United States Environmental Protection Agency
Region 1

Decision Document
Former A Range, Former K Range, and Gun and Mortar Positions

Camp Edwards
Massachusetts Military Reservation
Cape Cod, Massachusetts

September 2012

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PART I: DECLARATION FOR THE SDWA DECISION DOCUMENT

A. SITE NAMES

The subject sites are the Former A Range, Former K Range, and the Gun and Mortar Positions ("the Sites") within the Camp Edwards at the Massachusetts Military Reservation (MMR) (Figure 1).

B. STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected decisions for the Sites. The decisions were selected in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA), 42 USC §300i(a), as amended, and with the following Administrative Orders concerning response actions issued thereunder, USEPA Region 1 Administrative Order No.s: SDWA-1-97-1019; SDWA-1-97-1030; and SDWA-1-2000-0014. The Regional Administrator of USEPA Region I has been delegated the authority to select the necessary response action pursuant to USEPA Delegation No. 9-17 (1200-TN-350) dated May 11, 1994, and further delegated to EPA Region 1's Director, Office of Site Remediation and Restoration, pursuant to a redelegation of authorities dated April 6, 2010.

Documentation to support the decisions are contained in 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 40.000. The Index of Key Supporting Documents is available for review at the Impact Area Groundwater Study Program (IAGWSP) Office, PB0516 West Outer Road, Camp Edwards, MA. Documents included in the Index of Key Supporting Documents are listed in Appendix C.

C. ASSESSMENT OF THE SITE

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

D. DESCRIPTION OF THE ACTIONS

This Decision Document sets forth the selected decisions for the Sites (Figure 1).

Based on sampling results and removal actions presented in remedial investigation reports for each of the Sites, it was determined that no further action is necessary with regard to the source area and groundwater at the Former K Range and the Gun and Mortar Positions. For the Former A Range, limited action with long term groundwater monitoring and land use controls to protect monitoring wells is the selected decision.

The selected decision is that no further action is necessary for the Former K Range and Gun and Mortar Positions are protective of human health, based the findings that indicate there is no groundwater contamination related to these sites and that removal actions conducted at these sites removed any soil contamination that could be a source of continuing groundwater contamination. For the Former A Range, the selected decision is limited action with long term groundwater monitoring and land use controls to protect monitoring wells which is protective of human health and the environment based on the investigation findings indicating that there is a potential for UXO and/or munitions remaining at the site to provide a future source for contaminating the groundwater.

E. DETERMINATIONS

The selected decisions in this Decision Document will protect the public health and are based on the investigations and removal actions which were already conducted in the past.

In this Decision Document, EPA is making no determination regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the Sites.

The selected action for the Former A Range includes a periodic review at frequencies not to exceed five years. At each periodic interval, the IAGWSP will provide to EPA and MassDEP sampling and other relevant data. EPA and MassDEP wil review this and any other relevant information to determine if additional measures are necessary for the protection of public health. This will include information acquired after finalization of this document or five-year period (such as new regulatory requirements or changes in the environmental conditions of the site).

F. SUPPORTING DATA

Detailed information on these sites is included in the *Final Former A Range Investigation Report, April 2012,* the *Final Former K Range Investigation Report, January 31, 2011,* and the *Final Gun and Mortar Position Investigation Report, October 2011.* An overview of the Sites, is included in the Decision Summary section of this document. Additional information can be found in the Index of Key Supporting Documents, which is Appendix C to this Decision Document.

G. AUTHORIZING SIGNATURE

This Decision Document documents EPA's selected decisions, under the authority of the SDWA, for no further action at the Former K Range, and the Gun and Mortar Positions, and limited action with long term groundwater monitoring and a land use controls to protect monitoring wells at the Former A Range. The determination was made by the U.S. Environmental Protection Agency under the authority of the Safe Drinking Water Act. The Massachusetts Department of Environmental Protection concurs with this decision.

U.S. Environmental Protection Agency

By: _____ Date: 9/28/12

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

PART II. THE DECISION SUMMARY

A. SITE DESCRIPTIONS

Former A Range

The Former A Range (also known as the Former Gravity Anti-Tank Range) is an inactive anti-tank artillery and rocket practice range. It is located west of the Camp Edwards Impact Area in the southern portion of Training Area B-9. Wood Road and Training Area B-8 lie to the immediate south (Figure 1).

The range is generally comprised of densely vegetated pitch pine (*Pinus rigida*) surrounded by oak (*Quercus spp.*) trees near the perimeter of the range. The firing point is located at the southwestern tip of the range and is primarily bare sand and gravel deposits with limited vegetation, including immature pitch pine and grasses. The target area includes disturbed areas consisting of fine to coarse sand and gravel with little topsoil present.

Former K Range

The Former K Range was constructed in 1960 on the western side of Greenway Road and south of Wood Road (Figure 1). During the 1960s, the range was configured with ten firing points and several targets at various distances downrange. Sometime after the mid-1960s, the northern portion of the range was extended to 2000 meters to a new target located on the north side of Wood Road. After the 1970s, the eastern (up-range) end of the Former K Range was converted to a pistol range and renamed P Range, which is used as the current designation of this range. The range is heavily wooded with the up-range portion being relatively flat and the downrange portion having sloped areas. A concrete pad remains along the firing line.

Gun and Mortar Positions

There are 24 gun positions and 13 mortar positions located south, west, and northwest of the Impact Area (Figure 1). Eight of the gun positions (Old GP-1, Old GP-2, Old GP-3 (Area 53), Old GP-3 (Area 63), Old GP-4 (Area 55), Old GP-4 (Area 56), GP-15, and Old GP-19) and four of the mortar positions (MP-9, and Old MP-1, Old MP-2, and Old MP-3) were replaced by other positions during the history of use at the site. The inactive positions, which were replaced by another location designated by the same range number, are listed as “old” gun positions. This designation process occurred over a period of time and, therefore, there are duplicate designations such as two “Old GP-3s,” however their area number was included to differentiate between the two duplicates. Currently, none of the gun and mortar positions are in service. GP-9 (also known as Chemical Spill-18) was addressed in the Air Force’s Installation Restoration Program. After completion of a soil removal action, no further action at GP-9 was finalized in a no further action decision document in 2009.

The 24 gun positions are: GP-2, GP-5, GP-6, GP-7, GP-8, GP-9, GP-10, GP-11, GP-12, GP-14, GP-16, GP-17, GP-18, GP-20, GP-22, GP-24, Old F Range, GP-1, Old GP-2, Old GP-3 (Area 53 & 63), Old GP-4 (Area 55 & 56), Old GP-15, Old GP-19

The 13 mortar positions are: MP-1, MP-2, MP-3, MP-4, MP-5, MP-6, MP-7, MP-8, MP-9, Old MP-1, Old MP-2, Old MP-3.

The Gun and Mortar positions, although variable in size, are all essentially flat areas cleared of vegetation. At many sites, vegetation is growing back, particularly scrub pines, in those areas that have not been used in many years. Otherwise, surface vegetation generally consists of grasses and small shrubs. The sites are typically accessed from remote unimproved gravel roads, although some are located along paved roadways. The positions all lie within either the Sandwich Moraine northwest of the Impact Area, the Buzzards Bay Moraine west of the Impact Area, or the Mashpee Pitted Plain outwash south of the Impact Area.

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

Former A Range

The range was originally constructed in 1941 and functioned as an anti-tank artillery and rocket practice site up until the 1960s. Targets were placed on specially designed rail cars and rolled on tracks, via gravity, downhill through two sets of switchbacks traversing the target area. The target area switchbacks are visible in aerial photographs of the site. Trainees would fire in an easterly direction at moving targets from a firing point approximately 2,400 feet to the west of the target area on the southern side of Wood Road.

The target area includes four berms labeled Berm A, B, C, and D. Berms A and B were the upper berms and Berms C and D were the lower berms. These berms were designed to capture munitions fired at the moving targets as they passed through the target area (Figure 2).

At the base of the hillside, the targets would coast through a rollout section of the course to a platform where they were repaired, loaded onto trucks, and returned to the top of the hill via Avery Road. Records indicate that ordnance used during this period included 37 millimeter (mm) armor piercing and high explosive (HE) rounds, 40 mm armor piercing and HE projectiles, 75 mm HE and shot projectiles, 90 mm artillery projectiles, and 3.5-inch practice rockets (bazooka).

Between the early 1960s and mid-1970s, the range was converted to a machine gun practice area. It is not clear how the range was configured and whether firing was conducted on moving targets in a manner similar to earlier artillery and rocket training, but records do indicate that .50 caliber ball and tracer rounds were used at that time. No documentation has been identified that describes activities at the range after the mid-1970s.

Former K Range

Records show that this range was used between 1960 and 1967 as a 3.5-inch rocket range. In 1968, the range was converted to an M79 grenade launcher range where, until the early 1970s, 40 mm HE and practice grenades were used. During this time period, the range was configured with a firing point and several targets at various distances downrange (Figure 3). Sometime after the mid-1960s, the northern portion of the range was extended to 2000 meters to a new target located on the north side of Wood Road. A 30-foot square wood-frame target was

constructed using six vertical telephone poles joined with a series of horizontal wooden slats similar to fence rails. This frame was likely clad with canvas or fiberboard through which a fired missile would pass, leaving a hole to mark the point of impact. An observation bunker, consisting of a partially buried steel culvert pipe, was located approximately 100 feet in front of the target. Although there are no available records regarding the types of munitions used on the range extension, its configuration and period of use suggests that it could have been used for training with Dragon and/or TOW anti-tank missiles. In addition, given the nature and condition of the target and its close proximity to the observation bunker, it is highly unlikely that explosive rounds were used. No munitions were observed during reconnaissance of the former target conducted in 2001 and 2010 and no further investigation was deemed necessary. After the 1970s, the eastern (up-range) end of the Former K Range was converted to a pistol range and renamed P Range, which is used as the current designation of this range.

Gun and Mortar Positions

The earliest known usage of any of the Gun and Mortar positions began during the World War II period starting around 1940. Several different types of artillery were used, but the most common were howitzers firing 105 and 155 mm artillery shells. Other known types of artillery munitions fired at Camp Edwards include 37 mm, 40 mm, 75 mm, 90 mm, and 8-inch HE and inert training projectiles. The most common mortar rounds fired at MMR were the 60 and 81 mm. Records also indicate that 40 mm, 3-inch Stokes, and 4.2-inch mortars (both HE and inert) have been fired at MMR. In addition, smoke and illumination projectiles were also periodically fired. The firing of HE artillery rounds was discontinued in 1989. Practice rounds were fired until the USEPA moratorium on live artillery and mortar firing at Camp Edwards was established in 1997.

2. History of Investigations, Findings, and Response Actions

The history of investigations and response actions for Former A, Former K, and Gun and Mortar Positions are summarized in the proceeding sections of this decision document.

Remedial investigations were conducted at the Former A Range, Former K Range, and the Gun and Mortar positions 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 these sites, 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 these sites.

A brief summary of the investigations, findings, and response actions performed at each of the Sites is provided below. A more detailed discussion can be found in the Investigation Report for each site.

Former A Range

Source Area Investigations

Source investigations were conducted at Former A Range to determine the nature and extent of the contamination in the soil as well as the nature and extent of munitions that may remain on the range.

The initial soil investigation of the Former A Range was conducted in 2001 under the Phase IIb Investigation and focused on the firing point, target area, and target roll-out area (Figure 2). Twenty samples were collected from various locations on the range, including the target area, target berms, the lower half of the rail line, the firing point, and at the base of a slope containing 37 mm projectiles in March and April 2001. These samples were analyzed for explosives, semi-volatile organic compound (SVOCs) and metals. Selected samples were analyzed also for pesticides/polychlorinated biphenyls (PCBs), herbicides, and inorganics.

Based on the initial soil sample results, a multi-component field investigation was conducted to further evaluate chemical contaminant distribution in soil including explosives, semi-volatile organic compounds, and metals in the target area; polycyclic aromatic hydrocarbons (PAHs) along the rail line; and propellant at the firing point. Samples were collected in November and December 2004 from within the target area where there was visible evidence of small arms projectile fragments on the surface, evidence of small arms targets, or sediment deposition to assess the possible impacts of past small arms activities on soil metal concentrations. These samples were analyzed for metals; half of the samples were also analyzed for explosives. Multi-point samples were also collected in January 2005 from a target-area wide sampling array, from the area just outside the limits of the target area, and from the upper hillside and analyzed for explosives, SVOCs, and metals to further help delineate the target area. Samples were collected from four areas along the rail line in November 2004 and analyzed for SVOCs. Samples were collected from the firing point in December 2004 and analyzed for explosives, perchlorate, volatile organic compounds (VOCs), and SVOCs to further evaluate traces of propellants identified during the previous investigation. Based on particle back-tracks and a site reconnaissance, three locations southeast of the range were sampled in an effort to delineate the potential source of hexahydro-1, 3, 5-trinitro-1, 3, 5-triazine (RDX) in two downgradient monitoring wells. These samples were analyzed for explosives, perchlorate, SVOCs, and metals.

In addition to the investigations to determine the nature and extent of contamination in the soil, several geophysical surveys have been performed at the Former A Range (Figure 4) to determine the nature and extent of munitions that may be present on the range and act as a long term source of contamination to groundwater. An airborne magnetometer (AIRMAG) survey of Training Area B-9, which includes the Former A Range, was performed in January 2001 to detect large metallic anomalies and to identify sites where ground-based geophysical surveys might be needed. In August and November 2001, a ground-based electromagnetic survey of four separate areas within the Former A Range target area, each representing a partially exposed, up-range hillside surface where ordnance was expected to be present, was performed in order to identify concentrations of ordnance on the range. In 2004, a ground-based survey of ten transects across the Former A Range was performed to supplement

previous surveys and to confirm that the target area had been adequately sampled and delineated. In 2010, a ground-based survey and visual site inspection along several predefined meandering paths was performed to confirm that there were no areas of high munitions density outside of the target area. Based on the location and type of munitions discovered during the initial surveys, a further investigation was conducted at the northern and southern ends of the primary berms. Two irregularly shaped areas at the end of the berms were investigated and an additional 300' section of meandering path was surveyed. The northern area was investigated in phases as the area of investigation was expanded until the extent of munitions items was defined.

Groundwater Investigations

Several monitoring wells have been installed within or in the vicinity of the Former A Range (Figure 2). During the Phase IIb Investigation, one monitoring well (MW-149S) was installed to intercept groundwater downgradient of the upper target area. During 2001 and 2002, two monitoring well clusters (MW-206 and MW-249) were installed as part of the Central Impact Area and/or Former A Range investigations. Two of these monitoring wells (MW-206S and MW-249M3) were positioned and screened to monitor groundwater originating from the target area. In 2009, MW-536 was installed just north of Former A Range along Avery Road to further assess whether any explosives-related contaminants may be migrating to groundwater from surface soils in the target area of the Former A Range.

Source Area Findings

The results of soil sampling and analyses indicated that explosives compounds, primarily 2-amino-4,6-dinitrotoluene (2A-DNT), 4-amino-2,6-dinitrotoluene (4A-DNT), and 2,4,6-trinitrotoluene (TNT), were detected generally in samples located on or in close proximity to the target area berms. The distributions of these compounds exhibited no systematic pattern within the target area and are presumed to represent residual soil contaminants associated with past range activities. Outside the berm areas, explosives were infrequently detected at low concentrations.

2,4-DNT was detected one time in a single soil sample from the firing point (0.34 mg/Kg) at a concentration below the MCP Method S-1/GW-1 Standard (0.7 mg/Kg) and has never been detected in the monitoring wells associated with the range. Almost all detections of TNT (0.15 to 9.0 mg/Kg), 2A-DNT (0.24 to 6.8 mg/Kg), and 4A-DNT (0.02 to 2.4 mg/Kg) were located in the target area. One low level detection of 2A-DNT (0.085 mg/Kg) was observed outside the target area. TNT, 2A-DNT, and 4A-DNT have been sporadically detected in only one monitoring well associated with the range and the maximum detected groundwater concentrations of these explosives were all below screening criteria. The only nitroglycerin detection was observed in a post-BIP excavation sample taken from a BIP crater at a concentration below the BIP excavation criteria. Relatively low levels of tetryl were detected in only two target area samples (0.044 mg/Kg and 0.14 mg/Kg). The maximum detected concentration was below its EPA SSL and this compound has never been detected in any of the four groundwater monitoring wells associated with the Former A Range.

A suite of SVOCs, consisting mostly of PAHs, was detected in several of the initial target area samples located near the rail line. The results of the additional investigation confirmed the

presence of PAHs at varying concentrations in some surface soil samples along the rail line. PAH concentrations vary with location, but the similarities in the PAH patterns suggest a common source (i.e., creosote or grease used on the rail line). At almost all of the locations, PAH concentrations decrease significantly in the deeper soil samples.

Soil sampling results indicated some elevated copper (25,100 mg/Kg) and lead (11,600 mg/Kg) concentrations in the target area. Only the maximum detection of copper exceeded the EPA RSL of 3,100 mg/Kg; the duplicate result for this sample was 63.1 mg/Kg. This sample was collected from a post blown-in-place location. Otherwise, the maximum concentration of copper was 1,330 mg/Kg. Copper was detected in groundwater; however, the maximum groundwater detection was far below its MCL. The maximum detection of lead exceeded its State MCP Standard, but the average concentration of lead (125 mg/Kg) was well below its State MCP Standard. Further investigation of these areas was conducted and soil copper concentrations were found to vary considerably; Lead was only detected in samples from three of the 14 additional characterization sampling locations. The soil sample results suggest that elevated metals concentrations, specifically copper, are likely associated with either copper in certain anti-tank munitions (2.36-inch and 3.5-inch anti-tank rockets) or bullet pockets and are confined to the surface and shallow subsurface soils. Elevated lead detections may be related to the use of shot rounds that contained small lead balls.

At the firing point, the propellant-related compound 2,4-dinitrotoluene (2,4-DNT) was detected in the initial sampling grid at low concentration (340 µg/L). Two SVOCs potentially related to propellants (n-nitrosodiphenylamine and di-n-butyl phthalate) were detected at concentrations below the reporting limit (<0.35 mg/Kg). Trace detections of a few VOCs were reported but were likely artifacts of the sampling and laboratory analysis programs. No explosives or perchlorate were detected in any of the soil samples collected under the additional range delineation study. These results suggest that no significant residual contamination is present at the firing point.

Extensive geophysical investigations have been performed at the Former A Range. The majority of HE items discovered on the range were 37 mm and 40 mm projectiles, which contain very small amounts of explosives (black powder, tetryl, TNT, or MAX-2). Of the most frequently detected items, only the 37 mm developmental projectiles with MAX-2 (aluminum, Comp A4, and graphite) contain RDX (1.4 ounces). Fifty-five of the 37 mm developmental projectiles were discovered. Other items discovered on Former A Range include forty-five conventional 37 mm projectiles, thirteen 40 mm projectiles, one 4.5-inch rocket (TNT), one 3.5-inch HEAT rocket (Comp B [TNT/RDX]), four 81 mm mortars (TNT or Comp B), two 57 mm projectiles (TNT or Comp B), one partial 90 mm projectile (TNT), and several partial 75 mm shrapnel projectiles (black powder). Most of the 40 mm projectiles were inert and found around Berm A. The 2010 detailed reconnaissance confirmed that vast majority of munitions were located within the target area that was addressed during the 2009 soil removal action. In addition, intrusive activities continued based on depth, signal strength and areal extent from higher to lower density areas until only one or two items were found and removed. Thus, it is unlikely a significant number of munitions remain undetected at the site. Any remaining rounds are likely to be single, randomly scattered munitions unlikely to represent a threat to groundwater.

Groundwater Findings

Data from four monitoring wells (MW-149S, MW-206S, MW-249M3 and MW-536S) were used to evaluate groundwater associated with the Former A Range (Figure 2).

All four monitoring wells were sampled for explosives compounds. Explosives compounds were detected in one well (MW-249M3) at low concentrations. TNT and its degradation products, 2A-DNT and 4A-DNT, were detected at concentrations of less than 1 µg/L, well below the health advisory (HA) of 400 µg/L. RDX (0.31 µg/L) and 1, 3, 5-trinitrobenzene (0.33 µg/L) were each detected once in June 2005. The RDX detection was well below the 2 µg/L HA and the 0.6 µg/L risk-based level.

All four monitoring wells were sampled for perchlorate. Perchlorate was detected twice in MW-249M3 at concentrations of 0.44 µg/L (November 2004) and 0.075 µg/l (June 2009). Perchlorate was also detected in MW-536S at a concentration of 0.2 µg/L in January 2010. All of these detections are well below the Massachusetts Maximum Contaminant Level for perchlorate of 2 µg/L.

One well (MW-149S) was sampled for metals, SVOCs, VOCs, and herbicides/ pesticides. Several metals were detected in groundwater at concentrations generally consistent with MMR background levels. Bis(2-ethylhexyl)phthalate, a common laboratory contaminant, was sporadically detected and naphthalene was detected only once in March 2001. Chloroform was the only VOC detected in groundwater and is believed to be naturally-occurring.

Response Actions

In June 2008, the Air Force Research Laboratory conducted a technology demonstration at the Former A Range. A remotely-controlled C325 excavator equipped with an electromagnetic attachment was used to remove munitions items from the surface and near-surface of Berm A Twelve 37 mm suspected HE projectiles, one suspected 57 mm HE projectile, and a large number of 50 caliber small arms rounds were recovered by the excavator (Figure 8).

In November 2009, soil from the face of both Berms A and C in the target area was excavated to a depth of approximately two feet bgs to remove any munitions that might be present (Figure 9). Approximately 2,500 cubic yards of material were removed. Five potentially live MK1 75 mm shrapnel projectiles were found in Berm B soils. Four potentially live 75 mm shrapnel projectile bases with pusher plate, two practice 37 mm projectiles, and fifteen MK 29 3.5-inch practice rockets were found in Berm D soils. No explosives compounds were detected in any of the samples collected from the excavations. Approximately 50 cubic yards of soil within-situ explosives detections was shipped off site to an approved disposal facility. The remainder of the excavated soil, which had no in-situ detections above screening levels, was sampled with one sample collected for every 500 tons of soil and was mechanically screened to remove small arms projectiles. The soil was then used to backfill the soil excavation footprints and support area.

Former K Range

Source Area Investigations

Source investigations were conducted at Former K Range to determine the nature and extent of the contamination in the soil as well as the nature and extent of munitions that may remain on the range.

Soil sampling at the Former K Range was completed during three separate phases of field activities (Figure 5). Soil samples were collected from the firing line and five target areas in March and April 2001 as part of the Phase IIb Investigation. Seven of these samples (two from the firing line and one from each target area) were tested for a full suite of analytes; the remaining samples were tested for explosives compounds, SVOCs, and metals. Additional soil samples from the firing line and from three of the target areas were collected in late 2004 and early 2005 as part of Phase IIb – Additional Soil Sampling. Samples from the firing line were tested for pesticides, polychlorinated biphenyls, and perchlorate. Samples from two target locations were analyzed for explosives compounds and perchlorate; samples from the third target area were tested for metals. Samples were collected in July and September 2009 as part of the Former K Range Additional Characterization Activities in order to characterize areas where a significant quantity of 3.5-inch rockets was found following a prescribed fire. These samples were tested for explosives compounds and perchlorate. Two additional samples were collected in November 2009; one to further define the extent of contamination and one post-excavation sample collected after completion of a soil removal action.

Several geophysical investigations have occurred at Former K Range. An AIRMAG survey was performed in 2000 in order to identify areas where ground-based surveys were appropriate. Multiple techniques were used to validate the AIRMAG survey, including evaluation of the Archive Search Reports, facility plans, and aerial photographs; field reconnaissance surveys; and intrusive investigations. In 2001, ground-based geophysical surveys and intrusive investigations of the four target areas were performed as part of the Munitions Survey Program Phase 2 (Figure 6). The fifth target area was surveyed with a hand-held magnetometer. Additional investigations were conducted in 2008 to complete site characterization, including EM-61 surveys with intrusive investigations; detailed reconnaissance with intrusive investigations in areas of the range following prescribed fire; meandering path reconnaissance with intrusive investigation in firebreaks; aerial photograph feature investigations; and trenching.

Groundwater Investigations

Two monitoring wells and four drivepoints were used to characterize groundwater associated with Former K Range (Figure 3). Well cluster MW-170 was installed north of Former K Range along Wood Road and downgradient of the Former K Range target area in 2001. Groundwater samples from MW-170M2 through January 2002 were analyzed for explosives compounds, SVOCs, volatile organic compounds (VOCs), metals, PCBs, pesticides, herbicides, and inorganic compounds. Samples collected since July 2002 were analyzed for explosives compounds and perchlorate. MW-366M3 was installed as part of the J-2 Range investigation but is also used to monitor groundwater from Former K Range. Groundwater samples from

MW-366M3 since March 2005 have been analyzed for explosives compound and perchlorate. Groundwater data from drivepoints DP-459-462, which were located within Former K Range, were analyzed for explosives compounds and perchlorate.

Source Area Findings

No explosives compounds or perchlorate were detected at the firing line. Two propellant-related SVOCs were reported at estimated levels below detection limits. Cobalt and lead were observed at slightly elevated concentrations in a few samples, but average concentrations across the site were near background levels.

Explosives compounds (RDX, 2A-DNT and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine [HMX]) were found in samples at Target Area E at concentrations up to 7.5 mg/Kg; HMX was also found in samples at a second target location. Perchlorate was detected in 17% of samples collected from the target locations and at all seven locations sampled in Target Area F. The maximum detection (0.241 mg/Kg) exceeded the MCP S-1/GW-1 Standard, MADEP leaching concentration, and MMR SSL. Two of the seven perchlorate concentrations exceeded the MADEP leaching concentration and the MMR SSL. Both the average perchlorate concentration of Target Area F and the site-wide average concentration were below screening levels.

Several pesticides and herbicides were observed at concentrations that suggest application in accordance with the manufacturer's guidelines.

The maximum concentration of cobalt exceeded the EPA risk-based SSL but was less than the site-specific MMR SSL. The MMR SSL is based on site-specific information. The average concentration of cobalt only slightly exceeded the MMR background value. Cobalt was detected in only one groundwater sample and was below screening values.

The maximum lead concentration exceeded its MMR SSL but was less than its MCP standard. A review of the lead data indicates that two detections had concentrations greater than 100 mg/Kg. The average concentration exceeded background but was well below the MCP S-1/GW-1 standards. Also, lead was not detected in groundwater.

The majority of the items recovered from the Former K Range were practice or inert items not containing explosives. Seven items were found that potentially contained high explosives (RDX). These items, two 20 mm projectiles, a perforator, one 30 mm projectile, one 57 mm projectile, and two 3.5-inch rockets HE, were recovered. Except for the 3.5-inch rockets, the items discovered were munitions that were not expected to be present on the range based on historical documentation. In addition, explosives compounds and perchlorate have not been detected in groundwater samples collected from the monitoring wells/drivepoints at the range with the exception of MW-366M3 where a decreasing trend in perchlorate concentrations to non-detect has been observed. This further suggests no leachable munition constituent contamination and, therefore, likely minimal use of explosive rounds at the Former K Range. It is unlikely that any items that remain would pose a significant threat to groundwater.

An inspection of the suspected man-portable missile range, constructed as an extension of the original northern boundary of the Former K Range was conducted in September 2001. No evidence of live munitions use was found during this inspection.

Groundwater Findings

Two monitoring wells and four drive points were used to monitor groundwater associated with the Former K Range. RDX was the only explosives compound detected in groundwater and it was only detected once at 0.42 µg/L in a profile sample from MW-170. Perchlorate was detected once in MW-170M2 at 0.064 µg/L in May 2009, but has not been detected in subsequent samples. Perchlorate was detected in MW-366M3 in three rounds of sampling in 2005 (maximum detection of 2.3 µg/L in March 2005), but has not been detected in subsequent rounds of sampling through August 2009. No explosives or perchlorate were detected in any of the four drivepoint samples which were collected in August 2006. Based on the more recent results, there is not a plume of contaminants migrating from the Former K Range.

Response Actions

A soil removal action was performed at Area E of the Former K Range in the Fall of 2009. The removal action was conducted to remove explosive-contaminated soils from Area E (Figure 6). The soil in the removal footprint was excavated to 1.5 feet bgs and approximately 125 cubic yards of soil was removed. The soil was transported to a lined cell at L Range and treated by alkaline hydrolysis using hydrated lime. The lime mineralizes the explosives compounds to more elemental compounds of nitrogen and carbon dioxide. The soil was treated successfully, removed from the cell, and will be used for site restoration.

One 50-point multi-increment soil sample was collected from 1.5 to 2.0 feet bgs from the floor of the excavation and submitted for explosives compounds analysis. Results were non-detect for all explosives compounds.

Gun and Mortar Positions

Source Area Investigations

Source area investigations were conducted at Gun and Mortar positions to determine the nature and extent of the contamination in the soil. Additional investigations were also conducted to determine if bags of propellants or discarded munitions may have been buried within the Gun and Mortar positions.

Soil sampling initially conducted as part of the Phase I Investigation in October 1997 through March 1998 included grid sampling at three gun positions and four mortar positions representing histories of high, medium, or low activity. The remaining Gun and Mortar positions (except GP-9, which was investigated by the Air Force Center for Engineering and the Environment as Chemical Spill-18) were sampled during November 1999 through February 2000 as part of the Phase IIa Investigation. Additional sampling was conducted as part of the grenade courts investigation (GP-11, Area 61), the Munitions Survey Project (17 positions and adjacent trails), and the GP-2 Re-sampling Effort. Based on the results of these earlier sampling programs, selected Gun and Mortar positions were included in the Multi-point Sampling Program in 2009.

Each site was divided into areas and a systematic random sampling approach was used to collect samples from each area. An example of the soil sampling locations at GP-10 is shown in Figure 7. A more detailed discussion of sampling of the Gun and Mortar positions can be found in the *Final Gun and Mortar Position Investigation Report, October 2010*.

Source area investigations were conducted at the gun and mortar positions in 2000 and 2001 as part of the Munitions Survey Project (MSP). During Phase 1 of the MSP, geophysical surveys were performed at 17 positions and trails adjacent to the positions . Based on the results of the surveys, 94 anomalies were excavated at GP-10 and 95 anomalies were excavated at GP-11. During Phase 3 of the MSP, selected anomalies were excavated from GP-7, GP-11, GP-16, GP-22, Former F Range, and MP-4 and their associated trails. GP-16 was chosen for comprehensive investigation and all 324 geophysical anomalies were excavated from this position. Anomalies at the majority of the 17 positions surveyed during the MSP were considered isolated targets and were not investigated further.

Groundwater Investigations

Groundwater investigations were conducted at the four most heavily-used gun (GP-6, GP-14, GP-16, and GP-20) and mortar (MP-1, MP-3, MP-4, and MP-8) positions (Figure 10). Wells installed downgradient of certain positions as part of other investigations (i.e. Northwest Corner and Western Boundary) were also sampled. In 2007, direct push groundwater sampling was performed at GP-10 and GP-11, two of the most contaminated gun positions based upon past use of these sites and previous investigations. Two permanent monitoring wells, MW-495 and MW-496, were installed in GP-10 and GP-11 (respectively) in Fall of 2007.

Source Area Findings

Results of the Phase I sampling and extensive 2009 multi-point sampling indicated that the principal propellant-related contaminant present in the surface soils was 2,4-DNT. In 2009, the highest 2,4-DNT concentrations were observed at GP-6 (2.0 mg/Kg), GP-7 (3.7 mg/Kg), GP-10 (2.6 mg/Kg), and GP-11 (2.5 mg/Kg). Maximum concentrations of 2,6-dintritoluene (2,6-DNT) were uniformly lower than the corresponding 2,4-DNT concentrations or non-detect at all sites. Certain other propellant-related contaminants, including di-n-butylphthalate, 2-nitrodiphenylamine, and n-nitrosodiphenylamine, were detected at generally low to trace concentrations at various positions. The maximum perchlorate detection (0.007 mg/Kg) only marginally exceeded the MMR SSL (0.003 mg/Kg). At most of the positions, perchlorate was either not detected or reported at trace concentrations below the laboratory reporting limit of 0.0008 mg/Kg. The propellant-related contaminants detected during the 2009 MIS sampling event were generally similar to contaminant levels reported in previous investigations.

Excavation of anomalies identified two supplemental charges at GP-10 and one supplemental charge at GP-11. Supplemental charges are used to fill gaps in 155 mm fuses. Twelve supplemental charges were identified at GP-16. The remaining anomalies were generally items related to routine artillery firing (e.g., shipping containers, lifting lugs, and rotating band protectors). There was no evidence of the systematic disposal of munitions or other material that would pose a threat to groundwater.

Soil sampling at Old GP-2 detected one PAH with an average concentration above State MCP Method 1 S-1/GW-1 Standards. The soil does not pose a leaching threat to groundwater but may pose a direct contact threat. Old GP-2 is located on top of a portion of the north west corner of the Former Main Base Landfill (LF-1) with access restricted by a fence. Closure of this portion of the former landfill will be addressed as part of the Superfund site through an Explanation of Significant Difference (ESD) to be issued by the Air Force for the LF-1 Record of Decision.

In addition to the traditional soil sampling, laboratory studies were conducted to determine the mobility of certain contaminants found in the propellants. A technical report was published in 2009 and presented the studies which were conducted to quantify the dissolution rates of nitroglycerin (NG) and dinitrotoluene (DNT) from propellant grains, to determine the extent of sorption and desorption characteristics as DNT and NG migrate through the soil, and to qualitatively evaluate the effects of biodegradation. The results of the laboratory studies indicated that residual DNT and NG in weathered fired propellants, such as those found on the Gun and Mortar positions, is essentially immobile.

Groundwater Findings

Groundwater investigations were conducted at the four most heavily-used gun and mortar positions as part of the Phase IIa Investigation. Propellant-related compounds (2,4-DNT and NG), which are present in some firing position soils, have not been detected in groundwater samples collected at any of these sites. Perchlorate was detected in wells installed downgradient of the Gun and Mortar positions as part of other investigations. However, these detections are believed to be unrelated to activities at the gun positions and have been addressed as part of the Northwest Corner Site.

Response Actions

Soil with elevated concentrations of 2,4-DNT was removed from two gun positions. Soil with a maximum concentration of 2,4-DNT of 1.3 µg/L was removed from GP-7 (Area 17) in 2000 and disposed of off-site. A total of 38 cubic yards was removed. Soil with concentrations of 2,4-DNT up to 9.5 mg/Kg were removed from GP-6 (Area 58) in 2004. A total of 500 cubic yards of soil was removed. This soil was successfully treated in a low temperature thermal desorprtion system constructed primarily to treat soils from the Demolition Area 1 source area.

A removal action was also conducted at GP-9 (Chemical Spill-18) under the MMR Installation Restoration Program (IRP). The total quantity of soil shipped off-site for disposal during the GP-9 (Chemical Spill-18) soil removal action was 5,406 tons. Following these removal actions, leaching studies conducted in 2009 indicated that 2,4-DNT is encapsulated in nitrocellulose at the gun and mortar positions and therefore is unlikely to pose a threat to groundwater. Therefore, the DEP MCP Method 2 Direct Contact Standard was used to determine whether any additional removal actions were required. None of the remaining sites supported concentrations of 2,4-DNT in excess of this standard.

3. History of SDWA Enforcement Activity

Federal Enforcement Activities

In February 1997, EPA Region 1 issued SDWA Administrative Order 1-97-1019 (AO1) requiring investigation of contamination at or emanating from the Training Ranges and Impact Area upon the sole source aquifer.

In May 1997, EPA issued SDWA Adminstrative 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 (Paragraph II.A.1).

In January 2000, EPA issued SDWA Administrative Order 1-2000-0014 (AO3) which required the IAGWSP to implement RRAs and remedial actions to abate the threat to public health presented by the 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 remedial action component of AO3 requires that a Feasibility Study (FS), Remedial Design (RD) and Remedial Action (RA) be completed for several areas of concern.

State Enforcement Activities

There have been no State enforcement actions taken at Former A Range, Former K Range or the Gun and Mortar Positions.

C. COMMUNITY PARTICIPATION

Throughout the Sites' history, the IAGWSP, USEPA and MassDEP have kept the community and other interested parties apprised of activities at the Former A Range, Former K Range, and the Gun and Mortar position 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 USEPA, 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 Cleanup Team, the citizens' advisory team for the Air Force Center for Engineering & Environment's MMR Installation Restoration Program, and renamed the MMR Cleanup Team. The combined team meets regularly throughout the year to hear updates and provide public input on the MMR investigations and cleanup.

The IAGWSP has occasionally briefed the Senior Management Board (SMB), which used to meet regularly and advised MMR organizations on environmental programs and policies. Members of the SMB included selectmen or their designated representative from the towns of Bourne, Falmouth, Mashpee, and Sandwich and representatives from the USEPA, 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.

From the time of 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:

- Each of the sites were briefed individually at the following MMRCT meetings: Gun and Mortar Positions, April 28, 2010; Former K Range, May 19, 2010; and Former A Range, July 17, 2010 Subsequently, at the MMRCT meetings on December 15, 2010 and July 12, 2011, all three Sites were briefed.

- On June 20, 2012, a presentation on the Sites was given that the MMRCT meeting to describe the Remedy Selection Plan for the Former A Range, Former K Range, and the Gun and Mortar Positions. At the meeting, the IAGWSP gave a presentation on the Sites, the Remedy Selection Plan, and answered questions from the MMR Cleanup Team. The IAGWSP notified the p*ublic of the m*eetin*g in a display* ad placed in the *Cape Cod Times* and *The Enterprise* newspapers.

- From June 11, 2012 through July 10, 2012, a Public Comment Period was held on the Remedy Selection Plan for the Former A Range, Former K Range, and the Gun and Mortar Positions. The IAGWSP placed copes of the Remedy Selection Plan in the IAGWSP's information repositories at the Bourne, Falmouth, and Sandwich, MA public libraries. The repositories contain documents on the Former A Range, Former K Range, and Gun and Mortar Positions investigations and findings supporting this decision document. The Remedy Selection Plan also was made available on the IAGWSP Web site, which also contains the supporting documents and which offered a means of submitting public comments on the Remedy Selection Plan. In addition, the IAGWSP provided copies of the Remedy Selection Plan to MMR Cleanup Team members and distributed it to individuals in attendance at the public meeting and public hearing.

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.

D. SITE CHARACTERISTICS

Site Geology

The surficial geology of western Cape Cod comprises glacial sediments deposited during the retreat of the Wisconsin stage of Holocene glaciation. Three extensive sedimentary units dominate the regional geology: the Buzzards Bay and Sandwich Moraines, and the Mashpee

Pitted Plain. The Buzzards Bay Moraine and the Sandwich Moraine are located and visible as hummocky ridges along the western and northern boundaries of Camp Edwards, respectively. The Buzzards Bay Moraine and Sandwich Moraine are composed of ablation till, which is unsorted material ranging from clay to boulder size that was deposited at the leading edge of two lobes of the Wisconsinian glacier at its furthest advance. The Mashpee Pitted Plain is a broad outwash plain that lies between the two moraines and consists of fine to coarse-grained sands and is underlain by fine-grained giaciolacustrine sediments and a basal till layer over bedrock. The Mashpee Pitted Plain underlies most of MMR, including the

Site Hydrogeology

A single groundwater-flow system underlies western Cape Cod including MMR. Camp Edwards lies over the Sagamore Lens, which is part of the larger, Cape Cod Aquifer. The primary source of natural fresh water recharge to this groundwater system is rainfall and snow melt-water that averages approximately 48 inches per year. Additional water is returned to the aquifer as wastewater from domestic septic systems. Municipal sewer systems at the MMR and in parts of Falmouth return treated wastewater to the groundwater flow system through infiltration beds at the sewage treatment facilities. Wastewater return flow accounts for approximately 5 percent of the total groundwater recharge in the MMR region. The high point of the water table within the western Cape Cod groundwater system occurs as a groundwater mound located beneath the east central portion of MMR. Groundwater flows radially outward: north to either the Cape Cod Canal or the Cape Cod Bay, east to the Bass River, south and southeast to Nantucket Sound, and west and southwest to Buzzards Bay.

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

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

E. SUMMARY OF SITE RISKS

Results of soil and groundwater sampling were compared to several screening tools in order to determine whether concentrations of contaminants present a risk to human health or the environment. Background values were used to determine which analytes are naturally present in soil or groundwater and at what levels. Soil screening levels (SSLs) were developed as initial screening values for the IAGWSP investigation. They are to help determine whether the detection of an analyte is above a concentration that requires additional leaching analysis. Massachusetts Contingency Plan (MCP) Method standards provide default soil and groundwater concentrations that have been determined to be protective of human health and the environment.

Former A Range

Risk screening of the soil data from the Former A Range was performed using the maximum soil concentrations of each detected constituent. Explosives compounds were detected primarily in the target area of the range and had low frequencies of detection, no significant groundwater detections, and generally low detected concentrations. Perchlorate was infrequently detected at concentrations below all screening criteria. Metals were below screening levels. Based on their chemical properties, metals are preferentially adsorbed to the soil and relatively immobile. This suggests that metals detected at the range are unlikely to migrate through the vadose zone to groundwater. Of the 15 metals detected above screening levels, only five were detected in groundwater (copper, manganese, molybdenum, silver, and zinc) all at concentrations well below the lowest groundwater screening value. Based on the results of the risk screening, no Contaminants of Concern (COCs) were identified in the Former A Range soil.

Groundwater monitoring data from the four monitoring wells associated with the Former A Range were used in the risk screening. Five explosives and perchlorate were detected at least once in these monitoring wells but the concentrations did not exceed any risk screening levels. Two SVOCs exceeded risk screening levels, but these were either believed to be unrelated to the site or were not reproduced in subsequent sampling. Based on these findings, no COCs were identified in the Former A Range groundwater.

The areas containing the highest density of munitions, the four primary berms, were excavated in 2009 and the post-excavation geophysical survey confirmed that munitions were successfully removed from these areas. The area between the berms was also cleared of munitions so it could be used as a staging area for equipment and materials. No munitions items were discovered during the meandering path surveys conducted outside the target area and it is unlikely there are significant residual munitions on the range. Generally, intrusive activities continued to depth, signal strength and areal extent from higher to lower density areas until only one of two items were found and removed. Thus, it is unlikely a significant number of munitions remain undetected at the site.

Former K Range

The risk screening for soil on the Former K Range included both an evaluation of the entire site and an evaluation of specific subareas defined by the conceptual site model.

Concentrations of the explosives compounds HMX and 2-amino-4, 6-dinitrotoluene in soil slightly exceeded one or more screening values. However, these compounds are not widespread in soil at the Former K Range at concentrations above screening levels. All RDX concentrations were removed when soil was excavated from one of the target areas. Concentrations of perchlorate slightly exceeded screening values at one target location, but the average concentration of perchlorate at this location did not exceed cleanup standards. Based on these findings, no COCs were identified in soil at the Former K Range.

Groundwater monitoring data from the four drive points and two monitoring wells associated with Former K Range were used in the risk screening. The maximum concentration of perchlorate slightly exceeded one screening criteria but was observed in only four of 24 samples and all sample locations have been non-detect since 2006. Based on these findings, there were no COCs identified in the Former K Range groundwater.

Only seven potentially explosive items (two 20 mm projectiles, a perforator, one 30 mm projectile, one 57 mm projectile, and two 3.5-inch rockets HE) were recovered from the Former K Range. Except for the 3.5-inch rockets, the items discovered were munitions that were not expected to be present on the range based on historical documentation. In addition, explosives compounds and perchlorate have not been detected in groundwater samples collected from the monitoring wells/drivepoints at the range with the exception of MW-366M3 where a decreasing trend in perchlorate concentrations to non-detect has been observed. MW-366M3 was installed as part of J-2 Range investigations and groundwater model particle tracks from the M3 screen tracked back to the vicinity of the Former K Range. The combination of a decreasing trend of perchlorate concentrations and data from the four drive points with shallow groundwater data at the Former K Range suggest no leachable munitions constituent contamination and, therefore, likely minimal use of explosive rounds at the Former K Range.

Gun and Mortar Positions

The initial risk screening for soils was conducted using a site-wide soil data set for all 37 Gun and Mortar Positions. Post-removal soil data were used to represent those locations where rapid response actions had occurred. Site-wide risk screening of the soil data from the Gun and Mortar Positions was performed using the maximum soil concentrations of each detected constituent.

The maximum detected concentrations of nine explosives in soil samples exceeded at least one screening criterion. However, all of these explosives were detected infrequently and at low levels. The maximum detected concentrations of the compounds 2,4-DNT and 2,6-DNT exceeded their respective MMR SSLs. DNT encapsulated in nitrocellulose is essentially immobile in the environment and neither of these compounds has been detected in the groundwater associated with the positions. TNT was the only explosive that was found in both soil and groundwater; however, the groundwater result was considered anomalous as it could not be reproduced. Perchlorate was detected at low levels, and only one detection slightly exceeded one screening criterion.

Of the 18 metals detected in soil at concentrations exceeding at least one screening criterion only arsenic was detected in both soil and groundwater above screening levels. However, arsenic is frequently detected in soil throughout MMR and has not been identified as a

constituent of artillery or mortar propellant or munitions casings. Thus arsenic detections in soil are not believed to be related to activities conducted at the Gun and Mortar positions. Based on the available data and their chemical properties, metals detected in Gun and Mortar position soils are unlikely to impact groundwater. Most pesticides/herbicides bind strongly to soil and are therefore immobile in the environment. While seventeen of these analytes were detected at concentrations exceeding an SSL, most were detected at low concentration in only a few samples. A few (dieldrin, gamma-chlordane, MCPA, MCPP, p.p'-DDT, p.p'-DD, p.p'-DDT) were detected more frequently but only MCPP was detected in both soil and groundwater above screening levels. MCPP detections have been established to be false positive results caused by interferences to the older analytical method. In general, SVOCs are highly adsorbed or complexed with the soil matrix and their overall tendency is for low mobility in the environment. The only SVOCs detected in both soil and groundwater were butyl benzyl phthalate, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and diethyl phthalate. All of the groundwater detections for these constituents were below their respective risk-based screening criteria. Soil sampling at Old GP-2 detected one PAH with an average concentration above State MCP Method 1 S-1/GW-1 Standards. The soil does not pose a leaching threat to groundwater but may pose a direct contact threat. Old GP-2 is located on top of a portion of the north west corner of the Former Main Base Landfill (LF-1) with access restricted by a fence. Closure of this portion of the former landfill will be addressed as part of the Superfund site through an Explanation of Significant Difference (ESD) to be issued by the Air Force for the LF-1 Record of Decision. Based on these findings, there were no COCs identified in the soil at the Gun and Mortar Positions.

Groundwater monitoring data from 11 monitoring wells associated with the Gun and Mortar Positions were used in the risk screening (Figure 10). Groundwater data were screened for explosives, perchlorate, metals, pesticides/herbicides, SVOCs, VOCs, and PCBs. TNT was detected in groundwater at a concentration slightly above one screening criterion in a single sample. However, this result is considered anomalous as TNT has not otherwise been detected in this well or in the soil upgradient of the well. RDX was detected in five groundwater samples in one well at concentrations below screening levels; RDX has not been observed in this well since 2006. Perchlorate was observed in five wells and exceeded one screening criterion in two wells. These detections were evaluated as part of the Northwest Corner Investigation and the detections are believed to be unrelated to the gun or mortar positions. Only one metal, arsenic, and one VOC, chloroform, slightly exceeded one screening criteria. Chloroform is believed to be naturally-occurring in the aquifer. Arsenic in groundwater is frequently detected throughout MMR and has not been identified as a constituent of artillery or mortar propellant or munitions casings. Thus arsenic detections in groundwater are not believed to be related to activities conducted at the Gun and Mortar positions. No pesticides/herbicides or PCBs were detected above screening criteria. Based on these findings, no COCs were identified in groundwater at the Gun and Mortar positions.

Munitions found at the Gun and Mortar Positions were limited to supplemental charges and items related to routine artillery firing. There was no evidence of the systematic disposal of munitions or other material that would pose a threat to groundwater.

F. THE SELECTED SITE DECISIONS

For reasons set forth herein, EPA has determined that no further action is appropriate for the Former K Range and the Gun and Mortar Positions, and that groundwater monitoring and land use controls to protect the monitoring wells is appropriate for the Former A Range.

Former K Range and the Gun and Mortar Positions

The response activities conducted at the Former K Range, and Gun and Mortar positions are protective of human health, the environment, and the aquifer. USEPA has determined that the response activities have achieved the objectives set forth in SDWA § 1431(a), 42 U.S.C. § 300i, and the Administrative Orders. Therefore, USEPA requires no further response actions with respect to these sites.

Extensive investigations at Former K Range and the Gun and Mortar Positions were performed over a ten year period. The groundwater investigations revealed only low concentrations of several analytes with only isolated detections slightly above any screening criteria. Thus it does not appear that past activities at the Sites have significantly impacted groundwater. In addition, there does not appear to be a source for potential future groundwater contamination. Concentrations of contaminants and munitions have been removed. The results of the soil risk screenings suggest that any analytes detected in the remaining soil are unlikely to impact groundwater. Also, based on the types and quantities of munitions found during various investigation and removal actions, it is unlikely that any residual munitions represent a significant threat to groundwater. Finally, based on a comparison of soil results with State MCP Standards, no significant risk to human health or the environment exists at these sites. Therefore, no further action is necessary to address groundwater or source areas on Former K Range, and Gun and Mortar Positions.

Former A Range

Based on the removal actions and results of the risk screening of soil samples, EPA has determined that no further action for the source area for the Former A Range.

However, due to concerns with the potential for residual MEC items that may remain and pose a threat to groundwater, EPA has determined that limited action with long-term groundwater monitoring, land use controls to protect monitoring wells, and five year reviews are appropriate for the Former A Range.

Groundwater Monitoring

In order to confirm that no further sources of groundwater contamination remain at the Former A Range, groundwater monitoring will be conducted at monitoring wells MW-149S and MW-206S for explosives and MW-249M3 and MW-536S for explosives and perchlorate once in 2014 and again in 2016. The results will be presented in monitoring reports to be submitted after each sampling event. The data will be assessed as part of a five-year review to be conducted in 2017 and the need for additional monitoring will be determined at that time.

Land Use Controls

The Army is responsible for ensuring that the following land use controls are established, monitored, maintained, reported on, and enforced as part of this final remedy to ensure protection of human health in accordance with SDWA § 1431(a) for the duration of the final remedy selected in this Decision Document. . The Massachusetts Air National Guard and Massachusetts Army National Guard have enforcement authority regarding the first land use control (base digging permit). The Army has enforcement authority regarding the second land use control (Dig Safe).

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).

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

In the event that the Massachusetts Air and/or Army National Guards fail to promptly enforce the first land use control, or the Army fails to promptly enforce the second land use control, the Army will act in accordance with the paragraph below 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 Massachusetts Air and Army National Guards') discovery of the violation or potential violation; otherwise, enforce as soon as possible.

Land Use Controls Monitoring

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

The annual monitoring report, submitted to the regulatory agencies by the Army, will evaluate the status of the land use controls and how any land use controls deficiencies or inconsistent uses have been addressed. The annual evaluation will address (1) whether the use restrictions and controls referenced above were put in place and effectively communicated, (2) whether the operator, owner, and state and local agencies were notified of the use restrictions and controls affecting the property, and (3) whether use of the property has conformed with such restrictions and controls and, in the event of any violations, summarize what actions have been taken to address the violations.

Operational Responsibilities and Liability

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

Activities Inconsistent With Land Use Controls

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

the discovery of any activity that is inconsistent with the land use controls objectives or use restrictions, or any other action that may interfere with the effectiveness of the land use controls. The Army will notify the EPA and MassDEP regarding how the Army has addressed or will address the breach within 10 days of sending the EPA and MassDEP notification of the breach.

Ensuring Continued Maintenance of LUCs

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

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

Five-Year Reviews

In addition to annual reports on groundwater monitoring and verification of land-use controls, this limited action decision for the Former A Range 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 (i.e., monitoring or land use controls); 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 selected decision described in this Decision Document will be documented in a technical memorandum in the Administrative Record. If the EPA, in consultation with MassDEP, believes that fundamental changes to the selected decisions are necessary, the EPA will issue a proposed revised Decision Document and accept public comment on it before issuing a final, revised Decision Document.

G. DETERMINATIONS

The selected actions of no further action for the Former K Range and Gun and Mortar Positions, and limited action with long term groundwater monitoring and land use controls to protect monitoring wells for the Former A Range, are consistent with the SDWA §1431(a), 42 USC §300i(a), as amended and with AO3.

No further action at the Former K Range and the Gun and Mortar Positions are protective of human health. At the Former A Range, long term groundwater monitoring and land use controls will adequately protect human health and the sole source aquifer which constitutes a current and potential drinking water supply.

H. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented the Decision Document Fact Sheet for the Former A Range, the Former K Range, and the Gun and Mortar Positions on Wednesday, June 20, 2012. The proposed decisions are no further action for the Former K Range and the Gun and Mortar Positions, and limited action with long term groundwater monitoring and land use controls to protect monitoring wells for the Former A Range. No written or verbal comments were submitted during the public comment period. It was determined that no significant changes to the actions, as originally identified in the Decision Document Fact Sheet, were necessary.

I. STATE ROLE

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

PART III. THE RESPONSIVENESS SUMMARY

On June 11, 2012, the IAGWSP published the Decision Document Fact Sheet for the Former A Range, Former K Range, and Gun and Mortar Positions, which included the EPA proposed remedies of no further action for Former K Range and Gun and Mortar Positions, and groundwater monitoring and land use controls for Former A Range.

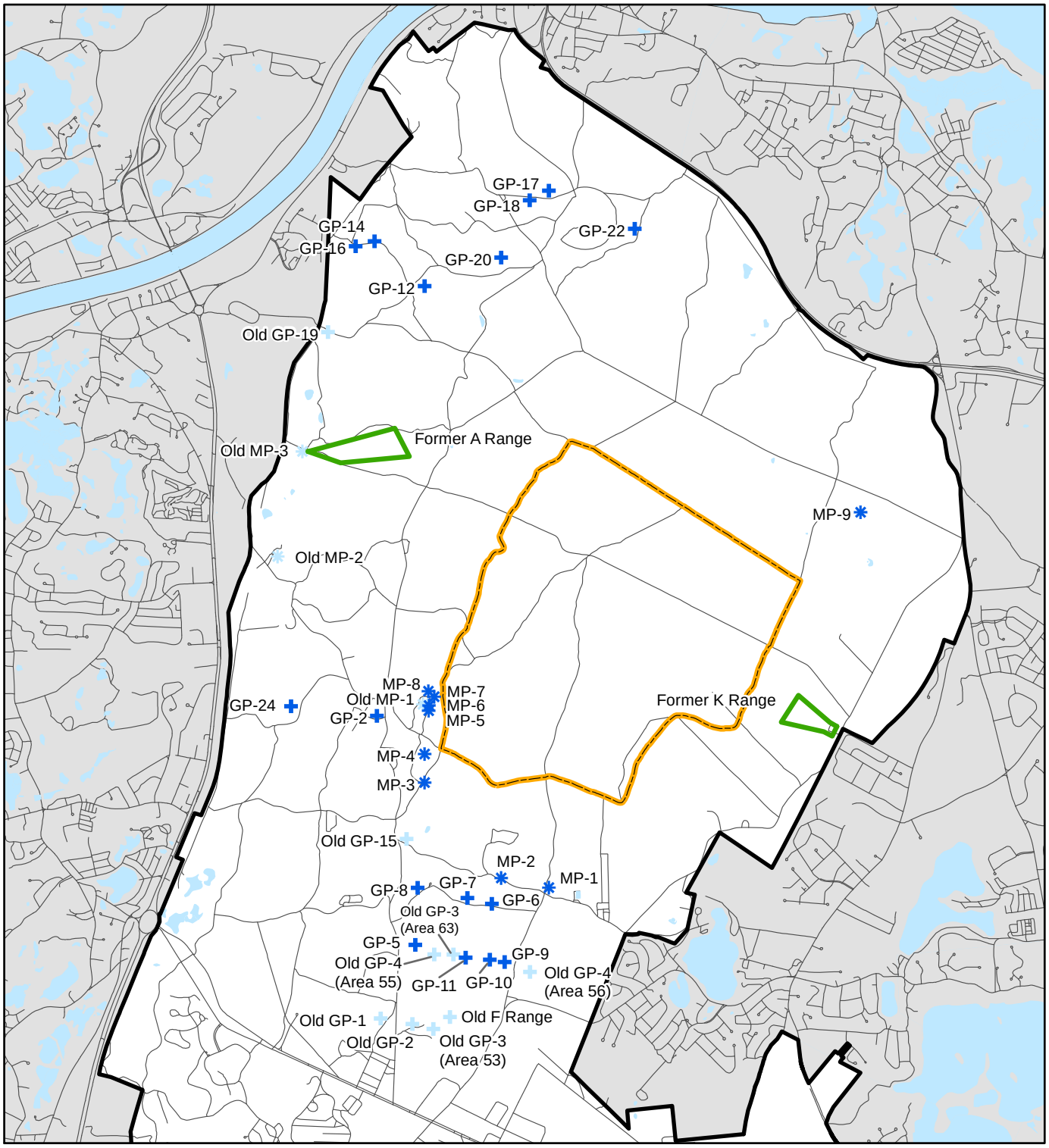
At the June 20, 2012, public meeting of the MMRCT, held on base, the EPA gave a presentation on the Decision Document Fact Sheet and answered questions and solicited comments from the MMRCT and members of the public in attendance. Local residents and officials, new media representatives, representatives from the EPA, MassDEP, and the IAGWSP were invited to attend the meeting. Representatives from EPA, MassDEP, and IAGWSP were present.

The IAGWSP notified the public of the June 20, 2012 public meeting and announced the public comment period in a display ad placed in the June 11, 2012 edition of *The Cape Cod Times* and in the June 15, 2012 edition of *The Enterprise* newspapers.

The IAGWSP placed copies of the Decision Document Fact Sheet for the Former A Range, Former K Range, and Gun and Mortar Positions in the IAGWSP information repositories at the Bourne, Falmouth, Mashpee and Sandwich, MA public libraries. The repository contains documents on the investigation and findings supporting selection of no further action for Former K Range and the Gun and Mortar Positions, and groundwater monitoring with land use controls to protect monitoring wells for the Former A Range. The Decision Document Fact Sheet also was made available on the EPA and IAGWSP web sites, which also contains the supporting documents and which offered a means of submitting public comments on the Decision Document Fact Sheet. In addition, the IAGWSP mailed copies of the Decision Document Fact Sheet to MMRCT members and distributed to individuals in attendance at the MMRCT meeting.

There were no comments submitted on the Decision Document Fact Sheet for the Former A Range, Former K Range and Gun and Mortar Positions.

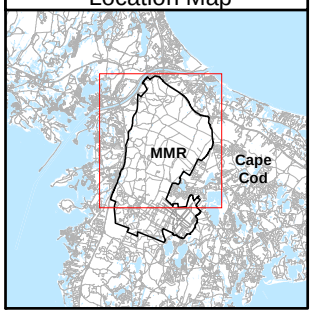
FIGURES



Legend

- MMR Boundary
- Impact Area Boundary
- Former Gun Position
- Former Mortar Position
- Current Gun Position
- Current Mortar Position

Location Map



0 2,500 5,000 Feet

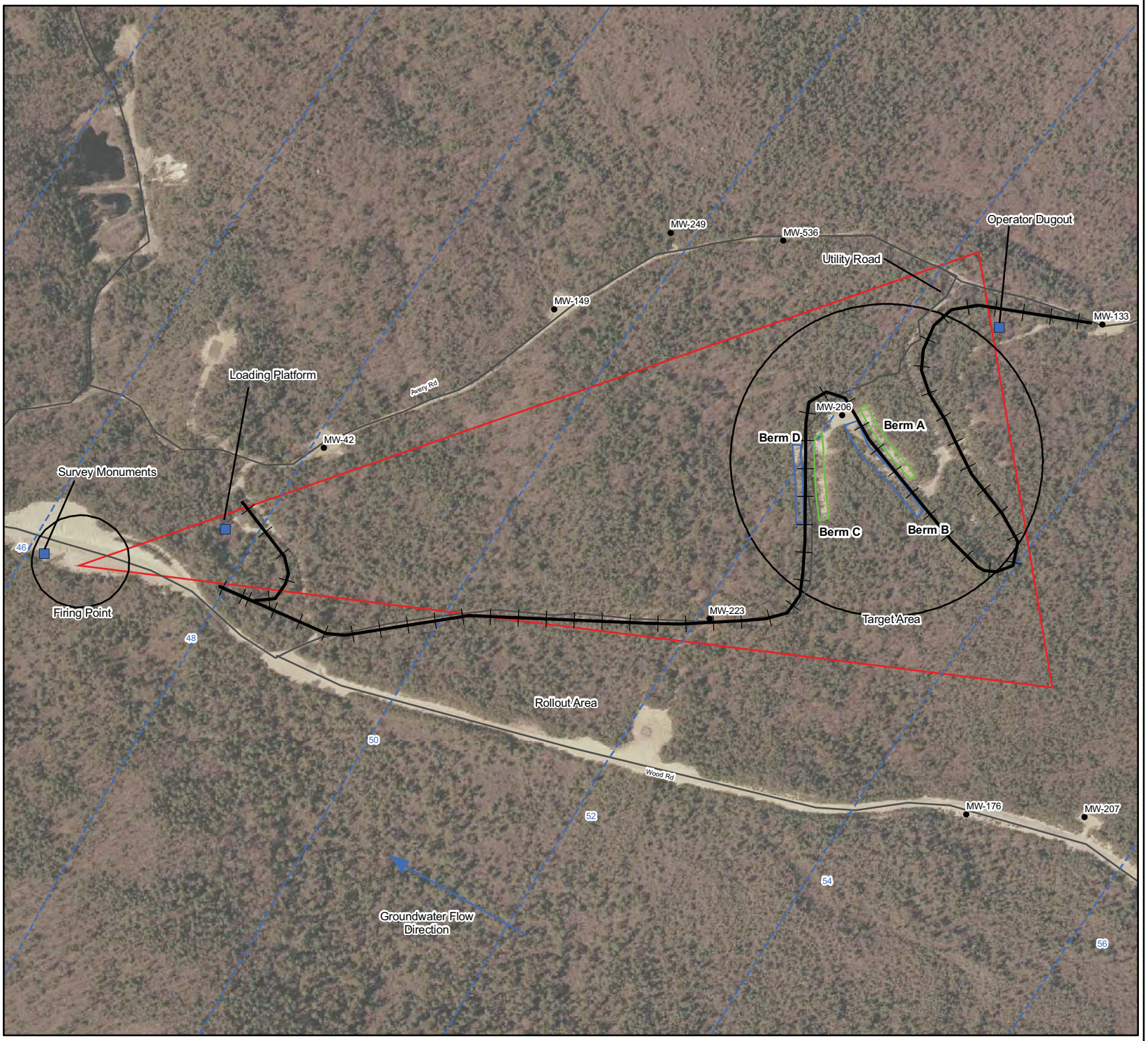
US Army Corps of Engineers
New England District

Location of Former A and Former K Ranges, and Gun & Mortar Positions
Massachusetts Military Reservation

FIGURE 1

M:\MMR\2012\DecisionDocuments\Figures\Fig1_071112.pdf
M:\MMR\2012\DecisionDocuments\MXDs\Fig1_070912.mxd
July 11, 2012 DWN: MTW CHKD: PJR

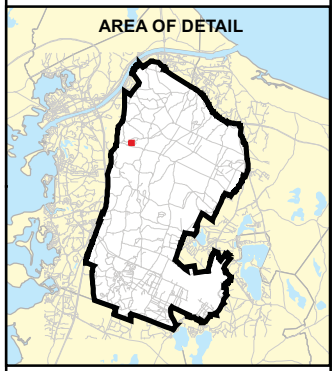
Impact Area Groundwater Study Program



Impact Area Groundwater Study Program

- Monitoring Wells
- Backstop Berm (A-upper, C-lower)
- Protective Berm (B-upper, D-lower)
- Roads
- Rail Line
- Groundwater Contours (MMR-10 Model)

AREA OF DETAIL



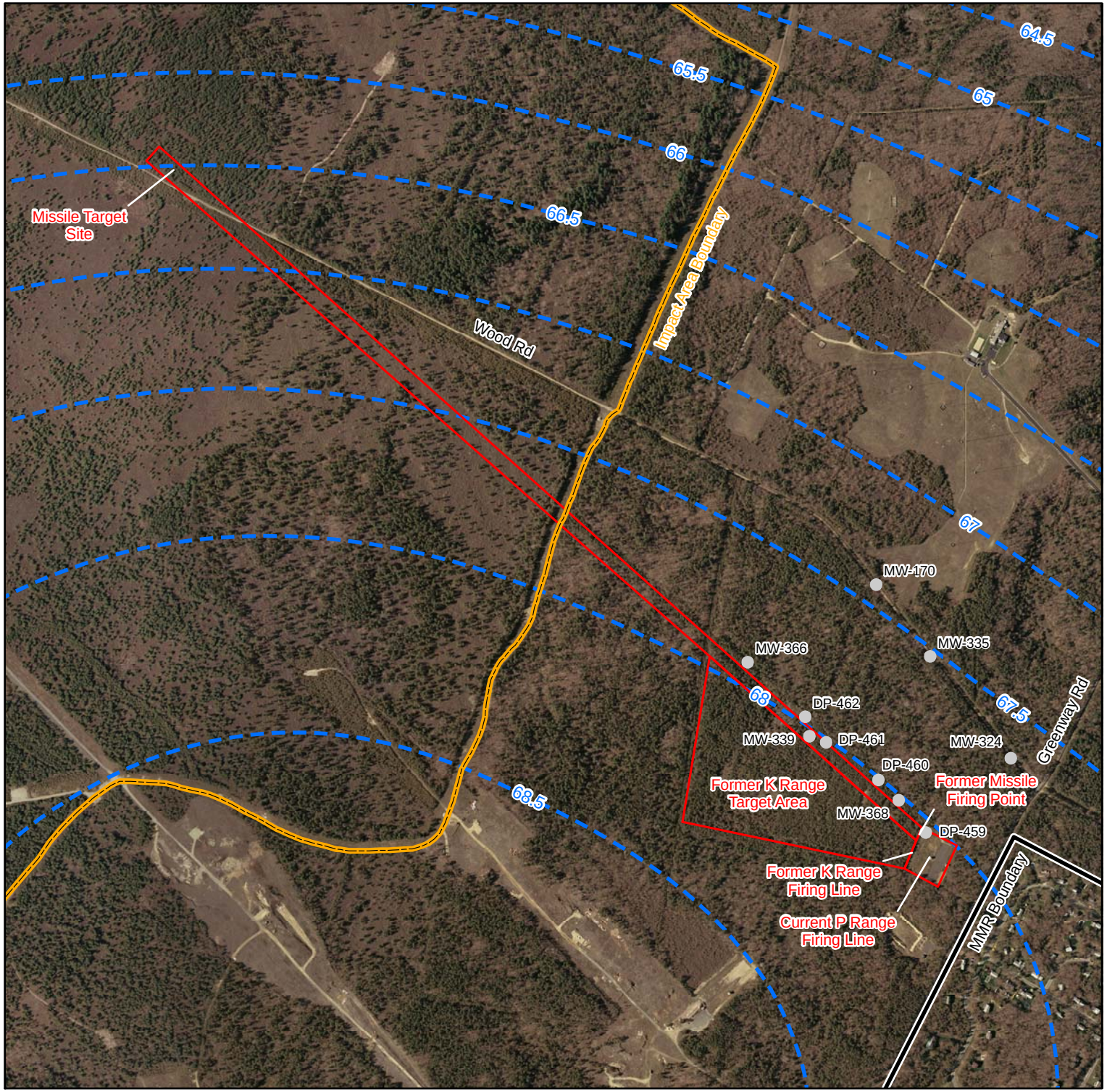
Former A Range Soil Sample and Monitoring Well Locations

0 560 Feet

N

File: P:\GIS\MMR\FormerARange\GIS\Spatial\MXD\20110418_InvReport\20110510_Fig2-3_FAR_Layout.mxd
Prepared By: william.scales
Coordinate System: NAD 1983 UTM Zone 19N

FIGURE 2

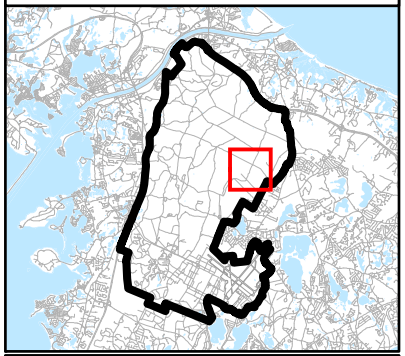


Impact Area Groundwater Study Program

LEGEND

- Monitoring Well/Drive Point
- Range Boundary
- 67 — Ambient 2003 Synoptic Water Table Contours (feet mean sea level)

LOCATION MAP



NOTES & SOURCES

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

TITLE

Details for Former K Range

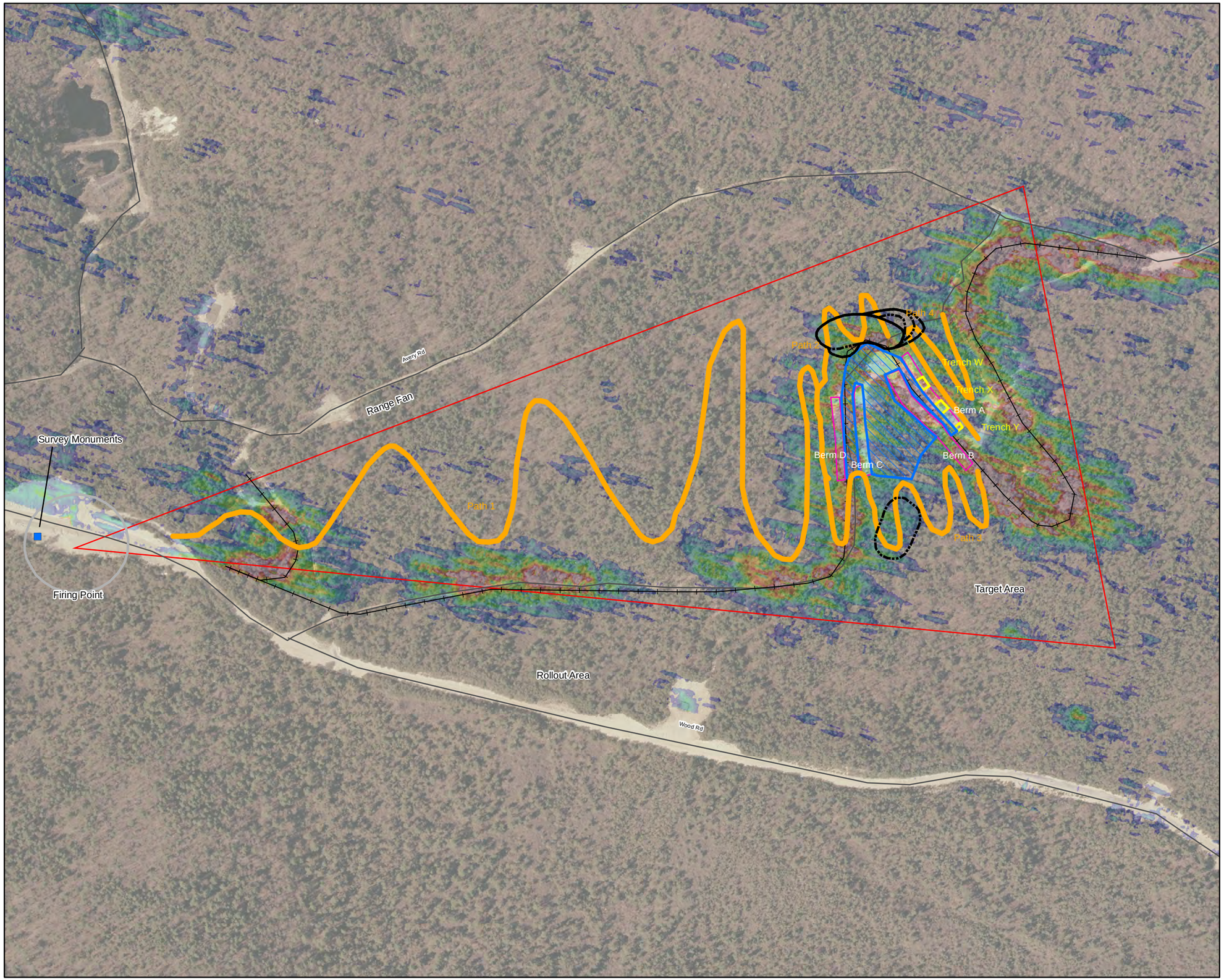
0 900 Feet

N

US Army Corps of Engineers
New England District

FIGURE 3

M:\MMR\2012\FormerK\Figures\Fig3_080112.pdf
M:\MMR\2012\FormerK\MXDs\Fig3_080112.mxd
August 1, 2012 DWN: MTW CHKD: PJR



Impact Area Groundwater Study Program

- Detailed Site Reconnaissance
- Berm Extension Investigation Area
- Firing Point
- Backstop Berm Excavation Survey Area
- Backstop Trench Penetration Study Area
- Source Investigation/ Removal Cleared Area
- Road
- Rail Line

Note:
1. Background includes 2001 AIRMAG Anomaly Map - Survey Area 2 imagery. AirMag Anomaly Data Source: Tetra Tech, Inc.
2. Aerial photos: 1:2400 color digital orthophotos Resolution: 0.5 feet; Date Flown: 2002; Source: EarthData International of Maryland, LLC
3. Topography: 10 meter contours generated from digital terrain models (DTMs) Source: MASSGIS

Former A Range Geophysical Survey Areas

0 480 Feet

N

File: P:\GIS\MMR\FormerARange\GIS\SpatialMXD\20110418_InvReport\20120801_Fig4_GeophysicalSurveyArea_Updated.mxd
Prepared By: william.scales
Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001

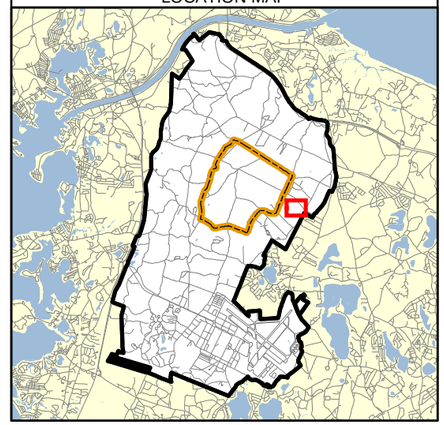
FIGURE 4

Impact Area
Groundwater Study Program

LEGEND

- Monitoring Well
- Soil Grid
- Topographic Contours (3m)
- Area Boundaries
- Range Boundary
- 100-point Multi-Increment Sample Locations
- Excavation Area
- MMR Boundary

LOCATION MAP



NOTES & SOURCES

Basemap data from US Geological Survey 7 1/2 minute
Topographic Map Source: MassGIS.
Aerial photos: 1:5000 black & white digital orthophotos
Resolution: 0.5 feet; Date Flown: 1997; Source: Jacobs Eng.

TITLE

Former K Range Soil Sample Locations and Monitoring Wells

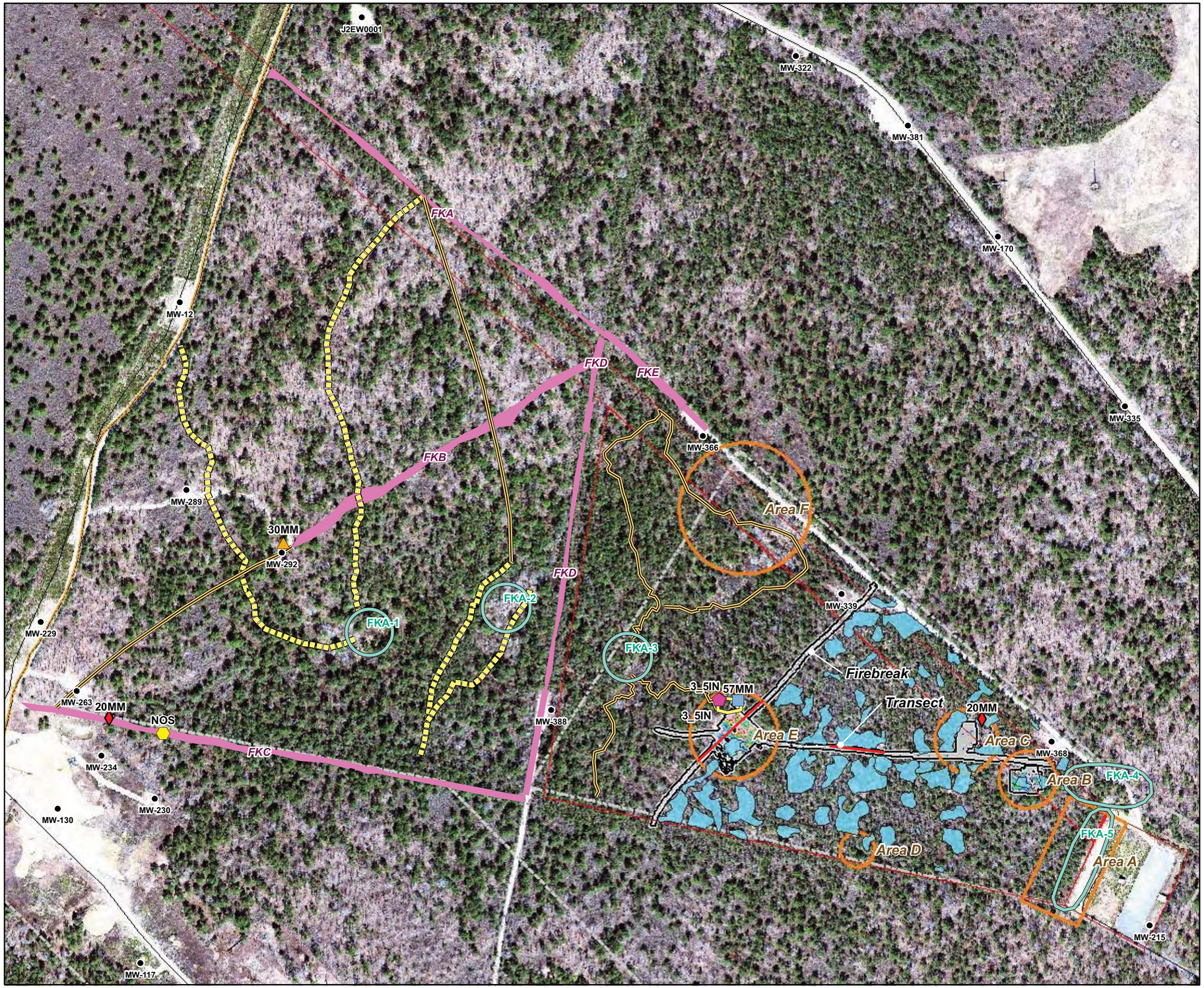
0 140 280 420 Feet

N

File: P:\GIS\MMR\SmallArmsRange\GIS\SpatialMXD\20110405_DD\20120801_Figure3_FormerKSoilAndMWLocs_Updated.mxd
Prepared By: william.scalies
Coordinate System: NAD 1983 UTM Zone 19N

FIGURE

5



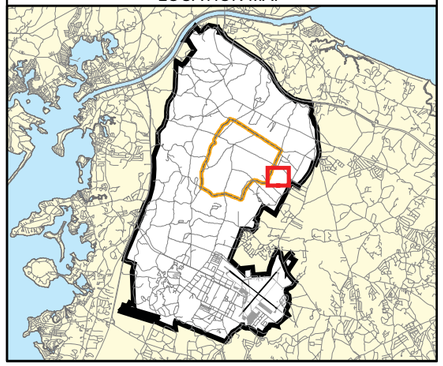
Impact Area Groundwater Study Program

LEGEND

Former K MEC Items

- 20 MM Projectile (2)
- 30 MM Projectile (1)
- 3.5 Inch Rocket (2)
- 57 MM Projectile (1)
- Perforator (1)
- Existing Monitoring Wells
- Trench Locations (3 ft wide)
- Excavation Area
- Aerial Assessment Locations
- Meandering Path Reconnaissance
- Jeep Trails (GPS Surveyed)
- AFRL Cut Firebreaks
- Detailed Reconnaissance Area
- Presumed Target Areas
- Range Boundary
- Geophysically Surveyed Area Boundary
- Impact Area Boundary
- Study Area

LOCATION MAP



NOTES & SOURCES

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

TITLE

Former K Range Investigation Areas

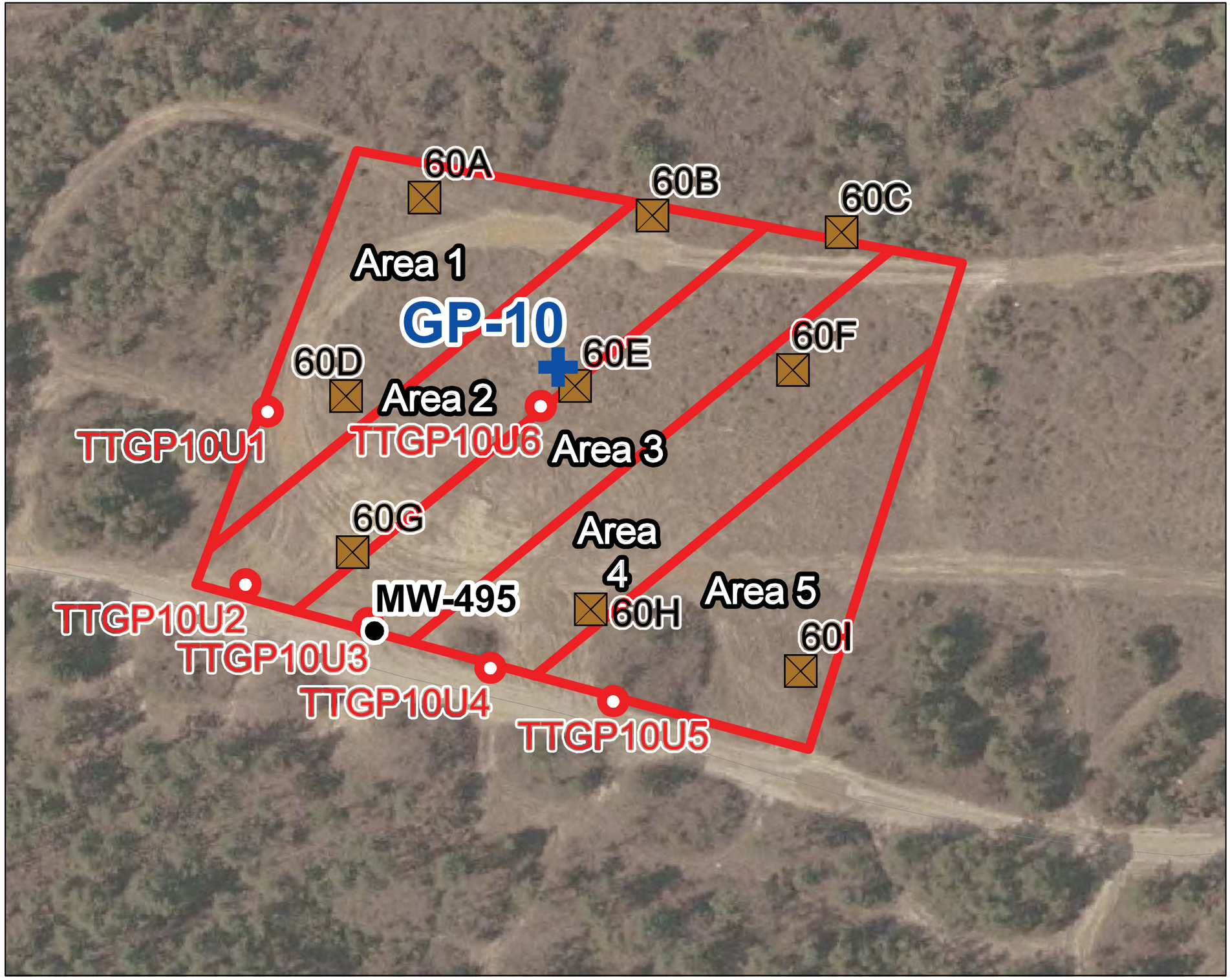
0 400 Feet

DRAFT

ECC MMR
Cape Cod, Massachusetts

ECC GIS Server
C:\TERC_GIS\CTO002\FormerK\MECstudy\
MSA_Fig3_FormerK_InvAreas.mxd
September 2009 DWN BY: JYK CHKD BY: RF

FIGURE
6

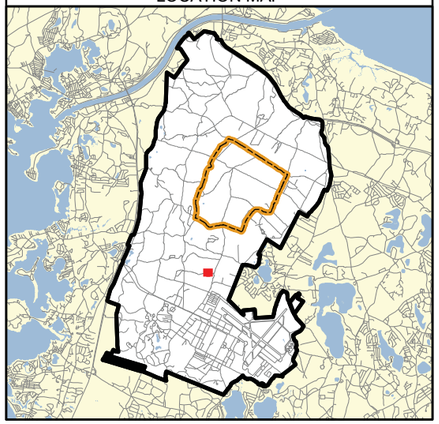


Impact Area Groundwater Study Program

LEGEND

- Drive Point Locations
- Sampling Grids
- Monitoring Wells
- GP-10 Area

LOCATION MAP



NOTES & SOURCES

Basemap data from US Geological Survey
7 1/2 minuteTopographic Map Source: MassGIS.
Aerial photos: 1:5000 black & white digital orthophotos
Resolution: 0.5 feet; Date Flown: 1997; Source: Jacobs Eng.

TITLE

GP-10 Soil Sample Locations

0 100 Feet

N

DRAFT

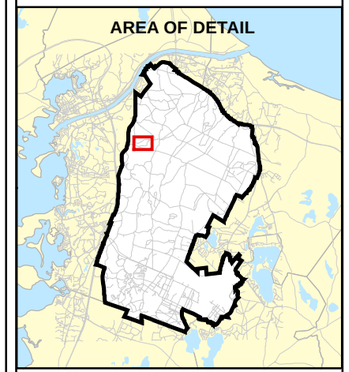
File: P:\GIS\MMR\GunAndMortar\GIS\Spatial\MXD\20110408_DD\201104058_Figure4_GP10_SoilSampleLocs.mxd
Prepared By: tim.dougherty
Coordinate System: NAD 1983 UTM Zone 19N

FIGURE 7

Impact Area Groundwater Study Program

Munitions Summary - 2010 Detailed Reconnaissance

- Suspected HE
- 2010 Detailed Reconnaissance Meandering Path
- Areas Excavated During 2009 Source Removal
- Trench Excavated During Ordnance Penetration Study
- Cleared During 2009 Source Investigation/Removal
- Area Cleared During Berm Extension Investigation
- Road
- Rail Line



Note:
1. Background includes 2001 AIRMAG Anomaly Map - Survey Area 2 imagery. AirMag Anomaly Data Source: Tetra Tech, Inc.
2. Aerial photos: 1:2400 color digital orthophotos Resolution: 0.5 feet; Date Flown: 2002; Source: EarthData International of Maryland, LLC
3. Topography: 10 meter contours generated from digital terrain models (DTMs) Source: MASSGIS

Former A Range Munitions Summary

0 300 Feet

N

File: P:\GIS\MMR\FormerARange\GIS\Spatial\MXD\20120801_FigB-_FormerARange_MunitionsSummary_Updated.mxd
Drawn by: william.scalies
Coordinate System: NAD 1927 StatePlane Massachusetts Mainland FIPS 2001

FIGURE 8

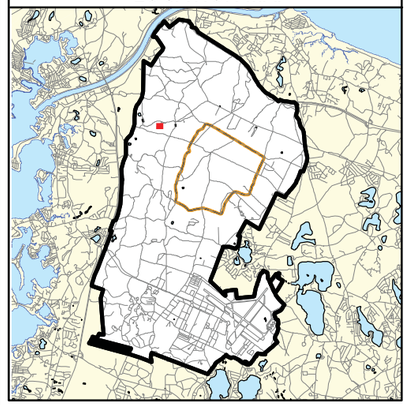
Operator Dugout
Loading Platform
Survey Monuments
Firing Point
Avery Rd
Berm A
Berm B
Berm C
Berm D
Target Area
Rollout Area
Wood Rd

Impact Area Groundwater Study Program

LEGEND

- Monitoring Well
- Excavation Area
- Rail Line

LOCATION MAP



NOTES & SOURCES

Aerial photos: 1:2400 color digital orthophotos
Resolution: 0.5 feet; Date Flown: 2002; Source: EarthData International of Maryland, LLC
Topography: 10 meter contours generated from digital terrain models (DTMs) Source: MASSGIS
Does not include results from Target Area Penetration Study.

TITLE

Former A Range Excavated Areas

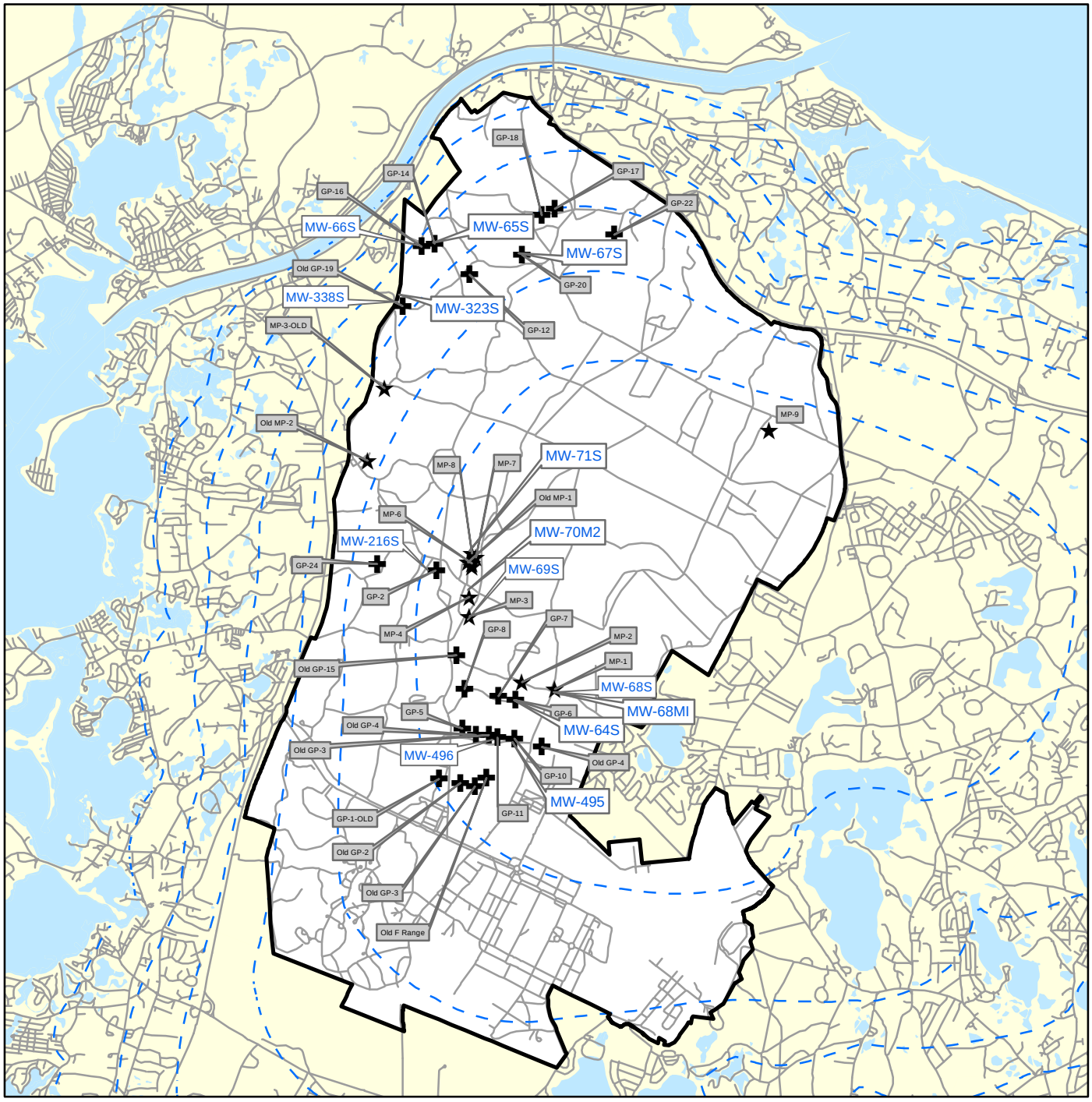
0 80 Feet

N

DRAFT

File: P:\GIS\MMR\FormerARange\GIS\Spatial\MXD\20110408_DD\20110408_Figure5_ExcavatedAreas.mxd
Prepared By: tim.dougherty
Coordinate System: NAD 1983 UTM Zone 19N

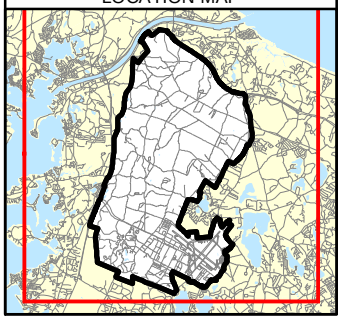
FIGURE 9



LEGEND

- Groundwater Wells
- Gun Position
- Mortar Position
- MMR Boundary
- Groundwater Elevation Contours
- Roads

LOCATION MAP



N

0 8,000 Feet

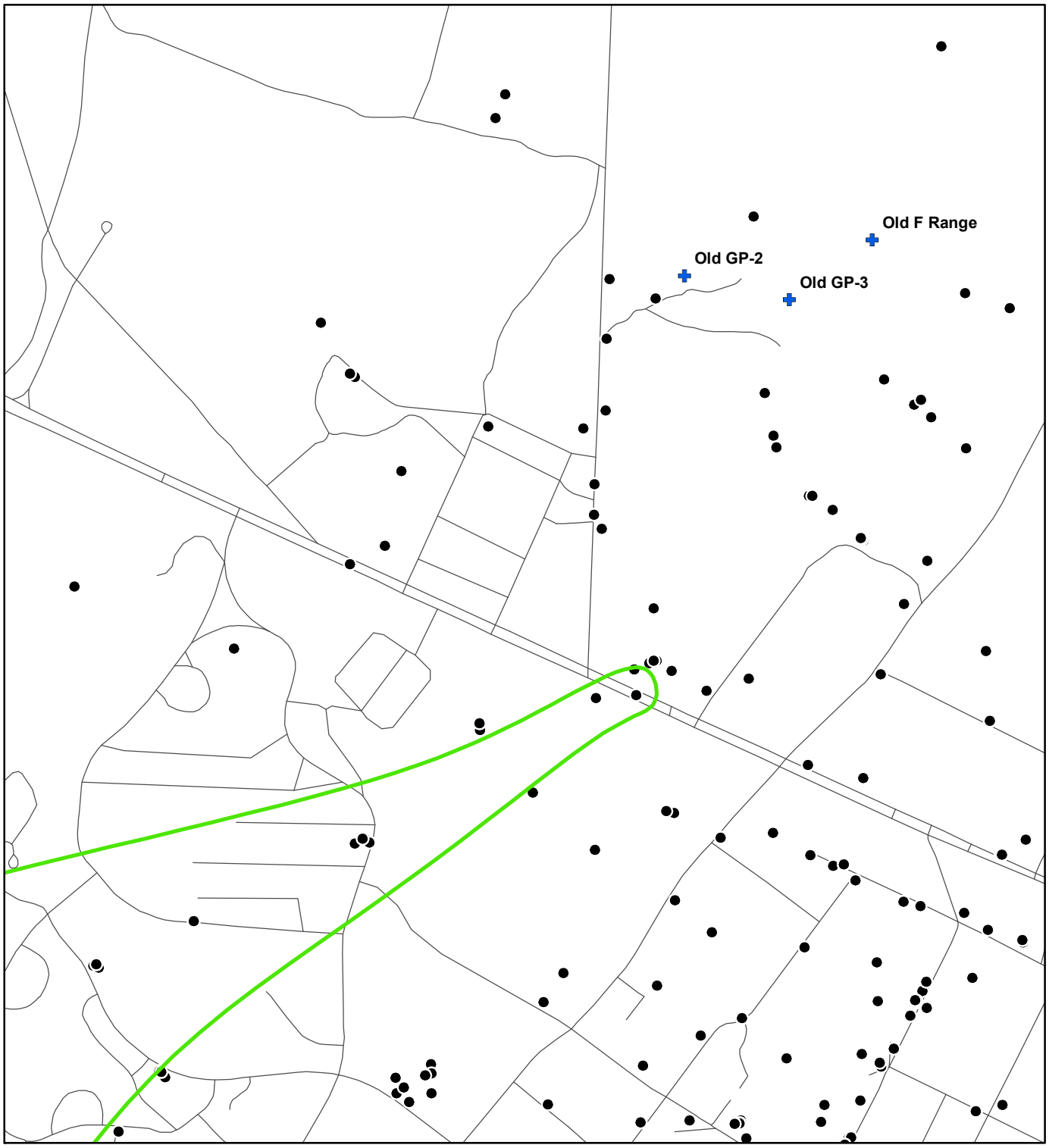
NOTES & SOURCES
Map Projection: NAD 83, UTM, Zone 19N, Meters
Basemap data from US Geological Survey 7 1/2 minute
Topographic Map Source: MassGIS

Location of Monitoring Wells From Which Data Were Used for Gun and Mortar Position Risk Screening

FIGURE 10

File: P:\GIS\MMR\GunAndMortar\GIS\Spatial\MXD\
20110411_DD\20110411_Figure6_ScreeningWellLocs.mxd
Prepared By: tim.dougherty
Coordinate System: NAD 1983 UTM Zone 19N

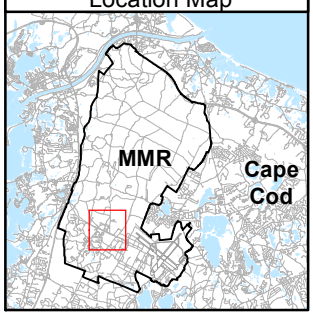
Impact Area
Groundwater Study Program



Legend

- Monitoring Well
- Gun & Mortar Firing Positions
- LF1 Boundary
- MMR Boundary

Location Map



0 500 1,000 Feet

N

US Army Corps of Engineers
New England District

Location of Old GP-2 in Northwest Operable Unit of Landfill-1
Camp Edwards Superfund Site

FIGURE 11

M:\MMR\2012\DecisionDocuments\Figures\Fig11_100112.pdf
M:\MMR\2012\DecisionDocuments\MXDs\Fig11_092712.mxd
October 1, 2012 DWN: MTW CHKD: PJR

Impact Area Groundwater Study Program

APPENDIX A
MASSDEP LETTER FOR 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

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

September 28, 2012

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

RE: **BOURNE**
Release Tracking Number: 4-15031
Massachusetts Military Reservation (MMR)
Decision Document Former A Range, Former K Range, and Gun and Mortar Positions, Concurrence

Dear Mr. Owens:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the document entitled **"Decision Document Former A Range, Former K Range, and Gun and Mortar Positions"** (Decision Document), dated September, 2012. The Decision Document presents the selected remedy for the Former A Range, Former K Range, and Gun and Mortar Positions Operable Units located on Camp Edwards at the Massachusetts Military Reservation (MMR). 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 USEPA decision for Former K Range and Gun and Mortar Positions Operable Units is that no further action is necessary with regard to the source areas and groundwater. The decision for the Former A Range is that no further action for the source area and limited action with regard to groundwater, which includes long term groundwater monitoring and Land Use Controls (LUCs). Investigation findings for the Former A Range indicate that there is a potential for military munitions remaining at the site to provide a future contamination source for groundwater. The LUCs implemented by the Army/NGB will serve to control access to the Former A Range area to protect groundwater monitoring wells.

The Former A Range is an inactive anti-tank artillery and rocket practice range. The investigation findings indicate that explosives compounds found in soils at the range are primarily 2-amino-4,6-dinitrotoluene (2A-DNT), 4-amino-2,6-dinitrotoluene (4A-DNT), and 2,4,6-trinitrotoluene (TNT). Average concentrations of explosives are below MCP Method 1 S-1/GW-1 standards. Four monitoring wells have

been installed in the vicinity of the Former A target area. Explosives compounds were detected in groundwater well below health advisories, MCP groundwater standards and risk-based concentrations. Perchlorate was detected in groundwater well below the Massachusetts Maximum Contaminant Level. Monitoring of groundwater will be conducted for explosives and perchlorate once in 2014 and again in 2016. The results will be presented in monitoring reports to be submitted after each sampling event. The data will be assessed as part of five-year review to be conducted in 2017 and the need for additional monitoring will be determined at that time. Based on the removal actions and results of the risk screening of soil samples, USEPA has determined that no further action is necessary for the source area for the Former A Range. However, due to the potential for military munitions remaining at the site to provide a future contamination source for groundwater, USEPA has determined that limited action with long-term groundwater monitoring, land use controls to protect monitoring wells, and five year reviews are appropriate for the Former A Range. It is unlikely a significant number of munitions remain undetected at the Former A Range. Remaining munitions are likely to be single, randomly scattered items which may present a safety risk but are unlikely to represent a threat to groundwater.

The Former K Range is an inactive rocket range, constructed in 1960 on the western side of Greenway Road and south of Wood Road. Explosives compounds RDX, 2A-DNT and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) were found in soil samples at the Former K Range. Average concentrations of perchlorate and explosives detected in soil samples are below the MCP Method 1 S-1/GW-1 standards. Perchlorate detected in groundwater at the Former K Range has decreased in concentration to below the Massachusetts Maximum Contaminant Level. No perchlorate has been detected in groundwater at the Former K Range since 2005. Contaminants and munitions have been removed from the source area at the Former K Range. Residual munitions at the Former K Range may present a safety risk but will not represent a significant threat to groundwater. Based on the removal actions and results of the risk screening of soil samples, USEPA has determined that no further action is necessary for the source area and groundwater for the Former K Range.

There are 24 former artillery gun positions and 13 former mortar positions located south, west, and northwest of the Central Impact Area comprising the Gun and Mortar Operable Unit. The principal contaminant present in the surface soils at Gun and Mortar Positions is the propellant 2,4-DNT. Average concentrations of 2,4-dinitrotoluene (2,4-DNT) and perchlorate at each Gun and Mortar Position are below the applicable MCP Method 1 standards. No propellant-related compounds have been found in the groundwater at Gun and Mortar Positions. Contaminants and munitions have been removed from the source areas at the Gun and Mortar Positions. Residual munitions may present a safety risk but will not represent a significant threat to groundwater. Based on the removal actions and results of the risk screening of soil samples, USEPA has determined that no further action is necessary for the source areas and groundwater at the Gun and Mortar Positions.

There are military munitions currently remaining in areas of the Former A Range, Former K Range, and Gun and Mortar Position Operable Units that were not completely removed. These munitions may pose a current and potential future risk of injury resulting from an explosion and a release or threat of release to the environment due to corrosion of the munitions. Therefore, it is necessary to put into place clearly defined LUCs at the Former A Range, Former K Range, and Gun and Mortar Position Operable Units until such time that they are no longer needed to mitigate the risk posed by the munitions. MassDEP will continue to work with the Massachusetts Army National Guard, the Environmental Management Commission and the Department of Fish and Game to establish and implement LUCs at the Former A Range, Former K Range, and Gun and Mortar Position Operable Units.

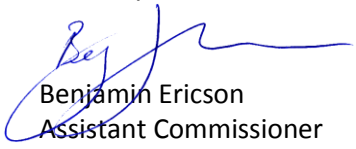
Determination

MassDEP concurs with the remedy proposed in the Decision Document for the Former A Range, Former K Range, and Gun and Mortar Position Operable Units which consists of no further action for the source area and groundwater at the Former K Range and Gun and Mortar Positions. The decision is no further action for the source area and limited action with long term groundwater monitoring and Land Use Controls (LUCs) for the Former A Range. The selected remedy will ensure a sufficient and protective level of control for the Former A Range, Former K Range, and Gun and Mortar Position Operable Units such that none of the contamination associated with the Former A Range groundwater will present a significant risk of harm to health, safety, public welfare or the environment during any foreseeable period of time. Moreover, the groundwater remedy has been designed to reduce the level of contaminants to background levels, consistent with MCP requirements. There may be additional areas associated with military munitions on the Former A Range, Former K Range, and Gun and Mortar Position Operable Units which pose public safety risks, ecological risks, dermal contact risks, and/or soil ingestion risks. These potential risks are not addressed by this Decision Document, which was issued by USEPA pursuant to Administrative Order No. SDWA-1-2000-0014 and Section 1431(a) of the SDWA, and which focuses on potential endangerment to the health of persons deriving from contaminants present in or likely to enter the underground source of drinking water. USEPA is making no determination in this Decision Document regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the Site.

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

Please incorporate this letter into the Administrative Record for the Former A Range, Former K Range, and Gun and Mortar Position Operable Units. If you have any questions regarding this matter, please contact Leonard J. Pinaud, Chief, State & Federal Sites Management at (508) 946-2871 or Millie Garcia-Serrano, Deputy Regional Director of the Bureau of Waste Site Cleanup at (508) 946-2727.

Sincerely,



Benjamin Ericson
Assistant Commissioner
Bureau of Waste Site Cleanup

BE/lp/

File : 4-0015031 Former A, K, G&M DD Letter 09-2012

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

APPENDIX B
GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS

2A-DNT	2-amino-4,6-dinitrotoluene
2,4-DNT	2,4-dinitrotoluene
4A-DNT	4-amino-2,6-dinitrotoluene
TNT	2,4,6-trinitrotoluene
AIRMAG	airborne magnetometer
AO1	Administrative Order Number 1
bgs	below ground surface
COC	Contaminants of Concern
DDT	**d**ichloro**d**iphenyl**t**richloroethane
DNT	dinitrotoluene
GP	gun position
HA	Health Advisory
HC	smoke mixture, zinc oxide (46.5%), hexachoroethane (44.5%), and aluminum powder (9%)
HE	high explosive
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAGWSP	Impact Area Groundwater Study Program
IART	Impact Area Review Team
J	estimated result
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MCPA	2-methyl-4-chlorophenoxyacetic acid
MCPP	methylchlorophenoxypropionic acid
mg	milligram
mg/Kg	milligrams per kilogram
mm	millimeter
MMR	Massachusetts Military Reservation
MP	mortar position
MIS	multi-increment sampling
NG	nitroglycerine
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PRG	Preliminary Remediation Goals
RDX	hexahydro-1, 3, 5-trinitro-1, 3, 5-triazine
SVOC	semi-volatile organic compound
VOC	volatile organic compound
SDWA	Safe Drinking Water Act
SMB	Senior Management Board
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
VOC	volatile organic compounds

APPENDIX C
INDEX OF KEY SUPPORTING DOCUMENTS

Document Name	Creation Date
Former A Range, Former K Range and Gun and Mortar Positions Decision Document Fact Sheet	Jun-12
Gun and Mortar Positions	
Field Sampling Plan for Gun and Mortar Positions of the Camp Edwards Impact Area Groundwater Quality Study	Feb-98
Final Phase II(a) Field Sampling Plan for Mortar Targets	Dec-99
PHASE I INTIAL SITE INVESTIGATION REPORT AREA 17 ,GUN POSITION 7 (GP-7) RTN 4-15032	Sep-00
Gun and Mortar Firing Positions Draft Technical Memorandum TM-01-14	Oct-01
Final Field Sampling Plan for Gun & Mortar Positions	Feb-12
Final Phase II(a) Field Sample Plan for Gun and Mortar Positions	Feb-02
Final Gun and Mortar Firing Positions Additional Characterization Workplan	Apr-02
Final Completion of Work Report, RRA (Round 2) - AO3	May-02
Final Gun and Mortar Positions Work Plan	Oct-03
Letter Report: Gun Position 6 (GP-6) Soil Removal and Thermal Treatment	Jul-05
Final Gun Position 6 Soil Removal and Thermal Treatment Letter Report	Dec-05
Final Investigation Work Plan for the Gun and Mortar Firing Positions	Apr-09
EDD Pilot Study Post-Survey Phase II Investigation Results	Jun-09
Draft Final Report, Sorption/Desorption Measurements of Nitroglycerin and Dinitrotoluene in Camp Edwards, Massachusetts Soil	Jul-09
Gun and Motar Postions Soil Removal Action	Jun-10
Final Gun and Mortar Position Investigation Report	Oct-11
Former A Range	
Final Technical Team Memorandum 02-1, Former A, Former K and Demolition Area 2 Report	Jun-00
Final IAGS Phase II(b) Workplan ;Draft Phase II (b)Field Sampling Plan for Inactive Demolition Sites ;Draft Phase II (b) Field Sampling Plan for Gravity Anti-Tank Range (Former A Range)	Jul-00
Final Phase II (b) Field Sampling Plan for Gravity Anti-Tank Range (Former A Range)	Oct-00
Final IAGWSP Technical Team Memorandum 02-1 Former A, Former K, and Demo Area 2 Report	Jul-02
Final Former A Range Geophysical Survey and Investigation Report	Aug-02
Final Former A Range Additional Delineation Work Plan	Sep-04
Former A Range Groundwater Investigation and Monitoring Well Installation	Oct-09
Former A Range Soil Sampling-Characterization of Stockpiled Soil	Mar-10
Final Former A Range – Proposed Munitions and Explosives of Concern (MEC) Site Reconnaissance and Geophysical Surveys Project Note	Jul-10
Former A Range - Additional Screening and Disposition of Excavated Soil	Oct-10
Change to Former A Range Groundwater Monitoring Well Network Project Note	Oct-11
Final Former A Range Investigation Report	Apr-12
Former K Range	
Final Phase IIb Field Sampling Plan for Former K Range	Nov-00
Final Former K Range Geophysics Investigation Report	Nov-01
Memorandum of Resolution for MSP Phase II Letter Reports - ASP Geophysics - Demolition Area 1 - Former A Range - Former K Range	Feb-02
Final IAGWSP Technical Team Memorandum 02-1 Former A, Former K, and Demo Area 2 Report	Jul-02
Final Former K Range Geophysical Survey and Investigation Report	Aug-02
Final Former K Range Supplemental Work Plan	Sep-03
Final Former K Range Additional Delineation Work Plan	Jul-04
Final Former K Range Additional Characterization Activities	Jul-09
Final Former K Range Additional Characterization Activities Project Note	Jul-09
On-Site Transport and Alkaline Hydrolysis Treatment Activities for J-1, J-2 and Former K Ranges Soils - Project Note	May-10
Final Former K Range Investigation Report	Jan-11
Final J-1, J-2 and Former K Ranges Batch #2 Soil Treatment Report	Feb-12