Environmental Restoration Program
Final Record of Decision for Site 15

174th Fighter Wing
New York Air National Guard
Hancock Air National Guard Base
Syracuse, New York

April 2011

NGB/A7OR
Andrews AFB, Maryland

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Prepared For:

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Project Number: HAAW20077054

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

Acronym	Definition
µg/L	Micrograms per liter
AFB	Air Force Base
ANG	Air National Guard
ARAR	Applicable or Relevant and Appropriate Requirement
BEX	Benzene, ethylbenzene and xylenes
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	Chemicals of concern
EPA	United States Environmental Protection Agency
ERP	Environmental Restoration Program
FFS	Focused Feasibility Study
ft	Feet/Foot
FW	Fighter Wing
IRA	Interim Remedial Action
JP	Jet Propulsion
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substances Contingency Plan
ND	Non-detect
NGB	National Guard Bureau
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCBs	Poly-chlorinated bi-phenols
POL	Petroleum, Oil and Lubricants
PP	Proposed Plan
PT	Pilot Test
RA	Remedial Action
RAOs	Remedial action objectives
RBC	Risk Based Concentration
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCG	Standards, Criteria and Guidance
SCO	Soil Cleanup Objective
TMV	Toxicity, mobility or volume
UIC	Underground Injection Control
VOCs	Volatile organic compounds

SECTION 1.0

DECLARATION

1.1 Site Name and Location

This Record of Decision (ROD) applies to Environmental Restoration Program (ERP) Site 15, which is identified as having groundwater contamination. The site is located within the New York Air National Guard (ANG) 174th Fighter Wing (FW) at Hancock ANG Base. The Site is listed as a Class 2 site on the New York State Inactive Hazardous Waste Disposal Site Registry in 1994 as Site Number 734054. A site location map is provided as Figure 1-1.

1.2 Statement of Basis and Purpose

This ROD presents the selected remedial actions for ERP Site 15 located at the 174th FW of the New York ANG, in Syracuse, New York. Figure 1-2 provides a map depicting the location of ERP Site 15 on the Base and the affected adjacent off-site properties. The remedial action (RA) was chosen by the ANG, which is the lead agency responsible for implementing the ERP, and was concurred with by the New York State Department of Environmental Conservation (NYSDEC) which provides regulatory oversight of activities at this Site. The RA selected for this Site is in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This decision is based on the Administrative Record for Site 15. The NYSDEC concurs with the RA presented in this ROD.

1.3 Assessment of the Site

The RA selected in this ROD is necessary to protect public health or welfare, or the environment, from actual or potential releases from of pollutants or contaminants into the environment.

ERP Site 15 is located in the southwestern portion of the Base and north of East Molloy Road as shown on Figure 1-1. Site 15 was formerly used as a pump house for the Petroleum, Oil and Lubricants (POL) area. It is approximately 2.5 acres in area, and originally consisted of brush and wooded vegetation, a large concrete pad, and a bermed area where a 215,000-gallon aboveground tank was formerly located. Site 15 has sustained spills of mainly jet propulsion (JP)-4 and JP-8 military aviation fuels and poly-chlorinated bi-phenols (PCBs).

1.4 Description of the Selected Remedy

The following subsections present the selected remedial action for ERP Site 15 as described in the *Final Focused Feasibility Study* (FFS) (ERM 2010b) and the *Final Proposed Plan* (PP) (ERM 2010c).

Excavation, transportation, and disposal of petroleum-affected soil were completed in August 2008. Petroleum-affected soils were transported to the Ontario County Landfill for use as daily cover at their Stanley, New York facility. A total of 84 truck loads of petroleum-affected soil (approximately 2,890-tons) were removed from the site. Approximately 4,800 pounds of the chemical equivalent of PermeOx® Plus, an oxygen releasing material, were applied within the bottom of the excavation areas prior to backfilling.

Successful field scale testing of a BEX cleanup technology was conducted in April 2009, consisting of an aerobic bioremediation Pilot Test (PT) via injection of calcium peroxide in 20 locations. The injection of the calcium peroxide provided an additional energy source (i.e., food) for the natural microorganisms so that their populations can grow and metabolize the BEX compounds in groundwater. The results of this pilot study are the basis for selecting Alternative 3: Source Removal (already completed in August 2008) and Focused Enhanced Aerobic Bioremediation as the RA for Site 15 groundwater.

A monitored natural attenuation (MNA) program will be implemented as a polishing step until the remedial action objectives (RAOs) are met.

1.5 Statutory Determinations

The selected remedy satisfies the statutory requirements of CERCLA and the NCP. The selected RA is protective of human health and the environment; it complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy also satisfies the statutory preference for remediation technologies that reduce toxicity, mobility and/or volume of site contaminants (United States Environmental Protection Agency [EPA] 1988).

This RA will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. However, it may take approximately 4 to 5 years to achieve the RAOs and cleanup levels at Site 15. Five-Year Reviews will be conducted until concentrations of hazardous substances, pollutants, or contaminants remaining on-site are reduced to levels that allow for unlimited use and unrestricted exposure.

1.6 Record of Decision Data Certification Checklist

The following information is included in the Decision Summary section of this ROD:

- A summary of the chemicals of concern (COCs) and their respective concentrations;
- Cleanup levels established for COCs and the basis for these levels;
- Current and reasonably anticipated future land use assumptions used in the development of the ROD;
- Potential land use that will be available at the Site as a result of the selected remedy;
- Community Participation in the ROD Process;
- The number of years over which the remedy is projected; and
- A summary of the key factors that led to selecting the remedy.

1.7 Authorizing Signatures

FOR AIR NATIONAL GUARD:

Signature

9/27/11
Date

Benjamin W. Lawless, P.E.
Chief, Operations Division
Installations and Mission Support Directorate

FOR STATE OF NEW YORK:*

Signature

Date

Dale A. Desnoyers, Director
Division of Environmental Remediation

* See NYSDEC Concurrence Letter dated 31 March 2011 on the following page.

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Joe Martens
Commissioner

March 31, 2011

Brent R. Lynch, TSgt
Department of the Air Force
Headquarters 174th Fighter Wing (ANG)
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Syracuse, NY 13211-7099

RE: Draft Final Record of Decision– January 2011
Site 15, Hancock Air National Guard Base
DEC Site No. 734054

Dear Sergeant Lynch:

The New York State Department of Environmental Conservation (Department) and the New York State Department of Health (NYSDOH) have reviewed the Draft Final Record of Decision (ROD) dated January 2011 for Site 15 at the Hancock Field Air National Guard Base in Syracuse, NY.

Based upon the considerable past remedial activities at the site including extensive excavation and removal of contaminated soil, enhanced natural attenuation of contamination via chemical oxidation, and historical groundwater data indicating a steady decline in concentrations of the contaminants of concern, both the Department and NYSDOH concur with the selected remedy, alternative #3.

Alternative #3, which includes additional enhanced aerobic bioremediation via injection of calcium peroxide, monitored natural attenuation and groundwater use restrictions until such time as groundwater standards are achieved, will achieve our mutual remedial action objectives.

The Department concurs with the selected remedy as stated in the ROD.

Sincerely,

Dale A. Desnoyers

Dale A. Desnoyers, Director
Division of Environmental Remediation

ec: R. Corcoran
J. Swartwout
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K. Anders - DOH
J. Murata – ANG
D. Myers - ERM

SECTION 2.0

DECISION SUMMARY

The Decision Summary describes the factors and analyses that led to the selection of the soil and groundwater remedies for ERP Site 15. It includes site background, community involvement efforts, site characteristics, the nature and extent of contamination, current and future site use, the assessment of human health and environmental risks posed by the contaminants, RAOs, and the identification and evaluation of remedial action alternatives.

2.1 Site Name, Location, and Description

Site 15 is located at the 174th FW, which is based at Hancock Field, an active international airport and a former Air Force Base (AFB) located two miles north-northeast of the City of Syracuse in Onondaga County in central New York (Figure 1-1). The ANG facility is currently operating within the southern portion of the former Hancock AFB located south of the municipal airport.

The 174th FW is in the northwest portion of the United States Geologic Survey Syracuse East quadrangle. Topographically, the 174th FW is generally flat terrain that is gently sloping to the southeast. Surface elevations generally range from 395 to 415 feet (ft) above mean sea level.

Cleanup of the materials causing the contamination has taken place over the last decade in order to prevent further environmental impacts. The current focus is to cleanup COC impacted groundwater at Site 15. This Site is the subject of this ROD.

2.2 Site History and Enforcement Activities

There have been no CERCLA enforcement actions related to ERP Site 15. The following subsections summarize previous investigations and remedial actions conducted at the 174th FW.

2.2.1 Remedial Investigation

The Site 15 *Final Technical Memorandum – Supplemental Remedial Investigation(RI)/Pilot Test Report* (ERM 2010a) summarized all previous site investigations and indicated that benzene, ethylbenzene, and total xylenes (BEX) were detected in groundwater samples at this site. Groundwater monitoring identified the BEX compounds exceeding NYSDEC Class GA ambient groundwater quality standards. The results of the environmental investigations conducted at Site 15 and the off-site locations indicated the following:

- Groundwater flows in a south to southeasterly direction as shown on Figure 2-1;
- Depth to groundwater is approximately 2.0 to 10.5-feet below ground surface; and
- The COCs in groundwater are BEX as shown in Table 2-1 and as presented on Figure 2-1.

These results suggest that a cleanup, technically referred to as a RA, is necessary to address BEX-impacted groundwater at Site 15.

2.2.2 Interim Remedial Actions

A removal action was completed at Site 15 by the ANG in accordance with an approved Work Plan for the *Time Critical Removal Action at Site 15 at Hancock Field* (Parsons, October 2001). The objective of the removal action was to reduce the risk to potential receptors by excavation and removal of the PCB-impacted soil from Site 15. Supplemental objectives included removing the closed underground tanks and soil directly adjacent to the tanks, conducting additional investigation of groundwater conditions at and down-gradient of Site 15, and providing selected monitoring well rehabilitation and abandonment.

Field work consisted of excavation and offsite disposal of 2,880 tons of PCB-impacted soil and 5,360 tons of petroleum affected soil, removal and offsite disposal of steel tanks and associated piping, monitoring well rehabilitation, abandonment of one monitoring well within the excavation area, and additional groundwater investigation work. A report is available that documents the methods and findings of the removal action (Parsons, 2003).

In August 2008, an Interim Remedial Action (IRA) was performed to remove the majority of the "grossly contaminated" petroleum-affected soil in the source area at Site 15 overlying groundwater. Petroleum-affected soils were transported to the Ontario County Landfill for use as a non-hazardous daily cover at their Stanley, New York facility. A total of 84 truck loads of petroleum-affected soil (approximately 2,890-tons) were removed from the site. Approximately 4,800 pounds of the chemical equivalent of PermeOx® Plus, an oxygen releasing material, were applied within the bottom of the excavation areas.

The excavation limits, which were documented in *Site 15 Final Construction Completion Report - Source Area Soil Removal (*ERM 2009*),* are presented in Figure 2-2 (Areas A, B, and C located within ERP Site 15). Removal of the petroleum affected source area soils will aid the effectiveness of planned future groundwater remediation and will reduce the potential threats to human health and the environment.

2.2.3 Enhanced Bioremediation Pilot Test

An enhanced bioremediation pilot test was conducted per the *Site 15 Supplemental RI/PT Work Plan* (ERM 2008). The PT was performed southeast of the Ram-Tech Engineering facility, west of along Fairway Drive, and north and south of Molloy Road as shown on Figure 2-2 to evaluate the effectiveness of enhanced natural attenuation within the BEX-plume.

The objectives of the PT were to decrease the concentrations of BEX in groundwater, and to prevent further migration of the BEX plume onto off-site property. Calcium peroxide (CaO_2) slurry was injected into the saturated zone within the BEX plume during the PT. The introduction of CaO_2 provides a controlled release of oxygen which permeates throughout the subsurface, enhances microbial activity, and biodegrades BEX compounds.

The overall conclusions were that the injection of CaO_2 slurry enhanced natural attenuation within the plume, that the loading of CaO_2 slurry was sufficient in the down gradient portion of plume, but that the loading of CaO_2 slurry was insufficient near Molloy Road to significantly decrease the mass flux closer to the former source area.

2.3 Community Participation

Additional information regarding ERP Site 15 can be found in the Information Repository file for this Site, available at the 174th FW and the Salina Free (Public) Library. The complete Administrative Record can be viewed at the 174th FW Environmental Office.

A PP was prepared to summarize Site conditions and types of contaminants, current and future risks to human health and the environment, preferred alternatives for cleaning up environmental impacts to soil and groundwater at ERP Site 15 (ERM 2010c). The PP was made available to the community at the Salina Free (Public) Library in accordance with the public participation requirements of CERCLA, as amended by the SARA, section 117(a). A public meeting was held at the Salina Free Library on 9 September 2010 at 6:00 p.m. to discuss cleanup alternatives and to address questions and concerns the public may have about these RAs. The only attendees at this meeting were several members of the 174th FW, two representatives of the NYSDEC, one representative of the New York State Department of Health (NYSDOH), the ANG Program Manager and their technical representative and two representatives from ANG's technical consultant. No representatives from the public attended this meeting.

The public was allowed to submit comments on the preferred and other alternatives during a 30-day public comment period. No comments were received with a postmark prior to or with the date specified in the public notice; therefore, review per CERCLA requirements was not required.

2.4 Scope and Role of the Remedial Actions

The primary objective of the RAs at Site 15 is to reduce potential risks to human health and the environment from COC impacted soil and groundwater. Cleanup of the impacted soil has already been accomplished by the performance of the soil removal IRA in August 2008 as previously discussed. Cleanup of the groundwater will reduce COC concentrations to below the applicable or relevant and appropriate requirements (ARARs), thereby reducing potential future risk to human health and the environment. Because the Site exhibits exceedances of the chemical specific ARARs for groundwater, the ANG has determined that a RA at ERP Site 15 is necessary. The selected remedy therefore consists of actions that will mitigate the potential risks to human health that result

from COCs that exceed the chemical-specific ARARs. Detailed descriptions of the selected RAs are provided in Section 2.10 of this ROD.

The scope of the selected RA includes the following:

- Application of CaO_2 to reduce and/or eliminate the COCs in groundwater; and
- Implementation of MNA as a final polishing step, as necessary.

2.5 Site Characteristics

Physical site characteristics of ERP Site 15 are described below.

2.5.1 Surface Water Hydrology

One permanent pond, and a local stream, or other water bodies are present at the 174th FW. The nearest body of surface water is an unnamed pond just west of the ERP Site on the Hancock ANG Facility. Ley Creek is located approximately ¼ mile west of the 174th FW, and Ley Creek is a tributary to Onondaga Lake located approximately 2½ mile southeast of the 174th FW. Surface elevations generally range from 395 to 415-ft above mean sea level and anticipated surface water flow will be to the southeast.

2.5.2 Geology

The surficial geology at Site 15 consists of glaciofluvial sediments deposited by glacial meltwater underlying by poorly sorted till deposited directly by glaciers. The glaciofluvial sediments include clayey silts, sands, and gravels, with thickness ranging from 45 to 55 ft. The underlying till consists of gravel, cobbles, and boulders entrained in a clayey silt matrix and ranges in thickness from 30 to 100 ft (Lockheed 1997).

Bedrock is encountered at depths ranging from 75 to 109 ft below ground surface (bgs), and is part of the Upper Silurian Vernon Formation. This formation consists of thinly bedded soft red shale with thin beds of green shale, gypsum, halite, and dolomite. Competence varies from soft and crumbly to dense and hard. The degree of competence appears to be proportional to the density of the fractures in the shale. The shale is characterized by enlarged fractures, joints, and bedding planes (Lockheed 1997).

2.5.3 Hydrogeology

The overburden at Site 15 consists of fine-grained sediments. The subgrade soils are fairly uniform, with the upper 10 to 15 ft of the soil characterized by relatively soft, dark yellowish-brown silt and clayey silt. Towards the southeast the interval thins to approximately 5 ft. Beneath the clayey silt are fine to medium-grained sands, yellowish brown to dark brown with silt, and trace amounts of clay down to a depth of approximately 20 ft. Underlying these silty sands is a lens of stiff clayey silts (often called glacial till). Till was encountered at as much as 15 ft thick (Lockheed 1997).

Groundwater was generally encountered at depths of 2 to 10-ft below ground surface and as previously discussed generally flows in a south to southeasterly direction towards Ley Creek and eventually into Onondaga Lake.

2.5.4 Nearby Wells

A water well survey was performed during the preparation of the RI. The survey indicated that no water supply wells were located within ½ mile of the 174th FW.

2.5.5 Ecology

The areas encompassed by Site 15 are primarily covered by grasses, trees, bushes, buildings and asphalt or concrete pavement, with no significant natural wildlife other birds, and small mammals.

2.5.6 Surface Features

Surface features at Site 15 mainly consist of landscaped areas, buildings and paved areas. In general, the base is nearly flat with little change in topography.

2.6 Current and Potential Future Site Uses

The 174th FW is based at Hancock Field, which is an active international airport and a former AFB located 2 miles north-northeast of the City of Syracuse in Onondaga County in central New York. The ANG facility is

currently operating within the southern portion of the former Hancock AFB.

The surrounding land use is currently a mixture of recreational, industrial, commercial, and some residential properties within one-quarter mile down-gradient (south) of the site. The 174th FW is bordered by the airport to the north, the Town of Dewitt to the east and south, and the Town of Salina to the west. Lands to the west, north, and east of Site 15 are used for military and transportation purposes that have been ongoing for decades. Land directly to the south of Site 15 across Molloy Road is used as a golf course. Overall land use in the site vicinity has not changed significantly in the last 30 to 40 years and is not expected to change significantly in the foreseeable future.

2.7 Summary of Site Risks

As part of the FFS, the potential risk to people who would be living or working at or near the impacted site was evaluated. Additional information on the risk to human health and the environment is presented in the FFS report (ERM 2010b).

The NYSDEC Remedial goals are derived in Title 6, New York Code of Rules and Regulations [6NYCRR] Part 375. Media that are candidates for remedial evaluation are identified based on the nature and extent of contamination and ARARs, standards, criteria, and guidance (SCGs). As identified in 6 NYCRR 375-1.10(c)(1)(ii), SCGs are provided in NYSDEC guidance. Class GA standards are found in *NYSDEC Division of Water Technical and Operational Guidance Series Memorandum Number 1.1.1* (TOGS 1.1.1; NYSDEC 1998). The most recent NYSDEC guidance containing SCGs is DER-10 (NYSDEC 2010).

Migration pathways define the routes and transport mechanisms by which chemicals move from a source area to a location where people could potentially be exposed. The soil associated with Site 15 is silty, which results in slow groundwater flow that limits contaminant migration across the base. The Site is currently an active commercial and industrial Site that is fully fenced to restrict access to trespassers, and none of the COCs identified for soil exceeded protection of public health Soil Cleanup Objectives (SCOs) for restricted commercial use, which accounts for several direct contact scenarios for both visitors and Site workers (the potential receptors of concern). In addition, to evaluate potential risks to Site workers and visitors, maximum detected concentrations of the COCs

in Site soil were also compared to criteria appropriate for commercial/industrial exposures. Region III of EPA has established acceptable levels of chemicals in soil based on direct contact with soil by commercial/industrial workers in occupational settings Risk Based Concentration (RBCs) (EPA 2007). None of the COCs identified for soil exceeded the direct contact RBCs for commercial/industrial use.

Therefore, under current conditions, direct contact with soil COCs (benzene, ethylbenzene, and xylenes) present at a limited number of subsurface locations does not represent a significant human exposure pathway for Site workers and visitors as maximum detected concentrations for these compounds did not exceed the applicable direct contact criteria for the current use. In addition, cleanup of petroleum affected soil, consisting of removal of thousands of cubic yards of material, has already been performed at Site 15.

The focus of the risk evaluation was exposure to groundwater by ingestion (i.e., by drinking COC-impacted well water). Exposure by inhalation and skin contact are not considered to be realistic exposure scenarios for groundwater at Site 15. Site worker exposure to impacted groundwater through ingestion is unlikely due to the absence of groundwater supply wells and the availability of municipal water at the site. Exposure to groundwater for people living or working off the Base is also unlikely because of the availability of municipal water.

The basis for implementing the groundwater RA at this site is to reduce COC concentrations in groundwater to below the ARARs. The extent of COC concentrations in groundwater that need to be reduced are presented by the plume outline on Figure 2-1.

Previous investigation results indicate that the primary transport mechanism for dissolved BEX in groundwater at Site 15 is advection (i.e., bulk groundwater flow). Water level data indicate that groundwater flow at the site is towards the southeast. Advective transport of BEX compounds in groundwater is impeded ("retarded") by the compound's adsorption to organic material in soil, its tendency to volatilize, and by natural degradation processes.

Benzene, ethylbenzene, and xylenes naturally attenuate in the environment through multiple mechanisms including advection, dispersion, adsorption, volatilization and degradation. The physical mechanisms of advection, dispersion and adsorption result in the attenuation of concentration in groundwater with distance, but do not remove mass. Volatilization removes mass from the soil and groundwater

into the atmosphere where photodegradation can occur. The major mass removal processes for BEX and other hydrocarbons are aerobic and anaerobic biodegradation. The major biological degradation processes occurring within the dissolved plume are anaerobic processes – sulfate reduction and iron reduction. Aerobic degradation is also occurring, as evidenced by the depletion of oxygen within the plume; however, this process is limited by the availability of oxygen. Groundwater testing at these sites indicates that contaminants have migrated south of the Base boundary; however, the potential for residential exposure is very low as only commercial properties have been affected.

The silty soil also reduces the opportunity for vapors originating from the groundwater to penetrate upward and into buildings. The areas encompassed by Site 15 are primarily covered by natural vegetation, structures and asphalt or concrete pavement, with no significant wildlife other than birds, and small mammals. Therefore, the impacts are not anticipated to have an effect on the ecology.

As discussed in Section 2.5.4, a survey for the presence of water supply wells was conducted during the RI. There were no confirmed water supply wells within a ½ mile radius of the Site. Therefore, no supply wells are known to be threatened by the environmental impacts.

2.8 Chemicals of Concern and Cleanup Criteria

As presented in Section 2.2.1, the latest round of groundwater analysis indicated concentrations of BEX above the NYSDEC groundwater standards were observed. Groundwater data associated with the October 2009 sampling event are summarized relative to the NYSDEC ambient groundwater quality standard in Table 2-1. BEX are the COCs associated with the proposed groundwater remedial action.

Table 2-2 summarizes the maximum concentrations of the chemicals detected at Site 15 during the 2009 Supplemental Investigation (ERM 2010a).

2.9 Remedial Action Objectives

Based on the evaluation discussed above and the final NYSDEC guidance regarding development of RAOs in DER-10 (NYSDEC 2010), the RAOs for groundwater are:

GWRAO1 - Prevent exposure to contaminated groundwater containing BEX concentrations above the NYSDEC Ambient Water Quality Standards and Guidance;

GWRAO2 - Prevent or minimize further off-site migration of the contaminant plume (plume containment);

GWRAO3 - Prevent or minimize further migration of contaminants from source materials to groundwater (source control); and

GWRAO4 - Enhance the natural process for the attenuation of BEX compounds on-site and off-site.

Soil RAOs, SRAO1 and SRAO2 as discussed in the FFS (ERM 2010b) are not presented here as the removal of the soil source area was performed in August 2008. Groundwater GWRAO5 as discussed in the FFS (ERM 2010b) is also not presented here as completion of indoor air sampling at the Ram-Tech Engineering Facility has not yet been completed.

Achieving these applicable groundwater RAOs through the application of the selected groundwater RA should allow unrestricted future uses of ERP Site 15.

2.10 Description of Remedial Alternatives

A FFS was conducted to evaluate potential remediation technologies for remediating COCs in soil and groundwater at the 174th FW (ERM 2010b). Remediation technologies were identified for evaluation based on professional experience and site-specific conditions. The FFS process incorporated the results of the remedial investigation, field pilot studies and the requirements and directives of the ANG in selecting remedies for impacted soil and groundwater at ERP Site 15. Evaluation of each alternative was performed in the FFS using eight of the nine regulatory and technical criteria outlined in the NCP (EPA 1990). The nine evaluation criteria stipulated in the NCP are: overall protection of human health and the environment; compliance with ARARs; Long-Term Effectiveness or persistence; reduction of mobility, toxicity, or volume; short-term effectiveness; implementability; cost; state acceptance; and community acceptance. The community acceptance criteria were evaluated based on the results of the public notice period (2 August 2010 to 10 September 2010) and a public meeting held at the Salina Free Library on 9 August 2010.

The following subsections provide a summary of the remediation alternatives evaluated for ERP Site 15.

Four potential alternatives for the Site 15 media of interest were developed using the technologies that remained after the initial screening (Table 2-3). These alternatives are based on the current understanding of the BEX distribution in groundwater at Site 15. The four remedial alternatives are outlined below:

- Alternative 1: No Action. This alternative would leave the site in its present condition. No actions would be taken to monitor groundwater, prevent human contact, prevent contaminant migration, or mitigate the contaminants.

- Alternative 2: Source Removal and MNA. Alternative 2 utilizes excavation and off-site disposal of the source areas (previously performed as described in Section 2.2.2) and MNA as the primary treatment methods.

- Alternative 3: Source Removal and Focused Enhanced Aerobic Bioremediation with MNA. In Alternative 3, the primary treatment utilizes excavation and off-site disposal of the source areas (previously performed as described in Section 2.2.2), targeted aerobic bioremediation to prevent further off-site migration and MNA as the primary treatment methods.

- Alternative 4: Source Removal and Expanded Enhanced Aerobic Bioremediation with MNA. In Alternative 4, the primary treatment utilizes excavation and off-site disposal of the source areas (previously performed as described in Section 2.2.2), aerobic bioremediation of the plume site wide (on-site and off-site) using calcium peroxide and MNA as the primary treatment methods.

2.11 Summary of Comparative Analysis of Alternatives

The comparative analysis evaluates the relative performance of each alternative using the criteria upon which the detailed analysis of alternatives was based. The purpose of the comparative analysis is to identify the advantages and disadvantages of the alternatives relative to one another to aid in the selection of remedy options for each site. This section highlights differences between the alternatives for each criterion. Community participation was requested during public review of the PP.

Alternative 1 – No Further Action. The No Further Action alternative assumes that no active treatment measures, site modifications, groundwater monitoring, or other actions would be undertaken to prevent or eliminate human health and environmental risks associated with impacted media. Please note: As previously discussed, soil IRAs were performed in 2003 and 2008.

This alternative does not meet the effectiveness criterion, as it includes no measures to protect human health and the environment, comply with RAOs, or reduce contaminant, toxicity, mobility or volume (TMV), except through unmonitored natural attenuation processes. The only protection to human health would be the formation of an institutional control in the form of an environmental notice to prohibit future groundwater use at the site. The easement would prevent installation of a private potable water supply well in areas that are served by a public water supply system. This would prevent potable water consumption of affected Site groundwater. No costs would be associated with implementing the No Action Alternative as shown on Table 2-4.

The No Further Action alternative is a required component of the United States Environmental Protection Agency Feasibility Study process and thus was retained as a baseline for comparison against the other alternatives.

Alternative 2 – Alternative 2 utilizes excavation and off-site disposal of the source areas (previously performed as described in Section 2.2.2) and MNA as the primary treatment methods. Based on the observed BEX concentrations, the duration of this alternative is expected to range from up to 30 years.

Implementation of Alternative 2 at the Site would involve:

Use restrictions: An institutional control in the form of an environmental notice to prohibit future groundwater use at the site will be necessary. Since the Base is Federal Property, a groundwater use restriction must be written into the Base Master Plan which prohibits groundwater use until such time that groundwater standards have been achieved. If the property leaves Federal ownership prior to groundwater standards being achieved, the ANG will place an environmental notice on the Site**.** This would prevent future use of the BEX affected groundwater as drinking water;

Implementation of Common Action No. 1: Indoor Air investigation at the Ram-Tech Engineering Property;

Implementation of the excavation IRA: Excavation and disposal of the identified source area (previously performed as described in Section 2.2.2);

Completion of the aerobic bioremediation Pilot Study (this portion of Alternative 2 has already been completed as part of the RI); used to evaluate effectiveness of enhanced bioremediation, spacing of the injection points and peroxide loading.

Monitoring BEX concentrations and natural attenuation parameters in shallow groundwater quarterly for 5 years and annually for up to 30 years; and

Monitoring of volatile organic compounds (VOCs) would be performed to verify that concentrations are decreasing with time. A decreasing trend in VOC concentrations throughout the area of contamination would indicate that the TMV of the COCs are decreasing and that VOC plume is not continuing to expand. Monitoring of natural attenuation parameters would be conducted to verify that VOCs are biodegrading and to estimate the rate of intrinsic bioremediation.

This alternative meets the criteria of implementability and cost, but does not meet the criteria for effectiveness, since the rate at which attenuation is occurring has been insufficient to contain the plume on site and decrease concentrations across the plume. Therefore, this alternative was not retained for further evaluation and a cost evaluation was not applicable.

Alternative 3 – In Alternative 3, the primary treatment utilizes excavation and off-site disposal of the source areas, aerobic bioremediation to prevent further off-site migration and MNA as the primary treatment methods.

Use restrictions: An institutional control in the form of an environmental notice to prohibit future groundwater use at the site will be necessary. Since the Base is Federal Property, a groundwater use restriction must be written into the Base Master Plan which prohibits groundwater use until such time that groundwater standards have been achieved. If the property leaves Federal ownership prior to groundwater standards being achieved, the ANG will place an environmental notice on the Site**.** This would prevent future use of the BEX affected groundwater as drinking water;

Implementation of Common Action No. 1: Indoor Air investigation at the Ram-Tech Engineering Property;

Implementation of the IRA: Excavation and disposal of the identified source area (previously performed as described in Section 2.2.2). This portion of Alternative 3 has already been completed as an IRA; and

Completion of the aerobic bioremediation Pilot Study (this portion of Alternative 2 has already been completed as part of the RI); used to evaluate effectiveness of enhanced bioremediation, spacing of the injection points and peroxide loading.

Installation of aerobic biological treatment barriers primarily along Molloy Road and Fairway Drive to control off-site migration of VOCs; approximately 43 injection points would be installed using direct-push techniques with a maximum of 50 pounds of calcium peroxide injected at each injection location; the barriers would consist of rows of direct-push injection points, with 20 feet spacing as determined during the PT;

Monitoring BEX concentrations and natural attenuation parameters in shallow groundwater conducted quarterly for 4 years and annually for up to 10 years with a review of status each 5-years to determine potential for additional monitoring; and

Since calcium peroxide generally persists for 1 to 3 years after injection, additional injections will be required at Year 2 at 50% of the original injection locations with a maximum of 50 pounds of calcium peroxide injected at each injection location; the number of injection points will be fewer than the first injection event, since the attenuation of the plume is expected to accelerate due to the flux reduction resulting from the source area removal action and the initial injections. For cost estimation purposes it has been assumed that follow-up injections in approximately 50% of the 43 original locations (i.e., 22 locations) will be required at Year 2. The cost estimate of Alternative 3 is also presented on Table 2-4.

This alternative meets the criteria of effectiveness, implementability, and cost, and was, therefore, retained for further evaluation.

Alternative 4 – In Alternative 4, the primary treatment utilizes excavation and off-site disposal of the source areas, aerobic bioremediation of the plume site wide using calcium peroxide and MNA as the primary treatment methods.

Use restrictions: An institutional control in the form of an environmental notice to prohibit future groundwater use at the site will be necessary. Since the Base is Federal Property, a groundwater use restriction must be written into the Base Master Plan which prohibits groundwater use until

such time that groundwater standards have been achieved. If the property leaves Federal ownership prior to groundwater standards being achieved, the ANG will place an environmental notice on the Site**.** This would prevent future use of the BEX affected groundwater as drinking water;

Implementation of Common Action No. 1: Indoor Air investigation at the Ram-Tech Engineering Property;

Implementation of the IRA: Excavation and disposal of the identified source area (previously performed as described in Section 2.2.2). This portion of Alternative 3 has already been completed as an IRA; and

Completion of the aerobic bioremediation Pilot Study (this portion of Alternative 2 has already been completed as part of the RI); used to evaluate effectiveness of enhanced bioremediation, spacing of the injection points and peroxide loading.

Injection of a slurry of calcium peroxide into rows of direct push points located within both on-site and accessible off-site areas of the plume that are currently above RAOs. The released oxygen will enhance aerobic biodegradation and as concentrations of VOCs decrease over time, the treatment area will be reduced.

Assuming an inter-well spacing within rows of 20 feet and 12 rows of points (7 on-site and 5 off-site), approximately 106 injection points will be required to address areas of the plume after excavation.

Monitoring VOC concentrations and natural attenuation parameters in shallow groundwater will be monitored quarterly for 3 years during active remediation and annually for up to 10 years. A review of Site status should be performed each 5-years to determine potential for additional monitoring

Since calcium peroxide generally persists for 1 to 3 years after injection, additional injections will be required at Year 2 at 53 of the original injection locations with a maximum of 50 pounds of calcium peroxide injected at each injection location; the number of injection points will be fewer than the first injection event, since the attenuation of the plume is expected to accelerate due to the flux reduction resulting from the source area removal action and the initial injections. For cost estimation purposes it has been assumed that follow-up injections in approximately 50% of the 106 original locations (i.e. 50 locations) will be required at Year 2. The cost estimate of Alternative 4 is also presented on Table 2-4.

This alternative meets the criteria of effectiveness, implementability, and cost, and was, therefore, retained for further evaluation.

The evaluation of the four RA alternatives for Site 15 groundwater, based on the NCP criteria is summarized in Table 2-5.

TABLE 2-5

Summary of Comparative Analysis Site 15 Groundwater

NCP Evaluation Criteria	Site 15 Groundwater			
	A1	A2	A3	A4
Overall Protection of Human Health and the Environment	***	**	*	*
Compliance with ARARs	***	**	*	*
Long-Term Effectiveness and Permanence	***	**	*	*
Reduction of Mobility, Toxicity, or Volume	***	**	*	*
Short-Term Effectiveness	***	**	**	
Implementability	*	*	*	*
Cost	*	*	**	***
State Acceptance	***	*	*	*

Notes: Relative performance of remedy
* = alternative effectively satisfies criterion
** = alternative moderately satisfies criterion
*** = alternative poorly satisfies criterion
Alternative 1 (A1) – No Further Action
Alternative 2 (A2) – Source Removal and MNA
Alternative 3 (A3) – Source Removal and Focused Enhanced Aerobic Bioremediation with MNA
Alternative 4 (A4) - Source Removal and Expanded Enhanced Aerobic Bioremediation with MNA

2.12 Principal Threat Wastes

No principal threat wastes are present at this site.

2.13 Selected Remedy

Based on information currently available, the ANG believes that Alternative 3 meets the threshold criteria and provides the best balance of trade-offs among the other alternatives with respect to the balancing and modifying criteria.

Alternative 3 involves excavation of the identified source areas (already performed in August 2008); the direct-push injection of calcium peroxide in targeted migration pathway areas mostly located within the off-site

plume, institutional controls and MNA (see Figure 2-3). The calcium peroxide solution in the migration pathways is expected to prevent further off-site migration by completely and permanently destroying dissolved VOCs and enhancing natural bioremediation. Impacted on-site groundwater would eventually be treated off-site, and source removal and natural attenuation processes would reduce on-site VOC levels within a reasonable timeframe. Alternative 3 is expected to achieve site RAOs within a relatively short time (i.e., 4 to 5 years).

2.14 Statutory Determinations

The RA selected for implementation at Site 15 is consistent with CERCLA requirements. The selected RA is protective of human health and the environment, and will comply with ARARs. In addition, the selected remedy uses permanent solutions that permanently and significantly reduce the concentration of hazardous substances. The selected RA meets all Federal and State ARARs and therefore no waivers of ARARs are required.

The selected groundwater RA may result in COCs remaining on-site following implementation, a site review would be performed every 5 years pursuant to CERCLA Section 121(c) and 40 Code of Federal Regulations 300.430(f)(4)(iii)(c). Five-Year Reviews will be conducted until concentrations of hazardous substances, pollutants, or contaminants remaining on-site are reduced to levels that allow for unlimited use and unrestricted exposure. All site activities, including RA and monitoring, will be carried out pursuant to OSHA standards (29 Code of Federal Regulations 1904, 1910, and 1926).

2.14.1 Protection of Human Health and the Environment

The selected RA will adequately protect human health and the environment by eliminating, reducing, or controlling exposures to human and environmental receptors through remediation of the contaminated soil and groundwater at ERP Site 15.

2.14.2 Compliance with Applicable or Relevant and Appropriate Requirements

The ERP is responsible to perform RAs within the overall framework of CERCLA that are protective of both human health and the environment,

and comply with applicable state and federal ARARs. Chemical-specific, location-specific, and action-specific ARARs were reviewed in the FFS and include the following ARARs provided by NYSDEC, as well as ARARs compiled based on ANG's review.

Chemical-Specific ARARs. ANG reviewed potential numerical federal, state, and local chemical-specific ARARs for soil and groundwater. The FFS provides a summary of numerical chemical-specific ARARs and SCGs (ERM 2010b).

ARARs for implementation of a soil and groundwater remedy at the Base originate from the National Guard Bureau (NGB), CERCLA, SARA, and the NYSDEC. The NGB requires that remediation activities be executed in compliance with CERCLA and SARA. The NGB is the primary regulatory agency and the NYSDEC provides oversight for all activities at the Base.

An evaluation of hydrogeology and groundwater quality using NYSDEC classification criteria concluded that groundwater at the Base meets the criteria for Class GA groundwater as defined by the *NYSDEC Division of Water Technical and Operational Guidance Series Memorandum Number 1.1.1* (TOGS 1.1.1; NYSDEC 2000). The Class GA groundwater designation subjects the 174th FW to the chemical-specific SCGs promulgated under DER-10 (NYSDEC 2010).

Any remediation alternative including direct injection of a remediation additive will be regulated under the EPA Underground Injection Control (UIC) program, thus requiring the submission of a Class V Injection Well Inventory Form (according to 40 CFR144.26 (Form OMB No 2040-0042 (EPA form 7520-16))) to the EPA Region 2 Branch in New York, New York.

2.15 Documentation of Significant Changes

The Final PP (ERM 2010c) for Site 15 was released for public comment on 2 August 2010. Based upon its review of the written and verbal comments submitted during the public comment period, the ANG determined that only one significant change, as requested by the NYSDEC, to the RA, as originally identified in the PP, was necessary or appropriate.

This change is as follows:

The use restriction in Alternates 1-4 is changed from:

Use restrictions: Part 5 of the NYSDOH State Sanitary Code, which prevents installation of a private potable water supply well in areas that are served by a public water supply system, would continue to be enforced. This would prevent future use of the BEX affected groundwater as drinking water;

To the following:

Use restrictions: An institutional control in the form of an environmental notice to prohibit future groundwater use at the site will be necessary. Since the Base is Federal Property, a groundwater use restriction must be written into the Base Master Plan which prohibits groundwater use until such time that groundwater standards have been achieved. If the property leaves Federal ownership prior to groundwater standards being achieved, the ANG will place an environmental notice on the Site**.** This would prevent future use of the BEX affected groundwater as drinking water.

The NYSDEC does concur that the chosen remedy, Alternative 3, satisfies most of the RAOs, but questions the efficacy and cost effectiveness of additional calcium peroxide injections. The NYSDEC believes that the already completed IRAs - source area contaminated soil removal and Enhanced Bioremediation Pilot Study - have eliminated any further threat of groundwater contamination and satisfy the RAOs, and that additional injections are not cost effective.

While the ANG believes the NYSDEC comments are valid (regarding MNA vs. injections), in the abundance of caution and to expedite the remedial process, the ANG recommends Alternative 3 because it satisfies the remedy-selection evaluation criteria and addresses the impacted groundwater and soil at the Site in the most cost-effective way.

SECTION 3.0

RESPONSIVENESS SUMMARY

3.1 Stakeholder Comments and Lead Agency Reponses

The NGB has prepared this Responsiveness Summary for the Site, as part of the process for making a final remedy selection. This Responsiveness Summary documents for the Administrative Record, public comments and issues raised during the public comment period on the NGB's preferred remedial alternative presented in the PP, and provides the NGB's responses to those comments. The NGB's actual decisions for the Site are detailed in the ROD. Pursuant to Section 117 of the CERCLA, 42 USC. § 9617, the NGB has considered all comments received during the public comment period in making the final decision contained in the ROD for the Site.

3.2 Overview of Public Comment Period

The NGB issued its PP of Action detailing remedial action recommendations for public review and comment on 2 August 2010. Documents and information that the NGB used in making its recommendations in the PP were made available to the public on 2 August 2010 in two locations, including the Administrative Record file located at the Environmental Office, New York ANG 174th FW at the Syracuse International Airport, in Syracuse, New York; and the Information Repository located at the Salina Free (Public) Library in Mattydale, New York. The public comment period started on 2 August 2010 and ended on 10 September 2010. The NGB held a public meeting on 9 September 2010 at the Salina Free (Public) Library in Mattydale, New York. All written comments as well as the transcript of oral comments received during the public comment period were planned for inclusion in the Administrative Record for the Site. However, there were no written comments received during the comment period and there were no attendees from public at the meeting held on 9 September 2010.

This Responsiveness Summary summarizes comments submitted during the public comment period and presents NGB's written response to each issue, in compliance with the community relations requirements of the NCP. NGB's responses to comments received during the public meeting are provided below.

3.2.1 Summary of Public Comments and NGB's Responses

NBG received no oral or written comments from the general public during the public comment period.

3.3 Technical and Legal Issues

The Selected Remedy is consistent with the future property use for unrestricted purposes assuming the RAOs are achieved.

SECTION 4.0

REFERENCES

EPA. 2007. *EPA Region III Risk-Based Concentration Table*, latest amendment October 2007.

EPA. 1988. *Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*. Office of Emergency and Remedial Response. October 1988.

ERM. 2008. *Site 15 Supplemental RI/Pilot Test (PT) Work Plan* -174th Fighter Wing - New York Air National Guard- Hancock Air National Guard Base – Syracuse, New York dated October 2008.

ERM. 2009. *Site 15 Final Construction Completion Report - Source Area Soil Removal*, 174th Fighter Wing - New York Air National Guard- Hancock Air National Guard Base – Syracuse, New York, January 2009.

ERM. 2010a. *Final Technical Memorandum – Supplemental Remedial Investigation/Pilot Test* - 174th Fighter Wing - New York Air National Guard- Hancock Air National Guard Base – Syracuse, New York, March 2010.

ERM. 2010b. *Final Focused Feasibility Study* - 174th Fighter Wing - New York Air National Guard- Hancock Air National Guard Base – Syracuse, New York, March 2010.

ERM. 2010c. *Final Proposed Plan for Environmental Cleanup* - 174th Fighter Wing - New York Air National Guard- Hancock Air National Guard Base – Syracuse, New York, July 2010.

Lockheed. 1997. *Final Remedial Investigation Report for Petroleum, Oil, and Lubricant Facility, Site 15. Volumes I and II*. Prepared by Lockheed Martin for the Air National Guard Readiness Center, Andrews AFB, Maryland. July 1997.

NYSDEC. 1994. *Determination of Soil Cleanup Objectives and Cleanup Levels*. NYSDEC Division of Hazardous Waste Remediation Technical and Administrative Guidance Memorandum Number 4046, April 1994 (latest amendment 20 December 2000).

NYSDEC. 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. *NYSDEC Division of Water Technical and Operational Guidance Series Memorandum Number 1.1.1.*, June 1998 (latest amendment April 2000).

NYSDEC. 2010. DER-10, *Final Technical Guidance for Site Investigation and Remediation*, Division of Environmental Remediation, May 2010.

Parsons. 2001. Work Plan for the *Time Critical Removal Action at Site 15 at Hancock Field,* Prepared for the Air National Guard Readiness Center, Andrews AFB, Maryland, October 2002.

Parsons. 2003. Construction Completion Report for the *Time Critical Removal Action at Site 15 at Hancock Field* Prepared for the Air National Guard Readiness Center, Andrews AFB, Maryland.

FIGURES

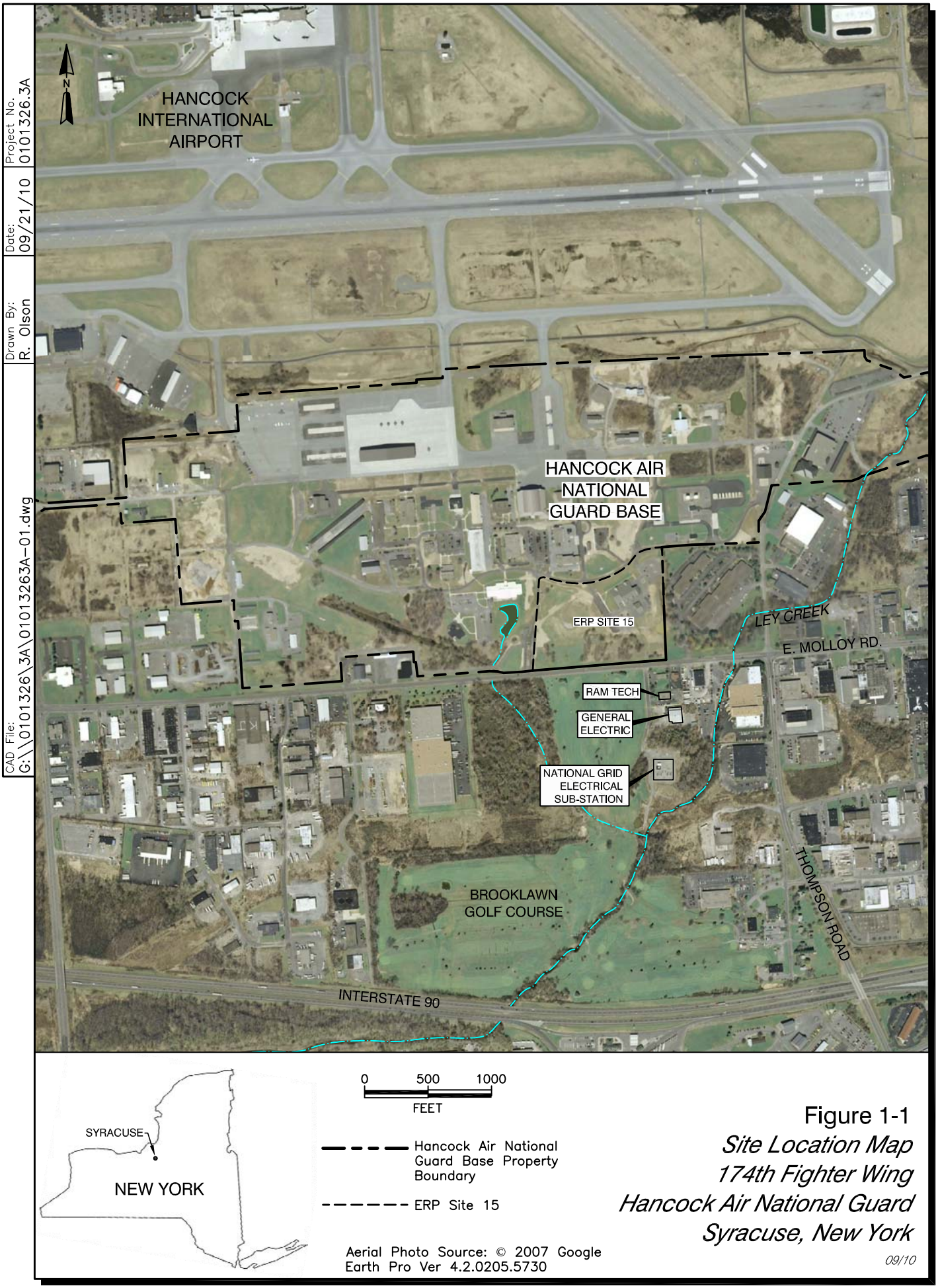

Figure 1-1
Site Location Map
174th Fighter Wing
Hancock Air National Guard
Syracuse, New York
09/10

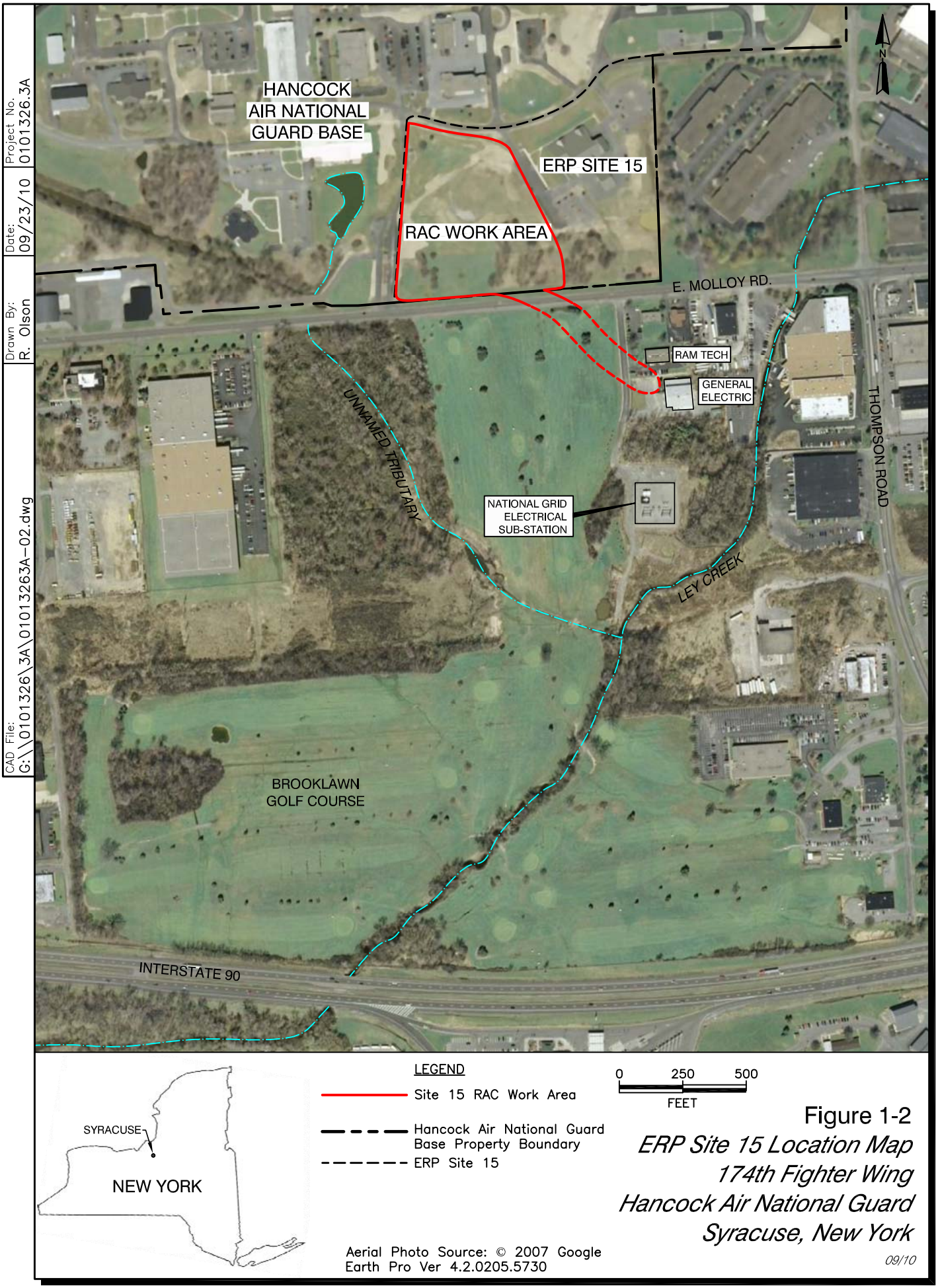

Figure 1-2

ERP Site 15 Location Map
174th Fighter Wing
Hancock Air National Guard
Syracuse, New York

09/10

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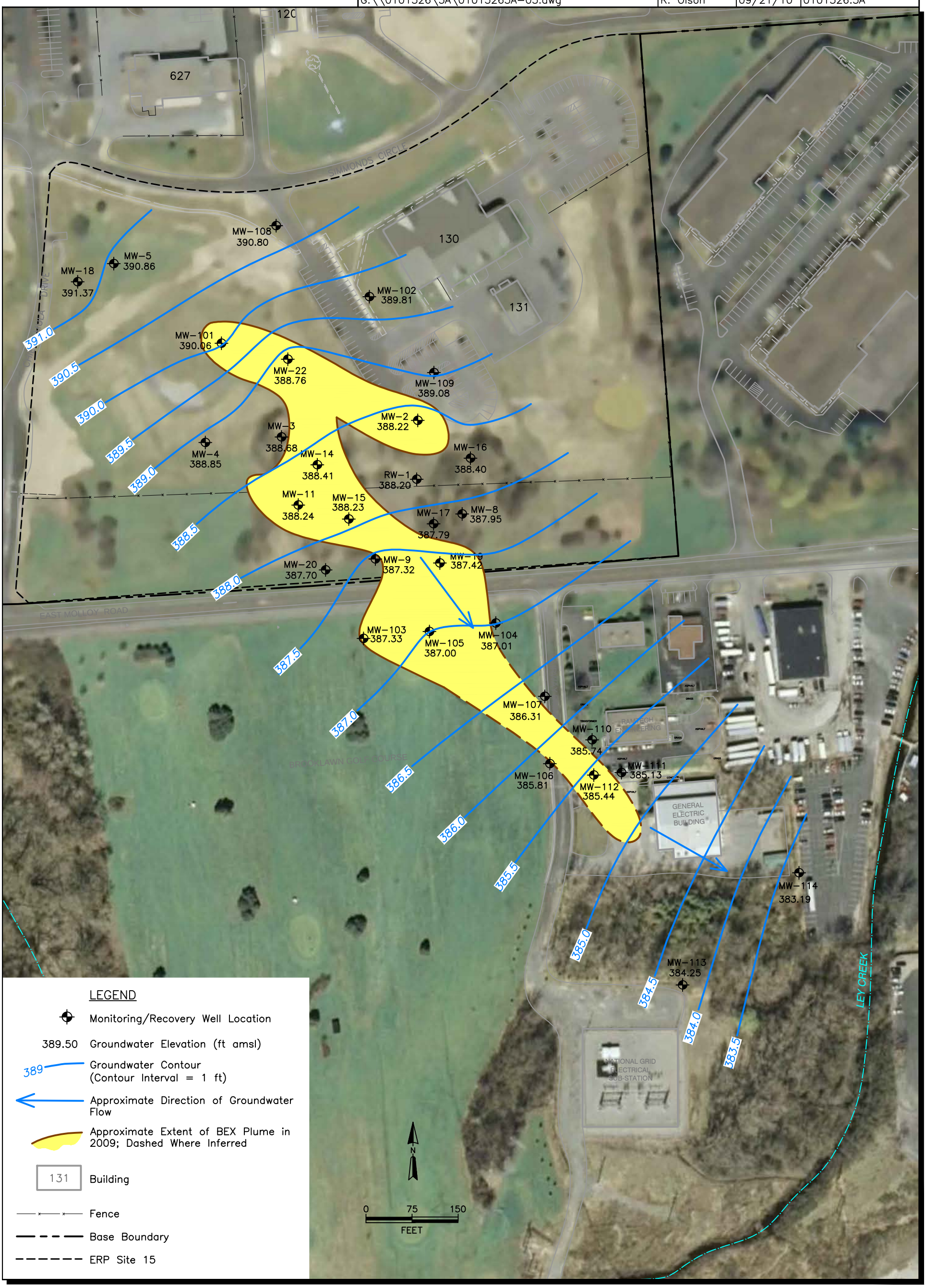

Figure 2-1

Site 15 Monitoring Well Locations and
Static Groundwater Contour Map - 6 October 2009
174th Fighter Wing
Hancock Air National Guard
Syracuse, New York

09/10

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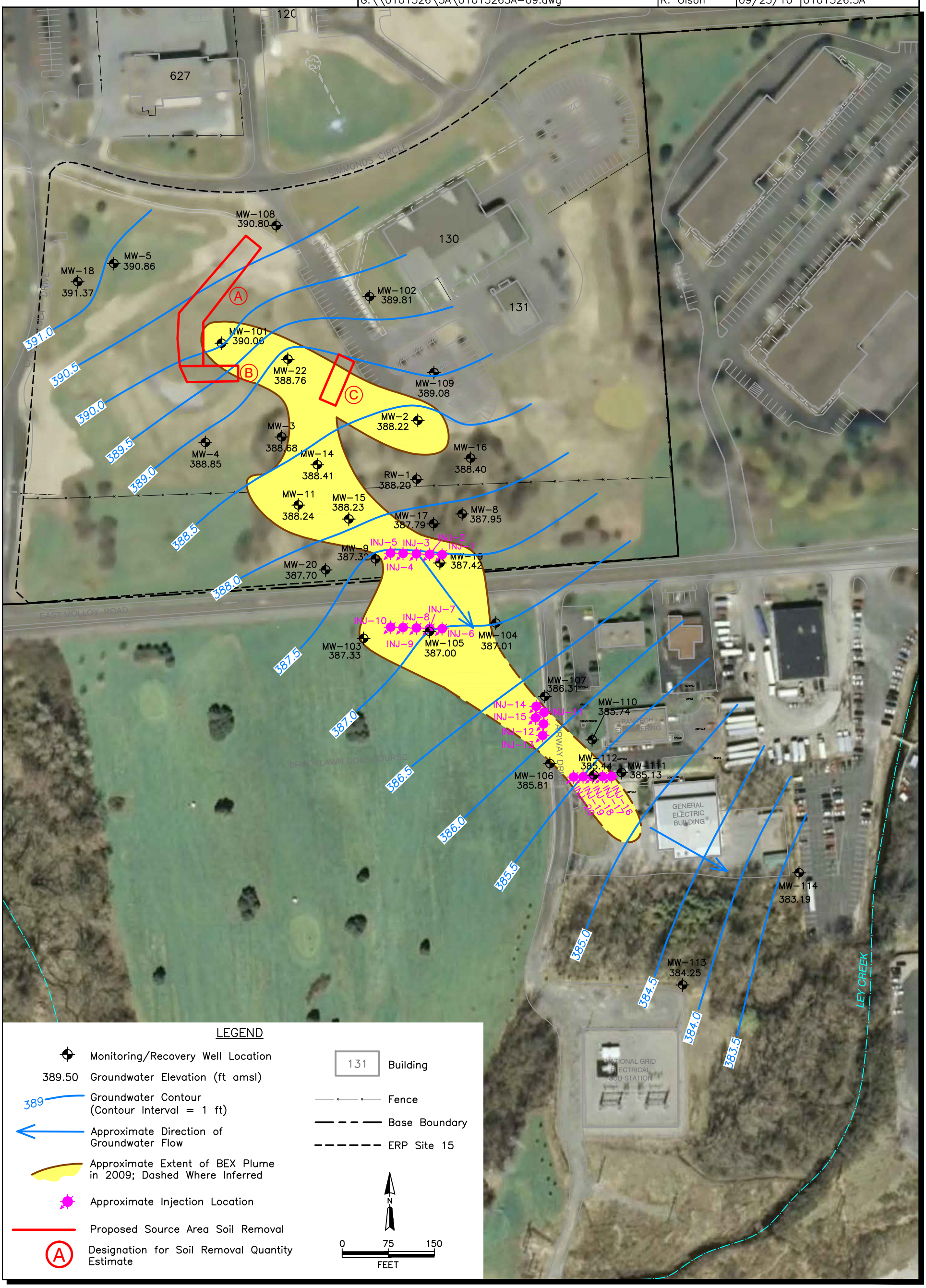

Figure 2-2
Pilot Test and Interim Remedial Action Locations
174th Fighter Wing
Hancock Air National Guard
Syracuse, New York

09/10

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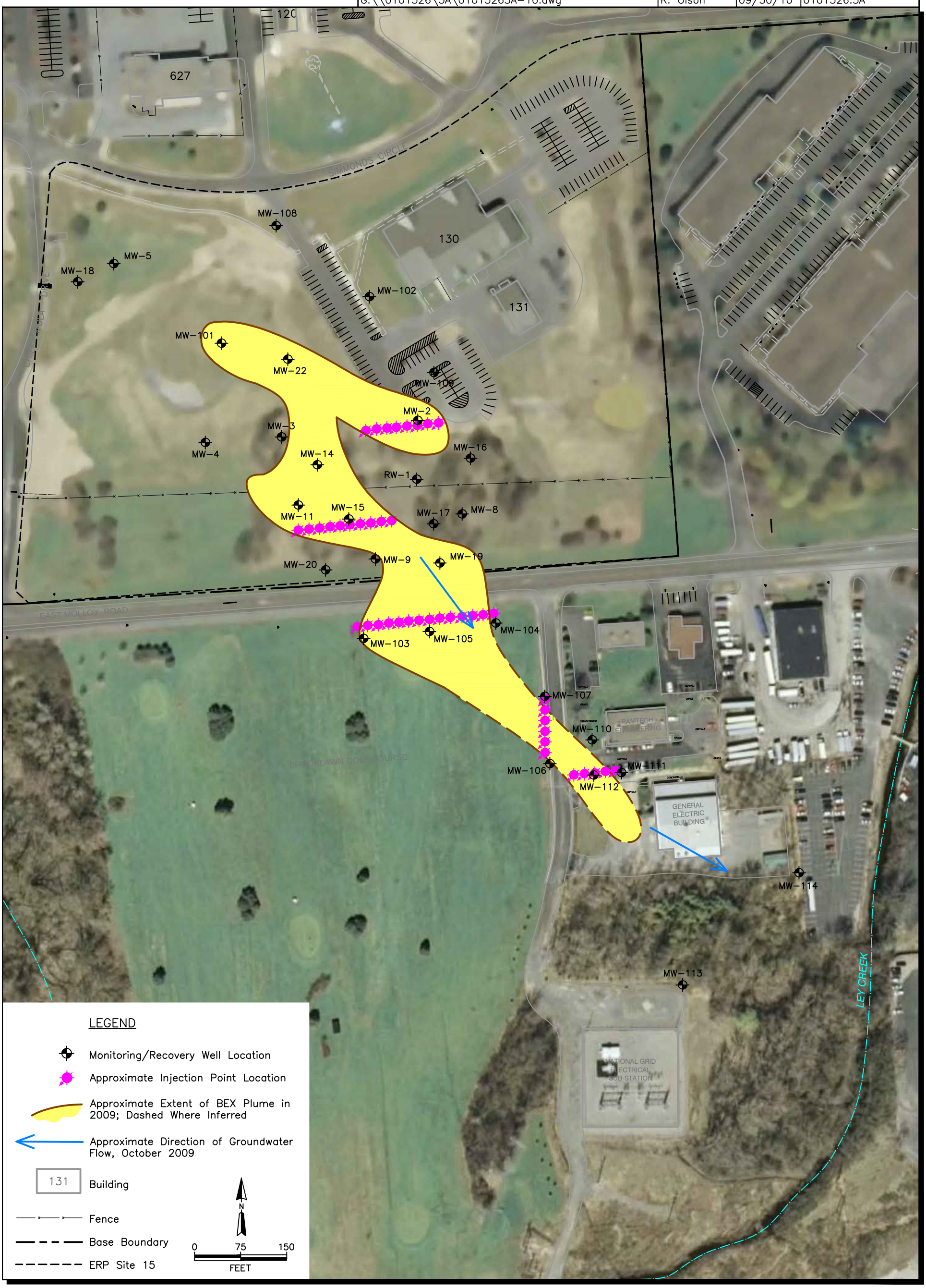

Figure 2-3

Alternative 3: Focused Enhanced Aerobic Bioremediation
Conceptual Design Slurry Injection Locations
174th Fighter Wing
Hancock Air National Guard
Syracuse, New York

09/10

TABLES

Table 2-1 Final
SUMMARY OF GROUNDWATER ANALYTICAL DATA - 2005 through 2009
SITE 15- 174th FIGHTER WING AIR NATIONAL GUARD
HANCOCK FIELD, SYRACUSE, NY
NYSDEC SITE NUMBER 734054
ERM PROJECT NUMBER 0101326

WELL ID	MW-2					MW-3					MW-4					MW-5					NYSDEC
Sample Date	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	STANDARD
VOCs (ug/l)																					
BENZENE	----	----	----	----	----	**200**	**57**	**75**	----	----	----	----	----	----	----	----	----	----	----	----	1
ETHYL BENZENE	3.5	**83**	**52**	----	**200**	**200**	**16**	**61**	----	----	----	----	----	----	----	----	----	----	----	----	5
TOLUENE	----	----	----	----	NA	----	----	0.34J	----	NA	----	----	----	----	NA	----	----	----	----	NA	5
XYLENE	2	**98**	**44**	----	**370**	**95**	**15**	**28**	----	----	----	----	----	----	----	----	----	----	----	----	5
MTBE	----	----	----	----	NA	----	----	----	----	NA	----	----	----	----	NA	----	----	----	----	NA	10
NATURAL ATTENUATION PARAMETERS (mg/l)																					
NITRATE	0.55	----	0.17	0.86	< 0.1	0.21	----	----	0.33	< 0.1	0.13	0.41	----	0.18	0.21	1.20	0.98	0.28	1.3	< 0.1	NA
SULFATE	67.0	7.5	37	98	2.8	2.8	2.4	4	6.0	9.3	26.0	26.0	8.9	3.7	37.0	12.0	15.0	11	8.0	8.6	NA
ALKALINITY	300	310	380	190	400	270	350	300	120	360	190	250	240	40	290	220	260	340	140	280	NA
TOTAL HARDNESS	740	310	350	820	590	380	310	230	57	500	240	250	180	37	350	280	260	270	180	310	NA
AMMONIA	----	0.088	UJ	0.046	0.20	----	0.76	0.065J	----	0.75	----	0.18	----	----	0.11	----	----	UJ	----	<0.03	NA
METHANE	----	8.800	----	0.0076	4.4	0.100	1.600	----	----	0.28	0.011	0.011	----	----	0.012	----	----	----	----	0.02	NA
PARAMETERS MEASURED IN THE FIELD																					
FERROUS IRON	----	3.8	0.9	0.8	4.2	6.1	3.3	2.2	0	2.1	----	1.200	0	0	1	----	0.300	0	0	1.7	NA
pH	7.06	6.95	8.26	6.96	7.54	6.92	6.45	6.77	6.3	6.33	7.30	6.88	8.26	7.16	7.43	7.12	8.21	6.68	7.04	7.14	NA
DISSOLVED OXYGEN	0.00	0.00	0.29	2.28	0.18	0.00	0.00	2.79	7.99	0.12	1.15	0.00	0	0.64	0.49	4.80	0.00	0.77	7.70	0.00	NA
OXIDATION REDUCTION POTENTIAL	76	-127	-76	123.9	44.4	-61	-81	-8	146.6	-71	43	-113	-46	186.9	44	146	-50	121	41.6	-109	NA
CONDUCTIVITY	1.120	0.999	1.4	6.794	1.471	0.531	0.811	0.76	0.106	0.822	0.366	0.803	0.391	0.067	0.440	0.391	0.362	0.577	0.377	0.595	NA
FIELD OBSERVATIONS	----	----	----	----	---	Odor	Odor	Odor	----	---	----	----	----	----	---	----	----	----	----	---	----

NOTES:

ug/L = Micrograms per liter

VOCs - volatile organic compounds determined by USEPA Method 8260

NYSDEC Standards - NYS Division of Water Technical and Operational Guidance Series (1.1.1) 1998

The MTBE ground water standard is from NYSDEC's TAGM 8086

- Bold white type with black background indicates exceedance of the NYSDEC Standards or Guidance Value

J = Results greater than the reporting limit that are considered estimated.

UJ= Results less than the reporting limit that are considered estimated.

---- = the compound was not detected at a concentration above the laboratory reporting limit

Natural Attenuation Parameters are used to characterize the physical, chemical and biological response of a hydrologic system to contamination.

Dissolved Oxygen, Oxidation Reduction Potential, pH and conductivity were measured in the field using a Horiba U-22 and flow through cell just prior to collecting samples.

Ferrous Iron concentration were measured using a HACH Test Kit

Ferrous Iron and DO are reported in mg/L

pH is reported in standard units

Oxidation Reduction Potential is reported in mV

Conductivity is reported in ms/cm

Odor = "Petroleum-like" odor

mg/L= Milligrams per liter

Sheen= Sheen on purge water and/or sample

Table 2-1 Final
SUMMARY OF GROUNDWATER ANALYTICAL DATA - 2005 through 2009
SITE 15- 174th FIGHTER WING AIR NATIONAL GUARD
HANCOCK FIELD, SYRACUSE, NY
NYSDEC SITE NUMBER 734054
ERM PROJECT NUMBER 0101326

WELL ID	MW-8					MW-9					MW-11					MW-14					NYSDEC
Sample Date	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	STANDARDS
VOCs (ug/l)																					
BENZENE	----	----	----	----	----	----	----	----	----	----	**32**	**31**	**17**	----	**49**	**3.7**	**4.5**	**2**	----	**3.9**	1
ETHYL BENZENE	**6.4**	----	----	----	----	----	----	----	----	----	----	1.4	0.63J	----	**11**	----	1.2	0.22J	----	----	5
TOLUENE	----	----	----	----	NA	----	----	----	----	NA	----	----	0.11J	----	NA	----	----	----	----	NA	5
XYLENE	4	----	----	----	----	----	----	----	----	----	----	**5.2**	0.36J	----	16	----	----	----	----	----	5
MTBE	----	----	----	----	NA	----	----	----	----	NA	----	2.2	----	----	NA	----	1.9	----	----	NA	10
NATURAL ATTENUATION PARAMETERS (mg/l)																					
NITRATE	0.20	----	----	1.2	< 0.1	0.16	0.37	0.1	0.91	< 0.1	0.23	0.15	----	0.34	<0.1	0.77	----	----	0.26	<0.1	NA
SULFATE	24.0	28.0	42	8.7	52.0	38.0	21.0	20	6.1	12.0	8.8	22.0	22	72	4.5	24.0	43.0	45	66.0	45.0	NA
ALKALINITY	320	320	250	88	400	110	200	270	32	260	330	330	260	370	360	230	320	370	350	340	NA
TOTAL HARDNESS	380	120	370	96	650	130	360	83	26	220	320	320	370	440	510	230	350	380	400	470	NA
AMMONIA	----	----	UJ	----	< 0.03	----	0.25	0.12J	0.14	0.37	----	----	0.042J	----	<0.03	----	----	0.2	----	<0.03	NA
METHANE	0.730	0.015	----	0.0024	0.011	----	0.020	----	----	----	0.006	0.740	----	0.052	1.6	1.800	0.130	0.039	0.14	0.16	NA
PARAMETERS MEASURED IN THE FIELD																					
FERROUS IRON	2.0	2.4	1	0.8	1.2	0.1	2.0	1.05	1.1	2.0	4.0	4.4	1.6	2.5	2.2	0.5	2.8	NM	1.4	2.0	NA
pH	6.94	7.12	4.58	6.29	7.70	6.27	6.51	6.41	6.64	8.31	7.38	7.19	4.51	7.29	7.00	6.96	7.07	7.33	7.13	7.68	NA
DISSOLVED OXYGEN	0.00	0.00	10.9	6.21	0.35	0.00	0.00	0	10.09	3.02	0.00	0.00	11.36	0.23	0.00	2.12	0.00	0	0.20	0.15	NA
OXIDATION REDUCTION POTENTIAL	-28	-126	271	41	12.8	152	-26	0.43	109.9	-144.7	-271	-155	270	-93.1	-163	-14	-137	-121	-50.2	14.7	NA
CONDUCTIVITY	0.706	0.999	0	0.172	0.873	1.270	0.969	0.83	0.137	1.006	0.643	0.97	0	1.056	1.280	0.496	0.9	0.91	0.567	0.467	NA
FIELD OBSERVATIONS	----	----	----	----	----	Odor	Odor	----	----	----	Odor	Odor	----	----	Odor	Odor	Odor	Odor	Dye Visible	Dye Visible	----

NOTES:

ug/L = Micrograms per liter

VOCs - volatile organic compounds determined by USEPA Method 8260

NYSDEC Standards - NYS Division of Water Technical and Operational Guidance Series (1.1.1) 1998

The MTBE ground water standard is from NYSDEC's TAGM 8086

- Bold white type with black background indicates exceedance of the NYSDEC Standards or Guidance Value

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Odor = "Petroleum-like" odor

mg/L= Milligrams per liter

Sheen= Sheen on purge water and/or sample

Table 2-1 Final
SUMMARY OF GROUNDWATER ANALYTICAL DATA - 2005 through 2009
SITE 15- 174th FIGHTER WING AIR NATIONAL GUARD
HANCOCK FIELD, SYRACUSE, NY
NYSDEC SITE NUMBER 734054
ERM PROJECT NUMBER 0101326

WELL ID	MW-15					MW-16					MW-17					MW-18					NYSDEC
Sample Date	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	STANDARDS
VOCs (ug/l)																					
BENZENE	**100**	**140**	**66**	**6.8**	**10**	----	----	----	----	----	----	----	0.18J	----	----	----	----	----	----	----	1
ETHYL BENZENE	**28**	**33**	**38**	----	**11**	----	----	0.25J	----	----	----	2	**49**	----	----	----	----	----	----	----	5
TOLUENE	----	----	----	----	NA	----	----	0.38J	----	NA	----	----	----	----	NA	----	----	----	----	NA	5
XYLENE	3	----	----	----	----	----	----	----	----	----	----	----	**31**	----	----	----	----	----	----	----	5
MTBE	----	2.8	----	----	NA	----	----	----	----	NA	----	----	----	----	NA	----	----	----	----	NA	10
NATURAL ATTENUATION PARAMETERS (mg/l)																					
NITRATE	0.21	----	----	0.8	<0.1	0.20	----	0.11	0.48	<0.1	3.20	0.13	----	3.3	<0.1	1.40	0.34	0.83	0.52	<0.1	NA
SULFATE	37.0	17.0	27	28	31	62.0	37.0	99	63	63	58.0	16.0	41	27	19	13.0	12.0	13	6.0	14.0	NA
ALKALINITY	380	340	290	410	340	260	350	520	400	370	260.0	360.0	320	260	370	290	310	320	92	390	NA
TOTAL HARDNESS	430	370	380	460	420	450	390	480	530	550	300	370	370	260	540	300	280	300	99	430	NA
AMMONIA	----	----	0.11J	0.041	<0.03	----	----	5.1J	----	<0.03	1.50	1.20	0.13J	----	0.22	----	----	UJ	----	<0.03	NA
METHANE	2.100	1.400	----	0.93	0.19	----	0.057	0.0078	----	0.0089	0.033	1.400	----	----	1.1	----	----	----	----	0.0029	NA
PARAMETERS MEASURED IN THE FIELD																					
FERROUS IRON	4.6	3.1	2.95	2.2	2.4	----	0.400	NM	0.2	0.2	----	2.200	3.2	0	1.4	----	0.000	0	0	0	NA
pH	7.00	6.88	7.2	7.16	7.55	7.17	6.99	7.15	6.67	7.60	7.35	6.83	7.01	6.75	6.69	7.25	8.10	7.13	7.07	7.49	NA
DISSOLVED OXYGEN	0.00	0.00	0	0.31	0.13	1.70	0.00	0	1.30	0.42	0.00	0.00	0	6.29	0.00	0.20	0.00	0	1.06	1.11	NA
OXIDATION REDUCTION POTENTIAL	-67	150	-153	-99.1	7.8	-85	-16	-19	153.8	18.9	-308	-139	-98	53.9	-115	-202	127	185	181.1	44.5	NA
CONDUCTIVITY	1.170	1.01	0.99	0.630	525	1.050	0.97	3.06	1.052	0.891	0.623	0.6	0.9	0.522	1.260	0.486	0.378	0.986	0.143	0.568	NA
FIELD OBSERVATIONS	----	----	Odor	----	Odor	----	----	----	Dye Visible	Dye Visible	----	----	----	----	----	----	----	----	----	----	----

NOTES:

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VOCs - volatile organic compounds determined by USEPA Method 8260

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SITE 15- 174th FIGHTER WING AIR NATIONAL GUARD
HANCOCK FIELD, SYRACUSE, NY
NYSDEC SITE NUMBER 734054
ERM PROJECT NUMBER 0101326

WELL ID	MW-19							MW-20					MW-22					NYSDEC
Sample Date	Apr-05	Sep-05	Nov-06	Feb-08	Apr-09	Aug-09	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	STANDARDS
VOCs (ug/l)																		
BENZENE	**28**	**33**	**17J**	----	0.71 J	**6**	**< 10**	----	----	----	----	----	**110**	**70**	**51**	----	**5.6**	1
ETHYL BENZENE	**300**	**610**	**270**	**8.5**	**17**	**410**	**380**	----	----	----	----	----	**89**	**32**	**82**	----	**21**	5
TOLUENE	----	----	----	----	NA	NA	NA	----	----	----	----	NA	----	----	0.34J	----	NA	5
XYLENE	**650**	**860**	**460**	**9**	**20**	**760**	**420**	----	----	----	----	----	**88**	**46**	**90**	----	3	5
MTBE	----	----	----	----	NA	NA	NA	----	----	----	----	NA	----	----	----	----	NA	10
NATURAL ATTENUATION PARAMETERS (mg/l)																		
NITRATE	0.19	----	----	0.28	----	----	<0.1	0.45	----	----	1.4	<0.1	1.50	----	0.3	1.9	<0.1	NA
SULFATE	15.0	----	11	25.0	20.0	6.7	4.9	36.0	15.0	240	11.0	9.4	32.0	8.8	41	16.0	31.0	NA
ALKALINITY	350	330	240	410	330	330	340	340	340	370	67	350	330	400	370	170	410	NA
TOTAL HARDNESS	340	350	330	350	400	560	550	420	330	300	83	330	390	340	340	160	570	NA
AMMONIA	----	----	0.75J	----	----	0.077	0.16	----	----	0.03J	----	< 0.03	----	0.12	0.1	----	<0.03	NA
METHANE	3.400	3.500	----	0.99	0.61	0.98	3	0.018	0.027	----	----	0.13	2.300	1.800	1.3	0.017	1.0	NA
PARAMETERS MEASURED IN THE FIELD																		
FERROUS IRON	----	4.100	2.2	2	1.7	2.7	1.9	----	2.500	1.2	0	1.8	----	5.300	NM	0	0.8	NA
pH	6.78	6.68	4.66	6.37	7.1	6.64	8.21	7.06	6.71	4.69	6.47	7.48	6.87	7.81	5.19	6.57	6.85	NA
DISSOLVED OXYGEN	0.00	0.00	10.95	0.88	0.71	0.29	0.21	0.00	0.00	11.17	0.26	0.23	5.70	0.00	9.55	0.16	0.00	NA
OXIDATION REDUCTION POTENTIAL	-79	-101	267	23.7	11.6	-33.4	-132.6	-390	-76	261	207.5	-50.1	-242	-92	226	174.9	-25	NA
CONDUCTIVITY	1.210	0.91	0	1.260	0.997	1.052	1.450	0.839	0.954	0	0.143	0.807	0.607	1.07	0	0.155	1.410	NA
FIELD OBSERVATIONS	----	----	----	----	----	Odor	----	----	----	----	----	----	Odor	Odor	----	Odor	----	----

NOTES:

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SITE 15- 174th FIGHTER WING AIR NATIONAL GUARD
HANCOCK FIELD, SYRACUSE, NY
NYSDEC SITE NUMBER 734054
ERM PROJECT NUMBER 0101326

WELL ID	RW-1					MW-101			MW-102			MW-103			MW-104			NYSDEC
Sample Date	Apr-05	Sep-05	Nov-06	Feb-08	Oct-09	Nov-06	Feb-08	Oct-09	Nov-06	Feb-08	Oct-09	Nov-06	Feb-08	Oct-09	Nov-06	Feb-08	Oct-09	STANDARDS
VOCs (ug/l)																		
BENZENE	----	**2.4**	**1.4J**	----	----	**8.9**	----	----	----	----	----	----	----	**1.3**	----	----	----	1
ETHYL BENZENE	**11.0**	**18**	**60**	**45**	----	**110**	**22**	**7.9**	----	----	----	----	----	----	----	----	----	5
TOLUENE	----	----	0.4J	----	NA	----	----	NA	----	----	NA	----	----	NA	----	----	NA	5
XYLENE	**21.0**	**36.0**	**30**	**60**	----	**230**	**41**	**7.4**	----	----	----	----	----	----	----	----	----	5
MTBE	----	----	----	----	NA	----	----	NA	----	----	NA	----	----	NA	----	----	NA	10
NATURAL ATTENUATION PARAMETERS (mg/l)																		
NITRATE	0.12	----	----	0.18	<0.1	0.72	0.47	<0.1	0.13	0.42	<0.1	0.34	0.32	<0.1	0.38	0.3	<0.1	NA
SULFATE	13.0	19.0	170	6.7	5	44	35	42	50	52	5	27	36	33	39	4.5	41	NA
ALKALINITY	200	310	310	250	310	380	300	360	410	390	340	250	340	330	330	54	370	NA
TOTAL HARDNESS	240.0	310.0	380	280	430	430	420	490	550	520	640	310	360	510	440	22	500	NA
AMMONIA	0.45	0.34	1.1	0.44	0.82	0.12	----	<0.03	UJ	----	<0.03	----	----	<0.03	0.13	0.34	<0.03	NA
METHANE	1.300	1.300	6.3	4.4	1.3	0.63	0.55	0.44	0.026	0.016	0.0084	0.27	0.90	0.0970	0.055	----	0.033	NA
PARAMETERS MEASURED IN THE FIELD																		
FERROUS IRON	1.0	3.2	NM	1.3	2.5	2.8	1.6	1.2	0.6	0.4	1.8	1.2	0.9	2.9	0.2	0.0	2.1	NA
pH	7.11	7.01	6.8	6.90	6.83	5.15	7.82	6.98	4.89	6.93	7.40	4.65	7.12	6.82	7.27	6.99	7.55	NA
DISSOLVED OXYGEN	0.00	0.00	0	0.13	0.00	9.84	0.50	0.00	9.9	0.72	0.16	10.92	0.33	0.00	0	12.38	0.28	NA
OXIDATION REDUCTION POTENTIAL	-129	-166	-200	-248.8	-156	238	-35.2	-103	267	46.3	46.8	275	-48.9	-132	-51	112.3	-70.5	NA
CONDUCTIVITY	0.605	0.999	12.1	0.666	1.100	0	0.731	1.280	0	1.459	1.532	0	1.776	1.420	1.49	0.034	1.674	NA
FIELD OBSERVATIONS	Odor/ Sheen	Odor	Odor	Odor/sheen	Dye Visible/ Odor	Odor/sheen	----	----	----	----	----	----	----	----	----	----	----	----

NOTES:

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HANCOCK FIELD, SYRACUSE, NY
NYSDEC SITE NUMBER 734054
ERM PROJECT NUMBER 0101326

WELL ID	MW-105					MW-106					MW-107					NYSDEC
Sample Date	Nov-06	Feb-08	Apr-09	Aug-09	Oct-09	Nov-06	Feb-08	Apr-09	Aug-09	Oct-09	Nov-06	Feb-08	Apr-09	Aug-09	Oct-09	STANDARDS
VOCs (ug/l)																
BENZENE	**110**	**86**	**6.2**	**3.3**	**16**	----	----	----	----	----	0.52J	----	----	----	----	1
ETHYL BENZENE	**300**	**260**	**120**	----	**8.6**	----	----	----	----	----	**30**	----	----	----	----	5
TOLUENE	----	----	NA	NA	NA	----	----	NA	NA	NA	----	----	NA	NA	NA	5
XYLENE	**480**	**430**	**260**	----	**14**	----	----	----	----	----	0.41J	----	0.27 J	----	----	5
MTBE	----	----	NA	NA	NA	0.34J	----	NA	NA	NA	----	----	NA	NA	NA	10
NATURAL ATTENUATION PARAMETERS (mg/l)																
NITRATE	0.11	0.29	0.21	----	<0.1	----	0.12	----	----	<0.1	1.1	2.6	2.1	0.41	0.54	NA
SULFATE	6.3	5.6	8.1	25	14	28	42	49	48	36	17	12	15	45	42	NA
ALKALINITY	270	420	380	320	360	420	340	390	340	340	290	100	200	190	180	NA
TOTAL HARDNESS	370	320	370	370	460	430	410	450	550	380	360	120	200	510	330	NA
AMMONIA	0.054	----	----	----	<0.03	UJ	----	----	----	<0.03	0.099	----	---	---	<0.03	NA
METHANE	3.3	7.8	2.8	1.5	0.51	0.14	0.07	0.051	0.28	0.045	0.29	----	0.0049	0.033	0.057	NA
PARAMETERS MEASURED IN THE FIELD																
FERROUS IRON	2.2	1.1	3.5	0.8	2.9	0	0.0	0.8	0.0	0.0	1.6	0.0	0.0	5.2	3.5	NA
pH	4.64	6.97	7.39	7.21	7.77	7.32	7.35	6.97	7.53	7.38	5	6.88	6.92	7.62	7.49	NA
DISSOLVED OXYGEN	11.09	0.38	0.29	2.95	0.38	0	0.19	0.23	0.26	0.14	10.45	7.57	4.89	2.57	2.24	NA
OXIDATION REDUCTION POTENTIAL	272	-66.1	-43.1	86.1	-107.1	-20	-58.7	-5.3	10.1	-6.0	255	99.8	21.4	-21.7	-17.7	NA
CONDUCTIVITY	0	0.567	817	0.956	1.128	1.66	0.558	1.404	0.850	0.854	0	0.490	0.845	0.915	1.238	NA
FIELD OBSERVATIONS	Odor/sheen	Odor	Odor	Oxidant in H2O	----	----	----	----	----	----	----	----	----	----	----	----

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NYSDEC SITE NUMBER 734054
ERM PROJECT NUMBER 0101326

WELL ID	MW-108		MW-109		MW-110		MW-111				MW-112				MW-113		MW-114		NYSDEC
Sample Date	Feb-08	Oct-09	Feb-08	Oct-09	Feb-08	Oct-09	Feb-08	Apr-09	Aug-09	Oct-09	Feb-08	Apr-09	Aug-09	Oct-09	Feb-08	Oct-09	Feb-08	Oct-09	STANDARDS
VOCs (ug/l)																			
BENZENE	----	----	----	----	----	----	----	----	----	----	----	**13**	**6.9**	**< 10**	----	----	----	----	1
ETHYL BENZENE	----	----	----	----	----	----	----	----	----	----	**410**	**250**	**300**	**48**	----	----	----	----	5
TOLUENE	----	NA	----	NA	----	NA	----	NA	NA	NA	----	NA	NA	NA	NA	NA	NA	NA	5
XYLENE	----	----	----	----	----	----	----	----	----	----	**740**	**480**	**170**	**<20**	----	----	----	----	5
MTBE	----	NA	----	NA	----	NA	----	NA	NA	NA	----	NA	NA	NA	NA	NA	NA	NA	10
NATURAL ATTENUATION PARAMETERS (mg/l)																			
NITRATE	0.39	<0.1	0.66	<0.1	----	<0.1	----	----	----	<0.1	----	----	----	1.4	----	<0.1	----	<0.1	NA
SULFATE	41	44	70	65	41	57	65	45	48	49	19	11	11	8.4	11	62	11	56	NA
ALKALINITY	400	380	410	340	370	380	350	360	330	360	370	360	330	340	330	470	330	350	NA
TOTAL HARDNESS	510	540	460	420	450	570	410	490	600	540	380	570	530	510	530	540	530	400	NA
AMMONIA	< 0.03	< 0.03	< 0.03	< 0.03	----	< 0.03	----	----	----	< 0.03	----	----	----	0.051	----	< 0.03	----	< 0.03	NA
METHANE	0.018	0.0082	0.28	0.0078	0.048	0.061	0.044	0.040	0.051	0.039	7.2	3	1.6	1.4	1.6	0.021	1.6	0.0044	NA
PARAMETERS MEASURED IN THE FIELD																			
FERROUS IRON	1.6	1.2	0.0	0.2	0.4	0.0	0.0	0.0	0.2	0.0	1.3	2.1	2.2	0.0	1.7	1.5	1.8	1.4	NA
pH	6.92	6.93	6.95	7.49	7.14	7.54	7.23	7.34	7.24	7.21	7.25	8.30	6.57	7.33	7.06	7.19	6.90	7.12	NA
DISSOLVED OXYGEN	0.39	0	0.04	0.68	0.11	0.17	0.10	0.28	0.33	0.15	0.42	0.16	0.37	0.26	0.30	0.00	0.14	0.00	NA
OXIDATION REDUCTION POTENTIAL	27.6	-61	162.5	59.1	0.4	30.7	14.7	22.3	28.8	27.9	-110.2	-74.6	-71.3	21.5	-57.8	-42.7	-43.3	-112	NA
CONDUCTIVITY	1.033	2.16	1.269	1	0.970	1.311	0.725	0.848	1.199	1.750	0.599	0.855	15.890	1.481	1.349	1.863	1.055	1.38	NA
FIELD OBSERVATIONS	----		----	----	----	----	----	----	----	----	Odor	Odor	Odor	Odor	----	----	artesian	artesian	----

NOTES:

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Sheen= Sheen on purge water and/or sample

TABLE 2-2

Final
Chemicals of Concern in Groundwater at Site 15

Chemical	Highest Level Detected (mg/l)	Groundwater Quality Standards* (mg/l)
Benzene	0.049	0.001
Ethylbenzene	0.380	0.005
Xylenes	0.420	0.005

Notes:
Highest Level Detected Data is from the October 2009 Sampling Event described in the 2010 Final Technical Memorandum on 2009 Supplemental Remedial Investigation.
mg/L – milligrams per liter
* *NYSDEC Division of Water Technical and Operational Guidance Series Memorandum Number 1.1.1* (TOGS 1.1.1; NYSDEC 2000).Class GA. and DER-10 (NYSDEC 2010)

TABLE 2-3 - Final
Evaluation of Potential Remedial Technologies
174th Fighter Wing
New York Air National Guard
Hancock Air National Guard Base
Syracuse, New York

TECHNOLOGY	DESCRIPTION	ABILITY TO MEET RAOs*	EFFECTIVENESS	IMPLEMENTABILITY	Technology Carried Forward?
Institutional Controls - Notice	This technology involves filing a Notice preventing the use of Site groundwater as drinking water.	This technology meets the following RAOs: SRAO1 and GWRAO1.	This technology would need to be used in conjunction with other technologies to be effective.	This technology may be difficult to implement. ANG does not own all the properties within the affected BEX plume, and cannot add restrictions to those property deeds. Notice issues would have to be coordinated with several property owner's and therefore, would difficult it's implementability.	**Yes - Alternatives 3 and 4 only**
Institutional Controls - Part 5 of NYSDOH Sanitary Code	Part 5 of the New York State Department of Health State Sanitary Code prevents installation of a private potable water supply well in areas that are served by a public water supply system.	This technology meets the following RAOs: SRAO1 and GWRAO1.	This technology would need to be used in conjunction with other technologies to be effective.	All the properties within the BEX affected plume are supplied by a public water system, therefore, this part of the code is readily implementable and would continue to be enforced by NYSDOH. preventing contact with the BEX-affected groundwater.	**Yes**
Soil Excavation	This technology involves the excavation of the residual grossly affected soil identified in the Site 15 source area.	This technology meets the following RAOs: SRAO1, SRAO2 and GWRAO3.	Excavation is a conventional technology that is expected to be effective for removal of grossly affected soil in the source area.	Soil excavation would require clearing of the area and mobilization of heavy equipment. No space constraints exist at the Site that would prevent mobilization of heavy equipment. This technology is, therefore, readily implementable.	**Yes**
Monitored Natural Attenuation (Ground Water Monitoring)	Relies on natural processes to breakdown ground water contaminants. Natural attenuation processes include physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce mass, toxicity, mobility, volume.	This technology meets the following RAOs: GWRAO1 and GWRAO2.	Evaluation of contaminant trends and geochemical parameters indicates that natural attenuation through aerobic and anaerobic biodegradation is occurring within the plume. On site, groundwater concentrations are showing decreasing trends and MNA will be an effective technology for meeting RAOs within an acceptable timeframe, especially when combined with additional source area soil removal. Offsite, however, the rate of attenuation may not be sufficient to achieve RAOs within an acceptable timeframe.	MNA is readily implementable. Demonstration of MNA requires significant sampling frequency and parameters, which is currently underway at the site.	**Yes**
Aerobic Biological Treatment using Solid Peroxide.	The solid peroxide is applied as a slurry through injection wells or direct push points arrayed as a grid for treatment of a source zone or dissolved plume, or as rows of points to form a biological barrier against further downgradient flux of contaminants. Solid peroxide hydrolyzes to release oxygen that will support aerobic biological degradation of the VOCs. Solid peroxides, if applied in sufficient mass, typical persist for six months to three years before reapplication is required.	This technology meets the following RAOs: GWRAO1, GWRAO2, GWRAO4 and GWRAO5.	The biodegradation evaluation concluded that aerobic biological degradation is occurring at the site, but is limited by the availability of oxygen. This technology can effectively treat the dissolved plume, residual source areas (after grossly contaminated material is removed), and downgradient flux of contaminants.	The equipment and construction methods required for the injection of peroxide slurry through wells or direct-push points are readily available and easily implemented. Preferential flow paths and areas of low conductivity may limit the ability to distribute the peroxide slurry radially away from the injection point and the solid peroxide may need to be injected more frequently than projected by vendors (once every 2 to 3 years). These limitations can be overcome by conducting a pilot test to evaluate effectiveness parameters and/or by reducing the grid spacing for the injections. This technology can also be easily scaled up to treat additional areas or scaled down as the plume shrinks over time.	**Yes**
Aerobic Biological Treatment using Air Sparging	The injection of air under pressure into wells screened at the bottom of the impacted aquifer unit will provide oxygen to support aerobic biological degradation of the VOCs. The wells can be arrayed as a grid for treatment of a source zone or dissolved plume, or as rows of points to form a biological barrier against further downgradient flux of contaminants. A soil vapor extraction system would be used to capture VOCs that are stripped by the sparge air but not completely degraded.	This technology meets the following RAOs: GWRAO1, GWRAO2, GWRAO4 and GWRAO5.	The biodegradation evaluation concluded that aerobic biological degradation is occurring at the site, but is limited by the availability of oxygen. This technology can effectively treat the dissolved plume, residual source areas (after grossly contaminated material is removed), and downgradient flux of contaminants.	The equipment and construction methods required for air sparging are readily available and easily implemented. Preferential flow paths and areas of low conductivity may limit the ability to distribute the air radially away from the injection point; however, the effective radius of influence can be determined by pilot testing. Although the number of operating sparge points can be reduced over time as the plume shrinks, this technology has less flexibility to be scaled up or down over time without incurring additional capital expenses. Capital and O&M expenses for air sparging technologies are generally much larger than technologies involving direct push injections.	No

TABLE 2-3 - Final
Evaluation of Potential Remedial Technologies
174th Fighter Wing
New York Air National Guard
Hancock Air National Guard Base
Syracuse, New York

TECHNOLOGY	DESCRIPTION	ABILITY TO MEET RAOs*	EFFECTIVENESS	IMPLEMENTABILITY	Technology Carried Forward?
Enhanced Anaerobic Bioremediation	Anaerobic biodegradation of the VOCs can be enhanced by the addition of an anaerobic electron acceptor, which is typically either nitrate or sulfate. Nitrate and sulfate salts are highly soluble in water and can be provided through either batch or continuous addition. This technology can be used either for source, dissolved plume or barrier treatment.	This technology would not meet the applicable GW RAOs.	The biodegradation evaluation concluded that anaerobic biological degradation through sulfate reduction and iron reduction is occurring at the site and that these are the main naturally occurring processes. Based on this evaluation, anaerobic bioremediation using sulfate reduction would be an effective technology to treat the dissolved plume on site, but the offsite rate of degradation might not be sufficient to prevent the continued migration in the more permeable zone. This technology may also be less effective for treating benzene, since benzene is more recalcitrant to anaerobic biological degradation than ethylbenzene or xylenes.	The equipment and construction methods required for the direct-push injection of sulfate or nitrate are readily available and easily implemented. Preferential flow paths and areas of low conductivity may limit the ability to distribute sulfate radially away from the injection point and the rate of consumption of sulfate can not be easily predicted. However, the effective radius of influence persistence of sulfate can be determined by pilot testing.	No
Permanganate Oxidation	This technology includes in situ chemical oxidation of VOCs using potassium permanganate, with follow-up MNA as necessary	This technology may not meet the following RAOs, GWRAO1, GWRAO2, GWRAO4 and GWRAO5.	Permanganate is an effective oxidant for the treatment of VOCs such as ethylbenzene and xylenes, but is less effective for the treatment of benzene.	The equipment and construction methods required for the direct-push injection of potassium permanganate are readily available and easily implemented. Preferential flow paths and areas of low conductivity will dictate where injected potassium permanganate will flow, which could result in portions of the treatment area not receiving injected material. This can be overcome by conducting a pilot test to evaluate effectiveness parameters and/or by reducing the grid spacing for the direct-push injections.	No

(*) **Soil RAOs**

SRAO1 - Prevent ingestion, direct contact, and/or inhalation of/with soil that poses a risk to public health and the environment given the intended use of the Site; and
SRAO2 - Prevent inhalation of or exposure from COPCs volatilizing from soil that poses a risk to public health and the environment given the intended use of the Site.

(*) **Ground water RAOs**

GWRAO1 - Prevent exposure to contaminated ground water containing BTEX concentrations above the NYSDEC Ambient Water Quality Standards and Guidance Values (that poses a risk to public health and the environment given the intended use of the Site)
GWRAO2 - Prevent or minimize further migration of the contaminant plume (plume containment).
GWRAO3 - Prevent or minimize further migration of contaminants from source materials to ground water (source control).
GWRAO4 - Enhance the natural process for the attenuation of BTEX compounds on-site and off-site.
GWRAO5 - Prevent inhalation of or exposure from COPCs volatilizing from groundwater that poses a risk to public health and the environment given the intended use of the Site.

Table 2-4 – Alternative Cost Estimates

Final

No.	Remedial Action Alternative	Total Incurred Capital Costs	Total Capital Costs to be Incurred	Total O&M NPV Cost	Total NPV Cost
		A	B	C	B + C
1	No Further Action	$0	$0	$0	$0
3	Source Removal + Focused Enhanced Aerobic Bioremediation + MNA	$607,000	$165,985	$507,244	$673,229
4	Source Removal + Extended Enhanced Aerobic Bioremediation + MNA	$607,000	$421,164	$512,349	$933,514