

**Report on Implementation of
Remedial Action at Landfill 1 AOC**

**Former Griffiss Air Force Base
Rome, NY**

September 2009



Air Force Real Property Agency



DEPARTMENT OF THE AIR FORCE
AIR FORCE REAL PROPERTY AGENCY

17 September 2009

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SUBJECT: Griffiss Landfill 1 Closure

1. Attached is the Report on Implementation of Remedial Action at Landfill 1.
2. If you have any questions, please contact Cathy Jerrard at (315) 356-0810 ext. 204.

A handwritten signature in black ink, appearing to read "Michael F. Mc Dermott", with a long horizontal flourish extending to the right.

MICHAEL F. MCDERMOTT
BRAC Environmental Coordinator

Attachment: As Noted

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**REPORT ON IMPLEMENTATION OF REMEDIAL ACTION AT
LANDFILL 1
Former Griffiss Air Force Base, Rome, New York**

1 INTRODUCTION AND SITE BACKGROUND

The purpose of this report is to document the implementation of remedial actions for the Landfill 1 Area of Concern (AOC) at the former Griffiss Air Force Base (AFB). Detailed information regarding specific variations to the implementation of remedial actions can be located in the Final Landfill 1 Cover Improvements, Engineer's Certification Report (Conti/EA, February 2005) and Landfill 1 Cover Improvements Engineer's Certification Report Addendum (Conti, September 2006). The Engineer's Certification Report is utilized to document the remedy implementation in accordance with the design, noting any variances, and was completed in conformance with the United States Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC) approved Closure Plan for Landfill 1 (Conti/EA, October 2002).

1.1 Site History

Landfill 1 is an unlined landfill comprising approximately 22 acres. The landfill is located in the northeastern portion of the former Griffiss AFB on the east side of Six Mile Creek, northeast of the flight line, and within the Six Mile Creek Drainage Basin. The landfill is bounded by the installation boundary on the north side, regulated wetlands on the east side, Six Mile Creek and regulated wetlands on the west side, and woodlands on the south side (FPM, May 2009). Figure 1 illustrates the landfill boundary and the locations of existing monitoring wells.

The sources of potential contamination at Landfill 1 are an estimated 90,000 to 100,000 cubic yards of waste, reportedly consisting of general refuse, hardfill, and boiler ash which were buried using trench and cover methods at the site between 1960 and 1973. Unlabeled 55-gallon drums were also discarded in the landfill; these, along with the miscellaneous debris including metallic and sheetrock components along the margin of the landfill, were evident in the site visit conducted in 1982 (Law, December 1996). Debris from a fire that occurred in the Base commissary in 1973 was buried in the western area of the landfill near the intersection of the unpaved access road and Six Mile Creek. Portions of the landfill were capped in the 1970s. In 1984, the same portions of the landfill were regraded and re-capped with clay and other soils.

1.2 Characterization Results

Preliminary studies of Landfill 1 were performed in 1982, 1991, 1992, and 1993. Groundwater investigations conducted by Roy F. Weston, Inc. in 1982 and by the United States Air Force (USAF) in 1991 detected benzene, chlorobenzene, ethylbenzene, and phenol exceeding New York State (NYS) Groundwater Standards (Law, December 1996). In 1992 and 1993, the USAF detected chlorinated volatile organic compounds (VOCs) (1,1,1-trichloromethane, chlorobenzene, and methylene chloride), petroleum hydrocarbon-related VOCs (benzene, ethylbenzene and xylenes) and acetone above NYS Groundwater Standards; glycols levels also exceeded the NYS Groundwater Standard of 0.05 milligrams per liter (mg/L) (Law, December 1996). Inorganic constituents exceeding NYS Groundwater Standards included manganese,

zinc, lead and cadmium; however, concentrations of most detected metals were within the range of concentrations encountered at other sites on the former Griffiss AFB.

1.2.1 1994/1995 Remedial Investigation

The Remedial Investigation (RI) was performed in 1994/1995 by Law and involved the collection of numerous soil, landfill leachate, surface water, and groundwater samples for contamination evaluation.

During the RI, three downgradient wells at the southwestern slope of the landfill (LF1MW-5, -101, and LF1P-2) were found to contain a number of VOCs. These wells are located along an axis parallel to the southwesterly groundwater flow direction. Monitoring well LF1MW-101, which lies the most hydraulically upgradient and closest to Landfill 1, was the most contaminated of the three downgradient wells. Concentrations were reported of 192 µg/L trimethylbenzenes, 110 µg/L xylenes, 7.2 µg/L 1,4-dichlorobenzene, 11 µg/L chlorobenzene, and 12 µg/L ethylbenzene. Monitoring well LF1P-2, located approximately 175 feet downgradient of LF1MW-101, was the least contaminated of the three wells and had reported concentrations of 18 µg/L trimethylbenzenes, 1.4 µg/L benzene, and 11 µg/L xylenes. Monitoring well LF1MW-5 is an additional 240 feet downgradient and across Six Mile Creek and was reported with concentrations of 102 µg/L trimethylbenzenes, 6 µg/L benzene, and 63 µg/L xylenes (Law, December 1996).

Landfill leachate samples were also collected during the RI (LF1LL-1, LF1LL-2). Several VOCs, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,4-dichlorobenzene, benzene, chlorobenzene, ethylbenzene, isopropylbenzene, naphthalene, n-propylbenzene, and total xylenes were detected at elevated concentrations. Analyses of the surface water conditions during the RI showed no VOC exceedances of the potential surface water applicable or relevant and appropriate requirements (ARARs).

A geophysical investigation was also performed during the RI. Geophysical data were collected on an extensive grid, which included the entire area of the landfill. The results of the geophysical survey indicated the presence of numerous discrete anomalies distributed widely throughout the surveyed area. The anomalies were concentrated in eight primary trench locations, as well as numerous discrete subsurface disposal locations dispersed in the vicinity of the trenches (Law, December 1996).

1.2.2 1997 Supplemental Investigation

Ecology and Environment (E&E) performed a base-wide Supplemental Investigation (SI) in 1997. Based on the geophysical data from the RI, test pits were dug during the SI at locations where anomalous geophysical indicators suggested buried drums, but none were discovered. Also during the SI, a partially buried drum, found north of the Small Arms Range in Landfill 1, was removed and surrounding stained soils were excavated, removed and disposed of at a permitted facility in January 1998. Confirmatory soil sampling indicated no residual contamination (E&E, November 1998).

1.2.3 1997 Landfill Cover Investigation

A Landfill Cover Investigation performed in 1997 (Law, December 1997) further defined the areal extent of the landfill and the landfill boundary and revealed that the thickness of the landfill soil cover generally ranged from 1 to 4 feet. Debris was encountered by augering at depths ranging from 2 to 4 feet. At some locations, auger borings extended to 4 feet but failed to penetrate through the cover to the landfill materials. The southwestern corner of the landfill contained areas where the debris, consisting of household and office waste and construction and demolition debris, was exposed at the surface. Along the northeastern portion of the landfill, fine black ash was found underlying the soil cover at depths ranging from 2 to 4 feet or greater (Law, December 1996). As a follow-up to the Landfill Cover Investigation, 14 exposed empty drums and surrounding soils were excavated and transferred to Landfill 2/3 for consolidation. After the excavation activity, visual inspection and verification sampling using a photo-ionization detector (PID) indicated no residual contamination (IT, November 1999).

1.2.4 1999 Baseline Study

FPM performed a Baseline Study at the landfills in 1999. Vertical profile temporary wells LF1TW-1, -2, -3, and -4 were installed southwest of the landfill in January 1999. Vertical profile temporary well LF1TW-5 was also installed in April 1999. Because VOCs only minimally exceeded the NYS ARARs in these wells, it was concluded that the VOC plume is localized within 750 feet of the southwestern boundary of the landfill. Only benzene was detected above NYS Groundwater Standards (at 1.3 µg/L) in well LF1TW-1 at 20 ft bgs; however, the presence of benzene was suspected to be field activities-related (FPM, July 2000).

Across the four sampling rounds in 1999, LF1MW-101 showed a general decrease in VOC concentrations, while both LF1P-2 and LF1MW-5 showed a slight increase in corresponding concentrations. By the last sampling round in November 1999, levels exceeding NYS Groundwater Standards were measured in all three wells for 1,2,4-trimethylbenzene, xylene (m+p), and benzene, in LF1MW-101 and LF1MW-5 for 1,3,5-trimethylbenzene, and in LF1MW-101 only for 1,4-dichlorobenzene and chlorobenzene (FPM, July 2000).

Generally, the Baseline Study showed that VOC concentrations are stabilizing or generally decreasing as compared to those results recorded during the RI (Law, December 1996). Time-series analyses of each of the VOCs confirmed the longitudinal axis of a VOC plume along a flow orientation intercepted by wells LF1MW-5, -101, and LF1P-2. The absence of VOCs from downgradient temporary wells and cross-gradient wells aided in the delineation of the lateral extent of the VOC contamination plume (FPM, July 2000).

Additional VOCs that were detected in either permanent or temporary wells associated with Landfill 1 but decreased to levels below ARARs by the November 1999 sampling round included isopropylbenzene, n-propylbenzene, p-isopropyltoluene, tert-butylbenzene, and toluene. With the exception of one isolated detection in LF1TW-1 at 20 ft bgs at 2.04 µg/L, all vinyl chloride exceedances above the NYS Groundwater Standard were reported in monitoring well LF1MW-101 only. Concentrations varied from 2.25 µg/L to 4.45 µg/L over the four sampling rounds (FPM, July 2000).

Inorganic metals were also detected in excess of NYS ARARs during the Baseline Study. Elevated concentrations were found in one or more wells for antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, selenium, sodium, thallium, vanadium, and zinc. Elevated levels of iron and manganese were reported at upgradient well LF1MW-1, which indicates these metal exceedances are part of background conditions. The presence of sodium and magnesium at elevated levels in some downgradient permanent monitoring wells and temporary wells may have resulted from the landfill leachate as described below (FPM, July 2000).

Surface water samples were collected from Six Mile Creek downgradient from the southwestern toe of the landfill during all four rounds of the Baseline Study to determine whether contamination was potentially leaving the Landfill 1 AOC. VOCs detected above NYS Class A Surface Water Standards included 1,2,4-trimethylbenzene at 5.79 µg/L at LF1SW-2, 1,4-dichlorobenzene at 4.77 µg/L and 3.12 µg/L at LF1SW-1 and LF1SW-2, respectively, and benzene at 1.93 µg/L at LF1SW-1. All exceedances were reported during the August 1999 sampling round. In addition, aluminum, iron, and manganese were detected above ARARs at all three sampling locations during at least one sampling round (FPM, July 2000).

All four sampling rounds of the Baseline Study showed alkalinity, hardness, and total dissolved solids (TDS) levels in the downgradient temporary/permanent well samples that exceeded those levels measured in the background wells. These results indicated a landfill leachate plume spreading in an area broader than the wells contaminated with VOCs. The water quality analyses indicated a shallow landfill leachate plume with a flow path towards the southwest, which may discharge to Six Mile Creek, based on the results of elevated concentrations of the landfill leachate indicators in samples LF1-L1 and LF1-L2 (FPM, July 2000).

2 REAL ESTATE ISSUES

2.1 Property Proposed for Transfer

This document will be used in conjunction with the preparation and submission of a Finding of Suitability to Transfer (FOST), as required in Section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for transfer of the Landfill 1 AOC property. A complete description of the Landfill 1 AOC can be found in the Landfill 1 AOC ROD (E&E, March 2000).

2.2 Institutional Controls/Deed Restrictions

CERCLA Section 120 (h)(3) requires that deeds transferring property where hazardous substances had been stored, released or disposed of, shall contain a covenant warranting that “all remedial action necessary to protect human health and the environment with respect to any (hazardous) substance remaining on the property has been taken before the date of such transfer.” CERCLA Section 120 (h)(3) was amended in October 1992 to add language stating that all necessary actions have been taken “if the construction and installation of an approved remedial design has been completed and the remedy has been demonstrated to the (EPA) Administrator to be operating properly and successfully.”

The Air Force Real Property Agency (AFRPA) has implemented land use controls at the Landfill 1 AOC. The AFRPA plans on maintaining Landfill 1 as open space (non-residential) throughout the post-closure period as required by the ROD. Once the property is deeded, the land use controls will be recorded as deed restrictions.

Land use controls and signage are implemented and enforced during the 30-year post-closure maintenance period. Through land use controls, the property owner is restricted as follows:

- Groundwater extraction/ utilization/ consumption by any current or future landowner within the groundwater restriction area (see Figure 2) will not be permitted without prior testing and written approval from the New York State Department of Health (NYSDOH).
- Activities that disrupt or interfere with the post-closure activities will not be permitted.
- Intrusive work within the intrusive area will not be permitted without prior written approval from the AFRPA, NYSDEC, and the USEPA.

Signs erected during closure construction will serve to minimize the potential for interference with closure and post-closure activities. Signs have been posted along the landfill property boundary that read “SOLID WASTE LANDFILL – CONTAINS HAZARDOUS SUBSTANCES – NO TRESPASSING.”

Monitoring and enforcement of the institutional controls is accomplished through landfill site inspections. Contingency maintenance activities are addressed through the Landfill 1 Post-Closure Operations and Maintenance Manual (Conti/EA, January 2005) and Landfill 1 Post-Closure Operations and Maintenance Manual Addendum (Conti/EA, May 2006).

2.3 Adjacent properties

A Small Arms firing range is located adjacent to the south boundary of Landfill 1. The north boundary of Landfill 1 is bounded by the property boundary. Jurisdictional wetlands are present outside the landfill on the east and west sides of the landfill. Two habitats of special concern are associated with Landfill 1: (1) A white-cedar-dominated rich sloping fen adjacent to the Landfill 1 wetlands on the east side, and (2) a hemlock-hardwood swamp located in a mature forest occurring hydraulically upgradient of Landfill 1 (New York Natural Heritage Program, January 1996). Groundwater flow is generally to the southwest across site. Surface water eventually drains into Six Mile Creek.

3 DOCUMENTATION OF REMEDIAL ACTION IMPLEMENTATION

3.1 Record of Decision

The Landfill 1 ROD was issued after public comment period (July 20, 1999 to August 19, 1999). A public meeting on the proposed plan for remedial action was held on August 10, 1999. The ROD was signed on March 30, 2000 by the Air Force and June 5, 2000 by the EPA, with concurrence from the NYSDEC.

The Landfill 1 ROD presented in the following remedial action objectives (RAOs) to address existing and future potential threats to the environment posed by Landfill 1:

- Consolidation of various debris and waste areas into the main landfill boundary in order to reduce the area to be capped and the potential for nearby wildlife and human populations to be exposed to the landfill mass;
- Significantly reduce infiltration of rainwater and snow-melt water through the landfill mass in order to minimize the potential for leachate generation and groundwater contamination;
- Monitoring the groundwater and stream environment (which may include, but it is not necessarily limited to, sediment, surface water, and biota) downgradient of the site to evaluate the effectiveness of the presumptive remedy; and
- Collection and treatment of groundwater/leachate in order to reduce or eliminate the discharge of contaminants to the environment.

To address the RAOs listed above, the presumptive remedy (i.e., preferred alternative) in the Landfill 1 ROD called for:

- Implementation of institutional controls in the form of deed restrictions within the main landfill boundary and for affected groundwater to prohibit use of the area and groundwater, and to ensure the impermeable cover is not damaged and the area is maintained as a landfill;
- Preparation of the landfill surface prior to providing cover materials. The landfill cover will be cleared and grubbed, and low areas will be backfilled. The landfill surface also will be regraded to prevent future erosion or ponding. Any rare plants, significant natural communities, or wetlands disturbed during the remedial action will be restored;
- Decommissioning of monitoring wells located within the construction limits;
- Collection of groundwater/leachate from a trench located at the landfill toe. Groundwater flow will be collected in a trench and then pumped to a treatment facility. Groundwater from the collection trench will enter a vault, where a pump will move the groundwater up to the treatment facility (See Section 3.1.1 for ROD Amendment).
- Treatment of collected groundwater by a carbon-adsorption system. A liquid-phase, activated-carbon system will remove contaminants of concern in the leachate. The treated water will be discharged on site to Six Mile Creek. All water to be discharged will be in compliance with the New York State Pollution Discharge Elimination System (SPDES) requirements (See Section 3.1.1 for ROD Amendment).
- Installation of an impermeable cover in accordance with 6 New York Codes, Rules and Regulations (NYCRR) Part 360 landfill closure regulations, dated November 26, 1996.

This action would include placing a gas venting layer, a geomembrane cover and a barrier protection layer over the entire landfill to reduce the amount of water infiltrating through the landfill. The cover at Landfill 1 will consist of a foundation layer, gas-venting layer, geomembrane, drainage layer, geotextile, barrier protection layer, and topsoil layer. The foundation layer will consist of borrow soils placed to establish the final contour and slope requirements. Other component details include: a passive gas-venting layer with trenches and gas vents; a 40-mil-thick geomembrane that will serve as the impermeable layer required by 6 NYCRR Part 360; a six-inch-thick drainage layer placed above the geomembrane primarily to drain water from the overlying soil; a geotextile placed above the drainage layer to restrict the movement of fine particles; and an 18-inch-thick barrier protection layer consisting of borrow soils placed above the geotextile to support vegetative growth and prevent penetration of the geomembrane. Six inches of topsoil will be placed above the barrier protection layer to support vegetation;

- Maintenance of the impermeable cover and long-term monitoring of the groundwater, surface water, and sediment in accordance with 6 NYCRR Part 360, the landfill post-closure regulations dated November 26, 1996;
- Long-term monitoring of the groundwater and stream environment downgradient of the site to evaluate the effectiveness of the Presumptive Remedy; the groundwater will be monitored in accordance with the Air Force's On-base Groundwater Monitoring Plan and the stream environment will be monitored in accordance with the Six Mile Creek AOC work plan; both plans will be subject to the approval of the EPA and NYSDEC;
- Monitoring the groundwater and stream environment (which may include, but is not limited to, sediment, surface water, and biota) downgradient of the site to evaluate the effectiveness of the presumptive remedy; and
- Evaluation of site conditions at least once every five years to ensure that the remedy is protective of human health and the environment.

The presumptive remedy provides adequate protection from exposure to groundwater by limiting the future use of the landfill through the implementation of institutional controls. The installation of the impermeable cover will eliminate the possibility of human exposure to the landfill mass and reduce the amount of water infiltration through the landfill. The landfill cover will also reduce leachate generation and transportation of contaminants from the landfill to Six Mile Creek through groundwater migration. In addition, if leachate discharges are observed during routine walkovers of the landfill, this information will be documented on the inspection form and samples will be collected. This information and sample results would be included in the subsequent monitoring reports to EPA and NYSDEC.

Groundwater monitoring will be conducted to assure that there is no further contaminant migration and that groundwater standards will be achieved over time.

A separate Basewide Wetlands Management Plan was prepared, with consideration from the United States Army Corps of Engineers (USACE), EPA, and NYSDEC, to evaluate disturbances

at all AOC wetlands located on base. As stated in the ROD, any wetlands disturbed during the remedial action would be restored.

3.1.1 Record of Decision Amendment

A ROD Amendment for Landfill 1 was issued after public comment period (September 25, 2008 to October 25, 2008). A public meeting on the revised Landfill 1 proposed plan was held on October 8, 2008. The ROD Amendment was signed on (date to be inserted), by the Air Force and the EPA, with concurrence from the NYSDEC.

As specified in the June 2000 ROD, the presumptive remedy at the Landfill 1 AOC included the installation of a groundwater/ leachate collection and treatment system. The system was selected because of the presence of VOCs and metals in the groundwater at the AOC. A groundwater/ leachate collection trench performance test (Conti/EA, February 2004) and four subsequent sampling rounds (FPM, January 2007) indicated an overall stabilization and/or decreasing trend of AOC contaminant concentrations. Quarterly groundwater monitoring from 2003 to 2008 indicated a Site-wide stabilization of all chemicals of concern (COCs), as reported in the Long-Term Monitoring Report (FPM, May 2009). Analysis of the results of the performance test and groundwater sampling resulted in a determination that the groundwater/ leachate collection system is not necessary to ensure the protection of public health and the environment.

3.2 Remedial Design

The final design for Landfill 1 cover improvements included the clearing of vegetation from the cap, grubbing, subgrade preparation, placement of a 12-inch barrier protection layer and a geocomposite drainage layer, placement of a 6-inch layer of topsoil, and installation of erosion control features. In addition, provisions were made to install a leachate collection and treatment system to control leachate outbreaks and prevent them from adversely affecting the landfill cover or threatening surface waters (Conti/EA, August 2003). Details of the remedial design are presented in the Landfill 1 Cover Improvements, Engineer's Certification Report (Conti/EA, February 2005).

Prior to the installation of any of the cap components, common borrow fill material was placed on Landfill 1 to achieve the design grades. The primary source of borrow fill material was from Strategic Air Command (SAC) Hill on the former Griffiss AFB. A portion of the fill material used at Landfill 1 consisted of soil/ debris from various on-base projects, including: approximately 3,500 cubic yards of material from Apron 1 and approximately 175 cubic yards of material from Bunker 905.

The final design of the Landfill 1 cap met the substantive requirements of 6 NYCRR Part 360 landfill closure regulations, dated November 26, 1996, and the requirements of the ROD for Landfill 1 (E&E, February 2000).

3.3 Remedial Action Construction

In October 2002, the final versions of the Landfill 1 Closure Plan, Project Work Plan, Site Safety Health Plan, Contractor Quality Control Plan (CQCP), and Sampling and Analysis Plan were approved by USACE. These documents were subsequently approved by the EPA and NYSDEC.

Field work was initiated in October 2002. The final design included clearing and grubbing of vegetation, subgrade preparation (including placement of common borrow material to achieve minimum grades), placement of a geosynthetic gas venting layer, installation of gas vents and gas monitoring probes, installation of a 40-mil linear low density polyethylene (LLDPE) geomembrane, installation of a geocomposite drainage net, installation of a geosynthetic geogrid, placement of a 12-inch barrier protection layer, placement of a 6-inch topsoil layer, seeding and mulching, installation of a leachate collection and treatment system, and monitoring well decommissioning. Details of field modifications during construction can be found in the Landfill 1 Cover Improvements, Engineer's Certification Report (Conti/EA, February 2005) and Landfill 1 Cover Improvements Engineer's Certification Report Addendum (Conti, September 2006).

Prior to the cap construction activities, Conti installed a decontamination pad at the southeast corner of the landfill, northwest of the firing range in accordance with the Closure Plan (Conti/EA, October 2002). Upon completion of the landfill construction activities, the pad was removed and disposed of in accordance with the project requirements. In addition, erosion and sedimentation control measures were taken prior any intrusive construction activities and the clearing of vegetation from within the limit of waste.

Construction activities at the landfill included a limit of waste verification along the northern boundary of Landfill 1. During the limit of waste evaluations, three additional areas adjacent to the landfill's northeast, east, and west boundary were identified. These areas were identified in the Landfill 1 Closure Plan Addendum (Conti/EA, August 2003). Waste from these areas was removed and consolidated within the Landfill 1 limit of waste. The cap components at Landfill 1 were constructed over the revised limit of waste (Conti/EA, January 2007). Details of the minor variations are documented in Section 2.3.2 of the Engineer's Certification Report. Soil samples collected during the limit of waste verification [analyzed for VOC, semi-volatile organics (SVOCs), polychlorinated biphenyl (PCBs), pesticides, cyanide, and total analyte list (TAL) metals and compared to NYSDEC Technical Guidance Memorandum (TAGM) 4046] showed no exceedances for any of the COCs, with the exception of a few metals. The metal exceedances were attributed to site background conditions.

As documented in the Closure Plan, a passive gas collection and venting system was included in the closure design for Landfill 1 in accordance with 6 NYCRR Part 360-2.13(p)(2) (Conti/EA, October 2002). Passive gas vents were installed at Landfill 1 at a minimum frequency of 1 per acre. A total of 22 passive gas vents were installed. Gas monitoring probes were installed around the perimeter of the landfill at a minimum spacing of 400 linear feet, except in areas delineated as wetlands or other areas with high groundwater elevations. Fifteen gas probes were installed.

During initial landfill gas monitoring events in August and September 2004, and subsequent monthly sampling, high methane concentrations were detected throughout the landfill. Based on

these results and the requirements presented in 6NYCRR 360-2.179(f) additional gas monitoring probes and gas vents were installed at Landfill 1. In addition, turbine ventilators were installed on all existing passive gas vents to enhance gas venting. In September 2005, Conti installed a passive gas vent trench between the northwestern landfill boundary and the northern property boundary to alleviate high methane concentrations (Conti/EA, June 2006). In total, 18 gas monitoring probes and 30 gas vents are installed at Landfill 1. Figure 1 illustrates the distribution of passive gas vents and gas monitoring probes at Landfill 1.

3.4 Remedial Action Performance

3.4.1 Operations and Maintenance

The landfill 1 Post-Closure Operations and Maintenance (O&M) Manual (Conti/EA, January 2005) provides a comprehensive guide to the landfill owners for maintenance and facility monitoring for a period of 30 years. The manual fulfills NYSDEC's requirements for post-closure O&M for closed solid waste landfills (6 NYCRR Part 360-2.15[k]). An addendum to the Landfill 1 Post-Closure Operations and Maintenance Manual was issued in May 2006 (Conti/EA, May 2006).

In accordance with the O&M Manual, periodic inspections of the landfill have been and continue to be performed. During the first year after final inspection of the construction, quarterly inspections of the landfill cover and inspections following major rainfall events were performed to ensure that the final landfill cover materials, site drainage swales, and on-site monitoring wells are maintained and functioning within the design standards. The property has also been inspected to ensure compliance with institutional control measures. A checklist was utilized to facilitate and standardize post-closure inspections. Contingency maintenance measures are performed if any deficiencies are encountered during these inspections, and the AFRPA is notified if unauthorized activity is observed on the landfill property.

The following post-closure inspection activities are included in the quarterly landfill inspections, and inspections following major storm events:

- Soil cover integrity is inspected for holes, rifts, ruts, washouts, or similar damage;
- Slopes and top surface of the landfill are inspected for major deviations from as-built grades and any areas of significant surface water ponding;
- The vegetative cover and grass-lined swales are inspected for proper establishment, thickness, growth, and signs of stress or disturbance due to erosion;
- The landfill, particularly the base of the slopes, is inspected for leachate breakouts;
- The monitoring wells are inspected for integrity and damage to the surface protective casings;

- The landfill surface is inspected for the presence of vectors (intrusive animals such as groundhogs or similar inhabitants);
- Drainage structure is inspected for erosion and loss;
- Gas monitoring probes and vents are inspected for integrity and damage;
- All fences and gates are inspected for integrity and damage;
- All signs and support structures are inspected for damage and wear; and
- To ensure compliance with institutional control measures, the landfill property is inspected for evidence of activities, such as construction activities that have not been approved by the Air Force, NYSDEC, and EPA.

Landfill maintenance activities include grass mowing and any contingency maintenance measures required as a result of the above inspections. The O&M Manual specifies two mowing in the first year (one in late/early summer and one after September 1st) and one mowing after September 1st every year thereafter, which allows for grass germination and full coverage development. Mowing has been performed at Landfill 1 as specified in the O&M Manual.

3.4.2 Environmental Monitoring

The LTM program for Landfill 1 groundwater is described in the Final Long-Term Monitoring Work Plan, Landfill 1 Area of Concern (FPM, October 2002). The monitoring results from December 2003 through April 2008 are provided in the Long Term Monitoring Report, Landfill AOCs LTM Program (FPM, May 2009). Environmental monitoring reports and summary reports are prepared annually.

3.4.2.1 Groundwater

The LTM groundwater monitoring network at Landfill 1 consists of 12 groundwater monitoring wells (see Figure 1). Target analytes are based on COCs and 6 NYCRR Part 360 baseline (annually) and routine (quarterly) parameters. Data collected from monitoring wells MWSAR03, LF1P-2, -3, -5, LF1MW-5, -6, -10, -11, and -12 monitor the effectiveness of attenuation process on COCs at the AOC. Bedrock monitoring well LF1MW-103 is sampled to monitor the bedrock aquifer. Monitoring wells LF1MW-13 and -14 serve as POC wells. Upgradient monitoring well LF1MW-1R monitors groundwater conditions prior to migration through the landfill.

Quarterly sampling was conducted at all 12 monitoring wells from December 2003 to March 2006. After the March 2006 sampling round, the frequency of sampling was reduced to semi-annual (FPM, May 2009). A summary of the groundwater monitoring parameters analyzed from December 2003 to April 2008 and prescribed analytical methodologies are provided below:

- VOCs (EPA Method SW8260);

- SVOCs (EPA Method SW8270);
- Metals (EPA Method SW6010B, total and dissolved);
- Mercury (EPA Method SW7470A, Baseline only);
- Cyanide (EPA Method SW9010B), Baseline only);
- Pesticides (EPA Method SW8081);
- PCBs (EPA Method SW8082);
- Anions (EPA Method SW9056);
- Nitrogen (TKN) (EPA Method 351.2);
- Ammonia (EPA Method 350.2);
- Chemical Oxygen Demand (EPA Method 410.4);
- Biological Oxygen Demand (EPA Method 405.1);
- Total Organic Carbon (EPA Method SW9060);
- Total Dissolved Solids (EPA Method 160.1);
- Alkalinity (EPA Method 310.1);
- Phenols (EPA Method SW9066);
- Hardness (EPA Method 130.2);
- Color (EPA Method 110.2, Baseline only); and
- Boron (EPA Method SW6010B, Baseline only).

Additional field measurements which will be collected at the time of sample collection are:

- pH
- Electrical Conductivity
- Temperature
- Turbidity
- Dissolved Oxygen
- Oxidative Reduction Potential

3.4.2.2 Surface Water

Monitoring at surface water sampling locations LF1SW-1, -2, and -3 (all three are Six Mile Creek locations), is performed for determining the potential levels of exposure to contamination caused by groundwater/leachate discharge into jurisdictional wetlands surrounding Landfill 1, and ultimately into Six Mile Creek.

Quarterly sampling was conducted at all three surface water sampling locations from December 2003 to March 2006. Since the March 2006 sampling round, the frequency of sampling has been reduced to semi-annual (FPM, May 2009).

3.4.2.3 Leachate

To evaluate the necessity of a groundwater/ leachate collection and treatment system, a pump station performance test was conducted at the Landfill 1 groundwater/ leachate collection trench on November 3, 2003 (Conti/EA, February 2004). Groundwater samples were analyzed in

accordance with baseline parameters detailed in 6 NYCRR Part 360-2.11(d)(6), using the analytical methods detailed in Section 3.4.2.1.

To substantiate the findings of the initial Landfill 1 Groundwater/ Leachate Collection Pump Test (Conti/EA, February 2004), four quarterly sampling rounds were proposed to identify the need for continuous operation of the trench system. The purpose of the sampling was to monitor various COCs, including: VOCs, SVOCs, metals, pesticides/herbicides, PCBs, and landfill leachate parameters that were identified in the Pump Station Performance Test (Conti/EA, February 2004). Beginning in April 2004, quarterly sampling was conducted for one year at the groundwater/ leachate collection trench and corresponding fen sampling locations.

3.4.2.4 Landfill Gas

The gas monitoring LTM network currently consists of 18 gas monitoring probes (LF1GMP-1 through -20, but not including LF1GMP -5 and -7) and 30 gas vents (LF1VENT-1 through -31, but not including LF1VENT-23) (see Figure 1). Quarterly sampling was conducted at the gas monitoring probes and vents from September 2004 to April 2008 to identify and evaluate trends in landfill gas concentrations and to assure that the landfill continues to comply with 6 NYCRR Part 360-2.17(f).

Gas samples are analyzed for methane, LEL, oxygen, and carbon dioxide, in accordance 6 NYCRR Part 360-2.17(f).

As prescribed in the Landfill 1 O&M Plan, if the perimeter gas probe monitoring shows explosive gas levels in excess of 25% of the LEL at the property boundary, the EPA and NYSDEC are to be notified within 7 days of detection and further actions will be evaluated. A remediation plan to address the landfill gas migration will be submitted within 45 days of detection of the elevated levels of explosive gas at the perimeter. The plan will describe the nature and extent of the problem, and the proposed remedy. A schedule implementation of the proposed remedy within 60 days of the date of detection will be included with the plan.

3.4.2.5 Sediment and Biota

The LTM of sediment and biota is being performed under the approved final Six Mile Creek LTM WP (FPM, October 2004).

3.4.3 Recordkeeping

Records are maintained of all site inspections, sampling, events, and any contingency maintenance measures. The O&M contractor prepares environmental monitoring reports and annual summary reports outlining the previous year's monitoring and maintenance activities. Site conditions will be evaluated every five years to ensure that the remedy is protective of human health and the environment. Alterations to the frequency and duration of the landfill inspections and environmental monitoring may be sought at any time and are subject to the approval of EPA and NYSDEC.

3.4.4 Remedy Performance

The key documenting implementation of remedy is the evaluation of remedy performance as it relates to applicable RAOs presented in the ROD. Five years of O&M and LTM sampling have been completed for Landfill 1. The quarterly reports are provided in the Spring 2008 Long Term Monitoring Report, Landfills AOCs LTM Program (FPM, May 2009). An evaluation of the Landfill 1 presumptive remedy activities is provided below.

3.4.4.1 Soil and Solid Waste

The installation of an impermeable cover was completed in 2003. The cover consisted of a foundation layer, gas-venting layer, geomembrane, drainage layer, geotextile, barrier protection layer, and topsoil layer. The additional cover reduces infiltration of rainwater and snowmelt water through the landfill and minimizes the potential for leachate generation and groundwater contamination. This is shown by the preferential flow paths observed throughout the site during quarterly landfill cap inspections and significant storm events. The surplus of water has been attributed to the increased flow across the landfill surface because the landfill cap installation reduced rainwater infiltration. The potential for nearby wildlife and human populations to be exposed to the landfill has also been reduced by this measure. Thus, this action of the presumptive remedy satisfies the RAOs established for Landfill 1.

3.4.4.2 Groundwater and Surface Water Quality

The results of the groundwater well quarterly/semi-annual sampling rounds indicated a site-wide stabilization of all contaminants of concern, including VOCs, metals, and leachate indicators at Landfill 1, as reported in the LTM Report (FPM, May 2009). Several VOCs at a few monitoring wells continue to exceed the NYSDEC Class GA groundwater standards. The best use of Class GA waters is as a source of potable water. Therefore, comparison of the groundwater sample analytical results at Landfill 1 to NYSDEC Class GA standards is a conservative approach because it is unlikely that groundwater at the former base will be used as a source of potable water.

VOC exceedances have been reported at monitoring wells LF1P-2, LF1MW-5, and LF1MW-11, but only wells LF1MW-5 and LF1MW-11 have showed sustained exceedances of the groundwater standards. In well LF1P-2, benzene slightly exceeded the groundwater standard of 1 µg/L in six out of the 16 sampling rounds since December 2003. The concentrations ranged from 1.01 µg/L to 1.6 µg/L. In the most current sampling round (April 2008), the benzene concentration (0.550 µg/L) was below the standard. In well LF1MW-5, benzene slightly exceeded the standard for 14 out of the 16 sampling rounds with concentrations ranging from 1.13 µg/L to 3.7 µg/L. In April 2008, the benzene concentration (0.690 µg/L) was below the standard. Three other VOCs (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and m,p-xylene) exceeded the groundwater standards in 2003 and 2004, but have since been below the standard. In well LF1MW-11, four VOCs exceeded the groundwater standards for 15 out of the 16 sampling rounds. With the exception of the April 2005 sampling round (when all the VOCs were below the groundwater standard), the highest concentration of these VOCs was in December 2003 and they have been steadily decreasing. The concentration of 1,2-dichlorobenzene (standard of 3 µg/L) decreased from a high of 13 µg/L to 5.84 µg/L in April

2008. The concentration of 1,4-dichlorobenzene (standard of 3 µg/L) decreased from a high of 16 µg/L to 7.24 µg/L in April 2008. The concentration of benzene decreased from a high of 4.9 µg/L to 1.67 µg/L in April 2008. The concentration of chlorobenzene (standard of 5 µg/L) decreased from a high of 17 µg/L to 6.49 µg/L in April 2008.

Iron and manganese exceeded the groundwater standard (0.3 mg/L) in all 16 sampling rounds in five monitoring wells and intermittently in three monitoring wells. Concentrations of iron above the standard ranged from 0.313 mg/L to 122 mg/L (unfiltered sample at LF1MW-14, September 2005) and concentrations of manganese above the standard ranged from 0.307 mg/L to 11.6 mg/L. Elevated metals at the former Griffiss AFB have generally been found to be naturally occurring. Upgradient monitoring well LF1MW-1R continues to show excessive concentrations of iron, even when the sample is filtered.

Concentrations of key leachate indicators (alkalinity, hardness, and TDS) show site-wide stabilization at Landfill 1. During the Baseline Study these indicators were utilized in the identification of a landfill leachate plume spreading in area broader than the wells contaminated with VOCs (FPM, July 200). However the past 16 sampling rounds (December 2003 through April 2008) show that sustained landfill leachate indicator exceedances appear to be concentrated at those monitoring wells with VOC exceedances (LF1P-2, LF1MW-5, and LF1MW-11).

VOCs did not exceed the NYSDEC Class A Surface Water Standards at the three surface water sampling locations during the 14 sampling rounds from December 2003 to April 2008. Iron and manganese exceeded the standard of 0.3 mg/L consistently at all three locations. Concentrations of iron above the standard ranged from 0.301 to 133 mg/L (sample collected September 2006 at location where creek beds are orange, indicating iron staining) and concentrations of manganese above the standard ranged from 0.343 mg/L to 5.03 mg/L.

Water chemistry analyses for samples collected at the Landfill 1 AOC during the December 2003 to April 2008 sampling rounds suggest that groundwater migrating through Landfill 1 is not impacting surface water at Six Mile Creek. Comparisons of downgradient monitoring well samples, upgradient monitoring well samples and surface water samples indicate a notable distinction in the water quality type as groundwater migrates downgradient through the landfill and into Six Mile Creek. Downgradient monitoring wells showed a predominately calcium-bicarbonate-type water (indicative of reducing conditions). Surface water sampling locations demonstrated a water quality type that consisted equally of sodium-chloride and calcium-bicarbonate. The upgradient monitoring well at Landfill 1 is predominantly sodium-chloride-type water.

The landfill has been capped, thereby eliminating direct contact to the public. The remedial actions, which included placement of additional landfill cover materials, an impermeable cover, and grading the landfill to reduce rain and surface water infiltration and the migration of contaminated soil, have satisfied the RAOs. In addition, the cover is expected to reduce leachate generation, which in turn will reduce the potential for transporting COCs from the landfill to Six Mile Creek via groundwater.

3.4.4.3 Leachate Monitoring

In November 2003, a performance test was conducted on the seven pump stations located along the groundwater/ leachate collection trench to evaluate the necessity of a groundwater/ leachate collection and treatment system. Upon review of the analytical results, the design of the treatment system was suspended because at all pump station sample locations:

- The levels of inorganic contamination were indicative of background levels found throughout the base.
- PCB results were nondetect.
- VOCs were below groundwater standards or marginally exceeded groundwater standards, with the exception of Pump Station PS-04.
- SVOCs were below groundwater standards or marginally exceeded groundwater standards.

Four quarterly sampling rounds were performed to substantiate the findings of the pump station performance test and determine if continuous operation of the trench system was warranted. The results from the four quarterly sampling rounds confirmed the overall groundwater observations reported during the November 2003 Pump Station Performance Test (FPM, January 2007). The data was evaluated using a statistical trend analysis, which supported the following conclusions:

- Levels of inorganic contamination reported at the seven pump stations had remained at concentrations indicative of background levels found throughout the base. Iron and manganese consistently exceeded the groundwater standard of 0.3 mg/L with iron concentrations above the standard ranging from 0.327 mg/L to 25.5 mg/L and manganese concentrations above the standard ranging from 0.611 mg/L to 11.2 mg/L;
- PCBs and pesticides were not detected at any sampling location during any sampling round;
- Several VOCs were reported above state standards, however, the VOC exceedances reported between the April 2004 and December 2004 sampling rounds were within one order of magnitude of the state standard and at similar levels to those reported in the November 2003 pump station performance test;
- SVOCs remained at concentrations below state standards with one exception: 1,4-dichlorobenzene consistently exceeded the standard of 3 µg/L with concentrations ranging from 6 µg/L to 8 µg/L at four pump stations. However, the results were qualified as below the reporting limit; and
- The observed concentrations indicated an overall stable and/or decreasing trend.

3.4.4.4 Landfill Gas Monitoring

In 28 sampling rounds, methane concentrations at the landfill gas vents varied greatly. All landfill gas vents have had at least one sampling round with a methane concentration above the LEL. Methane concentrations have been detected in all but two gas monitoring probes (LF1GMP-16 and -17). The detections have occurred in all 28 sampling rounds. Eleven gas monitoring probes (LF1GMP-1, -2, -3, -4, -6, -8, -9, -10, -11, -18, and -19) have shown detections above the LEL.

The passive gas trench installed near the northwestern perimeter of Landfill 1 to prevent the migration of methane into neighboring properties appears to be an effective treatment. The effectiveness of the system is made apparent by the gradient established between LF1GMP-4 and LF1GMP-19. LF1GMP-4 was installed between the landfill boundary and the passive gas trench (Figure 1); methane readings at this location have exceeded the LEL in all but one sampling round. In contrast, LF1GMP-19 was installed just outside of both the landfill boundary and the passive gas trench and within 25 feet of LF1GMP-4 (Figure 1); methane readings at this location are consistently lower than those reported at LF1GMP-4 and in some sampling rounds magnitudes less.

3.4.5 Protection of Human Health and the Environment

The presumptive remedy implemented at Landfill 1 has reduced the risks posed to human health and the environment by eliminating, reducing, or controlling the exposure to human and environmental receptors through engineering controls, institutional controls, and monitoring.

Specifically, this has been established through:

- Grading the landfill to promote surface water drainage and minimize infiltration;
- Covering the landfill with several layers including: gas venting layer (consisting of a drainage net geotextile geocomposite), 40-mil linear LLDPE geomembrane, geocomposite drainage net, geosynthetic geogrid, 12-inch barrier protection layer, and 6-inch topsoil layer to reduce water infiltration and reduce receptor exposure to contaminants by reducing leachate generation and potential transportation of contaminants from the landfill to the creek via groundwater migration;
- Installation of gas vents, a passive gas trench, and gas monitoring probes;
- Placement of additional landfill cover materials to eliminate the possibility of human exposure to contaminated soils;
- Implementation of institutional controls to provide adequate protection from exposure to groundwater by limiting the future use of the landfill; and
- Conducting LTM and gas monitoring to ensure that the remedial action is continuing to operate properly and successfully.

3.5 Enforceability

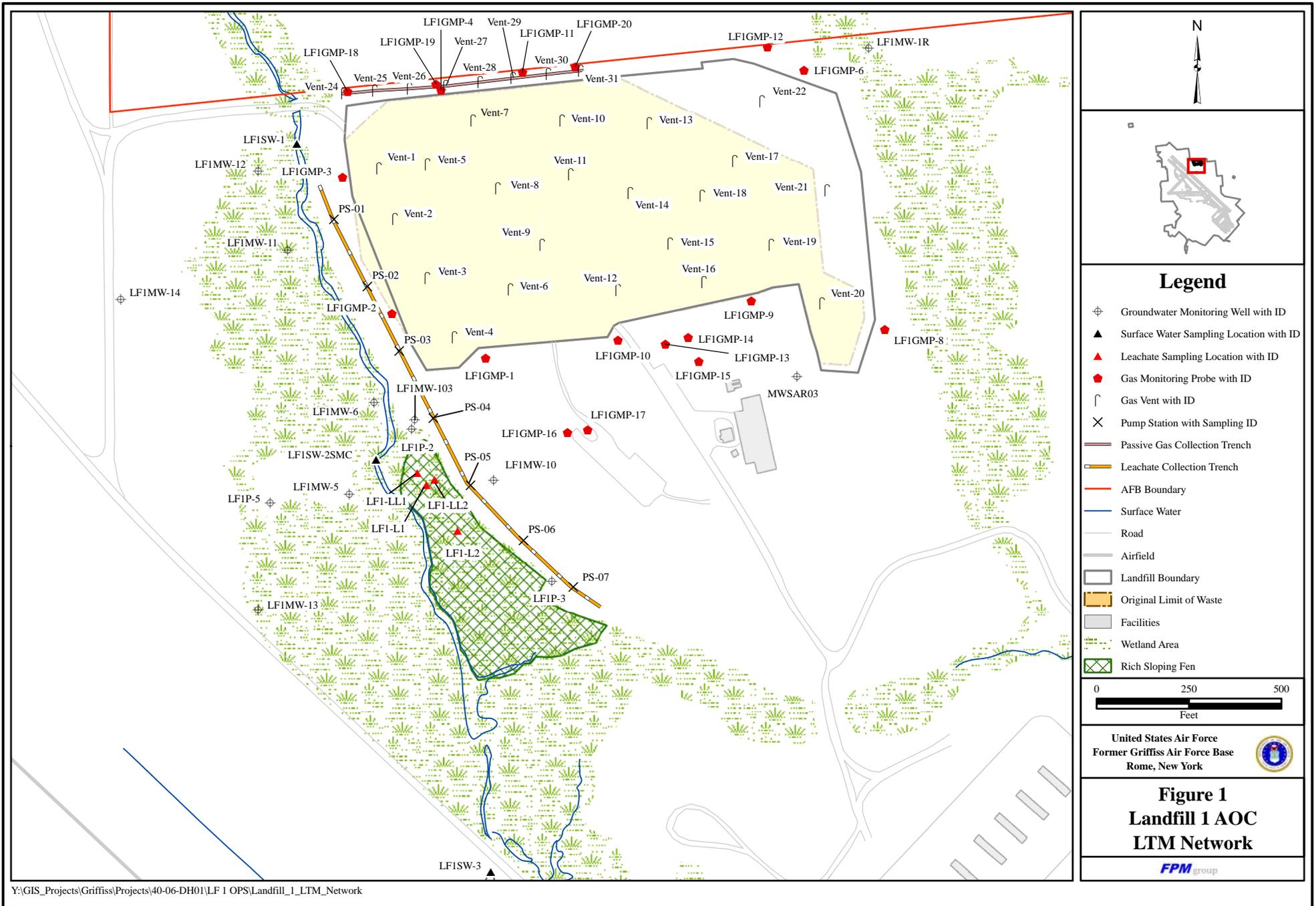
Griffiss AFB was placed on the National Priorities List on July 15, 1987. On August 21, 1990, the Air Force, EPA, and NYSDEC entered into a Federal Facility Agreement (FFA) under Section 120 of CERCLA. Both the EPA and NYSDEC have been continuously involved in the enforcement of remedial actions undertaken at the former Griffiss AFB. The FFA provides the enforcement vehicle for continued action at the former Griffiss AFB, including all work associated with implementation and monitoring of remedial actions. Additionally, the Landfill 1 ROD is a vehicle of enforceability in itself. These two documents provide sufficient enforcement avenues to ensure actions are continued as necessary to achieve the Landfill 1 RAOs.

3.6 Technology Reliability and Uncertainty Analysis

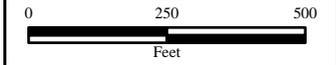
Placement of an impermeable cover, consisting of a gas vent layer, geomembrane, drainage net, geogrid, barrier protection layer and top soil cover, is a presumptive remedy for closure of landfills and has been demonstrated to be effective for similar military landfills. Landfill 1 was covered in accordance with 6 NYCRR Part 360 landfill closure regulations, dated November 26, 1996, as agreed upon by the EPA, NYSDEC, and the Air Force. At Landfill 1, the monitoring results indicate that VOCs, metals, and leachate indicators remain at elevated concentrations in groundwater monitoring wells. The majority of these exceedances appear to have stable concentrations within one order of magnitude of their respective state standards. Elevated methane readings at Landfill 1 gas monitoring probes suggest continued monitoring is necessary to ensure methane is not migrating off the property.

4 CONCLUSIONS

The Air Force concludes that the remedial actions at Landfill 1 are being properly and successfully implemented consistent with the provisions of CERCLA Section 120(h)(3) and that further monitoring is needed to confirm successful reduction of COCs to below the NYS Groundwater and Surface Water Standards and acceptable levels of explosive gases.



- ### Legend
- ⊕ Groundwater Monitoring Well with ID
 - ▲ Surface Water Sampling Location with ID
 - ▲ Leachate Sampling Location with ID
 - Gas Monitoring Probe with ID
 - ∩ Gas Vent with ID
 - × Pump Station with Sampling ID
 - Passive Gas Collection Trench
 - Leachate Collection Trench
 - AFB Boundary
 - Surface Water
 - Road
 - Airfield
 - Landfill Boundary
 - Original Limit of Waste
 - Facilities
 - Wetland Area
 - Rich Sloping Fen

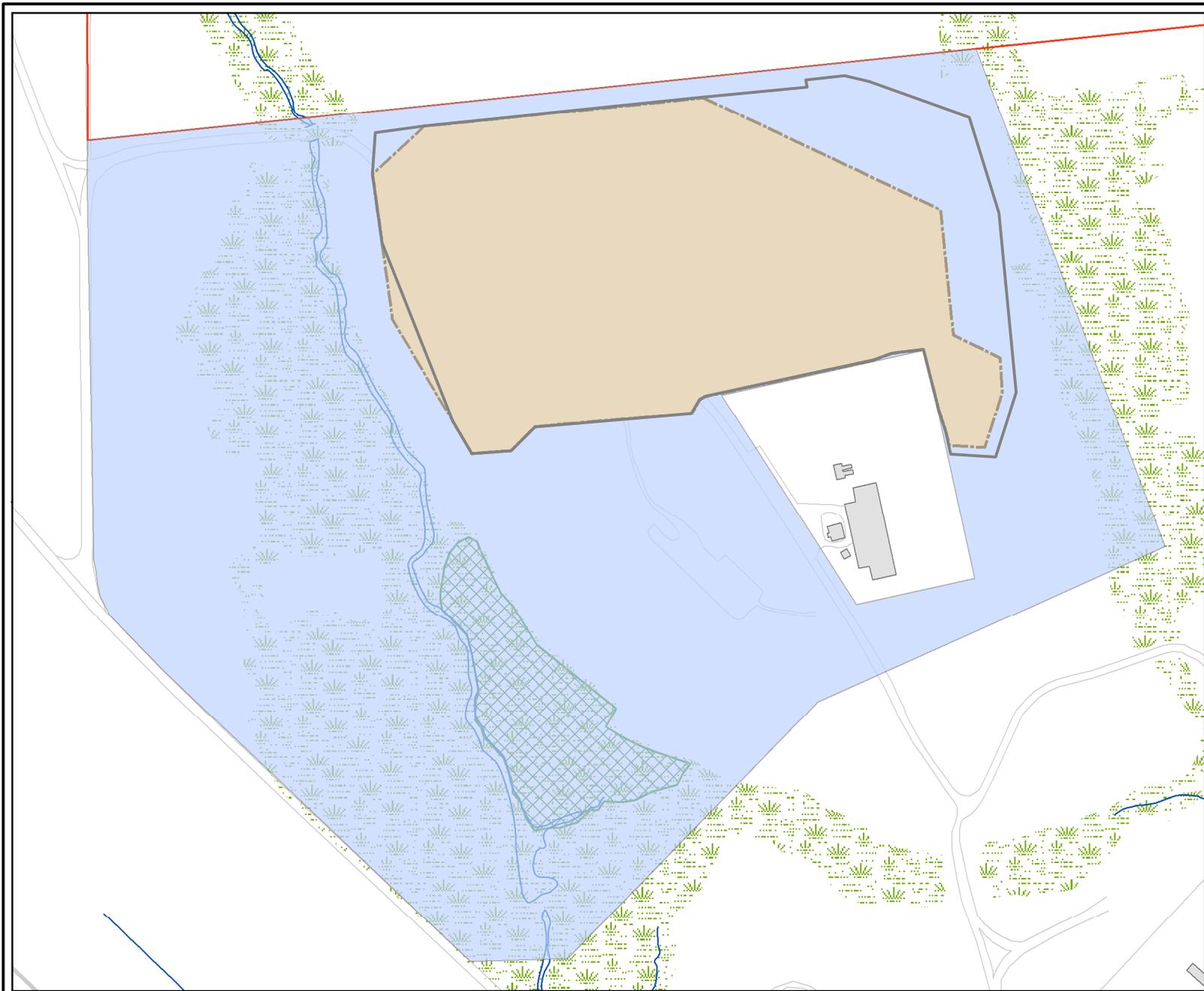


United States Air Force
Former Griffiss Air Force Base
Rome, New York



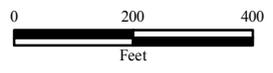
Figure 1
Landfill 1 AOC
LTM Network

FPM group



Legend

- Land Use Control/
Institutional Control
- AFB Boundary
- Surface Water
- Road
- Airfield
- Landfill Boundary
- Original Limit of Waste
- Facilities
- Wetland Area
- Rich Sloping Fen



United States Air Force
Former Griffiss Air Force Base
Rome, New York

Figure 2
Landfill 1 AOC
**Land Use Control/
Institutional Control**

FPM group