

**REPORT OF PRELIMINARY
GEOTECHNICAL EXPLORATION**

**SOLID WASTE AUTHORITY
NEW WTE FACILITY
7501 NORTH JOG ROAD
WEST PALM BEACH, FLORIDA**

FOR

**MALCOLM PIRNIE, INC.
1425 SOUTH ANDRES AVENUE
SECOND FLOOR
FORT LAUDERDALE, FLORIDA 33316**

PREPARED BY

**NUTTING ENGINEERS OF FLORIDA, INC.
1310 NEPTUNE DRIVE
BOYNTON BEACH, FLORIDA 33426**

ORDER NO. 13228.9

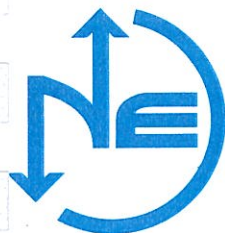
FEBRUARY 2008



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February 18, 2008

Ms. Leah K. Richter, P.E.
Malcolm Pirnie, Inc.
1425 South Andrews Avenue, 2nd Floor
Fort Lauderdale, Florida 33316
Phone: 954-761-3460 Fax: 954-761-7939

Subject: Report of Preliminary Geotechnical Exploration
Solid Waste Authority – New WTE Facility
7501 North Jog Road
West Palm Beach, Florida

Dear Ms. Richter:

Nutting Engineers of Florida, Inc. (NE), has performed a Preliminary Geotechnical Exploration for the proposed WTE Facility at the above referenced site in West Palm Beach, Florida. This exploration was performed in accordance with the written authorization to proceed provided by Malcolm Pirnie, Inc.. This preliminary evaluation was performed to develop preliminary information regarding subsurface conditions at specific test locations which along with proposed construction information provided was used to develop preliminary opinions regarding the remedial earthwork procedures for the proposed construction. This report presents our subsurface findings and preliminary general earthwork recommendations based upon the information examined at the time of this evaluation.

PROJECT INFORMATION

We understand that preliminary plans include the construction of a new WTE facility immediately north of the existing facility at the site. The new facility will consist of a main processing building ranging from two to three stories in height consisting of steel or concrete in construction. Beyond the main structure ancillary one to two story buildings, tank farms, and other processing structures similar to the existing facility will be constructed. Associated asphalt paved parking lots and roadways will also be developed.

Our office was provided a preliminary overlay of the new facility over the existing site features. The overlay indicates that the approximate southern two-thirds of the facility area will exist over existing roads, vacant land and open areas. The remaining approximate one-third portion to the north will be located over the existing lake feature at the site. Because of this part of the construction will require the backfilling of the existing lake. The depth and other information regarding the present state of the lake are currently not known.

Further discussions with Ms. Richter indicates that along the approximate southern edge of the new facility footprint elevations are approximately +17 NGVD with elevations decreasing up to the edge of the lake. We understand that the existing facility finish floor elevations are approximately +40 NGVD. The new facility is planned to have a finish floor elevation of approximately +45 NGVD. Based on this information greater than twenty-eight feet of fill will be needed to develop the construction area to final elevations. The type of fill to be used for the development (clean structural fill or recycled construction debris) is not known at this time. We note that the type of fill used affects the foundation recommendations that may be best implemented for the project.

Structural information is very preliminary at this time however based on discussions we understand that an augercast piling system may be used for support of the proposed main structures. Smaller ancillary type structures (one-story in size) may be constructed on shallow foundation systems, however additional information will be needed in order to better finalize foundation recommendations.

GENERAL SUBSURFACE CONDITIONS

Soil Survey Maps

As part of the geotechnical exploration, we have reviewed available Soil Conservation Service (SCS) survey maps for Palm Beach County. These SCS maps provide qualitative information about potential general shallow soil conditions in the project vicinity. This information was derived from approximately 6 ft. deep manual auger borings, aerial photo and surface feature interpretation at some point in the past (mid 1980's to early 1970's). The SCS data may or may not reflect actual current site conditions. A review of the Soil Survey for Palm Beach County revealed that at the time the survey was conducted, the soils at the site were described as Oldsmar sand. It is a nearly level, poorly drained, sandy soil that has a dark colored weakly cemented layer below a depth of 30 inches over a loamy layer. Mapped within the subject area were smaller pockets of Riviera, Basinger, and Jupiter Soils. We note that the soil surveys were typically penetrated to a depth of approximately six feet.

Geologic Survey Map Review

Review of the United States Geological Survey Map of this area indicates the following approximate geologic soil profile:

0'-30'	Sand with Some Proportions of Shell
30'-110'	Limestone and Sandstone with Sand
110'-160'	Sand

Note that the geologic conditions tend to vary considerably in the east-west direction and significantly less in the north-south direction.

Subsurface Exploration

NUTTING ENGINEERS OF FLORIDA, INC. was requested to perform two Standard Penetration Test (SPT) borings (ASTM D-1586) to depths of one-hundred twenty-five feet below land surface. The soil boring locations may have been altered by the geotechnical engineer through site access limitations, lithologic conditions and other considerations from that originally proposed. The locations of the test borings are indicated on the individual test boring reports presented in the Appendix of this report. The boring locations were identified in the field using approximate methods; namely, a measuring wheel and available surface controls. As such the soil boring locations should be considered to be approximate. We note that test boring B-1 was performed approximate five feet lower than test boring B-2. Please refer to the boring location plan in the appendix section of this report in order to better understand approximate test boring locations.

Test Boring Results

In general, the test borings revealed a surface layer of intermixed loose to medium dense sand with some organics or limestone fragments in the upper five to seven feet underlain by loose to medium dense brown to gray sand with some shell to depths of approximately sixty-two to sixty-eight feet below the ground surface. Medium hard to very hard gray limestone and sandstone with some intermixed sand lenses was encountered extending to depths varying from one-hundred five to one-hundred twenty feet. Below the rock formation dense gray sand with some limestone and shell fragments was encountered to a depth of one-hundred twenty-five feet, the maximum depth explored. Please see the enclosed soil classification sheet in the Appendix of this report for additional important information regarding these descriptions, the field evaluation and other related information.

We note that in test boring B-1 from twenty-six to twenty-nine feet some medium stiff brown sandy clay was encountered.

Note: Substantially different subsurface conditions may exist at intervening locations between soil borings. Buried debris may or may not be identified or adequately delineated by soil borings. Test pit excavation can provide more insight into such conditions and rock lithology if present. Such conditions may be revealed during site development activities (e.g. proof rolling, utility & foundation excavation activities) or other related activities. Should additional assurance be desired by the client, further subsurface investigation could be performed.

Laboratory Testing and Analysis

Representative soil samples were collected during the fieldwork and returned to the laboratory for testing. Specifically, natural water content test was performed on the brown sandy clay material encountered in test boring B-1 from twenty-six to twenty-nine feet below the ground surface. The natural water content was determined to be approximately 48 percent. This indicates that the soils are slightly compressible.

Groundwater Information

The immediate groundwater level was measured at the boring location at the time of drilling. The groundwater level was encountered at approximately five feet below the ground surface in test boring B-1, while the groundwater was not encountered up to ten feet below the ground surface in test boring B-2, when the drilling began using mud-rotary drilling fluid to maintain the test hole. Please review the paragraphs presented below regarding water table information and accuracy.

The immediate depth to groundwater measurements presented in this report may not provide a reliable indication of stabilized or more long term depth to groundwater at this site. Water table elevations can vary dramatically with time through rainfall, droughts, storm events, flood control activities, nearby surface water bodies, tidal activity, pumping and many other factors. For these reasons, this immediate depth to water data **should not** be relied upon alone for project design considerations.

Further information regarding stabilized groundwater elevations at the site could be developed upon specific request. Additional evaluation might include monitoring of piezometers, survey of the project area for evidence of current groundwater elevation influences such as wellfields, obvious construction dewatering, tidal activity, flood control canals and other surface water bodies.

PRELIMINARY ANALYSIS AND RECOMMENDATIONS

At this time limited information is available pertaining to the planned construction. Because of this and due to the limited test borings performed, this report is preliminary in nature. Provided below are some preliminary findings and recommendations that should be further discussed with all interested parties, in order to determine the best possible methodology for site and foundation development. Once this has been performed and additional testing has been performed a more detailed analysis and recommendations can be provided for the proposed construction.

Preliminary Shallow Foundation Analysis

The test borings performed for this project revealed that in general loose to medium dense sands exist in the upper thirty-five feet underlain by medium dense to dense sands to a depth of approximately sixty-two to sixty-eight feet. Medium hard to hard limestone/sandstone then exists within intermixed sands to the final depth of the test borings at one-hundred twenty-five feet. We note that a stratum of brown sandy clay was encountered at a depth of twenty-six to twenty-nine feet below the ground surface at test boring B-1. This would need to be further evaluated to determine if this condition is relatively small and isolated or may represent a lens within the eastern portion of the site which may cause some slope stability concerns.

Overall, if suitable structural fill is utilized for filling of the lake portion along with the remainder of the construction site area, the proposed structures may be constructed upon a shallow foundation system with an allowable soil bearing pressure of 4,000 pounds per square foot. Based on properly monitored fill placement and compaction testing of the building pad areas settlements would be on the order of approximately one-inch.

We note that a shallow foundation design for the site is dependent upon the condition of the existing lake and the material conditions at the lake bottom. If thick deposits of silt soils exist at the bottom of the lake, the portion of the construction lying over the existing lake may be subject to long-term settlements of the bottom silt layer. Also if poor quality fill is used (high organic/silt content) to develop the pad, a shallow foundation system would not be viable. Recycled construction debris may be a possible alternative for the lake fill, however the material type, size, and other factors would need to be carefully monitored to ensure proper filling for the building construction.

Preliminary Deep Foundation Analysis

If it is determined that a deep foundation system is the more preferred foundation for the site, the piles would need to be installed to a suitable bearing location below the ground surface that can overcome the group effect of settlement. Because information regarding foundation location, type of fill used, lake conditions, etc. is not known at this time, pile depths cannot be fully determined. We note that in general a 14-inch augercast pile installed to a suitable sand stratum can provide up to 70 ton allowable compressive capacity. If needed, a properly installed 16-inch diameter augercast pile can provide a 100 ton compressive capacity. Further discussions are needed in order to fully analyze a pile foundation system.

If vibration levels can be tolerated driven piles may also be used which can provide similar capacities, however their required depths may be less than an augercast pile system.

Additional Testing

Once further discussions are held, the construction location is more firmly established, and more structural information is provided, additional testing should be performed. The testing should consist of building specific location test borings and possibly lake exploration test borings. Depending upon soils encountered more additional laboratory testing can be performed along with more in depth analysis and recommendations for the planned project.

GENERAL INFORMATION

Our client for this geotechnical evaluation was:

Ms. Leah K. Richter, P.E.
Malcolm Pirnie, Inc.
1425 South Andrews Avenue, 2nd Floor
Fort Lauderdale, Florida 33316

The contents of this report are for the exclusive use of the client, the client's design & construction team and governmental authorities for this specific project exclusively. Information conveyed in this report shall not be used or relied upon by other parties or for other projects without the expressed written consent of Nutting Engineers of Florida, Inc. This report discusses geotechnical considerations for this site based upon observed conditions and our understanding of proposed construction for foundation support. Environmental issues including (but not limited to), soil and/or groundwater contamination, methane are beyond our scope of service for this project. As such, this report should not be used or relied upon for evaluation of environmental issues.

Benefit may be realized by the performance of exploratory test pits on the site to develop additional subsurface information. The client may wish to consider performance of test pits on this project to supplement information already developed.

Prior to initiating compaction operations, we recommend that representative samples of the structural fill material to be used and acceptable in-place soils be collected and tested to determine their compaction and classification characteristics. The maximum dry density, optimum moisture content, gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill and existing soils, and to determine if the fill material is acceptable.

If conditions are encountered which are not consistent with the findings presented in this report, or if proposed construction is moved from the location investigated, this office shall be notified immediately so that the condition or change can be evaluated and appropriate action taken.

Nutting Engineers of Florida, Inc. shall bear no liability for the implementation of recommended inspection and testing services as described in this report if implemented by others. Nutting has no ability to verify the completeness, accuracy or proper technique of such procedures if performed by others.

The vibratory compaction equipment may cause vibrations that could be felt by persons within nearby buildings and could potentially induce structural settlements. Additionally, preexisting settlements may exist within these structures that could be construed to have been caused or worsened by the proposed vibratory compaction after the fact. Pre- and post conditions surveys of these structures along with the vibration monitoring during vibratory compaction could be performed to better evaluate this concern. The contractor should exercise due care during the performance of the vibratory compaction work with due consideration of potential impacts on existing structures. If potential vibrations and impacts are not considered tolerable, then alternate foundation modification techniques should be considered.

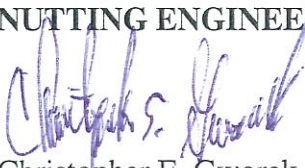
Nutting Engineers of Florida, Inc. shall bear no liability for the implementation of recommended inspection and testing services as described in this report if implemented by others. Nutting has no ability to verify the completeness, accuracy or proper technique of such procedures if performed by others.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with general accepted professional practice in the field of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

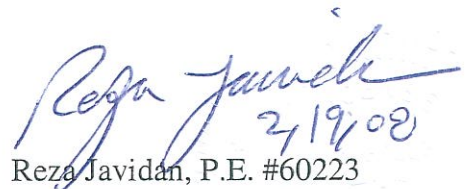
We appreciate the opportunity to provide these services for you. If we can be of any further assistance, or if you need additional information, please feel free to contact us.

Sincerely,

NUTTING ENGINEERS OF FLORIDA, INC.



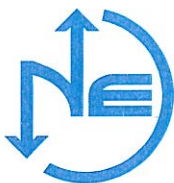
Christopher E. Gworek
Project Engineer



Reza Javidan, P.E. #60223
Senior Geotechnical Engineer

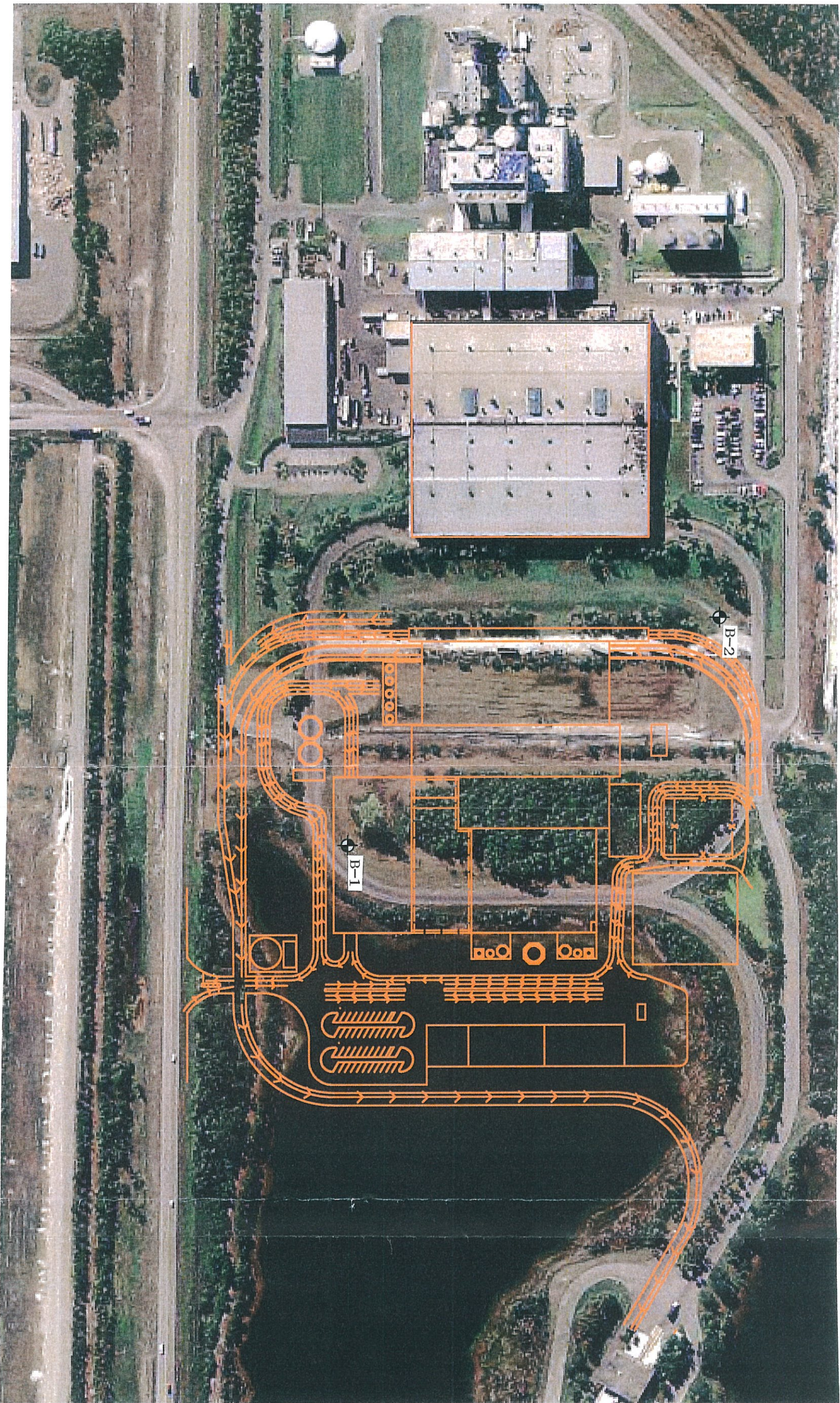
Attachments: Boring Location Plan
Test Boring Reports
Limitations of Liability
Soil Classification Criteria

REP MALCOLMPIRNIE SWA WTE FACILITY CEG



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NOT TO SCALE
PROJECT NO. 13228.9

MALCOLM PIRNIE, INC.
SOLID WASTE AUTHORITY NEW WTE FACILITY

7501 NORTH JOG ROAD
WEST PALM BEACH, FLORIDA

FIGURE 1



1310 Neptune Drive
Boynton Beach, 33426
Telephone: 561-736-4900
Fax: 561-737-9975

BORING NUMBER B-1

PAGE 1 OF 3

PROJECT NUMBER 13228.9

CLIENT Malcolm Pirnie, Inc.

PROJECT NAME Solid Waste Auth· New WTE Facility

PROJECT LOCATION 7501 North Jog Road, West Palm Beach, Florida

DATE STARTED 1/30/08 COMPLETED 1/31/08 SURFACE ELEVATION REFERENCE 2'-3' Below Road Crown

DRILLING METHOD Standard Penetration Boring

GROUND WATER LEVELS:

LOGGED BY D. Tyson CHECKED BY C. Gworek ☒ AT TIME OF DRILLING 5.0 ft

APPROXIMATE LOCATION OF BORING Approx. 145' S. and 35' W. of the Roadway

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL	MC	LL	
						20	40	60	80
						□ FINES CONTENT (%) □			
						20	40	60	80
0		Brown quartz fine SAND, trace organics	SS 1	1-2-2-2	4	▲			
		Gray quartz fine SAND, trace organics	SS 2	1-1-1-1	2	▲			
5	▽	Tan quartz fine SAND	SS 3	3-5-14-15	19		▲		
			SS 4	12-13-15-16	28			▲	
			SS 5	5-7-11-12	18		▲		
10									
			SS 6	4-6-8	10		▲		
15									
		Brown quartz fine SAND	SS 7	3-5-8	8		▲		
20									
			SS 8	4-4-4	8		▲		
25									
		Brown sandy CLAY, some root fibers							
30		Brown quartz fine SAND	SS 9	5-4-4	9		▲		
			SS 10	4-5-6	9		▲		
35									
			SS 11	6-5-5	11		▲		
40									
		Light gray quartz medium SAND and shell fragments	SS 12	6-7-10	13		▲		
45									

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Disclaimer Nutting Engineers of Florida, Inc. accepts no liability for the consequences of the independent interpretation of drilling logs by others.



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Fax: 561-737-9975

BORING NUMBER B-1

PAGE 2 OF 3

PROJECT NUMBER 13228.9

CLIENT Malcolm Pirnie, Inc.

PROJECT NAME Solid Waste Auth New WTE Facility

PROJECT LOCATION 7501 North Jog Road, West Palm Beach, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL MC LL			
						20	40	60	80
						□ FINES CONTENT (%) □			
						20	40	60	80
45		Light gray quartz medium SAND and shell fragments <i>(continued)</i>							
50			X SS 13	5-8-9	13		▲		
55			X SS 14	9-14-16	23			▲	
60			X SS 15	10-16-35	26			▲	
65			X SS 16	30-30-32	60				>>▲
70		Light gray SANDSTONE and sand	X SS 17	16-17-19	33			▲	
75			X SS 18	18-18-21	36			▲	
80			X SS 19	15-16-18	31			▲	
85		Gray SANDSTONE	X SS 20	50-50	100				>>▲
90		Light gray quartz very fine SAND, little sandstone	X SS 21	12-14-20	26			▲	
95			X SS 22	14-13-19	27			▲	

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BORING NUMBER B-1

PAGE 3 OF 3

PROJECT NUMBER 13228.9

CLIENT Malcolm Pirnie, Inc.

PROJECT NAME Solid Waste Auth. New WTE Facility

PROJECT LOCATION 7501 North Jog Road, West Palm Beach, Florida

TEST NUTTING BOREHOLE 13228.9 MALCOLM PIRNIE- SOLID WASTE AUTHORITY NEW WTE FACILITY.GPJ GINT US.GDT 2/20/08

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL	MC	LL	
						20	40	60	80
						☐ FINES CONTENT (%) ☐			
						20	40	60	80
100		Light gray quartz very fine SAND, little sandstone (continued)							
		Light gray quartz very fine SAND, some shell fragments	SS 23	15-17-21	32				▲
105		Gray SANDSTONE and gray quartz fine sand	SS 24	16-50	66				>>▲
		Light gray quartz very fine SAND, some shell fragments, little sandstone							
110			SS 25	15-19-21	34				▲
115			SS 26	20-30-24	50				
120			SS 27	19-23-28	42				▲
125			SS 28	50-37-35	87				>>▲
		Bottom of hole at 125.0 feet.							



1310 Neptune Drive
Boynton Beach, 33426
Telephone: 561-736-4900
Fax: 561-737-9975

BORING NUMBER B-2

PAGE 1 OF 3

PROJECT NUMBER 13228.9

CLIENT Malcolm Pirnie, Inc.

PROJECT NAME Solid Waste Auth- New WTE Facility

PROJECT LOCATION 7501 North Jog Road, West Palm Beach, Florida

DATE STARTED 1/29/08 COMPLETED 1/29/08

SURFACE ELEVATION REFERENCE 2' Below Road Crown

DRILLING METHOD Standard Penetration Boring

GROUND WATER LEVELS:

LOGGED BY D. Tyson

CHECKED BY C. Gworek

AT TIME OF DRILLING N/A

APPROXIMATE LOCATION OF BORING Approx. 150' W. and 130' N. of the NW Corner of Existing Bldg.

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL MC LL 20 40 60 80 ☐ FINES CONTENT (%) ☐			
0									
		Gray quartz fine SAND and limestone fragments	SS 1	3-5-7-9	12	▲			
		Tan quartz fine SAND, little limestone fragments	SS 2	10-11-15-20	26			▲	
5			SS 3	15-16-18-20	34				▲
		Hard LIMESTONE	SS 4	15-16-17-50	33				▲
		Tan quartz fine SAND and shell fragments	SS 5	7-9-11-8	20		▲		
10									
			SS 6	7-9-8	16		▲		
15									
		Tan quartz fine SAND	SS 7	8-5-9	13		▲		
20									
		Brown quartz fine SAND	SS 8	5-5-7	10		▲		
25									
			SS 9	6-7-8	13		▲		
30									
		Tan quartz fine SAND	SS 10	5-7-8	12		▲		
35									
			SS 11	10-14-16	24			▲	
40									
			SS 12	9-11-12	20			▲	
45									

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BORING NUMBER B-2

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CLIENT Malcolm Pirnie, Inc.

PROJECT NAME Solid Waste Auth. New WTE Facility

PROJECT LOCATION 7501 North Jog Road, West Palm Beach, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL MC LL			
						20	40	60	80
45						□ FINES CONTENT (%) □			
						20	40	60	80
		Tan quartz fine SAND (continued)							
50		Gray quartz very fine SAND and shell fragments	SS 13	9-7-5	16		▲		
55			SS 14	10-10-10	20		▲		
60		Light gray quartz fine SAND, some gray limestone fragments	SS 15	14-16-16	30			▲	
65		Light gray LIMESTONE and sand	SS 16	21-30-20	51				>>▲
70			SS 17	7-10-7	17		▲		
75			SS 18	10-14-16	24			▲	
80		Hard gray LIMESTONE	SS 19	50-50	100				>>▲
85			SS 20	50-50	100				>>▲
90		Light gray quartz very fine SAND, some gray limestone fragments	SS 21	12-13-14	25			▲	
95		Gray quartz very fine slightly silty SAND, some gray sandstone	SS 22	24-23-20	47				▲

(Continued Next Page)

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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	Blows	N-Value	▲ SPT N VALUE ▲			
						10	20	30	40
						PL	MC	LL	
						20	40	60	80
						☐ FINES CONTENT (%) ☐			
						20	40	60	80
100		Gray quartz very fine slightly silty SAND, some gray sandstone <i>(continued)</i>							
		Gray SANDSTONE and light gray quartz medium sand	X SS 23	19-21-20	40				▲
105			X SS 24	30-24-27	54				>>▲
110			X SS 25	44-41-36	85				>>▲
115			X SS 26	20-21-24	41				▲
120		Light gray quartz very fine SAND, little gray limestone fragments	X SS 27	19-22-26	41				▲
125			X SS 28	24-32-36	56				>>▲
		Bottom of hole at 125.0 feet.							

LIMITATIONS OF LIABILITY

WARRANTY

We warrant that the services performed by Nutting Engineers of Florida, Inc. are conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions. ***No other warranties, expressed or implied, are made.*** While the services of Nutting Engineers of Florida, Inc. are a valuable and integral part of the design and construction teams, we do not warrant, guarantee or insure the quality, completeness, or satisfactory performance of construction plans and specifications which we have not prepared, nor the ultimate performance of building site materials.

SUBSURFACE EXPLORATION

Subsurface exploration is normally accomplished by test borings; test pits are sometimes employed. The method of determining the boring location and the surface elevation at the boring is noted in the report. This information is represented on a drawing or on the boring log. The location and elevation of the borings should be considered accurate only to the degree inherent with the method used.

The soil boring log includes sampling information, description of the materials recovered, approximate depths of boundaries between soil and rock strata and groundwater data. The log represents conditions specifically at the location where the boring was made. The boundaries between different soil strata are indicated at specific depths; however, these depths are in fact approximate and dependent upon the frequency of sampling. The transition between soil strata is often gradual. Water level readings are made at the time and under conditions stated on the boring logs. Water levels change with time, precipitation, canal level, local well drawdown and other factors.

LABORATORY AND FIELD TESTS

Tests are performed in accordance with specific ASTM Standards unless otherwise indicated. All criteria included in a given ASTM Standard are not always required and performed. Each test report indicates the measurement and determination actually made.

ANALYSIS AND RECOMMENDATIONS

The geotechnical report is prepared primarily to aid in the design of site work and structural foundations. Although the information in the report is expected to be sufficient for these purposes, it is not intended to determine the cost of construction or to stand alone as a construction specification.

Report recommendations are based primarily on data from test borings made at the locations shown on the test boring reports. Soil variations may exist between borings and may not become evident until construction. If variations are then noted, the geotechnical engineer should be contacted so that field conditions can be examined and recommendations revised if necessary.

The geotechnical report states our understanding as to the location, dimensions and structural features proposed for the site. ***Any significant changes in the nature, design, or location of the site improvements must be communicated to the geotechnical engineer*** so that the geotechnical analysis, conclusions, and recommendations can be appropriately adjusted.

CONSTRUCTION OBSERVATION

Construction observation and testing is an important element of geotechnical services. The geotechnical engineer's field representative (G.E.F.R.) is the "owner's representative" observing the work of the contractor, performing tests and reporting data from such tests and observations. ***The geotechnical engineer's field representative does not direct the contractor's construction means, methods, operations or personnel.*** The G.E.F.R. does not interfere with the relationship between the owner and the contractor and, except as an observer, does not become a substitute owner on site. The G.E.F.R. is responsible for his/her safety, but has no responsibility for the safety of other personnel at the site. The G.E.F.R. is an important member of a team whose responsibility is to observe and test the work being done and report to the owner whether that work is being carried out in general conformance with the plans and specifications.

SOIL CLASSIFICATION CRITERIA

RELATIVE DENSITY SAND

SPT N-VALUE (blows/ft.)	RELATIVE DENSITY
0 - 4	Very Loose
5 - 10	Loose
11 - 29	Medium
30 - 49	Dense
>50	Very Dense
100/6"	Refusal

SHEAR STRENGTH CLAY

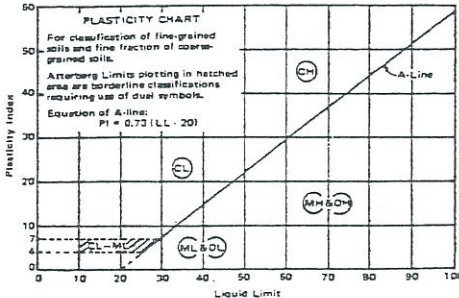
SPT N-Value (blows/ft.)	UNCONFINED COMP. STRENGTH (tons/ft.2)	CONSISTENCY
<2	<0.25	Very soft
2 - 4	0.25-0.50	Soft
5 - 8	0.50-1.00	Medium
9 - 15	1.00-2.00	Stiff
16 - 30	2.00-4.00	Very Stiff
>30	>4.00	Hard

PARTICLE SIZE

Boulder	>12 in.
Cobble	3 to 12 in.
Gravel	4.76mm to 3 in.
Sand	0.074mm to 4.76mm
Silt	0.005mm to 0.074mm
Clay	<0.005mm

DESCRIPTION MODIFIERS

0 - 5%	Slight trace
6 - 10%	Trace
11 - 20%	Little
21 - 35%	Some
>35%	And

Major Divisions			Group Symbols	Typical Names	Classification Criteria		
Coarse-Grained Soils More than 50% retained on No. 200 sieve*	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 6% pass No. 200 sieve Less than 12% pass No. 200 sieve 5% to 12% pass No. 200 sieve Borderline classification requiring use of dual symbols	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7	
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		Sands with Fines	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7	
		Fine-Grained Soils 50% or more passes No. 200 sieve*	Silt and Clays Liquid limit 50% or less	ML		Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
				CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
OL	Organic silts and organic silty clays of low plasticity						
Silt and Clays Liquid limit greater than 50%	MH		Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts				
	CH		Inorganic clays of high plasticity, fat clays				
	OH		Organic clays of medium to high plasticity				
	Highly Organic Soils		PT	Peat, muck, and other highly organic soils	Visual-Manual Identification, see ASTM Designation D 2488.		

*Based on the material passing the 3-in. (75-mm.) sieve.