Attachment VI-2

Appendix C

Closure Construction Design Report

Cells 4 and 5

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ENGINEERS

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December 8, 2009

Mr. Faizur Khan
Manager of Landfill Engineering Projects
Clean Harbors
2027 Battleground Road
Laporte, Texas 77571

Re: Landfill Cells 4, 5, and Z Closure Construction Designs

Dear Mr. Khan:

Hansen, Allen & Luce, Inc. (HAL) has completed the attached construction design drawings for the closures of Landfill Cells 4, 5, and Z in accordance with the design criteria set forth in "Grassy Mountain Facility - Landfill Cells 4, 5, and Z - Potential for Raising Closure Caps" dated June 1998, prepared for Laidlaw Environmental Services (former owner and operator of the Grassy Mountain Facility) by HA&L Engineering. We understand that the current permitted design for capacity, waste mounding, and closure is based on the criteria set forth in the referenced report.

The above referenced report presents the following design criteria:

1. Design components in the area of the top 5% slope (from bottom to top)
   a. 0.5 foot of imported sand for cushion layer.
   b. Geosynthetic Clay Liner (GCL).
   c. 60-mil HDPE geomembrane liner.
   d. Geonet drainage layer.
   e. 8 oz. non-woven geotextile filter fabric.
   f. 2 feet of imported soil for protective soil cover.
   g. 4 inches of gravel armor plating (stone mulch).
2. Design components in the area of the 2H:1V (horizontal to vertical) perimeter slopes (from bottom to top)
   a. 2 feet minimum of Compacted Clay Liner (CCL).
   b. 60-mil HDPE geomembrane liner (textured).
   c. 2 feet of compacted clay soil.
   d. 4 inches of gravel armor plating (stone mulch).
3. There is also an 8-mil geomembrane barrier between the CCL and the extension of the GCL at the upper surface of the CCL.
4. The 4-inch thick gravel armor plating consists of a mean rock diameter of D_{50}=0.86 inch.
5. Original design elevations at the center point of each closure cap is 4292.25, 4298.00, and 4293.60 for Cells 4, 5, and Z, respectively. These design elevations are based on the

original embankment design elevations of 4363 for Cell 4 and 4264 for Cells 5 and Z.

6. The design elevations for the closure caps will be adjusted for settlement at the time the closure caps are constructed.

Clean Harbors, and previous facility owners and operators, have historically conducted periodic waste grade surveys to determine remaining capacities within operating landfills at the time of the surveys. Each survey included a settlement evaluation to determine the amount of adjustment needed to the closure design grades in calculating remaining capacities within the landfills. These settlement evaluations, including a settlement evaluation completed with the June 2009 waste grade survey, are based on surveyed points on the geomembrane surface between the top inside crest of the cell embankments and the geosynthetics anchor trenches.

The landfill cells consist of embankments that are common with adjacent landfills and embankments that are not common with any other landfill. Since embankments common with adjacent landfills have opposing forces that enhance stability (they have a buttressing effect on each other), embankments that are not common with other landfills control landfill and closure stability. Settlement evaluations were based on these non-common embankments for the final closure grades provided with the attached drawings. Horizontal adjustments were also made to the location of the top of the perimeter slopes resulting in a 2H:1V maximum slope. The perimeter slopes are flatter than 2H:1V in many areas as a result of differential settlement of the cell embankments.

Seven years of survey and settlement data were used to establish settlement trends in estimating the anticipated amount of settlement at the time of construction of the closure caps. Construction of the closure caps for Cells 4 and 5 are expected to occur sometime in the spring and summer months of 2010. Results of the settlement evaluations and final design grades for the center of the closure caps used to prepare the final design drawings are summarized in the following table.

Description	Original Center Closure Cap Design Elevation	Total Settlement for Final Design	Center Closure Cap Design Elevations After Settlement
Cell 4	4292.25	4.48	4287.77
Cell 5	4298.00	4.81	4293.19
Cell Z	4293.60	4.79	4288.81

If you have any questions regarding the final closure cap designs and the information presented herein which provides the basis for design, please call.

Sincerely,

HANSEN, ALLEN & LUCE, INC.

Marvin E. Allen, P.E.
Principal

attachments

I. Purpose and Procedure.

a. The purpose of these calculations is to determine the final design grades for closure of Landfill Cells 4, 5, and Z that will be used for closure construction.

b. Waste grade surveys have been conducted at least annually and at times quarterly to determine the settlement that has occurred on the landfill cell embankments, make waste design grade adjustments resulting from settlement, and to determine remaining capacity based on the differences between the surveyed top of waste and the adjusted design waste grades. Use these waste grade surveys to determine a design grade that will be used for closure of the landfill cells based on a waste grade survey conducted at the end of June 2009.

c. Provide additional design grade adjustments based on estimated settlement rates from the current and previous waste grade surveys. Assume closure will occur starting in the spring (between March and May) of 2010. Thus, there will be approximately 10 months of settlement time between the June 2009 survey and when closure construction will begin.

d. Establish a final waste grade design based on final closure grade adjustments from the above activities. The waste grade design will be used to grade waste currently disposed in the landfill in order to provide an appropriate subgrade for closure activities and grades to occur.

II. Calculations

a. The final design grade of the final closure cap is based on a height restriction of the top perimeter break line of the closure cap (top of the 2H:1V perimeter slope) above the landfill cell embankment. The following table tabulates the embankment design elevation, maximum height above the embankment to the perimeter break line, and the design elevations for maximum elevation around the top perimeter and the center of the landfill cells. The data in the table account for the total additional height adjustment of 10 feet above the original closure cap designs for all three cells as modified in 1998 and 7.5 feet above the 2.5-foot height adjustment above the original design as modified for Cells 4 and 5 in 1993.

Description	Embankment Design Elevation	Maximum Height of Cap Perimeter Break Line (Top of Berm)	Maximum Design Elevation of Cap Perimeter Break Line (Top of Berm)	Center Design Elevation of Closure Cap
Cell 4	4263.00	20.50	4283.41	4292.25
Cell 5	4264.00	19.00	4282.99	4298.00
Cell Z	4264.00	19.60	4283.60	4293.60

b. Maximum embankment settlement determined from surveys, in feet, for each of the cells are presented in the following table.

Description	12/31/02	12/31/03	12/31/04	12/31/05	12/31/06	12/31/07	12/31/08	06/30/09
Cell 4	3.29	3.51	3.68	4.13	NA	3.92	4.32	4.42
Cell 5	3.62	3.89	4.06	4.06	4.36	4.45	4.69	4.71
Cell Z	3.74	4.01	4.15	4.34	4.30	4.56	4.68	4.74

c. Settlement differences between years and average annual settlement over the past 6.5 years are summarized in the following table.

Description	1-Year 12/31/02 to 12/31/03	1-Year 12/31/03 to 12/31/04	1-Year 12/31/04 to 12/31/05	1-Year 12/31/05 to 12/31/06	1-Year 12/31/06 to 12/31/07	1-Year 12/31/07 to 12/31/08	12/31/08 to 06/30/09*		Average Annual Settlement
							6-Month	1-Year Adjusted	
Cell 4	0.22	0.17	0.45	-0.21		0.40	0.10	0.20	0.17
Cell 5	0.27	0.17	0.00	0.30	0.09	0.24	0.02	0.04	0.17
Cell Z	0.27	0.14	0.19	-0.04	0.26	0.12	0.06	0.12	0.15

* Note: Provided are the measured settlement values after 6 months (12/31/08 to 06/30/09) and the projected 1-year settlement assuming double the amount of the 6-month measured settlement.

d. Cell 4 has received no waste in the past 4.5 years during which time the average annual settlement has been 0.16 foot per year. Since the settlement numbers are inconsistent from one year to the next, assume the average annual settlement will occur between the latest survey conducted on June 30, 2009 and construction of the landfill closure caps to begin sometime in the spring of 2010.

e. The following table presents final embankment design elevations that will govern closure cap construction in 2010. These settlement projections are based on multiplying the average annual settlement by 7 years and adding this amount to the 2002 measured embankment settlement elevation. This will provide a reasonable average for the basis of the closure grade design.

Description	Original Embankment Design Elevation	December 2002 Measured Settlement	December 2002 Embankment Elevation	7-Year Projected Settlement Since December 2002	Total Settlement for Final Design	Estimated Embankment Elevations After Settlement for Closure Cap Design
Cell 4	4263.00	3.29	4259.71	1.19	4.48	4258.52
Cell 5	4264.00	3.62	4260.38	1.19	4.81	4259.19
Cell Z	4264.00	3.74	4260.26	1.05	4.79	4259.21

f. The following table presents final center design elevations for the closure caps that will govern closure cap construction in 2010. These settlement projections are based on lowering the closure cap elevations by the amount of settlement for final design.

Description	Original Center Closure Cap Design Elevation	Total Settlement for Final Design	Center Closure Cap Design Elevations After Settlement
Cell 4	4292.25	4.48	4287.77
Cell 5	4298.00	4.81	4293.19
Cell Z	4293.60	4.79	4288.81