David Garrett & Associates
Engineering and Geology

April 8, 2009

John A.K. Tucker, P.E.
Consulting Engineer
P.O. Box 297
Fuquay-Varina, North Carolina 27526

RE: Updated Work Plan for Rowland LCID
Ground Water and Landfill Gas Evaluation

Dear John:

This work plan was prepared at your request and is based in part on our June 23, 2008 visit to the offices of Rowland Landfill, located on Gresham Lake Road in Raleigh, NC, where we reviewed several documents pertaining to a prior ground water investigation at the site, and a meeting with the NC DENR Solid Waste Section on February 24, 2009. During that meeting we discussed the Section's concerns regarding the potential for residual contamination and landfill gas migration due to the former operation of the facility as a demolition landfill (pre-1998). An investigation is being planned to resolve those concerns relative to a forthcoming Permit to Operate for a Processing Facility (formerly a "Treatment and Processing Facility") for mulching LCID materials and a planned vertical expansion an LCID landfill – as the facility has been permitted post-1998 – pursuant to plans submitted to Wake County ca. 2005 by John Tucker, PE.

Topography and Surroundings

The landfill is situated amidst old industrial properties, adjacent to a concrete batch plant. The site is physically located just south of a topographic divide (defined by Gresham Lake Road) and drained by natural drainage features located east and west of the facility southward toward Perry Creek, which flows to the south and east to Gresham Lake then to the Neuse River (**Figure 1**). The jurisdictional status of the smaller drainage features is not known to me. The site is within the City Limits of Raleigh and served by paved streets. The area is largely served by municipal water, but extant water supply wells are known (i.e., on the project premises). The presence of domestic wells nearby has not been verified – this is part of the planned work scope.

Occupied structures (commercial buildings, no residences) are shown within 500 feet of the landfill boundary in the northwest, north (on-site buildings), northeast and east directions. Residences are located just over 500 feet away to the north (across Gresham Lake Road). Utility pipelines – potential gas migration conduits – are expected along the road but no large pipelines appear to cut through the property. The facility boundary does not extend to the assumed local ground water discharge feature (Perry Creek), located approximately 100 feet south of the landfill boundary, but there is no development between the landfill and the creek.

5105 Harbour Towne Drive • Raleigh • North Carolina • 27604
919-418-4375 (Mobile) • 919-231-1818 (Office fax) • E-mail: david@davidgarrettpe.com

Figure 1 – Current Site Conditions (from Google Maps), not to scale

Property Information

The following information came from the Wake County IMAPS web site (tax records):

Map Coordinates	X: 2122362.3507652692
	Y: 776028.0174716837
PIN Number	1727262194 (landfill parcel)
Zoning	IND-1 (allows landfills)
Acreage	28.38 (three parcels)

Brief Project History

The Rowland landfill began in the 1980's as backfill for a quarry dating to the 1960's. The landfill was formerly operated under a permit from Wake County and has recently come under NC DENR Solid Waste Section regulation (Permit #92O-LCID). At present, the Section is reviewing the old Wake County permits for consistency with current rules, requiring permit updates as needed. A ground water assessment was performed in the 1990's (ending ca. 2004) under the auspices of the NC DENR Superfund Section.

Correspondence I reviewed, dated between 2001 and 2005 from the Superfund Section, indicated the landfill had been assigned "No Further Action" status in the Inactive Hazardous Sites Program and recommended a discontinuation of monitoring and abandonment of the monitoring wells. Abandonment records were presented to (and acknowledged by) the Superfund Section, upon which I concluded in my letter to you dated July 15, 2008 that the facility appears to have complied with the regulatory requirements at the time. Based on the data, there does not appear to be cause for further concern regarding ground water impacts, nor does the facility appear to constitute a threat to the environment or the public at large.

Regulatory Concerns

During our February 24, 2009 meeting, Solid Waste Section (SWS) regulators expressed a desire to confirm the aforementioned conclusions prior to renewing the Permit to Operate, scheduled for later this year. Two main concerns need to be investigated:

1) Evaluate ground water conditions to verify the findings of the earlier assessment, i.e., demonstrate that there is still no apparent impact on the ground water, by monitoring on-site streams and the on-site water supply well, and
2) Monitor for methane in accordance with Solid Waste Section rules pertaining to threshold limits for occupied structures on the site and at the property line.

Ground water monitoring is not normally required at LCID landfills, but this is a special case due to the historical operation of the landfill – the whole class of "demolition" landfills has been eliminated by the 1998 rule change, and most of the existing landfills that planned to continue operating into 1998 and beyond – those regulated by the SWS at least – were required to demonstrate compliance with the post-1998 regulations, including the potential for ground water impacts and verifying that flow conditions are relatively well understood. Methane monitoring has neither been required historically at LCID landfills, but the past use of the site warrants confirmation monitoring – there is indication that the site may have once been fitted with gas extraction wells for methane recovery as an energy source, but this activity was discontinued.

Work Plan Summary

A preliminary work plan for the gas evaluation dated December 24, 2008 was reviewed with the Solid Waste Section and is thus modified based on comments received during the meeting. The work plan is also expanded to include the water quality sampling, which was discussed verbally with the Section but evidently not committed to paper. Please refer to the attached map showing the tentative sampling locations. We will notify the SWS one week in advance of each sampling event. Data will be furnished to the SWS as it becomes available. The following is a summary of the proposed work, modified per the February 24, 2009meeting with the SWS:

<u>Area Water Well Reconnaissance</u>

- Conduct a survey or identify water wells in use within 1500 feet of the facility

- Prepare a map showing ground water flow directions and identified wells

Ground Water Monitoring

- Conduct four quarterly samples of ground water from the on-site water supply well and from the nearest active stream – either the "east" drainage feature (preferred, if running), or from Perry Creek – stream sample locations will be selected based on ambient conditions

- Analyze the samples for Appendix I parameters and report results from each event using NC DENR Solid Waste Section reporting protocols

- Prepare a summary report after four quarters completed with recommendations for amending the monitoring program or discontinuing the sampling, as may be appropriate

Methane Monitoring

- Finalize the methane sampling location map – locations are shown tentatively, pending detailed area reconnaissance) – sampling locations will be selected based on proximity and direction of occupied structures, utilities, natural barriers (i.e., topography and surface streams), and the facility boundary

- Conduct four quarterly rounds of methane sampling using conventional soil-gas detection monitoring techniques, i.e., a bar-hole punch test conducted to depths of approximately 3 feet* using an organic vapor analyzer (OVA) or similar meter specifically calibrated to detect methane (a meter known as a Gem 5000 is an example) – tentatively, I anticipate 20 sampling locations (see **Figure 2**)

- Monitor on-site buildings using the OVA or Gem 5000 equipment

- Review the methane sampling results with the Solid Waste Section and evaluate data to determine if additional testing is warranted**

- Prepare a final report with findings and recommendations.

* This depth is approximately equal to most shallow utilities along a roadway shoulder, i.e., the north property boundary; driving the bar-hole punch may be assisted with a backhoe.

**A second stage of monitoring might be warranted, or perhaps a permanent monitoring program, possibly consisting of continuous gas alarms in the buildings and future gas monitoring probes (similar to ground water monitoring wells, except these do not penetrate the water table). The methane sampling locations might need to be shifted to determine the gas migration patterns and concentrations. It is not prudent to install permanent methane monitoring probes until gas has been detected and a migration pattern has been tentatively established to guide the selection of probe locations. It is highly likely that if any gas is migrating from the landfill, it has been doing so for many years – steady state conditions would have been achieved – and the gas will show up at depths reachable with the bar-hole punch test.

Figure 2 – Tentative Sampling Locations (from Google Maps), not to scale

Schedule

This work will commence with the reconnaissance and first sampling event for ground water and methane within three weeks of approval of the work plan by the Solid Waste Section. I anticipate that the final report will be completed within three weeks following receipt of the analytical data from the last quarterly ground water sampling event (May-June 2010).

Please contact me if you have any questions or if I can be of further assistance.

Cordially, yours,

G. David Garrett, P.G., P.E.

cc: John Tucker, P.E. – Consultant
Sylvia Rowland – Owner