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ASSOCIATES

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November 22, 2010

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SOLID WASTE SECTION

Mr. Zinith Barbee
Hydrogeologist
Solid Waste Section
Division of Waste Management
North Carolina Department of Environment and Natural Resources
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

RE: Clay County Closed MSW Landfill
Permit No. 22-01
Clay County, North Carolina

Dear Mr. Barbee:

On behalf of Clay County, North Carolina, McGill Associates is pleased to submit for your review and approval, the enclosed Landfill Gas Monitoring Plan for the Clay County Closed MSW Landfill, Permit No. 22-01. A Facility Plan for the site is included as Figure 1, Sheet C-101, Facility Plan, Clay County Closed MSW Landfill, Permit No. 22-01, Clay County, Clay County, North Carolina.

The County intends to install the proposed landfill gas monitoring probes, at the locations shown on the Facility Plan, in a timely manner once approval of the Landfill Gas Monitoring Plan is received.

Please find enclosed a hard copy and a digital copy of the Landfill Gas Monitoring Plan for the Clay County Closed MSW Landfill, Permit No. 22-01.

McGill Associates, P.A. • P.O. Box 2259, Asheville, NC 28802 • 55 Broad Street, Asheville, NC 28801
828-252-0575 • Fax: 828-252-2518

Thanks in advance for your attention to the County's request. Please do not hesitate to contact us should you have any questions regarding this submittal.

Sincerely,
McGILL ASSOCIATES, P.A.

WILLIAM H. SPERRY, PE
Project Manager

Enclosures

cc: Troy Harrison, NCDENR Solid Waste Section, w/enc
Jim Smith, Director, Clay County Solid Waste Department, w/enc

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McGill
ASSOCIATES

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Solid Waste Section
Division of Waste Management
North Carolina Department of Environment and Natural Resources
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LANDFILL GAS MONITORING PLAN

CLAY COUNTY CLOSED MSW LANDFILL
PERMIT NO. 22-01
CLAY COUNTY, NORTH CAROLINA

WILLIAM H. SPERRY, PE

NORTH CAROLINA PROFESSIONAL SEAL 36132 ENGINEER WILLIAM H. SPERRY 11/19/10

McGill ASSOCIATES

Engineering • Planning • Finance
Asheville, North Carolina

November 2010

10.00710

Landfill Gas Monitoring Plan
Clay County Closed MSW Landfill
Permit No. 22-01

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INTRODUCTION

Clay County, North Carolina presently maintains the Clay County Closed Municipal Solid Waste Landfill, Permit No. 22-01, located at 1160 Hinton Center Road (S.R. 1148), Hayesville, North Carolina 28904. The Facility was officially closed per a letter to the North Carolina Department of Environment and Natural Resources (NCDENR) dated December 21, 1995. The Facility encompasses approximately 25.63 acres within the proposed Property Boundary which is also the Facility Boundary as shown in Figure 1, Sheet C-101, Facility Boundary, Clay County Closed MSW Landfill, Permit No. 22-01. Within the Facility Boundary, the County presently maintains a Transfer Station operating under Permit No. 22-02-T, a Treatment and Processing Area operating under Permit No. T&PN-22-001, and a scale and scalehouse facility. Various recycling collection drop-off facilities are also operated by the County and include, but are not limited to the collection of white goods, miscellaneous metals, assorted glass, aluminum cans, plastics, used batteries, waste oil and antifreeze and scrap tires. The Facility also has and maintains three separate closed disposal areas totaling approximately 6.62 acres (0.73 acres, 2.92 acres, and 2.97 acres respectively) that were identified by County staff as being utilized for the disposal of municipal solid waste. The approximate boundaries of these areas are shown on the aforementioned Figure 1.

The property is bounded on the north and upper northeast corner by property owned by Clay County and on the south by property controlled by Abner G. and Carol S. Moore as well as the Tennessee Valley Authority (TVA). On the east, the facility is bounded by property owned by Abner G. and Carol S. Moore. On the west side, north of S.R. 1148, the Facility is bounded by property owned by Reese and Glenda K Barnard. On the west side of the Facility, south of S. R. 1148, the Facility is bounded by property owned by John W. and Angela U. Kelly. Hinton Center Road (S.R. 1148) bisects the property, approximately mid-way of the western property line in a northwestern to southeastern direction, exiting the property near the southeastern property corner.

The groundwater monitoring network consists of an upgradient or background monitoring point (MW-01) located to the north of the Facility and five (5) down gradient monitoring wells (MW-02 through MW-06). Monitoring point MW-01 is located in the northern portion of the Facility just north of an existing closed MSW disposal cell and the County's wood waste collection/processing area. MW-02 is located in the southeast corner of the facility property on the north side of S.R. 1148, south of an existing closed MSW landfill cell. MW-03 and MW-04 are strategically located along or near the southern most property line of the Facility down gradient of an existing closed MSW landfill cell. MW-05 and MW-06 are located along the southwestern property line of the facility down gradient of an existing closed MSW landfill cell.

Landfill gas monitoring has not been conducted at the site on a routine basis. However, the County is proposing to initiate a routine monitoring program by utilizing five of the six existing groundwater monitoring wells (MW#1, MW#2, MW#3, MW#5 and MW#6) in addition to installing six (6) strategically located landfill gas monitoring wells (GP-1 through GP-6) to complete the monitoring network around the site. The locations of the existing groundwater monitoring well network and the locations of the proposed additional landfill gas monitoring wells are shown on Figure 1, Sheet C-101, Facility Plan, Clay County Closed MSW Landfill, Permit No. 22-01. A detail of the proposed landfill gas monitoring well is shown in Appendix 2. Once installed, the proposed landfill gas monitoring wells, in addition to the designated existing groundwater monitoring wells will be monitored on a quarterly basis by the County.

LANDFILL GAS CONTROL

a. Methane Gas Concentration Limits

Clay County must ensure that:

i. The concentration of methane gas generated by the landfill does not exceed 25 percent of the Lower Explosive Limit* (25% LEL) for methane in landfill structures (excluding gas control or recovery system components); and

ii. The concentration of methane gas does not exceed 100 percent of the Lower Explosive Limit (100% LEL) for methane at the landfill property boundary.

b. Routine Landfill Gas Monitoring Program

Clay County will implement a routine landfill gas monitoring program to ensure that the standards of (a) are met. See Appendix 1 for the Landfill Gas Control Plan for the Clay County Closed MSW Landfill, Permit No. 22-01, located on Hinton Center Road (S.R. 1148), Hayesville, North Carolina 28904.

i. The type and frequency of monitoring must be determined based on the following factors:

I. Soil conditions;

II. The hydrogeologic conditions surrounding the facility;

III. The hydraulic conditions surrounding the facility;

IV. The location of facility structures and property boundaries.

ii. The minimum frequency of monitoring will be quarterly.

c. Methane Gas Response Plan

If methane gas levels exceeding the limits specified in (a) are detected, the owner or operator will:

i. Immediately take all necessary steps to ensure protection of human health, i.e. no smoking, temporarily abandon the structure and notify the Division of Solid Waste Management.

ii. Within seven days of detection, place in the operating record the methane gas levels detected and a description of the steps taken to protect human health; and

iii. Within 60 days of detection, prepare and implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, and notify the Division of Solid Waste Management that the plan has been implemented. The plan will describe the nature and extent of the problem and the proposed remedy.

* - "Lower Explosive Limit" (LEL) means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25° C and atmospheric pressure.

APPENDICES

APPENDIX 1

Landfill Gas Monitoring Plan
for
Clay County Closed MSW Landfill
Permit No. 22-01

LANDFILL GAS MONITORING PLAN
FOR
CLAY COUNTY CLOSED MSW LANDFILL
PERMIT NO. 22-01

Each quarter, Clay County will monitor for landfill gas at the designated onsite landfill structures and at or near the Facility Boundary by means of the selected existing groundwater monitoring wells and the permanently installed landfill gas monitoring wells. The permanent landfill gas monitoring wells will consist of a plastic stand pipe similar to a piezometer used for groundwater detection. A typical permanent landfill gas monitoring well is detailed in Appendix 2. The permanent well will be constructed at a depth of approximately six (6) feet. The 6" diameter hole will contain a one (1) inch Schedule 40 PVC pipe. The bottom one foot (1') of the one (1) inch schedule 40 PVC pipe will be perforated. The bottom two (2) feet of the hole will be backfilled with non-carbonate pea gravel with a bentonite seal one (1) foot thick above it. The remaining three (3) feet will be backfilled with *in situ* soils. The one (1) inch PVC pipe will be extended approximately three (3) feet above the existing grade. The PVC pipe will be capped with a one (1) inch PVC cap with a one quarter (1/4) inch stopcock valve with quick connect coupling which will be plugged or capped to prevent contamination. A minimum four (4) inch diameter schedule 40 PVC sleeve will be placed over the one (1) inch pipe and filled with clean masonry sand to within four (4) inches of the one (1) inch schedule 40 PVC cap. The top of the four (4) inch schedule 40 PVC pipe sleeve will be secured with a removable water tight cap. A marker post will be placed in close proximity to the well. A permanent well I.D. will be placed/painted on the marker post or the 4" schedule 40 PVC sleeve.

Each existing groundwater monitoring well, proposed to be included within the landfill gas monitoring network, will be capped with a tight fitting removable cap system to facilitate the monitoring for landfill gas as well as provide access to the well during groundwater monitoring events. The removable cap will be fitted with a one quarter (1/4) inch stopcock valve with quick connect coupling which will be plugged or capped to prevent contamination.

The proposed permanent landfill gas monitoring wells have been strategically located around the perimeter of the Facility Boundary to complete the monitoring system as shown on Figure 1, Sheet C-101, Facility Plan for the Clay County Closed MSW Landfill, Permit No. 22-01. The locations were chosen based on the relationship of solid waste disposal areas to property lines, onsite landfill structures and the existing groundwater monitoring well system. The spacing of the monitoring points (existing groundwater monitoring wells and proposed landfill gas monitoring wells) is between 200 and 450 feet depending on the location to the closed waste mass. Clay County's Closed MSW Landfill was not constructed with an impermeable base liner system and cap system. There may be a chance for landfill gas migration through the permeable *in situ* soils. The migration of landfill gas is induced by pressure gradients. The landfill gas will move from areas of high pressure to those of low pressure following the path of least resistance. The landfill gas generally migrates vertically until it reaches the landfill cap,

where it may begin to flow horizontally. This occurs until it finds a pathway out through the permeable *in situ* soils. As the landfill gas migrates it will fill the void created by the monitoring point's permeable backfill whereupon a landfill gas detection device will detect and read the level of gas concentration. The six foot depth of the proposed landfill gas monitoring wells is to ensure a stable monitoring point. The only time a shallow monitoring point has not worked is in a very heavy, impermeable clay layer that acts as a seal to the migration of the landfill gas. If a clay layer is encountered during the construction of the monitoring points, it will either be moved beyond the clay or excavated to a depth that is in a conductive zone below the clay.

The level of methane gas (CH_4), a constituent within the landfill gas, can be detected by use of an instrument designed to detect explosive gas concentrations. In this case, the instrument that will be used will be a landfill gas detection metering device specifically designed for use in monitoring landfill gas concentrations. The meter will be equipped with an internal vacuum pump capable of drawing gas from within the voids in the monitoring well. Meter readings will depict methane gas (CH_4) concentrations in percent of the Lower Explosive Limit (% LEL) and/or total percent methane gas concentration (% CH_4). Depending on the particular meter utilized, other readings such as the percent concentration of carbon dioxide (% CO_2) and percent concentration of oxygen (% O_2) will be recorded along with well pressure or vacuum.

Quarterly, a County employee or a contractor for the County will visit each monitoring point. The monitoring points will consist of designated groundwater monitoring wells and the proposed additional landfill gas monitoring wells. At the beginning of each monitoring cycle, the County will complete the top half of the Landfill Gas Measurements – Field Worksheet form included in Appendix 3. Using a landfill gas detection metering device, the County will monitor each well to determine if landfill gas has filled the wells' voids. The readings and the time of the reading at each well will be recorded on the Landfill Gas Measurements – Field Worksheet form. If the well is near the facility boundary and the level of methane gas is detected at or above the lower explosive limit (100% LEL), it must then be determined if the gas is migrating across the facility boundary. If the well is on the facility boundary or methane gas has migrated beyond the facility boundary, a remediation plan must be prepared and implemented by Clay County.

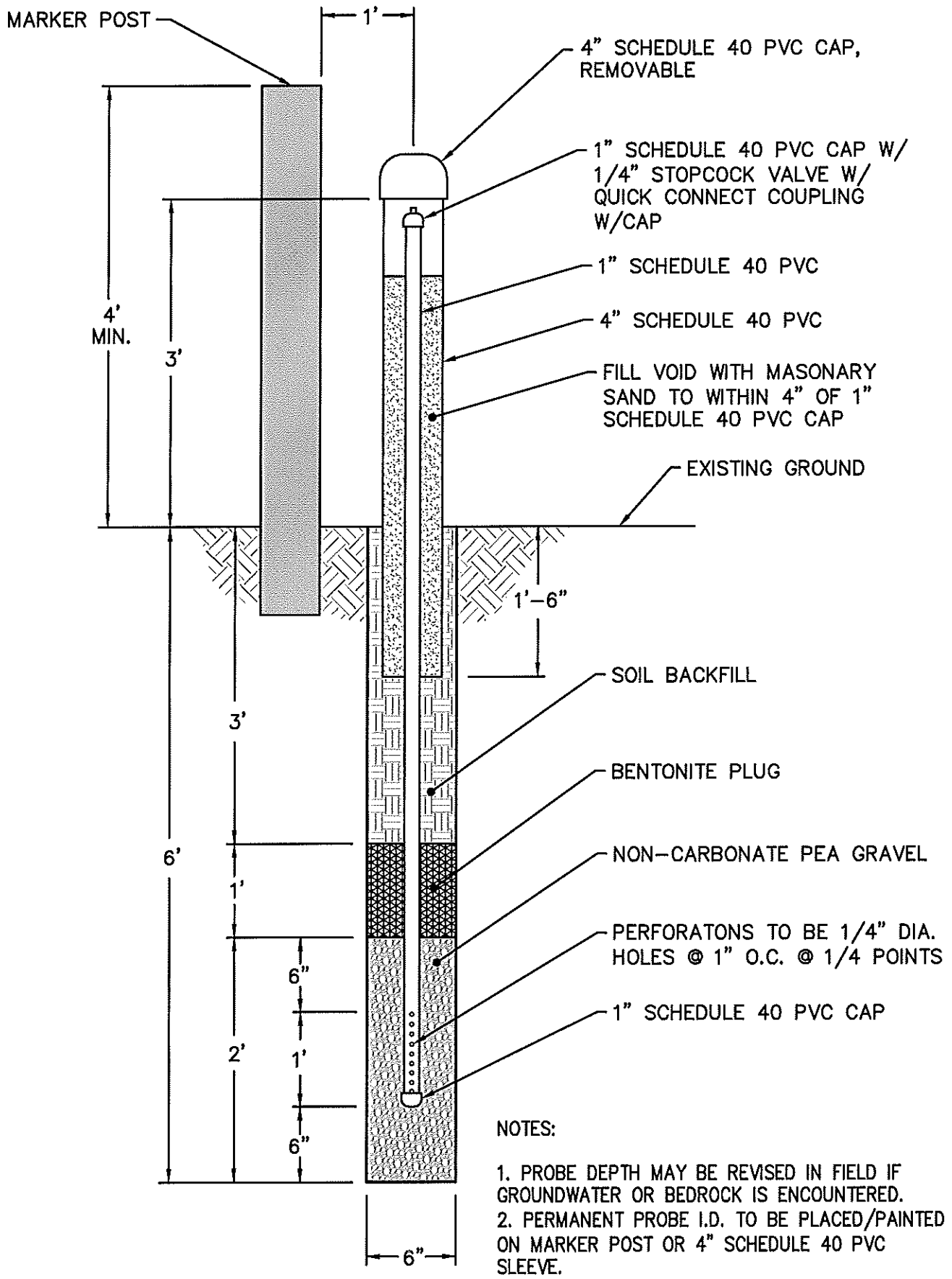
Other points requiring monitoring will be the selected onsite structures located within the landfill's Facility Boundary. The time and the meter readings for each structure will be recorded on the Landfill Gas Measurements – Field Worksheet form. Each structure will be monitored for methane gas using the following methods:

1. All crawl spaces will be monitored (if applicable);
2. All corners in the structure will be monitored;
3. Any holes, cracks and pipes through the foundation will be monitored

If methane gas is detected beyond 25% of the lower explosive limit (25% LEL) in any structure, check the calibration of the monitor and resample. If the reading is still above 25% of the LEL, evacuate the building and try to find the source of gas. If the source is found, try to remove and/or repair the source. If this fails, a remediation plan must be prepared and implemented by Clay County.

APPENDIX 2

Landfill Gas Monitoring Well



NOTES:

1. PROBE DEPTH MAY BE REVISED IN FIELD IF GROUNDWATER OR BEDROCK IS ENCOUNTERED.
2. PERMANENT PROBE I.D. TO BE PLACED/PAINTED ON MARKER POST OR 4" SCHEDULE 40 PVC SLEEVE.

LANDFILL GAS MONITORING WELL

NOT TO SCALE

APPENDIX 3

Landfill Gas Measurements – Field Worksheet

LANDFILL GAS MEASUREMENTS – FIELD WORKSHEET

Clay County Closed MSW Landfill: Permit #22-01

Name of Person Taking Readings: _____ Date: _____

Weather Conditions: _____ Ambient Temperature: _____

Atmospheric Pressure: _____

Gas Monitoring Equipment: _____

Field Calibration Date: _____

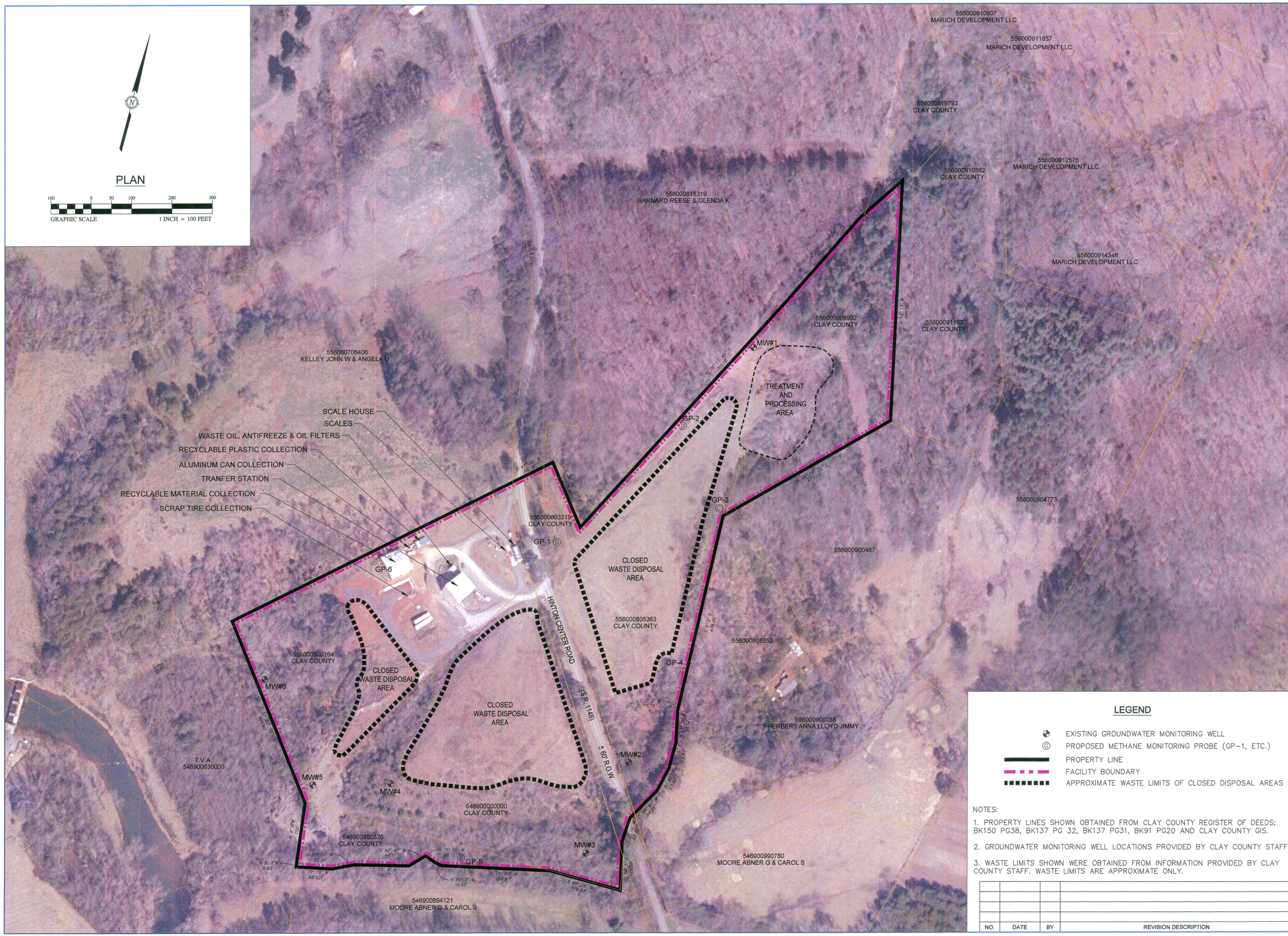
Gas Readings Field Worksheet

Probe ID or Structure	Time	Readings (stable or variable)	% LEL	% CH_4	% CO_2	% O_2	Probe Pressure or Vacuum
GP-1							
GP-2							
MW#1							
GP-3							
GP-4							
MW#2							
MW#3							
GP-5							
MW#5							
MW#6							
GP-6							
Scale House							
Tool/Storage Shed							
Recycle/ Collection Facility							

FIGURES

FIGURE 1

Sheet C-101
Facility Plan
Clay County Closed MSW Landfill
Permit No. 22-01
Clay County
Clay County, North Carolina



LEGEND

- EXISTING GROUNDWATER MONITORING WELL
- PROPOSED METHANE MONITORING PROBE (GP–1, ETC.)
- PROPERTY LINE
- FACILITY BOUNDARY
- APPROXIMATE WASTE LIMITS OF CLOSED DISPOSAL AREAS

NOTES:

1. PROPERTY LINES SHOWN OBTAINED FROM CLAY COUNTY REGISTER OF DEEDS; BK150 PG38, BK137 PG 32, BK137 PG31, BK91 PG20 AND CLAY COUNTY GIS.
2. GROUNDWATER MONITORING WELL LOCATIONS PROVIDED BY CLAY COUNTY STAFF.
3. WASTE LIMITS SHOWN WERE OBTAINED FROM INFORMATION PROVIDED BY CLAY COUNTY STAFF. WASTE LIMITS ARE APPROXIMATE ONLY.

NO.	DATE	BY	REVISION DESCRIPTION

McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

CLAY COUNTY LANDFILL
FACILITY PLAN
CLAY COUNTY
CLAY COUNTY, NORTH CAROLINA

JOB NO.: 10.00710
DATE: OCT. 6, 2010
DESIGNED BY: WHS
CADD BY: KS
DESIGN REVIEW: ____
CONST. REVIEW: ____
FILE NAME: Facility Plan - 11 18 2010.dwg

FACILITY PLAN

SHEET
C-101

Q:\2010\10.00710\Design\Solid Waste\Drawings\Facility Plan - 11 18 2010.dwg 11/18/2010 1:36 PM KELLY