FINAL

LETTER WORK PLAN

Prepared for:

Soil Gas Sampling
Landfills 2/3, 5, and 7
Former Griffiss Air Force Base
Rome, New York

through

The Air Force Center for Environmental Excellence
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1.0 INTRODUCTION

FPM Group, Ltd. (FPM) has been contracted by the Air Force Center for Environmental Excellence (AFCEE) to perform long-term monitoring at Landfills 2/3, 5, and 7. This letter Work Plan (WP) establishes the field investigation tasks necessary to perform soil gas sampling for the principal landfill gas (methane), trace volatile organic compound (VOC) gases, and hydrogen sulfide gas.

The purpose of the soil gas sampling is to confirm the absence of landfill gas emissions from Landfills 2/3, 5, and 7, as a step towards implementation of the final closure plan. Disposal activities at the landfills ceased between 21 and 52 years ago. Passive soil gas surveys were conducted as part of the Remedial Investigation (RI) at each landfill, for which soil gas samples were collected for VOC analysis using EPA Method 8240; however, methane and hydrogen sulfide analyses were not performed (Law, 1996). A more detailed history of each landfill is provided below.

2.0 SITE BACKGROUNDS

2.1 LANDFILL 2/3

2.1.1 Site Location and History

Landfill 2/3 is located on a topographic high east of Perimeter Road near the east-central boundary of the former Griffiss AFB. The landfill is bounded by the installation boundary on the north, east, and south sides; areas to the west, southwest, and northeast have been identified as wetlands. The attached Figure 1 shows the landfill boundary together with the location of the existing monitoring wells.

The Landfill 2 section was operated from 1973 to 1982. In the southern portion of Landfill 2, hardfill was disposed of using the area method. In both the northern and southern portions of the landfill, solid waste was disposed of using the trench and cover method. The Landfill 3 section received wastes intermittently from 1980 to 1981, consisting primarily of asbestos generated from the demolition and repair of asbestos insulated piping. The wetted asbestos was double-bagged and disposed in pits approximately 8 feet deep. It is estimated that Landfill 3 contains one ton of asbestos wastes.

A Landfill Cover Investigation performed in 1997 (Law, 1997) revealed that the thickness of the existing landfill soil cover ranges from 0.5 to 4 feet. Landfill 2/3 is unlined, but three areas of Landfill 2 are capped with up to 1 foot of natural soils and clay.

2.1.2 Geological Setting

Landfill 2/3 is located on a small hill of outwash, approximately 40 feet high on the eastern boundary of the Base. The site is located in an area of variable topography. A portion of the

northern section of the site was graded to the northeast, towards a tributary of Slate Creek. Subsidence and erosion occurs on the western slope of Landfill 2/3 (Law, 1996). Surface cover material consists of dark brown sandy silt with coarse gravel and cobbles. Deeper soils range from brown fine sand to brown, sandy, gravelly silt to approximately 55 ft bgs. Bedrock at the site is Utica Shale that was encountered at depths up to 50 ft bgs.

2.2 LANDFILL 5

2.2.1 Site Location and History

Landfill 5 is located in the south-central portion of the former Base, south of Patrick Square, immediately southwest of the unpaved access road and east of Three Mile Creek. Attached Figure 2 illustrates the landfill boundary together with the location of all monitoring wells.

Landfill 5 was used from 1959 to 1960 to dispose of 18,000 cubic yards of domestic wastes using an area type method, to a depth of 6 feet bgs. The waste was reportedly burned prior to disposal.

A Landfill Cover Investigation performed in 1997 (Law, 1997) revealed that the thickness of the existing landfill soil cover ranges from 0.8 to 2.4 feet. Landfill 5 is unlined.

2.2.2 Geological Setting

The topography at Landfill 5 ranges from flat and grass-covered in the northern half to gently sloping and densely wooded in the southern half. The landfill is adjacent to the 100-year floodplain of Three Mile Creek.

Surface cover material in the northern half consists of brown sandy silt with fine to coarse gravel. Surface cover material in the southern half consists of dark brown to black slightly humic sandy silt with large rock and hardfill-like material. The hardfill material was composed primarily of concrete, brick and asphalt fragments.

2.3 LANDFILL 7

2.3.1 Site Location and History

Landfill 7 is located northeast of the main runway, south of Perimeter Road, and southwest of the Suspected Fire Training Area. Figure 3 illustrates the landfill boundary and the locations of the existing monitoring wells.

The landfill was used from 1950 to 1954 to dispose of domestic refuse and solid waste, liquid wastes, petroleum products, and miscellaneous Base operations waste (such as airplane parts), which were placed into four trenches in the landfill area and subsequently burned.

In 1985, the landfill was capped with an additional 6 inches of clay, covered by 6 inches of topsoil, and seeded with grass. A Landfill Cover Investigation performed in 1997 (Law, 1997) revealed that the thickness of the existing landfill soil cover ranges from 1.2 to 4 feet. Landfill 7 is unlined.

2.3.2 Geological Setting

Landfill 7 rests on a sloping plane of low permeability Utica Shale bedrock. At the toe of the landfill, the bedrock is about 15 ft bgs. Clay glacial till overlies the Utica Shale and is found at depth ranging from 5 to 35 ft bgs. An important surface water feature in the area of Landfill 7 is an unnamed tributary to Six Mile Creek which originates in the area west of Landfill 2/3.

3.0 DATA QUALITY OBJECTIVE

The objective of the soil gas sampling is to confirm the absence of landfill gas emissions from the surface of Landfills 2/3, 5, and 7 using in situ data. This real-time, screening data is considered to be an appropriate data quality objective (DQO) primarily because of the age of the landfills. Gas production in typical landfills with adequate moisture peaks in five to ten years and ceases to be measurable in 20 to 25 years (Tchobanoglous and O'Leary, 1994). Disposal activities at all three landfills ceased between 21 and 52 years ago, which is generally considered outside the period of measurable gas production.

The proposed soil gas sampling instruments and technical specifications, that are considered acceptable for the DQO, are shown in Table 1.

Table 1
In Situ Soil Gas Sampling Instrument Summary

Instrument	Proposed Model	Analytical Capability	Instrument Range	Accuracy	Time per Single Measurement*
Flame Ionization Detector (FID)	Photovac MicroFID	Methane and volatile organic compounds (VOCs) (as appropriate)	0 to 10,000 ppmV	+/- 2.5 ppm or +/- 25% of reading, whichever is greater	10 seconds
Combustible Gas Indicator (CGI)	MultiRAE Plus	Hydrogen Sulfide Lower Explosive Limit (LEL)	0 to 300 ppmV 0 to 10,000 ppmV	+/- 10% of reading +/- 5% of reading	3 seconds

Notes: ppmV = part per million (Volumetric)
* - Based on manufacturers specification for T90 (90^{th} percentile).

All screening results from the FID and CGI will be provided in a table, along with the GPS coordinates of each sampling point, to be included in a summary report subject to regulatory review.

4.0 DESCRIPTION OF SOIL GAS SAMPLING METHODOLOGY

Soil gas samples will be collected from locations that have been positioned according to a grid pattern. The proposed grid sizes shall be 100 feet by 100 feet, in accordance with NYSDEC Part 360 requirements for explosive gas investigations [2.15(a)(2)]. Maps of the landfill extents for Landfills 2/3, 5, and 7 are shown in Figures 1, 2, and 3, respectively, in the Attachments. Soil gas samples shall be collected from a depth of approximately 1.5 ft bgs; this depth was chosen to ensure that the soil gas is collected from below the clay cap at Landfills 2/3 and 7.

The soil gas sampling event will be performed within the proposed range of meteorological conditions that are summarized in Table 2. The four weather conditions will be recorded on the sampling form prior to and at the end of each sampling day. Observations of precipitation, wind, and temperature shall be made periodically during the sampling event. Gas sampling will be postponed if conditions move outside the acceptable range.

Table 2
Acceptable Meteorological Conditions for Soil Gas Sampling

Meteorological Condition	Sampling Event Range	Reasoning
Atmospheric Pressure	29.7 in to 30.4 in. Refer to www.intellicast.com for current atmospheric pressure.	Landfill gas is released through convective (pressure driven) flow and molecular diffusion. In the presence of a meteorological high pressure system, convective flow can be significantly reduced.
Precipitation	Dry (or unsaturated) while conducting sampling.	The landfill surface should be mostly dry. Gas has a reduced capacity to move through wet soil. Previous or ongoing precipitation events should not interfere with the collection of soil gas or with the instrumentation for soil gas measurements.
Temperature	35 degrees F. to 95 degrees F. The ground must be completely thawed.	These are the optimum operating temperatures of the instruments. Frozen soil has reduced porosity, which would reduce the flow of landfill gas to the surface.
Wind	< 10 mph	Gas samples will be collected from discrete depths using Teflon or polyethylene tubing. Strong wind may cause dilution of landfill gases in the gas sample.

4.1 In Situ Sampling

An AMS Gas Vapor Probe (GVP) kit with retractable tip shall be used to extract the soil gas samples from a depth of 1.5 ft bgs. The GVP is designed specifically for hand collection of discrete gas samples from depth using a retracting point with a Teflon umbrella and screen to prevent soil from clogging the vapor inlet holes. Dedicated Teflon or polyethylene tubing is used to transfer the gas sample to the surface.

The general procedure for measurement of a soil gas sample and recording the data is as follows:

1. Follow manufacturer's recommendations for calibration of instruments and/or checking readouts three times per day - prior to the data collection event, in the middle of the event, and at the end of the event. In the event of a malfunction, corrective action shall consist of replacement of the equipment and re-sampling the affected data.

2. Upon arriving at each landfill, check instrument readouts for power and proper function, then collect an ambient air measurement. The ambient air conditions shall be measured in the breathing zone, approximately 5 feet above ground surface and facing towards the wind (if present). Update as necessary, based on changing site conditions, throughout the day.

3. With the aid of a global position system (GPS) and surveyor's tape, sampling locations will be positioned and location markers will be placed on a 100 ft by 100 ft grid. It is estimated that Landfill 2/3 encompasses an area of approximately 73 sampling locations; for Landfill 5, 19 locations; and for Landfill 7, 56 locations. Final numbers of sampling locations may be adjusted in the field as appropriate as the grids are placed.

4. Upon arriving at a sampling location, dedicated Teflon or polyethylene tubing should be attached to the probe point. Use a slide hammer to drive the point and attached rod approximately 4 inches past the target depth of 1.5 ft bgs. Pull out the rod so that the retractable point and screen is exposed.

5. Purge three volumes of air from the Teflon or polyethylene sampling tubing (volume is equal to 2 cubic centimeters (CCs) per foot of tubing). Tubing length will be approximately 4 feet (1.5 feet bgs and 2.5 feet above ground). Total purge volume will be 24 CCs (recalculate in field if different tubing length is used). The Photovac MicroFID air pump rate is 2.5 CCs per second; therefore the required purge time is approximately 10 seconds. The FID will be fitted with a charcoal filter to obtain direct methane readings at each sampling location; VOC readings for confirmation of LEL readings can also be obtained using the FID by removing the charcoal filter. The MultiRAE Plus air pump rate is 10 CCs per second; therefore the required purge time is approximately 3 seconds. Hydrogen sulfide and LEL readings will be obtained at each location using the MultiRAE.

6. The instrument readouts (or use data logging function) for the full purge period plus the instrument measurement time period (from Table 1) should be observed. The maximum concentration measured after the purge period should be the recorded concentration. All of the above mentioned measurements will be recorded on the attached field form.

7. At every fifth sampling location, a soil probe will be advanced to approximately 1.5 ft bgs to obtain a small soil sample and confirm that the sampling depth is below the clay caps (at Landfills 2/3 and 7), and that the soil moisture is not saturated.

8. The air inside groundwater monitoring wells that are located within the landfill boundaries or adjoining the border, and bridge the top of the groundwater table, will also be sampled for landfill gas. The air sampling event should be planned at a time when the monitoring wells have been closed for several days. The sampling tip of both instruments shall be fitted with a 4-inch diameter (minimum) funnel. The instrument tip shall be fit securely inside the funnel stem so that no short-circuiting of air occurs through the stem. The well casing cap or plug should be removed and the instrument funnel fitted tightly on the casing as quickly as possible. The first measurement should be from the FID followed immediately by the CGI.

4.2 Health and Safety

The Health and Safety Plan associated with the Work Plan for the AOC Long-Term Monitoring Baseline Study (FPM, 1998) will be operational in conjunction with this Work Plan.

The 1% LEL is chosen as a conservative health and safety action level. If the 1% LEL is exceeded using the combustible gas indicator (CGI), while the methane-specific monitoring (using an FID with a charcoal filter) indicates a reading less than 20% of the LEL (corresponding to 10,000 ppm), the field work will continue. If the source of the LEL is not methane (confirmed using the FID without the charcoal filter), a personal protective equipment upgrade to level C will be considered.

5.0 REPORTING REQUIREMENTS

The results of the soil gas sampling monitoring shall be prepared as a letter report. The letter report will contain figures with sampling locations, descriptions of any pertinent surface features, and summary tables containing any detected gas emissions.

6.0 REFERENCES

Conti Environmental, Inc., prepared in association with EA Engineering, P.C., and its affiliate EA Engineering, Science and Technology, *Landfill 2/3 Cover Improvements at the Former Griffiss Air Force Base, Rome, NY, Closure Plan,* March 2002.

Conti Environmental, Inc., prepared in association with EA Engineering, P.C., and its affiliate EA Engineering, Science and Technology, *Landfill 5 Cover Improvements at the Former Griffiss Air Force Base, Rome, NY, Closure Plan,* April 2002 (to be issued).

Conti Environmental, Inc., prepared in association with EA Engineering, P.C., and its affiliate EA Engineering, Science and Technology, *Landfill 7 Cover Improvements at the Former Griffiss Air Force Base, Rome, NY, Closure Plan,* March 2002.

FPM Group, Ltd., Draft Final Work Plan, *AOC Long-Term Monitoring Baseline Study,* Griffiss Air Force Base, Revision 1.2, December 1998.

Ecology & Environment, Inc., *Final Report for Supplemental Investigations of Areas of Concern,* Griffiss Air Force Base, November 1998.

Law Engineering and Environmental Services, Inc., Draft Final Primary Report, *Remedial Investigation at Griffiss Air Force Base,* New York, December 1996.

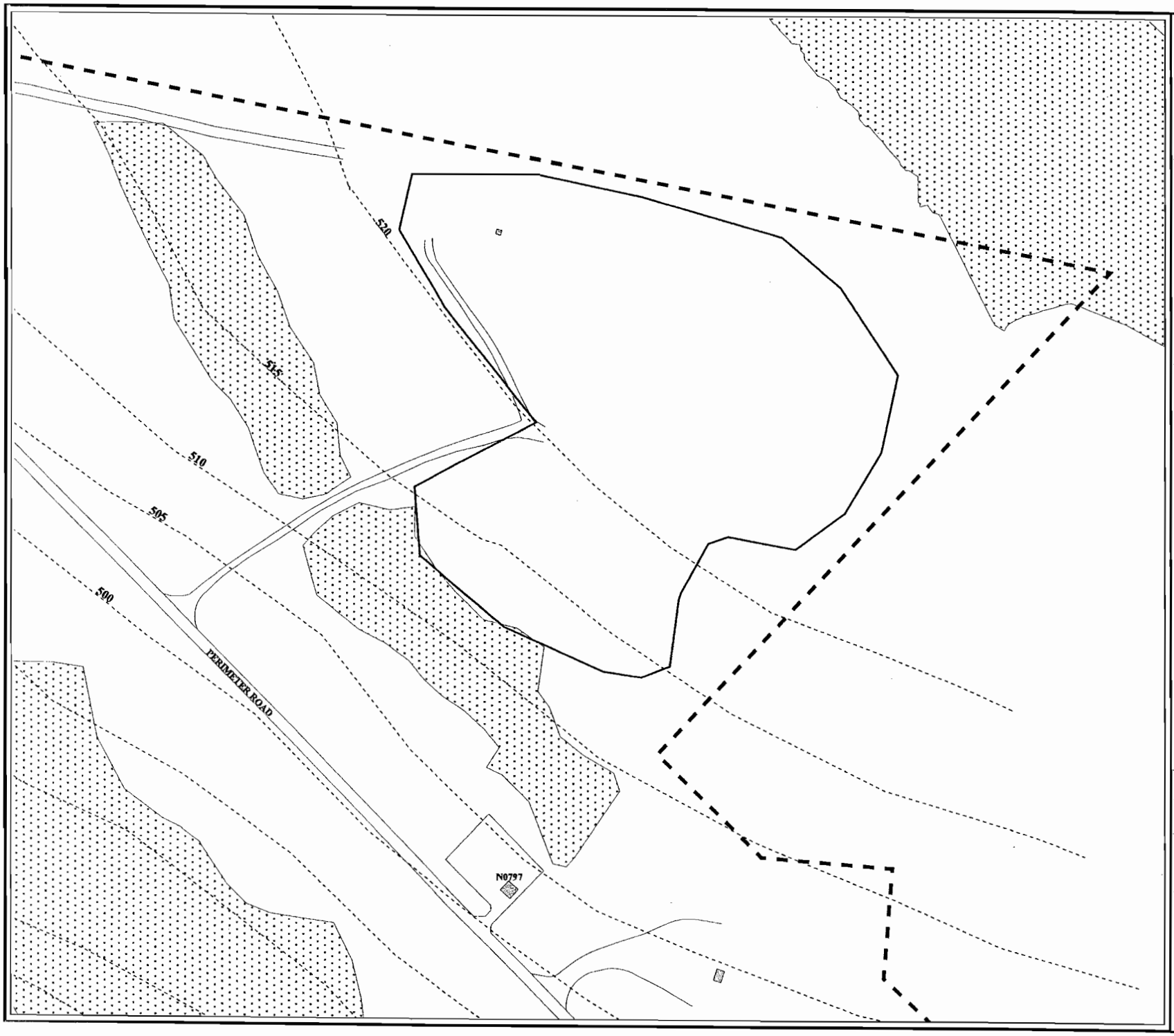
Law Engineering and Environmental Services, Inc., *Landfill Cover Investigation Report,* December 1997.

Tchobanoglous and O'Leary, *Handbook of Solid Waste Management*, Chapter 12, 1994.

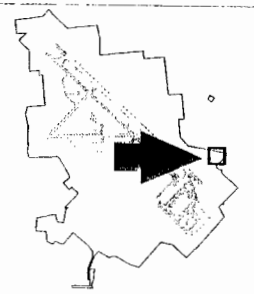
U.S. Environmental Protection Agency, *Data Quality Objectives Process for Superfund, Interim Final Guidance*, EPA/540/G-93/071, Publication 9355.9-01, Office of Emergency and Remedial Response, September 1993.

ATTACHMENTS

Figure 1 – Landfill 2/3
Figure 2 – Landfill 5
Figure 3 – Landfill 7
Weather Observation Form
Surface Soil Gas Sampling Monitoring Form



N



Landfill 2/3

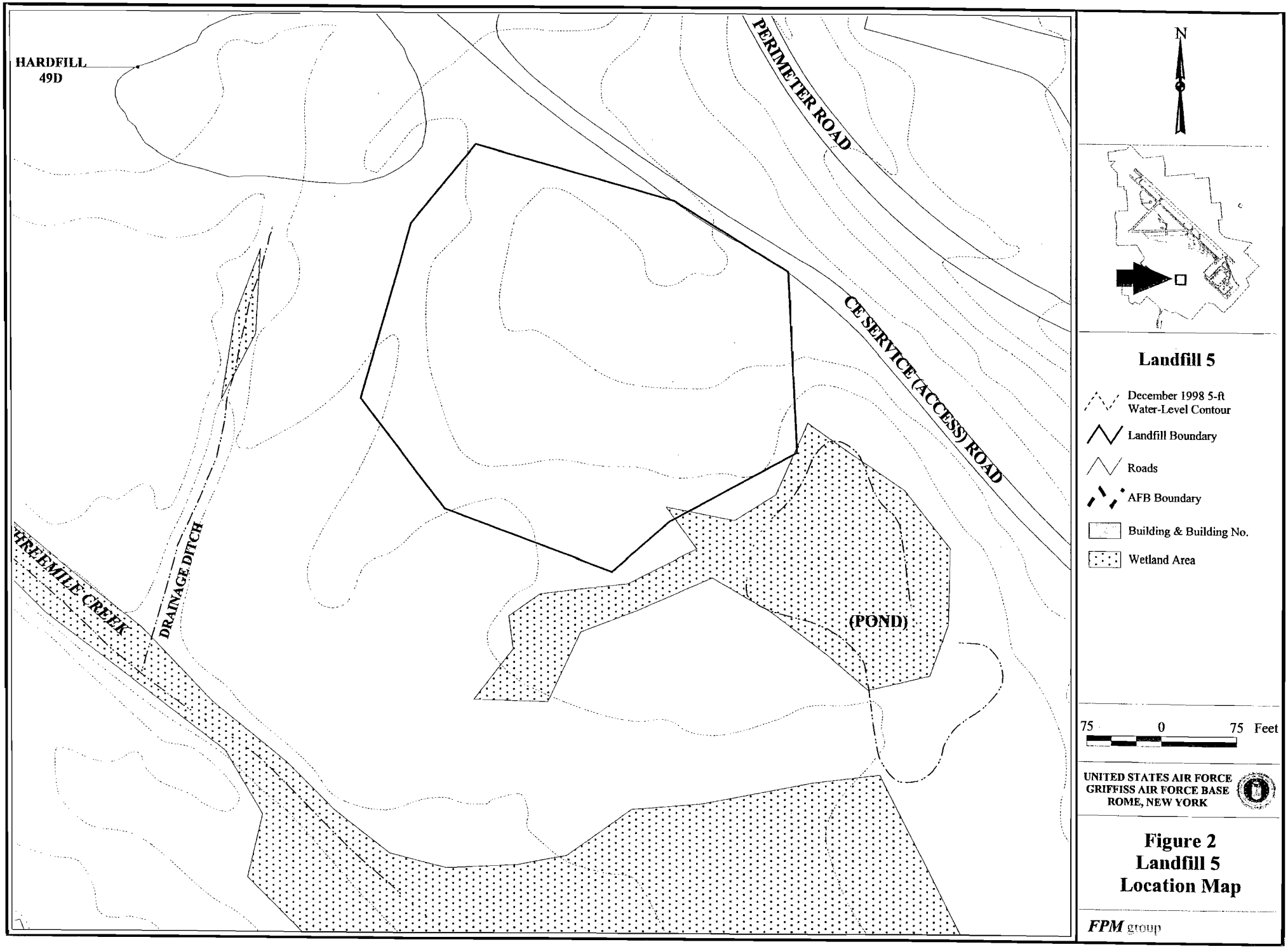
- December 1998 5-ft Water-Level Contour
- Landfill Boundary
- Roads
- AFB Boundary
- Building & Building No.
- Building & Building No.

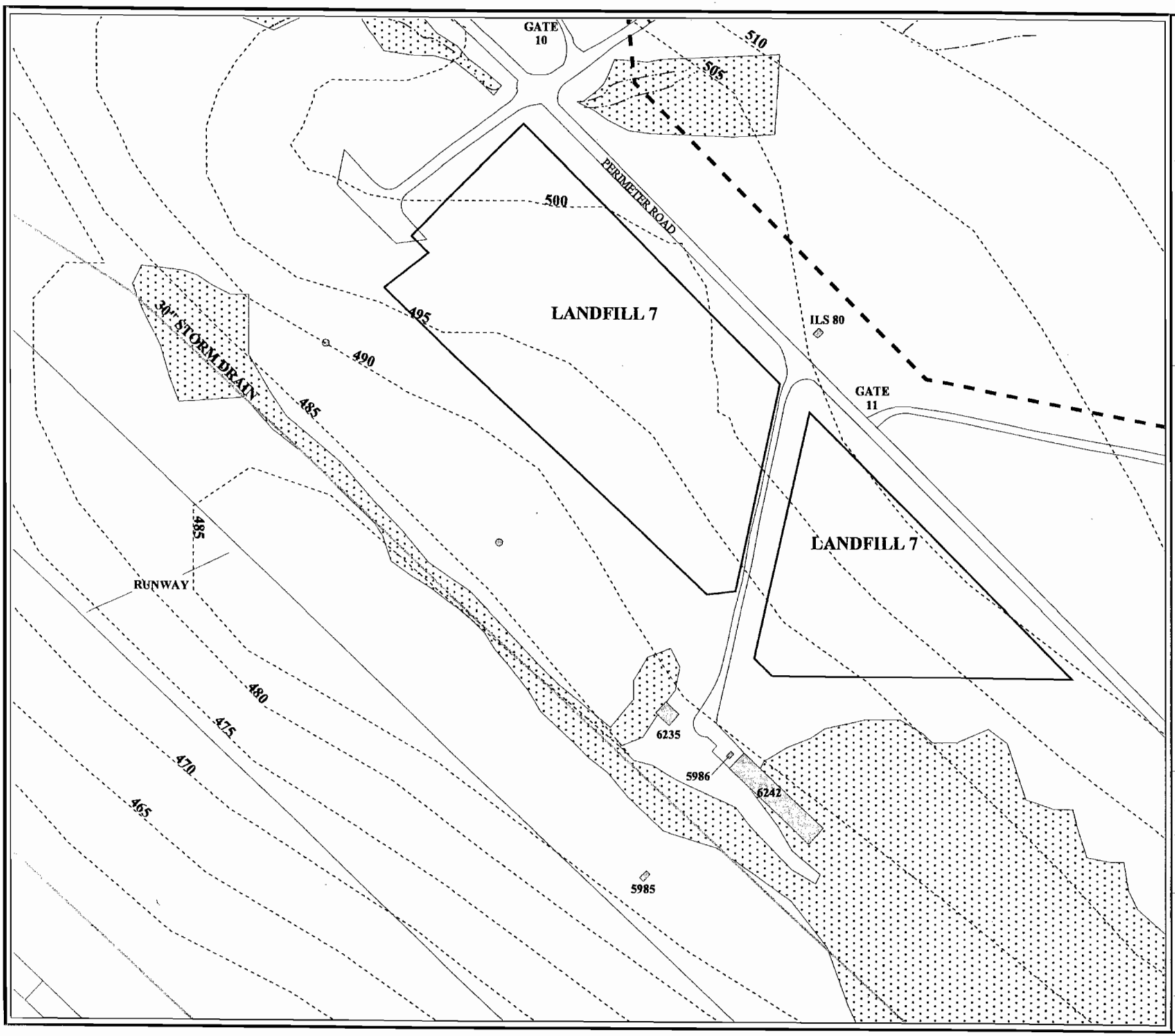
100 0 100 200 Feet

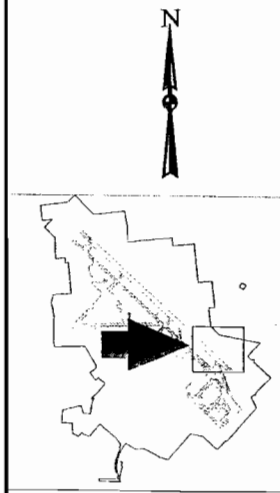
UNITED STATES AIR FORCE
GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 1
Landfill 2/3
Location Map

FPM group


HARDFILL
49D
PERIMETER ROAD
CE SERVICE (ACCESS) ROAD
DRAINAGE DITCH
THREEMILE CREEK
(POND)
N
Landfill 5
December 1998 5-ft
Water-Level Contour
Landfill Boundary
Roads
AFB Boundary
Building & Building No.
Wetland Area
75 0 75 Feet
UNITED STATES AIR FORCE
GRIFFISS AIR FORCE BASE
ROME, NEW YORK
Figure 2
Landfill 5
Location Map
FPM group





Landfill 7

- Streams
- Storm Drain
- Landfill Boundary
- December 1998 5-ft Water-Level Contour
- Roads
- AFB Boundary
- Buildings & Building No.
- Wetland Area

100 0 100 200 Feet

UNITED STATES AIR FORCE
GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Figure 3
Landfill 7
Location Map

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WEATHER OBSERVATION FORM

LOCATION: _____

DATE: _____

FIELD PERSONNEL: _____

INSTRUMENTS (model and serial number):

Thermometer: _____

Anemometer: _____

	Time (military)	Precip. (in)	Atmospheric pressure (in)	Temp. (degrees F)	Wind (mph)	Comments
Prior to Sampling						
Mid Day						
End of Sampling						

Notes: Additional measurements should be taken in case of weather condition changes.
Air sampling will be postponed if conditions move outside the acceptable range.

Sampling Event Acceptable Range:
1. Precipitation: dry while conducting sampling.
2. Atmospheric pressure: 29.7 – 30.4 in.
3. Temperature: 35 – 95 degrees F. The ground must be completely thawed.
4. Wind: <10 mph.

SURFACE SOIL GAS MONITORING FORM

DATE: _____

SITE LOCATION: _____

FIELD PERSONNEL: _____

INSTRUMENTS (model and serial number):
FID: _____

CGI: _____

Sample Location	Time (military)	FID (max)		CGI (max)		Comments/Surface Features
		Methane (ppmV)	VOCs (ppmV)	LEL (ppmV)	H_2S (ppmV)	

Notes: Time per single measurement: 10 seconds for FID and 3 seconds for CGI.