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June 4, 2007

Mr. Brian Wootton
Hydrogeologist
NCDENR – Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina, 27699-1646

RE: Coble's Sandrock C&D Landfill, Alamance County
Permit # 01-05 - Phase 3 Expansion
Response to DENR Comments and Revised Hydrogeologic Report
JEI Project No. 419.00; Task 27

Dear Brian:

Enclosed please find a revised Hydrogeologic Report for the Coble's Sandrock C&D Landfill. This report incorporates the additional data and other changes requested in your letter dated June 15, 2006, and discussed in our meeting on October 12, 2006 and during subsequent phone conversations. Following is a point-by-point response to your questions and comments in the June 2006 letter.

DENR Comment #1: *Page 1 of the Hydrogeologic Report states, in part, the following: "The total acreage included in the Site Plan Application consists of approximately 139 acres in Alamance County ...". However, page 1 of the site suitability report states, in part, the following: "The proposed facility will include 114.4 acres in addition to the currently permitted 39.6 acres for a total facility area of 154.0 acres...". Please clarify the discrepancies of the new acreage to be added and the total acreage at the site.*

The acreage reported in the Site Suitability Report is correct. The currently permitted facility is 39.6 acres and the proposed expansion area is 114.4 acres so the total acreage for the proposed facility is 154 acres.

DENR Comment #2: *According to historical and current boring logs, construction diagrams for piezometers and monitoring wells, and groundwater elevation data (Table 5) submitted in the Report; the information compiled below by the SWS depicts some missing criteria... Based on some incomplete boring piezometer log information and water level data submitted thus far and noted above, site suitability for the new acreage 114.4 (?) acres and design study for Phase 3A, 3B cannot be determined at this time.*

Table 1 of the Hydrogeologic Report has been updated to include minimum and maximum water levels originally presented elsewhere in the report and to make some of the other data clearer. In some cases the "missing" data are not available, for example, some borings were terminated before reaching bedrock, so depths to bedrock are not available for those borings. In these cases, the minimum depth to bedrock is indicated by "> dd.dd" where dd.dd equals the total depth of the boring.

It should be noted that the majority of "missing" data are for old borings previously accepted by the Department of Environment and Natural Resources (DENR) as part of earlier permit applications. The piezometers with missing boring logs (P-2, P-2A, P-3 (now MW-6), P-4, P-5, P-6, and P-7) were installed by Trigon Engineering Consultants for the original permit application in 1997. Trigon did not include boring logs for these piezometers in the 1997 application. Data for these piezometers, such as depth to bedrock and groundwater levels, were presented in tables in the 1997 permit application. These data are included in Tables 1 and 5 of this report.

DENR Comment #3: *More Hydrogeological data is needed from borings in the proposed phase 3A and 3B areas. Presently, there is not enough complete boring/piezometer well data and boring number density at these proposed phases. It is the Solid Waste Section's policy that a minimum of one boring/piezometer per acre be installed within the proposed footprint(s) for design purposes. Also, an ample number of borings/piezometers need to be installed within the compliance area (250 feet from the footprint). As noted in the compliance table above, some of the historical borings/piezometers do not depict water levels at time of boring piezometer installation, nor depict historical high or low groundwater level trends (i.e.- B-2, B-3, B-4, B-5, C-3 within the proposed Phase 3B and B-1, C-1, and C-2 located near the existing C&D Phase 1; therefore, these borings represent incomplete data.*

In our meeting in October 2006 and during subsequent phone conversations, we discussed the need for additional borings in and around the Phase 3A and Phase 3B footprints. We agreed on installing three additional piezometers within the Phase 3A foot print (P-31, P-32, and P-33), 3 additional piezometers within the Phase 3B footprint (P-35, P-36, and P-37), and one additional piezometer just outside the Phase 3B footprint (P-38). These piezometers were installed between January 29 and February 5, 2007. The attached Revised Hydrogeologic Report presents the data from these piezometers, including soil analyses, core data, and slug test results. With the addition of these piezometers, there are now 6 existing wells/piezometers within the 6.3 acre footprint of Phase 3A (plus 1 abandoned boring with incomplete information) and 5 existing wells/piezometers within the 5.6 acre Phase 3B footprint (plus 2 abandoned borings and one abandoned well with incomplete information). In addition, there are 6 existing piezometers and 2 abandoned borings within 150 feet of the Phase 3A footprint and there are 3 existing piezometers, 2 abandoned piezometers, and 2 abandoned borings within 200 feet of the Phase 3B footprint.

DENR Comment #4: *There are not enough borings/piezometers and lithologic/hydrological data to adequately characterize the proposed additional 114.4 (?)acres for site suitability (i.e., especially on the eastern and southeastern side of the property.) It's the Solid Waste Sections policy that a minimum of one boring/piezometer per 10 acres be within the facility boundary for site suitability purposes. Also, some of the proposed new borings/piezometers need to be drilled and lithologically characterized to 50 feet below land surface according to Rule 15A NCAC 13B.0504(1)(c)(i)(E).*

Before the 2007 piezometer installations, there were 26 active monitoring wells and piezometers within the proposed 154 acre facility, which is one for every 5.92 acres. Eight of these borings extended to greater than 50 feet below the ground surface. Within the proposed 114.4 acre expansion area, there were 16 active monitoring wells and piezometers, which is one for every 7.15 acres. Four of these borings extended to greater than 50 feet below the ground surface. In addition, many of the borings that did not reach 50 feet below the ground surface did reach 15 feet or greater below bedrock. In a phone conversation in August 2006 and again in our October 2006 meeting, DENR agreed that the total number of borings/piezometers and the depths of characterization were adequate, but that there were two specific areas within the proposed expansion area that DENR believed were not adequately characterized. These were: (1) the area down gradient of the sedimentation pond on the east side of the facility, between the proposed waste area and the creek; and (2) near the southern end of the facility in the general vicinity of hand-augered piezometer P-27.

Since the creek is a potential receptor, piezometer P-34 was installed between the proposed waste area and the creek, down gradient of the sedimentation pond, to address the first area of concern. The data from this well, including soil analyses and slug test results, are included in the Revised Hydrogeologic Report.

The second area of concern was primarily focused on the lack of a boring near the southern end of the proposed facility that characterized the full stratigraphy to and including bedrock. As we discussed in our October 2006 meeting and phone conversations, this area is mostly low-lying, with very shallow groundwater and very soft, frequently saturated soil conditions, and some of this area may be considered wetlands. Since: (1) this area is not proposed for waste disposal due to shallow groundwater and possible wetlands impacts; (2) this area is hydrologically separated from the proposed waste areas by a groundwater discharge feature (a creek); therefore, a detailed hydrogeologic characterization of this area will not improve monitorability of the landfill; and (3) the area does not allow drill rig access without potential wetlands impacts; it was agreed that an additional piezometer was not needed in this area.

DENR Comment #5: *According to boring/piezometer logs in the Report and the compiled table above, some of the borings/piezometers (i.e.- B-1, B-2, B-3, MW-6, P-27, P-28, P-29, and P-30) do not show auger refusal (top of rock). Borings/piezometers need to show all lithological units, including top of bedrock (auger refusal).*

In cases where borings were terminated before reaching bedrock, the minimum depth to bedrock is assumed to be the total depth of the boring. Use of these minimum depths to constrain the depth to bedrock map results in a conservatively shallow bedrock map. Some of the piezometers installed for the original permit application in 1997 were installed using air-rotary drilling, so depth to bedrock based on auger refusal is not available. Trigon reported bedrock depths for these borings; however, these depths can only be considered estimates. In general, these depths were not used in producing the top of bedrock map presented in the Hydrogeologic Report. In most cases, Trigon's reported depth to bedrock is deeper than the bedrock surface as mapped, indicating that the bedrock map is conservative.

To better constrain the top of bedrock, all new piezometers installed in 2007 were installed using hollow-stem augers to auger refusal, then an air hammer to a minimum of 15 feet into bedrock, with the exception of P-34, which was advanced to auger refusal but not advanced into bedrock. The top of bedrock map and cross sections have been revised to incorporate these new data.

DENR Comment #6: *According to much of the existing boring/piezometer data submitted thus far, groundwater is noted below top of rock. Since this is the case, further characterization of the entire site (via more borings/piezometers, pump tests, etc.) is needed to determine if bedrock fractures are interconnected or not and if the site can be adequately monitored for the new Construction and Debris landfill phases.*

Although we distinguish between saprolite, partially weathered rock (PWR), and bedrock as lithological units at this site, we believe that there is ample evidence that the hydrologic characteristics of these units do not vary significantly and that they are strongly interconnected. It is reasonable to believe that groundwater flowing through these units will behave as if the units are a single, continuous aquifer; therefore, groundwater will be easily monitored, even where it is below the top of bedrock.

Rock core was obtained from two of the piezometer borings advanced in 2007, one in the Phase 2A footprint (P-32) and one in the Phase 2B footprint (P-37). Evidence from these rock cores, as well as the seven rock cores obtained prior to 2007, indicate that bedrock is highly fractured and weathered to a depth of at least 50 feet. Both strike and dip of fractures observed in cores appeared random. Evidence from topographic fracture trace analyses also shows that fracture orientations are generally random. These observations indicate that bedrock fractures are highly interconnected and are not expected to exhibit preferential flow paths or directions. The observed weathering profile on the site also indicates fractured bedrock is well connected to the overlying PWR and saprolite zones.

Evidence of strong hydrologic connection between shallow and deep portions of the aquifer can be seen in the three nested pairs of piezometers on the site. Monitoring wells MW-10S and MW-10D, piezometers P-9S and P-9D, and abandoned piezometers P-2 and

P-2A, are all pairs located very close to each other, but with significantly different screened intervals. By comparing the water levels in two such paired wells, we can determine the vertical hydraulic gradient. In general, a low vertical gradient means the deep and shallow zones are well-connected and behave as a single aquifer. The vertical gradients for these three pairs based on historic groundwater elevations are shown in Table 7 in the Revised Hydrogeologic Report. The very low vertical hydraulic gradients observed at this site are a strong indication that there is good connectivity between shallow and deep portions of the aquifer and that the bedrock and saprolite/PWR units act as a single aquifer.

Another line of evidence supporting the contention that the saprolite, PWR, and bedrock units can be monitored effectively, as if they are a single aquifer, comes from the slug test data collected for monitoring wells and piezometers on the site. Additional rising and falling head slug tests were performed on all of the new piezometers, plus piezometer P-20 in February 2007. Of the 23 wells/piezometers with slug test results, 12 were screened mostly or completely in fractured bedrock and 11 were screened in the saprolite/PWR zone. For many of these wells/piezometers, both rising-head and falling-head tests were conducted. The average hydraulic conductivities determined from the slug tests were 1.95E-04 cm/sec for the bedrock and 1.47E-04 cm/sec for the saprolite/PWR (see Table 2 in the revised Hydrogeologic Report). The very similar ranges of hydraulic conductivities indicate that there is little or no significant difference between the saprolite/PWR zone and the fractured bedrock in terms of groundwater flow.

If you have any further questions or comments regarding this workplan or other issues concerning this site, please email me at me at vburbach@joyceengineering.com or call me at (336) 323-0092. We appreciate all of your input on this project and look forward to working with you in the future.

Sincerely,
JOYCE ENGINEERING, INC.

Van Burbach, Ph.D., PG
Senior Project Hydrogeologist

Copy: Kent Coble, Coble's Sandrock
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