FINAL
OPTIMIZATION PLAN FOR LANDFILL AREAS OF CONCERN
LONG-TERM MANAGEMENT PROGRAM
FORMER GRIFFISS AFB, ROME, NEW YORK

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFRL/RRS	Air Force Research Laboratory/Rome Research Site
AFRPA	Air Force Real Property Agency
AMSL	Above mean seal level
AOC	Area of Concern
bgs	Below ground surface
Bhate	Bhate Environmental Associates, Inc.
BOD	Biological Oxygen Demand
BRAC	Base Realignment and Closure Act
CAPE	CAPE Environmental
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Confidence Factor
CGI	Combustible Gas Indicator
COC	Chemical of concern
COD	Chemical Oxygen Demand
Conti	Conti Environmental, Inc.
COV	Coefficient of Variation
CY	Cubic yards
DCE	cis-1,2-Dichloroethene
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
ERPIMS	Environmental Resources Program Information Management System
FFA	Federal Facilities Agreement
FID	Flame ionization detector
FPM	FPM Remediations, Inc.
GLDC	Griffiss Local Development Corporation
IC	Institutional Control
LEL	Lower explosive limit
LTM	Long-Term Management
LUC	Land use control

mg/L	Milligrams per liter
µg/L	Micrograms per liter
MAROS	Monitoring and Remediation Optimization System
MKS	Mann-Kendall Statistic
NCP	National Contingency Plan
NPL	National Priorities List
NYCRR	New York Code of Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
O&M	Operations and Maintenance
OP	Optimization Plan
OU	Operable Unit
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
POC	Point of compliance
POP	Period of performance
p	Probability
RC	Response Complete
ROD	Record of Decision
SAC	Strategic Air Command
SCGs	Standards, Criteria, and Guidance
SMC	Six Mile Creek
SVOC	Semi-Volatile Organic Compound
TCA	Trichloroethane
TCE	Trichloroethene
TDS	Total Dissolved Solids
TKN	Total Kjehldahl Nitrogen
TMC	Three Mile Creek
TOC	Total Organic Carbon
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
U.S.	United States
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

1 INTRODUCTION

Bhate Environmental Associates, Inc. (Bhate), has been contracted by the Air Force Civil Engineer Center (AFCEC), to perform Long-Term Management (LTM) at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites at the former Griffiss Air Force Base (AFB) in Rome, New York. The work discussed in this Optimization Plan (OP) will be conducted under contract number FA8903-16-F-0012.

LTM is defined by the Department of Defense (DoD) as "Environmental monitoring, review of site conditions, and maintenance of a remedial action to ensure continued protection as designed once a site achieves RC" [Response Complete] (DoD, March 9, 2012). Specifically the DoD Manual Number 4715.20 regarding Defense Environmental Restoration Program (DERP) Management states that "LTM includes the operations and maintenance measures required to maintain the effectiveness of response actions. LTM should be used until no further environmental restoration response actions are appropriate or anticipated. Examples of LTM include landfill cap maintenance, leachate disposal, fence monitoring and repair, performance of 5-year reviews, and LUC [land use control] maintenance."

The LTM CERCLA sites addressed in this OP include:

- LF001 – Landfill 1 Area of Concern (AOC)
- LF002 – Landfill 2/3 AOC
- LF003 – Landfill 7 AOC
- LF007 – Landfill 5 AOC
- LF009 – Landfill 6 AOC

The locations of the Former Griffiss AFB and the five landfill AOCs are presented on **Appendix A-Figure 1**. Work conducted at these sites will be performed in accordance with the former Griffiss AFB Uniform Federal Policy (UFP) - Quality Assurance Project Plan (QAPP) (Bhate, September 2016). Sections 2 through 6 of this OP provide a site description and the proposed LTM activities and outcome for each site.

1.1 Griffiss AFB Operational History

The mission of the former Griffiss AFB varied over the years. The base was activated on February 1, 1942, as Rome Air Depot, with the mission of storage, maintenance, and shipment of material for the United States (U.S.) Army Air Corps. Upon creation of the Air Force in 1947, the depot was renamed Griffiss AFB. The base became an electronics center in 1950, with the transfer of Watson Laboratory Complex (later Rome Air Development Center [1951], Air Force Research Laboratory/Rome Research Site [AFRL/RRS]), and then the Information Directorate at RRS was established with the mission of applied research, development, and testing of

electronic air-ground systems. The headquarters of the Ground Electronics Engineering Installations Agency was established in June 1958 to engineer and install ground communication equipment throughout the world. The 49th Fighter Interceptor Squadron served at Griffiss AFB from 1959 until its inactivation in 1987. On July 1, 1970, the 416th Bombardment Wing of the Strategic Air Command (SAC) was activated with the mission of maintenance and implementation of both effective air refueling operations and long-range bombardment capability. Griffiss AFB was designated for realignment under the Base Realignment and Closure Act (BRAC) in 1993 and 1995, resulting in deactivation of the 416th Bombardment Wing in September 1995.

1.2 Environmental Background

As a result of the various national defense missions carried out at the former Griffiss AFB since 1942, hazardous and toxic substances were used, and hazardous wastes were generated, stored, or disposed of at various sites on the installation. The defense missions involved were, among others: the procurement, storage, maintenance, and shipment of war material; research and development; and aircraft operations and maintenance.

Pursuant to Section 105 of CERCLA, Griffiss AFB was included on the National Priorities List (NPL) on July 15, 1987. On August 21, 1990, the Air Force, the U.S. Environmental Protection Agency (USEPA), and New York State Department of Environmental Conservation (NYSDEC) entered into a Federal Facilities Agreement (FFA) under Section 120 of CERCLA. On March 20, 2009, 2,897.2 acres of the 3,552 acres at the former Griffiss AFB were removed from the NPL (Air Force Real Property Agency [AFRPA], 2011).

1.3 Standards Criteria and Guidance and Remedial Action Objectives

Pursuant to New York State's Solid Waste Management Regulations, 6-New York Code of Rules and Regulations (NYCRR) Part 360-2.15, the baseline parameters analyzed consisted of Volatile Organic Compounds (VOCs); Semi-Volatile Organic Compounds (SVOCs); metals, including cadmium and mercury; pesticides; polychlorinated biphenyls (PCBs); and landfill leachate indicators. As presented herein, analysis has reduced over time to include landfill leachate indicators only at most of the landfills. The samples will be collected in accordance with the UFP-QAPP for Griffiss AFB. The site-specific sections in this OP highlight the Record of Decision (ROD) requirements and applicable regulatory drivers for meeting the remedial action objectives.

1.4 Approach to Optimization of LTM and the Landfill AOCs

The primary goal of the optimization is to reduce LTM requirements while ensuring protection of human health and the environment. Mann-Kendall trend analysis was performed on the landfill leachate indicator parameters at Griffiss AFB to quantitatively determine if the

measured concentrations of analytes are increasing, decreasing, or stable over time. By using this trend analysis, the optimization presented ensures that reduction of sampling frequency or elimination of sampling locations is based upon decreasing or stable trends such that such reductions will not adversely affect human health or the environment.

Analysis of the trend of constituent concentrations in affected groundwater plumes has many applications in groundwater plume management and remediation. Evidence for the discontinuation of remedies often includes demonstration of stable or shrinking plumes after shut-down of the remedial systems. Formal evaluation of plume stability can be accomplished using a variety of statistical methods, of which the Mann-Kendall protocol is one of the most commonly used and widely applicable tools.

The Mann-Kendall analysis is a non-parametric statistical procedure that is used for analyzing trends in data over time (Gilbert, 1987). Nonparametric methods require no assumptions regarding the underlying statistical distribution of the data. Accordingly, the Mann-Kendall test neither requires a specific statistical distribution of the data, nor is the test sensitive to the sampling interval over which the monitoring data are collected. The outcome of the procedure depends on the ranking of individual data points and not the overall magnitude of the data points. Therefore, the Mann-Kendall procedure can be used for data sets that include irregular sampling intervals, data below the detection limit, and trace or missing data. The approach is particularly advantageous in cases where outliers in the data could produce biased estimates using parametric trend analysis. The method is routinely applied to track data trends for purpose of groundwater compliance monitoring, site assessment, and monitoring of the performance of groundwater corrective actions.

The data used for the landfill leachate parameters trend analysis for Griffiss AFB was obtained from the AFCEC Environmental Resources Program Information Management System (ERPIMS), July 2016 extract along with the Final 2015 Annual Long Term Monitoring Report/Optimized Exit Strategy Report for Landfill AOCs (FPM Remediations, Inc. [FPM], December 2015). The database contained 69 monitoring wells at Sites LF001 (Landfill 1), LF002 (Landfills 2 and 3), LF003 (Landfill 7), LF007 (Landfill 5), and LF009 (Landfill 6). Data was available for the following landfill leachate analytes: alkalinity, ammonia, chloride, 5 day Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), bromide, color, cyanide, fluoride, hardness, sulfate, Total Dissolved Solids (TDS), Total Kjehldahl Nitrogen (TKN), Total Organic Carbon (TOC), and nitrate. Only monitoring wells that contained data from 4 sampling events or more and had sample detections above the NYSDEC established Class GA Groundwater Standards were used in the analysis. Additional evaluation was then performed on the Mann-Kendall output for the increasing trends. If there were no exceedances above the NYSDEC established Class GA Groundwater Standards for a particular increasing trend within the last 3 years, then those trends were not truly considered to be increasing and were not discussed in the text of this Plan.

The Mann-Kendall test for trend analysis for the landfill AOCs at Griffiss AFB relies on three statistical metrics and was adapted from methodology based on [Monitoring and Remediation Optimization System] *MAROS: A Decision Support System for Optimizing Monitoring Plans* (J.J. Aziz, et al., 2003), as well as the *Mann-Kendall Toolkit for Constituent Trend Analysis* (GSI Environmental, 2012) as follows:

- Mann-Kendall Statistic (MKS): Indicates whether concentration trend vs. time is generally decreasing (negative S value) or increasing (positive S value).
- The Confidence Factor (CF): The CF value modifies the MKS calculation to indicate the degree of confidence in the trend result, as in 'Decreasing" vs. "Probably Decreasing" or "Increasing" vs. "Probably Increasing." Additionally, if the CF is quite low, due either to considerable variability in concentrations vs. time or little change in concentrations vs. time, the CF is used to apply a preliminary "No Trend" classification, pending consideration of the Coefficient of Variation (COV).
- The COV: The COV is used to distinguish between a "No Trend" result (significant scatter in concentration trend vs. time) and a "Stable" result (limited variability in concentration vs. time) for datasets with no significant increasing or decreasing trend (e.g. low CF).

Mann-Kendall Statistic: The MKS is the sum of the differences between sequential sampling events, for the full population of sampling events conducted at a single sampling location (e.g., a monitoring well) for a selected landfill leachate parameter. A value of MKS greater than 0 indicates an increasing trend, while a value of MKS less than 0 indicates a decreasing trend subject to further modification based on the CF and the COV. The MKS indicates the direction of the trend (increasing or decreasing), while the strength of the trend is characterized by the CF, as described below. Furthermore, if the degree of confidence regarding an increasing or decreasing trend is insufficient (due either to considerable variability in concentrations vs. time or little change in concentrations vs. time), the MKS result is re-classified as "No Trend."

Confidence Factor: In order to test the validity and strength of the trend indicated by the MKS, the calculation of the CF value represents a minor modification of the approach to the Mann-Kendall test for trend, as published in Gilbert (1987) and elsewhere. Results for the conventional Mann-Kendall test include the designations of "No Trend," "Increasing," or "Decreasing" for the chemical concentration vs. time at a given sampling location (e.g., well). The minor modification helps to identify less certain conditions that may correspond to "Probably Increasing" or "Probably Decreasing," depending on the level of confidence in the calculation.

When CF > 95% (probability [p] < 0.05), the data demonstrate a strong trend, either "Increasing" or "Decreasing". When the CF falls between 90 to 95% ($0.1 > p > 0.05$), a trend is indicated; however, due to the lower confidence in the trend, the qualifier "Probably" is applied, as in "Probably Increasing" or "Probably Decreasing." If the CF is less than 90% ($p > 0.1$), a "No Trend" condition or a "Stable" condition is indicated, depending on the COV, as described below.

Coefficient of Variation: The COV for the dataset is the standard deviation divided by the mean. The COV provides a general indicator of the degree of variability in the concentrations at a particular monitoring location over time. The COV of the sample data set for each constituent at each well distinguishes between a "Stable" plume condition (relatively constant concentration in well vs. time) and a "No Trend" condition (highly variable concentrations vs. time) for datasets with no significant increasing or decreasing trend (see Aziz et al., 2003 referenced above). Depending on the values of the MKS and the COV, sampling locations that exhibit a low CF (CF < 90%) are designated as either 'Stable' (MKS ≤ 0 and COV < 1) or 'No Trend' (COV ≥ 1).

By using the metrics described above, the concentration trend at each monitoring location can be matched to 1 of 6 categories: Increasing, Decreasing, Probably Increasing, Probably Decreasing, Stable, or No Trend.

Appendix B contains the Mann-Kendall trend analysis results of select monitoring wells that had at least one sample detection above the NYSDEC established Class GA Groundwater Standards for Landfill AOCs at Griffiss AFB.

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2 LF001 (LANDFILL 1 AOC)

2.1 Site Description

LF001 (Landfill 1 AOC) is located in the northern portion of the former Griffiss AFB and is approximately 22 acres in size (**Appendix A-Figure 2**). The wastes disposed within LF001 consisted of general refuse, hardfill, and boiler ash, buried using trench and cover methods. An estimated 90,000 to 100,000 cubic yards (CY) of wastes were disposed of at the site from 1960 to 1973. The groundwater flow rate at LF001 is approximately 2,000 feet per year, and groundwater flows to the southwest (FPM, December 2015). The ROD for LF001 was signed by the USEPA on June 5, 2000, which required landfilling capping. In accordance with the ROD, the landfill was re-graded and capped in 2003. The cap components include a gas venting layer, a low-permeability layer, drainage layer, barrier protection layer, and a topsoil layer.

2.2 Historical and Current Long Term Management

Beginning in December 2003, groundwater monitoring was performed at 11 monitoring wells (MWSAR03, LF1P-2, -3, -5, LF1MW-1R, -5, -6, -10, -11, -12, and -13), and surface water monitoring was performed at 3 surface water locations (LF1SW-1, -2SMC, and -3). LF1MW-103 was added to the groundwater monitoring network during the March 2004 sampling round, and LF1MW-14 was added to the monitoring network during the December 2004 sampling round. These sampling locations are illustrated on the LF001 (Landfill 1) Site Map (**Appendix A-Figure 2**).

Currently, based on several rounds of sampling data, landfill leachate indicators and VOCs are sampled annually. Recommendations to alter the sampling network were provided in previous Landfill AOCs Long Term Monitoring Reports and reviewed by the USEPA and NYSDEC. During the groundwater monitoring conducted in 2015, a benzene exceedance was reported at LF1MW-5 (1.3 micrograms per liter [µg/L]), which is slightly above the New York State (NYS) Class GA Groundwater Standards of 1 µg/L and are similar to previous monitoring results. No other wells had VOC exceedances.

Landfill leachate indicators previously detected above the NYS Groundwater/Surface water Standards, Criteria, or Guidance (SCGs) values included ammonia, color, TDS, and TKN. The concentrations of TKN, TDS, and ammonia at the overburden wells are comparable to previous results and below the typical range of municipal landfill leachate (Lee and Jones, 1991b). Metals previously in exceedance of NYS SCGs include manganese, iron, sodium, aluminum, chromium, and nickel. Several of the metals (e.g., manganese, iron, and sodium) are indicative of base background conditions. As a result, metals analysis was eliminated from the LF001 monitoring network in 2011 in accordance with the LF001 (Landfill 1 AOC) Optimization Plan (FPM/CAPE Environmental [CAPE], November 2011).

Landfill gas monitoring is performed at LF001 to identify the presence and concentration of methane at or near the landfill. A total of 180 gas monitoring probes and 31 landfill gas vents were monitored on a quarterly basis from October 2005 until May 2010. Landfill gas sampling was optimized after the spring 2010 sampling round and is sampled semiannually. Results from the gas sampling events at LF001 continue to show elevated methane concentrations throughout the landfill. However, methane concentrations at point of compliance (POC) gas monitoring probes (LF1GMP-13 through -17) remained at non-detectable concentrations through the September 2015 sampling round. The absence of methane at the POC gas monitoring probes demonstrates continued protection of potential receptors. In addition, the passive gas trench installed near the northwestern perimeter of LF001 to prevent methane migration into neighboring properties appears to remain an effective treatment. Therefore, the 2015 Final Long Term Monitoring Report recommended reducing the landfill gas monitoring to annual based upon data from 2011 to 2015 that demonstrates elevated methane levels are stable or absent at the POC gas monitoring probes.

Landfill inspections and cover maintenance are performed at LF001. Inspections and maintenance are conducted on a semiannual basis with annual landfill cover mowing (conducted in the fall). LUCs/Institutional Controls (ICs) have been implemented by the ROD and are verified annually as part of the landfill cover inspection program. The fall inspections are performed in conjunction with the Basewide LUC/IC Site Inspections.

2.3 Regulatory Drivers

LF001 is regulated under the CERCLA of 1980, as amended, and the Oil and Hazardous Substances Pollution National Contingency Plan (NCP). Landfill recapping and LTM were/are conducted in accordance with New York State's Solid Waste Management Regulations, 6 NYCRR Part 360. Groundwater and surface water sample results are compared to NYSDEC Class GA Groundwater Standards and NYSDEC Class C Surface Water Standards (NYSDEC, June 1998). Additionally, the site activities are conducted under the supervision and recommendations of USEPA, Region 2 and NYSDEC.

2.4 Proposed Outcome

The proposed outcome for this site is monitoring optimization through reduction of groundwater and surface water sampling frequency from annual to biennial and reduction of sample locations to eight that have leachate indicators that exceed the SCGs. Optimization of the landfill gas monitoring will be further evaluated with the goal of reducing the monitoring locations by half within the period of performance (POP). The POP for the current contract managing the LTM of the former Griffiss AFB landfills is June 2016 to June 2021. Optimization presented within this plan will commence upon approval from the Air Force and regulators. Specifically for Site LF001 (Landfill 1), LTM optimization will commence after the fall 2016 LTM events including mowing, landfill gas monitoring, and LUC inspections. Annual groundwater

sampling was completed in May 2016. Given the stability of the cap installed in 2003, landfill cap inspections will be optimized to annual. None of the proposed optimizations result in changes to the ROD.

2.4.1 Pathways to Achieve Proposed Outcome

Groundwater monitoring, surface water monitoring, landfill gas monitoring, and landfill cover maintenance will continue to be performed at LF001. The decision to optimize the monitoring at the site will be guided by the sampling data. VOC exceedances at LF001 are currently limited to two monitoring wells. Benzene exceedances were reported at LF1MW-5 (1.1 µg/L) and LF1MW-11 (1.4 µg/L) from the May 2016 sampling event. In addition, 1,2-dichlorobenzene and 1,4-dichlorobenzene exceedances were reported at LF1MW-11. All exceedances were within one order of magnitude of the NYS Class GA Groundwater Standards and are similar to previous groundwater monitoring results. In the Final 2016 Semiannual Long Term Monitoring Report for Landfill Areas of Concern, a Mann-Kendall and Linear Regression trend analysis was conducted on VOCs at LF1MW-5 and LF1MW-11 using the MAROS methodology. Table 2-2 in the 2016 Semiannual Long Term Monitoring Report (FPM/CAPE, July 2016) indicates either non-detects or decreasing trends using both Mann-Kendall and Linear Regression for benzene; 1,2-dichlorobenzene; and 1,4-dichlorobenzene at LF1MW-5 and LF1MW-11. Monitoring well LF1MW-5 is located downgradient of the landfill boundary on the opposite side of Six Mile Creek (SMC) (**Appendix A-Figure 2**). No VOC exceedances have occurred at any of the surface water locations since sampling was initiated in December 2003. Further, benzene in LF1MW-5 and LF1-MW11 is decreasing as demonstrated by **Charts 1 and 2** below. Therefore, reduction of groundwater monitoring for VOCs to biennial is reasonable and recommended for groundwater and surface water monitoring optimization at LF001.

Chart 1. Benzene Trends at Monitoring Well LF1MW-5

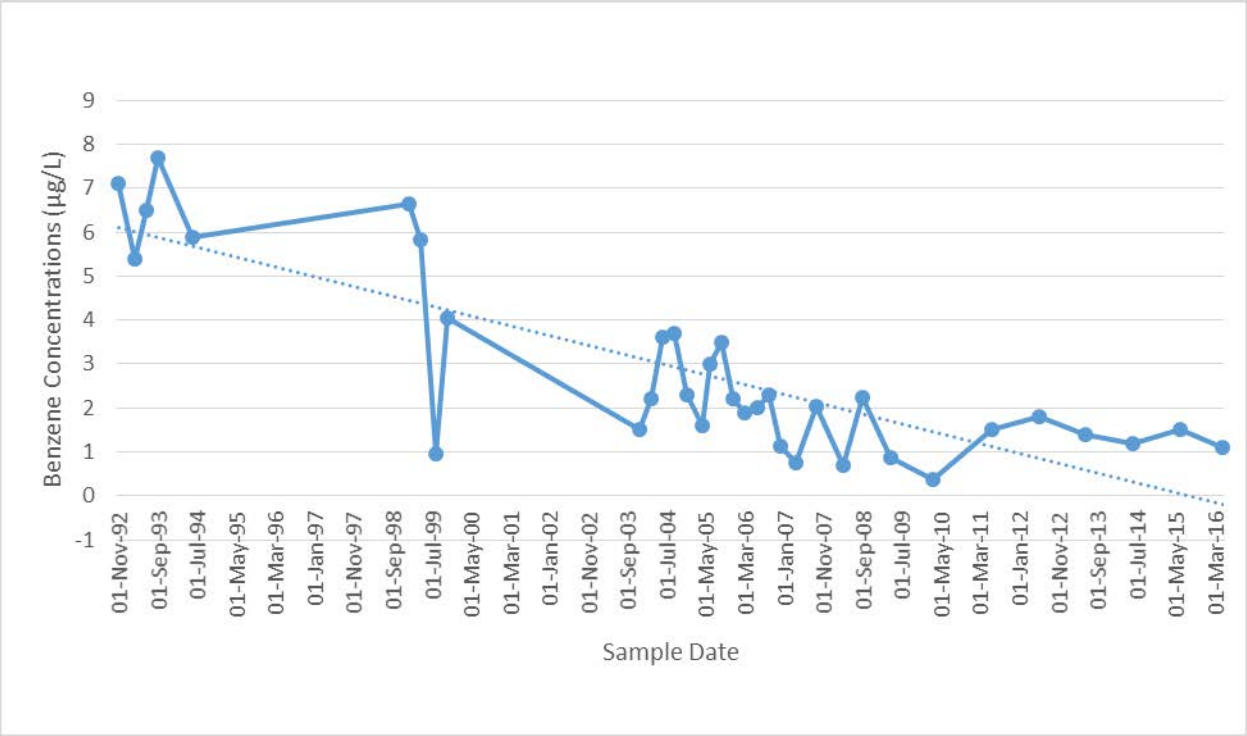
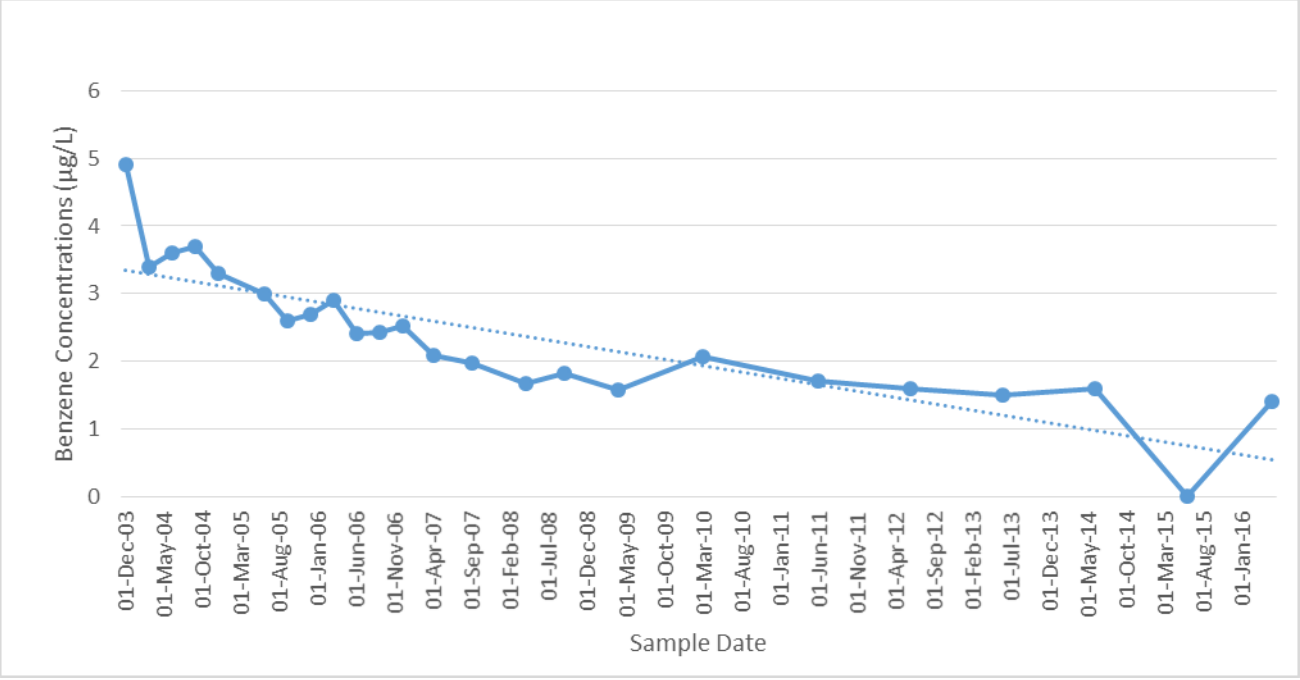


Chart 2. Benzene Trends at Monitoring Well LF1MW-11



The leachate results are comparable to previous results and below the typical range of municipal landfill leachate, therefore, reduction of sampling monitoring wells for leachate indicators to biennial is recommended with the next groundwater and surface water sampling event occurring in 2018. The Mann-Kendall trend analysis indicated that monitoring well LF1MW-103 had an increasing trend in ammonia. This monitoring well is located within an existing wetland. In the wetland, nitrates and ammonia are absorbed by the plants or converted to nitrogen gas lost to the atmosphere. Given the location of this monitoring well, the presence of ammonia does not adversely affect the environment. Ammonia remains significantly below the average concentration for leachate in municipal landfills (Lee et. al., 1991b). Further, the use of a bailer to sample this monitoring well may bias the data. Turbidity in wells sampled with bailers can greatly elevate concentrations of metals and some organics such as SVOCs that are bound to soil particles. Bailers may also aerate wells, resulting in lower VOC and dissolved metal results. Further, use of a bailer leads to significant data imprecision and inaccuracy due to the inability to collect a precise duplicate under the same sampling conditions.

Appendix B presents the Mann-Kendall trend analysis for LF001. Only the following wells exceeded the NYS groundwater and surface water standards for leachate indicators in May 2016: LF1MW-5, -6, -11, -13, -1R, -103, LF1P-2, -5, and MWSAR03. Therefore, it is recommended that the monitoring well network be optimized to only include these sampling locations in 2018 based upon the May 2016 event verifying that exceedances are limited to these nine monitoring wells. **Table 1** summarizes the increasing trends identified in the Mann-Kendall analysis at LF001.

Table 1. LF001 Mann-Kendall Trend Analysis Increasing Trend Results

Well ID	Analyte	NYSDEC Groundwater Standards (mg/L)	Number of samples in the data set	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	COV	MKS	CF	Trend
WL-LF1MW-103	Ammonia	2 mg/L	9	0	32	0.60	17	95.1%	Increasing
Notes: mg/L – milligrams per liter									

The landfill gas monitoring will be optimized from semiannually to annually per the Final 2015 Long Term Monitoring Report. Previous landfill gas monitoring rounds show that elevated methane concentrations persist throughout the landfill. However, these levels are stable. Methane concentrations at POC gas monitoring probes (LF1GMP-13 through -17) remained at non-detect through the fall 2015 sampling round. The absence of methane at the POC gas monitoring probes demonstrates continued protection of potential receptors. In addition, the passive gas trench installed near the northwestern perimeter of LF001 to prevent methane migration into neighboring properties appears to remain an effective barrier (FPM, July 2016). Therefore, data from the perimeter monitoring points supports that methane is not migrating off the site's boundaries. Optimization during the POP (years 2016 through 2021) will include

reducing the landfill gas monitoring by half to approximately 25 sample locations (includes both gas monitoring probes and gas vents) based upon redundancy and lack of methane detections.

The landfill inspections will continue to be conducted semiannually. However, only a full landfill inspection will be completed each year, likely in the fall. A "spot-check" inspection will be completed in the spring to assess signage, encroachment, digging, and similar LUC concerns associated with active redevelopment in Rome, New York by the Griffiss Local Development Corporation (GLDC). Additional inspections and/or maintenance will be performed as needed; following the guidance established in the May 2006 Landfill 1 Operations and Maintenance (O&M) Manual (Conti Environmental, Inc. [Conti], May 2006).

2.4.2 Metric Development: Proposed End Point, Metrics, and Approach

2.4.2.1 Groundwater/Surface Water Monitoring

The proposed end point is the optimization of groundwater and surface water monitoring. Groundwater and surface water are anticipated to be monitored biennially with the next groundwater and surface monitoring to be performed in 2018 which is 2 years after the May 2016 sampling was completed. However, further alternations to the monitoring for LF001 may be made based upon analysis of the sampling data trends. Subject to data confirmation and regulatory concurrence, the LTM schedule for LF001 is provided in **Table 2**. The current LF001 LTM network is provided in **Table 3** at the end of Section 2.

Table 2. LF001 LTM Schedule

Years	Activity	Timing
Period of Performance		
2016 through 2021	Annual Complete Landfill Inspections Annual Landfill Gas Monitoring	Fall Inspections Annual Monitoring in Fall
	Annual Reporting	4th Quarter (December)
2016 (completed in May), 2018, and 2020	Groundwater and Surface Water Monitoring	2nd Quarter (June)
2020	Five-Year Review	2nd Quarter (April)
Post-Period of Performance		
2021 through 2041	Annual Complete Landfill Inspections, Landfill Gas Monitoring	4th Quarter (October)
	Reporting	4th Quarter (December)
2024, 2029, 2034, and 2039	Groundwater and Surface Water Monitoring	2nd Quarter (June)
2025, 2030, 2035, and 2040	Five-Year Review	2nd Quarter (April)

Period of Performance

Groundwater and surface water monitoring currently involves 13 monitoring wells and 3 surface water locations for landfill leachate indicators. Alterations to the frequency and

duration of the groundwater monitoring will be conducted through the analysis of sampling data trends. Proposal to reduce the sampling frequency and/or discontinue the monitoring of a sampling location may be prompted by the indication of a decreasing or stable trend and/or at least two consecutive rounds with chemical of concern (COC) levels below NYS Groundwater or Surface Water SCGs. Proposal to increase the monitoring network is detailed in the Contingencies section.

As previously presented, the following wells had groundwater with COCs that exceed NYS groundwater and surface water standards: LF1MW-5, -6, -11, -13, -1R, -103, LF1P-2, -5, and MWSAR03. Therefore, it is recommended that the monitoring well network be optimized to only include these sampling locations in 2018 based upon the 2016 groundwater sampling results, which verifies that exceedances are limited to these nine monitoring wells (FPM, July 2016). Sampling data from LF001 has shown continued sitewide stabilization of VOCs and leachate indicators. Therefore, the recommended monitoring frequency will provide adequate warning to any potential release of COCs to the environment by the landfill. Low-flow sampling will be performed at the monitoring wells, except bedrock monitoring well LF1MW-103 where bailer sampling will be performed. The surface water samples will be collected as grab samples.

Post-Period of Performance

As a result of the stabilization/decline of contaminants at the site, we anticipate sampling will be optimized to every 5 years (2024, 2029, 2034, and 2039) at the nine monitoring wells and three surface water sampling locations after 2021. Samples will be analyzed for landfill leachate indicators only. This sampling will be conducted one year ahead of each Five-Year Review. Based on stable/declining VOC results, Bhate anticipates recommending the discontinuation of VOC analysis from the monitoring network after the 2018 groundwater sampling event.

2.4.2.2 Landfill Gas Monitoring

The proposed end point is the optimization of landfill gas monitoring.

Period of Performance

A total of 18 gas monitoring probes and 31 gas vents are currently monitored annually for methane, lower explosive limit (LEL), oxygen, and carbon dioxide. Previous landfill gas monitoring rounds show that elevated methane concentrations persist throughout the landfill, but these levels are stable. Methane is not detected at any of the POC gas monitoring probes, which minimizes risk of human exposure.

In May 2015, LEL values equaled or exceeded 100% at one gas monitoring probe (LF1GMP-6) and at 20 gas vents (LF1GV-1, -2, -3, -6, -8 to -14, -17 to -22, -24, -25, and -27). In September 2015, LEL values equaled or exceeded 100% at 7 gas monitoring probes (LF1GMP-1, -2, -3, -4, -

6, -9, and -10). LEL values did not equal or exceed 100% at any of the gas vents (FPM, December 2015).

Optimization during the POP (years 2016 through 2021) will include reducing the landfill gas monitoring in half to approximately 25 sample locations based upon redundancy and lack of methane detections. Elimination of sample locations will be assessed following each annual monitoring event. Based upon landfill gas readings from October 2012 through October 2015 and redundancy of sample locations, 15 locations are recommended for elimination from the landfill gas monitoring program, reducing the sampling locations from 49 to 34. These locations were selected if LEL did not exceed 100% during any of the sampling events. The locations include landfill gas monitoring probes LF1GMP-08,-11, -12, -14, -15, -17, -18, -19, - and 20 and landfill gas vents LF1GV-15, -16, -26, -29, -30, and -31. Most of the sample locations proposed for elimination are located along the passive gas trench installed near the northwestern perimeter of Landfill 1, which is operating properly and successfully. Further optimization of landfill gas monitoring will be based upon continued manual monitoring of both vents and probes. In addition, given the age of the landfill and time since the initial capping occurred, methane production should continue to be stable and decreasing.

Post-Period of Performance

As a result of the stable landfill gas results, we anticipate that optimization within the POP (years 2016 through 2021) will remain in place post-POP (after 2021).

2.4.2.3 Landfill Cover Inspections and Maintenance

The proposed end point is the optimization of landfill cover inspections.

Period of Performance

The current scope of semiannual landfill cover inspections and maintenance will be optimized to annual to coincide with annual landfill cover mowing. Vegetation growth on the landfill cap shows optimal coverage for erosion control and cover system stabilization. Additional inspections or maintenance will be performed as needed, as required by the May 2006 Landfill 1 O&M Manual (Conti, May 2006).

Post-Period of Performance

The optimization for landfill cover inspections to annual is anticipated to remain in place post-POP (after 2021).

2.4.2.4 Annual LUC/IC Inspections

LUC/ICs, as required by the ROD, will be maintained in order to protect human health and the environment until the site is closed in 2040. The Annual LUC/IC inspections will be conducted to confirm the implementation and performance of the LUC/ICs. Results will be reported annually in the Basewide LUC/IC Site Inspection Report.

2.4.2.5 Five-Year Review

The site will be included in the 2020, 2025, 2030, 2035, and 2040 Five-Year Reviews.

2.5 Contingencies

All contingent actions will be completed as established in the May 2006 Landfill 1 O&M Manual (Conti, May 2006) and will be compliant with the approved ROD.

2.5.1 Groundwater/Surface Water Monitoring

Groundwater and surface water monitoring is anticipated to ensure that the landfill is not releasing contamination to the environment. If it is found that the landfill is indeed releasing COCs to the environment, based on an increase in landfill leachate indicator detections and concentrations, a contingent analysis will be conducted. At this site, the contingent analysis will include VOCs, metals, PCBs, and landfill leachate indicators. Additional recommendations will be made using this data.

2.5.2 Landfill Gas Monitoring

Landfill gas monitoring will be performed to ensure that methane gas does not travel outside the LF001 boundary. If methane gas is detected at any of the perimeter POC monitoring locations and is suspected of leaving the landfill boundary there will be an increase in frequency of gas sampling events to track upward trends and migration of methane.

2.5.3 Landfill Cover Inspections and Maintenance

The landfill cover inspections and maintenance will be performed to ensure landfill cover materials, site drainage structures, and onsite monitoring wells are maintained and functioning within the design standards. In the event that the integrity of any of the above mentioned criteria is compromised, inspections and/or maintenance will be performed immediately to address any damages or flaws at the site. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the May 2006 Landfill 1 O&M Manual (Conti, May 2006).

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Table 3. LF001 Proposed LTM Network Schedule

Sampling Locations	Screen Interval Depth (feet AMSL)	Sampling Rationale	Target Analytes - Method Numbers	Matrix	Number of Samples	Sampling Frequency	Evaluation Criteria
Groundwater LF1P-5 LF1MW-11 LF1MW-103	479.91-474.94 494.25-484.25 Not surveyed	Downgradient Downgradient Bedrock	Anions - SW9056A Nitrogen (TKN) - 351.2 Ammonia - 350.1 COD -410.4 BOD – SM5210B TOC –SW9060A TDS - SM2540C Alkalinity - SM2320B Phenols - SW9066 Hardness - SM2340C Color - SM2120B Boron - SW6010C	Water	3	Biennial	Groundwater data is compared to NYSDEC Groundwater Standards to evaluate the context of trends and to ensure protection of human health and the environment. Surface water analytes and frequency will be varied to follow groundwater program.
Groundwater LF1P-2 LF1MW-5 LF1MW-6 LF1MW-1R LF1MW-13 MWSAR03 **Surface Water** LF1SW-1 LF1SW-2SMC LF1SW-3	495.07-490.07 485.26-475.26 492.36-482.36 534.46-524.46 495.82-485.82 521.28-511.28 Depth to groundwater ranged from 0 to 27 feet below ground surface (bgs)	Downgradient Downgradient Downgradient Downgradient POC Well Downgradient Potential contaminant receptor via surface water at SMC	Anions - SW9056A Nitrogen (TKN) - 351.2 Ammonia - 350.1 COD - 410.4 BOD – SM5210B TOC - SW9060 TDS - SM2540C Alkalinity - SM2320B Phenols - SW9066 Hardness - SM2340C Color - SM2120B Boron - SW6010C VOCs - SW8260B	Water	9		
Landfill gas Monitoring probes/vents		In accordance with 6 NYCRR 360-2.17(f)	Combustible Gas Indicator (CGI) Methane or % LEL	Gas	9 probes 25 vents	Annually	Evaluate methane and LEL trends.
Notes: AMSL – above mean sea level							

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3 LF002 (LANDFILL 2/3 AOC)

3.1 Site Description

LF002 (Landfill 2/3 AOC) is approximately 13 acres in size and is located in the northern portion of the base. The wastes at LF002 consisted of hardfill in the southern portion of Landfill 2, on-board aircraft wastes in the northern portion of Landfill 2 and approximately 1 ton of wetted and double-bagged asbestos waste in Landfill 3, located in the eastern portion of Landfill 2. The groundwater flow rate at LF002 is approximately 47 feet per year (FPM, December 2015). Groundwater flow is very gradual to the southwest in the area of LF002.

The ROD for LF002 was signed by the USEPA on June 5, 2000. In accordance with the ROD, the landfill was re-graded and capped in summer 2003. The cap components include a gas venting layer, a low-permeability layer, drainage layer, barrier protection layer, and a topsoil layer. LTM was initiated at LF002 in December 2003.

3.2 Historical and Current Long Term Management

Beginning in December 2003, groundwater monitoring was performed at six monitoring wells (LF2MW2-1, LF2MW-4, -12, -13, -14, and -100), and surface water monitoring was performed at three surface water locations (LF2SW-1, -2, and -3). These sampling locations are illustrated on the LF002 (Landfill 2/3) Site Map (see **Appendix A-Figure 3**). The monitoring network was analyzed quarterly (routine) and annually (baseline) for landfill leachate indicators and VOCs. VOCs, cyanide, and mercury were analyzed until 2006 and then removed from the sampling network due to their low or absent concentrations at the site. Currently, based on several rounds of sampling data, landfill leachate indicators are sampled biennially. Recommendations to alter the sampling network were provided in previous Landfill AOCs Long Term Monitoring Reports and reviewed by the USEPA and NYSDEC.

Metals previously in exceedance of NYS Groundwater SCGs include barium, chromium, manganese, iron, sodium, aluminum, chromium, and nickel. Several of the metals (e.g., manganese, iron, and sodium) are indicative of base background conditions. As a result, metals analysis was eliminated from the LF002 monitoring network in 2011 in accordance with the LF002 Optimization Plan (FPM/CAPE, November 2011).

Landfill gas monitoring has been performed at LF002 to identify the presence and concentration of methane at or near the landfill. A total of 9 gas monitoring probes and 14 landfill gas vents were monitored on a quarterly basis from October 2005 until May 2010. Landfill gas sampling has been optimized and is now sampled annually. Results from the gas sampling events at LF002 continue to show sitewide stabilization of methane concentrations.

Landfill inspections and cover maintenance are being performed at LF002 on a semiannual basis with annual landfill cover mowing (conducted in the fall). LUC/ICs have been implemented by the ROD and are verified as part of the landfill cover inspection program. The fall inspections are performed in conjunction with the Basewide LUC/IC Site Inspections.

3.3 Regulatory Drivers

LF002 is regulated under the CERCLA of 1980, as amended, and the NCP. Landfill recapping and LTM were/are conducted in accordance with New York State's Solid Waste Management Regulations, 6-NYCRR Part 360. Groundwater and surface water sample results are compared to NYSDEC Class GA Groundwater Standards and NYSDEC Class C Surface Water Standards (NYSDEC, June 1998). Additionally, the site activities are conducted under the supervision and recommendations of the USEPA, Region 2 and NYSDEC.

3.4 Proposed Outcome

The proposed outcome for this site is LTM Optimization through implementation of the 2015 Long Term Monitoring Report recommendation for sampling every 5 years, reduction of landfill gas monitoring locations by 40-percent, and reduction of landfill inspection to annual. The next groundwater and surface water monitoring will occur in 2019. Annual inspections and landfill gas monitoring will commence with the Fall 2016 event. None of the proposed optimizations result in changes to the ROD.

3.4.1 Pathways to Achieve Proposed Outcome

Groundwater monitoring, surface water monitoring, landfill gas monitoring, and landfill cover maintenance will continue to be performed at LF002. The decision to optimize the monitoring at the site will be guided by the sampling data. Currently, no plumes or COCs are associated with the site as shown in the past 8 years of 13 years of sampling data. In addition, no VOC exceedances have occurred at any of the surface water locations since groundwater sampling was initiated in December 2003.

Landfill leachate indicators previously detected above the NYS Groundwater/Surface Water SCGs included ammonia, chloride, bromide, color, TDS, TKN, and nitrate. TDS at LF002 has historically been detected near or below the NYS Groundwater Standard of 500 mg/L at all of the monitoring wells with the exception of LF2MW-100 (bedrock well). The TDS is higher at this well due to the sampling method (bailing) producing a greater amount of suspended solids in the sample. While the Mann-Kendall trend analysis indicates that LF2MW-100 had increasing trends for ammonia, the ammonia concentrations have been relatively stable, within 1 mg/L of 8.5 mg/L, for the past 8 years. Therefore, the recent data supports that the landfill leachate indicators at LF2MW-100 are stable or decreasing. Further, the sampling method for this bedrock well biases the sample results and is not truly reflective of the aquifer conditions. Turbidity in wells sampled with bailers can greatly elevate concentrations of metals and some

organics such as SVOCs that are bound to soil particles. Bailers may also aerate wells, resulting in lower VOC and dissolved metal results. Further, use of a bailer leads to significant data imprecision and inaccuracy due to the inability to collect a precise duplicate under the same sampling conditions. **Chart 3** presents the TDS trends in six wells at LF002. **Table 4** presents the Mann-Kendall analysis for the increasing trend in ammonia at LF2MW-100.

Chart 3. LF002 TDS Concentration Trends in Groundwater

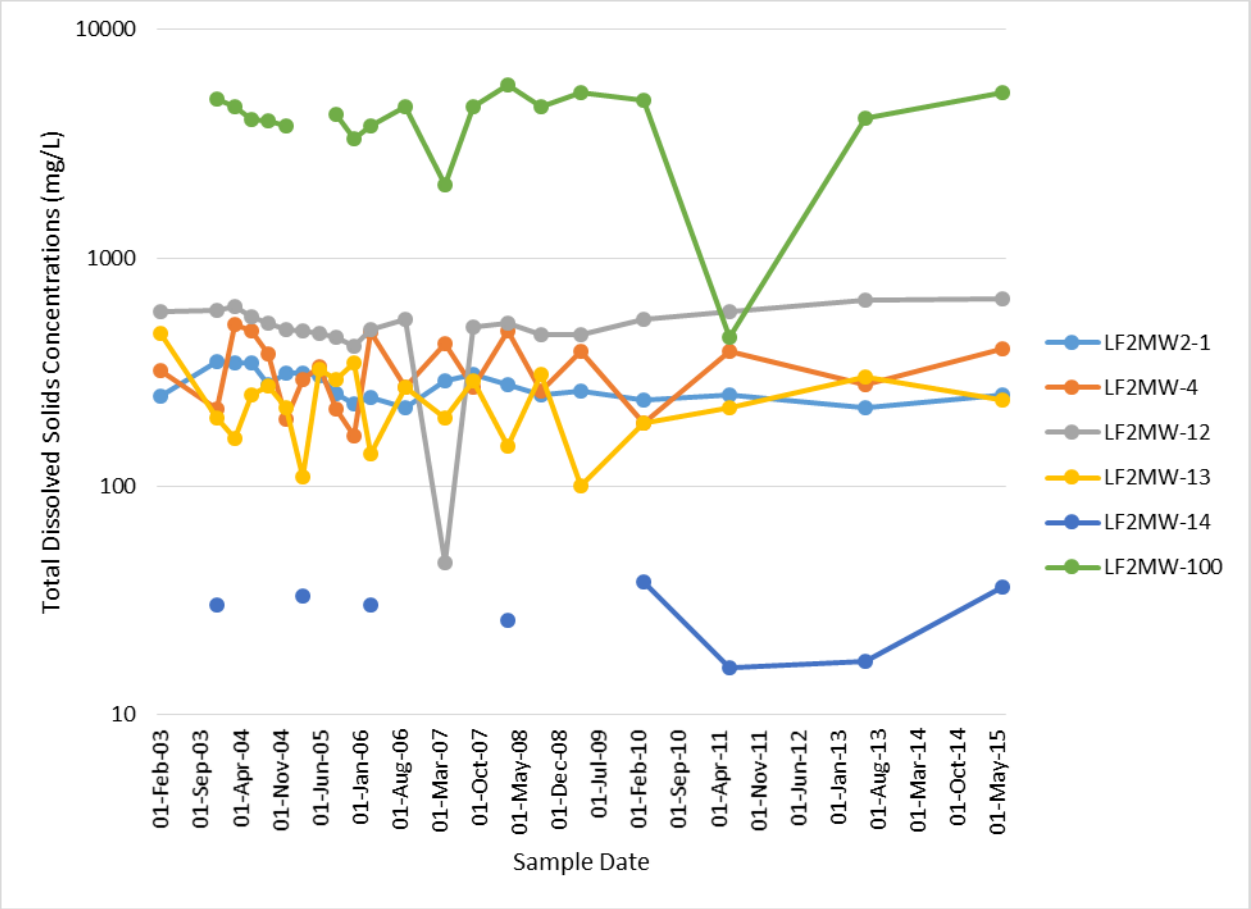

Table 4. LF002 Mann-Kendall Trend Analysis Increasing Trend Results

Well ID	Analyte	NYSDEC Groundwater Standards	Number of samples in the data set	Minimum Concentration	Maximum Concentration	COV	MKS	CF	Concentration Trend:
WL-LF2MW-100	Ammonia	2 mg/L	20	0.25	9.7	0.27	103	>99.9%	Increasing

The landfill inspections will continue to be conducted semiannually. However, only a full landfill inspection will be completed each year, likely in the fall. A "spot-check" inspection will be completed in the spring to assess signage, encroachment, digging, and similar LUC concerns associated with active redevelopment in Rome, New York by the GLDC. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the December 2004 Landfill 2/3 O&M Manual (Conti, December 2004).

3.4.2 Metric Development: Proposed End Point, Metrics, and Approach

3.4.2.1 Groundwater/Surface Water Monitoring

The proposed end point at this site is the optimization of groundwater and surface water monitoring. Groundwater and surface water will be sampled every 5 years per the Final 2015 LTM Report. Subject to data confirmation and regulatory concurrence, the projected LTM schedule for LF002 is provided in **Table 5**.

Table 5. LF002 LTM Schedule

Years	Activity	Timing
Period of Performance		
2016 through 2021	Full Landfill Inspections, Landfill Gas Monitoring	Fall Inspections Annual Monitoring in Fall
	Reporting	4th Quarter (December)
2020	Five-Year Review	2nd Quarter (April)
2019	Groundwater and Surface Water Monitoring	2nd Quarter (June)
Post-Period of Performance		
2021 through 2041	Landfill Inspections, Landfill Gas Monitoring	4th Quarter (October)
	Reporting	4th Quarter (December)
2025, 2030, 2035, and 2040	Five-Year Review	2nd Quarter (April)
2024, 2029, 2034, and 2039	Groundwater and Surface Water Monitoring	2nd Quarter (June)

Period of Performance

Groundwater and surface water monitoring will be conducted at four monitoring wells, and three surface water locations for landfill leachate indicators one year ahead of the next Five-Year Review. Since the landfill does not have a COC plume, the sole analysis of landfill leachate indicators provides sufficient detection of potential contamination from the landfill entering the environment. Two monitoring wells are proposed for elimination under this OP. Bedrock well LF2MW-100 does not produce sufficient groundwater for sampling of the full leachate indicator list. Therefore, this monitoring well is proposed for discontinuation of sampling because of limited data able to be obtained and the data obtained from this well not being representative. LF2MW-12 is adjacent to the bedrock well and provides a better representation of the potential impacts from the landfill. In addition, LF2MW-14 is recommended for discontinuation of sampling due to consistently low levels of landfill leachate indicators and its location upgradient

of the landfill. Proposal to reduce the sampling frequency and/or discontinue the monitoring of a sampling location may be prompted by the indication of a decreasing trend and/or at least two consecutive rounds with COC levels below NYS Groundwater or Surface water SCGs. Proposal to increase the LTM network is detailed in the Contingencies section.

The sampling will be conducted every 5 years at existing monitoring wells and surface water locations. Given the low groundwater velocity, the recommended monitoring frequency will provide adequate warning to any potential release of COCs to the environment by the landfill. As mentioned above, the groundwater flow velocity at this landfill is approximately 47 feet per year (FPM, December 2015). It will take groundwater approximately 4 years to migrate from upgradient of the landfill to the Landfill 2/3 toe. Additionally, sampling data from LF002 has shown continued sitewide stabilization of the leachate indicators. Therefore, the recommended monitoring frequency will provide adequate warning to any potential release of COCs to the environment by the landfill.

The four monitoring wells include LF2MW2-1, LF2MW-4, -12, and -13, and the three surface water sampling locations include LF2SW-1, -2, and -3. Low-flow sampling will be performed at the monitoring wells and the surface water samples will be collected as grab samples. The LF002 LTM network is provided in **Table 6** at the end of Section 3.

Post-Period of Performance

As a result of the absence of a contamination plume or COCs and the velocity of groundwater at the site, we anticipate sampling will be optimized to every 5 years (2024, 2029, 2034, and 2039) at the four monitoring wells and three surface water sampling locations. Samples will be analyzed for landfill leachate indicators. This sampling will be conducted one year ahead of each Five-Year Review.

3.4.2.2 Landfill Gas Monitoring

The proposed end point is the optimization of landfill gas monitoring through reduction of the monitoring locations by 40-percent.

Period of Performance

Nine gas monitoring probes and 14 gas vents are monitored annually for methane, LEL, oxygen, and carbon dioxide. Previous landfill gas monitoring rounds show that elevated methane concentrations persist throughout the landfill, but these levels are stable. Methane is not detected at any of the POC gas monitoring probes, therefore limiting potential risk of human exposure.

In May 2015, LEL values did not equal or exceed 100% at any of the gas monitoring probes or gas vents. In September 2015, LEL values equaled or exceeded 100% at two gas monitoring probes (LF2GMP-2 and -5), but did not exceed at any of the gas vents (FPM, December 2015).

Based upon recent monitoring results, landfill gas monitoring will be reduced from 23 monitoring locations to less than 14 locations during the POP (years 2016 through 2021). Recommendation for reduction of specific gas monitoring probes and gas vents will be presented in the next LTM report after the Fall 2016 readings are collected.

3.4.2.3 Post-Period of Performance

As a result of the stable landfill gas results, we anticipate that the optimization during the POP (years 2016 through 2021) will remain for post-POP (after 2021).

3.4.2.4 Landfill Cover Inspections and Maintenance

The proposed end point is the optimization of landfill cover inspections to annual.

Period of Performance

The current semiannual landfill cover inspections and maintenance will be optimized from semiannual to annual to coincide with annual landfill cover mowing. Previous semiannual inspections have not identified any major deficiencies that would jeopardize the integrity of the cover. The inspections indicated that vegetation growth on the landfill cap has optimal coverage for erosion control and cover system stabilization. Additional inspections or maintenance will be performed as needed, as required by the December 2004 Landfill 2/3 O&M Manual (Conti, December 2004).

Post-Period of Performance

If supported by landfill conditions, the optimized frequency of annual will continue post-POP (after 2021).

3.4.2.5 Annual LUC/IC Inspections

LUC/ICs, as required by the ROD, will be maintained in order to protect human health and the environment. The Annual LUC/IC inspections will be conducted to confirm the implementation and performance of the LUC/ICs. Results will be reported annually in the Basewide LUC/IC Site Inspection Report.

3.4.2.6 Five-Year Review

LF002 will be included in the 2020 Five-Year Review to evaluate the protectiveness of the remedy. The site will also be included in Five-Year Reviews from 2020 through 2040.

3.5 Contingencies

All contingent actions will be completed as established in the December 2004 Landfill 2/3 O&M Manual (Conti, December 2004) and will be compliant with the approved ROD.

3.5.1 Groundwater/Surface Water Monitoring

Groundwater and surface water monitoring is anticipated to ensure that the landfill is not releasing contamination to the environment. If it is found that the landfill is indeed releasing COCs to the environment, based on an increase in landfill leachate indicator detections and concentrations, a contingent analysis will be conducted. At this site, the contingent analysis will include VOCs, metals, PCBs, and landfill leachate indicators. Additional recommendations will be made using this data.

3.5.2 Landfill Gas Monitoring

Landfill gas monitoring will be performed to ensure that methane gas does not travel outside the LF002 boundary. If methane gas is detected at any of the perimeter POC monitoring locations and is suspected of leaving the landfill boundary there will be an increase in frequency of gas sampling events to track upward trends and migration of methane.

3.5.3 Landfill Cover Inspections and Maintenance

The landfill cover inspections and maintenance will be performed to ensure landfill cover materials, site drainage structures, and onsite monitoring wells are maintained and functioning within the design standards. In the event that the integrity of any of the above mentioned criteria are compromised, inspections and/or maintenance will be performed immediately to address any damages or flaws at the site. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the December 2004 Landfill 2/3 O&M Manual (Conti, December 2004).

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Table 6. LF002 Proposed LTM Network Summary

Sampling Locations	Screen Interval Depth (feet AMSL)	Sampling Rationale	Target Analytes – Method Numbers	Matrix	Number of Samples	Sampling Frequency	Evaluation Criteria
Groundwater LF2MW2-1 LF2MW-4 LF2MW-12 LF2MW-13 **Surface Water** LF2SW-1 LF2SW-2 LF2SW-3	516.28 – 506.28 526.17 – 516.19 521.5 – 511.5 519.98 – 509.98 Depth to groundwater ranged from 3.12 to 29.79 feet bgs.	Downgradient from potential source Downgradient from potential source Downgradient from potential source Downgradient from potential source Potential contaminant receptor Potential contaminant receptor Potential contaminant receptor	Anions – SW9056 Nitrogen (TKN) – 351.2 Ammonia – 350.1 COD – 410.4 BOD – SM5210B TOC – SW9060 TDS – SM2540C Alkalinity – SM2320B Phenols – SW9066 Hardness – SM2340C Color – SM2120B Boron – SW6010C	Water	7	Every 5 years	Groundwater data is compared to NYSDEC Groundwater Standards to evaluate the context of trends and to ensure protection of human health and the environment. Surface water analytes and frequency will be varied to follow groundwater program
Gas Sampling Monitoring probes/vents		In accordance with 6 NYCRR 360-2.17(f)	Methane (Flame ionization detector [FID]/CGI)	Gas	9 probes 14 vents	Annual	Evaluate methane and LEL trends.

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4 LF003 (LANDFILL 7 AOC)

4.1 Site Description

LF003 (Landfill 7 AOC) is approximately 11 acres in size, was active from 1950 through 1954, and is located northeast of Runway 15/33. The wastes disposed of at this landfill consisted of domestic refuse, solid waste, liquid wastes, petroleum products, and miscellaneous Base operations waste (such as airplane parts). Waste was placed into four trenches in the landfill area and subsequently burned. The groundwater flow rate at LF003 is approximately 445 feet per year and the general groundwater flow direction is south-southwest (FPM, December 2015). The ROD for LF003 was signed by the USEPA on June 6, 2000. In accordance with the ROD, the landfill was re-graded and capped in 2002. The landfill was capped with an 18-inch low permeability soil layer, covered by a 6-inch layer of topsoil, and seeded with grass (FPM, December 2015).

4.2 Historical and Current Long Term Management

Beginning in February 2003, monitoring was performed at eight monitoring wells (LF7MW-22, -23, -26, -27, -28, -29, -30, and -100) and two wetland surface water locations (LF7WL-3 and -4). These sampling locations are illustrated on the LF003 Site Map (see **Appendix A-Figure 4**). The monitoring network was analyzed quarterly (routine) and annually (baseline) for landfill leachate indicators and VOCs. Currently, based on several rounds of sampling data, the 2015 Landfill AOCs Long Term Monitoring Report recommends optimizing sampling to every 5 years. Recommendations to alter the sampling network were provided in previous Landfill AOCs Long Term Monitoring Reports and reviewed by the USEPA and NYSDEC.

VOCs, mercury, and PCBs were removed from the LF003 monitoring network analysis list in spring 2006, due to their low or absent concentrations at the site. Landfill leachate indicators previously detected above the NYS Groundwater/Surface Water SCGs included color, TDS, and TKN. Metals previously showed levels above NYS Groundwater SCGs. Several of the metals, including manganese, iron, and sodium are indicative of base background conditions. As a result, metals analysis was eliminated from the LF003 monitoring network in 2011 in accordance with the LF003 (Landfill 7 AOC) Optimization Plan (FPM/CAPE, November 2011).

Since September 2003, landfill inspections and cover maintenance have been performed at LF003. Inspections and maintenance are conducted on a semiannual basis with annual landfill cover mowing (conducted in the fall). LUC/ICs have been implemented by the ROD and are verified annually as part of the landfill cover inspection program. The inspections are performed in conjunction with the Basewide LUC/IC Site Inspections.

4.3 Regulatory Drivers

LF003 is regulated under the CERCLA of 1980, as amended, and the NCP. LTM is conducted in accordance with New York State's Solid Waste Management Regulations, 6-NYCRR Part 360. Groundwater and surface water sample results are compared to NYSDEC Class GA Groundwater Standards and NYSDEC Class C Surface Water Standards (NYSDEC, June 1998). Additionally, the site activities are conducted under the supervision and recommendations of the USEPA, Region 2 and NYSDEC.

4.4 Proposed Outcome

The proposed outcome for this site is LTM optimization by implementing the 2015 Long Term Monitoring Report recommendation for sampling every 5 years and reducing landfill cover inspections to annual. The next groundwater and surface water monitoring will occur in 2019, which is ahead of the Five-Year Review. Annual landfill cover inspections will commence with the Fall 2016 event. None of the proposed optimizations result in changes to the ROD.

4.4.1 Pathways to Achieve Proposed Outcome

Groundwater monitoring, surface water monitoring, and landfill cover maintenance will continue to be performed at LF003. Currently, no plumes or COCs are associated with the site as shown in the past 7 years of the 13 years of sampling data. The Mann-Kendall trend analysis is presented in **Appendix B** and shows no trend, stable, or decreasing trends. The analyte that primarily exceeds NYSDEC groundwater standards is color. Therefore, the sampling frequency will be optimized to every 5 years as recommended in the 2015 Long Term Monitoring Report.

The landfill inspections will continue to be conducted semiannually. However, only a full landfill inspection will be completed each year, likely in the fall. A "spot-check" inspection will be completed in the spring to assess signage, encroachment, digging, and similar LUC concerns associated with active redevelopment in Rome, New York by the GLDC. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the May 2004 Landfill 7 O&M Manual (Conti, May 2004a).

4.4.2 Metric Development: Proposed End Point, Metrics, and Approach

4.4.2.1 Groundwater/Surface Water Monitoring

The proposed end point at this site is the optimization of groundwater and surface water monitoring. Groundwater and surface water are anticipated to be monitored every 5 years for leachate indicators only to be completed ahead of the next Five-Year Review. The LTM schedule for LF003 is provided in **Table 7**. The LF003 monitoring network is provided in **Table 8** at the end of Section 4.

Table 7. LF003 LTM Schedule

Years	Activity	Timing
Period of Performance		
2016 through 2021	Annual Complete Landfill Inspections	4th Quarter (October)
	Reporting	4th Quarter (December)
2020	Five-Year Review	2nd Quarter (April)
2019	Groundwater and Surface Water Monitoring	2nd Quarter (June)
	Reporting	4th Quarter (December)
Post-Period of Performance		
2021 through 2040	Landfill Inspections	4th Quarter (October)
	Reporting	4th Quarter (December)
2024, 2029, 2034, and 2039	Groundwater and Surface Water Monitoring	2nd Quarter (June)
2025, 2030, 2035, and 2040	Five-Year Review	2nd Quarter (April)

Period of Performance

Groundwater and surface water monitoring will be conducted at six monitoring wells and two wetland surface water locations for landfill leachate indicators in 2019. Since the landfill does not have a COC plume, the sole analysis of landfill leachate indicators provides detection of potential contamination from the landfill entering the environment. Two monitoring wells are proposed for elimination under this OP. Bedrock well LF7MW-100 does not produce sufficient groundwater for sampling of the full leachate indicator list. Therefore, this monitoring well is proposed for discontinuation of sampling because of limited data able to be obtained and the data obtained from this well not representative. LF7MW-26 is adjacent to the bedrock well and provides a better representation of the potential impacts from the landfill. In addition, LF7MW-29 is recommended for discontinuation of sampling due to consistently low levels of landfill leachate indicators and its location upgradient of the landfill.

Further reduction of the sampling frequency and/or discontinuing the monitoring of a sampling location may be prompted by the indication of a decreasing trend and/or at least two consecutive rounds with COC levels below NYS Groundwater or Surface Water SCGs. The proposal to increase the monitoring network is detailed in the Contingencies section.

The sampling will be conducted every 5 years, starting in June 2019, at monitoring wells and surface water locations. Given the absence of COCs, sampling will be conducted for landfill leachate indicators only. The recommended monitoring frequency will provide adequate warning to any potential release of COCs to the environment by the landfill.

The six monitoring wells include LF7MW-22, -23, -26, -27, -28, -and -30 and the two wetland surface water sampling locations include LF7WL-3 and -4. Low-flow sampling will be performed

at monitoring wells. The surface water samples will be collected as grab samples. These sampling methods are described in detail in the Griffiss UFP-QAPP.

Post-Period of Performance

As a result of the absence of a contamination plume or COCs and the velocity of groundwater at the site, we anticipate sampling to continue every 5 years (2024, 2029, 2034, and 2039) but be reduced to sampling of six monitoring wells and two wetland surface water sampling locations. Samples will be analyzed for landfill leachate indicators only. This sampling will be conducted one year ahead of each Five-Year Review.

4.4.2.2 Landfill Cover Inspections and Maintenance

The proposed end point at this site for landfill cover maintenance is annual.

Period of Performance

The current scope of semiannual landfill cover inspections and maintenance will be reduced to annual to coincide with the annual landfill cover mowing. Previous semiannual inspections have not identified any major deficiencies that would jeopardize the integrity of the cover. The inspections indicated that vegetation growth on the landfill cap has optimal coverage for erosion control and cover system stabilization. Additional inspections or maintenance will be performed as needed, as required by the May 2004 Landfill 7 O&M Manual (Conti, May 2004a).

Post-Period of Performance

If supported by the landfill conditions, the desired inspection frequency will be annual with annual reporting. It is necessary that inspections continue to ensure the integrity of landfill fencing, signage, and the landfill cover.

4.4.2.3 Annual LUC/IC Inspections

LUC/ICs, as required by the ROD, will be maintained in order to protect human health and the environment until the site is closed in 2040. The Annual LUC/IC inspections will be conducted to confirm the implementation and performance of the LUC/ICs. Results will be reported annually in the Basewide LUC/IC Site Inspection Report.

4.4.2.4 Five-Year Review

LF003 will be included in the 2020 Five-Year Review to evaluate the protectiveness of the remedy. The site will also be included in the 2025, 2030, 2035, and 2040 Five-Year Reviews.

4.5 Contingencies

All contingent actions will be completed as established in the May 2004 Landfill 7 O&M Manual (Conti, May 2004a) and will be compliant with the approved ROD.

4.5.1 Groundwater/Surface Water Monitoring

Groundwater and surface water monitoring is anticipated to ensure that the landfill is not releasing contamination to the environment. If it is found that the landfill is indeed releasing COCs to the environment, based on an increase in landfill leachate indicator detections and concentrations, a contingent analysis will be conducted. At this site, the contingent analysis will include VOCs, metals, PCBs, and landfill leachate indicators. Additional recommendations will be made using this data.

4.5.2 Landfill Cover Inspections and Maintenance

The landfill cover inspections and maintenance will be performed to ensure landfill cover materials, site drainage structures, and on-site monitoring wells are maintained and functioning within the design standards. In the event that the integrity of any of the above mentioned criteria are compromised, inspections and/or maintenance will be performed immediately to address any damages or flaws at the site. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the May 2004 Landfill 7 O&M Manual (Conti, May 2004a).

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Table 8. LF003 Proposed LTM Network Summary

Sampling Locations	Screen Interval Depth (feet AMSL)	Sampling Rationale	Target Analytes – Method Numbers	Matrix	Number of Samples	Sampling Frequency	Evaluation Criteria
Groundwater			Anions – SW9056 Nitrogen (TKN) – 351.2 Ammonia – 350.2 COD – 410.4 BOD – SM5210B TOC – SW9060 TDS – SM2540C Alkalinity – SM2320B Phenols – SW9066 Hardness – SM2340C Color – SM2120B Boron – SW6010C	Water	8	Every 5 years	Groundwater data is compared to NYSDEC Groundwater Standards to evaluate the context of trends and to ensure protection of human health and the environment. Surface water analytes and frequency will be varied to follow groundwater program.
LF7MW-22	479.12 – 474.19	Downgradient from source, within plume					
LF7MW-23	482.03 – 472.01	Downgradient from source, cross-gradient from plume					
LF7MW-26	495.53 – 485.53	Downgradient from source, within plume					
LF7MW-27	500.91 – 490.91	Downgradient from source					
LF7MW-28	484.31 – 474.31	POC well					
LF7MW-30	494.67 – 484.67	Downgradient from source					
	Depth to groundwater ranged from less than 1 foot to 17.71 feet bgs.						
Surface Water							
LF7WL-3		Potential contaminant receptor					
LF7WL-4		Potential contaminant receptor					

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5 LF007 (LANDFILL 5 AOC)

5.1 Site Description

LF007 (Landfill 5 AOC) is approximately 4 acres in size and is located in the south-central portion of the base (**Appendix A-Figure 5**). The waste at LF007 consisted of domestic wastes, reportedly having been burned and then buried. Approximately 18,000 CY of wastes were disposed of at the site from 1950 through 1960. Groundwater flow rates were found to be approximately 240 feet per year (FPM, December 2015). Principal groundwater flow directions at LF007 are to the west.

The ROD for LF007 was signed by the USEPA on June 5, 2000. In accordance with the ROD, the landfill was re-graded and capped in 2002. The cap components include a low-permeability layer, drainage layer, barrier protection layer, and a topsoil layer. LTM was initiated in February 2003.

5.2 Historical and Current Long Term Management

Beginning in February 2003, groundwater sampling was performed at five monitoring wells (LF5MW-1A,-3, -5, -100, and MW49D07), and surface water sampling was performed at three surface water locations (LF5SW-1, -2, and -3). These sampling locations are illustrated on the LF007 Site Map (see **Appendix A-Figure 5**). The monitoring network was analyzed initially quarterly (routine) and annually (baseline) for landfill leachate indicators and VOCs. Based upon the 2015 Long Term Monitoring Report, groundwater monitoring is completed biannually and surface water is to be sampled every 5 years. Recommendations to alter the sampling network were provided in previous Landfill AOCs Long Term Monitoring Reports and reviewed by the USEPA and NYSDEC.

VOCs were analyzed until 2006 and no exceedances were reported. PCBs were analyzed until 2006 at sampling locations and until 2008 at LF5MW-100 (bedrock well). PCBs were only detected in LF5MW-100. In 2005 and 2006, the PCB detections were above the NYS Groundwater SCGs. No PCBs were detected at this location in 2007 and 2008. Landfill leachate indicators previously detected above the NYS Groundwater/Surface Water SCGs included ammonia, bromide, chloride, color, nitrate, sulfate, TDS, and TKN. Metals analysis for this site previously showed levels above NYS Groundwater SCGs. Several of the metals (e.g., manganese, iron, and sodium) are indicative of base background conditions. As a result, metals analysis was eliminated from the LF007 monitoring network in 2011 in accordance with the LF007 Optimization Plan (FPM/CAPE, November 2011).

Since September 2003, landfill inspections and cover maintenance have been performed at LF007. Inspections and maintenance are conducted on a semiannual basis with annual landfill cover mowing (fall). LUC/ICs have been implemented by the ROD and are verified semiannually

as part of the landfill cover inspection program. The fall inspections are performed in conjunction with the Basewide LUC/IC Site Inspections.

5.3 Regulatory Drivers

LF007 is regulated under the CERCLA of 1980, as amended, and the NCP. LTM is conducted in accordance with New York State's Solid Waste Management Regulations, 6-NYCRR Part 360. Groundwater and surface water sample results are compared to NYSDEC Class GA Groundwater Standards and NYSDEC Class C Surface Water Standards (NYSDEC, June 1998). Additionally, the site activities are conducted under the supervision and recommendations of the USEPA, Region 2 and NYSDEC.

5.4 Proposed Outcome

The proposed outcome for this site is Optimized Exit Strategy through reducing groundwater and surface water monitoring to every 5 years commencing in 2019 and by reducing landfill inspections to annual. The next groundwater and surface water monitoring will occur in 2019. Annual landfill cover monitoring will commence with the Fall 2016 event. None of the proposed optimizations result in changes to the ROD.

5.4.1 Pathways to Achieve Proposed Outcome

Groundwater monitoring, surface water monitoring, and landfill cover maintenance will continue to be performed at LF007. The decision to further optimize the monitoring at the site will be guided by the sampling data. Monitoring of groundwater and surface water will be optimized to every 5 years by 2019. Mann-Kendall trend analysis was completed for LF007 constituents, as presented in **Appendix B**. All of the leachate indicators at LF007 were stable, decreasing, or had no trend with the exception of chloride at LF5MW5-1A and sulfate at LF5MW-3. The chloride in LF5MW5-1A exceeded the NYSDEC groundwater standard of 250 mg/L in September 2005, December 2005, and June 2013 only. These chloride detections are directly correlated to an increase in TDS within this well during those sampling events. Similarly, the sulfate detections at LF5MW-3 appear to correlate to elevated TDS (> 700 mg/L). Therefore these trends identified by the Mann-Kendall analysis are more likely due to a turbid sample than representative analysis of the groundwater aquifer. **Table 9** summarizes the increasing trends identified in the Mann-Kendall analysis at LF007.

Table 9. LF007 Mann-Kendall Trend Analysis Increasing Trend Results

Well ID	Analyte	NYSDEC Groundwater Standards (mg/L)	Number of samples in the data set	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	COV	MKS	CF	Trend
WL-LF5MW-1A	Chloride	250	19	27.9	363	0.52	52	96.3%	Increasing
LF5MW-3	Sulfate	250	20	9.6	1,100	1.5	68	98.6%	Increasing

The landfill inspections will continue to be conducted semiannually. However, only a full landfill inspection will be completed each year, likely in the fall. A "spot-check" inspection will be completed in the spring to assess signage, encroachment, digging, and similar LUC concerns associated with active redevelopment in Rome, New York by the GLDC. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the May 2004 Landfill 5 O&M Manual (Conti, May 2004b).

5.4.2 Metric Development: Proposed End Point, Metrics, and Approach

5.4.2.1 Groundwater/Surface Water Monitoring

The proposed end point at this site is the optimization of groundwater and surface water monitoring. Groundwater and surface water are anticipated to be monitored every 5 years. The LTM schedule for LF007 is provided in **Table 10**.

Table 10. LF007 LTM Schedule

Years	Activity	Timing
Period of Performance		
2016, 2017, 2018, 2019, and 2020	Annual Complete Landfill Inspections	4th Quarter (October)
	Reporting	4th Quarter (December)
2019	Groundwater and Surface Water Monitoring	2nd Quarter (June)
2020	Five-Year Review	2nd Quarter (April)
Post Period of Performance		
2021 through 2041	Landfill Inspections	4th Quarter (October)
	Reporting	4th Quarter (December)
2024, 2029, 2034, and 2039	Groundwater and Surface Water Monitoring	2nd Quarter (June)
2025, 2030, 2035, and 2040	Five-Year Review	2nd Quarter (April)

Period of Performance

Groundwater and surface water monitoring will be conducted at five monitoring wells and three surface water locations for landfill leachate indicators. Since the landfill does not have a COC plume, the sole analysis of landfill leachate indicators every 5 years provides detection of potential contamination from the landfill entering the environment. Alterations to the frequency and duration of the monitoring network will be conducted through the analysis of sampling data trends. Proposal to reduce the sampling frequency and/or discontinue the monitoring of a sampling location may be prompted by the indication of a decreasing trend and/or at least two consecutive rounds with COC levels below NYS Groundwater or Surface water SCGs. Proposal to increase the monitoring network is detailed in the Contingencies section.

Given the low velocity of the groundwater flow at the site and absence of COCs, the sampling will be conducted every 5 years at the monitoring wells and surface water locations. Low-flow sampling will be performed at LF5MW-3 and -5, while bailer sampling will be performed at

LF5MW-1A, -100, and MW49D07. The surface water samples will be collected as grab samples. These sampling methods are described in detail in the Griffiss AFB UFP-QAPP.

Post-Period of Performance

As a result of the absence of a contamination plume or COCs and the velocity of groundwater at the site, we anticipate sampling will continue every 5 years at the 5 monitoring wells and 3 surface water sampling locations. Samples will be analyzed for landfill leachate indicators. This sampling will be conducted the year ahead of the Five-Year Review process.

5.4.2.2 Landfill Cover Inspections and Maintenance

The proposed end point at this site for landfill cover maintenance is annual.

Period of Performance

The current scope of semiannual landfill cover inspections and maintenance will be optimized to annual to coincide with the annual landfill cover mowing. Previous semiannual inspections have not identified any major deficiencies that would jeopardize the integrity of the cover. The inspections indicated that vegetation growth on the landfill cap has optimal coverage for erosion control and cover system stabilization. Additional inspections or maintenance will be performed as needed, as required by the May 2004 Landfill 5 O&M Manual (Conti, May 2004b). An example of additional inspections includes the inspections of the landfill covers following a 5-year storm event (6 inches of rainfall within a 24-hour period).

Post-Period of Performance

It is necessary that inspections continue to ensure the integrity of landfill fencing, signage, and the landfill cover. Therefore, the annual inspections are proposed to continue post-POP (after 2021).

5.4.2.3 Annual LUC/IC Inspections

LUC/ICs, as required by the ROD, will be maintained in order to protect human health and the environment until the site is closed in 2040. The Annual LUC/IC inspections will be conducted to confirm the implementation and performance of the LUC/ICs. Results will be reported annually in the Basewide LUC/IC Site Inspection Report.

5.4.2.4 Five-Year Review

LF007 will be included in the 2020 Five-Year Review to evaluate the protectiveness of the remedy. The site will also be included in the 2025, 2030, 2035, and 2040 Five-Year Reviews.

5.5 Contingencies

All contingent actions will be completed as established in the May 2004 Landfill 5 O&M Manual (Conti, May 2004b) and will be compliant with the approved ROD.

5.5.1 Groundwater/Surface Water Monitoring

Groundwater and surface water monitoring is anticipated to ensure that the landfill is not releasing contamination to the environment. If it is found that the landfill is indeed releasing COCs to the environment, based on an increase in landfill leachate indicator detections and concentrations, a contingent analysis will be conducted. At this site, the contingent analysis will include VOCs, metals, PCBs, and landfill leachate indicators. Additional recommendations will be made using this data.

5.5.2 Landfill Cover Inspections and Maintenance

The landfill cover inspections and maintenance will be performed to ensure landfill cover materials, site drainage structures, and onsite monitoring wells are maintained and functioning within the design standards. In the event that the integrity of any of the above mentioned criteria are compromised, inspections and/or maintenance will be performed immediately to address any damages or flaws at the site. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the May 2004 Landfill 5 O&M Manual (Conti, May 2004b).

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Table 11. LF007 Proposed LTM Network Summary

Sampling Locations	Screen Interval Depth (feet AMSL)	Sampling Rationale	Target Analytes - Method Numbers	Matrix	Number of Samples	Sampling Frequency	Evaluation Criteria
Groundwater			Anions -SW9056 Nitrogen (TKN) - 351.2 Ammonia -350.1 COD - 410.4 BOD - SM5210B TOC - SW9060 TDS - SM2540C Alkalinity -SM2320B Phenols - SW9066 Hardness - SM2340C Color - SM2120B Boron - SW6010C	Water	5	Every 5 years	Groundwater data is compared to NYSDEC Groundwater Standards to evaluate the context of trends and to ensure protection of human health and the environment. Surface water analytes and frequency will be varied to follow groundwater program.
LF5MW-3	459.25-449.25	Downgradient of potential source and between landfill and hardfill					
MW49D07	455.51-445.51	Downgradient from potential source					
LF5MW-5	459.49-449.49	Downgradient from potential source					
LF5MW-100	405.92-395.92	Bedrock, downgradient					
LF5MW-1A	465.6-455.6	Upgradient from potential source					
Surface Water LF5SW-1 LF5SW-2 LF5SW-3	Depth to groundwater ranged from4.90 to 21.80 feet bgs	Potential contaminant receptor-surface water and wetlands		Water	3		

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6 LF009 (LANDFILL 6 AOC)

6.1 Site Description

LF009 (Landfill 6) is approximately 15.7 acres in size and is located near the southern boundary of the base (**Appendix A-Figure 6**). The wastes disposed at the landfill include general refuse and hardfill that was buried and some of which was burned at the site. An estimated 38,000 to 62,000 CY of wastes were disposed at the site from 1955 to 1959. During the 1980s, although the landfill was no longer active, an unknown quantity of fuel-contaminated soil from the tank excavations at Tank Farms 1 and 3 was disposed of in the southern portion of LF009. In 1986, a clay cap was constructed over the fuel-contaminated soils area. The groundwater flow rate at LF009 is approximately 31 feet per year, south-southwest toward Three Mile Creek (TMC) at Landfill 6 (FPM, December 2015).

The ROD for LF009 was signed by the USEPA on June 7, 2001, which required a landfill cap. The cap was completed in 2004 and includes a gas venting layer, a low-permeability layer, drainage layer, barrier protection layer, and a topsoil layer.

Site SD052-02 borders LF009 (Landfill 6) to the north and is associated with a plume that is located downgradient of former maintenance facilities in Buildings 774 and 776, and former fuel pump house Building 775. During the investigation process, it was determined that the most probable source of the trichloroethene (TCE) contamination detected at Building 775 was the former TCE vat and drum storage area previously located on the east side of Building 774. Solvent use was widespread in these facilities in the 1950s, 1960s, and early 1970s. The primary contaminant exceeding NYS Class GA Groundwater Standards is TCE with minor detections of 1,1,1-trichloroethane (TCA) and tetrachlorothene (PCE). Site SD052-02 is anticipated to achieve the remedial action objectives by the end of 2020, which may result in additional groundwater monitoring optimization for LF009.

Site SD052-04 is the Landfill 6 TCE Site plume, located immediately downgradient to the south of Landfill 6. The most contaminated portion of the plume is located southwest of the landfill beneath the floodplain of TMC. Contaminants exceeding NYS Class GA Groundwater Standards (NYSDEC, June 1998) are TCE, cis-1,2-dichloroethene (DCE), and vinyl chloride. The selected remedy for the Landfill 6 TCE Site is enhanced bioremediation. Continued reduction of contaminants at this downgradient site may result in additional monitoring optimization for LF009.

6.2 Historical and Current Long Term Management

Beginning in June 2006, groundwater monitoring was performed at 19 monitoring wells (775VMW-10, -18R, -20R, LF6MW-1, -12, LF6VMW-10R2, -17D, -17S, -18, -19, -20, -21, -22, -23, -24, -25, -26, ATMCMW-9, and TMC-USGS-2), and surface water sampling was performed at

three surface water locations (LF6SW-1, -2, -3), and one wetland sampling location (LF6W-1). As recommended by the NYSDEC, landfill leachate sampling locations LF6LH-1 and -2 were added to the LF009 monitoring network in December 2006. These sampling locations are illustrated on the LF009 (Landfill 6) Site Map (see **Appendix A-Figure 6**). Currently, leachate indicators are sampled annually. Recommendations to alter the sampling network were provided in previous Landfill AOCs Long Term Monitoring Reports and reviewed by the USEPA and NYSDEC.

VOCs currently detected above the NYS Groundwater/Surface Water SCGs include TCE and DCE. Exceedances occur at monitoring wells 775VMW-10, LF6MW-12, and LF6VMW-26. However, VOC contamination is associated with SD052-04 (Landfill 6 Operable Unit [OU]), which is monitored with Site SD052-04. Therefore, VOCs are not monitored as part of LF009.

Landfill leachate indicators previously detected above the NYS Groundwater/Surface Water SCGs included chloride, color, TDS, and TKN. The detections of landfill leachate indicators were evaluated through Mann-Kendall analysis as presented in **Appendix B**. While LF6MW-12 indicates an increasing trend for TDS, the TDS has consistently averaged 540 mg/L since 2006 with the exception of the October 2007 event where the TDS was 1,000 mg/L and the 2014 sampling event where TDS was 1,300 mg/L. It should be noted that LF6MW-12 is present immediately downgradient of the injection wells used for the enhanced bioremediation of the Landfill 6 TCE plume under Site SD052-04, which likely affects the results of the landfill indicators in this location. While the TDS and chloride slightly increased over time at LF6VMW-24 as identified by the Mann-Kendall analysis, these trends have been stable since 2012 with TDS at approximately 770 mg/L and chloride at approximately 350 mg/L. While TDS at LF6VMW-26 has exceeded the NYSDEC Groundwater standards since 2009, these results have remained stable and only slightly exceed the groundwater standard of 500 mg/L. **Table 12** summarizes the increasing trends identified in the Mann-Kendall analysis at LF009.

Table 12. LF009 Mann-Kendall Trend Analysis Increasing Trend Results

Well ID	Analyte	NYSDEC Groundwater Standards (mg/L)	Number of samples in the data set	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	COV	MKS	CF	Concentration Trend
LF6MW-12	TDS	500	19	310	1,300	0.35	66	98.9%	Increasing
WL-LF6VMW-24	TDS	200	20	300	800	0.36	149	>99.9%	Increasing
WL-LF6VMW-24	Chloride	250	32	98	390	0.47	351	>99.9%	Increasing
WL-LF6VMW-26	TDS	500	20	350	590	0.14	101	>99.9%	Increasing

Landfill gas monitoring has been performed at LF009 to identify the presence and concentration of methane at or near the landfill. A total of 13 gas monitoring probes and 16 landfill gas vents were monitored on a quarterly basis from October 2005 until October 2009. Landfill gas sampling was optimized after the October 2009 sampling round and is now sampled semiannually. Results from the gas sampling events at LF009 showed elevated methane concentrations throughout the landfill, but these levels have declined. Methane has not been detected at LF009 since the fall 2009 gas monitoring round.

Since July 2006, landfill inspections and cover maintenance have been performed at LF009. Inspections and maintenance are conducted on a semiannual basis with annual landfill cover mowing (conducted in the fall). LUC/ICs have been implemented by the ROD and are verified quarterly as part of the landfill cover inspection program. The fall inspections are performed in conjunction with the Basewide LUC/IC Site Inspections.

6.3 Regulatory Drivers

LF009 is regulated under the CERCLA of 1980, as amended, and the NCP. LTM is conducted in accordance with New York State's Solid Waste Management Regulations, 6-NYCRR Part 360. Groundwater and surface water sample results are compared to NYSDEC Class GA Groundwater Standards and NYSDEC Class C Surface Water Standards (NYSDEC, June 1998). Additionally, the site activities are conducted under the supervision and recommendations of the USEPA, Region 2 and NYSDEC.

6.4 Proposed Outcome

The proposed outcome for this site is LTM Optimization through reduction of groundwater and surface water sampling frequency to every 5 years and landfill inspection and landfill gas monitoring frequency reduced to annually. In addition, the number of monitoring wells analyzed for leachate indicators will be reduced by 50-percent over the POP (years 2016 through 2021). A similar reduction in landfill gas monitoring points is proposed for optimization. The next groundwater and surface water monitoring will occur in 2019. Annual inspections and landfill gas monitoring will commence with the Fall 2016 event. None of the proposed optimizations result in changes to the ROD.

6.4.1 Pathways to Achieve Proposed Outcome

Groundwater monitoring, surface water monitoring, and landfill cover maintenance will continue to be performed at LF009 but will be optimized for frequency.

The landfill gas monitoring will be optimized from semiannual to annual. Previous landfill gas monitoring rounds show that elevated methane concentrations were detected throughout the landfill but these levels have declined.

The landfill inspections will continue to be conducted semiannually. However, only a full landfill inspection will be completed each year, likely in the fall. A "spot-check" inspection will be completed in the spring to assess signage, encroachment, digging, and similar LUC concerns associated with active redevelopment in Rome, New York by the GLDC. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the December 2006 Landfill 6 O&M Manual (Conti, December 2006). Additional inspections and/or maintenance may be warranted as the result of significant rainfall over a 24-hour period or vector disturbance to the landfill cap.

6.4.2 Metric Development: Proposed End Point, Metric, and Approach

6.4.2.1 Groundwater/Surface Water Monitoring

The proposed end point at this site is the optimization of groundwater and surface water monitoring. Subject to data confirmation and regulatory concurrence, the projected LTM schedule for LF009 is provided in **Table 13**. The LF009 LTM network is provided in **Table 14** at the end of Section 6.

Table 13. LF009 LTM Schedule

Years	Activity	Timing
Period of Performance		
2016 through 2021	Annual Complete Landfill Inspections, Landfill Gas Monitoring	4th Quarter (October)
	Reporting	4th Quarter (December)
2019	Groundwater, Leachate, and Surface Water Monitoring	Every 5 years
2020	Five-Year Review	2nd Quarter (April)
Post-Period of Performance		
2021 through 2041	Landfill Inspections, Landfill Gas Monitoring	4th Quarter (October)
	Reporting	4th Quarter (December)
2024, 2029, 2034, and 2039	Groundwater and Surface Water Monitoring	2nd Quarter (June)
2025, 2030, 2035, and 2040	Five-Year Review	2nd Quarter (April)

Period of Performance

Groundwater and surface water monitoring will be conducted the year prior to the Five-Year Review at 19 monitoring wells, 3 surface water locations, 1 wetland location, and 2 leachate locations for landfill leachate indicators. Of the 19 monitoring wells sampled in 2015, only 9 of the wells had leachate indicator exceedances. Concentrations of leachate indicators at the overburden wells and surface water locations were comparable to previous results and were below/within the typical range of municipal landfill leachate (Lee and Jones, April 1991a). Since

LF009 is currently only sampled for landfill leachate indicators under the Landfill AOC (Landfill 6 TCE plume is addressed under Site SD052-04) and has a low groundwater flow rate, monitoring optimization is appropriate. Similar to all of the landfill AOCs (except LF001), the sampling frequency is proposed to be optimized to every 5 years with the next sampling event be completed ahead of the Five-Year Review in 2019. As mentioned above, the groundwater flow velocity at this landfill is 31 feet per year. It will take groundwater approximately 10 years to migrate from upgradient of the landfill to the LF009 toe. Given the low groundwater velocity, the recommended monitoring frequency will provide adequate warning to any potential release of COCs to the environment by the landfill.

Additionally, the sampling network will be optimized to reduce the monitoring wells sampled to 10 locations by 2021. Downgradient monitoring wells LF6VMW-18, -19, and -20 are recommended to cease sampling based upon no exceedances. Upgradient monitoring wells 775VMW-10 and -20R are recommended for elimination as the existing three monitoring wells upgradient provide sufficient and representative coverage. Monitoring wells LF6VMW-25 and LF6VMW-23 can be eliminated due to duplication with nearby wells and lack of exceedances. Based upon low level leachate indicator concentrations, both LFVMW-17S and -17D are also recommended for elimination from the monitoring program. Proposal to reduce the sampling frequency and/or discontinue the monitoring of a sampling location may be further prompted by the indication of a decreasing or stable trend and/or at least two consecutive rounds with COC levels below NYS Groundwater or Surface Water SCGs. Proposal to increase the monitoring network is detailed in the Contingencies section.

Low-flow sampling will be performed at the monitoring wells. The surface water samples and wetland sample will be collected as grab samples. These sampling methods are described in detail in the Griffiss AFB UFP-QAPP.

Post-Period of Performance

As a result of the stabilization/decline of contaminants at the site, we anticipate sampling will be optimized to every 5 years (2024, 2029, 2034, and 2039) at the 9 monitoring wells, 2 leachate sampling locations, 3 surface water sampling locations, and 1 wetland location. Samples will be analyzed for landfill leachate indicators only. This sampling will be conducted in conjunction with the Five-Year Review process.

6.4.2.2 Landfill Gas Monitoring

The proposed end point is the optimization of landfill gas monitoring.

Period of Performance

Thirteen gas monitoring probes and 16 gas vents will be monitored annually for methane, LEL, oxygen, and carbon dioxide. Previous landfill gas monitoring rounds show that elevated

methane concentrations persist throughout the landfill, but these levels are stable. Methane is not detected at any of the POC gas monitoring probes, therefore limiting potential risk of human exposure. Therefore, the total points monitored for landfill gas will also be reduced from 29 to less than 15 within the POP (years 2016 through 2021).

Post-Period of Performance

As a result of the stable landfill gas results, it is anticipated the optimization within the POP (by 2021) will continue post-POP (after 2021).

6.4.2.3 Landfill Cover Inspections and Maintenance

The proposed end point at this site for landfill cover maintenance is semiannual.

Period of Performance

The current scope of semiannual landfill cover inspections and maintenance will be reduced to annual to coincide with the annual landfill cover mowing. Previous semiannual inspections have not identified any major deficiencies that would jeopardize the integrity of the cover. The inspections indicated that vegetation growth on the landfill cap has optimal coverage for erosion control and cover system stabilization. Additional inspections or maintenance will be performed as needed, as required by the December 2006 Landfill 6 O&M Manual (Conti, December 2006). An example of additional inspections includes the inspections of the landfill covers following a 5-year storm event (6 inches of rainfall within a 24-hour period).

Post-Period of Performance

It is necessary that inspections continue to ensure the integrity of landfill fencing, signage and the landfill cover. Therefore, the optimized annual inspections will continue after 2021.

6.4.2.4 Annual LUC/IC Inspections

LUC/ICs, as required by the ROD, will be maintained in order to protect human health and the environment until the site is closed in 2040. The Annual LUC/IC inspections will be conducted to confirm the implementation and performance of the LUC/ICs. Results will be reported annually in the Basewide LUC/IC Site Inspection Report.

6.4.2.5 Five-Year Review

LF009 will be included in the 2020 Five-Year Review to evaluate the protectiveness of the remedy. The site will also be included in the 2025, 2030, 2035, and 2040 Five-Year Reviews.

6.5 Contingencies

All contingent actions will be completed as established in the December 2006 Landfill 6 O&M Manual (Conti, December 2006) and will be compliant with the approved ROD.

6.5.1 Groundwater/Surface Water Monitoring

Groundwater and surface water monitoring is anticipated to ensure that the landfill is not releasing contamination to the environment. If it is found that the landfill is indeed releasing COCs to the environment, based on an increase in landfill leachate indicator detections and concentrations, a contingent analysis will be conducted. At this site, the contingent analysis will include VOCs, metals, PCBs, and landfill leachate indicators. Additional recommendations will be made using these data.

6.5.2 Landfill Gas Monitoring

Landfill gas monitoring will be performed to ensure that methane gas does not travel outside the LF009 boundary. If methane gas is detected at any of the perimeter POC wells and suspected of leaving the landfill boundary there will be an increase in frequency of gas sampling events to track upward trends and migration of methane.

6.5.3 Landfill Cover Inspections and Maintenance

The landfill cover inspections and maintenance will be performed to ensure landfill cover materials, site drainage structures, and on-site monitoring wells are maintained and functioning within the design standards. In the event that the integrity of any of the above mentioned criteria are compromised, inspections and/or maintenance will be performed immediately to address any damages or flaws at the site. Additional inspections and/or maintenance will be performed as needed; following the guidance established in the December 2006 Landfill 6 O&M Manual (Conti, December 2006).

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Table 14. LF009 Proposed LTM Network Summary

Sampling Locations	Screen Interval Depth (feet AMSL)	Sampling Rationale	Target Analytes - Method Numbers	Matrix	Number of Samples	Sampling Frequency	Evaluation Criteria
Groundwater LF6MW-1 TMC-USGS-2 775VMW-18R LF6VMW-10R2 LF6VMW-21 LF6VMW-22 LF6MW-12 LF6VMW-24 LF6VMW-26 TMCMW-9 **Leachate** LF6LH-1 LF6LH-2	 460.8-450.8 428.6-426.1 423.7-413.7 439.2-429.2 434.93-424.93 435.76-425.76 416.59-406.59 419.25-409.25 412.9-402.9 439.16-429.1	 Upgradient well Downgradient from landfill Upgradient well Downgradient from landfill Upgradient well Downgradient, vertical profile Downgradient from landfill Downgradient, vertical profile Downgradient from landfill Downgradient from landfill Leachate locations	Anions - SW9056 Nitrogen (TKN) - 351.2 Ammonia - 350.1 COD - 410.4 BOD – SM5210B TOC - SW9060 TDS - SM2540C Alkalinity - SM2320B Phenols - SW9066 Hardness - SM2340C Color - SM2120B Boron - SW6010C	Water	12	Every 5 years	Groundwater data is compared to NYSDEC Groundwater Standards to evaluate the context of trends and to ensure protection of human health and the environment. Surface water analytes and frequency will be varied to follow groundwater program.
Surface water LF6/TMCSW-1 LF6/TMCSW-2 LF6/TMCSW-3 **Wetland** LF6W-1		Potential contaminant receptor-surface water and wetlands		Water	4		
Gas sampling Monitoring probes/vents		In accordance with 6 NYCRR 360-2.17(f)	Methane (FID/CGI)	Gas	13 probes 16 vents	Annually	Evaluate methane and LEL trends.

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7 SUMMARY OF LTM OPTIMIZATION AT THE LANDFILLS

These five CERCLA sites are all capped landfills with ongoing post-closure activities that include the performance of routine, preventive, predictive, scheduled, and unscheduled inspections. Per the FFA, LTM of the landfills will continue until 2040. The purpose of optimizing the landfill AOCs at Griffiss AFB is to minimize cost while maintaining compliance with the FFA and signed RODs.

Therefore, the proposed optimization is based upon over 10 years of air and water data coupled with regular cap inspections and maintenance. The proposed reductions in sampling and inspection frequency will ensure compliance with the FFA and ROD and protect human health and the environment. Monitoring wells eliminated from the LTM program will be decommissioned in accordance with the *NYSDEC Groundwater Monitoring Well Decommissioning Policy* (NYSDEC, November 2009). During the Restoration Advisory Board Meeting held on 16 June 2016, the Air Force presented reductions in LTM at the landfills including sampling every 5 years at LF002, LF003, and LF007. Bhate recommends further optimization for the sampling frequency at LF001 and LF009. The following table summarizes the LTM optimization proposed for each landfill AOC within the POP (years 2016 through 2021).

Table 15. LTM Optimization Summary

Site	Current LTM Activities (FPM, 2015)	Optimized Exit Strategy during POP
LF001	• Semiannual landfill gas monitoring at 18 gas monitoring probes/31 gas vents. • Annual groundwater monitoring at 13 monitoring wells. • Surface water monitoring at 3 locations. • Semiannual cap inspections.	• Reduce landfill gas monitoring by 50% through reduction of gas vents monitored and to annual from semiannual within POP. • Reduce groundwater monitoring locations by approximately 25% based upon continued non-exceedance of landfill leachate indicators or VOCs and all sampling to biennial. • Annual cap inspections.
LF002	• Semiannual landfill gas monitoring at 9 gas monitoring probes/14 gas vents. • Biennial groundwater monitoring at 6 monitoring wells and biennial surface water monitoring at 3 locations. • Semiannual cap inspections.	• Reduce landfill gas monitoring by 40% and to annual within POP. • Sampling every 5 years with the next sampling event one year prior to the next Five-Year Review. • Eliminate sampling from 2 groundwater monitoring wells. • Annual cap inspections.

Site	Current LTM Activities (FPM, 2015)	Optimized Exit Strategy during POP
LF003	• NO landfill gas monitoring. • Biennial groundwater monitoring at 8 monitoring wells and biennial surface water monitoring at 2 locations. • Semiannual cap inspections.	• Reduce sample locations by approximately 25%. • Sampling every 5 years with the next sampling event one year prior to the next Five-Year Review. • Annual cap inspections.
LF007	• NO landfill gas monitoring. • Biennial groundwater monitoring at 5 monitoring wells and biennial surface water monitoring at 3 locations. • Semiannual cap inspections.	• Sampling every 5 years with the next sampling event one year prior to the next Five-Year Review. • Annual cap inspections.
LF009	• Semiannual landfill gas monitoring at 13 gas monitoring probes/16 gas vents. • Annual groundwater monitoring at 19 monitoring wells, 2 leachate locations, 1 wetland location, and 3 surface water locations. • Semiannual cap inspections.	• Reduce landfill gas monitoring by approximately 50% and to annual within POP. • Reduce groundwater monitoring locations to 10. • Sampling every 5 years with the next sampling event one year prior to the next Five-Year Review. • Annual cap inspections.

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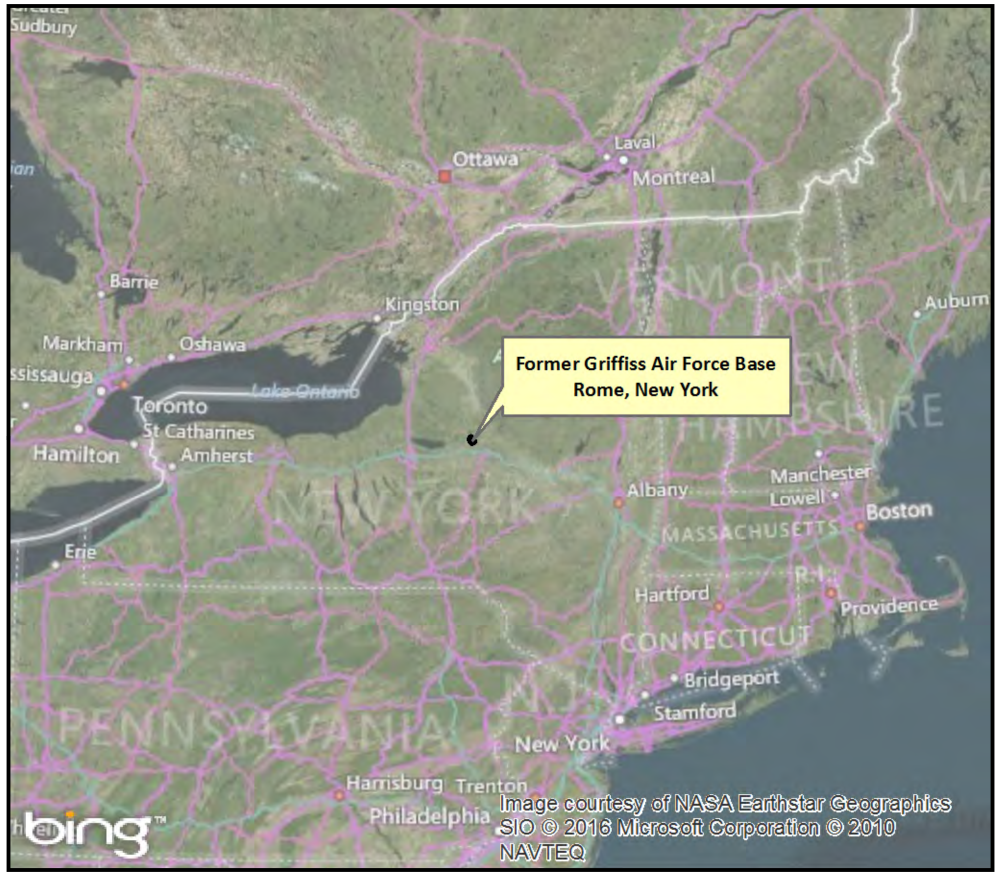
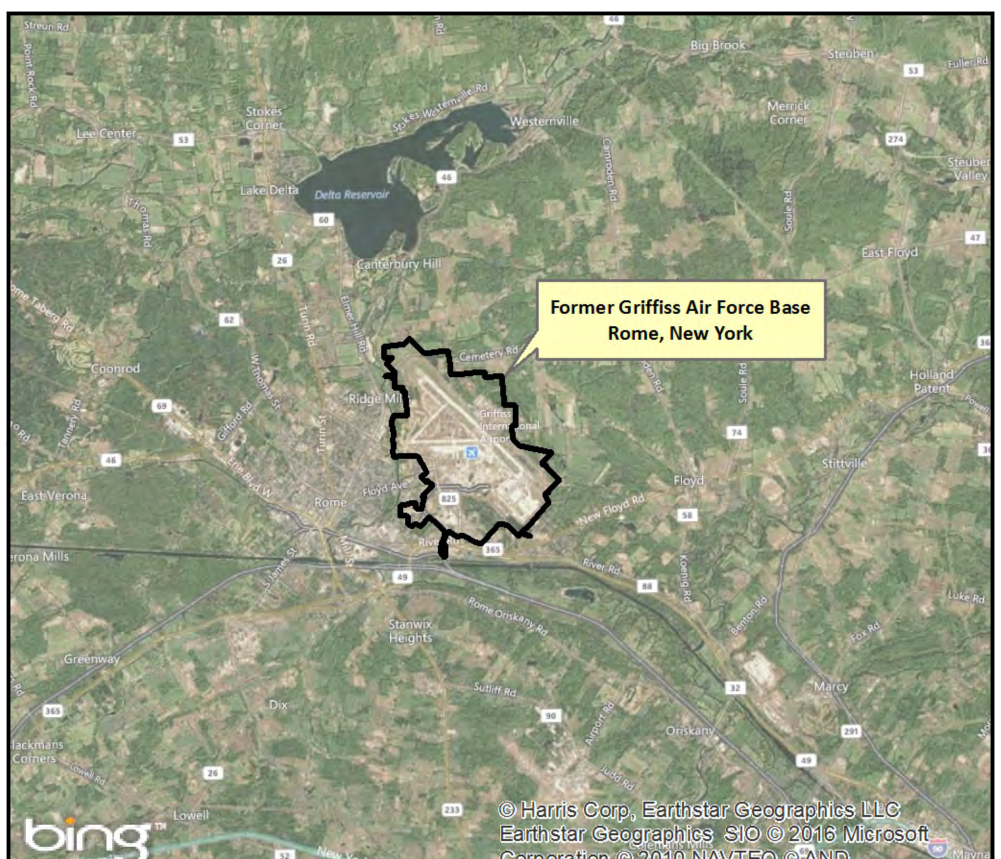
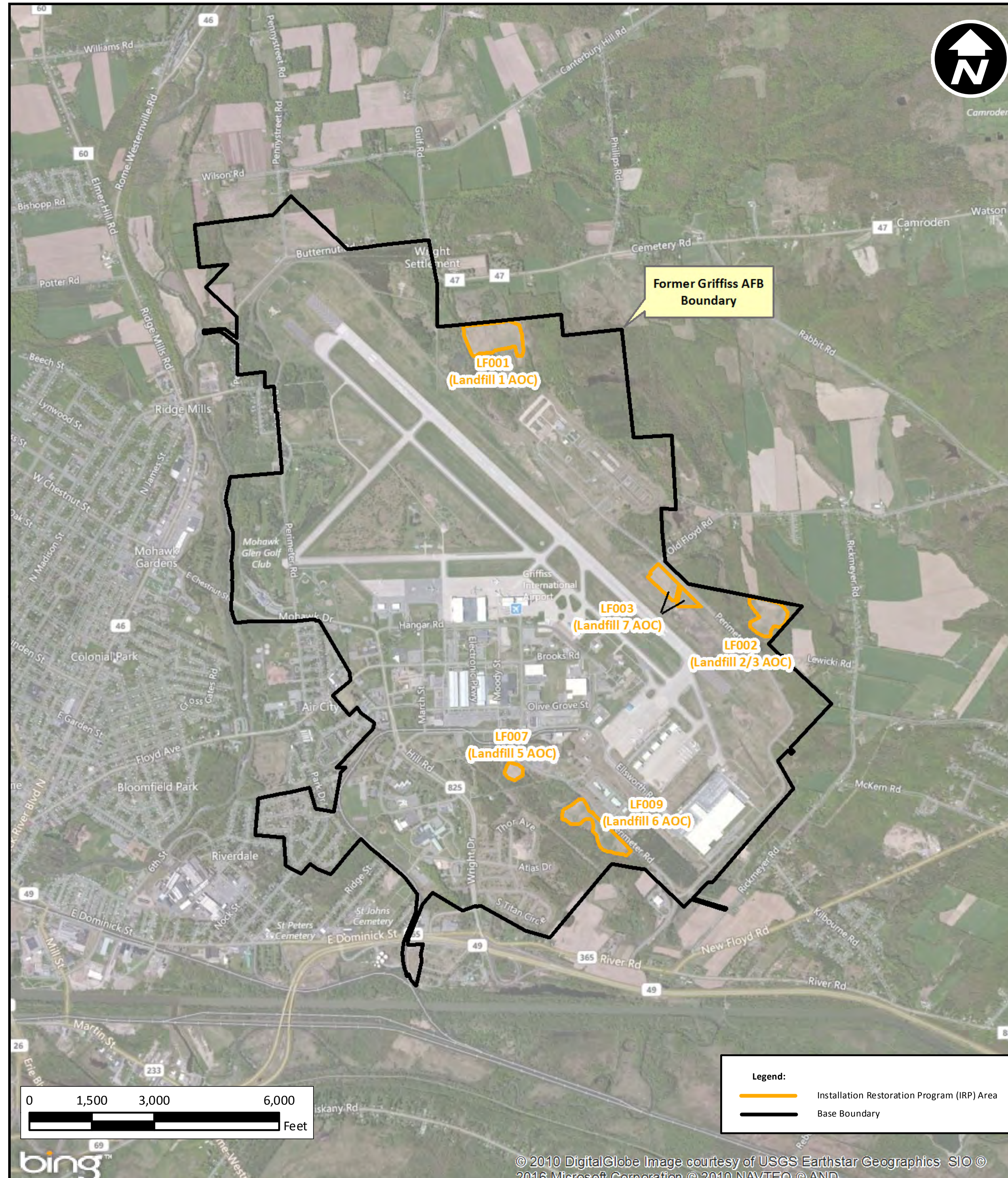
APPENDIX A
SITE FIGURES







Former Griffiss Air Force Base
Landfill AOC Sites Location Map

Figure 1

Optimization Plan for Landfill Areas of Concern
Long-Term Management Program
Former Griffiss Air Force Base, Rome, New York

DRAWN BY:	MRM
DATE:	8/31/2016
SCALE:	As Shown
PROJECT NO:	AFCGSA3

bhate
ENVIRONMENT
INFRASTRUCTURE

LF001 (Landfill 1 AOC) Site Map

Figure 2

Optimization Plan for Landfill Areas of Concern
Long-Term Management Program
Former Griffiss Air Force Base, Rome, New York

DRAWN BY: MRM

DATE: 9/1/2016

SCALE: As Shown

PROJECT NO: AFCGSA3

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Passive Gas Collection Trench Location

Approximate Direction of Groundwater Flow

Pistol Range

LF001

F10C

F10B

SS062

NEADS

Gulf Road

Perimeter Road

Six Mile Creek

Intermittent Stream

Intermittent Stream

A1A

LF1GMP-18 LF1GMP-19 Vent-27 LF1GMP-11 LF1GMP-20 LF1GMP-12 LF1GMP-6 LF1MW-1R

Vent-24 Vent-25 Vent-26 LF1GMP-4 Vent-28 Vent-29 Vent-30 Vent-31 Vent-22

LF1SW-1 LF1MW-12 Vent-7 Vent-10 Vent-13

Vent-1 Vent-5 Vent-17

LF1GMP-3 Vent-8 Vent-11 Vent-14 Vent-18 Vent-21

Vent-2

LF1MW-11 Vent-9 Vent-15 Vent-19

LF1MW-14 Vent-3 Vent-6 Vent-12 Vent-16 LF1GMP-9 Vent-20

LF1GMP-2 LF1GMP-8

Vent-4 LF1GMP-10 LF1GMP-14

LF1GMP-1 LF1GMP-13

LF1GMP-15

MWSAR03

LF1MW-6 LF1MW-103 LF1P-2 LF1GMP-16 LF1GMP-17

LF1SW-25MC LF1MW-10

LF1MW-5

LF1P-5

LF1P-3

LF1MW-13

LF1SW-3

5936 5950 6028 0854 6025 0738 0900 0901 0902 0903 0904 0905 0906 0907 0930 0912 0913 0915

Notes:
This information is depicted to provide visual aid within the context of this document and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.

The location of Vent-23 is unknown at this time and will be verified in the field.

0 150 300 600 Feet

Legend:

- Proposed LTM Monitoring Well Sample Location
- Monitoring Well Location
- Gas Monitoring Probe Location
- Gas Vent Location
- Surface Water Sample Location
- Installation Restoration Program (IRP) Area
- Base Boundary
- Parcel Boundary
- 5657 Building Number
- Surface Water Location

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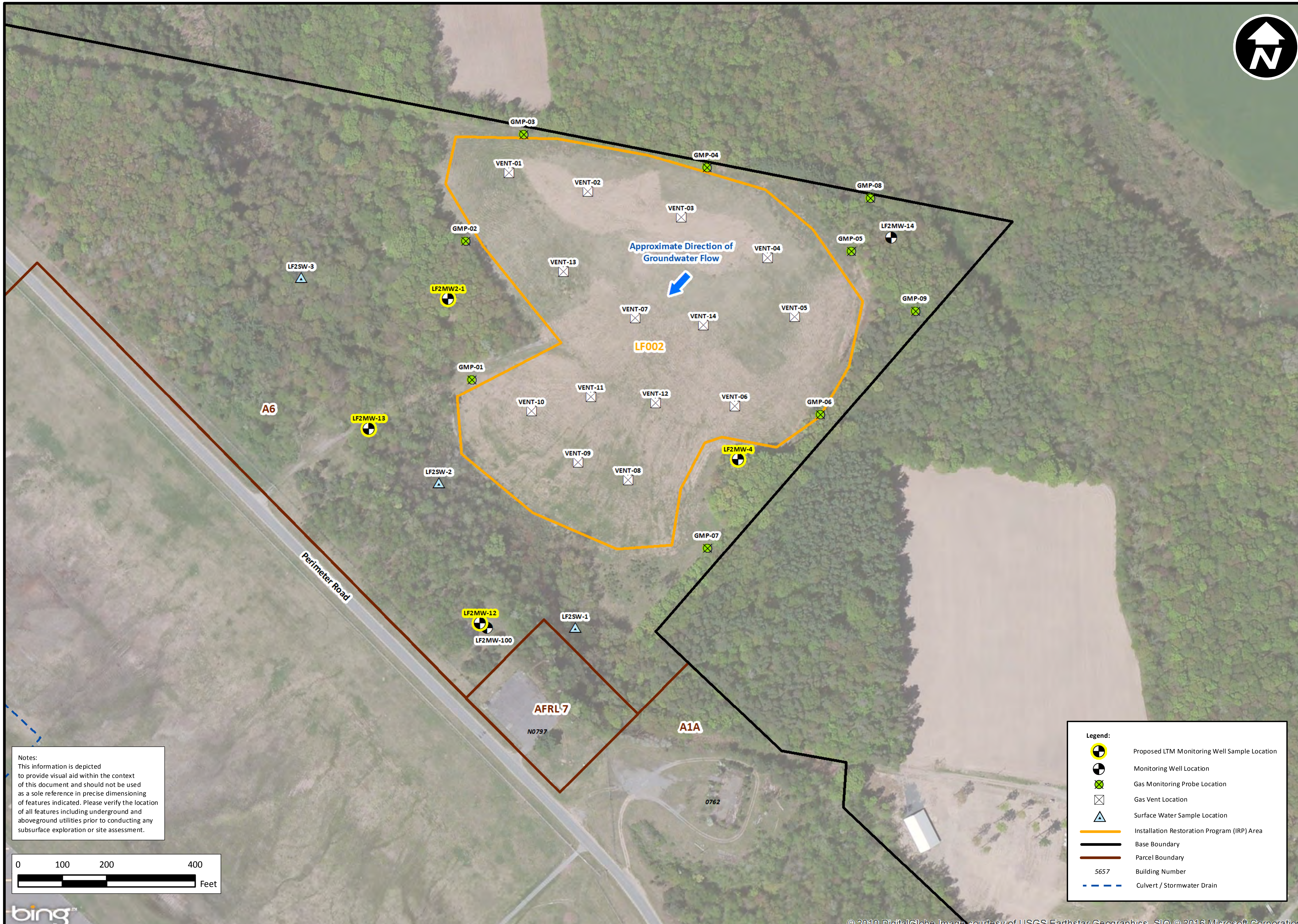

LF002 (Landfill 2/3 AOC) Site Map

Figure 3

Optimization Plan for Landfill Areas of Concern
Long-Term Management Program
Former Griffiss Air Force Base, Rome, New York

DRAWN BY:	DATE:	SCALE:	PROJECT NO:
MRM	8/31/2016	As Shown	AFCGSA3

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ENVIRONMENT
INFRASTRUCTURE

LF003 (Landfill 7 AOC) Site Map

Figure 4

F10B

Pond

Pond

Approximate Direction of Groundwater Flow

LF7WL-4

LF7MW-27

5960

LF003

LF7MW-29

0802

Perimeter Road

LF7MW-22

LF7WL-3

LF7MW-100

LF7MW-26

5945

LF7MW-28

A6

LF003

A1A

LF7MW-30

LF7MW-23

6235

5986

6242

5985

5525

A1A

Notes:
This information is depicted to provide visual aid within the context of this document and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.

0 100 200 400 Feet

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Legend:

- Proposed LTM Monitoring Well Sample Location
- Monitoring Well Location
- Surface Water Sample Location
- Installation Restoration Program (IRP) Area
- Base Boundary
- Parcel Boundary
- 5657 Building Number
- Surface Water Location
- Culvert / Stormwater Drain

Optimization Plan for Landfill Areas of Concern
Long-Term Management Program
Former Griffiss Air Force Base, Rome, New York

DRAWN BY: MRM

DATE: 8/31/2016

SCALE: As Shown

PROJECT NO: AFCGSA3

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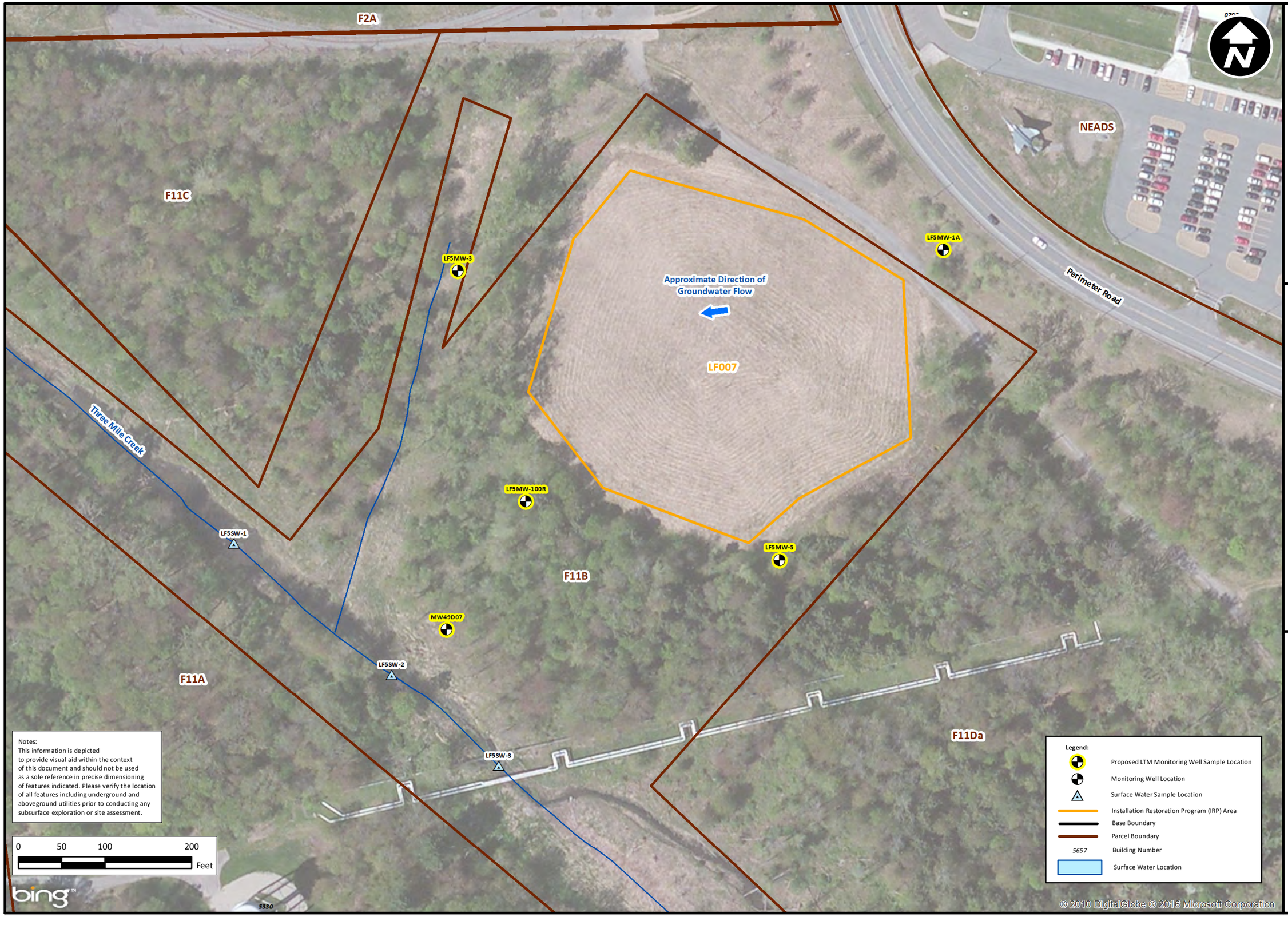

LF007 (Landfill 5 AOC) Site Map

Figure 5

Optimization Plan for Landfill Areas of Concern
Long-Term Management Program
Former Griffiss Air Force Base, Rome, New York

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SCALE: As Shown

PROJECT NO: AFCGSA3

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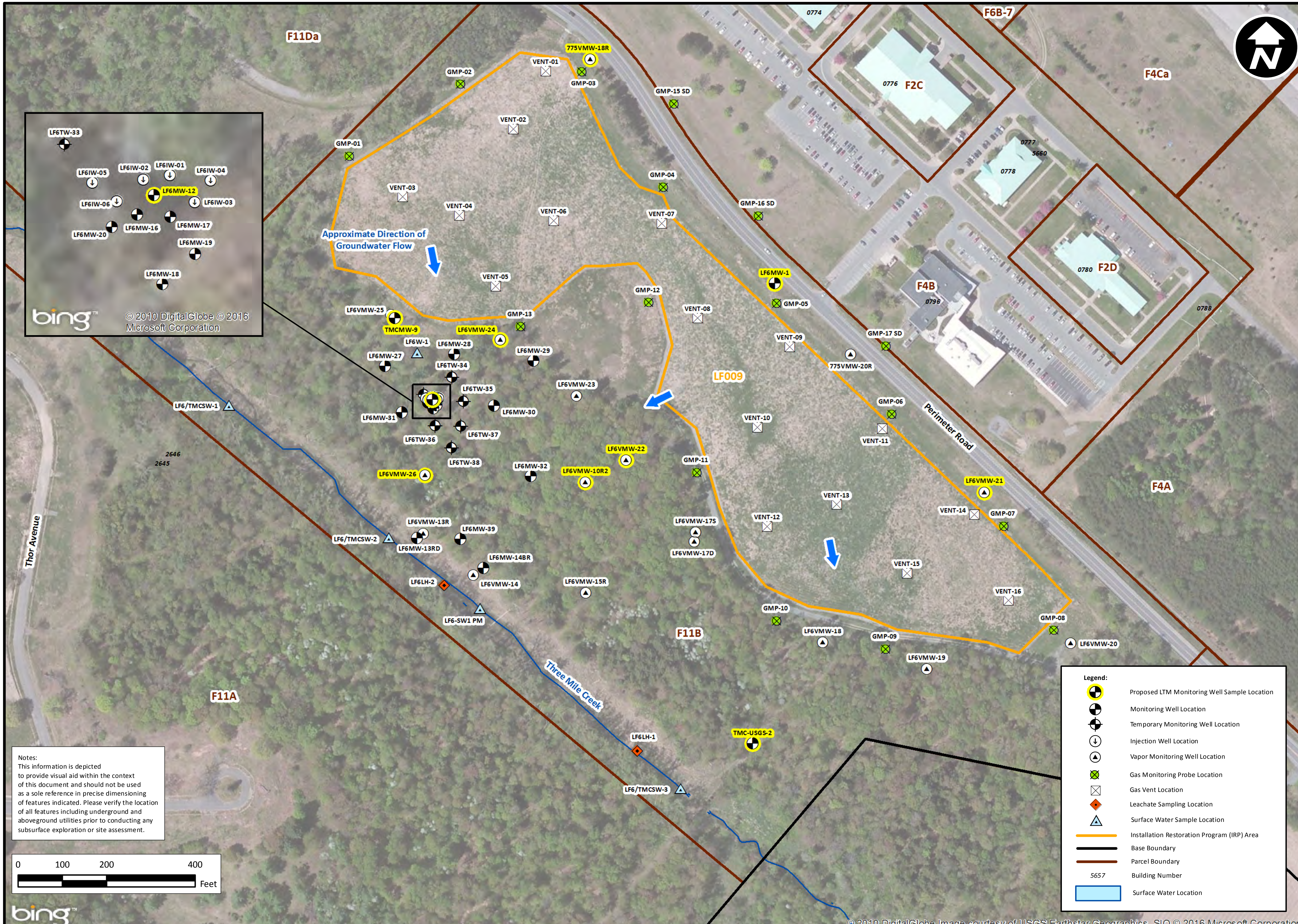

F11Da
F6B-7
F4Ca
F2C
F2D
F4B
F4A
F11B
F11A
LF009
Approximate Direction of Groundwater Flow
Perimeter Road
Thor Avenue
Three Mile Creek
0774
0776
0777
5660
0778
0780
0796
0788
2646
2645
775VMW-18R
VENT-01
GMP-02
GMP-03
GMP-15 SD
VENT-02
GMP-01
GMP-04
VENT-03
VENT-04
VENT-06
VENT-07
GMP-16 SD
VENT-05
GMP-12
LF6MW-1
GMP-05
VENT-08
GMP-13
VENT-09
GMP-17 SD
775VMW-20R
LF6VMW-25
TMCMW-9
LF6VMW-24
LF6W-1
LF6MW-28
LF6MW-29
LF6MW-27
LF6TW-34
LF6TW-35
LF6VMW-23
LF6/TMCSW-1
LF6MW-31
LF6MW-30
LF6TW-36
LF6TW-37
LF6TW-38
VENT-10
GMP-06
VENT-11
LF6VMW-22
GMP-11
LF6VMW-26
LF6MW-32
LF6VMW-10R2
LF6VMW-21
VENT-13
VENT-14
GMP-07
LF6VMW-13R
LF6MW-39
LF6VMW-17S
VENT-12
LF6/TMCSW-2
LF6MW-13RD
LF6VMW-17D
LF6MW-14BR
VENT-15
LF6LH-2
LF6VMW-14
LF6VMW-15R
VENT-16
LF6-SW1 PM
GMP-10
GMP-08
LF6VMW-18
GMP-09
LF6VMW-20
LF6VMW-19
LF6LH-1
TMC-USGS-2
LF6/TMCSW-3
LF6TW-33
LF6IW-05
LF6IW-02
LF6IW-01
LF6IW-04
LF6MW-12
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LF6MW-16
LF6MW-17
LF6MW-20
LF6MW-19
LF6MW-18
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Notes:
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of all features including underground and
aboveground utilities prior to conducting any
subsurface exploration or site assessment.
0
100
200
400
Feet
bing
© 2010 DigitalGlobe Image courtesy of USGS Earthstar Geographics SIO © 2016 Microsoft Corporation
Legend:
Proposed LTM Monitoring Well Sample Location
Monitoring Well Location
Temporary Monitoring Well Location
Injection Well Location
Vapor Monitoring Well Location
Gas Monitoring Probe Location
Gas Vent Location
Leachate Sampling Location
Surface Water Sample Location
Installation Restoration Program (IRP) Area
Base Boundary
Parcel Boundary
5657
Building Number
Surface Water Location

LF009 (Landfill 6 AOC) Site Map

Figure 6

Optimization Plan for Landfill Areas of Concern
Long-Term Management Program
Former Griffiss Air Force Base, Rome, New York

DRAWN BY: MRM

DATE: 8/31/2016

SCALE: As Shown

PROJECT NO: AFCGSA3

bhate ENVIRONMENT INFRASTRUCTURE

APPENDIX B
MANN-KENDALL TREND ANALYSIS RESULTS

Appendix B
Mann-Kendall Trend Analysis for Select Monitoring
Wells Associated wiith Landfills 1, 2, 4, 5, 6 and 7 at Griffiss AFB.
Rome, New York

Well ID	Site ID	Analyte	NYSDEC Groundwater Standards	Any detections above NYSDEC?	Number of samples in the data set	Minimum Concentration	Maximum Concentration	Coefficient of Variation (COV)	Mann-Kendall Statistic (MKS)	Confidence Factor (CF)	Concentration Trend
LF1MW-5	LF001 (Landfill 1)	Color	15 color units	Yes	12	0	180	1.31	-11	74.85%	No Trend
LF1MW-6		Color	15 color units	Yes	12	0	60	1.20	1	50.00%	No Trend
LF1P-2		Color	15 color units	Yes	13	0	250	1.16	-23	90.80%	Prob. Decreasing
LF1P-5		Color	15 color units	Yes	13	0	160	1.28	-17	83.15%	No Trend
WL-LF1MW-10		Color	15 color units	Yes	11	0	50	1.99	-22	94.85%	Prob. Decreasing
WL-LF1MW-11		Color	15 color units	Yes	12	0	120	1.05	-28	96.90%	Decreasing
WL-LF1MW-12		Color	15 color units	Yes	11	0	25	1.52	-4	58.95%	No Trend
WL-LF1MW-13		Color	15 color units	Yes	12	0	200	0.88	-22	92.40%	Prob. Decreasing
WL-LF1MW-14		Color	15 color units	Yes	10	0	25	2.02	-10	78.40%	No Trend
WL-LF1MW-1R		Color	15 color units	Yes	12	0	250	1.24	-11	74.85%	No Trend
LF1MW-5		TKN	1 mg/L	Yes	28	0	4.11	0.33	-190	>99.9%	Decreasing
LF1MW-6		TKN	1 mg/L	Yes	27	0.42	5.6	0.96	-7	54.90%	Stable
LF1P-2		TKN	1 mg/L	Yes	30	1.1	3.4	0.24	-196	>99.9%	Decreasing
LF1P-3		TKN	1 mg/L	Yes	23	0	6.4	1.68	30	77.60%	No Trend
LF1P-5		TKN	1 mg/L	Yes	27	0	3.16	0.92	-92	97.15%	Decreasing
WL-LF1MW-10		TKN	1 mg/L	Yes	22	0	3.64	1.71	-65	96.50%	Decreasing
WL-LF1MW-103		TKN	1 mg/L	Yes	8	0	30	0.69	3	59.40%	No Trend
WL-LF1MW-11		TKN	1 mg/L	Yes	26	0	5.4	0.33	-43	82.10%	Stable
WL-LF1MW-12		TKN	1 mg/L	Yes	22	0	1.9	1.57	47	90.10%	Prob. Increasing but no exceedances within last 3 years
WL-LF1MW-13		TKN	1 mg/L	Yes	23	0	1.1	0.81	-18	67.15%	Stable
WL-LF1MW-14		TKN	1 mg/L	Yes	26	0	4.4	1.79	64	91.65%	Prob. Increasing but no exceedances within last 3 years
LF1MW-5		Ammonia	2 mg/L	Yes	28	0.76	3.78	0.31	-64	89.20%	Stable
LF1MW-6		Ammonia	2 mg/L	Yes	29	0.21	2.4	0.72	93	95.75%	Increasing but no exceedances with last 3 years
LF1P-2		Ammonia	2 mg/L	Yes	31	0.74	2.6	0.24	23	63.80%	No Trend
LF1P-3		Ammonia	2 mg/L	Yes	23	0.27	6	1.89	93	99.30%	Increasing but no exceedances with last 3 years
WL-LF1MW-10		Ammonia	2 mg/L	Yes	22	0	3.5	2.45	-164	>99.9%	Decreasing
WL-LF1MW-103		Ammonia	2 mg/L	Yes	9	0	32	0.60	17	95.10%	Increasing
WL-LF1MW-11		Ammonia	2 mg/L	Yes	31	0.044	4.2	0.33	-15	59.30%	Stable
WL-LF1MW-103		Nitrate	10 mg/L	Yes	10	0	220	2.03	-40	>99.9%	Decreasing
WL-LF1MW-103		Sulfate	250 mg/L	Yes	7	0	390	2.08	-12	94.85%	Prob. Decreasing
LF1MW-5		TDS	500 mg/L	Yes	28	339	685	0.20	-90	96.10%	Decreasing
LF1MW-6		TDS	500 mg/L	Yes	28	249	536	0.20	20	64.50%	No Trend
LF1P-2		TDS	500 mg/L	Yes	28	340	552	0.11	-121	99.15%	Decreasing
LF1P-3		TDS	500 mg/L	Yes	23	345	510	0.09	-71	96.80%	Decreasing
WL-LF1MW-103		TDS	500 mg/L	Yes	7	0	2,400	1.29	-16	99.00%	Decreasing
WL-LF1MW-11		TDS	500 mg/L	Yes	25	200	594	0.19	-102	99.10%	Decreasing
WL-LF1MW-14		TDS	500 mg/L	Yes	18	47	778	1.26	-54	97.80%	Decreasing
LF2MW2-1	LF002 (Landfill 2/3)	Color	15 color units	Yes	11	0	200	1.05	-16	87.50%	No Trend
LF2MW-4		Color	15 color units	Yes	11	0	70	1.76	-2	53.00%	No Trend
WL-LF2MW-12		Color	15 color units	Yes	11	0	20	1.57	-2	53.00%	No Trend
WL-LF2MW-13		Color	15 color units	Yes	10	0	60	0.67	-3	56.90%	Stable
LF2MW2-1		TKN	1 mg/L	Yes	25	0	1.2	0.74	27	72.60%	No Trend
LF2MW-4		TKN	1 mg/L	Yes	25	0	1.81	1.47	-51	87.70%	No Trend
WL-LF2MW-12		TKN	1 mg/L	Yes	22	0	1.1	0.55	-26	75.70%	Stable
WL-LF2MW-13		TKN	1 mg/L	Yes	21	0	1.8	0.79	-24	75.40%	Stable
LF2MW-4		TDS	500 mg/L	Yes	25	157	511	0.34	46	85.20%	No Trend
WL-LF2MW-100		TDS	500 mg/L	Yes	18	450	5,700	0.30	14	68.65%	No Trend
WL-LF2MW-12		TDS	500 mg/L	Yes	22	46	660	0.31	15	65.20%	No Trend
WL-LF2MW-100		Bromide	2 mg/L	Yes	18	0	47.3	0.41	6	57.40%	No Trend
WL-LF2MW-100		Chloride	250 mg/L	Yes	18	0.4	4,670	0.41	2	51.50%	No Trend
WL-LF2MW-100		Color	15 color units	Yes	8	0	150	2.18	-3	59.40%	No Trend
WL-LF2MW-100		Ammonia	2 mg/L	Yes	20	0.25	9.7	0.27	103	>99.9%	Increasing
WL-LF2MW-100		TKN	1 mg/L	Yes	20	0.54	14	0.33	34	85.60%	No Trend
LF7MW-22	LF003 (Landfill 7)	Color	15 color units	Yes	9	0	200	0.90	3	57.95%	No Trend
LF7MW-22		TDS	500 mg/L	Yes	20	306	790	0.16	-8	58.90%	Stable
LF7MW-22		TKN	1 mg/L	Yes	20	0	2.32	0.49	-41	90.15%	Prob. Decreasing
LF7MW-23		Color	15 color units	Yes	9	0	35	1.25	8	76.20%	No Trend
WL-LF7MW-26		Color	15 color units	Yes	7	0	250	1.06	-13	96.50%	Decreasing
WL-LF7MW-28		Color	15 color units	Yes	7	0	20	2.32	7	80.90%	No Trend
WL-LF7MW-30		Color	15 color units	Yes	7	0	40	2.65	-2	55.70%	No Trend
WL-LF7MW-26		TDS	500 mg/L	Yes	14	225	614	0.29	7	62.60%	No Trend
WL-LF7MW-30		TDS	500 mg/L	Yes	15	276	542	0.15	35	95.40%	Increasing but no exceedances with last 3 years

Appendix B
Mann-Kendall Trend Analysis for Select Monitoring
Wells Associated wiith Landfills 1, 2, 4, 5, 6 and 7 at Griffiss AFB.
Rome, New York

Well ID	Site ID	Analyte	NYSDEC Groundwater Standards	Any detections above NYSDEC?	Number of samples in the data set	Minimum Concentration	Maximum Concentration	Coefficient of Variation (COV)	Mann-Kendall Statistic (MKS)	Confidence Factor (CF)	Concentration Trend
LF5MW-3	LF007 (Landfill 5)	Bromide	2 mg/L	Yes	20	0	9.1	4.15	38	88.30%	No Trend
WL-LF5MW-100R		Bromide	2 mg/L	Yes	12	4.3	252	0.70	-12	77.00%	Stable
WL-LF5MW-100R		Chloride	250 mg/L	Yes	12	375	13,500	0.53	-12	77.00%	Stable
WL-LF5MW-1A		Chloride	250 mg/L	Yes	19	27.9	363	0.52	52	96.30%	Increasing
WL-LF5MW-100R		Ammonia	2 mg/L	Yes	12	1.9	30	0.40	10	72.70%	No Trend
LF5MW-2		Sulfate	250 mg/L	Yes	4	49.5	361	0.81	0	37.50%	Stable
LF5MW-3		Sulfate	250 mg/L	Yes	20	9.6	1,100	1.50	68	98.60%	Increasing
LF5MW-1		TDS	500 mg/L	Yes	4	206	572	0.36	0	37.50%	Stable
LF5MW-2		TDS	500 mg/L	Yes	4	567	991	0.29	-2	62.50%	Stable
LF5MW-3		TDS	500 mg/L	Yes	20	200	2,000	0.69	34	85.60%	No Trend
WL-LF5MW-100R		TDS	500 mg/L	Yes	12	1,640	16,000	0.45	-10	72.70%	Stable
WL-LF5MW-1A		TDS	500 mg/L	Yes	19	275.6	1,040	0.33	35	88.10%	No Trend
LF5MW-1		TKN	1 mg/L	Yes	4	0	1.41	1.38	3	72.90%	No Trend
LF5MW-2		TKN	1 mg/L	Yes	4	0	2.54	0.69	2	62.50%	No Trend
LF5MW-3		TKN	1 mg/L	Yes	19	0	6.4	0.89	-20	74.40%	Stable
LF5MW-4		TKN	1 mg/L	Yes	4	0	1.81	1.42	5	89.55%	No Trend
WL-LF5MW-100R		TKN	1 mg/L	Yes	12	2.2	22	0.36	16	84.50%	No Trend
WL-LF5MW-1A		TKN	1 mg/L	Yes	16	0	3.91	1.08	-31	91.00%	Prob. Decreasing
WL-LF5MW-5		TKN	1 mg/L	Yes	16	0.37	1.4	0.42	2	51.80%	No Trend
LF6MW-1	LF009 (Landfill 6)	Chloride	250 mg/L	Yes	27	3.6	1,400	0.57	-42	80.20%	Stable
WL-LF6VMW-20		Chloride	250 mg/L	Yes	37	1.9175	490	0.85	-90	87.70%	Stable
WL-LF6VMW-24		Chloride	250 mg/L	Yes	32	98	390	0.47	351	>99.9%	Increasing
LF6MW-1		Color	15 color units	Yes	11	0	80	2.93	-3	56.00%	No Trend
LF6VMW-10R2		Color	15 color units	Yes	12	0	250	2.16	2	52.70%	No Trend
LF6VMW-11		Color	15 color units	Yes	5	20	150	0.62	-5	82.05%	Stable
TMC-USGS-2		Color	15 color units	Yes	12	0	100	2.23	-12	77.00%	No Trend
WL-LF6VMW-17D		Color	15 color units	Yes	11	0	50	3.32	-10	75.30%	No Trend
WL-LF6VMW-18		Color	15 color units	Yes	18	0	40	2.12	-21	77.30%	No Trend
WL-LF6VMW-19		Color	15 color units	Yes	14	0	50	2.33	-28	92.90%	Prob. Decreasing
WL-LF6VMW-20		Color	15 color units	Yes	19	0	6,000	2.49	-76	99.65%	Decreasing
WL-LF6VMW-21		Color	15 color units	Yes	11	0	180	1.86	-6	64.75%	No Trend
WL-LF6VMW-22		Color	15 color units	Yes	11	0	20	2.67	-1	50.00%	No Trend
WL-LF6VMW-23		Color	15 color units	Yes	11	0	60	3.05	-1	50.00%	No Trend
WL-LF6VMW-24		Color	15 color units	Yes	11	0	30	2.83	-1	50.00%	No Trend
WL-LF6VMW-25		Color	15 color units	Yes	11	0	25	2.76	-1	50.00%	No Trend
WL-LF6VMW-26		Color	15 color units	Yes	11	0	70	2.40	1	50.00%	No Trend
LF6VMW-10R2		TKN	1 mg/L	Yes	21	0	1.4	1.84	13	64.00%	No Trend
TMC-USGS-2		TKN	1 mg/L	Yes	21	0	2.5	1.34	38	86.60%	No Trend
WL-LF6VMW-18		TKN	1 mg/L	Yes	27	0	19.88	2.13	-107	98.70%	Decreasing
WL-LF6VMW-19		TKN	1 mg/L	Yes	23	0	10.92	2.37	-9	58.30%	No Trend
WL-LF6VMW-20		TKN	1 mg/L	Yes	28	0	8.68	1.79	-123	99.25%	Decreasing
WL-LF6VMW-25		TKN	1 mg/L	Yes	20	0	2.1	0.38	-11	62.55%	Stable
LF6MW-1		TDS	500 mg/L	Yes	20	156	3,000	0.49	1	50.00%	No Trend
LF6MW-12		TDS	500 mg/L	Yes	19	310	1,300	0.35	66	98.90%	Increasing
WL-LF6VMW-18		TDS	500 mg/L	Yes	27	108	820	0.27	-72	93.00%	Prob. Decreasing
WL-LF6VMW-19		TDS	500 mg/L	Yes	23	0	1,700	0.86	40	84.65%	No Trend
WL-LF6VMW-20		TDS	500 mg/L	Yes	28	31.2	1,100	0.61	-111	98.55%	Decreasing
WL-LF6VMW-24		TDS	500 mg/L	Yes	20	300	800	0.36	149	>99.9%	Increasing
WL-LF6VMW-25		TDS	500 mg/L	Yes	20	420	670	0.12	-33	84.85%	Stable
WL-LF6VMW-26		TDS	500 mg/L	Yes	20	350	590	0.14	101	>99.9%	Increasing

Notes:

ND = Non-detect, NYSDEC = New York State Department of Environmental Conservation, mg/L = milligrams per liter, TKN = Total Kjehldahl Nitrogen, TDS = Total Dissolved Solids

Yellow highlighted records are presented and discussed within the report text

At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*

Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing;

≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.

Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales,

Ground Water, 41(3):355-367, 2003.