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STATE OF NEW HAMPSHIRE

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RECEIVED MAY 25 2000 DEPARTMENT OF ENVIRONMENTAL SERVICES SOLID WASTE COMPLIANCE SECTION

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

DATE: May 25, 2000

AT(OFFICE): Permitting and Design Review Section

FROM: JC John Cotton, Hydrogeologist
through John Regan, Supervisor
Hazardous Waste Remediation Bureau

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SUBJECT: **BETHLEHEM - North Country Environmental Services Facility (NCES), Hydrogeologic Report for Proposed Stage III (DES #198704033)**

TO: P&DRS File through Pamela H. Sprague, Supervisor
Permitting and Design Review Section

Richard S. Reed, Administrator
Solid Waste Management Bureau

I have reviewed the subject report (received October 21, 1999) prepared for NCES by Sanborn, Head & Associates, Inc. (SHA); the first round of groundwater sampling results from new monitoring wells and gas monitoring results for August through December 1999 (both received January 24, 2000); and the second round of groundwater sampling results (received April 24, 2000). The data contained in these reports complete the requirements for this detailed hydrogeologic investigation. Summary statements, review comments, requests and suggestions follow.

Groundwater Quality and Soils

New groundwater quality data as measured at monitoring well couplets B-901U&L through B-904U&L indicate background water quality near the southern and eastern property boundaries upgradient, side gradient and down gradient of proposed Stage III. The material logs for B-901 through B-904 describe stratified drift underlain by compact till. There is no upper till unit at these sites. The upper monitoring wells are screened across the water table in the stratified drift. The lower wells are screened in till.

Additional Monitoring Wells

1. I concur with the SHA proposal for one additional monitoring well location on the eastern property boundary northerly of B-904U&L. A well couplet should be installed at this location with well screens in the stratified drift and lower till. A couplet is desirable because at adjacent well sites there is only a shallow well at MW-603 and VOCs have been detected in the deeper screen at B-102.

2. An additional monitoring well triplet needs to be installed midway along the 550-foot distance between MW-403U&L and MW-404U&L. These wells are necessary for the following reasons:

   a. New data from test holes B-905 to B-911 to the north indicate groundwater flow paths in that area are more complex than previously thought.

   b. The thickness of stratified drift increases from about 20 feet at MW-403 to about 80 feet at MW-404. Additional information of stratified drift thickness will aid in understanding the groundwater flow regimen.

   c. Water level elevation in recently installed well MW-806 (screened in lower till and a lower stratified drift unit) is about 10 feet higher than indicated by other nearby water levels in lower till. This measured water level is actually similar to elevations measured in the upper stratified drift.

   Based on present knowledge of stratigraphy, a well should be screened across the water table in the upper till. A well should be screened in the most transmissive zone (based on continuous split spoon sampling) in the stratified drift. The third well should be screened in the lower till.

   These wells will not only improve release detection monitoring of Stage I, but should also confirm whether some of the groundwater flow beneath the southern most part of proposed Stage III extends westerly of MW-404U&L.

3. If construction approval is granted for Stage III, these five release detection wells should be installed within 60 days of approval with immediate submission of installation data to the Department. This would allow Department review prior to completion of Stage III construction which SHA estimates to be 3 months. These wells need to be installed prior to any potential operational approval.

Decommissioning of Wells

1. It is proposed to decommission well couplet MW-406U&L during construction of Stage III. This seems necessary although it is a sensitive issue given the recent (and earlier) water quality results for water samples from these wells.

2. It is not stated in the report, but according to Scott Shillaber of SHA, the well couplet at B-302 is scheduled to be decommissioned. This 3/4-inch diameter well couplet has been used for water level measurements, but is not suitable for sampling. The new well triplet between MW-403U&L and MW-404U&L as explained above will provide better coverage in this area.

Bromide Tracer

At present, bromide is used as a tracer in Stage II. It is proposed to use bromide as a tracer in Stage III. Groundwater flow beneath proposed Stage III is northerly beneath adjacent

land to the east, beneath Stage II and to a lesser extent beneath Stage I. A potential leachate leak from Phase III would be indicated by detection of bromide and contaminants in the new 900-series release detection wells along the eastern boundary or in the Stage I release detection wells. Detection of bromide in the Stage II release detection wells would not distinguish between a potential leak from Stage II or Stage III.

Management of Landfill Gas

1. Improvements in the gas management program for the existing Stages need to be incorporated to minimize release of landfill gas through the bottom liner system. Ideally, adequate performance of this enhanced system should be proven before DES approves construction of Stage III. At a minimum, substantial and consistent reduction in gas detection easterly and southerly of the existing Stages needs to be demonstrated before any approval is given.

2. Design of the gas management system for Stage III is critical because there would be only a 100-foot separation from property boundaries.

Corrections

1. Section B-B' (Figure 3): At B-302, the hydraulic conductivity value at 95 feet should be 0.06 ft/d. At B-901L, the hydraulic conductivity value for 90 to 100 feet (determined by a slug test) was 0.05 ft/d, and the value for 93 to 95 feet (determined by a wick test) was 0.1 ft/d.

2. Page 8, Section 6.2.1, second paragraph: The next to last line should read ". . . indicated bedrock at depths of 254 and 113 feet in eastern and western portions of the Site, respectively. . . ."

3. Page 14, second bullet: The last sentence should read "Stage III base grades should be established at least 8 feet above the water table contours shown on Figure 9."

Hydraulic Gradients and Seepage Velocities, Section 6.3.3:

1. Hydraulic gradients within stratified-drift are presented for different parts of the site. The values presented range from 0.005 to 0.18 foot per foot. Slightly different values can also be calculated. Examples of alternative values are given in parentheses following the values in the report. These alternative calculations are not very significant with respect to hydrogeologic interpretations. However, the different gradients should be used to provide ranges of flow velocities.

   South to north across proposed Stage III - 0.007 ft/ft (0.008)

   South to north across southern part of Stage I - 0.005 ft/ft (0.004)

   Edge of Stage II north to the big seep - 0.027 ft/ft (0.03)

   Edge of Stage II northwest to spring S-108 - 0.05 ft/ft (0.06)

2. Water levels from the new well installations should be combined with the above data to recalculate ranges of hydraulic gradients and estimates of flow velocities. These data should be submitted before completion of Stage III construction.

Groundwater Levels and Flow Directions, Section 6.3.2

The following comments and observations do not require any response from NCES at the present time.

1. Three water-level contour maps are presented depicting water table conditions and head distribution in stratified drift and lower till.

2. Water levels measured in the past from wells that have been decommissioned during landfill development are used with recent measurements to construct water-level contour maps and interpret groundwater flow directions in the same manner that has been judged reasonable (through comparison over time of water levels in all wells) in previous reports.

3. The summary statement that "the upper groundwater flow from beneath the majority of the landfill is northeasterly toward the 100-series and 800-series monitoring wells and the main seep. . . ." may need some qualification. Based on the water table map and reinterpretation of the water-level map for the stratified drift (using data from new wells B-907 to B-911), flow beneath most of Stage II and much of Phase 1 of Stage I is northeasterly toward the Main Seep and northerly toward springs S-108 and S-109. Upper groundwater flow beneath the southwestern part of Phase 1 of Stage I, most of Phase I of Stage I and all of Phases 2 through 4 of Stage I is northerly and northwesterly probably reaching the river west of springs S-108 and S-109.

4. Correlative comments for future consideration. -The original material logs of the 300-series wells described distribution of particle size, but did not assign a genesis to the material. Later B-302D was interpreted as screened in the lower part of stratified drift from 92.9 to 94.9 feet below the surface. Water level in well B-302D is about 10 feet lower than in B-302S which was interpreted as screened in upper till from 38 to 48 feet below the surface. These interpretations and water levels measured in 5 new test wells (B-907 to B-911) to the north, may now indicate a preferential northwesterly convergent groundwater flow in the stratified drift forming a "trough" in the groundwater-level contour map for stratified drift north of Stage I.

   a. The water level in B-302D actually fits much better with the water levels in the lower till. However, the B-302D material log describes laminae of clayey silt and silt at 89 to 89.5 in the split spoon sample. This type of evidence has been consistently used to separate stratified drift and till (although, in reality, this is not perfect method).

   b. Additional strong evidence that B-302D is screened in stratified drift is found in two 1987 sieve analyses of samples from depth intervals of 80 to 81 feet and 95.3 to 96.6 feet. These samples were well-sorted silt and fine to medium sand, respectively, as illustrated by cumulative grain size distribution curves.

c. Water levels from B-302D and MW-404L (which is interpreted as screened within the uppermost part of lower till) are similar. Any additional interpretive consideration of the contact between stratified drift and lower till needs to include data from both wells as well as MW-806 discussed above.

d. The cumulative grain size distribution curve for a sample from the depth interval of 60 to 61 feet in B-302D may indicate till. Thus, the interpreted contact between upper till and stratified drift probably should be lowered from a depth of about 57 feet to below 61 feet.

5. The hydraulic conductivity of 9.2 ft/d determined by a wick test at a depth of 80 to 81.5 feet in B-307 suggests stratified drift instead of lower till as shown on Sections A-A' and D-D'.

6. Following installation of the additional wells, DES will request that cross sections be updated to include that data along with data from MW-806, test holes B-905 and B-906, and test wells B-907 through B-911.

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cc: HWRB PM File
Cc Jim B