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To: Mr. Mark Poindexter **From:** Stu Ryman
Fax: (919) 733-4810 **Pages:** 8
Phone: **Date:** March 11, 1999
Re: Jackson County Landfill **CC:**

Urgent For Review Please Comment Please Reply Please Recycle

● **Comments:**

Mark -

I am faxing you the workplan for the Phase II groundwater quality investigation at the Jackson County Landfill. We plan to begin field work Monday March 15, 1999.
Please call if you have questions or comments.

Thank you -

THE FLETCHER GROUP
Engineering and Environmental Solutions

March 11, 1999

Via Facsimile

Mr. Mark Poindexter
Division of Waste Management
North Carolina Department of Environment
and Natural Resources
401 Oberlin Road
Suite 150
Raleigh, North Carolina 27065

Subject: Jackson County Landfill
Workplan for Phase II Groundwater Quality Investigation

Dear Mr. Poindexter:

This letter provides a workplan for the Phase II Groundwater Investigation described in the March 4, 1999 "Phase I Groundwater Investigation, Jackson County Landfill," prepared by The Fletcher Group. As discussed in the Phase I report, the North Carolina Department of Environment and Natural Resources (DENR) is requiring Jackson County to define the horizontal and vertical extent of groundwater contamination identified during previous sampling of monitoring wells located adjacent to the landfill.

PURPOSE

DENR has indicated that additional monitoring wells will be required at the site. The Fletcher Group has developed a phased approach to this project designed to meet the DENR requirements while reducing the number of additional wells and the associated long-term costs.

The Fletcher Group anticipates that this approach will prevent the installation of at least one, and possibly two or more permanent groundwater monitoring wells. The reduction in the number of wells will result in significant long-term savings to Jackson County.

BACKGROUND

The Phase I Groundwater Investigation was conducted in response to the DENR requirement. The following determinations were made during Phase I:

- Potable water well sampling demonstrated that current groundwater quality at the landfill does ? not pose a risk to the local residents who use groundwater for domestic purposes.
- Landfill gas is present at relatively high concentrations along much of the landfill perimeter. This gas could be degrading groundwater quality beneath or near the landfill. However, landfill gas does not appear to be the sole source of contamination.

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- Pumping from two domestic wells located near the landfill affects the water level in onsite monitoring wells. Due to a regional hydraulic gradient to the west, the pumping stress does not appear to draw contamination toward the domestic wells.
- There is a strong correlation between the occurrence of landfill gas in the unsaturated zone above groundwater, and the detection of groundwater contaminants. This correlation provides Jackson County with the basis for utilizing a cost-effective method on which to base the number and locations of future wells.

Using the information obtained in Phase I, The Fletcher Group recommends that the initial Phase II tasks focus on evaluating the extent of VOCs in soil gas and collecting exploratory groundwater samples. The data obtained during these tasks will be used to estimate the horizontal extent of groundwater contamination. Subsequent to this evaluation, a monitoring well network will be designed to assess water quality near the perimeter of the gas plume. Use of an exploratory drilling program prior to well installation is intended to prevent the installation of unnecessary or inappropriate monitoring wells.

The Fletcher Group understands that McGill Associates (McGill) is implementing a landfill gas mitigation program for Jackson County. Their efforts are in response to landfill gas measurements made near the property boundary. The scope of work for the Phase II Groundwater Investigation has been designed to complement the work completed by McGill. Specifically, the concentration of landfill gas constituents will be measured in the gas probes installed by The Fletcher Group both before and after the landfill gas mitigation system is installed by McGill and their subcontractor. A comparison of the measurements will be used to evaluate the effectiveness of the gas mitigation system.

The following tasks define the Phase II scope of work.

SCOPE OF SERVICES

TASK 1: Prepare A Workplan for Phase II

This workplan is being provided to DENR for review and comment prior to initiating work.

TASK 2: Obtain Access to Offsite Properties

Tasks 3 and 4, described in the following paragraphs, require that intrusive drilling be completed on offsite properties. Before drilling begins, The Fletcher Group will work with representatives of Jackson County to contact the owners of the properties where drilling is planned. The field activities will be reviewed and specific drilling locations identified for the property owners. Drilling will not commence until the property owner has agreed to allow access.

TASK 3: Install Three Sets of Gas Probes North and East of the Landfill Using the GeoProbe Direct Push Method

Technical Rationale:

High concentrations of landfill gas have been noted in gas probes GP-2 and GP-3, both of which are

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located on top of the ridge north and northeast of the landfill. Groundwater contamination has also been noted in monitoring well MW-1, located near GP-2 on the ridge north of the landfill. Although the information obtained during the Phase I Groundwater Investigation showed that contamination has not migrated to any of the tested potable water wells north or east of the landfill, the extent of landfill gas and groundwater contamination in the vicinity of MW-1 is unknown. If there is movement of groundwater in a northern or easterly direction from MW-1, then contaminants may have migrated in the same direction. Defining the extent of landfill gas and evaluating water quality north and northeast of the landfill is an important element in complying with the DENR requirements.

To evaluate conditions north and northeast of the landfill, The Fletcher Group recommends installing three sets of gas monitoring probes offsite on properties owned by Wilkie, Connor, and Fowler. These probes will be used to monitor soil gas and, if possible, groundwater quality. These probes will be used for five purposes:

- Define the extent of landfill gas north and northeast of the landfill.
- Establish the vertical zones in which most of the gas migration occurs.
- Provide early warning monitoring points beneath the neighboring property for the identification of landfill gas.
- Provide access for the collection of one time groundwater quality samples (if groundwater occurs above the top of bedrock).
- Estimate the elevation of the top of the bedrock.
- Allow for reproducible determination of water table elevation groundwater flow direction north and northeast of the landfill.

The depth to bedrock in MW-1 is approximately 83 feet below the ground surface; the depth to groundwater is approximately 92 feet. These depths indicate that groundwater flow occurs in bedrock on top of the ridge. However, downslope of MW-1 to the south, in the vicinity of MW-3 and MW-5, groundwater occurs in saprolite. This indicates that groundwater flow transitions from bedrock to saprolite south of MW-1. A similar pattern is expected north and northeast of the landfill.

Field Methods:

The GeoProbe direct push drilling method is effective in unconsolidated material such as saprolite. It cannot penetrate dense material such as bedrock or large boulders. If, as expected, groundwater occurs in saprolite in the downslope direction north and northeast of the landfill, then the GeoProbe drilling method will be effective for collecting exploratory groundwater samples and installing permanent gas monitoring probes.

Three probes should be installed at each location in separate boreholes. All probes installed above the water table will be constructed using two foot screens. Where groundwater is observed during drilling, ten foot screens will be used in construction of the probe. During drilling, representative samples of the subsurface material will be collected at 10 foot intervals for evaluation of lithology.

In locations where the water table is encountered above ^{bedrock?} drilling will continue in an attempt to identify the top of bedrock. For estimation of costs, The Fletcher Group has assumed that bedrock will be encountered within 15 feet of the water table. The GeoProbe will then be pulled back and a permanent gas probe will be installed at the water table. The water table gas probe will be constructed with a 10 foot screen.

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Approximately five feet of the screen will be installed below the water table. This construction method will allow the completed probe to be used as both a piezometer and a gas monitoring probe. Based on measurements made during installation of MW-1, the maximum depth to bedrock is estimated to be approximately 80 feet below the ground surface.

In locations where bedrock is encountered above groundwater, the depth of the bedrock will be noted. The deepest probe at each location will then be installed with a two foot screen set just above the saprolite-bedrock interface.

At each location, a second and third gas probe will also be installed. The middle probe will be installed midway between the ground surface and the deepest probe. For cost estimating, the midpoint depth has been assumed to be approximately 40 feet below the ground surface. The third probe will be installed near the ground surface. It will be screened from approximately five to seven feet below the ground surface.

The exact screen depths will be determined during field activities. If the depth of the deep probe at any location is less than 40 feet, then the middle probe will not be installed.

Where deep gas probes are constructed across the water table, they will be constructed of 1/2-inch diameter PVC threaded casing with ten feet of pre-packed screen. The screens will be placed across the water table. Approximately 10 feet of fine sand will be placed in the annular space of the borehole above the pre-packed screen to provide separation between the screen and the bentonite. Bentonite chips will be filled in the borehole above the sand to the ground surface.

The intermediate and shallow gas probes will be constructed of 1-inch diameter PVC threaded casing and two foot screens. Each will otherwise be constructed similar to the deep probes. The sand-filled portion of the borehole will be constructed to an approximate length of eight feet. Coupled with the two foot screen, this construction method will provide soil gas screening across a ten foot portion of the unsaturated zone.

Each probe will be protected with a locking steel protective casing. The top of each probe will be fitted with a tight fitting cap and stopcock to allow gas monitoring while reducing the introduction of ambient air in the probe. The cap of each deep probe will be removable to allow measurements of the depth to water.

After the deep probes are installed, screening samples will be collected of groundwater and analyzed for volatile organic compounds (VOCs) using US EPA Method 8260. The laboratory reporting limit will be between one and five micrograms per liter ($\mu\text{g/L}$). The groundwater samples will also be analyzed for calcium, magnesium, sodium, chloride, and sulfate. Each of these parameters is a common indicator of landfill leachate impacts.

TASK 4: Install Five Sets of Gas Probes Generally South of the Landfill

Technical Rationale:

Landfill gas has been detected in gas probes and monitoring wells located south and west of the landfill. Groundwater contamination has also been identified in these areas. According to well logs and water level data from wells MW-3, MW-4 and MW-5, groundwater occurs in saprolite south and west of the landfill.

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Field Method:

To evaluate the extent of VOC contamination in groundwater and soil gas, five sets of gas probes will be installed around the southern portion of the landfill. The installation of probes will begin southeast of the landfill and proceed clockwise. One set will be installed on the Webster Enterprise property, one on the Western Builders property, and one on the G.S. Railroad property. Two sets will also be installed on Jackson County property southwest of Dillsboro Road. Each of the sets will consist of two gas probes. One probe will be screened from approximately five to seven feet below the ground surface, and the second will be screened across the water table. Previously collected data suggests that groundwater will occur in saprolite at a maximum depth of 40 feet below the ground surface.

Construction of the gas probes will be the same as that described in Task 3. A groundwater sample will be collected from the deeper probes that encounter groundwater. The groundwater samples will be analyzed for the same parameters as described in Task 3.

TASK 5: Measure the Concentration of Landfill Gas in Each Probe and Plot the Location of the Gas Data on a Landfill Base Map

The concentration of landfill gas in each new gas probe will be monitored approximately 24 hours after installation using a meter designed specifically to measure landfill gas. The meter will be used to measure the concentration (by volume) of methane, carbon dioxide and oxygen. In addition, the percent lower explosive limit (LEL) for methane will be measured at each probe. The depth to water will also be measured in any probe screened across the water table. Additional gas and water level measurements will be collected from each probe approximately one and two weeks after installation.

The location and elevation of each new probe will be surveyed by a licensed land surveyor. The surveyor will tie the new locations to the existing monitoring wells using the same horizontal and vertical datum. Jackson County has indicated that a surveyor in the area typically performs work for the County. The Fletcher Group has assumed that Jackson County will contract directly for surveying services. The survey data will be used to accurately identify the location of each probe on a map of the site. The survey data will also be used in conjunction with water level measurements to calculate the groundwater gradient; data that are critical to proper placement of additional permanent wells. The Fletcher Group will use a base map of the site previously prepared by McGill.

TASK 6: Evaluate the Gas Monitoring Data and Estimate the Extent of Groundwater Impacts

The results of gas monitoring will be evaluated to determine the horizontal and vertical distribution of landfill gas. The results of the first three tasks will be used to map the distribution of gas. Any new groundwater quality results will be evaluated to update the correlation of landfill gas with groundwater contamination and estimate the extent of groundwater quality impacts. New water level measurements and survey data will be combined to map groundwater flow direction.

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TASK 7: Review Findings with DENR

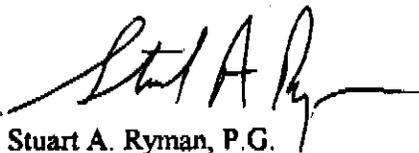
The data obtained during completion of Tasks 3 through 6 will be utilized to determine the number and locations of additional permanent monitoring wells. Currently, The Fletcher Group anticipates that one additional monitoring well will be required north of the landfill and at least two monitoring wells will be required to the south and southeast. The Phase II investigation will be summarized in a series of tables and figures. The tables and figures will be provided to DENR and the results will be discussed with representatives of the department by telephone. In those discussions, The Fletcher Group will summarize the findings and justify the proposed locations for permanent monitoring wells. The installation of monitoring wells will be implemented as a separate scope of work.

SCHEDULE

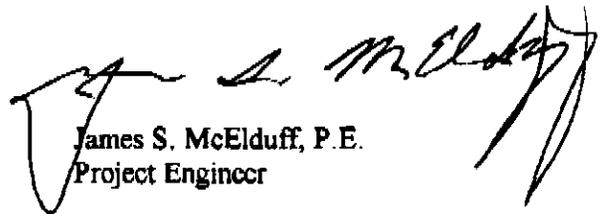
In order to coordinate with the landfill gas mitigation program being implemented by McGill and Associates, The Fletcher Group anticipates starting field work on March 15, 1999. Access to the offsite properties will be required before work can begin. Initial results will be available for discussion within three weeks of initiating work. A proposed project schedule is attached.

We appreciate your assistance with this project. If you have any questions or comments, please contact either of us at (828) 281-3350.

Sincerely,



Stuart A. Ryman, P.G.
Project Geologist



James S. McElduff, P.E.
Project Engineer

enclosures

Jackson County Landfill

Proposed Schedule For Phase II Groundwater Investigation

Task

Submit Phase I Groundwater Report to DENR	3/4/99		
Task 1 - Prepare Cost Estimate and Workplan for Phase II	3/4/99	thru	3/10/99
Present Phase I Findings and Phase II Recommendations to Commissioners	3/10/99		
Receive Approval to Proceed with Phase II	3/11/99		
Submit Phase II Workplan to DENR	3/11/99		
DENR Review and Approval of Workplan	3/11/99	thru	3/12/99
Request That The DENR Deadline For the Installation of the Methane Venting System Be Extended to April 9, 1999	3/11/99		current deadline is March 29, 1999
Task 2 - Obtain Access for Offsite Drilling	3/10/99	thru	3/12/99
Task 3 - Install Three Sets of Gas Probes North and East of Landfill	3/15/99	thru	3/16/99
Task 4 - Install Five Sets of Gas Probes South and West of The Landfill	3/17/99	thru	3/18/99
Task 5 - Measure the Concentration of Landfill Gas In Each Probe	3/15/99	thru	4/11/99
McGill Associates Installs Methane Gas Venting System.	3/18/99	thru	4/7/99
Task 6 - Evaluate the Gas Monitoring Data and Estimate the Extent of Groundwater Impacts	3/18/99	thru	4/21/99
Task 7 - Review Findings with DENR and Select Appropriate Locations for Additional Monitoring Wells	4/21/99		