Hillsborough County
Report of
Geotechnical Exploration,
Proposed Leachate Treatment Plant
Southeast Landfill, C.R. 672
Hillsborough County, Florida

Ardaman & Associates, Inc.

OFFICES

Orlando, 8008 S. Orange Avenue, P.O. Box 593003, Orlando, Florida 32859-3003, Phone (407) 855-3860
Bartow, 1987 S. Holland Parkway, P.O. Box 812, Bartow, Florida 33830, Phone (813) 533-0858
Bradenton, 209 A 6th Avenue East, P.O. Box 1335, Bradenton, Florida 33508, Phone (813) 748-3971
Cocoa, 1300 N. Cocoa Blvd., P.O. Box 3557, Cocoa, Florida 32924, Phone (407) 632-2503
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Tallahassee, 3175 West Tharpe Street, Tallahassee, Florida 32303, Phone (904) 576-6131
Tampa, 105 N. Faulkenburg Road, Suite D, P.O. Box 1506, Brandon, Florida 34299-1506, Phone (813) 654-2336
West Palm Beach, 2511 Westgate Avenue, Suite 10, West Palm Beach, Florida 33409, Phone (407) 687-8200

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Ardaman & Associates, Inc.

Consultants in Soils, Hydrogeology,
Foundations and Materials Testing

May 2, 1991
File Number 91-9629

Hillsborough County
Department of Solid Waste
Post Office Box 1110
Tampa, Florida 33601

Attn: John Johnson

Subject: Report of Geotechnical Exploration, Proposed Leachate Treatment Plant, Southeast Landfill, C.R. 672, Hillsborough County, Florida

Gentlemen:

Pursuant to your authorization given by Work Order No. TI-41-89-573, and in general accordance with our proposal of March 22, 1991, our firm has completed the exploration of subsurface soil conditions beneath the proposed alternative location for the leachate treatment plant, at the referenced site. The purpose of this exploration was to determine the stratification and engineering properties of subsurface soils, and to provide recommendations for foundation design and site preparation. This study covers foundation soils well within the influence of building loads, including the first rigid surface of underlying bedrock/bedclay strata.

This report was prepared for the exclusive use of Hillsborough County, Department of Solid Waste, and their consultants for use in the design of a foundation system for the proposed leachate plant structures, in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

SCOPE

The scope of our services has included the following items:

1. Performance of five (5) Standard Penetration Test (SPT) borings, designated TH-19 through TH-23, to determine the stratification and engineering properties of subsurface soils at the newly selected leachate plant location;

2. Review of each soil sample obtained in our field testing program, by a soils engineer in our laboratory, for verification of classification and assignment of laboratory tests, if required;

3. Performance of routine laboratory soils classification tests, to aid in confirming the classification of soils returned to our laboratory, and to provide data necessary to estimate engineering parameters;

4. Analysis of the existing building site soil and groundwater conditions, as they relate to the proposed construction;

5. Preparation of this report, to document the results of our field testing program, engineering analysis, and foundation design and site earthwork recommendations.

SITE LOCATION AND CONDITIONS

The proposed leachate plant site is located within a tract of land situated in the southeast one-quarter of the southeast one-quarter of Section 14, Township 31 S., Range 21 E., Hillsborough County, and more specifically, north of the access roadway, with the east side of the tank containment area located along the coordinate E 444,500, and the majority of the area north of the coordinate N 1,252,000.

The treatment plant site was bare of trees and covered with weeds at the time of our exploration. The site lies on flat, south sloping topography, with the east side of the containment keyed in the berm along the E 444,500 coordinate.

FIELD EXPLORATION

Our field operations during this phase consisted of conducting five (5) SPT borings, using procedures similar to those outlined in ASTM D-1586, at the locations indicated on the attached Figure 1. Test locations of the proposed borings were specified by SCS Engineers. The depths of the SPT borings were determined by Ardaman & Associates, Inc. The borings were performed to determine the stratification and engineering properties of the subsurface soils, to a maximum depth of 70 feet below the existing ground surface. A continuous drilling and sampling procedure was performed within the upper 10.5 feet of the SPT boring, to detect subtle changes in soil stratigraphy, and pertinent engineering properties within this critical depth. Furthermore, borings were located in the field by survey crews from Hillsborough County. The accuracy of the boring locations is that implied by the measurement method used. Upon completion, each borehole was filled in with local soil, and sealed with cement slurry, in accordance with SWFWMD requirements. A brief summary of the drilling and testing procedures utilized in the SPT and MA borings, is included in the attached Appendix I.

LABORATORY TESTING

The field soil boring logs and recovered soil samples were returned to our Tampa office. At our soils laboratory, each soil sample was examined by a soils engineer, to obtain an accurate definition of the soil profile, and to assign pertinent laboratory tests. The visual classification of the samples was performed in accordance with the current Unified Soil Classification System (ASTM D-2487).

Four (4) moisture content, and four (4) percent fines tests (the percent by dry weight finer than the U.S. No. 200 sieve) were performed on selected soil samples, obtained from selected borings. These indices are useful in estimating compressibility characteristics of the clayey soils, and in confirming our visual classification of the soils. The results of the tests are plotted adjacent to the final soil boring logs, in the attached Appendix II, at the depth of the individually tested soil sample.

SOIL CONDITIONS

Delineation of soil strata, engineering properties, where applicable, and soil descriptions, are given in the final soil boring logs, contained in the attached Appendix II. The final logs were prepared by a geotechnical engineer, after review of the field logs, and examination and classification of the recovered soil samples, and analysis of laboratory test data. The stratification lines shown are used to indicate a transition from one soil type to another; however, they are in no way intended to designate a depth of exact geological change. Furthermore, the recommendations contained in this report, are based on the contents of the final logs and information obtained during the previous phase of subsurface exploration, performed in the second half of 1990. While the borings are representative of subsurface conditions at their respective locations and vertical reaches, local variations characteristic of the subsurface materials of the region may be encountered.

The subsurface soil profile, based on the data obtained from five (5) SPT borings performed during this phase of field exploration, and selected borings performed during the previous phase of subsurface exploration, is generally described below:

Figures 2 and 3 show a linear profile through borings TH-12[1]*, TH-23, TH-22 and TH-8*, and TH-15*, TH-21, TH-20 and TH-7*, respectively. Generally, subsurface conditions encountered within the proposed containment, and treatment plant building area, consist of four (4) major strata. The fill soils, approximately 30 feet thick, were placed at the time of the strip mining operation in the area. This fill stratum consists of cast overburden material, sand, silty sand, and clayey sand, randomly placed at the time of the strip mining operation. Phosphatic waste clay, found as "pockets" within the former low areas, and sand tailings fill area, were placed hydraulically after completion of strip mining. The density of the cast overburden material was found to range from very loose to medium dense, with the majority of it being in a very loose to loose state. Phosphatic waste clays were found to be very soft to soft. The sand tailings, placed hydraulically over the cast material and phosphatic waste clays, was found to be loose to medium dense, with a rather uniform density throughout the depth of each of the borings.

The second major stratum is natural sand to silty sand. The thickness of this stratum, based on information obtained from the SPT borings, ranges from 13 to 29 feet. The density of these natural soils range from very loose to very dense. Although some loose pockets were encountered, the stratum, in general, exhibits hardpan characteristics.

The third major soil stratum consists of clayey sand with a variable amount of phosphate. This soil stratum was found to be generally in a medium dense state, with individual areas ranging from loose to dense.

The bedrock/bedclay surface was encountered at 63 to 70 feet of depth, and consists of hard clayey silt with sand, to very dense clayey sand with phosphate.

GROUNDWATER CONDITIONS

The groundwater level readings were obtained in the borehole, upon completion of testing, where possible, and are plotted adjacent to the final logs. If a water table is not indicated, it does not necessarily mean that groundwater does not

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[1]*Borings performed during the previous subsurface exploration in September 1990.

exist within the vertical reach of the borehole. It must be noted that fluctuations in the groundwater level may occur, due to variations in rainfall and other environmental or physical factors, at the time measurements are made.

The measured borehole groundwater table level ranged from 11 to 15 feet below land surface at the time of the field exploration. We are presently in the dry season, therefore, the indicated groundwater table may be at, or near its seasonal low. The level of the surficial aquifer in this area is very complex, since perched water levels exist above the waste clays, and flow through the more permeable cast spoil area. We believe that the encountered water levels represent a perched water table.

EVALUATION AND RECOMMENDATIONS

Proposed Development

Based on information provided by SCS Engineers, it is our understanding that the proposed development will consist of the construction of a prefabricated metal building, with miscellaneous tanks, pumps, and blowers, a 45-foot diameter PACT unit (weighing 1,700 kips), a 70-foot diameter leachate storage tank (weighing 4,500 kips), and an enclosed tank containment area.

Foundation loads for the metal building are expected to be light to moderate. Individual columns, supporting up to 60 kips, were considered for our analysis. Moreover, we have assumed that the existing grades at this site, will remain essentially the same as during this exploration.

Soil Evaluation - Proposed Leachate Treatment Plant

Much of the plant area is underlain by a layer of medium dense sand tailings. The average thickness of this soil, within the containment area, was 16 feet. The west side of the containment area, however, lies over the sand tailings, underlain by a 5 to 7 foot-thick layer of phosphatic waste clay. Our analyses indicate a possibility of excessive differential settlement in case of placing the proposed construction over the existing soils. Therefore, in developing our recommendations, we concluded that removal of phosphatic clays by over-excavation and replacement with granular soils will be necessary.

Site Preparation Recommendations

The following site preparation recommendations were developed for the case of over-excavation of the phosphatic clay soils:

It is our opinion that the natural and fill soils encountered at the site, with the exception of buried phosphatic waste clay strata, are capable of supporting the anticipated loads on a conventionally designed, shallow foundation system, provided that surface re-working, phosphatic waste clay soil removal and replacement, and compaction are performed.

The existing fill surficial soils should be prepared prior to placement of engineered fill and foundation construction on the soils in accordance with the following site preparation recommendations. The recommended procedures should be covered in the project specifications, and completed prior to construction of the foundation system.

1. The proposed concrete containment and building area, plus a margin of 5 feet beyond the perimeter of the foundation system, should be cleared and grubbed of any vegetation, stumps, tree root systems, and sod. Organic topsoil should be excavated and removed. Strippings, debris, and organic soils should be disposed in accordance with the owner's instructions. Any hole larger than 3 feet in diameter, resulting from the removal of any tree, should be ramped, to aid in the compaction of the bottom and sides, with mechanical equipment, prior to filling;

2. Complete removal of the unsuitable phosphatic waste clay strata, and replacement with compacted granular fill in the buried phosphatic waste clay areas, will be necessary, in order to allow safe structure support, by a conventional shallow foundation system. The phosphatic waste clay material should be removed from beneath the entire containment and building areas, and any other area that will be adversely affected by differential settlement, caused by consolidation of the highly compressible phosphatic waste clay layer under the weight of new fill, and applied surface loads. Excavation limits should include a suitable margin beyond the perimeter of the foundation system, that will be dependent upon the excavation depth. As a minimum, the excavation margin should extend a horizontal distance of 1 foot for every 2 feet of vertical cut below the foundation, as measured from the outer edge of the footing bottom, whichever is greater.

   During construction, the side slopes of all the excavations performed in native soils should be maintained at an inclination no steeper than two horizontal to one vertical (2H : 1V). Vehicles should be maintained at least 5 feet away from the top of the excavation slope.

If site conditions do not permit such side slopes, the excavations should be performed using sheeting, shoring, and bracing for protection. In all instances, the excavation must be in compliance with the safety regulations outlined by the Department of Labor, Occupational Safety and Health Administration (OSHA).

The existing soil cover, consisting of sand tailings should be removed from above the phosphatic waste clay stratum, and stockpiled and reused as engineered fill, under the direction of the soils engineer or his representative;

Based on the groundwater table levels encountered during the field exploration, it should be assumed that dewatering will be required in any excavation, penetrating a depth of 10 feet below existing grade. This can be accomplished with a rim ditch and sump pump. The permeable soil strata should be considered as having a permeability coefficient of 5×10^{-3} cm/sec. Dewatering should be performed to a depth of 2 feet below the slope toe and 2 feet below the excavated bottom.

After clearing, grubbing and organic topsoil removal, the entire containment area, plus the margin as described above, should be excavated to the base of the phosphatic waste clay layer, as described above. The exposed soils within the construction area, plus the margin, should be compacted with a steel-wheeled, self-propelled, vibratory roller having a minimum drum centrifugal force of 25,000 pounds, to a depth of 12 inches below stripped grade, to a minimum of 98 percent of the Standard Proctor (ASTM D-698) maximum dry density. This density level should be measured by a qualified soils technician, using procedures described by ASTM D-2937 or an approved equal, prior to commencement of subsequent procedures. A minimum of six (6) overlapping passes of the self-propelled, vibratory roller shall be applied in the compaction process. In the event that initial rolling results in unstable yielding or pumping conditions, the soils engineer shall be contacted to determine the cause of the problem, and make recommendations for remediation. As a minimum, soft, yielding, excessively wet, or otherwise unsuitable material shall be cut, out and replaced with compacted clean sand. In the event that applied water does not penetrate sufficiently deep into natural soils, to act as a lubricant in the compaction process, it will be necessary to disk or otherwise break up the soils before and during application of water.

The steel-wheeled, vibratory roller should be operated at a forward speed not greater than one (1) mile per hour. Furthermore, this roller should not be operated within 25

feet of any existing structure. In the event that the equipment vibrations result in incipient instability of the excavation sides or base, a static method of site compaction shall be substituted, at no extra charge to the owner;

3. After steps 1 and 2 are completed, fill necessary to raise the grade to finished floor subgrade, or any interim working grade, should then be placed in 1-foot thick layers, moisture-conditioned, and compacted to a minimum of 98 percent of the Standard Proctor maximum dry density. All fill should consist of clean sand which is free of roots and debris.

4. Continuous wall footing trenches and individual footing pits should be excavated to footing line and bottom grade. Foundation soils should be moisture conditioned with water, and compacted with suitable mechanical equipment, to achieve the specified level of density to the required depth. Foundation bottom grade should be tested to confirm that a minimum density of 98 percent of the Standard Proctor maximum dry density, exists to a depth of 24 inches below footing bottom. If necessary, the bottom of the footing excavation shall be over-excavated, refilled, and re-compacted with mechanical equipment, to achieve the necessary minimum field density to the required depth;

5. Foundation backfill on sides of formed footings, and containment or building slab subgrade fill, should consist of clean sand, free of roots and debris, which is placed in 12-inch lifts, and compacted to 98 percent of the Standard Proctor maximum dry density;

6. Ardaman & Associates, Inc., Tampa office, should be engaged by the owner prior to site preparation to provide field observation of site preparation steps, compaction operations on natural and fill soils, and conduct field in-place density testing to confirm that the specified requirements are met.

Foundation Recommendations

For miscellaneous building foundations, as well as proposed reservoir mat foundations placed on the soils prepared as previously recommended, the foundations may be proportioned for a maximum net allowable soil bearing pressure of 2,500 pounds per square foot. We anticipate the maximum settlement to be on the order of 0.5 inches for the continuous wall footings, and 1 inch for the individual pad footings, supporting up to 60 kips. We also anticipate that the settlement would occur almost immediately as the loads are applied, due to the granular nature of the modified foundation soils.

Settlement of the storage tanks is estimated to be 1 inch at the center of the leachate tank, and 3/4 inch at the perimeter.

A soil cover of 18 inches, as measured from the bottom of the foundation system to finished grade, should be provided. Spread footings should be at least 2.5 feet wide. Also, for any continuous wall foundations, a minimum lateral dimension of 18 inches should be provided. The foundation should be designed for equal dead-load distribution, in accordance with Standard Building Code requirements.

Tank Containment Area

We recommend that the tank containment area be constructed as originally anticipated, with the concrete slab and concrete perimeter walls around the Leachate storage tank and PACT unit. The containment area should be constructed with water-tight, high quality joints.

Field Observations

Site preparation, including preparation of foundation bearing surfaces, including removal of unsuitable phosphatic waste clay and compaction of any structural fill, should be observed by a soils engineer or his representative from Ardaman & Associates, Inc., to verify that conditions are as anticipated in the design, and completed in accordance with the recommendations contained in this report.

Closure

The analyses and recommendations submitted in this report are based on the data obtained from five (5) SPT borings, performed during this phase, and nearby SPT borings performed during our initial subsurface exploration, at the locations indicated on the attached Figure 1. This report does not reflect any variation which may occur in-between the borings. The nature and extent of variations may not become evident, until during the course of construction. If variations then appear evident, it will be necessary for a re-evaluation of the recommendations of this report, to be made after performing on-site observations during the construction period, and noting the characteristics of any variations.

When the final design and specifications are completed, we would like the opportunity to review them, in order to determine whether changes in the original concept may have affected the validity of our recommendations, and whether these recommendations have been implemented in the design and specifications.

The recovered soil samples are available for examination at our Tampa office. Unless otherwise instructed in writing, the soil samples will be discarded 60 days after issuing this report.

It has been a pleasure assisting you with this phase of your project. If there are any questions, or when we may be of further assistance, please contact the undersigned at 813/654-2336.

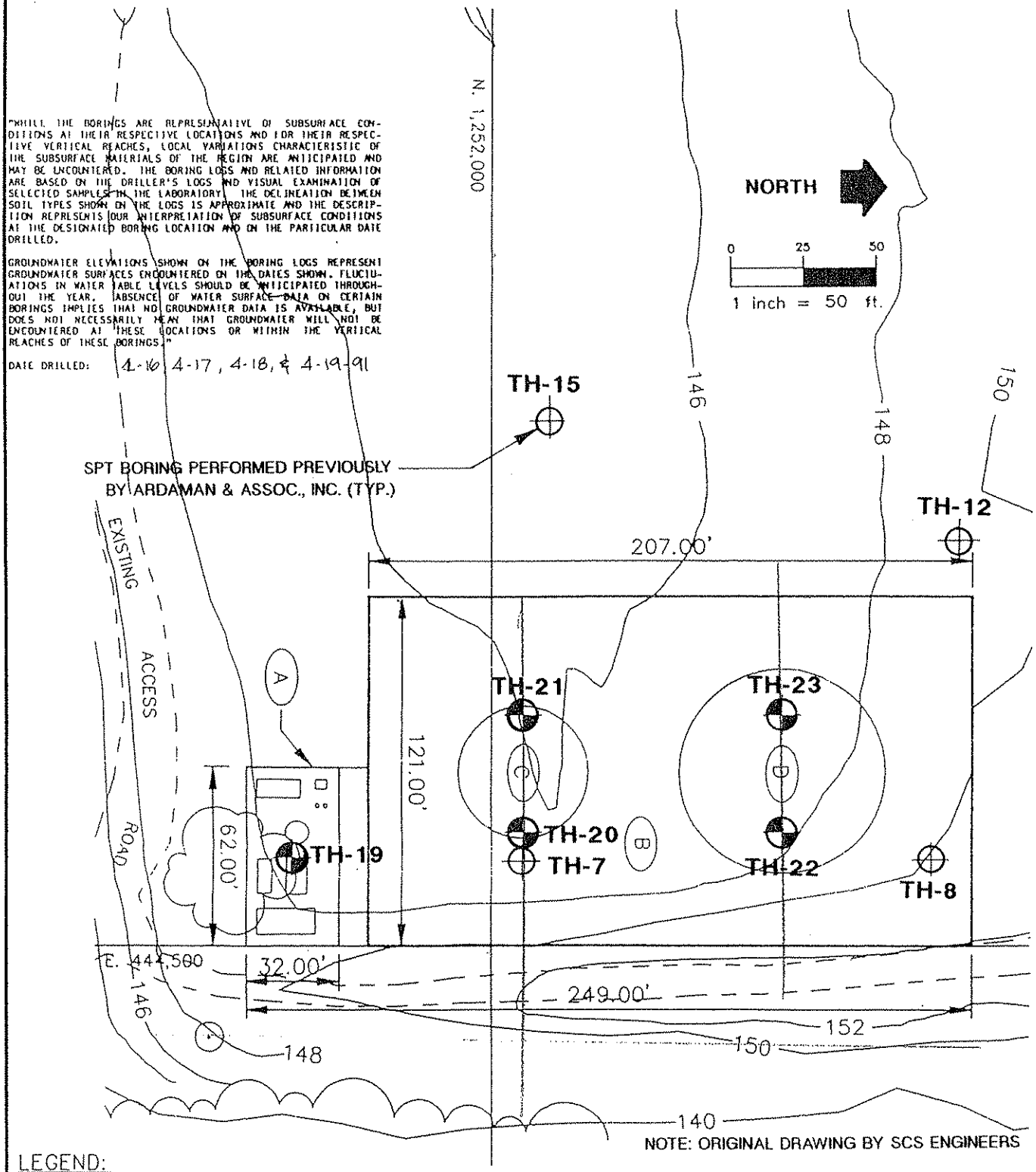
Very truly yours,
ARDAMAN & ASSOCIATES, INC.

Dusan Jovanovic
Project Engineer

Thomas J. Leto, P.E.
Principal
Florida Registration No. 12458
DJ/JAE/TJL:paw Enclosures
sse21/91-9629.geo

FIGURES

SOIL BORING LOCATION PLAN



LEGEND:

A– PREFABRICATED METAL BUILDING WITH MISC'S. TANKS PUMPS AND BLOWERS.

B– TANKS CONC. CONTAINMENT AREA WITH 4' HIGH CONC. WALLS.

C– 45' DIA. PACT UNIT FLOODED WEIGHT 1,700 KIPS

D– 70' DIA. LEACHATE STORAGE TANK FLOODED WEIGHT 4,500 KIPS

TH-19 **STANDARD PENETRATION TEST BORING (ASTM D-1586)**

Ardaman & Associates, Inc.
Consulting Engineers in Soils, Hydrogeology, Foundations, and Materials Testing

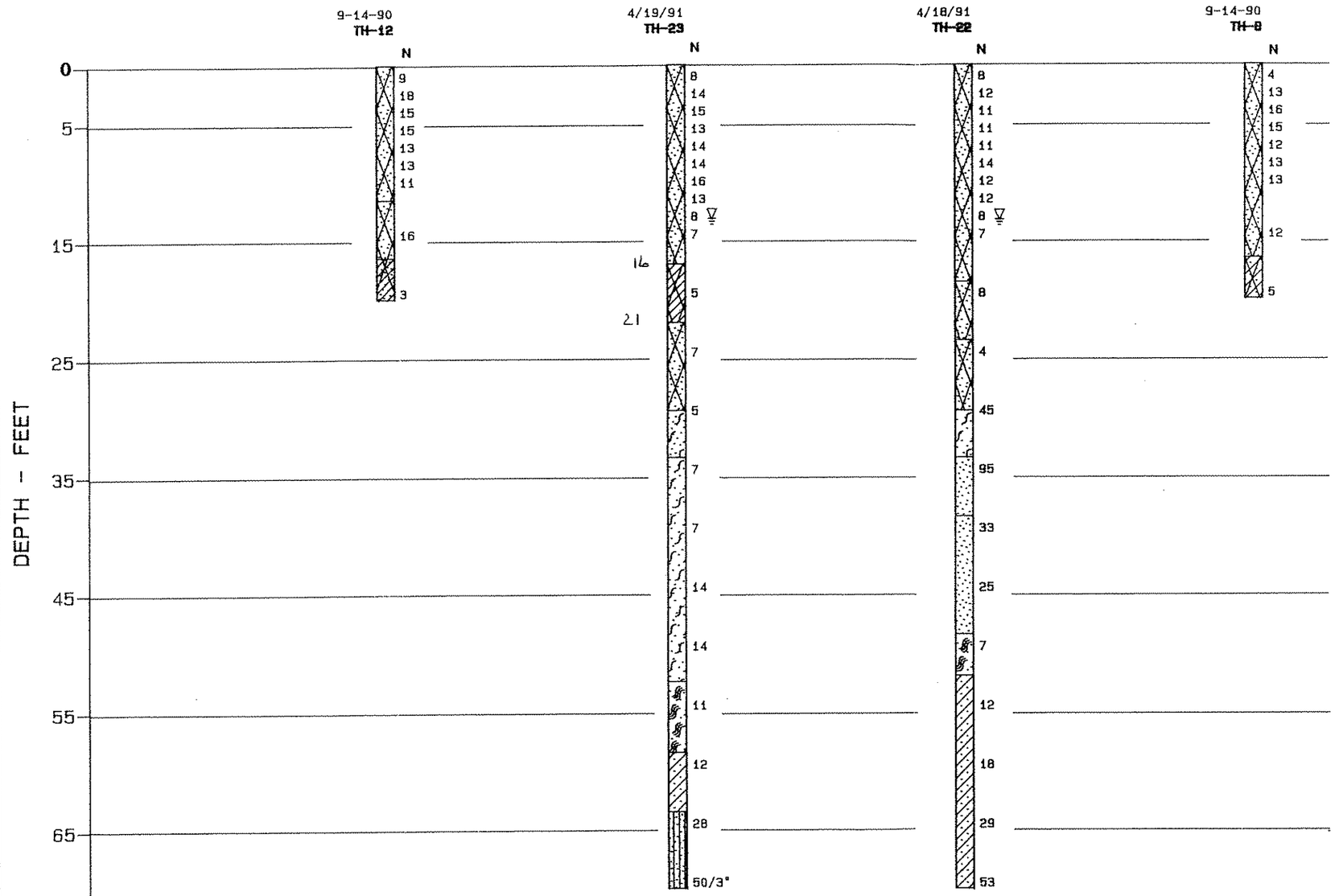
SOUTHEAST LANDFILL SITE
PROPOSED TREATMENT PLANT
COUNTY ROAD 672
HILLSBOROUGH COUNTY, FLORIDA

DRAWN BY: J.W.	CHECKED BY:	DATE: 4-29-91
FILE NO: 91-962	APPROVED BY:	

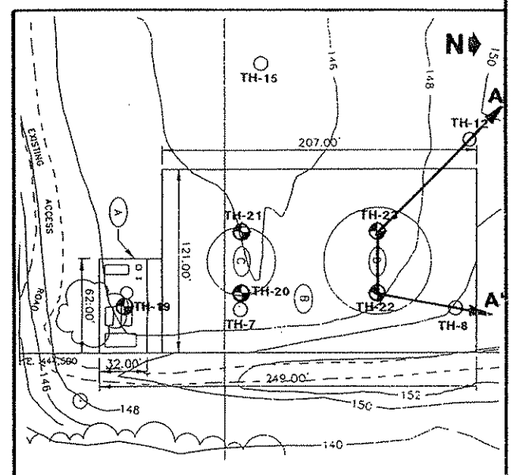
N39695

FIGURE 1

CROSS SECTION A-A'



HORIZONTAL DISTANCE NOT TO SCALE



CROSS SECTION CONFIGURATION DETAIL

NOT TO SCALE

LEGEND

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT

FOR SOIL IDENTIFICATION SEE LEGEND IN APPENDIX II

"WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATION AND ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR. ABSENCE OF WATER SURFACE DATA ON CERTAIN BORINGS IMPLIES THAT NO GROUNDWATER DATA IS AVAILABLE, BUT DOES NOT NECESSARILY MEAN THAT GROUNDWATER WILL NOT BE ENCOUNTERED AT THESE LOCATIONS OR WITHIN THE VERTICAL REACHES OF THESE BORINGS."

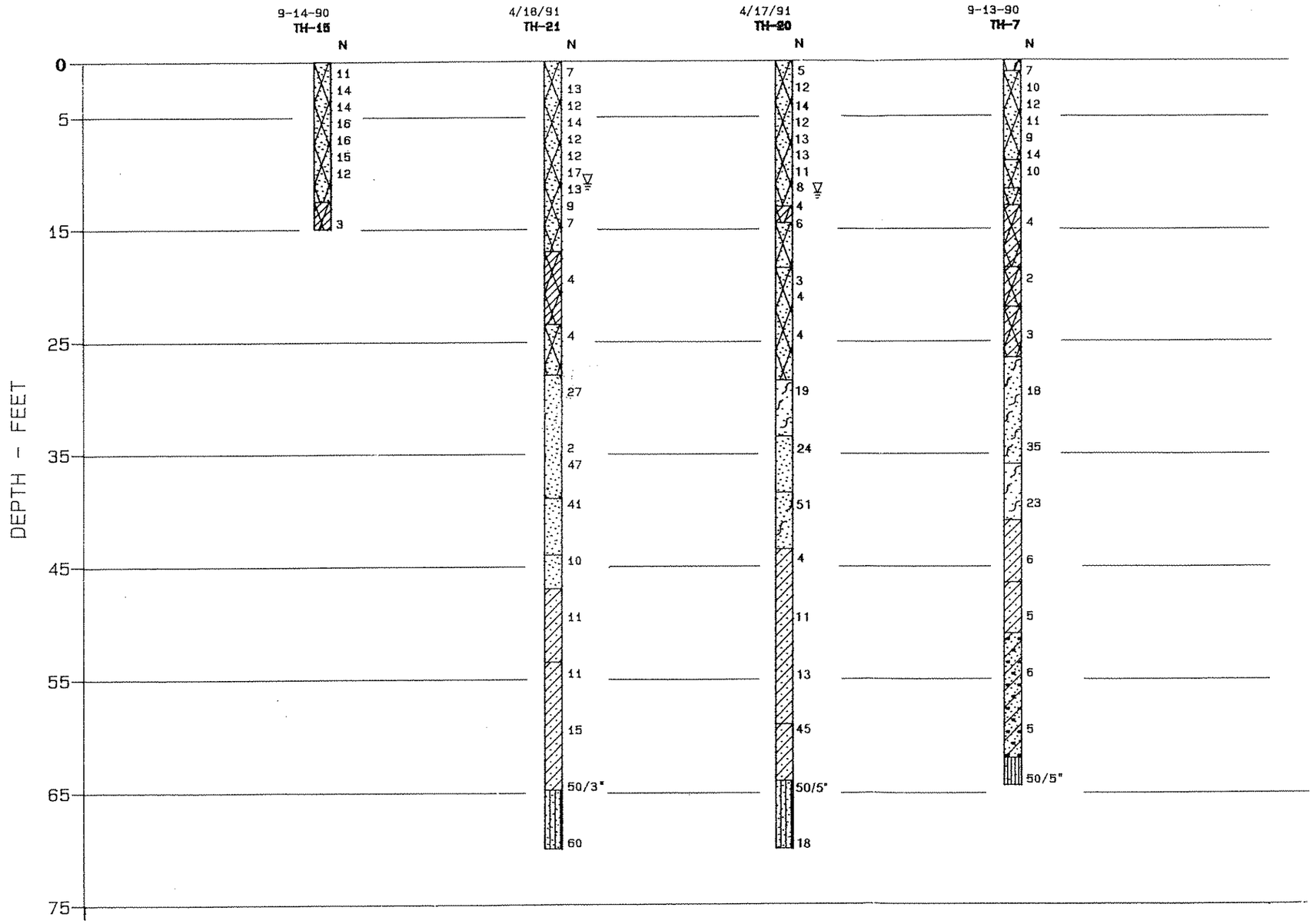
Ardaman & Associates, Inc.
Consulting Engineers in Soils, Hydrogeology, Foundations, and Materials Testing

SOUTHEAST LANDFILL SITE
PROPOSED TREATMENT PLANT
COUNTY ROAD 672
HILLSBOROUGH COUNTY, FLORIDA

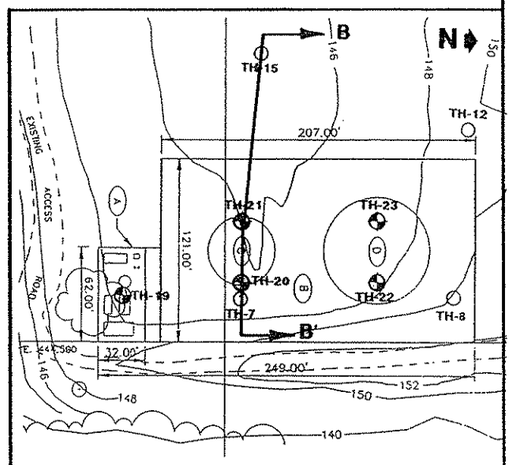
DRAWN BY	CHECKED BY	DATE
		5-7-91
FILE NO. 91-9029	APPROVED BY	

FIGURE 2

CROSS SECTION B-B'



HORIZONTAL DISTANCE NOT TO SCALE



CROSS SECTION CONFIGURATION DETAIL

NOT TO SCALE

LEGEND

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT

FOR SOIL IDENTIFICATION SEE LEGEND IN APPENDIX II

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SOUTHEAST LANDFILL SITE
PROPOSED TREATMENT PLANT
COUNTY ROAD 672
HILLSBOROUGH COUNTY, FLORIDA

DRAWN BY	CHECKED BY	DATE
J.W.		5-7-91
FILE NO. 91-9629	APPROVED BY	

FIGURE 3

LEGEND

PROJECT: Southeast Landfill

FILE NO.: 91-9629

GEOLOGICAL SYMBOLS


sp light fine SAND


sp dark fine SAND


sp-sm SAND with silt


sp SAND w/cemented SAND


sm silty SAND

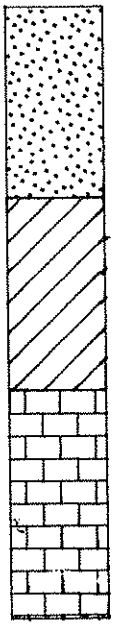

sc clayey SAND


ch phosphatic waste CLAY slimes


ch FAT CLAY with sand


mh clayey SILT with sand and phosphate

LOSS OF DRILLING FLUID



UNDISTURBED SHELBY SAMPLE

GROUND WATER LEVEL

BUCKET AUGER

ESTIMATED SEASONAL HIGH GWL

STANDARD PENETRATION TEST

CORE SIZE

CORE RECOVERY (%)

ENGINEERING CLASSIFICATION

CONSISTENCY

COHESIONLESS SOIL

VERY LOOSE	0–4 BLOWS PER FOOT
LOOSE	4–10 BLOWS PER FOOT
FIRM	10–30 BLOWS PER FOOT
DENSE	30–50 BLOWS PER FOOT
VERY DENSE	50–UP BLOWS PER FOOT

COHESIVE SOIL

VERY SOFT	0–2 BLOWS PER FOOT
SOFT	2–4 BLOWS PER FOOT
FIRM	4–8 BLOWS PER FOOT
STIFF	8–15 BLOWS PER FOOT
VERY STIFF	15–30 BLOWS PER FOOT
HARD	30–UP BLOWS PER FOOT

GRAIN SIZE IDENTIFICATION

BOULDERS	LARGER THAN 6"
COBBLES	2" TO 6"
GRAVEL	2mm TO 2"
SAND	0.074mm TO 2mm
SILT	0.002mm TO 0.074mm
CLAY	SMALLER THAN 0.002mm

Ardaman & Associates, Inc.
Consulting Engineers in Soil Mechanics, Foundations, and Material Testing

ARDAMAN & ASSOCIATES, INC.
105 N. FAULKENBURG ROAD, SUITE D
TAMPA, FLORIDA, 33619
(813) 654-2336

FINAL BORING LOG

PROJECT Southeast Landfill
CLIENT Hillsborough County - Solid Waste
FILE NO. 91-9629
COUNTY/CITY Hillsborough
STATE Florida

BORING NUMBER TH-19
BORING LOCATION As Per Figure 1
DATE STARTED 4/16/91
DATE COMPLETED 4/16/91
ELEVATION 149.1

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
0	1	3-4-3	7		sp	Dark brown SAND - fill					
	2	5-7-6	13		sp	Light grayish-brown SAND tailings - fill					
	3	7-6-5	11								
5	4	7-6-5	11								
	5	5-5-4	9		sc	Grayish to greenish-brown clayey SAND - fill					
	6	3-3-3	6								
10	7	3-3-5	8								
	8	5-4-4	8								
	9	6-3-4	7		sm	Light brown to brown silty SAND with clay and cemented sand nodules- fill ▽					
15	10	4-4-3	7		sc						
	11	2-2-3	5		sp	Dark brown SAND - fill					
	12	3-2-3	5								
	13	4-10-9	19								
20											
	14	2-1-2	3		sm	Light brown to brown silty SAND with clay and cemented sand nodules- fill					
25	15	0-0-2	2		sc						
	16	4-4-7	11		sm	dark brown silty SAND - fill					
	17	10-16-22	38		sp	brownish-gray SAND					
30											
					sp						
	18	21-14-15	29		sm	Reddish-brown SAND with silt to silty SAND					
35											
	19	21-25-25	50								
40											
	20	10-9-5	14		sm	Light yellowish to grayish-brown silty SAND with clay					
45					sc						
	21	1-2-3	5		sc	Greenish-gray clayey SAND with phosphate					
50	22	3-4-5	9								
	23	5-5-5	10								
55											

DRILLER/RIG W. Alderman/CME 45
BORING TYPE SPT
LENGTH/TYPE CASING None

WATER TABLE DEPTH:
1st 15'0" DATE TIME 4/16/91
2nd _____ DATE TIME _____

PROJECT Southeast Landfill

CLIENT Hillsborough County - Solid Waste

FILE NO. 91-9629

BORING NUMBER TH-19

COUNTY Hillsborough

STATE Florida

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
58											
	24	5-4-6	10		sc	Greenish-gray clayey SAND with phosphate					
63											
	25	6-7-27	34		mh	Grayish-brown clayey SILT with sand and phosphate					
68											
	26	22-50/6"	50/6"			Total Depth 70.0 feet					
73											
78											
83											
88											
93											
98											
103											
108											
113											

ARDAMAN & ASSOCIATES, INC.
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FINAL BORING LOG

SHEET 1 OF 2

PROJECT Southeast Landfill
CLIENT Hillsborough County - Solid Waste
FILE NO. 91-9629
COUNTY/CITY Hillsborough
STATE Florida

BORING NUMBER TH-20
BORING LOCATION As Per Figure 1
DATE STARTED 4/17/91
DATE COMPLETED 4/17/91
ELEVATION 149.1

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
0	1	1-2-3	5		sp	Light grayish-brown SAND tailings - fill					
	2	5-5-7	12								
	3	7-7-7	14								
5	4	6-6-6	12								
	5	7-6-7	13								
	6	6-6-7	13								
10	7	7-5-6	11								
	8	5-4-4	8								
	9	1-0-4	4		ch	Greenish to brownish-gray phosphatic waste CLAY (slimes)					
15	10	5-3-3	6		sp	Light grayish-brown SAND tailings - fill					
20	11	1-1-2	3		sc	Grayish to greenish-brown clayey SAND - fill					
	12	0-2-2	4								
25	13	1-2-2	4								
30	14	7-9-10	19		sp/sm	Reddish-brown SAND with silt to silty SAND					
35	15	19-14-10	24		sp	Light brown SAND					
40	16	45-31-30	61		sp/sm	Reddish-brown SAND with silt to silty SAND					
45	17	2-1-3	4		sc	Grayish-to greenish-brown clayey SAND					
50	18	4-5-6	11								
55	19	6-6-7	13								

DRILLER/RIG W. Alderman/CME 45
BORING TYPE SPT
LENGTH/TYPE CASING None

WATER TABLE DEPTH:
1st 11'10" DATE TIME 4/17/91
2nd _____ DATE TIME _____

SHEET 2 OF 2

PROJECT Southeast Landfill

BORING NUMBER TH-20

CLIENT Hillsborough County - Solid Waste

COUNTY Hillsborough

FILE NO. 91-9629

STATE Florida

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
58					sc	Grayish-to greenish-brown clayey SAND					
	20	6-19-26	45		sc	Greenish-gray clayey SAND with silt and phosphate					
63											
	21	50/5.5"	50/5"		mh	Grayish-brown clayey SILT with sand and phosphate					
68											
	22	10-10-8	18			Total Depth 70.0 feet					
73											
78											
83											
88											
93											
98											
103											
108											
113											

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FINAL BORING LOG

SHEET 1 OF 2

PROJECT Southeast Landfill
CLIENT Hillsborough County - Solid Waste
FILE NO. 91-9629
COUNTY/CITY Hillsborough
STATE Florida

BORING NUMBER TH-21
BORING LOCATION As Per Figure 1
DATE STARTED 4/18/91
DATE COMPLETED 4/18/91
ELEVATION 148.6

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
0	1	2-3-4	7		sp	Light grayish-brown SAND tailings - fill ▽					
	2	6-6-7	13								
	3	7-7-5	12								
5	4	7-7-7	14								
	5	6-6-6	12								
	6	5-6-6	12								
10	7	7-8-9	17								
	8	8-7-6	13								
	9	3-4-5	9								
15	10	5-3-4	7								
20	11	2-2-2	4		ch	Greenish to brownish-gray phosphatic waste CLAY (slimes) - fill	115	96.6			
25	12	1-2-2	4		sc	Grayish to greenish-brown clayey SAND - fill	26.5	23			
30	13	2-10-17	27		sp/sm	Reddish-brown SAND with silt to silty SAND					
35	14	0-0-2	2								
	15	8-17-30	47								
40	16	30-22-19	41		sp	Brown SAND - occasionally cemented					
45	17	2-5-5	10		sp	Light brown SAND					
50	18	4-5-6	11		sc	Grayish to greenish-brown clayey SAND					
55	19	4-5-6	11		sc	Greenish-gray clayey SAND with phosphate					

DRILLER/RIG W. Alderman/CME 45
BORING TYPE SPT
LENGTH/TYPE CASING None

WATER TABLE DEPTH:
1st 11'0 DATE TIME 4/18/91
2nd _____ DATE TIME _____

PROJECT Southeast Landfill

BORING NUMBER TH-21

CLIENT Hillsborough County - Solid Waste

COUNTY Hillsborough

FILE NO. 91-9629

STATE Florida

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
58											
	20	7-5-10	15		sc	Greenish-gray clayey SAND with phosphate					
63											
	21	17-17-_	50/3"		mh	Grayish-brown clayey SILT with sand and phosphate					
68											
	22	15-20-40	60			Total Depth 70.0 feet					
73											
78											
83											
88											
93											
98											
103											
108											
113											

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FINAL BORING LOG

PROJECT Southeast Landfill
CLIENT Hillsborough County - Solid Waste
FILE NO. 91-9629
COUNTY/CITY Hillsborough
STATE Florida

BORING NUMBER TH-22
BORING LOCATION As Per Figure 1
DATE STARTED 4/18/91
DATE COMPLETED 4/18/91
ELEVATION 150.7

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
0	1	1-3-5	8		sp	Light grayish-brown SAND tailings - fill					
	2	5-6-6	12								
	3	6-5-6	11								
5	4	6-5-6	11								
	5	6-5-6	11								
	6	8-7-7	14								
10	7	8-6-6	12								
	8	5-6-6	12								
	9	4-4-4	8								
15	10	4-3-4	7								
20	11	3-3-5	8		sm	Dark brown silty SAND with roots - fill					
25	12	2-2-2	4		sm/sc	Light brown to brown silty SAND with clay and cemented sand nodules - fill					
30	13	2-9-36	45		sp/sm	Reddish-brown SAND with silt to silty SAND					
35	14	9-40-56	95		sp	Brown SAND - occasionally cemented					
40	15	8-12-21	33		sp	Light brown SAND					
45	16	12-13-12	25								
50	17	2-2-5	7		sm/sc	Light yellowish to grayish-brown silty SAND with clay					
55	18	5-5-7	12		sc	Greenish-gray clayey SAND with silt and phosphate	43	32.7			

DRILLER/RIG W. Alderman/CME 45
BORING TYPE SPT
LENGTH/TYPE CASING None

WATER TABLE DEPTH:
1st 13'3" DATE TIME 4/18/91
2nd _____ DATE TIME _____

SHEET 2 OF 2

PROJECT Southeast Landfill

BORING NUMBER TH-22

CLIENT Hillsborough County - Solid Waste

COUNTY Hillsborough

FILE NO. 91-9629

STATE Florida

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
58	19	7-8-10	18		SC						
63	20	10-12-17	29			Greenish-gray clayey SAND with silt and phosphate					
68	21	8-7-46	53								
						Total Depth 70.0 feet					
73											
78											
83											
88											
93											
98											
103											
108											
113											

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FINAL BORING LOG

SHEET 1 OF 2

PROJECT Southeast Landfill
CLIENT Hillsborough County - Solid Waste
FILE NO. 91-9629
COUNTY/CITY Hillsborough
STATE Florida

BORING NUMBER TH-23
BORING LOCATION As Per Figure 1
DATE STARTED 4/19/91
DATE COMPLETED 4/19/91
ELEVATION 150.5

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS: LIQUID LIMIT	ATTERBURG LIMITS: PLAST. INDEX
0	1	2-3-5	8		sp	Light grayish-brown SAND tailings - fill					
	2	6-7-7	14								
	3	7-7-8	15								
5	4	6-6-7	13								
	5	6-7-7	14								
	6	7-7-7	14								
10	7	6-8-8	16								
	8	8-7-6	13								
	9	4-4-4	8								
15	10	4-3-4	7								
20	11	1-2-3	5		ch	Greenish to brownish-gray phosphatic waste CLAY (slimes) - fill	84.4	79			
25	12	3-3-4	7		sc	Grayish to greenish-brown clayey SAND - fill					
30	13	1-2-3	5		sp/sm	Dark grayish-brown SAND with silt					
35	14	3-3-4	7		sp/sm	Reddish-brown SAND with silt to silty SAND					
40	15	3-3-4	7								
45	16	10-8-6	14								
50	17	4-5-9	14								
55	18	4-5-6	11		sm/sc	Light yellowish to grayish-brown silty SAND with clay					

DRILLER/RIG W. Alderman/CME 45
BORING TYPE SPT
LENGTH/TYPE CASING None

WATER TABLE DEPTH:
1st 13'2" DATE TIME 4/19/91
2nd _____ DATE TIME _____

PROJECT Southeast Landfill

BORING NUMBER TH-23

CLIENT Hillsborough County - Solid Waste

COUNTY Hillsborough

FILE NO. 91-9629

STATE Florida

DEPTH IN FEET	SAMPLES SAMPLE NO.	BLOW COUNT	N-VALUE	GRAPHIC LOG	USCS CLASS	SOIL DESCRIPTION	NATURAL MOISTURE %	-200 WASH %	ORGANIC CONTENT %	ATTERBURG LIMITS LIQUID LIMIT	ATTERBURG LIMITS PLAST. INDEX
58											
	19	4-5-7	12		sm sc sc	Greenish-gray clayey SAND with phosphate					
63											
	20	6-12-16	28		mh	Grayish-brown clayey SILT with sand and phosphate					
68	21	50/3"	50/3"								
						Total Depth 70.0 feet					
73											
78											
83											
88											
93											
98											
103											
108											
113											

APPENDIX I

FIELD TESTING PROCEDURES

STANDARD PENETRATION TEST

The Standard Penetration Test is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A two-foot long, two-inch outside diameter, split-barrel ("spoon") sampler, attached to the end of drilling rods, is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each six inches of penetration is recorded. The sum of the blows required for penetration of the second and third six-inch increments of penetration, constitutes the test result or N-value. After the test, the sampler is extracted from the ground, and opened, to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties, allowing a conservative estimate of the behavior of soils under load.

The tests are usually performed at five-foot intervals. However, more frequent or continuous testing is done by our firm, through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings, and hold the fine grains in suspension. Usually, the circulating fluid, which is a bentonite drilling mud, also serves to keep the hole open below the water table, by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth, to keep the hole open, and/or to prevent the loss of circulating fluid.

Representative split-spoon samples from soils at every five feet of drilled depth and from every different stratum are brought to our laboratory in air-tight jars for further evaluation and testing, if necessary. Samples not used in testing are stored for at least sixty (60) days prior to being discarded. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed if necessary, and backfilled.