United States Environmental Protection Agency
Region 1

Decision Document

Western Boundary, Demolition Area 2 and Northwest Corner Soil and Groundwater Operable Units

Camp Edwards
Massachusetts Military Reservation
Cape Cod, Massachusetts

March 2010

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

A. SITE NAMES

The subject sites are the Western Boundary, Demolition Area 2, and the Northwest Corner Operable Units (collectively, "the Sites"), which are located at Camp Edwards at the Massachusetts Military Reservation (MMR).

B. STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected response actions for the Sites. 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 there under, 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.

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 at the Impact Area Groundwater Study Program (IAGWSP) office, 1803 West Outer Road, Camp Edwards, MA.

C. ASSESSMENT OF THE SITES

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

D. DESCRIPTION OF COMPREHENSIVE RESPONSE ACTIONS

This Decision Document sets forth the selected response actions for addressing source area and groundwater contamination at and emanating from the Sites (Figures 4, 6, and 11).

Based on recent sampling results presented in remedial investigation reports for each of the Sites, it was determined that no further action was necessary with regards to soils associated with each of the Sites. Soil contamination at Demolition Area 2 was adequately removed under a Rapid Response Action (RRA) in 2004, and soil contamination at the Northwest Corner and Western Boundary appears to be depleted. Since surface soil samples collected from each of the sites revealed only low, infrequent detections of various compounds and no further contribution from soil to groundwater contamination is expected, the proposed alternatives did not include any further source-area cleanup or control.

However, based on groundwater sampling results, EPA deemed it necessary to develop and evaluate a range of potential response actions to address contaminants detected in groundwater associated with each of the Sites. The feasibility studies for the specific sites identified the contaminants of concern (COCs) for groundwater as follows:

- The oxidizer perchlorate is the COC for the Western Boundary.
- The explosive RDX is the COC for Demolition Area 2.
- RDX and perchlorate are COCs for the Northwest Corner.

These specific COCs were used to develop and evaluate a range of potential response actions for each site. Groundwater modeling was used to determine the feasibility of the alternatives and the selected response action was based on the remediation of the perchlorate plume at the Western Boundary, the RDX plume at Demolition Area 2, and the RDX and perchlorate plumes at the Northwest Corner. The cleanup objectives for the Sites are to restore the useable groundwater to its beneficial use, wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site; to provide a level of protection in the aquifer that takes into account that the Cape Cod Aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent the ingestion and inhalation of groundwater containing the COCs (perchlorate at Western Boundary, RDX at Demolition Area

2, and perchlorate and RDX at Northwest Corner), in excess of federal Maximum Contaminant Levels (MCLs), Health Advisories (HA), Drinking Water Equivalent Levels (DWELs), applicable State standards or unacceptable excess lifetime cancer risk or non-cancer Hazard Index (HI) .

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

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

The EPA has selected response actions for the Western Boundary, Demolition Area 2, and Northwest Corner groundwater plumes under which the aquifer, which has been designated a Sole Source Aquifer by the EPA and a Potentially Productive Aquifer by the Massachusetts Department of Environmental Protection (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 for each site (Western Boundary, Demolition Area 2, and Northwest Corner) is Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs). This alternative, as presented in each of the site-specific feasibility studies, provides the best balance of the criteria used to evaluate cleanup alternatives.

The selected alternative achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the Sites are correct and that any residual contamination remains below risk-based levels. Human health will be further protected through the implementation and verification of land use controls. These controls will

prevent use of contaminated portions of the aquifer at the Sites for drinking water purposes until groundwater data confirms that contamination has been reduced to below risk-based levels.

The major components of this response action are:

- Development and implementation of a long-term monitoring program that would be optimized yearly, as contamination levels are reduced through natural processes,
- Implementation of land use controls to prevent access to and use of the contaminated portions of the aquifer for drinking water,
- Monitoring reports to verify actual versus predicted migration and attenuation (i.e., confirmation that cleanup levels have been achieved),
- Site closeout documentation,
- Well abandonment after monitoring is complete, and
- Two additional groundwater monitoring well clusters installed downgradient of the plume for long-term monitoring of predicted plume migration and attenuation at Demolition Area 2.

E. DETERMINATIONS

The soil and groundwater 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 Western Boundary, Demolition Area 2, and Northwest Corner sites into the underlying Sole Source Aquifer.

The selected response actions meet current applicable federal and state requirements. According to MassDEP, residual concentrations of contaminants remaining in soil pose no significant risk to health, safety, public welfare or the environment.

As required by AO3, the selected alternative for each site (Monitored Natural Attenuation and Land Use Controls for groundwater and no further action for source areas) provides a level of protection to the aquifer underlying and downgradient of the Sites 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 actions (such as new regulatory requirements or changes in the environmental conditions of the Sites).

F. SUPPORTING DATA

Detailed information on the Sites is included in the *Final Western Boundary Remedial Investigation and Feasibility Study* dated September 16, 2009, the *Final Demolition Area 2 Remedial Investigation and Feasibility Study* dated September 16, 2009 and the *Final Northwest Corner Remedial Investigation and Feasibility Study* dated September 16, 2009. Detailed information on the Demolition Area 2 source area response is included in the *Demo 2 Soil RRA Completion of Work Report* dated December 29, 2005. An overview of the Sites, 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 contaminants of concern (COCs) and their respective concentrations, the baseline risk represented by the COCs, cleanup levels established for COCs and the basis for the levels, current and future land and groundwater use assumptions used in the baseline risk screening and Decision Document, land and groundwater use that will be available at the Sites 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 Administrative Record for the Sites.

G. AUTHORIZING SIGNATURE

This Decision Document documents the selected response actions for remediation of the Western Boundary, Demolition Area 2, and Northwest Corner soil and groundwater operable units within Camp Edwards at the MMR. These response actions were selected by EPA under the authority of the SDWA. The MassDEP concurs with this decision.

U.S. Environmental Protection Agency

By: _____ Date: June 2, 2010

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

PART II: THE DECISION SUMMARY

A. SITE DESCRIPTIONS

Western Boundary

In early 2002, perchlorate was discovered in groundwater on the western boundary of Camp Edwards and in the downgradient Monument Beach Well Field located in Bourne, Massachusetts. An investigation was initiated to determine the nature and extent of contamination in the well field and the upgradient area, hereafter referred to as the Western Boundary (Figure 4). The western portion of Camp Edwards consists of mostly vegetated training areas, gun and mortar firing positions, the southwestern portion of the Impact Area, and cleared areas for roads and a variety of training activities. The Monument Beach area is generally commercial and residential development and undeveloped land. Perchlorate has been detected in groundwater throughout the Western Boundary area and was identified as the COC for the site.

Demolition Area 2

Demolition Area 2 is located in the central northern portion of Camp Edwards approximately one mile south of the Mid-Cape Highway (Figure 9). The area was used primarily for demolition training, is generally flat and situated in a relatively shallow topographic depression. A man-made, arc-shaped berm of small soil piles formerly traversed the west end of the cleared area with similar soil piles located west of that berm. Removal of the explosives-contaminated material in the berm and soil piles has eliminated these topographic features. Remaining surface soils are typically fine to coarse-grained sands with relatively little topsoil present. Demolition Area 2 supports patches of immature pitch pine, scrub oak, and grasses within bare sand. RDX has been detected in groundwater and is identified as the COC in groundwater for Demolition Area 2.

Northwest Corner

The Northwest Corner site is located on the northwestern portion of Camp Edwards and extends from just south of the installation boundary to the Cape Cod Canal (Figure 11). The site inside the installation boundary consists of areas of undisturbed vegetation and cleared

areas for roads and various training activities. Four gun positions, two training areas, and the L-3 Range are located within the Northwest Corner, but are being addressed in separate, operable unit (OU)-specific remedial investigations. The area between the installation boundary and the canal includes residential and commercial properties within the Town of Bourne (Figure 12). RDX and perchlorate have been identified as the COCs for the Northwest Corner.

B. SITE HISTORIES AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

Western Boundary

The portion of the Western Boundary located on Camp Edwards includes military training areas (BA-4, A-5, A-6, and B-7); gun and mortar firing positions (GP-2, GP-24, MP-1, MP-3, MP-4, MP-5, MP-6, MP-7, and MP-8); the Former D Range; and the southwestern portion of the impact area (Figure 1). These areas were used at various times, beginning in the 1930s, for troop training exercises including small arms training, artillery and mortar training, land-navigation training, and as bivouac training sites. The gun and mortar positions are being addressed under the Gun and Mortar Position (GMP) Operable Unit, Former D Range is being addressed under the Small Arms Range (SAR) Operable Unit, and portions in the southwestern portion of the impact area are being addressed as part of the Central Impact Area (CIA) Operable Unit. Perchlorate, which is the only COC for the Western Boundary, was a constituent of some pyrotechnic devices used in the training areas. The use of pyrotechnics was discontinued in 1997.

Demolition Area 2

Demolition Area 2 was primarily used for light demolition training from the late 1970s to the late 1980s. Records indicate that explosive charges of Composition C-4 (C-4) and 2,4,6-trinitrotoluene (TNT), in quantities less than 10 pounds, and claymore mines were used in training exercises there.

Northwest Corner

The portion of the Northwest Corner located on Camp Edwards includes training areas used for small-unit maneuvers, training and bivouacs (Figure 12). Expected munitions use in the areas includes small-arms blank rounds, smoke grenades, and various forms of pyrotechnics. Four gun positions (GP-12, GP-14, GP-16 and GP-19) located in the Northwest Corner were used to fire artillery rounds at targets located in the impact area. These sites are being addressed under the GMP Operable Unit. The area also includes the L-3 Range, a former small arms range which is being addressed under the Small Arms Range Operable Unit. Commercial fireworks displays, launched from the Upper Cape Cod Regional Technical School, also took place in the Northwest Corner between 1996 and 2003. The fireworks were part of local Independence Day celebrations and not related to military activities. Perchlorate is a component of both pyrotechnics and fireworks and use of these items in the Northwest Corner area is the likely source of the shallow plume of perchlorate in groundwater at the Northwest Corner.

A more detailed description of each site can be found in Section 2 of the site-specific September 2009, Remedial Investigation/Feasibility Study (RI/FS) documents.

2. History of Investigations and Response Actions

Remedial investigations were conducted at the Western Boundary, Demolition Area 2, and the Northwest Corner to investigate 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 contamination from unexploded ordnance (UXO), and to provide a basis for the evaluation of risk(s) posed by the site (soil data collected from areas associated with other OUs will be evaluated in their respective RI/FS reports).

A brief summary of the investigations and response actions performed at each of the Sites is provided below. A more detailed discussion can be found in Sections 3 and 4 of the September 2009, Remedial Investigation/Feasibility Study (RI/FS) Report for each Site.

Western Boundary

Soil Investigations and Results

In 2002, soil samples were collected from several areas (upgradient of the Bourne Monument Beach public water supply well field) identified as potential sources of perchlorate detections in groundwater. (Although sampling results from adjacent source area investigations (i.e., GMPs, HUTA 2, Former D Range, SAR, and CIA) are discussed in the Western Boundary RI, potential health risks associated with these data, if any, will be identified and evaluated in the site-specific RI/FS Reports to be issued for each of these sites.)

A number of soil samples were also collected from areas identified as warranting additional investigation during a site reconnaissance of the area south and west of Range Control, also located within the Western Boundary operable unit. The sampled areas were found to contain, among other inert items, blank munition rounds, munitions scrap, and an expended smoke grenade,

A total of 29 soil samples, including duplicates, were collected for perchlorate analysis from the Western Boundary area. There were two, low-level detections among all of the samples collected; one from beneath a smoke grenade and one near the end of the 97-5 sentinel well particle track in the southwest Impact Area (Figure 3). Although eight soil samples were also analyzed for explosives, laboratory results were reported non-detect (with qualifiers due to interferences during sample analysis).

Based on the inconsistency in groundwater detections at or near the water table and the low frequency and concentrations of surface soil detections in samples collected from potential source areas, the Western Boundary RI concluded that any pre-existing source areas have likely been depleted. Therefore, soils were excluded from further evaluation in the Western Boundary FS.

Groundwater Investigations and Results

In August 1999, five monitoring well clusters (MW-80 through MW-84) were installed upgradient of the Bourne Water District Monument Beach well field along the MMR property boundary to monitor groundwater quality at the MMR base boundary. Although perchlorate was not initially detected, a base wide perchlorate sampling event conducted in August 2001, revealed perchlorate at 1.7 micrograms per liter (µg/L) in one of the cluster wells, which resulted in the development and implementation of a groundwater monitoring program in the area associated with the Monument Beach Well Field. Routine groundwater sampling for perchlorate was initiated in the Bourne Monument Beach water supply wells and nearby sentinel wells in October 2001. Perchlorate was not detected in the water supply wells or base boundary wells during subsequent sampling rounds. However, in February 2002, perchlorate was detected within the nearby sentinel wells at concentrations of less than 1 µg/L. As a result, weekly sampling of the four water supply wells was initiated in March 2002, which revealed low level (less than 0.5 ug/L) perchlorate concentrations in three of the Bourne Monument Beach water supply wells. In response the detections of perchlorate in the supply wells and sentinel wells, the existing groundwater sampling program was expanded to include upgradient monitoring wells.

As of March 2002, an additional 35 monitoring well screens at 12 monitoring well locations had been installed within or adjacent to the Monument Beach Well Field to more accurately define the extent of perchlorate in groundwater and to monitor groundwater quality within the water supply wells' zones of contribution. In response to perchlorate detections in the most recently installed wells, 16 additional monitoring well screens were installed upgradient of the well field at five monitoring well locations on MMR. From February 2003 through May 2004, an additional 20 monitoring well screens were installed at 11 monitoring well locations on MMR to further delineate perchlorate detections in groundwater.

As of May 1, 2006, perchlorate had been detected in 693 (~15%) of the 4495 groundwater samples collected from monitoring wells associated with the Western Boundary. Most of the detections were inconsistent and, in many cases, slightly above the detection limit of 0.35 µg/L, Several munitions-related, explosive compounds were also detected in groundwater.

Specifically, 2,4,6-Trinitrotoluene (TNT) was detected one time, in a single well (later determined to be a false positive and subsequently assigned a concentration of zero); 2,6-Dinitrotoluene (DNT) was detected once each in two different well screens in August 2001, but was not found in subsequent samples collected from December 2001 through 2005; and, a single detection of RDX was reported in a single well screen between October 1999 and December 2006. Other analytes, including VOCs (i.e., chloroform, bromodichloromethane,, cis-1,3-dichloropropene, and trichloroethylene (TCE)), SVOCs (i.e., Bis (2-ethylhexyl) phthalate (BEHP), 1,4-dichlorobenzene, 2-chloronaphthalene, 2-methylnaphthalene, benzoic acid, di-n-butyl phthalate, diethyl phthalate, and phenol), and metals (i.e., lead, molybdenum, arsenic, antimony, and. thallium) were also detected.. With the exception of perchlorate, none of these compounds were carried forward for further evaluation in the Western Boundary FS, based on the low concentrations and infrequency of detections reported.

Current perchlorate concentrations in groundwater are relatively low and sporadic. Therefore, it appears that soil concentrations producing these groundwater levels were likely uniformly low and somewhat randomly distributed. This assumption is consistent with the use of perchlorate containing pyrotechnics distributed randomly over a broad training area. In addition, perchlorate concentrations appear to be declining in groundwater which is consistent with both the end of perchlorate containing pyrotechnic use at MMR in 1997 and the fate and transport mechanisms as described in Section 5.3 of the September 2009, Western Boundary RI/FS Report. A small perchlorate plume above the MMCL of 2 µg/L was identified in the northeastern portion of the site. Maximum observed perchlorate concentrations in these wells were ~3 µg/L. This area of perchlorate contamination was the only groundwater plume evaluated in the Western Boundary FS.

Demolition Area 2

Soil Investigations and Results

The Demolition Area 2 (Demo 2) site was originally identified in 1997, as warranting evaluation under the Phase I investigation. Samples were collected from a number of locations across the site to locate residual contaminants, if any, in soils. In 1999, additional soil sampling was

performed as a result of emergency detonations of two cases of artillery simulators at the site. RDX was detected in one of two detonation craters. Contaminated soils from within the crater were subsequently excavated and transported off-site. In preparation for a Contained Detonation Chamber (CDC) demonstration program to be conducted at the site, additional sampling was performed in 2000 to ensure that the soils at the proposed CDC location (and surrounding observation area) did not present pre-existing, explosives contamination issues. No explosives were detected at any location. On June 8, 2000, a field reconnaissance of the entire Demo 2 area was conducted to investigate possible sources of RDX contamination that had recently been detected in groundwater associated with the site. Three pieces of C-4 explosive were discovered and removed, along with six inches of soil below each piece, Investigatory efforts continued in early 2001 to further explore additional sources of groundwater contamination. RDX was detected in one (i.e., 133T) of three soil sampling grids investigated (see Figure 7). Subsequent sampling was conducted to identify the nature and extent of contamination in soil and surrounding berm area. Detectable concentrations of several explosives (RDX, HMX, 2A-DNT and 4A-DNT) were found in soils collected from the berm area. RDX and HMX were the highest detected at 3,000 micrograms per kilogram (ug/kg) and 300J ug/kg, respectively,

As briefly discussed in Part I, Section D above, a Rapid Response Action (RRA) was conducted in 2004, to address those areas identified as potential sources of groundwater contamination during previous soil sampling and site investigation activities (Figure 8). A total of approximately 750 cubic yards of contaminated soil were excavated from previously discussed berm areas, soil piles, and sampling grid 133T and treated in an onsite, thermal treatment unit. A Completion of Work and Operable Unit Closure Report was issued in 2005, which documented the successful removal of explosives-contaminated soils associated with the Demolition Area 2 site. In correspondence issued on December 14, 2005, the EPA agreed, based on post-excavation sampling results collected under the RRA, that no further action was necessary to address soil contamination; however, the Demolition Area 2 site could not be removed from further consideration under the SDWA AOs, until a final decision for the groundwater operable unit was selected and implemented.

Groundwater Investigations and Results

Groundwater sampling activities at the Demolition Area 2 commenced during the 1997 Phase I investigation. Initially, a single (dual screen) monitoring well was installed to provide water quality data from both shallow (water table) and deep (bedrock interface) portions of the aquifer. RDX was first detected in December 2000, at the shallow monitoring point at concentrations ranging from non-detect to 2.5J ug/L. No other explosive compounds had been detected at either monitoring location upon conclusion of the Phase I investigation in 2001. Additional monitoring wells were installed as part of a subsequent, Phase IIb investigation, initiated to evaluate groundwater conditions downgradient of the Phase I monitoring well location. As result of consistent RDX detections in both Phase I and Phase IIb monitoring wells, Demolition Area 2 was removed from Phase IIb activities in 2003, and was designated a separate site warranting further investigation.

As of April 2007, groundwater data had been collected from 21 well screens (at 13 monitoring well locations) installed throughout and downgradient of the Demolition Area 2 site. Although several explosives, including HMX and picric acid, were sporadically identified in groundwater sample data, RDX was found most frequently, with confirmed detections in 13 (of 21) well screens and 10 (of 13) monitoring wells. The presence of RDX in groundwater is consistent with the observation that C-4, which is 90 percent RDX, was the primary explosive used at Demolition Area 2. A number of VOCs (i.e., acetone, toluene, chloroform, and pentachlorophenol), SVOCs (i.e., bis (2-ethylhexyl) phthalate and chloromethane), and metals (arsenic) were also detected, all at frequencies and concentrations unnecessary of further evaluation.

Northwest Corner

Soil Investigations and Results

Phase I and II Investigations conducted at the four gun positions (i.e., GP-12, GP-14, GP-16, and GP-19) from October 1997 through April 2002 (as part of the investigation of all GMPs), revealed low concentrations of explosive compounds in soils.

A perchlorate detection (1.9J ug/L) in an August 2001 groundwater sample collected near GP-16 was the impetus for a more focused investigation of perchlorate at GP-16 and the Northwest Corner area. This effort included the sampling of GP-16 soils for perchlorate analysis and the sampling of off-base private wells located to the west (cross gradient) of GP-16. The private wells to be sampled included a Community Water Supply Well and a decommissioned water supply well. In December 2002, perchlorate was detected in the decommissioned well at a concentration of 5.26 µg/L. As a result, investigation of the Northwest Corner expanded to include plume delineation and source characterization. Monitoring well installation and sampling, identification and sampling of off-base wells, and soil sampling were conducted to determine the extent of perchlorate in groundwater and soil in the Northwest Corner.

Subsequent soil sampling events were conducted in the Northwest Corner in June 2002, July 2003, September/October 2003, December 2003, and April 2008. The maximum detected perchlorate concentration of 7.56 milligrams per kilogram (mg/Kg) was collected from a sample location along Canal View Road (area associated with fireworks displays) in July 2003. Although this detection exceeded several screening levels (see Table 5-A), perchlorate is highly soluble and was not expected to persist in soil. This was supported by multi-increment sampling conducted in April 2008 that revealed very low residual concentrations in site soils (including those along Canal View Road) . Since there do not appear to be any existing sources of perchlorate in the Northwest Corner (the fireworks displays were discontinued after 2003 and perchlorate-containing pyrotechnics use was discontinued in 1997), and perchlorate appears to have been depleted in Northwest Corner soils, perchlorate in soils was not evaluated in the NWC FS. (Potential human health risks associated with compounds detected in soils associated with other sites, will be evaluated in their respective OU-specific, RI/FS Reports.)

Groundwater Investigations and Results

Two monitoring wells (both constructed with 3 well screens) were initially installed in the Northwest Corner to monitor groundwater quality downgradient of GP-14 and GP-16. None of the detections in groundwater samples associated with these wells were in excess of promulgated drinking water standards. In addition, no explosives compounds or perchlorate were detected.

Efforts to more fully characterize groundwater in the Northwest Corner consisted of identifying and sampling existing wells and installing additional monitoring wells to fill data gaps. Six residential wells, two commercial wells, twenty-five existing monitoring wells and one water supply well (abandoned in 2004) were identified within and downgradient of the Northwest Corner. A total of 45 new monitoring points were installed at 21 monitoring well locations and sampled for perchlorate. In addition, drivepoints were advanced at eight locations upgradient (i.e. southeast) of GP-19 to explore possible sources for the deep RDX contamination detected in several monitoring wells.

With the exception of two locations, RDX has been detected in portions of the aquifer deeper than the perchlorate plume which indicates two distinct, upgradient source areas (i.e., Former A Range and Central Impact Area). Further evaluation of these two sites as potential source areas will be performed as part of the Former A Range and Central Impact Area RI/FS's currently underway. As of May 2008, the highest concentrations of perchlorate and RDX detected in groundwater were 13.4 ug/L and 5.6 ug/L, respectively. Low level, sporadic detections of other analytes including VOCs (chloroform and benzene), SVOCs (benzoic acid, bis(2-ethlyhexyl)phthalate, diethyl phthalate, di-N-butyl phthalate), and metals (aluminum, antimony, arsenic, barium, boron, calcium, chromium, copper, iron, lead, manganese, magnesium, molybdenum, nickel, potassium, selenium, silver, sodium, vanadium and zinc) were also reported A more detailed summary of groundwater sampling activities and results is presented in the September 2009, NWC RI/FS Report.

Air Dispersion Modeling

Air dispersion modeling was also conducted to assess the location and distribution of particulate deposited from the fireworks bursts during the Independence Day fireworks events conducted from 1996 to 2003 at the Upper Cape Regional Technical School launch site in Bourne,

Massachusetts. The analysis was conducted to test the hypothesis that the location and distribution of particulate from the fireworks burst would be similar to the source area of the Northwest Corner shallow perchlorate plume. The modeled results show that particulate deposition generally decreases with the distance from the launch area, with relative particulate deposition rates decreasing sharply in the area immediately downgradient of the launch area and then diminishing more gradually to the north and east. This is also the pattern of perchlorate concentrations observed in the groundwater plume. The concentrations of perchlorate are highest on the southern half of the plume and past the midpoint of the plume and decrease more gradually with increased distance to the northeast (Figure 19).

Summary

Based on the investigation findings summarized above, it was determined that no further action was necessary with regards to soils at any of these sites. The Demolition Area 2 source area was previously remediated under a 2004 Rapid Response Action during which approximately 750 cubic yards of soil were removed from the berms, soil piles, and center of the cleared area. A Completion of Work Report was issued in 2005, documenting the successful completion of the Demolition Area 2 source area response action. In addition, existing soil data associated with the Demolition Area 2 site were evaluated by comparing the maximum concentration of each detected constituent to a series of risk-based screening criteria. (Table 4-A) The results of this screening process further support a no further action decision for Demolition 2 soils. Sporadic, declining concentrations of perchlorate detected in soils during the Western Boundary and Northwest Corner source area investigations revealed that further investigations or response actions are not warranted. The explosives results for the five areas investigated in the Western Boundary area were reported non-detect (with qualifiers due to matrix interferences during sample analyses) and, as such, require no further evaluation. In addition, the explosives detected in Northwest Corner soils will be evaluated as potential source areas in their respective, OU-specific investigations (e.g., Gun and Mortar Positions, Small Arms Range, and Central Impact Area RI/FS's).

Groundwater has been monitored at the Western Boundary since 1999 and at Demolition Area 2 and the Northwest Corner since 1997. Current perchlorate concentrations reported for the Western Boundary are relatively low, uniform, and sporadic for locations having previous

detections. A small perchlorate plume, which model predictions indicate has already achieved regulatory standards, was evaluated in the Western Boundary FS.

RDX was detected at Demolition Area 2 at levels up to 6.7 µg/L. The maximum RDX concentration as of March 2008 was 1.7 µg/L. This apparent downward trend of RDX concentrations within the plume was further evaluated in the Demolition Area 2 FS. At the Northwest Corner, perchlorate was detected in a shallow plume at concentrations up to 26.3 µg/L. RDX was detected in a small, shallow plume at low concentrations and a deeper, narrow plume at concentrations up to 15 µg/L. The maximum concentration as of May 2008 was 13.4 µg/L for perchlorate and 5.6 µg/L for RDX. These two compounds were carried forward for further evaluation in the Northwest Corner FS.

3. History of Relevant Federal and State Enforcement Activities

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

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

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

The MassDEP issued a Notice of Responsibility (NOR) dated May 13, 2003, to the Army/NGB due to the detection of perchlorate in a private drinking water well on Foretop Road in Bourne. The NOR advised the Army/NGB that the detection of perchlorate in a private residential well constituted a Condition of Substantial Release Migration (SRM) and a Critical Exposure Pathway (CEP) pursuant to 310 CMR 40.0000 et seq, the Massachusetts Contingency Plan (the "MCP"). The NOR required that the Army/NGB perform specified response actions to eliminate or mitigate the SRM and the CEP and established a deadline for completion of these mitigation measures. Subsequently, groundwater samples were collected from six residential wells (indoor and outdoor taps), two commercial supply wells, and a water supply well and analyzed for perchlorate and explosives. Based on the sample results, the frequency of sampling events at each of the water supply wells was increased until they could be disconnected and/or decommissioned. (Groundwater sampling results for these wells are provided in Table 4-7.of the September 2009, Final Northwest Corner RI/FS Report.)

C. COMMUNITY PARTICIPATION

Throughout the Sites' history, the IAGWSP, EPA and MassDEP have kept the community and other interested parties apprised of response activities at the Western Boundary, Demolition Area 2, and Northwest Corner sites through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach 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 Army, and MassDEP to hear first hand the concern of the public related to the ongoing investigation and cleanup effort at Camp Edwards. In 2007, this team was merged with the Plume Containment Team, the citizens' advisory team for the Air Force Center for Engineering & Environment's MMR Installation Restoration Program, and renamed the MMR Cleanup Team. The combined team meets regularly throughout the year to hear updates and provide public input on the MMR investigations and cleanup.

The IAGWSP also regularly briefs the Senior Management Board (SMB), which advises MMR organizations on environmental programs and policies. Members of the SMB include selectmen or their designated representative from the towns of Bourne, Falmouth, Mashpee, and

Sandwich and representatives from the EPA, MassDEP, Massachusetts Department of Public Health, Massachusetts National Guard, U.S. Coast Guard, and a representative from the Mashpee Wampanoag Tribe.

All IART, MMR Cleanup Team, and Senior Management Board meetings related to the Sites' 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 Sites began, through the present, the IAGWSP regularly presented updates on the investigation and response activities at the Sites. With respect to this Decision Document, the most important updates were:

- On January 14, 2009, an informational meeting was held at Camp Edwards, MA, to present the findings of the RI/FS reports for the Western Boundary, Demolition Area 2, and the Northwest Corner to the MMR Cleanup Team and the public. A display ad regarding the meeting was placed in the January 9, 2009 editions of the *Cape Cod Times* and *The Enterprise* newspapers and a news release regarding the meeting was sent to the local media on January 12, 2009.

- On September 16, 2009, an informational meeting was held at the Quality Inn in Bourne, MA, to describe the Remedy Selection Plan for the Western Boundary, Demolition Area 2, and the Northwest Corner. At the meeting, the IAGWSP gave a presentation on the Sites and the Remedy Selection Plan, and the EPA presented the proposed response and answered questions from the MMR Cleanup Team. The IAGWSP notified the public of the meeting and announced the public comment period in a display ad placed in the September 18, 2009 editions of the *Cape Cod Times* and *The Enterprise* newspapers. These ads also announced the September 30, 2009 public meeting, and included a reminder of the public comment period.

- From September 16, 2009 through October 15, 2009, a Public Comment Period was held on the Remedy Selection Plan for the Western Boundary, Demolition Area 2, and the Northwest Corner. 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 repository contains documents on the Western Boundary, Demolition Area 2, and the Northwest Corner investigations and findings supporting selection of the response action including the RI/FS reports for the Western Boundary, Demolition Area 2, and the Northwest Corner, along with other relevant documents. The Remedy Selection Plan also was made available on the IAGWSP Web site, which also contains the supporting documents and which offered a means of submitting public comments on the Remedy Selection Plan. In addition, the IAGWSP mailed copies of the Remedy Selection Plan to MMR Cleanup Team members and distributed it to individuals in attendance at the public meeting and public hearing.

- On September 30, 2009, a Public Information Session and Public Hearing was held on the Remedy Selection Plan for the Western Boundary, Demolition Area 2, and the Northwest Corner in Bourne, MA. The public information session, along with a presentation on the Remedy Selection Plan and EPA's proposed response, was held prior to the opening of the public hearing. Local residents and officials, news media representatives, and members of the public interested in site activities and cleanup decisions were invited to attend both meetings. Representatives from EPA, MassDEP and IAGWSP were available to answer questions. The IAGWSP notified the public of the September 30, 2009 information session and public hearing, and reminded them about the public comment period in a display ad placed in the September 25, 2009 editions of the *Cape Cod Times* and *The Enterprise* newspapers. Comments received during the Public Comment Period for the Remedy Selection Plan for the Western Boundary, Demolition Area 2, and the Northwest Corner were compiled and answered in the Responsiveness Summary included in Part III of this document.

All draft and final reports related to the Sites' investigation and response activities were made available through the Information Repository at the public libraries in Bourne, Falmouth, and Sandwich, MA. These documents also were made available to the public through the IAGWSP

Web site: groundwaterprogram.army.mil (formerly www.groundwaterprogram.org.) and the Administrative Record at 1803 West Outer Road, Camp Edwards, MA.

Media releases on presentations and Public Comment Periods for the Sites 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 Sites' investigation and response activities. General fact sheets pertaining to the IAGWSP investigations and findings and on related issues, such as the contaminants of concern, were also published and distributed.

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

D. SCOPE AND ROLE OF OPERABLE UNITS

All three sites consist of soil (i.e., source area) and groundwater operable units. The source area for Demolition Area 2 was removed in 2004 and the source areas evaluated in the Western Boundary and the Northwest Corner investigations appear to be depleted. Therefore, the remedy decision process included in this Decision Document is limited to groundwater,

As mentioned above in Section B.1, History of Site Activities, several sites were excluded from detailed evaluation as potential source areas in the Western Boundary, Demolition 2 and Northwest Corner operable units because they are the focus of separate, OU-specific investigations (i.e., Gun and Mortar Position RI, Small Arms Range RI, and Central Impact Area RI).

E. SITE CHARACTERISTICS

Site Geology

The geology of Western Cape Cod comprises glacial sediments deposited during the retreat of the Wisconsin stage of glaciation. Three extensive sedimentary units dominate the regional

geology: the Buzzards Bay Moraine, the Sandwich Moraine, and the Mashpee Pitted Plain. These moraines form hummocky ridges. The Mashpee Pitted Plain, which consists of fine- to coarse-grained sands forming a broad outwash plain, lies south and east of the two moraines. Underlying the Mashpee Pitted Plain are fine-grained, glaciolacustrine sediments and basal till at the base of the unconsolidated sediments.

- The Western Boundary plume is located in the Buzzards Bay Moraine. Subsurface lithology at the Western Boundary sites is dominated by varying compositions of fine, medium and coarse sand with occasional gravels.

- The Demolition Area 2 plume is located where the Buzzards Bay Moraine adjoins the Sandwich Moraine. At Demolition Area 2 the subsurface lithology is consistent with descriptions of Sandwich Moraine soils - generally consisting of gravel, sand, silt and clay with locally poorly to moderately sorted sand and gravel.

- The Northwest Corner plume is located in the Buzzards Bay Moraine. The Northwest Corner is characterized by the steepest and most irregular terrain at MMR; relief across the site is more than 50 feet. The Buzzards Bay Moraine is characterized by an abundance of boulders on the surface, and is comprised of sand, silt and clay, and scattered gravel in a compacted, unsorted matrix.

Site Hydrogeology

A single groundwater-flow system underlies Western Cape Cod, including the MMR. Camp Edwards lies over the Sagamore Lens, which is part of the larger Cape Cod Aquifer. The primary source of natural fresh water recharge to this groundwater system is rainfall and snow-melt water. Additional water is returned to the aquifer as wastewater from domestic septic systems. Municipal sewer systems at the MMR and in parts of Falmouth return treated wastewater to the groundwater flow system through infiltration beds at the sewage treatment facilities. Wastewater return flow accounts for approximately 5 percent of the total groundwater recharge in the MMR region.

The high point of the water table within the Western Cape Cod groundwater system occurs as a groundwater mound located beneath the east central portion of MMR. Groundwater flows radially outward: north to either the Cape Cod Canal or the Cape Cod Bay, east to the Bass River, south and southeast to Nantucket Sound, and west and southwest to Buzzards Bay. Groundwater at the Western Boundary generally flows from east to west (Figure 4). Groundwater from Demolition Area 2 generally flows south to north (Figure 9), and groundwater from the Northwest Corner generally flows southeast to northwest (Figure 19).

The height of the water table in and around MMR can fluctuate up to seven feet annually due to seasonal variations in groundwater recharge. Groundwater levels are highest in the spring when recharge rates are high and lowest in the late summer/early autumn when rainfall is minimal. 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.

Surface water resources are sparse on Camp Edwards. No large lakes, rivers, or streams exist on the property, only small marshy wetlands and ponds. Most of the wetlands and surface waters in the Sandwich and Buzzards Bay Moraines on Camp Edwards are considered to be perched. Surface water is present at MMR in a few ponds in kettle holes. The kettle hole ponds are land-surface depressions that generally extend below the water table. Where these kettle holes do not extend down to the water table, they are merely surface depressions. Larger and deeper ponds have greater effect on slope and direction of the regional water table near the pond. While horizontal groundwater flow is dominant in the aquifer system, vertical flow is important in areas near ponds and near the top of the groundwater mound for the Sagamore Lens aquifer.

Movement of Contaminants in Groundwater

Two COCs are present in groundwater at the Sites: RDX (Demolition Area 2 and Northwest Corner) and perchlorate (Western Boundary and Northwest Corner). 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 will move generally 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 estimated volume and mass of the plumes at the Western Boundary, Demolition Area 2, and the Northwest Corner are presented below.

Site	COC	Estimated Volume (Gallons)	Estimated Mass (Pounds)
Western Boundary	Perchlorate	57,072,400	0.95
Demolition Area 2	RDX	91,000,000	1.07
Northwest Corner	Perchlorate	857,000,000	29.5
	RDX	145,000,000	1.7

Current Exposure Pathways

No one is currently believed to be drinking water (related to the Western Boundary, Demolition Area 2, or the Northwest Corner sites), that contains COCs at concentrations that exceed applicable drinking water standards, health advisories, and/or risk-based levels.

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 Western Boundary, Demolition Area 2, and Northwest Corner 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 Sites, have been set aside as a drinking water supply reserve by the Massachusetts legislature.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The portions of the Western Boundary, Demolition Area 2, and the Northwest Corner sites that are located on the MMR itself are designated as active military training areas. It is anticipated that these sites will remain under the control and direction of government agencies and will continue to be used for military training and support purposes until 2052 (and perhaps longer). The area also is designated as a water and wildlife preserve by Chapter 47 of the Massachusetts Acts of 2002. Areas of the Northwest Corner that lie between the installation boundary and the Cape Cod Canal are used for residential, commercial and industrial purposes The Sites overlay portions of a sole source aquifer that is a valued water supply for the upper portion of Cape Cod. The Land Use Controls (described in Section K below) 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.

G. SUMMARY OF SITE RISKS

A Human Health Risk Screening was prepared for each of the Sites (see Tables 3 (A & B), 4 (A & B), and 5 (A & B).) The objective of the risk screening was to identify any contaminants that required further evaluation in the site-specific FS.

Constituents detected in soil samples were evaluated by comparing the maximum concentration of each detected constituent to a series of risk-based criteria. Post-excavation soil sampling results for the Demolition 2 site were all non-detect for RDX and other residual explosives. Sporadic, declining concentrations of perchlorate were detected during the Western Boundary and Northwest Corner source area investigations. The explosives results for the five areas investigated in the Western Boundary area were reported non-detect (with qualifiers due to matrix interferences during sample analyses). Explosives detected in Northwest Corner soils will be evaluated as potential source areas in their respective, OU-specific investigations (e.g., GMPs, SAR, and CIA RI/FS's). As a result of this screening process and the subsequent

analysis of the anticipated leaching behavior of the constituents that were highlighted by the screening, only perchlorate was projected to reach groundwater in a timeframe that would commingle with the Northwest Corner plume.

Other factors considered in the screening evaluation were whether the constituent was an essential human nutrient, the frequency of detection of that constituent in the samples, and documented prior false positive analytical results. The results of this screening identified groundwater containing the COCs (perchlorate at Western Boundary, RDX at Demolition Area 2, and perchlorate and RDX at Northwest Corner), in excess of federal Maximum Contaminant Levels (MCLs), Health Advisories (HA), Drinking Water Equivalent Levels (DWELs), applicable State standards or unacceptable excess lifetime cancer risk or non-cancer Hazard Index (HI).

The baseline risk screenings revealed that there are believed to be no existing exposure routes for human receptors, and no one is currently believed to be drinking groundwater associated with the Western Boundary, Demolition Area 2, or Northwest Corner sites that contains COCs above current drinking water standards, health advisories, and/or risk-based levels. A potential future exposure pathway exists through development and consumption of groundwater resources in the area downgradient from the Sites. Since groundwater contamination has been detected (depending on the specific site and the specific COC) above drinking water regulatory standards, health advisories, and/or risk-based levels, unacceptable human health risks could occur if future exposures occur. However, as noted above, land use controls will prevent the installation of water wells that could provide a pathway for ingestion of drinking water that contains COCs in concentrations that exceed applicable drinking water standards, health advisories, and/or risk-based levels.

H. RESPONSE ACTION OBJECTIVES FOR GROUNDWATER

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives were developed to aid in the development and screening of alternatives. The response action objectives for the selected Western Boundary, Demolition Area 2, and Northwest Corner alternatives are: to restore the useable groundwater to its beneficial use wherever practicable within a timeframe that is reasonable given the particular circumstances of the site; to provide a level of protection in the

aquifer that takes into account that the Cape Cod Aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent ingestion and inhalation of groundwater containing COCs (RDX and/or perchlorate) in excess of federal maximum contaminant levels, Health Advisories, drinking water equivalent levels (DWELs), applicable State standards and/or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES FOR GROUNDWATER

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

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

A range of alternatives from no action to focused extraction were developed specifically for groundwater in consideration of the response action objectives described in Part II.H above. The range of alternatives did not consider further soil remediation or control since no further contribution from soil to groundwater contamination is expected at any of the source areas

investigated. (The Demolition Area 2 source area was successfully remediated during a 2005 RRA and the source areas evaluated in the Western Boundary and Northwest Corner RI/FS's appeared to be depleted.) As previously discussed, however, there are several OU-specific investigations currently underway that will further evaluate suspected source areas located within the Northwest Corner and Western Boundary sites in separate, OU-specific RI/FS's. Other alternatives utilizing one or more different technologies were not included because, for the circumstances of these operable units, would not provide superior performance or implementability, fewer or less adverse impacts, or lower costs for similar levels of performance, than the two alternatives evaluated.

Three alternatives were developed to address the response action objectives discussed in Part II.H. above and to meet the requirements set forth in the AO3. Each of the alternatives reduces the contaminant concentrations to background conditions. In addition, each alternative reduces the contaminant concentrations to levels that meet or exceed all regulatory and risk-based standards in 10 years or less.

- Alternative 1 – No Action
- Alternative 2 – Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs)
- Alternative 3 – Focused Extraction (with MNA and LUCs)

For each of the three sites, at least one alternative included both long-term groundwater monitoring (to confirm model predictions and achievement of cleanup goals) and monitoring of LUCs (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 LUCs will be conducted annually by the Army and results will be included in a separate report or as section of another report, if appropriate, and submitted annually to the regulatory agencies. The annual monitoring report will evaluate the status of the LUCs and how any LUC deficiencies or inconsistent uses have been addressed. (The annual monitoring report prepared for the Northwest Corner will also include a discussion of the efforts undertaken to complete the tasks outlined in Section K (Land Use Controls/*Private Wells*)). 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 provide a useful framework for evaluating response alternatives. The threshold criteria include the protection of human health and the environment and compliance with regulations. These criteria must be met by the remedy. The balancing criteria include the long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short-term effectiveness, implementability, and cost. Modifying criteria include state and community acceptance of the selected remedy. These criteria were modeled on those used under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Contingency Plan (NCP).

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

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

- Short-term effectiveness.
- Implementability.
- Cost.
- State acceptance.
- Community acceptance.

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

1. Western Boundary

Description of Alternatives

Alternative 1 - No Action: Alternative 1 provides for no further action to address any remaining groundwater contamination at the Western Boundary. Under this alternative:

- No active groundwater treatment would occur.
- Model predictions could not be verified due to discontinued groundwater sampling/analysis and abandonment of existing monitoring wells.
- Site close-out documentation would be completed.
- Land use controls would not be implemented to ensure against exposure until cleanup is achieved
- The total cost of Alternative 1 is estimated to be $278,000.
- Contamination within the plume is believed to have already dropped below the 2 µg/L MMCL for perchlorate and is expected to reach the 0.35 µg/L background level by 2017.

Alternative 2 - Monitored Natural Attenuation and Land Use Controls: Alternative 2 would provide optimized monitoring of Western Boundary groundwater to confirm model predictions that the plume has attenuated to (and remains below) cleanup levels. Under this alternative:

- A long-term groundwater monitoring program would be implemented and optimized yearly as the plume attenuates.

- Land use controls would be implemented to prevent use of contaminated portions of the aquifer for drinking water.
- Monitoring, reporting and site close-out documentation would be completed.
- Monitoring wells would be abandoned approximately three years after remedial goals are achieved.
- The total cost of Alternative 2 is estimated to be $343,000.
- Contamination within the plume is believed to have already dropped below the 2 µg/L MMCL for perchlorate and is expected to reach the 0.35 µg/L background level by 2017.

Summary of the Comparative Analysis of Alternatives

The following discussion summarizes the strengths and weaknesses of each response action alternative identified for the Western Boundary with respect to the nine criteria:

Overall Protection of Human Health and the Environment: Alternative **1** provides the least protection of human health and the aquifer because it does not contain any land use controls to ensure that future exposure (use of aquifer as a drinking water source) does not occur, or groundwater monitoring to confirm that perchlorate concentrations are or will be below regulatory standards. Alternative 2 adds provisions for plume monitoring to confirm model predictions and land use controls to prevent exposure to contaminated groundwater above state and federal drinking water standards.

Compliance with Regulations: The two alternatives are expected to eventually result in compliance with applicable regulations. Alternatives 1 and 2 would meet chemical-specific regulations when contaminant concentrations decrease below the cleanup standards. Alternative 2 includes monitoring to confirm that this occurs; Alternative 1 does not. Alternative 2 would comply with location- and action-specific regulations. Alternative 1 involves no action so no location- or action-specific requirements apply.

Long-Term Effectiveness and Permanence: Both alternatives are expected to provide long-term effectiveness and permanence. Both are predicted to reduce perchlorate concentrations to below 2 µg/L through natural attenuation processes. Because no further contribution from the source is likely, both alternatives are expected to be permanent.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives 1 and 2 are not treatment alternatives and, therefore; would not actively reduce toxicity, mobility or volume through treatment. However, the toxicity and volume of the contaminated groundwater is expected to be reduced through natural processes.

Short-Term Effectiveness: Short-term effectiveness would be similar for the two alternatives because the cleanup time frames are relatively short. Alternative 1 would have the least impact on the community or workers because construction is minimal. Alternative 2 would have some relatively minor short-term impacts associated with continuation of the groundwater monitoring program.

Implementability: Both alternatives are readily implementable.

Cost: Alternative 1- No Action is the least expensive alternative with a total estimated cost of $278,000. Alternative 2 – Monitored Natural Attenuation and Land Use Controls is the next least expensive alternative with a total estimated cost of $343,000.

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

Community Acceptance: Comments were received from five members of the public as part of the public comment period on the Remedy Selection Plan for the Western Boundary, Demolition Area 2, and the Northwest Corner. Based on the comments received on the Remedy Selection Plan, three citizens supported Alternative 2 – Monitored Natural Attenuation and Land Use Controls for Western Boundary and Demolition Area 2. Of those three citizens, two supported Alternative 2 for Northwest Corner and one supported Alternative 1 – No Action for Northwest Corner. Of the remaining two commenters, the Cape Cod and Islands Group of the Sierra Club indicated its opposition to MNA with LUCs as a matter of policy and as a remedial strategy for

groundwater at the Sites and a member of the MMRCT had a number of questions as well. See "Part III: The Responsiveness Summary" for more details.

The Selected Response Action

For the reasons set forth herein, EPA has identified Alternative 2 - Monitored Natural Attenuation and Land Use Controls as the appropriate response action for the Western Boundary site. This alternative, as presented in the feasibility study, provides the best balance of the criteria used to evaluate cleanup alternatives.

This alternative achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the Western Boundary site are correct and that any residual contamination remains below risk-based levels. Human health will be further protected through the implementation and verification of land use controls. These controls will prevent use of contaminated portions of the aquifer at the Western Boundary for drinking water until it is clear that contamination is reduced to below regulatory standards. In addition to continued groundwater monitoring and use of LUCs, the Army shall review this selected remedy every five years for purposes of evaluating the appropriateness of the remedy in providing adequate protection of human health.

The Monitored Natural Attenuation and Land Use Controls remedy includes:

- A long-term groundwater monitoring program that will be optimized yearly as the plume attenuates.
- Land-use controls to prevent use of contaminated portions of the aquifer for drinking water.
- Monitoring, reporting and site close-out documentation.
- Monitoring well abandonment approximately three years after remedial goals are achieved.

2. Demolition Area 2

Description of Alternatives

Alternative 1 - No Further Action: Alternative 1 provides no further action to address any remaining groundwater contamination at Demolition Area 2. Under this alternative:

- No active groundwater treatment would occur.
- Model predictions could not be verified due to discontinued groundwater sampling/analysis and abandonment of existing monitoring wells.
- Site close-out documentation would be completed.
- Land use controls would not be implemented to ensure against exposure until cleanup is achieved
- The cost of Alternative 1 is estimated to be $140,000.
- RDX concentrations are expected to drop below the 2 µg/L Health Advisory by 2011, the 0.6 µg/L 10^{-6} risk-based level by 2013 and background levels (0.25 µg/L) by 2021.

Alternative 2 - Monitored Natural Attenuation and Land Use Controls: Alternative 2 would provide optimized monitoring of Demolition Area 2 groundwater to confirm model predictions that the plume has attenuated to (and remains below) cleanup levels. Under this alternative:

- A long-term groundwater monitoring program would be implemented and optimized yearly as the plume attenuates.
- Two groundwater monitoring well clusters would be installed downgradient of the plume.
- Land use controls would be implemented to prevent use of contaminated portions of the aquifer for drinking water.
- Monitoring, reporting and site close-out documentation would be completed.
- Monitoring wells would be abandoned approximately three years after remedial goals are achieved.
- The cost of Alternative 2 is estimated to be $790,000.
- RDX concentrations are expected to drop below the 2 µg/L Health Advisory by 2011, the 0.6 µg/L 10^{-6} risk-based level by 2013 and background levels (0.25 µg/L) by 2021.

Alternative 3 - Focused Extraction (w/MNA and LUCs): Alternative 3 provides for extraction and treatment of the groundwater. Under this alternative:

- A 100-gallon-per-minute pump and treat system would be installed consisting of:
  - One extraction well, one reinjection well, a modular treatment unit and associated pipeline and power networks.
  - Granular activated carbon containers to remove contaminants
- A groundwater monitoring well cluster would be installed downgradient of the plume.

- A long-term groundwater monitoring plan would be implemented and optimized as required.
- Land use controls would be implemented to prevent use of contaminated portions of the aquifer for drinking water.
- Monitoring, reporting and site close-out documentation would be completed.
- Monitoring wells would be abandoned approximately three years after remedial goals are achieved.
- The cost of Alternative 3 is estimated to be $3,720,000.
- RDX concentrations are expected to drop below the 2 µg/L Health Advisory by 2010, the 0.6 *µg/L 10^{-6} risk-based level by 2012 and background levels (0.25 µg/L) by 2016.*

Summary of the Comparative Analysis of Alternatives

The following discussion summarizes the strengths and weaknesses of each response action alternative identified for Demolition Area 2 with respect to the nine criteria:

Overall Protection of Human Health and the Environment: Alternative 1 provides the least protection of human health and the aquifer because it does not contain any land use controls to ensure that future exposure (use of aquifer as a drinking water source) does not occur, or groundwater monitoring to confirm that RDX concentrations are or will be below regulatory standards. Alternatives 2 and 3 add provisions for plume monitoring to confirm model predictions and land use controls to prevent exposure to contaminated groundwater above state and federal drinking water standards, health advisories, and/or risk-based levels.

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

Long-Term Effectiveness and Permanence: All alternatives are expected to provide long-term effectiveness and permanence. All are predicted to reduce RDX concentrations to below risk-

based standards. Because no further contribution from the source is likely, all alternatives are expected to be permanent.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives 1 and 2 are not treatment alternatives and, therefore, would not actively reduce toxicity, mobility, or volume through treatment. However, the toxicity and volume of the contaminated groundwater is expected to be reduced through natural processes. Alternative 3 would remove approximately 0.5 pounds of RDX from the groundwater through treatment.

Short-Term Effectiveness: Short-term effectiveness would be similar for the three alternatives because the cleanup time frames are relatively short (five to six years). Alternative 1 would have the least impact on the community or workers because construction is minimal. Alternative 2 would have some relatively minor short-term impacts associated with the installation of two downgradient monitoring well clusters and continuation of the groundwater monitoring program. Alternative 3 would have the greatest impact on the community and environment because of the construction involved.

Implementability: None of the alternatives are limited by administrative or technical feasibility. Alternative 1 is the most easily implemented alternative as it requires no further action. Alternative 3 is the most difficult because it includes the installation of wells, a treatment system and over one mile of new power lines.

Cost: Alternative 1: No Further Action is the least expensive alternative with a total estimated cost of $140,000. Alternative 2 – Monitored Natural Attenuation and Land Use Controls is the next least expensive alternative with a total estimated cost of $790,000. Alternative 3 - Focused Extraction (w/ MNA and LUCs) is the most expensive alternative with a total estimated cost of $3,720,000.

State Acceptance: This criterion is continually evaluated as the 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 five members of the public as part of the public comment period on the Remedy Selection Plan for the Western Boundary, Demolition Area 2, and the Northwest Corner. Based on the comments received on the Remedy Selection Plan, three citizens supported Alternative 2 – Monitored Natural Attenuation and Land Use Controls for Western Boundary and Demolition Area 2. Of those three citizens, two supported Alternative 2 for Northwest Corner and one supported Alternative 1 – No Action for Northwest Corner. Of the remaining two commenters, the Cape Cod and Islands Group of the Sierra Club indicated its opposition to MNA with LUCs as a matter of policy and as a remedial strategy for groundwater at the Sites and a member of the MMRCT had a number of questions as well. See "Part III: The Responsiveness Summary" for more details.

The Selected Response Action

For the reasons set forth herein, EPA has identified Alternative 2 – Monitored Natural Attenuation and Land Use Controls as the appropriate response action for Demolition Area 2. This alternative, as presented in the feasibility study, provides the best balance of the criteria used to evaluate cleanup alternatives.

This alternative achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the Demolition Area 2 site are correct and that any residual contamination remains below risk-based levels. Human health will be further protected through the implementation and verification of land use controls. These controls will prevent use of contaminated portions of the aquifer at Demolition Area 2 for drinking water until it is clear that contamination is reduced to below regulatory standards. In addition to continued groundwater monitoring and use of LUCs, the Army shall review this selected remedy every five years for purposes of evaluating the appropriateness of the remedy in providing adequate protection of human health. The Monitored Natural Attenuation and Land Use Controls remedy includes:

- Two additional monitoring well clusters to monitor groundwater migrating north (e.g. downgradient).

- A long-term groundwater monitoring program that will be optimized yearly as the plume attenuates.
- Land use controls to prevent use of contaminated portions of the aquifer for drinking water.
- Monitoring, reporting and site close-out documentation.
- Well abandonment approximately three years after remedial goals are achieved.

3. Northwest Corner

Description of Alternatives

Alternative 1 - No Action: Alternative 1 provides for no further action to address any remaining contamination at the Northwest Corner plume. Under this alternative:

- No active groundwater treatment would occur.
- Model predictions could not be verified due to discontinued groundwater sampling/analysis and abandonment of existing monitoring wells.
- Site close-out documentation would be completed.
- Land use controls would not be implemented to ensure against exposure until cleanup is achieved
- The cost of Alternative 1 is estimated to be $150,000.
- Contamination within the broad perchlorate plume is expected to drop below the 2 µg/L MMCL by 2012 and the 0.35 µg/L background level by 2019. Contamination within the narrow RDX plume is expected to drop below the 2 µg/L health advisory by 2012, the 0.6 µg/L 10^{-6} risk-based level by 2022, and the 0.25 µg/L background level by 2044.

Alternative 2 - Monitored Natural Attenuation and Land Use Controls: Alternative 2 would provide optimized monitoring of Northwest Corner groundwater to confirm model predictions that the plume has attenuated to (and remains below) cleanup levels. Under this alternative:

- A long-term groundwater monitoring program would be implemented and optimized yearly as the plume attenuates.
- Land use controls would be implemented to prevent use of contaminated portions of the aquifer for drinking water.
- Monitoring, reporting and site close-out documentation would be completed.

- Monitoring wells would be abandoned approximately three years after remedial goals are achieved.
- The cost of Alternative 2 is estimated to be $1,198,000.
- Contamination within the broad perchlorate plume is expected to drop below the 2 µg/L MMCL by 2012 and the 0.35 µg/L background level by 2019. Contamination within the narrow RDX plume is expected to drop below the 2 µg/L health advisory by 2012, the 0.6 µg/L 10^{-6} risk-based level by 2022, and the 0.25 µg/L background level by 2044.

Alternative 3 - Focused Extraction: Alternative 3 provides for extraction and treatment of the groundwater. Under this alternative:

- A 300 gallon per minute pump and treat system would be installed to capture the highest concentrations of contamination in the plume. It would consist of:
  - Three 100 gpm extraction wells; one along Route 6A, one on the MMR boundary along Canal View Road, and one in the Port-of-Call neighborhood, between Canal View Road and the Cape Cod Canal
  - Three granular activated carbon and ion-exchange resin modular treatment units to remove contaminants
  - A reinjection system, consisting of three new injection wells, to return treated water to the aquifer
  - 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 use of contaminated portions of the aquifer for drinking water.
- Monitoring, reporting and site close-out documentation would be completed.
- Monitoring wells would be abandoned approximately three years after remedial goals are achieved.
- The cost of Alternative 3 is estimated to be $9,789,000.
- Contamination within the broad perchlorate plume is expected to drop below the 2 µg/L MMCL by 2012 and the 0.35 µg/L background level by 2019. Contamination within the narrow RDX plume is expected to drop below the 2 µg/L health advisory by 2012, the 0.6 µg/L 10^{-6} risk-based level by 2020, and the 0.25 µg/L background level by 2020.

Summary of the Comparative Analysis of Alternatives

The following discussion summarizes the strengths and weaknesses of each response action alternative identified for the Northwest Corner with respect to the nine criteria:

Overall Protection of Human Health and the Environment: Alternative 1 provides the least protection of human health and the aquifer because it does not contain any land use controls to ensure that future exposure (i.e., use of the aquifer as a drinking water source) does not occur, or groundwater monitoring to confirm model predictions and ensure that RDX and perchlorate concentrations are or will be below regulatory standards. Alternatives 2 and 3 add provisions for long-term groundwater monitoring to confirm model predictions and land use controls to prevent exposure to contaminated groundwater above state and federal drinking water standards..

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

Long-Term Effectiveness and Permanence: All alternatives are expected to provide long-term effectiveness and permanence. All are predicted to reduce perchlorate and RDX concentrations to below regulatory standards. Because no further contribution from the source is likely, all alternatives are expected to be permanent.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives 1 and 2 are not treatment alternatives and, therefore, would not actively reduce toxicity, mobility, or volume through treatment. However, the toxicity and volume of the contaminated groundwater is expected to be reduced through natural processes. Based on model predictions, the RDX plume and perchlorate plume will contain 1.3 lbs of mass and 6.7 lbs of mass, respectively, at

the time of system startup in 2010. Alternative 3 would remove a majority of the RDX mass and a small percentage of the perchlorate mass through treatment.

Short-Term Effectiveness: Short-term effectiveness would be similar for the three alternatives because the time frames to achieve risk-based levels are all within 3 years for perchlorate and 11 to 13 years for RDX. Alternative 1 would have the least impact on the community and workers because construction is minimal. Alternative 2 would have some relatively minor short-term impacts associated with continuation of the groundwater monitoring program. Alternative 3 would have the greatest impact on the community and environment because of the construction involved.

Implementability: Alternative 1 and Alternative 2 are readily implementable. Alternative 3 could have implementability issues associated with off-site groundwater extraction. Property access problems could develop in locating three extraction wells, treatment facilities and associated piping within a densely developed off-site area.

Cost: Alternative 1 - No Further Action is the least expensive alternative with a total estimated cost of $150,000. Alternative 2 - Monitored Natural Attenuation and Land Use Controls is the next least expensive alternative with a total estimated cost of $1,198,000. Alternative 3 - Focused Extraction (with MNA and LUCs) is the most expensive alternative with a total estimated cost of $9,789,000.

State Acceptance: This criterion is continually evaluated as the 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 five members of the public as part of the public comment period on the Remedy Selection Plan for the Western Boundary, Demolition Area 2, and the Northwest Corner. Based on the comments received on the Remedy Selection Plan, three citizens supported Alternative 2 – Monitored Natural Attenuation and Land Use Controls for Western Boundary and Demolition Area 2. Of those three citizens, two supported Alternative 2 for Northwest Corner and one supported Alternative 1 – No Action for Northwest Corner. Of the remaining two commenters, the Cape Cod and Islands Group of the Sierra Club

indicated its opposition to MNA with LUCs as a matter of policy and as a remedial strategy for groundwater at the Sites and a member of the MMRCT had a number of questions as well. See "Part III: The Responsiveness Summary" for more details.

The Selected Response Action

For the reasons set forth herein, EPA has identified Alternative 2 - Monitored Natural Attenuation and Land Use Controls as the appropriate response action for the Northwest Corner. This alternative, as presented in the feasibility study provides the best balance of the criteria used to evaluate cleanup alternatives.

This alternative achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the Northwest Corner are correct and that any residual contamination remains below risk-based levels. Human health will be further protected through the implementation and verification of land use controls. These controls will prevent use of contaminated portions of the aquifer at the Northwest Corner for drinking water until it is confirmed that contamination is reduced to below risk-based standards (i.e., 2 ug/L for perchlorate and 0.6 ug/L for RDX). In addition to continued groundwater monitoring and use of LUCs, the Army shall review this selected remedy every five years for purposes of evaluating the appropriateness of the remedy in providing adequate protection of human health.

The Monitored Natural Attenuation and Land Use Controls alternative includes:

- A long-term groundwater monitoring program that will be optimized yearly as the plume attenuates.
- Land use controls to prevent use of contaminated portions of the aquifer for drinking water.
- Monitoring, reporting and site close-out documentation.
- Well abandonment approximately three years after remedial goals are achieved.

K. RESPONSE ACTION IMPLEMENTATION

Plume Monitoring

At each of the three Sites, the cleanup goals will be achieved through 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 that will be developed for the Western Boundary, Demolition Area 2, and Northwest Corner sites. Optimization changes will be documented in the periodic monitoring reports.

Currently, only the Northwest Corner plume has been detected off-post at concentrations exceeding cleanup standards. The Western Boundary and Demolition Area 2 plumes are located on-post and are expected to dissipate through natural attenuation processes prior to reaching the MMR boundary. 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 Western Boundary, Demolition Area 2, and/or Northwest Corner RI/FS's, the Army will conduct a detailed analysis to determine, as accurately as possible, the extent of the deviation(s), including whether the plume in question might migrate off-base at concentrations exceeding cleanup standards. If EPA, in consultation with MassDEP, determines based on the results of the detailed analysis, that significant changes to the response actions described in this Decision Document are warranted, such changes will 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 Massachusetts Maximum Contaminant Level (MMCL).

Land Use Controls

Contaminated groundwater at each of the Sites 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" (LUCs), must be established to avoid the risk of exposure to contaminated

groundwater above regulatory standards, health advisories, and/or risk-based levels from the Western Boundary, Demolition Area 2, and Northwest Corner Sites. The LUCs are needed until the groundwater contamination no longer poses an unacceptable risk.

The performance objectives of the LUCs are to:

- Prevent access to or use of the groundwater from the Western Boundary, Demolition Area 2 or Northwest Corner plume areas until the groundwater no longer poses an unacceptable risk, and

- Maintain the integrity of any current or future groundwater monitoring systems such as monitoring wells.

The LUCs will be implemented in the areas encompassing the Western Boundary, Demolition Area 2, and Northwest Corner contaminated groundwater and surrounding areas to prevent risks from exposure to contaminated groundwater (Figures 5, 10, and 20, respectively). 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 three Sites 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 LUCs for the Sites. While contaminated groundwater is not expected to migrate past the MMR boundary at concentrations above regulatory standards, health advisories, and/or risk-based levels at the Western Boundary or Demolition Area 2 sites, the Northwest Corner contamination has migrated off-post. Although all homes in the area have been connected to town water, an additional land use control will be necessary within the Town of Bourne for the downgradient portion of the Northwest Corner site.

Each land use control will be maintained until either (1) the concentrations of RDX and/or perchlorate in the groundwater are at levels that allow for unrestricted use and unlimited exposure, or (2) the Army, with the prior approval of the EPA, in consultation with MassDEP, modifies or terminates the land use control in question.

Specific Land Use Controls

The Army is responsible for ensuring that the following land use controls are established, monitored, maintained, reported on, and enforced as part of this final remedy to ensure protection of human health in accordance with SDWA § 1431(a) for the duration of the final remedies selected in this Decision Document. The Town of Bourne has enforcement authority regarding the first land use control, which is applicable to the off-base portion of the Northwest Corner site. The Commonwealth of Massachusetts has enforcement authority regarding the second land use control, which applies to all sites. 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 portions of all three sites. The Air Force has enforcement authority regarding the fifth land use control, which is applicable to the on-base portions of all three sites.

1. The Bourne Board of Health requires a permit for the installation and use of all wells, including drinking water wells, irrigation wells, and monitoring wells. If a permit to install a drinking water well is approved, the Bourne Board of Health will not approve the use of that well until its water has been tested and the Board of Health has determined that the water is potable. The Bourne Board of Health Water Well Regulations do not apply to use of existing drinking water wells and irrigation wells. To assist the Town of Bourne in the implementation of this land use control, the Army will meet with the Bourne 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 Northwest Corner plume within the town of Bourne. While Figure 20 shows the current area of land use controls in the town, the Bourne 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 Bourne Board of Health regulations, which generally apply to small water supply wells, existing land use controls also prevent the possible creation of a large potable water supply well. The MassDEP

administers a permitting process for any new drinking water supply wells in Massachusetts that propose to service more than 25 customers or exceed a withdrawal rate of 100,000 gallons per day. This permitting process, which serves to regulate the use of the Western Boundary, Demolition Area 2, and Northwest Corner 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 Guards (major tenants at the MMR). The prohibition will be applied to future land-use planning per Massachusetts Air National Guard Instruction (ANGI) 32-1003, Facilities Board and Massachusetts Army National Guard Regulation 210-20, Real Property Development Planning for the Army National Guard.

4. For the on-post areas, the Massachusetts Air National Guard has administrative processes and procedures that require approval for all projects involving construction or digging/subsurface soil disturbance, currently set forth in Massachusetts Air National Guard Instruction 32-1001, Operations Management. This procedure is a requirement of the Massachusetts Army National Guard, by the Massachusetts Air National Guard, through Installation Support Agreements. The Massachusetts Air National Guard requires a completed AF Form 103, Base Civil Engineer Work Clearance Request (also known as the base digging permit), prior to allowing any construction, digging, or subsurface soil disturbance activity. All such permits are forwarded to the Army for concurrence before issuance. An AF Form 103 will not be processed without a Dig Safe permit number (see next paragraph).

5. The Dig Safe program implemented in Massachusetts provides an added layer of protection to prevent the installation of water supply wells in the Western Boundary, Demolition Area 2 and Northwest Corner groundwater area and to protect monitoring wells. This program requires, by law, anyone conducting digging activities (e.g., well drilling) to request clearance through the Dig Safe network. The Air Force at the MMR is a member utility of Dig Safe. The Camp Edwards Training Range and Impact Area, including the Western Boundary, Demolition Area 2, and Northwest Corner Sites, 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, including the three Sites), the Air Force will promptly transmit the Dig Safe notification information to the Army with a copy to the Massachusetts National Guard MMR Environmental & Readiness Center (E&RC). The Army (or its designee) will promptly review each notification and if the digging activity is intended to provide a previously unknown water supply well, the Army (or its designee) will immediately notify the project sponsor (of the well drilling), the EPA, and the MassDEP in order to curtail the digging activity. If the Dig Safe notification indicates proposed work near monitoring wells, the Army (or its designee) will mark its components to prevent damage due to excavation. The extent of the Army's enforcement of this land use control does not address off-base parties failing to file a Dig Safe request or the improper processing of a notification; but if incidents do occur, the Army is responsible for ensuring remedy integrity and, if necessary, repairing damage caused by third parties to the monitoring wells.

In the event that the Town of Bourne 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 LUCs are intended to prevent exposure to groundwater impacted by the three plumes. However, to ensure that the LUCs achieve the LUC performance objectives, the Army will take the following additional action with respect to the Northwest Corner plume.

Within three years of the signing of this Decision Document, the Army shall:

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 Northwest Corner plume.

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

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

d. If neither b nor c is able to confirm that the identified well is safe for human use, the Army will offer the owner decommissioning of the well. If accepted, the Army will document such action with the Bourne Board of Health. If the decommissioning is not accepted, the Army will take other steps to ensure protectiveness to include, but not be limited to, requesting assistance from the Bourne 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 Northwest Corner 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 LUCs and how any LUC 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 LUCs (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 shall seek EPA review and concurrence at least 45 days prior to any proposed land-use change(s). In addition, if the Army discovers a proposed or ongoing activity that would be or is inconsistent with the land-use control objectives or use restrictions, or any other action (or failure to act) that may interfere with the effectiveness of the land use controls, it will address this activity or action as soon as practicable, but in no case will the process be initiated later than 10 days after the Army becomes aware of this breach. The Army will notify the EPA and MassDEP as soon as practicable, but no later than 10 days after the discovery of any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs. 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 Western Boundary, Demolition Area 2 or Northwest Corner Sites 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 LUCs. 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 LUCs.

The Army shall not modify or terminate LUCs 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 Western Boundary, Demolition Area 2 and Northwest Corner sites, shall obtain prior approval before taking any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs. 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 Western Boundary, Demolition Area 2 or the Northwest Corner.

Expected Outcomes of the Selected Responses

The response action objectives for groundwater associated with the Western Boundary, Demolition 2, and Northwest Corner Sites 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 at Western Boundary, RDX at Demolition Area 2, and perchlorate and RDX at Northwest Corner) in excess of federal Maximum Contaminant Levels, Health Advisories, DWELs, applicable State standards or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index.

The proposed remedy is expected to achieve permanent cleanup of COCs in groundwater at the three Sites. Specifically, for the Western Boundary groundwater, perchlorate is predicted to have already dropped below the 2 ppb MMCL and is expected to reach background levels (0.35 ug/L) by 2017. For the Demolition 2 groundwater, RDX concentrations in groundwater are expected to drop below the 2 ppb Health Advisory by 2011, the 0.6 ppb 10^{-6} risk-based level by 2013, and the 0.25 ug/L background level by 2021. For the Northwest Corner groundwater, perchlorate is expected to be reduced to the 2 ppb MMCL by 2012 and the background level (0.35 ug/L) by 2019; RDX is expected to be reduced to the 2 ppb Health Advisory by 2012, the 0.6 ppb 10^{-6} risk-based level by 2022, and the 0.25 ug/L background level by 2044.

Five-Year Reviews

In addition to annual reports on groundwater monitoring and verification of land use controls at each of the sites, groundwater responses for the Western Boundary, Demolition Area 2, and the Northwest Corner 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 of the three Sites. 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

Before the response actions can be deemed complete, the Army shall conduct, pursuant to a work plan approved by EPA, in consultation with MassDEP, a residual risk assessment to determine if COCs remaining in the aquifer pose unacceptable human health risks. The Army will continue monitoring and take additional measures, as necessary, until COCs remaining in the aquifer no longer pose unacceptable human health risks. If EPA, in consultation with MassDEP, concurs that any COCs remaining in the aquifer do not pose unacceptable human health risks, the Army will prepare and submit site closeout documentation to EPA for concurrence, upon consultation with MassDEP.

L. DETERMINATIONS

The groundwater response actions selected for implementation at the Western Boundary, Demolition Area 2, and Northwest Corner sites 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 include 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.

The MassDEP has concurred with EPA's decision and has determined that the selected response actions are necessary at the Western Boundary, Demolition Area 2, and the Northwest Corner to achieve the level of protection required under M.G.L. c.21E and 310 CMR 40.0000, the MCP.

M. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a Remedy Selection Plan for the selected alternatives set forth in Part II for the Sites on September 16, 2009. 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 September 16, 2009, EPA published the remedy selection plan for the Western Boundary, Demolition Area 2 and Northwest Corner sites, which included the proposed remedies for each site and announced the public comment period on the proposed remedies. The EPA proposed the Monitored Natural Attenuation and Land Use Controls alternative as the remedy for each of the sites.

At the September 16, 2009 public meeting of the MMRCT and the SMB, held in Bourne, MA, the Army gave a presentation on the remedy selection plan and the EPA presented its proposed remedies and answered questions from the teams.

In addition, the Army held a public hearing on the remedy selection plan on September 30, 2009 in Bourne, MA. A public information session, along with a presentation on the remedy selection plan and EPA's proposed remedies were held prior to the opening of the public hearing. Local residents, officials, and news media representatives interested in site activities and cleanup decisions were invited to attend both meetings. Representatives from EPA, MassDEP, and Army were present.

The Army notified the public of the September 30 public meeting and announced the public comment period in a display ad placed in the September 18, 2009 editions of the *Cape Cod Times* and *Enterprise* newspapers, and display ads were placed in the September 25, 2009 editions of these same newspapers to announce the public hearing and as a reminder of the public comment period.

The Army placed copies of the remedy selection plan for the Western Boundary, Demolition Area 2 and Northwest Corner 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 action including the feasibility study for the sites and other relevant documents upon which EPA relied in selecting the proposed remedies. The remedy selection plan also was made available on the Army Web site, which also contains the supporting documents and which offered a means of submitting public comments on the remedy selection plan.

At the October 16, 2009 public meeting of the MMRCT, the team and public were given another opportunity to ask questions or make comments on the proposed remedies.

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 Western Boundary, Demolition Area 2 and Northwest Corner sites from September 16 through October 15, 2009.

Comments:	Responses:
Comments from Ron Reif, P.E., MMRCT Member I concur with the Remedy Selection Plan for the Western Boundary, Demolition Area 2 and the Northwest Corner.	The commenter's concurrence with the Remedy Selection Plan's proposed remedies for all three sites is noted.
Comments from Charles Logiudice, MMRCT Member My recommendation for the northwest corner would be alternative 1 as groundwater contamination would be reduced through natural processes. RDX would dissipate below 2ppb by 2012 and below 0.6ppb by 2022. My recommendation for the western boundary would be alternative 2. It will achieve goals in a reasonable time (2009), it also includes land use controls. On demo area 2, I favor alternative 2 it also achieves cleanup in a reasonable time and also includes land use controls.	The commenter's concurrence with the Remedy Selection Plan's proposed remedies for Western Boundary and Demolition Area 2 is noted. For the Northwest Corner, EPA has determined that Alternative 2 (Monitored Natural Attenuation and Land Use Controls) is superior to Alternative 1 (No Action) because Alternative 2 includes provisions for plume monitoring to confirm that the plume is actually attenuating below cleanup levels, and land use controls to prevent exposure until cleanup levels are attained. These added elements provide greater overall protection of human health and the environment, and will confirm compliance with chemical-specific regulations by verifying that contaminant concentrations in fact decrease below cleanup standards.
Comments from David Dow, Cape Cod and Islands Group of the Sierra Club Cape Cod and Islands Group of the Sierra Club Comments on Western Boundary, Demo Area 2 and Northwest Corner Plumes; Since the preferred remedy for all three plumes is monitored natural attenuation with land use controls (MNA w. LUCs), we oppose this mitigation approach because it is contrary to Club policy. The Sierra Club opposes dilution/dispersion as a solution for toxic contaminants in air (under CAA), water (under CWA and SDWA) and soils (under CERCLA), since the toxic contaminant mass is not removed. There are cases in which the Club	Mr. Dow's letter identifies a number of issues that will be addressed below: 1. Cape Cod and Islands Group of the Sierra Club disagrees with dilution/dispersion of toxics as a solution, and thus disagrees with EPA's selection of monitored natural attenuation with land use controls (:MNA w LUCs) at these three operable units. EPA Response 1: Contaminants in the Western Boundary plume are already predicted to be below drinking water standards and the Demolition Area 2 plume is predicted to be restored to drinking water standards

supports dilution as an appropriate approach for conventional pollutants if they don't threaten public health or damage wild places/wild things following mitigation.

When Tad McCall (Dept. of Defense) told Cape Cod residents that the military would make us whole from toxic contamination of our sole source aquifer for drinking water as a result of past military training activities, MNA w. LUCs was not the solution that local environmental activists envisioned. It is disappointing that under the Obama Administration that EPA continues to support MNA w. LUCs as a mitigation approach at Superfund sites throughout the country.

Katherine Probst (Resources for the Future) testified before the Senate Environment and Public Works Committee in 2006 on the limitations of institutional controls at EPA's NPL sites nationwide. LUCs seem to be especially problematic for off base plumes like the Northwest Corner perchlorate/RDX plume. In my recent meeting with Ma. DEP staff, I learned that their MNA policy presumes removal of the source area and that some active process beyond dilution/dispersion is responsible for the natural attenuation (NA). In the June 2 letter that I received from James Owens (Director- Office of Site Remediation and Restoration), I understand that for EPA dilution/dispersion are appropriate NA mechanisms at the MMR and other Superfund sites.

The Sierra Club feels that the conceptual model framework underlying the MMR groundwater cleanups is inadequate, since it ignores dynamic processes (biology), climate change (the system is not at equilibrium or in a steady state) and cumulative effects from other human stressors (associated with population growth on Cape Cod and regional air pollution). Neither Ma. DEP nor EPA have the ability to verify the predictions made by the AFCEE/IAGWSP models for transport through the vadose zone and in the saturated zone. There have been numerous situations in which the groundwater transport models for contaminants of concern (COCs) have not matched the groundwater monitoring results (including some of the plumes involved in this proposed plan). Ron Reif and other MMRCT members have expressed concerns about these groundwater models and the lack of validation. These models are used to justify within only three years and prior to reaching the installation boundary. These two plumes are located entirely within an active military installation.

With respect to the Northwest Corner plume, which does extend off-base, all homes and businesses in the area of the Northwest Corner plume are connected to town water and there are no public drinking water supplies downgradient of the plume. Thus, there is believed to be no current exposure to any of these plumes. Moreover, this Decision Document requires the Army to take specific measures to document all private non-decommissioned wells (including wells not currently in use) that are above or within the projected path of the Northwest Corner plume; demonstrate that any such wells are either (1) not capable of drawing contaminated groundwater originating from the Northwest Corner plume, or (2) demonstrated to be safe for human use; or, if this is not possible, to offer the owner decommissioning of the well and take other steps as necessary to ensure protectiveness. This will further ensure that there is no exposure to contaminated groundwater associated with the Northwest Corner plume.

Moreover, the groundwater modeling predicts that the estimated time for restoring the aquifer to risk-based levels via natural attenuation (year 2009, 2013 and 2022 respectively) is nearly the same as that of the active restoration scenarios (year 2012 for Demolition Area 2 and year 2020 for the Northwest Corner – there was no active remediation alternative for the Western Boundary), yet the cost for active restoration is approximately $3 million to $8 million dollars more. In addition, the extraction alternatives have short-term environmental and community impacts.

Given all of these factors, EPA believes that monitored natural attenuation with land use controls is protective of human health and the environment, complies with regulations, and provides an appropriate balance of the various factors for selecting the appropriate remedy for these plumes.

Under the monitored natural attenuation remedy, EPA will continue to evaluate the results of the long-term groundwater monitoring program that will occur over the next several years, both through ongoing review of monitoring results and through

the MNA w. LUCs claim that plumes remain on the base where effective institutional controls are possible and to justify the cleanup times for this preferred solution. If one used dynamic rather than steady state models, one could estimate the uncertainty in model predictions and provide a range for the cleanup date, instead of a single number (which is likely to be erroneous in the real world).

Given the above situation the Sierra Club would like to see an independent peer review by outside experts on the vadose and saturated zone models used to support the MNA w. LUCs preferred alternative. EPA and Ma. DEP should not use any model to support management action that has not been subject to independent scientific review. NOAA Fisheries uses the Center for Independent Experts to peer review its dynamic stock assessment models which support the total allowable catch targets in fishery management plans. EPA and Ma. DEP should follow a similar practice. The U.S. Geological Survey's regional groundwater model has been subject to peer review when papers are published in scientific journals. Since the EPA technical assistance grant program that supported the citizen involvement process has been eliminated, local citizens and activists have to depend on the regulatory agencies to ensure the scientific credibility of the cleanup process. The Sierra Club is an environmental advocacy group and we lack the technical resources to evaluate these models. Thus we support an independent peer review process analogous to that used at NOAA (National Oceanic and Atmospheric Agency).

The Sierra Club's national Toxics Activist Team has had discussions about the safe levels for perchlorate required to protect sensitive populations (pregnant women, babies and children). There is a large gap between EPA's perchlorate cleanup goal (15 ppb) and that used in the Massachusetts Contingency Plan (2 ppb). Since the Toxics Activist Team has not concluded its perchlorate deliberations, it is not possible at this point in time to state what the Sierra Club target is for this COC. The safe level for RDX is also uncertain, so that it is hard to evaluate the adequacy of the 2 ppb Health Advisory standard or the 0.6 ppb cancer risk-based advisory level. Since health risk assessments assume some

the five-year review process. If the conditions change or the plumes are not behaving consistent with current groundwater modeling predictions, EPA can require the IAGWSP to re-evaluate and amend the current remedy, if necessary.

2. Cape Cod and Islands Group of the Sierra Club disagrees that MNA with LUCs is consistent with a statement by Tad McCall, formerly of DOD, reportedly that the military would "make us whole from toxic contamination" of the sole source aquifer.

EPA Response 2: The remedy selection criteria for the selected response actions are included in AO3, and include nine criteria, rather than Mr. McCall's statement. EPA believes that the selected remedies for these three operable units are appropriate pursuant to those nine criteria.

3. Cape Cod and Islands Group of the Sierra Club believes LUCs have limitations nationwide and have particular issues at off-base plumes like Northwest Corner's RDX plume.

EPA Response 3: LUCs may not be appropriate response actions at all sites, based on the nature and extent of contamination at a particular site. However, for these three operable units, EPA has determined that LUCs are an appropriate component – along with monitored natural attenuation – of a response action. Each response action includes periodic reviews of its effectiveness, and the effectiveness of LUCs will be a component of such periodic reviews.

4. Cape Cod and Islands Group of the Sierra Club expressed concern with limitations and inadequacies of the conceptual model being used for MMR groundwater cleanups.

EPA Response 4:

Regarding a dynamic conceptual model, the plumes are relatively short lived and will not be subject to the longer term effects of climate change and population growth. Changes in climate have little impact on existing groundwater contamination. Biological processes are most active at the surface, but don't impact these deep plumes because the sources have been removed or are depleted. With the source removed, vadose zone transport

understanding of the cause/effect relationship between contaminant concentration and health effects, EPA's risk assessment process uses various models in the absence of epidemiological investigations or laboratory bioassays. The Sierra Club has many concerns about the applicability of this risk assessment process in protecting human health. Given the proceeding general comments, the Sierra Club has concerns in regards to the following criteria for evaluation of the cleanup remedy: #1 (overall protection of human health and the environment); #2 (long term effectiveness and permanence); #5 (short term effectiveness); and # 9 (community acceptance- in this case by the Cape Cod & the Islands Group).	modeling becomes less important and we rely on groundwater monitoring data to confirm that the source removal has been successful. 5. Cape Cod and Islands Group of the Sierra Club would like to see independent review of the models being used at MMR. EPA Response 5: The Army and Air Force have been working closely with the USGS on groundwater modeling since the beginning of the program. The three site-specific models for the Western Boundary, Demolition Area 2 and the Northwest Corner are based on a regional model developed by the USGS in 2001. The IAGWSP uses data collected in the field to confirm predictions made by the models, and EPA reviews those data and their implications, if any, for the models. Fate and transport models for these sites are routinely calibrated to measured water levels, and RDX and perchlorate concentrations measured in monitoring wells are compared to model-predicted concentrations. These refinements to the models will continue until cleanup goals are reached to ensure that the models are accurately predicting the fate of the plumes. 6. Cape Cod and Islands Group of the Sierra Club expressed concern about the safe level of perchlorate. EPA Response 6: The alternatives were assessed using the most protective standards available: the Massachusetts MCL for perchlorate (2 ug/L) and the one-in-one million cancer risk for RDX (0.6 ug/L). The protectiveness of the remedy will be reassessed if the standards change. 7. Cape Cod and Islands Group of the Sierra Club expressed concern that EPA's human health risk assessment process may be inapplicable to protecting human health. EPA Response 7: Human health is protected since there are no exposures to contaminated groundwater at these plumes and controls will remain in place to prevent

	human contact. The alternatives were assessed using the most protective standards available: the Massachusetts MCL for perchlorate (2 ug/L) and the one-in-one million cancer risk for RDX (0.6 ug/L). The protectiveness of the remedy will be reassessed if the standards change. 8. Based on the above, the Cape Cod and Islands Group of the Sierra Club has concerns with the following criteria: overall protection of human health and the environment; long term effectiveness and permanence; short term effectiveness; and community acceptance. EPA Response 8: After considering the Sierra Club's comments, EPA continues to adhere to its determination that the alternative of Monitored Natural Attenuation and Land Use Controls presents the best balance of the criteria used to evaluate cleanup alternatives at each of these three sites.
Specific Comments: Since perchlorate has been detected in a monitoring well near the MMR western boundary and in the past at one of the sentinel wells for the Bourne Water Districts Monument Beach well field, we don't accept the claim that the Western Boundary Plume may not eventually reach this public water supply source. This is the justification used to support the MNA w. LUCs mitigation approach. The proposed plan doesn't even *consider an active alternative for this plume.*	The remedial investigation for the Western Boundary included extensive soil and groundwater sampling. No significant mass of perchlorate has been identified in groundwater upgradient of the well field that would indicate a potential for contamination above regulatory standards to reach the public water supply. The perchlorate concentrations in all monitoring wells at the Western Boundary are below all regulatory standards. This is consistent with the model that predicts that the levels throughout the plume will be below standards by 2009. However, to be conservative, since there may be a small area of contamination (between two monitoring wells in the northeastern portion of the site) that is above 2 ug/L, on-post monitoring will continue. Future groundwater monitoring will track the fate of this small plume, but it is not expected to migrate off-post. Monitoring will continue to make sure that drinking water wells are not threatened.
For the Demo Area 2 plume we have concerns about the completeness of the soil removal rapid response action at the source area. Since the former demolition area lies in a relatively shallow depression that was last used in the late 1980's, there is no guarantee that small C-4 fragments	A number of soil and site investigations, as well as a geophysical investigation were conducted at and around the Demolition Area 2 clearing between 1997 and 2005. The only C-4 chunks found were at the center of the Demolition Area 2 clearing and they were removed. There were no detections of

(source of RDX, HMX, 2A-DNT and 4A-DNT) have not moved beyond this source area in the last 20-30 years.	C-4 constituents other than those in the clearing and the man-made berms, which were excavated as part of the source removal. Following the source removal, which was conducted in 2004, post excavation soil samples were collected to verify that the removal was complete. The results of those samples showed no residual explosives in soil. Since the soil removal, the levels of RDX in groundwater beneath the source area have continued to decrease, thereby confirming that the source of groundwater contamination has been successfully removed. Groundwater monitoring will continue to ensure that no residual source exists.
There is a need for the off base perchlorate pollution (shallow and deep) (up to 13.4 ppb in 2008) to be addressed by an active treatment system. The evidence that the shallow perchlorate plume is due to fireworks displays conducted on July 4 by the Town of Bourne is largely circumstantial. Certainly the study conducted by the IAGWSP following a fireworks display by the town where they sampled at spots with fireworks residues at the soil surface gives a biased representation of the soil concentrations for which the town is a responsible party. The air modeling done by the military show that it is plausible that the fireworks residue deposition area could coincide with the extent of the plume. In the absence of a detailed soil sampling program using random sampling within stratified zones extending out from the fireworks point source, it is not possible to establish a cause/effect relationship for the shallow perchlorate plume. We don't care whether the responsible party is the military or the Town of Bourne, some type of active system should be installed to remove this COC before it discharges into the Cape Cod Canal.	During the feasibility study process, alternatives for active remediation of the perchlorate plume at the Northwest Corner were considered but not selected due to the following considerations: there is no current risk to human health; in the near future (i.e., until cleanup levels are attained), human health can be protected via land use controls; active remediation would not significantly reduce the time frame for perchlorate concentrations to reach regulatory standards; an active treatment remedy would be difficult to implement given the lack of success to date in obtaining easements to place wells in the community; such a remedy would have a significant impact on the community due to having to place wells in residential neighborhoods; and the fact that the focused extraction alternative would remove a minimal mass at a significant cost. The source of the perchlorate at the Northwest Corner is not completely determined, and may be some combination of fireworks and military training with pyrotechnics. An ongoing source does not exist since both activities were discontinued. This is confirmed by the results of soil sampling conducted in 2008, and a decreasing trend in groundwater samples collected at the water table. In any event, EPA's remedy selection decision does not depend on the cause or original source of the plume, but rather the factors described above and in the Decision Document.
The deeper, narrow RDX/perchlorate plume is obviously connected to the MMR and should be subject to active remediation by the IAGWSP. The four gun and mortar positions in the Northwest corner and L-3 small arms range source area investigations are being conducted separately from the Northwest Corner Plume (for which the	Although no COCs in groundwater have been identified for the Gun and Mortar Positions or the Small Arms Ranges, both of these operable units will be addressed in separate RI/FS's. Investigations conducted to date for both the Northwest Corner and these other sites do not indicate there is a continuing source of

detached lobes of perchlorate/RDX pollution are attributed to a Central Impact Area source). What are the downgradient COCs in the groundwater from the gun and mortar positions and L-3 range? How will these potential groundwater plumes be addressed by MNA w. LUCs for the off base mitigation program identified for the Northwest Corner Plume? The Sierra Club has always advocated for combined studies/remediation programs for the source areas and the associated groundwater plumes, but the military and the regulators (EPA and Ma. DEP) often separate these components.	contamination for the Northwest Corner plume. The location of these sites within the Northwest Corner study area had no bearing on the selection of an appropriate groundwater alternative. Potential sources for the Northwest Corner plume were considered in the RI/FS for the site and the results from the investigation indicate that the source has been depleted.
Since the IAGWSP and the regulators still have to develop mitigation schemes for the Central Impact Area and J-1 Range North and South plumes, there is further potential degradation of our sole source aquifer for drinking water during the period in which MNA w. LUCs/active treatment options occur. Since the focus at the MMR has shifted from groundwater remediation to making the base BRAC (Base Realignment and Closure)-proof, there will likely be more civilian activities at the base to share the costs of running the facility as the size of the military mission is reduced. This change in the military/civilian usage needs to be considered when the Environmental Management Commission (EMC) develops appropriate institutional controls to support the MNA w. LUCs solution for toxic pollution	Groundwater remedies for the Central Impact Area and J-1 plumes are being evaluated and will be selected within the next year. EPA's remedy selection decision is not based on any assumptions regarding the amount or nature of civilian activities on the MMR. The LUCs as specified in this Decision Document will remain in place until cleanup levels are achieved regardless of land ownership or control. Moreover, the Decision Document prohibits the Army from modifying or terminating land use controls or implementation actions, or modifying land use that would be inconsistent with the land use control objectives, without approval by the EPA, in consultation with MassDEP.
The prevailing wisdom has been that the MMR will continue to be primarily a military training facility with the existing LUCs being effective, but this seems to be a short sighted perspective as the civilian activities further evolve. The Community Working Group received a number of proposals for a regional transportation center; hotel complex with golf courses; public housing for our less affluent residents; etc that could require more direct water usage at the base. Since making the base BRAC-proof is driven by the perception that the MMR should be the economic engine for the Upper Cape, passive military uses will likely be supplemented by active, revenue producing civilian uses. The proposed plume mitigation plans need to address this future reality.	EPA's remedy selection decision is not based on any assumptions regarding the amount or nature of civilian activities on the MMR. LUCs as specified in this Decision Document will remain will remain in place to prevent exposure to the groundwater regardless of land ownership or control. Moreover, the Decision Document prohibits the Army from modifying or terminating land use controls or implementation actions, or modifying land use that would be inconsistent with the land use control objectives, without approval by the EPA, in consultation with MassDEP.
When the MMR becomes BRAC-proof there will be less incentive for the military to switch to active treatment options if the MNA w. LUCs approach is	EPA will reevaluate the selected remedies if monitoring results or other information indicates that the behavior of any plume differs sufficiently

not working for either the off base or on base MMR plumes. Ma. DEP doesn't seem to feel that contingent MNA w. LUCs remedies are legally enforceable on the IAGWSP or EPA under the Safe Drinking Water Act mandates. It is certainly true than many formerly used defense sites (FUDS) have fences around sites that are too polluted for civilian uses. Potential legal liabilities can constrain development of EPA Brownfield locations at former Superfund sites. The Sierra Club expects to see these MNA w. LUCs remedies replaced by active cleanup if they are shown to be not working as predicted. We don't want to see any legal haggling on this cleanup responsibility by the military or EPA Region 1.	from modeling predictions, or if the land use controls are failing to achieve their objectives. If EPA determines that one or more of the selected remedies is failing to meet the cleanup objectives (or otherwise is no longer protective), EPA will reevaluate this decision and decide whether to require additional action, including, if appropriate, active treatment.
Daniel J. DiNardo, MMRCT Member Sorry for the delay in responding to your reminder for input on the remedy selection plan for the western boundary, demolition area 2 and northwest corner on the MMR. It is clear that a significant amount of progress has occurred to date with the support and efforts of a multitude of professional organizations, departments and sub contractors. After considerable review of the technical data and the information presented in the RSP I offer the following; In all three cases I am in support of the proposed alternative 2 remedy. For the Western boundary, demolition area 2 and northwest corner monitored natural attenuation and land-use controls offer the most practical and economic means for achieving our cleanup goals in a reasonable time frame. I do believe that monitoring is an essential component of the process so that we can insure that the programs are proceeding as outlined and that the public at large is continually informed of the progress and resulting changes over the term of the attenuation. Land use controls is a vital part of that process. It also allows for any changes in testing methods, threshold levels and/or public concerns to be address during the life of the cleanup.	The commenter's concurrence with the Remedy Selection Plan's proposed remedies for all three sites is noted.

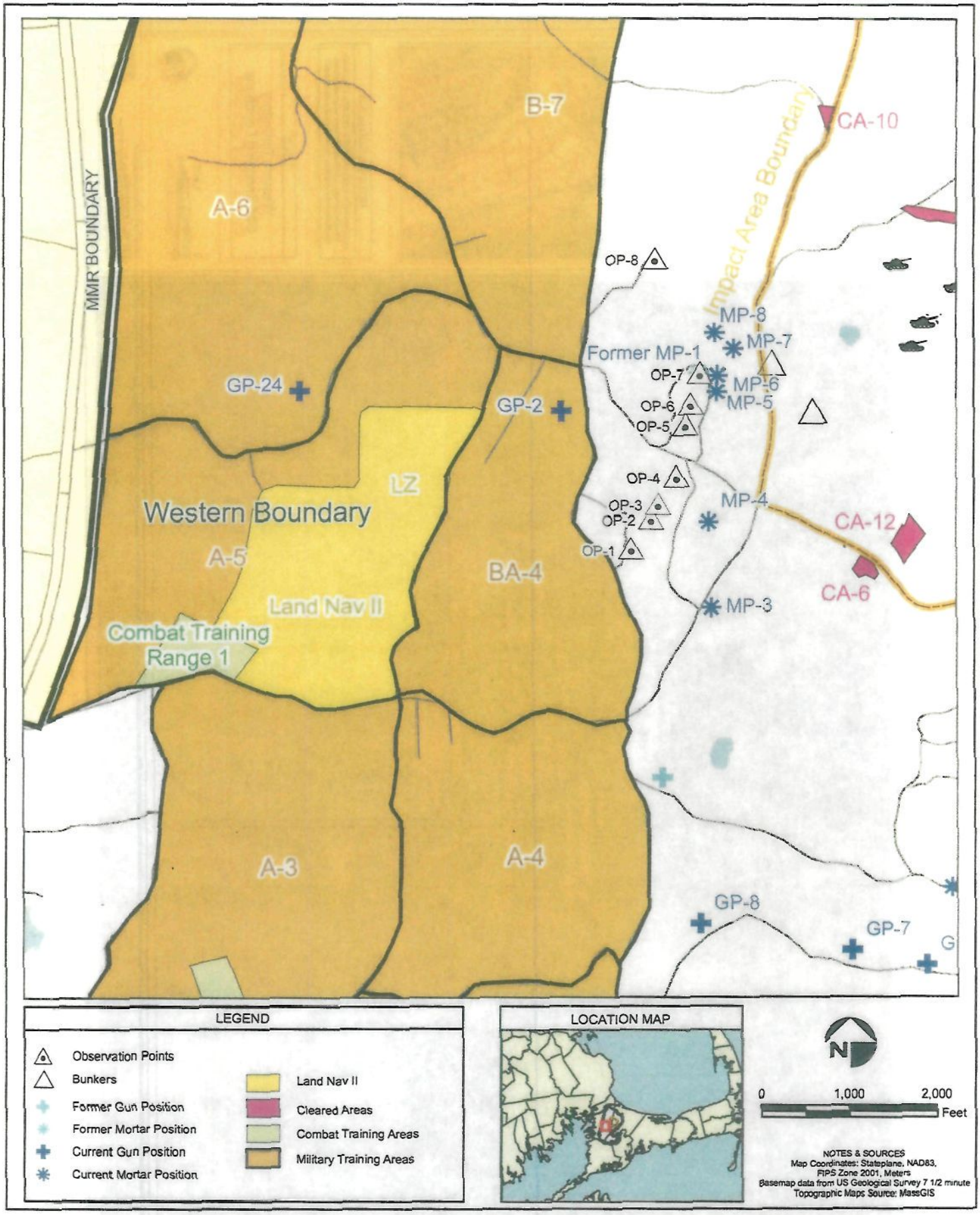
I don't believe that choosing other alternatives would offer any greater return and certainly not worth the significant increase in cost. As stated in the RSP by instituting alternative 2 in all three cases we will be successful by "continued monitoring and enforcement of institutional controls that would prevent future use of contaminated groundwater, Alternative 2 ensures protection of human health and the environment."	
Comments from Harold Foster, MMRCT Member Western Boundary Alternative 2 can only be productive if the remedy includes the flexibility of including a pump and treat option if future monitoring well data shows increasing, or consistently high, perchlorate concentrations. (Alternative 3) Even with all the remedial investigative work done to date, there are persistent source area uncertainties associated with the Plume(s). Therefore. no one can say, with certainty, how much COC's we are dealing with. Also the model predictions have proven to be inaccurate for these plumes, and that's another concern. Questions: Is perchlorate really the only COC that has been identified in the Western Boundary area? (what about TCE & PCE). Under what circumstances would existing monitoring wells be abandoned? Is there the possibility that remote (displaced or off-base) source areas could exist? Such as improperly disposed 100 gallon drums, in a ditch just off one of the main roads headed out of town? Would it be possible, or feasible to convert one or more monitoring wells into extraction wells? Could mobile treatment units be used near, or down gradient of the monitoring wells that currently show the highest perchlorate concentrations? Is Direct Push extraction technology available for the "hot spots" within the existing plumes? Thoughts and More Concerns: The agencies may have too much faith in the model predictions, even when the predictions can't be confirmed due to either the lack of monitoring	Please see response to David Dow's comments on behalf of the Cape Cod and Islands Group of the Sierra Club above . The remedy for the Western Boundary is based on a history of almost ten years of monitoring data from a comprehensive monitoring well network. All perchlorate concentrations in monitoring wells are below regulatory standards and levels continue to decline. The plume will continue to be monitored, however, to evaluate the possible existence of a small area of contamination between two monitoring wells and to ensure the remedy remains protective. If EPA determines that Alternative 2 is failing to meet the cleanup objectives (or otherwise is no longer protective), EPA will reevaluate this decision and decide whether to require additional action, including, if appropriate, active treatment. The soil and groundwater investigations indicate that the source has been depleted. Model predicted plume migration has been compared to and confirmed by actual monitoring data. This comparison and confirmation is an ongoing verification that what the models predict will happen is what is actually happening. Perchlorate is the only COC in groundwater associated with the Western Boundary site. TCE detections found off-post during the Western Boundary investigation were infrequent, at concentrations below the MCL and are likely from an off-post source since no corresponding detections were found on post. PCE has not been detected in Western Boundary groundwater samples. Existing monitoring wells will be abandoned after they are no longer needed to track the plume attenuation. According to the

well data, or an un-willingness to compare past modeling predictions with current monitoring well data! Source area uncertainties persist! For the Western Boundary, Alternative 2 would result in zero cleanup related Reduction of Toxicity, Mobility, or Volume Through Treatment. This is significant! If we go forward with Alternative 2, we will likely have to re-address these issues, in the very near future.	conceptual site model based on sampling results, the source of perchlorate is likely surface deposition, over a wide area, of fine smoke particles and debris containing perchlorate. Other sources, such as drum disposal off post, are unlikely since the highest concentrations were found on post. It would be possible to turn monitoring wells into extraction wells; however, such a conversion would be inefficient given the small diameter of the wells and the limited water volume that could be pumped. Mobile treatment units can be used in most locations; however, even the monitoring wells with the highest concentrations are below cleanup levels. It is unlikely there would be detectable levels of contamination in the water extracted. Please see the response to Mr. Dow's comments on how groundwater models are used, how their limitations are taken into account, and how EPA will respond if monitoring results or land use control compliance results indicate that Alternative 2 is failing to meet cleanup objectives. In summary, the levels of perchlorate in all groundwater monitoring wells in the Western Boundary appear to be below applicable cleanup standards. Monitoring will continue to make sure the levels remain low and to confirm model predictions.
Demolition Area 2 Questions. Concerns. Comments: As of September, 2009 we were informed that the source areas associated with this area had been identified and removed. How confident are the agencies that this statement is true and accurate? This information did seem to surface on rather short notice. This area looks like a good candidate for at least a modular treatment unit that could focus on the "hot spot" in the leading edge of the plume. Because of its small size, and the removal of the associated source area, isn't this a groundwater plume that can be completely removed, or at least have the RDX levels reduced to below 2 ppb, as soon as possible? Can we keep this one on the base? We should be assisting the natural attenuation process, not depending on it. Nature didn't create this mess! • Reduction of toxicity, mobility, and volume through treatment • Shorten the timeframe for cleanup	The Demolition Area 2 source area was removed in 2004 and was documented in the *Demo 2 RRA Completion of Work Report* (AMEC 2005). (Please see the response to David Dow's comment regarding this site for more information.) Groundwater monitoring has continued since that time and has shown a consistent, decreasing trend in RDX concentrations (confirming that the source removal was successful). Active treatment is not recommended since the plume is rapidly depleting through natural processes. Current groundwater sampling results are all below the 2 ug/L HA. In addition, groundwater modeling predicts that RDX concentrations will be below the risk-based level of 0.6 ug/L by 2013 (which is only one year longer than it would take to reach that level through focused extraction of the "hot spot.") Such extraction would not remove a significant amount of mass from the plume, but would substantially increase cost and have environmental impacts due to the construction and pumping. The plume is not

• Community acceptance	predicted to migrate off-post and monitoring wells will be installed to confirm this and other modeling predictions
Northwest Corner Questions: What if the source area for the RDX in the Northwest Corner in not the CIA? Are there any ongoing investigations into potential source areas for the Northwest Corner? Is the Cape Cod Canal really a natural barrier for either of these plumes? Could either of the plumes, in particular the RDX plume, pass under the canal? Are there any monitoring wells on the other side of the canal? Has *any* direct push sampling been done on the other side of the canal? Were the Gun & Mortar Firing Positions a source area for either plume? Has all the contaminated soil from these positions been sampled and removed? Thoughts and Concerns: Source area uncertainties persist! Again, as in Western Boundary and Demolition Area 2, Alternative 2 falls short. Alternative 3, or any alternative that includes a pump and treat option, would be the correct alternative. At this time, no one knows what will happen with the CIA cleanup. We can't afford to sit back and wait for that plan to be formulated and implemented.	The source of the RDX in the Northwest Corner is most likely the CIA, with some contribution from Former A Range possible. Additional investigations are being conducted to evaluate any RDX at Former A Range. The Cape Cod Canal is a hydrologic barrier. Flow from this side of the canal can not flow across the canal since there is a similar volume of groundwater flowing into the canal from the mainland side. For this reasons, EPA has not required any monitoring or sampling on the mainland. Although preliminary data seem to suggest that the Gun and Mortar Positions (GMPs) have not contributed to the Northwest Corner plumes, investigations of the GMPs are being conducted to evaluate this more thoroughly. A draft Investigation Report is scheduled for release in early 2010. Please see the response to Mr. Dow's comments on how groundwater models are used, how their limitations are taken into account, and how EPA will respond if monitoring results or land use control compliance results indicate that Alternative 2 is failing to meet cleanup objectives. In particular, if EPA determines that Alternative 2 is failing to meet the cleanup objectives (or otherwise is no longer protective), EPA will reevaluate this decision and decide whether to require additional action, including, if appropriate, active treatment. Plans to address groundwater at the Central Impact Area are progressing and a cleanup decision will be finalized within the next year.
Even as we go through this process of deciding how best to move forward with this remedy, the groundwater plumes continuously contaminate the cape cod aquafer. This aquafer is also being stressed by non-MMR related contributors, commercial and private. Although the MMR did not produce these sources, their impact will still be depicted within the groundwater. These sources may never be remedied. It makes it that much more important to cleanup as much of the COC's as is humanly possible. Maybe the practice of focusing on Monitoring Wells (screens) with greater than MCL detections is not the best practice to depict	

plume shell dimensions and characteristics. Should the focus be on monitoring wells (screens) that have repeatedly shown non-detects, or sub MCL readings. This to determine why they have not captured significant CoUs. Particularly if high concentration have been detected in nearby wells. To date, the mindset seems to have been, if we don't capture it, its not there! Does the model support such a theory? Maybe our ability to realistically capture enough groundwater sampling data to confidently present an accurate depicting of all, or certain, groundwater plumes is diminished due to access related issues. We seem to have under-estimated the total environmental impact of the MMR related groundwater plumes, and in particular the direct effects upon indigenous non-human life forms (i.e. fish & wildlife, vegetation, insects) that have a direct and in-direct impact upon the quality of life of all local inhabitants. We can't depend upon future decisions, for remedies that need to be in place now. Let's cleanup what we can cleanup, and leave as little to chance, as possible.	

FIGURES



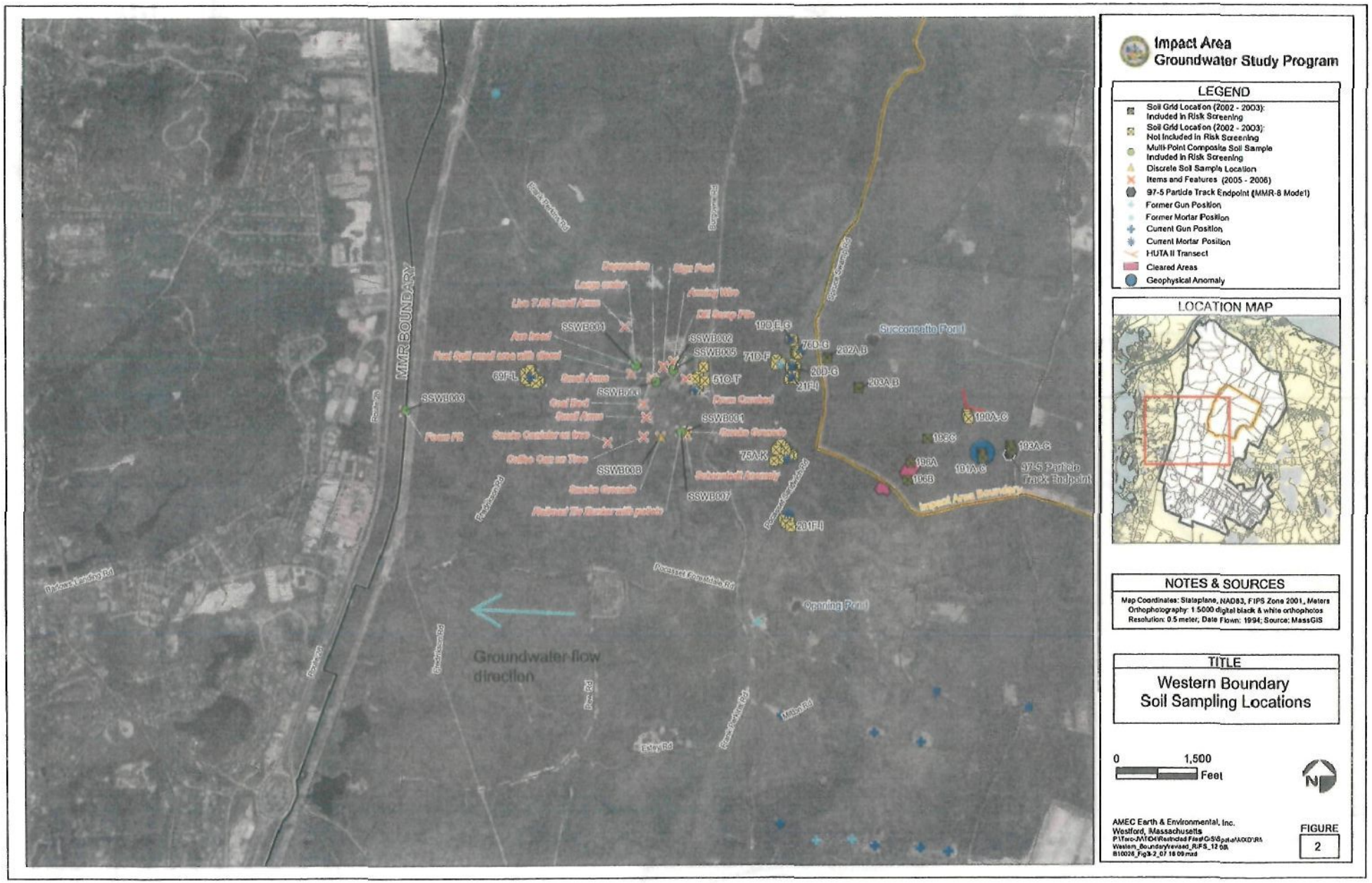
AMEC Earth & Environmental, Inc.
Westford, Massachusetts

Site Use History

FIGURE
1

P:\Terc-JV\TO4\Restricted Files\GIS\Spatial\MXD\RI\Western_Boundary\revised_RIFS_12.08\B10026_Fig2-2_12.22.08.mxd

Impact Area Groundwater Study Program



Impact Area Groundwater Study Program

LEGEND

- Soil Grid Location (2002 - 2003): Included in Risk Screening
- Soil Grid Location (2002 - 2003): Not Included in Risk Screening
- Multi-Point Composite Soil Sample Included in Risk Screening
- Discrete Soil Sample Location
- Items and Features (2005 - 2006)
- 97-5 Particle Track Endpoint (MMR-8 Model)
- Former Gun Position
- Former Mortar Position
- Current Gun Position
- Current Mortar Position
- HUTA II Transect
- Cleared Areas
- Geophysical Anomaly

LOCATION MAP

NOTES & SOURCES

Map Coordinates: Stateplane, NAD83, FIPS Zone 2001, Meters
Orthophotography: 1:5000 digital black & white orthophotos
Resolution: 0.5 meter; Date Flown: 1994; Source: MassGIS

TITLE

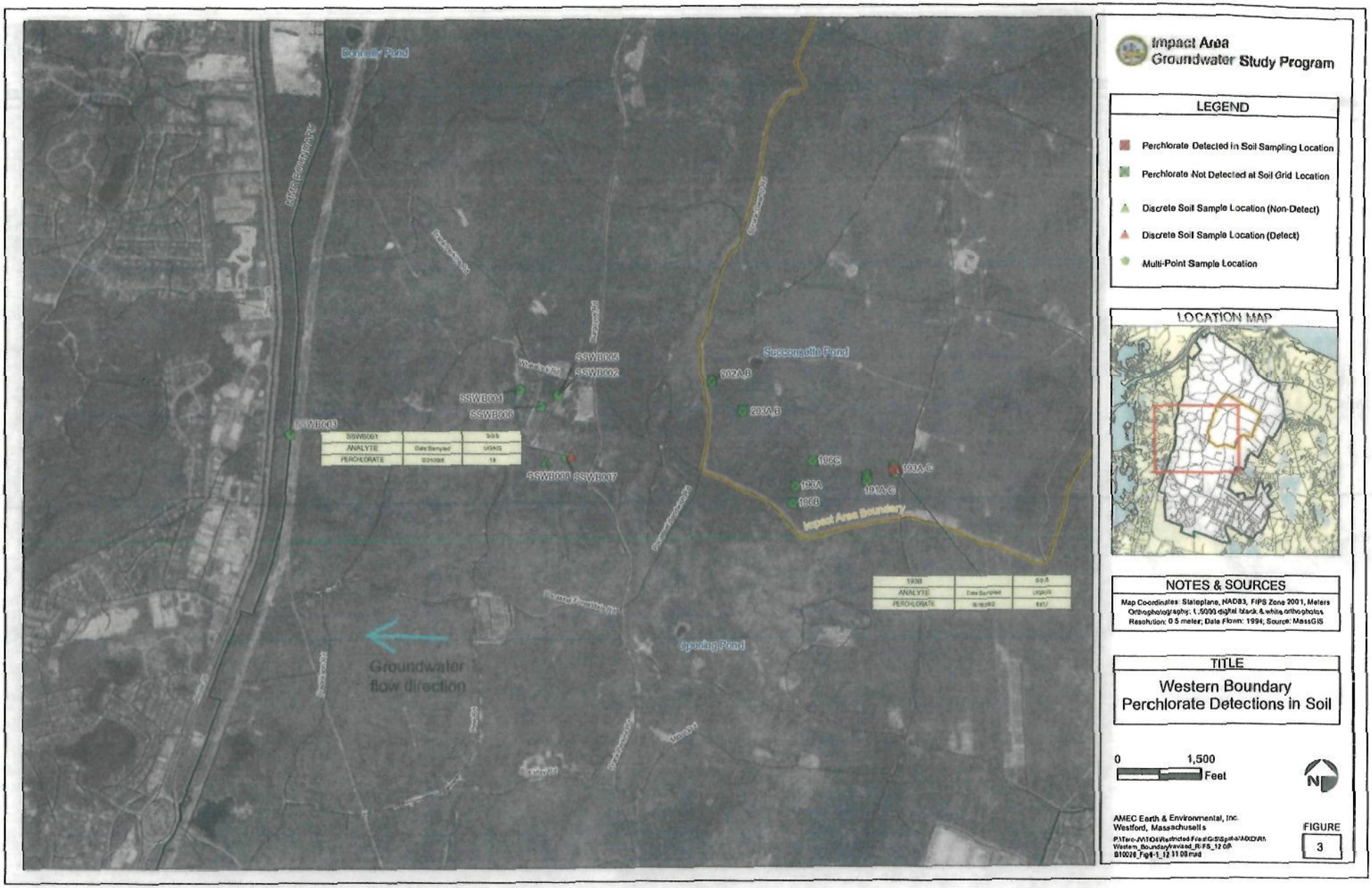
Western Boundary Soil Sampling Locations

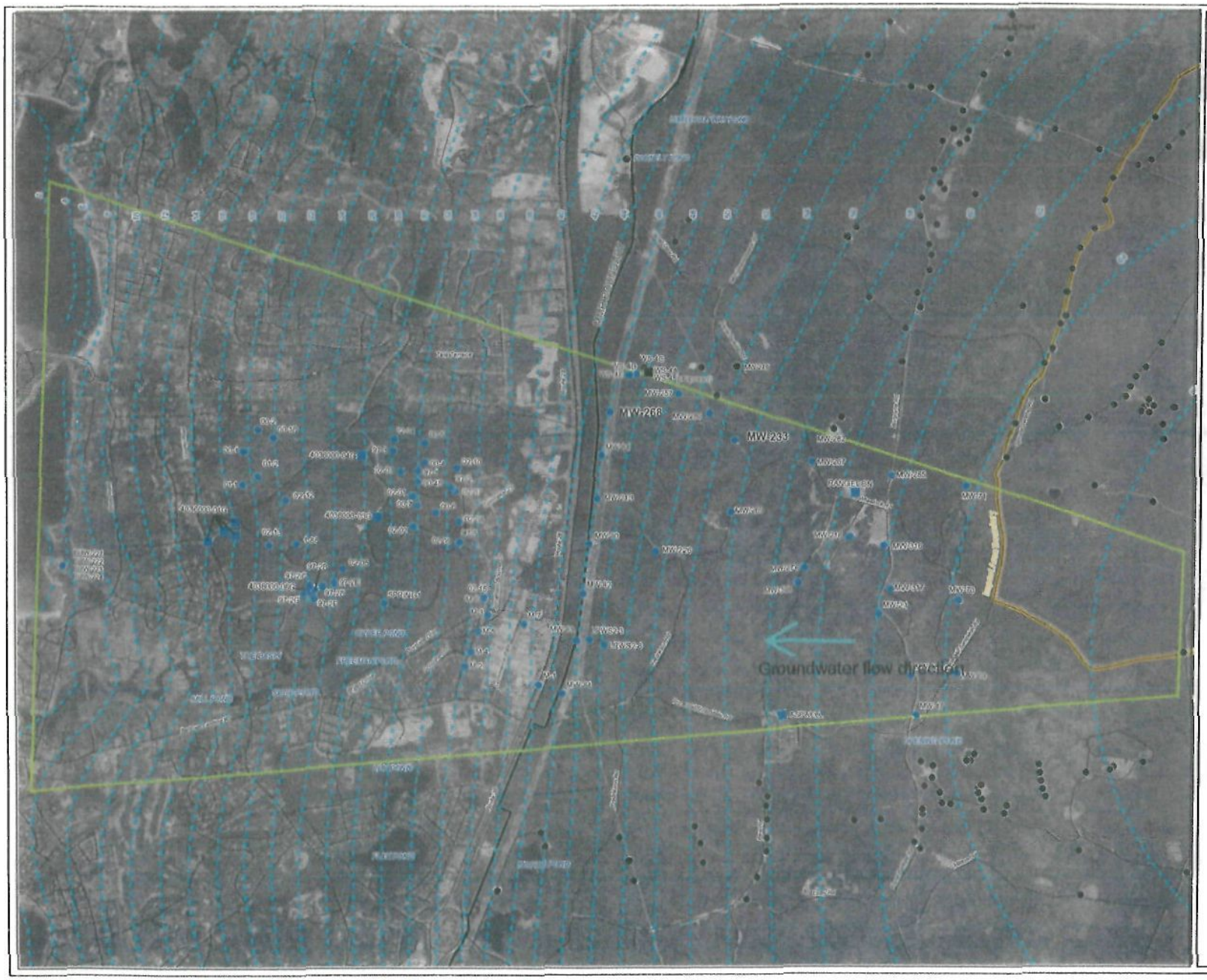
0 1,500 Feet

N

AMEC Earth & Environmental, Inc.
Westford, Massachusetts
P:\Tarc-JMTD4\Restricted Files\GIS\Spatial\MXD\RI Western_BoundaryRevised_RUFS_12 08 B10026_Fig3-2_07 18 09.mxd

FIGURE 2



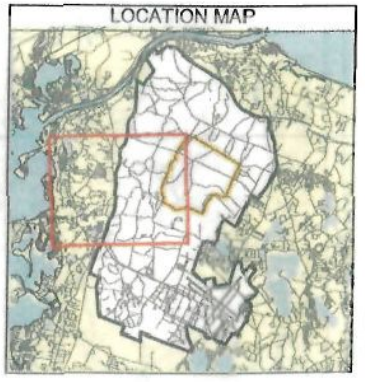


Impact Area Groundwater Study Program

LEGEND

- Existing Monitoring Well
- Existing Water Supply Well
- Monitoring Well Outside Study Area
- Groundwater Elevation Countours, AMEC MMR-10 Model (In Feet Above NGVD)
- Western Boundary Area

LOCATION MAP



NOTES & SOURCES

Map Coordinates: Stateplane, NAD83, FIPS Zone 2001, Meters
Orthophotography: 1:5000 digital black & white orthophotos
Resolution: 0.5 meter; Date Flown: 1994; Source: MassGIS

TITLE

Western Boundary Site

0 2,000 Feet

N

AMEC Earth & Environmental, Inc.
Westford, Massachusetts

P:\Terc-JVTO4\Restricted Files\GIS\Spatial\MXD\RA Western_Boundary\revised_RIFS_12 6th \WB026_Fig3-1_03.14.06.mxd

FIGURE 4

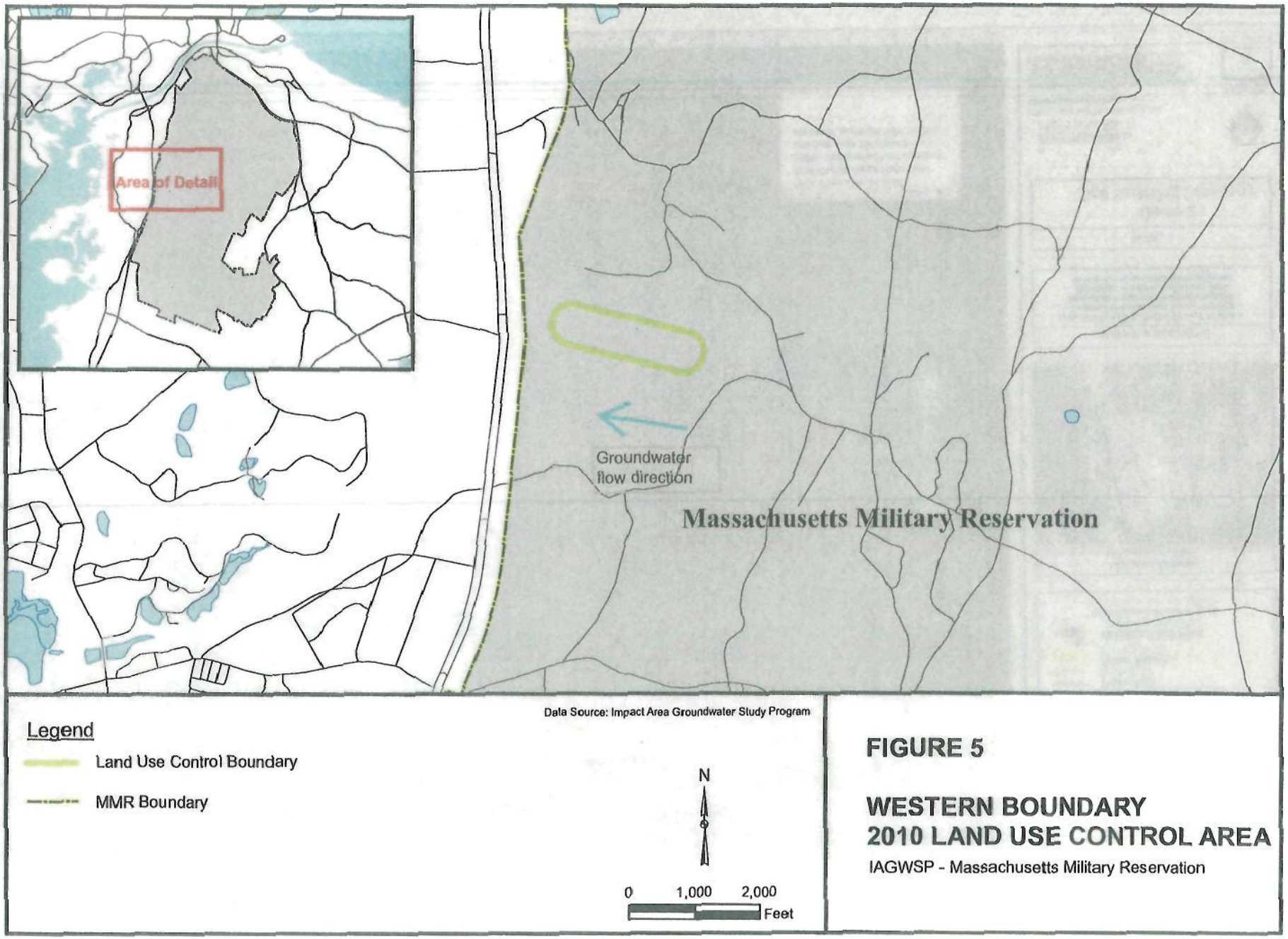
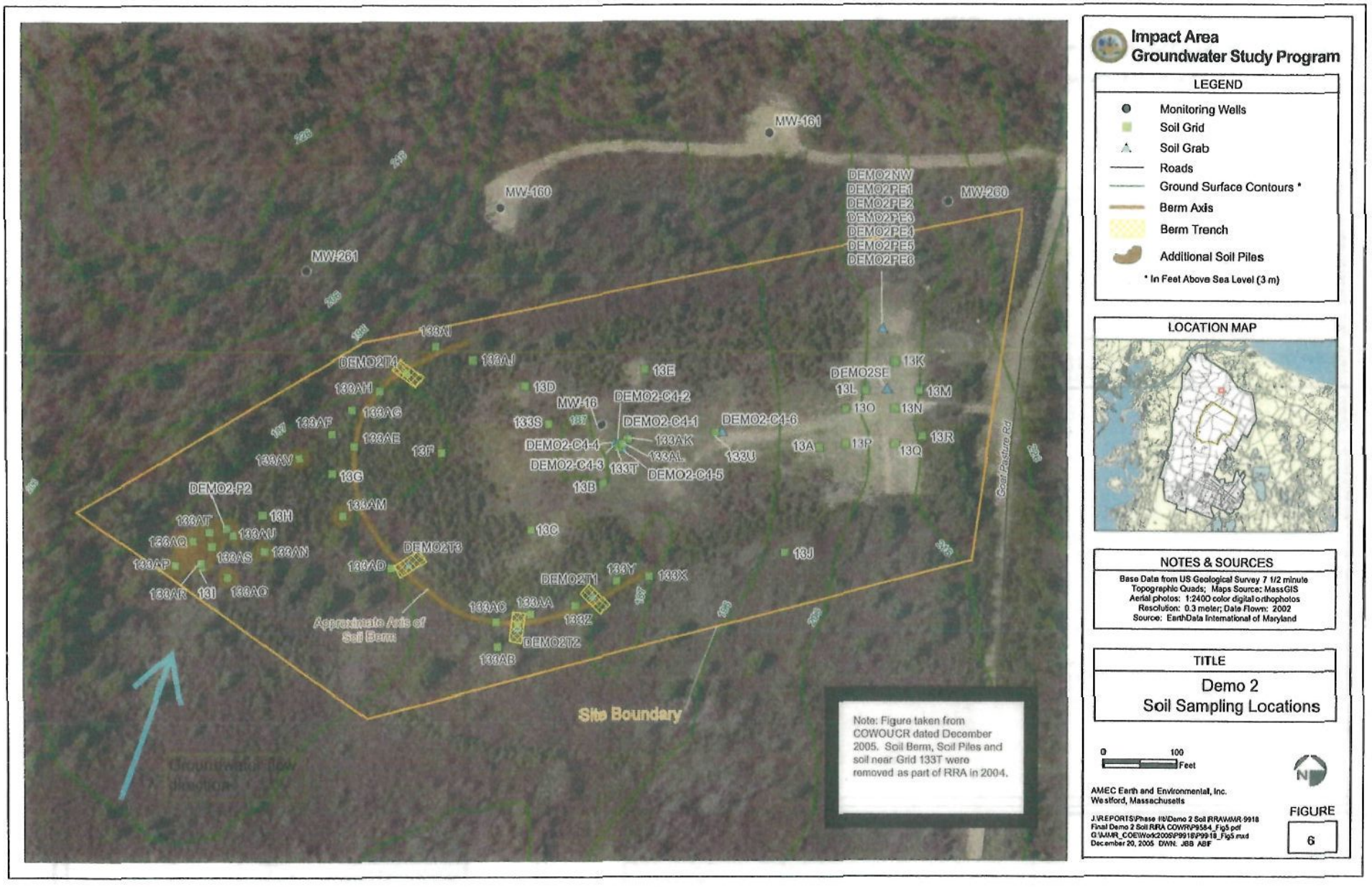


FIGURE 5

WESTERN BOUNDARY
2010 LAND USE CONTROL AREA

IAGWSP - Massachusetts Military Reservation



Impact Area Groundwater Study Program

LEGEND

- Monitoring Wells
- Soil Grid
- Soil Grab
- Roads
- Ground Surface Contours *
- Berm Axis
- Berm Trench
- Additional Soil Piles

* In Feet Above Sea Level (3 m)

LOCATION MAP

NOTES & SOURCES

Base Data from US Geological Survey 7 1/2 minute Topographic Quads; Maps Source: MassGIS
Aerial photos: 1:2400 color digital orthophotos
Resolution: 0.3 meter; Date Flown: 2002
Source: EarthData International of Maryland

TITLE

Demo 2 Soil Sampling Locations

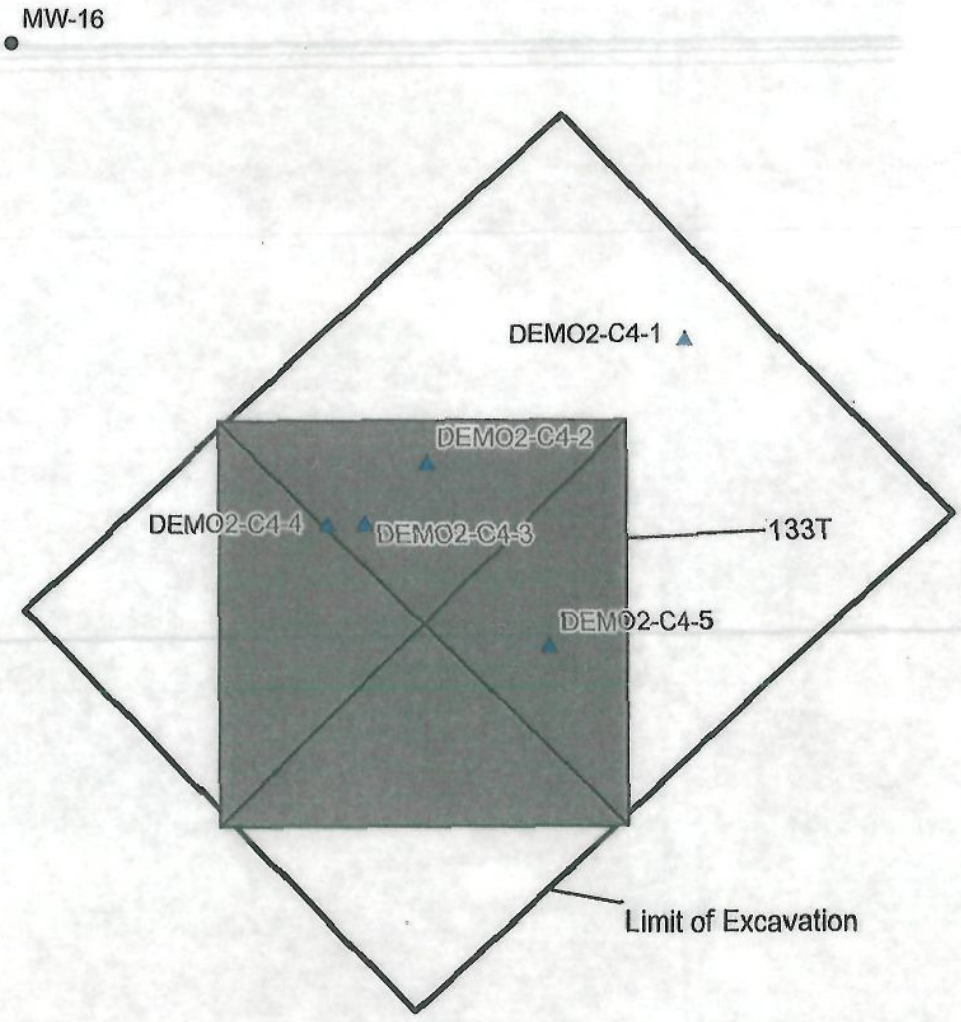
0 100 Feet

N

AMEC Earth and Environmental, Inc.
Westford, Massachusetts

J:\REPORTS\Phase II\Demo 2 Soil RRA\WMR-9918 Final Demo 2 Soil RRA COWR\P9584_Fig5.pdf
G:\WMR_COE\Work2005\P9918\P99-18_Fig5.mxd
December 20, 2005 DWN: JBB ABF

FIGURE 6

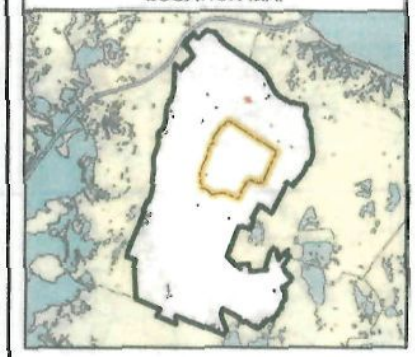


Impact Area
Groundwater Study Program

LEGEND

- Monitoring Well
- Soil Grab
- Soil Grid (to scale)

LOCATION MAP



NOTES & SOURCES

Basemap data from US Geological Survey 7 1/2 minute
Topographic Maps: Source: MassGIS
Aerial Photos: Color Digital Orthophotos; Date Flown: 2002
Source: EarthData International

TITLE

Demo 2 C4 Discoveries
and Grid 133T Excavation

0 10 Feet

N

US Army Corps of Engineers
New England District

DRAFT

FIGURE 7

M:\MMR2006\Demo2\Figures\FinalReportFigures042506\Fig3-1_042706.pdf
M:\MMR2006\Demo2\FinalMXDs042506\Fig3-1_042706.mxd
April 27, 2006 DWN: MTW CHKD: MRK DGW

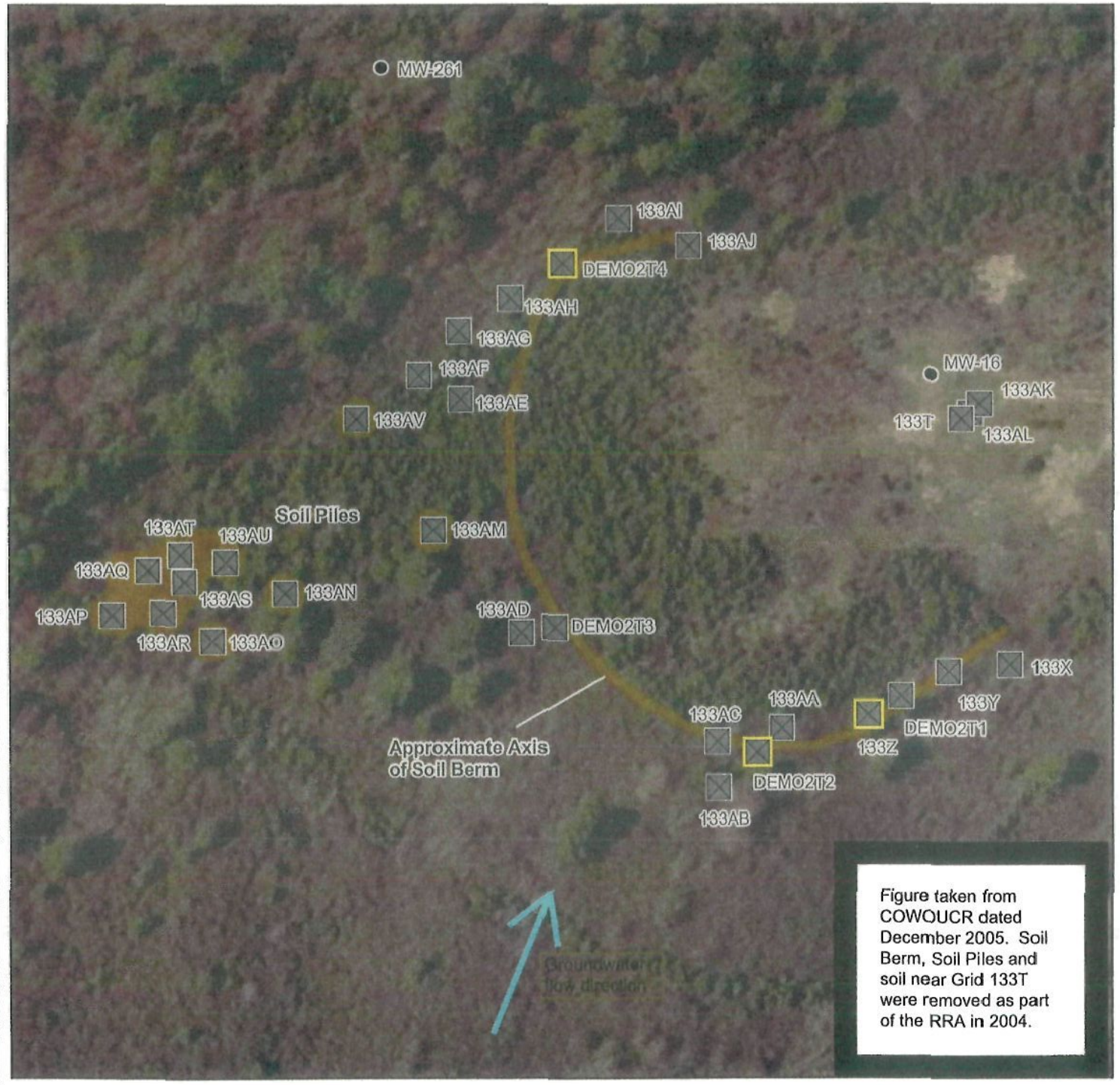


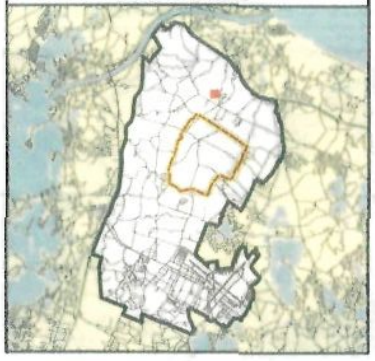
Figure taken from COWOUCR dated December 2005. Soil Berm, Soil Piles and soil near Grid 133T were removed as part of the RRA in 2004.

Impact Area Groundwater Study Program

LEGEND

- Existing Monitoring Well
- Soil Sampling Location (to scale)
- 22' x 22' Additional Excavation Site
- Berm Axis
- Additional Soil Piles

LOCATION MAP



NOTES & SOURCES

Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from US Geological Survey 7 1/2 minute
Topographic Map Source: MassGIS
Aerial photos: 1:2400 color digital orthophotos
Resolution: 0.3 meter; Date Flown: 2002
Source: EarthData International of Maryland

TITLE

Demo 2 -
Soil RRA Post-Excavation Sampling Locations and Additional Excavation Sites

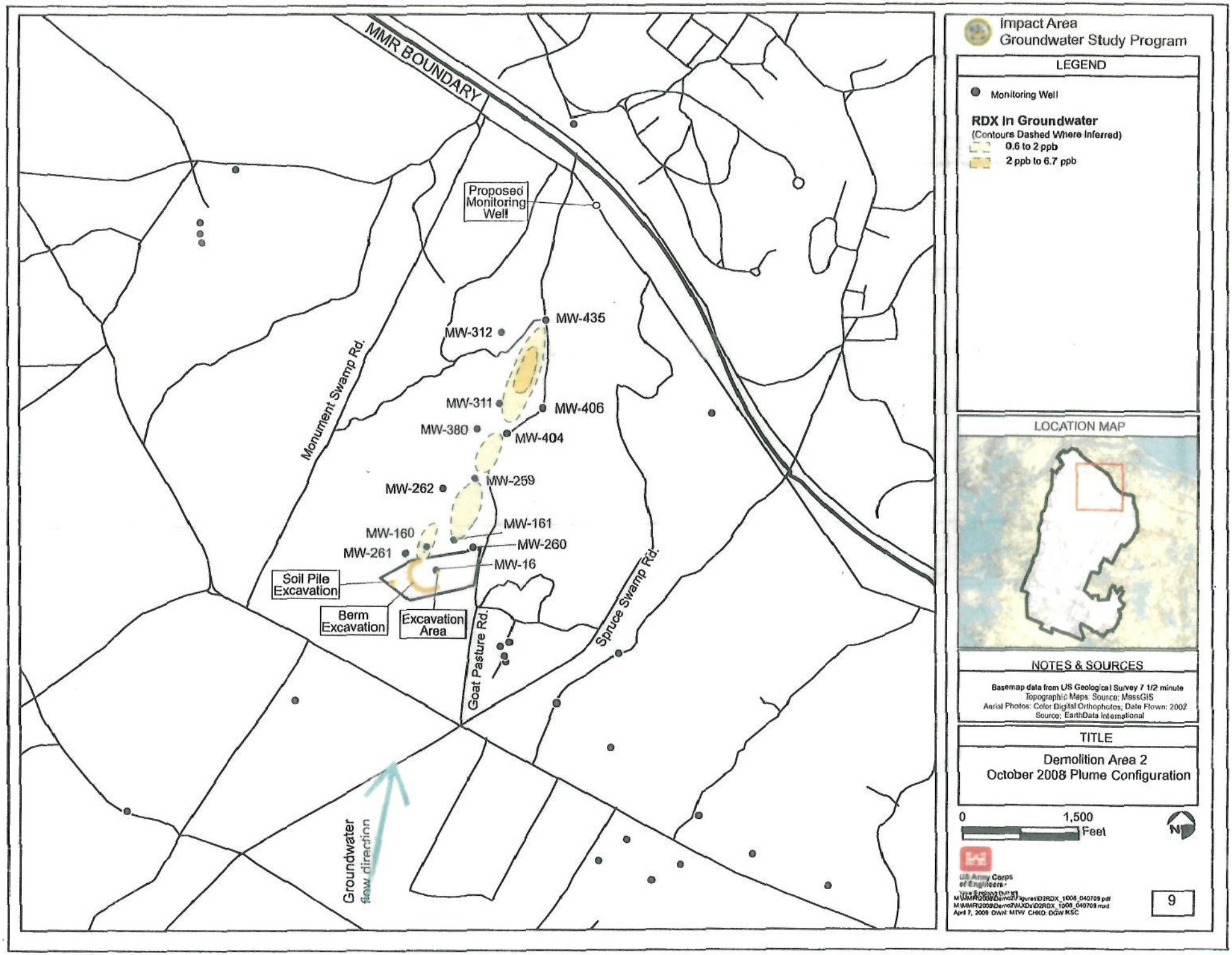
0 100 Feet

N

AMEC Earth and Environmental, Inc.
Westford, Massachusetts

J:\REPORTS\Phase IIb\Demo 2 Soil RRA\MMR-9918 Final Demo 2 Soil RRA COW\P9584_Fig4.pdf
G:\MMR_COE\Work\2005\P9918\P9918_Fig4.mxd
December 20, 2005 DWN: JBB ABF

FIGURE 8



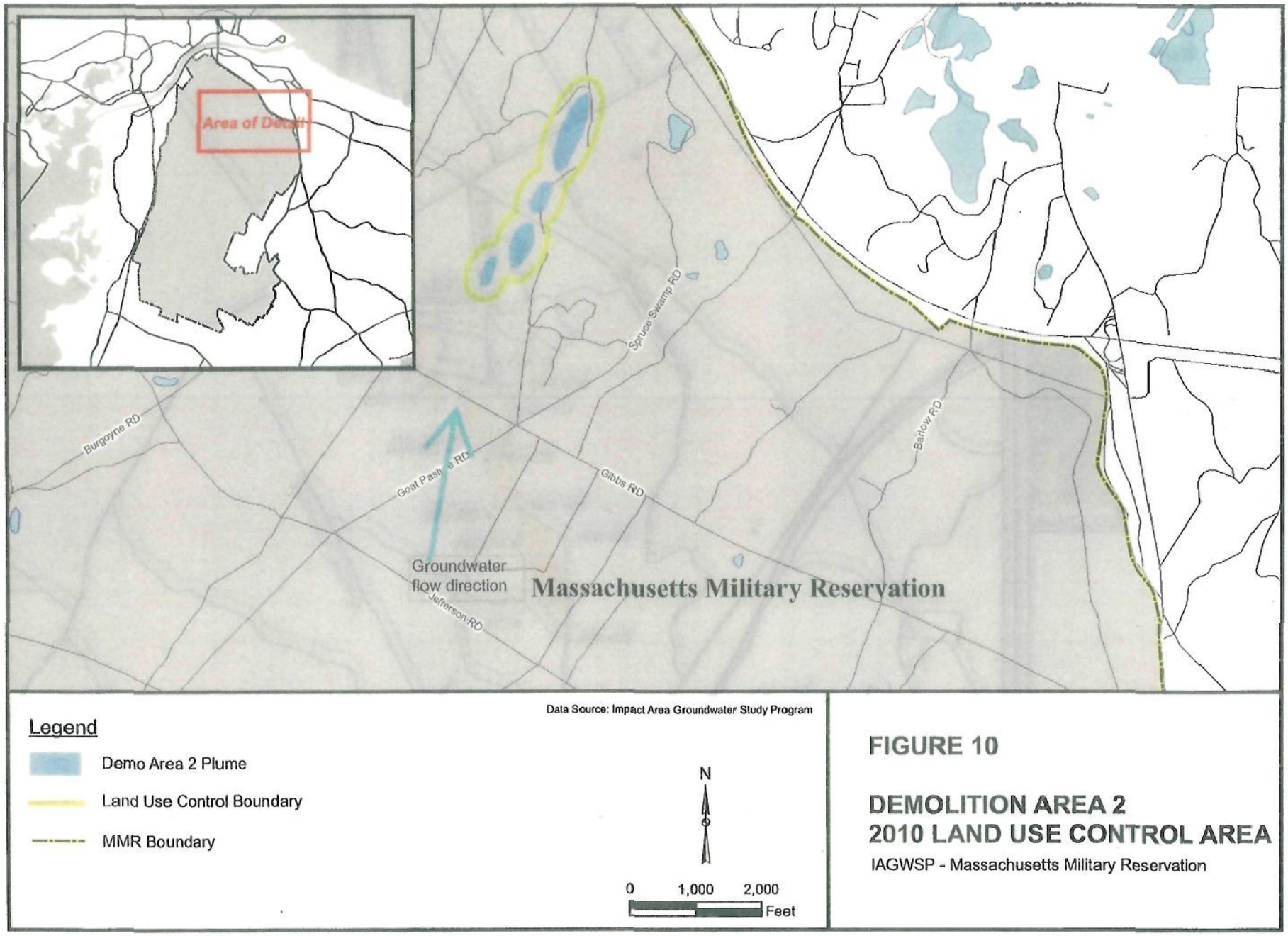
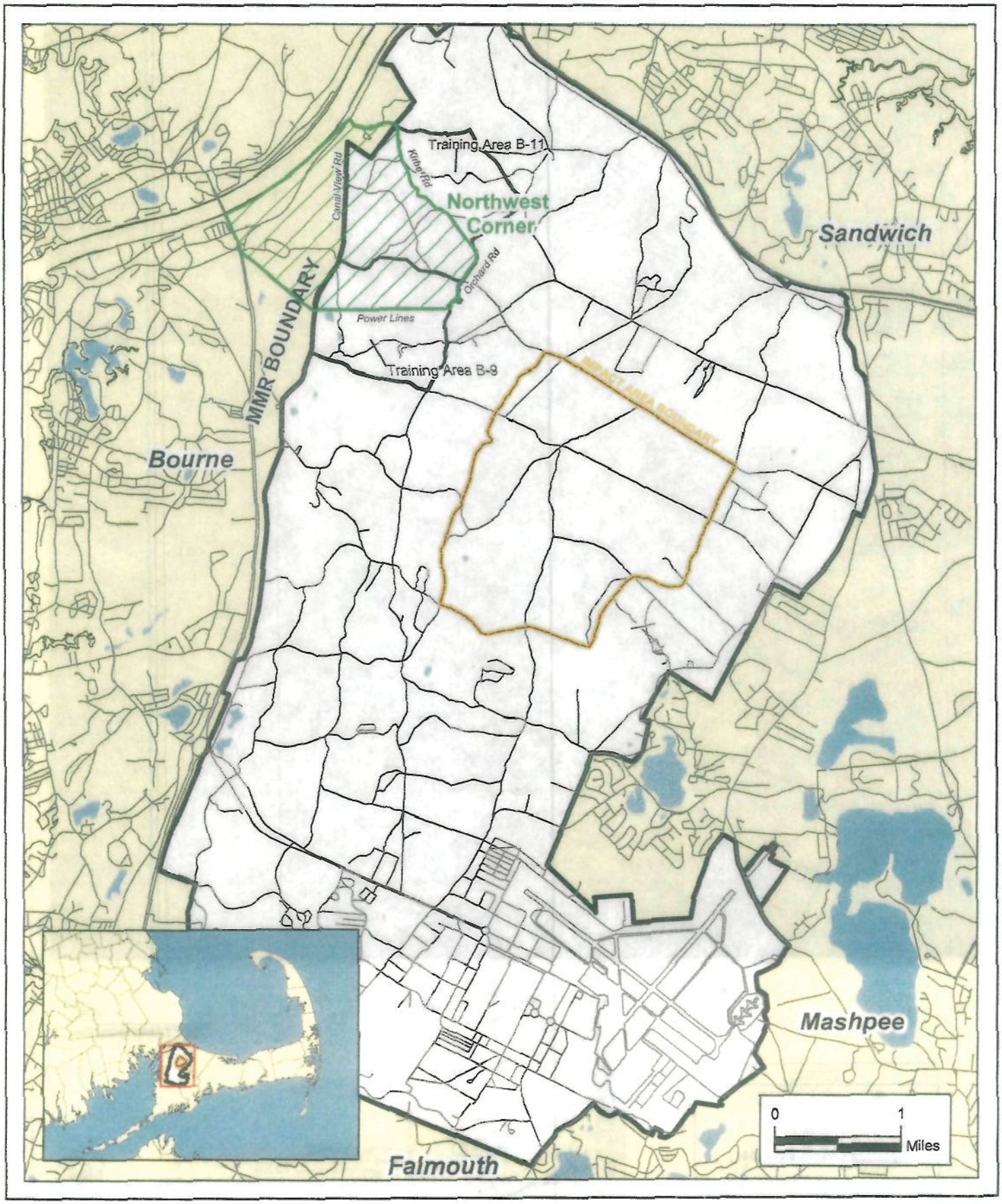


FIGURE 10

DEMOLITION AREA 2
2010 LAND USE CONTROL AREA

IAGWSP - Massachusetts Military Reservation



Location of Northwest Corner, Camp Edwards
Massachusetts Military Reservation

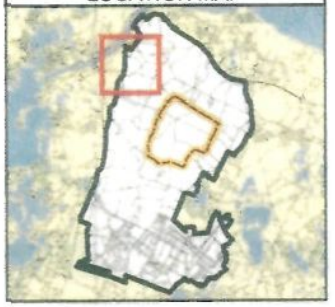
FIGURE
11

Tetra Tech EC, Inc.
Boston, Massachusetts

P:\Terc-JV\TO4\Restricted Files\Spatial\Source_Data\from_AMEC\
Discs_073109\MMR Northwest Corner\
MMR-9964 D NWC RI Report\Figures\GIS Data and MXDs\
N9964_Fig1-1.mxd

Impact Area
Groundwater Study Program

LOCATION MAP



0 1,200 Feet

LEGEND

- Gun Position
- Roads
- MMR Boundary
- L-3 Range Area

NOTES & SOURCES
Base Map Data from US Geological Survey 7 1/2 minute Topgraphic Maps Source: MassGIS
Aerial Photos: Color Digital Orthophotos. Date Flown: 2001. Source: MassGIS

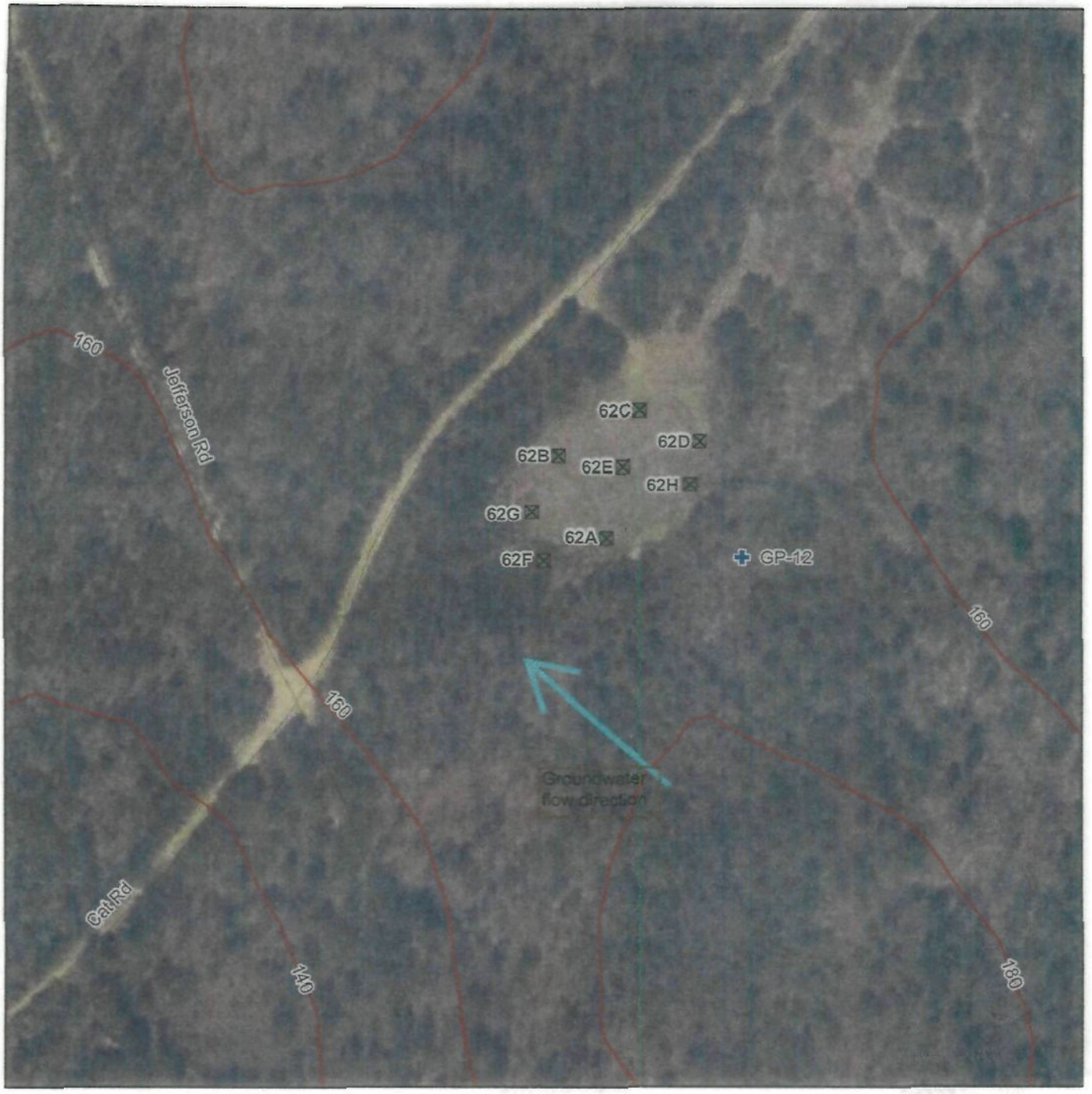
Tetra Tech EC, Inc.
Boston, Massachusetts

Northwest Corner Site Map

FIGURE 12

P:\Terc-JV\TO4\Restricted Files\GIS\Spatial\Source_Data\from_AMEC\Discs_073109\MMR Northwest Corner\MMR-9964 D NWC RI Report\Figures\GIS Data and MXDs\N9964_Fig2-1.mxd

Impact Area Groundwater Study Program



LEGEND

Soil Sampling Location

Topographic Surface
Elevation Contours (20 ft intervals)

0 150
Feet

N

LOCATION MAP

NOTES & SOURCES
Base Map Data from US Geological Survey 7 1/2 minute
Topographic Maps Source: MassGIS
Aerial Photos: Color Digital Orthophotos.
Date Flown: 2001. Source: MassGIS

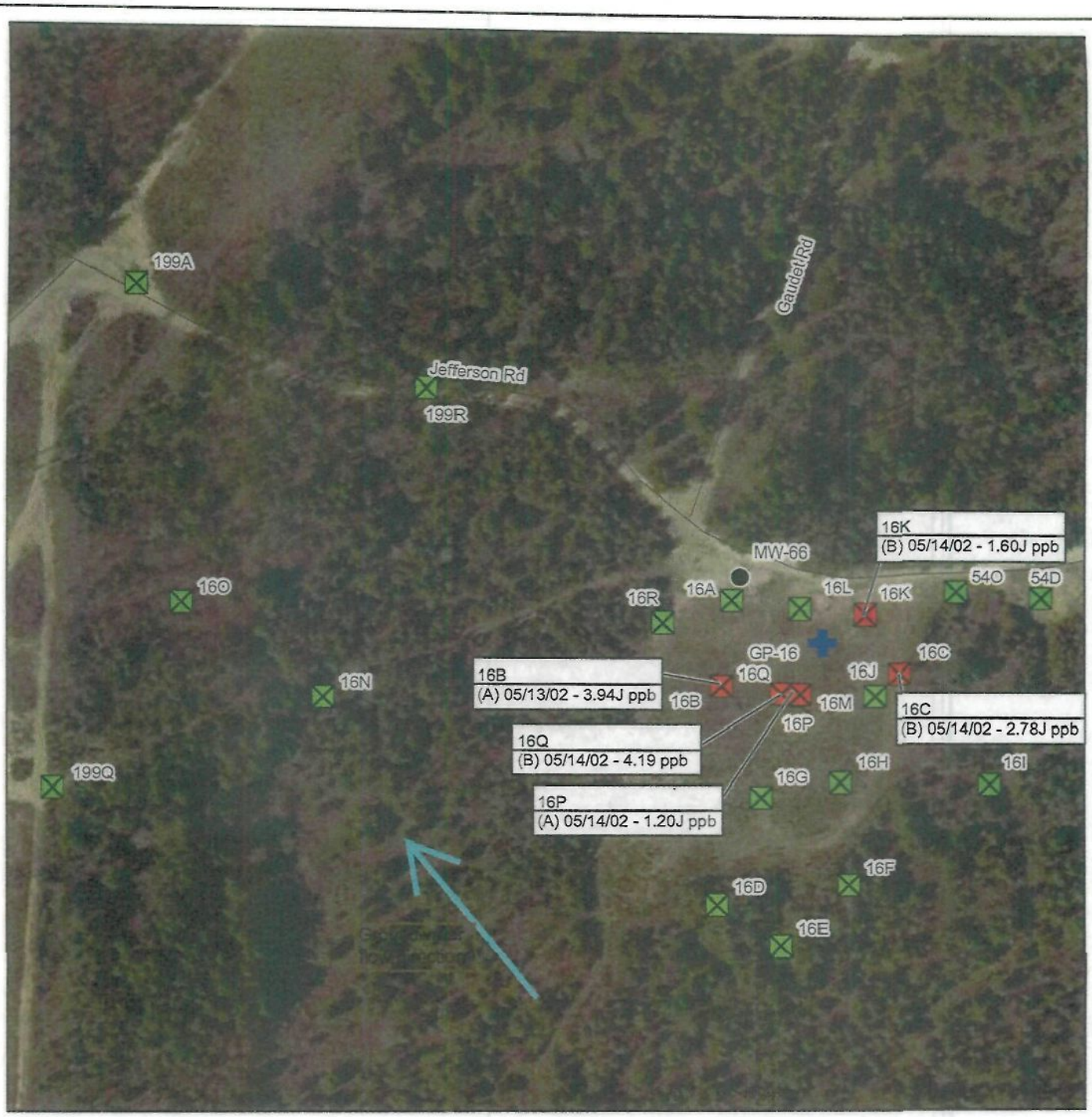
Soil Sampling Locations
Gun Position GP-12

FIGURE
13

AMEC Earth & Environmental, Inc.
Westford, Massachusetts

J:\Gun&Mortar\Northwest Corner\Northwest Corner RI Report\
MMR-9964 Backcheck NWC RI Report\Figures\N9964_Fig3-2.pdf
G:\MMR_COE\Work2006\N9964\N9964_Fig3-2.mxd
February 14, 2006 DWN: AP CHKD: BK

Impact Area
Groundwater Study Program



LEGEND

- Existing Monitoring Well
- Gun Position
- Soil Sample with Perchlorate Greater than Non-Detect
- Soil Sample with Perchlorate Non-Detect

Notes:
A Result is 0 - 0.5 ft.
B Result is 1.5 - 2 ft.

LOCATION MAP

N

0 150 Feet

NOTES & SOURCES
Base Map Data from US Geological Survey 7 1/2 minute
Topgraphic Maps Source: MassGIS
Aerial Photos: Color Digital Orthophotos.
Date Flown: 2001. Source: MassGIS

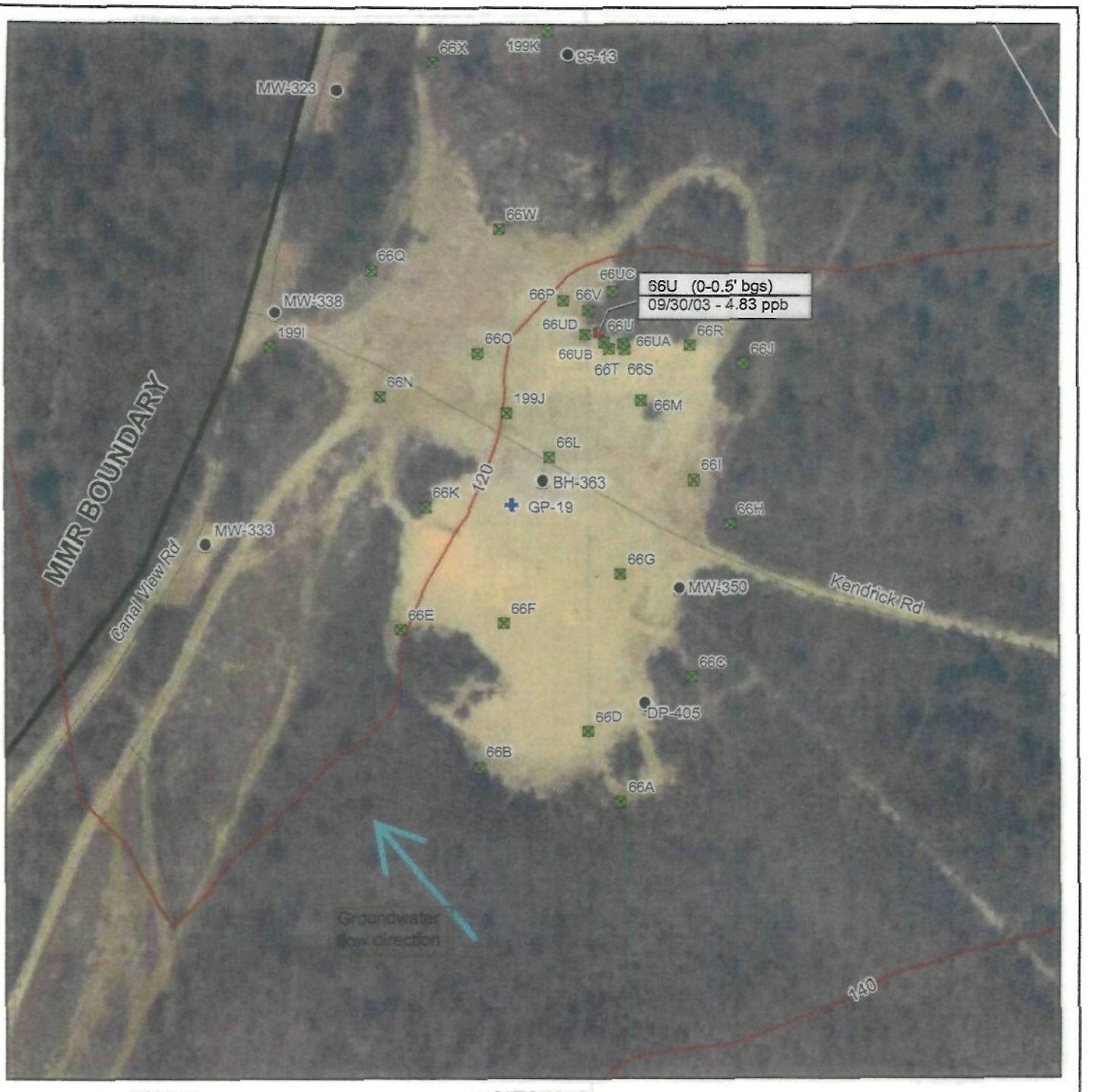
Perchlorate Concentrations in Soil
Gun Position GP-16

FIGURE
14

AMEC Earth & Environmental, Inc.
Westford, Massachusetts

J:\Gun&Mortar\Northwest Corner\Northwest Corner RI Report\
MMR-9964 Backcheck NWC RI Report\Figures\N9964_Fig4-1.pdf
G:\MMR_COE\Work2006\N9964\N9964_Fig4-1.mxd
February 14, 2006 DWN: AP CHKD: BK

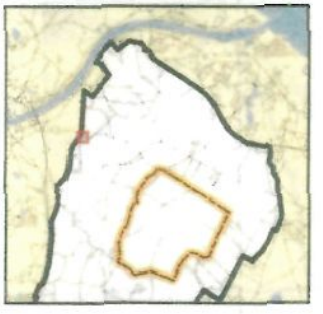
Impact Area Groundwater Study Program



LEGEND

- Proposed Monitoring Well
- Existing Monitoring Well
- Soil Sample with Perchlorate Greater than Non-Detect
- Soil Sample with Perchlorate Non-Detect
- Gun Position
- Topographic Surface Elevation Contours (20 ft intervals)

LOCATION MAP



N

0 150 Feet

NOTES & SOURCES
Base Map Data from US Geological Survey 7 1/2 minute Topgraphic Maps Source: MassGIS
Aerial Photos: Color Digital Orthophotos. Date Flown: 2001. Source: MassGIS

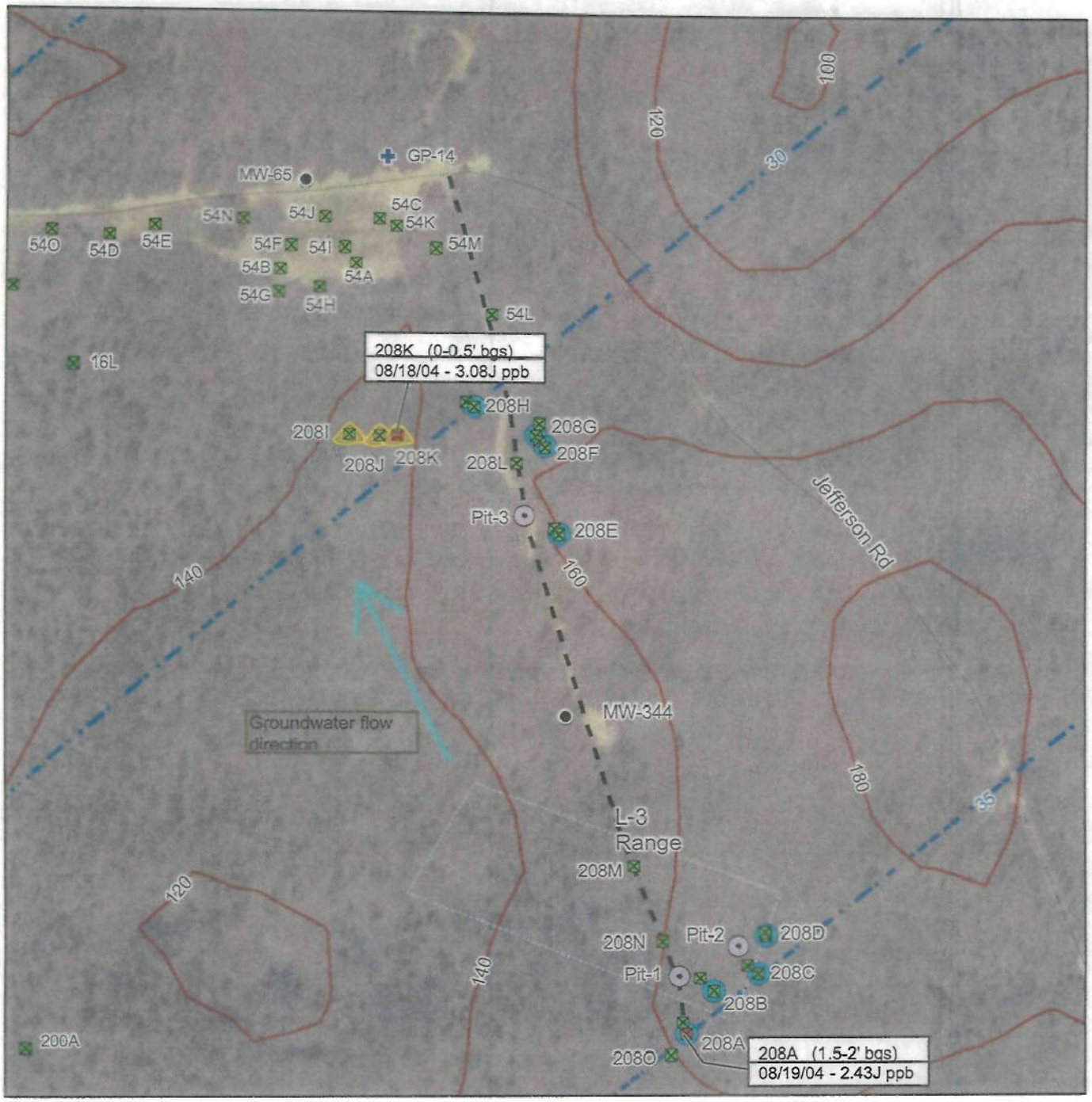
Perchlorate Concentrations in Soil
Gun Position GP-19

FIGURE 15

AMEC Earth & Environmental, Inc.
Westford, Massachusetts

J:\Gun&Mortar\Northwest Corner\Northwest Corner RI Report\MMR-9964 Backcheck NWC RI Report\Figures\N9964_Fig4-2.pdf
G:\MMR_COE\Work2006\N9964\N9964_Fig4-2.mxd
February 14, 2006 DWN: AP CHKD: BK

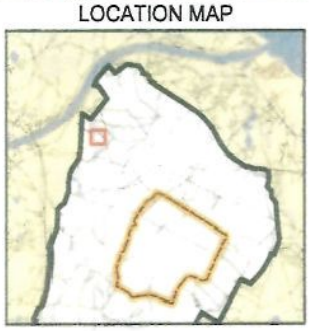
Impact Area Groundwater Study Program



LEGEND

- Existing Monitoring Well
- Soil Sample with Perchlorate - Greater than Non-Detect
- Soil Sample with Perchlorate Non-Detect
- Soil Piles
- Control Pits
- Target Pits
- Gun Position
- Topographic Surface Elevation Contours (20 ft intervals)
- GW Elevation Contours, AMEC NWC10M4 Model (In feet above NGVD)
- Access Trail from GP-14

LOCATION MAP



0 150 Feet

NOTES & SOURCES
Base Map Data from US Geological Survey 7 1/2 minute Topographic Maps Source: MassGIS
Aerial Photos: Color Digital Orthophotos. Date Flown: 2001. Source: MassGIS

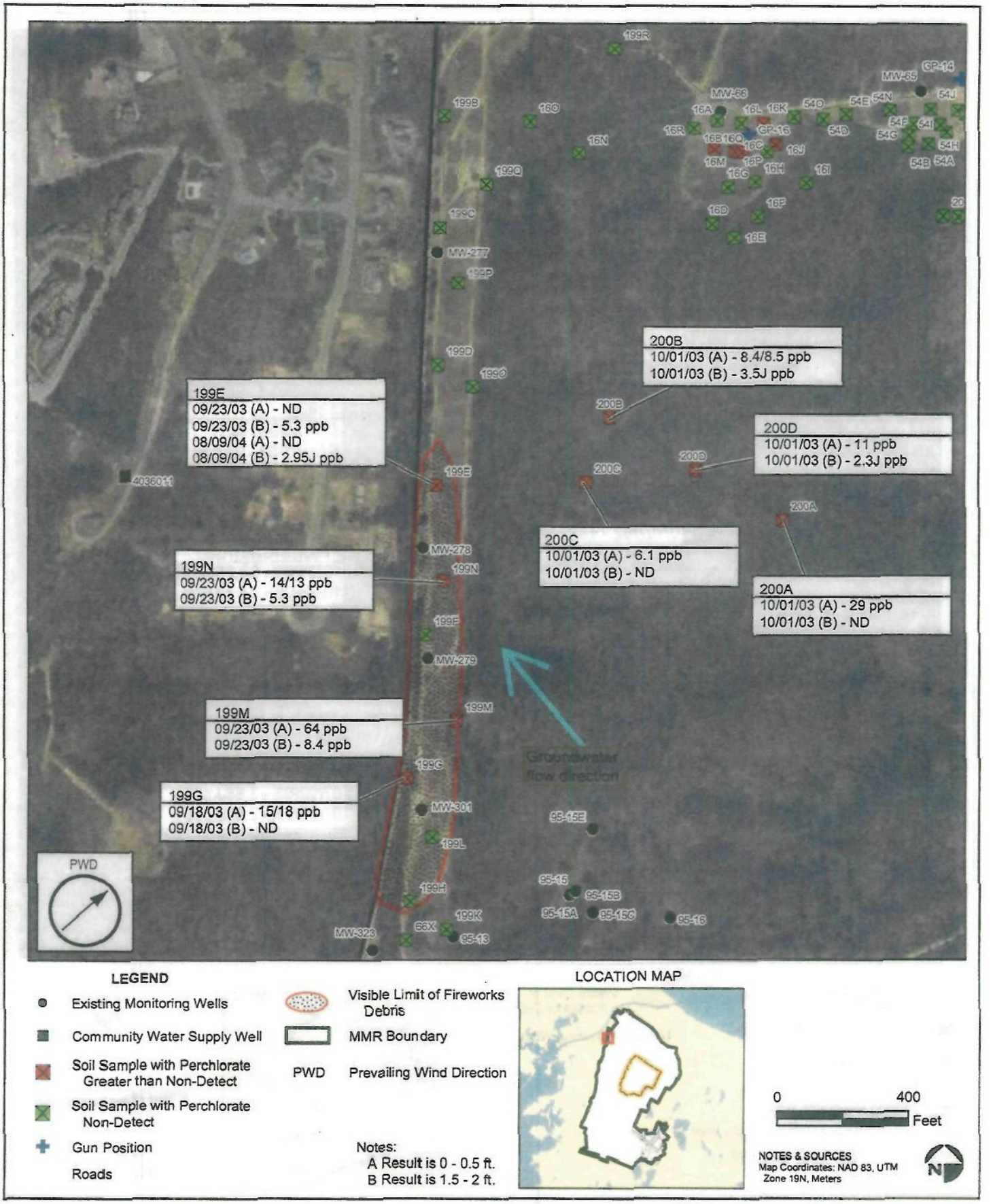
Perchlorate Concentrations in Soil
L-3 Range and Gun Position GP-14

FIGURE 16

AMEC Earth & Environmental, Inc.
Westford, Massachusetts

J:\Gun&Mortar\Northwest Corner\Northwest Corner RI Report\
MMR-9964 Backcheck NWC RI Report\Figures\N9964_Fig4-3.pdf
G:\MMR_COE\Work2006\N9964\N9964_Fig4-3.mxd
February 14, 2006 DWN: AP CHKD: BK

Impact Area Groundwater Study Program



LEGEND

- Existing Monitoring Wells
- Community Water Supply Well
- Soil Sample with Perchlorate Greater than Non-Detect
- Soil Sample with Perchlorate Non-Detect
- Gun Position
- Roads
- Visible Limit of Fireworks Debris
- MMR Boundary
- PWD — Prevailing Wind Direction

Notes:
A Result is 0 - 0.5 ft.
B Result is 1.5 - 2 ft.

LOCATION MAP

0 400 Feet

NOTES & SOURCES
Map Coordinates: NAD 83, UTM Zone 19N, Meters

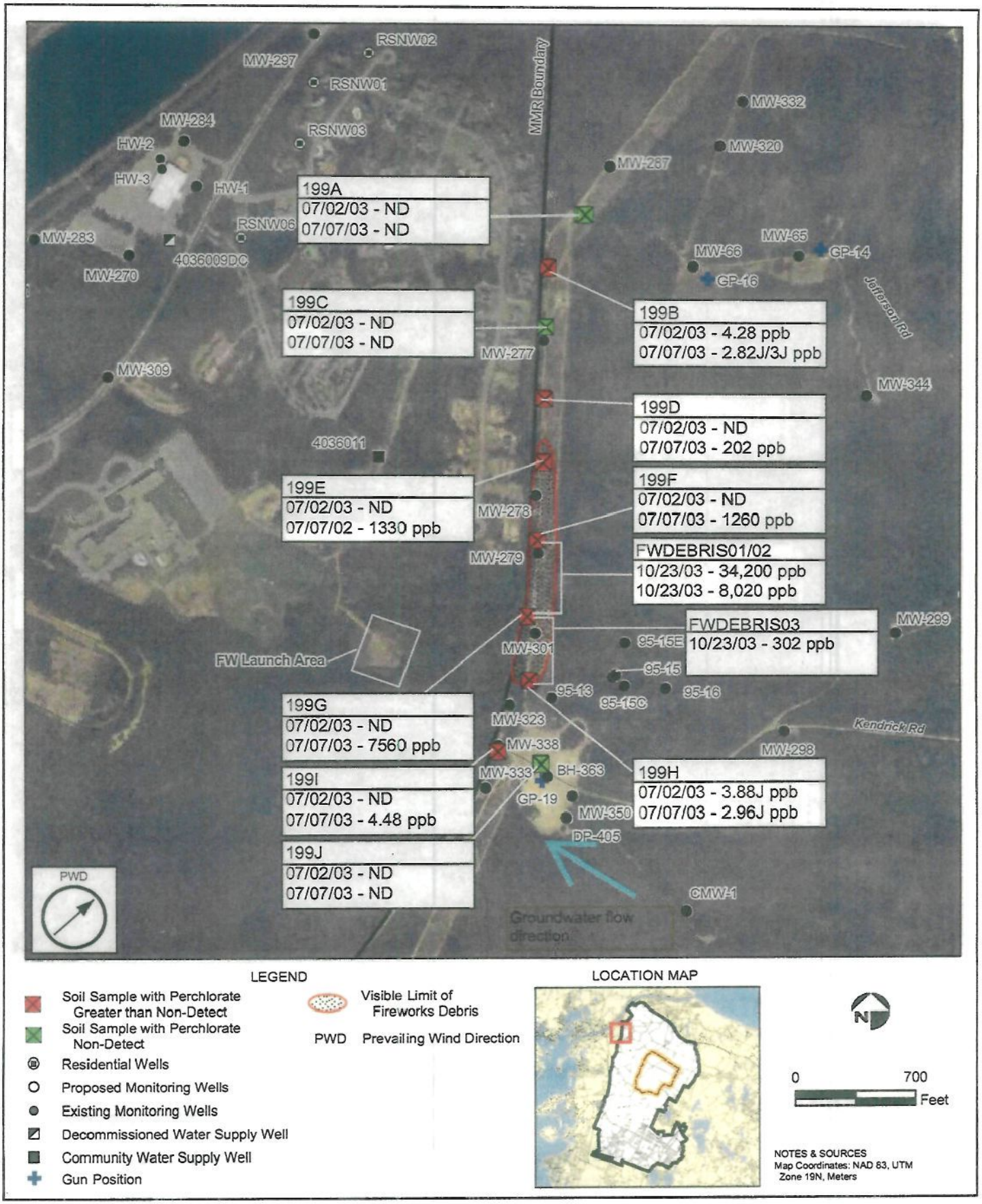
AMEC Earth & Environmental, Inc.
Westford, Massachusetts

Perchlorate Sampling Results, Canal View Road (Area 199) and Area South of GP-16 (Area 200); Northwest Corner

FIGURE 17

J:\Gun&Mortar\Northwest Corner\Northwest Corner RI Report\
MMR-9964 Backcheck NWC RI Report\Figures\N9964_Fig4-4.pdf
G:\MMR_COE\Work2006\N9964\N9964_Fig4-4.mxd
February 14, 2006 DWN: AP CHKD: BK

Impact Area Groundwater Study Program



LEGEND

- Soil Sample with Perchlorate Greater than Non-Detect
- Soil Sample with Perchlorate Non-Detect
- Residential Wells
- Proposed Monitoring Wells
- Existing Monitoring Wells
- Decommissioned Water Supply Well
- Community Water Supply Well
- Gun Position
- Visible Limit of Fireworks Debris
- PWD Prevailing Wind Direction

LOCATION MAP

N

0 700 Feet

NOTES & SOURCES
Map Coordinates: NAD 83, UTM Zone 19N, Meters

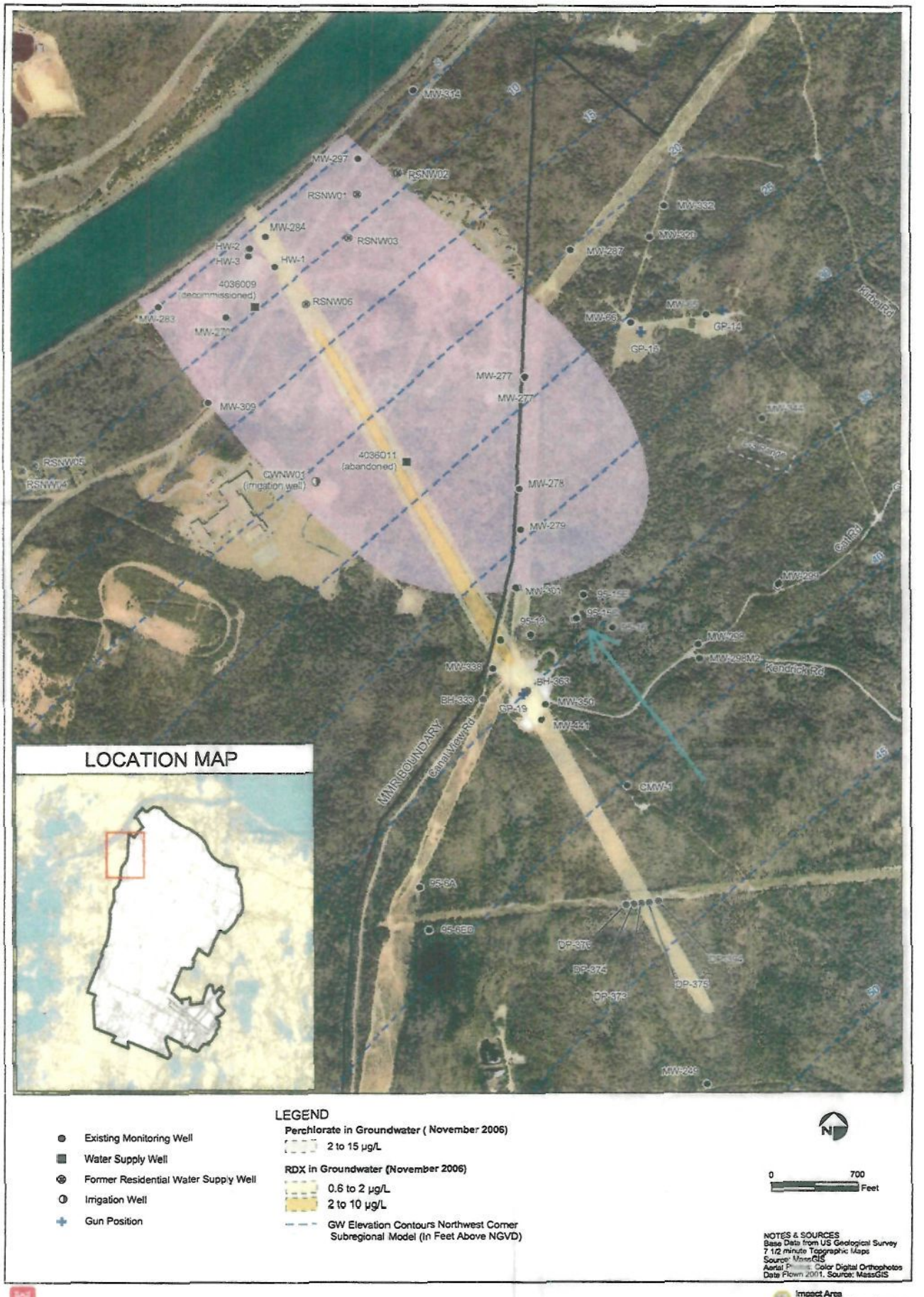
Northwest Corner Soil and Fireworks Debris Sampling Results, July 2003

FIGURE 18

AMEC Earth & Environmental, Inc.
Westford, Massachusetts

J:\Gun&Mortar\Northwest Corner\Northwest Corner RI Report\
MMR-9964 Backcheck NWC RI Report\Figures\N9964_Fig4-4a.pdf
G:\MMR_COE\Work2006\N9964\N9964_Fig4-4a.mxd
February 14, 2006 DWN: AP CHKD: BK

Impact Area Groundwater Study Program



US Army Corps of Engineers, New England District

Impact Area Groundwater Study Program

Northwest Corner Site
November 2006 Plume Configuration

FIGURE
19

M:\MMR\2009\NWC\Figures\DecisionDoc_Fig3_102609.pdf
M:\MMR\2009\NWC\MXD\s\DecisionDoc_Fig3_102609.mxd
October 26, 2009 DWN MTW CHKD LB KC

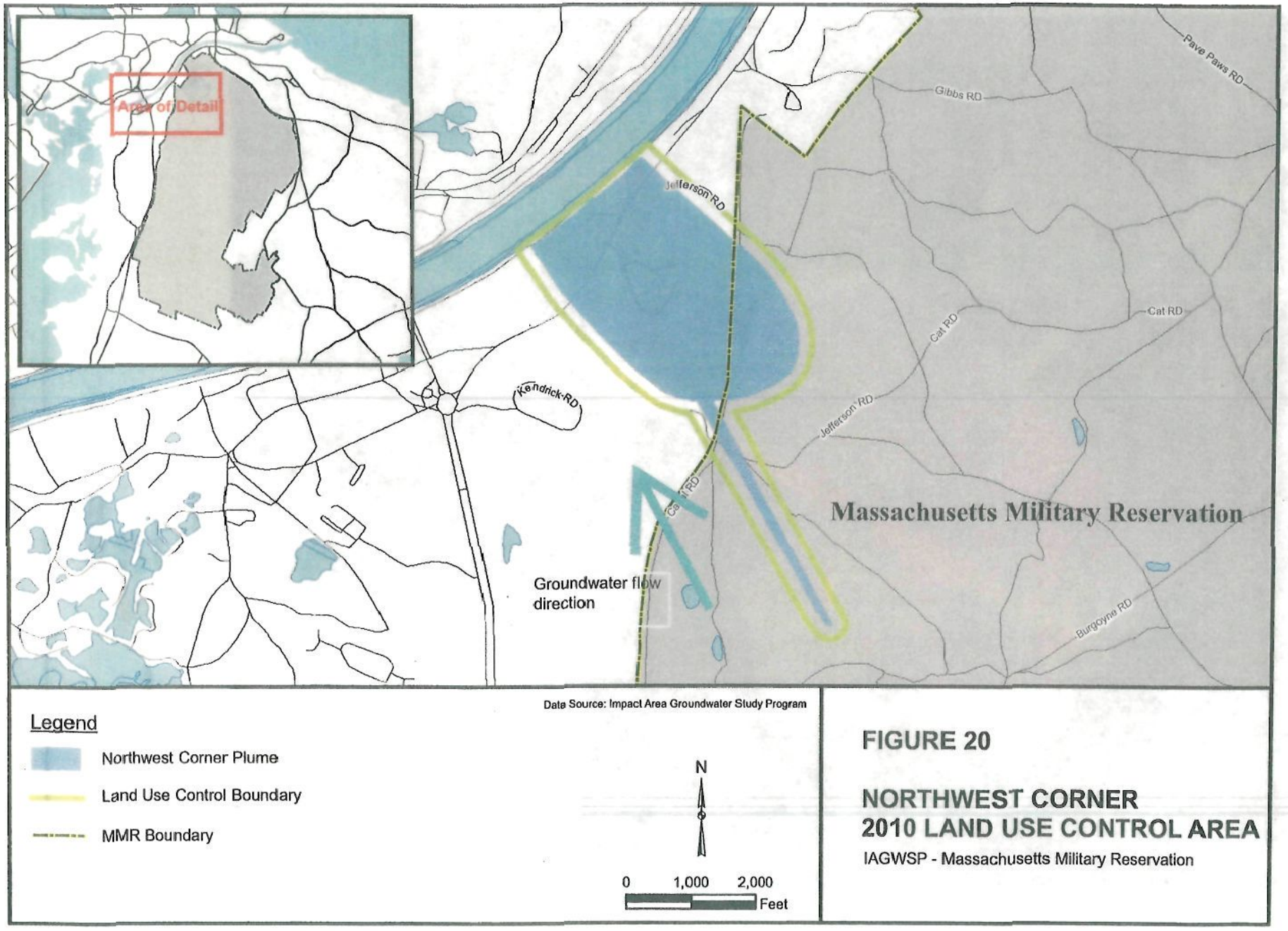


FIGURE 20

NORTHWEST CORNER
2010 LAND USE CONTROL AREA

IAGWSP - Massachusetts Military Reservation

TABLES

TABLE 1
SUMMARY OF ALTERNATIVES

Alternative	Design Details			RDX Remediation			Perchlorate Remediation	
				Predicted Year to Achieve			Predicted Year to Achieve	
	# of Extraction Wells	Total Extraction Rate (gpm)	Total Cost	Lifetime Health Advisory (2 ug/L)	10^{-6} Cancer Risk Level (0.6 ug/L)	Background (0.25 ug/L)	MMCL (2 ug/L)	Background (0.35 ug/L)
Western Boundary								
1 No Action	N/A	N/A	$278,000	N/A	N/A	N/A	2009	2017
2. Monitored Natural Attenuation and Land Use Controls	N/A	N/A	$373,000	N/A	N/A	N/A	2009	2017
Demolition Area 2								
1. No Further Action	N/A	N/A	$140,000	2011	2013	2021	N/A	N/A
2. Monitored Natural Attenuation and Land Use Controls	N/A	N/A	$790,000	2011	2013	2021	N/A	N/A
3. Focused Extraction	1	100	$3,720,000	2010	2012	2016	N/A	N/A
Northwest Corner								
1. No Action	N/A	N/A	$150,000	2012	2022	2044	2012	2019
2. Monitored Natural Attenuation and Land-Use Controls	N/A	N/A	$1,198,000	2012	2022	2044	2012	2019
3 Focused Extraction	3	300	$9,789,000	2012	2020	2020	2012	2019

N/A – Not applicable or relevant to remedial alternative or site-specific evaluation criteria.

Table 2
Summary of Regulatory Considerations*

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

Table 2
Summary of Regulatory Considerations*

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. e
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.	Synopsis: This document lists both promulgated Massachusetts MCLs and also MassDEP Office of Research and Standards guidelines for chemicals that do not have Massachusetts MCLs. Standards promulgated by EPA but not yet effective may be included on the Guidelines list. These values are derived based on a review and evaluation of all available data for the chemical of interest.
State/Action Specific	Massachusetts Surface Water Quality Standards, 314 CMR 4.00	These MassDEP standards prescribe the minimum water quality criteria required to sustain the designated uses of Massachusetts waters. The levels are designed to prevent all adverse health effects from ingestion, inhalation or dermal contact.
Federal/Action Specific	Subtitle C Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 CFR Part 264	These requirements establish minimum national standards that define the acceptable management of hazardous waste. □
State/Action Specific	MA Hazardous Waste Management Regulations (310 CMR 30.0000)	These requirements specify how a generator of solid waste must determine whether that waste is hazardous. If waste is determined to be hazardous, it must be managed in accordance with these requirements.

Table 2
Summary of Regulatory Considerations*

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.
	Resource Conservation and Recovery Act (RCRA) [40 CFR 261; 40 CFR 262.34]	Resource Conservation and Recovery Act (RCRA) regulations at 40 CFR 261.24 identify the concentrations of contaminants that make a waste material a RCRA -characteristic hazardous waste for toxicity.
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.

Table 2
Summary of Regulatory Considerations*

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

Table 2
Summary of Regulatory Considerations*

State/Action Specific, Chemical Specific	Discharge of Groundwater 310 CMR 40.0045	Regulations restrict remedial wastewater discharge to the ground surface or subsurface and/or groundwater. Such a discharge should not erode or impair the functioning of the surficial and subsurface soils, infiltrate underground utilities, building interiors or subsurface structures, result in groundwater mounding within two feet of the ground surface, or result in flooding or breakout to the ground surface. The concentrations of all pollutants discharged must be below the Massachusetts Groundwater Quality Standards established by 314 CMR 6.0. The concentrations must also be below the applicable Reportable Concentrations established by 310 CMR 40.0300 and 40.1600.
State/Action Specific	Discharge of Groundwater 310 CMR 40.0300 and 310 CMR 40.1600	The MCP contains special provisions for the discharge of groundwater containing very low levels of oil or hazardous material. Groundwater containing oil and/or hazardous material in concentrations less than the applicable release notification threshold established by 310 CMR 40.0300 and 40.1600, can be discharged to the ground subsurface and/or groundwater only when following appropriate guidelines.
State/Action Specific	Groundwater Discharge Regulations [314 CMR 5.00]	Recharge of effluent from some treatment works requires a permit under Groundwater Discharge Regulations at 314 CMR 5.00 unless the exemption allowing for actions taken in compliance with MGL C. 21E and regulations at 40 CMR 40.00 applies. The effluent discharged must not exceed any Massachusetts Groundwater Quality Standards and effluent limitations in 314 CMR 5.10(3). For previous projects on MMR, the MassDEP has determined that effluent from any constructed treatment system is "conditionally exempt" from obtaining the permit provided that the applicable or relevant provisions of the MCP 310 CMR 40.0000 are complied with.

State/Action Specific	MassDEP Drinking Water Program, Private Well Guidelines (2008), available at http://www.mass.gov/dep/water/laws/prwellgd.pdf	These are guidelines concerning private well location, design, construction, development, water quality testing, operation, maintenance, and decommissioning.
State/Action Specific	Underground Injection Control [310 CMR 27.00]	These regulations prohibit injection of fluid containing any pollutant into underground sources of drinking water where such pollutant will, or is likely to, cause a violation of any state drinking water standard or adversely affect the health of persons.
State/Action Specific	STATE - MA Erosion and Sediment Control Guidelines for Urban and Suburban Areas (May 2003), available at http://www.mass.gov/dep/water/essec1.pdf	Provides guidance and best management practices regarding erosion and sediment control.

Table 2
Summary of Regulatory Considerations*

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.	Actions that jeopardize state-listed endangered or threatened species, or species of special concern or their habitats must be avoided, or, if that is not possible, minimized and mitigated.

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

Table 3-A
Western Boundary
Soil Screening

Analyte	Maximum Concentration (mg/Kg)	Location of Maximum Detected Concentration	Total Number of Analyses	Number of Analyses Detected	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [5]	MMR SSL	EPA Region 3 Risk-Based SSL	Moraine Background Concentration (0 - 2 ft bgs)
Data applicable to the Western Boundary Risk Screening									
Perchlorate	0.00587	SS193B	29	2	0.1	0.002	0.003	-	-
Data to be evaluated under other operable units									
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	0.000064	SS051607-C-01E 0-6	11	10	0.00045	-	0.002	0.000015	-
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-p-DIOXIN	0.00027	SS051607-C-01E 0-6	11	11	0.00045	-	0.002	0.000015	-
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	0.0000032 J	SS051607-C-01E 0-6	11	8	0.00045	-	0.002	0.000015	-
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	0.0000035 J	SS051607-C-01E 0-6	11	9	0.000045	-	0.0002	0.0000015	-
1,2,3,4,7,8-HEXACHLORODIBENZO-p-DIOXIN	0.0000038 J	SS051607-C-01E 0-6	11	8	0.000045	-	0.0002	0.0000015	-
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	0.0000038 J	SS051607-C-01E 0-6	11	8	0.000045	-	0.0002	0.0000015	-
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	0.000013	SS051607-C-01E 0-6	11	8	0.000045	-	0.0002	0.0000015	-
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	0.00000023 J	SS051607-C-01S 0-6	11	1	0.000045	-	0.0002	0.0000015	-
1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN	0.000012	SS051607-C-01E 0-6	11	8	0.000045	-	0.0002	0.0000015	-
1,2,3,7,8-PENTACHLORODIBENZOFURAN	0.00000056 J	SS051607-C-01E 0-6	11	4	0.000045	-	0.0002	0.0000015	-
1,2,3,7,8-PENTACHLORODIBENZO-p-DIOXIN	0.0000029 J	SS051607-C-01E 0-6	11	8	0.0000045	-	0.00002	0.00000015	-
1,3,5-TRINITROBENZENE	0.41	SS09184-A 0-0.25	248	1	-	-	-	2.6	-
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	0.0000028 J	SS051607-C-01E 0-6	11	9	0.000045	-	0.0002	0.0000015	-
2,3,4,7,8-PENTACHLORODIBENZOFURAN	0.00000067 J	SS051607-C-01E 0-6	11	8	0.000015	-	0.000067	0.0000005	-
2,3,7,8-TETRACHLORODIBENZOFURAN	0.0000005 J	SS051607-C-01E 0-6	11	6	0.000045	-	0.0002	0.0000015	-
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0.011 NJ	CP203C 0-0.5	155	2	-	-	0.493	0.11	-
2,4,6-TRINITROTOLUENE	3.4	CP198B 0-0.5	48	28	-	-	0.000212	0.0087	-
2,4-DINITROTOLUENE	0.26 J	SS69F 1.5-2	446	2	0.7	0.057	0.020	0.0002	-
2,6-DINITROTOLUENE	0.85 J	SS09195-A 0-1.0	446	1	-	-	0.009	0.034	-
2-AMINO-4,6-DINITROTOLUENE	0.56 J	SS09165-A 0-0.25	248	1	-	-	0.000385	0.029	-
2-CHLORONAPHTHALENE	0.32 J	OG042000-01 0-0.25	198	1	-	-	-	18	-
2-METHYLNAPHTHALENE	0.069 J	SS51H 0-0.5	197	3	0.7	0.36	0.072	0.9	-
4-AMINO-2,6-DINITROTOLUENE	0.76	SS09195-A 0-0.25	248	3	-	-	0.000385	0.029	-
ACENAPHTHENE	0.047 J	SS51H 0-0.5	198	3	4	3.88	2.7	27	-
ACENAPHTHYLENE	0.064 J	SS51H 0-0.5	197	4	1	1.18	0.068	-	-
ACETONE	2.18 J	SS09162-A 0-0.25	169	115	6	6.3	0.107	4.4	-
ACIFLUORFEN	0.01 NJ	SS76C 0-0.5	116	1	-	-	0.000107	3.1	-
ALDRIN	0.0022 J	SS51H 0-0.5	155	1	0.04	-	0.010	0.00084	-
ALPHA-CHLORDANE	0.0034 J	SS71B 0-0.5	155	1	0.7	-	0.000384	0.033	-
ALUMINUM	14500	SS04246-A 0-0.25	183	183	-	-	54006	55000	15500
ANTHRACENE	0.03 J	SS51H 0-0.5	198	1	1000	-	53.8	450	-
ANTIMONY	1.3 J	SS51I 1.5-2.0	183	30	20	-	0.271	0.66	2.3
ARSENIC	7.4	SS04246-A 0-0.25	184	146	20	-	0.009	0.0013	3.9
BARIUM	56.6	SS04246-A 0-0.25	184	184	1000	-	120.349	300	20.2
BENZENE	0.0173	SS07967-A 0-0.25	171	4	2	1.50	0.000103	0.00023	-
BENZO(a)ANTHRACENE	0.2 J	SS51H 0-0.5	198	7	7	-	0.037	0.014	0.46
BENZO(a)PYRENE	0.3 J	SS51H 0-0.5	197	8	2	-	0.203	0.0046	0.46
BENZO(b)FLUORANTHENE	0.57	SS51H 0-0.5	197	11	7	-	0.114	0.047	0.46
BENZO(g,h,i)PERYLENE	0.093 J	SS51H 0-0.5	198	7	1000	-	553.8	-	0.46
BENZO(k)FLUORANTHENE	0.39 J	SS51H 0-0.5	197	9	70	-	0.114	0.46	0.46
BENZOIC ACID	0.505 J	SS09184-A 0-0.25	65	10	-	-	-	33	-
BERYLLIUM	0.49	SS69D 0-0.5	183	119	100	-	2.6	58	0.41
bis(2-ETHYLHEXYL) PHTHALATE	0.37 J	OG042000-01 0-0.25	197	43	200	-	72.0	1.6	-
BORON	12.1	SS76B 1.5-2.0	140	41	-	-	9.523	23	17.3
BROMOFORM	0.00522 J	SS09171-A 0-0.25	171	14	0.1	0.007	0.002	0.0023	-
BROMOMETHANE	0.00282 J	SS07948-A 0-0.75	171	1	0.5	0.05	0.00182	0.0022	-
CADMIUM	47.8	OG042000-01 0-0.25	187	28	2	-	0.401	-	0.35
CALCIUM	540	SS04246-A 0-0.25	183	148	-	-	-	-	-

Table 3-A
Western Boundary
Soil Screening

Analyte	Maximum Concentration (mg/Kg)	Location of Maximum Detected Concentration	Total Number of Analyses	Number of Analyses Detected	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [5]	MMR SSL	EPA Region 3 Risk Based SSL	Moraine Background Concentration (0 - 2 ft bgs)
CARBAZOLE	0.095 J	SS51H 0-0.5	197	3	-	-	0.012	-	-
CHLOROBENZENE	0.004 J	OG042000-01 0-0.25	170	1	1	1.2	-	0.068	-
CHLOROFORM	0.00571 J	SS09191-A 0-0.25	171	10	0.4	0.35	0.0000364	0.000055	-
CHROMIUM, TOTAL [1]	15.5	SS04246-A 0-0.25	178	178	30	-	7.0	-	15.5
CHRYSENE	0.52	SS51H 0-0.5	197	15	70	-	3.4	1.4	0.46
COBALT	4.5	SS51L 1.5-2.0	183	162	-	-	132.4	0.49	4.5
COPPER	1230	OG042000-01 0-0.25	189	176	-	-	45.7	51	11
DIBENZ(a,h)ANTHRACENE	0.034 J	SS51H 0-0.5	197	3	0.7	-	0.038	0.015	-
DIBENZOFURAN	0.056 J	SS51H 0-0.5	198	2	-	-	0.262	-	0
DICAMBA	0.017 NJ	CP42D 0-0.5	147	2	-	-	0.266	0.28	-
DIELDRIN	0.91	SS51J 0-0.5	158	18	0.05	-	0.0008	0.00009	0.03
DIETHYL PHTHALATE	3 J	SS75D 0-0.5	198	11	10	9.98	13.4	13	-
DI-n-BUTYL PHTHALATE	0.4	SS69F 1.5-2	190	9	-	-	150.6	11	-
ENDRIN ALDEHYDE [4]	0.0046 NJ	SS51H 0-0.5	155	3	8	-	0.2	0.23	-
ENDRIN KETONE [4]	0.0078 J	SS51J 0-0.5	155	6	8	-	0.1	0.23	-
ETHYLBENZENE	0.00534 J	SS09194-A 0-0.25	170	2	40	44.8	1.9	0.0019	-
FLUORANTHENE	0.83	SS51H 0-0.5	197	18	1000	-	108.1	210	0.46
FLUORENE	0.052 J	SS51H 0-0.5	198	3	1000	-	13.9	33	-
GAMMA-CHLORDANE	0.0029	SS71B 0-0.5	155	1	-	-	0.0000384	-	-
HEPTACHLOR	0.0023	CP42D 0-0.5	155	1	0.2	-	0.021	0.0016	-
HEPTACHLORINATED DIBENZOFURANS, (TOTAL)	0.00000099	SS151A 0-0.5	3	2	-	-	-	-	-
HEPTACHLORINATED DIBENZO-p-DIOXINS, (TOTAL)	0.0000363	SS151B 0-0.5	3	3	-	-	-	-	-
HEXACHLORINATED DIBENZOFURANS, (TOTAL)	0.000002	SS151A 0-0.5	3	2	-	-	-	-	-
HEXACHLORINATED DIBENZO-p-DIOXINS, (TOTAL)	0.0000027	SS151B 0-0.5	3	2	-	-	-	0.000009	-
HEXACHLOROBENZENE	0.02 J	SPOIL1004BIP5 0.5-1.0	198	1	0.7	-	0.007	0.00029	-
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX)	1.6	CP198A 1.5-2.0	48	14	1	0.00168	0.000109	0.00036	-
INDENO(1,2,3-c,d)PYRENE	0.1 J	SS51H 0-0.5	198	6	7	-	0.317	0.15	0.46
IRON	18600	SS04246-A 0-0.25	183	183	-	-	2421.9	640	12100
LEAD	79.3	SS04246-A 0-0.25	187	185	300	-	4.1	-	19
MAGNESIUM	2350	SS69D 0-0.5	183	181	-	-	-	-	1980
MANGANESE	250	SSASPATP01 0-6.0	183	183	-	-	44.2	57	122
MCPA	42 NJ	CP42I 0-0.5	147	19	-	-	0.001	0.0047	-
MCPP	33 J	CP42D 1.5-2.0	155	2	-	-	0.050	0.011	-
MERCURY	0.08 J	SS76B 0-0.5	184	9	20	-	0.020	0.03	0.1
METHYL ETHYL KETONE (2-BUTANONE)	0.039 J	SS51A 0-0.5	171	62	4	4	0.335	1.5	-
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.0371	SS09197-A 0-0.5	170	3	0.4	0.35	-	0.44	-
METHYLENE CHLORIDE	0.002 J	CP206C 0-0.5	163	3	0.1	0.01	-	0.0012	-
MOLYBDENUM	3.3	SSASPATP01 0-6.0	140	46	-	-	0.183	3.7	1.1
NAPHTHALENE	0.59	OG042000-01 0-0.25	197	6	4	4.48	0.014	0.00055	-
NICKEL	19.1	CP42D 1.5-2.0	183	161	20	-	292.1	48	9.4
NITROGEN, AMMONIA (AS N)	33.9 J	CP203B 0-0.5	159	126	-	-	-	-	20
NITROGEN, NITRATE-NITRITE	0.94	CP198A 0-0.5	159	143	-	-	-	-	0.94
N-NITROSODIPHENYLAMINE	0.034 J	SS69F 1.5-2	197	1	-	-	0.008	0.17	-
OCTACHLORODIBENZOFURAN	0.00014	TTASPETP01 0-0.6	11	8	0.015	-	0.067	0.0005	-
OCTACHLORODIBENZO-p-DIOXIN	0.0042 J	TTASPETP01 0-0.6	11	11	0.015	-	0.067	0.0005	-
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE (HI	7 J	SS09180-A 0-0.25	248	6	2	0.339	0.321	7.1	-
p,p'-DDE	0.013	TTASPETP01 0-0.6	155	34	3	-	0.884	0.06	-
p,p'-DDT	0.03	CP22D 0-0.5	155	53	3	-	0.525	0.087	-
PCB-1260 (AROCHLOR 1260)	0.039	SS139B 0.5-1.0	155	2	-	-	0.010	0.014	-
PENTACHLORINATED DIBENZOFURANS, (TOTAL)	0.0000024	SS151A 0-0.5	3	2	-	-	-	-	-
PENTACHLORINATED DIBENZO-p-DIOXINS, (TOTAL)	0.00000033	SS151A 0-0.5	3	1	-	-	-	-	-
PENTACHLOROPHENOL	0.016 J	CP206A 0-0.5	275	1	3	0.008	0.000429	0.0039	-

Table 3-A
Western Boundary
Soil Screening

Analyte	Maximum Concentration (mg/Kg)	Location of Maximum Detected Concentration	Total Number of Analyses	Number of Analyses Detected	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [5]	MMR SSL	EPA Region 3 Risk-Based SSL	Moraine Background Concentration (0 - 2 ft bgs)
PERCHLORATE	0.00587 J	SS193B 0-0.5	152	16	0.1	0.002	0.003	-	-
PHENANTHRENE	0.92	SS51H 0-0.5	197	17	10	10.873	48.1	-	0.46
PHENOL	0.047 J	SS75A 1.5-2.0	198	3	1	0.951	0.766	8.1	-
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO4)	157	SS139A 0.5-1.0	159	159	-	-	-	-	143
PICLORAM	0.011 J	CP203B 0-0.5	103	1	-	-	0.088	0.6	-
POTASSIUM	1740	SSASPATP01 0-6.0	183	158	-	-	-	-	733
PYRENE	0.71	SS51H 0-0.5	198	23	1000	-	19.0	150	0.46
SELENIUM	4.2	OG042000-01 0-0.25	184	29	400	-	2.8	0.95	1.1
SILVER	0.36	OG042000-01 0-0.16	181	6	100	-	16.2	1.6	0.61
SILVEX (2,4,5-TP)	0.0067 J	CP42D 0-0.5	155	1	-	-	-	0.11	-
SODIUM	523 J	SS139B 0-0.25	183	29	-	-	-	-	-
STYRENE	0.001 J	OG042000-02 0-0.25	170	1	3	2.9	2.3	2	-
TETRACHLORINATED DIBENZOFURANS, (TOTAL)	0.0000023	SS151A 0-0.5	3	2	-	-	-	-	-
TETRACHLOROETHYLENE(PCE)	0.001 J	SS139A 0.5-1.0	170	7	1	1.235	0.000435	0.000052	-
TETRYL	0.68	SS09189-A 0-0.25	248	3	-	-	0.064	0.65	-
THALLIUM [2]	1.8 J	CP203B 1.5-2.0	183	16	8	-	3.0	0.17	1.6
TOLUENE	0.00729 J	SS07967-A 0-0.25	170	36	30	32	0.272	1.7	-
TOTAL ORGANIC CARBON	90800	SS51H 0-0.5	111	79	-	-	-	-	-
TRICHLOROETHYLENE (TCE)	0.002 J	CP198B 0-0.5	171	4	0.3	0.28	0.000496	0.00061	-
VANADIUM	31.4	SS04246-A 0-0.25	183	183	600	-	260.0	260	21.7
XYLENES, TOTAL	0.0261 J	SS09194-A 0-0.25	170	2	400	360	0.808	0.23	-
ZINC	292	SS04246-A 0-0.25	183	152	2500	-	2201.9	680	25.6

Notes.

Data summary considers all soil samples from all operable units and subareas within the Western Boundary Study Area from all sampling dates (1997-2007).

Qualifier codes used for the "Maximum Concentration" are as follows.

J = Estimated Concentration

NJ = Presumptively Identified Compound, Estimated Concentration

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

[1] MCP standards for Chromium VI used as a surrogate for Chromium, Total.

[2] EPA Risk-Based SSL for Thallium, Soluable Salts used as a surrogate for Thallium.

[3] Sodium Acifluorfen used as a surrogate for the RSL value for Acifluorfen.

[4] MCP and EPA values for Endrin used as a surrogate for Endrin Aldehyde and Endrin Ketone.

[5] MADEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

[6] MCP S-1/GW-1s, MMR SSLs, and EPA Risk-Based SSLs for CDDs/CDFs based on TEQ-adjusted 2,3,7,8-TCDD values.

Table 3-B
Western Boundary Groundwater Screening
(Start of Program through May 2006)

Chemical	Maximum Detected Concentration (ug/L)		Location of Maximum Concentration	Detection Frequency	Maximum Contaminant Level [1] (ug/L)	EPA Chronic (Lifetime) Health Advisory Level (HA) for Drinking Water [2] (ug/L)	EPA Regional Screening Level for Tapwater (ug/L)	Massachusetts Contingency Plan GW-1 Standard (ug/L)
1,4-DICHLOROBENZENE	0.4	J	W02-03M1	5 / 1631	75	75	0.43	5
2,4 DB	1.1	J	W71SS	1 / 390	-	-	290	-
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0.22	J	W71SS	13 / 390	-	70	370	-
2,6-DINITROTOLUENE	1.9	J	W84D	2 / 2160	-		37	-
2-CHLORONAPHTHALENE	0.26	J	W84M1	1 / 457	-	-	2900	-
2-METHYLNAPHTHALENE	0.29	J	ASPWELL	1 / 457	-	-	150	10
ACETONE	16	J	TW1-88B	23 / 1343	-	-	22000	6300
ACIFLUORFEN	0.15	J	97-1	1 / 390	-	-	470 [5]	-
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	0.01	J	W81M1	1 / 259	-	-	0.011	-
ALUMINUM	7400		W47M3	99 / 456	-	-	37000	-
ANTIMONY	5.9	J	W46SS	5 / 598	6	6	15	6
ARSENIC	6.4	J	W81M2	20 / 457	10	-	0.045	10
BARIUM	64.8		W47M3	115 / 474	2000	-	7300	2000
BENZENE	0.3	J	W46M3	5 / 1362	5	-	0.41	5
BENZOIC ACID	2.4	J	W70SS	3 / 445	-	-	150000	-
BERYLLIUM	0.5		W46D	15 / 474	4	-	73	4
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.01	J	W81M3	1 / 259	0.2 [6]	-	0.037	-
BIS(2-ETHYLHEXYL) PHTHALATE	73	J	W9703	79 / 475	6	-	4.8	6
BORON	20		W46M1	233 / 434	-	1000	7300	-
BROMODICHLOROMETHANE	0.5		ASPWELL	1 / 1362	-	-	0.12	3
CADMIUM	1.6		WL26L	5 / 474	5	5	18	5
CALCIUM	10100		W46D	449 / 456	-	-	-	-
CARBON DISULFIDE	0.3	J	W81M1	3 / 1343	-	-	1000	-
CARBON TETRACHLORIDE	0.2	J	W213M2	1 / 1362	5	-	0.2	5
CHLORAMBEN	0.58	NJ	W21M3	10 / 390	-	100	550	-
CHLOROFORM	4		W80SS	1262 / 1362	-	70	0.19	70
CHLOROMETHANE	7		W80M2	40 / 1362	-	30	190	-
CHROMIUM, TOTAL	26		W47M3	61 / 476	100	1000	-	100
CIS-1,3-DICHLOROPROPENE [3]	0.5	J	W80M1	1 / 1362	-	-	0.43	0.4
COBALT	5.7		W69SS	23 / 456	-	-	11	-
COPPER	632		ASPWELL	72 / 456	1300	-	1500	-
DCPA (DACTHAL)	0.18	J	W46M1	3 / 379	-	70	370	-
DIETHYL PHTHALATE	140		W70SS	5 / 457	-	-	29000	2000
DI-N-BUTYL PHTHALATE	0.23	J	W82SS	1 / 457	-	-	3700	-
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX)	0.3	J	W70SS	2 / 1703	-	2	0.61	1
IRON	7760		W47M3	172 / 456	-	-	26000	-
LEAD	53		ASPWELL	35 / 475	15	-	-	15
MAGNESIUM	5560		W46SS	444 / 456	-	-	-	-
MANGANESE	676		W46M1	351 / 456	-	300	880	-
MCPP	140	NJ	W81D	2 / 390	-	30 [7]	37	-
MERCURY	0.28		W83M2	17 / 473	2	2	0.57	2
METHYL ETHYL KETONE (2-BUTANONE)	2	J	TW1-88B	3 / 1343	-	4000	7100	4000
METHYLENE CHLORIDE	0.7	J	XXM973	1 / 1362	5	-	4.8	5
MOLYBDENUM	51		W46M2L	69 / 434	-	40	180	-
NICKEL	66		ASPWELL	62 / 474	-	100	730	100
PENTACHLOROPHENOL	0.18	J	W70SS	1 / 865	1	-	0.56	1
PERCHLORATE	2.89		W267M1	693 / 4623	2 [1]	15 [4]	26	2
PHENOL	2	J	W46M1	1 / 457	-	2000	11000	1000
POTASSIUM	9980		W46M1	364 / 456	-	-	-	-
SELENIUM	5.9	J	W69M2	12 / 474	50	50	180	50
SILVER	3.2	J	W81M2	7 / 456	-	100	180	100
SODIUM	38000		ASPWELL	471 / 473	-	-	-	-
TERT-BUTYL METHYL ETHER (MBTE)	0.8		W276M3	17 / 441	-	-	12	70
THALLIUM	6.9	J	W21SS	15 / 598	2	0.5	2.4	2
TOLUENE	10		W70SS	52 / 1362	1000	-	2300	1000
TRICHLOROETHYLENE (TCE)	2		TW00-2D	26 / 1362	5	-	1.7	5
VANADIUM	11.3		W81M1	16 / 456	-	-	260	30
XYLENES, TOTAL	0.6	J	W267M1	3 / 1362	10000	-	200	10000
ZINC	39.4		W21M2	150 / 456	-	2000	11000	5000

Notes:

All data as reported by AMEC in the IAGWSP Draft Western Boundary RI (July 21, 2006).

"Qualifier" codes used for the "Maximum Concentration" are as follows:

J = Estimated Concentration

NJ = Presumptively Identified Compound, Estimated Concentration

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

[1] Maximum Contaminant Level is both Federal and State except for perchlorate, which reflects the State MCL

[2] HA is the Federal EPA lifetime health advisory value (June, 2006).

[3] RSL is for 1,3-dichloropropene (isomer not specified).

[4] Interim Health Advisory

[5] Sodium Acifluorfen used as a surrogate for the RSL value for Acifluorfen.

[6] Lindane (technical grade BHC) used as a surrogate for the MCL value for Beta BHC.

[7] MCPA used as a surrogate for the HA value for MCPP.

Table 4-A
Demoliton Area 2
Soil Screening

Analyte	Maximum Concentration Detected[1]	Location of Maximum Detected Concentration	Total No. of Analyses	No. of Analyses Detected	MCP S-1/GW-1	MassDEP Leaching Based Soil Concentration[3]	MMR SSL	EPA Region 3 Risk-Based SSL	Marine Background Concentration (0 2 ft bgs)
2-METHYLNAPHTHALENE	0.021J	SSDEMO2NW	16	1	0.7	0.36	0.072	0.9	-
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0.012	CP13C	12	1	-	-	0.493	0.11	-
ACENAPHTHYLENE	0.056J	SSDEMO2NW	16	2	1	1.18	0.068	-	-
ACETONE	0.0370J	CP13H	14	1	6	6.3	0.107	4.4	
ALUMINUM	13500	CP13J	13	13	-	-	54006	55000	15500
ARSENIC	4.3	CP13D	13	13	20	-	0.009	0.0013	3.9
BARIUM	24.5	CP13D	13	13	1000	-	120.349	300	20.2
BENZO(a)ANTHRACENE	0.033J	CP13F	16	1	7	-	0.037	0.014	0.46
BENZO(a)PYRENE	0.023J	CP13F	16	1	2	-	0.203	0.0046	0.46
BENZO(b)FLUORANTHENE	0.042J	CP13F	16	2	7	-	0.114	0.047	0.46
BENZO(g,h,i)PERYLENE	0.022J	CP13F	16	2	1000	-	553.8	-	0.46
BENZO(k)FLUORANTHENE	0.035J	CP13F	16	1	70	-	0.114	0.46	0.46
BENZYL BUTYL PHTHALATE	1.2	SSDEMO2NW	16	4	-	-	491	0.67	-
BERYLLIUM	0.41	CP13D	13	13	100	-	2.6	58	0.41
BORON	2.7	SS133W	9	2	-	-	9.52	23	17.3
CADMIUM	1.6	SSDEMO2NW	13	1	2	-	0.401	1.4	0.35
CALCIUM	734	SSDEMO2_SE	13	13	-	-	-	-	-
CHROMIUM, TOTAL[2]	14.5	CP13G	13	16	30	-	7	-	15.5
COBALT	7.7	SSDEMO2_SE	13	13	-	-	132.4	0.49	4.5
COPPER	32.1	CP13B	13	13	-	-	45.7	51	11
DICAMBA	0.0078	CP13H	11	1	-	-	0.265	0.28	-
DIELDRIN	0.015J	CP13F	11	1	0.05	-	0.0008	0.0009	0.03
FLUORENE	0.023J	SSDEMO2NW	17	2	1000	-	13.9	33	-
INDENO(1,2,3-c,d)PYRENE	0.019J	CP13F	16	1	7	-	0.317	0.16	0.46
IRON	14400	CP13J	13	13	-	-	2420	640	12100
LEAD	29.9J	CP13F	13	13	300	-	4.1	-	19
MAGNESIUM	2720	SSDEMO2_SE	13	13	-	-	-	-	1980
MANGANESE	200	SSDEMO2_SE	13	13	-	-	44.2	57	122
MCPA	11J	CP13G	11	2	-	-	0.001	0.0047	-
MERCURY	0.07	SSDEMO2NW	13	2	20	-	0.02	0.03	0.1
METHYLENE CHLORIDE	0.004J	CP13G	13	1	0.1	0.01	-	0.0012	-
MOLYBDENUM	0.7J	SSDEMO2_SE	6	2	-	-	0.183	3.7	1.1
NAPHTHALENE	0.086J	SSDEMO2NW	16	2	4	4.48	0.014	0.00055	-
NICKEL	11.1	SSDEMO2_SE	13	13	20	-	292.1	48	9.4
NITROGEN, AMMONIA (AS N)	12.6	CP13J	11	8	-	-	-	-	20
NITROGEN, NITRATE-NITRITE	0.35	CP13B	11	8	-	-	-	-	0.94
p,p'-DDT	0.0084	CP13B	11	1	3	-	0.525	0.087	
PHENANTHRENE	0.065J	SSDEMO2NW	16	1	10	10.873	48.1	-	0.46
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO4)	125	CP13J	11	11	-	-	-	-	143
PICLORAM	.0074J	CP131	12	1			0.88	0.6	#VALUE!
POTASSIUM	712	CP13C	13	13	-	-	-	-	733
PYRENE	0.1055	MW-16D	17	5	1000		19	150	0.46
SELENIUM	1.8J	CP13J	13	3	400	-	2.8	0.95	1.1
SILVEX (2,4,5-TP)	0.0075J	CP13J	11	1	-	-	-	0.11	-
THALLIUM[4]	1.6	SSDEMO2NW	13	2	8	-	3	0.17	1.6
TRICHLOROETHYLENE (TCE)	0.002J	CP13D	13	1	0.3	0.28	0.000496	0.00061	-
VANADIUM	27.1	CP13J	13	13	600	-	260	260	21.7
ZINC	29.5J	CP13C	13	13	2500	-	2210.9	680	25.6

Notes:
Data based on post-excavation soil sampling results collected as part of the RRA.
Highlighting indicates those criteria that have been exceeded.
Qualifier codes used for the "Maximum Concentrations" are as follows:
J = Estimated Concentration
1. All values in milligrams per kilogram (mg/kg)
2. MCP Standards for Chrominum VI used a surrogate for Chrominum Total
3. MassDEP Leaching Based Soil Concentrrations are not used as a screening criteria but are included for comparison purposes only.
4. EPA Risk-Based SSL for Thallium, Soluable Salts used as a surrogate for Thallium

Table 4-B
Demolition Area 2 Groundwater Screening
(Start of Program through April 2007)

Chemical	Maximum Detected Concentration (ug/L)	Location of Max Detection	Detection Frequency	Maximum Contaminant Level [1] (ug/L)	EPA Chronic (Lifetime) Health Advisory Level (HAL) for Drinking Water [2] (ug/L)	EPA Regional Screening Level for Tapwater (ug/L)	Massachusetts Contingency Plan GW-1 Standard (ug/L)
2,4,6-TRINITROTOLUENE	0.17	MW-16S	1/117		2	2.2	
2,4-DINITROTOLUENE	0.58	MW-16S	1/117			0.22	30
2,6-DINTROTLUENE	0.28	MW-16S	1/117		0.05	37	
2-AMINO-4,6-DINITROTOLUENE	0.12	MW-16S	1/117			73	
4-AMINO-2,6-DINITROTOLUENE	0.2	MW-16S	1/117			73	
4-NITROPHENOL*	2.6	MW-161S	1/40				
ACETONE	13	MW-16S	2/38			22000	6300
ALUMINUM	7170	MW-16S	22/38	-	-	37000	
ARSENIC	4.7	MW-404S	3/38	10	-	0.045	10
BARIUM	56.6 J	MW-16D	22/38	2000	-	7300	2000
BERYLLIUM	0.59	MW-16D	5/38	4	-	73	4
bis(2-ETHYLHEXYL) PHTHALATE	43 J	MW-16D	5/38	6	-	4.8	6
BORON	16	MW-16D	17/38	-	1,000	7300	-
CADMIUM	0.88 J	MW-404S	1/38	5	5	18	5
CARBON DISULFIDE	1	MW-16D	3/38	-	-	-	-
CHLORAMBEN	0.26 NJ	MW-16D	1/38	-	-	550	-
CHLOROFORM	3	MW-160S	12/38	80	70	0.19	70
CHLOROMETHANE	1	MW-16D	2/38	-	30	190	-
CHROMIUM, TOTAL	17.8 J	MW-16S	8/38	100	1000	-	100
COBALT	2.1	MW-16S	3/38	-	-	11	-
COPPER	6.6 J	MW-16D	7/38	1300	-	1500	-
DCPA (DACTHAL)	0.12	MW-16D	2/38	-	70	370	-
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX)	6.7 J	MW-404M2	94/117	-	2	0.61	1
IRON	6930	MW-16S	28/38	-	-	26,000	-
LEAD	4.2 J	MW-404S	3/38	15	-	-	15
MANGANESE	460	MW-16S	35/38	-	300	880	-
MOLYBDENUM	23.2	MW-16D	18/38	-	40	180	-
NICKEL	4.5	MW-16S	5/38	-	100	730	100
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE (HMX)	0.91	MW-404M2	18/117	-	400	1800	200
PENTACHLOROPHENAL	0.11 J	MW-161S	1/38	15	-	0.56	1
PICRIC ACID*	0.29	MW-16S	1/117	-	-		-
SELENIUM	5.3 J	MW-16S	3/38	50	50	180	50
SILVER	4.9 J	MW-404S	2/38	100	100	180	100
tert-BUTYL METHYL ETHER	1.6	MW-16D	3/38	-	-	12	70
TOLUENE	0.3 J	MW-16D	2/38	1000		2300	1000
TUNGSTEN*	0.63	MW-404S	1/38	-	-		-
VANADIUM	5.8 J	MW-16S	3/38	-	-	260	30
ZINC	20.6	MW-16S	19/38	-	2000	11,000	5000

Notes:

* No screening level exists for this compound. See text in Section 7.2 of the Demo 2 RI/FS for further discussion.

All data as reported by the US Army Corps of Engineers in the IAGWSP Draft Final Demolition Area 2 RI/FS (February 19, 2009).

"Qualifier" codes used for the "Maximum Concentration" are as follows:

J = Estimated Concentration

NJ = Presumptively Identified Compound, Estimated Concentration

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

[1] Maximum Contaminant Level is both Federal and State

[2] HA is the Federal EPA lifetime health advisory value (June, 2006).

Table 5-A
Northwest Corner Soil Screening

Analyte	Maximum Concentration (mg/Kg)		Location of Maximum Detected Concentration	Total Number of Analyses	Number of Analyses Detected	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [5]	MMR SSL	EPA Region 3 Risk-Based SSL	Moraine Background Concentration (0 - 2 ft bgs)
ALUMINUM	42300		SS16R 0-0.25	151	151	-	-	54000	55,000	15500
ANTIMONY	1.3	J	CP16J 1.5-2	141	8	20	-	0.271	0.66	2.3
ARSENIC	5.5		SS208CB 1.5-2	151	123	20	-	0.00901	0.0013	3.9
BARIUM	25.5		CP42K 1.5-2	151	151	1000	-	120	300	20.2
BERYLLIUM	0.76		SS66E 1.5-2	151	99	100	-	2.6	58	0.41
BORON	20.6		CP16M 0-0.5	127	36	-	-	9.52	23	17.3
CADMIUM	1.1		SS16R 0-0.25	151	32	2	-	0.401	1.4	0.35
CALCIUM	242		SS62C 1.5-2	151	105	-	-	-	-	-
CHROMIUM, TOTAL [1]	19.7		SS16R 0-0.25	151	144	30	-	7.02	-	15.5
COBALT	5.8		SS208C 1.5-2	151	135	-	-	132	0.49	4.5
COPPER	931		SS16R 0-0.25	151	145	-	-	45.7	51	11
IRON	15400		SS208CB 1.5-2	151	151	-	-	2420	640	12100
LEAD	357		SS208FB 0-0.5	151	151	300	-	4.05	-	19
MAGNESIUM	2260		SS208A 1.5-2	151	151	-	-	-	-	1980
MANGANESE	396		SS66I 1.5-2	151	151	-	-	44.2	57	122
MERCURY	0.11		CP16A 1.5-2	151	3	20	-	0.0204	0.03	0.1
MOLYBDENUM	1.7		SS208A 0-0.5	127	82	-	-	0.183	3.7	1.1
NICKEL	27.7		SS16R 0-0.25	151	139	20	-	292	48	9.4
NITROGEN, AMMONIA (AS N)	37.6	J	SS66J 0-0.5	108	85	-	-	-	-	20
NITROGEN, NITRATE-NITRITE	1.2		SS66Q 0-0.5	108	105	-	-	-	-	0.94
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO4)	199		CP26N 1.5-2	107	106	-	-	-	-	143
POTASSIUM	750		SS208C 1.5-2	151	122	-	-	-	-	733
SELENIUM	2.2	J	SS208H 0-0.5	151	14	400	-	2.76	0.95	1.1
SODIUM	348		SS208G 1.5-2	151	12	-	-	-	-	-
THALLIUM [2]	2	J	CP16G 1.5-2	151	3	8	-	3	0.17	1.6
TOTAL ORGANIC CARBON	48900.00		CP42C	74	50	-	#N/A	-	#N/A	-
VANADIUM	25.3		SS208H 0-0.5	151	150	600	-	260	260	21.7
ZINC	553		SS16R 0-0.25	151	139	2500	-	2200	680	25.6
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	0.000001	J		3	2	0.002	-	5E-11	-	-
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-p-DIOXIN	0.00001			3	3	0.002	-	5E-11	-	-
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	-			3	0	-	-	-	-	-
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	0.0000003	J		3	1	0.0002	-	5E-12	-	-
1,2,3,4,7,8-HEXACHLORODIBENZO-p-DIOXIN	-			3	0	-	-	-	0.000009	-
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	-			3	0	-	-	-	-	-
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	-			3	0	-	-	-	0.000009	-
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	-			3	0	-	-	-	-	-
1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN	-			3	0	-	-	-	0.000009	-
1,2,3,7,8-PENTACHLORODIBENZOFURAN	-			3	0	-	-	-	-	-
1,2,3,7,8-PENTACHLORODIBENZO-p-DIOXIN	-			3	0	-	-	-	-	-
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	0.0000002	J		3	1	0.000002	-	5E-14	-	-
2,3,4,7,8-PENTACHLORODIBENZOFURAN	0.0000003	J		3	1	0.00001	-	2.5E-13	-	-
2,3,7,8-TETRACHLORODIBENZOFURAN	0.0000003			3	1	0.000002	-	5E-14	-	-
2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN	-			3	0	0.00002	-	5E-13	0.00000015	-
Dibenzofuran Mixture Toxicity Equivalency [2]	0.0000002					0.00002	-	5E-13	-	-
Dibenzodioxin Mixture Toxicity Equivalency [2]	0.0000001					0.00002	-	5E-13	-	-
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0.006	J	SS66F 1.5-2	73	1	-	-	0.493	0.11	-
2,4,6-TRINITROTOLUENE by 8330	-		-	80	0	-	-	0.000212	0.0087	-
2,4-DINITROTOLUENE	0.6	J	SS62E 0-0.5	211	8	0.7	0.057	0.0196	0.0002	-
2,6-DINITROTOLUENE	0.03	J	SS62E 0-0.5	211	1	-	-	0.00876	0.034	-
2-CHLOROBENZOIC ACID	0.39	J	SS208A 0-0.5	8	1	-	-	-	-	-
ACETONE	0.16	J	SS66J 1.5-2	65	48	6	6.3	0.107	4.4	-
ANTHRACENE	0.02	J	SS66Q 0-0.5	195	1	1000	-	53.8	450	-
BENZO(a)ANTHRACENE	0.12	J	SS66Q 0-0.5	195	9	7	-	0.0369	0.014	0.46
BENZO(a)PYRENE	0.09	J	SS66Q 0-0.5	195	7	2	-	0.203	0.0046	0.46
BENZO(b)FLUORANTHENE	0.16	J	SS66Q 0-0.5	195	10	7	-	0.114	0.047	0.46
BENZO(g,h,i)PERYLENE	0.06	J	SS66Q 0-0.5	195	3	1000	-	554	-	0.46
BENZO(k)FLUORANTHENE	0.13	J	SS66Q 0-0.5	195	10	70	-	0.114	0.46	0.46
BENZOIC ACID	0.25	J	SS54L 1.5-2	63	8	-	-	-	33	-
BENZYL BUTYL PHTHALATE	0.02	J	SS62G 0-0.5	157	1	-	-	491	0.67	-
bis(2-ETHYLHEXYL) PHTHALATE	0.77		SS54G 0-0.5	195	32	200	-	72	1.6	-
BROMOMETHANE	0.003	J	SS16R 0-0.25	65	1	0.5	0.05	0.00192	0.0022	-
CARBON DISULFIDE	0.001	J	SS16R 0-0.25	65	1	-	-	0.414	0.27	-
CHLORAMBEN	0.01	J	SS62B 0-0.5	114	4	-	-	0.116	0.12	-
CHLOROFORM	0.01		SS66J 1.5-2	65	1	0.4	0.35	0.0000364	0.000055	-
CHLOROMETHANE	0.001	J	SS66J 1.5-2	65	2	-	-	0.000399	0.049	-
CHRYSENE	0.20	J	SS66Q 0-0.5	195	16	70	-	3.4	1.4	0.46
DCPA (DACTHAL)	0.01	NJ	SS66M 0-0.5	65	1	-	-	4.91	0.28	-
DIBENZ(a,h)ANTHRACENE	0.03	J	SS66Q 0-0.5	195	2	0.7	-	0.0377	0.015	-
DICAMBA	0.02	NJ	CP42D 0-0.5	111	3	-	-	0.264	0.28	-
DIELDRIN	0.05		SS62A 0-0.5	98	7	0.05	-	0.0008	0.00009	0.03

Table 5-A
Northwest Corner Soil Screening

Analyte	Maximum Concentration (mg/Kg)		Location of Maximum Detected Concentration	Total Number of Analyses	Number of Analyses Detected	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [6]	MMR SSL	EPA Region 3 Risk-Based SSL	Moraine Background Concentration (0 - 2 ft bgs)
DIETHYL PHTHALATE	0.05	J	SS66R 1.5-2	195	1	10	9.98	13.4	13	-
DI-n-BUTYL PHTHALATE	1.1	J	CP16M 0-0.5	195	22	-	-	150	11	-
ENDOSULFAN SULFATE [3]	0.002	NJ	SS66Q 0-0.5	98	1	0.5	0.54 [3]	2.18	9.7	-
ENDRIN ALDEHYDE [4]	0.003	J	SS62B 0-0.5	98	2	8	-	0.189	0.23	-
ENDRIN KETONE [4]	0.002	J	SS62A 0-0.5	98	1	8	-	0.189	0.23	-
FLUORANTHENE	0.28	J	SS66Q 0-0.5	195	17	1000	-	108	210	0.46
GAMMA-CHLORDANE	0.002	J	SS62A 0-0.5	98	1	0.7	-	0.0000384	0.033	-
HEPTACHLOR	0.002		CP42D 0-0.5	62	1	0.2	-	0.0215	0.0016	-
HEPTACHLOR EPOXIDE	0.002	J	SS62C 1.5-2	98	1	0.09	-	0.0061	0.000079	-
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX) by 8330	-		-	118	0	1	0.00168	0.000109	0.00036	-
INDENO(1,2,3-c,d)PYRENE	0.06	J	SS66Q 0-0.5	195	3	7	-	0.317	0.16	0.46
MCPA [5]	42	NJ	CP42I 0-0.5	111	25	-	-	0.00143	0.0047	-
MCPP [5]	52		CP16N 1.5-2	119	5	-	-	0.05	0.011	-
METHYL ETHYL KETONE (2-BUTANONE)	0.01		SS66J 1.5-2	65	22	4	4	0.335	1.5	-
METHYLENE CHLORIDE	0.01	J	CP16E 0-0.5	65	8	0.1	0.01	-	0.0012	-
N-NITROSODIPHENYLAMINE	0.11	J	CP16M 0-0.5	195	10	-	-	0.0076	0.17	-
p,p'-DDE	0.01	J	SS65J 0-0.5	99	20	3	-	0.884	0.06	0.0022
p,p'-DDT	0.01		CP42G 0-0.5	99	23	3	-	0.525	0.087	-
PCB-1254 (AROCHLOR 1254)	0.05		CP16A 1.5-2	98	1	2	-	0.0104	0.0051	-
PCB-1260 (AROCHLOR 1260)	0.03	J	SS66Q 0-0.5	98	2	2	-	0.0104	0.014	-
PENTACHLOROPHENOL	0.05		SS65I 1.5-2	253	2	3	0.008	0.000429	0.0039	-
PENTAERYTHRITOL TETRANITRATE	47		CP16C 0-0.5	118	2	-	-	-	-	-
PERCHLORATE	7.56		SS199G	250	43	0.1	0.002	0.00314	-	-
PHENANTHRENE	0.09	J	CP16B 0-0.5	195	8	10	10.9	48.1	-	0.46
PHENOL	0.08	J	SS66R 0-0.5	195	2	1	0.951	0.766	8.1	-
PYRENE	0.26	J	SS66Q 0-0.5	195	22	1000	-	19	150	0.46
SILVEX (2,4,5-TP)	0.01	J	CP42D 0-0.5	119	1	-	-	-	0.11	-
TOLUENE	0.003	J	SS66F 1.5-2	65	14	30	32	0.272	1.7	-

Notes:
Data summary considers all samples from site-wide monitoring wells in the Northwest Corner (On Base and Off Base) from all sampling dates (1997-2008).
"Qualifier" codes used for the "Maximum Concentration" are as follows:
J = Estimated Concentration
NJ = Presumptively Identified Compound, Estimated Concentration
Highlighting indicates those criteria that have been exceeded and will be discussed further within the report.
[1] MCP standards for Chromium VI used as a surrogate for Chromium, Total.
[2] EPA Risk-Based SSL for Thallium, Soluable Salts used as a surrogate for Thallium.
[3] MCP standards for Endosulfan used as a surrogate for Endosulfan sulfate.
[4] MCP and EPA values for Endrin used as a surrogate for Endrin Aldehyde and Endrin Ketone.
[5] AMEC (2002) confirmed that the detections of these analytes were false positives
[6] MADEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Table 5-B
Northwest Corner Groundwater Screening

Chemical	Maximum Detected Concentration (ug/L)	Location of Maximum Concentration	Detection Frequency	Maximum Contaminant Level [1]	EPA Chronic (Lifetime) Health Advisory Level (HA) for Drinking Water [2] (ug/L)	EPA Regional Screening Level for Tapwater	Massachusetts Contingency Plan GW-1 Standard
2,4,5-T (TRICHLOROPHENOXYACETIC ACID)	0.42 NJ	MW-66M2	2 / 62	-	70	370	-
ACETONE	4	LRMW9515	2 / 57	-	-	22,000	6,300
ALUMINUM	651	95-6A	16 / 73	-	-	37,000	-
ANTIMONY	4.9 J	LRMW9515	3 / 73	6	6	15	6
ARSENIC	4.2 J	MW-66S	2 / 73	10	-	0.045	10
BARIUM	14.8 J	95-6ES	15 / 73	2000	-	7,300	2,000
BENZENE	0.2 J	95-6ES	1 / 72	5	-	0.41	5
BENZOIC ACID	0.25 J	95-6A	1 / 71	-	-	150,000	-
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.0065 J	LRMW9515	1 / 45	0.2 [4]	-	0.037	0.2
bis(2-ETHYLHEXYL) PHTHALATE	4 J	LRMW9515	7 / 79	6	-	4.8	6
BORON	10.4	95-6ES	38 / 69	-	1,000	7,300	-
CADMIUM	0.5 J	LRMW9515	2 / 73	5	5	18	5
CALCIUM	2820	LRMW9515	69 / 73	-	-	-	-
CHLORAMBEN	0.3 NJ	MW-66M2	5 / 46	-	-	550	-
CHLOROFORM	3	LRMW9515	72 / 72	80	70	0.19	70
CHLOROMETHANE	1	95-6ES	5 / 72	-	30	190	-
CHROMIUM, TOTAL	15 J	LRMW9515	17 / 73	100	-	-	100
COPPER	18.3 J	XXWSCN	9 / 73	1300	-	1,500	-
DIETHYL PHTHALATE	9	MW-65M1	3 / 79	-	-	29,000	2,000
DI-n-BUTYL PHTHALATE	0.53 J	MW-66S	2 / 79	-	-	3,700	-
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX)	15 J	BH-363	86 / 506	-	2	0.61	1
IRON	26700	LRMW9515	30 / 73	-	-	26,000	-
LEAD	4.3 J	MW-65S	3 / 73	15	-	-	15
MAGNESIUM	1730	95-6ES	66 / 73	-	-	-	-
MANGANESE	220	MW-65M1	64 / 73	-	300	880	-
MCPP	1300	95-6ES	2 / 62	-	30 [5]	37	-
MERCURY	0.15 J	MW-65S	3 / 73	-	2	0.57	2
MOLYBDENUM	3.4	MW-65M1	8 / 69	-	40	180	-
NICKEL	10	LRMW9515	16 / 73	-	100	730	100
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE (HMX)	0.26	BH-363	2 / 506	-	400	1,800	200
PERCHLORATE	26.3	MW-279S	530 / 792	2	15 [3]	26	2
PICLORAM	0.14 J	95-6ES	1 / 38	500	-	2,600	-
POTASSIUM	1400	MW-65M1	54 / 73	-	-	-	-
SELENIUM	4.1 J	95-6ES	2 / 73	50	50	180	50
SILVER	0.65 J	95-15C	1 / 73	-	100	180	100
SODIUM	7420	LRMW9515	73 / 73	-	-	-	-
tert-BUTYL METHYL ETHER	0.82	LRMW9515	1 / 56	-	-	12	70
THALLIUM	0.24 J	95-6ES	2 / 73	2	0.5	2.4	2
VANADIUM	3 J	95-6A	4 / 73	-	-	260	30
ZINC	7210	LRMW9515	28 / 73	-	2000	11,000	5,000

Notes:

Data summary considers all samples from site-wide monitoring wells in the Northwest Corner (On Base and Off Base) from all sampling dates (1997-2008).

"Qualifier" codes used for the "Maximum Concentration" are as follows:

J = Estimated Concentration

NJ = Presumptively Identified Compound, Estimated Concentration

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

[1] Maximum Contaminant Level is both Federal and State except for perchlorate, which reflects the State MCL

[2] HA is the Federal EPA lifetime health advisory value (June, 2006).

[3] Interim Health Advisory

[4] Lindane (technical grade BHC) used as a surrogate for the MCL value for Beta BHC.

[5] MCPA used as a surrogate for the HA value for MCPP.

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

TIMOTHY P. MURRAY
Lieutenant Governor

IAN A. BOWLES
Secretary

LAURIE BURT
Commissioner

June 7, 2010

Mr. James T. Owens III, Director
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency,
New England Office
One Congress Street, Suite 1100
Boston, MA 02114-2023

RE: **BOURNE**
Release Tracking Number: 4-15031
Massachusetts Military Reservation (MMR)
Decision Document Western Boundary, Demolition Area 2, and Northwest Corner Soil and Groundwater Operable Units,
Concurrence

Dear Mr. Owens:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the document entitled **"Decision Document Western Boundary, Demolition Area 2, and Northwest Corner Soil and Groundwater Operable Units"** (Decision Document), dated March 2010. The Decision Document presents the selected remedy for the Western Boundary, Demolition Area 2, and Northwest Corner soil and groundwater Operable Units, located on Camp Edwards at the Massachusetts Military Reservation (MMR), situated in Bourne, Massachusetts. The remedy was selected by the United States Environmental Protection Agency (USEPA) in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA), 42 USC §300i(a), as amended and Administrative Order No. SDWA-1-2000-0014 (AO3), which includes consideration of the substantive cleanup standards set forth under M.G.L. c. 21E and 310 CMR 40.0000, the Massachusetts Contingency Plan (MCP). The U.S. Army (Army) and the National Guard Bureau (NGB) are Respondents under USEPA AO3.

The selected remedy for the Western Boundary, Demolition Area 2, and Northwest Corner groundwater Operable Units consists of *Monitored Natural Attenuation* (MNA) with *Land Use Controls* (LUCs). *No further action* is proposed for soils at each Operable Unit. LUCs implemented by the Army/NGB will serve to control access to or use of the groundwater at the Operable Units until the groundwater no longer poses an unacceptable risk to human health. Monitoring of the LUCs will be conducted annually by the Army/NGB. Additionally, the Army/NGB will submit an annual monitoring report to the regulatory agencies that will evaluate the status of the LUCs and state how any identified deficiencies and/or inconsistent uses have been addressed.

Perchlorate, the contaminant of concern (COC) for the Western Boundary soil and groundwater Operable Unit, was initially detected in 2001 in groundwater monitoring wells located along the western property boundary of the MMR and, in 2002, in public water supply wells at the Monument Beach Well Field in Bourne, Massachusetts. The source of the perchlorate contamination is believed to be from the past use of military pyrotechnics at various training areas in the western portion of Camp Edwards on the

MMR. Numerous soil samples were collected on the MMR from several possible perchlorate source areas upgradient of the Bourne Monument Beach public water supply well field. Perchlorate was detected at low concentrations in two of the soil samples collected. The Western Boundary Remedial Investigation concluded that source areas for perchlorate in the Western Boundary Operable Unit have likely been depleted. The public water supply wells are currently sampled annually for perchlorate. In 2008, very low concentrations of perchlorate (i.e. 0.07 µg/L to 0.08 µg/L) were detected in three of the four public water supply wells. These perchlorate concentrations are far below the Massachusetts Maximum Contaminant Level (MMCL) of 2 µg/L. Perchlorate has not been detected at a concentration above the MMCL since March, 2008.

The Demolition Area 2 groundwater plume is a body of groundwater contamination emanating from the Demo 2 Operable Unit. The plume is located in the north-central region of Camp Edwards at the MMR and is defined by groundwater concentrations of the explosive compound hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) above the EPA's risk-based concentration of 0.6 µg/L. The source of the Demolition Area 2 plume was eliminated in 2004 when approximately 750 cubic yards of RDX-contaminated soil were excavated from the Demolition Area 2 Operable Unit and treated in an onsite thermal treatment unit. A Completion of Work and Operable Unit Closure Report was issued in 2005, which documented the successful removal of explosives-contaminated soils associated with the Demolition Area 2 Operable Unit. The Demolition Area 2 groundwater plume is approximately 3,300 feet long, up to 350 feet wide, and 30 feet thick. The plume occurs entirely within the boundaries of the MMR. The leading edge of the Demolition Area 2 groundwater plume is located approximately one-half mile from the northern MMR base boundary. RDX is the only COC identified for Demolition Area 2 groundwater. In 2008, the maximum RDX concentration detected in the Demolition Area 2 groundwater monitoring network was 1.7 µg/L. The extent and magnitude of RDX in the Demolition Area 2 plume is currently declining and groundwater modeling predicts that RDX concentrations will be below the risk-based concentration throughout the entire plume by 2013.

RDX and perchlorate are the COCs for the Northwest Corner groundwater Operable Unit. Perchlorate has been detected as a broad, shallow plume at concentrations up to 26.3 µg/L. RDX has generally been detected deeper in the aquifer than the perchlorate plume, which suggests two distinct, upgradient source areas (i.e., Former A Range and Central Impact Area). Further evaluation of these two Operable Units as potential source areas will be performed as part of the remedial investigations for the Gun and Mortar Positions, Former A Range, and Central Impact Area Operable Units. Perchlorate concentrations above the MMCL are distributed over an area of approximately 150 acres in the Northwest Corner with plume dimensions of approximately 3,750 feet long, up to 2,000 feet wide, and up to 100 feet thick. RDX was detected in a small, shallow plume at low concentrations and a deeper, narrow plume at concentrations up to 15 µg/L. The RDX plume is located within the footprint of the perchlorate plume and is approximately 4,000 long, 200 feet wide, and 100 feet thick. In May 2008, the maximum concentration of perchlorate and RDX in the Northwest Corner groundwater was 13.4 µg/L and 5.6 µg/L, respectively. The extent and magnitude of perchlorate and RDX contamination in the Northwest Corner plume is declining. Modeling predicts that perchlorate concentrations within the plume will drop below the MMCL by 2012. Contamination within the narrow RDX plume is predicted to drop below the risk-based level by 2022.

It is MassDEP's expectation, in order to evaluate whether MNA is occurring, that a robust long term monitoring program for the Western Boundary, Demolition Area 2, and the Northwest Corner groundwater Operable Units will be designed and implemented following the guidelines outlined in the U.S. EPA OSWER Directive 9200.4-17P; April 21, 1999 entitled "*Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*" ("the OSWER Directive"). The OSWER Directive is MassDEP's primary reference for evaluating MNA remedies. Although various attenuation processes are known to occur under certain conditions, the OSWER Directive "prefers those

processes that degrade or destroy contaminants". Moreover, 310 CMR 40.0191, the MCP *Response Action Performance Standard*, requires the consideration of "technologies which reuse, recycle, destroy, detoxify or treat oil and/or hazardous materials" as well as "remedial actions to reduce the overall mass and volume of oil and/or hazardous materials". Accordingly, the MCP and the OSWER Directive require site-specific documentation to demonstrate that degradation or destruction of contaminants is the primary attenuation process. If it is demonstrated that dispersion (i.e. the dilution of contaminated groundwater by mixing with unaffected groundwater) and not degradation or destruction is the primary means of contaminant reduction in the aquifer for the groundwater in the Western Boundary, Demolition Area 2, and the Northwest Corner groundwater Operable Units, MassDEP will not consider the selected remedy to be MNA, but solely *Long-Term Monitoring* with *Land Use Controls*.

MassDEP concurs with the Decision Document. The selected remedy will ensure a sufficient level of control for the Western Boundary, Demolition Area 2, and Northwest Corner soil and groundwater Operable Units such that none of the contamination associated with the Operable Units will present a significant risk of harm to health, safety, public welfare or the environment during any foreseeable period of time. Moreover, the remedy has been designed to reduce the level of contaminants to background levels, consistent with the MCP. The distinction between MNA and Long Term Monitoring does not affect MassDEP's concurrence with the selected remedy.

MassDEP's concurrence with 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 Western Boundary, Demolition Area 2, and Northwest Corner soil and groundwater Operable Units change, 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.

Please incorporate this letter into the Administrative Record for the Western Boundary, Demolition Area 2, and Northwest Corner soil and groundwater Operable Units. 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.

Very truly yours,

Laurie Burt
Commissioner
Massachusetts Department of Environmental Protection

LB/lp

MassDEP WB D2 NWC Decision Document Concurrence Letter.doc

Ec: David Johnston, Acting Regional Director
Millie Garcia-Serrano, Deputy Regional Director
Leonard J. Pinaud, Chief, State & Federal Site Management Section

Rebecca Tobin, Regional Counsel
Mark Begley, Environmental Management Commission
MassDEP Southeast Region
MMR Senior Management Board
MMR Plume Cleanup Team
Upper Cape Boards of Selectmen
Upper Cape Boards of Health

APPENDIX B

APPENDIX B
GLOSSARY OF TERMS AND ACRONYMS

2A-DNT	2-amino-4,6-dinitrotoluene, a breakdown product of the explosive TNT
4A-DNT	4-amino-2,6-dinitrotoluene, a breakdown product of the explosive TNT
AFCEE	U.S. Air Force Center for Environmental Excellence
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
FS	Feasibility Study
ft	feet
GMP	Gun and Mortar Position
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
kettle hole	a depression that 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)
mg/Kg	Milligrams per Kilogram
MMCL	Massachusetts Maximum Contaminant Level (State-promulgated)
MMR	Massachusetts Military Reservation
O&M	Operation and Maintenance
OU	Operable Unit
oxidizer	A substance that gives up oxygen easily to stimulate combustion of organic material
perchlorate	A water-soluble salt used as an oxidizer

ppb	parts per billion, a measure of concentration in liquid, e.g. one part of contaminant in one billion parts of water is 1 ppb, or 1 microgram per liter
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine / Royal Demolition Explosive, an explosive compound
RI/FS	Remedial Investigation/Feasibility Study
RRA	Rapid Response Action (an interim cleanup action taken to reduce contamination while the investigation and selection, design and implementation of a comprehensive cleanup plan is completed)
RSP	Remedy Selection Plan, the plan outlining the cleanup alternatives and the proposed plan
SDWA	Safe Drinking Water Act
SVOC	semi-volatile organic compound
TNT	Trinitrotoluene (an explosives compound)
ug/Kg	Micrograms per Kilogram
ug/L	Micrograms per Liter
UXO	Unexploded Ordnance
VOC	volatile organic compound