Environmental Consultants

3012 U.S. Highway 301 North
Suite 700
Tampa, FL 33619-2242

813 621-0080
FAX 813 623-6757

SCS ENGINEERS

December 23, 2002
File No. 09199056.02

Mr. Lee Martin
Florida Department of Environmental Protection (FDEP)
2600 Blair Stone Road
Twin Tower Office Building
Tallahassee, Florida 32399-2400

Subject: Request for Approval of Alternate Procedure
Landfill Sideslope Subbase Design and Horizontal Separation to Property Line
Citrus County Central Landfill Phase 2 Expansion

Dear Mr. Martin:

In accordance with your recent request pursuant to the above referenced requests for alternate procedures, SCS Engineers is providing the enclosed documents to assist in your review of this request. Enclosed please find a sketch delineating the future phases of landfill expansion with the current project noted as Phase 2, a boundary survey that shows the Withlacoochee Sate Forest abutting the entire east side of the landfill property; and the revised liner stress analysis calculations recently submitted to the District office.

You will note that the liner stress analysis now incorporates a geogrid in the upper layer of the liner system. Therefore please amend the alternate procedures request for the two to one side slope to include the geogrid in the proposed design.

Please contact us if you have any questions or need additional information to assist in the review process.

Sincerely,

Lindsay Kennelly for
John A. Banks, P.E.
Project Director
SCS ENGINEERS

Raymond J. Dever
Raymond J. Dever, P.E., DEE
Vice President
SCS ENGINEERS

BJC:eac

cc: Susan Metcalfe, P.G. – Citrus County

Attachments

Environmental Consultants

3012 U.S. Highway 301 North
Suite 700
Tampa, FL 33619-2242

813 621-0080
FAX 813 623-6757

Lee

SCS ENGINEERS

December 16, 2002
File No. 09199056.02

Kim B. Ford, P.E.
Florida Department of Environmental Protection
3804 Coconut Palm Drive
Tampa, Florida 33619

Subject: Citrus County Central Landfill - Phase 2 Expansion
Permit No.: #21375-004-SC, Citrus County

Dear Mr. Ford:

On behalf of Citrus County, SCS Engineers (SCS) submits the following responses to your request for additional information in a letter dated November 15, 2002. For ease of review, each FDEP comment is reiterated in bold type, followed by our response.

We have provided revised submittals, or replacement pages to the submittals, using a ~~strikethrough~~ and underline format, to facilitate review. Enclosed are one original and two copies of all revisions. The following documents are enclosed:

1. Calculations related to Liner Stress on the 2:1 side slopes.

2. Calculations related to the size of the leak detection sump.

3. The following revised specifications sections:

   Section 02212 - Low Permeability Soil
   Section 02220 - Excavation, Backfill, Fill, and Grading
   Section 02776 - HDPE Liner
   Section 02930 - Geocomposite

4. The following new specification section: Section 02950 - Geogrid.

5. Revised Draft Liner CQA Plan.

6. Revised Drawing Sheet Nos. 3,5,7,8,9,10,11,14, and 15.

The following information is needed in support of the solid waste applications [Chapters 62-701, Florida Administrative Code (F.A.C.)]. Please provide:

1. **62-701.340(4)(c). Approval of the requested alternate procedure for the reduced setback of less than 100 feet is requested.**

   Response: It is our understanding that approval of the alternate procedure will be received soon. This approval will be provided to you upon receipt.

2. **62-701.320(10). List and reaffirm those referenced parts of the previously provided 1998 and July 2001 groundwater monitoring reports that are still valid. Those parts that are no longer valid should be deleted or replaced.**

   Response: There are no changes to the Groundwater Monitoring Plan submitted by PSB&J on 1998 except as revised by revisions included in biennial reviews. The current revisions were submitted in April, July, September and most recently on October 16, 2001 by Jones Edmonds and Associates.

3. **62-701.320(7)(f)6. Site plan revisions are requested to show the additional information as discussed with SCS and as listed below:**

   a. **Sheet 5, Section B revised to match the detail on Sheet 11;**

   b. **Sheet 7, Detail 1 revised to show the leachate sampling port on the leachate manifold piping;**

   c. **Sheet 8. Detail B revised to note the cutting and opening of the geotextile between the leachate collection piping and the gravel in the stamp, and to show the geotextile between the primary liner and the gravel in the leak detection sump;**

   d. **Sheet 11, Detail F revised to show detail for the geonet overlap at the toe of the east and west side slopes with notes for installation and the geonet orientation;**

   e. **Sheet 14 revised to include all stormwater collection details;**

   f. **Sheet 15, Detail A revised to show the leachate collection and leak detection systems across the internal terrace, with a slope to promote drainage.**

   Response: Please see the revised Construction Drawings that address each of the listed issues.

4. **62-701.400(3)(a)1. The rationale for calculating the factor of safety for the internal sideslopes is unclear. Technical documents are requested that support the assumption that the "resistance" to the downslope force (used for calculating the factor of safety) is the sum of the individual resistances provided by each component rather than the resistance of the weakest component (being the geonet) . A copy of each of the "technical reference reports on the subject of liner analysis on side slopes" mentioned in Section H.2.a.1 are requested. *Each component of the liner system must be able to withstand the stresses imposed by the component's own weight with the weight of the 24-inch sand layer, and any potential down-drag forces from the ongoing compression of the waste, on 2H:IV side slopes with the condition of operating heavy equipment for spreading and compaction. Design calculations must be based* on *friction angles from published data and confirmed by the actual results from shear box tests for the proposed design.***

   Response: Please see the enclosed calculations for liner system stress. We have

Response: Please see the enclosed calculations for liner system stress. We have included the use of a geogrid on the 2:1 sideslopes to add an additional factor of safety. The resulting calculations show that no stress is applied to any of the geosynthetic liner system materials. The geogrid specified can withstand the downward force calculated using methods prescribed by Koerner plus the addition of the landfill compactor and maintain at least a 1.5 FS with only 5-percent strain on the material. A portion of the downward force is transferred to the bottom interface due to frictional forces within the liner system layers. The friction angles of the interface between the geogrid and the geocomposite, geocomposite and textured HDPE 60-mil geomembrane, and the textured geomembrane and the bottom soils will be measured with the actual materials to be used on the project. The resulting values will be compared to the values used in these calculations and the factor of safety will be verified.

5. **62-701.400(3)(c)1. A description of the procedures to be used for constructing the bottom and side slopes of the sump, and the related method and frequency of testing on these slopes, are requested.**

Response: Section 02212 of the Specifications is revised to include the requirement to perform CQC testing specifically in the sump area for liner sub-base. See note 8 on Table 02212-1.

6. **62-701.400(3)(c)2. An Action Leakage Rate (ALR) that is not based on an "average" leakage rate is requested. The referenced specific condition 17 in the current operation permit is not based on an "average" leakage rate.**

Response: The Action Leakage Rate of 100 gallons per day is equivalent to 600 gallons per day based on six acres of lined area. The effective volume of the leak detection sump is 600 gallons when using a 1-ft. operating zone (see attached calculations). Thus if the Action Leakage Rate is exceeded the pump should cycle more than one time in a 24-hour period, thus pumping more than 600 gallons during this period of time. If the actual leakage rate is less than 600 gallons it will take longer to cycle the pump; however, when the pump does come on, it should pump approximately 600 gallons per cycle. In summary, as long as the pump does not pump more than 600 gallons in any 24-hour period, the Action Leakage Rate has not been exceeded.

7. **62-701.400(3)(d) and (e). 1) Revisions to the project specifications are requested to demonstrate compliance with rules 62—701.400(3) (d)7., 10., and 11. 2) Revisions to Section 3.02D are requested to indicate that the test results shall not be averaged unless specified in SRI CMl3. 3) The coefficient of interface friction angle of 25 degrees as provided in Table 02930-2 is less then the 26.6 degree angle for the proposed side slope, therefore the composite geonet appears to be an unstable component of the liner system. Revision to Table 02930-2 to provide the minimum design interface friction angle, and related calculations for its factor of safety, are requested.**

Response: Please see the enclosed revised specifications for geomembrane, geogrid, and geocomposite products that incorporate the requirements of Rule 62-701.400(3)(d) 7., 10., and 11., FAC. Please note that the angle of the slope and the friction angle of the materials are related only by the fact that the steeper the angle the lower the normal

be. The fact that the slope angle is steeper than a given friction angle does not mean there will necessarily be a failure or stress applied to a material. The entire calculation must be evaluated to make this determination.

8. **62-701.400(4)(a). The design of the leachate collection system and leak detection system over the internal terrace is requested.**

Response: Please see the revised Detail A on Sheet 15 of the Drawings.

9. **62-701.400(4)(b). 1) Specifications including the gradation and maximum percent organic matter for the sand (drainage layer and protective material) to demonstrate chemical compatibility and adequate hydraulic conductivity are requested. 2) The design detail for the geonet overlap at the toe of the east and west side slopes with notes for installation and the geonet orientation are requested.**

Response: 1) The specification Section 2220, Excavation, Backfill, Fill, and Grading has been revised to include a hydraulic conductivity requirement, a maximum fines content, a maximum organics content, and chemical compatibility requirements for the protective sand layer (Select Sand). As discussed, a gradation requirement is not necessary to achieve the desired function. A requirement to remove fines that may accumulate on the surface of the protective sand has also been added. 2) Please see the new detail and notes on Sheet 8 of the Drawings.

10. **62-701.400(7). Revisions to the CQA Plan are requested to provide construction quality assurance procedures including material sampling and conformance testing for each component of the liner system including the composite geonet, leachate piping, gravel, and sand layer.**

Response: Please see the revisions to the enclosed CQA plan.

11. **(62-701.400(9)(b). Revisions to the project specifications are requested to require a site plan (to be submitted by the contractor for approval by the engineer) to show the location of the proposed temporary lined soil dike, including design details with elevations, to prevent stormwater from Phase 1 and 1A from entering Phase 2.**

Response: Please see the notes added to Sheet 3 of the Drawings and revision to the Earthwork specification (Section 02220).

12. **62-709.320. A site plan with the layout and design for the yard trash processing facility to demonstrate compliance with this rule is requested.**

Response: The Yard Waste Procession Area (YWPA) is permitted under a separate registration. The proposed work will not effect the ability for the facility to stay in compliance with the applicable requirements. Future changes to the facility's layout will be address at the time of permit renewal for the YWPA.

Please provide all responses that relate to engineering required for construction signed and sealed by a professional engineer. Responses that relate to the facility operation should be included as part of the Operations Plan.

An original and two copies are provided as requested. Please call if you have any questions.

Sincerely,

12-16-02

John A. Banks, P.E.
Project Director
SCS ENGINEERS

Bruce J. Clark, P.E., DEE
Project Manager
SCS ENGINEERS

JAB/BJC:jlh

Enclosures

cc: Lee Martin, P.E., FDEP Tallahassee (w/o enclosures)
Susan Pelz, P.E., FDEP Tampa (w/enclosures)
Susan Metcalfe, P.G., Citrus County (w/enclosures)

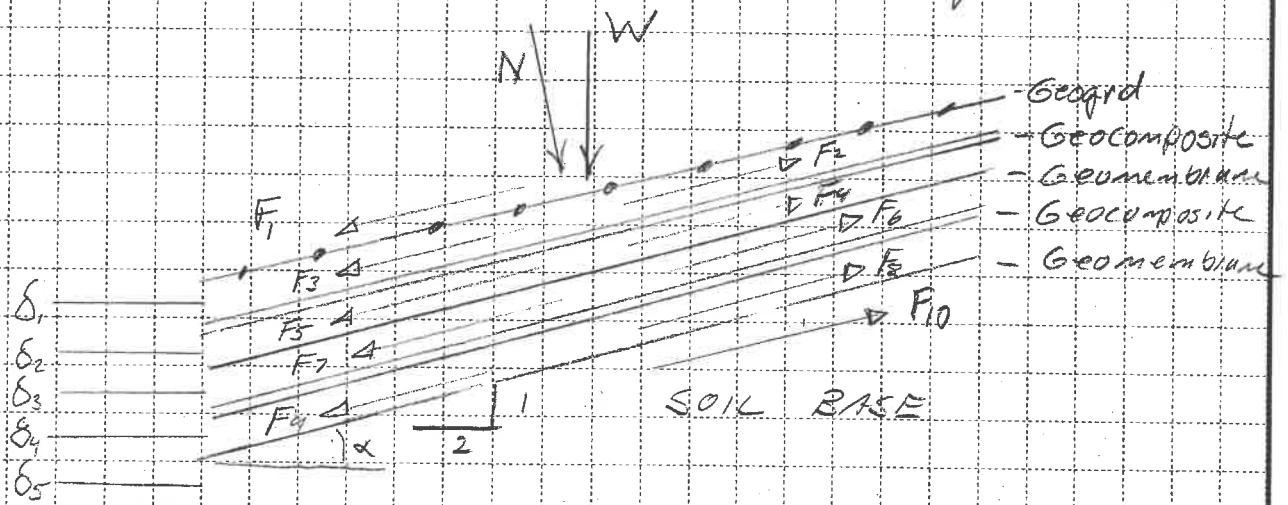
Liner Stress Analysis - Weight of Liner, Protective Sand, Refuse, and Equipment Load on Side Slope

12/16/02

SCS ENGINEERS

SHEET 1 OF 6

CLIENT	PROJECT	JOB NO.
Citrus Co.	Phase 2 Expansion	09199056.02
SUBJECT	BY	DATE
Liner Stress Analysis	JAB	12-6-02
	CHECKED	DATE
	[illegible]	12/16/02



Given: Slope angle $\alpha = 26.6°$

δ_1 = Friction Angle Between the Geogrid and the Geocomposite = 12°

$\delta_2 = \delta_3 = \delta_4$ = Friction Angle Between Geocomposite and Textured HDPE Liner = 15-18°

δ_5 = Friction Angle Between Textured HDPE the underlying Sandy Soil = 17-20°

F_1 on Geogrid = W Sin 26.6°

F_2, F_4, F_6, F_8 and F_{10} = N Tan δ
= Resistance force due to Friction

Because $\delta_2 = \delta_3 = \delta_4$ $F_4 = F_6 = F_8$

δ_5 = 17-20°

$N = \cos \alpha \, W$

Objective: Calculate Forces on the layers

CLIENT	PROJECT	JOB NO.
Citrus Co.	Phase 2 Expansion	09199056.02
SUBJECT	BY / DATE	CHECKED / DATE
Liner Stress Analysis	JAB 11-27-02	12/16/02

Calculations using Residual Friction Angles
Calculate various weight components acting on liner system using one 1 ft² of waste (SEE example problem Koerner Second Ed page 769)

A) Calculated Loads

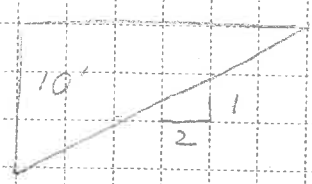
Given: Density of waste = 1200 lb/cy
= 45 lb/ft³

Friction Angle of waste = 32°
(Based on SCS studies)

Waste 1 ft thickness = 10 ft

Side slope = 2:1

Area of waste =



(1) Weight of waste = $\frac{1}{2}(10')(20')\left(45\frac{lb}{ft^3}\right)$

$W_w = 4500\frac{lb}{ft}$

(2) Calculate Shear resistance of waste

$\tau_{ss} = \sigma_H \tan\phi$ (D) where D = 10'

$= K_o \sigma_v \tan\phi$ (D) $\sigma_v = .5\,\sigma_H$

$= (1 - \sin 32^\circ)(.5)\ 634\frac{lb}{ft^2} \tan 32^\circ\ (10ft)$

$= 931\ \frac{lb}{ft}$

See bottom of next page.

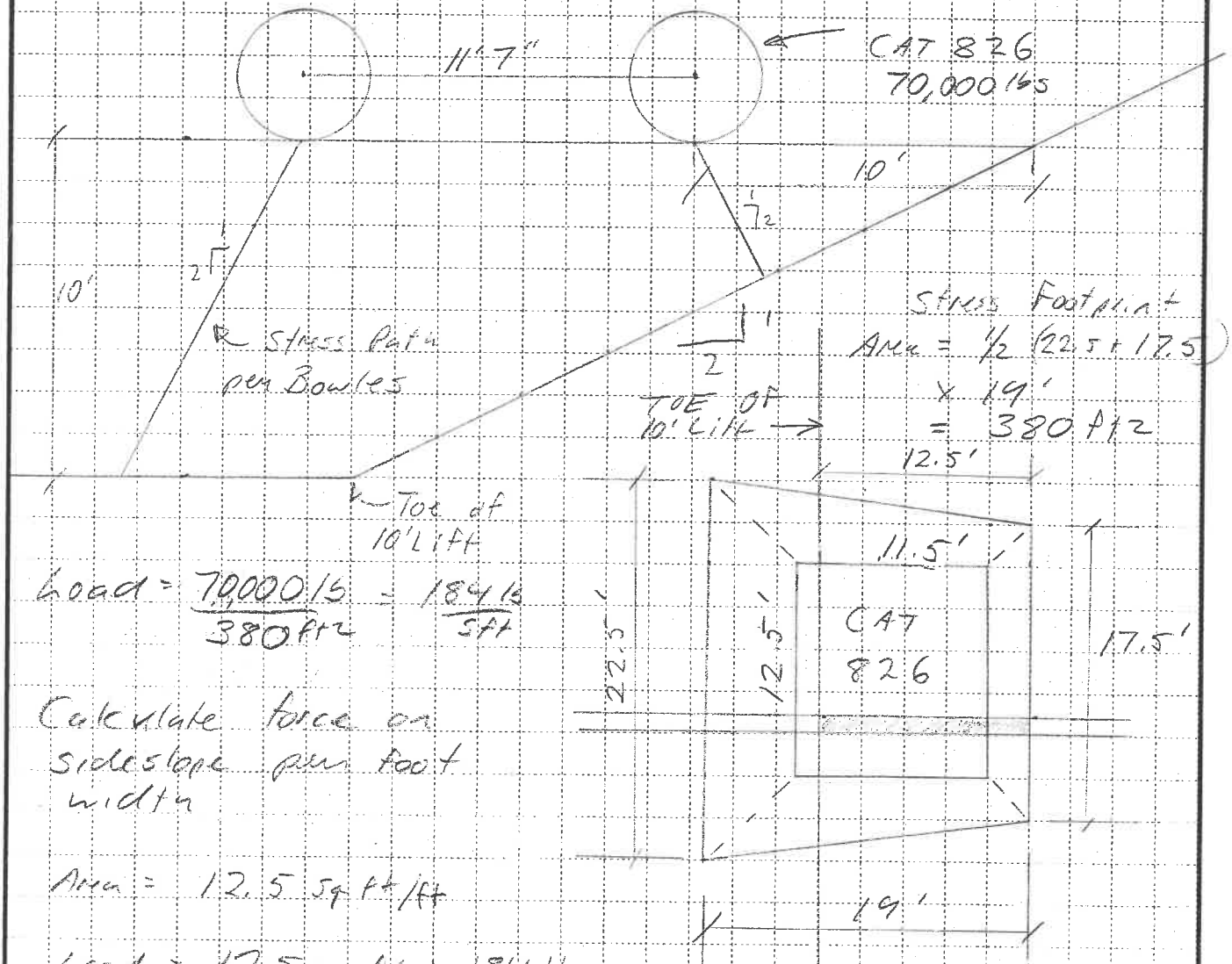
CLIENT	PROJECT	JOB NO.
Citrus Co.	Phase 2 Expansion	941990560 02
SUBJECT	BY	DATE
Liner Stress Analysis	JAB	1-27-02
	CHECKED	DATE
	[illegible]	12/16/02

(3) $W_{w\ net} = W_w - T_w = 4500 - 931$

$= 3569\ lb/ft$

(4) Calculate weight of Compactor

Assume Compactor maintains 10 Ft from liner slope



Load = $\frac{70{,}000\ lb}{380\ Ft^2} = 184\ lb/Sft$

Calculate force on sideslope per foot width

Area = 12.5 Sq Ft/ft

Load = 12.5 Sq Ft/ft x 184 lb/Sq Ft

= 2,303 lb/ft

$\sigma_H = (10 \times 45) + 184\ lb/ft^2$

$= 634\ lb/ft^2$

CLIENT	PROJECT	JOB NO.
Citrus Co.	Phase 2 Expansion	19905602
SUBJECT	BY / DATE	
Liner Stress Analysis	JAB 1-27-02	
	CHECKED / DATE	
	12/16/02	

(3) Calculate weight of Sand layer

$(2\,ft \times 22\,ft \times 110\,lb/ft^3) + (2\,ft \times 10\,ft \times 110\,lb/ft^3)$

$= 7040\,lb/ft$

(4) Calculate weight of Geosynthetics

Liner @ $0.94\,g/cm^3 \times 0.0361 = 0.0339\,lb/in^3$

$V_L = 180\,ft \times 0.005\,ft = 0.9\,ft^2/ft$

$W_L = 0.9\,\frac{ft^3}{ft} \times 0.0339\,\frac{lb}{in^3} \times \frac{12\,in}{ft} \times \frac{144\,in^2}{ft^2}$

$0.9\,\frac{ft^3}{ft} = 58.6\,\frac{lb}{ft^3}$

$W_L = 52.7\,lb/ft$

Geonet @ $0.51\,lb/ft^2$ Assume 25% Moisture

$W_G = 0.51 \times 1.25 = 64\,lb/ft^2$

Total for 2 Liners + 2 geonets

$(58.6 \times 2) + (64 \times 2) = 245\,lb/ft$

(5) Total W is sum of above weights

$3569 + 2,303 + 7040 + 245$

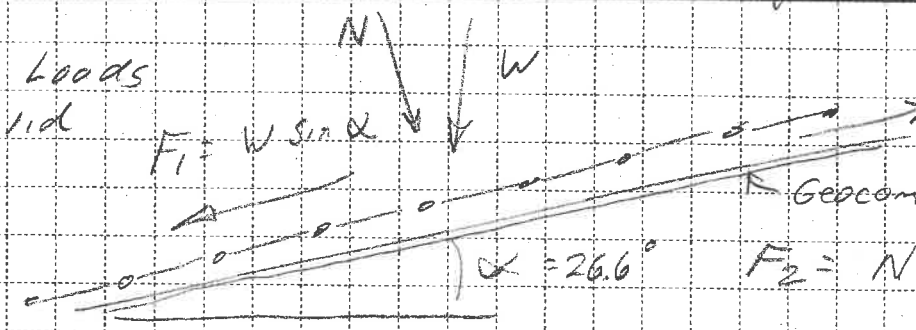
$= \boxed{13,157\,lb/ft}$

SCS ENGINEERS

SHEET 5 OF 6

CLIENT	PROJECT	JOB NO.
Citrus Co.	Phase 2 Expansion	01199056.02
SUBJECT	**BY**	**DATE**
Liner Stress Analysis	JAB	12-6-02
(2) Calculate Forces	**CHECKED**	**DATE**
	BJR	12/6/02

① Calculate Loads on Geogrid



$W = 13,157$ lb/ft

$N = W \cos\alpha$

$= 11,764$ lb/ft

$F_1 = 13,157$ lb/ft $\sin 26.6° = 5891$ lb/ft

$F_2 = N \tan\delta_1$

$\delta_1 = 12°$

$F_2 = 2501$ lb/ft

Stress on Geogrid

$\sigma = F_1 - F_2 = 5891 - 2501 = 3,390$ lb/ft

Use Tensar UX1700HS

Tensile Strength @ 5% Strain = 5,140 lb/ft

$F_S = \frac{5140}{3390} = 1.52$ OK

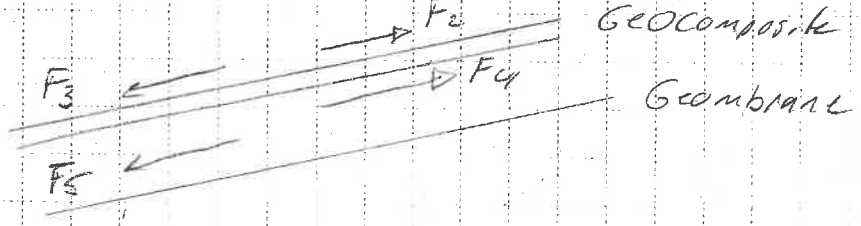
② Calculate Loads on Underlying Materials

δ_2 = Geocomposite to textured HDPE

= 15 - 18° Use 16.5°

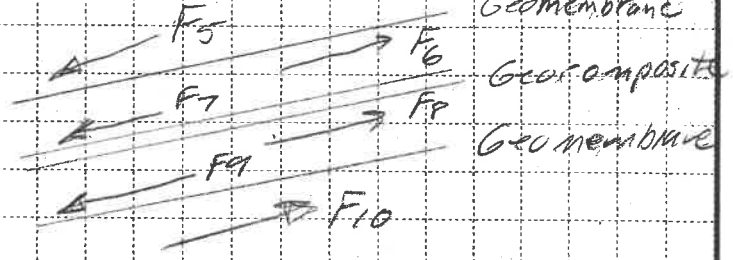
$F_2 = F_3$ $F_4 = N \tan 16.5 = 3,484$ lb/ft

$F_4 > F_3$ No tension F_2 gets transmitted to the next layer = F_5



CLIENT	PROJECT	JOB NO.
Citrus Co	Phase 2 Expansion	01990560.02
SUBJECT	BY / DATE	
Liner Stress Analysis	JAB 12-6-02	
	CHECKED / DATE	
	12/16/02	

Because the Friction resistance is Greater than the downward Force There is no stress on the material and the downward load is transfered to the next layer



$F_5 = F_7 = F_9$

Thus $F_9 = F_2 = 2501$ lb/ft

$F_{10} = N \tan \delta_5 = 11{,}764 \frac{lb}{ft} \tan 17°$

Use $\delta_5 = 17°$ as worst case

$F_{10} = 3597$ lb/ft

$F_{10} > F_9$ $\quad \frac{3597}{2501} = 1.44$ FS

No stress on bottom Liner OK