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January 30, 2008

Mr. Roger Thompson
Vermont Department of Environmental Conservation
Wastewater Management Division
103 South Main Street, Sewing Building
Waterbury, VT 05671-0405

RE: Evaluation of Addison County Wastewater Disposal Systems
(Contract No. 10923)

Dear Mr. Thompson:

This letter is written in response to your December 19, 2007, correspondence presenting a number of questions and requesting modification of our November 19, 2007, Evaluation of Addison County Wastewater Disposal System report. The responses below are numbered identically to your correspondence. Also included with this letter is a revised version of the report and companion binder of site specific data.

1. The text has been corrected to indicate five occupants at Site No. 40.

   With regard to water usage and the relatively low flow rates calculated at nearly all of the studied sites, our brief inspections performed throughout the study period indicate that the bulk of the individuals occupying these residences are engaged in full-time jobs and lead active lifestyles. These conditions limit home occupation to a minimum number of hours per day, which directly correlates to the low volumes of water and wastewater generated. Re-evaluation of the correlation between assumed water usage per device (toilet, shower, etc.) and metered flow readings indicates that our estimated flow volumes are slightly conservative (overestimate water usage).

2. The mottling identified throughout our soil borings is considered to represent redoximorphic features associated with seasonal soil saturation. We would need to monitor the system through a number of springtime monitoring cycles to confidently indicate whether the redoximorphic features are consistently above actual free water table in all cases. It is our opinion that the accuracy of water level prediction based on redoximorphic features in fine-grained soils (silt/loam, clay/loam, silt) is quite variable. Our experience with soil and groundwater evaluations in this study and through our normal course of business consistently indicates that secondary permeability associated with soil structure is the dominant controlling factor with regard to free water table surface. We have also noted that a significant capillary fringe will exist in fine-grained soils, often on the order of one to two feet in thickness. The capillary fringe is, by definition, 100 percent saturated; however, no free groundwater surface is measurable. The resultant fluctuation in the groundwater surface

and capillary fringe above it will create redoximorphic features due to the displacement of atmospheric oxygen containing soil gas.
A second issue regarding consistent estimation of the thickness of the capillary fringe and creation of redoximorphic features is that there is a unique "tipping point" between capillary fringe at complete saturation and creation of a phreatic surface. When the saturation "tipping point" is met, a dramatic groundwater elevation increase can occur very quickly (hour to days). During a relatively dry spring, as seen in 2007, the capillary fringe-to-free groundwater depth relationship can be sizable and remain sizable during individual storm events. However, if the overall degree of saturation of the subsurface soils is near the "tipping point," a minor storm event may result in the free groundwater surface increasing one to two feet to the top of the capillary fringe's previous location. This drastic and near instantaneous elevation of the groundwater surface is, at this point, unpredictable in the sites observed.

3. The map legend for depth to water table has not been changed, as the NRCS water table data qualifies muck and some silt loams as -1.0' to 0'. If these areas are left out of the plotted data, significant gaps occur in the mapping. Therefore, we have included the -1.0' to 0' data.

4. When reviewing the precipitation data collected in Burlington in March, April, May, and June 2007 it becomes obvious that the rainfall amounts in May and June 2007 were approximately 33 percent less than average levels historically seen. March and April 2007 precipitation levels were at or slightly above the average amounts. Therefore, H & N believes that the overall decline in water level beneath the subject sites may be over estimated as compared with a "normal" year. Review of the datalogger information presented in Appendix 2, Page 14, indicates that initial water level data collection appears to have started after the peak season high groundwater on many sites. However, the rapid decline in groundwater elevations and relatively minor increases seen during precipitation events suggests that the bulk of the sites studied would not have shown evidence of effluent surfacing during a "normal" season. This being said, however, without the data from a number of spring groundwater seasons to evaluate, it is unclear what the "tipping point" is for complete saturation of the soil types. Therefore, it is impossible to predict whether a slightly wetter than normal spring would result in groundwater elevations near or at the ground surface (*i.e.*, at the levels of redoximorphic features).

5. As mentioned in No. 3 above, the data set provided by the NRCS includes descriptions of soils up to 99.9'. In this case, 99.9' is utilized when encountering surface water or bedrock.

6. The mottles identified at Site No. 11 appear to be indicative of seasonal high water table, as the soils are sandy till in nature.

7. The text has been changed to indicate that surfacing was not seen at Site No. 43.

8. As you note, the soils in the area of many of the wastewater disposal systems are of better quality for effluent disposal than indicated on the NRCS maps. Generally, the wastewater disposal systems were placed on the subject properties at the locations which were most likely to have the highest quality soils, such as: isolated areas surrounded with positive drainage, crest of slope, good secondary permeability, and consistent grade. These localized characteristics may explain the slightly better soil types than the regional mapping unit.

9. Review of the datalogger and manual groundwater monitoring data for Site No. 52 does not appear to show significant inconsistencies. Data collected on May 15, 2007, indicates water levels at approximately 4.1' below grade by manual measurement and 3.75' below grade by datalogger. On May 25, 2007, manual measurements were approximately 2.75' below grade, while the datalogger recorded approximately 3' below grade. The difference in the timescale of each of these graphs may be what is leading to an apparent inconsistency in elevation data.

   Both the soil borings and the depth to groundwater measurements in MW-2 and -3 are indicative of a near borderline failure of the system, as groundwater elevations are at or slightly less than 6" below grade.

10. We have utilized the maps and drawings provided at sites with engineering plans to correct our slope estimates, as several did not appear to be too great. Generally, any changes performed reduced the percent slope on site.

11. The appropriate photo for Site No. 54 has been inserted.

12. Review of Site No. 57 indicates that the transmitting soils are logged as a silt loam with friable consistency and a granular structure. This site also has an in ground disposal system that appears to be a "cut and fill" type installation. The installation has resulted in a flat surface across the top of the leachfield. Evidence of positive drainage of surface water around the leachfield does not appear to be in place. Therefore, surface water flows across the leachfield. The combination of these factors appears to be the reason why groundwater levels become so close to grade at this site.

13. Review of the soils log, slope, and location of Site No. 80 indicates that it may qualify under the current rules for a performance based design approach. However, the required mound would be significantly larger than the mound currently operating on site and would require 2.5' of sand beneath the dispersal stone. The current system is less than 100' long and has 1' of sand beneath the dispersal stone.

Site No. 83 would not qualify for a performance based design approach, as the transmitting soils are described as "firm to hard."

14. A note as to the origin of the ponded water and indication that failure may be occurring on Site No. 90 has been included in the text.

15. Tables 3-18 and 3-19 on Pages 3-28 and 3-29 of the On-Site Wastewater Treatment Systems Manual produced by the EPA (in 1992) summarize typical bacteria and virus removal statistics.

16. H & N is hesitant to predict what impact an increase in effluent dosing to the studied systems would have on the measured groundwater table beneath them. Each of the studied systems was being loaded at less than 1.0 gallon per day per linear foot. We have estimated that loading above this rate would result in potentially marginal function, primarily due to the thicker induced groundwater mound limiting vadose zone treatment. Because the data we have collected are for only one spring season, it is impossible to predict the "buffering capacity" of the wastewater disposal systems and native soils beneath them to accommodate increased effluent flow volume. Our "gut" feeling is that increasing the loading rates to 2 gpd/ft would result in wet areas on the downslope side of the disposal systems. The duration of the wet conditions (groundwater within six inches of grade) would vary likely dependent upon the precipitation amounts and degree of snow melt occurring during the spring high groundwater season. Many of the sites appear as if they will have minimal degradation of treatment capabilities with increased flow rates; however, an equal number or more give the feeling that increased flow rate may push the phreatic surface and capillary fringe relationship over the "tipping point" discussed above.

17. At this time the data set contained in this study is limited and does not allow us to put forth any concrete recommendations with regard to Rules changes.

18. Based on the research performed to date and our in-field experience, we continue to believe that the majority of failed systems historically seen throughout Addison County are a result of being undersized for the volume of wastewater flow. However, the dataset collected to date does not allow us to present a "clear basis for separating functioning system from non-functioning system" designs.

The final paragraph of your letter poses three questions.

- *Would the selected systems be considered to be failed if observed throughout the normal monitoring period during a year with average water levels?*

H & N believes greater than 75 percent of the selected systems would not have shown signs of failure during a year with "average" water levels.

- *Does the SHWT reach the levels indicated by the redoximorphic features, or is the free water level deeper than predicted which provides the needed hydraulic capacity?*

Based on the limited dataset collected to date, it appears that the SHWT would routinely be measured below the redoximorphic features. However, insufficient data exist to estimate the difference between redoximorphic features and average SHWT with any degree of confidence. Continued data collection through several spring seasons would greatly assist in determining the correlation between measured SHWT and redoximorphic features.

- *Does the research indicate that the sites have more hydraulic capacity than our mathematical models and on-site testing predict?*

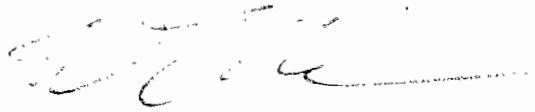
The data do not indicate that the hydraulic capacity of the soils observed is greater than the mathematic models or testing, as none of the systems researched were being loaded at the Rules-required volumes for design of single-family residences. The research data clearly indicate that the volume of wastewater generated per single-family residence is significantly lower than the Rules' dictated volumes.

H & N is pleased to have been able to perform this research and provide the attached final report. H & N will be formally abandoning the monitoring wells remaining at the research sites in accordance with the Water Supply Rules requirements. During the well abandonment process, we will provide property owners with the data collected at their individual site if they have requested it. We anticipate completing this field work within the next two weeks.

If you have any questions, please contact me at 802-658-0820 X 25 or slarosa@q-city.com.

Sincerely,

HEINDEL & NOYES, INC.



Steven LaRosa
Hydrogeologist

c w/o enc: Christine Thompson, Director of WW Mgmt. Div.

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