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England-Thims & Miller, Inc.

ENGINEERS • PLANNERS • SURVEYORS • LANDSCAPE ARCHITECTS

Dayao

NORTHEAST DISTRICT

RECEIVED

APR 28 1997

DEP - JACKSONVILLE

Principals
James E. England, P.E., Pres.
Robert E. Thims, Exec. V.P.
Douglas C. Miller, P.E., Exec. V.P.
N. Hugh Mathews, P.E., Exec. V.P.

April 24, 1997

Ms. Mary C. Nogas, P.E.
Solid Waste Supervisor
Department of Environmental Protection
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444
FDEP File Numbers 296641 and 296642
ET&M No. E96-49-1C

33628

Dear Ms. Nogas:

We have received your second Request for Additional Information (RAI) dated March 28, 1997 regarding the referenced project. The following is our response to your RAI request.

Attachment 1
Review Memorandum dated March 28, 1997, prepared by Francis Dayao

Comments 1. - 9.

These items are complete and therefore, no response is required.

Comments 10. ***Please note that FAC Rule 62-701.500(7)(e)(1) allows initial cover which may consist of temporary cover to be utilized on areas where additional waste will be deposited on the working face within 18 hours. In addition, application of initial cover is required in order to minimize adverse environmental, safety, or health effects such as those resulting from birds, unauthorized wastes, blowing litter, odors, disease vectors, or fires.***

The facility will abide by FAC Rule 62-701.500(7)(e)(1).

Comment 15. ***Please justify not proposing to install gas monitoring probes along the southern property boundary.***

According to FAC Rule 62-701.400 (10)(a), landfill gas control systems shall be designed to prevent the concentration of methane and other gasses generated by the landfill from exceeding the lower explosive limit for gasses at or beyond the landfill property boundary. The southern property boundary is approximately 700 feet from the landfill limits and there is a wetlands between the landfill and the property boundary. In the remote circumstances where gas is found outside the lined area, we do not anticipate that methane or other gases could potentially migrate beyond the southern property boundary.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-184444

Comments 16. - 28.

These items are complete and therefore, no response is required.

Comment ***The following comments are a result of the review of the proposed gas collection system (system) received by the Department on November 19, 1996.***

Please see the attached letter from Rust Environmental & Infrastructure Inc. for a response to each of the comments regarding the gas collection system for Trail Ridge Landfill.

Comment ***Please note that the following Specific Conditions will be included in the permit:***

1. ***All piezometers (installed as part of the requirements of Specific Condition No. 48I.(6) of the previous permit) at the wetland/upland boundary and at the mid-elevation of each line transect, installed to determine groundwater elevations in the wetland discharge areas, shall be monitored at 6 month intervals commencing from the permit issuance date. The reports shall be submitted to the Department's Northeast District's Environmental Resource Permitting Section within 15 days from the monitoring event.***

We recommend that this specific condition be revised as follows (additions are underlined and deletions are in ~~strike-out~~):

> All piezometers (installed as part of the requirements of Specific Condition No. 48I.(6) of the previous permit) at the wetland/upland boundary and at ~~the mid-elevation of each line transect~~ existing groundwater monitoring locations, installed to determine groundwater elevations in the wetland discharge areas, shall be monitored at 6 month intervals commencing ~~from~~ 6 months after the permit issuance date. The hydrology monitoring reports shall be submitted to the Department's Northeast District's Environmental Resource Permitting Section within ~~15~~ 30 days from the monitoring event.

2. ***The wetland areas of discharge shall be monitored every 2 years commencing from the permit issuance date. These monitoring reports shall utilize the transect established in the Base Line Study and include all the required information in the Base Line Study. These monitoring reports shall be submitted to the Department's Northeast District's Environmental Resource Permitting Section no later than 2 weeks after each monitoring event.***

We recommend that this specific condition be revised as follows:

> The vegetation in the wetland areas of discharge shall be monitored every 2 years commencing from the permit issuance date. These vegetation monitoring reports shall utilize the transect established in the Base Line Study and shall include all ~~the~~ required information in the Base Line Study. These vegetation monitoring reports shall be submitted to the Department's Northeast District's Environmental Resource Permitting Section no later than ~~2 weeks~~ 30 days after each monitoring event.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-184444

3. ***In the event of any quantified vegetational species compositional changes along any interval of any transect during any monitoring event, the Permittee shall include any changes in that periods monitoring report and include any proposed changes in the discharge schedule to mitigate these changes. The Department shall review the proposed changes and the Permittee shall take what remedial actions deemed necessary by the Department.***

We recommend that this specific condition be revised as follows:

Each vegetation monitoring report will document any significant quantified vegetational compositional changes which indicate drainage of the wetlands. Monitoring data will be collected from all previously established quadrants along the existing transects. Minor fluctuations in species composition due to natural factors such as rainfall, temperature, fire, shading, etc., will be evaluated and will not necessarily be indicative of unnatural changes to the hydroperiod of the wetlands. ~~In the event of any quantified vegetational species compositional changes along any interval of any transect during any monitoring event,~~ tThe Permittee shall include any changes in that period's monitoring report and include any proposed changes in the discharge schedule to mitigate these changes. The Department shall review the proposed changes and the Permittee shall take whatever remedial actions are deemed necessary by their authorized agent and approved by the Department.

4. ***The Permittee shall take all appropriate measures to insure that the wetland stormwater discharge system does not cause erosion into any wetland area during construction and operation.***

Trail Ridge Landfill, Inc has not objection to this proposed specific condition.

5. ***The landfill owner or operator is not required to obtain any air construction permit unless landfill construction or any modification is subject to the prevention of significant deterioration (PSD) requirements of Chapter 62-212, F.A.C. A landfill for which construction or modification is subject to PSD requirements must make application to the Bureau of Air Regulation, Mail Station 5505, 2600 Blair Stone Road, Tallahassee, Florida, 32399-2400, for an air construction permit and must obtain such permit prior to beginning any construction or modification.***

Trail Ridge Landfill, Inc. agrees to obtain the proper air permit(s), if and when required. However, it does not appear necessary to include this proposed specific condition (pertaining to air quality) in a solid waste management permit.

6. ***The landfill owner or operator is not required to obtain any air operating permit unless the landfill is required to obtain a Title V air operating permit (Title V permit) pursuant to Section 403.0872, F.S. A landfill is required to obtain a Title V permit if the landfill (or the total facility, if the landfill is collocated or part of a larger facility) has the potential to emit 10 TPY of any hazardous air pollutant, 25 TPY of any combination of hazardous air pollutants or 100 TPY of any other regulated air pollutant. A landfill is also required to obtain a Title V permit if the maximum design capacity, as defined at 40 CFR 60, Subpart WWW, is equal or greater than 2.5 million Megagrams of 2.5 million***

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-184444

cubic meters. Title V permits must be applied for in accordance with the timing and content requirements of Rule 62-213, F.A.C. Title V applications shall be submitted to the District Air Program Administrator or County Air Program Administrator with air permitting authority for the landfill location.

As stated above, Trail Ridge Landfill, Inc. agrees to obtain the proper air permit(s), if and when required. However, it does not appear necessary to include this proposed specific condition (pertaining to air quality) in a solid waste management permit.

7. ***The permittee shall comply with the requirements of 40 CFR 60, Subparts WWW and Cc, as adopted by reference at Rule 62-204.800, F.A.C. The permittee shall submit to the Division of Air Resources Management, Department of Environmental Protection, Mail Station 5500, 2600 Blair Stone Road, Tallahassee, FL 32399-2400 any amended design capacity report and any Non-Methane Organic Compound (NMOC) emission rate report, as applicable, pursuant to 40 CFR 60.757 (a)(3) and (b).***

Trail Ridge Landfill, Inc. agrees to comply with 40 CFR 60, Subparts WWW and Cc, if required. However, it does not appear necessary to include this proposed specific condition (pertaining to air quality) in a solid waste management permit.

Attachment 2
Review Memorandum dated March 26, 1997, prepared by Brian Kelley, P.G.

1. ***Conservative groundwater flow velocity values presented, indicate that groundwater could flow more than 45 feet in between annual sampling events. Considering the maximum distance that a potential contaminant plume could migrate prior to any given sampling event and the fact that most of the groundwater monitoring wells are greater than 55 feet away from the limit of the waste, a potential contaminant plume could migrate a considerable distance past the zone of discharge before being detected. Additionally, variability in the hydraulic conductivity values across the site indicate that greater groundwater rates may exist within the area encompassed by the monitoring plan. Therefore, annual sampling frequencies for volatile organic compounds or specified metals are not considered appropriate.***

Please see the attached response from Golder Associates.

2. ***Although the pollutant removal efficiency of a filter drain stormwater system versus a wet detention system can be debated, the continued quarterly surface water monitoring appears to be reasonable and prudent and will establish the effectiveness of the new system.***

Please see the attached response from Golder Associates.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-184444

3. ***The request to reduce the frequency of leachate testing for specific metals (arsenic, barium, beryllium, copper, selenium, silver and vanadium) is supported only by historical data. Since leachate can be expected to vary both with waste stream variation and over time, historical data is not sufficient to justify limiting sampling parameters.***

Please see the attached response from Golder Associates.

4. ***Due to the fact that no additional tributaries contribute to the stream between the existing surface water sampling point SW-1 and the proposed sampling point, little variation in the water quality would be expected. Therefore, the newly proposed location for SW-1 is acceptable.***

Comment is noted. Thank you.

I sincerely hope that this response will provide sufficient additional information to complete the application. If you have any questions, feel free to give me a call.

Sincerely,

ENGLAND, THIMS & MILLER, INC.

Juanilla Bader Clem

Juanilla Bader Clem, P.E.
Vice President

JBC:sl

cc: Greg Mathes w/attachments
Scott McCallister w/attachments
Chris Pearson w/attachments

Attachments: Response Letter from Rust Environmental & Infrastructure, Inc.
Response Letter from Golder Associates

Golder Associates Inc.
8933 Western Way, Suite 12
Jacksonville, FL USA 32256
Telephone (904) 363-3430
Fax (904) 363-3445

April 24, 1997 963-3989

England, Thims & Miller, Inc.
3131 St. Johns Bluff Road, South
Jacksonville, Florida 32246

Attn: Ms. Juanitta Bader Clem, P.E.

RE: RESPONSE TO COMMENTS
FDEP MEMORANDUM DATED MARCH 26, 1997
TRAIL RIDGE LANDFILL - JACKSONVILLE, FLORIDA

Dear Ms. Clem:

As requested, Golder Associates Inc. (Golder Associates) has reviewed comments made by the Northeast District of the Florida Department of Environmental Protection (FDEP) in a Memorandum from Brian Kelly, P.G. to Mary Nogas, P.E. through Brian Cheary, Ph.D. dated March 26, 1997. The comments were related to the February 27, 1997 response document submitted by England, Thims & Miller, Inc. (ETM) and February 6, 1997 supplemental letter. The following addresses each of FDEP's comments by the number referenced in their March 26, 1997 memorandum.

Comment 1

Conservative groundwater flow velocity values presented indicate that groundwater could flow more than 45 feet between annual sampling events. Considering the maximum distance that a potential contaminant plume could migrate prior to any given sampling event and the fact that most of the groundwater monitoring wells are greater than 55 feet away from the limits of waste, a potential contaminant plume could migrate a considerable distance past the zone of discharge before being detected. Additionally, variability in the hydraulic conductivity values across the site indicate that greater groundwater flow rates may exist within the area encompassed by the monitoring plan. Therefore, annual sampling frequencies for volatile organic compounds or specified metals are not considered appropriate.

Response 1

The zone of discharge (wetlands to the east of the site) is actually a considerable distance greater than the 100 feet used in the groundwater velocity calculations in our initial response (see Response to Comment #2 in Golder Associates' letter to ETM dated February 25, 1997 - included in the February 27, 1997 ETM response document). Therefore, we continue to believe that there is sufficient "buffer" time to detect any potential release before it reaches any

potential zone of discharge and, consequently, that annual sampling frequencies are appropriate in situations where the compounds in question have historically not been present and are not normally associated with the activity being monitored.

However, it is our understanding that Trail Ridge Landfill will agree to a semi-annual monitoring frequency with the understanding that this issue will be revisited during the next permit renewal.

Comment 2

Although the pollutant removal efficiency of a filter drain stormwater system versus a wet detention system can be debated, the continued quarterly surface water monitoring appears to be reasonable and prudent and will establish the effectiveness of the new system.

Response 2

The surface water has been monitored quarterly at this site for over five years. The permit was modified as a result of F.A.C. Rule 62-701.510 becoming effective October 9, 1994. Trail Ridge Landfill agreed at that time to continue to sample surface water quarterly, even though the rule (62-701.510(6)(d)) only requires semi-annual sampling. The results of the sampling indicate there has been no detrimental impact on the surface water surrounding the site. The data further indicates there is no seasonal variation in the quality of the water to justify more frequent sampling than required by regulations. There has been a good faith effort to monitor the surface water more frequently than required by regulation over the past two years. The results indicate and the rule substantiates that four samples per year are not necessary to ensure the surface water standards are met.

We respectfully request the Department consider the information presented above and approve semi-annual sampling of surface water. If surface water quality becomes poor in the future, the Department has the ability to require more frequent sampling.

Comment 3

The request to reduce the frequency of leachate testing for specific metals (arsenic, barium, beryllium, copper, selenium, silver, and vanadium) is supported only by historical data. Since leachate can be expected to vary both with waste stream variation over time, historical data is not sufficient to justify limiting sampling parameters.

Response 3

It is agreed that the waste stream can be expected to vary. However, there are many safeguards in-place to ensure that waste with high concentrations of heavy metals will not be accepted at the landfill. One safeguard is a very strict Special Waste Program with mandatory testing of industrial waste, sludges, soils and other wastes that are suspected of having adverse leachate characteristics, such as high concentrations of heavy metals. Random loads of waste are inspected, and all spotters and operators are trained to look for unacceptable wastes. This

program is likely the reason that the metals have not historically been detected in the leachate and why they likely will not be detected in the future.

It is requested that FDEP consider a frequency of every two years to analyze the leachate for these metals.

Comment 4.

Due to the fact that no additional tributaries contribute to the stream between the existing surface water sampling point SW-1 and the proposed sampling point, little variation in the water quality would be expected. Therefore, the newly proposed location for SW-1 is acceptable.

Response 4

Comment acknowledged.

If you have any questions regarding this letter, please call.

Very truly yours,

GOLDER ASSOCIATES INC.

Kenneth B. Karably, P.G.
Senior Project Manager/Associate

cc: Scott McCallister

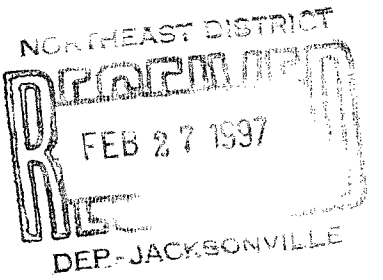
FN: d:\t-ridge\permit\fdep0497.rsp

England-Thims & Miller, Inc.
ENGINEERS • PLANNERS • SURVEYORS • LANDSCAPE ARCHITECTS

Principals
James E. England, P.E., Pres.
Robert E. Thims, Exec. V.P.
Douglas C. Miller, P.E., Exec. V.P.
N. Hugh Mathews, P.E., Exec. V.P.

February 27, 1997

Ms. Mary C. Nogas, P.E.
Solid Waste Supervisor
Department of Environmental Protection
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590



Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444
FDEP File Numbers 296641 and 296642
ET&M No. E96-49-1C

Dear Ms. Nogas:

We have received your Request for Additional Information (RAI) dated November 25, 1996 regarding the referenced project. The following is our response to your RAI request.

<u>Attachment Number 1</u>
<u>Review Memorandum dated November 25, 1996, prepared by Francis Dayao</u>

1. **Please note that DEP Form Number 62-701.900 (1) is the most recent permit application form.**

The comment is noted.

2. **Page 4 of the application form, Location Coordinates, please note that the UTM for the facility is zone 17, 399764 km. East and 3344918 km. North.**

Page 4 of 36 of the application form has been revised to include UTM as requested and is contained in Attachment A.

3. **Please provide proof of publication to the Department of the Notice of Application.**

The Notice of Application has been published in both Duval and Baker Counties. Proof of publication for both Counties is contained in Attachment B.

4. **The station numbers on the Site Plan prepared by LAW Engineering is not clear. Please resubmit the site plan which clearly shows the stations to help review the tabulated data for settlements. A drawing with a scale of 1 inch is to 200 feet is preferred if available.**

The Site Plan has been revised as requested and is contained in Attachment C. Further, please note that these cross-sections are shown on Drawing Nos. 9 and 10 on a horizontal scale of 1 inch = 200 feet.

3131 St. Johns Bluff Road S. • Jacksonville, FL 32246 • Tel: (904) 642-8990 • Fax: (904) 646-9485

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444

5. **Please resubmit a signed and sealed copy of the Post Construction Settlement Evaluation Memorandum found in Appendix C, from S. Laroia, P. E./J. Horton, P. E., as required by Florida Administrative Code (FAC) Rule 62-701.320 (6). Alternatively, if this work prepared under Ms. Juanitta Clem's direct supervision, and her seal is to cover this work, please advise.**

Signed and sealed copies of the Post Construction Settlement Evaluation are provided in Attachment C.

6. **Please justify the assumptions used for the Landfill Material Internal Friction Angles found on page 4, Appendix I.**

Please see the memorandum from Law Engineering and Environmental Services, Inc. as provided in Attachment D.

7. **Please provide an evaluation of the leachate collection (leachate collection pipes) system's integrity and operation after the expected differential settlements have occurred.**

The pipe strength calculations including the vertical expansion were provided in the Permit Documents, Appendix G. Based upon the Post Construction Settlement Evaluation (as prepared by Law Engineering and Environmental Services, Inc.), the post settlement of the cross slope of the liner will range from 1.93% to 3.13% and the slope of the leachate collection pipe will range from 0.80% to 1.3%. Based upon these post-settlement slopes, the leachate collection pipe will continue to have capacity which exceeds the estimated leachate flow rate. The calculations of the post-settlement slopes as well as the calculations of the leachate collection pipe flow capacity are contained in Attachment E.

Please note that the minimum cross slope of 1.93% was used in the "Design Calculation for Liner System" (as contained in Appendix E of the Permit Documents) .

8. **Please justify that the SDR-11 leachate collection pipe utilized for the previous phases (filled areas) is capable of withstanding the additional load from the proposed vertical expansion.**

The pipe strength calculations including the vertical expansion were provided in the Permit Documents, Appendix G.

9. **Please list the personnel that will normally be present at the landfill during peak operating hours. In addition, please justify that the facility has adequate personnel to handle the expected volume of waste.**

During peak operating hours, the personnel present on the landfill will normally include one spotter, one material handler (laborer) and two equipment operators. The landfill personnel include the General Manager, Site Engineer, Operations Manager, equipment operators, spotters and laborers.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444

A work schedule is developed on a weekly basis to ensure that adequate staff is present on the landfill to handle the expected volume of waste. During non-peak hours, the staff may include a spotter and an equipment operator. Whereas, during extreme peaks, the staff may include two spotters, one material handler (laborer), and three equipment operators. It should be noted that the Operations Manager can operate the equipment on an as needed basis as well as provide back-up for spotting.

10. **On page 40, please clarify what was meant by the statement "the maximum time any area may be covered with a tarpaulin is 30 days." Please note that FAC Rule 62-701.500 (7) (e) (1) authorizes the use of tarpaulin as temporary cover only for those areas where additional waste will be deposited within 18 hours.**

In Modification No. 236034, dated June 2, 1994, it is stated that "The maximum time any area may be covered with geotextile materials is 30 days." The facility hereby requests that the condition remain as stated in the modification

11. **Please demonstrate that the facility will have sufficient equipment capable of handling a peak volume of 3,500 tons per day of waste to be received.**

The equipment on site includes three compactors. According to the compactor manufacturer, the compactors can handle approximately 100 tons/hour. Therefore based upon the facility's thirteen hour day, two compactors can handle approximately 2,600 tons/day which exceeds the monthly average waste receipt of 2,400 tons/day. Further with the third compactor, they can handle approximately 3,900 ton/day which is the estimated peak waste receipt. It should be noted that the on-site equipment includes doziers to supplement the compactors. Therefore, the facility could handle waste receipt in excess of the 3,900 tons/day. In addition, Waste Management, Inc has equipment throughout the State of Florida which can be made available as needed.

12. **Page 45, Gas Monitoring Program, please note that a specific condition shall be included in the permit that will require quarterly gas monitoring to be conducted at the site as per FAC Rule 62-701.400 (10) (c).**

The comment is noted.

13. **Please indicate whether or not Fabric 52048000, Fabric 52049000 and Fabric 52051375 are still being utilized for initial cover. Please note that these are the only materials previously approved (modification number 288638) by the Department for the subject facility. Other equivalent geotextile materials may be utilized upon written approval from the Department.**

Fabrics 52048000, 52049000 and 52051375 are still being utilized for initial cover. Other equivalent geotextile materials will be utilized upon written approval from the Department, as requested.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444

14. Page 53, Other Wastes, please note that ash residue shall not be utilized for initial cover unless authorized by the Department.

The comment is noted.

15. Appendix H, Gas Monitoring Plan, please note that all gas monitoring probes will be considered compliance points.

According to Rule 62-701.400 (10)(a), F.A.C., landfill gas control systems shall be designed to prevent the concentration of methane and other gasses generated by the landfill from exceeding the lower explosive limit for gasses at or beyond the landfill property boundary. Therefore, if the gas monitoring probes will be considered compliance points, the probes will be moved to the property boundary. Please see the revised Gas Probe Plan as contained in Attachment F.

16. Please discuss how the total tonnage for the waste tires being accepted at the facility is being tracked to ensure that the maximum storage capacity of 3,900 tons is being met.

The waste tire tonnage is being tracked on a quarterly basis. The Waste Tire Processing Facility Quarterly Report (Form 17-711.900(4)) is completed and submitted to the Department four times per year. Trial Ridge Landfill, Inc. uses a computerized system to track permit conditions such as this one. The computer prints a reminder in the third quarter to check the tonnage and ensure that at least 75 percent of the tires stored on-site will be processed by the year end. Trail Ridge Landfill, Inc. is currently only accepting 60 tons of tires per quarter. Therefore, the site does not anticipate reaching the maximum storage capacity of 3,900 tons any time in the near future.

17. Please note that a specific condition shall be included in the permit specifying that at least 75 percent of the waste tires stored at the site at the beginning of each calendar year be processed and disposed of and that no more than 3,900 tons of waste tires are stored at the waste tire processing area on any day.

The comment is noted.

18. Please note that a specific condition shall be included in the permit that shall allow waste tires cut into sufficiently small parts to be utilized as initial cover. Sufficiently small parts means that 70 percent of the waste tire is cut into pieces of 4 square inches or leass and 100 percent of the waste tire material is 32 square inches or less.

The comment is noted.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444

19. The closure cost estimate presented in Appendix N does not seem to include closure cost of the waste tire processing facility.

The Financial Assurance Cost Estimates have been revised to include more recent unit prices as well as disposal of waste tires. The revised closure cost estimates are provided in Attachment G.

20. Page J-1, Appendix J, Section 3, Operations and Maintenance, please note that transporting more than 25 waste tires over public highways at any one time requires vehicle registration with the Department.

The comment is noted.

PLEASE PROVIDE SUPPORTING CALCULATIONS FOR COMMENTS 21 THROUGH 25:

21. Estimated Landfill Construction Related Settlements, prepared by LAW Engineering, presented in Appendix C, Foundation Analysis.

The calculations for the Estimated Landfill Construction Related Settlements are provided in Attachment H.

22. Global Slope Stability and Landfill Final Cover Sliding Stability, prepared by LAW Engineering, presented in Appendix I, Slope Stability Analysis.

The calculations for the Global Slope Stability and Landfill Final Cover Sliding Stability are provided in Attachment I.

23. Appendix E, Design Calculations for Liner System, please illustrate how the value of L (200 ft.), length of the horizontal projection of the leachate collection layer from top of collector, was acheived. In addition, please provide supporting calculations to show how the values (37.59 cm/sec to 73.77 cm/sec) for the hydraulic conductivity were acheived.

The value of "L" represents the horizontal projection from the ridge in the liner system to the valley in the liner system (where the leachate collection trench is located). In the calculations, the worst case scenario was used, Phases IA and IIA which include a horizontal projection distance of 200 feet in the northern half of the phases (See Section 26 on Drawing No. 10).

The hydraulic conductivity values were calculated based upon transmissivity testing which was conducted by National Seal Company. The transmissivity values are divided by the geonet thickness (which was determined to be 0.5377 cm as stated in the analysis) to determine the hydraulic conductivity. Please see the attached letter from National Seal Company (Attachment J).

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444

24. Appendix L, Alternate Closure Design Demonstration, please illustrate how the values of the projected length L (110 ft. and 60 ft.) were acheived.

The value of "L" in Section A (Final Closure - Minimum Design) is the distance between underdrains which will be installed above the liner on the Top Area of the landfill (the area with a 4% slope). The underdrains on the Top Area 110 feet apart as shown on the Master Drainage Plan, Drawing No. 8. The 110 foot spacing of the underdrains on the Top Area is provided to prevent the top soil from becoming fully saturated which may cause slippage and erosion of the top soil.

The value of "L" in Section B (Final Closure - Alternate Design) is the distance from the outside edge of a side slope terrace to the center of the terrace, which is a distance of 67.5 feet. Please note that the Alternate Closure Design Demonstration has been revised due to the change in distance from 60 feet to 67.5 feet and is contained in Attachment K.

25. Please demonstrate that the 12 inches of clay with a permeability of 1 EE -7 cm/sec proposed for the side slope closure design, will result in a substantially equivalent rate of stormwater infiltration through the final cover if 18 inches of clay with a permeability of 1 EE -7 were used (FAC Rule 62-701.600 (5) (g) (4)). Please note that the Alternate Design Closure Guidance Document, on page 11, item 4, stated that the guidance only applies to approval of alternate barrier layers in the final cover system. It does not apply to changes in the thickness of the protective soil layer required by the general criteria.

The hydraulic conductivity of the barrier soil layer has been changed to 6.67×10^{-8} cm/sec. Please see the Alternate Barrier Soil Layer Equivalency Analysis as provided in Attachment L and the attached revised closure details as contained on Drawing Nos. 16, 18 and 20.

26. Please justify the constructibility and durability of the proposed 12 inches of clay for the side slope final cover system.

The 12 inch barrier clay layer will be constructed over a prepared intermediate cover layer with a minimum density of 90 percent and will be constructed (and QA/QC tested) in two six-inch lifts. If the clay material must be installed in lifts that are thicker than the required six inches, the material will be placed in a thicker lift, worked to provide a homogeneous material, and then trimmed to the required six inch lift. The durability of the 12 inch barrier clay layer has been demonstrated in the previously closed areas of the landfill. Further, it should be noted that the barrier clay layer will be overlaid with 24 inches of vegetative cover material and sodded which will protect the barrier clay layer from erosion and desiccation.

Incremental closure of this landfill has been conducted successfully with a 12 inch barrier soil layer. This layer has been in-place for as long as three years and is functioning as designed.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444

27. On page 1 of the financial assurance cost estimate form, the design life of disposal unit has been left blank. Please resubmit this page with the design life indicated.

The revised closure cost estimates including the design life of the landfill are provided in Attachment G.

28. The size of the proposed test strip for the side slope closure appears inadequate. Please note that EPA/600/R-93/182 recommends a test pad normally about 10 to 15 meters in width by 15 to 30 meters in length; please discuss.

The size of the test strip has been revised to 40 feet wide (12.2 meters) by 60 feet long (18.3 meters) for the clay subbase in the Project-Specific Addenda to Quality Assurance Manual as well as the Incremental Side Slope Closure, Quality Assurance/Quality Control Plan. Please see the revised documents in Attachment M.

Please note that the information received on November 20 for the proposed active gas collection system has not been included in this review: however, the information submitted shall be reviewed by the Department as part of your response to this request for additional information.

The comment is noted.

Attachment Number 2
Review Memorandum dated November 25, 1996, prepared by Brian Kelley, P.G.
And Review Memorandum dated January 30, 1997, prepared by Brian Kelley, P.G.

1. Based upon the groundwater contour maps provided with the October 28, 1996 Operation and Construction Renewal in addition to 1996 groundwater contour maps received on January 29, 1997, the groundwater flow data sets appear to be complete. Moreover, the consistent easterly flow indicates that MWB-16S, MWB-18S, MWB-28S, and MWB-30S are redundant and may be eliminated from the monitoring program. The remaining side gradient monitoring wells appear to be adequate to monitor groundwater at the north and south sides of the landfill.

The comment is noted.

2. A history of infrequent detection of certain metals does not provide adequate technical justification to reduce groundwater sampling frequencies or relax any requirements of Chapter 62-701.510 (1) (a) F.A.C. In consideration of any reduced sampling frequencies, a geotechnical justification is required.

Please see the attached response from Golder Associates.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444

3. **A history of infrequent detection or non-detection of volatile organic compounds does not provide adequate technical justification to reduce groundwater sampling frequencies or relax any requirements of 62-701.510 (1) (a) F.A.C. As previously stated, any reduction of sampling frequencies will require a geotechnical justification.**

Please see the attached response from Golder Associates.

4. **Since the Class III landfill is not being permitted, SW-3 may be removed from the monitoring program.**

The comment is noted.

5. **The current filter-drain stormwater system is proposed to be changed to a wet detention system: therefore, surface water sampling should continue to be conducted on a quarterly basis to monitor the effectiveness of the new system. Surface water data and the effectiveness of the stormwater system may be evaluated after one year to determine if an alternative sampling frequency is appropriate.**

Please see the attached response from Golder Associates.

6. **In accordance with Chapter 62-701.510 (5), leachate sampling is to be characteristic of the leachate coming from the waste; before it is subjected to conditions that may change the characteristics of the leachate. The current collection system provides discreet leachate samples which are derived from specific portions of the landfill. Composite sampling results may differ significantly from individual sampling results and will not be representative of specific potential source areas. Additional justification to modify the existing leachate sampling procedures should be provided.**

Please see the attached response from Golder Associates.

7. **A history of infrequent detection or non-detection of certain metals (arsenic, barium, beryllium, copper, selenium, silver, and vanadium) in previous leachate samples does not provide reasonable assurance that these parameters will not be expected to be in or derived from the waste to be placed in the landfill. Therefore, the frequency of sampling for these specific parameters should not be reduced without further justification.**

Please see the attached response from Golder Associates.

Reference: Trail Ridge Landfill
Renewal of FDEP Permit No. SC16-18444

I sincerely hope that this response will provide sufficient additional information to complete the application. If you have any questions, feel free to give me a call.

Sincerely,

ENGLAND, THIMS & MILLER, INC.

Juanitta Bader Clem, P.E.
Vice President

JBC:sl

cc: Greg Mathes w/attachments
Scott McCallister w/attachments
Chris Pearson w/attachments

Attachments: Attachments A- M
Response Letter from Golder Associates
Permit Drawings 16, 18 and 20

ATTACHMENT A

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

APPLICATION FOR PERMIT TO CONSTRUCT, OPERATE, MODIFY OR CLOSE A SOLID WASTE MANAGEMENT FACILITY

Please Type or Print

A. GENERAL INFORMATION

1. Type of facility:

Disposal [X]

Class I Landfill	[X]	Ash Monofill	[ ]
Class II Landfill	[ ]	Asbestos Monofill	[ ]
Class III Landfill	[ ]	Industrial Solid Waste	[ ]
Other	[X]	Waste Tire Processing	

Volume Reduction [ ]

Incinerator	[ ]	Pulverizer / Shredder	[ ]
Composting	[ ]	Compactor/Baling Plant	[ ]
Materials Recovery	[ ]	Energy Recovery	[ ]
Other	[ ]		

2. Type of application:

Construction	[ ]	Construction/Operation	[ ]
Operation	[ ]	Closure	[ ]

3. Classification of application: This application includes a vertical expansion over th double lined landfill.

New	[ ]	Substantial Modification	[ ]
Renewal	[X]	Minor Modification	[ ]

4. Facility name: Trail Ridge Landfill

5. DER ID number: GMS3116P03090 County: Duval

6. Facility location (main entrance): 5110 U.S. Hwy. 301
Baldwin, FL 32234

7. Location coordinates:
Section: 18,19 20,21 Township: 3S Range: 23E

UTMs: Zone 17 399764 km E 3344918 km N

Latitude: 30 ° 14 ' 00 " Longitude: 82 ° 02 ' 30 "

8. Applicant name (operating authority): Trail Ridge Landfill, Inc.

Mailing address: 5110 U.S. Hwy. 301 (Street or P.O. Box) Baldwin (City) Florida (State) 32234 (Zip)

Contact person: Greg Mathes Telephone: (904) 289-9100

Title: Division President and General Manager

ATTACHMENT B

Public Notice of Receipt of Application
State of Florida
Department of Environmental Protection
Notice of Application

The Department announces receipt of an application for a permit from Trail Ridge Landfill, Inc., to continue to construct and operate the Trail Ridge Landfill. Included in the application are proposals to construct Phases IIIC, IVC, and V, increase the maximum height of the landfill from elevation 285 ft. to 350 ft., and construct and operate an active gas collection system. The facility is located at 5110 U.S. Hwy. 301, Baldwin, Duval County, Florida.

This application is being processed and is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at 7825 Baymeadows Way, Suite B-200, Jacksonville, Florida. Any comments or objections should be filed in writing with the Department at this address. Comments or objections should be submitted as soon as possible to insure that there is adequate time for them to be considered in the Department's decision on the application.

FLORIDA PUBLISHING COMPANY

Publisher

JACKSONVILLE, DUVAL COUNTY, FLORIDA

STATE OF FLORIDA }
COUNTY OF DUVAL }

Before the undersigned authority personally appeared Karen Farber who on oath says that he is Legal Advertising REP of The Florida Times-Union, a daily newspaper published at Jacksonville in Duval County, Florida; that the attached copy of advertisement, being a Legal Notice in the matter of Public Notice of Receipt of application in the Court, was published in THE FLORIDA TIMES-UNION in the issues of Nov. 23rd

Affiant further says that the said The Florida Times-Union is a newspaper published at Jacksonville, in said Duval County, Florida, and that the said newspaper has heretofore been continuously published in said Duval County, Florida, The Florida Times-Union each day, has been entered as second class mail matter at the postoffice in Jacksonville, in said Duval County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that he has neither paid nor promised any person, firm or corporation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in said newspaper.

Sworn to and subscribed before me this 29th. day of Nov. A.D. 1996

Karen Farber

Notary Public,
State of Florida at Large.

My Commission Expires

VERA JANIE LIKENS
COMMISSION # CC 547400
EXPIRES JUN 01, 2000
BONDED THRU
ATLANTIC BONDING

DA 444

Public Notice of Receipt of Application
State of Florida
Department of Environmental Protection
Notice of Application

The Department announces receipt of an application for a permit from Trail Ridge Landfill, Inc., to continue to construct and operate the Trail Ridge Landfill. Included in the application are proposals to construct Phases IIIC, IVC, and V, increase the maximum height of the landfill from elevation 285 ft. to 350 ft., and construct and operate an active gas collection system. The facility is located at 5110 U.S. Hwy. 301, Baldwin, Duval County, Florida.

This application is being processed and is available for public inspection during normal business hours, 8:00 am to 5:00 pm, Monday through Friday, except legal holidays, at 7825 Baymeadows Way, Suite B-200, Jacksonville, Florida. Any comments or objections should be filed in writing with the Department at this address. Comments or objections should be submitted as soon as possible to insure that there is adequate time for them to be considered in the Department's decision on the application.

11/21c

THE BAKER COUNTY PRESS

Published Weekly, Macclenny, Baker County, Florida

AFFIDAVIT OF PUBLICATION

STATE OF FLORIDA
COUNTY OF BAKER:

Before me the undersigned authority personally appeared Kim Taylor, who on oath says that he/she is an employee of ***The Baker County Press***, a weekly newspaper published at Macclenny in Baker County, Florida; that the attached copy of the advertisement, being a Public Notice in the matter of Notice of Application in the _____ Court, was published in said newspaper in the issues of Nov. 21, 1996.

Affiant further says that said ***The Baker County Press*** is a newspaper published at Macclenny, in said Baker County, Florida, and that the said newspaper has heretofore been continuously published in said Baker County, Florida, each week and has been entered as second-class mail matter at the post office in Macclenny, in said Baker County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that he/she has neither paid nor promised any person, firm or corporation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper.

Kim Taylor
(Signature of Affiant)

Sworn and subscribed before me this 25 day of November, 19 96.

Karin G. Thomas
(Signature of notary public)

Karin G.Thomas
(Name of notary typed, printed or stamped)

Personally Known x or Produced Identification _____

NOTARY PUBLIC STATE OF FLORIDA
OFFICIAL NOTARY SEAL
KARIN G THOMAS
COMMISSION NUMBER
CC439366
MY COMMISSION EXP
FEB. 14,1998

ATTACHMENT C

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
3901 Carmichael Avenue
Jacksonville, Florida 32207
Phone: 904-396-5173
Fax: 904-396-5703

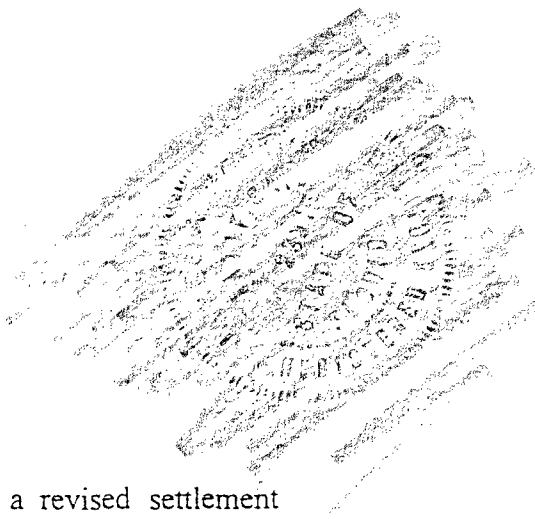
MEMORANDUM

TO: Juanitta Clem, P.E.
England, Thims and Miller, Inc.

FROM: S. Laroia, P.E./J. Horton, P.E. (LAW)

DATE: October 7, 1996

SUBJECT: **Post Construction Settlement Evaluation**
Trail Ridge Landfill Vertical Expansion
Jacksonville, Florida
LAW Project No. 40522-6-7221



As authorized by you on August 9, 1996, we have performed a revised settlement evaluation for the subject landfill in accordance with our Work Authorization Sheet No. 96-4393S (dated August 19, 1996). LAW previously performed a settlement evaluation which was documented in our report dated December 12, 1994 (LAW Project No. 442-07221-01). This previous settlement evaluation was based on a maximum landfill elevation of +285 feet and an average waste (fill) unit weight of 60 pcf. We now understand that a revised maximum landfill elevation of +350 feet has been established, along with an average waste unit weight of 70 pcf.

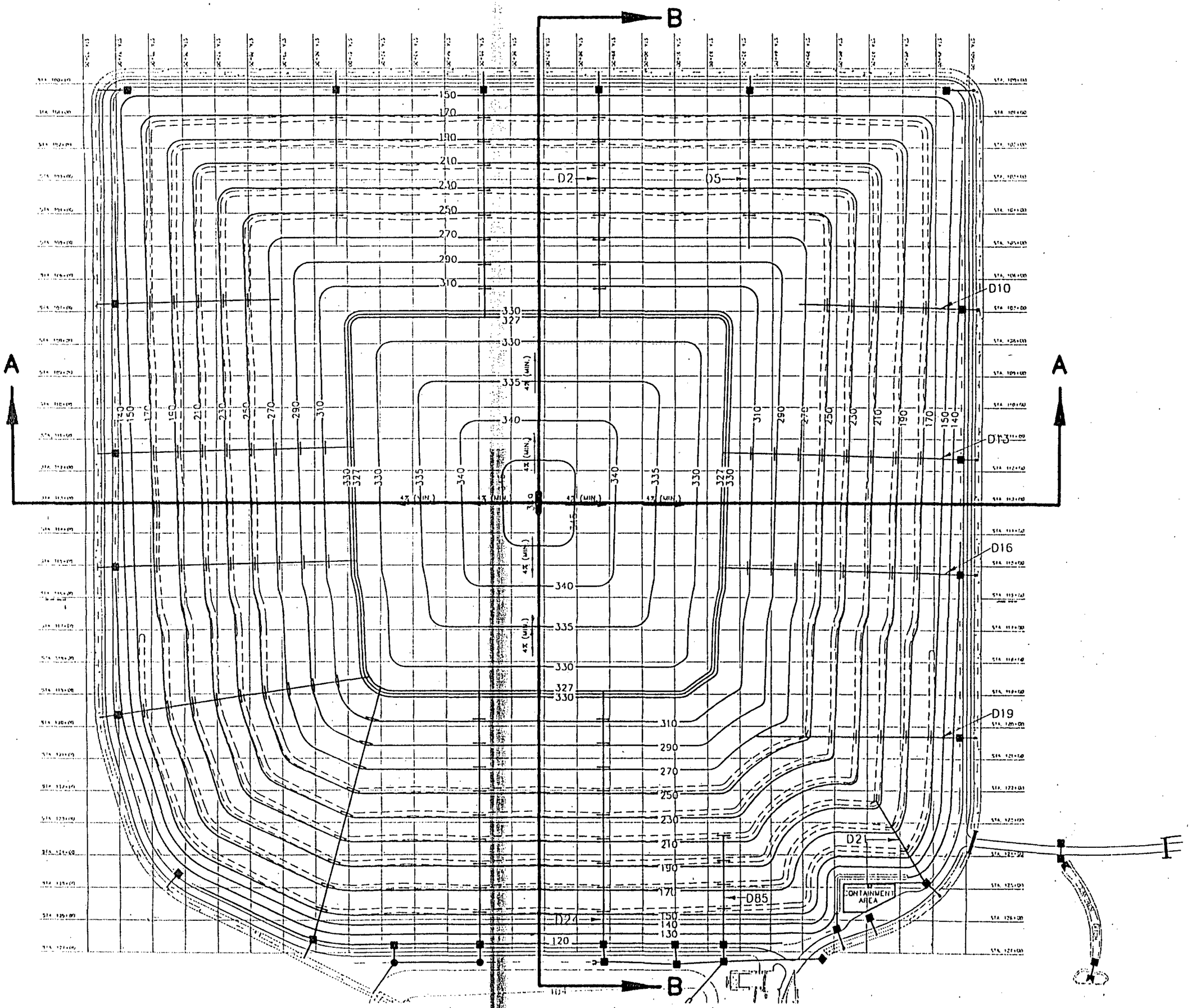
Evaluation procedures similar to those documented in our December 12, 1994 report were utilized for the currently planned landfill configuration. Our current evaluation indicates a maximum landfill related ground settlement of about 1.8 feet (at the center of the landfill). This settlement magnitude does not include the subsidence of the fill material itself due to decomposition and/or consolidation under self-weight. We understand that you desire that the settlement magnitudes be presented along two perpendicular sections (Sections AA and BB). Such estimated settlement magnitudes are presented on the attached table. The locations of the sections are indicated on the attached drawing.

From a landfill stability viewpoint, settlement magnitudes presented in the attached table are considered to be acceptable. The differential settlements should be fairly uniform from the center to the edges or corners of the landfill. Accordingly, in our opinion, the

liner integrity will not be compromised by this magnitude of settlement. We understand that the impact of such settlements on the leachate collection system integrity and operation will be evaluated by others.

We appreciate the opportunity to be of continued assistance and look forward to serving you in the future. If you have any questions concerning this memorandum, please contact us.

ATTACHMENTS



GRAPHIC SCALE

200 0 100 200 400

(IN FEET)

REFERENCE: Preliminary Drawing
Furnished by: England, Thims & Miller, Inc.
Undated

LAW ENGINEERING

JACKSONVILLE, FLORIDA

SITE PLAN

Trail Ridge Landfill Vertical Expansion

Jacksonville, Florida

DRAWN: SL	DATE: 8/29/96	SCALE: 3"=1000'
CHECKED: JAH	PROJ. NO. 40522-6-7211	APPROX.

Estimated Landfill Construction Related Settlements
Trail Ridge Landfill Vertical Expansion
Jacksonville, Florida
LAW Project No. 40522-6-7221

Section	Station	Constructed Elevation (feet)	Estimated Settlement (Feet)	Estimated Post Settlement Elevation (Feet)
A-A	74+60	139.3	0.5	138.8
	76+10	136.3	0.7	135.6
	77+60	140.8	1.0	139.8
	79+10	137.8	1.2	136.6
	80+60	141.8	1.5	140.3
	82+10	138.8	1.6	137.2
	83+60	142.8	1.7	141.1
	85+10	139.8	1.8	138.0
	86+60	142.8	1.8	141.0
	88+10	139.8	1.8	138.0
	89+60	142.8	1.7	141.1
	91+10	139.8	1.6	138.2
	92+60	142.8	1.5	141.3
	94+10	138.3	1.2	137.1
	95+60	141.3	1.0	140.3
	97+10	136.3	0.7	135.6
	99+10	140.3	0.5	139.8
B-B	101+00	153.0	0.5	152.5
	102+00	151.9	0.7	151.2
	104+00	150.2	1.0	149.2
	106+00	148.5	1.3	147.2
	108+00	146.8	1.6	145.2
	110+00	145.1	1.7	143.4
	112+00	143.4	1.8	141.6

Estimated Landfill Construction Related Settlements
Trail Ridge Landfill Vertical Expansion
Jacksonville, Florida
LAW Project No. 40522-6-7221

Section	Station	Constructed Elevation (feet)	Estimated Settlement (Feet)	Estimated Post Settlement Elevation (Feet)
B-B	114+00	141.7	1.8	139.9
	116+00	140.0	1.7	138.3
	118+00	137.7	1.6	136.1
	120+00	135.4	1.3	134.1
	122+00	133.1	1.0	132.1
	124+00	130.8	0.7	130.1
	126+00	128.5	0.5	128.0

Notes:
1. Please refer to the attached drawing for the location of Sections AA and BB.
2. The "Estimated Settlement" magnitudes presented in the table above indicate the anticipated settlements at the bottom of the landfill.

ATTACHMENT D

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
3901 Carmichael Avenue
Jacksonville, Florida 32207
Phone: (904) 396-5173
Fax: (904) 396-5703

MEMORANDUM

December 30,1996

To: Juanita Clem, P.E.

From: T. Selfridge, P.E. / J. Horton, P.E.

Subject: **Angle of Internal Friction of Landfill Municipal Waste**
Trail Ridge Class A Landfill Vertical Expansion
Duval County, Florida
LAW Project No. 40505-6-7221-02

The material properties utilized in our global stability evaluation were based on our experience as well as a review of available geotechnical literature. Our review of a publication by Singh and Murphy in ASTM Special Technical Publication 1070 ("Evaluation of the Stability of Sanitary Landfills," Geotechnics of Waste Fills - Theory and Practice, 1990), indicated that when neglecting the beneficial effects of material cohesion, a range in friction angle of 25 to 36 degrees is recommended.

Our assumption of a minimum angle of internal friction of 22 degrees and no cohesion for compacted municipal solid waste is considered relatively conservative and results in an acceptable safety factor for the proposed landfill slope geometry.

We appreciate the opportunity to be of continued assistance and look forward to serving you in the future. If you have any questions concerning this memorandum, please contact us.

ATTACHMENT E

TRAIL RIDGE LANDFILL
LEACHATE COLLECTION PIPE EVALUATION

In order to evaluate the effect of the post-construction settlement on the leachate collection pipe, the flow rate within a leachate collection unit is compared to the design pipe flow capacity.

LEACHATE FLOW RATE:

Q = (350' x 2400')* x 0.03 in/day** x ft/12 in x day/24 hour x hr/60 min x 7.48 gallons/CF

Thus,

Q = 10.91 GPM (Gallons Per Minute)

* These dimensions represent Phases IA and IIA which is the largest leachate collection unit by area.

** This is the impingement rate as determined using the HELP Model, Version 3. See Appendix E of the Permit Documents for the calculation of the impingement rate.

FLOW CAPACITY (of 8" SDR 11 Drisco pipe):

$Q = 98.3 \times A \times (R_h)^{2/3} \times S^{1/2}$ (Mannings Equation)

Where:
- Q = Flow (GPM)
- R_h = Hydraulic radius (ID/4) (in)
- S = Slope (foot/foot)
- A = Cross sectional area of pipe inside diameter (in^2)
- ID = Inside Diameter (in)

Note: The above formula includes a Mannings Coefficient equal to 0.009.

Based upon the design minimum slope and 8" SDR 11 pipe;

R_h = 7.057 in / 4 = 1.76 in
S = 0.008
A = Pi x (7.057 in./ 2)^2 = 39.11 in^2

Thus,

$Q = 98.3 \times 39.11 \times (1.76)^{2/3} \times (0.008)^{1/2}$

Q = 501.24 GPM

Therefore, the 8" SDR 11 Drisco pipe has the capacity to carry approximately 46 times the flow that is generated and the post-construction settlement does not adversely affect the pipe.

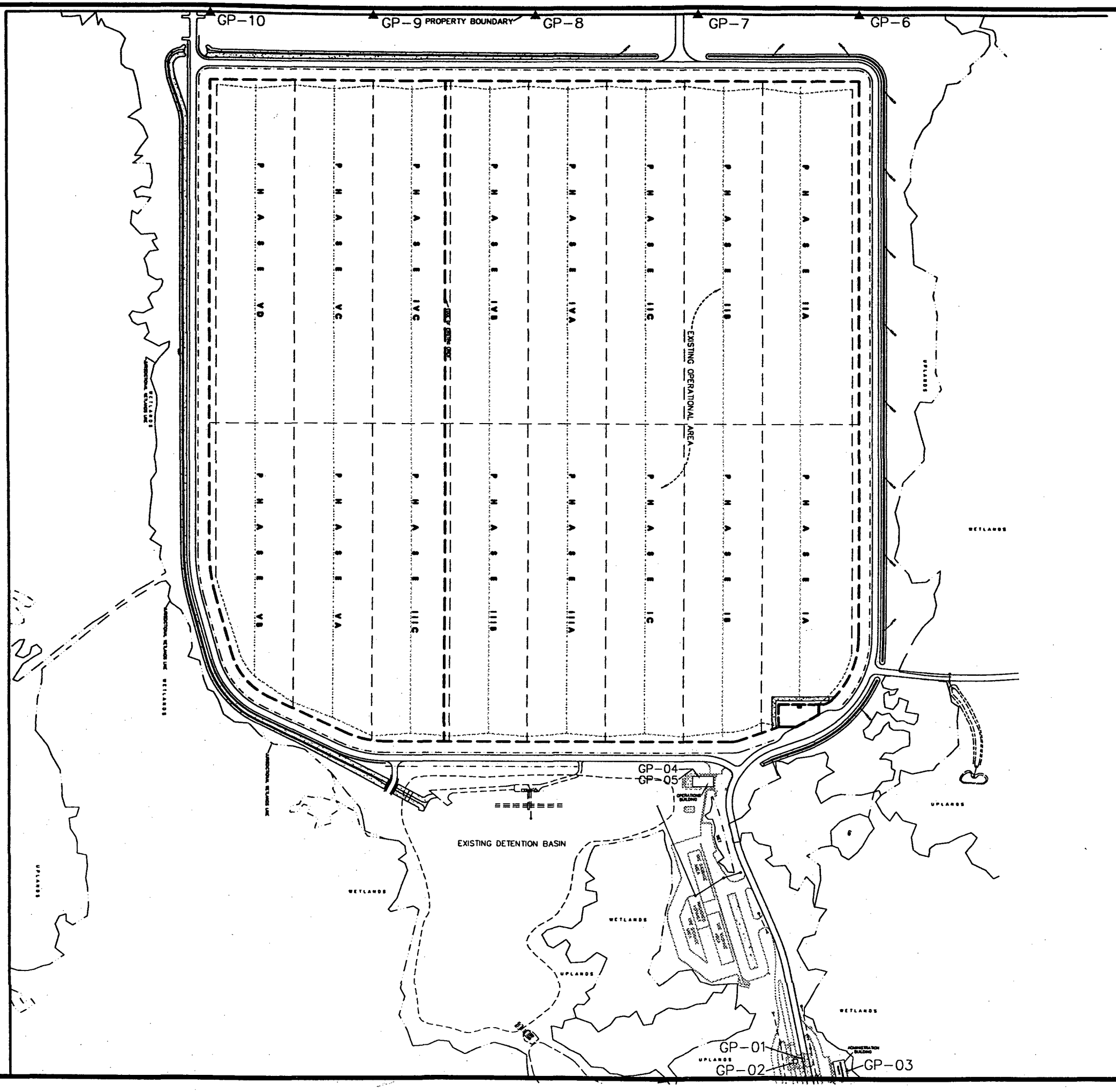
TRAIL RIDGE LANDFILL
Vertical Expansion
Base Slope Calculations

Section[1]	Station	Estimated Post Settlement Elevation (Feet)[2]	Slope
	74+60	138.8	
			2.13%
	76+10	135.6	
			2.80%
	77+60	139.8	
			2.13%
	79+10	136.6	
			2.47%
	80+60	140.3	
			2.07%
	82+10	137.2	
			2.60%
	83+60	141.1	
			2.07%
	85+10	138.0	
			2.00%
26	86+60	141.0	
			2.00%
	88+10	138.0	
			2.07%
	89+60	141.1	
			1.93%
	91+10	138.2	
			2.07%
	92+60	141.3	
			2.80%
	94+10	137.1	
			2.13%
	95+60	140.3	
			3.13%
	97+10	135.6	
			2.10%
	99+10	139.8	

Section[1]	Station	Estimated Post Settlement Elevation (Feet)[2]	Slope
27	101+00	152.5	
			1.30%
	102+00	151.2	
			1.00%
	104+00	149.2	
			1.00%
	106+00	147.2	
			1.00%
	108+00	145.2	
			0.90%
	110+00	143.4	
			0.90%
	112+00	141.6	
			0.85%
	114+00	139.9	
			0.80%
	116+00	138.3	
			1.10%
	118+00	136.1	
			1.00%
	120+00	134.1	
			1.00%
	122+00	132.1	
			1.00%
	124+00	130.1	
			1.05%
	126+00	128.0	

Notes:
1. Refer to Drawing No. 9 of the Permit Drawings for the locations of Sections 26 and 27.
2. The "Estimated Settlements" magnitudes presented in the table above indicate the anticipated settlements at the bottom of the landfill, as provided by Law Engineering and Environmental Services, Inc.

ATTACHMENT F



N

GRAPHIC SCALE

(IN FEET)
1 INCH = 400 FEET

LEGEND

▲ GAS PROBE
GP-10 GAS PROBE NUMBER

REVISIONS:

ETM. NO.	E 96 -49
DRAWN BY:	J.B.C.
DESIGNED BY:	J.B.C.
CHECKED BY:	J.B.C.
DATE:	OCTOBER 28, 1996

GAS PROBE PLAN

TRAIL RIDGE LANDFILL
FOR
TRAIL RIDGE LANDFILL, INC.

England·Thims&Miller,Inc.
Consulting & Design Engineers
3131 ST. JOHNS BLUFF ROAD SOUTH
JACKSONVILLE, FLORIDA 32246
PHONE NUMBER (904) 642-8990 FAX NUMBER (904) 646-9485

DRAWING NO.
1

ATTACHMENT G

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

FINANCIAL ASSURANCE COST ESTIMATES

Date: Feb. 18, 1997

Date of FDEP Approval: _____

I. GENERAL INFORMATION:

Facility Name: Trail Ridge Class I Landfill GMS No.: GMS 3116PO3090

Permit No.: SC16-184444 Expiration Date: 12-24-96

Address (facility): 5110 U.S. Highway 301, Baldwin, FL 32234

Address (mailing): Same as above

Permittee (operating authority): Trail Ridge Landfill, Inc.

Facility Lat. 30°14'00"N Long. 82°02'30" or UTM's _____

Description of the Solid Waste Disposal Units included: This Estimate is for closure after Fill Phase 10 (The estimated worst case).

Landfill Acreage included in this Estimate: 100.1 Acres (94.8 Acres of Top Area, plus 5.3 acres of side slope)

Date Disposal Unit Began Accepting Waste 5-18-92 Design Life of Disposal Unit 17+/- years

Type of Landfill: XX Class I _____ Class III

_____ Exempt; Type of Exemption: _____

Closure Plan Approved: (Yes) / No

II. TYPE OF FINANCIAL DOCUMENT SUBMITTED TO ENSURE FINANCIAL ASSURANCE:

___ Trust Fund Agreement ___ Performance Bond (only for landfills with an approved closure plan)

___ Letter of Credit ___ Standby Trust Fund Agreement

___ Insurance Certificate XX Escrow Account

___ Financial Guarantee Bond ___ Other (Explain) _____

III. ESTIMATED CLOSING COST

For the time period in the landfill operation when the extent and manner of its operation makes closing most expensive.

** Third Party Estimate/Quote must be provided for each item.
** Costs must be for a third party providing all material and labor.

All items must be addressed. Attach a detailed explanation for all items marked not applicable (N/A).

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL**
1. Monitoring Wells: The monitoring wells have been or will be installed prior to closure (as part of operation).				
Borehole Excavation	CY			
Backfill	CY			
Gravel Pack	CY			
Casing	LF			
Screen	EA			
Cap	EA			
			Subtotal Monitor Wells	$0
2. Slope and Fill:				
Excavation	CY	N/A		
Placement/Spreading	SY	484,484	$0.93/SY*	$450,570
Compaction	CY	Included with placement/spreading		
Off- Site Material	CY	Included as part of operation		
			Subtotal Slope and Fill	$450,570
3. Cover Material (Barrier Layer):				
(side slope) Off-Site Clay	SY	25,652	$5.29/SY*	$135,699
On-Site Clay	CY	N/A		
(top area) Synthetics - 40 mil	SY	458,832	$3.87/SY**	$1,775,680
Synthetics - 30 mil	SY	N/A		
Synthetics - GCL	SY	N/A		
			Subtotal Cover Material	$1,911,379

**Based upon textured 40mil HDPE and NSC, October 1, 1996 Price List.

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL**
4. Top Soil Cover:				
Off-Site Material (sand)	CY	152,944	$11.80/CY	$1,804,739
Off-Site Material (top soil)	CY	170,046	$9.04/CY*	$1,537,216
Delivery	CY	Included with Material		
Spreading	CY	Included with Material		
Compaction	CY	Included with Material		
			Subtotal Top Soil Cover	$ 3,341,955
5. Stormwater Control:				
Excavation, Grading & Recontouring	CY	8,815	$6.00/CY*	$52,890
Stormwater Sideslope Conveyances	LF	4,450	$135/LF*	$600,750
Terrance Drains	EA	14	$4,046/EA*	$56,644
Underdrain	LF	41,050	$18.06/LF*	$741,363
			Subtotal Stormwater Control	$1,451,647
6. Gas Migration Control: The Gas Collection System will be constructed during operation.				
Wells	EA	42	$7,306/EA*	$306,852
Pipe and Fittings (6",8" & 10")	LF	13,000	$25.00/LF	$325,000
Traps	EA	5	$4,000/EA	$20,000
Well Head Assembly	EA	42	$2,000/EA	$84,000
Flare Assembly	EA	Installed during operation		
Flame Arrestor	EA	Installed during operation		
Mist Eliminator	EA	Installed during operation		
Flow Meter	EA	Installed during operation		
Blowers	EA	Installed during operation		
Monitoring Probes	LF	Installed during operation		
			Subtotal Gas Migration Control	$735,852

This Gas Management System is based upon the design by Rust Environmental & Infastructure, prepared in November 1996.

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL**
7. Revegetation:				
Sodding	SY	484,484	$1.56/SY*	$755,795
Soil Preparation/Grading	SY	N/A		
Hydroseeding	AC	Included with Sodding		
Fertilizer	AC	Included with Sodding		
Mulch	AC	N/A		
			Subtotal Revegetation	$755,795
8. Landscape Irrigation System:				
Pipe and Fittings	LF			
Pumps	EA			
			Subtotal Landscape Irrigation System	$0
9. Security System:	The security system was installed as part of operation			
Fencing	LF			
Gate(s)	EA			
Sign(s)	EA			
			Subtotal Security System	$0
10. Engineering:				
Closure Plan Report	LS			$20,000
Certified Engineering Drawings (for construction)	LS			$250,000
Closure Permit	LS			$50,000
Other (Detail):				
			Subtotal Engineering	$320,000

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL**
11. Benchmark Installation	EA	Included with Benchmark Survey		
Benchmark Survey	LS			$20,000
			Subtotal Benchmark Installation	$20,000
12. Certification of Closure	LS			$60,000
			Subtotal Certification of Closure	$60,000
13. Administrative: ***		Hours	@ $/hour	
P.E. Supervisor	HR	104	$125.00/HR	$13,000
On-Site Engineer	HR	1300	$75.00/HR	$97,500
Office Engineer	HR	208	$95.00/HR	$19,760
On-Site Technician	HR			
Other- (explain):				
Clerical				$5,824
Expenses				$10,000
			Subtotal Administrative	$146,084
14. Quality Assurance: ***		Hours	@ $/hour	
P.E. Supervisor	HR	100	$100.00/HR	$10,000
On-Site Engineer	HR	1200	$52.00/HR	$62,400
Office Engineer	HR	400	$80.00/HR	$32,000
On-Site Technician	HR	4800	$39.50/HR	$189,600
QA Testing	LS			$60,000
Other- (explain):				
			Subtotal Quality Assurance	$354,000

***Based upon a construction schedule of 26 weeks

DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL**

15. Site Specific Costs (explain):

Waste Tire Facility (if applicable)	(3,900 Tons @ $62.00/Ton)	$241,800
Mobilization/Demobilization		$100,000
Erosion Control		$100,000
Bonds (0.8% of Construction Costs)*		$69,178
	Subtotal Site Specific Costs	$510, 978
16. Contingency 15 % of Total		$1,508,739
	TOTAL CLOSING COSTS	$11,566,999

*These unit prices are based upon Bid prices from R.B. Baker, received on February 7, 1997 for closure of Side Slope Units 1-4 and 12-20.

CERTIFICATION BY ENGINEER

This is to certify that the Financial Assurance Cost Estimates pertaining to the engineering features of this solid waste management facility have been examined by me and found to conform to engineering principals applicable to such facilities. In my professional judgement, the Cost Estimates are a true, correct and complete representation of the financial liabilities for closing and long-term care of the facility, and comply with the requirements of Florida Administrative Code (FAC), Rule 17-701.630 and all other Department of Environmental Protection rules, and statutes of the State of Florida. It is understood that the Financial Assurance Cost Estimates shall be revised and submitted to the Department annually as required by FAC 17-701.630(4).

Juanitta Bader Clem
Signature

England Thims & Miller
Company Name

Juanitta Bader Clem, Vice President
Name and Title (please type)

3131 St. Johns Bluff Rd., S.
Mailing Address

43245
Florida Registration Number (please affix seal)

Jacksonville, FL 32246
City, State, Zip Code

(904)642-8990
Telephone Number

Date: 2/26/97

This Opinion of Probable Cost is based upon a final closure after Fill Phase 10, which would require final closure design. This Opinion of Probable Cost is without benefit of final closure design.

IV. ANNUAL COST FOR LONG-TERM CARE

(for 20 or (30 yrs) ,sec 17-701.600(1)a.1.)
(circle one)

****Third Party Estimate/Quote must be provided for each item**
****Costs must be for a third party providing material and labor.**

All items must be addressed. Attach a detailed explanation for all items marked not applicable (N/A).

DESCRIPTION	UNIT (A)	QUANTITY (B)	UNIT COST (C)	ANNUAL COST** (D)=(A)x(B)x(C)
1. Groundwater Monitoring 17-701.510(6), (8)(a)	sampling frequency events/yr	# of wells	$/well/event	$/yr
Monthly	N/A			
Quarterly	N/A			
Semi-Annual	2	38	$784.50*	$59,622
Annual Report	1			$1,528
Semi-Annual Report	1			$1,284
			Subtotal Groundwater Monitoring	$62,434

*Includes sampling and labratory analysis.

2. Gas Monitoring 17-701.400(10)	sampling frequency events/yr	# of locations	$/location/event	$/yr
Monthly	N/A			
Quarterly	4	10*	$35/Location	$1,400
Semi-Annual	N/A			
Annual	N/A			
			Subtotal Gas Migration Monitoring	$1,400

*Assume one gas probe every 500 feet on the western boundary of the landfill plus the on-site buildings

3. Leachate Monitoring 17-701.510(5), (6)(b), 17-701.510(8)(c)	sampling frequency events/yr	# of locations	$/location/event	$/yr
Monthly	N/A			
Semi-Annual	2	2	$1,892.50*	$7,570
Composite	2	1	$1,114.00*	$2,228
Annual	Semi-Annual Report is included with Groundwater Monitoring			
			Subtotal Leachate Monitoring	$9,798

* Includes sampling and laboratory analysis.

DESCRIPTION	UNIT (A)	QUANTITY (B)	UNIT COST (C)	ANNUAL COST** (D)=(A)x(B)x(C)
4. Surface Water Monitoring 17-701.510(4), (8)(b)	sampling frequency events/yr	# of locations	$/location/event	$/yr
Monthly	N/A			
Quarterly	4	2	$486**	$3,888
	** Includes sampling and laboratory analysis.			
Semi-Annual	N/A			
Quarterly Report*				
~~Annual~~	2	1	$ 516	$ 1,032
	* Includes quarterly surface water and gas monitoring reports			
			Subtotal Surface Water Monitoring	$ 4,920
5. Maintenance of Leachate Collection/Treatment Systems				
Collection Pipes	LF	N/A		
Sumps, Traps	EA	N/A		
Lift Stations	EA	N/A		
Tanks	EA	N/A		
Impoundments-Liner Repair	SY	N/A		
Sludge Removal	CY	N/A		
Aeration Systems-Floating Aerators	EA	N/A		
Spray Aerators	EA	N/A		
Off-Site Disposal (include transportation and disposal)	1000gal	5,657.5	$ 50/1000 gal	$ 282,875
On-Site Pretreatment System Maintenance-(Describe)				
Other (Describe)-				
Replace/Maintain Pumps, Panels, etc.				$ 30,500
			Subtotal Leachate Collection/Treatment System Maintenance	$ 313,375

DESCRIPTION	UNIT (A)	QUANTITY (B)	UNIT COST (C)	ANNUAL COST** (D)=(A)x(B)x(C)

6. Maintenance of Groundwater Monitoring Wells LS — 1 — $ 5,300 — $ 5,300

Subtotal Groundwater Monitoring Well Maintenance $ 5,300.00

* Assume replacement of one well per year.

7. Maintenance of Gas Migration System

Piping, Vents	LF	N/A		
Blowers	EA	Assume		
Flaring Units	EA	$ 12,000 per year for all		
Meters, Valves	EA	Maintenance.		

Subtotal Gas Migration System Maintenance $ 12,000

8. Landscape Maintenance

Mowing	AC	155	$ 220/AC	$ 34,100
Fertilizer	AC	155	$ 275/AC	$ 42,625
Irrigation	AC	N/A		

Subtotal Landscape Maintenance $ 76,725

9. Benchmark Maintenance EA — N/A

Subtotal Benchmark Maintenance $0

10. Administrative/Overhead:

		Hours	@ $/hour	
P.E. Supervisor	HR	2080	$ 25/HR*	$ 52,000
On-Site Engineer	HR			
Office Engineer	HR			
On-Site Technician	HR	2080 x 4	$ 18/HR*	$ 149,760
Other (explain):				
Electricity: -include Leachate Pumps, Blowers, Lighting, etc.	LS			$ 25,000

Subtotal Administrative $ 226,760

* Labor rates include direct and indirect labor costs, including benefits, ect.

DESCRIPTION	UNIT (A)	QUANTITY (B)	UNIT COST (C)	ANNUAL COST** (D)=(A)x(B)x(C)
11. Maintenance of Cover				
Seeding, Soil	SY	7.75*	$ 1200/AC	$ 9,300
Regrading	AC	Included with seeding, soil		
Liner Repair-Synthetic	SY	Included with seeding, soil		
Clay	CY	N/A		
			Subtotal Cover Integrity Maintenance	$ 9,300
* 5% Of the 155 AC landfill				
12. Surface Water Drainage Maintenance				
Ditch Cleaning	LF	10,400	$1.00/LF	$10,400
Stormwater Conveyance Maint.	EA	1	$4,600/EA	$4,600
			Subtotal Drainage Maintenance	$15,000
13. Security System Maintenance				
Fences	LF	Assume $10,000 per year		
Gate(s)	EA	for all maintenance.		
Sign(s)	EA			
			Subtotal Security System Maintenance	$10,000
14. Remedial Actions	LS			
			Subtotal Remedial Actions	$0
15. Site Specific Costs (explain):				
			Subtotal Site Specific Costs	$0
			LONG-TERM CARE COSTS ($/yr)	$747,012
			TOTAL LONG-TERM CARE COSTS ($) ($/year times required years of long-term care)	$22,410,360

CERTIFICATION BY ENGINEER

This is to certify that the Financial Assurance Cost Estimates pertaining to the engineering features of this solid waste management facility have been examined by me and found to conform to engineering principals applicable to such facilities. In my professional judgement, the Cost Estimates are a true, correct and complete representation of the financial liabilities for closing and long-term care of the facility, and comply with the requirements of Florida Administrative Code (FAC), Rule 17-701.630 and all other Department of Environmental Protection rules and statutes of the State of Florida. It is understood that the Financial Assurance Cost Estimates shall be revised and submitted to the Department annually as required by FAC 17-701.630(4).

Juanitta Bader Clem

Signature

England, Thims & Miller, Inc.

Company Name

Juanitta Bader Clem, Vice President

Name and Title (please type)

3131 St. Johns Bluff Rd., S.

Mailing Address

43245

Florida Registration Number (please affix seal)

Jacksonville, FL 32246

City, State, Zip Code

(904)642-8990

Telephone Number

Date: 2/26/97

ATTACHMENT H

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

JOB NO. 40522-6-7221 SHEET 1 OF ____

JOB NAME Trail Ridge LF Vert. Expansion

BY SL DATE 8-20-96

CHECKED BY [signature] DATE 8/29/96

- Landfill Width (along A-A) = 2600' (STA. 74-100) ✓
- Landfill Length (along B-B) = 2600' (STA. 100+50 to 126+50) ✓
- Side Slopes: 3.7 (H) : 1 (V) ✓
- Assume average bottom elevation = +140' ✓
- New LF elevation: +330' → +350' ✓

FORM 17

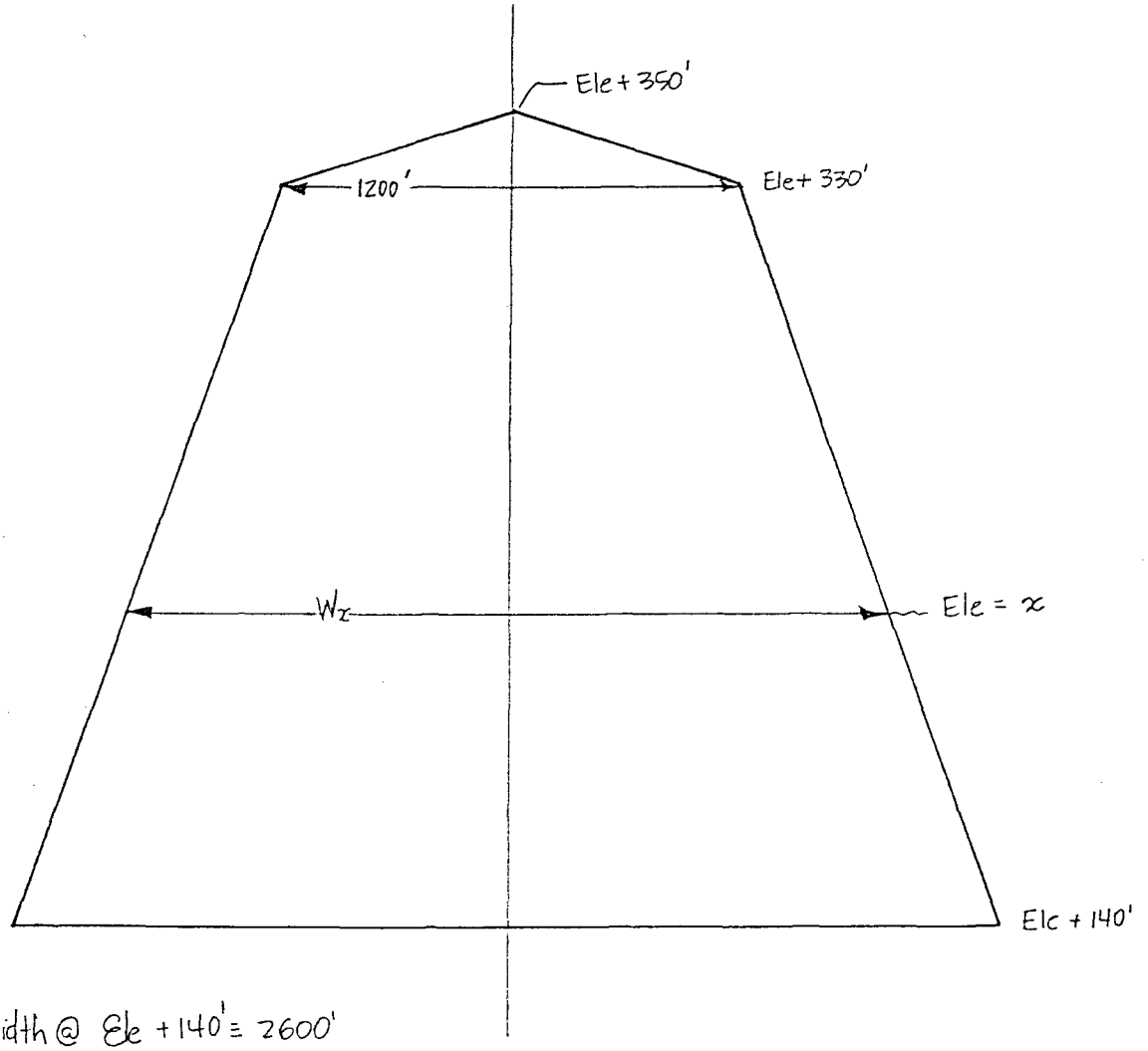
LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

JOB NO. 4.522-6-7221 SHEET 2 OF ____

JOB NAME Trail Ridge Landfill

BY JL DATE 8-20-96

CHECKED BY [signature] DATE 8/25/96



Landfill Width @ Ele + 140' = 2600'
Landfill Width @ Ele + 330' = 1200'

Landfill Width @ Ele $x = W_x = 1200 + 1400\left[\frac{330-x}{330-140}\right]$ feet $= 1200 + 7.37(330-x)$ feet

$= 3631.6 - 7.37x$ feet

FORM 17

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

JOB NO. 4522-6-7221 SHEET 3 OF 3
JOB NAME Trail Ridge Landfill
BY SC DATE 8-24-96
CHECKED BY [signature] DATE 8/29/96

LOADS

Slice No.	Elevation Range (Feet)	Mid Elevation (Feet)	Average Width (Feet)	Load Magnitude (psf)
1	+140 to +160	+150	2526	1400
2	+160 to +180	+170	2379	1400
3	+180 to +200	+190	2232	1400
4	+200 to +220	+210	2084	1400
5	+220 to +240	+230	1937	1400
6	+240 to +260	+250	1789	1400
7	+260 to +280	+270	1642	1400
8	+280 to +300	+290	1495	1400
9	+300 to +320	+310	1347	1400
10	+320 to +330	+325	1237	700
11	+330 to +350	+340	600	1400

SUBSURFACE CONDITIONS (SAME AS THOSE ASSUMED BY SAS; 442-7221-01) ✓

Elevation Range (Feet)	Layer Thickness (Feet)	Modulus (KSF)	Poisson's Ratio
+140 to +60	80	1800	0.3
+60 to +10	50	1500	0.3
+10 to -400	410	5,000	0.3
-4000 to ↓	--	30,000	0.3

GeoSet by Geocorp Input File: C:\GEOCORP\TRIDGE.GEO
Version 1.95 Date: 8/21/96
June, 1995 Time: 3:20:58 PM
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Jacksonville, Florida
Unauthorized use of this product is UNLAWFUL

ORIGINAL (SAS) Profile

0-80' Soil @ 1000 ksf
80-130' Soil @ 1500 ksf
130'-540' Marl @ 5000 ksf
540+ Lmst @ 30,000 ksf

General Information

Project Name: Trail Ridge Landfill Vertical Expansion
Project Number: 40522-6-7221
Analysis Title: Global Settlements - Trail Ridge Landfill Vertical Expansion
Analysis Description: Landfill Material Unit Weight: 70 pcf
Performed By: Sandeep Laroia, P.E.
Checked By: _____ Date: _____

Site Definition

Site Characteristics	X-Direction	Y-Direction
No. of Segments	10.0	10.0
Segment Length (Feet)	500.0	500.0
Site Length (Feet)	5000.0	5000.0

Subsurface Information (4 Layers)

Layer No.	Thickness (Feet)	Modulus (ksf)	Poisson's Ratio
01	80.00	1000.0	0.30

02	50.00	1500.0	0.30
03	410.00	5000.0	0.30
04	1000.00	30000.0	0.30

Rectangular Loading (11 Loads)

Load No.	Xc (Feet)	Yc (Feet)	O	Xl (Feet)	Yl (Feet)	Load (psf)	Segments X	Segments Y	Settlement (in.)
01	2500.0	2500.0	0	2526.0	2526.0	1400	100	100	21.658
02	2500.0	2500.0	0	2379.0	2379.0	1400	100	100	21.658
03	2500.0	2500.0	0	2232.0	2232.0	1400	100	100	21.658
04	2500.0	2500.0	0	2084.0	2084.0	1400	100	100	21.658
05	2500.0	2500.0	0	1937.0	1937.0	1400	100	100	21.658
06	2500.0	2500.0	0	1789.0	1789.0	1400	100	100	21.658
07	2500.0	2500.0	0	1642.0	1642.0	1400	100	100	21.658
08	2500.0	2500.0	0	1495.0	1495.0	1400	100	100	21.658
09	2500.0	2500.0	0	1347.0	1347.0	1400	100	100	21.658
10	2500.0	2500.0	0	1237.0	1237.0	700	100	100	21.658
11	2500.0	2500.0	0	600.0	600.0	1400	100	100	21.658

Xc, Yc: Center Coordinates
Xl, Yl: Load Lengths
O: Orientation
Settlement @ (Xc,Yc)

Circular Loading (0 Loads)

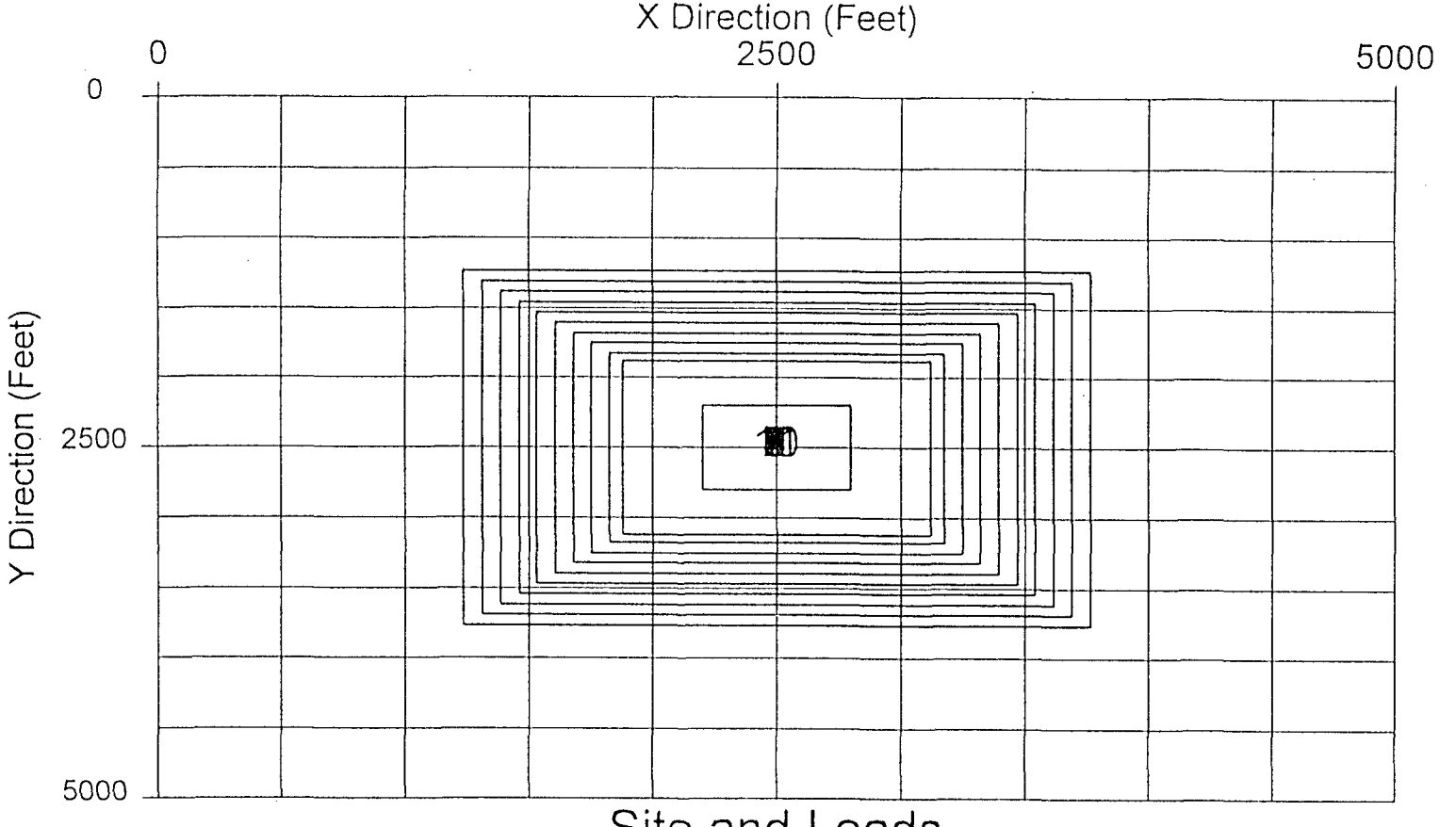
405226-7221

Trail Ridge Landfill Vertical Expansion

40522- 6.724

Global Settlements - Trail Ridge Landfill Vertical Expansion

Landfill Material Unit Weight: 70 pcf



Site and Loads

Detailed loading information is presented in the output file

Circular loads (if any) may appear as ellipses

Trail Ridge Landfill Vertical Expansion

40522-6-7221

Global Settlements - Trail Ridge Landfill Vertical Expansion

Landfill Material Unit Weight: 70 pcf

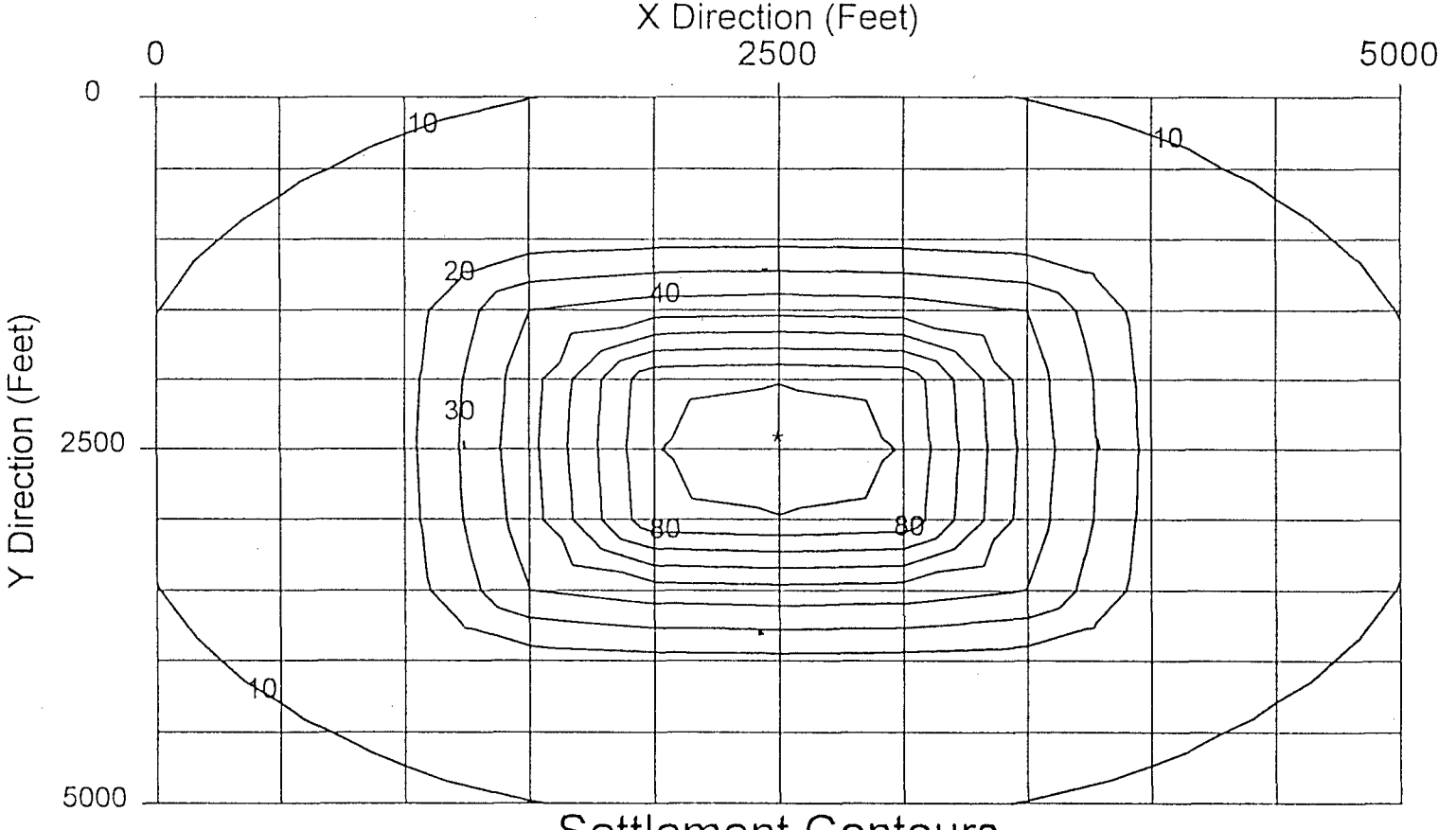
	X = 0.0'	X = 500.0'	X = 1000.0'	X = 1500.0'	X = 2000.0'	X = 2500.0'	X = 3000.0'	X = 3500.0'	X = 4000.0'	X = 4500.0'	X = 5000.0'
Y = 0.0'	1.646"	1.818"	1.997"	2.157"	2.271"	2.311"	2.269"	2.155"	1.994"	1.816"	1.644"
Y = 500.0'	1.818"	2.060"	2.330"	2.592"	2.787"	2.857"	2.784"	2.588"	2.325"	2.056"	1.815"
Y = 1000.0'	1.997"	2.330"	2.745"	3.219"	3.573"	3.700"	3.568"	3.211"	2.737"	2.323"	1.992"
Y = 1500.0'	2.157"	2.592"	3.219"	8.653"	9.823"	10.105"	9.815"	8.632"	3.202"	2.583"	2.151"
Y = 2000.0'	2.271"	2.787"	3.573"	9.823"	18.995"	19.353"	18.971"	9.769"	3.552"	2.776"	2.263"
Y = 2500.0'	2.311"	2.857"	3.700"	10.105"	19.353"	21.658"	19.327"	10.047"	3.678"	2.846"	2.304"
Y = 3000.0'	2.269"	2.784"	3.568"	9.815"	18.970"	19.327"	18.947"	9.760"	3.547"	2.773"	2.262"
Y = 3500.0'	2.155"	2.588"	3.211"	8.632"	9.769"	10.047"	9.760"	8.611"	3.194"	2.579"	2.149"
Y = 4000.0'	1.994"	2.325"	2.737"	3.202"	3.552"	3.678"	3.547"	3.194"	2.729"	2.318"	1.989"
Y = 4500.0'	1.816"	2.056"	2.323"	2.583"	2.776"	2.846"	2.773"	2.579"	2.318"	2.052"	1.813"
Y = 5000.0'	1.644"	1.815"	1.992"	2.151"	2.263"	2.304"	2.262"	2.149"	1.989"	1.813"	1.642"

Trail Ridge Landfill Vertical Expansion

40522-6-7221

Global Settlements - Trail Ridge Landfill Vertical Expansion

Landfill Material Unit Weight: 70 pcf



Settlement Contours

* Maximum Settlement = 21.66 Inches

The contour values indicate precentage of maximum settlement.

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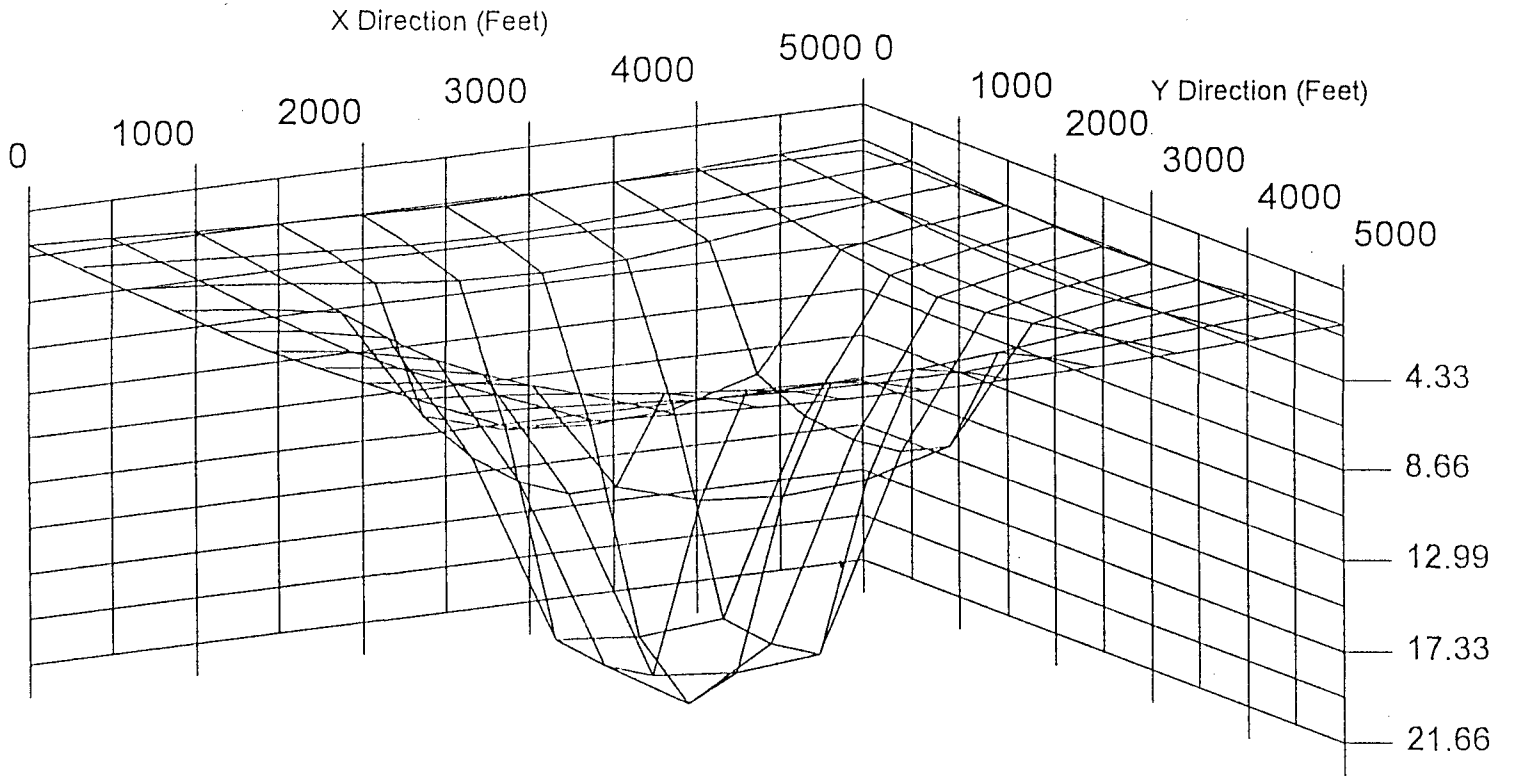
Trail Ridge Landfill Vertical Expansion

40522- C-7221

Global Settlements - Trail Ridge Landfill Vertical Expansion

Landfill Material Unit Weight: 70 pcf



Surface Plot

Maximum Settlement = 21.66 Inches

Licensed To: Law Engineering and Environmental Services - Jacksonville, Florida

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GeoSet by Geocorp Input File: C:\GEOCORP\TRIDGE3.GEO
Version 1.95 Date: 8/21/96
June, 1995 Time: 3:46:17 PM
Licensed To: Law Engineering and Environmental Services
Jacksonville, Florida
Unauthorized use of this product is UNLAWFUL

Modified Profile
Limestone Removed

General Information

Project Name: Trail Ridge Landfill Vertical Expansion
Project Number: 40522-
Analysis Title: Global Settlements - Trail Ridge Landfill Vertical Expansion
Analysis Description: Landfill Material Unit Weight: 70 pcf
Performed By: Sandeep Laroia, P.E.
Checked By: _____ Date: _____

Site Definition

Site Characteristics	X-Direction	Y-Direction
No. of Segments	2.0	2.0
Segment Length (Feet)	1000.0	1000.0
Site Length (Feet)	2000.0	2000.0

Subsurface Information (4 Layers)

Layer No.	Thickness (Feet)	Modulus (ksf)	Poisson's Ratio
01	80.00	1000.0	0.30

02	50.00	1500.0	0.30
03	410.00	5000.0	0.30
04	1000.00	5000.0	0.30

Rectangular Loading (11 Loads)

Load No.	Xc (Feet)	Yc (Feet)	O	Xl (Feet)	Yl (Feet)	Load (psf)	Segments X	Segments Y	Settlement (in.)
01	2500.0	2500.0	0	2526.0	2526.0	1400	100	100	68.442
02	2500.0	2500.0	0	2379.0	2379.0	1400	100	100	68.442
03	2500.0	2500.0	0	2232.0	2232.0	1400	100	100	68.442
04	2500.0	2500.0	0	2084.0	2084.0	1400	100	100	68.442
05	2500.0	2500.0	0	1937.0	1937.0	1400	100	100	68.442
06	2500.0	2500.0	0	1789.0	1789.0	1400	100	100	68.442
07	2500.0	2500.0	0	1642.0	1642.0	1400	100	100	68.442
08	2500.0	2500.0	0	1495.0	1495.0	1400	100	100	68.442
09	2500.0	2500.0	0	1347.0	1347.0	1400	100	100	68.442
10	2500.0	2500.0	0	1237.0	1237.0	700	100	100	68.442
11	2500.0	2500.0	0	600.0	600.0	1400	100	100	68.442

Xc, Yc: Center Coordinates
Xl, Yl: Load Lengths
O: Orientation
Settlement @ (Xc,Yc)

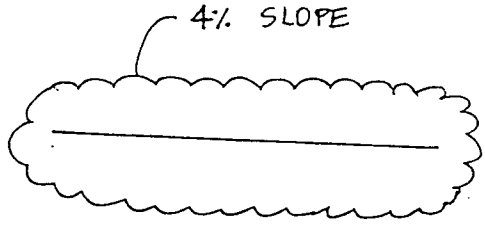
Circular Loading (0 Loads)

ATTACHMENT I

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

JOB NO. 40522-6-7221 SHEET 1 OF 2
JOB NAME TRAIL RIDGE LF TOP COVER STABILITY
BY SC DATE 9-17-96
CHECKED BY TES DATE 9/18/96

SLIDING STABILITY EVALUATION -- TOP COVER



- SLOPE MAGNITUDE: 4%
- SLOPE ANGLE : $\tan^{-1}(4\%) = 2.3°$
- SLOPE CONFIGURATION: 12" TOPSOIL
  12" SAND
  40 MIL TEXTURED GEOMEMBRANE

ASSUMED MATERIAL PROPERTIES:

- TOPSOIL - SATURATED MATERIAL WEIGHT = 100 PCF
- SAND - SATURATED MATERIAL WEIGHT = 110 PCF
- GEOMEMBRANE - INTERFACE FRICTION ANGLE = B

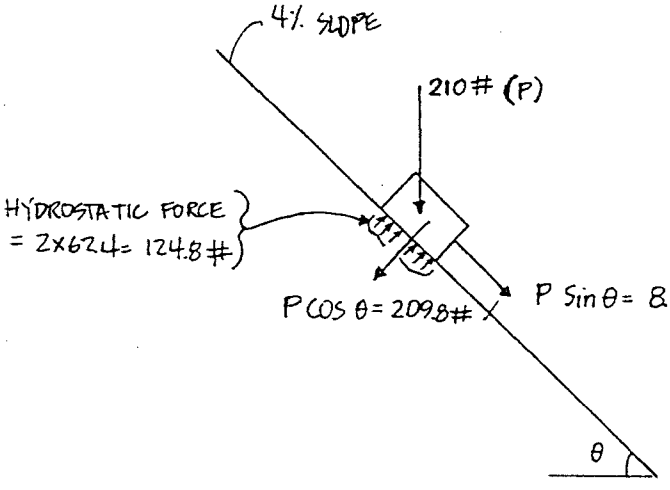
ANALYSIS:

- ASSUME TOPSOIL AND SAND LAYERS ARE SATURATED
- SLIDING FORCE MAGNITUDE BASED ON TOTAL UNIT WEIGHTS ✓
- RESISTING FORCE MAGNITUDE BASED ON BUOYANT (EFFECTIVE) UNIT WEIGHTS ✓
- CONSIDER 1 SQUARE FOOT (TOP VIEW) OF SOIL SLIDING DOWN THE SLOPE ✓
- TOTAL WEIGHT OF SLIDING BLOCK = $110 + \cancel{100}\ 110 = 210\#$ ✓
- BUOYANT WEIGHT OF SLIDING BLOCK = $210\# - 2 * 62.4 = 85.2\#$ ✓

FORM 17

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

JOB NO. 46522-6-7221 SHEET 2 OF 2
JOB NAME Trail Ridge
BY SL DATE 9-17-96
CHECKED BY TES DATE 9/18/96



EXAGERATED SCALE

NORMAL EFFECTIVE STRESS @ SOIL/GEOMEMBRANE INTERFACE = 209.8# - 124.8# = 85# (N_R) ✓

SLIDING RESISTANCE = μN_R where μ: Coeff of sliding resistance (= tan β) ✓

$$\text{SAFETY FACTOR} = \frac{\text{SLIDING RESISTANCE}}{\text{DRIVING FORCE}} = \frac{85 * \tan(\beta)}{8.39}$$ ✓

For a safety factor of at least 2.0, $\frac{85 * \tan(\beta)}{8.39} \geq 2$

$$\therefore \tan(\beta) \geq \frac{2 \times 8.39}{85} = 0.2$$ ✓

$$\beta \geq 11^\circ$$ ✓

∴ If the friction angle between soil and geomembrane is greater than 11° (which it should be), a safety factor of at least 2.0 will exist against block sliding

FORM 17

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

JOB NO. 40522-6-7221 SHEET 1 OF 1
JOB NAME TRAIL RIDGE LD SIDE BLOCK SLIDING
BY SL DATE 9/18/96
CHECKED BY TES DATE 9/19/96

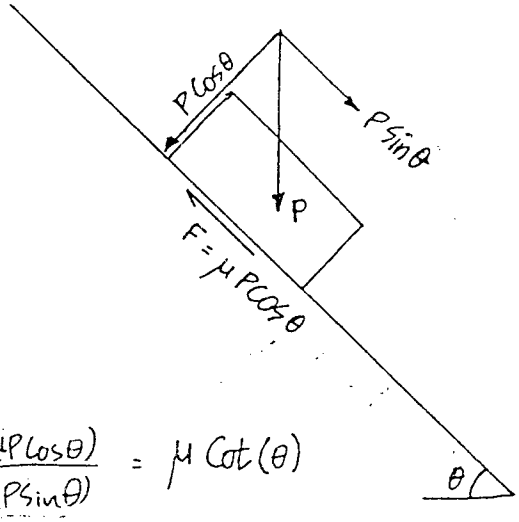
SLIDING STABILITY EVALUATION -- SIDES

SLOPE: 3:1 (H:V) ≡ 18.4° ✓

CONFIGURATION: 2' OF TOPSOIL (100 PCF, SMOIST)
1' OF COMPACTED CLAY

- CHECK SLIDING OF TOPSOIL (INITIALLY UN-VEGETATED) OVER CLAY.
- ASSUME 18.4° SLOPE WILL PREVENT SATURATED (BUOYANT CONDITION).
- Assume 1 square-foot of soil block sliding

SAND OVER SAND



$$F.S. = \frac{\text{Resisting Force } (\mu P \cos\theta)}{\text{Driving Force } (P \sin\theta)} = \mu \cot(\theta)$$

Summary:
- Initial SF against sliding ≈ 1.5
- As the slope becomes vegetated, the safety factor will increase

For Soil (Sand sliding on Sand), $\mu = \tan\phi$

$F.S. = \tan\phi \cot\theta$ [$\cot\theta = 3.00$]

For F.S. = 2.0, $\tan\phi \equiv 2/3 = 0.667 \therefore \phi \geq 33.7°$

For F.S. = 1.5, $\tan\phi \equiv 1.5/3 \equiv 0.50 \therefore \phi \geq 26.6°$ } Appropriate for topsoil

FORM 17

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

JOB NO. 40822-6-7221 SHEET 1 OF 1
JOB NAME Tall Ridge
BY SL DATE 9/18/96
CHECKED BY TES DATE 9/18/96

SIDE COVER SLIDING: SAND OVER CLAY / CLAYEY SAND.

① SAND OVER CLAY -- $\phi_{sand/clay} = 0$ (conservative)

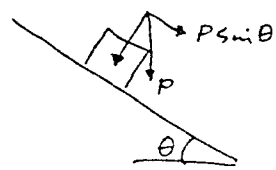
Cohesion C_{CLAY} = 500 psf (conservative)

α = adhesion factor = 0.5 (assumed, conservative).

Driving Force = $P \sin\theta$ = 200 Sin 18.4° = 63#

Resisting Force = αC (Adhesion) = 250#

SF = $\frac{250}{63}$ = 3.96



② Sand Over Clayey Sand : $\phi_{sand/cly\ sand} \approx 25°$

Cohesion C = 250 psf
Adhesion Factor (λ) = 0.5

Driving Force = 200 Sin 18.4° = 63#

Resisting Force = $\alpha C + \mu$ 200 Cos 18.4° ($\mu = \tan\phi_{sand/clay} = \tan 25°$)

Resisting Force = 125# + tan25° Cos18.4° * 200 = 213.5

SF = $\frac{213.5}{63}$ = 3.4

FORM 17

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

JOB NO. 40522-6-7211 SHEET 1 OF 1
JOB NAME TR LF Global Stability Eval
BY SL DATE 9/17/96
CHECKED BY TES DATE 9/18/96

BOUNDARY INFO

OF SURFACE BOUNDARIES : 23 (DEFINED ON DRAWING)

OF NON-SURFACE BOUNDARIES:

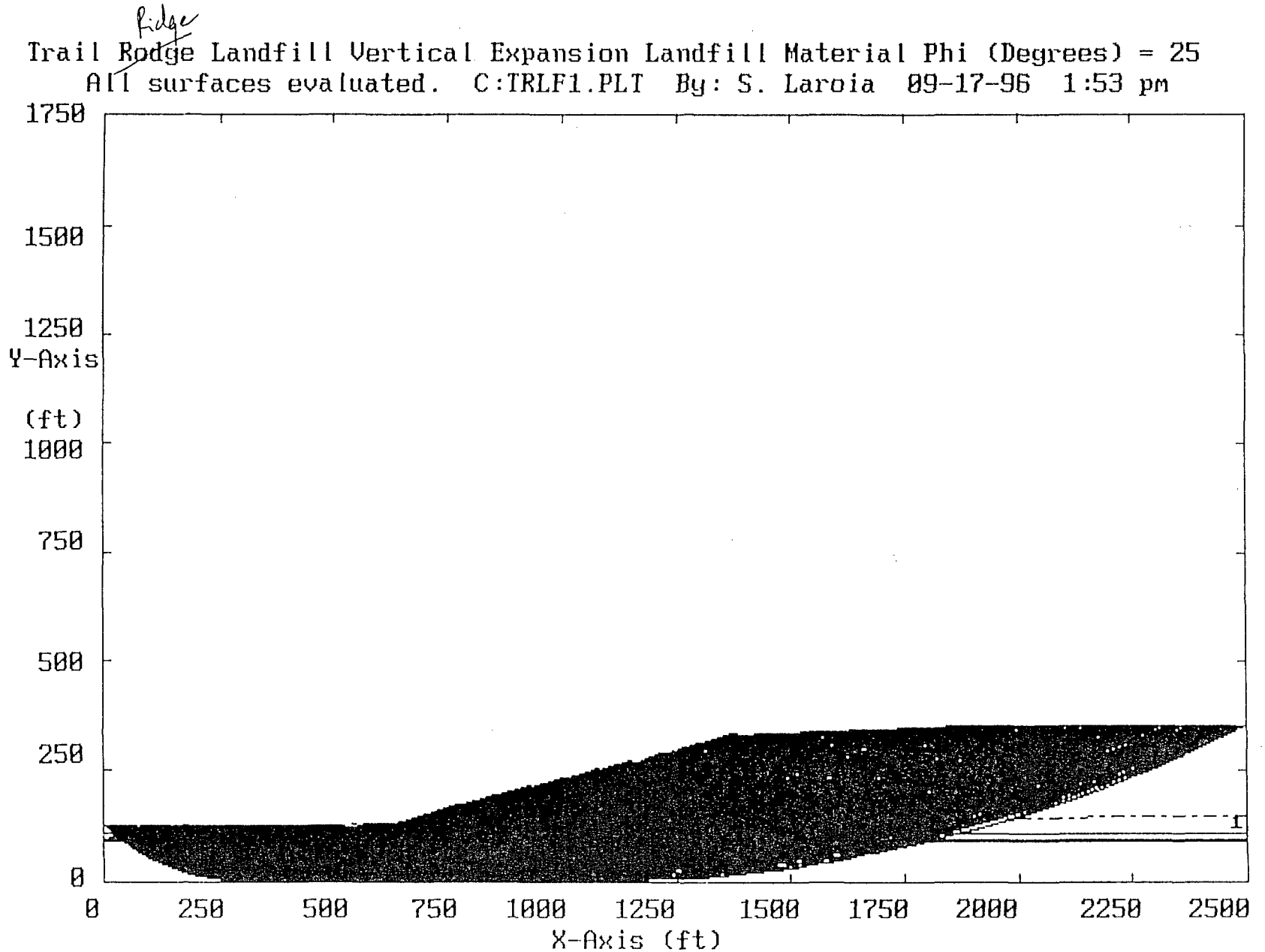
DESCRIPTION OF NON-SURFACE BOUNDARIES

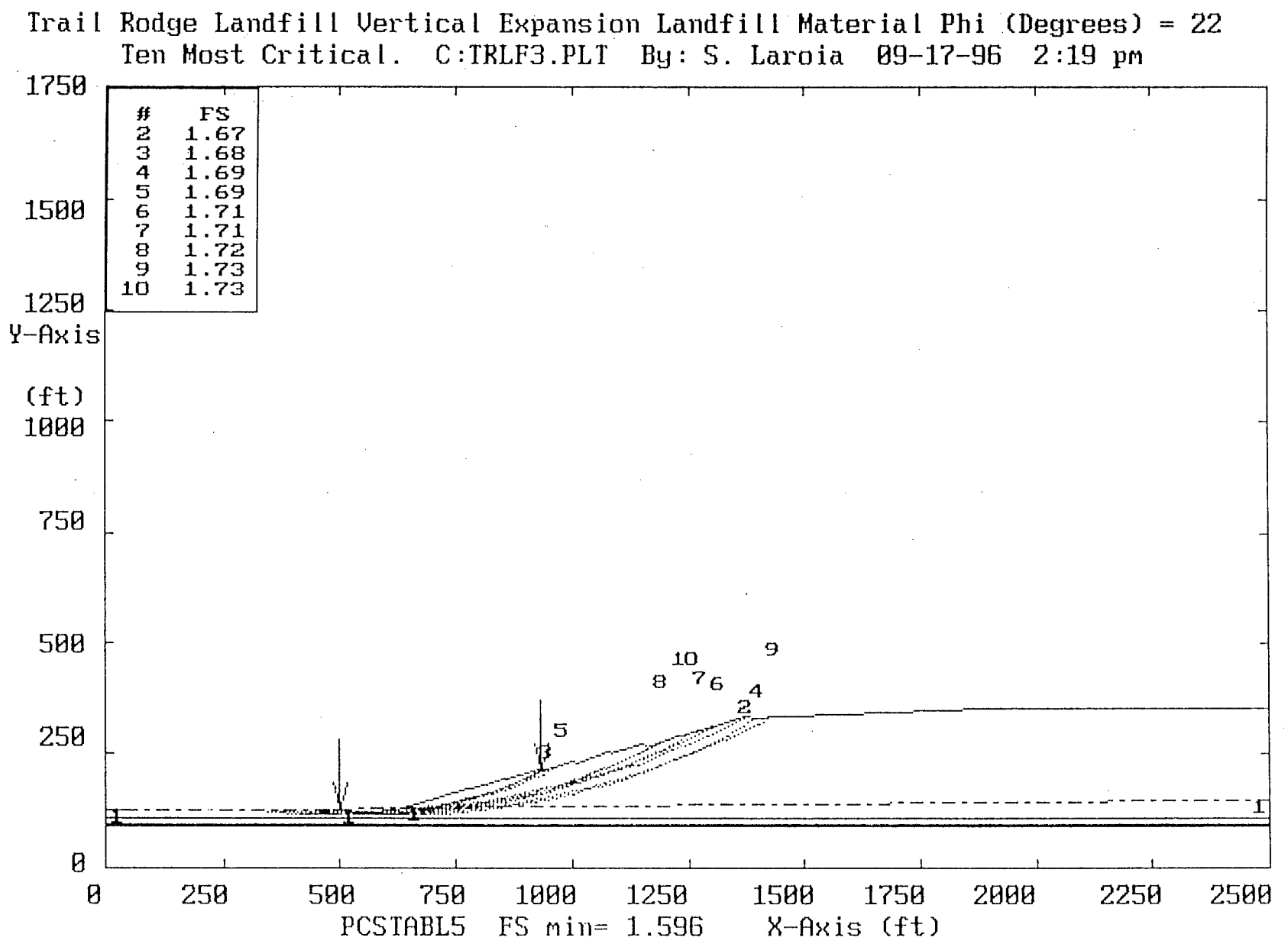
BOUNDARY No.	CO-ORDINATES (FEET) FROM	TO	Layer Below
24	640, 125	2500, 145	2 (Sand; $\bar{N}$ = 10)
25	0, 102.5	2500, 102.5	3 (Cly SA, $\bar{N}$ = 25)
26	0, 93	2500, 93	4 (SA, $\bar{N}$ = 5)
27	0, 87	2500, 87	5 (SA, $\bar{N}$ > 25)

GWL: Assume follows Natural Ground Surface : (0, 122) → (500, 123) → (640, 125) → (2500, 145)

Soil Conditions :

Layer No.	γ_{Total} (pcf)	γ_{moist} (pcf)	C (psf)	ϕ (degrees)
1 (Landfill)	70	70	?	Variable
2 (Sand, $\bar{N}$=10)	115	110	0	30° ✓
3 (Cly SA, $\bar{N}$=25)	120	112	1000	28° ✓
4 (SA, $\bar{N}$ = 5)	112	105	0	29° ✓
5 (SA, $\bar{N}$>25)	120	115	0	34° ✓


Trail Ridge Landfill Vertical Expansion Landfill Material Phi (Degrees) = 25
All surfaces evaluated. C:TRLF1.PLT By: S. Laroia 09-17-96 1:53 pm
1750
1500
1250
Y-Axis
(ft)
1000
750
500
250
0
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
X-Axis (ft)


Trail Rodge Landfill Vertical Expansion Landfill Material Phi (Degrees) = 22
Ten Most Critical. C:TRLF3.PLT By: S. Laroia 09-17-96 2:19 pm
FS
2 1.67
3 1.68
4 1.69
5 1.69
6 1.71
7 1.71
8 1.72
9 1.73
10 1.73
1750
1500
1250
Y-Axis
(ft)
1000
750
500
250
0
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
PCSTABL5 FS min= 1.596
X-Axis (ft)

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:	09-17-96
Time of Run:	2:19 pm
Run By:	S. Laroia
Input Data Filename:	C:TRLF3.IN
Output Filename:	C:TRLF3.OUT
Plotted Output Filename:	C:TRLF3.PLT

PROBLEM DESCRIPTION Trail Rodge Landfill Vertical Expansion
Landfill Material Phi (Degrees) = 22

BOUNDARY COORDINATES

23 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	122.00	500.00	123.00	2
2	500.00	123.00	640.00	125.00	2
3	640.00	125.00	780.00	171.80	1
4	780.00	171.80	787.50	169.30	1
5	787.50	169.30	855.00	191.80	1
6	855.00	191.80	862.50	189.30	1
7	862.50	189.30	930.00	211.80	1
8	930.00	211.80	937.50	209.30	1
9	937.50	209.30	1005.00	231.80	1
10	1005.00	231.80	1012.50	229.30	1
11	1012.50	229.30	1080.00	251.80	1
12	1080.00	251.80	1087.50	249.30	1
13	1087.50	249.30	1155.00	271.80	1
14	1155.00	271.80	1162.50	263.30	1
15	1162.50	263.30	1230.00	291.80	1
16	1230.00	291.80	1237.50	289.30	1
17	1237.50	289.30	1305.00	311.80	1
18	1305.00	311.80	1312.50	309.30	1
19	1312.50	309.30	1374.60	330.00	1
20	1374.60	330.00	1384.60	330.00	1
21	1384.60	330.00	1393.60	327.00	1
22	1393.60	327.00	1921.10	349.30	1
23	1921.10	349.30	2500.00	349.30	1
24	640.00	125.00	2500.00	143.00	2

25	.00	102.50	2500.00	102.50	3
26	.00	93.00	2500.00	93.00	4
27	.00	87.00	2500.00	87.00	5

1

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	70.0	70.0	.0	22.0	.00	.0	1
2	110.0	115.0	.0	30.0	.00	.0	1
3	112.0	120.0	1000.0	28.0	.00	.0	1
4	105.0	112.0	.0	29.0	.00	.0	1
5	115.0	120.0	.0	34.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	122.00
2	500.00	123.00
3	640.00	125.00
4	2500.00	145.00

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

4000 Trial Surfaces Have Been Generated.

100 Surfaces Initiate From Each Of 40 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 500.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X =2500.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = .00 ft.

40.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	500.00	123.00
2	539.89	119.97
3	579.88	119.09
4	619.86	120.38
5	659.71	123.82
6	699.32	129.40
7	738.56	137.12
8	777.34	146.94
9	815.53	158.84
10	853.02	172.78
11	889.71	188.72
12	925.48	206.62
13	932.88	210.84

*** 1.596 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	358.97	122.72
2	398.82	119.21
3	438.74	116.62
4	478.70	114.94
5	518.69	114.18
6	558.69	114.33
7	598.68	115.40
8	638.63	117.39
9	678.53	120.29
10	718.34	124.10
11	758.06	128.82
12	797.67	134.45

13	837.13	140.98
14	876.43	148.42
15	915.55	156.75
16	954.47	165.98
17	993.17	176.09
18	1031.63	187.09
19	1069.83	198.97
20	1107.74	211.72
21	1145.36	225.33
22	1182.65	239.80
23	1219.60	255.12
24	1256.19	271.28
25	1292.40	288.27
26	1328.21	306.09
27	1363.60	324.73
28	1370.81	328.74

*** 1.667 ***

1

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	474.36	122.95
2	514.19	119.25
3	554.15	117.56
4	594.15	117.88
5	634.08	120.20
6	673.85	124.52
7	713.35	130.83
8	752.48	139.11
9	791.15	149.35
10	829.26	161.52
11	866.70	175.58
12	903.40	191.50
13	939.25	209.24
14	942.09	210.83

*** 1.681 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	487.18	122.97
2	526.97	118.86
3	566.86	115.88
4	606.81	114.03
5	646.81	113.33

6	686.81	113.75
7	726.78	115.32
8	766.68	118.02
9	806.50	121.85
10	846.19	126.81
11	885.72	132.90
12	925.07	140.11
13	964.19	148.44
14	1003.06	157.87
15	1041.65	168.41
16	1079.92	180.04
17	1117.85	192.75
18	1155.40	206.54
19	1192.54	221.38
20	1229.25	237.28
21	1265.49	254.21
22	1301.23	272.17
23	1336.45	291.13
24	1371.12	311.09
25	1397.27	327.16

*** 1.685 ***

1

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	474.36	122.95
2	514.17	119.06
3	554.12	117.12
4	594.12	117.13
5	634.08	119.09
6	673.88	122.99
7	713.46	128.83
8	752.70	136.59
9	791.51	146.25
10	829.81	157.79
11	867.50	171.19
12	904.50	186.40
13	940.70	203.40
14	976.04	222.15
15	976.04	222.15

*** 1.687 ***

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	333.33	122.67
2	373.16	118.99
3	413.07	116.23
4	453.03	114.40
5	493.02	113.51
6	533.02	113.54
7	573.01	114.50
8	612.96	116.39
9	652.86	119.21
10	692.69	122.96
11	732.41	127.63
12	772.02	133.22
13	811.49	139.74
14	850.79	147.16
15	889.91	155.50
16	928.83	164.75
17	967.52	174.90
18	1005.96	185.94
19	1044.14	197.88
20	1082.03	210.70
21	1119.61	224.40
22	1156.87	238.97
23	1193.77	254.39
24	1230.31	270.68
25	1266.45	287.81
26	1302.19	305.77
27	1310.24	310.05

*** 1.705 ***

1

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	423.08	122.85
2	462.85	118.59
3	502.73	115.51
4	542.69	113.61
5	582.68	112.91
6	622.68	113.39
7	662.64	115.06
8	702.54	117.92
9	742.34	121.95
10	781.99	127.17
11	821.48	133.57
12	860.76	141.13
13	899.80	149.85
14	938.56	159.74
15	977.01	170.76
16	1015.11	182.93
17	1052.84	196.22
18	1090.16	210.62
19	1127.03	226.13
20	1163.42	242.72

21	1199.31	260.39
22	1234.66	279.11
23	1269.43	298.88
24	1273.31	301.24

*** 1.711 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	448.72	122.90
2	488.47	118.45
3	528.35	115.37
4	568.32	113.66
5	608.31	113.33
6	648.30	114.37
7	688.23	116.79
8	728.05	120.57
9	767.71	125.72
10	807.18	132.23
11	846.40	140.10
12	885.33	149.30
13	923.91	159.84
14	962.12	171.70
15	999.89	184.86
16	1037.19	199.31
17	1073.96	215.04
18	1110.18	232.02
19	1145.79	250.24
20	1180.76	269.66
21	1188.26	274.18

*** 1.720 ***

1

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	358.97	122.72
2	398.77	118.64
3	438.64	115.44
4	478.57	113.12
5	518.54	111.67
6	558.54	111.09
7	598.54	111.40
8	638.52	112.57
9	678.47	114.63
10	718.36	117.56

11	758.18	121.36
12	797.91	126.03
13	837.52	131.58
14	877.00	137.99
15	916.34	145.26
16	955.50	153.39
17	994.48	162.38
18	1033.25	172.22
19	1071.79	182.91
20	1110.10	194.44
21	1148.14	206.81
22	1185.90	220.00
23	1223.36	234.02
24	1260.51	248.86
25	1297.32	264.51
26	1333.78	280.96
27	1369.87	298.21
28	1405.57	316.24
29	1428.53	328.48

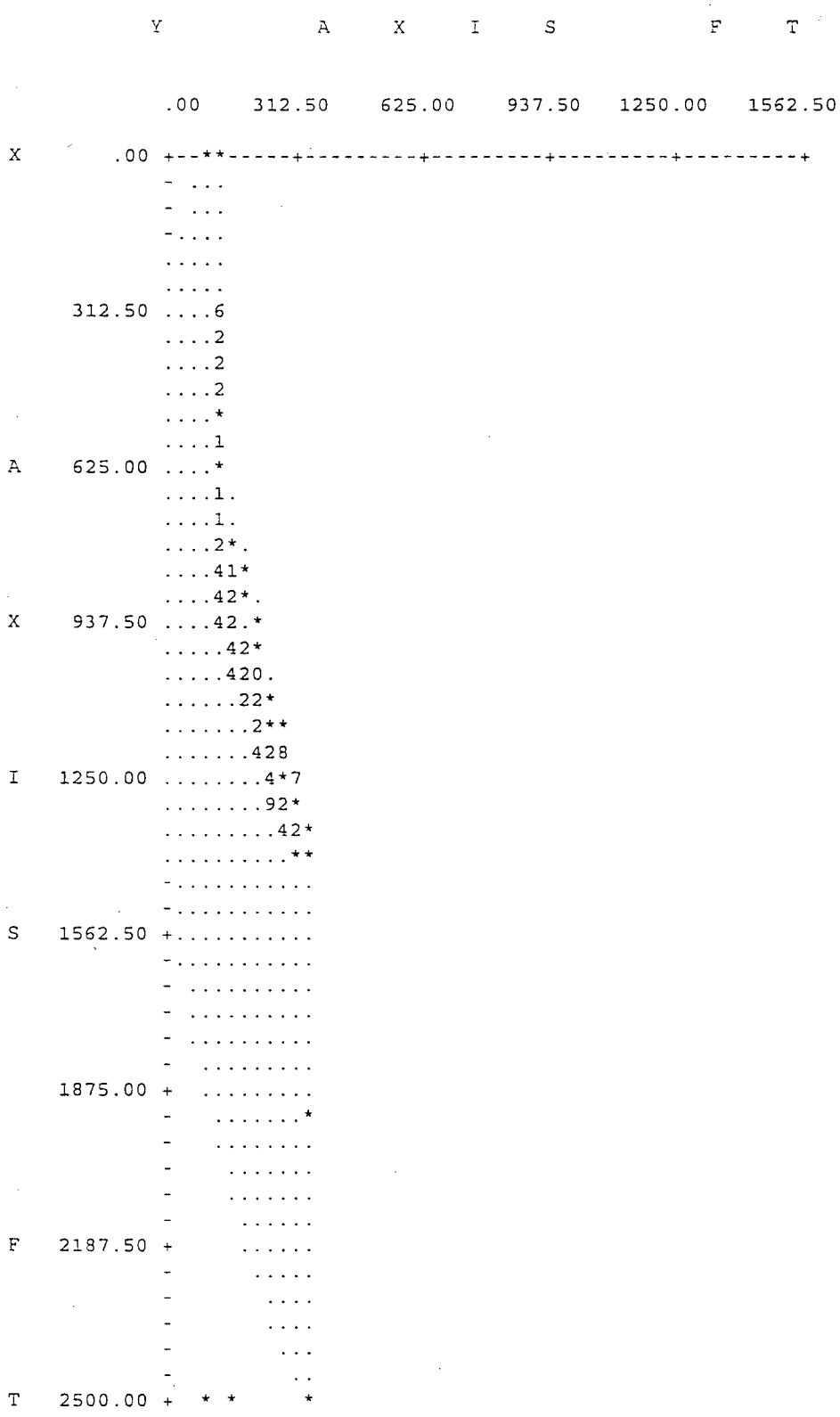
*** 1.726 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	384.62	122.77
2	424.41	118.71
3	464.30	115.79
4	504.26	114.02
5	544.26	113.39
6	584.26	113.91
7	624.22	115.57
8	664.12	118.38
9	703.93	122.33
10	743.60	127.41
11	783.11	133.63
12	822.43	140.99
13	861.53	149.46
14	900.36	159.05
15	938.90	169.75
16	977.12	181.55
17	1014.99	194.44
18	1052.47	208.41
19	1089.54	223.44
20	1126.16	239.53
21	1162.30	256.67
22	1197.94	274.83
23	1225.60	289.94

*** 1.731 ***

1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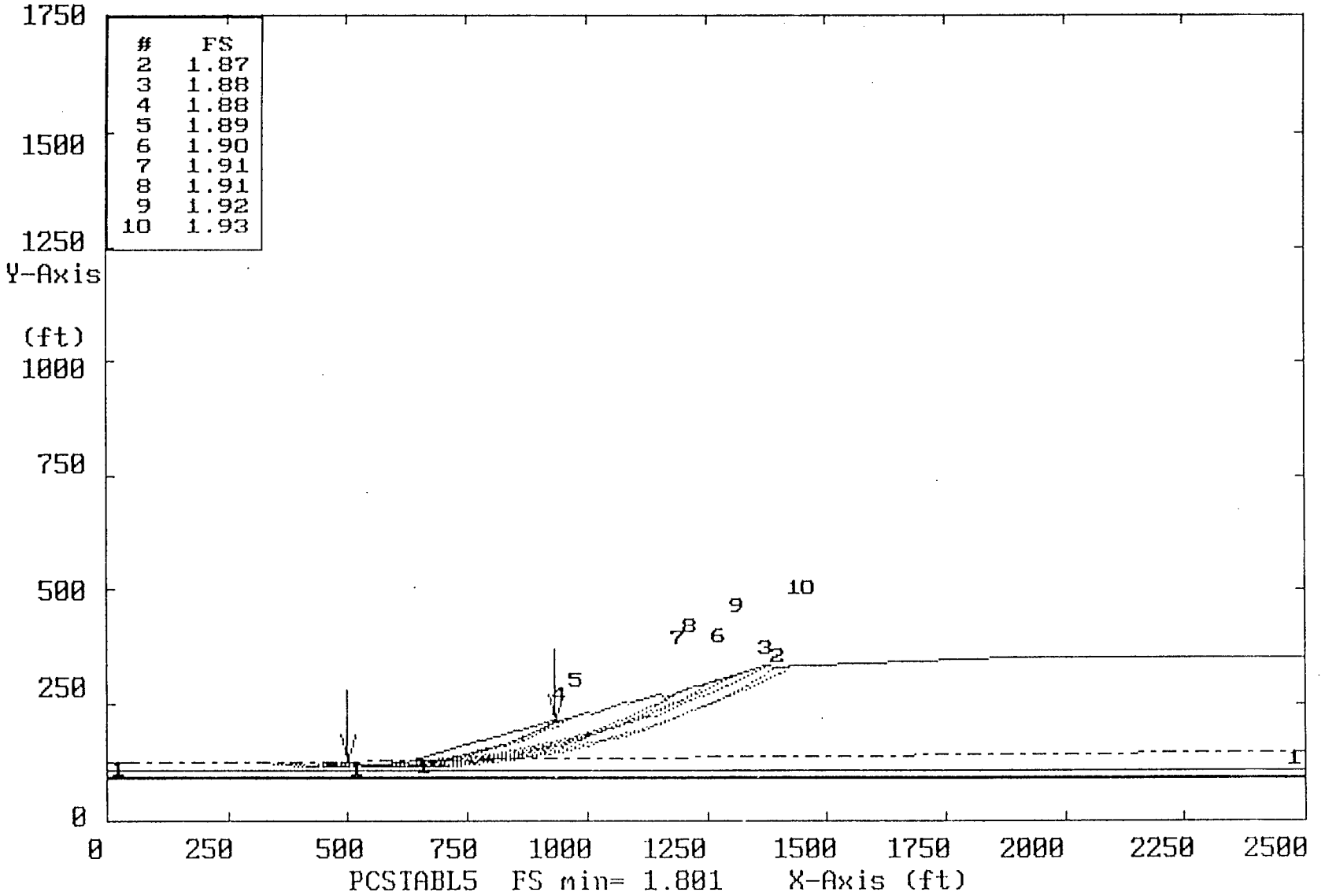
X .00
312.50
A 625.00
X 937.50
I 1250.00
S 1562.50
1875.00
F 2187.50
T 2500.00

Trail Ridge Landfill Vertical Expansion Landfill Material Phi (Degrees) = 25

Ten Most Critical. C:TRLF1.PLT By: S. Laroia 09-17-96 1:53 pm



** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 09-17-96
Time of Run: 1:53 pm
Run By: S. Laroia
Input Data Filename: C:TRLF1.IN
Output Filename: C:TRLF1.OUT
Plotted Output Filename: C:TRLF1.PLT

PROBLEM DESCRIPTION Trail Rodge Landfill Vertical Expansion
Landfill Material Phi (Degrees) = 25

BOUNDARY COORDINATES

23 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	122.00	500.00	123.00	2
2	500.00	123.00	640.00	125.00	2
3	640.00	125.00	780.00	171.80	1
4	780.00	171.80	787.50	169.30	1
5	787.50	169.30	855.00	191.80	1
6	855.00	191.80	862.50	189.30	1
7	862.50	189.30	930.00	211.80	1
8	930.00	211.80	937.50	209.30	1
9	937.50	209.30	1005.00	231.80	1
10	1005.00	231.80	1012.50	229.30	1
11	1012.50	229.30	1080.00	251.80	1
12	1080.00	251.80	1087.50	249.30	1
13	1087.50	249.30	1155.00	271.80	1
14	1155.00	271.80	1162.50	263.30	1
15	1162.50	263.30	1230.00	291.80	1
16	1230.00	291.80	1237.50	289.30	1
17	1237.50	289.30	1305.00	311.80	1
18	1305.00	311.80	1312.50	309.30	1
19	1312.50	309.30	1374.60	330.00	1
20	1374.60	330.00	1384.60	330.00	1
21	1384.60	330.00	1393.60	327.00	1
22	1393.60	327.00	1921.10	349.30	1
23	1921.10	349.30	2500.00	349.30	1
24	640.00	125.00	2500.00	143.00	2

25	.00	102.50	2500.00	102.50	3
26	.00	93.00	2500.00	93.00	4
27	.00	87.00	2500.00	87.00	5

1

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	70.0	70.0	.0	25.0	.00	.0	1
2	110.0	115.0	.0	30.0	.00	.0	1
3	112.0	120.0	1000.0	28.0	.00	.0	1
4	105.0	112.0	.0	29.0	.00	.0	1
5	115.0	120.0	.0	34.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	122.00
2	500.00	123.00
3	640.00	125.00
4	2500.00	145.00

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

4000 Trial Surfaces Have Been Generated.

100 Surfaces Initiate From Each Of 40 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 500.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X =2500.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

40.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	500.00	123.00
2	539.89	119.97
3	579.88	119.09
4	619.86	120.38
5	659.71	123.82
6	699.32	129.40
7	738.56	137.12
8	777.34	146.94
9	815.53	158.84
10	853.02	172.78
11	889.71	188.72
12	925.48	206.52
13	932.88	210.84

*** 1.801 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	487.18	122.97
2	526.97	118.86
3	566.86	115.88
4	606.81	114.03
5	646.81	113.33
6	686.81	113.75
7	726.78	115.32
8	766.68	118.02
9	806.50	121.85
10	846.19	126.81
11	885.72	132.90
12	925.07	140.11

13	964.19	148.44
14	1003.06	157.87
15	1041.65	168.41
16	1079.92	180.04
17	1117.85	192.75
18	1155.40	206.54
19	1192.54	221.38
20	1229.25	237.28
21	1265.49	254.21
22	1301.23	272.17
23	1336.45	291.13
24	1371.12	311.09
25	1397.27	327.16

*** 1.869 ***

1

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	358.97	122.72
2	398.82	119.21
3	438.74	116.62
4	478.70	114.94
5	518.69	114.18
6	558.69	114.33
7	598.68	115.40
8	638.63	117.39
9	678.53	120.29
10	718.34	124.10
11	758.06	128.82
12	797.67	134.45
13	837.13	140.98
14	876.43	148.42
15	915.55	156.75
16	954.47	165.98
17	993.17	176.09
18	1031.63	187.09
19	1069.83	198.97
20	1107.74	211.72
21	1145.36	225.33
22	1182.65	239.80
23	1219.60	255.12
24	1256.19	271.28
25	1292.40	288.27
26	1328.21	306.09
27	1363.60	324.73
28	1370.81	328.74

*** 1.882 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	474.36	122.95
2	514.19	119.25
3	554.15	117.56
4	594.15	117.88
5	634.08	120.20
6	673.85	124.52
7	713.35	130.83
8	752.48	139.11
9	791.15	149.35
10	829.26	161.52
11	866.70	175.58
12	903.40	191.50
13	939.25	209.24
14	942.09	210.83

*** 1.882 ***

1

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	474.36	122.95
2	514.17	119.06
3	554.12	117.12
4	594.12	117.13
5	634.08	119.09
6	673.88	122.99
7	713.46	128.83
8	752.70	136.59
9	791.51	146.25
10	829.81	157.79
11	867.50	171.19
12	904.50	186.40
13	940.70	203.40
14	976.04	222.15
15	976.04	222.15

*** 1.885 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	423.08	122.85
2	462.85	118.59
3	502.73	115.51
4	542.69	113.61
5	582.68	112.91
6	622.68	113.39
7	662.64	115.06
8	702.54	117.92
9	742.34	121.95
10	781.99	127.17
11	821.48	133.57
12	860.76	141.13
13	899.80	149.85
14	938.56	159.74
15	977.01	170.76
16	1015.11	182.93
17	1052.84	196.22
18	1090.16	210.62
19	1127.03	226.13
20	1163.42	242.72
21	1199.31	260.39
22	1234.66	279.11
23	1269.43	298.88
24	1273.31	301.24

*** 1.904 ***

1

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	448.72	122.90
2	488.47	118.45
3	528.35	115.37
4	568.32	113.66
5	608.31	113.33
6	648.30	114.37
7	688.23	116.79
8	728.05	120.57
9	767.71	125.72
10	807.18	132.23
11	846.40	140.10
12	885.33	149.30
13	923.91	159.84
14	962.12	171.70
15	999.89	184.86
16	1037.19	199.31
17	1073.96	215.04
18	1110.18	232.02
19	1145.79	250.24
20	1180.76	269.66
21	1188.26	274.18

*** 1.906 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	474.36	122.95
2	514.05	117.94
3	553.89	114.42
4	593.84	112.39
5	633.83	111.84
6	673.82	112.78
7	713.75	115.22
8	753.56	119.13
9	793.19	124.53
10	832.60	131.40
11	871.72	139.74
12	910.50	149.52
13	948.90	160.75
14	986.84	173.39
15	1024.30	187.44
16	1061.20	202.88
17	1097.50	219.68
18	1133.15	237.82
19	1168.10	257.28
20	1202.30	278.02
21	1211.10	283.82

*** 1.910 ***

1

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	333.33	122.67
2	373.16	118.99
3	413.07	116.23
4	453.03	114.40
5	493.02	113.51
6	533.02	113.54
7	573.01	114.50
8	612.96	116.39
9	652.86	119.21
10	692.69	122.96
11	732.41	127.63
12	772.02	133.22
13	811.49	139.74
14	850.79	147.16
15	889.91	155.50
16	928.83	164.75

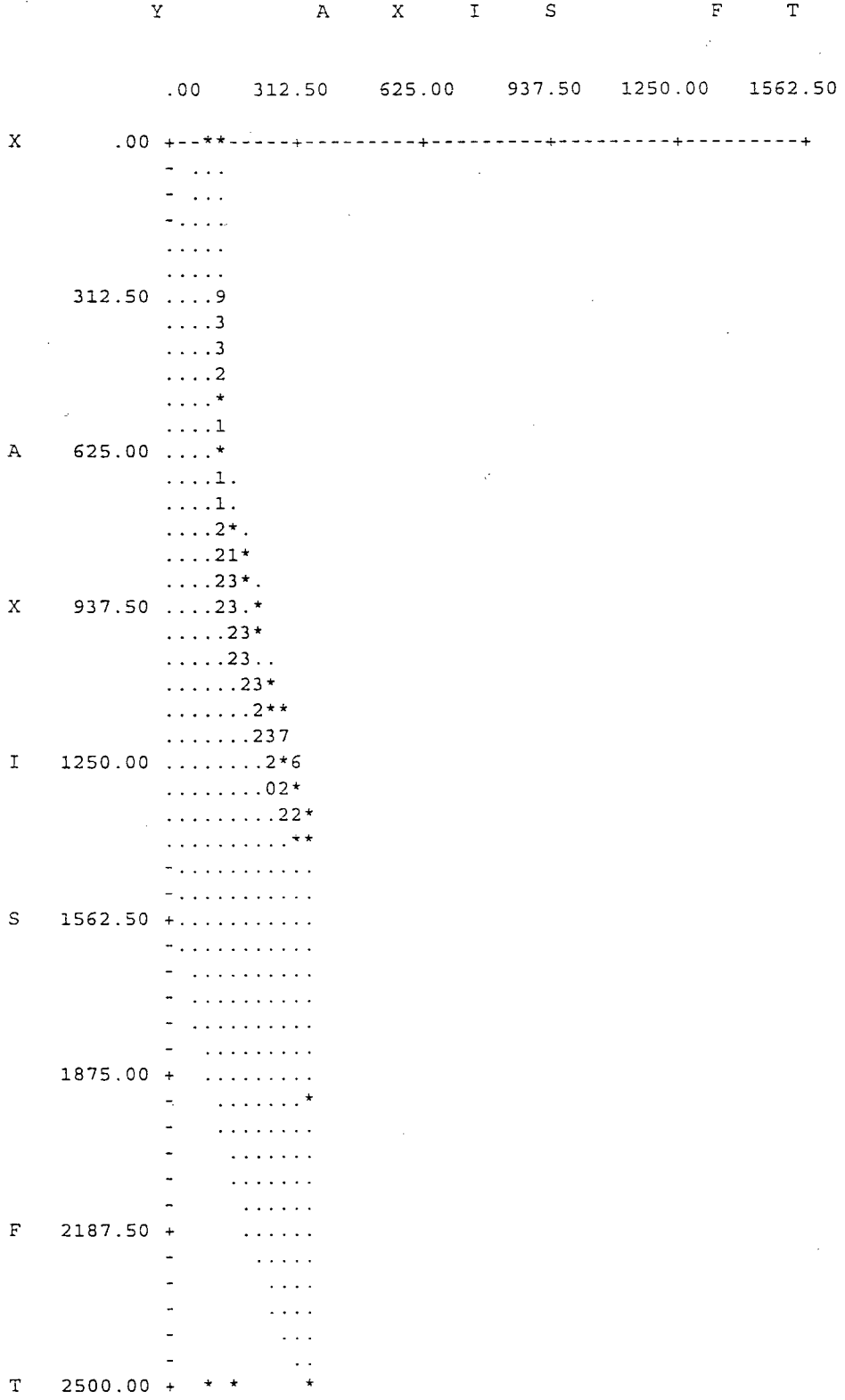
17	967.52	174.90
18	1005.96	185.94
19	1044.14	197.88
20	1082.03	210.70
21	1119.61	224.40
22	1156.87	238.97
23	1193.77	254.39
24	1230.31	270.68
25	1266.45	287.81
26	1302.19	305.77
27	1310.24	310.05

*** 1.922 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	358.97	122.72
2	398.77	118.64
3	438.64	115.44
4	478.57	113.12
5	518.54	111.67
6	558.54	111.09
7	598.54	111.40
8	638.52	112.57
9	678.47	114.63
10	718.36	117.56
11	758.18	121.36
12	797.91	126.03
13	837.52	131.58
14	877.00	137.99
15	916.34	145.26
16	955.50	153.39
17	994.48	162.38
18	1033.25	172.22
19	1071.79	182.91
20	1110.10	194.44
21	1148.14	206.81
22	1185.90	220.00
23	1223.36	234.02
24	1260.51	248.86
25	1297.32	264.51
26	1333.78	280.96
27	1369.87	298.21
28	1405.57	316.24
29	1428.53	328.48

*** 1.929 ***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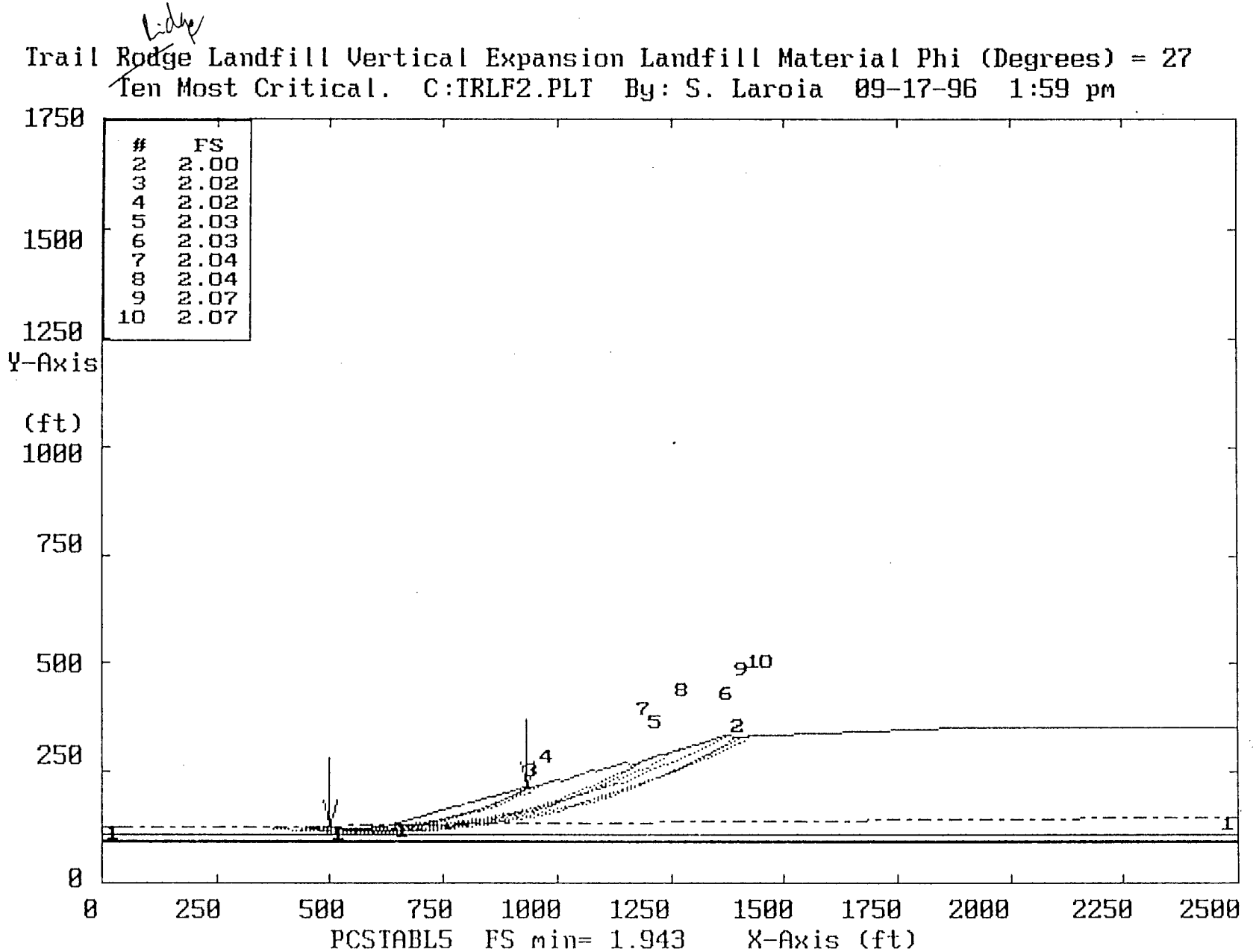
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Ten Most Critical. C:TRLF2.PLT By: S. Laroia 09-17-96 1:59 pm
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4 2.02
5 2.03
6 2.03
7 2.04
8 2.04
9 2.07
10 2.07
Y-Axis
(ft)
1750
1500
1250
1000
750
500
250
0
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
PCSTABL5 FS min= 1.943 X-Axis (ft)

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:	09-17-96
Time of Run:	1:59 pm
Run By:	S. Laroia
Input Data Filename:	C:TRLF2.IN
Output Filename:	C:TRLF2.OUT
Plotted Output Filename:	C:TRLF2.PLT

PROBLEM DESCRIPTION Trail Rodge Landfill Vertical Expansion
Landfill Material Phi (Degrees) = 27

BOUNDARY COORDINATES

23 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	122.00	500.00	123.00	2
2	500.00	123.00	640.00	125.00	2
3	640.00	125.00	780.00	171.80	1
4	780.00	171.80	787.50	169.30	1
5	787.50	169.30	855.00	191.80	1
6	855.00	191.80	862.50	189.30	1
7	862.50	189.30	930.00	211.80	1
8	930.00	211.80	937.50	209.30	1
9	937.50	209.30	1005.00	231.80	1
10	1005.00	231.80	1012.50	229.30	1
11	1012.50	229.30	1080.00	251.80	1
12	1080.00	251.80	1087.50	249.30	1
13	1087.50	249.30	1155.00	271.80	1
14	1155.00	271.80	1162.50	263.30	1
15	1162.50	263.30	1230.00	291.80	1
16	1230.00	291.80	1237.50	289.30	1
17	1237.50	289.30	1305.00	311.80	1
18	1305.00	311.80	1312.50	309.30	1
19	1312.50	309.30	1374.60	330.00	1
20	1374.60	330.00	1384.60	330.00	1
21	1384.60	330.00	1393.60	327.00	1
22	1393.60	327.00	1921.10	349.30	1
23	1921.10	349.30	2500.00	349.30	1
24	640.00	125.00	2500.00	143.00	2

25	.00	102.50	2500.00	102.50	3
26	.00	93.00	2500.00	93.00	4
27	.00	87.00	2500.00	87.00	5

1

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	70.0	70.0	.0	27.0	.00	.0	1
2	110.0	115.0	.0	30.0	.00	.0	1
3	112.0	120.0	1000.0	28.0	.00	.0	1
4	105.0	112.0	.0	29.0	.00	.0	1
5	115.0	120.0	.0	34.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	122.00
2	500.00	123.00
3	640.00	125.00
4	2500.00	145.00

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

4000 Trial Surfaces Have Been Generated.

100 Surfaces Initiate From Each Of 40 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 500.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X =2500.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

40.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	500.00	123.00
2	539.89	119.97
3	579.88	119.09
4	619.86	120.38
5	659.71	123.82
6	699.32	129.40
7	738.56	137.12
8	777.34	146.94
9	815.53	158.84
10	853.02	172.78
11	889.71	188.72
12	925.48	206.62
13	932.88	210.84

*** 1.943 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	487.18	122.97
2	526.97	118.86
3	566.86	115.88
4	606.81	114.03
5	646.81	113.33
6	686.81	113.75
7	726.78	115.32
8	766.68	118.02
9	806.50	121.85
10	846.19	126.81
11	885.72	132.90
12	925.07	140.11

13	964.19	148.44
14	1003.06	157.87
15	1041.65	168.41
16	1079.92	180.04
17	1117.85	192.75
18	1155.40	206.54
19	1192.54	221.38
20	1229.25	237.28
21	1265.49	254.21
22	1301.23	272.17
23	1336.45	291.13
24	1371.12	311.09
25	1397.27	327.16

*** 1.996 ***

1

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	474.36	122.95
2	514.19	119.25
3	554.15	117.56
4	594.15	117.88
5	634.08	120.20
6	673.85	124.52
7	713.35	130.83
8	752.48	139.11
9	791.15	149.35
10	829.26	161.52
11	866.70	175.58
12	903.40	191.50
13	939.25	209.24
14	942.09	210.83

*** 2.021 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	474.36	122.95
2	514.17	119.06
3	554.12	117.12
4	594.12	117.13
5	634.08	119.09
6	673.88	122.99
7	713.46	128.83
8	752.70	136.59

9	791.51	146.25
10	829.81	157.79
11	867.50	171.19
12	904.50	186.40
13	940.70	203.40
14	976.04	222.15
15	976.04	222.15

*** 2.022 ***

1

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	474.36	122.95
2	514.05	117.94
3	553.89	114.42
4	593.84	112.39
5	633.83	111.84
6	673.82	112.78
7	713.75	115.22
8	753.56	119.13
9	793.19	124.53
10	832.60	131.40
11	871.72	139.74
12	910.50	149.52
13	948.90	160.75
14	986.84	173.39
15	1024.30	187.44
16	1061.20	202.88
17	1097.50	219.68
18	1133.15	237.82
19	1168.10	257.28
20	1202.30	278.02
21	1211.10	283.82

*** 2.029 ***

Failure Surface Specified By 28 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	358.97	122.72
2	398.82	119.21
3	438.74	116.62
4	478.70	114.94
5	518.69	114.18
6	558.69	114.33
7	598.68	115.40

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	423.08	122.85
2	462.85	118.59
3	502.73	115.51
4	542.69	113.61
5	582.68	112.91
6	622.68	113.39
7	662.64	115.06
8	702.54	117.92
9	742.34	121.95
10	781.99	127.17
11	821.48	133.57
12	860.76	141.13
13	899.80	149.85
14	938.56	159.74
15	977.01	170.76
16	1015.11	182.93
17	1052.84	196.22
18	1090.16	210.62
19	1127.03	226.13
20	1163.42	242.72
21	1199.31	260.39
22	1234.66	279.11
23	1269.43	298.88
24	1273.31	301.24

*** 2.037 ***

1

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	358.97	122.72
2	398.71	118.10
3	438.54	114.42
4	478.44	111.69
5	518.40	109.90
6	558.40	109.07
7	598.40	109.18
8	638.38	110.24
9	678.33	112.25
10	718.22	115.21
11	758.03	119.11
12	797.74	123.96
13	837.32	129.75
14	876.75	136.47
15	916.01	144.13
16	955.07	152.71

17	993.93	162.22
18	1032.54	172.65
19	1070.90	183.99
20	1108.98	196.24
21	1146.76	209.39
22	1184.21	223.43
23	1221.32	238.36
24	1258.07	254.16
25	1294.43	270.83
26	1330.39	288.35
27	1365.92	306.73
28	1401.00	325.94
29	1403.56	327.42

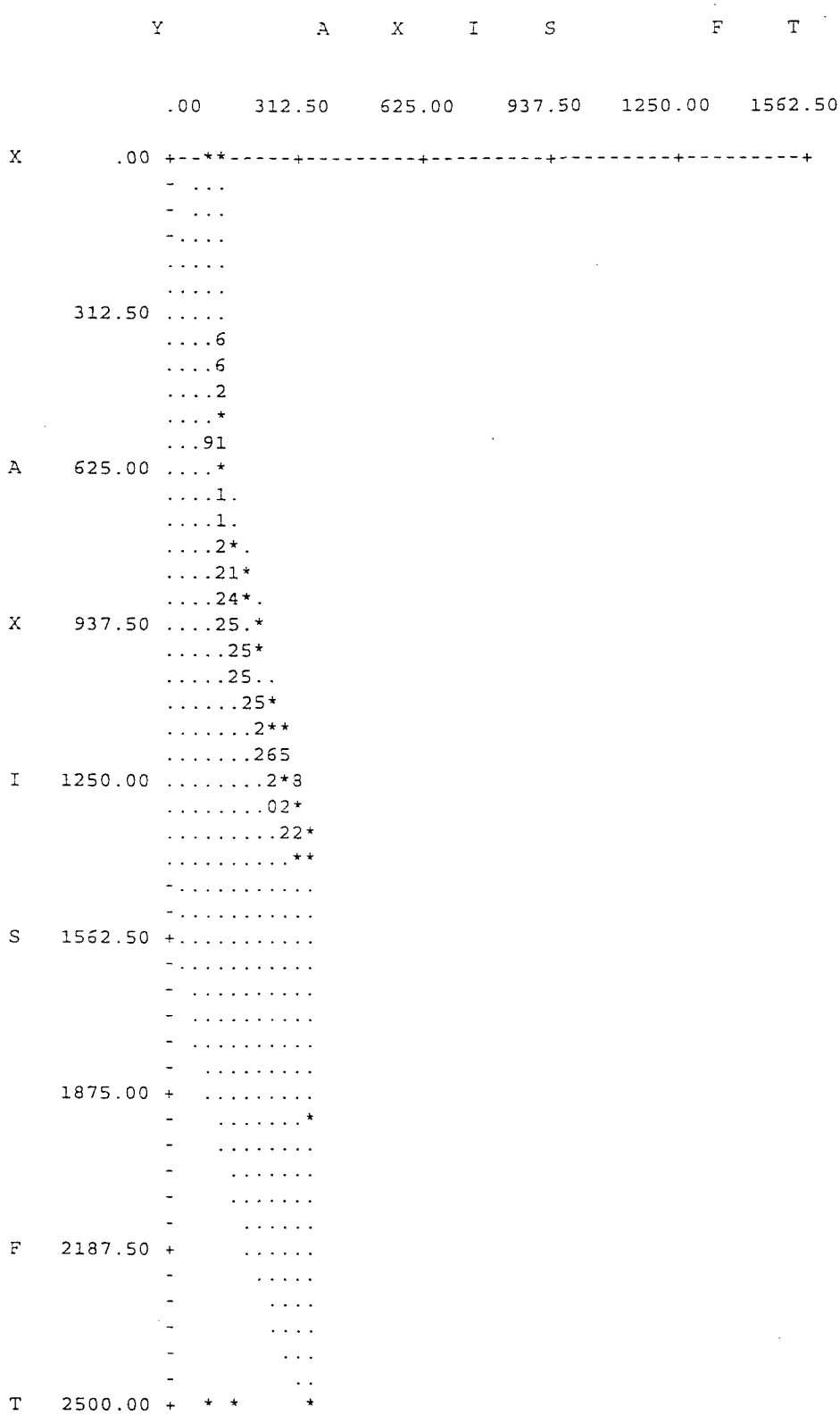
*** 2.068 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	358.97	122.72
2	398.77	118.64
3	438.64	115.44
4	478.57	113.12
5	518.54	111.67
6	558.54	111.09
7	598.54	111.40
8	638.52	112.57
9	678.47	114.63
10	718.36	117.56
11	758.18	121.36
12	797.91	126.03
13	837.52	131.58
14	877.00	137.99
15	916.34	145.26
16	955.50	153.39
17	994.48	162.38
18	1033.25	172.22
19	1071.79	182.91
20	1110.10	194.44
21	1148.14	206.81
22	1185.90	220.00
23	1223.36	234.02
24	1260.51	248.86
25	1297.32	264.51
26	1333.78	280.96
27	1369.87	298.21
28	1405.57	316.24
29	1428.53	328.48

*** 2.069 ***

1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ATTACHMENT J

FAX TRANSMISSION

NATIONAL SEAL COMPANY TECHNICAL CENTER
1264 IL ROUTE 41 SOUTH
GALESBURG, ILLINOIS 61401
309-342-1930
FAX: 309-342-2824

To: Fred Staab **Date:** January 24, 1997

Fax #: NSC - Aurora **Pages:** 2, including this cover sheet.

From: John Siebken

Subject: Converting Transmissivity to Hydraulic Conductivity

COMMENTS:

Fred,

The following example illustrates the conversion of transmissivity (Θ) to hydraulic conductivity (k). The conversion is based on Darcy's formula with all of its assumptions in place. The relationship between Θ and k is shown in the equation below:

$$kt = \Theta = \frac{q}{iW}$$

where q = the volumetric flow rate,
k = the coefficient of permeability (hydraulic conductivity),
i = the hydraulic gradient,
Θ = the transmissivity,
W = the width, and
t = the thickness.

Transmissivity Conversion (cont.)

So, in converting the transmissivity of our drainage products to a hydraulic conductivity, one must divide the transmissivity value by the thickness. For example, in the transmissivity testing for the Trail Ridge Landfill in 1994 one of the values for TexNet with Typar 3601 was 2.264×10^{-3} m^2/sec at a normal stress of 15,000 psf and a hydraulic gradient of 0.01. The conversion is as follows using a thickness of 0.2117 inches (0.5377 cm, or 0.005377 m).

$$\frac{2.264\times10^{-3}m^2/\text{sec}}{0.005377m}=0.4211m/\text{sec}$$

$$0.4211m/\text{sec}\times\frac{100cm}{1m}=42.11cm/\text{sec}$$

I hope that this helps. Please call if you wish to discuss this further.

John

ATTACHMENT K

TRAIL RIDGE LANDFILL
SIDE SLOPE CLOSURE
ALTERNATE CLOSURE DESIGN DEMONSTRATION

This analysis is based upon "Municipal Solid Waste Alternate Design Closure Guidance" Document dated February 10, 1995, prepared by the Department of Environmental Protection, Solid Waste Section.

A. FINAL CLOSURE - MINIMUM DESIGN

1. DETERMINE IMPINGEMENT RATE

Use the HELP Model, Version 3 and the following:

a. Default Rainfall and Temperature Data for Jacksonville
b. Maximum Leaf Area Index of 2.0 - Fair Gross
c. Evaporative Zone Depth at 22 Inches
d. Growing Season - 365 Days.

From the HELP Model Results - Average Annual
Precipitation - 46.43 IN
Runoff - 0.179 IN
Evapotranspiration - 36.93 IN

Thus:

IMPINGEMENT RATE (e) = Precipitation - Runoff - Evapotranspiration
= 46.34 IN - 0.179 IN - 36.93 IN/YR
= 9.23 IN/YR
= 0.025 IN/DAY = 7.44×10^{-9} m/sec

2. DETERMINE MAXIMUM HEAD OVER LINER - T_{MAX}

Moore's Equation:

$$T_{MAX} = C \times L[(4(e/k)+(\tan B)^2)^{1/2} - \tan B] / 2\cos B$$

Where:

L	=	Length of horizontal projection of the leachate collection layer from top to collector, m
e	=	Impingement rate, m/sec
k	=	Saturated hydraulic conductivity of the drainage layer, m/sec
tanB	=	Slope to collection pipe, dimensionless
C	=	Constant, 39.37 in/m

Therefore:

L = 110 FT = 33.52 m
e = 7.44×10^{-9} m/sec
k = 1×10^{-3} cm/sec = 1×10^{-5} m/sec
tanB = 0.04

Thus:

T_{MAX} = $39.37 \times 33.52[(4(7.44 \times 10^{-9}/1 \times 10^{-5})+(0.04)^2)^{1/2} - 0.04] / 2 \times 0.999$
T_{MAX} = 18.25 IN = 0.46 m

3. DETERMINE LEAKAGE RATE - Q

$Q = 0.6 \times C \times a^{0.1} \times h^{0.9} \times k^{0.74}$

Where:

Q = Leakage rate, gal/acre/day
a = Area of hole for leakage, 0.0001 m^2
h = Head of liquid over hole, m
k = Hydraulic conductivity of soil under liner, m/sec
C = Constant, 2.282×10^7 gal-sec/day/m^3

Therefore:

h = T_{MAX} = 2.32 m
k = 1×10^{-4} cm/sec = 1×10^{-6} m/sec

Thus:

Q = $0.6 \times 2.282 \times 10^7 \times (0.0001)^{0.1} \times (0.46)^{0.9} \times (1 \times 10^{-6})^{0.74}$
Q = 99.1 gal/acre/day

B. FINAL CLOSURE - ALTERNATE DESIGN

1. DETERMINE IMPINGEMENT RATE

e = 7.44×10^{-9} m/sec (Same as minimum design, See Page 1)

2. DETERMINE MAXIMUM HEAD OVER LINER - T_{MAX}

Moore's Equation:

$$T_{MAX} = C \times L[(4(e/k)+(\tan B)^2)^{1/2} - \tan B] / 2\cos B$$

Where:

L = 67.5 FT = 20.57 m
k = 1×10^{-5} m/sec
tanB = 0.333
cosB = 0.9487

Thus:

$T_{MAX} = 39.37 \times 20.57[(4(7.44 \times 10^{-9}/1 \times 10^{-5})+(0.333)^2)^{1/2} - 0.333] / 2 \times 0.9487$

T_{MAX} = 1.88 IN = 0.157 FT

3. DETERMINE LEAKAGE RATE - Q

Using Darcy's Law:

$$Q = C \times k\,(h+H)/H$$

Where:

h = Head of liquid above soil liner, ft
H = Thickness of soil liner, ft
k = Hydraulic conductivity of soil liner, cm/sec
C = Constant, 9.239×10^8 gal-sec/cm/acre/day

Therefore:

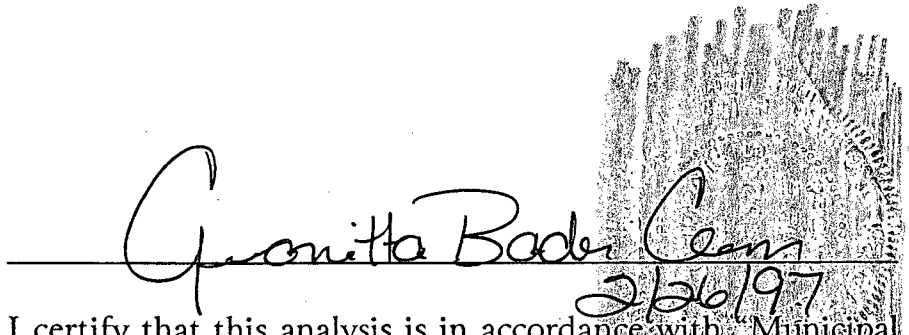
h = T_{MAX} = 0.157 FT
H = 1 FT
k = 6.67×10^{-8} cm/sec

Thus:

$Q = 9.239 \times 10^8 \times 6.67 \times 10^{-8} \times (0.157+1)/1$

Q = 71.3 gal/acre/day

Since the leakage rate for alternate design (71.3 gal/acre/day) is less than the leakage rate for the minimum design (99.1 gal/acre/day), the alternate design is acceptable based on "Municipal Solid Waste Alternate Design Closure Guidance" Document dated February 10, 1995 prepared by the Department of Environmental Protection, Solid Waste Section.



I certify that this analysis is in accordance with "Municipal Solid Waste Alternate Design Closure Guidance" Document dated February 10, 1995 as prepared by the Department of Environmental Protection, Solid Waste Section.

GRAPHIC SCALE

50 0 25 50 100

(IN FEET)
1 INCH = 100 FT.

LEGEND

124.0 — EXISTING SPOT ELEVATION
150 — EXISTING CONTOURS
EXISTING DRAINAGE STRUCTURE

NOTE:
THE MAXIMUM HEIGHT OF THE TIRE PILES WILL BE 10 FEET.

WETLANDS
EXISTING LAKE
EXISTING 12" CONC. HEADER CURB
EXISTING TIRE PILE AREA (10,000 SF)
12" WHITE STRIPE
50' x 130' CONCRETE (8" THICK W/6" x 6" x 10/10 WWM) FOR MOBILE TIRE SHREDDER
EXISTING DIESEL FUEL STORAGE AREA
EXISTING 4" ASPHALT CURB
END HEADER CURB TRANSITION 12" TO 4"
EXISTING CONC. DITCH PAVING
EXISTING 3' BOTTOM WIDTH DITCH WITH 4:1 SIDESLOPES
EXISTING NON - CONTRACT DROP OFF AREA
EXISTING CONC. (8" THICK W/6" x 6" x 10/10)
EXISTING ASPHALT
EXISTING OPERATIONS BUILDING
C.O.E. PERMIT
UPLANDS

ASPHALTIC CONCRETE
0.67" 3/4" R. 1.0' 2.0'

EXISTING 12" CONC. HEADER CURB

0.67' 10.0' 0.67' 0.33' 0.67' 1.0' 2.0'

EXISTING CONCRETE FLUME

3.0' 0.33'

EXISTING 4" MOUNTABLE ASPHALT CURB

1-1/2" S-1 ASPHALTIC CONCRETE SURFACE COURSE
8" COMPACTED LIMEROCK BASE COURSE MIN. LBR 75, 100% MAX. DENSITY AASHTO T-180
12" STABILIZED SUBBASE MIN. LBR 40 COMPACTED TO 98% MAX. DENSITY AASHTO T-180

EXISTING TIRE STORAGE AREA TYPICAL PAVEMENT SECTION

PERMIT DOCUMENT

WASTE TIRE STORAGE AND PROCESSING AREA

TRAIL RIDGE LANDFILL PERMIT RENEWAL FOR TRAIL RIDGE LANDFILL, INC.

SUBMITTED TO DEP: 9-25-02

REVISIONS:
8-22-02 REVISED MAXIMUM HEIGHT.

ETM NO.: 02-025
DRAWN BY: S.J.L.
DESIGNED BY: J.B.C.
CHECKED BY: D.C.M.
DATE: SEPTEMBER 25, 2002

England-Thims & Miller, Inc.
ENGINEERS - PLANNERS - SURVEYORS - LANDSCAPE ARCHITECTS
14775 ST. AUGUSTINE ROAD
JACKSONVILLE, FLORIDA 32258
PHONE NUMBER (904) 642-8990 FAX NUMBER (904) 646-9485

DRAWING NO.
EXHIBIT A

ATTACHMENT L

TRAIL RIDGE LANDFILL
ALTERNATE BARRIER SOIL LAYER
Equivalency Analysis

In accordance with Rule 62-701.600(5)(g)4., F.A.C., the proposed barrier layer must minimize infiltration to a substantially equivalent degree as an 18-inch layer of barrier soil with a permeability of 1×10^{-7} cm/sec.

The travel time allowed by rule with the 18-inch thick layer of barrier soil with a permeability of 1×10^{-5} cm/sec is determined as follows:

$$\text{Time of Travel (t)} = \frac{\text{Thickness (s)}}{\text{Velocity of Travel (k)}}$$

Where:

s = 18 inches = 45.7 cm
k = 1×10^{-7} cm/sec

Thus:

$$t = \frac{45.7 \text{ cm}}{1 \times 10^{-7} \text{ cm/sec}} = 4.57 \times 10^{8} \text{ sec}$$

The proposed equivalent barrier soil layer will be 12 inches thick. Using the same travel time as determined by rule above, the equivalent permeability is determined as follows:

$$\text{Velocity of Travel (k)} = \frac{\text{Thickness (s)}}{\text{Time of Travel (k)}}$$

Where:

s = 12 inches = 30.5 cm
t = 4.57×10^{8} sec

Thus:

$$k = \frac{30.5 \text{ cm}}{4.57 \times 10^{8} \text{ sec}} = 6.67 \times 10^{-8} \text{ cm/sec}$$

Therefore, the permeability of the 12-inch thick barrier soil layer used in the closure of this facility shall have a maximum permeability of 6.67×10^{-8} cm/sec.

ATTACHMENT M

TRAIL RIDGE LANDFILL
PROJECT-SPECIFIC ADDENDA
TO QUALIFY ASSURANCE MANUAL

TRAIL RIDGE LANDFILL
PROJECT-SPECIFIC ADDENDA
TO QUALITY ASSURANCE MANUAL

This plan specifically addresses the quality assurance and quality control (QA/QC) for Trail Ridge Landfill. This program delineates the quality procedures and standards for the construction.

In the context of this plan, quality assurance, quality control and the plan participants are defined as follows:

Quality Assurance - A planned and systematic pattern of all means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

Quality Control - Those actions which provide a means to measure and regulate the characteristics of an item or service to contract and regulatory requirements.

Permittee - Trail Ridge Landfill, Inc.

Owner - The City of Jacksonville

Design Engineer - England, Thims & Miller, Inc.

The QA/QC Program for this project includes General QA/QC, Soils QA/QC, and Synthetic Liner System QA/QC. These QA/QC activities (including monitoring, sampling and testing) shall be directed and conducted by the third parties whom are independent of the Contractor.

The General QA/QC includes full-time services to periodically observe the contractor's work to verify substantial compliance with permits, plans, specifications and design concepts.

General Quality Control Monitor - shall monitor the construction for compliance with the permits, plans, specifications and design including construction to proper lines and grades, maintain daily logs and weekly progress reports of the construction (including observation data sheets, problem identification and correction logs), make note of construction deviations, coordinate qualifying and testing of materials, and monitor filling. This individual shall be experienced in civil site construction and solid waste regulations.

General Quality Assurance Engineer - shall supervise the construction monitoring to verify compliance with permits, plans, specification and design concepts. This individual shall be experienced in civil site construction and solid waste regulations and shall be a registered Professional Engineer.

The General QA/QC Program includes monitoring the following activities:

1. General Earthwork
2. Drainage Installation
3. Leachate Pump System Installation
4. Leachate Forcemain Installation
5. Overall Liner System Installation
6. General Construction Quality Control

The Soils QA/QC for this project includes soil material qualifying, sampling and testing to verify substantial compliance with the material standards.

Soils Quality Control Monitor - shall pre-qualify soil materials, monitor the installation of soil materials, determine where in-place soil materials shall be tested, and test the in-place soil materials. This individual shall be responsible for assuring that all soil materials have been pre-qualified and have a chain-of-custody from the pre-qualified source to the project site, prior to installation. This individual shall be experienced in civil site construction and soil testing standards and procedures.

Soils Quality Assurance Engineer - shall supervise the soil material pre-qualifying and testing of in-place soil materials to assure compliance with the test standards and testing frequency requirements, and verify compliance with the plans, specification and design. This individual shall be experienced in civil site construction and soil testing procedures and shall be a registered Professional Engineer.

The QA/QC Plan shall include monitoring and testing of the following:

A. SUBGRADE

Prior to construction of the liner system including the clay subbase, a subgrade shall be prepared. The subgrade shall be placed and compacted in 12" lifts.

1. Subgrade

a. Location - The Soils Quality Control Monitor shall visually inspect the fill material and test the material in-place.

b. Standard - Soil shall be free of brush, weeds, and other litter; and free of roots 3/8" diameter or greater, stumps, stones 1" diameter or greater and any other extraneous or toxic matter.

The soil shall be cohesionless soil with a fines content of 15% or less.

Compacted to 96%* of Modified Proctor maximum dry density (ASTM D 1557) and a firm unyielding surface. Testing by Drive Cylinder (ASTM D2937), Nuclear (ASTM D2922) or Sand Cone (ASTM D1556) Methods

* If the required densities are achieved at a moisture content exceeding 2% of optimum moisture content, the soil will be proof rolled and visually inspected by the Soils Quality Control Monitor to determine if it is unyielding and not pumping. Clay subbase shall not be placed on a yielding subgrade.

c. Frequency - Density tests shall be conducted at the frequency of four tests per acre of finished subgrade including the same frequency for each 12-inch lift of fill.

B. CLAY SUBBASE

Prior to placement of the synthetic liner system, a clay subbase shall be prepared. The subbase shall be a minimum of 6" in thickness.

1. Clay Subbase

a. Borrow Source - Prior to clay subbase installation, an appropriate borrow source shall be located. Suitability of the subbase construction materials from that source shall be determined in accordance with the following:

(1) If demonstrated field experience is available from at least three prior successful projects of five or more acres each to document that a given borrow source can meet the requirements of the project specifications, then extensive laboratory testing of the borrow source will not be required. However, the source of material shall be geologically similar to and the methods of excavating and stockpiling the material shall be consistent with

those used on the prior projects. Furthermore, a minimum of three representative samples from the appropriate thickness of the in-situ stratum or from stockpiles of the borrow material proposed for subbase construction shall be submitted to the Soils Quality Assurance Engineer to document through index testing that the proposed material is consistent with the material used on prior successful projects. At a minimum, index testing shall consist of percent fines, Atterberg limits and moisture content determinations.

(2) If demonstrated field experience as defined above is not available or cannot be documented, then the following requirements shall be met.

(a) A field exploration and laboratory testing program shall be conducted by the Soils Quality Assurance Engineer to document the horizontal and vertical extent and the homogeneity of the soil strata proposed for use as subbase material. A sufficient number of index tests from each potential borrow stratum shall be performed to quantify the variability of the borrow materials and to document that the proposed borrow material complies with specifications. At a minimum, the index tests shall consist of percent fines (ASTM D1140), Atterberg limits (ASTM D4318) and moisture content (ASTM D2216) determinations.

(b) Sufficient laboratory hydraulic conductivity tests shall be conducted on samples representative of the range invariability of the proposed borrow source (ASTM D5084). At a minimum, the tests shall be taken once per 20,000 cubic yards of soil. For each such sample, test specimens shall be prepared and tested to cover the range of molding conditions (moisture content and dry density) required by project specifications. The hydraulic conductivity tests shall be conducted in triaxial type permeameters. The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow

increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured (ASTM D5084). The borrow source will only be considered suitable if the hydraulic conductivity of the material, as documented on laboratory test specimens, can be shown to meet the requirements of the project specifications at the 98 percent confidence level.

(3) The Soils Quality Assurance Engineer shall review the pre-qualification data and shall approve or reject the material for use.

b. Test Strip - Prior to full-scale clay subbase installation, a field test section or test strip shall be constructed at the site above a prepared subgrade. The test strip shall be considered acceptable if the measured hydraulic conductivities of undisturbed samples from the test strip meet the requirements of the project specifications at the 98 percent confidence level. If the test section fails to achieve the desired results, additional test sections shall be constructed in accordance with the following requirements:

(1) The test section shall be of sufficient size (40' wide x 60' long at a minimum) such that full-scale clay subbase installation procedures can be duplicated within the test section;

(2) The test section shall be constructed using the same equipment for spreading, kneading and compaction and the same construction procedures (e.g., number of passes, moisture addition and homogenization, if needed) that are anticipated for use during full-scale clay subbase installation;

(3) At a minimum, the clay subbase test section shall be subject to the following field and laboratory testing requirements by the Soils Quality Control Monitor:

(a) A minimum of five random samples of the clay subbase construction material delivered to the site during test section installation shall be tested for moisture content (ASTM D2216), percent fines (ASTM D1140) and Atterberg limits (ASTM D4318);

(b) At least five field density and moisture determinations shall be performed on the compacted clay subbase test section;

(c) Upon completion of the test section, the thickness of the section shall be measured at a minimum of five random locations to check for thickness adequacy; and

(d) A minimum of five Shelby tube or drive cylinder (ASTM D2937) samples shall be obtained from each test section for laboratory hydraulic conductivity testing. Laboratory hydraulic conductivity testing shall be conducted in triaxial type permeameters (ASTM D5084). The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured (ASTM D5084).

(e) The test strip shall meet or exceed the standards established below except the field density which shall be established by the Soils Quality Assurance Engineer based upon the test strip results. If the test strip fails to meet these standards, the construction methods and/or material will be rejected and the test strip shall be performed again.

c. Clay Subbase Installation - Full scale clay subbase installation may begin only after completion of a successful test section. During clay subbase construction, quality control testing shall be provided to document that the installed clay subbase conforms to project specifications. The testing frequency for quality control testing are specified below. <u>However, during construction of the first five acres of the clay subbase, the frequencies shall be doubled.</u> The clay subbase shall be installed in one 6" lift.

(1) Location - The clay subbase shall be tested in-place at random locations. These locations of tests shall be determined by the Soils Quality Control Monitor. If there are indications of a change in product quality or construction procedures during clay subbase construction, additional tests shall be performed to determine compliance.

(2) Standard

(a) Subgrade - Compacted to 96% of Modified Proctor maximum dry density (ASTM D1557) (See Subgrade).

(b) Field Density - The field density shall be established by the Soils Quality Assurance Engineer based upon the test strip results and shall be determined by Standard Proctor Density (ASTM D698). In no case shall the field density be less than 80% of Standard Proctor Density (ASTM D698).

(c) Thickness - The clay subbase shall have a minimum in-place thickness of 6"

(d) Hydraulic Conductivity - The compacted clay subbase shall have an in-place hydraulic conductivity no greater than 1.0×10^{-5} cm/sec (ASTM D5084).

(3) Field Testing Frequency

(a) Prior to the laying of the clay subbase materials, the subgrade shall be compacted to the specified density. Density tests shall be conducted at a minimum rate of four tests per acre of finished subgrade.

(b) A minimum of two moisture content and field density determinations shall be conducted per acre of compacted clay subbase. The degree of compaction shall be checked using the one-point field Proctor test or other appropriate test procedures; and

(c) A minimum of four thickness measures shall be conducted per acre of the compacted clay subbase.

(4) Laboratory Testing Frequency

(a) Percent fines (ASTM D1140) of the subbase construction material shall be determined at a minimum frequency of two tests per acre of installed clay subbase;

(b) Atterberg limits determinations shall be performed on one sample per acre of installed clay subbase; and

(c) Hydraulic conductivity testing of Shelby tube or drive cylinder (ASTM D-2937) samples of the compacted clay subbase shall be performed at a minimum frequency of one test per acre. Laboratory hydraulic conductivity tests shall be conducted in triaxial type permeameters (ASTM D-5084). The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured.

(5) Deficiency - If the test data from a clay subbase section does not meet the requirements of the project specifications, additional random samples shall be tested from that clay subbase section. If such additional testing demonstrates that the thickness and hydraulic conductivity meet the requirements of the project specifications at the 95 percent confidence level, that clay subbase section will be considered acceptable. If not, that clay subbase section shall be reworked or reconstructed so that it does meet these requirements.

C. BENTONITE MAT (Geosynthetic Clay Liner)

A bentonite mat shall be installed as part of the synthetic liner system. In addition to the requirements of the "Quality Assurance Manual For the Installation of Lining Systems", the bentonite mat shall be monitored and tested as follows:

1. Bentonite Mat

a. Location - Upon delivery of the bentonite mat rolls to the site (prior to installation) samples shall be obtained.

b. Standard

(1) Hydraulic Conductivity - The hydraulic conductivity (GRI GCL-2) shall be no greater than 1.0×10^{-9} cm/sec at a confining stress of 30 psi.

(2) Moisture Content - The moisture content (ASTM D4643) shall be no greater than 10 percent.

(3) Mass - The mass per unit area (ASTM D3776) of the sodium bentonite component of the bentonite mat shall be a minimum of 1.0 lb/ft^2 (4900 g/m^2).

c. Frequency - The bentonite mat shall be tested for moisture content, hydraulic conductivity and mass per unit area at least once per 40,000 square feet or once per lot, whichever is more frequent.

D. PROTECTIVE SAND BLANKET

After the synthetic liner system has been installed, it shall be covered with a protective sand blanket. The protective sand blanket shall be a minimum of 24" in thickness.

1. Protective Sand Blanket

a. Location - Material shall be pre-qualified by hydraulic conductivity, particle size, and calcium carbonate content testing at the borrow location.

Truck tickets shall be utilized for chain of custody to site.

Thickness shall be verified by as-built survey.

b. Standard - Sand shall be reasonably free of brush, weeds, and other litter; and relatively free of roots, stumps, stones and any other extraneous or toxic matter. The Soils Quality Control Monitor shall visually inspect the sand during placement.

Hydraulic Conductivity shall be greater than or equal to 1.0×10^{-3} cm/sec at a density of 96 percent Modified Proctor maximum dry density (ASTM D1557). Hydraulic Conductivity testing by Constant Head Method (ASTM D2434).

Thickness shall be no less than 24 inches at each location.

The sand shall be non-calcareous (ASTM D3042).

Compatibility of protective sand cover grain size with geotextile to be determined, prior to initial placement.

c. Frequency - Hydraulic Conductivity testing shall be on-going as necessary to support fill borrow operations with minimum of one test per 500 cubic yards.

Prior to placement, the sand shall be tested for particle size and calcium carbonate content. The test shall be taken at least once per 5,000 cubic yards and for each change in material source.

d. Miscellaneous - The material shall be placed loose and spread on top of the liner system to a minimum depth of 24 inches. No equipment shall come in direct contact with liner. Low ground pressure equipment shall be used for the placement and spreading of the sand cover. Temporary haul roads and access roads over the liner for the delivery of material shall include a minimum of 36 inches of sand cover depth. These temporary facilities shall be removed during the finish grading of the protective sand blanket.

The leading edge of sand placement over the synthetic liner system shall be by vertical placement versus pushing sand horizontally.

E. CLAY ANCHOR BERM

A clay anchor berm shall be constructed in accordance with the Contract Drawings.

1. Clay Anchor Berm

   a. Location - The clay anchor berm shall be sampled in place. Hydraulic conductivity testing shall be conducted in the laboratory.

   b. Standard - Hydraulic conductivity shall be less than 1.0×10^{-7} cm/sec. Hydraulic conductivity testing by Falling Head Method (ASTM D5084).

   c. Frequency - One testing location per 100 linear feet of anchor trench.

F. LEACHATE COLLECTION TRENCH AND SUMP AGGREGATE

Aggregate shall be placed in leachate collection trenches and sumps.

1. Aggregate

   a. Location - The aggregate shall be sampled on site, prior to placement.

   b. Standard - Gradient shall meet AASHTO No. 3 coarse aggregate (ASTM D448). Testing by Sieve Analysis (ASTM C136).

   The aggregate shall be non-calcareous (ASTM D3042).

   c. Frequency - Prior to placement, one gradation test per sump plus one testing location per trench with a minimum of one test per 500 cubic yards of aggregate.

   Prior to placement, the aggregate shall be tested for calcium carbonate content. The test shall be taken once for 2,600 LF of trench or once per change in material source.

TRAIL RIDGE LANDFILL
INCREMENTAL SIDE SLOPE CLOSURE
QUALITY ASSURANCE/QUALITY CONTROL PLAN

TRAIL RIDGE LANDFILL
INCREMENTAL SIDE SLOPE CLOSURE
QUALITY ASSURANCE/QUALITY CONTROL PLAN

This plan addresses the quality assurance and quality control (QA/QC) for the incremental closure (close-as-you-go) of Trail Ridge Landfill. This program delineates the quality procedures and standards for the construction. This plan includes the closure of the side slopes only. The top area will be the final closure for which a closure permit will be obtained, prior to final closure construction.

In the context of this plan, quality assurance and quality control are defined as follows:

Quality Assurance - A planned and systematic pattern of all means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

Quality Control - Those actions which provide a means to measure and regulate the characteristics of an item or service to contract and regulatory requirements.

The City of Jacksonville, Florida is the owner/permittee of Trail Ridge Landfill. Trail Ridge Landfill, Inc. operates the landfill. England, Thims & Miller, Inc. is the design engineer. The name of the Contractor for each incremental closure shall be provided to the Department of Environmental Protection (DEP), prior to construction.

All QA/QC activities (including monitoring, sampling and testing) shall be directed and conducted by third parties, whom are independent of the Contractor.

The QA/QC Plan for this project includes General QA/QC and Soils QA/QC. The General QA/QC includes full-time services to periodically observe the contractor's work to verify substantial compliance with permits, plans, specifications and design concepts. These services will include the following:

General Quality Control Monitor - shall monitor the construction for compliance with the permits, plans, specifications and design including construction to proper lines and grades, maintain daily logs and weekly progress reports of the construction (including observation data sheets, problem identification and correction logs), make note of any construction deviations, coordinate qualifying and testing of materials, monitor any waste excavation, and monitor filling. This individual shall be experienced in civil site construction and solid waste regulations.

General Quality Assurance Engineer - shall supervise the construction monitoring and waste removal to verify compliance with permits, plans, specification and design concepts. This individual shall be experienced in civil site construction and solid waste regulations and shall be a registered Professional Engineer.

The General QA/QC Program includes monitoring the following activities:

1. General Earthwork
2. Storm Drainage Installation
3. General Construction Quality Control

The Soils QA/QC for this project includes soil material qualifying, sampling and testing to verify substantial compliance with the material standards. This work will include the following:

Soils Quality Control Monitor - shall pre-qualify soil materials, monitor the installation of soil materials, determine where in-place soil materials shall be tested, and test the in-place soil materials. This individual shall be responsible for assuring that all soil materials have been pre-qualified and have a chain-of-custody from the pre-qualified source to the project site, prior to installation. This individual shall be experienced in civil site construction and soil testing standards and procedures.

Soils Quality Assurance Engineer - shall supervise the soil material pre-qualifying and testing of in-place soil materials to assure compliance with the test standards and testing frequency requirements, and verify compliance with the plans, specification and design. This individual shall be experienced in civil site construction and soil testing procedures and shall be a registered Professional Engineer.

The QA/QC Plan including monitoring construction of the following:

A. Final Cover (Intermediate Cover, Compacted Clay Layer and Vegetative Cover)

Incremental side slope closure of Trail Ridge Landfill includes a final cover consisting of 12" of intermediate cover, 12" of clay, and 24" of vegetative cover. The clay layer of the final cover must be placed in two 6" (minimum) lifts. The Soils Quality Control Monitor shall observe the clay layer construction on a full-time (on-site) basis. The QA/QC for the final cover is as follows:

1. Intermediate Cover

   a. Location - The fill material shall come from an off-site source. The Soils Quality Control Monitor shall visually inspect the fill material.

   b. Standard - Soil shall be free of brush, weeds, and other litter; and free of roots, stumps, stones and any other extraneous or toxic matter.

      The intermediate cover shall be a minimum of 12" thick.

      Compacted to 90% of Modified Proctor maximum dry density (ASTM D 1557)

   c. Frequency - Depth measurements and density tests shall be conducted at the frequency of four per acre.

2. Clay Layer (referred to as Barrier Layer in Chapter 62-701, F.A.C.)

   a. Borrow Source - Prior to clay layer installation, an appropriate borrow source shall be located. Suitability of the clay layer construction materials from that source shall be determined in accordance with the following:

      (1) If demonstrated field experience is available from at least three prior successful projects of five or more acres each to document that a given borrow source can meet the requirements of the project specifications, then extensive laboratory testing of the borrow source will not be required. However, the source of material shall be geologically similar to and the methods of excavating and stockpiling the material shall be consistent with those used on the prior projects. Furthermore, a minimum of three representative samples from the appropriate thickness of the in-situ stratum or from stockpiles of the borrow material proposed for clay layer construction shall be submitted to the Owners independent soil testing laboratory to document through index testing that the proposed material is consistent with the material used on prior successful projects. At a minimum, index testing shall consist of percent fines, Atterberg limits and moisture content determinations.

(2) If demonstrated field experience as defined above is not available or cannot be documented, then the following requirements shall be met.

(a) A field exploration and laboratory testing program shall be conducted by the Owners independent soil testing laboratory to document the horizontal and vertical extent and the homogeneity of the soil strata proposed for use as clay layer material. A sufficient number of index tests from each potential borrow stratum shall be performed to quantify the variability of the borrow materials and to document that the proposed borrow material complies with specifications. At a minimum, the index tests shall consist of percent fines, Atterberg limits and moisture content determinations.

(b) Sufficient laboratory hydraulic conductivity tests shall be conducted on samples representative of the range invariability of the proposed borrow source (ASTM D-5084). For each such sample, test specimens shall be prepared and tested to cover the range of molding conditions (moisture content and dry density) required by project specifications. The hydraulic conductivity tests shall be conducted in triaxial type permeameters. The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured (ASTM D-5084). The borrow source will only be considered suitable if the hydraulic conductivity of the material, as documented on laboratory test specimens, can be shown to meet the requirements of the project specifications at the 98 percent confidence level.

(3) The Soils Quality Assurance Engineer shall review the pre-qualification data and shall approve or reject the clay layer material for use.

b. Test Strip - Prior to full-scale clay layer installation, a field test section or test strip shall be constructed at the site above a prepared subbase. The test strip shall be considered acceptable if the measured hydraulic conductivities of undisturbed samples from the test strip meet the requirements of the project specifications at the 98 percent confidence level. If the test section fails to achieve the desired results, additional test sections shall be constructed in accordance with the following requirements:

(1) The test section shall be of sufficient size (40' wide x 60' long at a minimum) such that full-scale clay layer installation procedures can be duplicated within the test section;

(2) The test section shall be constructed using the same equipment for spreading, kneading and compaction and the same construction procedures (e.g., number of passes, moisture addition and homogenization, if needed) that are anticipated for use during full-scale clay layer installation;

(3) At a minimum, the clay layer test section shall be subject to the following field and laboratory testing requirements by Soils Quality Control Monitor:

(a) A minimum of five random samples of the clay layer construction material delivered to the site during test section installation shall be tested for moisture content (ASTM D-2216), percent fines (ASTM D-1140) and Atterberg limits (ASTM D-4318);

(b) At least five field density and moisture determinations shall be performed on each lift of the compacted clay layer test section;

(c) Upon completion of the test section lift, the thickness of the lift shall be measured at a minimum of five random locations to check for thickness adequacy; and

(d) A minimum of five Shelby tube or drive cylinder (ASTM D-2937) samples shall be obtained from each lift of the test section for laboratory hydraulic conductivity testing. Laboratory hydraulic conductivity testing shall be conducted in triaxial type permeameters (ASTM D-5084). The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured (ASTM D-5084).

(e) The test strip shall meet or exceed the standards established below except the field density which shall be established by the QA Engineer, based upon the test strip results. If the test strip fails to meet these standards, the construction methods and/or material will be rejected and the test strip shall be performed again.

c. Final Cover Installation - Full scale final cover installation may begin only after completion of a successful test section. During clay layer construction, quality control testing shall be provided to document that the installed clay layer conforms to project specifications. The testing frequency for quality control testing is specified below; however, <u>during construction of the first five acres, the frequencies shall be doubled</u>. The clay layer shall be installed in two 6" lifts for a total minimum thickness of 12".

(1) Location - The clay layer shall be tested in place. The locations of testing shall be random locations as determined by the Soils Quality Control Monitor. If there are indications of a change in product quality or construction procedures during final cover construction, additional tests shall be performed to determine compliance.

(2) Standard

(a) Clay Layer Subgrade - Compacted to 90% of Modified Proctor maximum dry density (ASTM D-1557) (See Intermediate Cover above).

(b) Field Density - The field density shall be established by the QA Engineer based upon the test strip results and shall be determined by Standard Proctor Density (ASTM D-698). In no case shall the field density be less than 80% of Standard Proctor Density (ASTM D-698).

(c) Thickness - Each lift (two total) shall be a minimum of 6" thick.

(d) Hydraulic Conductivity - The compacted clay layer shall have an in-place hydraulic conductivity no greater than 6.67×10^{-8} cm/sec (ASTM D-5084).

(3) Field Testing Frequency

(a) Prior to the laying of the clay layer materials, the clay layer subgrade shall be compacted to the specified density. Density tests shall be conducted at a minimum rate of two tests per acre;

(b) A minimum of two moisture content and field density determinations shall be conducted per acre per lift of the compacted clay layer. The degree of compaction shall be checked using the one-point field Proctor test or other appropriate test procedures; and

(c) A minimum of four thickness measures shall be conducted per acre per lift of the compacted clay layer.

(4) Laboratory Testing Frequency

(a) Percent fines (ASTM D-1140) of the clay layer material shall be determined at a minimum frequency of two tests per acre per lift of installed clay layer;

(b) Atterberg limits determinations shall be performed on one sample per acre per lift of installed clay layer; and

(c) Hydraulic conductivity testing of Shelby tube or drive cylinder (ASTM D-2937) samples of the compacted clay layer shall be performed at a minimum frequency of one test per acre per lift. Laboratory hydraulic conductivity tests shall be conducted in triaxial type permeameters (ASTM D-5084). The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10 pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured.

(5) Deficiency - If the test data from a clay layer section does not meet the requirements of the project specifications, additional random samples shall be tested from that clay layer section. If such additional testing demonstrates that the thickness and hydraulic conductivity meet the requirements of the project specifications at the 95 percent confidence level, that clay layer section will be considered acceptable. If not, that clay layer section shall be reworked or reconstructed so that it does meet these requirements.

3. Clay Layer Tie-In (To Existing Clay Layer, Where Applicable)

a. Location - The edge of any existing final cover adjacent to the proposed final cover area.

b. Standard - The compacted clay layer of any existing final cover and the proposed final cover must be tied together to form one continuous seamless layer. At the interface, the existing and new clay layers shall be compacted to form a seamless connection.

c. Frequency - The Soils Quality Control Monitor shall monitor the tie-in by visual inspection on a continuous basis.

4. Vegetative Cover

   a. Location - The vegetative cover shall be tested in place. The location of testing shall be determined by the Soils Quality Control Monitor.

   b. Standard - Top soil which is reasonably free of brush, weeds, and other litter; and relatively free of roots, stumps, stones and any other extraneous or toxic matter harmful to plant growth. Roots with a diameter greater than ⅜" shall be hand picked and removed.
   The vegetative cover shall be at least 24" thick.

   c. Frequency - Depth measurements shall be taken at the frequency of four per acre. The soil shall be monitored on a continuous basis for extraneous matter.

5. Final Cover Repairs (When Applicable)

   If, during construction of the final cover system, damage is sustained on the final cover system (including the intermediate cover, clay layer and vegetative cover), the areas of damage shall be reconstructed and retested in accordance with corresponding section described above. All repair areas shall be tested at the frequencies prescribed above, unless more frequent testing is required at the discretion of the Soils Quality Assurance Engineer.

B. Downcomer Pipes

Downcomer pipes shall be installed in the final cover at the low point of the terraces, to intercept the stormwater between terraces. The downcomer pipes shall include the terrace side drains and terrace underdrain piping.

The downcomer pipes shall be constructed as shown on the Construction Drawings. The clay around the pipes shall be compacted into a uniform homogeneous material. Prior to placement of vegetative cover over the downcomer pipes, the pipe shall be inspected by the General Quality Control Monitor.

pounds per square inch and permeated with water under an adequate backpressure to achieve saturation of the test specimens. The inflow to and outflow from the specimens shall be monitored with time and the hydraulic conductivity calculated for each recorded flow increment. The test shall continue until steady state flow is achieved and relatively constant values of hydraulic conductivity are measured.

5. Deficiency - If the test data from a compacted clay layer section does not meet the requirements of the project specifications, that section shall be reworked or reconstructed so that it does meet these requirements.

C. Underdrain Filter Sand

The underdrains in the terraces shall be surrounded by filter sand as shown on the Contract Drawings. The QA/QC for the filter sand is as follows:

1. Filter Sand

a. Location - The material shall be pre-qualified prior to installation.

If the testing is done at the borrow source, a chain of custody shall be provided.

b. Standard - Clean, uniformly graded sand with a uniformity coefficient of 1.5 or greater and an effective grain size of 0.2 mm to 0.5 mm. Grain size distribution shall be conducted as part of pre-qualification.

The sand shall have a hydraulic conductivity no less than 1.0×10^{-3} cm/sec at a density of 100 percent Modified Proctor. The hydraulic conductivity testing shall be by Constant Head method (ASTM D2434).

c. Frequency - The hydraulic conductivity of the sand shall be tested once per 100 C.Y. of sand material.

1. Location - The compacted clay layer shall be tested in place. The locations of testing shall be determined by the Soils Quality Control Monitor. If there are indications of a change in product quality or construction procedures during construction, additional tests shall be performed to determine compliance.

2. Standard -

   a. Clay Layer Subgrade - Compacted to 90% of Modified Proctor maximum dry density (ASTM D 1557) (12" thick minimum).

   b. Field Density - The field density of the clay layer shall be as established in Section A.2.c.(2)(b) above and shall be determined by Standard Proctor Density (ASTM D 698).

   c. Thickness - Twelve inches minimum below pipe.

   d. Hydraulic Conductivity - The compacted clay layer shall have an in-place hydraulic conductivity no greater than 6.67×10^{-8} cm/sec (ASTM D 5084).

3. Field Testing Frequency -

   a. Prior to the laying of the compacted clay materials, the subbase shall be compacted to the specified density. Density tests and thickness shall be conducted at a minimum rate of one per 75 L.F. of pipe. (Minimum of one test between terraces).

   b. A minimum of one moisture content and field density determination of the compacted clay layer shall be conducted per 75 L.F. of pipe

   c. A minimum of two thickness measures of the compacted clay layer shall be conducted per 75 L.F. of pipe.

4. Laboratory Testing Frequency -

   a. Hydraulic conductivity testing of Shelby tube or drive cylinder (ASTM D 2937) samples of the compacted clay layer shall be performed at a minimum frequency of one test per 75 L.F. of pipe (at least once between terraces). Laboratory hydraulic conductivity tests shall be conducted in triaxial type permeameters (ASTM D 5084). The test specimens shall be consolidated under an isotropic consolidation stress no greater than 10

D. Gas Vents

Gas vents shall be installed through the final cover. The QA/QC for gas vent materials shall be as follows:

1. Gravel

   a. Location - The gravel shall be pre-qualified by certification by the supplier.

   b. Standard - The gravel shall be clean gravel with no fines. The gravel shall be FDOT No. 4 Course Aggregate (ASTM D 448).

      The gravel shall be non-calcareous (ASTM D 4373).

   c. Frequency - The gravel shall be certified by the supplier. The gravel shall be tested once per 100 C.Y.

2. Bentonite

   a. Location - The material shall be pre-qualified with documentation from the supplier.

   b. Standard - The material shall be a homogeneous, inorganic material with at least 50 percent, by weight, passing the No. 200 sieve (ASTM D 1140)

   c. Frequency - The material shall be certified by the supplier, one time only.

Golder Associates Inc.
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Telephone (904) 363-3430
Fax (904) 363-3445

Golder Associates

February 25, 1997 963-3989

England, Thims & Miller, Inc.
3131 St. Johns Bluff Road, South
Jacksonville, Florida 32246

Attn: Ms. Juanitta Bader Clem, P.E.

RE: RESPONSE TO COMMENTS AND RAI'S
FDEP INTEROFFICE MEMORANDUM DATED NOVEMBER 25, 1996
TRAIL RIDGE LANDFILL - JACKSONVILLE, FLORIDA

Dear Ms. Clem:

As requested, Golder Associates Inc. (Golder Associates) has reviewed comments and Requests for Additional Information (RAIs) made by the Florida Department of Environmental Protection (FDEP) on our report entitled "Evaluation of Historical Data and Recommendations for Groundwater, Surface Water and Leachate Monitoring - Trail Ridge Landfill, Jacksonville, Florida" dated October 24, 1996. FDEP's comments were included in an "Interoffice Memorandum" dated November 25, 1996. The following addresses each of FDEP's comments/RAIs by the number referenced in their November 25, 1996 memorandum.

Comment 1

The addition of monitoring wells MWB-16S, MWB-18S, MWB-28S, and MWB-30S into the existing Monitoring Plan were based upon the recommendations of a hearing officer as part of the findings and conclusions of a September 20, 1991 Recommended Order which resulted from an Administrative Hearing. The findings and conclusions which addressed groundwater monitoring on the west, north, and south sides of the landfill, were incorporated into a Final Order dated November 1, 1991. Based upon the Final Order, the information presented is insufficient to approve the request to remove monitoring wells MWB-16S, MWB-18S, MWB-28S, and MWB-30S from the monitoring plan.

Response 1

This comment has been resolved. In an Interoffice Memorandum dated January 30 ,1997, FDEP concurred with the recommendation to remove monitoring wells MWB-16S, MWB-18S, MWB-28S, and MWB-30S from the facility's monitoring program.

Comment 2

A history of infrequent detection of certain metals does not provide adequate technical justification to reduce groundwater sampling frequencies or relax any requirements of Chapter 62-701.510(1)(a) F.A.C. In consideration of any reduced sampling frequencies, a geotechnical justification is required.

Response 2

To respond to this comment, groundwater flow velocity calculations were performed to determine the estimated length of time required for groundwater to travel 100 feet downgradient of a given monitoring well. As explained by Mr. Brian Kelly of FDEP during a telephone conversation on February 18, 1997 this evaluation is used by FDEP to determine the potential that a groundwater contaminant plume could migrate past a monitoring well and to a discharge point (such as a stream, a wetland, a production well, etc.) or an arbitrary point of compliance (suggested at 100 feet). To evaluate this scenario, groundwater hydraulic data was obtained from the "Report on Monitoring Well Installation - Trail Ridge Landfill, Jacksonville, Florida" (Golder Associates, May 1992) and the report entitled "Evaluation of Historical Data and Recommendations for Groundwater, Surface Water and Leachate Monitoring - Trail Ridge Landfill, Jacksonville, Florida" (Golder Associates, October 24, 1996). Since there are no discharge points closer, the arbitrary point-of-compliance distance of 100 feet was used for the transport calculations. The results of the calculations indicate that for mean hydraulic conductivity (K) and horizontal hydraulic gradient (i) values, and an assumed value for effective porosity (n_e) of 25%, groundwater flow velocities are estimated to be on the order of 800 to 4,000 days per 100 feet (deep zone slower than the shallow and intermediate zones). The attached Table 1 presents the data used in the calculations. Based on these groundwater flow velocities, the fact that the site is double-lined, and the low concentrations of metals and VOCs in the leachate, it would appear that changing the sampling frequency for metals and VOCs from a semi-annual to an annual basis would not pose a significant risk. Should the levels of these constituents begin to increase significantly above background in the future, a return to a semi-annual frequency may be justified.

Comment 3

A history of infrequent detection or non-detection of volatile organic compounds does not provide adequate technical justification to reduce groundwater sampling frequencies or relax any requirements of 62-701.510(1)(a) F.A.C. As previously stated, any reduction of sampling frequencies will require a geotechnical justification.

Response 3

See response to #2 above.

Comment 4

Since the Class III landfill is not being permitted, SW-3 may be removed from the monitoring program.

Response 4

No response required.

Comment 5

The current filter-drain stormwater system is proposed to be changed to a wet detention system; therefore, surface water sampling should continue to be conducted on a quarterly basis to monitor the effectiveness of the new system. Surface water data and the effectiveness of the stormwater system may be evaluated after one year to determine if an alternative sampling frequency is appropriate.

Response 5

We would like to point out that the proposed design change of the stormwater system from a filter-drain system to a wet detention system should have no effect on the frequency or quality of discharge from the pond. The change to the wet detention system results in essentially no net change to stormwater storage capacity. As a result, the frequency of the discharges should be unchanged as well as the quality of the water discharged. There have been approximately 20 samples collected from each sample point over the past five years, and the results have been very consistent. No water quality violations attributable to the landfill operations have been noted over that period of time. There is no reason to believe that an additional year of quarterly sampling will provide significantly different data that would affect FDEP's decision on whether to grant a reduction in the sampling frequency. The permittee is concerned that this will only result in their having to prepare this information again in one year and pay for a permit modification. On this basis, they respectfully request that FDEP reevaluate their need for an additional year of quarterly data.

Comment 6

In accordance with Chapter 62-701.510(5), leachate sampling is to be characteristic of the leachate coming from the waste; before it is subjected to conditions that may change the characteristics of the leachate. The current collection system provides discreet leachate samples which are derived from specific portions of the landfill. Composite sampling results may differ significantly from individual sampling results and will not be representative of specific potential source areas. Additional justification to modify the existing leachate sampling procedures should be provided.

Response 6

The current leachate collection system is constructed so that leachate from each sump is pumped directly into one of two force mains in which all of the leachate is mixed. One force main transfers the leachate from the primary liner sumps to the five primary leachate collection tanks and the other force main transfers leachate from the secondary liner sumps to a single secondary leachate collection tank (i.e., there are a total of six leachate tanks). The leachate from the primary liner sumps comes through the force main and is composited from all of the active primary sumps. Also, the primary liner sump leachate is further composited since all

five primary leachate tanks are interconnected with piping that allows flow between one another. The sixth leachate tank contains composite leachate from the secondary sumps only and does not receive leachate from the primary liner sumps.

Because the primary liner sump leachate is thoroughly mixed by the time it is stored in the storage tanks, it does not seem reasonable to have to collect samples from each location. As mentioned in our October 24, 1996 report, the data collected to date does not indicate that there has been any significant difference between the five primary leachate storage tanks and that the sampling is in essence redundant. As such, we would request that FDEP re-evaluate our recommendation to change the leachate sample collection requirement to two samples; one from the secondary leachate storage tank and one sample from one of the five primary leachate storage tanks.

Comment 7

A history of infrequent detection or non-detection of certain metals (arsenic, barium, beryllium, copper, selenium, silver and vanadium) in previous leachate samples does not provide reasonable assurance that these parameters will not be expected to be in or derived from the waste to be placed in the landfill. Therefore, the frequency of sampling for these specific parameters should not be reduced without further justification.

Response 7

We feel that the information collected to date supports our recommendation to decrease the frequency of leachate sampling for certain metals. The properties of the leachate are not likely to change rapidly since the site has been in operation for five years and accepts predominantly municipal solid waste. Leachate generated from this type of waste stream does not generally produce high concentrations of metals as shown by the historical data. We believe that past trends should be factored in the decision process for selecting sampling parameters and that there could be safeguards included in the permit conditions such that if these metals were detected in any of the annual sampling events, their sampling frequency would be reverted back to a semi-annual basis.

If you have any questions regarding this letter, please call.

Very truly yours,

GOLDER ASSOCIATES INC.

Kenneth B. Karably, P.G.
Senior Project Manager/Associate

cc: Scott McCallister

FN: disk\963-3989\respcomm.doc

Table 1

Summary of Groundwater Flow Velocity Calculations

Trail Ridge Landfill
Jacksonville, Florida

Well ID	K (cm/sec)	Geometric Mean K (cm/sec)	Geometric Mean K (ft/day)	Effective Porosity (ne)	Horizontal Gradient (i)	Calculated GW Flow Velocity (v = Ki/ne)	Estimated Number of Days for GW to Travel 100 feet
B-1S	1.10E-02						
B-6S	1.10E-03						
B-8S	3.50E-03						
B-9S	3.60E-03						
B-10S	6.90E-04						
B-11SR	1.23E-03						
B-13SR	1.40E-04						
B-14SR	1.10E-03						
B-17S	1.82E-03						
B-18S	1.17E-03						
B-19S	3.29E-04						
B-20S	7.49E-04						
B-21S	2.49E-04						
B-22SR	3.25E-04						
B-23S	1.16E-03						
B-24S	1.89E-03						
B-25S	1.13E-03						
B-26S	2.55E-03						
B-27S	1.89E-04						
B-28S	7.41E-04						
B-29S	1.95E-03						
		1.08E-03	3.05	0.25	9.82E-03	0.12	834
B-2I	1.90E-02						
B-3I	1.00E-03						
B-6I	1.00E-03						
B-8I	9.10E-03						
B-9I	2.40E-04						
B-10I	2.90E-03						
B-11I	1.10E-03						
B-12I	1.90E-02						
B-13IR	5.55E-04						
B-14IR	1.21E-04						
B-17I	5.68E-04						
B-19I	2.35E-04						
B-25I	2.67E-04						
B-27I	2.66E-04						
B-29I	2.49E-04						
		1.04E-03	2.94	0.25	9.71E-03	0.11	876
B-8D	1.50E-05						
B-12D	1.60E-03						
B-14DR	3.45E-04						
B-17D	4.40E-04						
B-19D	3.41E-05						
B-25D	4.38E-04						
B-27D	4.61E-04						
B-29D	7.20E-04						
B-31D	3.62E-04						
		2.65E-04	0.75	0.25	8.04E-03	0.02	4133

Notes: 1. Hydraulic Conductivity values from "Report on Monitoring Well Installation - Trail Ridge Landfill, Jacksonville, Florida" (Golder Associates, May 1992).
2. Hydraulic gradients from "Evaluation of Historical Data and Recommendations for Groundwater, Surface Water, and Leachate Monitoring - Trail Ridge Landfill, Jacksonville, Florida" (Golder Associates letter report dated October 24, 1996).
3. Value for effective porosity is estimated.

MAP(S)/ PLAN(S)

SCANNED

SEPARATELY