proposed J-2 Range Confirmatory Sampling Program
Phase 1

	Grids	Location	Rationale	Analytes[1]	Depths[2]	Comments
Area 1	L15/16/17, M15/16	Vicinity of propellant loading/conditioning building, and RRBA	• L15/16 – Confirm assessment of Loading/Conditioning Area • L17 – Not previously sampled perimeter area • M15/16 – Confirm absence of RRBA impacts • M16 – REP[4] PCN exceedance	Perchlorate/explosives (P and E) Also PCNs – M16	0-3"	• L15/16 – previously sampled in 2001/2002 at multiple depths • M15 – previously sampled 2001/2002/2004 at multiple depths • M16 – previously sampled in 2001/2002 • K16[3] – downrange of most Area 1 activities
	I14/15/16, J15/16/17, K17	Vicinity of melt/pour building and disposal pits	• I14/15/16 – Confirm assessment of Melt/Pour Area and explosives previously detected • J15/16 – Confirm assessment of FFP-1 and disposal pit area • J17 – Not previously sampled – Confirm absence of perimeter area contamination • K17 – Confirm absence of perimeter area contamination • J16 – S-1/GW-1 cadmium exceedance	Perchlorate/explosives Also cadmium – J16	0-3"	• I14/15 – previously sampled in 2000/2001 • I16 – previously sampled in 2005 • J16 – previously sampled in 2001/2003/2006 • J16 – average cadmium concentration exceeds S-1/GW-1 standard
	H17		• H17 – Confirm absence of disposal pit related contamination	Perchlorate/explosives	0-3"	• Post-excavation sampling in 2005
	J13/14, K13/14	Vicinity of loading building	• Evaluate loading area conditions	Perchlorate/explosives	0-3"	• J13/K13 previously sampled in 2006 • J14/K14 – not previously sampled
	J11, K11	Vicinity of latrine and polygon 32-34	• Confirm existing conditions/Limited previous 2,4-DNT detections	Perchlorate/explosives	0-3"	• J11 – previously sampled in 2000/2004
Area 2	N15/16/17, O15/16/17	Vicinity of FFP-3, FFP-4, and RRBA	• Confirm existing conditions in selected areas near FFP-3 and FFP-4 • Confirm conditions in areas adjacent to RRBA • N15/16 – REP PCN exceedance	Perchlorate/explosives PCNs – N15/16	0-3"	• N15[3] – FFP-3 extensively sampled in 2001-2004 at multiple depths • O15 – partially excavated in 2004 • O17 – not previously sampled
	M19/20	Vicinity of MEC Disposal Area	• Re-sample areas with REP PCN exceedances	PCNs		• M19/20 – partially excavated
	M22/23, N22/23/24, O23	Vicinity of Disposal Area 1	• Confirm conditions in selected areas adjacent to Disposal Area 1 • M22/23, N22/23/24 – REP PCN exceedances	Perchlorate/explosives, dioxins/furans PCNs – M22/23, N22/23/24	0-3"	• N23[3] – Disposal Area 1 extensively sampled from 2000-2006
	O24/25, P23/25,	Vicinity of Berm 2	• Confirm existing conditions in selected areas adjacent to Berm 2 • P25 not previously sampled	Perchlorate/explosives Also cadmium – P23	0-3"	• 024 – sampled multiple times from 2000-2008 at multiple depths • P23 – average cadmium concentration exceeds S-1/GW-1 standard
	N28, O26/27/28/29, P26	Vicinity of pile and MEC discoveries and downrange of Berm 2	• Characterize existing conditions in downrange portions of Area 2 • P26 – REP PCN exceedance	Perchlorate/explosives PCNs – P26	0-3"	• O26/27/28 – not previously sampled • N28/029 – evidence suggests limited past use
	M26	Uncharacterized soils and anomalies	• Confirm existing conditions	Perchlorate/explosives	0-3"	• M26 – not previously sampled
	M29	Vicinity of Berm 5	• Confirm existing conditions adjacent to Berm 5	Perchlorate/explosives	0-3"	

Table 1
Proposed J-2 Range Confirmatory Sampling Program
Phase 1

	Grids	Location	Rationale	Analytes[1]	Depths[2]	Comments
Area 3	I,30, M31	Vicinity of Berm 5	• Confirm existing conditions in areas adjacent to Berm 5	Perchlorate/explosives Also PCNs – M31	0-3"	• M30[3] – Berm 5 extensive past sampling/Area excavated • L30[3] – mutliple past sampling events 2000/2001/2002
	O30/31/32/33/35, M32/33, N34/35, P33/35	Vicinity of Disposal Area 2	• Confirm existing conditions in vicinity of Disposal Area 2 focusing on areas along and outside of excavation boundaries • O31 – S-1/GW-1 PCN exceedance	Perchlorate/explosives Also PCNs – O31	0-3"	• P34[3] – extensively excavated
	L33/34, K33/34	Vicinity of Brick-lined Pit 2	• Confirm existing conditions at Brick-lined Pit 2 and an adjacent perimeter areas	Perchlorate/explosives	0-3"	• K33 – not previously sampled
Area 4	N/A	N/A		N/A	N/A	

Scope may be adjusted based upon comments on draft RI/FS and additional anomaly investigation. Up to five additional multiple increment samples may be collected in Phase 1 based on field observations.
[1] Polychlorinated naphthalenes (PCNs) are proposed for analysis but will require specialized non-routine analysis due to lack of a standard method.
[2] Additional subsurface samples may be collected during Phase 2 following evaluation of Phase 1 data and any action level exceedances.
[3] Not proposed for sampling.
[4] REP - Relative Experimental Potency

Attachment 1
Metals

Pursuant to the soil risk screening, the "current conditions" metals data from for Areas 1, 2 and 3 presented in Tables 3-8, 3-11, and 3-14 of the J-2 Range RI/FS report was compared to MCP Method 1 S-1/GW-1 Standards. The risk screening results presented in Table 6-2, 6-3 and 6-4 identified individual exceedances of the MCP Method 1 S-1/GW-1 Standards for arsenic, cadmium, chromium, lead and nickel.

For those individual sample locations where an exceedance was noted, a further evaluation was conducted to identify any sampling or excavation activities that occurred after the J-2 Range RI/FS risk screening was prepared as well as any BIP excavations that may not have been previously identified. Based on Figure 3-18 of the J-2 Range RI/FS report, both SSJ2N35010 and SSJN35011 are within the footprint of the J2N35 Area 1 and therefore, it has been assumed that both have been excavated. A November 2012 30-point post-excavation sample (SSJ2N35011) from grid N35 was included in the data set utilized in this attachment. This sample was collected after the J-2 Range RI/FS risk screening was prepared and was therefore not listed on Table 3-14. Consequently, all data prior to Fall 2012 for locations SSJ2N35010 and SSJN35011 were removed. At grid M30, according to the BIP Management Table in 2006 a 5'x5'x1' excavation occurred at location SSJ2M300002. Consequently, both the pre-BIP and post-BIP 2004 data do not represent current conditions.

A summary of these exceedances, including the grid location, the analyte exhibiting the exceedance of its criterion, the analyte's frequency of detection, its number of exceedances, its maximum detected concentration, and its average concentration within that averaging area, is provided in Table 1-1. The MCP Method 1 S-1/GW-1 Standard (or its noted alternative) and the MCP Method 2 S-1 Standard (for direct contact exposure only) also are shown in Table 1-1.

The summary statistics provided in Table 1-1 were calculated using data from all current conditions data from various investigations conducted at the respective grid locations. Various sampling methodologies were used during these investigations, including discrete samples; 5- and 9-point composites samples; and multi-increment samples (MIS). These samples were collected from various depths, but primarily within 2 feet of the ground surface. At those locations where maintenance or response actions involving soil excavation and removal have been performed since 1999, only post-removal soil sampling results were utilized in the calculation of the averages to ensure that the contaminated soil that has already been removed from a grid does not bias the assessment of the current conditions for that grid. At locations where replicate MIS samples were collected each of the replicate results was used to determine the average concentration.

As seen in Table 1-1, in general, area average concentrations do not exceed the MCP Method 1 S-1/GW-1 or the Method 2 S-1 Standards. But at two grids the average cadimum concentration exceeded its Method 1 S-1/GW-1 Standard. These are: grid J16 in Area 1 and grid P23 in Area 2.

Table 1-1
Summary of MCP Method 1 S-1/GW-1 Exceedances as presented in J-2 RI/FS Report "Current Conditions" (Fall 2012)
Tables and Corresponding Current (Spring 2013) Average and Maximum Concentrations

Area	Grid	Analyte	EPA Method	Frequency of Detection	Maximum Concentration in "Current Conditions" Tables of RI/FS Report	Current Number of MCP Method 1 S-1/GW-1 Exceedances	Current Maximum Detected Concentration (mg/Kg)	Current Average Concentration (mg/Kg)	MCP Method 1 S-1/GW-1 Standard (mg/Kg)	MCP Method 2 S-1 Standard (mg/Kg)
Area 1	I14	CHROMIUM, TOTAL	CL200.7	28 / 28	**53.9**	1	**53.9**	8.1	30	30
	J11	CHROMIUM, TOTAL	CL200.7	2 / 2	**31.5**	1	**31.5**	19.4	30	30
		NICKEL	CL200.7	2 / 2	**28.7**	1	**28.7**	19.8	20	20
	J16	CADMIUM	SW6010B/CL200.7	4 / 4	**38.5**	1	**38.5**	**9.9**	2	2
	K11	CADMIUM	CL200.7/CLP_ILM04.1	11 / 11	**4.7**	1	**4.7**	0.9	2	2
		LEAD	CL200.7/CLP_ILM04.1	24 / 24	**423**	1	**423**	34.1	300	300
	outside (P12)	CADMIUM	CL200.7	5 / 5	**2.9**	1	**2.9**	1.1	2	2
Area 2	N19	CADMIUM	CL200.7	8 / 8	**2.3**	1	**2.3**	0.5	2	2
	N22	CADMIUM	SW6010B/CL200.7	9 / 9	**11.8**	1	**11.8**	1.8	2	2
	N23	CHROMIUM, TOTAL	CL200.7	109 / 109	**792**	1	**792**	20.4	30	30
		LEAD	SW6010B/CL200.7	111 / 111	**1,040**	1	**1,040**	38.8	300	300
		NICKEL	CL200.7	103 / 103	**853**	1	**853**	15.0	20	20
	P21	CADMIUM	CL200.7/CLP_ILM04.1	9 / 9	**2.1**	1	**2.1**	1.0	2	2
		CHROMIUM, TOTAL	CL200.7/CLP_ILM04.1	15 / 15	**54**	1	**54**	16.1	30	30
		LEAD	CL200.7/CLP_ILM04.1	15 / 15	**430**	1	**430**	40.8	300	300
		NICKEL	CL200.7/CLP_ILM04.1	15 / 15	**24.4**	1	**24.4**	7.3	20	20
	P23	CADMIUM	CL200.7/CLP_ILM04.1	5 / 5	**12.2**	1	**12.2**	**3.8**	2	2
Area 3	M30[a]	CADMIUM	SW6010B	0 / 0	**16.1**	0	No Data	No Data	2	2
		LEAD	SW6010B	0 / 0	**553**	0	No Data	No Data	300	300
		ZINC	SW6010B	0 / 0	**23800**	0	No Data	No Data	2,500	2,500
	N34	CADMIUM	SW6010B	5 / 5	**3.1**	1	**3.1**	1.1	2	2
	N35	ARSENIC	SW6010B	2 / 2	**20.1**	1	4.6	4.5	20	20
		LEAD	SW6010B	3 / 3	**942**	1	53.9	25.6	300	300

NOTES:
Bolded text indicates an exceedance of the MCP Method 1 S-1/GW-1 Standard.

[a] Table 3-14 and Appendix F of the J-2 RI/FS report indicate that the pre-BIP sample at location SSJ2M300002 was "outside the excavation". Although this location was outside the large M30 excavation, in 2006 a 5'x5'x1' area was excavated pursuant to the BIP Management Program. Consequently, neither the 2004 pre-BIP sample nor the 2004 post-BIP sample results are indicative of current conditions at this location.

[b] Table 3-17 and Appendix F of the J- RI/FS report include "current conditions" data for that was subsequently removed. In November 2012 these grids were excavated and 30-point MIS samples were collected from within the grid and along the central portion of the grid.

Attachment 2
Polychlorinated Naphthalenes

From 2000-2006, a number of soil samples from Areas 1, 2 and 3 at the J-2 Range were analyzed for polychlorinated naphthalenes (PCNs). PCNs were detected in some samples. The presence of the PCNs is likely to be associated with their use as inert munitions fillers. Research on the relative potencies of these compounds indicates that naphthalenes with four or fewer chlorines or eight chlorines do not have apparent "TCDD-like" toxicity (AMEC 2001). At least some of the penta-, hexa-, and hepta-chlorinated naphthalenes do have a mechanism of toxicity that is similar to TCDD, although to a much lesser degree than TCDD. The cited letter proposed that relative experimental potency (REP) factors be assigned to the penta-, hexa- and hepta-chlorinated naphthalenes based upon the published cellular assays (AMEC 2001). These REPs were used to adjust screening criteria for TCDD as follows:

- Penta-chlorinated naphthalenes have REP factors of approximately 10^{-4} suggesting they are on the order of 10,000 times less toxic than TCDD; and
- Hexa- and hepta-chlorinated naphthalenes have REP factors of approximately $3x10^{-3}$ suggesting they are on the order of 300 times less toxic than TCDD.

Using the MCP Method 1 S-1/GW-1 Standard (which is equivalent to the S-1 Standard) for 2,3,7,8-TCDD (0.02 µg/Kg) combined with the REP factors, the REP-adjusted screening criteria are 200 µg/Kg for pentachloronaphthalenes and 6.7 µg/Kg for hexachloronaphthalenes and heptachloronapthalenes.

In order to evaluate the extent of PCN exceedances at the J-2 Range, all of the PCN results for samples listed in the area-specific Current Conditions tables of the J-2 Range RI/FS (i.e., Tables 3-8, 3-11, 3-14, and 3-17) were compared to the REP-adjusted S-1 screening criteria. Each of these locations was then reviewed against historical informational data reports to gain further understanding. The results are discussed by area below.

Area 1 – Six of the 57 soil samples analyzed for PCNs were in excess of the REP-adjusted screening criteria. Samples were collected from five different grid locations (I14, L16, M15, M16, and M17), but all six exceedances were samples collected from grid M16. This area was used by contractors for testing and disposal.

Area 2 – A total of 164 samples were analyzed for PCNs by congener group and another 24 samples were collected from Targets 10, 14C, 15A, and 16 and were analyzed for individual chlorinated naphthalenes. Samples were collected from 14 different grids (M19-M23 inclusive, N15, N16, N19, N20, N22, N23, P19, P21, and P26). There were 49 samples with PCN concentrations in excess of the REP-adjusted screening criteria. Fifteen of the 49 samples were from grid N23, and some of which may have been removed pursuant to the Disposal Area 1 excavation. Sixteen other samples were from grids M19 and M20. Several of these locations may have been excavated as grids M19 and M20 were extensively investigated and excavated (e.g., Target 14C). Twenty-four locations are from the adjacent grids N22, N24, M22 and M23. Of the remaining four locations, one is from the FFP-3 area and one is from the Target Control Pit. The other two locations were N19 and N16. These samples were collected along the range road burn area. The location in grid N19 was collocated with Target 16, which was excavated in 2002.

Area 3 - A total of 31 samples were analyzed for PCNs by congener group and another seven samples were analyzed for individual chlorinated naphthalenes. Samples were collected from Grids M30 and O31. All of the seven exceedances were in Grid O31. These samples were within T2U Polygon 2 and are supplemental BIP samples. Polygon 2 was initially excavated in 2002. The 2002 sample was a post-excavation sample. The 2006 samples are supplemental BIP samples. The immediate BIP location was excavated.

Based on this evaluation, the grid locations listed in Table 2-1 are recommended for PCN sampling.

AMEC. 2001. Letter to Len Pinaud (MassDEP) and Todd Borci (EPA) from Marc Grant: USEPA Region I Administrative Order SDWA I-97-1019 Bourne-BWSC-4-13683 Camp Edwards Impact Area Groundwater Study MDL Results for PCNs. January 31.

Table 2-1
Proposed J-2 Range PCN Soil Sampling Locations

Area	Grid ID	BIP	non-BIP	Comments
1	M16		X	3 sample locations (SS101PG, SS101PJ, SS101PM) outside excavation area; 0-1' depth
2	M19		X	1 sample location (SS101LE) outside excavation area; 0-0.25' depth
	M20	X		1 sample location (SSJ2M19005) notes indicated PCNs left in-place for subsequent risk assessment; 1 other location (Target 14C) was excavated
	M22		X	1 sample location (SS15179-A)
	M23		X	1 sample location (SS15180-A)
	N15		X	1 sample location (SS101DE); 0-0.25' depth; FFP-3 area
	N16		X	1 sample location (SS101PH); 0-0.25' depth
	N22		X	3 sample locations (SS101NL, SS101NM, SS15185-A); 0-1' depth
	N23		X	7 sample locations (SS101NC, SS101ND, SS101NE, SS101NH, SS101NK, SS101NP, SS101NQ); 0-1' depth; possibly within Disposal Area 1 excavation to 0.75'
	N24		X	2 sample locations (SS101NR, SS15181-A); 0-1' depth; SS101NR is near Berm 2
	P26		X	1 sample location (TR5-A) near the Target Control Pit
3	O31	X		3 sample locations (SSJ2AT2U004, SSJ2AT2U005, SSJ2AT2U006) which met the 1 µg/Kg TEQ value for PCNs used in the BIP protocol; Locations SS04342-A and SS04343-A may have been excavated during the 2004 RRA.

Notes:
Area 1, 2 and 3 grids containing PCN sample results exceeding the REP-adjusted MCP S-1 Standard.
Grids have been segregated into BIP and non-BIP locations.

DRAFT PROJECT NOTE

Impact Area Groundwater Study Program
J-2 Range Confirmatory Geophysical Program
Camp Edwards, MA

Subject: Confirmatory Intrusive Geophysical Investigations at the J-2 Range

Date: August 28, 2013

1.0 PURPOSE

The purpose of this project note is to document regulatory concurrence with the proposed scope of confirmatory intrusive geophysical investigations at the J-2 Range.

2.0 BACKGROUND

The J-2 Range is located adjacent to (and partially within) the Impact Area and is the northernmost of the four former military training, and defense contractor, test ranges that operated from the 1930s until the 1990s. The range is approximately 1,180 meters long and between 100 and 180 meters wide.

Investigation and remediation of the range has been ongoing since 1997 and has resulted in the identification and removal of the sources of groundwater contamination as well as a good understanding of munitions use at the range and areas where munitions residue may remain. All munitions items encountered during investigations at the J-2 Range were removed.

The types of munitions reportedly tested and identified in the field include direct fire and indirect fire rounds including 105mm, 81mm, 60mm, 66mm, 57mm, 37mm, 30mm HEI, and several other types of munitions. The most frequently encountered projectile containing high explosives was the T330 30mm HEI projectile. The majority of mortars and rockets discovered on the range were inert munitions. It is also possible that some projectiles were fired during training activities from firing points outside the J-2 range boundaries; however, the density of these types of projectiles is expected to be very low since this range is more than a mile from the targets in the Central Impact Area.

Two distinct plumes of RDX and perchlorate contamination have been identified in groundwater downgradient from the J-2 Range. The primary source area of the J-2 northern plume is a former disposal area where open burning/detonation and burial of munitions and other energetic materials occurred over a number of years. More than 30 disposal/burn pits and over 5,000 cubic yards of contaminated soil have been removed from that portion of the range. The primary source of the J-2 eastern plume is in Area 2 of the range, where a large number of T330 30mm HEI projectiles and other munitions items, including several disposal pits, were found in the area of grids M19/20. Area 2 is shown on the attached Figure 1. Figures depicting other areas of the J-2 Range are included in the Final J-2 Range Remedial Investigation/Feasibility Study Report.

Even though the range was rigorously investigated, there will always be some uncertainty as is typical with all environmental investigations. It is noted however, that all potential burials identified using pit screening criteria were investigated and contents removed. Pit screening

criteria included visual identification of land features and the investigation of geophysical anomalies.

3.0 PREVIOUS GEOPHYSICAL INVESTIGATIONS SUMMARY

Investigations in the southern portion of the range (rows 10 to 17) Area 1, Firing Points/Melt Pour Facility, identified general disposal pits, former contractor testing infrastructure, single Munitions and Explosives of Concern (MEC) items, and Munitions Debris (MD). While there is a potential for residual single MEC items, the investigation findings suggest that there is a low likelihood of the presence of uninvestigated MEC burials or the potential for widespread distribution of MEC items. All large geophysical anomalies in the mid-portion of the J-2 Range area (rows 15 to 29) Area 2 have been investigated. Large anomalies that still remain are associated with concrete structures. Extensive clearance and the removal of approximately 300 cubic yards of soil to a depth of one foot have been conducted in the former 30mm HEI target area. Some small to medium anomalies still remain and it is likely that additional single 30mm High Explosives (HE), including High Explosives Incendiary (HEI), projectiles, 57mm HE projectiles and 66mm HE rockets could be found within this area. Some single 60mm or 81mm mortars also likely remain on the range that could have inert bodies with live fuzes.

The northern portion of the range (rows 30 to 35), Area 3, had a considerable amount of clearance and excavation during the Rapid Response Actions. Investigations in Area 3 included a quality control survey with an intrusive investigation of residual anomalies over most of the area. Therefore, remaining geophysical anomalies are small and scattered and are likely residual munitions debris and other metallic debris. It is unlikely that any subsurface burials still remain in the Area 3.

Investigations in the J-2 Extension area (rows 36 to 48, Area 4) have characterized this area as target/impact related. Items recovered are mostly munitions debris and other metallic debris. It's likely that a low density of 30mm HEI projectiles still remain in Area 4. This area of the J-2 Range falls within the MMR Impact Area, and geophysical data indicates a higher density of individual metallic items. Individual MEC items, both HE and inert with live fuzes, could still remain in this portion of the range. It is likely that the HE items could include: the T330 30mm HEI projectile, M374 81mm mortar, the M1 105mm projectile and the M107 155mm projectile.

4.0 PROPOSED ACTION

As noted above, downrange Areas 3 and 4 of the J-2 Range have been the subject of the most intensive and thorough intrusive investigations, based on their location and the types of activities found to have occurred there. Area 1 received somewhat less investigation, as the activities known and expected to occur, as well as findings of the investigations that were conducted, indicated lesser likelihood for the occurrence of residual munitions. However, based on their location, investigative findings and range of activities known to have occurred, additional confirmatory intrusive investigations are proposed in Area 2 and Area 4 as shown on Figures 1 and 2 and described in Section 4.1, below.

4.1 Approach

Although a significant amount of MEC removal has been performed in portions of the area during previous UXO clearance, EM-61-based geophysical investigations, and soil removal operations, UXO technicians will perform MEC removal in grids M17 through M22, N18 through N22 and M/N45 using hand-held magnetometers in order to remove all items detected in these grids. In addition, in Area 2 grids N17, M23, M25, M26, and L17-L22 and Area 4 grids O45, O44, and M43 and L43 through L45 all items detected along a meandering path traverse of each grid will be removed. In addition, previously identified individual anomalies located in grids O23, I13 and K16 will be intrusively investigated. The use of hand-held magnetometers will allow for the removal of MEC without the need to clear-cut the existing vegetation; although, depending on what is found during the course of the investigation, some vegetation may need to be cut. MEC removal will be performed to detection depth. All MEC and MD recovered will be managed in accordance with established protocols. The associated findings will be reported in a project note on conclusion of the investigation.

5.0 CONCURRENCE

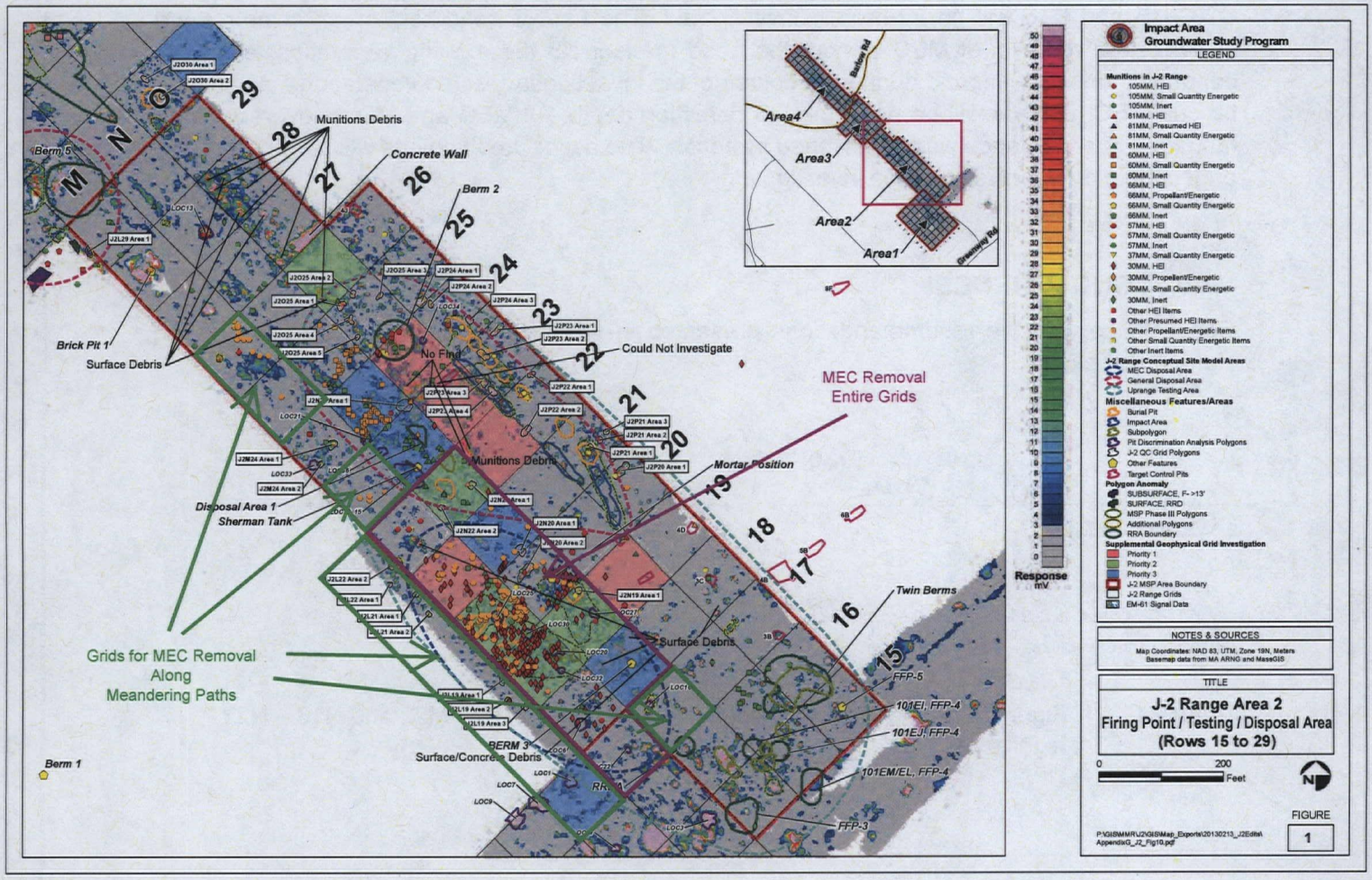
Concurrence with the recommendations presented in this project note is represented by the signatures below:

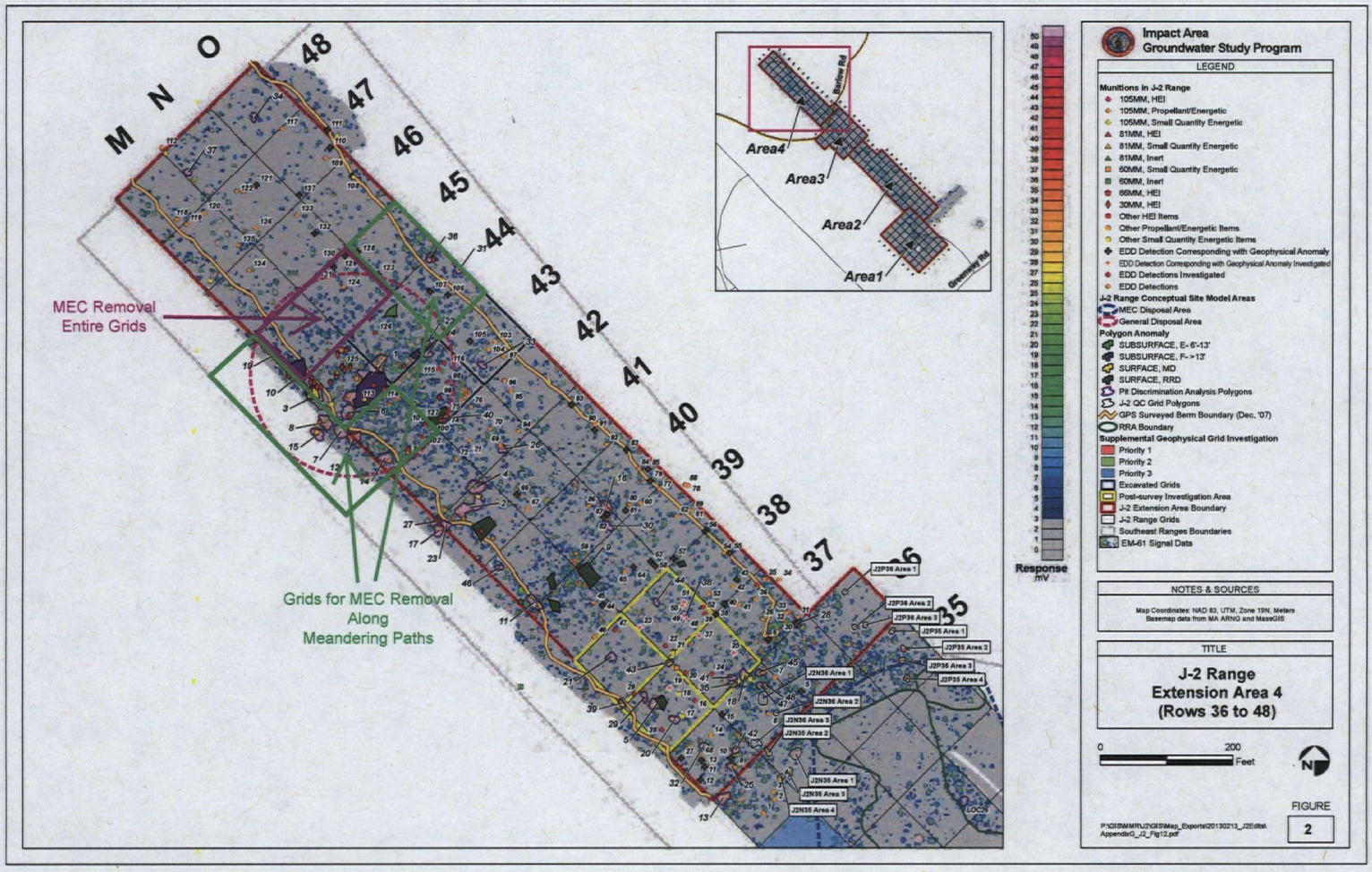
Jane Dolan 8-28-13
EPA Representative

Henry Lui 8/29/13
MassDEP Representative

Bryan P. Gregson 8/29/2013
IAGWSP Representative

Figure 1 Figure 10 from J-2 RI/FS appendix G with grids M18 – M22 and N18 – N22 highlighted


Impact Area Groundwater Study Program
LEGEND
Munitions in J-2 Range
105MM, HEI
105MM, Small Quantity Energetic
105MM, Inert
81MM, HEI
81MM, Presumed HEI
81MM, Small Quantity Energetic
81MM, Inert
60MM, HEI
60MM, Small Quantity Energetic
60MM, Inert
66MM, HEI
66MM, Propellant/Energetic
66MM, Small Quantity Energetic
66MM, Inert
57MM, HEI
57MM, Small Quantity Energetic
57MM, Inert
37MM, Small Quantity Energetic
30MM, HEI
30MM, Propellant/Energetic
30MM, Small Quantity Energetic
30MM, Inert
Other HEI Items
Other Presumed HEI Items
Other Propellant/Energetic Items
Other Small Quantity Energetic Items
Other Inert Items
J-2 Range Conceptual Site Model Areas
MEC Disposal Area
General Disposal Area
Uprange Testing Area
Miscellaneous Features/Areas
Burial Pit
Impact Area
Subpolygon
Pit Discrimination Analysis Polygons
J-2 QC Grid Polygons
Other Features
Target Control Pits
Polygon Anomaly
SUBSURFACE, F- >13'
SURFACE, RRD
MSP Phase III Polygons
Additional Polygons
RRA Boundary
Supplemental Geophysical Grid Investigation
Priority 1
Priority 2
Priority 3
J-2 MSP Area Boundary
J-2 Range Grids
EM-61 Signal Data
Response mV
NOTES & SOURCES
Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG and MassGIS
TITLE
J-2 Range Area 2
Firing Point / Testing / Disposal Area
(Rows 15 to 29)
0
200
Feet
FIGURE
1
P:\GIS\MMR\J2\GIS\Map_Exports\20130213_J2Edits\AppendixG_J2_Fig10.pdf
Area4
Area3
Area2
Area1
Berm 5
Brick Pit 1
Surface Debris
Munitions Debris
Concrete Wall
Berm 2
No Find
Could Not Investigate
MEC Removal
Entire Grids
Mortar Position
Disposal Area 1
Sherman Tank
Grids for MEC Removal
Along
Meandering Paths
Twin Berms
FFP-5
101EI, FFP-4
101EJ, FFP-4
101EM/EL, FFP-4
FFP-3
Berm 1
BERM 3
Surface/Concrete Debris


MEC Removal
Entire Grids
Grids for MEC Removal
Along
Meandering Paths
Area4
Area3
Area2
Area1
Barlow Rd
Greenway Rd
Response
mV
Impact Area
Groundwater Study Program
LEGEND
Munitions in J-2 Range
105MM, HEI
105MM, Propellant/Energetic
105MM, Small Quantity Energetic
81MM, HEI
81MM, Small Quantity Energetic
81MM, Inert
60MM, Small Quantity Energetic
60MM, Inert
66MM, HEI
30MM, HEI
Other HEI Items
Other Propellant/Energetic Items
Other Small Quantity Energetic Items
EDD Detection Corresponding with Geophysical Anomaly
EDD Detection Corresponding with Geophysical Anomaly Investigated
EDD Detections Investigated
EDD Detections
J-2 Range Conceptual Site Model Areas
MEC Disposal Area
General Disposal Area
Polygon Anomaly
SUBSURFACE, E- 6'-13'
SUBSURFACE, F- >13'
SURFACE, MD
SURFACE, RRD
Pit Discrimination Analysis Polygons
J-2 QC Grid Polygons
GPS Surveyed Berm Boundary (Dec. '07)
RRA Boundary
Supplemental Geophysical Grid Investigation
Priority 1
Priority 2
Priority 3
Excavated Grids
Post-survey Investigation Area
J-2 Extension Area Boundary
J-2 Range Grids
Southeast Ranges Boundaries
EM-61 Signal Data
NOTES & SOURCES
Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from MA ARNG and MassGIS
TITLE
J-2 Range
Extension Area 4
(Rows 36 to 48)
0
200
Feet
N
FIGURE
2
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