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ALTAMONT ENVIRONMENTAL, INC.

ENGINEERING 8 11-4-03
78 1/2 PATTON AVE.,
TEL. 828.281.3350
www.altamont.com

- Called Altamont
- Spoke w/ John
- Project in planning stage
- Will contact SWS before starting.

October 30, 2003

Mr. James Coffey
NCDENR Division of Waste Management
Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Subject: Landfill Gas Beneficial Use Work Plan
Closed Jackson County Landfill
Dillsboro, Jackson County, North Carolina



Dear Mr. Coffey:

Altamont Environmental, Inc. (Altamont) is working with Jackson County, North Carolina to plan and implement the extraction of landfill gas from the Closed Jackson County Landfill. Extracted gas will be put to beneficial use through the construction of a "Regional Arts and Crafts Center and Alternative Crops Development Station." This project represents a collaborative effort between Jackson County and a number of potential stakeholders. Altamont is writing this letter to make the Division of Waste Management aware of this impending activity at the Closed Jackson County Landfill.

The enclosed documents are presented for informational purposes only. These include a project work plan, schedule, and pertinent figures. Altamont and Jackson County are currently proceeding with tasks outlined on the schedule. Extraction well installation is tentatively scheduled for the week of November 17, 2003.

If you have any questions or would like further information, please call me at (828) 281-3350.

Sincerely,

James S. McElduff, P.E.
Altamont Environmental, Inc.

cc: James Patterson, NCDENR Solid Waste Section, Asheville Regional Office
Ken Westmoreland, Jackson County Manager

enclosures: Jackson County Landfill LFG System Work Plan
Schedule of Tasks
Figures

John

Jackson County Landfill LFG System Work Plan

Phase I Construction

- Construct 3 landfill gas extraction wells at locations shown on Sheet 1. Construct the wells in accordance with the details shown on Sheet 2. Log the boring being especially alert for fine soils or other conditions that may affect landfill gas flow. Planned depth of each well will be approximately at the landfill bottom unless saturated conditions are encountered. If saturated conditions are encountered the boring will be stopped and backfilled with bentonite chips to five feet above the contact elevation with leachate. Screen length shall be approximately one-third the depth of the boring. Screen and casing length listed in Note 1, Sheet 3 assume drilling to full depth as shown on Sheet 2. **No further purchases, fabrication, or other work shall be completed until successful construction of the landfill gas extraction wells and with approval of the County.**
- Select a qualified Contractor to purchase and install the following:
 - Fabricate simple flare for combustion of landfill gas. Flare will be fabricated from carbon steel pipe and plate. Pipe diameter will be four inches. Additional details will be provided under separate cover.
 - Cincinnati Fan Model HP, Series 1, Model HPD, Arrangement 4, 150 SCFM, 22" W.G. static pressure at standard conditions. Provide with drain plug option.
 - Enardo flame arrestor Model 71204/D-AAF.
 - Three, 1.5 inch well head control valves from CES-Landtec.
 - Wright-Austin Type TS 4-inch Gas/Liquid Separator with associated piping and manhole sump.
 - Two, 4-inch PVC butterfly valves with Viton seals by Hayward Industries.
 - Two, 4-inch rubber expansion joints by Holz Rubber or Proco Products.
 - 6" and 4" SDR 17 HDPE pipe of grade PE38, cell classification of PE345434C or greater, as defined by ASTM D3350-02a, plus associated fittings. All pipe joining shall be thermal butt fusion method except where flanged joints are shown on the plans.
 - Pour concrete pad, install blower and flare facility components, connect landfill gas wells and blower and flare facility with piping, and install and connect gas/liquid separator and sump. Design details to be provided under separate cover.

Phase I Operation & Testing

- Operate the Phase I system for at least two months.
- Monitor landfill gas flow and major properties (methane, oxygen, carbon dioxide and temperature) daily for the first week.
- Adjust gas extraction at each well to maximize flow while maintaining methane concentration at no less than 40%, oxygen concentration at no more than 5%, and temperature at no more than 120° F.

- Continue to monitor and adjust the landfill gas wells until system equalization is achieved. System equalization will be defined as optimum flow continuing for at least 5 days without well head valve adjustment.
- Sample landfill gas after system equalization and test for EPA's TO15 list and siloxanes.

Full Development Go/No Go Decision

- Review data and results from Phase I Construction, Operation & Testing.
- Evaluate operational reliability and performance.
- Update conceptual cost estimate based on field experience. Review economic feasibility.
- Make decision to proceed with full development or end project.

Week of	13	14	15	16	17
Date (October 2003 through January 2004)	Dec. 22	Dec. 29	Jan. 5	Jan. 12	Jan. 19
Installation and Testing of Extraction Wells					
Prepare conceptual plan showing full-scale system					
Obtain vendor quotes					
Complete pilot test cost estimate					
Obtain County approval					
Provide work plan to DENR					
Construct extraction wells					
Fabricate flare					
Deliver of blower to landfill					
Setup system					
Operate and monitor for two months					
Sample landfill gas					
Review results					
Update scope and cost of full scale system					
Review economic feasibility with County					
County decides whether to proceed with full development					

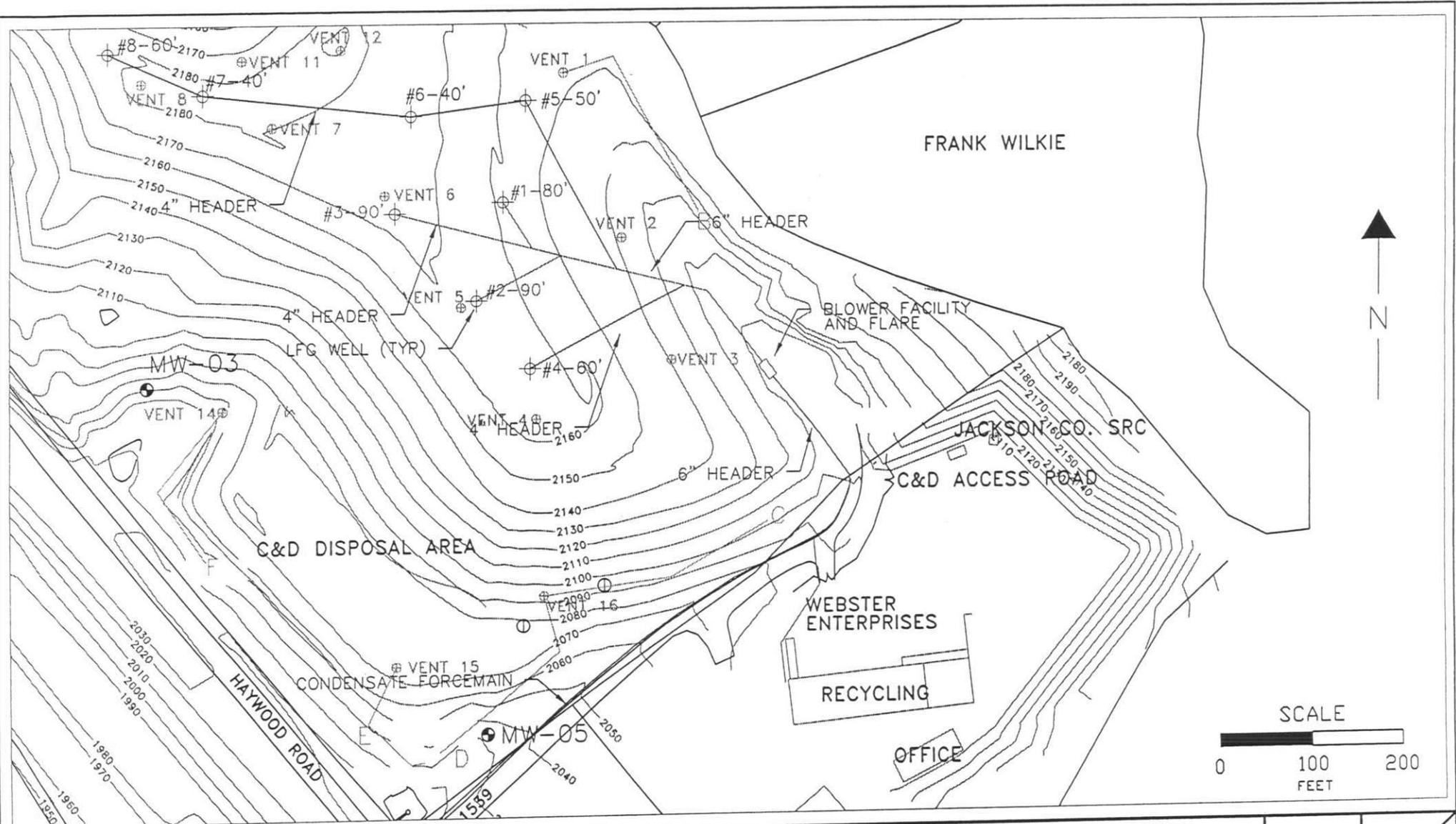
ENVIRONMENTAL, INC.

ENGINEERING & HYDROGEOLOGY

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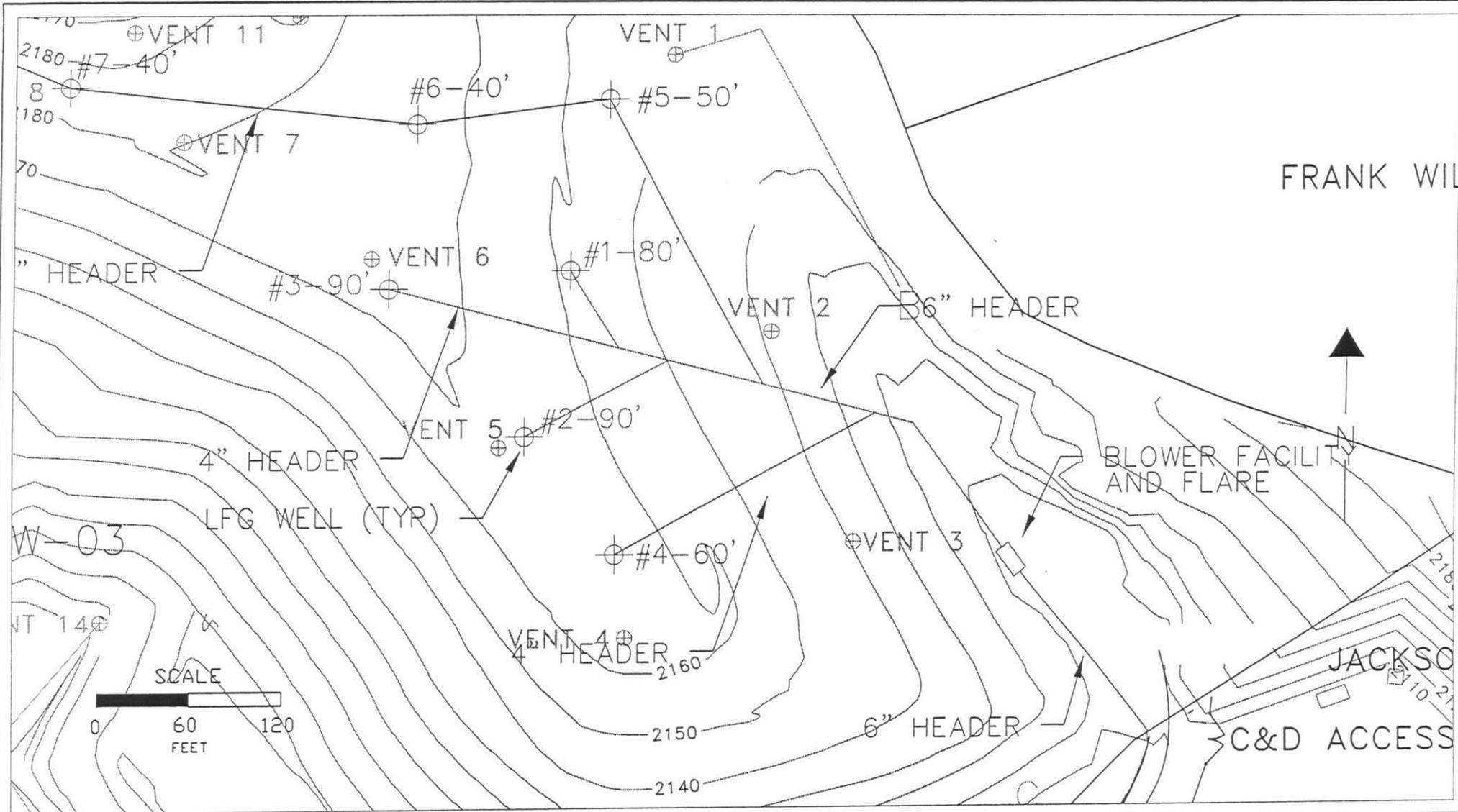


Landmarc Technologies, Inc.
 North Bend, WA
 (425) 888-5554

Altamont Environmental
 Asheville, NC

Jackson County Landfill
 Complete LFG Extraction Plan
 (Preliminary)

1
 3

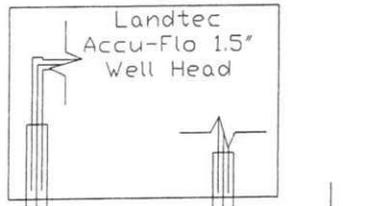


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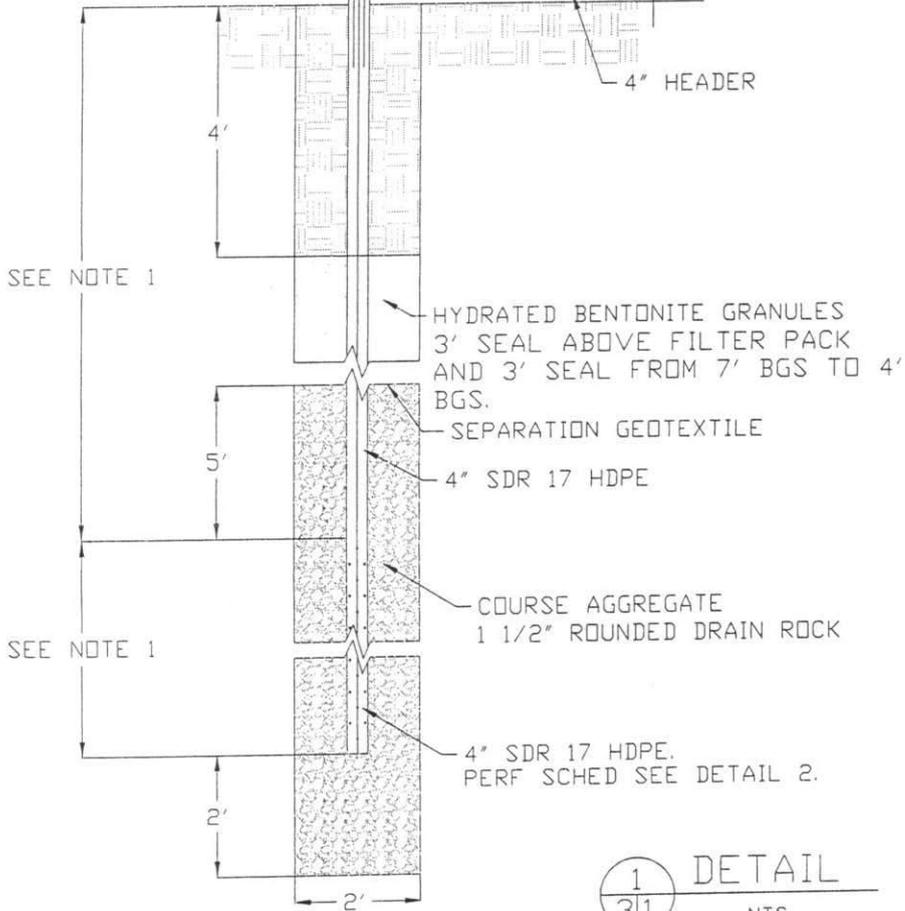
Jackson County Landfill
 Phase 1 LFG Extraction Plan
 (Preliminary)

2
3



NOTES

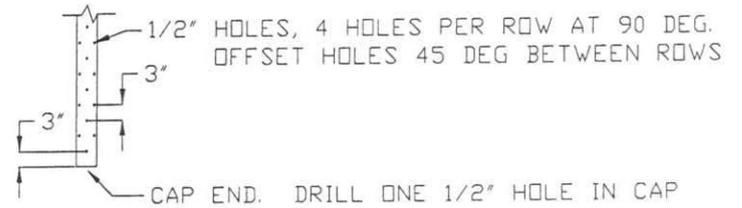
1. #1-25' SCREEN, 53' CASING.
- #2-30' SCREEN, 58' CASING.
- #3-30' SCREEN, 58' CASING.



SEE NOTE 1

SEE NOTE 1

1
31
DETAIL
NTS



2
33
NTS

PERFORATION DETAIL

Jackson County Landfill

Altamont Environmental

Landmarc Technologies, Inc.
North Bend, WA
(425) 888-5554

3

3

ALTAMONT ENVIRONMENTAL, INC.

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LANDFILL GAS EVALUATION REPORT

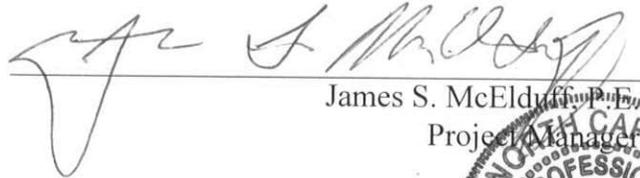
CLOSED JACKSON COUNTY MUNICIPAL SOLID WASTE LANDFILL JACKSON COUNTY, NORTH CAROLINA

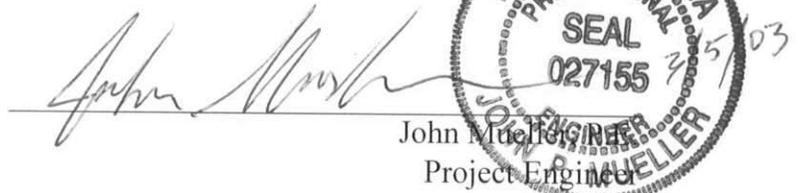
*- Best-based
- no provisions in
rules to allow
this approach for
remedial action.*

Prepared for
Jackson County

March 5, 2003

Prepared by
Altamont Environmental, Inc.
78½ Patton Avenue
Asheville, NC 28801
(828) 281-3350


James S. McElduff, P.E.
Project Manager


John Mueller, P.E.
Project Engineer



- 4 additional CH₄ probes installed
 - 20' → 55'
 - down to lowest known LF elevation.
 - " " H₂O on rock.
- County Maintenance Bld.
 - Installed sensors - 4 locations
 - Calibrated sensors & trained County personnel to perform monthly accuracy checks.
 - County to keep a calibration log. - Monthly.
 - Altamont conducted a FID screening of bld.
- Webster Enterprises Bld. (office) (unoccupied)
 - Screened the same as Co. maintenance bld.
- Webster Recycling Ctr. (open operation)
 - not screened.

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- A. Summary of Historic Landfill Gas Monitoring Results through November 19, 2002
- B. Methane Monitoring and Response Plan for the Jackson County Maintenance Building
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- D. Well Construction Records
- E. U.S. EPA Landfill Methane Outreach Program Preliminary Landfill Gas Analysis Report for Jackson County Landfill
- F. Supporting Documentation for Landfill Gas Resource Utilization Economic Evaluation

1.0 INTRODUCTION

Altamont Environmental, Inc. (Altamont), on behalf of Jackson County, has prepared this *Landfill Gas (LFG) Evaluation Report* for the closed municipal solid waste (MSW) landfill near Dillsboro, North Carolina. The site location is shown on Figure 1.

On July 9, 2002, Altamont met with representatives of the North Carolina Department of Environment and Natural Resources (DENR) in Raleigh to present results of a LFG extraction pilot study and to propose a risk-based approach to LFG management. Based on that meeting, Altamont submitted a comprehensive *Landfill Gas Management Plan* to DENR on August 19, 2002. The plan detailed steps necessary to identify and minimize potential risks to human health and property associated with explosive concentrations of methane. The plan also presented a strategy for developing LFG risk management and beneficial use options as appropriate.

This report describes the activities performed during implementation of the *Landfill Gas Management Plan* and presents findings and conclusions associated with those activities.

2.0 BACKGROUND

Jackson County, with the assistance of Altamont, has historically conducted two LFG monitoring programs at the closed MSW landfill near Dillsboro, North Carolina. The first LFG monitoring program was initiated in approximately 1996 and is related to compliance with the landfill permit conditions. As such, it is a continuing effort. The DENR Solid Waste Management Rules specify a regulatory compliance limit for methane concentrations at the property boundaries of five percent. Five percent methane corresponds to the lower explosive limit (LEL); the lowest concentration at which methane becomes explosive in air if an ignition source is present. The second LFG monitoring program was initiated in January 1999 as part of a groundwater quality assessment. In the second program, Altamont (formerly known as the Fletcher Group of North Carolina) measured LFG concentrations at onsite monitoring locations using the closed-loop protocol recommended by DENR. The measurements were collected on a monthly basis between January 1999 and November 2001. Jackson County collected the monitoring data from December 2001 through September 2002. Altamont resumed implementation of the monitoring program in October 2002. Throughout the monitoring programs, LFG concentrations have been measured using CES Landtec LFG meter models GA 90, GEM 500, and GEM 2000. The monitoring well, vent, and gas probe locations used to measure LFG concentrations are shown on Figure 2. Historic LFG monitoring data is summarized in Appendix A.

In January 1999, LFG was detected at concentrations greater than the LEL for methane at several locations on County property and in the groundwater monitoring well (PMW-01) on an adjacent property. At that time the property was owned by Western Builders. Currently, the property is owned by Jackson County and houses the County Maintenance Department. Between March 15 and 19, 1999, Altamont oversaw installation of LFG probes at 18 locations near the landfill. These probes were installed as part of the effort to characterize groundwater quality in the vicinity of landfill. Monitoring of the probes revealed several boundary locations at which the regulatory compliance limit for methane was exceeded.

On March 24, 1999, Jackson County awarded a contract to McGill Associates (McGill) of Asheville, North Carolina on March 24, 1999 for design and construction of LFG control structures. These

structures were installed between March 29 and April 9, 1999. Following installation of these structures, LFG measurements in some areas, particularly the northern and southeastern boundaries, generally remained greater than the LEL. As a result, the County requested that Altamont provide engineering services related to evaluation and mitigation of LFG for the Dillsboro facility.

Altamont submitted a LFG Mitigation Plan to DENR on September 28, 2001. The plan detailed a two-phased LFG mitigation pilot study for the northern (Phase I) and southeastern (Phase II) boundaries of the property. The purpose of the pilot study was to evaluate options for achieving regulatory compliance regarding methane concentrations at property boundaries. After submittal of the plan, Jackson County determined that LFG compliance along the southeast side of the landfill could be achieved by purchasing the adjacent property from Webster Enterprises. Since Jackson County was exploring this option, the LFG pilot study was redesigned to focus on the northern property boundary.

Altamont implemented Phase I of the LFG pilot study at the northern boundary between November 13 and December 3, 2001. DENR stipulated that if the Webster Enterprises property was not acquired by the end of December 2001, remedial alternatives for the southeast side should be evaluated and implemented. By January 1, 2002, the County had not acquired the Webster Enterprises property, so Altamont proceeded with design and implementation of a pilot study for the southeast side. Phase II of the study was implemented at the southeastern boundary between March 18 and April 2, 2002.

A *LFG Extraction Pilot Study Report* describing activities and results of both phases of the study was submitted to DENR on May 10, 2002. The study identified challenges (e.g., high water table, steep terrain, and small radius of influence) to achieving control of LFG migration along both of the property boundaries evaluated during the test. In the report, Altamont recommended a comprehensive evaluation of the LFG monitoring network, identification of data gaps, and evaluation of measures to increase the protection of human health as appropriate.

3.0 SCOPE OF WORK AND METHODS

3.1 Evaluation of Health and Safety Risks to Human Health and Real Property

The evaluation of health and safety risks presented in this section is based on over three years of LFG monitoring data. A summary of historic LFG monitoring data through November 19, 2002 is included as Appendix A.

3.1.1 Assessment of County Maintenance Building

The assessment of the County Maintenance Building was comprised of three components:

- 1) Evaluation of the LFG monitoring network in the vicinity of the building.
- 2) Inspection and screening of the building to assess the potential for LFG infiltration and accumulation.
- 3) Inspection and evaluation of the methane monitor and alarm system in the building.

The LFG monitoring network was evaluated using cross-sections that show the LFG probes and monitoring wells in relation to the landfill. In addition, historical methane concentration trends were evaluated for the LFG probes nearest the building. Based on this evaluation, data gaps in the LFG monitoring network were identified.

On August 16, 2002, Altamont inspected the entire County Maintenance Building and methane alarm system and initiated a quarterly LFG screening program for the County Maintenance Building using an intrinsically safe flame-ionization detector (FID). The FID is more sensitive than the LFG meter used for compliance monitoring at gas probes by approximately three orders of magnitude. Altamont used a Foxboro model TVA-1000 FID with a carbon filter to remove hydrocarbons, leaving only methane for measurement. The instrument accuracy in readings from 1.0 to 10,000 parts per million (ppm) is ± 25 percent of the reading, or ± 2.5 ppm, whichever is greater. During FID screening, particular attention was given to cracks or joints in the floor slab and walls, conduit openings, etc. In addition to the main

building, two detached storage buildings, one containing equipment and one containing fuel, were also screened with the FID. Results of the inspection and FID screening are discussed in Section 4.1.1.

Altamont interviewed County employees in the maintenance and solid waste departments about the methane monitor and alarm system and obtained an operations manual from the manufacturer. Altamont assessed the following parameters associated with the methane alarm system:

- Number and location of sensors
- Calibration and testing procedures
- Alarm settings and function
- Methane alarm response procedures

Altamont prepared a *Methane Monitoring and Response Plan* for County personnel working in the County Maintenance Building. The plan provides basic information about landfill gas, outlines responsibilities for implementing the methane monitoring program, and prescribes actions to be taken in the event that a methane alarm is activated. The plan is included in Appendix B.

3.1.2 Assessment of Nearby Residences and Commercial Buildings

The monitoring locations in which consistently high concentrations of LFG have been measured can be segregated into two general areas. One such area is along the north-central portion of the landfill. The second area is in the southeastern portion of the landfill. In addition, measurements from a more recently installed (January 4, 2002) gas monitoring probe located along the northeastern boundary of the landfill (GP-19) suggest that methane concentrations in that area also exceed the LEL.

Altamont re-evaluated the monitoring network along all boundaries of the landfill to assess whether potential LFG migration routes to structures are adequately monitored. Figure 2 shows the locations of residences and commercial buildings with respect to the landfill and LFG monitoring probes. Figures 3 through 9 show cross-sections through the landfill and adjoining properties.

During the July 9, 2002 meeting with DENR, Altamont obtained a set of landfill development plans for the Jackson MSW Landfill prepared by Butler/McGill Associates dated March 12, 1984. The plans include topographic contours and cross-sections showing proposed cut and fill areas for successive phases of landfill development. This information was used in conjunction with historic topographic contours, boring log data, and topographic information to refine previously prepared cross-sections and generate new cross-sections (refer to Figures 3 through 9). The new cross-sections were used to determine optimal LFG probe placement in the area. A discussion of geology and probe placement with respect to nearby structures is presented in Section 4.1.

3.1.3 Installation and Monitoring of Additional LFG Probes

Based on the evaluation of the LFG monitoring network with respect to nearby residences and structures, additional LFG monitoring probes were installed to fill data gaps. Probe installation began on October 28, 2002 and continued through October 30, 2002. LFG probes were constructed in four borings installed on adjacent properties. Three of the four borings were completed as single landfill gas probes (i.e., GP-10S, GP-13I, and GP-15I). The fourth boring was completed as a multi-depth probe screened over two distinct intervals (i.e., GP-12I and GP-12D1). The purpose of the probes was to provide increased monitoring of nearby structures (i.e., homes and other buildings).

The borings were advanced using a Mobile B-58 hollow stem auger drill rig. Boring depths ranged between 20 feet and 55 feet. The drilling was performed by Geologic Exploration, Inc., a contractor certified in the State of North Carolina (certification number 2345), under the supervision of Altamont personnel. All of the probes were secured with steel flush-mount covers.

At each location, probes were installed to provide monitoring to the depth of the lowest known elevation of the landfill (approximately 2040 feet above mean sea level), unless bedrock or groundwater was encountered first. Locations of the probes are shown on Figure 2. Figures 3 through 9 show the screened intervals for the newly installed probes and previously installed probes. The construction records for the new probes are included as Appendix D. Table 1 provides a summary of construction details for newly installed probes, previously installed probes, monitoring wells, and extraction wells. ✓

Altamont measured LFG concentrations in the newly installed LFG monitoring probes on October 31, 2002 and November 19, 2002 as part of the comprehensive LFG monitoring program. LFG monitoring results are summarized in Appendix A, and discussed in Section 4.1.

3.2 LFG Resource Evaluation

The LFG resource evaluation was conducted with the following objectives:

- Identify potential end users of LFG in the vicinity of the landfill
- Evaluate the economic feasibility of replacing current fuel demands with LFG
- Evaluate the potential for implementation of new and innovative LFG utilization projects

Procedures used to meet these objectives are described below.

3.2.1 Identification of Potential End Users of LFG

Altamont and Jackson County identified potential end users of LFG as an energy source in the vicinity of the landfill. The following entities were identified for evaluation of energy usage:

- Harrison Construction asphalt plant
- Jackson County Maintenance Building and Staffed Recycling Center
- Webster Enterprises recyclables sorting facility
- Best Western Motel
- Great Smoky Mountain Railroad maintenance facility

Altamont interviewed representatives of each of these facilities regarding types, quantities, fluctuations, and costs of energy consumption. In addition, the potential for sale of methane-generated electricity to the local electric utility, Nantahala Power and Light Company, was evaluated. Results of the evaluation are presented in Section 4.2.1.

3.2.2 Economic Evaluation of LFG Resource Utilization

The potential resource utilization scenarios identified in Section 3.2.1 were subject to an economic feasibility screening. The screening was intended to serve as an approximately order-of-magnitude analysis, with the objective of determining whether or not a more detailed analysis was warranted. The analysis took into consideration factors such as estimated remaining methane generation potential, costs associated with collection and distribution of LFG, current energy unit costs and demands, and costs associated with generating electricity. Potential revenues were estimated and balanced against estimated development costs. Results of the economic evaluation are presented in Section 4.2.1.

3.2.3 Evaluation of Innovative LFG Utilization Projects

In addition to the economic evaluation of LFG resource utilization, an analysis was performed to evaluate less tangible benefits to the community as well as potential for financial assistance grants for implementation of innovative LFG utilization projects. Based on discussions with the Jackson County Manager, Altamont assumed a conceptual LFG utilization project modeled after the Energy XChange program at the Yancey-Mitchell County Landfill, which uses LFG to heat greenhouses as well as fire pottery making and glass blowing operations. That project includes educational and training components in addition to support for native plant propagation in the greenhouses. Altamont identified potentially applicable federal, state, and private foundation sources of grants and loans to support a similar project. Results of the evaluation are presented in Section 4.2.2

3.3 Site Investigation Activities

The Phase II LFG Extraction Pilot Study identified the presence of perched water or leachate at the southeastern corner of the landfill. Other site-specific factors may have also contributed to the lack of LFG flow during the pilot study. Additional site investigation activities conducted to further evaluate these conditions are described in this section.

3.3.1 Hydrologic Evaluation of Landfill Performance (HELP) Model

The HELP Model, developed by the United States Army Corps of Engineers (USACE), estimates quantities of leachate generation based on site-specific parameters. Leachate can be an important design consideration for a LFG extraction system because it limits the effective depth of gas extraction. In

addition, leachate handling and disposal increases costs. Altamont ran HELP Model version 3.07 for the landfill. Input data was estimated for the following four layers from top to bottom: six-inch vertical percolation layer; two-foot barrier soil cap; 50-foot vertical percolation layer (waste); and 50-foot barrier soil liner (bedrock). The Soil Conservation Service (SCS) runoff curve was computed from a default soil database using site-specific soil texture with a poor stand of grass, a surface slope of 33 percent, and a slope length of 300 feet. Weather data for the following locations were used based on availability in the HELP model database: evapotranspiration data for Asheville, North Carolina and precipitation data for Knoxville, Tennessee. Temperature and solar radiation data was synthetically generated using coefficients for Asheville, North Carolina. Findings of the evaluation are presented in Section 4.3.1 and the complete model output is included in Appendix C.

3.3.2 Diagnosis of Phase II Pilot Study LFG Extraction Wells

Two LFG extraction wells, EW-1 and EW-2, were operated under a vacuum during the Phase II LFG Extraction Pilot Study. Despite application of a high vacuum, gas flow in these wells dropped to zero within a week. On November 8, 2002, Altamont investigated the apparent blockage of flow by visual inspection down the well casings and excavation of a trench next to EW-1 using a trackhoe to expose the top of the screened interval. The objective of the investigation was to identify the cause of blockage so that future gas extraction wells can be appropriately designed to eliminate this problem. Observations of the investigation are discussed in Section 4.3.2.

3.3.3 Direct Push Investigation

On October 21, 2002, Altamont mobilized a Geoprobe™ direct push soil coring system to the landfill. The purpose of the direct push investigation was to advance open boreholes to the water table for installation of piezometers. The objectives of installing piezometers were to evaluate leachate levels, determine hydraulic gradients, and evaluate LFG quality within the landfill. However, the direct push investigation was suspended after numerous attempts to advance probes into the landfill met with refusal within 20 feet of the cap surface. The probes apparently encountered impenetrable trash. There was no indication of saturated conditions at these shallow depths. ✓

4.0 FINDINGS

4.1 Evaluation of Health and Safety Risks to Human Health and Real Property

This section presents the results of the LFG risk evaluation. The evaluation encompassed all structures (residences and other buildings) that were identified as being potentially at risk from LFG migration.

4.1.1 Assessment of County Maintenance Building

The County Maintenance Building is located approximately 200 feet southeast of the landfill property boundary (see Figure 2). Gas monitoring probes GP-15D and GP-15S are also located approximately 200 feet from the landfill property boundary and approximately 37 feet southwest of the County Maintenance Building. GP-15S is screened from eight to ten feet deep and GP-15D is screened from 40 to 50 feet deep. The ground surface at GP-15 is approximately 27 feet lower than the deepest estimated portion of the landfill. These probes have periodically had concentrations of methane above the LEL (i.e., greater than five percent). During the Phase II Pilot Study at the southeastern corner of the landfill, methane concentrations generally ranged from five to 20 percent in these probes. One additional intermediate probe with a screened interval from 15 to 35 feet (GP-15I) deep was installed in October 2002 to complete the vertical characterization of LFG concentrations at this location. Methane concentrations measured in GP-15I during the October and November 2002 monitoring events were in the range of 14 percent. This is consistent with the historic range of methane concentrations in GP-15S and GP-15D.

The County Maintenance Building is comprised of two distinct work areas: a vehicle maintenance bay and finished office or storage area. The northwest portion of the building is a metal vehicle bay with high ceilings and a bare concrete floor. Some cracks in the concrete slab were observed throughout this area. The remainder of the building is comprised of offices, storage space, and restrooms. Flooring in the office and storage areas is tile and carpet. Both materials appear to be in good condition. The building is single story, slab-on-grade construction. The only utilities that protrude through the slab are drain lines in the restrooms.

The County Maintenance Building has been equipped with a methane detector and alarm since late 1999. The unit is mounted approximately 5.5 feet above the slab on the northwest wall of the vehicle bay. To date, there has been no reported triggering of the methane alarm system. However, until August 2002, there was no inspection, maintenance, and testing program in place for the system.

On August 16, 2002, Altamont inspected the entire County Maintenance Building and methane alarm system. Based on the inspection of the County Maintenance Building, Altamont recommended installation of an additional methane monitor and alarm in the office and storage portion of the main building. Since the office and storage area is likely to be more airtight and has lower ceilings than the vehicle bay, it provides a more conducive environment for LFG accumulation. The restrooms were selected as a monitoring location because they were the only rooms with protrusions through the slab (drain pipes). Jackson County purchased the same model methane monitor that was installed in the vehicle bay. On October 29, 2002, Jackson County installed the monitor on the southwest wall of the women's restroom. Altamont performed initial calibration of the monitor on October 31, 2002.

The methane alarms in the County Maintenance Building are Conspec Controls, Inc. model P2065-1 Smart Monitors with model P1246 Combustible Gas Sensors. The manufacturer recommends calibration upon installation and an accuracy check with calibration gas every 30 days. An auto-calibration should be performed every 90 days or if the accuracy check indicates that the sensor has drifted by two percent or more. A manual calibration should be performed if the sensor is replaced or if the auto calibration is unsuccessful. The factory settings for the alarms are 10 percent of the LEL for a strobe warning and 20 percent LEL for an audible alarm.

Jackson County purchased a calibration kit for the vehicle bay monitor in early August 2002. On August 15, 2002, Altamont attempted to perform a manual calibration. The calibration attempt revealed a faulty sensor. After replacement of the sensor on September 10, 2002, Altamont performed manual and auto calibrations and trained County personnel to perform a monthly accuracy check and calibrations as-needed.

Altamont prepared a calibration log to document the results of each accuracy test and calibration. The County Solid Waste Technician will be responsible for performing and documenting the monthly accuracy check and calibrations as-needed. Completed calibration logs will be included in the operating record for the landfill. (Note: Since completion of waste disposal operations at the landfill, the operations record has been maintained in the County Manager's office.)

On August 16, 2002, Altamont performed FID screening throughout the County Maintenance Building and two detached storage buildings. Background readings were measured outside the front door of the main building. Real-time measurements were read continuously during FID screening and deviations from background were noted. Readings throughout the main building deviated from background by ± 0.5 ppm. Based on the accuracy limits of the instrument as specified in Section 3.1.1, such low level deviations are probably associated with normal drift of the instrument rather than actual methane concentrations. The only location in the main building where the methane concentration exceeded background by greater than 0.5 ppm was a bathroom sink drain, which had a reading of 1.2 ppm above background. This concentration is probably associated with methane generated in the sewer system from decomposition of waste. There were no readings above background in the equipment storage building. The fuel storage building had a strong gasoline odor; however, as noted in Section 3.1.1, a carbon filter was used to screen organic vapors not associated with methane. The methane reading in the fuel storage building was 3.2 ppm above background. Based on the strong gasoline odor noted, this detection is probably associated with breakthrough of gasoline-related organic vapors through the carbon filter.

The FID was also used to check methane concentrations in gas monitoring probes GP-14S and GP-14D, which are located approximately 100 feet farther from the landfill than probes GP-15S and GP-15D. The concentration of methane in these probes has been at or near zero percent since installation in 1999. No readings above background were detected in the probes with the FID.

4.1.2 Assessment of Nearby Residences and Commercial Buildings

The assessment of the LFG monitoring network presented in this section formed the basis for identification of supplemental LFG monitoring probe locations. The locations and depths of supplemental LFG monitoring probes are shown on Figures 2 through 9.

Boring log indicates sandy silt

Comparison of geologic descriptions between probe, vent, and monitoring well locations around the landfill did not reveal any distinct, continuous geologic strata that would be preferentially conducive to gas migration (e.g., highly permeable sand and gravel layers). However, high permeability soils were identified in specific locations. The predominant soil types encountered between the surface and the top of bedrock are silty-sands with some isolated gravelly layers. These soil types would generally be expected to be capable of transmitting LFG in accordance with their relative permeabilities. LFG may also migrate through fractures in bedrock above the water table. Since LFG is not soluble in water at explosive concentrations, migration would not occur below the water table.

Most of the residences north of the landfill are separated from the landfill by topographic features, such as the ridge and a valley with a spring-fed creek shown in Figure 2. It is unlikely that explosive concentrations of LFG would migrate beyond these natural barriers, particularly the spring-fed creek, because it represents an interface between groundwater and ambient air.

The three residences nearest to the landfill are located between the landfill and the creek. According to County tax records, the nearest residence is owned by J.M. Fowler. Tax bills directed towards William Wilkey, the occupant. Mr. Wilkey has stated that Mr. Fowler is deceased and that he is the current owner. Pending verification of legal title, the property is referred to herein as the William Wilkey property. As shown in Figure 2, this residence is located in a valley approximately 300 feet downslope of the landfill toward the northwest. There is potential for migration of LFG toward the residence, however, the resident has repeatedly denied access to the County for installation of LFG probes on the property.

The LFG probes nearest this residence are GP-01A and GP-09. Both of these probes are five feet deep with a two-foot screened interval at the bottom. There have been no detected concentrations of methane in GP-09 since July 1999. Detected concentrations in GP-09 have never exceeded 0.6 percent methane. GP-01A was installed on November 27, 2001 to replace GP-01, which was suspected of being faulty. Methane concentrations in GP-01A have ranged from 1.3 to 43.2 percent since installation. This probe is near the property line, approximately 400 feet southeast of the William Wilkey residence.

Based on the high concentrations of methane in this probe and the distance to the residence, additional monitoring between the landfill and the residence is recommended to evaluate protectiveness. The ground elevation midway between GP-01A and the William Wilkey residence is approximately 40 feet above the deepest estimated portion of the landfill. Three probes with screened intervals of 5 to 20 feet, 25 to 40 feet, and 45 to 60 feet were proposed for this location. However, Mr. Wilkey once again denied access. Altamont has documented each of these denials to conduct LFG-related activities. Alternatives for addressing LFG at the William Wilkey property line are identified and evaluated in Section 4.4.

The Frank Wilkie residence is located approximately 400 feet north of the landfill. As shown on Figures 2, 3, and 8, a ridge separates the landfill from the Frank Wilkie residence. Gas probe GP-03, located near the property line between the landfill and the residence, is five feet deep with a two-foot screen at the bottom. This probe has a history of methane concentrations fluctuating from less than two percent to greater than 50 percent. Gas probes GP-12S (screened from five to seven feet) and GP-12D (screened from 31.8 to 33.8 feet) are located approximately midway between the landfill and the residence. The deepest estimated portion of the landfill is approximately 80 feet deeper than the ground surface at GP-12. Neither GP-12S nor GP-12D have ever had methane concentrations above 0.2 percent. Review of the boring log for GP-12D revealed a higher permeability gravelly layer at a depth of 19 to 20 feet. The gravelly layer has a higher permeability relative to the surrounding soils and, therefore, may represent a preferential migration pathway. Since there was a significant vertical gap in the monitoring network at this location, an intermediate depth probe (GP-12I) was installed in October 2002 with a screen interval from ten to 30 feet deep. In addition, a deeper probe (GP-12D1) was installed from 35 to 55 feet deep to provide monitoring to the water table and to serve as a piezometer. Groundwater was encountered in GP-12D1 at a depth of approximately 45 feet. Methane was not detected in GP-12I or GP-12D1 during October and November 2002 monitoring events.

The J.N. Bulla residence is located in the bottom of a valley approximately 600 feet north-northwest of the landfill. A long ridge separates the landfill from the Bulla property. Shallow gas probes GP-01A and GP-02 as well as bedrock monitoring well MW-01, located near the landfill property line in the direction of the Bulla residence, have a history of methane concentrations greater than five percent. Gas probe nest GP-11, located on the ridge between portions of the landfill and the Bulla residence, consists of GP-

11S (screened from five to seven feet deep), GP-11I (screened from 28 to 30 feet deep), and GP-11D (screened from 56 to 58 feet deep). A gravel layer was encountered at a depth of 35 to 40 feet during installation of GP-11. Otherwise, the boring was generally comprised of a uniform silty-sand. Methane concentrations in the GP-11 probe nest have never exceeded five percent. GP-11I generally has the highest concentration of methane, with concentrations ranging from 0 to 3.5 percent. GP-11D has the lowest concentrations with a high of 0.5 percent.

Gas probe GP-10 is located approximately 180 feet southeast of the Bulla residence (Refer to Figures 3 and 7). The ground surface elevation at GP-10 is approximately 12 feet above the elevation of the deepest estimated portion of the landfill. GP-10 has a two-foot screen at the top of bedrock, 21.5 feet below the ground surface. The soil horizon above the bedrock is sandy with no gravelly layers encountered. Methane was detected in GP-10 at very low levels (less than 0.3 percent) on a few occasions shortly after installation of the probe. Since August 1999 methane has been detected once at 0.1 percent. These results suggest that migration of methane over the ridge to the bottom of the valley is negligible and does not pose a threat to the Bulla residence. Nevertheless, one additional probe was installed (GP-10S) to monitor the shallow interval between five and 15 feet deep. Methane was not detected in GP-10S during October and November 2002 monitoring events.

In addition to the County Maintenance Building discussed in Section 4.1.1, there are two other commercial structures east of the landfill that could potentially be subject to LFG migration. The structures are owned by Webster Enterprises and are located on an adjacent property north of the County Maintenance Building. An unoccupied 17,000-square-foot office and warehouse building is located approximately 250 feet southeast of the landfill. A smaller building (approximately 1,600 square feet) is used as office space for recycling operations. Recycling operations are conducted in an open structure, which is not at risk for methane gas accumulation. Both of the enclosed buildings on the Webster Enterprises property have slab-on-grade foundations with no basements.

The 17,000 square foot unoccupied building is located approximately 250 feet southeast of gas probe GP-05. GP-05 (screened from five to seven feet) has historically had high concentrations of methane, with concentrations as high as 72 percent recorded. Gas probes GP-13S (screened from two to seven feet) and

GP-13D (screened from 25 to 35 feet) are located approximately 20 feet north of the building. LFG concentrations in both of these probes have been at or near zero since installation. Boring logs for probe GP-13D reveal a silty-sand saprolite throughout with a two-foot layer of white, coarse weathered material at approximately eight to ten feet deep. In light of the terrain in the vicinity of GP-05, LFG observed in GP-05 may vent to the atmosphere along the steep slope west of State Road (S.R.) 1539.

On August 16, 2002, Altamont performed FID screening throughout the building for methane using the same procedures used for the County Maintenance Building. FID readings were within 0.5 ppm of background throughout the building except for one bathroom floor drain, which had a reading of 15.0 ppm. The elevated reading is probably associated with methane generated in the sewer system from decomposition of waste. The FID was also used to check methane concentrations in gas probes GP-13D and GP-13S. No readings above background were detected in either of these probes.

The small office building on the Webster Enterprises property is located approximately 35 feet west of gas probes GP-13S and GP-13D. As noted above, LFG concentrations in both of these probes have been at or near zero since installation. The office building was screened with an FID on August 16, 2002. The only elevated readings were in the bathroom sink drains, which measured 1.3 ppm above background.

The lack of methane in the Webster Enterprises buildings and in gas probes GP-13D and GP-13S suggests that LFG has not migrated as far east as the buildings. However, to increase protectiveness, an intermediate-depth probe (GP-13I) was installed to monitor the interval between GP-13S and GP-13D. Methane was not detected in GP-13I during October and November 2002 monitoring events.

4.1.3 Monitoring of Supplemental LFG Probes

Altamont conducted two complete rounds of LFG monitoring since the new LFG probes were installed in October 2002. LFG monitoring was conducted on October 31, 2002 and November 19, 2002. Methane was detected in only one of the newly installed LFG probes. LFG monitoring probes GP-10S, GP-12I, GP-12D1, and GP-13I did not contain any detectable concentrations of methane. Methane was detected in LFG probe GP-15I at approximately 14 percent during both monitoring events. Table 1 provides a

summary of probe construction details. A summary of historic LFG concentrations for all LFG monitoring points is included as Appendix A.

4.2 LFG Resource Evaluation

Altamont evaluated two potential types of LFG projects:

- Those that would use the gas to fill the energy requirements of nearby existing businesses, and
- Others that would make innovative use of the gas in prospective projects such as greenhouses, pottery kilns, or glass furnaces.

Uses of LFG for energy needs in existing businesses were subjected to a strictly economic analysis. For the more innovative projects, the evaluation also considered other less tangible benefits that would accrue to the community. In addition, potential grant opportunities were identified for the innovative projects.

This summary of the evaluation includes three sections:

- Recovery Potential and Costs
- Energy Substitution
- Innovative Utilization Projects

4.2.1 Recovery Potential and Costs

Altamont contacted the United States Environmental Protection Agency (EPA) Landfill Methane Outreach Program (LMOP) for assistance in evaluating the potential for beneficial uses of LFG at the Dillsboro Landfill. LMOP prepared the attached *Preliminary Landfill Gas Analysis Report* for the Landfill. LMOP contractors used EPA's LandGEM software to estimate LFG production based on data provided by Altamont. The LMOP analysis indicated that gas production by the Landfill peaked in 1999. In other words, the model predicted that LFG production is now decreasing with time. As shown in the attachment, the LMOP analysis projected LFG recovery based on the assumption that 75 percent of the produced gas could be captured.

The current (2002) LFG recovery rate projected by LMOP is approximately 135 standard cubic feet per minute (scfm). The LMOP analysis shows that the LFG recovery rate is expected to drop to 66 scfm by 2020. Based on these projections, a small LFG resource utilization project could be sustained for a reasonably long period. The gas production rates projected by LMOP should be verified by site-specific testing at Dillsboro prior to designing or building any such system.

✓ The size and cost of the LFG recovery system would depend upon the energy requirements of the end-user. According to LMOP projections, the Jackson County Landfill could sustain a 50 scfm LFG recovery rate through the year 2028. Assuming a design flow rate of 50 scfm and an average flow rate of six to seven scfm per extraction well, eight extraction wells would be required.

Table 2 provides a budgetary cost estimate for a LFG collection system. The total estimated capital cost of an eight well system would be \$420,000. Annual operation and maintenance (O&M) costs are estimated to be \$42,000. The capital costs associated with installing the LFG collection system could be amortized over an assumed ten-year project life. Assuming a seven percent interest rate, the annual capital cost would be \$60,000. The total annual cost (i.e., amortized capital plus O&M) would be \$102,000. Assuming a methane concentration of 50 percent in the LFG, the fuel value of a 50-scfm system would be approximately 13,000 million British Thermal Units (BTUs) per year. Therefore, the average energy cost would be \$7.85 per million BTU, assuming 100 percent combustion of the methane.

4.2.2 Energy Substitution

Existing Energy Users

Altamont worked with Jackson County staff to identify potential beneficial uses of LFG in the vicinity of the Landfill. The attached Table 3 lists the potential end-users of LFG that were evaluated, with a summary of their current energy demands and costs. (*Note: Personnel associated with the Harrison Construction asphalt plant declined to provide actual fuel unit costs. As a result, the total fuel cost was calculated using the assumption that the plant receives a 25 percent bulk-user discount from the retail price.*)

Fuels with the highest cost per BTU and lowest probable cost of substitution with LFG were given priority in this evaluation. Propane and diesel (Number 2 Fuel Oil) had the highest costs per BTU. Both of these fuels can be replaced by LFG for most applications, with system retrofits completed as needed.

As shown in Table 3, propane costs ranged from \$8.00 per million BTU at the Best Western Hotel to \$13.80 per million BTU at the County Maintenance Building. An employee of the Great Smoky Mountain Railroad indicated that propane use at the railroad is minor (heating of one office). The Best Western Hotel uses propane for their laundry dryers, water heaters, and pool heater. Jackson County uses propane during the winter to heat the Maintenance Building.

Diesel is used at the Harrison Construction asphalt plant at an estimated cost of \$6.15 per million BTU. The asphalt plant uses large quantities of diesel for burners during the construction season, typically from May through October. Since the Maintenance Building is heated from October to April, and the asphalt plant is operated from May to October, those uses are complementary.

Cost Savings and Revenue

In addition to the assumption made regarding fuel costs at the asphalt plant, Altamont also assumed that each of the LFG users would be provided a 20 percent discount from current fuel costs to encourage substitution. As shown in Table 3, the following annual cost savings and revenue would be realized if LFG were substituted for the existing fuels:

Jackson County Maintenance Building (propane)	-	\$4,193
Best Western Hotel (propane)	-	\$5,840
Harrison Construction (diesel)	-	<u>\$6,072</u>
		\$16,105

The Harrison Construction asphalt plant has a high demand for energy; however, due to the daily and seasonal fluctuations in that demand, LFG can only supply a small fraction of their energy needs. The \$6,072 estimated revenue from the sale of LFG to the asphalt plant is based on the sale of all excess LFG available during the plant hours of operation. LFG collected when the plant is not operating would have

to be flared, unless a LFG compression and storage system is used. Such systems are costly and uneconomical.

Construction, Retrofitting, and O&M Costs

As shown in Table 2, the cost of a LFG collection system with eight extraction wells and a flare is estimated at approximately \$420,000. Research of comparable systems indicates that annual O&M costs are approximately ten percent of the capital costs (i.e., \$42,000). The capital costs do not include installation of a gas pipeline from the landfill to the asphalt plant beneath the Tuckasegee River. The cost for the pipeline installation using horizontal drilling would be at least \$20,000 if bedrock is not encountered. If bedrock is encountered during drilling, then the cost for pipeline installation would be considerably higher. Additional costs would also be incurred to retrofit the asphalt plant for combustion of LFG.

Benefit/Cost Comparison

Based on these estimates, the financial benefits of substituting LFG for propane and diesel would equal approximately \$16,100 per year. The expected minimum annualized costs would be \$102,000. As a result, this evaluation indicates that substitution of a LFG system for the existing setup would not be economically feasible.

Due to the energy needs of the existing energy users and the related seasonal fluctuations in demand, no more than 18 percent of the recovered BTU value would be utilized. Therefore, Altamont evaluated other means of increasing potential energy sales to improve the economics of energy substitution project.

Other Potential Uses of LFG

Electricity can be generated using small-scale generators (e.g., microturbines and gas-fired generators). Direct use of generated electricity by nearby energy users could potentially offset the cost of generation and additional revenue could be provided by selling additional capacity to the local electrical utility.

The total cost for a small capacity microturbine system, including installation and O&M, is in the range of \$0.07 to \$0.11 per kilowatt hour (kWh) based on a ten year service life. These costs do not include the

cost of the LFG collection system installation and O&M. The current retail cost for electricity from Nantahala Power and Light (NP&L) is \$0.07 per kWh. As these costs show, substitution of LFG-derived electricity for conventionally generated electricity would result in a break-even scenario at best. Nantahala Power and Light (NP&L) purchases additional capacity at a rate of approximately \$0.03 per kWh. This exchange would also result in a net loss.

Additional initial costs associated with electric grid interconnection equipment and installation were not included in the preceding figures. These costs would be at least \$30,000. Furthermore, NP&L has stated that there would be an unspecified monthly charge for being on standby to provide a backup power supply even if it were not used.

The other conventional means of generating electricity from LFG is a small reciprocating engine. According to LMOP, the smallest commercially available reciprocating engine can run on as little as 118 scfm of LFG. Altamont identified a reciprocating engine manufactured by Jenbacher that operates on 105 scfm of 50 percent methane LFG. Based on the projected future LFG recovery rates, flow rates cannot be sustained above 105 scfm beyond the year 2008.

Assuming installation of a reciprocating engine in 2003, the system would have a life expectancy of only five years. Therefore, revenue and savings would have to cover installation and O&M costs in five years to be economical. The capital cost for installation of a small reciprocating engine is approximately \$200,000. Operation and maintenance would cost an additional \$40,000 per year. With the capital costs spread over five years at seven percent interest, the total annual cost would be approximately \$89,000. At current rates, revenue and savings from the electricity generated would total approximately \$74,000 per year. Therefore, the system would be operated at a net loss.

There are currently no federal or state incentive programs that the County could use to help offset the cost of generating electricity from LFG. Based on this analysis, collection of LFG for the sole purpose of generating electricity would not be economical for the Dillsboro Landfill.

4.2.3 Innovative Utilization Projects

Based on the preceding economic evaluation, use of LFG as a substitute for currently utilized fuels is not feasible from a purely economic standpoint. However, innovative projects used for economic stimulation and to complement the existing retail mix in the Dillsboro area might provide additional steady demand for energy near the Landfill.

The Energy XChange project, located at the Yancey-Mitchell Landfill, provides a successful example of an innovative LFG utilization project. The Yancey-Mitchell LFG recovery system operates at approximately 40 scfm. It provides energy for a number of onsite enterprises (e.g., a greenhouse in which native plant species are propagated, a craft studio for potters and glass blowers, and a demonstration aquaponics greenhouse). In addition to serving as a business incubator for craftspeople and small businesses, the project also offers an apprentice program for local high school students. The Yancey-Mitchell Landfill project was funded by various public and private sector grants totaling over \$800,000. In addition, revenue is generated from the collection of rent from tenants and the sale of horticultural products and crafts.

An approach similar to the one used at the Yancey-Mitchell Landfill could be implemented at the Jackson County Landfill. The successful identification and implementation of an innovative LFG utilization project requires the dedicated involvement of county officials and community members.

The first step would be to identify beneficial uses that are supported locally. Western Carolina University in Cullowhee has a ceramics program and Haywood Community College in nearby Clyde has a large program that includes several energy intensive crafts (e.g., ceramics, woodworking, metalworking). Graduates from these programs could potentially benefit from a business incubator at the Landfill. Ceramics kilns and glass furnaces can easily be configured for the use of LFG as a fuel source. Additional energy intensive projects could be identified and further evaluated by a community-based task force.

Any project of this nature would require suitable land and/or building space adjacent to the landfill. The best location for project infrastructure is the commercial property adjacent to the southeast side of the

landfill. The County owns one parcel to the southeast of the landfill, which contains the County Maintenance Building. Another parcel, owned by Webster Enterprises, contains a vacant 17,000 square foot building, the Staffed Recycling Center (SRC), and a recyclables sorting facility. The vacant building contains warehouse and office space and would be a valuable asset to a LFG utilization project.

Another potential location is between the Tuckasegee River and Haywood Road. Although the property is not ideal for development, the County owns it. The parcel ranges in width from 150 to 200 feet, and has a 40-foot-wide railroad right-of-way through its length. Most of the property is steeply sloping or located in flood plain. However, a long, relatively flat area near the west end of the property could potentially be used for a small-scale project.

Grant opportunities that may be applicable to a project at the Dillsboro Landfill include the following:

- US Department of Energy Special Projects Grants: These grants are offered annually through the North Carolina State Energy Office. This program requires matching funds that can be in the form of equipment, labor, or facilities. A wide variety of energy-related projects are funded through this program. Funding levels under this program can be up to several hundred thousand dollars. Proposal solicitation for these grants normally occurs around the end of the calendar year.
- North Carolina State Energy Office Clean Technology Demonstration Fund: This program funds renewable energy projects such as LFG microturbines and direct uses of LFG and the associated heat. This is a new program this year. The State Energy Office expects to issue a request for grant proposals by the end of the year.
- North Carolina State Energy Office Sustainable Community Development Program: This program is broad in scope. Successful proposals typically have an energy component and provide a direct benefit to the community. This program is normally funded in June and October of each year.
- North Carolina Technology Development Authority (TDA): This program funds business incubator projects and other technology-related initiatives throughout the state. Funding levels for recent business incubators have been in the range of \$200,000. The TDA also administers a Rural Loan Program with funding from the U.S. Department of Agriculture. Loans in the amount of \$25,000 to \$250,000 are available for business incubators in areas with populations of 25,000 or less.

4.3 Site Investigation Activities

The activities described in this section were performed in order to improve the characterization of the landfill and identify design considerations for a LFG collection system.

4.3.1 Hydrologic Evaluation of Landfill Performance (HELP) Model

The output file for the HELP model that was run for the landfill is provided in Appendix C. Monthly and annual totals of percolation/leakage through the soil cap (layer 2) and underlying bedrock (layer 4) are estimated for five consecutive years. Based on the input variables provided, the estimated average annual percolation/leakage through the soil cap is approximately 20 inches or 8.6 million gallons. In light of saturated conditions observed in the southeast corner of the landfill during the LFG pilot-study, these results suggest that a full-scale LFG collection system may require some type of leachate collection system in order to maximize effectiveness. The presence of leachate in a LFG extraction well will reduce the length of screen available for gas collection. Significant accumulation of condensate can also be expected as a result of the likely saturated conditions near the bottom of the landfill.

4.3.2 Diagnosis of Phase II Pilot Study Extraction Wells

The visual inspection down the casings of the pilot study extraction wells did not reveal anything unusual. There was no evidence of blockage.

A trench was excavated next to EW-1 to approximately 12 feet deep with a trackhoe. At approximately seven to eight feet some trash and concrete rubble were encountered. The waste-to-soil ratio became greater at about nine feet. At this depth, the waste portion was estimated at 30 to 40 percent. The predominant waste type was fabric scrap. The soil was primarily dark brown moist sandy-silt. A minor water seep was encountered at approximately ten to 11 feet below the ground surface. The bentonite seal was noted at a depth of approximately ten to 11 feet and the gravel pack was encountered at 11 feet. A sample of gravel was collected from the trackhoe bucket for examination. The gravel was wet, but not saturated, and was coated with silty fines. Due to the disturbed nature of the sample, the ratio of fines to gravel could not be reliably estimated.

Based on these observations and those made during the pilot study, the following factors are likely to have contributed to the poor performance of the extraction wells:

- A high ratio of soil to waste, possibly associated with the location of the extraction wells near the edge of the landfill, resulted in a lower than expected effective porosity.
- Application of a strong vacuum to the extraction wells may have drawn silt into the gravel pack, thereby reducing the effective porosity.
- An unexpectedly high water level in the extraction wells reduced the length of exposed screen.
- High soil moistures probably contributed to reduced effective porosity.

4.3.3 Direct Push Investigation

The direct push techniques used in an attempt to install piezometers throughout the landfill were unsuccessful due to the presence of impenetrable waste at various depths. The deepest penetration was to 20 feet. Water was not encountered during any of the attempts. If a LFG resource utilization project is to be implemented, alternate techniques (e.g., bucket auger drilling) should be used to evaluate water levels in the landfill.

4.4 Identification and Evaluation of LFG Management Alternatives

Based on the evaluation of potential health and safety risks presented in Section 4.1, there is no evidence of imminent or substantial endangerment associated with LFG migration. However, one property, the William Wilkey residence, has not been fully evaluated for LFG migration. As previously noted, Mr. Wilkey has repeatedly denied access for installation of LFG probes or FID screening on the property. If LFG migration cannot be evaluated in this area due to access restrictions, then appropriate actions will be implemented to manage potential risk associated with methane at the property boundary.

Potential risks will be managed in all other areas through continued quarterly monitoring. If conditions warrant, appropriate risk management actions will be identified and evaluated.

From a risk management perspective, none of the findings of this report demonstrate the need for active LFG extraction at this time. However, utilization of LFG through innovative alternatives may be attractive to the County, particularly if funding assistance can be secured. Such a system would be designed to maximize quality and quantity of LFG collection with a minimum number of extraction wells. Although such a system would not be designed as a perimeter LFG control system, it might still provide the benefit of reducing LFG migration by reducing gas pressure throughout the landfill.

4.4.1 Identification of LFG Management Alternatives

Altamont identified the following three alternatives for managing risk associated with LFG at the William Wilkey property boundary:

- Alternative 1: Exercise the power of eminent domain to acquire the entire William Wilkey property as a buffer zone. Any at-risk structures would be removed. LFG monitoring probes would be installed to evaluate extent of migration. LFG probe installation would consist of three discrete screened intervals in one boring to a maximum depth of 60 feet as proposed in Section 4.1.2.
- Alternative 2: Exercise the power of eminent domain to acquire an easement on the William Wilkey property for installation and monitoring of LFG probes. LFG probe installation would consist of three discrete screened intervals in one boring to a maximum depth of 60 feet as proposed in Section 4.1.2.
- Alternative 3: Design and install a LFG mitigation system as needed in the vicinity of GP-01A to prevent migration of LFG over five percent methane.

- Will not correct problem of CH₄ @ property boundary

"

Does not address other problem areas of LF.

4.4.2 Comparative Evaluation of LFG Management Alternatives

The selection of a LFG management alternative for the William Wilkey property will be based on consideration of effectiveness, implementability, and cost.

Effectiveness

In terms of protection of public health, Alternative 1 would provide the highest level of effectiveness. By acquiring the property and removing all existing structures, the potential for accumulation of explosive concentrations of methane would be permanently eliminated. However, such drastic measures may not be necessary to effectively manage risks.

Alternative 2 provides a more moderate approach, consistent with the current LFG Management Plan. The County would gain right-of-way through the exercise of eminent domain authority. The extent of LFG migration would be evaluated as originally planned, by installing additional LFG monitoring probes between the landfill and the William Wilkey residence. The new probes would become part of the quarterly monitoring network. If concentrations of LFG are detected above five percent methane in the new probes, then additional risk management measures would be identified and implemented.

Alternative 3 would require a pilot scale test to evaluate effectiveness. Previous attempts to reduce concentrations of methane at LFG monitoring probe GP-01A were not successful. A passive trench and vent (Vent 10) installed in the area in the late 1980s had no effect on concentrations at GP -01A. Altamont performed active extraction of LFG through Vent 10 during the Phase I Pilot Study in November 2001. High concentrations of methane persisted in GP-01A during the pilot study. Prior to design and implementation of a LFG mitigation system, additional site characterization is recommended to evaluate preferential migration pathways and depth to bedrock in the vicinity of GP-01A. Further attempts to reduce methane concentrations in this area would probably include active extraction using trenches, vertical extraction wells, or horizontal extraction wells.

Implementability

Implementation of Alternative 1 would entail primarily administrative and possibly legal actions. Alternative 1 can be expected to be highly objectionable to William Wilkey. LFG probes would be installed to evaluate the extent of migration. If structures on the property are not at risk from LFG migration, then condemnation of the entire property would not be necessary for risk management.

Implementation of Alternative 2 would likely require less associated administrative and legal work than Alternative 1, although some level of opposition from Mr. Wilkey might be reasonably anticipated. If the additional LFG probes indicate that LFG is not migrating toward structures on the William Wilkey property, then quarterly monitoring will be performed to detect changes in methane concentrations. If methane concentrations exceed five percent in the new probes, additional investigative or remedial actions will be implemented as needed.

Alternative 3 would be the most technically challenging alternative to implement. The location of the area that would be subject to LFG mitigation efforts is difficult to access. Access from the north is restricted by the William Wilkey property and dense tree cover. Access from the south is difficult due to the steep slope of the landfill. Vertical LFG extraction wells could be installed on top of the landfill using bucket auger drilling; however it would be difficult to get within 200 feet of GP-01A. Directional drilling techniques could be used from accessible areas of the landfill to install horizontal LFG extraction wells in the vicinity of GP-01A. Alternatively, a trackhoe could be mobilized to the area between the landfill and the William Wilkey property line to install a LFG interceptor trench. An impermeable barrier could be installed on the north side of the trench to restrict LFG migration. Additional characterization of the subsurface conditions is required to further evaluate these options and design an appropriate LFG mitigation system.

Cost

Alternative 1 would entail purchase of the William Wilkey property at fair market value through eminent domain. Three LFG probes would be installed in one new boring at a cost of approximately \$9,000. The property consists of 10 acres of land and a mobile home with a total assessed tax value of \$54,700. Assuming acquisition at the assessed tax value of the property, the total cost of this alternative would be approximately \$63,700. Administrative and legal costs associated with exercising eminent domain to gain access have not been quantified and are not included.

Alternative 2 would be the least costly means of assessing risks on the William Wilkey property; however, if high concentrations of methane are detected, then additional investigation or remedial actions will have to be implemented to further assess and, if necessary, mitigate risks. The cost for installation of one nest of LFG monitoring probes on the William Wilkey property is estimated at \$9,000. This does not include administrative and legal costs associated with exercising eminent domain.

Costs for implementation of Alternative 3 cannot be accurately estimated at this time because the LFG mitigation system has not been designed. However, costs were estimated for an assumed system comprised of a combination of two vertical LFG extraction wells (75 feet deep each) and a LFG recovery trench (300 feet long by 20 feet deep) connected to a blower facility with condensate knockout and no

flare. Initial capital costs were estimated at \$220,000 as shown in Table 4. Annual O&M costs were estimated to be \$22,000 per year. The total present worth cost, including capital costs and present worth of O&M costs for 10 years at seven percent, is \$370,000.

4.4.3 Recommended LFG Management Alternative

Based on the evaluation of alternatives presented above, Alternative 2 is recommended for implementation. This alternative provides a means of evaluating risks associated with LFG migration at the William Wilkey property at a reasonable cost. If risks are found to be unacceptable, the other two Alternatives will still be available for implementation if necessary.

5.0 CONCLUSIONS

The LFG evaluation presented in this report supports the following summary conclusions:

Risk Evaluation

- The evaluation of the LFG monitoring network identified several areas that required supplemental LFG monitoring probes to fill data gaps.
- Supplemental LFG monitoring probes were installed at all proposed locations with the exception of the area between the landfill and the William Wilkey residence. The Wilkeys denied access to Altamont. LFG management alternatives were identified and evaluated for the William Wilkey property.
- Monitoring of supplemental LFG monitoring probes did not reveal any evidence of LFG migration to nearby residences.
- Structures near the landfill were monitored for the presence of LFG.
- The only structure that had detectable methane concentrations in nearby LFG monitoring probes is the County Maintenance Building.
- The County Maintenance Building was subjected to a rigorous inspection using an FID. There was no evidence of methane migration into the building from the landfill in detection range as low as the single digit part-per-million range.
- * • Based on the installation of supplemental LFG monitoring probes for nearby structures and the implementation of safeguards as described below, a perimeter control system for LFG is not necessary at this time to mitigate risk.

Potential Changes in Risk Evaluation

- Jackson County will monitor changes in land use on properties adjacent to the landfill. Changes such as new construction, demolition, or excavation activities will be evaluated with respect to potential LFG migration. Monitoring efforts will be adjusted accordingly. The need for implementation of LFG mitigation measures will be reevaluated as changing conditions warrant.
- Jackson County will impose deed restrictions on county-owned property to control the types and uses of structures that can be constructed in the future. Deed restrictions may preclude the construction of building features such as basements.

- Prior to issuance of any new building permits on adjacent properties, Jackson County will secure written access agreements for implementation of LFG monitoring and mitigation activities in perpetuity.
- Jackson County has entered into discussions with the Town of Dillsboro regarding extension of the Town's Extra-Territorial Jurisdiction (ETJ) to include the landfill and surrounding areas. The purpose of extending the ETJ would be to implement zoning in the area surrounding the landfill. Zoning would provide the Town and the County with a mechanism to control land uses in the area where LFG is a concern.

Implementation of Safeguards

- A Methane Monitoring and Response Plan has been prepared specifically for the County Maintenance Building. Implementation of the plan began in January 2003 and is an ongoing effort.
- The County Maintenance Building will remain under continuous methane monitoring with two stationary alarms. In addition, quarterly screening for methane will be performed throughout the building with an FID capable of detecting methane in the low part-per-million range.
- Quarterly screening for methane with an FID will also be performed at the two enclosed structures on the Webster Enterprises property.
- A complete round of LFG monitoring will be conducted on a quarterly basis at the landfill and surrounding properties. The monitoring network provides an early warning system for LFG migration towards structures. Increases in the extent of LFG migration, particularly in the vicinity of structures, will be thoroughly evaluated and protective measures will be implemented as necessary.

LFG Resource Evaluation

- Use of LFG as a substitute for other energy sources in nearby businesses is not economically feasible due to relatively low fuel costs and fluctuations in demand, which result in low utilization.
- Innovative LFG utilization projects (e.g., craft studio, greenhouse, etc.) have a high potential for partial funding by grants from public and private foundations. Because such projects typically provide benefits to some segment of the community, they can be successful without being strictly economical.
- The identification of specific LFG utilization projects that would serve the community and qualify for grant funding requires the participation of the County.

- A LFG utilization project would provide the ancillary benefit of relieving LFG pressure throughout the landfill, thereby reducing migration potential.

Site Investigation

- The HELP model predicts that approximately 8.6 million gallons of leachate are generated each year. Based on this estimate, leachate management would be an important consideration in designing a LFG collection system.
- The depth to water throughout the landfill could not be determined using direct-push investigation techniques due to the prevalence of impenetrable waste. If a LFG collection system is to be designed, then alternate investigation methods (e.g., bucket auger drill rig) should be used to further characterize the landfill subsurface.
- Diagnosis of extraction well EW-1 revealed the presence of silty soil within the gravel filter pack. The application of a high vacuum to EW-1 during the 2002 pilot study probably caused the silt to fill pore spaces in the gravel. The combination of high moisture content soils, high soil to trash ratio, and high water table contributed to the lack of LFG flow through the well.

LFG Management Alternative Evaluation

- A range of LFG management alternatives were identified and evaluated for the William Wilkey property. Elements of the alternatives included: exercising eminent domain authority to obtain right-of-way for further investigation and monitoring; acquisition of buffer property using eminent domain authority; and LFG mitigation using an active extraction system.
- The recommended alternative involves installation of LFG probes to evaluate the extent of LFG migration. If necessary, eminent domain authority will be exercised to obtain access for the investigation. Additional investigative or mitigation activities will be determined based on the results of the initial LFG evaluation and quarterly monitoring.

Table 1
Probe and Well Construction Details
Closed Jackson County Municipal Solid Waste Landfill
Dillsboro, North Carolina

Location	Total Well Depth (feet bgs)	Casing stickup (feet)	Screen Length (feet)	Casing Diameter (inches)	Depth to Water (feet from TOC)	Ground Surface Elevation (feet)	Elevation of Top of Casing (feet)	Ground-water Elevation (feet)	Elevation of Top of Screen (feet)	Elevation of Bottom of Screen (feet)
MW-1	110	2.02	10	2	98.85	2169.40	2171.42	2072.57	2071.42	2061.42
MW-2	60	2.23	15	2	26.92	2013.15	2015.38	1988.46	1970.38	1955.38
MW-3	63.5	1.37	15	2	53.22	2044.16	2045.53	1992.31	1997.03	1982.03
MW-4	40	2.09	15	2	28.55	1978.68	1980.77	1952.22	1955.77	1940.77
MW-5	60	1.59	10	2	52.94	2027.38	2028.97	1976.03	1978.97	1968.97
EW-1	30	4.00	20	6	32.85	2083	2087	2054	2077.00	2057.00
EW-2	36	4.00	25	6	31.15	2080	2084	2053	2073.00	2048.00
GP-1A	4.45	0.55	2	1	Dry	2134	2135	NA	2132.10	2130.10
GP-2	3.50	0.50	2	1	Dry	2184.42	2185	NA	2183.42	2181.42
GP-3	4.52	0.65	2	1	Dry	2155.07	2156	NA	2153.20	2151.20
GP-4	3.03	1.30	2	1	Dry	2173.60	2175	NA	2173.87	2171.87
GP-5	5.38	0.40	2	1	Dry	2057.12	2058	NA	2054.14	2052.14
GP-6	3.25	0.90	2	1	Dry	2019.96	2021	NA	2019.61	2017.61
GP-7	4.38	1.36	2	1	Dry	2026.30	2027.66	NA	2025.28	2023.28
GP-8	3.48	0.20	2	1	Dry	2036.56	2037	NA	2035.28	2033.28
GP-9	4.90	0.20	2	1	Dry	2042.11	2042	NA	2039.41	2037.41
GP-10	21.40	3.40	2	1	Dry	2062.01	2065	NA	2046.01	2044.01
GP-10S	20	0	15	1	Dry	2062	2062	NA	2057	2042
GP-11S	7.30	3.35	2	1	Dry	2174.80	2178	NA	2172.85	2170.85
GP-11I	28.93	3.32	2	1	Dry	2173.90	2177	NA	2150.29	2148.29
GP-11D	59.07	3.53	2	1	Dry	2174.28	2178	NA	2120.74	2118.74
GP-12S	7	-0.19	2	1	Dry	2130.17	2129.98	NA	2124.98	2122.98
GP-12I	30	0	20	1	Dry	2130	2130	NA	2120.00	2100.00
GP-12d1	33.8	-0.30	2	1	Dry	2129.20	2128.90	NA	2097.10	2095.10
GP-12D1	55	0	20	1	43.65	2130	2130	NA	2095.00	2075.00
GP-13S	7	3.51	2	1	Dry	2089.21	2092.72	NA	2087.72	2085.72
GP-13I	25	0	15	1	Dry	2089	2089	NA	2079.00	2064.00
GP-13D	35.1	3.24	10	1	33.70	2089.23	2092.47	2058.77	2067.37	2057.37
GP-14S	7	1.50	2	1	Dry	2023.51	2025.01	NA	2020.01	2018.01
GP-14D	24.2	3.48	10	1	Dry	2023.21	2026.69	#VALUE!	2012.49	2002.49
GP-15S	10.4	3.31	2	1	Dry	2023.40	2026.71	NA	2018.31	2016.31
GP-15I	35	0	20	1	Dry	2023	2023	NA	2008.00	1988.00
GP-15D	49.8	3.21	10	1	Dry	2023.58	2026.79	#VALUE!	1986.99	1976.99
GP-16S	Out of Commission									
GP-16D	Out of Commission									
GP-17	Out of Commission									
GP-18	Out of Commission									
GP-19	4.7	2.15	2	1	Dry	2110	2112	NA	2109.45	2107.45

Notes: Elevations with no decimals are estimated. Elevations with two decimals are surveyed.
 Depth to water was measured on November 19, 2002, except MW-02 measured October 9, 2002.
 Shaded rows indicate probes installed in October 2002.
 NA = not applicable
 TOC = top of casing

Table 2
Landfill Gas Collection System Cost Estimate
Closed Jackson County MSW Landfill
Dillsboro, North Carolina

Capital Costs				
Item Description	Quantity	Unit	Cost/Unit	Cost *
Direct Capital Costs				
Construct Extraction Wells (assume 8 wells with average depth of 75 feet each)	600	lf	\$175.00	\$105,000
Header pipe	2,000	lf	\$30.00	\$60,000
Wellhead valves and connections	8	ea	\$1,000.00	\$8,000
Blower facility and condensate knockout	1	ea	\$50,000.00	\$50,000
Condensate line	1,200	lf	\$20.00	\$24,000
Condensate pump station	1	ea	\$20,000.00	\$20,000
Backup Flare (includes setup)	1	ea	\$35,000.00	\$35,000
Subtotal Direct Capital Costs				\$302,000
Engineering & Design (10%)				\$30,200
Administrative (10%)				\$30,200
Total Direct Capital Costs (Rounded to Nearest \$1000)				\$362,000
Contingency Allowance (15%)				\$54,300
Total Capital Costs (Rounded to Nearest \$10,000)				\$420,000
Amortized Annual Capital Cost (10 years at 7%)				\$60,000
Annual Costs				
Operation and Maintenance Expenses (assume 10% of total capital cost per year)	1	yr	\$42,000.00	\$42,000
Total Annual Cost (amortized annual capital cost + annual costs)				\$102,000

Notes:

- * Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.

Table 3
Summary of Existing Major Energy Demands within One-Half Mile of Landfill
Closed Jackson County MSW Landfill
Dillsboro, North Carolina

Facility Name	Facility Type	Energy Type	Annual Usage	Units	Cost/unit	Seasonal fluctuations	Annual cost	BTU/unit	MMBTU/yr	Cost/MMBTU
Harrison Construction	asphalt plant	No. 2 diesel	1,030,000	gallons	\$ 0.80	May-Oct. only	\$ 824,000	130,000	133,900	\$ 6.15
Nantahala Power and Light	electric utility	electric	Unlimited	kWh	\$ 0.03	NA	NA	14,333	NA	\$ 2.09
Jackson County	maintenance building	electric	75,429	kWh	\$ 0.07	Minor	\$ 5,280	14,333	1,081	\$ 4.88
Jackson County	staffed recycling center	electric	17,143	kWh	\$ 0.07	Minor	\$ 1,200	14,333	246	\$ 4.88
Jackson County	maintenance building	propane	3,328	gallons	\$ 1.26	Winter only	\$ 4,193	91,300	304	\$ 13.80
Best Western	hotel	propane	10,000	gallons	\$ 0.73	Minor	\$ 7,300	91,300	913	\$ 8.00
Great Smoky Mountain Railroad	maintenance shop	propane	very little							

LFG generation:

Landfill annual BTU recovery at 50 scfm = 13,140 MMBTU/yr

Propane substitute:

County cost savings at Maintenance Building = \$ 4,193 per year
 Revenue from sales to Best Western = \$ 5,840 per year
 Total proceeds and savings from propane substitute = \$ 10,033 per year
 Estimated average summer daytime demand = 7 scfm

(Assumes 20% discount off current fuel costs to encourage substitution)
 (County Maintenance Building and Best Western)
 (Best Western usage during asphalt plant operations)

Number 2 Diesel substitute:

Average flow rate available for asphalt plant = 43 scfm
 Annual BTU balance available for asphalt plant = 1,233 MMBTU/yr
 Revenue from asphalt plant sales = \$ 6,072

(Total flow minus average daytime demand at Best Western)
 (Based on average flow rate available during hours of operation)
 (Assumes 20% discount off current fuel costs to encourage substitution)

Total savings and revenue:

Total estimated annual cost savings and revenue = \$ 16,105

(Propane and diesel substitute)

Utilization:

LFG excess capacity due to demand fluctuations = 10,690 MMBTU/yr
 Percent utilization of capacity = 19%

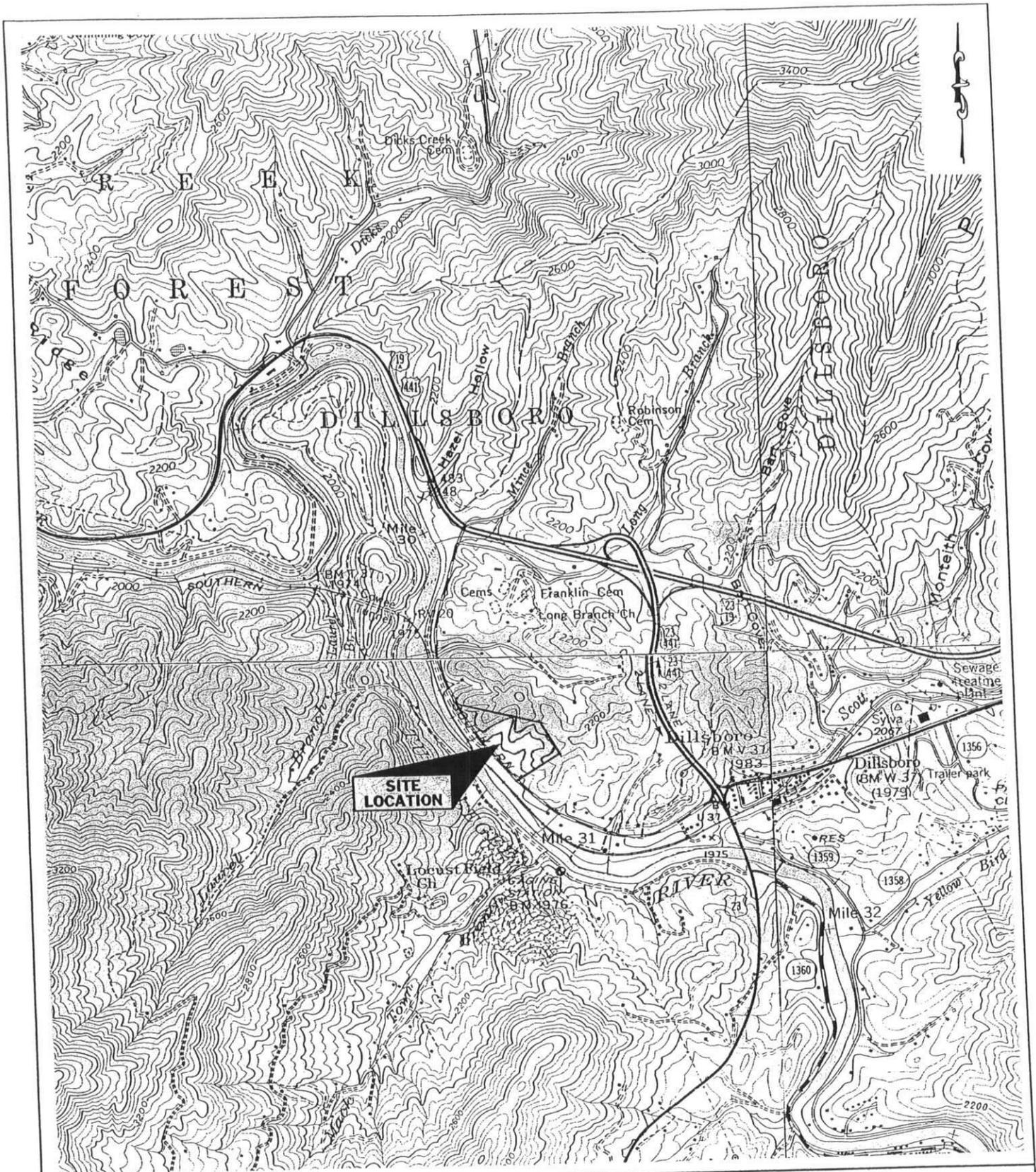
Notes: LFG revenues assume 20% discount off current fuel costs to encourage substitution
 Best Western average daytime demand is assumed based on 80% of average daily demand over 10 hours
 Asphalt plant operates on average 10 hours per day, 5 days per week, 6 months per year.
 MMBTU = million British Thermal Units
 kWh = kilowatt hour
 NA = not applicable
 scfm = standard cubic feet per minute

Table 4
Landfill Gas Mitigation System Cost Estimate
Closed Jackson County MSW Landfill
Dillsboro, North Carolina

Capital Costs				
Item Description	Quantity	Unit	Cost/Unit	Cost *
Direct Capital Costs				
Construct extraction wells (assume 2 wells with average depth of 75 feet each)	150	lf	\$175.00	\$26,250
Header pipe	400	lf	\$30.00	\$12,000
Wellhead valves and connections	2	ea	\$1,000.00	\$2,000
Blower facility and condensate knockout	1	ea	\$25,000.00	\$25,000
Condensate line	300	lf	\$20.00	\$6,000
Condensate pump station	1	ea	\$20,000.00	\$20,000
Carbon canister for emissions treatment	1	ea	\$5,000.00	\$5,000
Interceptor trench	300	ft	\$200.00	\$60,000
Subtotal Direct Capital Costs				\$156,250
Engineering & Design (10%)				\$15,625
Administrative (10%)				\$15,625
Total Direct Capital Costs (Rounded to Nearest \$1000)				\$188,000
Contingency Allowance (15%)				\$28,200
Total Capital Costs (Rounded to Nearest \$10,000)				\$220,000
Annual Costs				
Operation and Maintenance Expenses (assume 10% of total capital cost per year)	1	yr	\$22,000.00	\$22,000
Present Worth of Annual Costs (10 years at 7%, rounded to nearest \$10,000)				\$150,000
Total Present Worth Cost (capital cost + present worth of annual costs)				\$370,000

Notes:

- * Due to rounding, the amount in the Cost column may be slightly different than the product of the values in the Quantity, Cost/Unit, and Factor columns.



SITE LOCATION

Altamont Environmental, Inc.

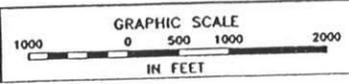
ENGINEERING & HYDROGEOLOGY

78½ PATTON AVENUE
 ASHEVILLE, NORTH CAROLINA
 PHONE 828-281-3350

FIGURE 1
 SITE LOCATION MAP
 JACKSON COUNTY LANDFILL
 JACKSON COUNTY, NORTH CAROLINA
 GREENS CREEK, WHITTIER, SYLVA NORTH & SYLVA SOUTH
 NORTH CAROLINA U.S.G.S. QUADRANGLES

DRAWN BY: JOHN CHASE DATE: 05-01-02
 PROJECT MANAGER: JIM MCLEDDUFF
 CLIENT: JACKSON COUNTY
 FILE: PROJECTS/JACKSON CO/FIGURE 1

COUNTOUR INTERVALS: 40 FEET
 MAP DATES: 1940, 1967, & 1946
 PHOTO REVISIONS: 1978 & 1990



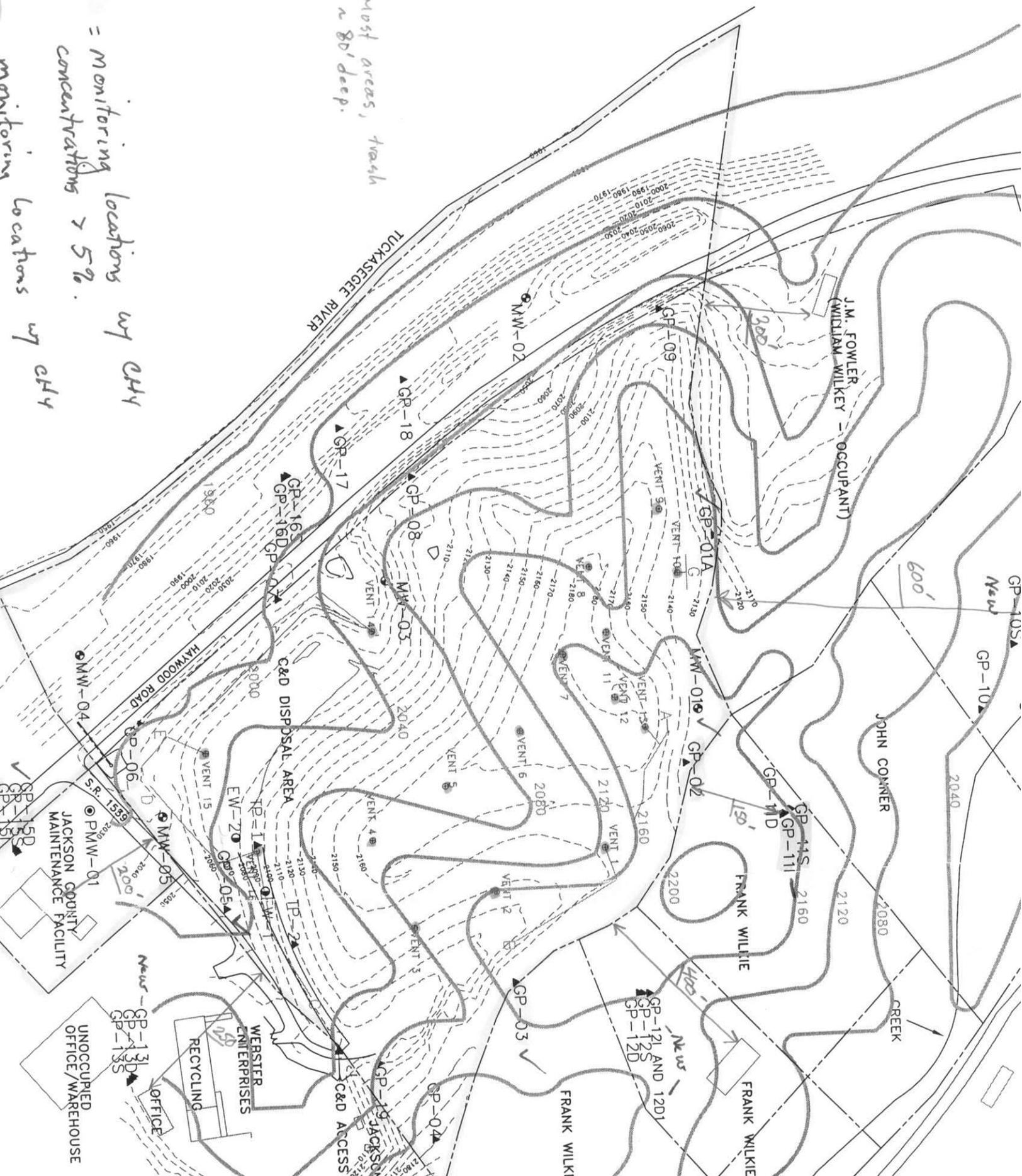
MW-4 - concentrations appear to be decreasing

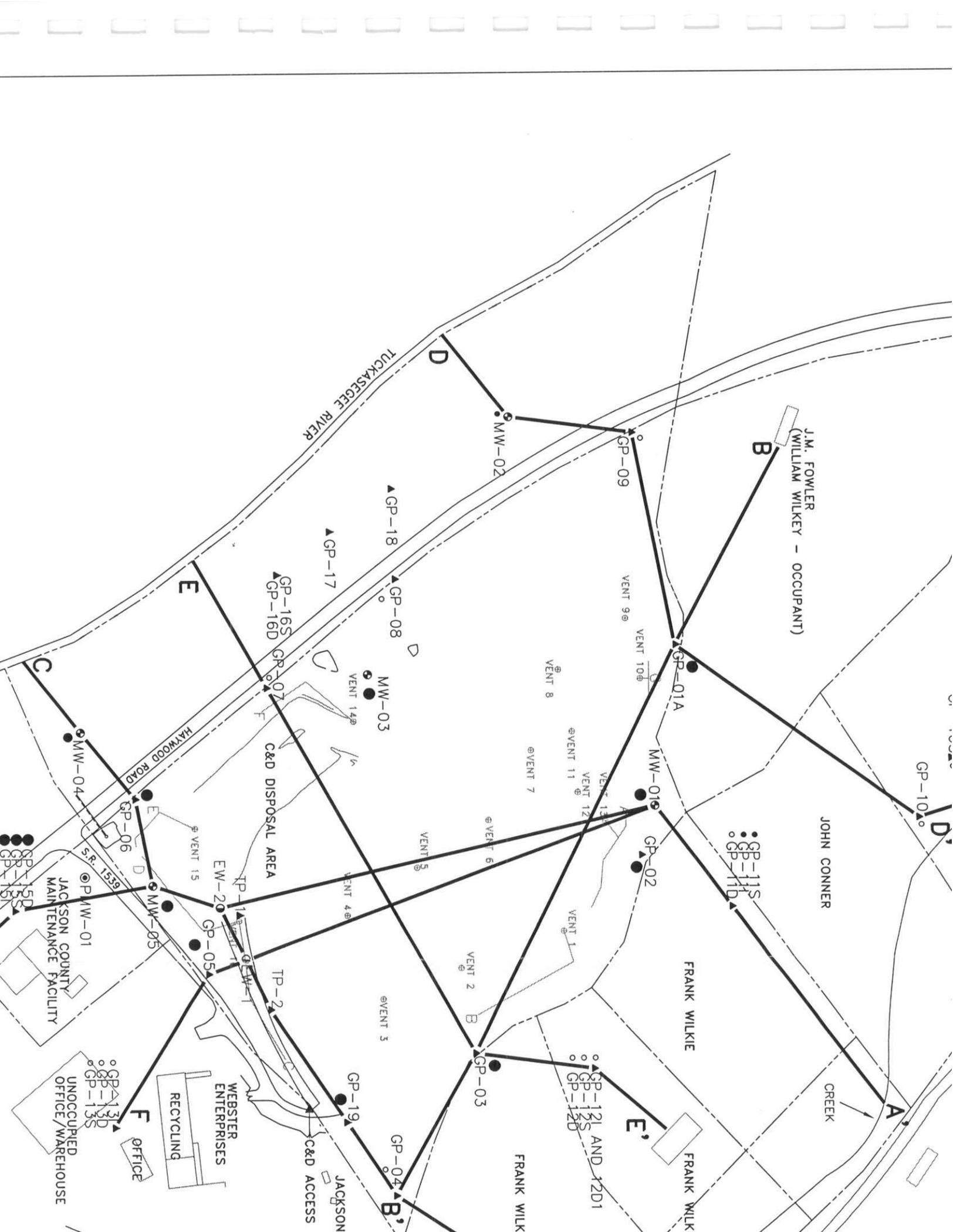
GR-16d - Initial concentrations $>$ LEL

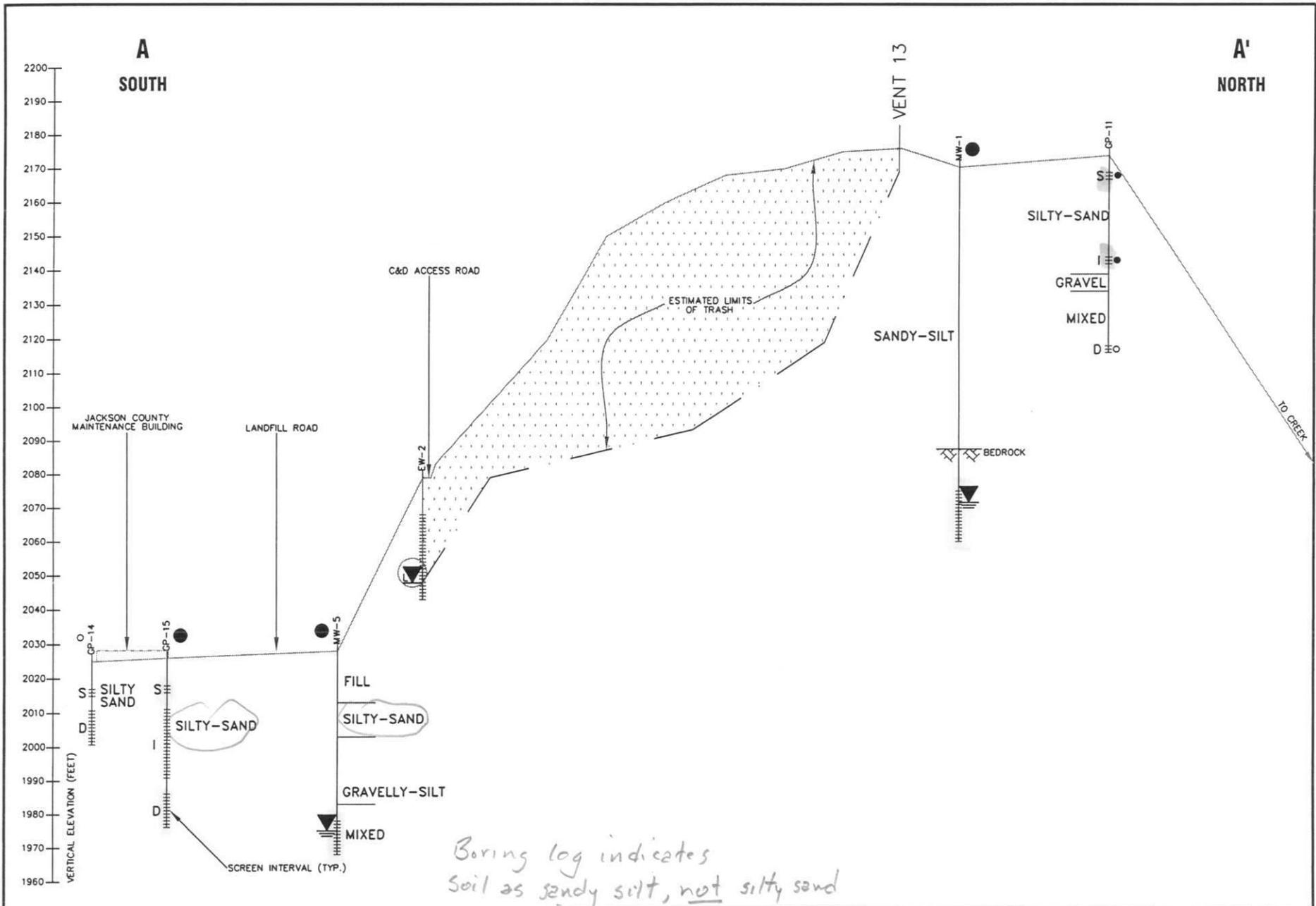
- More recent concentrations $<$ LEL

Monitoring locations w/ CHY
 = Monitoring locations w/ CHY
 concentrations > 5%
 monitoring locations w/ CHY

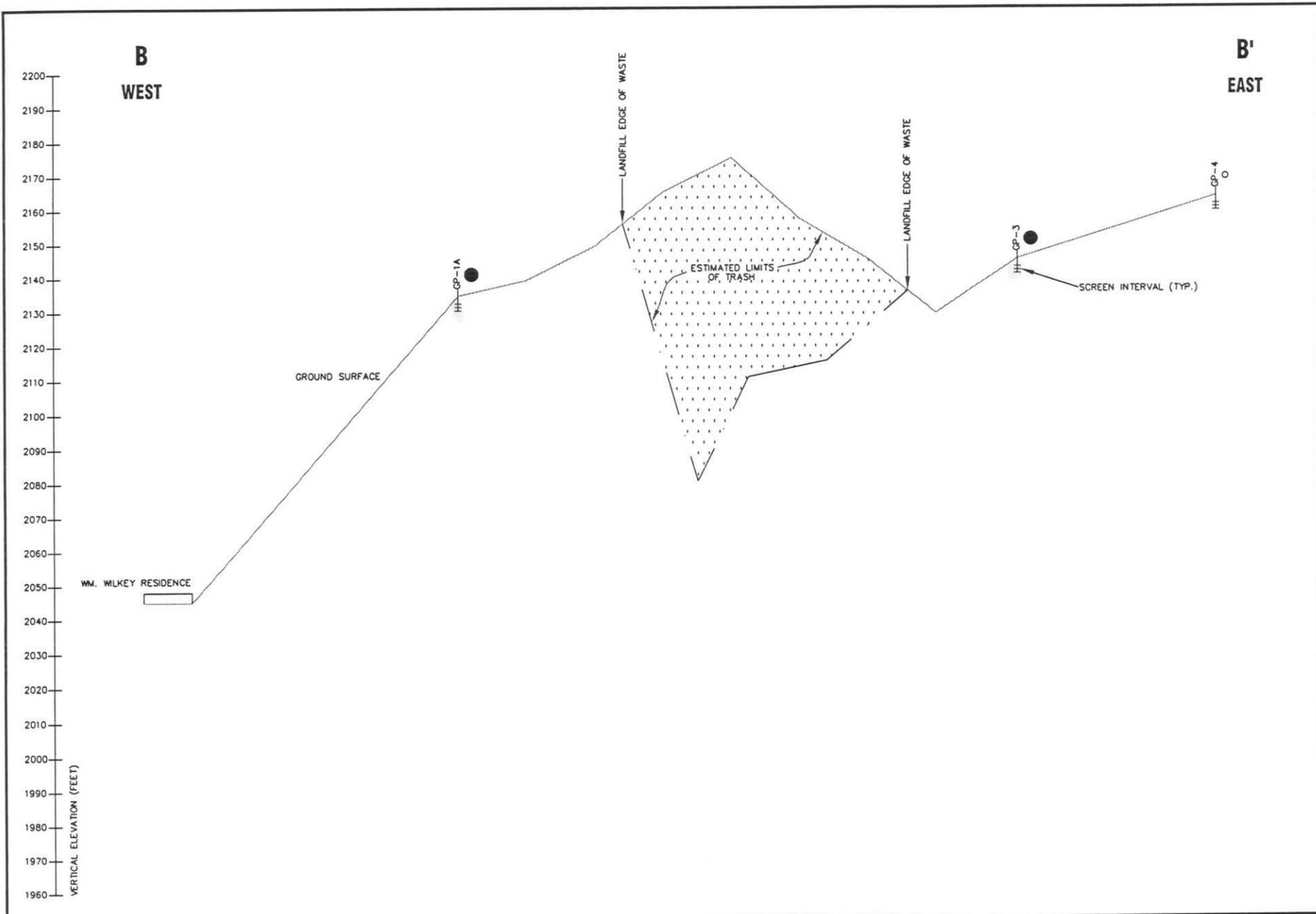
In most areas, trash
 is ~ 80' deep.







<p>LEGEND:</p> <ul style="list-style-type: none"> ▼ GROUNDWATER ELEVATION ⊖ LEACHATE ○ 0% METHANE TYPICAL ● 0-5% METHANE TYPICAL ● 5-10% METHANE TYPICAL ● >10% METHANE TYPICAL 	<p>NOTES:</p> <ol style="list-style-type: none"> 1. VERTICAL SCALE IS 1 INCH = 40 FEET. 2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL. 3. GROUNDWATER MEASUREMENTS TAKEN ON 11-19-02. 4. RELATIVE GAS PROBE SCREENED INTERVALS ARE INDICATED BY S (SHALLOW), I (INTERMEDIATE), AND D (DEEP). 5. ESTIMATED LIMITS OF TRASH TAKEN FROM BUTLER/MCGILL ASSOC. PA, DRAWING NUMBER 82194, DATED DECEMBER 1983. 	<p>HORIZONTAL SCALE (IN FEET)</p> <p>100 0 200</p> <p>1-INCH = 200- FEET</p>	<p>FIGURE 4 VENT AND PROBE CROSS SECTION A - A' JACKSON COUNTY LANDFILL JANUARY 2003</p>	<p>Altamont Environmental, Inc. ENGINEERING & HYDROGEOLOGY 78½ PATTON AVENUE ASHEVILLE, NORTH CAROLINA</p>
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LEGEND:

- ▼ GROUNDWATER ELEVATION
- 0% METHANE TYPICAL
- ◐ 0-5% METHANE TYPICAL
- 5-10% METHANE TYPICAL
- >10% METHANE TYPICAL

NOTES:

1. VERTICAL SCALE IS 1 INCH = 40 FEET.
2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL.
3. GROUNDWATER MEASUREMENTS TAKEN ON 11-19-02.
4. RELATIVE GAS PROBE SCREENED INTERVALS ARE INDICATED BY S (SHALLOW), I (INTERMEDIATE), AND D (DEEP).
5. ESTIMATED LIMITS OF TRASH TAKEN FROM BUTLER/MCGILL ASSOC. PA, DRAWING NUMBER 82194, DATED DECEMBER 1983.

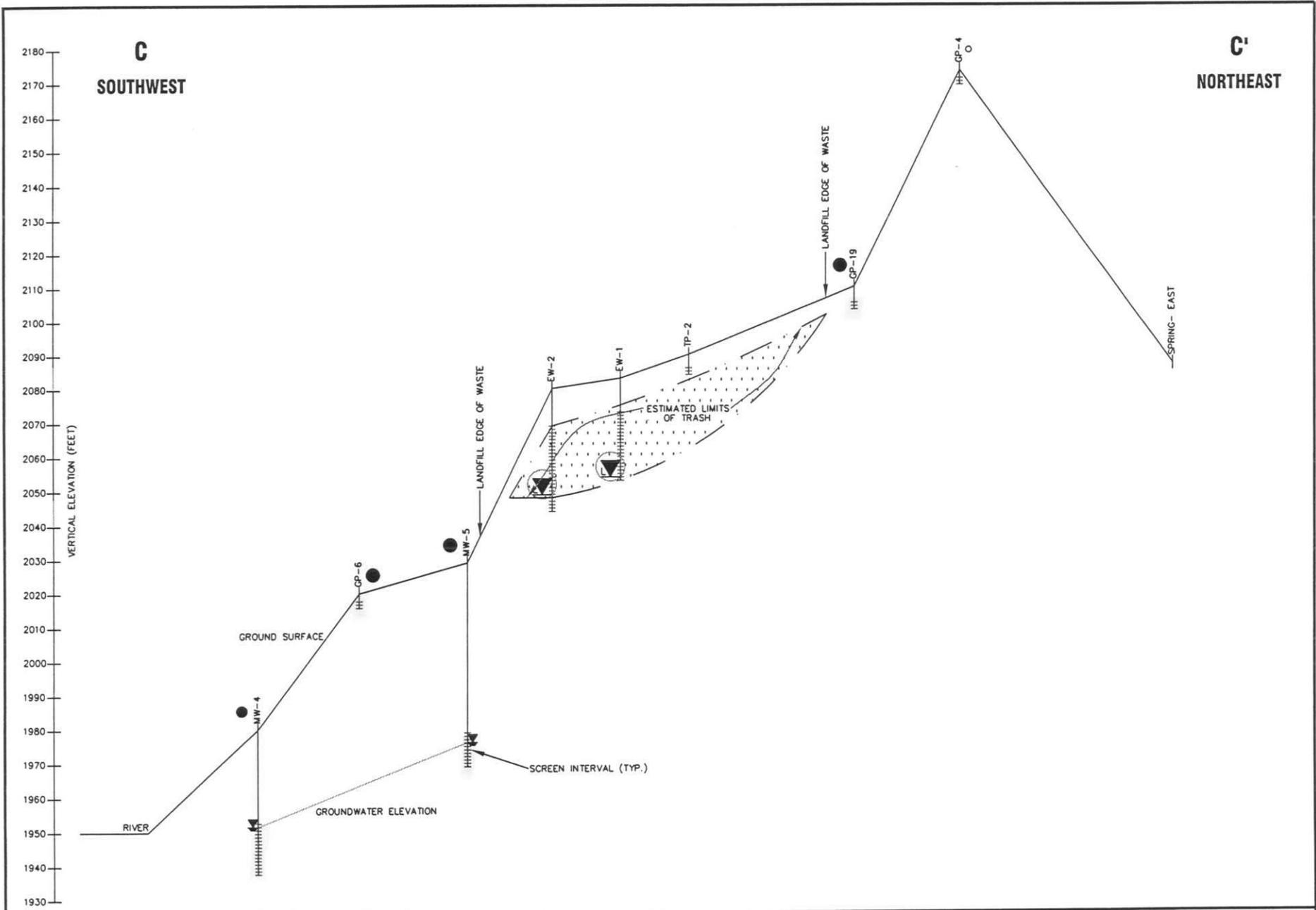
HORIZONTAL SCALE (IN FEET)

100 0 200

1-INCH = 200-FEET

FIGURE 5
 VENT AND PROBE CROSS SECTION
 B - B'
 JACKSON COUNTY LANDFILL
 JANUARY 2003

Altamont
Environmental, Inc.
 ENGINEERING & HYDROGEOLOGY
 78½ PATTON AVENUE
 ASHEVILLE, NORTH CAROLINA



- LEGEND:
- ▼ GROUNDWATER ELEVATION
 - LEACHATE
 - 0% METHANE TYPICAL
 - 0-5% METHANE TYPICAL
 - 5-10% METHANE TYPICAL
 - >10% METHANE TYPICAL

- NOTES:
1. VERTICAL SCALE IS 1 INCH = 40 FEET.
 2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL.
 3. GROUNDWATER MEASUREMENTS TAKEN ON 11-19-02.
 4. RELATIVE GAS PROBE SCREENED INTERVALS ARE INDICATED BY S (SHALLOW), I (INTERMEDIATE), AND D (DEEP).
 5. ESTIMATED LIMITS OF TRASH TAKEN FROM BUTLER/MCGILL ASSOC. PA, DRAWING NUMBER 82194, DATED DECEMBER 1983.

HORIZONTAL SCALE (IN FEET)

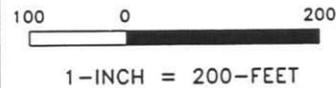
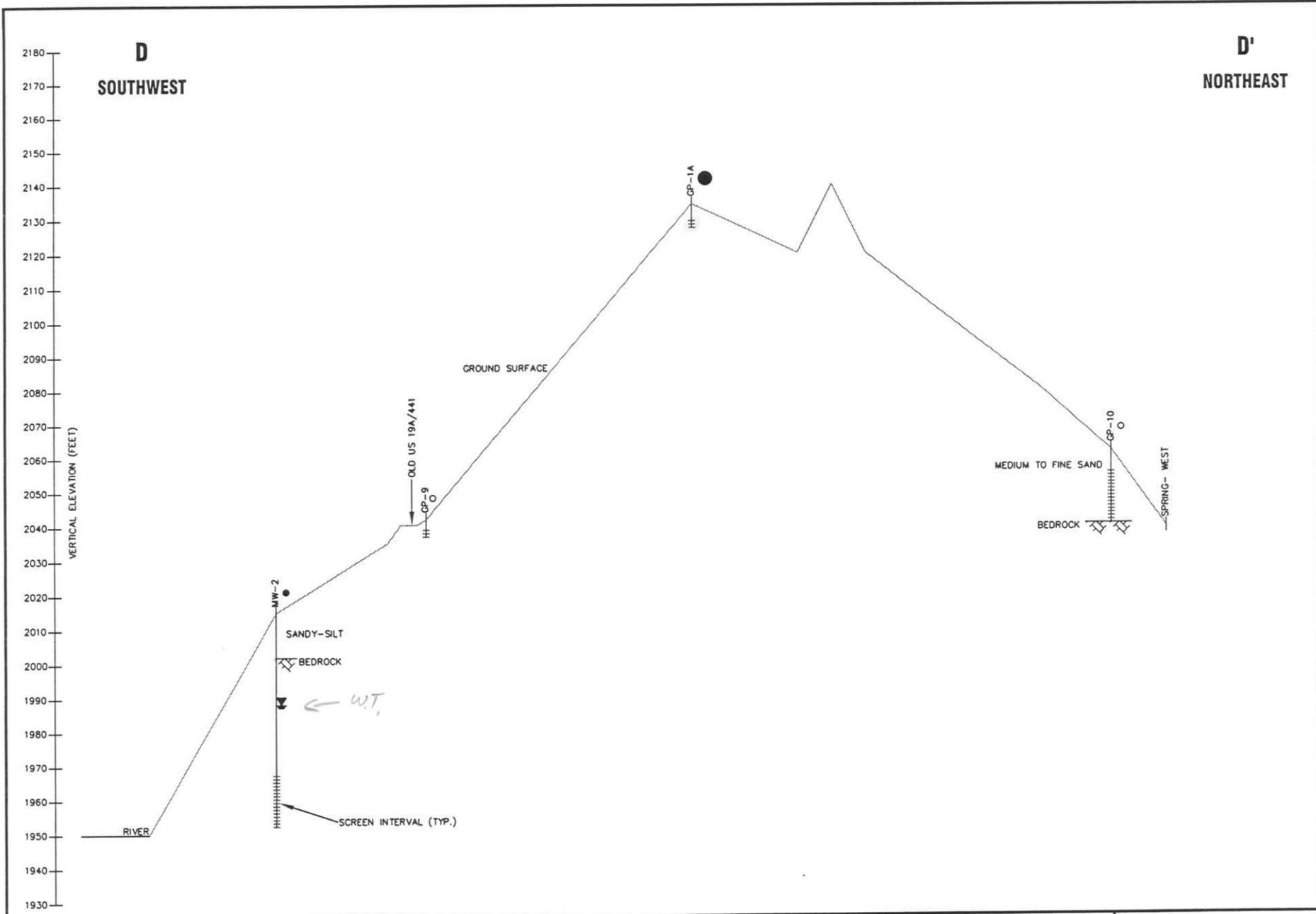


FIGURE 6
VENT AND PROBE CROSS SECTION
C - C'
JACKSON COUNTY LANDFILL
JANUARY 2003

Altamont
Environmental, Inc.
ENGINEERING & HYDROGEOLOGY
78 1/2 PATTON AVENUE
ASHEVILLE, NORTH CAROLINA



LEGEND:

- ▼ GROUNDWATER ELEVATION
- 0% METHANE TYPICAL
- 0-5% METHANE TYPICAL
- 5-10% METHANE TYPICAL
- >10% METHANE TYPICAL

NOTES:

1. VERTICAL SCALE IS 1 INCH = 40 FEET.
2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL.
3. MW-2 GROUNDWATER MEASUREMENT TAKEN ON 10-9-02.

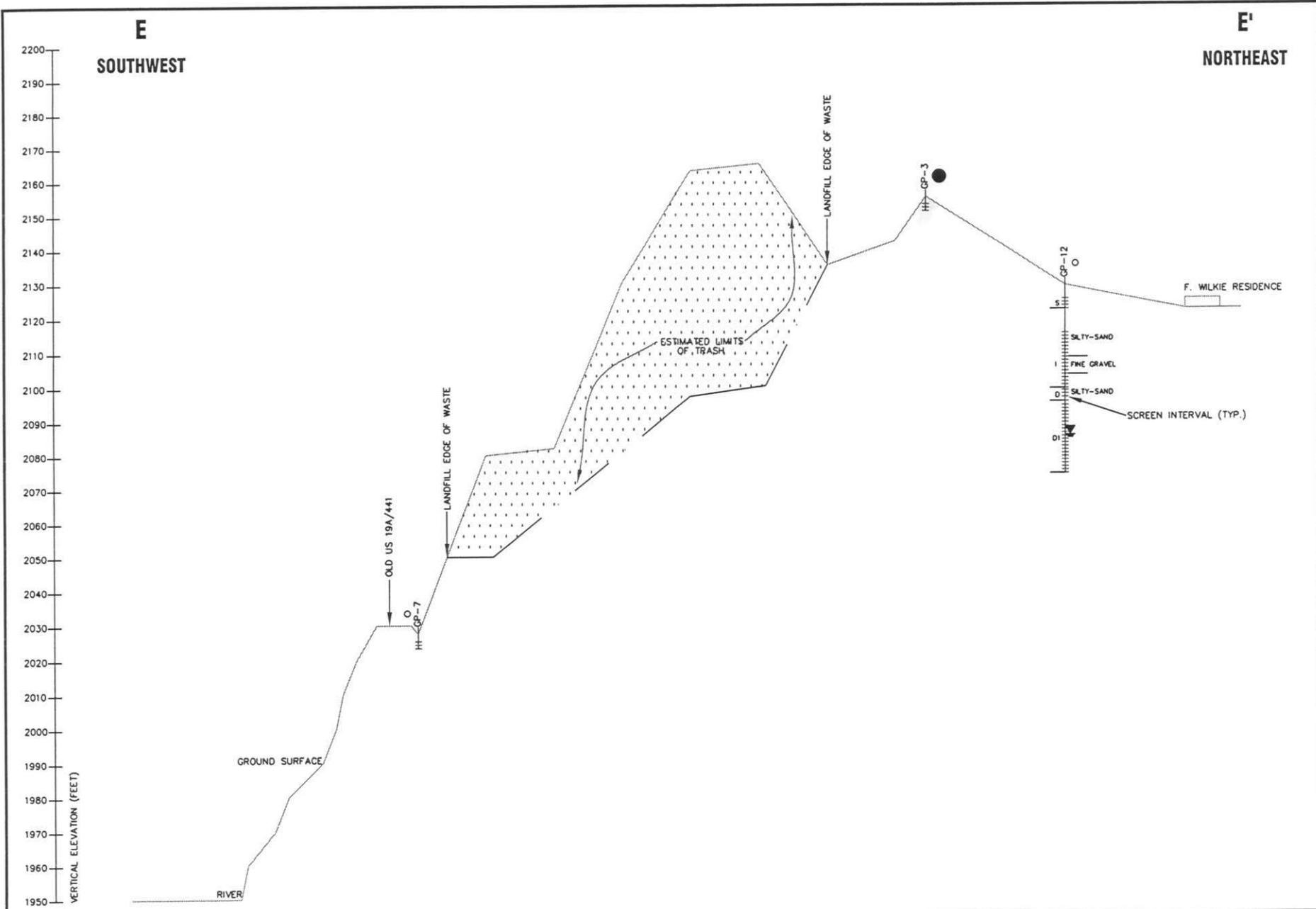
HORIZONTAL SCALE (IN FEET)

100 0 200

1-INCH = 200-FEET

FIGURE 7
VENT AND PROBE CROSS SECTION
D - D'
JACKSON COUNTY LANDFILL
JANUARY 2003

Altamont
Environmental, Inc.
 ENGINEERING & HYDROGEOLOGY
 78½ PATTON AVENUE
 ASHEVILLE, NORTH CAROLINA



- LEGEND:**
- GROUNDWATER ELEVATION
 - 0% METHANE TYPICAL
 - 0-5% METHANE TYPICAL
 - 5-10% METHANE TYPICAL
 - >10% METHANE TYPICAL

- NOTES:**
1. VERTICAL SCALE IS 1 INCH = 40 FEET.
 2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL.
 3. GROUNDWATER MEASUREMENTS TAKEN ON 11-19-02.
 4. RELATIVE GAS PROBE SCREENED INTERVALS ARE INDICATED BY S (SHALLOW), I (INTERMEDIATE), AND D (DEEP).
 5. ESTIMATED LIMITS OF TRASH TAKEN FROM BUTLER/MCGILL ASSOC. PA, DRAWING NUMBER 82194, DATED DECEMBER 1983.

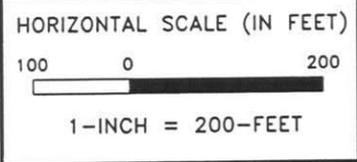
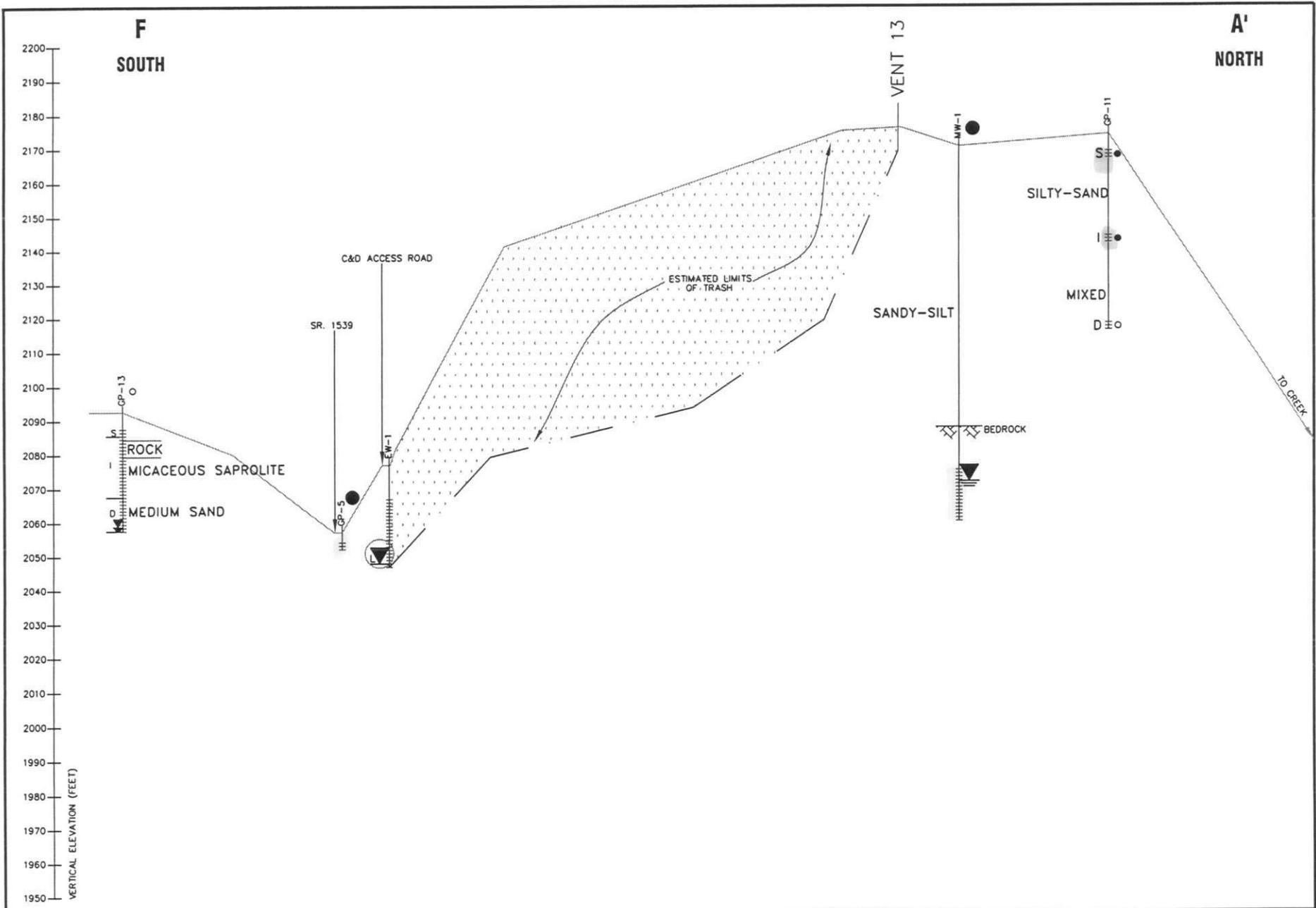


FIGURE 8
VENT AND PROBE CROSS SECTION
E - E'
JACKSON COUNTY LANDFILL
JANUARY 2003

Altamont
Environmental, Inc.
 ENGINEERING & HYDROGEOLOGY
 78½ PATTON AVENUE
 ASHEVILLE, NORTH CAROLINA



- LEGEND:**
- GROUNDWATER ELEVATION
 - LEACHATE
 - 0% METHANE TYPICAL
 - 0-5% METHANE TYPICAL
 - 5-10% METHANE TYPICAL
 - >10% METHANE TYPICAL

- NOTES:**
1. VERTICAL SCALE IS 1 INCH = 40 FEET.
 2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL.
 3. GROUNDWATER MEASUREMENTS TAKEN ON 11-19-02.
 4. RELATIVE GAS PROBE SCREENED INTERVALS ARE INDICATED BY S (SHALLOW), I (INTERMEDIATE), AND D (DEEP).
 5. ESTIMATED LIMITS OF TRASH TAKEN FROM BUTLER/MCGILL ASSOC. PA. DRAWING NUMBER 82194. DATED DECEMBER 1983.

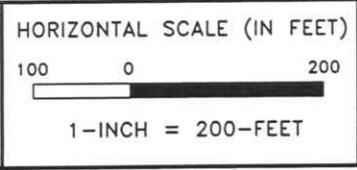


FIGURE 9
 VENT AND PROBE CROSS SECTION
 F - A'
 JACKSON COUNTY LANDFILL
 JANUARY 2003

Altamont
Environmental, Inc.
 ENGINEERING & HYDROGEOLOGY
 78½ PATTON AVENUE
 ASHEVILLE, NORTH CAROLINA

APPENDIX A

**SUMMARY OF HISTORIC LFG MONITORING
RESULTS THROUGH NOVEMBER 19, 2002**

**Jackson County Landfill
Dillsboro, North Carolina**

New LF Gas Probes

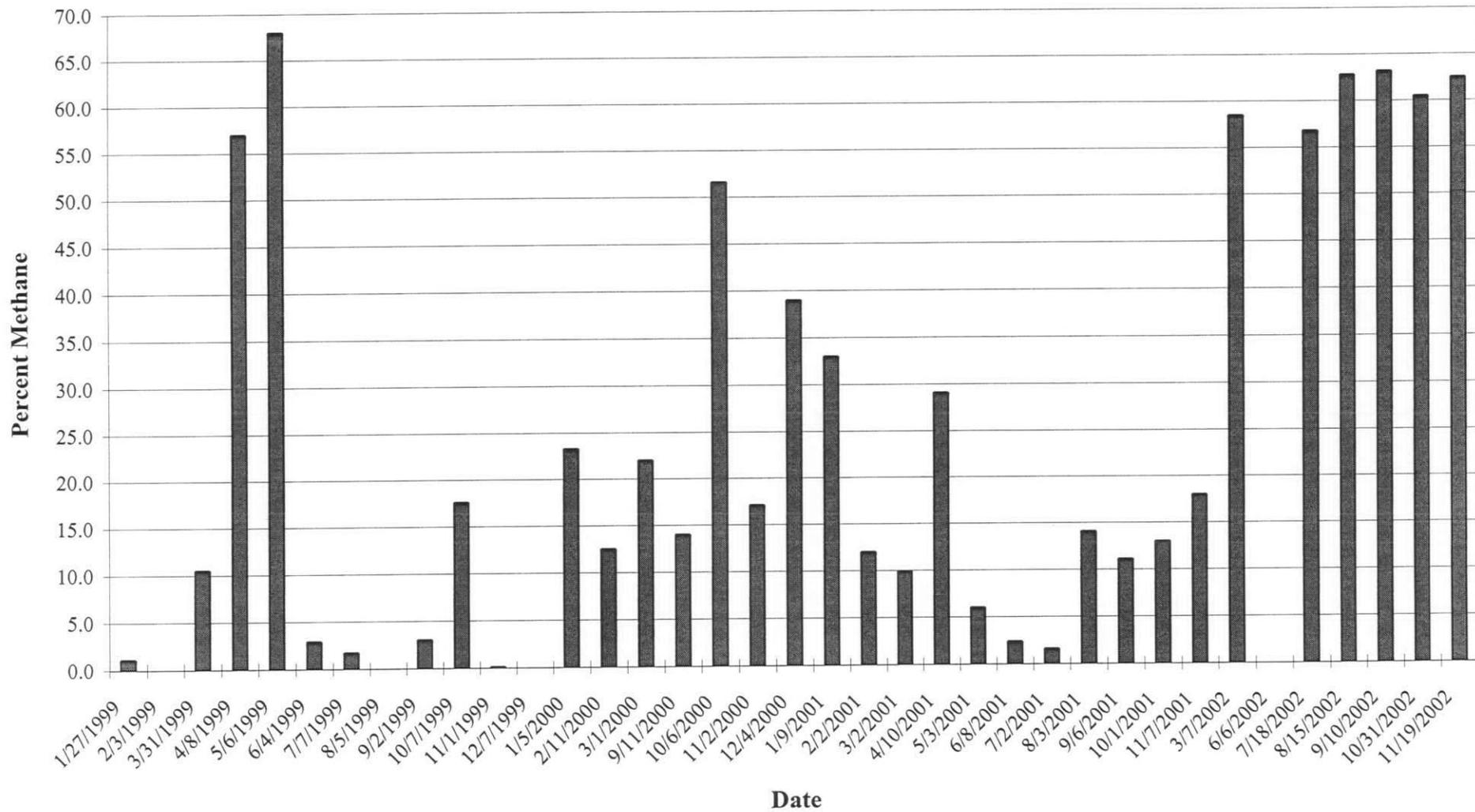
Monitoring Point	Date	Time	Percent Lower	Percent Methane	Percent Carbon	Percent Oxygen	Probe Pressure / Vacuum (inches of water)	Notes
Gas Probe 10S	10/31/2002	16:23	0	0.0	1.0	18.8	0.00	Readings recorded after 2 purge volumes
	11/19/2002	16:40	0	0.0	0.6	19.4	0.00	Readings recorded after 2 purge volumes
Gas Probe 12I	10/31/2002	15:55	0	0.0	2.2	17.9	0.00	Readings recorded after 2 purge volumes
	11/19/2002	16:15	0	0.0	2.6	16.7	0.00	Readings recorded after 2 purge volumes
Gas Probe 12D1	10/31/2002	15:55	0	0.0	0.0	20.2	-0.05	Readings recorded after 2 purge volumes
	11/19/2002	16:10	0	0.0	0.1	19.9	0.00	Readings recorded after 2 purge volumes
Gas Probe 13I	10/31/2002	14:20	0	0.0	0.9	19.0	0.00	Readings recorded after 2 purge volumes
	11/19/2002	14:20	0	0.0	0.9	18.5	0.00	Readings recorded after 2 purge volumes
Gas Probe 15I	10/31/2002	13:45	272	13.6 ✓	13.6	2.8	0.15	Readings recorded after 2 purge volumes
	11/19/2002	13:25	292	14.6 ✓	18.6	0.0	0.10	Readings recorded after 2 purge volumes

**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
MW-1	1/27/1999	11:50	24	1.1	1.4	20.4	Not measured	
	2/3/1999	14:45	0	0.0	0.0	20.4	Not measured	No cap due to pumping test
	3/25/1999	11:35						Needs pressure cap
	3/31/1999	14:10	210	10.5	7.8	17.2	0.13	Installed cap, Readings recorded at 180 seconds, DTW = 94.60 ft
	4/8/1999	10:00	>1000 @ 26 seconds	Peaked @ 65.0 @ 60 seconds 57.0 @ 180 seconds	39.1	5.5	0.11	Readings recorded at 180 seconds
	5/6/1999	9:45	>1000 @ 30 seconds	68.0	32.0	6.3	0.00	Readings recorded at 180 seconds
	6/4/1999	8:55	58	2.9	1.9	19.5	0.00	Readings recorded at 180 seconds
	7/7/1999	9:45	34	1.7	1.1	20.2	0.00	Readings recorded at 180 seconds
	8/5/1999	9:00	0	0.0	0.0	20.5	-0.02	Readings recorded after 2 purge volumes, DTW = 92.82 ft
	9/2/1999	12:25	60	3.0	2.0	19.1	0.10	Readings recorded after 2 purge volumes, DTW = 92.70 ft
	10/7/1999	9:40	352	17.6	13.2	14.0	0.06	Readings recorded after 2 purge volumes
	11/1/1999	11:40	2	0.1	0.3	21.0	0.15	Readings recorded after 2 purge volumes
	12/7/1999	10:00	0	0.0	0.0	19.8	0.03	Readings recorded after 2 purge volumes
	1/5/2000	13:15	466	23.3	15.5	12.9	0.12	Readings recorded after 2 purge volumes
	2/11/2000	9:50	250	12.5	8.0	16.3	0.10	Readings recorded after 2 purge volumes
	3/1/2000	9:35	Peaked @ 600 @ 30 seconds, 440 stable	22.0	14.0	15.1	0.50	Readings recorded after 2 purge volumes
	9/11/2000	13:30	280	14.0	3.0	18.8	0.05	Readings recorded after 2 purge volumes
	10/6/2000	12:05	>1000	51.6	34.6	3.3	0.01	Readings recorded after 2 purge volumes
	11/2/2000	10:15	342	17.1	11.5	15.2	-0.04	Readings recorded after 2 purge volumes
	12/4/2000	9:10	780	39.0	25.1	7.3	0.10	Readings recorded after 2 purge volumes
	1/9/2001	9:05	660	33.0	22.6	8.5	-0.02	Readings recorded after 2 purge volumes
	2/2/2001	9:40	240	12.0	7.9	16.7	0.15	Readings recorded after 2 purge volumes
	3/2/2001	8:45	198	9.9	6.1	17.0	0.25	Readings recorded after 2 purge volumes
	4/10/2001	12:30	582	29.1	18.9	9.8	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:05	120	6.0	4.3	18.2	0.02	Readings recorded after 2 purge volumes
	6/8/2001	9:05	48	2.4	NA	20.1	0.08	Readings recorded after 2 purge volumes
	7/2/2001	9:50	32	1.6	1.6	19.0	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:35	282	14.1	10.2	15.2	0.03	Readings recorded after 2 purge volumes
	9/6/2001	10:25	222	11.1	8.0	16.6	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:40	260	13.0	9.3	16.0	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:20	360	18.0	14.0	14.5	0.00	Readings recorded after 2 purge volumes
	3/7/2002	10:20	>1000	58.5	38.2	0.3	0.42	Readings recorded after 2 purge volumes
6/6/2002	10:00	0	0.0	0.1	20.7	0.44	Readings recorded after 2 purge volumes	
7/18/2002	11:16	>1000	56.8	35.9	2.1	0.52	Readings recorded after 2 purge volumes	
8/15/2002	13:50	>1000	62.8	38.9	0.9	0.46	Readings recorded after 2 purge volumes	
9/10/2002	9:58	>1000	63.2	38.6	0.0	0.56	Readings recorded after 2 purge volumes	
10/31/2002	15:20	>1000	60.5	39.0	0.4	0.42	Readings recorded after 2 purge volumes	
11/19/2002	15:30	>1000	62.5	39.4	0.0	0.40	Readings recorded after 2 purge volumes	

Notes: MW = Monitoring Well
 Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in MW-1



Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
MW-2	1/27/1999	16:30	0	0.0	0.0	20.8	Not measured	
	2/3/1999	13:46	0	0.0	0.0	19.8	Not measured	
	3/25/1999	13:16						Needs pressure cap
	4/1/1999	10:30	Did not record	0.0	0.0	20.6	0.65	Pressure cap installed (3/31/99), Readings stable at 120 seconds, DTW = 25.70' TOC
	4/8/1999	14:20	Did not record	0.0	0.0	20.6	-0.01	Slight vacuum--readings recorded at 180 seconds
	5/6/1999	14:20	Did not record	0.0	0.4	19.9	0.00	Readings recorded at 180 seconds
	6/4/1999	12:25	12	0.6	0.4	20.0	0.00	Readings recorded at 180 seconds
	7/7/1999	13:40	4	0.2	0.3	20.9	0.00	Readings recorded at 180 seconds
	8/5/1999	13:50	0	0.0	0.1	20.9	0.03	Readings recorded after 2 purge volumes, DTW = 26.33 ft @ 15:25
	9/2/1999	-	-	-	-	-	-	Not Measured, water above screen, DTW=26.83 ft
	10/7/1999	-	-	-	-	-	-	Not Measured, water above screen
	11/1/1999	-	-	-	-	-	-	Not Measured, water above screen
	12/7/1999	-	-	-	-	-	-	Not Measured, water above screen
	1/5/2000	-	-	-	-	-	-	Not Measured, water above screen
	2/11/2000	-	-	-	-	-	-	Not measured, water above screen
	3/1/2000	-	-	-	-	-	-	Not measured, water above screen
9/11/2000	-	-	-	-	-	-	Not measured, water above screen	

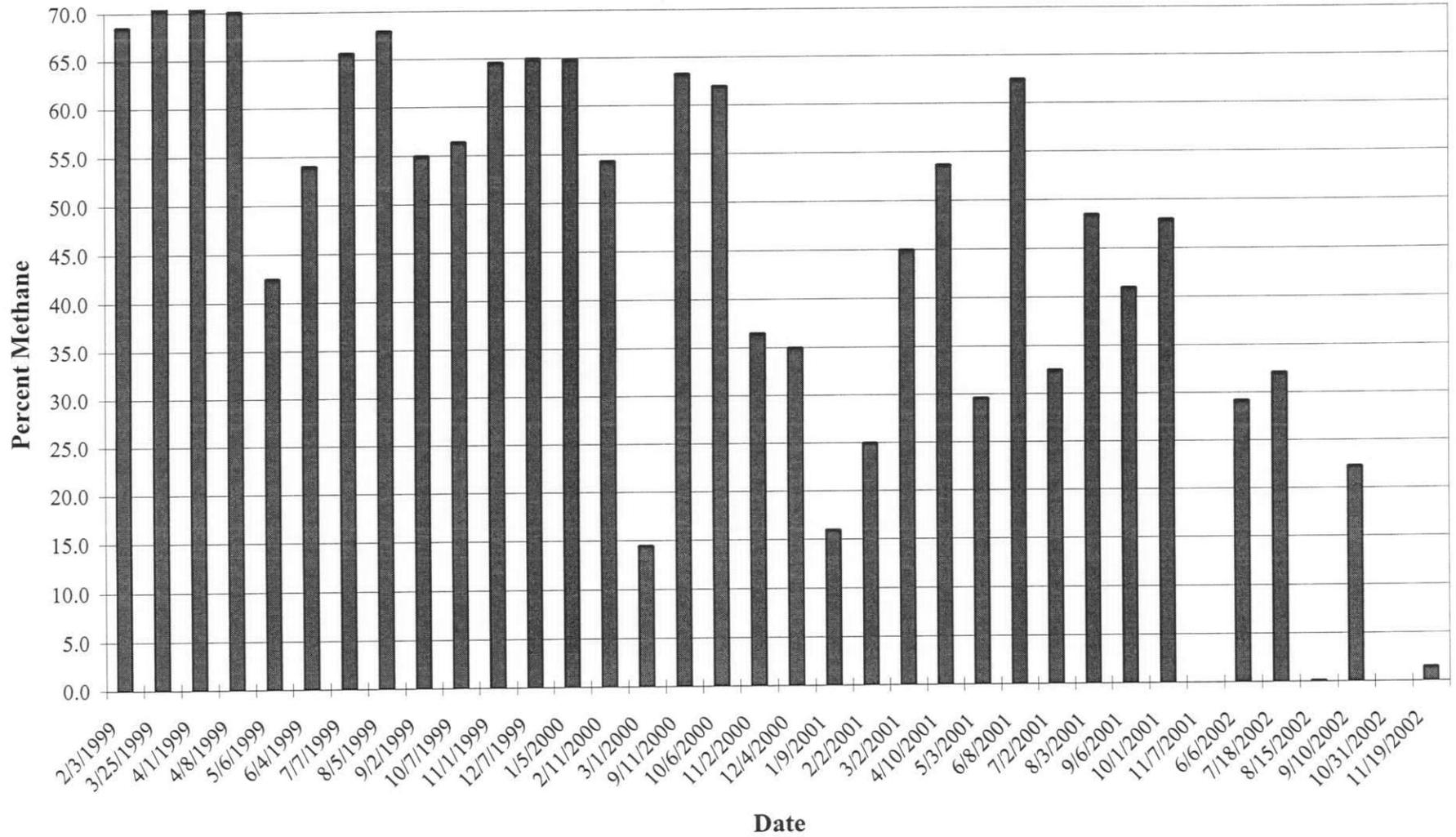
Notes: MW = Monitoring Well
 Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
MW-3	1/27/1999	16:10	>1000	64.6	26.6	0.6	Not measured	
	2/3/1999	13:53	>1000	68.5	27.7	0.0	Not measured	
	3/25/1999	13:00	>1000 @ 15 seconds	95.4	33.1	0.9	0.23	High pressure - peak reading recorded at 24 seconds
	4/1/1999	10:00	>1000 @ 20 seconds	95.0	34.9	0.2	0.15	Readings recorded at 180 seconds, DTW = 51.61' TOC
	4/8/1999	13:50	>1000 @ 15 seconds	70.1	26.8	4.4	0.30	Readings recorded at 180 seconds
	5/6/1999	13:50	850	42.5	15.9	7.2	0.15	Readings recorded at 180 seconds
	6/4/1999	11:55	>1000 @ 23 seconds	54.0	21.2	3.9	0.14	Readings recorded at 180 seconds
	7/7/1999	13:00	>1000 @ 60 seconds	65.7	23.9	3.0	0.25	Readings recorded at 180 seconds
	8/5/1999	13:20	>1000 @ 35 seconds	68.0	24.9	1.0	0.20	Readings recorded after 2 purge volumes, DTW = 52.20 ft
	9/2/1999	16:40	>1000 @ 22 seconds	55.0	20.4	2.9	0.19	Readings recorded after 2 purge volumes, DTW = 52.55 ft
	10/7/1999	12:50	>1000 @ 36 seconds	56.4	22.9	2.8	0.20	Readings recorded after 2 purge volumes
	11/1/1999	14:50	>1000 @ 25 seconds	64.6	25.6	0.9	0.26	Readings recorded after 2 purge volumes
	12/7/1999	13:05	>1000 @ 20 seconds	65.0	25.6	1.6	0.25	Readings recorded after 2 purge volumes
	1/5/2000	15:25	>1000 @ 36 seconds	64.9	27.0	0.7	0.12	Readings recorded after 2 purge volumes
	2/11/2000	11:40	>1000 @ 30 seconds	54.3	23.5	2.4	0.12	Readings recorded after 2 purge volumes
	3/1/2000	12:00	290	14.5	6.2	17.1	0.45	Readings recorded after 2 purge volumes
	9/11/2000	15:20	>1000 @ 45 seconds	63.3	23.0	1.1	0.25	Readings recorded after 2 purge volumes
	10/6/2000	14:00	>1000	62.0	23.9	1.8	0.05	Readings recorded after 2 purge volumes
	11/2/2000	12:30	730	36.5	21.9	5.9	0.15	Readings recorded after 2 purge volumes
	12/4/2000	10:35	700	35.0	19.0	7.6	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:25	320	16.0	10.3	13.3	0.00	Readings recorded after 2 purge volumes
	2/2/2001	11:10	500	25.0	10.7	12.4	0.00	Readings recorded after 2 purge volumes
	3/2/2001	10:45	900	45.0	24.4	2.0	0.10	Readings recorded after 2 purge volumes
	4/10/2001	11:40	>1000	53.7	22.1	3.0	0.03	Readings recorded after 2 purge volumes
	5/3/2001	10:45	592	29.6	13.7	10.5	0.05	Readings recorded after 2 purge volumes
	6/8/2001	10:40	>1000	62.5	NA	0.2	0.10	Readings recorded after 2 purge volumes
	7/2/2001	11:25	650	32.5	15.3	8.1	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:00	970	48.5	29.0	0.4	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:15	820	41.0	8.9	9.6	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:25	960	48.0	28.8	1.3	0.02	Readings recorded after 2 purge volumes
	11/7/2001	8:55	0	0.0	1.1	19.8	0.00	Readings recorded after 2 purge volumes
	3/7/2002	11:25	38	1.9	1.4	19.5	0.06	Readings recorded after 2 purge volumes
	6/6/2002	11:45	584	29.2	17.2	7.4	0.00	Readings recorded after 2 purge volumes
7/18/2002	12:37	642	32.1	24.7	2.9	0.04	Readings recorded after 2 purge volumes	
8/15/2002	15:35	2	0.1	0.2	20.7	0.00	Readings recorded after 2 purge volumes	
9/10/2002	11:20	446	22.3	26.9	0.6	0.00	Readings recorded after 2 purge volumes	
10/31/2002	14:05	0	0.0	1.7	18.3	0.00	Readings recorded after 2 purge volumes	
11/19/2002	13:50	30	1.5	9.5	11.3	0.04	Readings recorded after 2 purge volumes	

Notes: MW = Monitoring Well
Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in MW-3

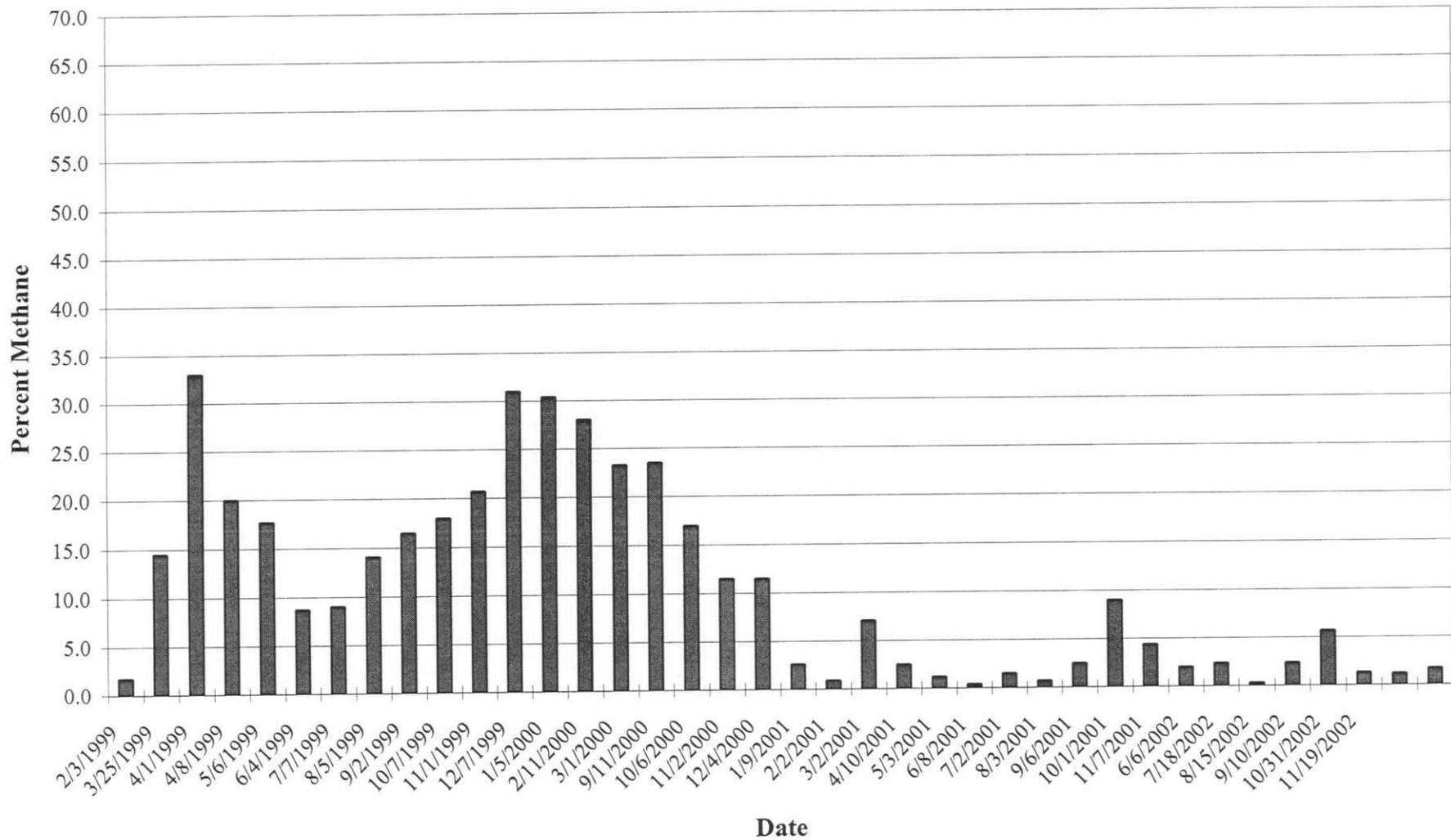


Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure / Vacuum (inches)	Notes
MW-4	1/27/1999	16:35	34	1.7	2.4	19.5	Not measured	
	2/3/1999	15:50	286	14.5	17.0	12.1	Not measured	
	3/25/1999	14:05	748 @ 30 seconds, 680 steady	35.0 + @ 30 seconds - 33.0+/- steady	40.8	4.6	0.02	Can watch pressure fluctuate - peak gas reading recorded at 30 seconds then drops
	4/1/1999	11:15	400	20.0	27.9	9.6	0.30	Readings recorded at 180 seconds, DTW = 22.90 ft
	4/8/1999	15:10	Peaked @ 520 @ 40 seconds, 350 steady	17.7	23.4	11.4	0.00	Readings recorded at 180 seconds
	5/6/1999	14:50	178	8.7	7.8	15.4	0.00	Readings recorded at 180 seconds
	6/4/1999	12:55	180	9.0	8.0	15.3	0.00	Readings recorded at 180 seconds
	7/7/1999	14:30	28	14.1	13.2	13.7	0.00	Readings recorded at 18.5 minutes
	8/5/1999	14:30	330	16.5	13.4	13.3	0.00	Readings recorded after 2 purge volumes, DTW = 29.00 ft
	9/2/1999	17:50	360	18.0	19.5	8.7	0.00	Readings recorded after 2 purge volumes, DTW = 29.71 ft
	10/7/1999	13:45	414	20.7	22.1	9.0	0.00	Readings recorded after 2 purge volumes
	11/1/1999	15:40	620	31.0	34.3	2.9	0.00	Readings recorded after 2 purge volumes
	12/7/1999	13:50	608	30.4	36.0	2.5	0.00	Readings recorded after 2 purge volumes
	1/5/2000	16:05	560	28.0	30.0	3.2	0.00	Readings recorded after 2 purge volumes
	2/11/2000	11:00	466	23.3	31.5	3.8	0.00	Readings recorded after 2 purge volumes
	3/1/2000	11:30	470	23.5	34.0	3.1	0.00	Readings recorded after 2 purge volumes
	9/11/2000	15:50	350	17.0	19.5	8.6	0.00	Readings recorded after 2 purge volumes
	10/6/2000	13:45	230	11.5	13.8	12.0	0.00	Readings recorded after 2 purge volumes
	11/2/2000	13:00	230	11.5	18.2	11.5	0.00	Readings recorded after 2 purge volumes
	12/4/2000	11:15	50	2.6	4.0	18.0	0.00	Readings recorded after 2 purge volumes
	1/9/2001	11:05	18	0.9	2.7	18.4	0.00	Readings recorded after 2 purge volumes
	2/2/2001	12:00	142	7.1	16.0	11.1	0.00	Readings recorded after 2 purge volumes
	3/2/2001	11:10	50	2.5	5.8	16.6	0.00	Readings recorded after 2 purge volumes
	4/10/2001	11:00	24	1.2	3.4	17.8	0.00	Readings recorded after 2 purge volumes
	5/3/2001	13:00	8	0.4	0.3	19.2	0.00	Readings recorded after 2 purge volumes
	6/8/2001	11:00	30	1.5	NA	18.5	0.00	Readings recorded after 2 purge volumes
	7/2/2001	11:50	14	0.7	0.6	18.9	0.00	Readings recorded after 2 purge volumes
	8/3/2001	11:10	50	2.5	3.0	17.9	0.00	Readings recorded after 2 purge volumes
	9/6/2001	11:25	180	9.0	8.2	16.8	0.05	Readings recorded after 2 purge volumes
	10/1/2001	11:10	88	4.4	6.9	15.2	0.00	Readings recorded after 2 purge volumes
11/7/2001	10:45	40	2.0	4.5	16.9	0.00	Readings recorded after 2 purge volumes	
3/7/2002	11:58	48	2.4	6.4	15.6	0.00	Readings recorded after 2 purge volumes	
6/6/2002	12:30	6	0.3	0.8	20.2	0.00	Readings recorded after 2 purge volumes	
7/18/2002	12:55	48	2.4	4.3	17.0	0.02	Readings recorded after 2 purge volumes	
8/15/2002	13:20	114	5.7	0.9	19.2	0.00	Readings recorded after 2 purge volumes	
9/10/2002	12:04	26	1.3	2.6	18.1	0.00	Readings recorded after 2 purge volumes	
10/31/2002	16:45	24	1.2	3.0	18.2	0.00	Readings recorded after 2 purge volumes	
11/19/2002	13:00	34	1.7	4.0	15.5	0.00	Readings recorded after 2 purge volumes	

Notes: MW = Monitoring Well
 Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in MW-4

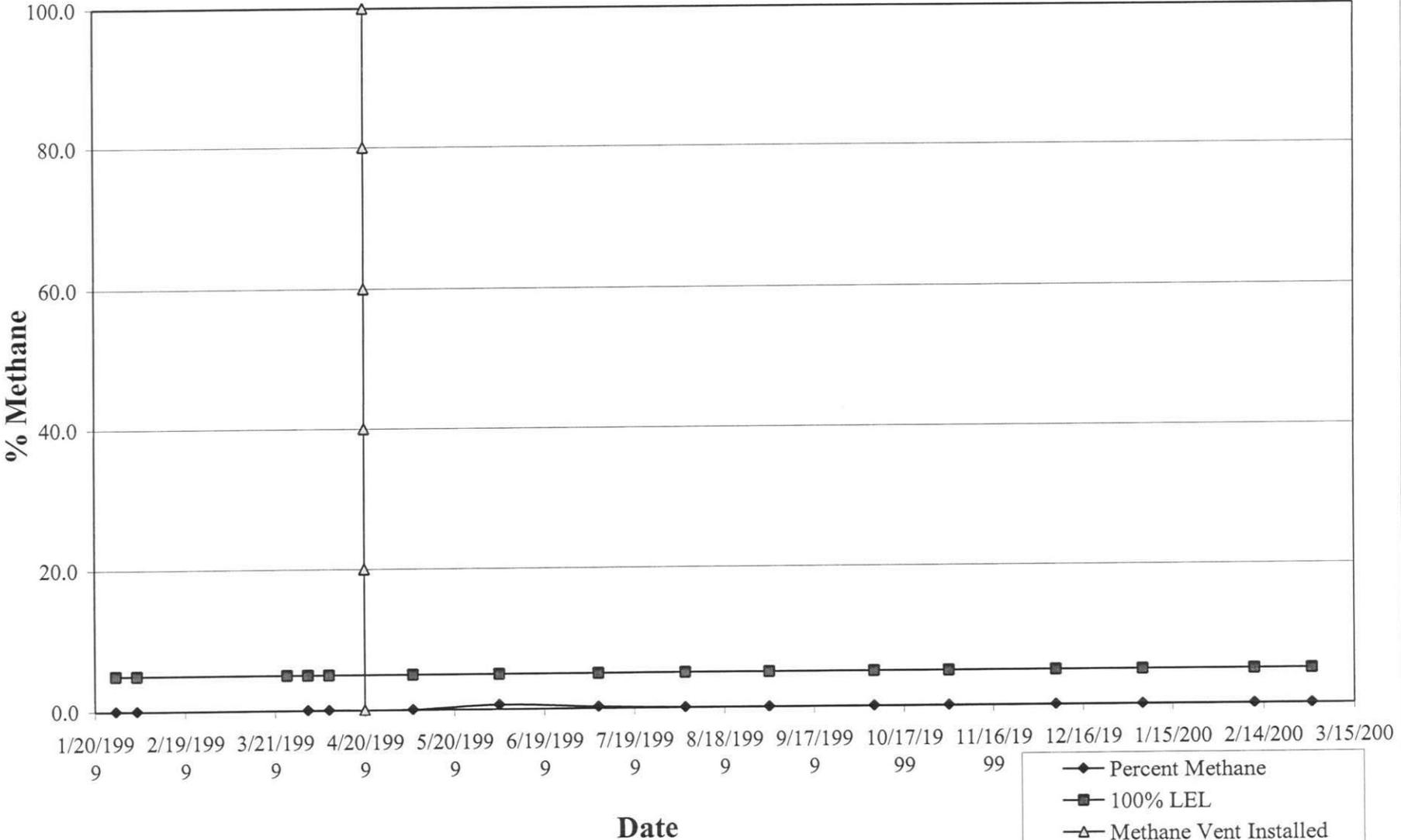


**Jackson County Landfill
Dillsboro, North Carolina**

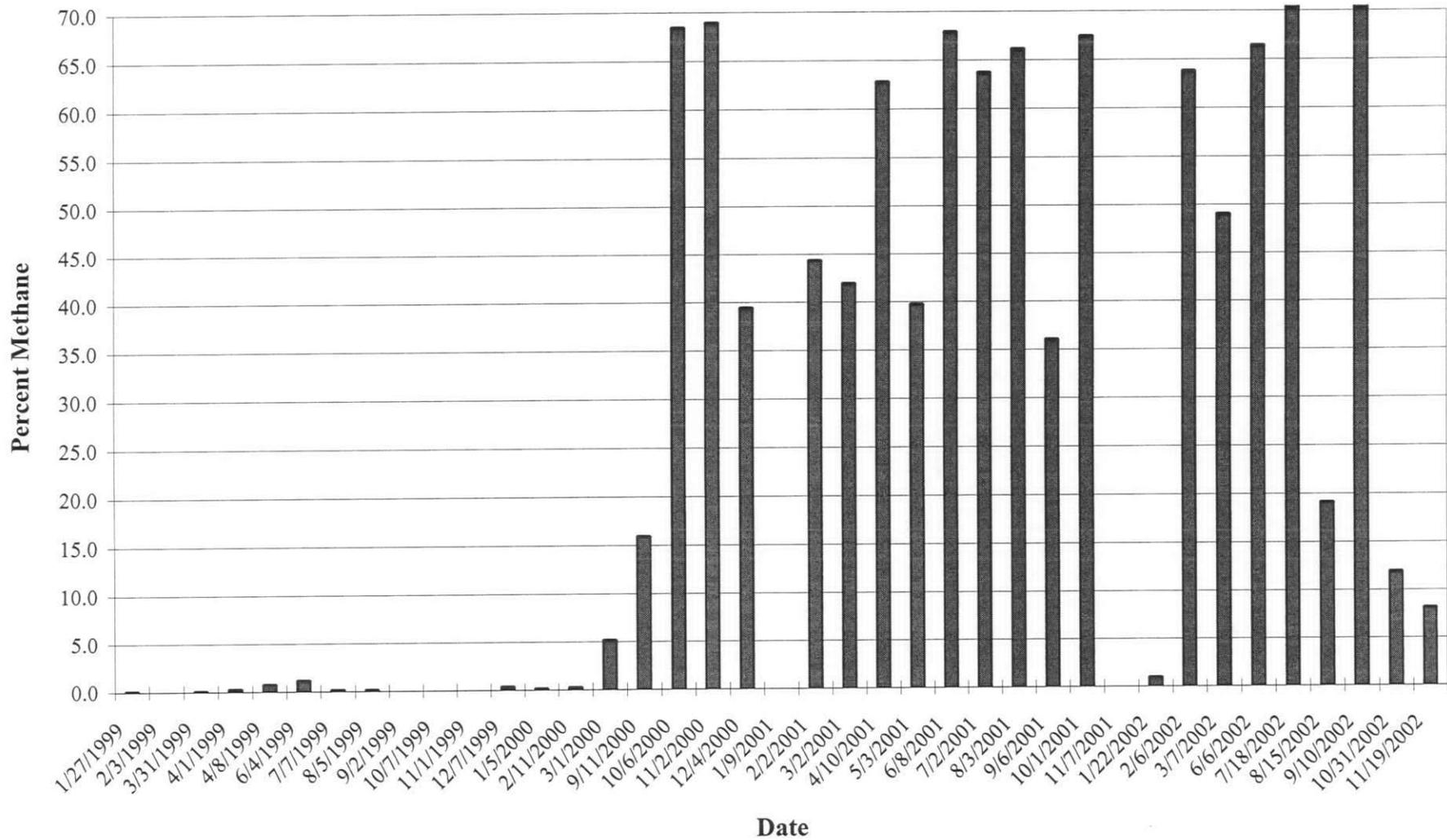
Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
MW-5	1/27/1999	15:40	2	0.1	0.2	20.3	Not measured	Screened entirely below the water table
	2/3/1999	14:24	0	0.0	0.0	21.0	Not measured	
	3/25/1999	14:20						Needs pressure cap, Did not check
	3/31/1999	16:20	Peaked @ 66 @ 20 seconds	0.1	0.6	20.2	0.10	Pressure cap installed
	4/1/1999	9:30	6.0	0.3	0.4	20.3	0.12	Readings recorded at 180 seconds, DTW = 48.24' TOC
	4/8/1999	12:40	16.0	0.8	0.5	20.0	0.16	Readings recorded at 180 seconds
	5/6/1999	12:45	24.0	1.2	1.5	19.5	0.00	Readings recorded at 180 seconds
	6/4/1999	10:55	Peaked @ 118 @ 20seconds, 24 @ 180 seconds	1.2	0.9	19.6	0.00	Readings recorded at 180 seconds
	7/7/1999	12:10	4	0.2	0.0	20.7	0.02	Readings recorded at 180 seconds
	8/5/1999	12:50	4	0.2	0.0	20.8	0.00	Readings recorded after 2 purge volumes, DTW = 48.22 ft
	9/2/1999	15:20	0	0.0	0.0	19.9	0.01	Readings recorded after 2 purge volumes, DTW = 48.40 ft
	10/7/1999	11:55	Peaked @ 4 @ 5 seconds	0.0	0.3	19.3	0.00	Readings recorded after 2 purge volumes
	11/1/1999	13:45	0	0.0	0.0	21.1	0.00	Water above the screen
	12/7/1999	12:15	8	0.4	0.1	19.1	0.00	Readings recorded after 2 purge volumes
	1/5/2000	14:45	4	0.2	0.0	19.9	0.00	Readings recorded after 2 purge volumes
	2/11/2000	10:25	6	0.3	0.1	20.0	0.00	Readings recorded after 2 purge volumes
	3/1/2000	10:50	Peaked @ 400, 104 stable	5.2	3.4	20.5	0.01	Readings recorded after 2 purge volumes
	9/11/2000	14:40	320	16.0	7.3	16.1	0.25	Readings recorded after 2 purge volumes
	10/6/2000	13:15	>1000	68.5	31.4	0.7	0.18	Readings recorded after 2 purge volumes
	11/2/2000	12:05	>1000	69.0	35.8	2.3	0.30	Readings recorded after 2 purge volumes
	12/4/2000	10:25	790	39.5	18.5	9.5	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:38	0	0.0	0.0	19.6	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:55	888	44.4	25.8	3.7	0.00	Readings recorded after 2 purge volumes
	3/2/2001	10:10	840	42.0	20.1	7.8	0.25	Readings recorded after 2 purge volumes
	4/10/2001	11:50	>1000	62.9	31.7	0.6	0.25	Readings recorded after 2 purge volumes
	5/3/2001	12:10	786	39.8	19.8	7.9	0.25	Readings recorded after 2 purge volumes
	6/8/2001	10:10	>1000	68.0	NA	0.4	0.12	Readings recorded after 2 purge volumes
	7/2/2001	10:55	>1000	63.8	33.7	0.9	0.18	Readings recorded after 2 purge volumes
	8/3/2001	10:35	>1000	66.2	33	0.4	0.25	Readings recorded after 2 purge volumes
	9/6/2001	11:20	722	36.1	18.4	9.4	0.2	Readings recorded after 2 purge volumes
10/1/2001	10:45	>1000	67.5	34	0.2	0.2	Readings recorded after 2 purge volumes	
11/7/2001	10:20	0	0.0	0.2	20.3	0.15	Readings recorded after 2 purge volumes	
1/22/2002	16:40	20	1.0	5.8	16.6	NM	Readings recorded after 2 purge volumes	
2/6/2002	11:10	>1000	63.9	24.2	0.5	0	Readings recorded after 2 purge volumes	
3/7/2002	11:09	982	49.1	23.1	1.5	0.22	Readings recorded after 2 purge volumes	
6/6/2002	11:22	>1000	66.5	26.7	1.9	0.32	Readings recorded after 2 purge volumes	
7/18/2002	12:15	1458	72.9	26.9	0.9	0.41	Readings recorded after 2 purge volumes	
8/15/2002	15:17	384	19.2	16	6.2	0.08	Readings recorded after 2 purge volumes	
9/10/2002	11:07	1496	74.8	26.9	0.01	0.48	Readings recorded after 2 purge volumes	
10/31/2002	14:45	240	12	11.5	5.8	0.18	Readings recorded after 2 purge volumes	
11/19/2002	14:10	164	8.2	4.5	17.3	0.50	Readings recorded after 2 purge volumes	

Notes: MW = Monitoring Well
 Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in MW-2



Percent Methane in MW-5

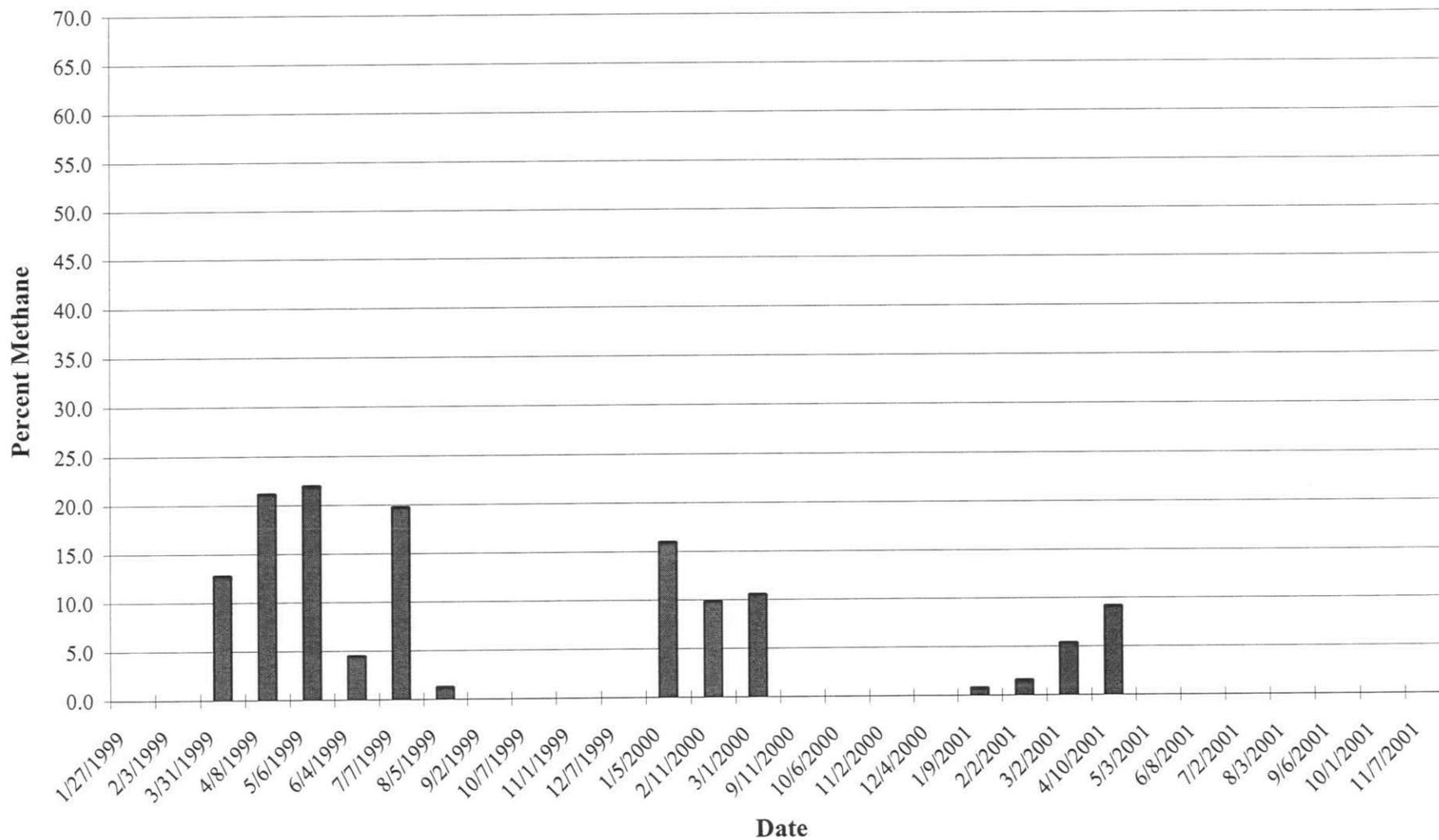


Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 1	1/27/1999	14:20	0	0.0	8.4	3.1	Not measured	
	2/3/1999	14:51	0	0.0	5.8	10.6	Not measured	
	3/25/1999							Did not check
	3/31/1999	11:44	246	12.8	15.5	0.0	0.00	Readings recorded @ 180 seconds, locked 3/31/99
	4/8/1999	9:45	428	21.2	17.3	0.0	0.01	Readings recorded at 180 seconds
	5/6/1999	9:30	440	22.0	18.0	0.0	0.00	Readings recorded at 180 seconds
	6/4/1999	8:45	90	4.5	17.5	0.0	0.00	Readings recorded at 180 seconds
	7/7/1999	9:30	396	19.8	25.1	0.3	0.00	Readings recorded at 180 seconds
	8/5/1999	8:45	26	1.3	21.5	0.4	0.00	Readings recorded at 2 purge volumes
	9/2/1999	12:15	0	0.0	9.2	11.9	0.00	Readings recorded at 2 purge volumes
	10/7/1999	9:30	0	0.0	11.6	11.3	0.00	Readings recorded after 2 purge volumes
	11/1/1999	11:30	0	0.0	11.2	11.6	0.00	Readings recorded after 2 purge volumes
	12/7/1999	9:45	0	0.0	7.0	13.5	0.00	Readings recorded after 2 purge volumes
	1/5/2000	13:00	16	0.8	1.3	21.0	0.00	Readings recorded after 2 purge volumes
	2/11/2000	8:45	198	9.9	19.9	0.6	0.00	Readings recorded after 2 purge volumes
	3/1/2000	9:30	212	10.6	21.0	0.2	0.00	Readings recorded after 2 purge volumes
	9/11/2000	13:20	0	0.0	9.5	12.7	0.00	Snags around probe, smell of gas @ toe of slope
	10/6/2000	12:00	0	0.0	11.0	10.9	0.00	Readings recorded after 2 purge volumes
	11/2/2000	10:00	0	0.0	7.7	14.9	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:00	0	0.0	14.2	4.2	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:00	16	0.8	18.5	2.0	0.00	Readings recorded after 2 purge volumes
	2/2/2001	9:30	32	1.6	16.8	1.7	0.00	Readings recorded after 2 purge volumes
	3/2/2001	8:30	108	5.4	17.4	0.2	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:20	184	9.2	22.2	0.4	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:00	0	0.0	15.0	7.1	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:00	0	0.0	NA	8.1	0.00	Readings recorded after 2 purge volumes
	7/2/2001	9:45	0	0.0	15.3	5.2	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:30	0	0.0	15.0	6.5	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:20	0	0.0	17.1	4.1	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:35	0	0.0	10.2	11.4	0.00	Readings recorded after 2 purge volumes
11/7/2001	9:15	0	0.0	4.5	16.9	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-1

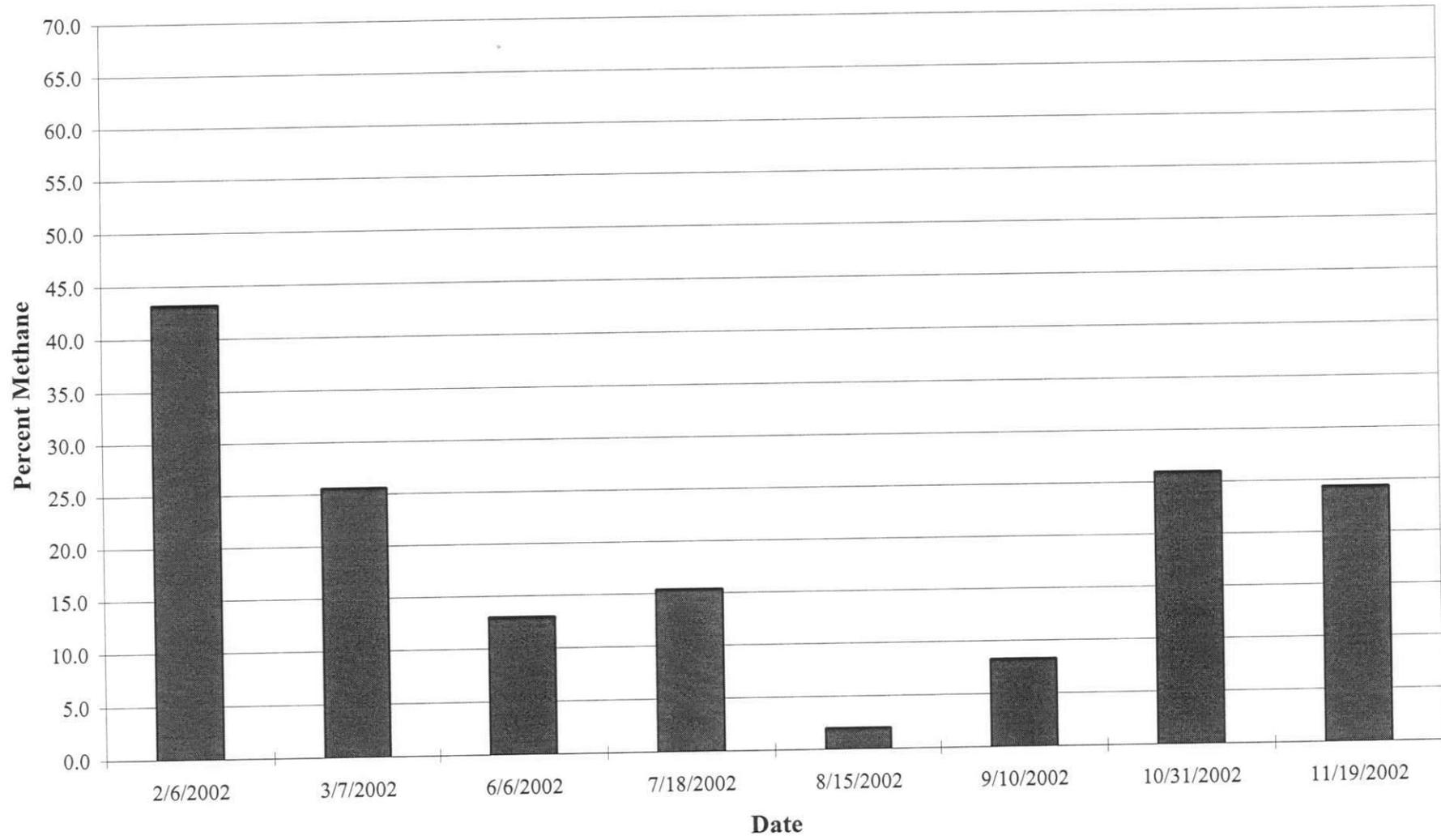


**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 1A	2/6/2002	10:10	864	43.2	17.1	0.5	0.00	Readings recorded after 2 purge volumes
	3/7/2002	10:11	512	25.6	22.0	0.1	0.00	Readings recorded after 2 purge volumes
	6/6/2002	9:58	260	13.0	24.8	0.8	0.00	Readings recorded after 2 purge volumes
	7/18/2002	11:07	308	15.4	24.2	0.7	0.00	Readings recorded after 2 purge volumes
	8/15/2002	13:44	40	2.0	19.7	3.6	0.00	Readings recorded after 2 purge volumes
	9/10/2002	9:50	166	8.3	23.1	0.0	0.00	Readings recorded after 2 purge volumes
	10/31/2002	15:10	520	26.0	22.1	0.1	0.00	Readings recorded after 2 purge volumes
	11/19/2002	15:20	488	24.4	13.5	0.0	0.00	Readings recorded after 2 purge volumes

Notes: Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-1A

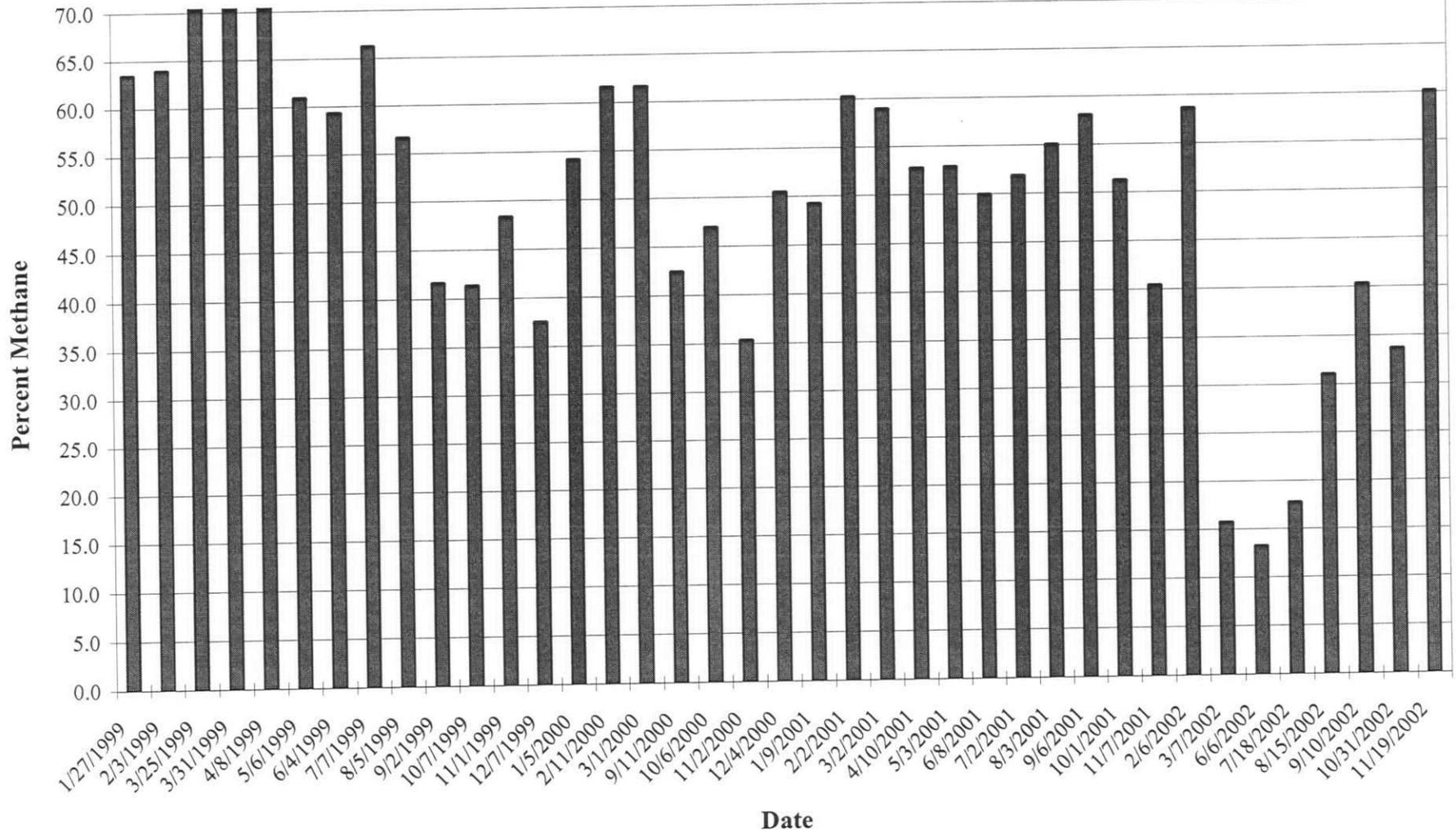


**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 2	1/27/1999	14:50	>1000	63.5	39.8	0.0	Not measured	
	2/3/1999	15:00	>1000	64.0	40.6	0.0	Not measured	
	3/25/1999	11:42	>1000 @ 20 seconds	83.0	53.5	0.0	0.00	Peak at 40 seconds - then stable
	3/31/1999	12:05	>1000 @ 18 seconds	85.0	55.6	0.0	0.00	Checked for vacuum, readings recorded at 180 seconds, locked on 3/31/99
	4/8/1999	10:10	>1000 @ 25 seconds	82.0	58.0	0.0	0.00	Readings recorded at 180 seconds
	5/6/1999	10:00	>1000 @ 40 seconds	61.0	44.7	0.0	0.00	Readings recorded at 180 seconds
	6/4/1999	9:05	>1000 @ 23 seconds	59.4	42.3	0.0	0.00	Readings recorded at 180 seconds
	7/7/1999	10:00	>1000 @ 70 seconds	66.3	33.6	0.2	0.00	Readings recorded at 180 seconds
	8/5/1999	9:15	>1000 @ 42 seconds	56.7	39.9	0.0	0.00	Readings recorded after 2 purge volumes
	9/2/1999	12:40	834	41.7	35.5	0.3	0.00	Readings recorded after 2 purge volumes
	10/7/1999	10:00	828	41.4	35.2	0.2	0.00	Readings recorded after 2 purge volumes
	11/1/1999	11:50	980	48.4	37.0	0.0	0.00	Readings recorded after 2 purge volumes
	12/7/1999	10:15	752	37.6	23.9	6.3	0.00	Readings recorded after 2 purge volumes
	1/5/2000	13:30	>1000 @ 24 seconds	54.2	39.0	0.7	0.00	Readings recorded after 2 purge volumes
	2/11/2000	9:05	>1000 @ 25 seconds	61.7	37.8	0.5	0.00	Readings recorded after 2 purge volumes
	3/1/2000	9:40	>1000 @ 32 seconds	61.7	40.2	1.7	0.01	Readings recorded after 2 purge volumes
	9/11/2000	13:35	850	42.5	35.6	0.0	0.00	Readings recorded after 2 purge volumes
	10/6/2000	12:10	940	47.0	36.0	0.2	0.00	Readings recorded after 2 purge volumes
	11/2/2000	10:20	708	35.4	30.3	4.2	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:15	>1000	50.5	34.1	1.0	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:15	986	49.3	34.4	1.2	0.00	Readings recorded after 2 purge volumes
	2/2/2001	9:45	>1000	60.3	38.8	0.3	0.00	Readings recorded after 2 purge volumes
	3/2/2001	8:50	>1000	59.0	39.1	1.6	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:35	>1000	52.8	38.1	1.0	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:10	>1000	52.9	39.3	0.5	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:10	>1000	50.0	NA	0.6	0.00	Readings recorded after 2 purge volumes
	7/2/2001	9:55	>1000	51.9	39.8	0.7	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:40	>1000	55.1	38.0	0.4	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:30	>1000	58.1	38.6	0.4	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:45	>1000	51.3	37.2	1.1	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:25	810	40.5	35.9	0.3	0.00	Readings recorded after 2 purge volumes
	2/6/2002	10:15	>1000	58.7	34.4	0.9	0.00	Readings recorded after 2 purge volumes
	3/7/2002	10:34	316	15.8	12.2	12.9	0.00	Readings recorded after 2 purge volumes
6/6/2002	10:12	266	13.3	12.0	14.6	0.00	Readings recorded after 2 purge volumes	
7/18/2002	11:31	356	17.8	14.6	12.4	0.00	Readings recorded after 2 purge volumes	
8/15/2002	13:55	622	31.1	33.1	0.9	0.00	Readings recorded after 2 purge volumes	
9/10/2002	10:09	808	40.4	33.8	0.0	0.00	Readings recorded after 2 purge volumes	
10/31/2002	15:26	674	33.7	26.6	3.7	0.00	Readings recorded after 2 purge volumes	
11/19/2002	15:35	>1000	60.2	36.0	0.0	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-2

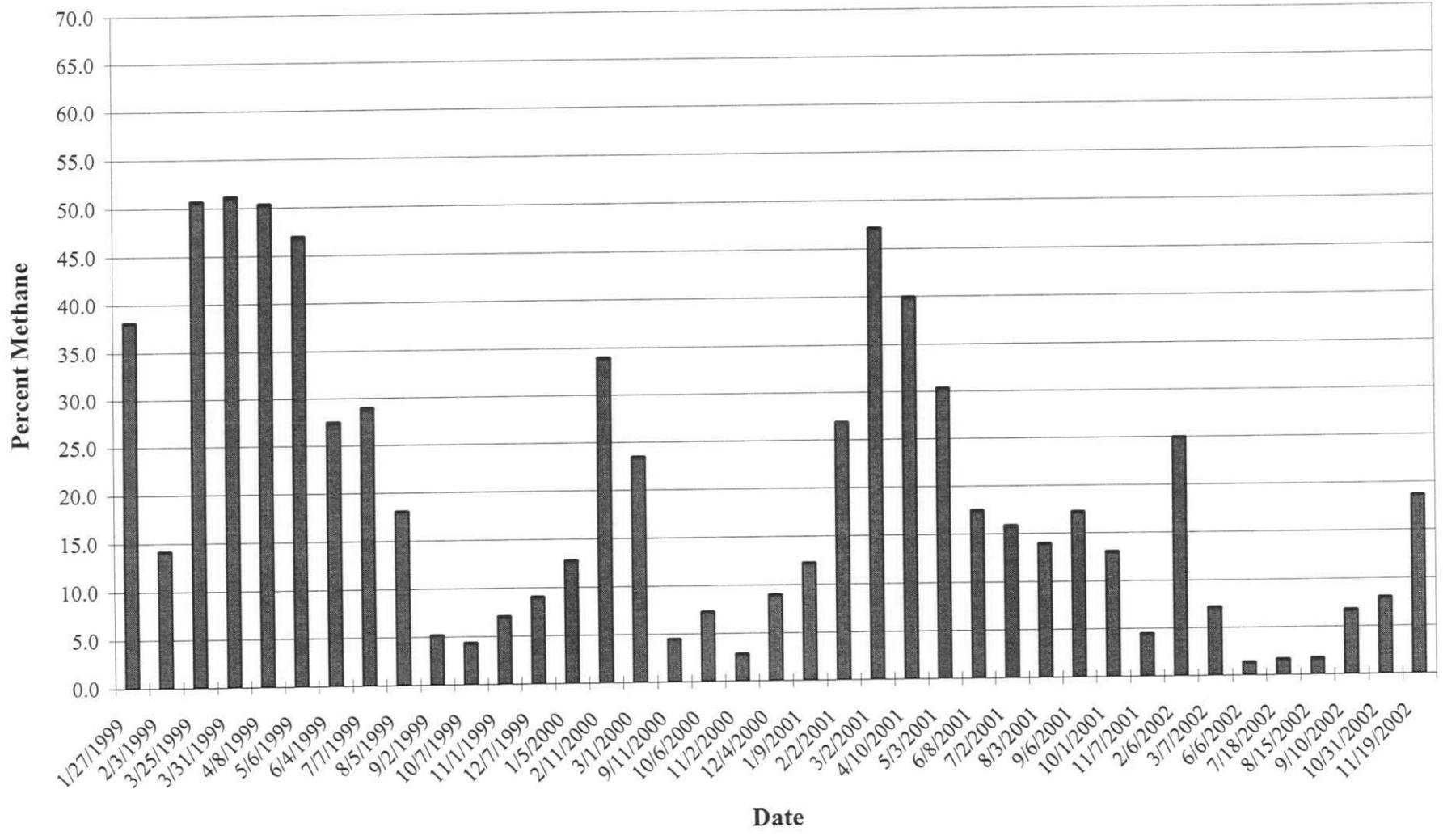


**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 3	1/27/1999	15:00	766	38.2	29.8	0.0	Not measured	
	2/3/1999	15:07	282	14.2	9.5	13.8	Not measured	
	3/25/1999	11:53	>1000 @ 60 seconds	50.7	41.0	1.1	-0.02	Vacuum - peak @ 70 seconds - then stable
	3/31/1999	12:20	>1000 @ 48 seconds	51.2	37.6	1.9	0.00	Readings recorded at 180 seconds, Locked on 3/31/99 Peaked @53.5 @ 110 seconds
	4/8/1999	10:20	>1000 @ 40 seconds	50.4	40.8	2.0	0.10	Readings recorded at 180 seconds
	5/6/1999	10:15	940	47.0	36.5	0.0	0.00	Readings recorded at 180 seconds
	6/4/1999	9:15	550	27.5	28.6	2.6	0.00	Readings recorded at 180 seconds
	7/7/1999	10:10	580	29.0	32.4	2.0	0.00	Readings recorded at 180 seconds
	8/5/1999	9:30	362	18.1	26.1	2.5	0.00	Readings recorded after 2 purge volumes
	9/2/1999	12:50	104	5.2	18.7	4.4	0.00	Readings recorded after 2 purge volumes
	10/7/1999	10:10	88	4.4	17.6	5.9	0.00	Readings recorded after 2 purge volumes
	11/1/1999	12:00	142	7.1	20.1	3.9	0.00	Readings recorded after 2 purge volumes
	12/7/1999	10:30	182	9.1	13.9	8.9	0.00	Readings recorded after 2 purge volumes
	1/5/2000	13:40	256	12.8	22.3	3.8	0.00	Readings recorded after 2 purge volumes
	2/11/2000	9:10	680	34.0	27.6	1.7	0.00	Readings recorded after 2 purge volumes
	3/1/2000	9:45	470	23.5	19.5	9.2	0.00	Readings recorded after 2 purge volumes
	9/11/2000	13:40	90	4.5	20.2	3.5	0.00	Readings recorded after 2 purge volumes
	10/6/2000	12:15	147	7.3	21.1	3.2	0.00	Readings recorded after 2 purge volumes
	11/2/2000	10:30	58	2.9	16.1	8.2	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:20	180	9.0	18.1	5.4	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:20	246	12.3	17.2	7.8	0.00	Readings recorded after 2 purge volumes
	2/2/2001	9:50	538	26.9	25.5	2.9	0.00	Readings recorded after 2 purge volumes
	3/2/2001	8:55	944	47.2	30.8	0.8	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:55	800	40.0	30.0	1.6	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:30	608	30.4	29.4	2.2	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:15	350	17.5	na	2.0	0.00	Readings recorded after 2 purge volumes
	7/2/2001	10:10	318	15.9	23.6	2.8	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:00	280	14.0	24.5	2.3	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:35	346	17.3	25.0	2.7	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:50	262	13.1	22.8	3.2	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:30	90	4.5	18.1	6.2	0.00	Readings recorded after 2 purge volumes
	2/6/2002	10:20	500	25.0	24.4	3.0	0.00	Readings recorded after 2 purge volumes
	3/7/2002	10:42	144	7.2	9.5	14.2	0.00	Readings recorded after 2 purge volumes
6/6/2002	10:23	28	1.4	3.0	18.7	0.00	Readings recorded after 2 purge volumes	
7/18/2002	11:40	34	1.7	5.9	16.8	0.00	Readings recorded after 2 purge volumes	
8/15/2002	14:02	36	1.8	15.0	7.6	0.00	Readings recorded after 2 purge volumes	
9/10/2002	10:22	136	6.8	18.5	4.8	0.00	Readings recorded after 2 purge volumes	
10/31/2002	15:30	162	8.1	18.6	5.8	0.50	Readings recorded after 2 purge volumes	
11/19/2002	15:45	374	18.7	25.2	0.9	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-3



**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 4	1/27/1999	15:10	0	0.0	0.5	20.0	Not measured	
	2/3/1999	15:15	0	0.0	0.6	19.8	Not measured	
	3/25/1999							Did not check
	3/31/1999	12:35	Did not record	1.8 @ 20 seconds 0.0 @ 160 seconds	0.6	20.6	0.00	Reading recorded at 160 seconds
	4/8/1999	10:30	Peaked @ 34 @ 20 seconds	0.0	0.9	19.7	0.00	Readings recorded at 180 seconds
	5/6/1999	10:30	16.0	0.8	1.1	9.2	0.00	Readings recorded at 180 seconds
	6/4/1999	9:25	Peaked @ 24 @ 20 seconds, 6 @ 180 seconds	0.3	1.1	19.4	0.00	Readings recorded at 180 seconds
	7/7/1999	10:20	2	0.1	1.8	18.7	0.00	Readings recorded at 180 seconds
	8/5/1999	9:45	2	0.1	1.3	19.7	0.00	Readings recorded after 2 purge volumes
	9/2/1999	13:00	0	0.0	0.5	19.3	0.00	Readings recorded after 2 purge volumes
	10/7/1999	10:20	Peaked @ 6 @ 15 seconds	0.0	0.8	19.3	0.00	Readings recorded after 2 purge volumes
	11/1/1999	12:10	Peaked @ 20 @30 seconds	0.0	0.9	20.7	0.00	Readings recorded after 2 purge volumes
	12/7/1999	10:40	Peaked @ 46 @ 20 seconds	0.0	0.5	19.3	0.00	Readings recorded after 2 purge volumes
	1/5/2000	13:45	6	0.3	0.6	19.5	0.00	Readings recorded after 2 purge volumes
	2/11/2000	9:15	Peaked @ 84 @ 25 seconds	0.0	0.3	19.5	0.00	Readings recorded after 2 purge volumes
			Peaked @ 80 @ 30 seconds, 0 stable	0.0	0.9	22.1	0.00	Readings recorded after 2 purge volumes
	9/11/2000	13:45	0	0.0	0.9	19.4	0.00	Readings recorded after 2 purge volumes
	10/6/2000	12:20	0	0.0	1.3	19.0	0.00	Readings recorded after 2 purge volumes
	11/2/2000	10:40	0	0.0	0.6	20.4	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:25	0	0.0	2.0	17.9	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:25	0	0.0	0.4	20.0	0.00	Readings recorded after 2 purge volumes
	2/2/2001	9:55	0	0.0	0.5	20.0	0.00	Readings recorded after 2 purge volumes
	3/2/2001	9:00	0	0.0	0.8	19.3	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:50	0	0.0	0.8	19.2	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:25	0	0.0	0.5	20.3	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:20	0	0.0	na	20.0	0.00	Readings recorded after 2 purge volumes
	7/2/2001	10:15	0	0.0	0.2	19.6	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:55	0	0.0	1.4	19.0	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:40	0	0.0	0.2	20.1	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:55	0	0.0	1.9	19.6	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:35	0	0.0	0.2	20.4	0.00	Readings recorded after 2 purge volumes
	6/6/2002	10:32	0	0.0	0.8	20.1	0.00	Readings recorded after 2 purge volumes
8/15/2002	14:10	0	0.0	0.9	19.9	0.00	Readings recorded after 2 purge volumes	
10/31/2002	15:40	0	0.0	1.4	19.0	0.00	Readings recorded after 2 purge volumes	
11/19/2002	15:50	0	0.0	1.2	18.6	0.00	Readings recorded after 2 purge volumes	

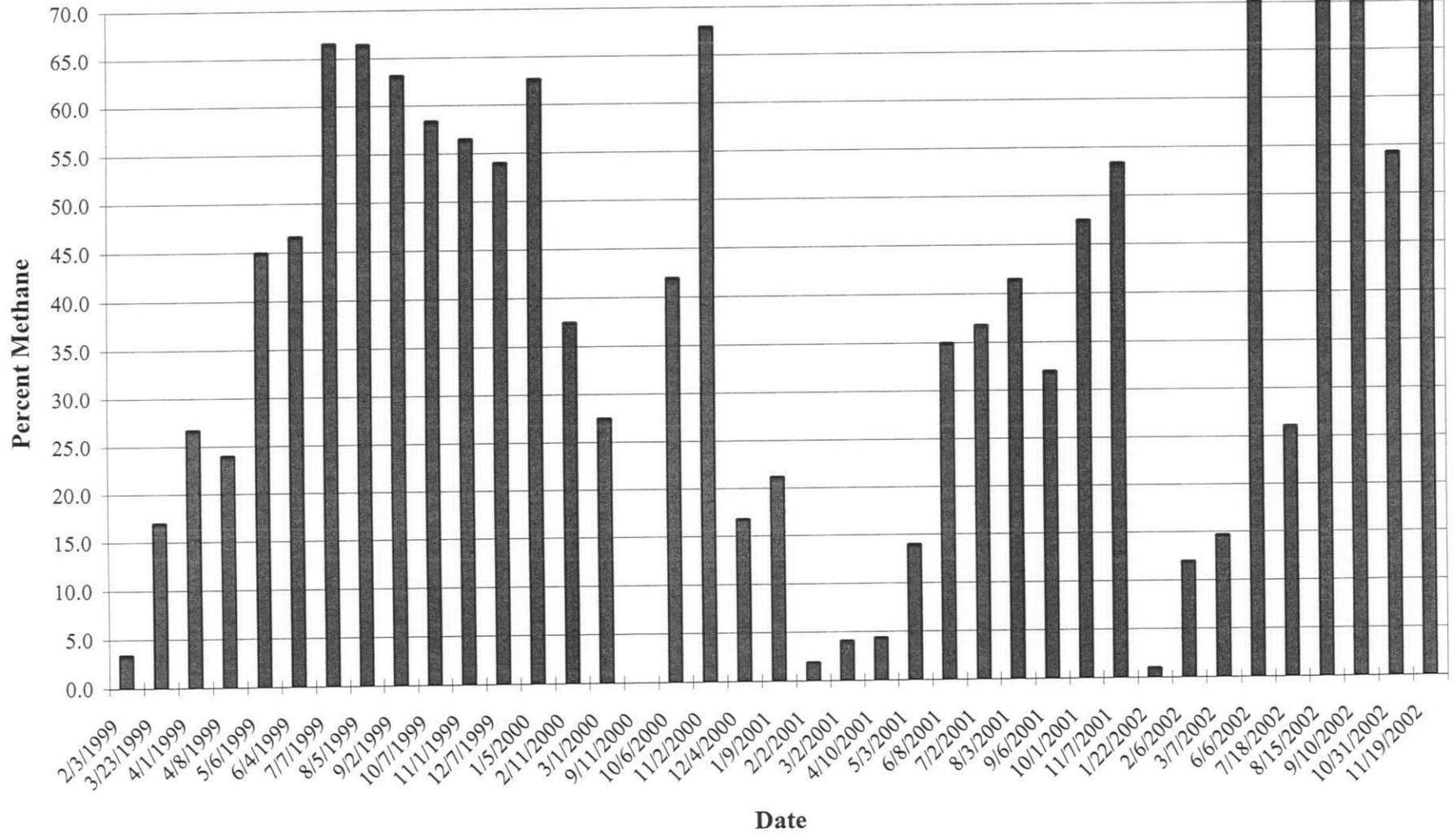
Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 5	1/27/1999	15:20	480	23.3	6.4	4.7	Not measured	
	2/3/1999	14:27	50	3.4	0.7	19.0	Not measured	
	3/23/1999	16:00	386	19.1 / 17.0	5.0	7.1	Did not check	50 seconds peak / steady
	3/25/1999	15:25					-0.24	Strong vacuum
	3/31/1999	15:15	Did not record				-0.90	Strong vacuum
	4/1/1999	9:00	536	26.7	7.2	2.7	2.00	Readings recorded at 180 seconds
	4/8/1999	12:30	484	24.0	8.8	0.4	-0.26	Vacuum - readings recorded at 180 seconds
	5/6/1999	12:35	900	45.0	11.2	0.0	>5.000	Pressure, readings recorded at 180 seconds
	6/4/1999	10:45	920	46.6	12.4	0.9	2.50	Pressure, readings recorded at 180seconds
	7/7/1999	12:00	>1000 @ 60 seconds	66.6	15.5	0.3	>5.0	Pressure, readings recorded at 180 seconds
	8/5/1999	12:00	>1000 @ 30 seconds	66.5	16.9	0.1	0.04	Readings recorded after 2 purge volumes
	9/2/1999	15:15	>1000 @ 28 seconds	63.2	25.4	0.4	0.05	Readings recorded after 2 purge volumes
	10/7/1999	11:45	>1000 @ 25 seconds	58.4	22.9	0.0	-0.26	Readings recorded after 2 purge volumes
	11/1/1999	13:30	> 1000 @ 20 seconds	56.5	19.3	0.2	0.00	Readings recorded after 2 purge volumes
	12/7/1999	12:00	>1000 @ 22 seconds	54.0	0.7	0.0	2.00	Readings recorded after 2 purge volumes
	1/5/2000	14:40	>1000 @ 44 seconds	62.7	12.4	0.0	2.50	Readings recorded after 2 purge volumes
	2/11/2000	10:15	750	37.5	4.9	4.3	0.06	Readings recorded after 2 purge volumes
	3/1/2000	10:45	550	27.5	6.7	0.4	0.50	Readings recorded after 2 purge volumes
	9/11/2000	14:35	0	0.0	0.8	20.8	0.00	Readings recorded after 2 purge volumes
	10/6/2000	13:10	840	42.0	18.4	2.5	0.00	Readings recorded after 2 purge volumes
	11/2/2000	12:00	>1000	68.0	26.5	3.9	0.04	Readings recorded after 2 purge volumes
	12/4/2000	10:20	336	16.8	13.3	4.2	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:20	424	21.2	10.9	3.0	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:50	38	1.9	2.5	15.5	0.00	Readings recorded after 2 purge volumes
	3/2/2001	10:00	82	4.1	8.3	2.0	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:00	88	4.4	4.5	9.2	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:10	280	14.0	6.9	4.9	0.00	Readings recorded after 2 purge volumes
	6/8/2001	10:05	700	35.0	na	0.2	0.05	Readings recorded after 2 purge volumes
	7/2/2001	10:50	736	36.8	13.8	0.4	0.01	Readings recorded after 2 purge volumes
	8/3/2001	10:30	830	41.5	16.5	2.4	0.00	Readings recorded after 2 purge volumes
	9/6/2001	11:10	640	32.0	10.6	6.0	0.00	Readings recorded after 2 purge volumes
	10/1/2001	10:35	950	47.5	16.8	0.4	0.00	Readings recorded after 2 purge volumes
	11/7/2001	10:15	>1000	53.4	23.9	0.4	0.12	Readings recorded after 2 purge volumes
	1/22/2002	16:35	80	1.0	5.8	16.6	NM	Readings recorded after 2 purge volumes
	2/6/2002	11:00	240	12.0	5.9	1.2	0.00	Readings recorded after 2 purge volumes
3/7/2002	10:58	294	14.7	5.2	8.5	0.00	Readings recorded after 2 purge volumes	
6/6/2002	11:08	>1000	72.1	19.3	0.4	0.00	Readings recorded after 2 purge volumes	
7/18/2002	12:03	522	26.1	8.7	11.7	0.00	Readings recorded after 2 purge volumes	
8/15/2002	15:12	>1000	77.1	27.1	1.0	0.01	Readings recorded after 2 purge volumes	
9/10/2002	10:58	>1000	77.7	28.0	0.0	0.00	Readings recorded after 2 purge volumes	
10/31/2002	14:35	>1000	54.3	15.3	3.5	0.00	Readings recorded after 2 purge volumes	
11/19/2002	15:15	>1000	74.1	9.4	0.6	0.40	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-5

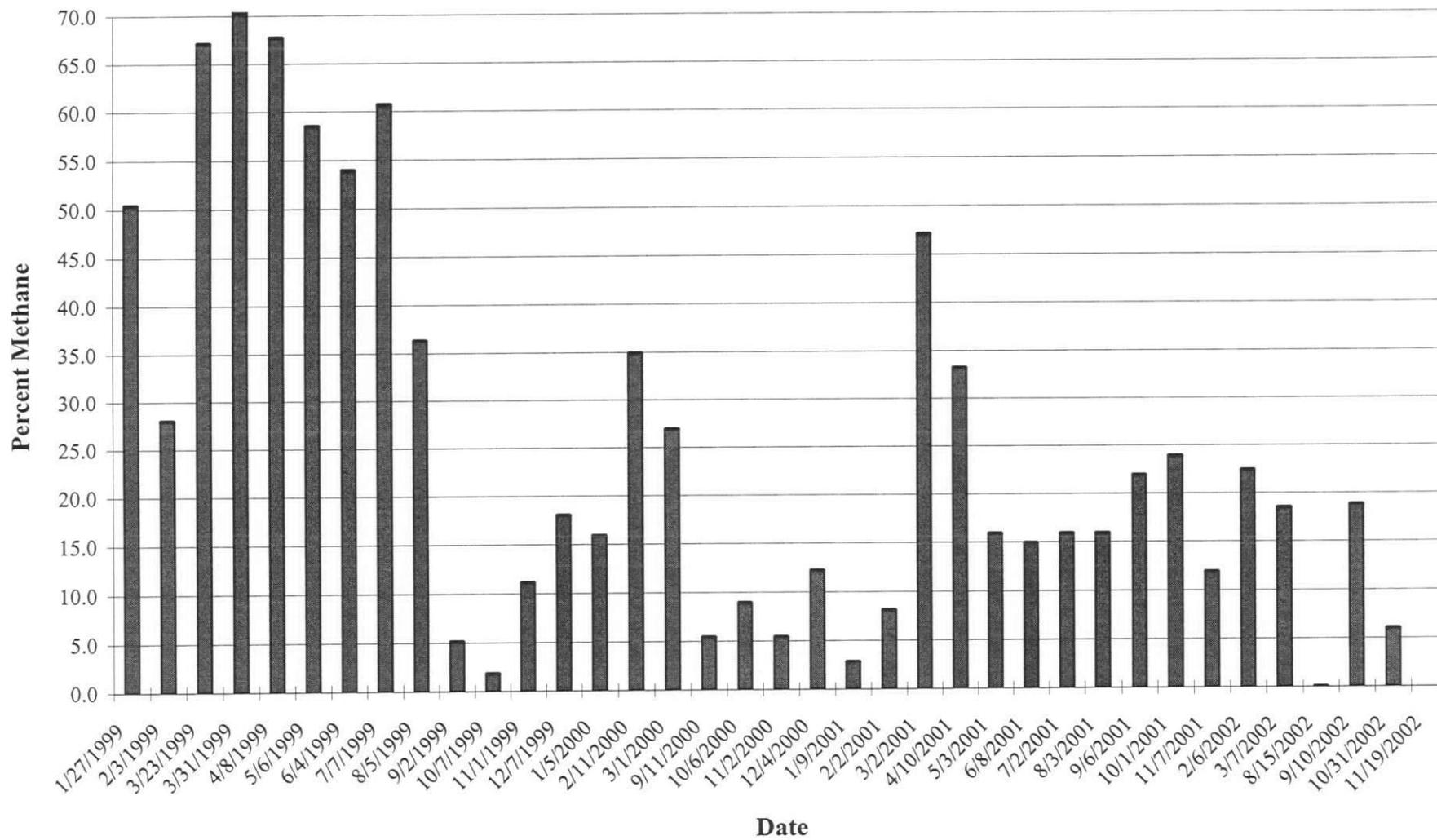


Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 6	1/27/1999	16:00	>1000	50.5	25.2	1.9	Not measured	
	2/3/1999	14:07	562	28.1	23.1	1.7	Not measured	
	3/23/1999	16:17	>1000 @ 19 seconds	67.2	42.9	0.9	Not measured	Over 1000% LEL in 19 seconds - peak reading recorded at 60 seconds
	3/25/1999	15:55					0.00	GP-6 checked twice - no pressure or vacuum
	3/31/1999	16:10	>1000 @ 26 seconds	81.4	37.7	0.1	0.00	Readings recorded at 180 seconds
	4/8/1999	12:50	>1000 @ 20 seconds	67.8	44.0	0.1	0.00	Readings recorded at 180 seconds
	5/6/1999	12:50	>1000 @ 36 seconds	58.6	34.4	0.0	0.00	Readings recorded at 180 seconds
	6/4/1999	11:05	>1000 @ 37 seconds	54.0	33.1	0.0	0.00	Readings recorded at 180 seconds
	7/7/1999	12:20	>1000 @ 60 seconds	60.8	38.8	0.2	0.00	Readings recorded at 180 seconds
	8/5/1999	13:00	728	36.4	30.7	0.2	0.00	Readings recorded after 2 purge volumes
	9/2/1999	15:30	104	5.2	17.6	3.3	0.00	Readings recorded after 2 purge volumes
	10/7/1999	12:00	38	1.9	15.4	5.3	0.00	Readings recorded after 2 purge volumes
	11/1/1999	13:55	224	11.2	19.9	0.1	0.00	Readings recorded after 2 purge volumes
	12/7/1999	12:25	362	18.1	22.8	0.0	0.00	Readings recorded after 2 purge volumes
	1/5/2000	14:50	320	16.0	23.1	1.7	0.00	Readings recorded after 2 purge volumes
	2/11/2000	10:30	700	35.0	23.8	1.4	0.00	Readings recorded after 2 purge volumes
	3/1/2000	11:00	540	27.0	17.6	7.5	0.00	Readings recorded after 2 purge volumes
	9/11/2000	14:45	110	5.5	18.6	2.3	0.00	Readings recorded after 2 purge volumes
	10/6/2000	13:20	180	9.0	21.3	0.5	0.00	Readings recorded after 2 purge volumes
	11/2/2000	12:10	110	5.5	17.3	6.1	0.00	Readings recorded after 2 purge volumes
	12/4/2000	10:30	246	12.3	19.4	1.4	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:42	58	2.9	12.9	11.5	0.00	Readings recorded after 2 purge volumes
	2/2/2001	11:00	164	8.2	18.0	1.6	0.00	Readings recorded after 2 purge volumes
	3/2/2001	10:15	944	47.2	25.7	0.0	0.00	Readings recorded after 2 purge volumes
	4/10/2001	11:55	666	33.3	26.4	0.4	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:15	320	16.0	24.8	0.6	0.00	Readings recorded after 2 purge volumes
	6/8/2001	10:15	300	15.0	na	2.7	0.00	Readings recorded after 2 purge volumes
	7/2/2001	11:00	320	16.0	22.3	0.4	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:40	320	16.0	20.0	7.2	0.00	Readings recorded after 2 purge volumes
	9/6/2001	11:15	440	22.0	24.8	1.7	0.00	Readings recorded after 2 purge volumes
	10/1/2001	10:40	480	24.0	24.1	0.7	0.00	Readings recorded after 2 purge volumes
	11/7/2001	10:25	240	12.0	23.0	0.8	0.00	Readings recorded after 2 purge volumes
	2/6/2002	11:15	450	22.5	17.2	0.6	0.00	Readings recorded after 2 purge volumes
3/7/2002	11:16	372	18.6	18.9	0.6	0.00	Readings recorded after 2 purge volumes	
8/15/2002	15:23	2	0.1	12.8	8.1	0.00	Readings recorded after 2 purge volumes	
9/10/2002	11:13	378	18.9	22.5	0.0	0.00	Readings recorded after 2 purge volumes	
10/31/2002	13:58	122	6.1	23.3	0.2	0.00	Readings recorded after 2 purge volumes	
11/19/2002	13:35	0	0.0	15.8	5.4	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-6



**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 7	1/27/1999	16:05	0	0.0	0.9	19.8	Not measured	
	2/3/1999	14:00	0	0.0	1.0	18.6	Not measured	
	3/23/1999	16:08	Did not record	0.0	2.2	18.5	Not measured	Steady at 60 seconds
	3/25/1999						0.00	No pressure or vacuum
	4/1/1999	9:45	Did not record	0.0	0.20 Peak, 0.00 stable	20.5	0.00	Readings recorded at 120 seconds
	4/8/1999	13:40	Peaked @ 6 @ 20 seconds	0.0	3.8	16.2	0.00	Readings recorded at 180 seconds
	5/6/1999	13:40	Peaked @ 60 @ 20 seconds	3.0	0.0	19.5	0.06	Readings recorded at 180 seconds
	6/4/1999	11:45	14	0.7	5.8	13.0	0.00	Readings recorded at 180 seconds
	7/7/1999	13:10	6	0.3	7.6	13.2	0.00	Readings recorded at 180 seconds
	8/5/1999	13:10	6	0.3	9.9	11.5	0.00	Readings recorded after 2 purge volumes
	9/2/1999	16:30	Peaked @ 18 @ 25 secs, 0 @ 204 seconds	0.0	6.7	13.6	0.00	Readings recorded after 2 purge volumes
	10/7/1999	12:40	Peaked @ 12 @ 25 seconds	0.0	7.7	13.0	0.00	Readings recorded after 2 purge volumes
	11/1/1999	14:30	2	0.1	6.4	14.9	0.00	Readings recorded after 2 purge volumes
	12/7/1999	13:10	Peaked @ 56 @ 20 seconds	0.0	1.7	18.8	0.00	Readings recorded after 2 purge volumes
	1/5/2000	15:20	0	0.0	0.0	20.1	0.00	Readings recorded after 2 purge volumes
	2/11/2000	11:50	0	0.0	1.0	18.0	0.00	Readings recorded after 2 purge volumes
	3/1/2000	12:05	0	0.0	0.5	21.6	0.00	Readings recorded after 2 purge volumes
	9/11/2000	15:25	0	0.0	1.0	19.2	0.00	Readings recorded after 2 purge volumes
	10/6/2000	14:05	0	0.0	2.1	18.3	0.00	Readings recorded after 2 purge volumes
	11/2/2000	12:15	6	0.3	1.7	18.2	0.00	Readings recorded after 2 purge volumes
	12/4/2000	10:40	0	0.0	1.2	18.8	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:25	0	0.0	0.2	19.6	0.00	Readings recorded after 2 purge volumes
	2/2/2001	11:05	0	0.0	1.8	18.9	0.00	Readings recorded after 2 purge volumes
	3/2/2001	10:40	0	0.0	1.3	18.4	0.00	Readings recorded after 2 purge volumes
	4/10/2001	11:45	0	0.0	0.7	20.1	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:40	0	0.0	4.9	15.5	0.00	Readings recorded after 2 purge volumes
	6/8/2001	10:45	0	0.0	na	16.2	0.00	Readings recorded after 2 purge volumes
	7/2/2001	11:30	4	0.2	2.5	15.3	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:15	0	0.0	7.6	10.9	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:10	0	0.0	7.5	10.5	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:30	0	0.0	6.0	15.2	0.00	Readings recorded after 2 purge volumes
	11/7/2001	8:50	0	0.0	4.8	16.8	0.00	Readings recorded after 2 purge volumes
	6/6/2002	11:37	0	0.0	7.1	13.6	0.00	Readings recorded after 2 purge volumes
8/15/2002	15:30	0	0.0	5.4	15.8	0.00	Readings recorded after 2 purge volumes	
10/31/2002	14:00	0	0.0	7.2	13.5	0.00	Readings recorded after 2 purge volumes	
11/19/2002	13:40	0	0.0	2.8	17.4	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure / Vacuum (inches of water)	Notes
Gas Probe 8	1/27/1999	16:15	0	0.0	1.4	19.3	Not measured	
	2/3/1999	13:37	0	0.0	2.4	15.6	Not measured	
	3/23/1999	16:22	26/ 0	1.3/ 0.0	0.4	20.6	Not measured	Peak reading at 20 seconds - drops back to 0 methane by 45 seconds
	3/25/1999							Did not check
	4/1/1999	10:10	Did not record	2.2@20seconds	2.0	11.3	0.00	Readings recorded at 180 seconds
	4/8/1999	14:00	Peaked @ 18 @ 11 seconds	0.0	0.0	20.6	0.00	Readings recorded at 180 seconds
	5/6/1999	14:00	2	0.1	3.2	9.2	0.00	Readings recorded at 180 seconds
	6/4/1999	12:05	Peaked @ 108 @ 20 seconds, 12 @ 180 seconds	0.6	0.3	19.7	0.00	Readings recorded at 180 seconds
	7/7/1999	13:20	6	0.3	1.8	15.4	0.00	Readings recorded at 180 seconds
	8/5/1999	13:30	6	0.3	0.0	20.9	0.00	Readings recorded after 2 purge volumes
	9/2/1999	17:00	0	0.0	0.0	19.7	0.00	Readings recorded after 2 purge volumes
	10/7/1999	13:00	Peaked @ 6 @ 20 seconds	0.0	3.5	13.0	0.00	Readings recorded after 2 purge volumes
	11/1/1999	14:40	2	0.1	3.6	14.3	0.00	Readings recorded after 2 purge volumes
	12/7/1999	13:15	0	0.0	4.8	12.1	0.00	Readings recorded after 2 purge volumes
	1/5/2000	15:30	2	0.1	2.9	16.0	0.00	Readings recorded after 2 purge volumes
	2/11/2000	13:35	0	0.0	0.0	20.2	0.00	Readings recorded after 2 purge volumes
	3/1/2000	11:55	0	0.0	0.0	22.8	0.00	Readings recorded after 2 purge volumes
	9/11/2000	15:30	0	0.0	0.1	20.5	0.00	Readings recorded after 2 purge volumes
	10/6/2000	14:10	0	0.0	0.0	20.1	0.00	Readings recorded after 2 purge volumes
	11/2/2000	12:20	2	0.1	1.0	18.6	0.00	Readings recorded after 2 purge volumes
	12/4/2000	10:45	0	0.0	4.0	14.5	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:30	0	0.0	0.5	19.5	0.00	Readings recorded after 2 purge volumes
	2/2/2001	11:15	0	0.0	0.4	20.2	0.00	Readings recorded after 2 purge volumes
	3/2/2001	10:55	0	0.0	1.8	16.7	0.00	Readings recorded after 2 purge volumes
	4/10/2001	11:30	0	0.0	0.0	20.6	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:45	0	0.0	0.3	19.6	0.00	Readings recorded after 2 purge volumes
	6/8/2001	10:50	0	0.0	na	18.1	0.00	Readings recorded after 2 purge volumes
	7/2/2001	11:35	0	0.0	0.0	19.7	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:05	0	0.0	2.3	16.3	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:05	0	0.0	0.9	19.6	0.00	Readings recorded after 2 purge volumes
10/1/2001	9:20	0	0.0	2.8	16.8	0.00	Readings recorded after 2 purge volumes	
11/7/2001	8:45	0	0.0	3.0	15.7	0.00	Readings recorded after 2 purge volumes	
6/6/2002	11:54	0	0.0	2.0	15.1	0.00	Readings recorded after 2 purge volumes	
8/15/2002	15:42	0	0.0	0.3	20.6	0.00	Readings recorded after 2 purge volumes	
10/31/2002	14:10	0	0.0	2.2	15.2	0.00	Readings recorded after 2 purge volumes	
11/19/2002	13:55	0	0.0	3.1	14.3	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 9	1/27/1999	16:25	0	0.0	0.0	20.4	Not measured	
	2/3/1999	13:33	0	0.0	0.1	20.3	Not measured	
	3/23/1999	16:30	Did not record	0.0	0.0	20.8	Not measured	60 seconds - steady
	3/25/1999							Did not check
	4/1/1999	10:20	Did not record	0.0	0.2	20.5	0.00	Stable at 120 seconds
	4/8/1999	14:10	Did not record	Peaked @ 0.2 @ 10 seconds	0.2	20.2	0.00	Readings recorded at 180 seconds
	5/6/1999	14:10	Did not record	0.0	0.7	18.5	0.00	Readings recorded at 180 seconds
	6/4/1999	12:15	12	0.6	0.3	18.4	0.00	Readings recorded at 180 seconds
	7/7/1999	13:30	4	0.2	0.5	18.9	0.00	Readings recorded at 180 seconds
	8/5/1999	13:40	0	0.0	0.7	19.1	0.00	Readings recorded after 2 purge volumes
	9/2/1999	17:10	0	0.0	0.1	18.3	0.00	Readings recorded after 2 purge volumes
	10/7/1999	13:10	0	0.0	0.1	19.0	0.00	Readings recorded after 2 purge volumes
	11/1/1999	15:00	0	0.0	0.0	19.6	0.00	Readings recorded after 2 purge volumes
	12/7/1999	13:20	0	0.0	0.1	19.5	0.00	Readings recorded after 2 purge volumes
	1/5/2000	15:35	0	0.0	0.0	19.9	0.00	Readings recorded after 2 purge volumes
	2/11/2000	11:30	0	0.0	0.1	19.9	0.00	Readings recorded after 2 purge volumes
	3/1/2000	11:50	0	0.0	0.1	22.2	0.00	Readings recorded after 2 purge volumes
	9/11/2000	15:35	0	0.0	0.0	20.8	0.00	Readings recorded after 2 purge volumes
	10/6/2000	14:15	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	11/2/2000	12:25	0	0.0	0.0	20.8	0.00	Readings recorded after 2 purge volumes
	12/4/2000	10:50	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:33	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	2/2/2001	11:20	0	0.0	0.0	20.5	0.00	Readings recorded after 2 purge volumes
	3/2/2001	11:00	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	4/10/2001	11:35	0	0.0	0.0	20.4	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:50	0	0.0	0.0	20.4	0.00	Readings recorded after 2 purge volumes
	6/8/2001	10:55	0	0.0	na	20.2	0.00	Readings recorded after 2 purge volumes
	7/2/2001	11:40	0	0.0	0.0	19.8	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:10	0	0.0	1.0	17.9	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:00	0	0.0	1.0	19.6	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:15	0	0.0	0.0	20.6	0.00	Readings recorded after 2 purge volumes
	11/7/2001	8:40	0	0.0	0.2	20.6	0.00	Readings recorded after 2 purge volumes
6/6/2002	12:00	0	0.0	0.4	19.7	0.00	Readings recorded after 2 purge volumes	
8/15/2002	15:48	0	0.0	0.5	19.2	0.00	Readings recorded after 2 purge volumes	
10/31/2002	14:15	0	0.0	0.5	18.6	0.00	Readings recorded after 2 purge volumes	
11/19/2002	14:00	0	0.0	0.1	19.8	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 10	3/17/1999	15:00	Did not record	0.0	0.0	19.8	Did not check	Reading collected during installation
	3/25/1999	14:40	Did not record	0.01 @ 20 seconds	1.4	20.3	Did not record	No pressure - peak @ 20 seconds - Did not record LEL
	4/1/1999	11:35	Did not record	0.0	0.0	20.3	0.00	Stable at 120 seconds
	4/8/1999	11:40	Did not record	0.0	Peaked @ 0.20 @ 20 seconds	20.0	0.00	Stable at 120 seconds
	5/6/1999	11:30	Did not record	Peaked @ 0.1 @ 20 seconds	0.0	19.9	0.00	Readings recorded at 180 seconds
	6/4/1999	10:10	6	0.3	0.0	20.1	0.00	Readings recorded at 180 seconds
	7/7/1999	11:10	2	0.1	0.0	20.5	0.00	Readings recorded at 180 seconds
	8/5/1999	10:50	2	0.1	0.0	20.7	0.00	Readings recorded after 2 purge volumes
	9/2/1999	14:15	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	10/7/1999	11:05	0	0.0	0.0	19.9	0.00	Readings recorded after 2 purge volumes
	11/1/1999	12:50	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	12/7/1999	11:25	0	0.0	0.0	19.8	0.00	Readings recorded after 2 purge volumes
	1/5/2000	14:20	0	0.0	0.1	20.5	0.00	Readings recorded after 2 purge volumes
	2/11/2000	9:55	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	3/1/2000	10:20	0	0.0	0.0	22.5	0.00	Readings recorded after 2 purge volumes
	9/11/2000	14:15	0	0.0	0.1	20.5	0.00	Readings recorded after 2 purge volumes
	10/6/2000	12:50	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	11/2/2000	11:25	2	0.1	0.0	20.8	0.00	Readings recorded after 2 purge volumes
	12/4/2000	10:00	0	0.0	0.1	20.0	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:00	0	0.0	0.0	20.2	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:30	0	0.0	0.0	20.4	0.00	Readings recorded after 2 purge volumes
	3/2/2001	9:40	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	4/10/2001	13:15	0	0.0	0.0	20.4	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:50	0	0.0	0.0	20.4	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:50	0	0.0	na	20.2	0.00	Readings recorded after 2 purge volumes
	7/2/2001	10:30	0	0.0	0.0	19.8	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:25	0	0.0	0.5	19.0	0.00	Readings recorded after 2 purge volumes
	9/6/2001	9:50	0	0.0	0.0	20.2	0.00	Readings recorded after 2 purge volumes
	10/1/2001	9:10	0	0.0	0.0	20.6	0.00	Readings recorded after 2 purge volumes
	11/7/2001	8:30	0	0.0	0.2	20.2	0.00	Readings recorded after 2 purge volumes
10/31/2002	16:20	0	0.0	0.0	20.4	0.00	Readings recorded after 2 purge volumes	
11/19/2002	16:35	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes	

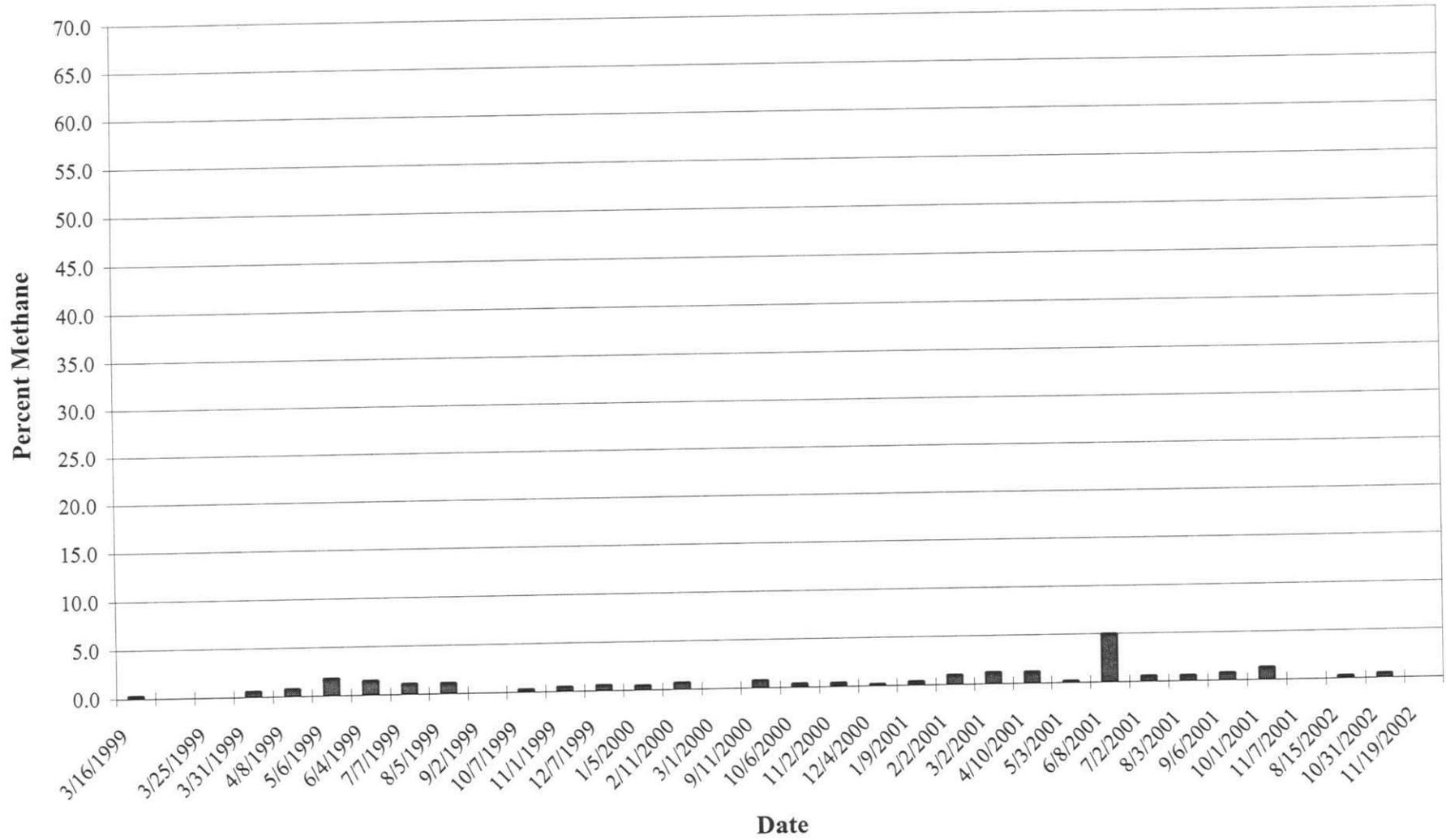
Notes: Not Measured = readings not taken
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**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 11s	3/16/1999	15:05	6	0.3	0.3	20.2	---	Reading collected during installation of the deep probe GP-11d
	3/25/1999	11:26	Did not record	0.0	0.0	20.6	0.010+/-	Readings recorded at 180 seconds
	3/31/1999	13:45	12	0.6	8.0	19.5	0.00	Readings recorded at 180 seconds
	4/8/1999	11:00	16	0.8	0.6	19.4	0.00	Readings recorded at 180 seconds
	5/6/1999	11:00	36	1.8	0.8	18.9	0.00	Readings recorded at 180 seconds
	6/4/1999	9:55	30	1.5	1.3	18.2	0.00	Readings recorded at 180 seconds
	7/7/1999	10:45	22	1.1	1.9	17.8	0.00	Readings recorded at 180 seconds
	8/5/1999	10:15	22	1.1	2.9	17.7	0.00	Readings recorded after 2 purge volumes
	9/2/1999	13:40	0	0.0	0.0	19.9	0.00	Readings recorded after 2 purge volumes
	10/7/1999	10:45	6	0.3	1.1	19.2	0.00	Readings recorded after 2 purge volumes
	11/1/1999	12:35	10	0.5	1.2	20.1	0.00	Readings recorded after 2 purge volumes
	12/7/1999	11:05	12	0.6	0.9	18.8	0.00	Readings recorded after 2 purge volumes
	1/5/2000	14:00	10	0.5	0.5	19.4	0.00	Readings recorded after 2 purge volumes
	2/11/2000	9:35	14	0.7	0.9	19.0	0.00	Readings recorded after 2 purge volumes
	3/1/2000	10:05	0	0.0	0.2	22.6	0.00	Readings recorded after 2 purge volumes
	9/11/2000	14:00	16	0.8	1.4	19.1	0.00	Readings recorded after 2 purge volumes
	10/6/2000	12:35	8	0.4	1.3	18.8	0.00	Readings recorded after 2 purge volumes
	11/2/2000	11:05	8	0.4	0.7	20.1	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:40	4	0.2	0.5	19.6	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:40	8	0.4	0.9	19.1	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:10	20	1.0	1.1	18.7	0.00	Readings recorded after 2 purge volumes
	3/2/2001	9:20	24	1.2	1.0	18.3	0.00	Readings recorded after 2 purge volumes
	4/10/2001	13:00	24	1.2	0.9	18.1	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:35	4	0.2	0.2	19.8	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:35	10	5.0	na	18.7	0.00	Readings recorded after 2 purge volumes
	7/2/2001	10:20	12	0.6	1.7	17.1	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:05	12	0.6	1.7	18.4	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:55	16	0.8	2.2	18.0	0.05	Readings recorded after 2 purge volumes
	10/1/2001	10:10	26	1.3	3.8	17.1	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:50	0	0.0	0.9	19.7	0.00	Readings recorded after 2 purge volumes
	8/15/2002	14:26	6	0.3	1.5	19.3	0.00	Readings recorded after 2 purge volumes
10/31/2002	16:05	10	0.5	2.6	17.4	0.00	Readings recorded after 2 purge volumes	
11/19/2002	16:20	0	0.0	0.3	19.8	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-11s

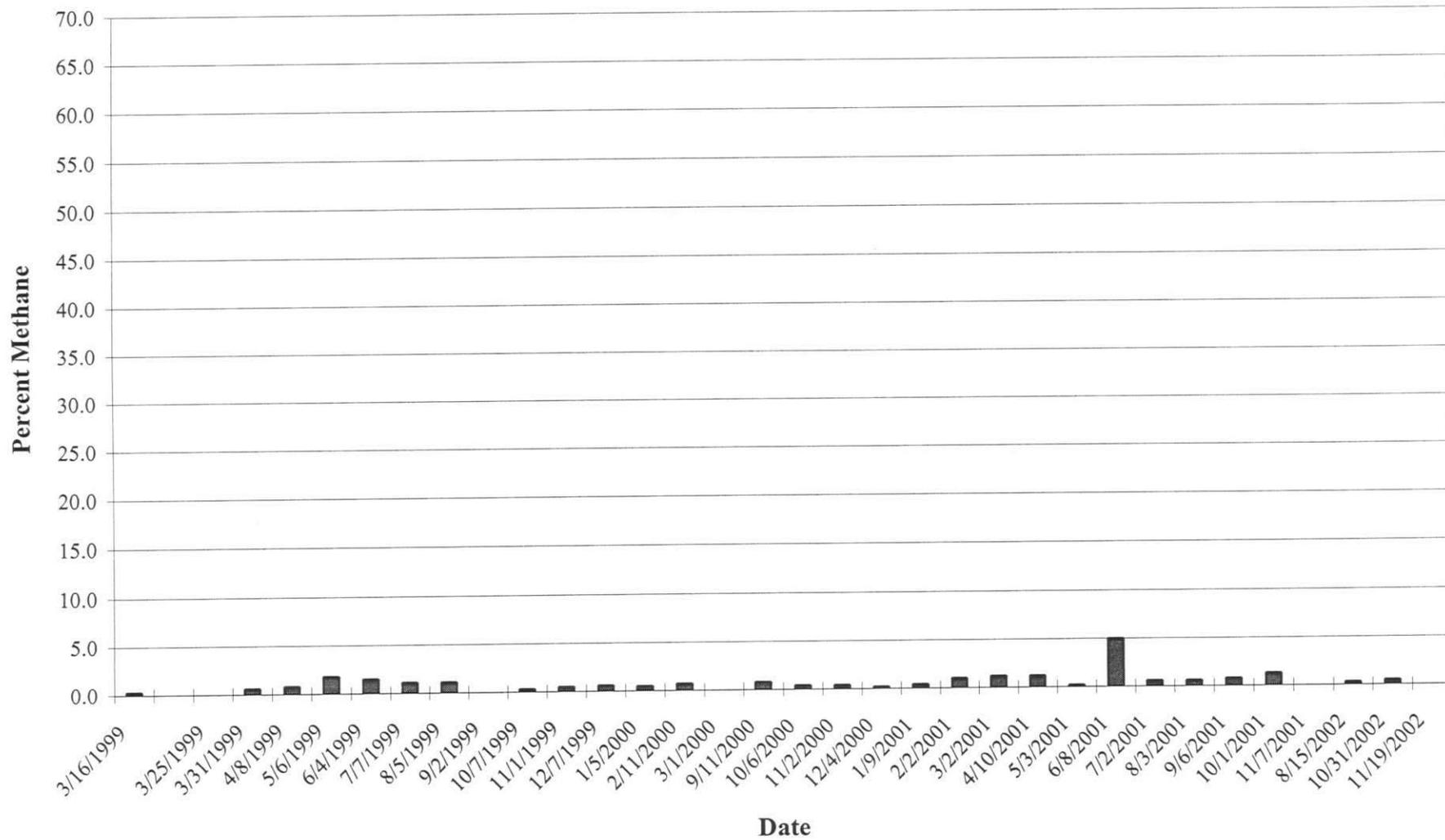


Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 11i	3/16/1999	16:30	10	0.5	0.6	20.0	---	Readings collected during installation of the deep probe GP-11d
	3/25/1999	11:15	20	1.0	0.5	19.8	0.00	LEL begins climbing at 60 seconds- 180 seconds climbing slowly
	3/31/1999	13:50	42	2.0	1.0	19.1	0.17	Readings recorded at 180 seconds
	4/8/1999	11:05	24	1.2	0.5	19.3	0.00	Readings recorded at 180 seconds
	5/6/1999	11:10	20	1.0	0.0	18.9	0.00	Readings recorded at 180 seconds
	6/4/1999	10:00	14	0.7	0.0	18.5	0.02	Readings recorded at 180 seconds
	7/7/1999	10:50	24	1.2	0.0	17.8	-0.04	Vacuum - reading recorded at 180 seconds
	8/5/1999	10:25	70	3.5	1.0	18.2	0.00	Readings recorded after 2 purge volumes
	9/2/1999	13:50	50	2.5	0.5	17.6	0.15	Readings recorded after 2 purge volumes
	10/7/1999	10:50	0	0.0	0.6	19.7	-0.01	Readings recorded after 2 purge volumes
	11/1/1999	12:40	62	3.1	1.6	18.8	0.12	Readings recorded after 2 purge volumes
	12/7/1999	11:10	0	0.0	0.5	19.4	0.30	Readings recorded after 2 purge volumes
	1/5/2000	14:05	4	0.2	0.6	19.4	0.07	Readings recorded after 2 purge volumes
	2/11/2000	9:40	8	0.4	0.9	19.2	-0.02	Readings recorded after 2 purge volumes
	3/1/2000	10:10	22	1.1	0.9	21.6	0.07	Readings recorded after 2 purge volumes
	9/11/2000	14:05	26	1.3	0.8	19.2	0.00	Readings recorded after 2 purge volumes
	10/6/2000	12:40	6	0.3	0.9	19.2	0.00	Readings recorded after 2 purge volumes
	11/2/2000	11:10	2	0.1	0.3	20.4	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:45	0	0.0	0.3	19.7	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:45	0	0.0	0.3	19.8	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:15	10	0.5	0.9	19.0	0.03	Readings recorded after 2 purge volumes
	3/2/2001	9:25	40	2.0	1.5	17.7	0.00	Readings recorded after 2 purge volumes
	4/10/2001	13:05	46	2.3	1.2	17.4	0.09	Readings recorded after 2 purge volumes
	5/3/2001	11:40	0	0.0	0.1	20.2	0.04	Readings recorded after 2 purge volumes
	6/8/2001	9:40	6	3.0	na	19.2	0.03	Readings recorded after 2 purge volumes
	7/2/2001	10:23	0	0.0	1.6	17.7	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:10	4	0.2	0.8	19.2	0.00	Readings recorded after 2 purge volumes
	9/6/2001	11:00	8	0.4	1.6	19.2	0.03	Readings recorded after 2 purge volumes
	10/1/2001	10:15	4	0.2	1.8	19.2	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:55	0	0.0	0.2	20.3	0.00	Readings recorded after 2 purge volumes
8/15/2002	14:30	0	0.0	0.4	20.5	0.04	Readings recorded after 2 purge volumes	
10/31/2002	16:07	0	0.0	0.3	20.2	-0.05	Readings recorded after 2 purge volumes	
11/19/2002	16:25	16	0.8	0.1	17.1	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-11i

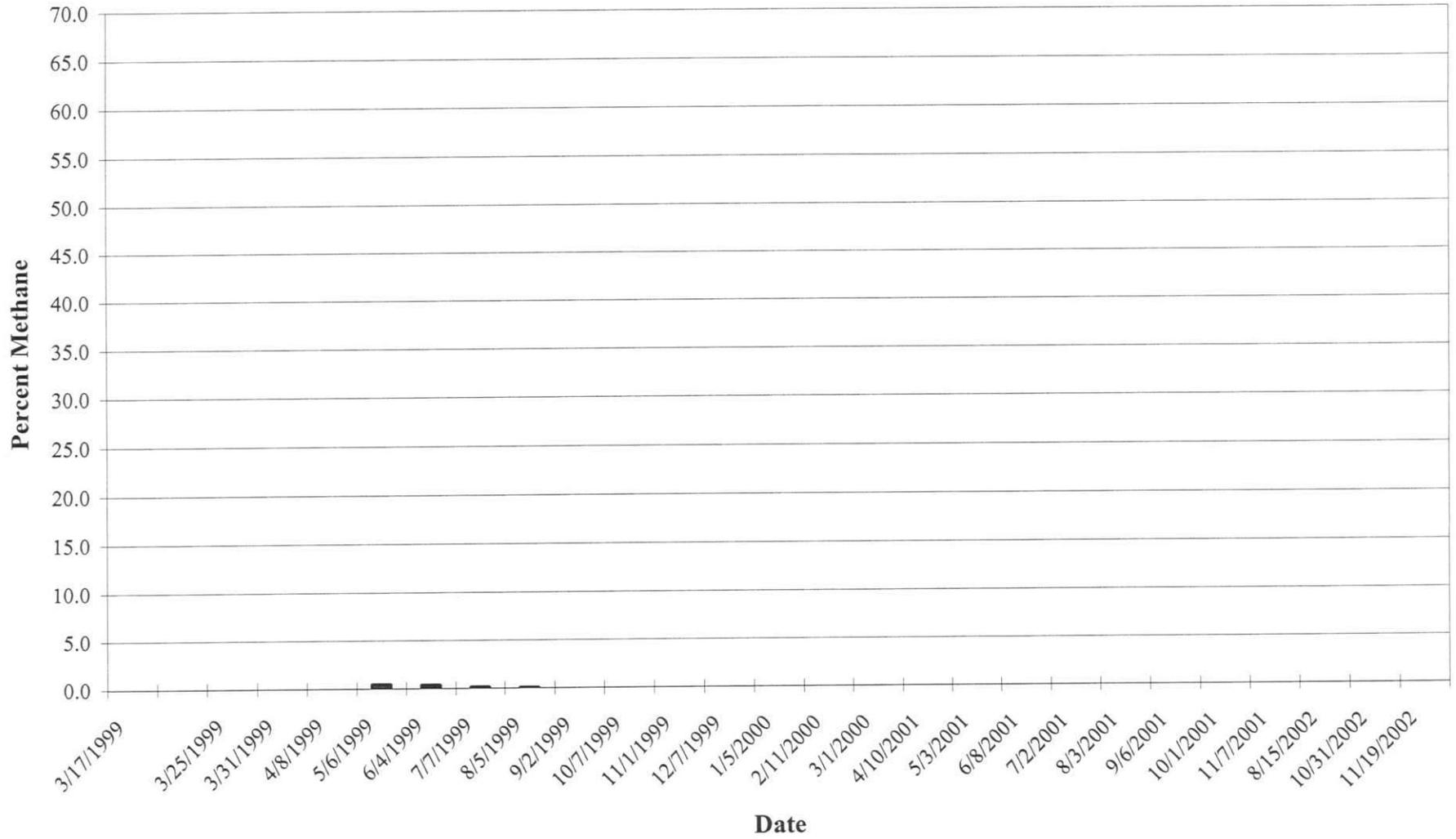


Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure / Vacuum (inches of water)	Notes
Gas Probe 11d	3/17/1999	8:30	0	0.0	0.2	20.9	Not Measured	Readings collected during installation of the deep probe GP-11d
	3/25/1999	11:03	0	0.0	0.0	20.8	-0.02	Vacuum - reading recorded at 180 seconds
	3/31/1999	13:55	Did not record	0.0	0.1	20.6	0.25	Readings recorded at 180 seconds
	4/8/1999	11:15	Did not record	0.0	0.0	20.6	0.00	Readings recorded at 180 seconds
	5/6/1999	11:20	10	0.5	0.0	20.2	0.13	Readings recorded at 180 seconds
	6/4/1999	10:05	8	0.4	0.0	20.4	0.00	Readings recorded at 180 seconds
	7/7/1999	10:55	4	0.2	0.0	20.9	-0.03	Vacuum - readings recorded at 180 seconds
	8/5/1999	10:35	2	0.1	0.0	20.6	0.00	Readings recorded after 2 purge volumes
	9/2/1999	14:00	0	0.0	0.0	19.8	0.10	Readings recorded after 2 purge volumes
	10/7/1999	10:55	0	0.0	0.0	20.2	-0.01	Readings recorded after 2 purge volumes
	11/1/1999	12:45	0	0.0	0.0	21.0	0.12	Readings recorded after 2 purge volumes
	12/7/1999	11:15	0	0.0	0.0	19.8	0.00	Readings recorded after 2 purge volumes
	1/5/2000	14:10	0	0.0	0.0	20.1	0.06	Readings recorded after 2 purge volumes
	2/11/2000	9:45	0	0.0	0.0	20.1	-0.02	Readings recorded after 2 purge volumes
	3/1/2000	10:15	0	0.0	0.1	22.7	0.11	Readings recorded after 2 purge volumes
	9/11/2000	14:10	0	0.0	0.0	20.5	0.10	Readings recorded after 2 purge volumes
	10/6/2000	12:50	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	11/2/2000	11:15	2	0.1	0.0	20.9	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:50	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:50	0	0.0	0.0	20.1	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:20	0	0.0	0.0	20.5	0.00	Readings recorded after 2 purge volumes
	3/2/2001	9:30	0	0.0	0.0	20.2	0.00	Readings recorded after 2 purge volumes
	4/10/2001	13:10	0	0.0	0.2	19.8	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:45	0	0.0	0.0	20.5	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:45	0	0.0	na	20.0	0.00	Readings recorded after 2 purge volumes
	7/2/2001	10:25	0	0.0	0.0	19.3	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:15	0	0.0	0.2	19.8	0.00	Readings recorded after 2 purge volumes
	9/6/2001	11:05	0	0.0	0.4	19.0	0.05	Readings recorded after 2 purge volumes
	10/1/2001	10:20	0	0.0	0.0	20.4	0.00	Readings recorded after 2 purge volumes
	11/7/2001	10:00	0	0.0	0.2	20.4	0.00	Readings recorded after 2 purge volumes
	8/15/2002	14:40	0	0.0	0.0	20.8	0.00	Readings recorded after 2 purge volumes
	10/31/2002	16:10	0	0.0	0.0	20.5	0.00	Readings recorded after 2 purge volumes
11/19/2002	16:27	0	0.0	0.0	19.9	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
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Percent Methane in GP-11d



Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 12s	3/17/1999	9:45	0	0.0	0.0	20.0	Did not check	Installed on 3/16/99
	3/25/1999	14:55	0	0.0	0.0	20.5	Did not check	Readings recorded at 120 seconds - very steady
	4/1/1999	11:50	Did not record	0.0	0.10 @ 60 seconds	20.5	0.00	Readings recorded at 180 seconds
	4/8/1999	10:40	Did not record	0.0	0.0	20.6	0.00	Stable at 120 seconds
	5/6/1999	10:40	2	0.1	0.0	20.2	0.00	Readings recorded at 180 seconds
	6/4/1999	9:35	4	0.2	0.0	20.5	0.00	Readings recorded at 180 seconds
	7/7/1999	10:30	2	0.1	0.0	20.7	0.00	Readings recorded at 180 seconds
	8/5/1999	9:55	2	0.1	0.0	20.6	0.00	Readings recorded after 2 purge volumes
	9/2/1999	13:10	0	0.0	0.8	18.7	0.00	Readings recorded after 2 purge volumes
	10/7/1999	10:30	0	0.0	0.8	19.5	0.00	Readings recorded after 2 purge volumes
	11/1/1999	12:20	0	0.0	1.3	20.3	0.00	Readings recorded after 2 purge volumes
	12/7/1999	10:50	0	0.0	0.6	19.2	0.00	Readings recorded after 2 purge volumes
	1/5/2000	13:50	0	0.0	0.1	19.9	0.00	Readings recorded after 2 purge volumes
	2/11/2000	9:20	0	0.0	0.7	19.0	0.00	Readings recorded after 2 purge volumes
	3/1/2000	9:55	0	0.0	0.1	22.9	0.00	Readings recorded after 2 purge volumes
	9/11/2000	13:50	0	0.0	1.0	19.0	0.00	Readings recorded after 2 purge volumes
	10/6/2000	12:25	0	0.0	1.4	18.8	0.00	Readings recorded after 2 purge volumes
	11/2/2000	10:50	2	0.1	0.6	20.4	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:30	0	0.0	0.6	19.4	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:30	0	0.0	0.2	19.8	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:00	0	0.0	0.3	19.8	0.00	Readings recorded after 2 purge volumes
	3/2/2001	9:05	0	0.0	0.2	19.4	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:40	0	0.0	0.3	18.9	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:15	0	0.0	0.1	20.3	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:25	0	0.0	na	19.5	0.00	Readings recorded after 2 purge volumes
	7/2/2001	10:00	0	0.0	0.5	18.9	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:45	0	0.0	1.3	18.4	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:45	0	0.0	0.0	20.2	0.00	Readings recorded after 2 purge volumes
	10/1/2001	10:00	0	0.0	0.1	19.2	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:40	0	0.0	0.6	20.1	0.00	Readings recorded after 2 purge volumes
8/15/2002	14:15	0	0.0	1.3	19.5	0.00	Readings recorded after 2 purge volumes	
10/31/2002	15:45	0	0.0	1.4	18.0	0.00	Readings recorded after 2 purge volumes	
11/19/2002	16:00	0	0.0	0.1	20.0	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 12d	3/17/1999	9:50	0	0.0	0.4	19.7	Did not check	Installed on 3/16/99
	3/25/1999	14:50	0	0.0	0.06 @ 10seconds, 0.02	19.2	Did not check	Readings recorded at 180 seconds
	4/1/1999	11:55	Did not record	0.0	0.4	19.2	0.30	Readings recorded at 180 seconds
	4/8/1999	10:55	Did not record	0.0	0.6	18.7	-0.30	Vacuum - readings stable at 120 seconds
	5/6/1999	10:50	Did not record	0.0	0.1	19.3	0.00	Readings recorded at 180 seconds
	6/4/1999	9:45	4	0.2	0.1	19.6	0.00	Readings recorded at 180 seconds
	7/7/1999	10:35	2	0.1	0.0	20.3	0.00	Readings recorded at 180 seconds
	8/5/1999	10:05	2	0.1	0.5	19.1	-0.01	Readings recorded after 2 purge volumes
	9/2/1999	13:20	0	0.0	0.1	18.2	0.10	Readings recorded after 2 purge volumes
	10/7/1999	10:40	0	0.0	0.3	19.4	0.00	Readings recorded after 2 purge volumes
	11/1/1999	12:25	0	0.0	1.0	18.5	0.00	Readings recorded after 2 purge volumes
	12/7/1999	11:00	0	0.0	0.0	19.5	0.00	Readings recorded after 2 purge volumes
	1/5/2000	13:55	0	0.0	1.0	17.4	0.00	Readings recorded after 2 purge volumes
	2/11/2000	9:25	0	0.0	0.0	20.0	0.00	Readings recorded after 2 purge volumes
	3/1/2000	10:00	0	0.0	0.1	22.8	0.00	Readings recorded after 2 purge volumes
	9/11/2000	13:55	0	0.0	0.6	19.5	0.00	Readings recorded after 2 purge volumes
	10/6/2000	12:30	0	0.0	0.7	19.2	0.00	Readings recorded after 2 purge volumes
	11/2/2000	10:55	2	0.1	0.0	20.7	0.00	Readings recorded after 2 purge volumes
	12/4/2000	9:35	0	0.0	0.3	20.0	0.00	Readings recorded after 2 purge volumes
	1/9/2001	9:35	0	0.0	0.1	20.0	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:05	0	0.0	1.0	16.8	-0.03	Readings recorded after 2 purge volumes
	3/2/2001	9:10	0	0.0	1.2	16.0	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:45	0	0.0	0.5	19.3	0.00	Readings recorded after 2 purge volumes
	5/3/2001	11:20	0	0.0	0.0	20.2	0.00	Readings recorded after 2 purge volumes
	6/8/2001	9:30	0	0.0	na	20.1	0.00	Readings recorded after 2 purge volumes
	7/2/2001	0:00	0	0.0	0.1	19.8	0.00	Readings recorded after 2 purge volumes
	8/3/2001	9:50	0	0.0	0.8	19.2	0.00	Readings recorded after 2 purge volumes
	9/6/2001	10:50	0	0.0	0.0	20.4	0.00	Readings recorded after 2 purge volumes
	10/1/2001	10:05	0	0.0	0.0	20.2	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:45	0	0.0	0.4	20.2	0.00	Readings recorded after 2 purge volumes
8/15/2002	14:18	0	0.0	0.5	20.2	0.00	Readings recorded after 2 purge volumes	
10/31/2002	15:47	0	0.0	0.3	20.3	0.00	Readings recorded after 2 purge volumes	
11/19/2002	16:05	0	0.0	0.1	20.1	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 13s	3/16/1999	8:00	0	0.0	0.2	20.6	Did not check	Installed on 3/15/99
	3/23/1999	15:45	0	0.0	0.0	20.6	Not measured	120 seconds
	3/25/1999	15:40					0.04	Pressure
	3/31/1999	14:50	Did not record	0.0	0.5	20.0	0.01	Readings recorded at 180 seconds
	4/8/1999	12:10	Did not record	Peaked @ 0.5 @ 5 seconds	0.3	20.1	0.06	Readings recorded at 180 seconds
	5/6/1999	12:25	4	0.2	0.5	19.5	0.00	Readings recorded at 180 seconds
	6/4/1999	10:25	8	0.4	0.6	19.3	0.04	Readings recorded at 180 seconds
	7/7/1999	11:45	2	0.1	0.8	19.2	0.00	Readings recorded at 180 seconds
	8/5/1999	11:30	2	0.1	1.5	18.8	0.02	Readings recorded after 2 purge volumes
	9/2/1999	14:50	0	0.0	0.7	18.8	0.00	Readings recorded after 2 purge volumes
	10/7/1999	11:20	0	0.0	0.8	19.3	0.01	Readings recorded after 2 purge volumes
	11/1/1999	13:15	0	0.0	0.9	20.5	0.05	Readings recorded after 2 purge volumes
	12/7/1999	11:45	0	0.0	0.5	19.5	0.30	Readings recorded after 2 purge volumes
	1/5/2000	14:30	2	0.1	0.5	19.7	0.00	Readings recorded after 2 purge volumes
	2/11/2000	10:05	0	0.0	0.2	19.8	0.00	Readings recorded after 2 purge volumes
	3/10/2000	10:30	0	0.0	0.1	22.7	0.00	Readings recorded after 2 purge volumes
	9/11/2000	14:25	0	0.0	0.2	20.2	0.03	Readings recorded after 2 purge volumes
	10/6/2000	13:00	0	0.0	0.3	19.8	0.00	Readings recorded after 2 purge volumes
	11/2/2000	11:40	0	0.0	0.0	20.8	0.03	Readings recorded after 2 purge volumes
	12/4/2000	10:10	0	0.0	0.1	20.0	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:10	0	0.0	0.0	19.8	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:40	0	0.0	0.4	19.8	0.00	Readings recorded after 2 purge volumes
	3/2/2001	9:50	0	0.0	0.2	19.6	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:05	0	0.0	0.0	20.3	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:00	0	0.0	0.0	20.4	0.02	Readings recorded after 2 purge volumes
	6/8/2001	9:55	0	0.0	na	20.2	0.00	Readings recorded after 2 purge volumes
	7/2/2001	10:40	0	0.0	0.0	19.4	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:20	0	0.0	0.8	19.4	0.00	Readings recorded after 2 purge volumes
	9/6/2001	9:40	0	0.0	0.0	20.1	0.00	Readings recorded after 2 purge volumes
	10/1/2001	10:25	0	0.0	0.4	20.3	0.00	Readings recorded after 2 purge volumes
	11/7/2001	10:05	0	0.0	1.1	19.7	0.01	Readings recorded after 2 purge volumes
	6/6/2002	10:56	0	0.0	0.7	20.4	0.00	Readings recorded after 2 purge volumes
8/15/2002	15:00	0	0.0	1.1	20.1	0.00	Readings recorded after 2 purge volumes	
10/31/2002	14:22	0	0.0	0.6	19.6	0.00	Readings recorded after 2 purge volumes	
11/19/2002	14:35	0	0.0	0.3	19.4	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 13d	3/16/1999	8:05	0	0.0	0.0	20.9	Did not check	installed on 3/15/99
	3/23/1999	15:48	0	0.0	0.1	20.4	Not measured	120 seconds
	3/25/1999	15:50					0.17	Pressure
	3/31/1999	14:45	Did not record	0.0	0.3	20.2	0.06	Readings recorded at 180 seconds, DTW reading taken 4/1/99 = 32.25' TOC
	4/8/1999	12:15	2	0.1	0.2	20.1	0.25	Readings recorded at 180 seconds
	5/6/1999	12:20	2	0.1	0.2	19.9	0.20	Readings recorded at 180 seconds
	6/4/1999	10:30	14	0.7	0.2	19.8	0.06	Readings recorded at 180 seconds
	7/7/1999	11:50	4	0.2	0.2	20.4	0.03	Readings recorded at 180 seconds
	8/5/1999	11:45	4	0.2	0.5	19.6	0.05	Readings recorded after 2 purge volumes, DTW = 32.10 ft
	9/2/1999	15:00	0	0.0	0.1	18.6	0.10	Readings recorded after 2 purge volumes, DTW = 32.90 ft
	10/7/1999	11:30	0	0.0	0.1	19.7	0.06	Readings recorded after 2 purge volumes
	11/1/1999	13:20	0	0.0	0.7	20.2	0.15	Readings recorded after 2 purge volumes
	12/7/1999	11:50	0	0.0	0.4	19.5	0.13	Readings recorded after 2 purge volumes
	1/5/2000	14:35	4	0.2	0.6	19.4	0.03	Readings recorded after 2 purge volumes
	2/11/2000	10:10	0	0.0	0.3	19.5	0.01	Readings recorded after 2 purge volumes
	3/1/2000	10:35	0	0.0	0.5	22.1	0.12	Readings recorded after 2 purge volumes
	9/11/2000	14:30	0	0.0	0.2	20.3	0.10	Readings recorded after 2 purge volumes
	10/6/2000	13:05	0	0.0	0.1	19.9	0.00	Readings recorded after 2 purge volumes
	11/2/2000	11:45	2	0.1	0.0	20.8	0.09	Readings recorded after 2 purge volumes
	12/4/2000	10:15	0	0.0	0.1	20.1	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:15	0	0.0	0.0	19.7	0.00	Readings recorded after 2 purge volumes
	2/2/2001	10:45	0	0.0	0.3	20.1	0.00	Readings recorded after 2 purge volumes
	3/2/2001	9:55	0	0.0	0.9	18.0	0.00	Readings recorded after 2 purge volumes
	4/10/2001	12:10	0	0.0	0.0	20.6	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:05	0	0.0	0.3	19.1	0.00	Readings recorded after 2 purge volumes
	6/8/2001	10:00	0	0.0	na	20.1	0.00	Readings recorded after 2 purge volumes
	7/2/2001	10:45	0	0.0	0.0	19.6	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:25	0	0.0	1.5	16.5	0.00	Readings recorded after 2 purge volumes
	9/6/2001	9:45	0	0.0	0.0	20.2	0.00	Readings recorded after 2 purge volumes
	10/1/2001	10:30	0	0.0	0.9	18.9	0.00	Readings recorded after 2 purge volumes
11/7/2001	10:10	0	0.0	0.5	18.0	0.00	Readings recorded after 2 purge volumes	
6/6/2002	10:59	0	0.0	0.0	20.8	0.00	Readings recorded after 2 purge volumes	
8/15/2002	15:06	0	0.0	0.6	19.7	0.00	Readings recorded after 2 purge volumes	
10/31/2002	14:25	0	0.0	4.8	15.1	0.00	Readings recorded after 2 purge volumes	
11/19/2002	14:30	0	0.0	0.7	18.6	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
 NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure / Vacuum (inches of water)	Notes
Gas Probe 14s	3/16/1999	8:20	0	0.0	1.8	19.1	Did not check	Installed on 3/15/99
	3/23/1999	15:21	0	0.0	1.7	18.8	Not measured	120 seconds
	3/25/1999	13:15					-0.01	Slight vacuum
	3/31/1999	15:30	Did not record	0.0	2.4	17.3	0.00	Readings recorded at 180 seconds
	4/8/1999	13:00	Peaked @ 26 @ 20 seconds	0.0	1.9	18.8	0.00	Readings recorded at 180 seconds
	5/6/1999	13:00	Peaked @ 200 @ 25 seconds	Peaked @ 10.0 @ 25 seconds	1.6	17.9	0.00	Readings recorded at 180 seconds
	6/4/1999	11:20	14	0.7	2.1	17.6	0.00	Readings recorded at 180 seconds
	7/7/1999	12:30	Peaked @ 66 @ 40 seconds, 4 @ 180 seconds	0.2	2.9	17.5	0.00	Readings recorded at 180 seconds
	8/5/1999	12:10	4	0.2	3.0	17.7	-0.01	Readings recorded after 2 purge volumes
	9/2/1999	15:45	0	0.0	1.8	17.6	0.00	Readings recorded after 2 purge volumes
	10/7/1999	12:10	Peaked @ 6 @ 15 seconds	0.0	2.8	17.3	0.00	Readings recorded after 2 purge volumes
	11/1/1999	14:00	0	0.0	3.0	17.9	0.00	Readings recorded after 2 purge volumes
	12/7/1999	12:30	Peaked @ 24 @ 10 seconds	0.0	2.9	16.8	0.00	Readings recorded after 2 purge volumes
	1/5/2000	15:00	0	0.0	0.9	19.3	0.00	Readings recorded after 2 purge volumes
	2/11/2000	10:45	0	0.0	2.3	16.2	0.00	Readings recorded after 2 purge volumes
	3/1/2000	11:15	Peaked @ 70 @ 15 seconds	0.0	1.6	20.9	0.00	Readings recorded after 2 purge volumes
	9/11/2000	15:05	6	0.3	2.6	18.0	0.00	Readings recorded after 2 purge volumes
	10/6/2000	13:35	0	0.0	3.2	16.9	0.00	Readings recorded after 2 purge volumes
	11/2/2000	12:35	4	0.2	0.9	19.7	0.00	Readings recorded after 2 purge volumes
	12/4/2000	11:05	0	0.0	5.0	15.3	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:55	0	0.0	0.2	19.8	0.00	Readings recorded after 2 purge volumes
	2/2/2001	11:40	0	0.0	2.5	18.1	-0.03	Readings recorded after 2 purge volumes
	3/2/2001	10:20	0	0.0	0.2	19.6	0.00	Readings recorded after 2 purge volumes
	4/10/2001	11:20	0	0.0	1.7	19.6	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:20	0	0.0	0.8	19.3	0.00	Readings recorded after 2 purge volumes
	6/8/2001	10:30	0	0.0	na	20.0	0.00	Readings recorded after 2 purge volumes
	7/2/2001	11:15	0	0.0	0.5	19.1	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:45	0	0.0	3.0	17.1	0.00	Readings recorded after 2 purge volumes
	9/6/2001	9:20	0	0.0	0.1	20.0	0.00	Readings recorded after 2 purge volumes
	10/1/2001	11:00	0	0.0	0.2	20.5	0.00	Readings recorded after 2 purge volumes
11/7/2001	9:00	0	0.0	0.3	20.6	0.00	Readings recorded after 2 purge volumes	
6/6/2002	12:17	0	0.0	2.1	18.7	0.00	Readings recorded after 2 purge volumes	
8/15/2002	12:48	0	0.0	2.4	18.0	0.00	Readings recorded after 2 purge volumes	
10/31/2002	13:40	0	0.0	0.2	19.5	0.00	Readings recorded after 2 purge volumes	
11/19/2002	13:15	0	0.0	3.7	16.9	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure / Vacuum (inches of water)	Notes
Gas Probe 14d	3/16/1999	8:15	0	0.0	4.0	16.3	Did not check	Installed on 3/15/99 - reading collected at 330 seconds
	3/23/1999	14:05	0	0.0	3.8	15.5	Did not check	250 seconds
	3/25/1999	13:12					0.03	
	3/31/1999	15:35	Did not record	0.0	3.4	17.1	0.00	Readings recorded at 180 seconds, DTW reading taken 4/1/99 = 21.80' TOC
	4/8/1999	13:10	Did not record	0.0	3.0	17.2	0.00	Readings recorded at 180 seconds
	5/6/1999	13:10	2	0.1	2.5	17.7	0.00	Readings recorded at 180 seconds
	6/4/1999	11:25	12	0.6	2.4	17.4	-0.01	Vacuum, readings recorded at 180 seconds
	7/7/1999	12:35	4	0.2	2.9	17.3	0.00	Readings recorded at 180 seconds
	8/5/1999	12:20	2	0.1	4.4	15.6	0.00	Readings recorded after 2 purge volumes, DTW = 21.40 ft @ 15:15
	9/2/1999	15:55	0	0.0	4.1	15.3	0.00	Readings recorded after 2 purge volumes, DTW = 21.30 ft
	10/7/1999	12:15	0	0.0	2.5	17.6	0.00	Readings recorded after 2 purge volumes
	11/1/1999	14:10	2	0.1	5.1	16.2	0.00	Readings recorded after 2 purge volumes
	12/7/1999	12:40	0	0.0	4.8	15.7	0.00	Readings recorded after 2 purge volumes
	1/5/2000	15:05	2	0.1	1.5	18.7	0.00	Readings recorded after 2 purge volumes
	2/11/2000	10:50	0	0.0	4.4	15.1	0.00	Readings recorded after 2 purge volumes
	3/1/2000	11:20	0	0.0	2.7	19.8	0.01	Readings recorded after 2 purge volumes
	9/11/2000	15:10	8	0.4	3.7	16.5	0.00	Readings recorded after 2 purge volumes
	10/6/2000	13:40	0	0.0	3.5	16.8	0.00	Readings recorded after 2 purge volumes
	11/2/2000	12:40	4	0.2	1.4	19.3	0.00	Readings recorded after 2 purge volumes
	12/4/2000	11:10	0	0.0	2.6	16.6	0.00	Readings recorded after 2 purge volumes
	1/9/2001	11:00	0	0.0	2.1	17.7	0.00	Readings recorded after 2 purge volumes
	2/2/2001	11:45	0	0.0	4.9	15.1	-0.01	Readings recorded after 2 purge volumes
	3/2/2001	10:25	0	0.0	2.2	18.8	0.00	Readings recorded after 2 purge volumes
	4/10/2001	11:25	0	0.0	4.0	16.8	0.00	Readings recorded after 2 purge volumes
	5/3/2001	12:25	0	0.0	1.2	19.2	0.00	Readings recorded after 2 purge volumes
	6/8/2001	10:35	0	0.0	na	20.1	0.00	Readings recorded after 2 purge volumes
	7/2/2001	11:20	0	0.0	1.5	18.1	0.00	Readings recorded after 2 purge volumes
	8/3/2001	10:50	0	0.0	1.6	18.9	0.00	Readings recorded after 2 purge volumes
	9/6/2001	9:35	0	0.0	0.2	20.0	0.00	Readings recorded after 2 purge volumes
	10/1/2001	11:05	0	0.0	2.5	18.8	0.00	Readings recorded after 2 purge volumes
	11/7/2001	9:05	0	0.0	1.8	19.2	0.00	Readings recorded after 2 purge volumes
	6/6/2002	12:16	0	0.0	1.2	19.4	0.00	Readings recorded after 2 purge volumes
8/15/2002	12:45	0	0.0	0.6	19.4	0.00	Readings recorded after 2 purge volumes	
10/31/2002	13:30	0	0.0	4.8	15.1	0.00	Readings recorded after 2 purge volumes	
11/19/2002	13:10	0	0.0	3.3	16.7	0.00	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Jackson County Landfill Dillsboro, North Carolina

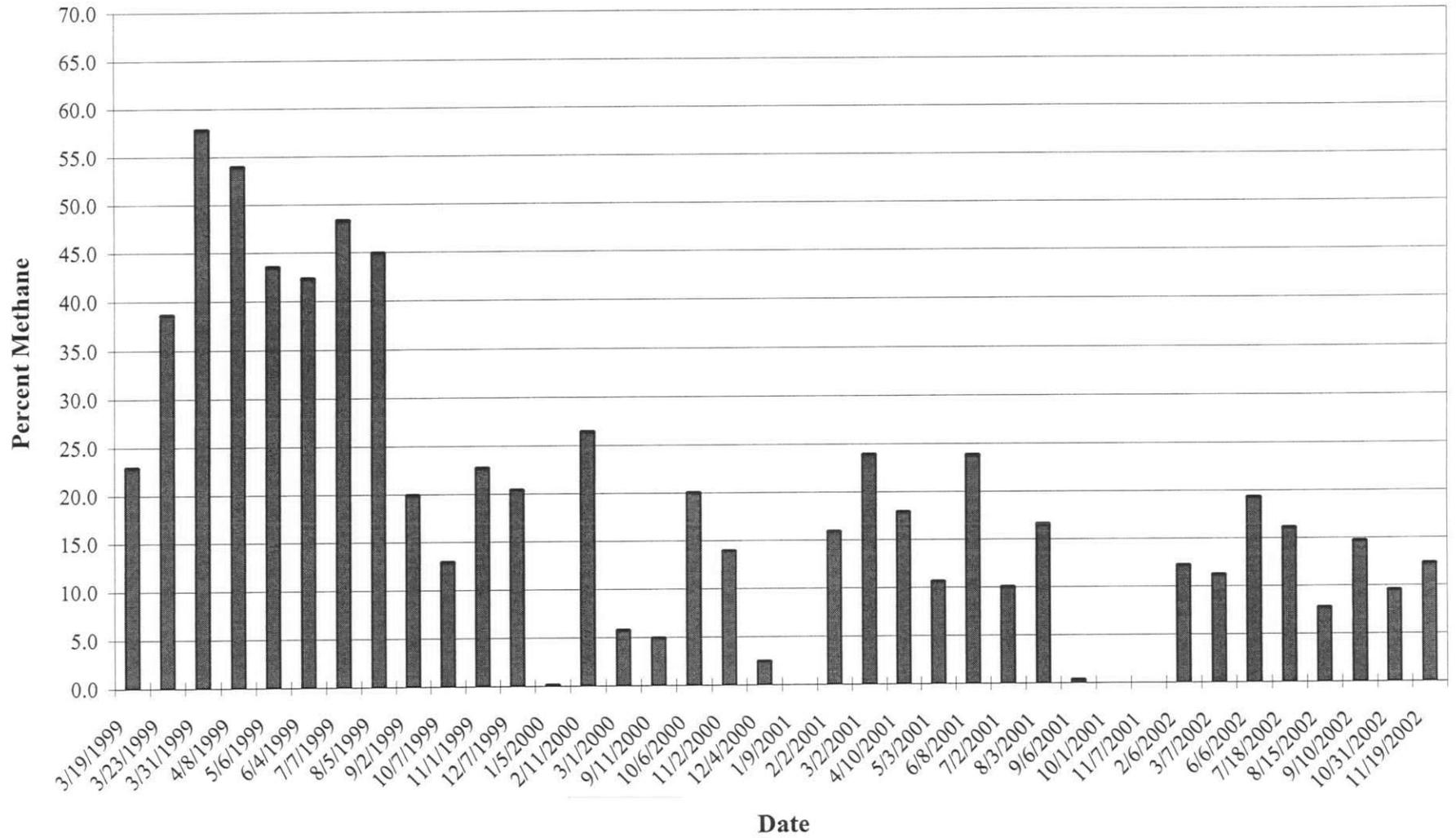
Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure / Vacuum (inches of water)	Notes
Gas Probe 15s	3/19/1999	9:40	470	23.0	11.9	10.6	-	Installed on 3/19/99 - checked one hour after installation
	3/23/1999	15:30	784	38.7	24.8	2.8	Not measured	120 seconds - methane still increasing
	3/25/1999	15:07	-	-	-	-	0.21	-
	3/31/1999	16:05	>1000 @ 20 seconds	57.9	28.6	0.0	0.22	Readings recorded at 180 seconds
	4/8/1999	13:15	>1000 @ 62 seconds	54.0	31.2	0.2	0.18	Readings recorded at 180 seconds
	5/6/1999	13:15	872	43.6	27.9	0.2	0.15	Readings recorded at 180 seconds
	6/4/1999	11:10	848	42.4	30.5	0.3	0.10	Readings recorded at 180 seconds
	7/7/1999	12:40	968	48.4	37.1	0.3	0.10	Pressure, readings recorded at 4.5 minutes
	8/5/1999	12:30	900	45.0	35.0	0.2	0.08	Readings recorded after 2 purge volumes, pressure
	9/2/1999	16:05	400	20.0	23.9	4.4	0.10	Readings recorded after 2 purge volumes, pressure
	10/7/1999	12:25	260	13.0	28.9	0.2	0.05	Readings recorded after 2 purge volumes
	11/1/1999	14:15	456	22.8	27.4	0.2	0.17	Readings recorded after 2 purge volumes
	12/7/1999	12:50	410	20.5	22.2	1.0	0.15	Readings recorded after 2 purge volumes
	1/5/2000	15:10	4	0.2	0.1	19.9	0.05	Readings recorded after 2 purge volumes
	2/11/2000	10:35	530	26.5	19.6	0.6	-0.01	Readings recorded after 2 purge volumes
	3/1/2000	11:05	Peaked @ 170 @ 20 secs, 116 stable	5.8	5.0	17.6	0.09	Readings recorded after 2 purge volumes
	9/11/2000	14:55	100	5.0	5.0	18.0	0.07	Readings recorded after 2 purge volumes
	10/6/2000	13:25	402	20.1	26.5	1.5	0.04	Readings recorded after 2 purge volumes
	11/2/2000	12:45	280	14.0	23.5	4.3	0.08	Readings recorded after 2 purge volumes
	12/4/2000	10:55	50	2.5	3.3	16.8	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:45	0	0.0	0.0	19.7	-0.20	Readings recorded after 2 purge volumes
	2/2/2001	11:25	320	16.0	16.0	2.0	0.03	Readings recorded after 2 purge volumes
	3/2/2001	10:30	480	24.0	18.6	0.8	0.01	Readings recorded after 2 purge volumes
	4/10/2001	11:10	360	18.0	18.0	0.6	0.07	Readings recorded after 2 purge volumes
	5/3/2001	12:30	204	10.7	15.9	1.0	0.08	Readings recorded after 2 purge volumes
	6/8/2001	10:20	478	23.9	na	12.1	0.15	Readings recorded after 2 purge volumes
	7/2/2001	11:05	202	10.1	20.7	2.1	0.01	Readings recorded after 2 purge volumes
	8/3/2001	10:55	334	16.7	21.4	6.1	0.10	Readings recorded after 2 purge volumes
	9/6/2001	11:30	8	0.4	0.9	19.0	0.15	Readings recorded after 2 purge volumes
	10/1/2001	10:50	0	0.0	0.2	20.4	0.02	Readings recorded after 2 purge volumes
	11/7/2001	10:30	0	0.0	0.3	20.2	0.04	Readings recorded after 2 purge volumes
	2/6/2002	11:20	246	12.3	10.8	8.5	0.00	Readings recorded after 2 purge volumes
	3/7/2002	11:38	226	11.3	14.9	3.6	0.13	Readings recorded after 2 purge volumes
6/6/2002	12:08	388	19.4	22.7	2.9	0.10	Readings recorded after 2 purge volumes	
7/18/2002	12:27	324	16.2	23.7	3.2	0.10	Readings recorded after 2 purge volumes	
8/15/2002	13:02	156	7.8	22.8	1.5	0.05	Readings recorded after 2 purge volumes	
9/10/2002	12:22	296	14.8	24.1	2.7	0.12	Readings recorded after 2 purge volumes	
10/31/2002	13:50	192	9.6	15.0	2.8	0.15	Readings recorded after 2 purge volumes	
11/19/2002	13:20	248	12.4	16.7	3.1	0.08	Readings recorded after 2 purge volumes	

Notes: Not Measured = readings not taken

Gas Readings and Plots, detail - columns.xls
NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

1/13/2003

Percent Methane in GP-15s



Jackson County Landfill Dillsboro, North Carolina

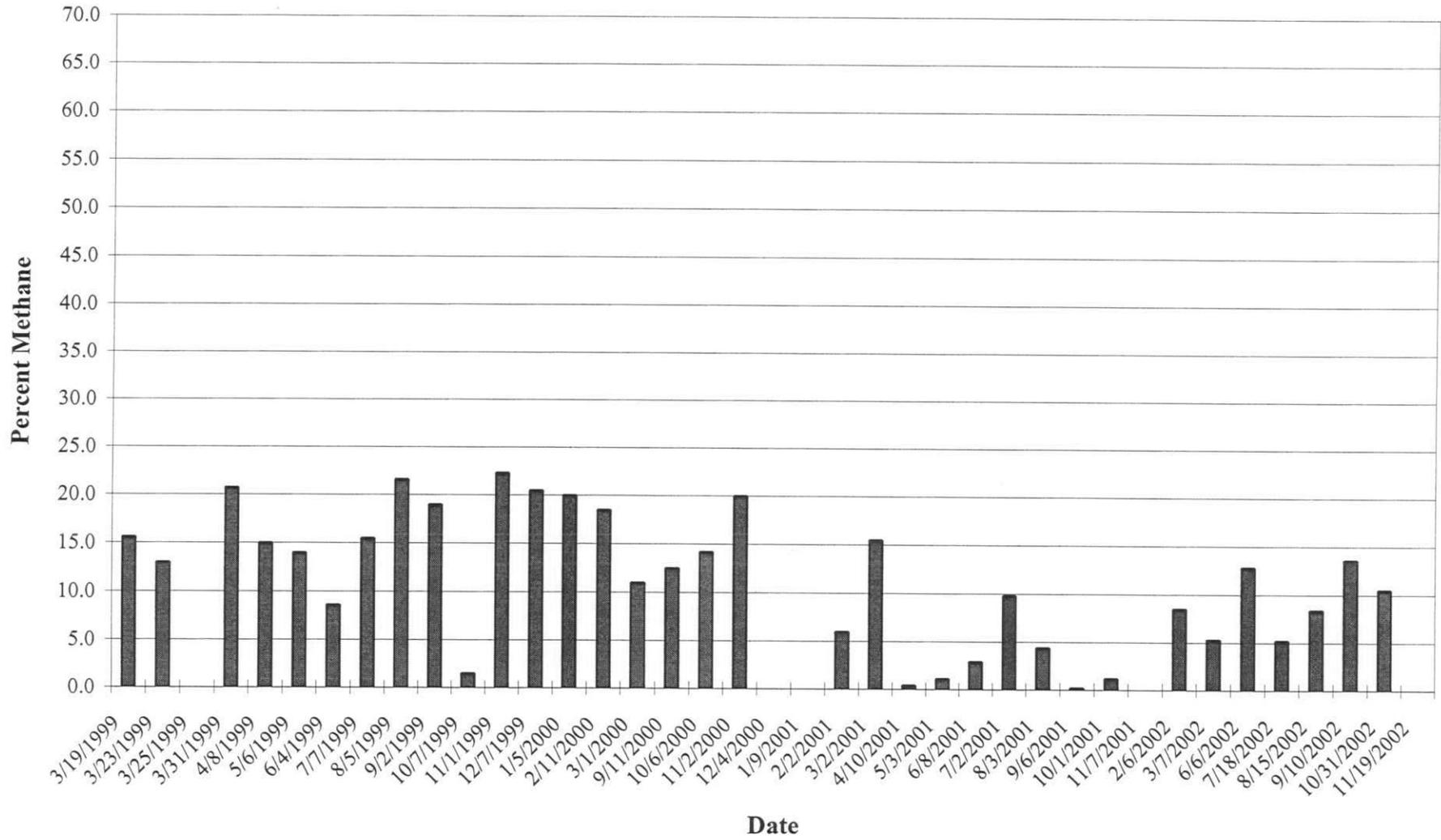
Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 15d	3/19/1999	9:30	314	15.6	1.5	7.9		Installed on 3/18/99
	3/23/1999	15:35	264	13.0	1.7	11.0	Not measured	120 seconds
	3/25/1999	15:05					0.22	24 at 120 seconds
	3/31/1999	16:00	422	20.7	13.6	3.7	0.20	Readings recorded at 180 seconds, DTW reading taken 4/1/99 = 46.28' TOC
	4/8/1999	13:20	300	15.0	12.4	6.2	0.14	Readings recorded at 180 seconds
	5/6/1999	13:20	280	14.0	10.2	6.5	0.02	Readings recorded at 180 seconds
	6/4/1999	11:15	172	8.6	5.2	12.1	0.09	Pressure, readings recorded at 180 seconds
	7/7/1999	12:50	310	15.5	9.9	6.5	0.09	Pressure, readings recorded at 180 seconds
	8/5/1999	12:40	432	21.6	14.4	0.6	0.10	Readings recorded after 2 purge volumes, DTW = 46.23 ft
	9/2/1999	16:15	380	19.0	14.1	0.8	0.14	Readings recorded after 2 purge volumes, DTW = 46.25 ft
	10/7/1999	12:35	30	1.5	1.5	17.9	0.10	Readings recorded after 2 purge volumes
	11/1/1999	14:20	446	22.3	15.5	0.5	0.20	Readings recorded after 2 purge volumes
	12/7/1999	13:00	410	20.5	15.1	1.1	0.20	Readings recorded after 2 purge volumes
	1/5/2000	15:15	400	20.0	16.0	0.5	0.06	Readings recorded after 2 purge volumes
	2/11/2000	10:40	370	18.5	15.0	0.9	-0.04	Readings recorded after 2 purge volumes
	3/1/2000	11:10	220	11.0	10.2	9.7	0.08	Readings recorded after 2 purge volumes
	9/11/2000	15:00	250	12.5	11	6.0	0.07	Readings recorded after 2 purge volumes
	10/6/2000	13:30	284	14.2	11.5	5.7	0.10	Readings recorded after 2 purge volumes
	11/2/2000	12:50	400	20.0	15.6	3.6	0.15	Readings recorded after 2 purge volumes
	12/4/2000	11:00	0	0.0	0.0	20.1	0.00	Readings recorded after 2 purge volumes
	1/9/2001	10:50	0	0.0	0.0	19.5	-0.15	Readings recorded after 2 purge volumes
	2/2/2001	11:30	120	6.0	7.1	11.0	0.04	Readings recorded after 2 purge volumes
	3/2/2001	10:35	310	15.5	15.5	0.5	0.04	Readings recorded after 2 purge volumes
	4/10/2001	11:15	8	0.4	0.6	20.3	0.09	Readings recorded after 2 purge volumes
	5/3/2001	12:35	22	1.1	1.1	8.6	0.12	Readings recorded after 2 purge volumes
	6/8/2001	10:25	58	2.9	na	16.8	0.05	Readings recorded after 2 purge volumes
	7/2/2001	11:10	196	9.8	10.1	6.9	-0.03	Readings recorded after 2 purge volumes
	8/3/2001	11:00	88	4.4	3.5	15.2	0.11	Readings recorded after 2 purge volumes
	9/6/2001	11:35	4	0.2	0	20.4	0.12	Readings recorded after 2 purge volumes
	10/1/2001	10:55	24	1.2	1.3	19.2	0.08	Readings recorded after 2 purge volumes
	11/7/2001	10:35	0	0.0	0.2	20.4	0.08	Readings recorded after 2 purge volumes
	2/6/2002	11:30	170	8.5	9.6	8.4	0.00	Readings recorded after 2 purge volumes
	3/7/2002	11:35	106	5.3	5.4	12.7	0.14	Readings recorded after 2 purge volumes
6/6/2002	12:11	256	12.8	14.2	3.4	0.1	Readings recorded after 2 purge volumes	
7/18/2002	12:26	104	5.2	5.3	13.9	0.1	Readings recorded after 2 purge volumes	
8/15/2002	12:57	168	8.4	7.6	7.9	0.08	Readings recorded after 2 purge volumes	
9/10/2002	12:25	272	13.6	16.2	0.8	0.16	Readings recorded after 2 purge volumes	
10/31/2002	13:55	210	10.5	14.1	1.5	0.16	Readings recorded after 2 purge volumes	
11/19/2002	13:30	0	0.0	0.2	19.8	0.05	Readings recorded after 2 purge volumes	

Notes:

Not Measured = readings not taken

NA means that the GA90 was not set up to read CO2 and CES-landtec could not set up that function over the phone.

Percent Methane in GP-15d



**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure / Vacuum (inches of water)	Notes
Gas Probe 16s	3/23/1999	16:50	390	19.7/ 23.3	21.5	2.3	Not measured	80 seconds / peak at 130 seconds
	3/25/1999	13:45	444	22.2 @ 45 seconds	20.9	2.6	0.00	No pressure - peak at 45 seconds
	4/1/1999	10:55	522	26.3	24.1	0.1	0.00	Readings recorded at 180 seconds
	4/8/1999	14:50	530	26.8	25.2	0.0	0.00	Readings recorded at 180 seconds
	5/6/1999	14:35	570	28.5	28.3	0.0	0.00	Readings recorded at 180 seconds
	6/4/1999	12:40	606	30.3	28.8	0.2	0.00	Readings recorded at 180 seconds
	7/7/1999	14:00	586	29.3	33.4	0.6	0.00	Readings recorded at 180 seconds
	8/5/1999	14:15	530	26.8	25.2	0.0	0.00	Readings recorded after 2 purge volumes
	9/2/1999	17:35	136	6.8	23.8	0.4	0.00	Readings recorded after 2 purge volumes
	10/7/1999	13:20	6	0.3	19.7	0.1	0.00	Readings recorded after 2 purge volumes
	11/1/1999	15:20	10	0.5	19.4	0.2	0.00	Readings recorded after 2 purge volumes
	12/7/1999	-	-	-	-	-	-	Out of commission, ran over by truck.
	1/5/2000	-	-	-	-	-	-	Out of commission, ran over by truck.
	2/11/2000	-	-	-	-	-	-	Out of commission, ran over by truck.
3/1/2000	-	-	-	-	-	-	Out of commission, ran over by truck.	

Notes: Not Measured = readings not taken

**Jackson County Landfill
Dillsboro, North Carolina**

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 16d	3/23/1999	16:44	242	12.1/ 14.5	3.3	8.8	Not measured	94 seconds / peak at 150 seconds
	3/25/1999	13:50	190/236	9.5/11.8	6.5	6.8	0.00	60 seconds = 9.5 - readings recorded at 100 seconds
	4/1/1999	11:00	150	7.5	11.6	7.6	0.00	Readings recorded at 180 seconds, DTW reading taken 4/1/99 = 21.90' TOC
	4/8/1999	15:00	194	9.6	5.7	11.1	-0.10	Vacuum, readings recorded at 180 seconds
	5/6/1999	14:45	142	7.1	13.1	7.7	0.00	Readings recorded at 180 seconds
	6/4/1999	12:45	182	9.1	11.7	9.1	0.00	Readings recorded at 180 seconds
	7/7/1999	14:05	126	6.3	9.4	12.0	-0.01	Vacuum, readings recorded at 180 seconds
	8/5/1999	14:20	100	5.0	3.0	18.1	0.00	Readings recorded after 2 purge volumes, no water in probe
	9/2/1999	17:40	8	0.4	11.4	6.5	-0.02	Readings recorded after 2 purge volumes, no water in probe
	10/7/1999	13:30	0	0.0	2.5	16.5	0.00	Readings recorded after 2 purge volumes
	11/1/1999	15:25	2	0.1	4.4	16.3	0.00	Readings recorded after 2 purge volumes
	12/7/1999	13:40	0	0.0	18.6	7.2	0.00	Readings recorded after 2 purge volumes
	1/5/2000	14:50	4	0.2	14.6	10.2	0.00	Readings recorded after 2 purge volumes
2/11/2000	-	-	-	-	-	-	-	Out of commission, ran over by truck.
3/1/2000	-	-	-	-	-	-	-	Out of commission, ran over by truck.

Notes: Not Measured = readings not taken

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure / Vacuum (inches of water)	Notes
Gas Probe 17	3/23/1999	17:05	0	0.0	0.0	20.6	Not measured	80 seconds
	3/25/1999	13:40	0	0.0	0.1	20.0	-0.02	Vacuum of 0.02 - readings recorded at 90 seconds - peak CH4 of 0.1% @ 20 seconds
	4/1/1999	10:45	Did not record	0.0	0.3	19.4	0.00	Readings recorded at 180 seconds, DTW reading taken 4/1/99 = 10.00' TOC *(No H2O)
	4/8/1999	14:40	Did not record	0.0	0.3	20.1	0.00	Readings stable at 120 seconds
	5/6/1999	14:30	Did not record	0.0	0.7	19.2	0.00	Readings stable at 120 seconds
	6/4/1999	12:35	12	0.6	1.5	17.9	0.00	Readings recorded at 180 seconds
	7/7/1999	13:50	6	0.3	1.2	19.5	0.00	Readings recorded at 180 seconds
	8/5/1999	14:10	6	0.3	2.2	18.8	0.00	Readings recorded after 2 purge volumes, no water in probe
	9/2/1999	17:30	0	0.0	1.6	18.2	0.00	Readings recorded after 2 purge volumes, no water in probe
	10/7/1999	13:20	0	0.0	0.3	19.5	0.00	Readings recorded after 2 purge volumes
	11/1/1999	15:15	2	0.1	0.5	20.7	0.00	Readings recorded after 2 purge volumes
	12/7/1999	13:30	0	0.0	0.1	19.7	0.00	Readings recorded after 2 purge volumes
	1/5/2000	15:45	4	0.2	0.1	19.9	0.00	Readings recorded after 2 purge volumes
	2/11/2000	11:15	0	0.0	0.0	20.1	0.00	Readings recorded after 2 purge volumes
	3/1/2000	11:40	0	0.0	0.2	22.1	0.00	Readings recorded after 2 purge volumes
	9/11/2000	15:40	0	0.0	1.0	19.0	0.00	
	10/6/2000	Out of Commission						

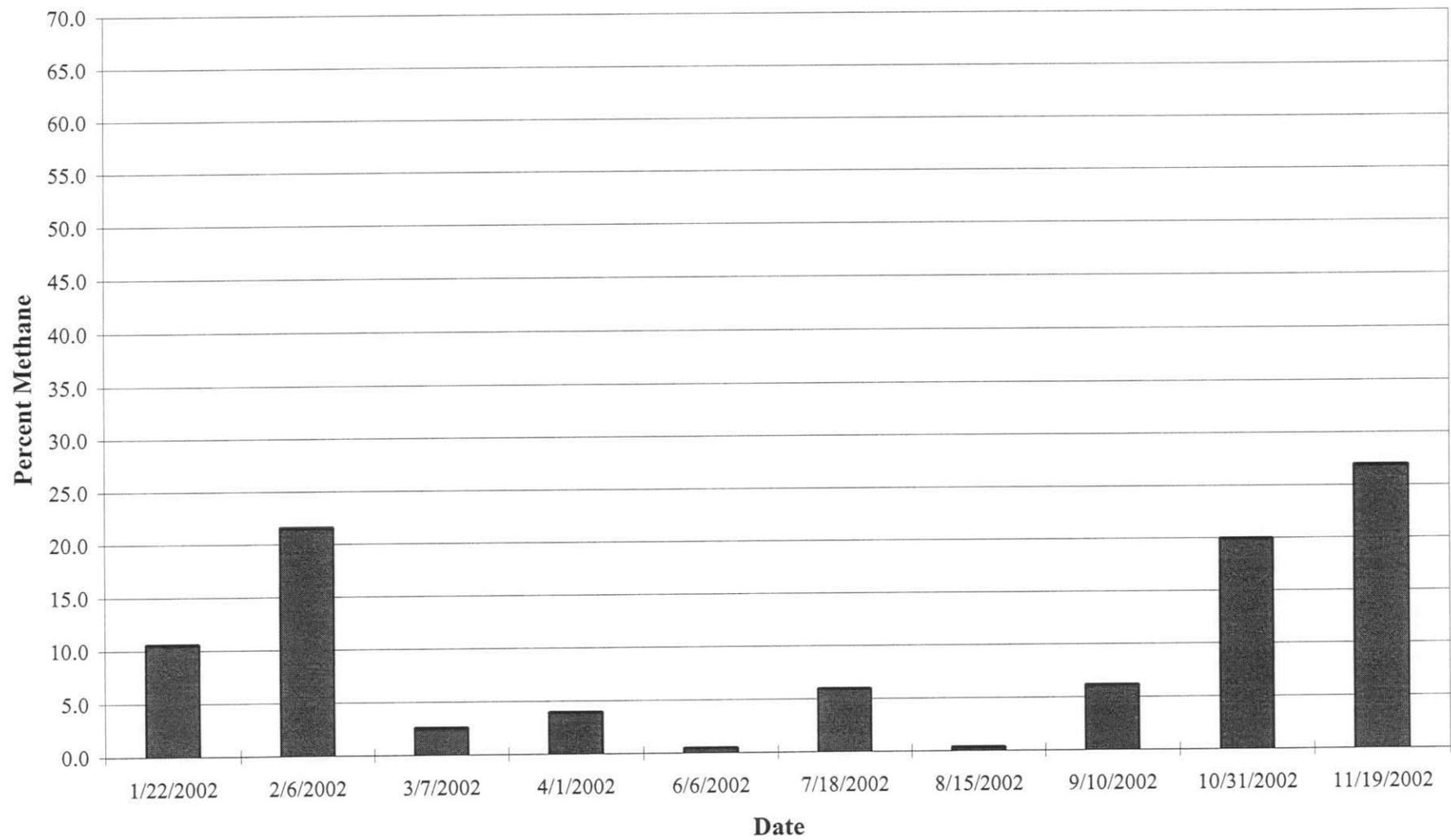
Notes: Not Measured = readings not taken

Jackson County Landfill Dillsboro, North Carolina

Monitoring Point	Date	Time	Percent Lower Explosive Limit	Percent Methane	Percent Carbon Dioxide	Percent Oxygen	Probe Pressure /Vacuum (inches of water)	Notes
Gas Probe 18	3/23/1999	16:57	0	0.0	0.1	20.6	Not measured	60 seconds - steady
	3/25/1999	13:20						Needs gas cap -- check for water DTW = 30.99' TOC DTB = 32.79' TOC
	4/1/1999	10:40	Did not record	0.0	0.1	20.6	0.00	Capped, replaced with pressure cap, stable at 120 seconds
	4/8/1999	14:30	Did not record	0.0	0.3	20.5	-0.10	Vacuum---readings stable at 120 seconds
	5/6/1999	14:25	Did not record	0.0	0.4	19.7	0.02	Readings stable at 120 seconds
	6/4/1999	12:30	12	0.6	1.3	18.9	-0.01	Vacuum, readings recorded at 180 seconds
	7/7/1999	13:40	6	0.3	1.8	18.9	0.00	Readings recorded at 180 seconds
	8/5/1999	14:00	2	0.1	2.8	18.2	-0.01	Readings recorded after 2 purge volumes, DTW = 31.75 ft @ 15:40, slight vacuum
	9/2/1999	17:20	0	0.0	2.1	17.2	0.00	Readings recorded after 2 purge volumes, DTW = 31.75 ft
	10/7/1999	13:15	0	0.0	2.3	17.8	0.00	Readings recorded after 2 purge volumes
	11/1/1999	15:10	4	0.2	4.1	18.3	0.00	Readings recorded after 2 purge volumes
	12/7/1999	13:20	0	0.0	4.0	17.5	0.00	Readings recorded after 2 purge volumes
	1/5/2000	15:40	4	0.2	4.5	17.8	0.00	Readings recorded after 2 purge volumes
	2/11/2000	11:20	0	0.0	3.7	18.0	0.00	Readings recorded after 2 purge volumes
	3/1/2000	11:45	0	0.0	3.8	20.2	0.00	Readings recorded after 2 purge volumes
9/11/2000	15:45	0	0.0	1	19.5	0.00	Readings recorded after 2 purge volumes	
10/6/2000	Out of Commission							

Notes: Not Measured = readings not taken

Percent Methane in GP-19



APPENDIX B

**METHANE MONITORING AND RESPONSE PLAN FOR
THE JACKSON COUNTY MAINTENANCE BUILDING**

ALTAMONT ENVIRONMENTAL, INC.

ENGINEERING & HYDROGEOLOGY

78½ PATTON AVE., ASHEVILLE, NC 28801

TEL. 828.281.3350 FAC. 828.281.3351

www.altamontenvironmental.com

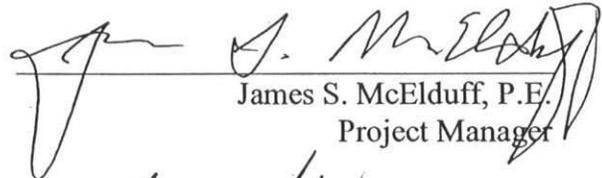
METHANE MONITORING AND RESPONSE PLAN

JACKSON COUNTY MAINTENANCE BUILDING DILLSBORO, NORTH CAROLINA

Prepared for
Jackson County

January 13, 2003

Prepared by
Altamont Environmental, Inc.
78½ Patton Avenue
Asheville, NC 28801
(828) 281-3350


James S. McElduff, P.E.
Project Manager

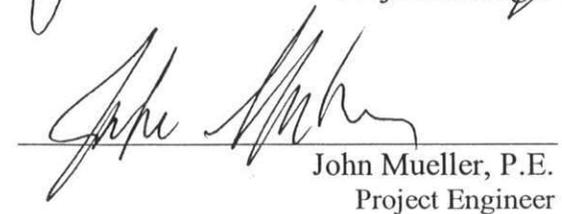

John Mueller, P.E.
Project Engineer

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B. Methane Monitor Testing and Calibration Record	
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1.0 INTRODUCTION

There has been periodic migration of landfill gas (LFG) from the closed Jackson County Municipal Solid Waste Landfill in Dillsboro to subsurface soils near the Jackson County Maintenance Building. LFG can accumulate in enclosed structures until it reaches explosive concentrations, at which time an ignition source (e.g., flame, cigarette, electric heater, etc.) can trigger an explosion. Therefore, to ensure protection of workers and property in the Jackson County Maintenance Building, a LFG monitoring program has been implemented.

This document has been prepared by Altamont Environmental, Inc., (Altamont) on behalf of Jackson County, to provide County workers in the Maintenance Building with a concise, readily available source of information about LFG, the methane monitoring program, and actions to take in the event of an alarm. All workers using the Maintenance Building must read and be oriented on the contents of this document and acknowledge such by completing the signature page. A copy of this document shall be mounted on the wall next to each methane alarm for easy reference.

LFG is generated within landfills by natural biological degradation processes. LFG is typically comprised of about 55 percent methane and 45 percent carbon dioxide. Carbon dioxide is a non-hazardous gas present in the atmosphere. Methane is a colorless, odorless, non-toxic gas that can be explosive if it accumulates in a confined space at concentrations between five and 15 percent. Five percent methane is the lower explosive limit (LEL) – the lowest concentration of methane that is explosive. Fifteen percent methane is the upper explosive limit (UEL) – the highest concentration of methane that is explosive. While concentrations of methane greater than 15 percent are not explosive, high concentrations of LFG will displace air and can cause an oxygen-deficient atmosphere.

The monitoring program consists of three components:

- 1) Monthly monitoring of methane concentrations in a network of subsurface monitoring points around the landfill and Maintenance Building;

- 2) Quarterly screening of the Maintenance Building with a very sensitive instrument that will detect low concentrations of methane, if present; and
- 3) Continuous monitoring for methane in the Maintenance Building with automatic strobe and audible alarms.

2.0 PROGRAM IMPLEMENTATION

The methane monitoring program is being implemented by Jackson County and Altamont, with responsibilities as follows:

- The Jackson County Solid Waste Technician has primary responsibility for conducting monthly monitoring of subsurface monitoring points. Landfill gas concentrations will be recorded, incorporated into the operating record for the landfill, and reported to Altamont for inclusion in a database.
- Altamont will perform the quarterly screening of structures near the landfill for methane using an intrinsically safe flame-ionization detector (FID). The FID can detect methane at very low concentrations (approximately one part per million). Locations and concentrations of methane detections will be documented and included in the operating record for the landfill. If concentrations of methane in the building exceed one percent, Altamont will advise the County to take specific appropriate actions.
- The Jackson County Solid Waste Technician has primary responsibility for performing regular testing and calibration of the two methane monitors in the Maintenance Building. An accuracy check with calibration gas will be performed monthly. An auto calibration will be performed every 90 days or if the accuracy check indicates that the sensor has drifted by two percent or more. A manual calibration will be performed if the sensor is replaced or if the auto calibration is unsuccessful. The factory settings for the alarms are 10 percent of the LEL for the strobe warning and 20 percent of the LEL for the audible alarm. The calibration kit and operations manual will be kept in the Maintenance Building in the supervisor's office. Testing and calibration records (Attachment C) will be maintained by the Solid Waste Technician in the operating record for the landfill. If the Solid Waste technician is unable to conduct any portion of these responsibilities, she/he will notify the County Manager and Altamont in advance.

3.0 ALARM RESPONSE PROCEDURES

The methane monitor alarms will warn the building occupants of elevated methane concentrations well before explosive conditions develop. The highest level supervisor present in the building is responsible for implementing the alarm response procedure described in this section.

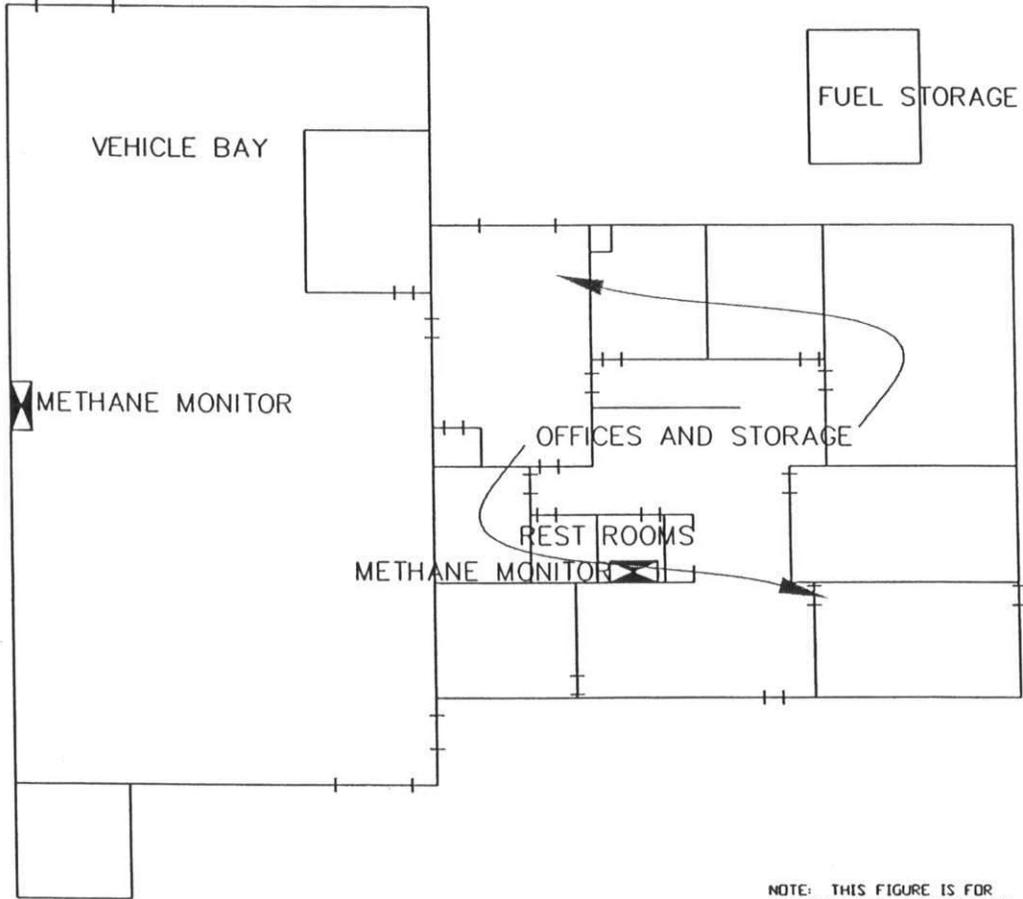
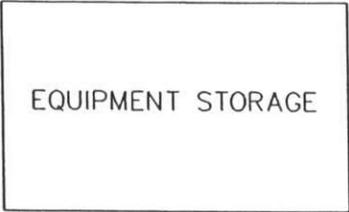
There are two methane monitors located in the Jackson County Maintenance Building as shown in Attachment A. One monitor is located on the northwest wall of the vehicle bay. This location was selected because it monitors the portion of the building closest to the landfill. The other monitor is located in the women's restroom. This location was selected because it has protrusions through the slab (drain lines) that could serve as conduit for migration of LFG.

At ten percent of the LEL (0.5 percent methane) the strobe alarm (flashing light) will be activated. If this condition occurs, all occupants of the building should be alerted and the percent LEL digital readout should be checked every five minutes until either the LEL drops below 10 percent or the audible alarm is activated. If the audible alarm is activated (20 percent LEL), the following steps should be taken immediately:

- 1) Open all exterior doors to provide additional ventilation.
- 2) Eliminate all potential sources of ignition. Turn off engines, lights, heaters, etc., and refrain from smoking.
- 3) Notify the Sylva Fire Department by dialing 586-2000 or 911. Provide the location (Jackson County Maintenance Building, 1148 Haywood Road, Dillsboro) and inform them that a methane alarm has been activated in the building.
- 4) While waiting for the fire department, continuously check the percent LEL digital readout on the monitor and respond as described below:
 - If the percent LEL is greater than 25 (*Note:* This displays as 025 on the screen), evacuate the premises by walking up to the staffed recycling center (SRC) and wait there until the fire department has arrived and cleared the building for reentry.
 - If the percent LEL is less than 25, continue to monitor until the percent LEL either exceeds 25 or drops back down below 20. If it exceeds 25, then evacuate as described

above. If it drops below 20, the audible alarm will stop. Perform periodic checks of the percent LEL until it drops below 10 and the strobe alarm is deactivated.

- 5) During regular business hours make the following telephone notifications:
 - Jackson County Solid Waste Technician, 586-7577; or the County Manager, 586-7580.
 - John Mueller or Jim McElduff, Altamont Environmental, Inc. (828) 281-3350.
- 6) Document the alarm activation, highest observed percent LEL reading, and response procedures implemented. An alarm activation record (Attachment C) is mounted on the wall next to each methane monitor.



S.R. 1539

NOTE: THIS FIGURE IS FOR INFORMATIONAL PURPOSES AND IS NOT INTENDED TO SERVE AS AN EVACUATION PLAN.

HAYWOOD ROAD

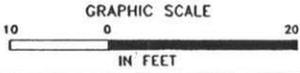
Altamont Environmental, Inc.
ENGINEERING & HYDROGEOLOGY

78½ PATTON AVENUE
ASHEVILLE, NORTH CAROLINA
PHONE 828-281-3350

ATTACHMENT A

METHANE MONITOR LOCATION MAP
JACKSON COUNTY MAINTENANCE FACILITY
DILLSBORO, NORTH CAROLINA

DRAWN BY: JC
PROJECT MANAGER: JM
CLIENT: JACKSON COUNTY DATE: 09-11-02
FILE: P:/JACKSON COUNTY/LFG/FIGURES/CAD



Methane Monitor Testing and Calibration Record

Facility Name and Address: Jackson County Maintenance Building
1148 Haywood Road
Dillsboro, North Carolina

Methane Monitor Manufacturer: Conspec Controls, Inc.
Model: P2065-1 Smart Monitor with P1246 Combustible Gas Sensor

Sensor Location (circle one): Vehicle bay | Women's room

Date: _____

Time: _____

Person Checking Calibration: _____

Perform Accuracy Test:

1. Remove hex-head screw from sensor and install threaded barb adaptor.
2. Attach methane calibration gas (2.5% methane) and open regulator.

Strobe warning light activated? _____

Audible alarm activated? _____

Percent LEL Reading = _____

(Using a 2.5% methane calibration gas concentration, the monitor should display 50% LEL +/- 2%)

(Note: Check manufacture date on calibration gas and replace every two years)

Accuracy Test Successful? _____

(If accuracy test is not successful, complete auto calibration. See Operations Manual.)

Auto Calibration Successful? _____

(If auto calibration not successful, complete manual calibration. See Operations Manual.)

Manual Calibration Successful? _____

(If manual calibration not successful, call Altamont Environmental, Inc at (828) 281-3350)

Comments: _____

Notes:

1. Complete Accuracy Test every 30 days.
2. Complete Auto Calibration every 90 days or if Accuracy Test indicates sensor readings have drifted more than 2%.
3. Complete Manual Calibration if Auto Calibration is not successful.
4. The HI alarm has been set to 10% of the LEL for a strobe warning.
5. The HI-HI alarm has been set to 20% of the LEL for an audible alarm.

Methane Alarm Activation Record

Instructions: This form must be mounted on the wall next to the methane alarm.
This form must be completed any time a methane alarm (strobe or audible) is activated.
Refer to *Methane Monitoring and Response Plan* for appropriate response actions.

Facility Name and Address: Jackson County Maintenance Building
1148 Haywood Road
Dillsboro, North Carolina

Methane Monitor Manufacturer: Conspec Controls, Inc.
Model: P2065-1 Smart Monitor with P1246 Combustible Gas Sensor

Sensor Location (circle one): Vehicle bay | Women's room
Date:
Time:

Person Monitoring Alarm:

Strobe warning light activated?
Audible alarm activated?
Highest Observed % LEL Reading =

Response Actions Taken:

Notifications: Sylva Fire Department, 586-2000 or 911	Contacted? (Yes/No)
Jackson County Solid waste Technician, 586-7577	
Jackson County Manager, 586-7580	
John Mueller or Jim McElduff, Altamont Environmental, Inc. (828) 281-3350	

- Notes:
- The HI alarm has been set to 10% of the LEL for a strobe warning.
 - The HI-HI alarm has been set to 20% of the LEL for an audible alarm.

APPENDIX C

**HYDROLOGIC EVALUATION OF LANDFILL
PERFORMANCE MODEL OUTPUT**

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 9

THICKNESS = 6.00 INCHES

POROSITY = 0.5010 VOL/VOL

FIELD CAPACITY = 0.2840 VOL/VOL

WILTING POINT = 0.1350 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.2753 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.190000006000E-03 CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 3.00
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 14

THICKNESS = 24.00 INCHES

POROSITY = 0.4790 VOL/VOL

FIELD CAPACITY = 0.3710 VOL/VOL

WILTING POINT = 0.2510 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.4790 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.249999994000E-04 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 18

THICKNESS = 600.00 INCHES

POROSITY = 0.6710 VOL/VOL

FIELD CAPACITY = 0.2920 VOL/VOL

WILTING POINT = 0.0770 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.3323 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 4

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 16

THICKNESS = 600.00 INCHES

POROSITY = 0.4270 VOL/VOL

FIELD CAPACITY = 0.4180 VOL/VOL

WILTING POINT = 0.3670 VOL/VOL

INITIAL SOIL WATER CONTENT = 0.4270 VOL/VOL

EFFECTIVE SAT. HYD. COND. = 0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A
POOR STAND OF GRASS, A SURFACE SLOPE OF 33.0%
AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER = 88.20
FRACTION OF AREA ALLOWING RUNOFF = 95.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 16.000 ACRES
EVAPORATIVE ZONE DEPTH = 6.0 INCHES
INITIAL WATER IN EVAPORATIVE ZONE = 1.652 INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE = 3.006 INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE = 0.810 INCHES
INITIAL SNOW WATER = 0.000 INCHES
INITIAL WATER IN LAYER MATERIALS = 468.722 INCHES
TOTAL INITIAL WATER = 468.722 INCHES
TOTAL SUBSURFACE INFLOW = 0.00 INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ASHEVILLE NORTH CAROLINA

STATION LATITUDE = 35.26 DEGREES
MAXIMUM LEAF AREA INDEX = 2.00
START OF GROWING SEASON (JULIAN DATE) = 96
END OF GROWING SEASON (JULIAN DATE) = 298
EVAPORATIVE ZONE DEPTH = 6.0 INCHES
AVERAGE ANNUAL WIND SPEED = 7.60 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 75.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 84.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 77.00 %

NOTE: PRECIPITATION DATA FOR KNOXVILLE TENNESSEE
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
36.80	39.10	46.40	55.70	63.30	69.80
73.20	72.60	66.90	56.00	46.40	39.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
 COEFFICIENTS FOR ASHEVILLE NORTH CAROLINA
 AND STATION LATITUDE = 35.26 DEGREES

 MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.05	5.24	6.15	5.77	10.98	2.70
	2.92	3.14	3.33	2.35	5.18	4.52
RUNOFF	0.414	0.432	0.298	0.787	1.990	0.099
	0.115	0.005	0.000	0.271	0.293	0.372
EVAPOTRANSPIRATION	1.373	1.788	2.650	2.738	4.885	3.183
	2.487	2.980	2.796	1.413	1.522	1.051
PERCOLATION/LEAKAGE THROUGH LAYER 2	5.3633	3.2179	2.8831	3.1081	3.1071	0.4171
	0.3187	0.0000	0.1242	1.0341	2.3205	3.4943
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.1153	0.1074	0.1197	0.1178	0.1230	0.1201
	0.1248	0.1248	0.1207	0.1249	0.1207	0.1258

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 2 0.140 0.119 0.048 0.144 0.220 0.010
 0.009 0.000 0.005 0.063 0.068 0.116

STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 2 0.224 0.355 0.115 0.489 0.748 0.046
 0.047 0.000 0.026 0.283 0.193 0.335

AVERAGE DAILY HEAD ON TOP OF LAYER 4 56.324 76.578 81.259 92.601 99.904 106.313
 109.983 110.024 109.868 110.822 109.499 115.605

STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4 23.246 17.514 21.324 21.109 12.212 14.216
 0.312 0.100 0.114 1.206 19.168 15.523

ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	59.33	3445886.500	100.00
RUNOFF	5.074	294698.687	8.55
EVAPOTRANSPIRATION	28.864	1676429.500	48.65
PERC./LEAKAGE THROUGH LAYER 2	25.388342	1474554.870	42.79
AVG. HEAD ON TOP OF LAYER 2	0.0786		
PERC./LEAKAGE THROUGH LAYER 4	1.445046	83928.281	2.44
AVG. HEAD ON TOP OF LAYER 4	98.2317		
CHANGE IN WATER STORAGE	23.947	1390828.870	40.36
SOIL WATER AT START OF YEAR	468.722	27223348.000	
SOIL WATER AT END OF YEAR	492.668	28614176.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	1.260	0.00

 MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION	4.66	4.68	10.42	2.43	2.98	2.43		
	2.25	1.61	3.28	4.02	2.92	3.59		
RUNOFF	0.249	2.206	1.819	0.021	0.004	0.000		
	0.010	0.000	0.104	0.074	0.218	0.160		
EVAPOTRANSPIRATION	0.882	1.235	2.664	2.802	2.207	3.213		
	2.098	1.754	1.790	1.946	1.432	0.812		
PERCOLATION/LEAKAGE THROUGH LAYER 2	2.5429	2.4329	5.7302	0.4348	0.0000	0.0000		
	0.0000	0.0000	1.0976	1.5352	1.2054	2.0134		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.1277	0.1168	0.1297	0.1284	0.1327	0.1283		
	0.1325	0.1325	0.1282	0.1332	0.1295	0.1342		

 MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 2	0.079	0.135	0.335	0.006	0.000	0.000		
	0.000	0.000	0.049	0.057	0.038	0.034		
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 2	0.272	0.429	0.826	0.018	0.000	0.000		
	0.000	0.000	0.237	0.172	0.190	0.078		
AVERAGE DAILY HEAD ON TOP OF LAYER 4	126.544	135.664	138.233	154.806	154.854	154.510		
	154.166	153.816	153.961	158.082	161.367	163.343		
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	15.927	2.008	25.312	0.710	0.103	0.087		
	0.059	0.084	0.931	1.258	1.447	1.130		

 ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT	
PRECIPITATION	45.27	2629281.500	100.00	
RUNOFF	4.864	282525.719	10.75	
EVAPOTRANSPIRATION		22.836	1326299.870	50.44
PERC./LEAKAGE THROUGH LAYER 2		16.992462	986922.187	37.54
AVG. HEAD ON TOP OF LAYER 2		0.0610		
PERC./LEAKAGE THROUGH LAYER 4		1.553690	90238.320	3.43
AVG. HEAD ON TOP OF LAYER 4		150.7788		
CHANGE IN WATER STORAGE		16.016	930219.375	35.38
SOIL WATER AT START OF YEAR		492.668	28614176.000	
SOIL WATER AT END OF YEAR		508.685	29544396.000	
SNOW WATER AT START OF YEAR		0.000	0.000	0.00
SNOW WATER AT END OF YEAR		0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE		0.0000	-1.862	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION	3.86	2.18	5.22	0.39	5.53	3.46			
	3.75	1.98	2.87	5.33	3.45	4.15			
RUNOFF	0.013	0.096	0.247	0.000	0.389	0.226			
	0.164	0.036	0.073	0.430	0.000	0.544			
EVAPOTRANSPIRATION	1.311	1.958	2.424	1.202	3.195	2.445			
	3.408	1.926	0.985	2.322	1.317	0.564			
PERCOLATION/LEAKAGE THROUGH LAYER 2	3.0661	0.7021	1.6426	0.2585	1.6655	0.8059			
	0.4849	0.0245	0.9015	2.6340	0.0900	4.7732			
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.1356	0.1276	0.1366	0.1329	0.1375	0.1336			
	0.1385	0.1385	0.1339	0.1392	0.1354	0.1411			

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 2	0.075	0.012	0.044	0.007	0.033	0.012			
	0.016	0.001	0.018	0.058	0.002	0.172			
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 2	0.116	0.037	0.165	0.030	0.105	0.054			
	0.087	0.002	0.064	0.142	0.009	0.545			
AVERAGE DAILY HEAD ON TOP OF LAYER 4	171.439	176.232	177.315	181.180	182.539	185.679			
	187.886	187.835	187.508	192.307	196.268	202.616			
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	2.071	0.704	0.293	0.664	1.487	0.826			
	0.415	0.000	0.135	1.987	0.176	4.674			

ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.17	2449233.000	100.00
RUNOFF	2.218	128847.070	5.26
EVAPOTRANSPIRATION	23.059	1339264.370	54.68
PERC./LEAKAGE THROUGH LAYER 2	17.048967	990204.000	40.43
AVG. HEAD ON TOP OF LAYER 2	0.0375		
PERC./LEAKAGE THROUGH LAYER 4	1.630405	94693.898	3.87
AVG. HEAD ON TOP OF LAYER 4	185.7336		
CHANGE IN WATER STORAGE	15.262	886425.625	36.19
SOIL WATER AT START OF YEAR	508.685	29544396.000	
SOIL WATER AT END OF YEAR	523.729	30418208.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.217	12613.022	0.51
ANNUAL WATER BUDGET BALANCE	0.0000	2.056	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION	2.82	1.52	6.08	6.93	1.19	6.49		
	1.08	5.78	6.89	4.06	5.04	3.29		
RUNOFF	0.212	0.002	0.810	1.833	0.000	0.131		
	0.000	0.398	0.719	0.324	0.214	0.055		
EVAPOTRANSPIRATION	1.041	1.234	2.457	2.250	1.257	3.557		
	1.032	3.626	2.273	1.823	1.365	0.958		
PERCOLATION/LEAKAGE THROUGH LAYER 2	2.1542	0.0000	1.9565	4.4404	0.0000	2.8113		
	0.0000	1.9528	3.1012	2.0622	2.6311	2.8935		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.1426	0.1291	0.1433	0.1405	0.1457	0.1412		
	0.1469	0.1472	0.1434	0.1495	0.1453	0.1517		

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 2	0.039	0.000	0.102	0.231	0.000	0.049		
	0.000	0.056	0.137	0.078	0.082	0.088		
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 2	0.077	0.000	0.335	0.687	0.000	0.119		
	0.000	0.210	0.425	0.258	0.217	0.205		
AVERAGE DAILY HEAD ON TOP OF LAYER 4	211.470	213.508	215.136	226.377	229.282	229.929		
	235.931	237.533	243.330	250.477	254.334	263.317		
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	1.451	0.000	1.320	3.775	0.112	1.832		
	0.109	2.194	2.453	1.576	1.224	2.171		

 ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT	
PRECIPITATION	51.17	2971953.000	100.00	
RUNOFF	4.698	272862.031	9.18	
EVAPOTRANSPIRATION		22.873	1328479.000	44.70
PERC./LEAKAGE THROUGH LAYER 2		24.003155	1394103.250	46.91
AVG. HEAD ON TOP OF LAYER 2		0.0719		
PERC./LEAKAGE THROUGH LAYER 4		1.726469	100273.328	3.37
AVG. HEAD ON TOP OF LAYER 4		234.2187		
CHANGE IN WATER STORAGE		21.872	1270343.750	42.74
SOIL WATER AT START OF YEAR		523.729	30418208.000	
SOIL WATER AT END OF YEAR		545.819	31701166.000	
SNOW WATER AT START OF YEAR		0.217	12613.022	0.42
SNOW WATER AT END OF YEAR		0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE		-0.0001	-5.103	0.00

 MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.25	0.78	4.65	3.52	4.02	5.27
	4.28	3.20	0.86	1.24	3.62	5.63
RUNOFF	0.616	0.000	0.059	0.091	0.157	0.872
	0.346	0.002	0.000	0.000	0.038	0.595
EVAPOTRANSPIRATION	1.160	1.353	2.721	2.022	3.327	3.125
	2.962	3.198	0.860	0.893	0.973	0.933
PERCOLATION/LEAKAGE THROUGH LAYER 2	3.7573	0.0000	1.7826	1.0798	0.9578	1.2735
	0.9717	0.0000	0.0000	0.0000	1.8453	4.2524
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.1529	0.1391	0.1544	0.1498	0.1555	0.1509
	0.1562	0.1564	0.1513	0.1563	0.1513	0.1579

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.080	0.000	0.043	0.005	0.018	0.099
TOP OF LAYER 2	0.013	0.000	0.000	0.000	0.036	0.159
STD. DEVIATION OF DAILY	0.174	0.000	0.128	0.015	0.071	0.512
HEAD ON TOP OF LAYER 2	0.044	0.000	0.000	0.000	0.083	0.589
AVERAGE DAILY HEAD ON	269.794	276.481	278.825	280.762	284.750	287.022
TOP OF LAYER 4	288.504	290.073	289.667	289.261	289.577	298.467
STD. DEVIATION OF DAILY	2.750	0.000	1.995	0.511	0.950	1.485
HEAD ON TOP OF LAYER 4	0.688	0.101	0.134	0.094	0.937	3.402

ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.32	2457946.000	100.00
RUNOFF	2.775	161183.672	6.56
EVAPOTRANSPIRATION	23.526	1366404.870	55.59
PERC./LEAKAGE THROUGH LAYER 2	15.920304	924651.250	37.62
AVG. HEAD ON TOP OF LAYER 2	0.0376		
PERC./LEAKAGE THROUGH LAYER 4	1.831958	106400.102	4.33
AVG. HEAD ON TOP OF LAYER 4	285.2651		
CHANGE IN WATER STORAGE	14.187	823953.250	33.52
SOIL WATER AT START OF YEAR	545.819	31701166.000	
SOIL WATER AT END OF YEAR	560.005	32525120.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0001	4.106	0.00

 AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION

TOTALS 4.73 2.88 6.50 3.81 4.94 4.07
 2.86 3.14 3.45 3.40 4.04 4.24

STD. DEVIATIONS 1.59 1.97 2.28 2.61 3.73 1.75
 1.26 1.63 2.17 1.61 1.01 0.91

RUNOFF

TOTALS 0.301 0.547 0.647 0.546 0.508 0.265
 0.127 0.088 0.179 0.220 0.152 0.345

STD. DEVIATIONS 0.226 0.944 0.712 0.790 0.843 0.348
 0.141 0.174 0.305 0.178 0.127 0.235

EVAPOTRANSPIRATION

TOTALS 1.153 1.513 2.583 2.203 2.974 3.105
 2.398 2.697 1.741 1.679 1.322 0.864

STD. DEVIATIONS 0.200 0.337 0.133 0.648 1.356 0.406
 0.909 0.818 0.829 0.546 0.209 0.188

PERCOLATION/LEAKAGE THROUGH LAYER 2

TOTALS 3.3767 1.2706 2.7990 1.8643 1.1461 1.0616
 0.3551 0.3955 1.0449 1.4531 1.6185 3.4854

STD. DEVIATIONS 1.2627 1.4744 1.7088 1.8317 1.3017 1.0856
 0.4033 0.8706 1.2441 1.0074 1.0095 1.0913

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS 0.1348 0.1240 0.1368 0.1339 0.1389 0.1348
 0.1398 0.1399 0.1355 0.1406 0.1364 0.1421

STD. DEVIATIONS 0.0143 0.0122 0.0132 0.0121 0.0124 0.0118
 0.0122 0.0124 0.0121 0.0125 0.0122 0.0130

 AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES 0.0827 0.0531 0.1145 0.0785 0.0543 0.0340
 0.0076 0.0114 0.0418 0.0512 0.0451 0.1138

STD. DEVIATIONS 0.0365 0.0678 0.1256 0.1041 0.0939 0.0406
 0.0073 0.0251 0.0567 0.0297 0.0312 0.0558

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES 167.1141 175.6926 178.1536 187.1452 190.2656 192.6906
 195.2939 195.8562 196.8667 200.1898 202.2089 208.6696

STD. DEVIATIONS 81.3168 75.8528 74.9755 71.2798 70.5841 69.3780
 69.5768 70.3787 71.1829 71.2117 71.8480 73.8275

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.05 (7.282)	2790859.7	100.00
RUNOFF	3.926 (1.3262)	228023.42	8.170
EVAPOTRANSPIRATION	24.232 (2.6042)	1407375.37	50.428
PERCOLATION/LEAKAGE THROUGH LAYER 2	19.87065 (4.45460)	1154087.120	41.35239
AVERAGE HEAD ON TOP OF LAYER 2	0.057 (0.019)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	1.63751 (0.14987)	95106.781	3.40780
AVERAGE HEAD ON TOP OF LAYER 4	190.846 (72.466)		
CHANGE IN WATER STORAGE	18.257 (4.3590)	1060354.12	37.994

 PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)	
PRECIPITATION	3.36	195148.797	
RUNOFF	1.489	86504.3437	
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.988879	57434.10550	
AVERAGE HEAD ON TOP OF LAYER 2	3.909		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.005117	297.17276	
AVERAGE HEAD ON TOP OF LAYER 4	302.528		
SNOW WATER	2.61	151315.2190	
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.4877	
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.1350	

 FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.7700	0.2950
2	11.4960	0.4790
3	290.5396	0.4842
4	256.2000	0.4270
SNOW WATER	0.000	

APPENDIX D

WELL CONSTRUCTION RECORDS

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) MARK GETTYS CERTIFICATION # 2345

WELL CONTRACTOR COMPANY NAME GEOLOGIC EXPLORATION, INC. PHONE # (704) 872-7686

STATE WELL CONSTRUCTION PERMIT# _____ ASSOCIATED WQ PERMIT# _____
(if applicable) (if applicable)

1. WELL USE (Check Applicable Box): Residential Municipal/Public Industrial Agricultural
Monitoring Recovery Heat Pump Water Injection Other If Other, list Use SOIL VAPOR EXTRACTION

2. WELL LOCATION:
Nearest Town: DILLSBORO County JACKSON
HAYWOOD & LANDFILL RD.
(Street Name, Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
 Ridge Slope Valley Flat
(check appropriate box)
Latitude/longitude of well location

3. OWNER: JACKSON COUNTY
Address 401 GRINDSTAFF COVE RD.
(Street or Route No.)
SYLVA NC 28779
City or Town State Zip Code
()
Area Code – Phone Number

(degrees/minutes/seconds)
Latitude/longitude source: GPS Topographic map
(check box)

DEPTH		DRILLING LOG
From	To	Formation Description
0.0	5.0	RED SANDY SILT
5.0	20.0	BROWN SANDY SILTY WITH COBBLES

4. DATE DRILLED 10-29-02
5. TOTAL DEPTH: 20.0 FEET
6. DOES WELL REPLACE EXISTING WELL? YES NO
7. STATIC WATER LEVEL Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.

9. YIELD (gpm): N/A METHOD OF TEST N/A

10. WATER ZONES (depth): N/A

11. DISINFECTION: Type N/A Amount _____

12. CASING:

From	To	Depth	Diameter	or Weight/Ft.	Material
0.0	5.0	Ft.	1 INCH	SCH 40	PVC

13. Grout:

From	To	Depth	Material	Method
0.0	1.0	Ft.	Portland Bentonite	Slurry

14. SCREEN:

From	To	Depth	Diameter	Slot Size	Material
5.0	20.0	Ft.	1.0 in.	.010 in.	PVC

15. SAND/GRAVEL PACK:

From	To	Depth	Size	Material
3.0	20.0	Ft.	20-40	FINE SILICA SAND

16. REMARKS: GP-10S BENTONITE SEAL FROM 1.0 TO 3.0 FEET

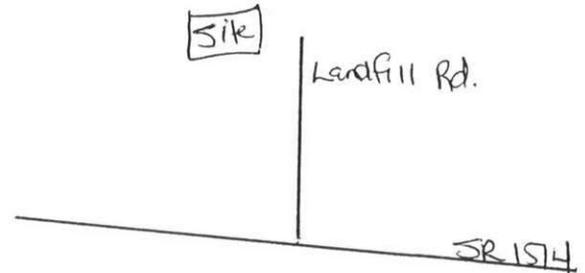
I DO HEARBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Mark K. Gettys

SIGNATURE OF PERSON CONSTRUCTING THE WELL

11/4/02
DATE

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads, inculed the road numbers and common road names.



Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) MARK GETTYS CERTIFICATION # 2345

WELL CONTRACTOR COMPANY NAME GEOLOGIC EXPLORATION, INC. PHONE # (704) 872-7686

STATE WELL CONSTRUCTION PERMIT# _____ ASSOCIATED WQ PERMIT# _____
(if applicable) (if applicable)

1. WELL USE (Check Applicable Box): Residential Municipal/Public Industrial Agricultural
Monitoring Recovery Heat Pump Water Injection Other If Other, list Use SOIL VAPOR EXTRACTION

2. WELL LOCATION:
Nearest Town: DILLSBORO County JACKSON
HAYWOOD & LANDFILL RD.
(Street Name, Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
 Ridge Slope Valley Flat
(check appropriate box)
Latitude/longitude of well location

3. OWNER: JACKSON COUNTY
Address 401 GRINDSTAFF COVE RD.
(Street or Route No.)

(degrees/minutes/seconds)
Latitude/longitude source: GPS Topographic map
(check box)

SYLVA NC 28779
City or Town State Zip Code
()
Area Code - Phone Number

DEPTH		DRILLING LOG
From	To	Formation Description
0.0	10.0	RED SANDY SILT
10.0	30.0	BROWN CLAYEY SILT WITH COBBLES

4. DATE DRILLED 10-30-02

5. TOTAL DEPTH: 30.0 FEET

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)

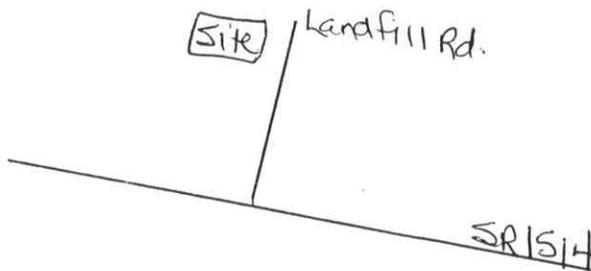
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.

9. YIELD (gpm): N/A METHOD OF TEST N/A

10. WATER ZONES (depth): N/A

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads, include the road numbers and common road names.



11. DISINFECTION: Type N/A Amount _____

12. CASING: Wall Thickness

From	Depth	To	Diameter	or Weight/Ft.	Material
From <u>0.0</u>	Depth <u>10.0</u>	To <u>10.0</u>	Ft. <u>1 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
From _____	Depth _____	To _____	Ft. _____	_____	_____
From _____	Depth _____	To _____	Ft. _____	_____	_____

13. Grout: Depth Material Method

From <u>0.0</u>	Depth <u>6.0</u>	To <u>6.0</u>	Ft. <u>Portland Bentonite</u>	<u>Slurry</u>
From _____	Depth _____	To _____	Ft. _____	_____

14. SCREEN: Depth Diameter Slot Size Material

From <u>10.0</u>	Depth <u>30.0</u>	To <u>30.0</u>	Ft. <u>1.0</u>	<u>in.</u>	<u>.010</u>	<u>in.</u>	<u>PVC</u>
From _____	Depth _____	To _____	Ft. _____	<u>in.</u>	<u>in.</u>	<u>in.</u>	_____

15. SAND/GRAVEL PACK: Depth Size Material

From <u>8.0</u>	Depth <u>30.0</u>	To <u>30.0</u>	Ft. <u>20-40</u>	<u>FINE SILICA SAND</u>
From _____	Depth _____	To _____	Ft. _____	_____

16. REMARKS: GP-12I BENTONITE SEAL FROM 6.0 TO 8.0 FEET

I DO HEARBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Mark K. Gettys

SIGNATURE OF PERSON CONSTRUCTING THE WELL

11/4/02
DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) MARK GETTYS CERTIFICATION # 2345

WELL CONTRACTOR COMPANY NAME GEOLOGIC EXPLORATION, INC. PHONE # (704) 872-7686

STATE WELL CONSTRUCTION PERMIT# _____ ASSOCIATED WQ PERMIT# _____
(if applicable) (if applicable)

1. WELL USE (Check Applicable Box): Residential Municipal/Public Industrial Agricultural
Monitoring Recovery Heat Pump Water Injection Other If Other, list Use SOIL VAPOR EXTRACTION

2. WELL LOCATION:
Nearest Town: DILLSBORO County JACKSON
HAYWOOD & LANDFILL RD.
(Street Name, Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
 Ridge Slope Valley Flat
(check appropriate box)
Latitude/longitude of well location

3. OWNER: JACKSON COUNTY
Address 401 GRINDSTAFF COVE RD.
(Street or Route No.)

(degrees/minutes/seconds)
Latitude/longitude source: GPS Topographic map
(check box)

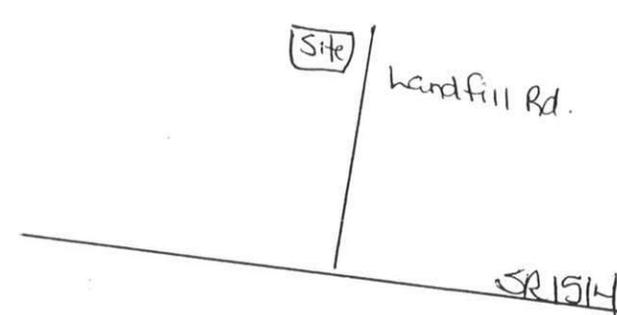
SYLVA NC 28779
City or Town State Zip Code
()
Area Code - Phone Number

DEPTH		DRILLING LOG
From	To	Formation Description
0.0	10.0	RED SANDY SILT
10.0	55.0	BROWN CLAYEY SILT WITH COBBLES

4. DATE DRILLED 10-30-02
5. TOTAL DEPTH: 55.0 FEET
6. DOES WELL REPLACE EXISTING WELL? YES NO
7. STATIC WATER LEVEL Below Top of Casing: 45.0 FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): N/A

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads, include the road numbers and common road names.



11. DISINFECTION: Type N/A Amount _____
12. CASING: Wall Thickness
From 0.0 To 35.0 Ft. 1 INCH SCH 40 PVC
From _____ To _____ Ft. _____
From _____ To _____ Ft. _____
13. Grout: Depth Material Method
From 0.0 To 31.0 Ft. Portland Bentonite Slurry
From _____ To _____ Ft. _____
14. SCREEN: Depth Diameter Slot Size Material
From 35.0 To 55.0 Ft. 1.0 in. .010 in. PVC
From _____ To _____ Ft. _____ in. _____ in.
15. SAND/GRAVEL PACK: Depth Size Material
From 33.0 To 55.0 Ft. 20-40 FINE SILICA SAND
From _____ To _____ Ft. _____

16. REMARKS: GP-12D 1 BENTONITE SEAL FROM 31.0 TO 33.0 FEET

I DO HEARBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Mark K. Gettys
SIGNATURE OF PERSON CONSTRUCTING THE WELL

10/4/02
DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) MARK GETTYS CERTIFICATION # 2345

WELL CONTRACTOR COMPANY NAME GEOLOGIC EXPLORATION, INC. PHONE # (704) 872-7686

STATE WELL CONSTRUCTION PERMIT# _____ ASSOCIATED WQ PERMIT# _____
(if applicable) (if applicable)

1. WELL USE (Check Applicable Box): Residential Municipal/Public Industrial Agricultural
Monitoring Recovery Heat Pump Water Injection Other If Other, list Use SOIL VAPOR EXTRACTION

2. WELL LOCATION:
Nearest Town: DILLSBORO County JACKSON
HAYWOOD & LANDFILL RD.
(Street Name, Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
 Ridge Slope Valley Flat
(check appropriate box)
Latitude/longitude of well location

3. OWNER: JACKSON COUNTY
Address 401 GRINDSTAFF COVE RD.
(Street or Route No.)
SYLVA NC 28779
City or Town State Zip Code
()
Area Code - Phone Number

(degrees/minutes/seconds)
Latitude/longitude source: GPS Topographic map
(check box)

DEPTH		DRILLING LOG
From	To	Formation Description
0.0	10.0	RED/BROWN SANDY SILT
10.0	25.0	BROWN SILT WITH COBBLES

4. DATE DRILLED 10-29-02
5. TOTAL DEPTH: 25.0 FEET
6. DOES WELL REPLACE EXISTING WELL? YES NO
7. STATIC WATER LEVEL Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.
9. YIELD (gpm): N/A METHOD OF TEST N/A
10. WATER ZONES (depth): N/A

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads, inculed the road numbers and common road names.



11. DISINFECTION: Type N/A Amount _____
12. CASING:

From	To	Depth	Diameter	Wall Thickness	Material
0.0	5.0	Ft.	1 INCH	SCH 40	PVC

From	To	Depth	Material	Method
0.0	1.0	Ft.	Portland Bentonite	Slurry

From	To	Depth	Diameter	Slot Size	Material
5.0	20.0	Ft.	1.0 in.	.010 in	PVC

From	To	Depth	Size	Material
3.0	20.0	Ft.	20-40	FINE SILICA SAND

16. REMARKS: GP-13I BENTONITE SEAL FROM 1.0 TO 3.0 FEET

I DO HEARBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Mark K. Gettys

SIGNATURE OF PERSON CONSTRUCTING THE WELL

11/4/02

DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina – Department of Environmental and Natural Resources – Division of Water Quality – Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) MARK GETTYS CERTIFICATION # 2345

WELL CONTRACTOR COMPANY NAME GEOLOGIC EXPLORATION, INC. PHONE # (704) 872-7686

STATE WELL CONSTRUCTION PERMIT# _____ ASSOCIATED WQ PERMIT# _____
(if applicable) (if applicable)

1. WELL USE (Check Applicable Box): Residential Municipal/Public Industrial Agricultural
Monitoring Recovery Heat Pump Water Injection Other If Other, list Use SOIL VAPOR EXTRACTION

2. WELL LOCATION:
Nearest Town: DILLSBORO County JACKSON
HAYWOOD & LANDFILL RD.
(Street Name, Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
 Ridge Slope Valley Flat
(check appropriate box)
Latitude/longitude of well location

3. OWNER: JACKSON COUNTY
Address 401 GRINDSTAFF COVE RD.
(Street or Route No.)
SYLVA NC 28779
City or Town State Zip Code
()
Area Code – Phone Number

(degrees/minutes/seconds)
Latitude/longitude source: GPS Topographic map
(check box)

DEPTH		DRILLING LOG
From	To	Formation Description
0.0	15.0	ORANGE/RED SANDY SILT
15.0	35.0	BROWN SANDY SILT WITH
		COBBLES

4. DATE DRILLED 10-29-02

5. TOTAL DEPTH: 35.0 FEET

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)

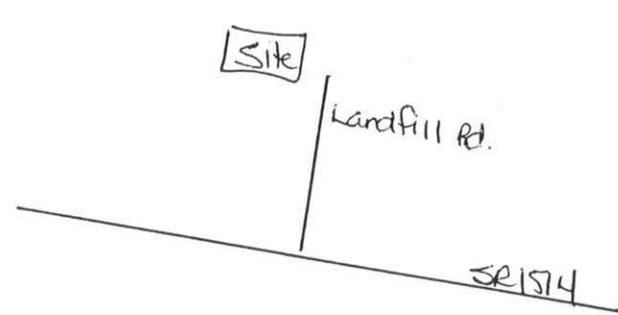
8. TOP OF CASING IS 0.0 FT. Above Land Surface*
*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.

9. YIELD (gpm): N/A METHOD OF TEST N/A

10. WATER ZONES (depth): N/A

LOCATION SKETCH

Show direction and distance in miles from at least two State Roads or County Roads, inculed the road numbers and common road names.



11. DISINFECTION: Type N/A Amount _____

12. CASING:

Depth		Wall Thickness		Material
From	To	Diameter	or Weight/Ft.	
0.0	15.0	1 INCH	SCH 40	PVC
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

13. Grout:

Depth		Material	Method
From	To		
0.0	10.0	Portland Bentonite	Slurry
_____	_____	_____	_____

14. SCREEN:

Depth		Diameter	Slot Size	Material
From	To			
15.0	35.0	1.0 in.	.010 in	PVC
_____	_____	_____	_____	_____

15. SAND/GRAVEL PACK:

Depth		Size	Material
From	To		
13.0	35.0	20-40	FINE SILICA SAND
_____	_____	_____	_____

16. REMARKS: GP-15I BENTONITE SEAL FROM 10.0 TO 13.0 FEET

I DO HEARBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

Mark K. Gettys
SIGNATURE OF PERSON CONSTRUCTING THE WELL

11/4/02
DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center – Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

APPENDIX E

**U.S. EPA LANDFILL METHANE OUTREACH
PROGRAM PRELIMINARY LANDFILL GAS ANALYSIS
REPORT FOR JACKSON COUNTY LANDFILL**

U.S. EPA Landfill Methane Outreach Program Preliminary Landfill Gas Analysis Report for Jackson County Landfill

A landfill gas generation curve was developed for the Jackson County Landfill in Dillsboro, NC, using several parameters specific to the landfill and defaults from AP-42¹. These data were entered into the EPA LandGEM² software to estimate landfill gas production, beginning with the year after the landfill opened. The values of these model input parameters are provided in Table 1. Landfill-specific data were obtained from a Prescreening Report submitted via email³, which is included in Appendix A. These data include the year the landfill opened, the current amount of waste-in-place, and the year of closure. The current waste-in-place amount was used to calculate an average annual waste acceptance rate from the year the landfill opened (1967 estimated) until closure (1999).

It is important to note that, as shown in Table 1, the calculated average annual waste acceptance rate for the landfill was established using an estimated landfill opening year and the closure years. This may result in an underestimate or overestimate of the actual landfill gas production over time. In future analyses, it would be useful to obtain actual annual acceptance rates for years prior to the closure year.

Also necessary for the model to run are the following parameters: L_0 (methane generation potential), k (methane generation rate constant), and the percent volume of methane and carbon dioxide in the landfill gas. Defaults from AP-42 were used for L_0 and k , and LandGEM software defaults were used for the percent methane and carbon dioxide. The AP-42 default value for k for non-arid areas was used because several sources indicated an average annual precipitation of greater than 25 inches for the area surrounding the landfill.

Collection of the landfill gas at its estimated extraction rate of 135 scfm for this year (2002) would be equivalent to any of the following annual environmental benefits for 2002:

Removing emissions equivalent to 3,160 cars
Planting 4,270 acres of forest
Offsetting the use of 71 railroad cars of coal
Preventing the use of 33,600 barrels of oil

Table 1: Model Input Parameters for the Jackson County Landfill

Model Parameter	Value	Units
Year Landfill Opened ^a	1967	----
Landfill Closure Year	1999	----
Waste-In-Place	725,000	tons
1967-1999 Annual Waste Acceptance Rate ^b	22,657	tons/yr
Methane Generation Rate Constant (k)	0.04	1/yr
Methane Generation Potential (L _o)	3,203	ft ³ /ton
Percent Methane in Landfill Gas	50	%
Percent Carbon Dioxide in Landfill Gas	50	%

^a According to the information provided the landfill opened in the mid-1960s, but for the purpose of producing this model the year 1967 has been used.

^b Calculated based on 725,000 tons of waste-in-place, as indicated in Reference 3.

The estimated waste-in-place in tons and landfill gas generation in standard cubic feet per minute (scfm) for a 30-year post-closure period are shown in Table 2. Also provided is the estimated amount of landfill gas recovered over time, which was calculated using the assumption of a 75% collection rate. The graph was created using the landfill gas production and recovery data in Table 2. The curves demonstrate the landfill gas generation and recovery rates over time and the straight, vertical line indicates the current year.

Though there do appear to be some end-users near the facility, the preliminary results of the Jackson County Landfill model indicate a limited amount of LFG extraction; which, in turn, limits the beneficial-use options. There is a possibility for implementing a microturbine, small reciprocating engine, or greenhouse (boiler option). There is a standard reciprocating engine small enough to operate on as little as 118 scfm, but the site was closed in 1999 and the flowrate is dropping such that there may not be enough LFG generated long enough to justify the cost of a reciprocating engine of this size.

These projections have been prepared specifically for the Jackson County Landfill on behalf of the U.S. EPA Landfill Methane Outreach Program (LMOP), and are based on engineering judgement and represent the standard of care that would be exercised by a professional reasonably experienced in the field of landfill gas projections. LMOP and its contractors ERG and EMCON do not guarantee the quantity of available landfill gas, and no other warranty is expressed or implied. No other party is intended as a beneficiary of this work product, its content, or information embedded therein. Third parties use this information at their own risk. LMOP and its contractors ERG and EMCON assume no responsibility for the accuracy of information obtained from, compiled, or provided by other parties.

References

1. Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume 1: Stationary Point and Area Sources. Chapter 2: Solid Waste Disposal. Section 2.4.4.1. U.S. EPA. November 1998. <http://www.epa.gov/ttn/chief/ap42/ch02/final/c02s04.pdf>
2. Landfill Gas Emissions Model, version 2.01. U.S. EPA. January 6, 1999. <http://www.epa.gov/ttn/catc/products.html>
3. Prescreening Information from Jim McElduff, Altamont Environmental, to Juene Franklin. January 22, 2002. Shown in Appendix A.

Table 2: Numerical Results for Jackson County Landfill

Jackson County Landfill, Dillsboro, SC
LMOP Landfill ID # 1099
 Year Landfill Opened: 1967
 Year Landfill Closed: 1999
 Waste-in-place: 725,000 tons

LandGEM Results Using Above Data

Year	Waste In Place (tons)	LFG Production (scfm)	LFG Recovery (scfm)
1968	22,657	11	8
1969	45,313	22	16
1970	67,970	32	24
1971	90,627	42	31
1972	113,283	51	38
1973	135,940	60	45
1974	158,597	69	52
1975	181,253	77	58
1976	203,910	85	64
1977	226,567	93	70
1978	249,223	100	75
1979	271,880	107	81
1980	294,537	114	86
1981	317,193	121	91
1982	339,850	127	95
1983	362,507	133	100
1984	385,163	139	104
1985	407,820	145	108
1986	430,477	150	112
1987	453,133	155	116
1988	475,790	160	120
1989	498,447	165	124
1990	521,104	169	127
1991	543,760	174	130
1992	566,417	178	134
1993	589,074	182	137
1994	611,730	186	140
1995	634,387	190	142
1996	657,044	193	145
1997	679,700	197	148
1998	702,357	200	150
1999	725,000	203	153
2000	725,000	195	147
2001	725,000	188	141
2002	725,000	180	135
2003	725,000	173	130
2004	725,000	166	125

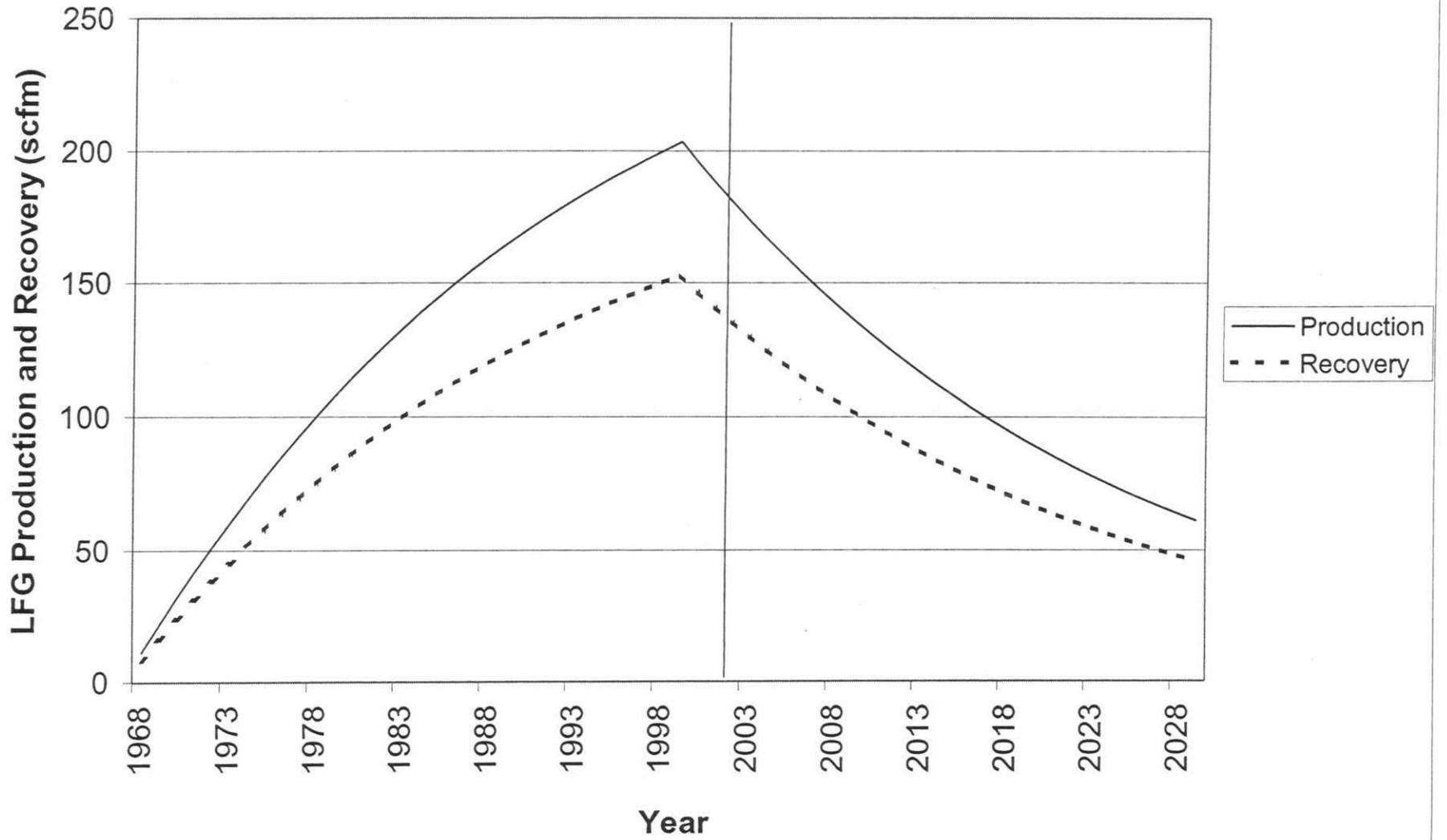
Table 2: Numerical Results for Jackson County Landfill

Year	Waste In Place (tons)	LFG Production (scfm)	LFG Recovery (scfm)
2005	725,000	160	120
2006	725,000	154	115
2007	725,000	148	111
2008	725,000	142	106
2009	725,000	136	102
2010	725,000	131	98
2011	725,000	126	94
2012	725,000	121	91
2013	725,000	116	87
2014	725,000	112	84
2015	725,000	107	80
2016	725,000	103	77
2017	725,000	99	74
2018	725,000	95	71
2019	725,000	91	69
2020	725,000	88	66
2021	725,000	84	63
2022	725,000	81	61
2023	725,000	78	58
2024	725,000	75	56
2025	725,000	72	54
2026	725,000	69	52
2027	725,000	66	50
2028	725,000	64	48
2029	725,000	61	46

Note: These projections have been prepared specifically for the Jackson County Landfill on behalf of the U.S. EPA Landfill Methane Outreach Program (LMOP), and are based on engineering judgment and represent the standard of care that would be exercised by a professional reasonably experienced in the field of landfill gas projections. LMOP and its contractors ERG and EMCON do not guarantee the quantity of available landfill gas, and no other warranty is expressed or implied. No other party is intended as a beneficiary of this work product, its content, or information embedded therein. Third parties use this information at their own risk. LMOP and its contractors ERG and EMCON assume no responsibility for the accuracy of information obtained from, compiled, or provided by other parties.

Jackson County Landfill

2002



Appendix A

E-mail Attachment Containing Data for the Jackson County Landfill

LANDFILL PRE-SCREENING INFORMATION FOR FEASIBILITY STUDIES/EEUAs

Exact landfill name: Jackson County Landfill (Dillsboro, NC)

EPA landfill ID number: NC DENR Permit No. 50-01 and 50-02

City where landfill is located: Dillsboro, NC

County where landfill is located: Jackson Co., NC

Landfill owner name: Jackson County

Landfill mailing/street address, city, state, zip:

Attn.: County Manager

Jackson County

401 Grindstaff Cove Road

Sylva, NC 28779

Landfill owner contact person, phone, fax, e-mail:

James McElduff

Tel.: (828) 281-3350

Fac.: (828) 281-3351

Email: jmcelduff@altamontenvironmental.com

Landfill owner type (public or private): Public

Landfill operator (if different from owner): Same

Landfill operator contact person, phone, fax, e-mail: Landfill is closed and unattended

Year landfill opened: approximately mid-1960s

Year landfill (or individual cells) closed: 12/31/99

Landfill area (acres): approximately 9-acres

Waste depth (feet): maximum waste thickness is approximately 90-feet

Waste in place (tons): approximately 725,000

Annual waste acceptance rate (tons/year): 24,000

Landfill subject to NSPS/EG? (yes/no): No

Please provide a brief description of NSPS/EG status:

Describe any development activities to date: County is currently installing test extraction wells (vertical) as part of a pilot program related to exceedances of LFG criteria at the property line.

Electric utility servicing the landfill: Duke Power

Natural gas utility servicing the landfill or vicinity: None

LANDFILL PRE-SCREENING INFORMATION FOR FEASIBILITY STUDIES/EEUAs
(Continued)

Potential end-users of the LFG within 10 mile radius of landfill (if known): Materials Recycling Facility, Asphalt Plant, Railroad Maintenance Shop, Hotels, Restaurants, and other tourist-related facilities.

Any other information you believe would be helpful to the LMOP:
The landfill is within one mile of several potential year-round energy users - including a Materials Recycling Facility operated by a third party under contract to the County. From a gas generation perspective, waste disposed in the landfill ranges in thickness up to approximately 90-feet. The landfill is located in a lightly populated rural county. Waste disposal was not monitored at the site until the 1980s. Approximately three years of monthly LFG measurements have been collected from gas probes using a closed loop protocol.

APPENDIX F

**SUPPORTING DOCUMENTATION FOR LFG
RESOURCE UTILIZATION ECONOMIC EVALUATION**

Summary of Abbreviations and Acronyms Used in Appendix F
Closed Jackson County MSW Landfill
Dillsboro, North Carolina

BTU = British Thermal Unit
cf = cubic foot
cy = cubic yard
d = day
ft = foot
hr = hour
kWh = kilowatt hour
lf = linear foot
min = minute
MMBTU = million BTUs
NA = not applicable
O&M = operation and maintenance
scfm = standard cubic feet per minute
yr = year
< = less than

Summary of Landfill Gas Generation Potential Closed Jackson County Municipal Solid Waste Landfill Dillsboro, North Carolina

LFG generation projections using LandGEM model

Year	Production (scfm)	Recovery (scfm)
2002	180	135
2010	131	98
2020	88	66

Energy potential of LFG

Design for 100 scfm recovery

$$\begin{aligned}
 \text{BTU/hr @100 scfm} &= 500 \text{ BTU/cf} \times 100 \text{ cfm} \times 60 \text{ min/hr} = && 3,000,000 \\
 &= && 72,000,000 \text{ BTU/day} \\
 &= && 26,280 \text{ MMBTU/yr}
 \end{aligned}$$

Design for 50 scfm recovery

$$\begin{aligned}
 \text{BTU/hr @50 scfm} &= 500 \text{ BTU/cf} \times 50 \text{ cfm} \times 60 \text{ min/hr} = && 1,500,000 \\
 &= && 36,000,000 \text{ BTU/day} \\
 &= && 13,140 \text{ MMBTU/yr}
 \end{aligned}$$

Assumptions:

- 50% methane content of LFG
- 1000 BTU/cf of methane
- 500 BTU/cf of LFG

Summary of Propane Substitute Economic Evaluation Closed Jackson County Municipal Solid Waste Landfill Dillsboro, North Carolina

Propane consumption at County Maintenance Building:

Groundskeeping demand		
12/7/01 to 1/7/01	440	gallons
1/7/01 to 2/7/01	375	gallons
4 other winter mos.	1087	gallons (County estimate)
Subtotal =	1,902	gallons
Maintenance demand		
Subtotal =	1,426	gallons (County estimate)
Total =	3,328	gallons per year

Propane cost = \$ 1.26 per gallon
 BTU value = 91,300 per gallon
 cost per million BTU = \$ 13.80

BTUs/yr = 303,838,792
 BTU cost/yr = \$ 4,193

LFG requirement/yr = 607,678 cf
 Average winter demand = 2.3 scfm
 Estimated peak demand = 39.1 scfm

Assumptions:

Peak demand is based on 12/7/01 to 1/7/01 consumption spread over 15 days at 4 hours per day
 County estimates that groundskeeping uses one third of average monthly December/January usage during 4 other winter months.
 County estimates maintenance consumption will be 75% of groundskeeping consumption.

Propane consumption at Best Western:

Consumption = 10,000 gallons per year

Propane cost = \$ 0.73 per gallon
 BTU value = 91,300 per gallon
 cost per million BTU = \$ 8.00

BTUs/yr = 913,000,000
 BTU cost/yr = \$ 7,300

LFG requirement/yr = 1,826,000 cf
 Revenue @ 80% discount = \$ 5,840 per year

Average daytime demand = 6.67 scfm
 Estimated peak demand = 39.10 scfm

Assumptions:

Average daytime demand is based on 80% of daily demand over 10 hours
 Peak demand is based on 75% of average daily demand over 8 hours and 25% of daily demand over 2 hours
 80% discount over current fuel cost is assumed as an incentive to use LFG

Conclusions:

Total peak demand = 78.16 scfm, is less than 50 scfm design flow rate, so demand can be met.
 Total revenue and savings = \$ 10,033 per year

Summary of LFG Economic Evaluation for Harrison Construction Asphalt Plant Closed Jackson County Municipal Solid Waste Landfill Dillsboro, North Carolina

Energy demand and cost

Energy Demand =		103,000,000 BTU/hr, 10 hrs/day, 5 days/week, 6 mos/yr
	=	133,900 Million BTU/year
Current fuel is No.4 recycled oil or No. 2 diesel		
No. 2 diesel BTU value =		130,000 BTU/gal
Unit Cost =	\$	0.80 per gallon
Cost per Million BTU =	\$	6.15

Landfill gas revenue

BTU/hr at 50 scfm =		1,500,000
BTU value/10 hr day =		15,000,000
BTU dollar value/day =	\$	92.31
Daily revenue (assume sale at 80% value) =	\$	73.85 per day
Gross revenue/year =	\$	9,600

Costs

Collection system capital cost =	\$	420,000
Gas distribution system capital cost =	\$	20,000
Collection system annual O&M =	\$	42,000
Note: system retrofit cost not included		

Conclusion

Not economical: annual O&M cost exceeds annual revenue

LFG distribution system cost basis:

Gas pipeline from landfill to bridge to asphalt plant:

	cost/unit	unit	quantity	total
Trenching	\$	2 cy	860	\$ 1,721
Pipe	\$	7 lf	11616	\$ 81,312
Backfill	\$	10 cy	860	\$ 8,604
				\$ 91,637
			Assume	\$ 100,000

Gas pipeline from landfill under river to asphalt plant:

	cost/unit	unit	quantity	total
Drilling	\$	10 ft	850	\$ 8,500
Trenching	\$	2 cy	74	\$ 148
Pipe	\$	7 lf	1000	\$ 7,000
Backfill	\$	10 cy	74	\$ 741
				\$ 16,389
			Use	\$ 20,000

**Estimated Cost for Gas Pipeline to Asphalt Plant
Closed Jackson County Municipal Solid waste Landfill
Dillsboro, North Carolina**

Means costs

Gas pipeline from landfill to bridge to asphalt plant:

	cost/unit	unit	quantity	total
Trenching	\$ 2	cy	860	\$ 1,721
Pipe	\$ 7	lf	11616	\$ 81,312
Backfill	\$ 10	cy	860	\$ 8,604
				\$ 91,637
			Assume	\$ 100,000

Gas pipeline from landfill under river to asphalt plant:

	cost/unit	unit	quantity	total
Drilling	\$ 10	ft	850	\$ 8,500
Trenching	\$ 2	cy	74	\$ 148
Pipe	\$ 7	lf	1000	\$ 7,000
Backfill	\$ 10	cy	74	\$ 741
				\$ 16,389
			say	\$ 20,000

Summary of Microturbine Evaluation Closed Jackson County Municipal Solid Waste Landfill Dillsboro, North Carolina

LFG requirements

LFG energy available at 50 scfm =	1,500,000 BTU/hr	
Capstone 30 kW microturbine energy input =	430,000 BTU/hr	
microturbine requirements:		
	15 scfm @ 50% methane	
	> 30% methane	
	< 5% water vapor	

Electric generation

Energy generation for three 30 kW units =	90 kW	
Daily output at 90 kW x 24 hr/d =	2160 kWh/d	
Yearly output at 80% operation =	630720 kWh/yr	

Costs

Microturbine cost installed (3 units)	\$ 300,000	
Microturbine annual O&M (assumes 80% operation)	\$ 19,000	= \$ 42,720 annually, amortized over 10 years at 7%
Total annual cost (amortized capital cost + O&M) =	\$ 61,720	
Total cost per kWh (at 80% operation) =	\$ 0.10	

Note: collection system capital and O&M costs not included

	cost/kWh	Annual usage (kWh)	Annual savings/revenue
Electric cost savings and revenue			
offset of electric bills (county maintenance building and SRC)	\$ 0.07	92571	\$ 6,480
sales to utility	\$ 0.03	538149	\$ 16,144.46
Total annual savings and revenue			\$ 22,624.46

Conclusion

Not economical, annual O&M costs exceed revenue and savings

Summary of Reciprocating Engine Evaluation Closed Jackson County Municipal Solid Waste Landfill Dillsboro, North Carolina

LFG requirements

LFG energy available at 105 scfm = 3,150,000 BTU/hr
 Jenbacher Model 208 engine energy input = 3,156,000 BTU/hr

Electric generation

Energy generation = 335 kW
 Daily output at 335 kW x 24 hr/d = 8,040 kWh/d
 Yearly output at 80% operation = 2,347,680 kWh/yr

Costs

Reciprocating engine cost installed (3 units)	\$ 200,000		
Annual O&M	\$ 40,000		= \$ 48,780 annually, amortized over 5 years at 7%
Total annual cost (amortized capital cost + O&M) =	\$ 88,780		
Total cost per kWh (at 80% operation) =	\$ 0.04		

Note: collection system capital and O&M costs not included

	cost/kWh	Annual usage (kWh)	Annual savings/revenue
Electric cost savings and revenue offset of electric bills (county maintenance building and SRC)	\$ 0.07	92571	\$ 6,480
sales to utility	\$ 0.03	2255109	\$ 67,653.26
Total annual savings and revenue			\$ 74,133.26

Conclusion

Not economical, annual costs exceed revenue and savings

ALTAMONT ENVIRONMENTAL, INC.

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TRANSMITTAL LETTER

To: Mr. Jim Coffey, NCDENR Solid Waste Section, Raleigh, NC

From: John Mueller

Date: March 5, 2003

cc: James Patterson, NCDENR Solid Waste Section, Asheville, NC
Ken Westmoreland, Jackson County Manager, Sylva, NC

Subject: Closed Jackson County Municipal Solid Waste Landfill

Contents:

One copy of the Landfill Gas Evaluation Report for the above referenced site