CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
416 W. Congress St., Suite 100
Tucson, Arizona 85701
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

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THE ZONIA CO

BORROW MATERIALS,

REPORT w/ VARIOUS

REPORTS

6/1/91

OWQ.A.II 4.0 **BORROW MATERIAL**

OWP.1.

OWP.1.a 4.1 **Sampling Program**

On February 20, 1991, Dames & Moore conducted an additional field investigation to evaluate the presence of clayey borrow material on the site. A total of eight test pits were excavated using a backhoe, and bulk samples of the excavated material were collected for subsequent laboratory testing. Two additional borrow areas were investigated in the southern portion of the site during the field program. Test pits were excavated in the previously identified borrow areas to gather additional data on the characteristics of the borrow material. Locations of the borrow areas are shown on the Permit and Operations Drawing 2. Based on Dames & Moore's borrow investigations, the borrow areas shown on the Permit and Operations Drawing 2 contain the following estimated quantity of available borrow material:

Table 4.1

BORROW VOLUME ESTIMATES

Location (Coordinates)	Test Pit ID	Surface Area (SF)	Estimated Volume (CY)
SOUTHERN BORROW AREAS			
7200N, 9300E	T-1, T-1a, T-12, T-13	109,000	18,200*
8100N, 9900E	T-2	89,000	29,000
6900N, 7300E	T-3	45,000	13,400*
7800N, 7900E	T-5	57,000	27,400*
7500N, 8300E	S-1, S-2	34,500	32,000*
7800N, 8600E	S-3	21,000	19,400*
7600N, 8700E	T-11	80,300	39,400*
9400N, 7200E	T-14, T-15	153,300	96,900
NORTHERN BORROW AREA			
11200N, 10500E	T-8, T-8a, T-10	245,300	87,700*
11700N, 10700E	T-9	321,500	113,500
TOTAL CLAYEY BORROW			**237,500**
TOTAL GRANULAR BORROW			**239,400**
TOTAL BORROW			**476,900**

*Borrow material exhibits clayey characteristics adequate for use in the landfill liner based upon laboratory testing.

Subsequent laboratory analysis on the borrow sources evaluated the use of the borrow material (i.e. liner, cap, or intermediate and daily cover). No field testing, such as field permeability tests, were performed during the borrow investigations.

OWP.2.f The designated borrow areas for the Zonia Landfill and their estimated volumes were chosen based on field and laboratory tests. The actual amount of excavation to be completed will be predicated on the quantity and quality of material encountered in the field. Establishing final contours for the borrow areas is therefore not possible at this time. Final contours of the borrow areas will be included in the as-builts.

OWQ.A.II.6 The correct coordinates for test pit T-5 are 7800N and 7900E.

OWP 1.b&c **4.2 Laboratory Testing**

On January 15, 1991, Dames & Moore submitted samples of soil collected on November 9, 1989 for further laboratory testing. Laboratory testing was performed by Western Technologies, Inc. of Phoenix, Arizona. Laboratory test procedures were consistent with procedures previously employed. Laboratory test results are provided in Appendix B.

Upon completion of the borrow investigation conducted on February 20, 1991, a laboratory testing program was implemented to address ADEQ's letters to Dames & Moore dated February 5 and February 20, 1991. The laboratory testing program included grain size analyses, Atterberg limits tests, moisture-density relationship tests, and permeability tests. Moisture-density relationships were conducted utilizing the ASTM D-698 Method C or D testing procedures rather than Method A previously used. Permeability tests were performed with 4-inch diameter testing apparatus. Dames & Moore believes that tests completed in the larger testing apparatus are more representative of the expected in-place liner material. Laboratory test results are provided in Appendix B.

Samples of potential clayey borrow material collected in a given area were combined prior to laboratory testing to best represent conditions in the field during excavation. Combining the samples eliminated any potential bias in the selection of borrow material for permeability testing.

OWQ.A.II.4 Provided as Appendix C is EM 1110-2-1906, Permeability Tests, Appendix VII, Department of the Army, requested in ADEQ's letter to Dames & Moore dated February 5, 1991.

4.3 Borrow Material Uses

Based upon Dames & Moore's field investigation and laboratory testing programs, seven of the ten borrow areas investigated appear to contain clayey materials. These areas are shown on Permit and Operations Drawing 2.

Two borrow areas in the southern portion of the site (identified by test pits T-5, T-11, S-1, S-2 and S-3) contain a reddish-brown to light brown, gravelly, clayey sand. These borrow materials exhibit a permeability of approximately 2×10^{-5} cm/sec when compacted to 90 percent of the maximum dry density as determined by ASTM D-698. This material may be utilized for the bottom liner, sidewall liner, and final cap.

One borrow area in the southern portion of the site (identified by test pits T-1, T-1a, T-12 and T-13) and one borrow area in the northern portion of the site (identified by test pits T-8, T-8a and T-10) contain reddish-brown to tan gravelly clayey sands. These borrow materials exhibit a permeability of approximately 3×10^{-6} cm/sec when compacted to 90 percent of the maximum dry density as determined by ASTM D-698. This material may be utilized for the bottom soil liner, sidewall liner, and final cap.

The remaining borrow areas contain gravelly silty sands. This material may be utilized for intermediate and daily cover.

OWQ.A.II

5.0 LINER DESIGN

5.1 Field Preparation

Clayey borrow material will be processed through screens having a maximum 3/4-inch opening prior to placement for the bottom liner, sidewall liner, and final cap. Processed material shall be representative of material used in laboratory permeability determination. Gradation analyses performed on the clayey borrow material indicate that processing the material through a 3/4-inch screen may reduce the total borrow source by 20% to 30%. The oversized material removed may be utilized as riprap in the diversion channels or processed for use as drainage material in the collection channels and leachate basins depending on its size and gradation.

The clayey borrow material excavated from the various borrow areas will require processing prior to field compaction in order to disaggregate (or break up clods) the material. Processing of this material may best be accomplished utilizing a CAT SS-250 road stabilizer or similar type of earthwork equipment. This type of earthwork equipment will crush the oversized material (i.e. clay clods and rock) to grain sizes more suitable for construction of the liners and final cap. The processed material will be representative of the material used in laboratory permeability determination. The excavated borrow material should be spread in

loose lifts not exceeding ten inches followed by a sufficient number of passes with the CAT SS-250. The number of passes to achieve the desired gradation will depend on the borrow material, and should be determined in the field based upon visual observation and field screening. The processed material may then be moisture conditioned and compacted to achieve the specified permeability as discussed in the following section. Any over-sized rock remaining after processing should be hand picked prior to compaction. This over-sized material may be utilized as riprap in the diversion channels or further processed for use as drainage material.

OWQ.A.II.5 **5.2 Field Placement**

Quality assurance of the bottom liner, sidewall liner and final cap shall be based upon established criteria for water contents and dry unit weights, rather than the water content-relative compaction criteria commonly used today. This recommended approach is based upon defining water content-dry unit weight requirements for a broad, but representative, range of compactive energy, and relating those requirements to permeability and other relevant factors. The following excerpt from the paper entitled "Water Content - Density Criteria for Compacted Soil Liners" in the Journal of Geotechnical Engineering (ASCE), explains the recommended approach:

THE RECOMMENDED PROCEDURE

Basis

Rational design of compacted soil liners should be based upon test data developed for each particular soil. Field test data would be better than laboratory data, but the cost of determining compaction criteria in the field through a series of test sections would almost always be prohibitive. For the design engineer, laboratory tests utilizing the most appropriate method of compaction (to match field compaction as closely as possible) are recommended. However, laboratory-scale compaction can never perfectly duplicate the repeated passage of heavy compaction equipment over a lift of soil in the field. Even if the method of laboratory compaction could be made to match field compaction, the compactive effort in the field is impossible to determine in advance and will undoubtedly vary from point to point. Given these facts, one is hard pressed to justify a single, arbitrary compactive effort for use in laboratory testing.

A logical approach is to select several compactive efforts in the laboratory that span the range of compactive effort anticipated in the field so that the water content/dry unit weight criterion applies to any reasonable compactive effort. This approach is similar to the one described by Mundell and Bailey (1985).

For most earthwork projects, modified Proctor (ASTM D1557) effort represents a reasonable upper limit on the compactive effort likely to be delivered to the soil in the field. Standard-Proctor effort (ASTM D698) likely represents a medium compactive effort. It is conceivable that on many projects, soil in at least a few locations will be compacted with an effort less than that of standard Proctor. The authors have recently worked with an altered standard Proctor procedure, called "reduced Proctor," in which the standard Proctor procedures are followed except that

only 15 drops of the hammer per lift are used instead of the usual 25 drops. The "reduced Proctor" procedure is the same as the "15-blow compaction test" described by the U.S. Army Corps of Engineers (1970, p. VI-13). The reduced Proctor effort is expected to correspond to a reasonable minimum level of compactive energy for a typical soil liner or cover. Other compaction methods, e.g., kneading compaction, could be used. The key is to span the range of compactive effort expected in the field with the laboratory compaction procedures.

Methodology

The recommended procedure involves establishing water content-dry density ranges needed to achieve the required hydraulic conductivity and then modifying these ranges to account for other factors besides k. The approach that is recommended is as follows.

1. Compact soil in the laboratory with modified, standard, and reduced Proctor compaction procedures to develop compaction curves as shown in Fig. 7a. Approximately 5 to 6 different specimens should be compacted with each effort. Other compaction procedures can be used if they better simulate field compaction and span the range of compactive effort expected in the field.

2. The compacted soils should be permeated to determine the hydraulic conductivity of each compacted specimen. Care should be taken to make sure that permeation procedures are correct, with important details such as degree of saturation and effective confining stress carefully selected. Guidance on these details may be found in Daniel et al. (1984, 1985) and Carpenter and Stephenson (1986). The measured hydraulic conductivities should be plotted as a function of molding water content as shown in Fig. 7b.

3. As shown in Fig. 7c, the dry unit weight-water content points should be replotted with different symbols used to represent compacted specimens that had hydraulic conductivities greater than the maximum acceptable value and specimens with hydraulic conductivities less than or equal to the maximum acceptable value. The "Acceptable Zone" should be drawn to encompass the data points representing test results meeting or exceeding the design criteria. Some judgment may be necessary in constructing the Acceptable Zone.

4. The "Acceptable Zone" should be modified (Fig. 7d) based on other considerations, e.g. shear strength, interfacial friction with an overlying geomembrane, shrink/swell considerations, concern over cracking when settlement occurs, concern for constructability, or local practices. For example, if shear strength is of concern, a limit on the water content and/or dry unit weight should be specified to ensure that excessively weak soils are not produced. Figure 8 shows how one might overlap acceptable zones defined from hydraulic conductivity and shear strength considerations to define a single Acceptable Zone. The same procedure can be applied to other factors, e.g. shrink/swell potential, that are relevant for any particular project.

This paper is included as Appendix D for your review, also included in Appendix D is EM 1110-2-1906, Compaction Tests, Appendix VI, Department of the Army. The 15-blow compaction test as outlined in EM 1110-2-1906, Appendix VI

stipulates that the 6-inch mold not be used. Since the clayey borrow materials contain a grain size distribution requiring use of the ASTM D-698 Method C or D testing procedures, a reduced compaction test using the 6-inch mold will be performed which represents a lower compactive effort. This reduced Proctor will correspond to a reasonable minimum level of compactive energy for the borrow material available, thus establishing a range of compactive effort expected in the field.

The recommended approach has advantages for both the QA personnel and earthwork contractor in the field. The advantages to both parties are as follows:

1. Compliance with the project specifications are easy to check, and therefore a pass/fail decision can be made immediately.

2. Construction operations may be accelerated as the contractor is not constrained to a minimum relative compaction or extremely narrow range of water content.

3. Soils which could not fall within the Acceptable Zone would not be accepted under the established criteria. Therefore, the method ensures that unsuitable soils not be used in the liner construction.

4. The Acceptable Zone for each borrow material may be easily modified for each component of the liner system (i.e. bottom, sidewall, and final cap) to account for the potential for desiccation, resistance to chemical attack, shear strength, ability to deform without cracking if settlement occurs, etc.

OWP.3

6.0 INTERMEDIATE COVER

Based on the HELP model simulation, Case E (Section 10.2) there will be 0.0000 inches of total average annual percolation from the base of the liner during the 24 years Phase II is in operation. Case E describes Phase II-A at completion with the addition of a flat intermediate cover. However the proposed intermediate cover is planned to have a surface slope of 0.5 percent away from the working face area. This should provide for general drainage during the more severe events. It is anticipated that there may be some areas on the intermediate cover where (due to differential settlement, for instance) some shallow ponding may occur. Shallow ponded water on the bottom of the mine pit evaporates under existing conditions in a matter of days, depending on the ponded depth. This fact and the HELP modeling results discussed in Section 10.2 indicate that no rainfall will move through the intermediate cover.

The intermediate cover will consist of an 18-inch compacted soil layer overlain with a 6-inch erosion cover (see Figure 4).

WESTERN TECHNOLOGIES INC.

P.O. Box 21387 85036
3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-3737 • 470-1341 FAX

Client: DAMES & MOORE
ATTN: TONY MAZZEI
4400 EAST BROADWAY, SUITE 703
TUCSON AZ 85711

Job No.
Inv/Lab No. 22410040
Report Date: 01-18-91
Reviewed by: M. Kuntzleman

Project Zonia

Location Tucson, ARizona

Material Silty Sand and Gravel Sampled By DM/V. Read Date 11-09-89

Source Test Pits/Borrow Areas - Sample T-1 Submitted By DM/T. Mazzei Date 01-15-91

Supplier Dames & Moore Authorized By DM/T. Mazzei Date 01-15-91

SIEVE ANALYSIS, ASTM C136 & C117

Sieve Size	%Passing Accumulative
3"	100
2"	96
1-1/2"	93
1"	87
3/4"	82
1/2"	74
3/8"	69
1/4"	59
No. 4	53
8	42
10	40
16	32
30	25
40	22
50	19
100	16
200	13

Plasticity Index, ASTM D4318

Liquid Limit	32
Plasticity Index	12

Moisture Density Relations ASTM D698 A

Maximum Dry Density, pcf	122.7
Optimum Moisture Content, %	11.8

Permeability ASTM D2434

Remolded Dry Density, pcf	110
% Compaction	89.8
Moisture Content, %	12.4

Permeability (K) = 1×10^{-4} $CM/_{SEC}$

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P.O. Box 21387 85036
3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-3737 • 470-1341 FAX

Client: DAMES & MOORE
ATTN: TONY MAZZEI
4400 EAST BROADWAY, SUITE 703
TUCSON AZ 85711

Job No.
Inv/Lab No. 22410040
Report Date: 01-18-91
Reviewed by: M. Kuntzleman

Project Zonia

Location Tucson, Arizona

Material Silty Sand and Gravel Sampled By DM/V. Read Date 11-09-89

Source Test Pits/Borrow Areas - Sample T-2 Submitted By DM/T. Mazzei Date 01-15-91

Supplier Dames & Moore Authorized By DM/T. Mazzei Date 01-15-91

SIEVE ANALYSIS, ASTM C136 & C117

Sieve Size	%Passing Accumulative
4"	100
3"	93
2"	86
1-1/2"	82
1"	77
3/4"	74
1/2"	69
3/8"	66
1/4"	61
No. 4	58
8	50
10	48
16	41
30	32
40	28
50	24
100	18
200	16

Plasticity Index, ASTM D4318

Liquid Limit	No Value
Plasticity Index	Non Plastic

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P.O. Box 21387 85036
3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-3737 • 470-1341 FAX

Client: DAMES & MOORE
ATTN: TONY MAZZEI
4400 EAST BROADWAY, SUITE 703
TUCSON AZ 85711

Job No.
Inv/Lab No. 22410040
Report Date: 01-18-91
Reviewed by: M. Kunkelman

Project Zonia

Location Tucson, Arizona

Material Gravelly Clayey Sand Sampled By DM/V. Read Date 11-09-89

Source Test Pits/Borrow Areas - Sample T-3 Submitted By DM/T. Mazzei Date 01-15-91

Supplier Dames & Moore Authorized By DM/T. Mazzei Date 01-15-91

SIEVE ANALYSIS, ASTM C136 & C117

Sieve Size	%Passing Accumulative
3"	100
2"	96
1-1/2"	93
1"	88
3/4"	86
1/2"	82
3/8"	80
1/4"	75
No. 4	72
8	60
10	57
16	48
30	39
40	35
50	32
100	27
200	24

Plasticity Index, ASTM D4318

Liquid Limit	34
Plasticity Index	15

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3737 East Broadway Road
Phoenix, Arizona 85040
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Client: DAMES & MOORE
ATTN: TONY MAZZEI
4400 EAST BROADWAY, SUITE 703
TUCSON AZ 85711

Job No. _____
Inv/Lab No. 22410040
Report Date: 01-18-91

Reviewed by: M. Kuntzleman

Project Zonia

Location Tucson, Arizona

Material Silty Sand with Gravel Sampled By DM/V. Read Date 11-09-89

Source Test Pits/Borrow Areas - Sample T-8 Submitted By DM/T. Mazzei Date 01-15-91

Supplier Dames & Moore Authorized By DM/T. Mazzei Date 01-15-91

Plasticity Index, ASTM D4318

Liquid Limit	No Value
Plasticity Index	Non Plastic

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WESTERN TECHNOLOGIES INC.

P.O. Box 21387 85036
3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-3737 • 470-1341 FAX

Client: DAMES & MOORE
ATTN: TONY MAZZEI
4400 EAST BROADWAY, SUITE 703
TUCSON AZ 85711

Job No.
Inv/Lab No. 22410040
Report Date: 01-18-91
Reviewed by: M. Kunz Samson

Project Zonia

Location Tucson, Arizona

Material Silty Sand and Gravel Sampled By DM/V. Read Date 11-09-89

Source Test Pits/Borrow Areas - Sample T-9 Submitted By DM/T. Mazzei Date 01-15-91

Supplier Dames & Moore Authorized By DM/T. Mazzei Date 01-15-91

SIEVE ANALYSIS, ASTM C136 & C117

Sieve Size	%Passing Accumulative
3"	100
2"	97
1-1/2"	92
1"	85
3/4"	81
1/2"	73
3/8"	69
1/4"	62
No. 4	57
8	46
10	43
16	35
30	27
40	24
50	21
100	17
200	14

Plasticity Index, ASTM D4318

Liquid Limit	No Value
Plasticity Index	Non Plastic

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4405J:4

Dames & Moore

BACK - PRESSURE

PERMEABILITY TEST DATA

Owner ZONIA LANDFILL

Job # 19601-001

Location –

Boring # T-1, T-12, & T-13 COMBINED

Sample # BULK SCALPED FOR 4" MOLD

Depth 90% MDD at OMC

Deflecting Speed ~~0~~ in/Hr Min

Lateral Pressure 7 PSF (PSI)

Saturated ☒ Field Moisture ☐

Set-Up 3/2/91 Tested EGR (162 Office)

Soil Type BR SI CLAYEY F-C SA W SO FI-CO. GRAVEL

[redacted]

		Initial	Final	
Weight soil & dish no.				
Dry weight soil & dish				
Net loss of moisture				
Weight of dish only				
Net weight of dry soil				
Moisture, % of dry weight		10.2	16.5	
Wt. solids + moisture	W_0	4.20	4.44	gms.
$W_0 \div 454$	W_0'			lbs.
Weight solids	W_s			gms.
Wet density $W_0' - V_0'$		125.9	135.6	pcf
Dry density		114.2	116.3	pcf
Net diameter	D_0	4.00		in.
Area ($0.785\ D_0^2$)	A_0	12.56	12.543	sq. in
Height	H_0	4.59	4.51	in.
Volume $(A_0H_0) \div 1728$	V_0'			cu. ft
Volume $(A_0H_0) \times 16.4$	V_0	945.47	928.09	cc
Specific gravity of solids	G_s			
Volume of solids $W_s \div G_s$	V_s			cc
$(V_0 - V_s) \div V_s$	e_1			
Initial burette reading				cc
Burette reading under pressure				cc
$(V_p - V_s) \div V_s$	e_p			

$K_{AV} = 4.50 \times 10^{-6}$ cm/s

T11213.1

Dames & Moore

SATURATION DATA

PROJECT: ZONIA NO.: 19601-001 LOCATION: _____

Boring No.: T-1, T-12, T-13 Sample: _____ Depth: _____ (ft./m.) Set up: EEL 3/2/91

σ_3 = 7 psi = _____ psf Type of Test: P&P Cell No.: _____ Dial No.: _____

DATE	TIME		CHAMBER PRESSURE (PSI)	BACK PRESSURE (PSI)	EXTERNAL BURETTE OR DIAL RDG. (CC)/(IN.)	PORE PRESSURE (PSI)	Δ	B
	CLOSED	OPEN						
3/2/91	1609	1610	0/10	0 9/9 CLOSED	-.321 / .294	0.0 / 2.1		.21
	1651	1652	10/40	0 39/39 CLOSED	-.309 / -.137	9.0 / 27.7	18.7/30	
	1721	1722	40/50	0 49/49 CLOSED	-.185 / -.166	39.6 / 46.9		.79
	1741		50/60	CLOSED	-.184 / -.170	49.0 / 58.7		.97
			60/56	CLOSED	-.170 / .174			
3/2/91	1741	0	56	0 49/49	-.174			
3/3	0704				-.123			
							T1213.	2

Dames & Moore

PERMEABILITY TEST BY BACK PRESSURE
CONSTANT HEAD (Pbp)

PROJECT: ZONIA LANDFILL NO.: 19601-001 LOCATION: _____

Boring No.: _____ Sample No.: T1, 12 & 13 Depth _____ (ft.)(m.) Tested by: [illegible] 3/3/91

DATE	TIME	ELAPSED TIME (min.)	CHAMBER PRESSURE (psi)	BACK PRESS 1 (psi)	BACK PRESS 2 (psi)	UNCORR. HYDRAULIC HEAD DIFFERENCE (psi)	CORR. OF HEAD DIFF. IN WATER COL. (in.)	CORRECTED HYDRAULIC HEAD DIFFERENCE (psi)	Q (cc)	ΔQ (cc)
3/3/91	0708	0	56	49	45	(4)	.120	—	16.3	
	0709						.115		13.4	
	0711								13.1	
	0714						.116		10.1	
	0716						.116		2.5	
	0719								6.1	
	0721						.106		4.4	
	0725								1.4	
	0727	0	56	49	45	(4)	.100	—	13.3	
	0733								17.1	
	0739								13.0	
	0747						.100		8.1	
	0752								5.5	
	0757								2.9	
	0802								1.2	
	0806	0	56	49	45	(4)	.098	—	24.0	
	0812								15.4	
	0832								4.4	
	0849								+0.1	
	0851	0	56	49	45	(4)	.098	—	24.1	
	0901								10.5	
	0920								2.1	
	0924								0.2	
	0926	0	56	49	45	(4)	.099	—	23.7	
	1004								+1.1	
	1005	0	56	49	45	(4)	.098	—	23.6	
	1032								5.9	
	1035								+0.1	
	1056	0	56	49	45	(4)	.098	—	24.1	
	1058								2.8	
	1101	2							15.1	
	1103	3							17.4	
	1108	5							14.[illegible]	
	1115	7							10.3	
	1121	6					-.098		7.[illegible]	
	1125	4							[illegible]	

Notes

PERMEABILITY TEST BY BACK PRESSURE CONSTANT-HEAD

Zonia Landfill job # 19601-001-7103-022

Combined Sample T-1,T-12 & T-13
Remolded to 90 % Mdd at omc
Scalped and prepared for gravel replacement in 4" MOLD

		Initial	Final
Wet Density	pcf	125.9	135.6
Dry density	pcf	114.2	116.3
% Moisture		10.2	16.5

Height Initial	4.590	4.2	Wet soil and dish
Diameter Initial	4.000	3.81	Dry soil and dish
Area Initial	12.560	0	dish only
Volume Initial	945.47	1906.8	Ws Initial
Initial dial	0.210	2015.76	Final Ws
Final dial	0.29	1729.7	Weight solids
Initial cc/in res	-0.321		
Final cc/in res.	-0.098		
Height Final	4.510	11.455 cm	
Diameter Final	3.998		
Area Final	12.548	81.018 cm^2	
Volume Final	928.09		
Height change	-0.08		
cc/in reser.	0.008		
Volume change	-27.875		
Cell Change	10.5	@ 56 psi	
Net Volume Change	-17.375		
h= T/B PREss. diff	4	280.40 cm	

Standard Water .005 N CaSO4

Hydraulic Gradient
24.48

Elapsed Time minutes	cc's	K cm/sec
3.0	2.40	6.26E-06
5.0	3.30	* 5.16E-06
7.0	3.80	* 4.25E-06
6.0	3.30	* 4.30E-06
4.0	2.20	* 4.30E-06

* K Average = 4.50E-06 cm/s

T11213.4

T-1, T-12 & T-13

SAMPLE NO. _____ DEPTH _____ ELEVATION _____

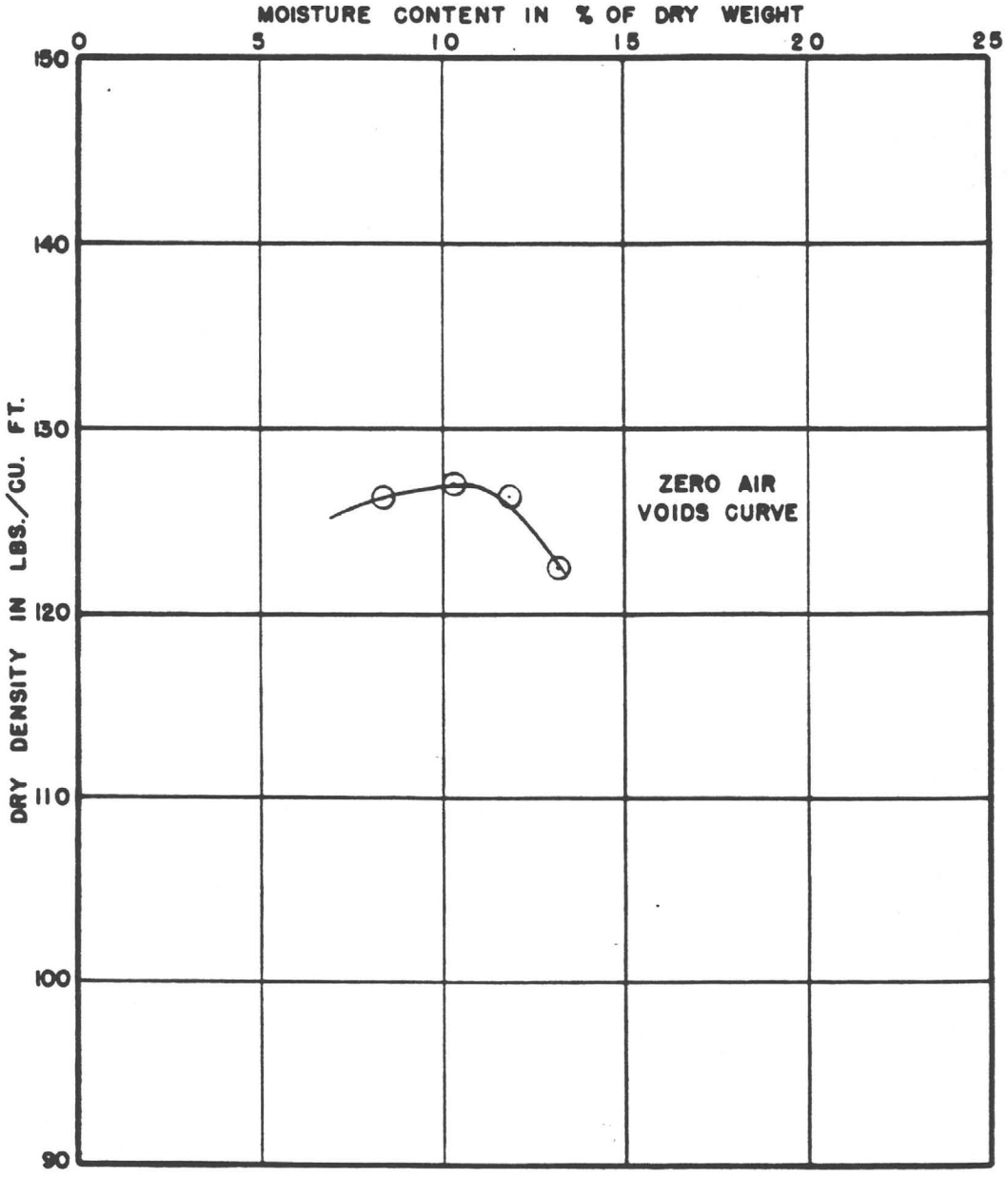
SOIL BR SI CLAY F-C SAND W SO F-C GRAVEL

LOCATION ZONIA LANDFILL

OPTIMUM MOISTURE CONTENT 10.2

MAXIMUM DRY DENSITY 127.

METHOD OF COMPACTION ASTM D698 METHOD C



COMPACTION TEST DATA

T1213.5

DAMES & MOORE

(REV. 4-57)

PLATE

COMPACTION TEST DATA

PAGE NO. _____ OF _____

Dames & Moore

Job No. 19601-001 Client ZONIA LANDFILL Sample COMBINED T-1, T-12, T-13 Depth _____

Location _____ Sampled _____ By _____

Soil BR SI CLAYEY F-C SA W/ SO FCO GVL Passing ¼" see SA / A % Sp. Gr. _____

Tested 2-28-91 By MH Computed 3-2-91 By MH Checked 3/2 By EEL

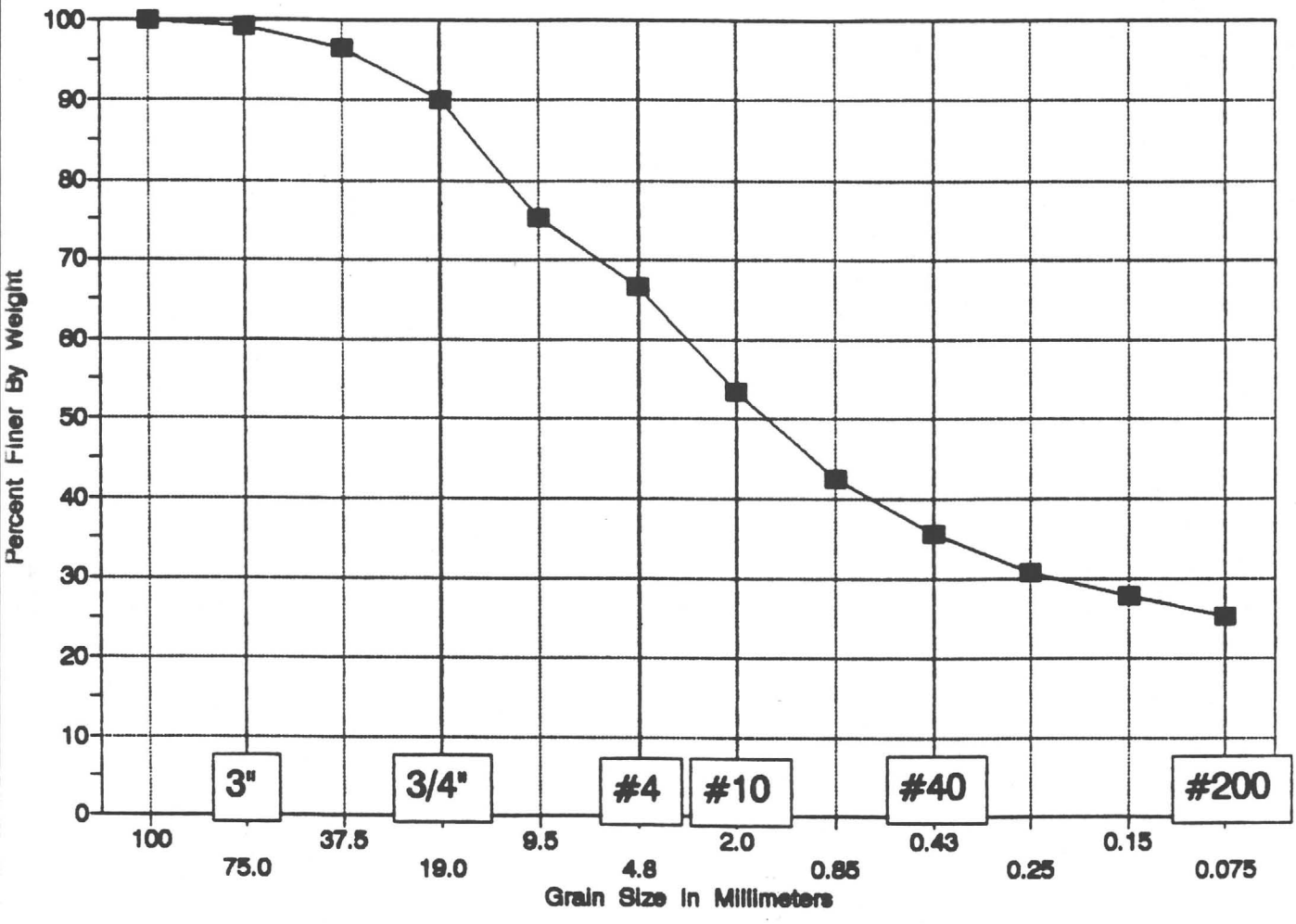
TYPE OF COMPACTION	CYLINDER CU. FT.	RAMMER LBS.	DROP INCHES	LAYERS	BLOWS PER LAYER
☐ ASTM D1557	1/30	10	18	5	25
☐ ASTM D1557	1/13.33 ✓	10	18	5	56 ✓
☒ ASTM D698 MET C	1/30	5½ ✓	12 ✓	3 ✓	25
☐					

POINT NO.	PENETROMETER: NEEDLE SIZE	PENETROMETER: RESISTANCE READING / RESISTANCE LBS./SQ.IN.	WT. OF MOLD & SOIL / MOLD WT. / WT. OF SOIL	WET DENSITY IN LBS./CU.FT.	MOISTURE DETERMINATION: DISH NO.	WET WT. -DRY WT. / MOISTURE WT.	DRY WT. -DISH WT. / DRY SOIL WT.	% MOISTURE	DRY DENSITY IN LBS./CU.FT.
+1.5%			16.73 (16.83) / 6.33	139.9 / 138.6	42	695.7 / 641.1 / 54.6	104.3 / 536.8	10.2 ✓	127.0 / 125.8
+3%			16.90 / 6.33	140.9 ✓	7	676.7 / 617.1 / 59.6	105.3 / 511.8	11.7 ~~11.6~~	126.2 ~~126.3~~
+4.5%			16.71 / 6.33	138.4 ✓	6	627.0 / 566.4 / 60.6	103.9 / 462.5	13.1 ✓	122.3 ~~122.4~~
as is			16.58 / 6.33	136.6 ✓	2	726.2 / 678.5 / 47.7	104.3 / 574.2	8.3 ✓	126.2 ✓
							REASONABLE ASSUME		

959P.1 (2) (6-86) ☐ NOTES OR CALCULATIONS ON REVERSE SIDE T11213.6

GRADATION CURVE

Combined Sample T-1,T-12, & T-13



T11213.7

MECHANICAL ANALYSIS

DATE 2-27-91 BY MH

JOB NUMBER 19601-001 OWNER/CLIENT ZONIA LANDFILL

LOCATION _____

BORING _____ SAMPLE T-1, T-12, T-13 COMBINED DEPTH _____

			⑦ #4	⑨ #4
NUMBER OF RINGS		DISH	35	99
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	621.9	
WT. OF RINGS		WT. OF DISH & DRY SOIL	591.4	238.9
WT. OF WET SOIL		WT. OF MOISTURE		
FIELD DENSITY		WT. OF DISH	109.1	95.9
DRY DENSITY		WT. OF DRY SOIL		
		FIELD MOISTURE CONTENT	6.3	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		4" / 3"	0 / 1.25		0.8	100 / 99.2
	TOTAL DRY SPL = 145.43	1-1/2"	3.86	5.11	3.5	96.5
		3/4"	9.67	14.78	10.2	89.8
		3/8"		94.01		75.2
	DRY 575.3 g	#4		149.44		66.5
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		28.21			53.4
		#20		51.63			42.5
		#40		66.55			35.6
	143 g DRY	#60		77.20			30.6
		#100		83.23			27.8
		#200		88.87			25.2
		PAN					
		TOTAL					

FEJ

Dames & Moore

T11213.8

MECHANICAL ANALYSIS

DATE 2-27-91 BY MH

JOB NUMBER 19601-001 OWNER/CLIENT ZONIA LANDFILL

LOCATION

BORING SAMPLE T-1, T-12, T-13 COMBINED DEPTH

			⊕ #4	⊖ #4
NUMBER OF RINGS		DISH	35	99
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	621.9	
WT. OF RINGS		WT. OF DISH & DRY SOIL	591.4	238.9
WT. OF WET SOIL		WT. OF MOISTURE		
FIELD DENSITY		WT. OF DISH	109.1	96.9
DRY DENSITY		WT. OF DRY SOIL		
		FIELD MOISTURE CONTENT	6.3	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		2"	0			100
		3"	1.25		0.8	99.2
	TOTAL DRY SPL = 145.43 gr	1-1/2"	3.86	5.11	3.5	96.5
		3/4"	9.67	14.78	10.2	89.8
		3/8"		9401		75.2
	DRY STS. 3 gr	#4		149.44		66.5
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	PERCENT		
					RETAINED	FINER	TOTAL FINER
		#10		28.21			53.4
		#20		51.63			42.5
		#40		66.55			35.6
	143 gr DRY	#60		77.20			30.6
		#100		83.23			27.8
		#200		88.87			25.2
		PAN					
		TOTAL					

Dames & Moore

T11213.8

ATTERBERG LIMITS TEST DATA

FIELD CLASSIFICATION _____

LABORATORY CLASSIFICATION _____

JOB NO. 19601-001

CLIENT/OWNER ZONIA

LOCATION _____

BORING T-1, T-12, T-13 SAMPLE ____ DEPTH ____

FIELD DENSITY BY ____/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS	—	—
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

THIS IS AN 1/8-INCH THREAD

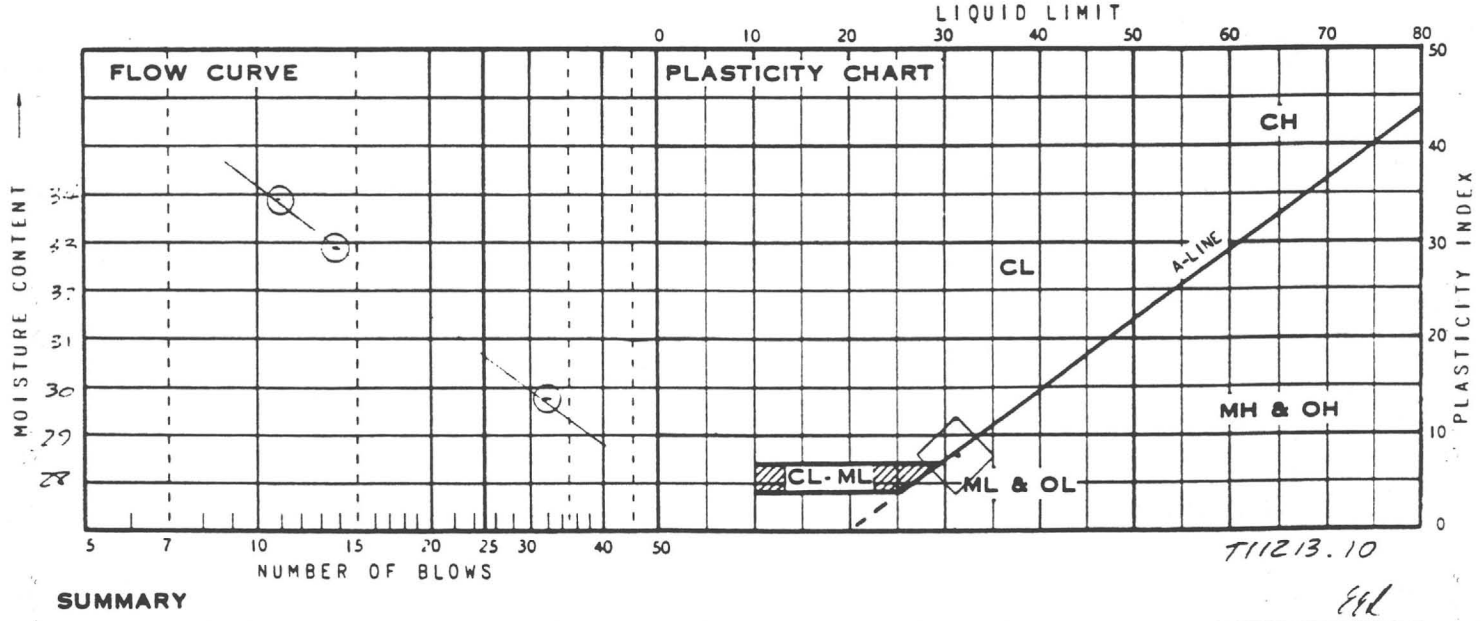
DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL	—	—
WT OF MOISTURE		
WT OF DISH	—	—
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

PLASTIC LIMIT BY JH 3-14-91

DETERMINATION	1	2	3	4	5	6
DISH	27	5				
WT OF DISH + WET SOIL	12.40	12.48				
WT OF DISH + DRY SOIL	10.35	10.41	—	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	—	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	22.91	22.97	av = 23			

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	A-3	A-4	9A			
NUMBER OF BLOWS	32	14	11			
WT OF DISH + WET SOIL	14.31	13.71	13.23			
WT OF DISH + DRY SOIL	11.35	10.66	10.23	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	1.40	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	29.75	32.94	33.98			



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		31	23	8	ML	

EEL

Dames & Moore

Dames & Moore

BACK - PRESSURE

PERMEABILITY TEST DATA

Owner ZONIA LANDFILL

Job # 19601-001

Location —

Boring # T-11 & S-3 COMBINED

Sample # BULK SCALPED FOR 4" MOLD

Depth GRAVEL REPLACEMENT

Deflecting Speed ~~0~~ in/Hr Min

Lateral Pressure 7 PSF (PSI)

Saturated ☒ Field Moisture ☐

Set-Up 3/2/91 Tested FGL (1620 ffice)

Soil Type YEL-BR SILTY CLAYEY F-C SA W F-C GRAVEL

[redacted]

		Initial	Final	
Weight soil & dish no.				
Dry weight soil & dish				
Net loss of moisture				
Weight of dish only				
Net weight of dry soil				
Moisture, % of dry weight		10.6	16.7	
Wt. solids + moisture	W_0	4.18	4.41	gms.
$W_0 \div 454$	W_0'			lbs.
Weight solids	W_s	1716.1		gms.
Wet density $W_0' \div V_0'$		125.3	134.3	pcf
Dry density		113.3	115.1	pcf
Net diameter	D_0	4.00		in.
Area ($0.785\ D_0^2$)	A_0	12.56	12.442	sq. in
Height	H_0	4.59	4.56	in.
Volume $(A_0H_0) \div 1728$	V_0'			cu. ft
Volume $(A_0H_0) \times 16.4$	V_0	945.47	930.47	cc
Specific gravity of solids	G_s			
Volume of solids $W_s \div G_s$	V_s			cc
$(V_0 - V_s) \div V_s$	e_1			
Initial burette reading				cc
Burette reading under pressure				cc
$(V_p - V_s) - V_s$	e_p			

K_{AV} = 2.76 x10^{-5} cm/s

T-11 + S-3.1

Dames & Moore

SATURATION DATA

PROJECT: ZONIA NO.: 19601-001 LOCATION:

Boring No.: Sample: T11 & S3 Depth: (ft./m.) Set up: EGL 3 / 2 / 91

σ_3 = 7 psi = psf Type of Test: PBP Cell No.: Dial No.:

DATE	TIME		CHAMBER PRESSURE (PSI)	BACK PRESSURE (PSI)	EXTERNAL BURETTE OR DIAL RDG. (CC)/(IN.)	PORE PRESSURE (PSI)	Δ	B
	CLOSED	OPEN						
		1341		0 9/9				
3/2/91	1340		0/10	CLOSED	-.406 / -.364	0.0 / 1.6		.16
		1357		0 39/39			19.1/	
	1356		10/40	CLOSED	-.383 / -.250	9.0 / 28.1	30	
		1411		0 49/49				
	1410		40/50	CLOSED	-.302 / -.284	39.0 / 48.4		.94
		1502						
	1501		50/60	CLOSED	-.298 / -.284	49.0 / 58.9		.99
			60/56	CLOSED	-.284 / .288	/		
					/	/		
3/2/91	1504	0	56	0 49/49	-.288 /	/		
		.1			.257 /	/		
		.25			.248			
		.5			.244 /	/		
		.75			.243			
		1.			.242 /	/		
	1507	3.			-.241			
	1513	9.			.239 /	/		
	1520	16			.238			
	1606				-.236 /	/		
3/3	0704				-.228 /	/		
					/	/		
					/	/		
					/	/		
					/	/		
					/	/		
					/	/		
					/	/		
					/	/		
					/	/		
					/	/		
					/	/		
					/	/	T-11 + S-3.2	

Dames & Moore

PERMEABILITY TEST BY BACK PRESSURE
CONSTANT HEAD (Pbp)

PROJECT: ZONIA NO.: 19601-001 LOCATION: _____

Boring No.: _____ Sample No.: _____ Depth _____ (ft.)(m.) Tested by: SGL 2/3/91

DATE	TIME	ELAPSED TIME (min.)	CHAMBER PRESSURE (psi)	BACK PRESS 1 (psi)	BACK PRESS 2 (psi)	UNCORR. HYDRAULIC HEAD DIFFERENCE (psi)	CORR. OF HEAD DIFF. IN WATER COL. (in.)	CORRECTED HYDRAULIC HEAD DIFFERENCE (psi)	Q (cc)	ΔQ (cc)
3/3/91	0707	0	56	49	45	(4)	.201	-	24.0	
	0708								21.0	
	0710						.201		12.2	
	0712								5.5	
	0713						.202		2.3	
	0715	0	56	49	45	(4)	.202	-	24.0	
	0718								13.6	
	0720								7.0	
	0722								3.3	
	0724	0	56	49	45	(4)	.202	-	22.3	
	0726								13.4	
	0728								5.2	
	0729								1.7	
	0731	0	56	49	46	(3)	.202	-	22.4	
	0733								16.5	
	0738								2.5	
	0739								0.0	
	0741	0	56	49	46	(3)	.202	-	23.5	
	0742								20.3	
	0744								14.3	
	0745								11.4	
	0746								8.5	
	0748								2.9	
	0750	0	56	49	46	(3)	.202	-	23.4	
	0751								20.5	
	0754								12.6	
	0756								7.2	
	0758								2.1	
	0800	0	56	49	46	(3)	.202	-	22.3	
	0801								19.8	
	0802								17.1	
	0803	1							14.5	2.6
	0805	2							9.3	4.8
	0806	1							6.8	2.5
	0807	1							4.3	2.5
	0809								1.9	
	0810	0	56	49	46	3	.202	-	22.4	
	0811								19.8	
	0817	6							3.2	16.6

On Reverse Side - Notes

T/1S.3.3

PERMEABILITY TEST BY BACK PRESSURE CONSTANT-HEAD

Zonia Landfill job # 19601-001-7103-022

Combined Sample T-11 & S-3
Remolded to 90 % Mdd at omc
Scalped and prepared for gravel replacement in 4" MOLD

	Initial	Final
Wet Density pcf	125.3	134.3
Dry density pcf	113.3	115.1
% Moisture	10.6	16.7

Height Initial	4.590	4.18	Wet soil and dish
Diameter Initial	4.000	3.78	Dry soil and dish
Area Initial	12.560	0	dish only
Volume Initial	945.47	1897.72	Ws Initial
Initial dial	-0.303	2002.14	Final Ws
Final dial	-0.273	1716.1	Weight solids
Initial cc/in res	-0.406		
Final cc/in res.	-0.202		
Height Final	4.560	11.582 cm	
Diameter Final	3.981		
Area Final	12.442	80.335 cm^2	
Volume Final	930.47		
Height change	-0.03		
cc/in reser.	0.008		
Volume change	-25.5		
Cell Change	10.5 @ 56 psi		
Net Volume Change	-15		
h= T/B PREss. diff	3	210.30 cm	

Standard Water .005 N CaSO4

Hydraulic Gradient
18.16

Elapsed Time minutes	cc's	K cm/sec
1.0	2.60	2.77E-05
2.0	5.20	* 2.77E-05
1.0	2.50	* 2.66E-05
1.0	2.50	* 2.66E-05
6.0	16.60	* 2.94E-05

* K Average = 2.76E-05 cm/s

T1153.4

T-11 d

SAMPLE NO. T-3 DEPTH COMBINED ELEVATION _____

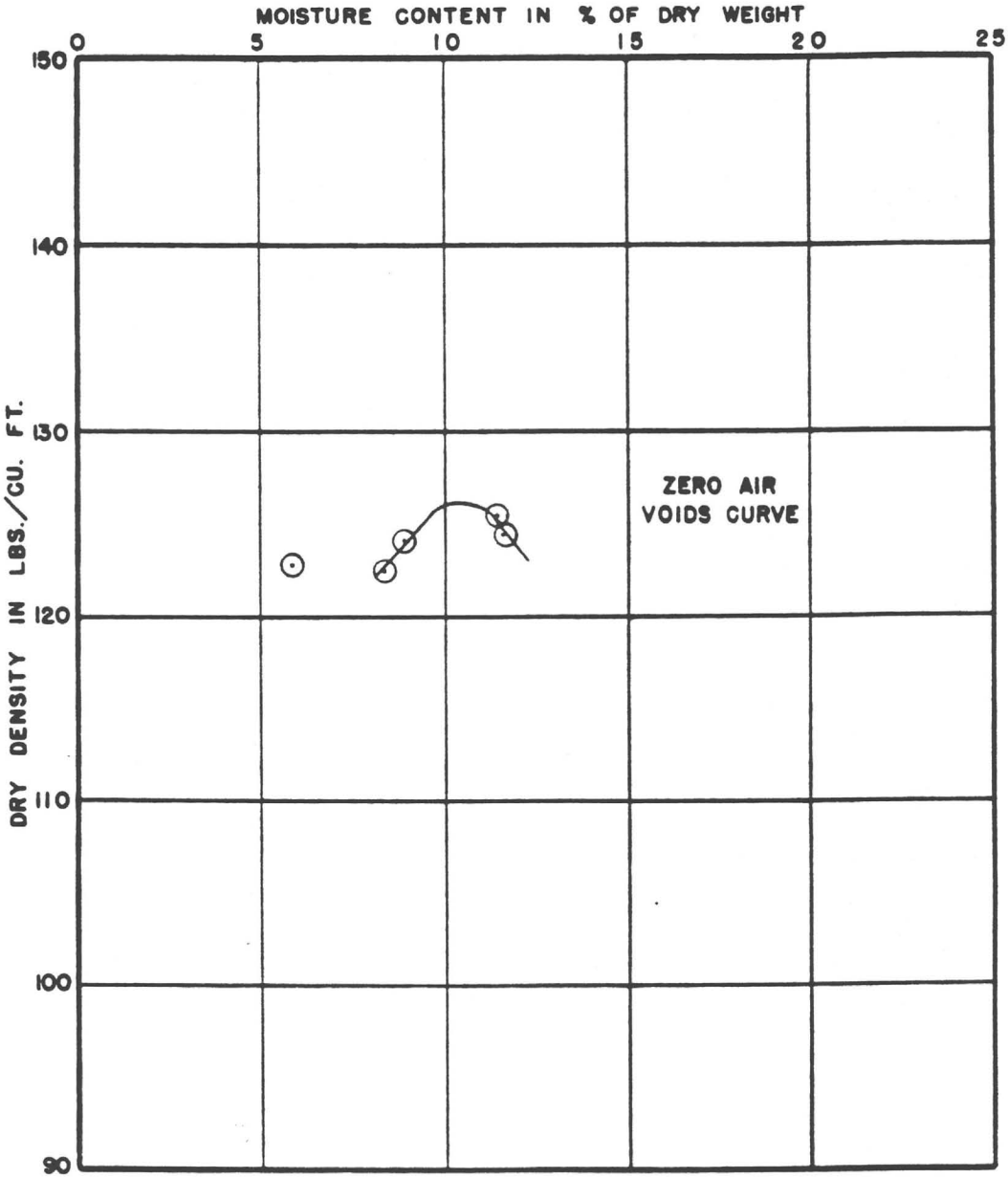
SOIL YEL-BR SILTY CLAYEY F-C SAND & F-C GRAVEL

LOCATION ZONIA LANDFILL

OPTIMUM MOISTURE CONTENT 10.5 %

MAXIMUM DRY DENSITY 126.1 pcf

METHOD OF COMPACTION ASTM D698 METHOD D



(-#40) LL = 34 PL = 20 P.I. = 14 (CL)

COMPACTION TEST DATA

T1153.5

BAMES & MOORE

PI ATE

COMPACTION TEST DATA

PAGE NO. _____ OF _____

Dames & Moore

Job No. 19601-001 Client ZONIA LANDFILL Sample COMBINED T-11, S-3 Depth _____

Location _____ Sampled _____ By _____

Soil YEL BR CLAYEY F-C SA W F-C GRAVEL Passing ¼" _____ % Sp. Gr. _____

Tested 2-27-91 By MH Computed 2-28-91 By MH Checked 2/28 By EEL

TYPE OF COMPACTION	CYLINDER CU. FT.	RAMMER LBS.	DROP INCHES	LAYERS	BLOWS PER LAYER
☐ ASTM D1557	1/30	10	18	5	25
☐ ASTM D1557	1/13.33 ✓	10	18	5	56 ✓
☒ ASTM D698 MET. D	1/30	5½ ✓	12 ✓	3 ✓	25
☐					

POINT NO.	PENETROMETER: NEEDLE SIZE	PENETROMETER: RESISTANCE READING / RESISTANCE LBS./SQ.IN.	WT. OF MOLD & SOIL / MOLD WT. / WT. OF SOIL	WET DENSITY IN LBS./ CU.FT.	MOISTURE DETERMINATION: DISH NO.	WET WT. -DRY WT. / MOISTURE WT.	DRY WT. -DISH WT. / DRY SOIL WT.	% MOISTURE	DRY DENSITY IN LBS./ CU.FT.
95 IS			16.08 / 6.33	129.9 ✓	31	683.4 / 652.3 / 31.1	111.0 / 541.3	5.8	122.9 ✓
+1.5%			16.29 / 6.33	132.8 ✓	36	718.2 / 671.5 / 46.7	108.2 / 563.3	8.3 ✓	122.6 ✓
+3%			16.46 / 6.33	135.0	127	574.6 / 536.5 / 38.1	103.1 / 433.4	8.8 ✓	124.1 ✓
+4.5%			16.81 / 6.33	139.7 ✓	6	655.4 / 599.1 / 56.3	104.0 / 495.1	11.4 ✓	125.4 ✓
+6%			16.73 / 6.33	138.6	101	756.7 / 689.2 / 67.5	102.6 / 586.6	11.5 ✓	124.3 ✓

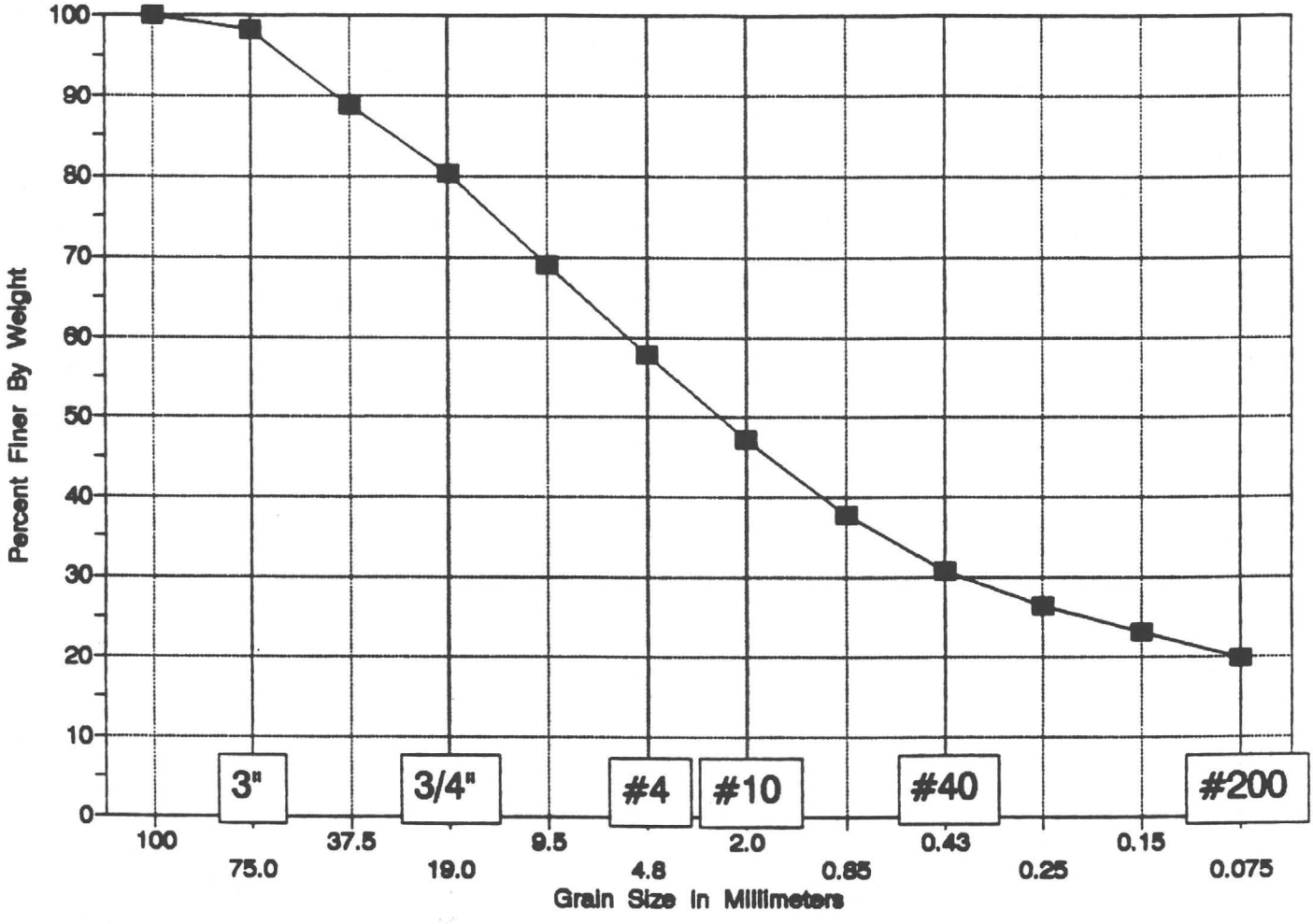
959P.1 (2) (6-86)

☐ NOTES OR CALCULATIONS ON REVERSE SIDE

T1153.6

GRADATION CURVE

Combined Sample T-11 & S-3



T1153.7

MECHANICAL ANALYSIS

DATE 2-27-91 BY MH

JOB NUMBER 19601-001 OWNER/CLIENT ZONIA LANDFILL

LOCATION

BORING SAMPLE T-11, S-3 COMBINED DEPTH

			⊕ #4	⊖ #4
NUMBER OF RINGS		DISH	29	97
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	736.1	
WT. OF RINGS		WT. OF DISH & DRY SOIL	699.8	310.5
WT. OF WET SOIL		WT. OF MOISTURE		
FIELD DENSITY		WT. OF DISH	107.0	102.6
DRY DENSITY		WT. OF DRY SOIL		
		FIELD MOISTURE CONTENT	6.1	

WASH SIEVE DRY SIEVE WEIGHT OF OVEN DRY SOIL (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		4 / 3"	1.81	0 / 1.81		100 / 98.1
	TOTAL SPL DRY	1-1/2"	9.21	11.02		88.6
=	96.43 lb	3/4"	8.0	19.02		80.3
	SPLIT #4	3/8"		80.24	13.9 86.1	69.1
	DRY = 575.3	#4		161.30		57.8
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		37.88	18.2	81.8	47.2
		#20		72.40			37.7
		#40		97.54			30.7
	-#4 SPLIT	#60		113.20			26.3
	DRY = 207.9	#100		125.17			23.0
		#200		137.14			19.7
		PAN					
		TOTAL					

Dames & Moore

T/S3.8

ATTERBERG LIMITS TEST DATA

JOB NO. 19601-001

FIELD CLASSIFICATION _____

CLIENT/OWNER _____

LABORATORY CLASSIFICATION _____

LOCATION _____

BORING T-11, S-3 SAMPLE ____ DEPTH ____

FIELD DENSITY BY ____

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS	—	—
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

THIS IS AN 1/8-INCH THREAD

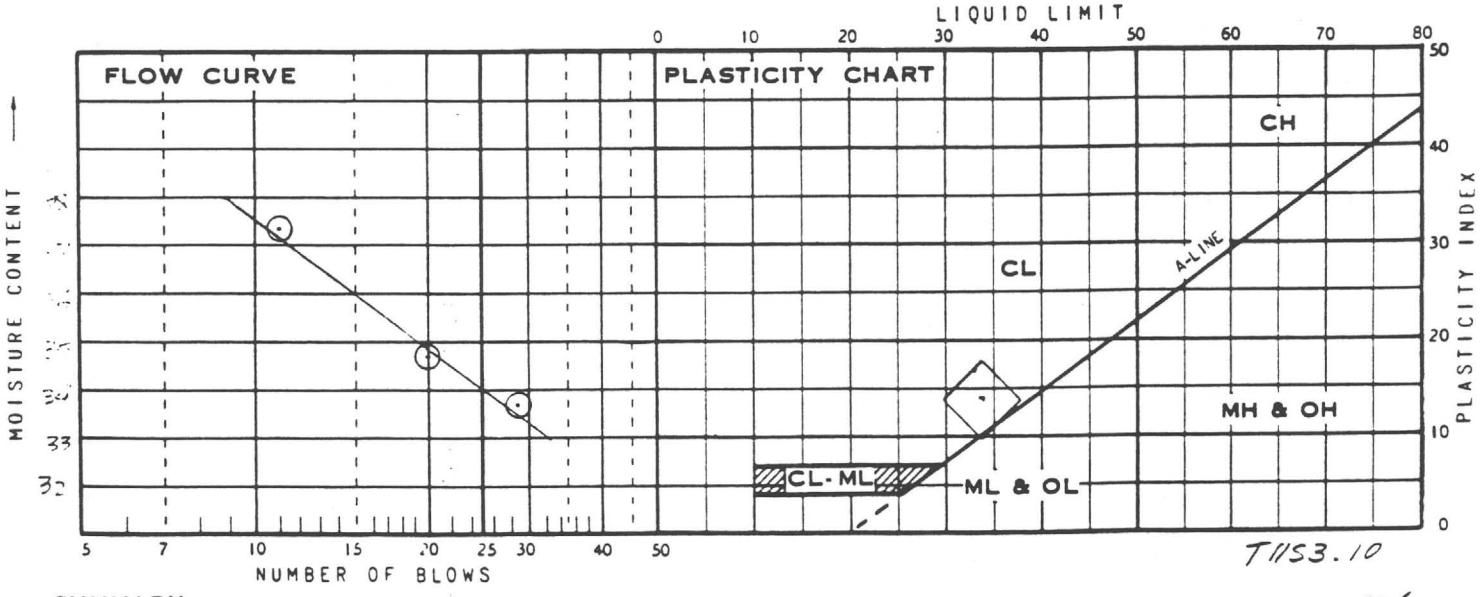
DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL	—	—
WT OF MOISTURE		
WT OF DISH	—	—
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

PLASTIC LIMIT BY JH 3/11/81

DETERMINATION	1	2	3	4	5	6
DISH	A-2	AL 31				
WT OF DISH + WET SOIL	7.46	10.40				
WT OF DISH + DRY SOIL	6.47	8.88	—	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	—	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	19.53	20.32	av = 20			

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	61	20	12			
NUMBER OF BLOWS	29	20	11			
WT OF DISH + WET SOIL	11.48	10.13	10.46			
WT OF DISH + DRY SOIL	8.94	7.88	8.00	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	1.40	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	33.69	34.72	37.27			



SUMMARY

EEL

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		34	20	14	CL	

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BACK - PRESSURE

PERMEABILITY TEST DATA

Owner ZONIA LANDFILL

Job # 19601-001

Location —

Boring # T-8 & T-10 COMBINED

Sample # BULK SCALPED FOR 4" MOLD

Depth 90% MDD at OMC

Deflecting Speed 0 in/Hr Min

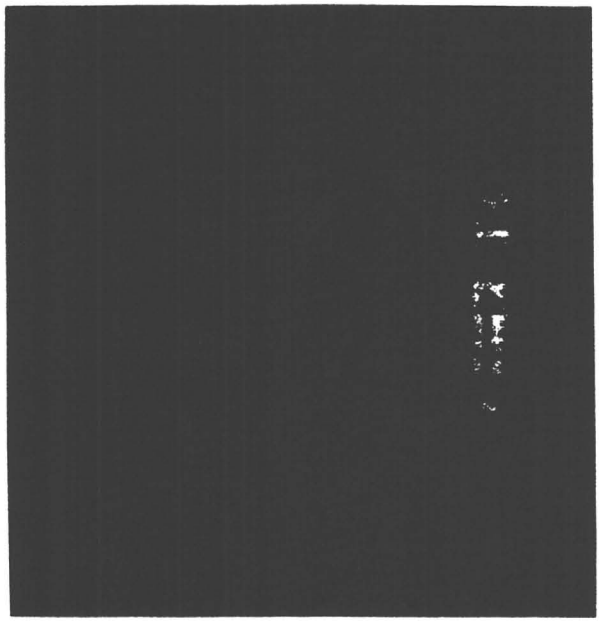
Lateral Pressure 7 PSF PSI

Saturated ☒ Field Moisture ☐

Set-Up 3/1/91 Tested EGK (162 Office)

Soil Type RD BR SI CLAY CLAYEY SILTY SAND SO F-C GRAVEL

ADD 19.5% (-3/8" + #4)



		Initial	Final	
Weight soil & dish no.				
Dry weight soil & dish				
Net loss of moisture				
Weight of dish only				
Net weight of dry soil				
Moisture, % of dry weight		10.5	16.3	
Wt. solids + moisture	W_0	4.21 lbs	4.43	gms.
$W_0 \div 454$	W_0'			lbs.
Weight solids	W_s	1729.7		gms.
Wet density $W_0' - V_0'$		126.2	135.1	pcf
Dry density		114.2	116.2	pcf
Net diameter 4" MOLD	D_0	4.00		in.
Area ($0.785\ D_0^2$)	A_0	12.56	12.551	sq. in
Height	H_0	4.59	4.516	in.
Volume $(A_0H_0) \div 1728$	V_0'			cu. ft
Volume $(A_0H_0) \times 16.4$	V_0	945.47	929.59	cc
Specific gravity of solids	G_s			
Volume of solids $W_s \div G_s$	V_s			cc
$(V_0 - V_s) - V_s$	e_i			
Initial burette reading				cc
Burette reading under pressure				cc
$(V_p - V_s) - V_s$	e_p			

$K_{AV} = 1.67 \times 10^{-6}$ cm/s

T-8 + T-10.1

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SATURATION DATA

PROJECT: ZONIA NO.: 19601-001 LOCATION: LANDFILL

Boring No.: _____ Sample: T-8 & T-10 Depth: _____ (ft./m.) Set up: EGL 3/1/91

σ_3 = 7 psi = 1008 psf Type of Test: PBQ Cell No.: _____ Dial No.: _____

DATE	TIME		CHAMBER PRESSURE (PSI)	BACK PRESSURE (PSI)	EXTERNAL BURETTE OR DIAL RDG. (CC)/(IN.)	PORE PRESSURE (PSI)	Δ	B
	CLOSED	OPEN						
3/1/91	1327	1338	0/10	0 9/9 CLOSED	-.420 / -.390	0.0 / 0.7		
	1407	1408	10/40	0 39/39 CLOSED	-.373 / -.250	90 / 32.2	23.2/30	
	1509	1510	40/50	0 49/49 CLOSED	-.277 / -.262	39.0 / 48.0		.7
	1527		50/60	CLOSED	.283 / .272	49.0 / 58.8		.93
			60/56	CLOSED	.272 / .274			
3/1/91	1529	0	56	0 49/49	-.274			
	1544				-.231			
	1700				-.228			
	0621				-.219			
							T-8 & T-10	

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PERMEABILITY TEST BY BACK PRESSURE
CONSTANT HEAD (Pbp)

PROJECT: Zonia NO.: 19601-001 LOCATION: _____

Boring No.: _____ Sample No.: T-8 & T-10 Depth _____ (ft.)(m.) Tested by: EGK / / /

DATE	TIME	ELAPSED TIME (min.)	CHAMBER PRESSURE (psi)	BACK PRESS 1 (psi)	BACK PRESS 2 (psi)	UNCORR. HYDRAULIC HEAD DIFFERENCE (psi)	CORR. OF HEAD DIFF. IN WATER COL. ~~(in.)~~ ΔV	CORRECTED HYDRAULIC HEAD DIFFERENCE (psi)	Q (cc)	ΔQ (cc)
3/2/91	0810	0	56	49	40	(9)	-.215	—	9.6	
	0812								8.5	
	0813						-.215		7.9	
	0815								6.7	
	0817								5.6	
	0820						-.214		4.0	
	0824						-.214		1.8	
	0825	0	56	49	40	9)	-.212	—	23.9	
	0827						-.212		22.6	
	0829								21.3	
	0852						-.211		8.3	
	0906						-.211		0.9	
	0907	0	56	49	40	(9)	-.211	—	24.0	
	0911								21.4	
	0920						-.211		16.2	
	0939						-.211		5.8	
	0956								+0.0 (3)	
	0957	0	56	49	40	(9)	-.210	—	23.6	
	1001								21.1	
	1016						-.210		12.7	
	1021								10.1	
	1052						-.210		+0.0 (3)	
	1053	0	56	49	40	(9).	-.209	—	24.0	
	1104								17.6	
	1108								15.4	
	1120								9.5	
	1132								3.8	
	1135								2.4	
	1139	0	56	49	40	(9)	-.209	—	22.7	
	1148								17.6	
	1153								15.0	
	1214	21							5.1	5.0
	1221	7							2.1	3.
	1222	0	56	49	40	9)	-.209	—	24.1	
	1227								21.3	
	1304	37							4.0	
	1305	0	56	49	40	9	-.209	—	23.5	
	1306								23.2	
	1339	4							20.4	2
	1345	35							4.1	

On Reverse Side -- Notes

3 4

PERMEABILITY TEST BY BACK PRESSURE CONSTANT-HEAD

Zonia Landfill job # 19601-001-7103-022

Combined Sample T-8 & T-10
Remolded to 90 % Mdd at omc
Scalped and prepared for gravel replacement in 4" MOLD

	Initial	Final
Wet Density pcf	126.2	135.1
Dry density pcf	114.2	116.2
% Moisture	10.5	16.3

Height Initial	4.590	4.21	Wet soil and dish
Diameter Initial	4.000	3.81	Dry soil and dish
Area Initial	12.560	0	dish only
Volume Initial	945.47	1911.34	Ws Initial
Initial dial	0.228	2011.22	Final Ws
Final dial	0.302	1729.7	Weight solids
Initial cc/in res	-0.42		
Final cc/in res.	-0.209		
Height Final	4.516	11.471 cm	
Diameter Final	3.999		
Area Final	12.551	81.041 cm^2	
Volume Final	929.59		
Height change	-0.074		
cc/in reser.	0.008		
Volume change	-26.375		
Cell Change	10.5	@ 56 psi	
Net Volume Change	-15.875		
h= T/B PREss. diff	9	630.90 cm	

Standard Water .005 N CaSO4

Hydraulic Gradient
55.00

Elapsed Time minutes	cc's	K cm/sec
21.0	9.90	1.64E-06
7.0	3.00	* 1.49E-06
37.0	17.30	* 1.63E-06
4.0	2.20	* 1.91E-06
35.0	16.70	* 1.66E-06

* K Average = 1.67E-06 cm/s

T-8 + T-10 . 4

SAMPLE NO. T-8, T-10 DEPTH COMB. ELEVATION _____

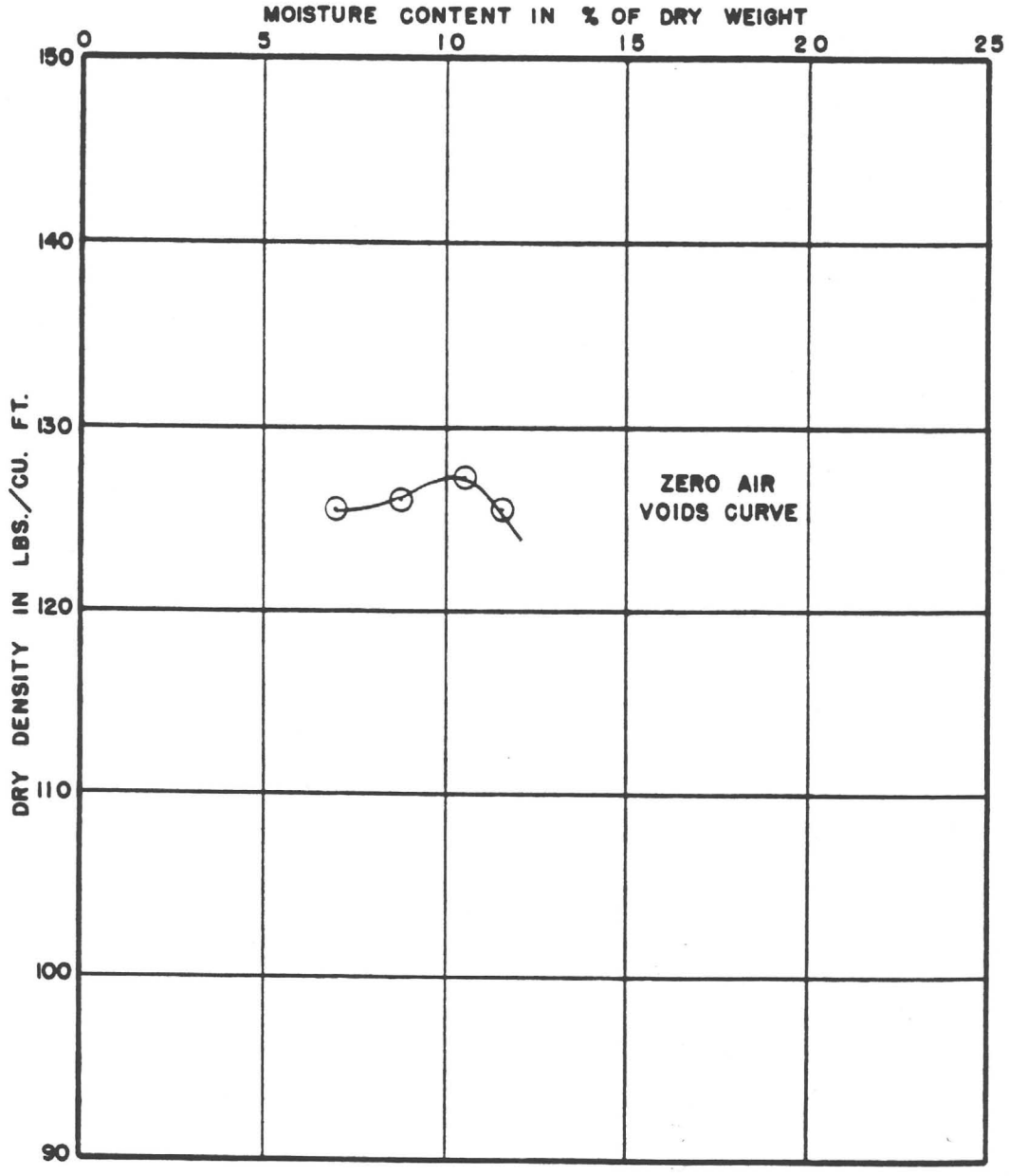
SOIL RD-BR SICLAY CLAYEY SILTY SAND, W/SO F-C GVL

LOCATION ZONIA LANDFILL

OPTIMUM MOISTURE CONTENT 10.4

MAXIMUM DRY DENSITY 127.2

METHOD OF COMPACTION ASTM D698 METHOD D



(-#40) LL = 26 PL = 21 PI = 5 (CL-ML)

COMPACTION TEST DATA

T-8 + T-10.5

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PLATE

COMPACTION TEST DATA

PAGE NO. ____ OF ____

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Job No. 19601-001 Client ____ Sample T-8 T-10 Depth ____

Location ZONIA LANDFILL Sampled ____ By ____

Soil BR RD SI CLAYEY F-C SA SO GRAVEL Passing ¼" see SA 4 % Sp. Gr. ____

Tested 2-27-91 By MH Computed 2-28-91 By MH Checked 2/28 By [illegible]

TYPE OF COMPACTION	CYLINDER CU. FT.	RAMMER LBS.	DROP INCHES	LAYERS	BLOWS PER LAYER
☐ ASTM D1557	1/30	10	18	5	25
☐ ASTM D1557	1/13.33 ✓	10	18	5	56 ✓
☒ ASTM D698 MET. D	1/30	5½ ✓	12 ✓	3 ✓	25
☐					

POINT NO.	PENETROMETER: NEEDLE SIZE	PENETROMETER: RESISTANCE READING / RESISTANCE LBS./SQ.IN.	WT. OF MOLD & SOIL / MOLD WT. / WT. OF SOIL	WET DENSITY IN LBS./CU.FT.	MOISTURE DETERMINATION: DISH NO.	WET WT. -DRY WT. / MOISTURE WT.	DRY WT. -DISH WT. / DRY SOIL WT.	% MOISTURE	DRY DENSITY IN LBS./CU.FT.
95 is			16.40 / 6.33	134.2 ✓	50	635.4 / 601.5 / 33.9	107.2 / 494.3	6.9 ~~6.8~~	125.6
+1.5%			16.61 / 6.33	137.0	79	663.6 / 618.9 / 44.7	105.2 / 513.7	8.7	126.1 ~~126.0~~
+3%			16.86 / 6.33	140.3	35	~~649.1~~ / 598.4 / 50.7	109.0 / 489.4	10.4 ~~10.3~~	127.2 ✓
+4.5%			16.83 / 6.33	139.9	8	636.0 / 581.3 / 54.7	104.6 / 476.7	11.5 ~~11.4~~	125.6

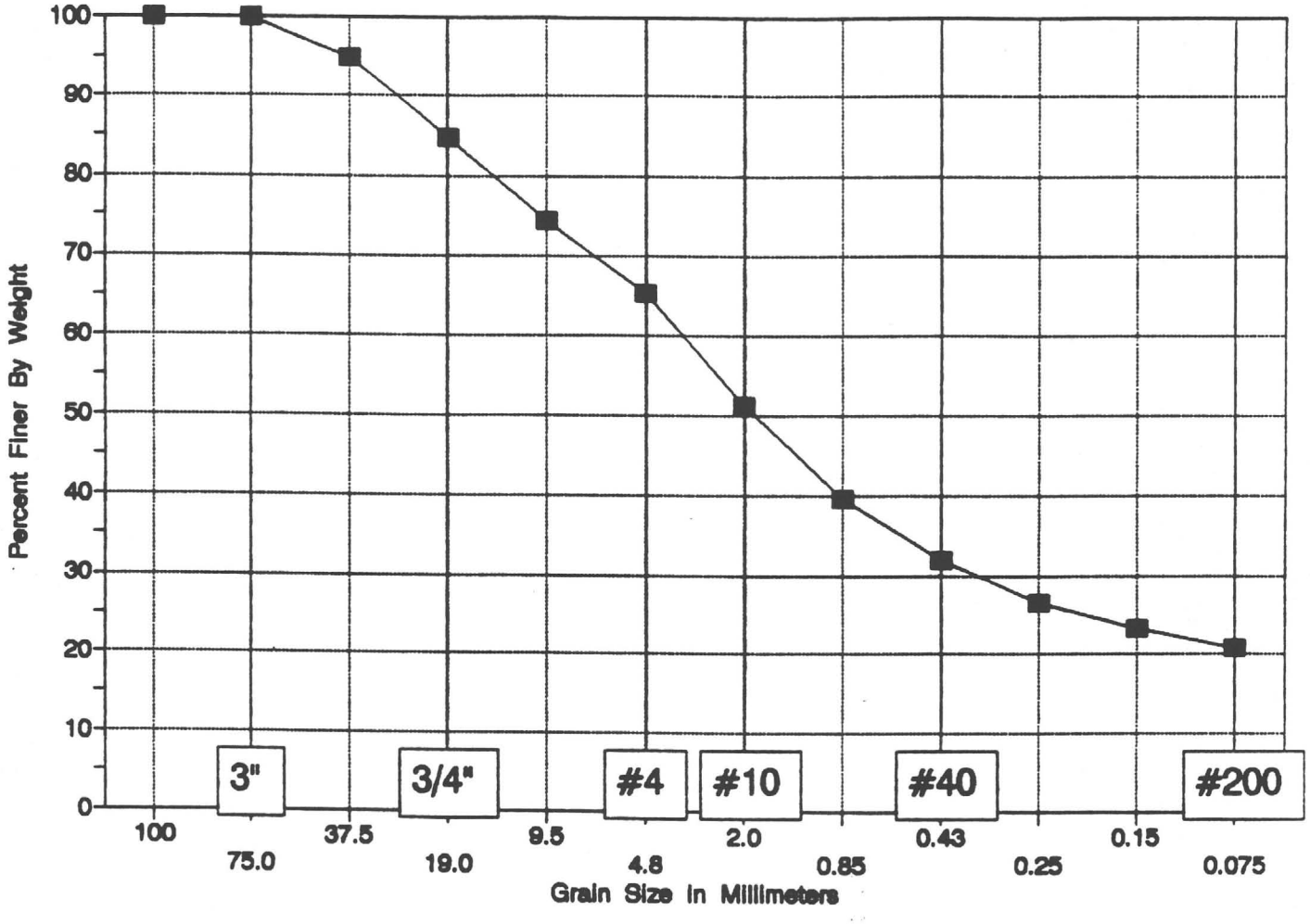
959P.1 (2) (6-86)

☐ NOTES OR CALCULATIONS ON REVERSE SIDE

T-8 + T-10 . 6

GRADATION CURVE

Combined Sample T-8 & T-10



T-8 + T-10

MECHANICAL ANALYSIS

DATE 2/27/91 BY JMenrath

JOB NUMBER 19601-001 OWNER/CLIENT ZONIA LANDELL

LOCATION _____

BORING _____ SAMPLE T-8 & T-10 DEPTH _____

-3/4" + #4 (6) #4

NUMBER OF RINGS		DISH	80 & 86	86
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL		
WT. OF RINGS		WT. OF DISH & DRY SOIL	1179.1	278.5
WT. OF WET SOIL		WT. OF MOISTURE		
FIELD DENSITY		WT. OF DISH	206.9	104.2
DRY DENSITY		WT. OF DRY SOIL	972.2g	
		FIELD MOISTURE CONTENT		

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

TOTAL SPL = 104.31

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				100.
		1-1/2"	4.72			94.8
		3/4"	9.23			84.6
80		3/8"		117.33		74.4
		#4		223.67		65.1
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		37.25	21.4	78.6	51.2
		#20		68.51			39.5
		#40		88.70			32.0
		#60		103.55			26.4
		#100		112.48			23.1
		#200		119.22			20.6
		PAN					
		TOTAL					

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T-8 + T-10.8

ATTERBERG LIMITS TEST DATA

FIELD CLASSIFICATION _____

LABORATORY CLASSIFICATION _____

JOB NO. 19601-001

CLIENT/OWNER _____

LOCATION _____

BORING T-8, T-10 SAMPLE ____ DEPTH ____

FIELD DENSITY BY ____/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS	—	—
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

THIS IS AN 1/8-INCH THREAD

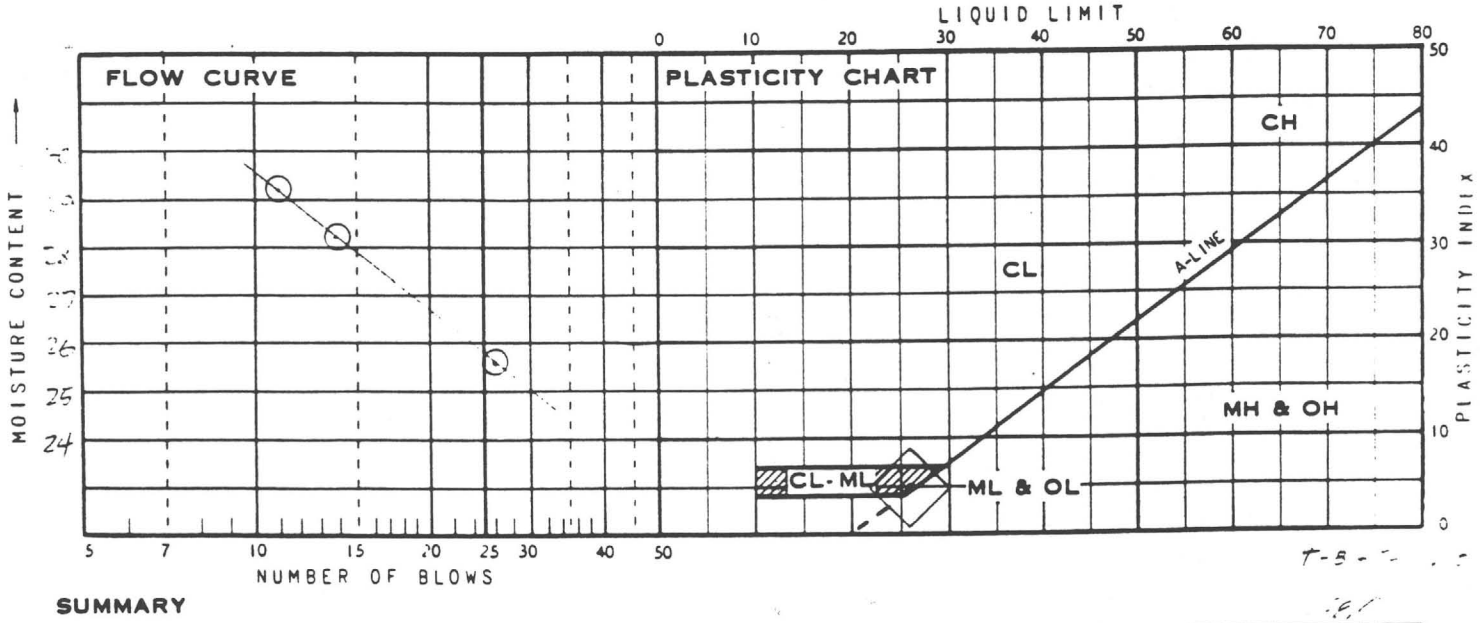
DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL	—	—
WT OF MOISTURE		
WT OF DISH	—	—
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

PLASTIC LIMIT BY JR 3/1/91

DETERMINATION	1	2	3	4	5	6
DISH	S-2	A-8				
WT OF DISH + WET SOIL	9.40	12.79				
WT OF DISH + DRY SOIL	8.00	10.82	—	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	—	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	21.21	20.91	$\bar{w}$ = 21			

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	000	29	19			
NUMBER OF BLOWS	26	14	11			
WT OF DISH + WET SOIL	12.78	11.93	11.34			
WT OF DISH + DRY SOIL	10.46	9.61	9.09	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	1.40	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	25.61	28.26	29.26			



T-8 - T-10

SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		26	21	5	CL-ML	

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ATTERBERG LIMITS TEST DATA

FIELD CLASSIFICATION _____

LABORATORY CLASSIFICATION _____

JOB NO. 19601-001

CLIENT/OWNER _____

LOCATION _____

BORING T-8 SAMPLE ____ DEPTH ____

FIELD DENSITY BY ____/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS	—	—
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

THIS IS AN 1/8-INCH THREAD

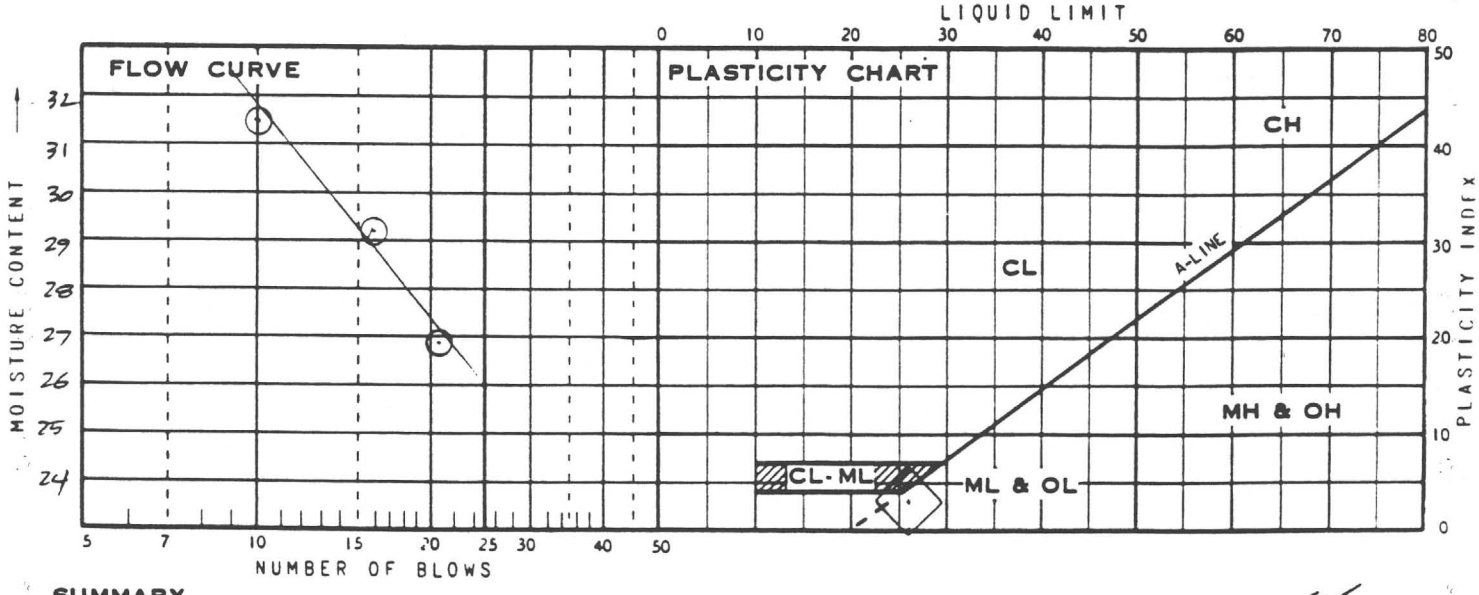
DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL	—	—
WT OF MOISTURE		
WT OF DISH	—	—
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

PLASTIC LIMIT BY JM 3/11/91

DETERMINATION	1	2	3	4	5	6
DISH	AL29	AL17				
WT OF DISH + WET SOIL	9.81	13.33				
WT OF DISH + DRY SOIL	8.24	11.12	—	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	—	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	22.95	22.74	w = 23			

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	13	14	18			
NUMBER OF BLOWS	21	16	10			
WT OF DISH + WET SOIL	8.13	10.87	12.07			
WT OF DISH + DRY SOIL	6.70	8.73	9.51	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	1.40	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	26.98	29.20	31.57			



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		26	23	3	ML	(-#40)

FEI

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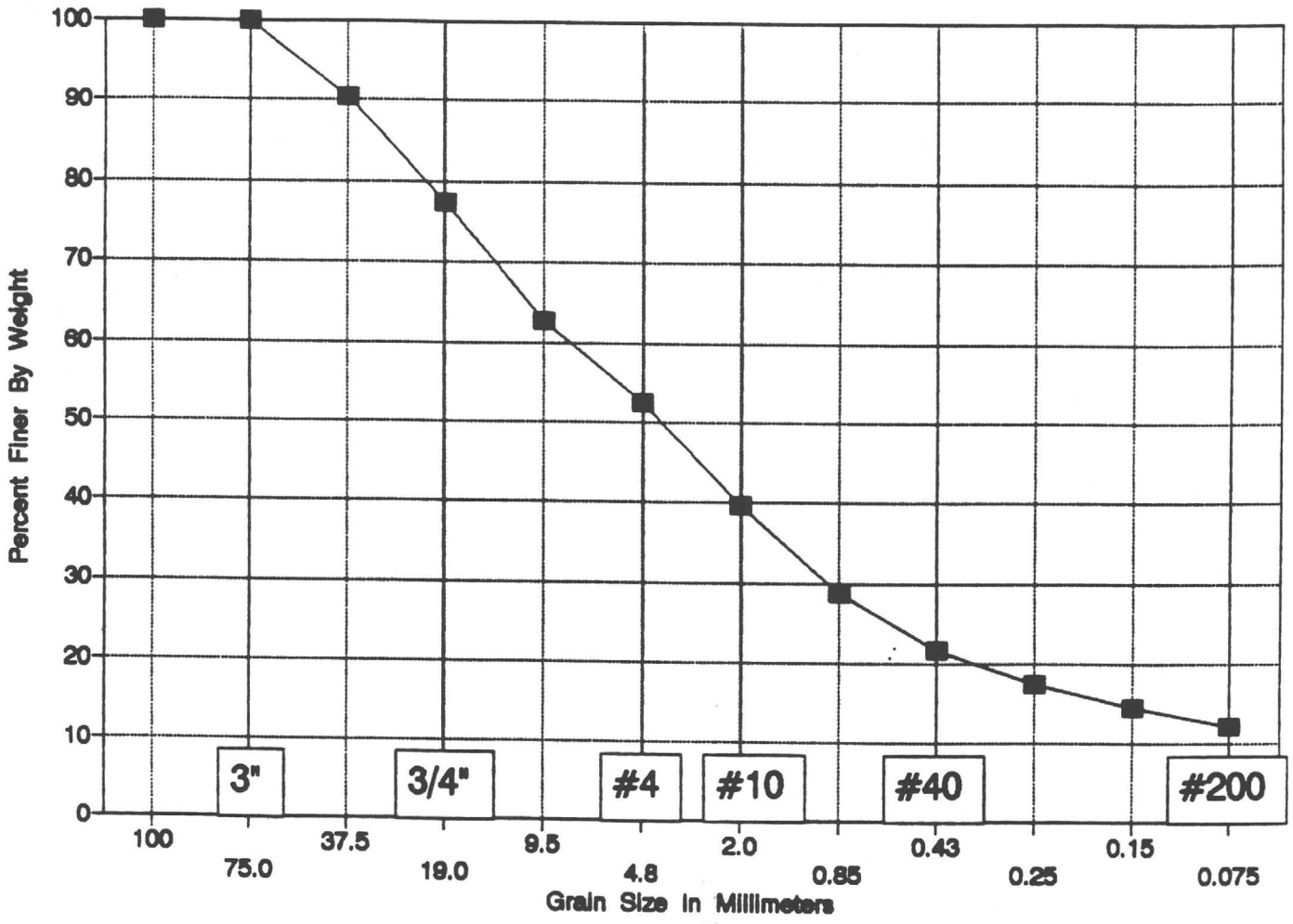
GRADATION CURVE

Combined Sample T-14 & T-15



SA

MECHANICAL ANALYSIS

DATE 3-1-91 BY MH

JOB NUMBER 19601-001 OWNER/CLIENT ZONIA LANDFILL

LOCATION

BORING COMBINED SAMPLE T-14, T-15 DEPTH

			⊕ #4	⊖ #4
NUMBER OF RINGS		DISH	31	6
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	524.9	
WT. OF RINGS		WT. OF DISH & DRY SOIL	506.2	233.9
WT. OF WET SOIL		WT. OF MOISTURE		
FIELD DENSITY		WT. OF DISH	110.9	103.9
DRY DENSITY		WT. OF DRY SOIL		
		FIELD MOISTURE CONTENT		

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DRY TOTAL = 51798.13 g

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"		0		100.
		1-1/2"	11.03	5007.6		90.3
		3/4"	25.87	11744.9		77.3
		3/8"		75.39		62.6
		#4		127.25		52.4
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		31.97			39.5
		#20		59.20			28.6
		#40		76.65			21.5
		#60		86.97			17.4
		#100		93.95			14.5
		#200		100.16			12.0
		PAN					
		TOTAL					

TEL

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ATTERBERG LIMITS TEST DATA

FIELD CLASSIFICATION _____

LABORATORY CLASSIFICATION _____

JOB NO. 19601-001

CLIENT/OWNER ZONIA

LOCATION _____

BORING T-14, T-15 SAMPLE ____ DEPTH ____

FIELD DENSITY BY ___/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS	—	—
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

THIS IS AN 1/8-INCH THREAD

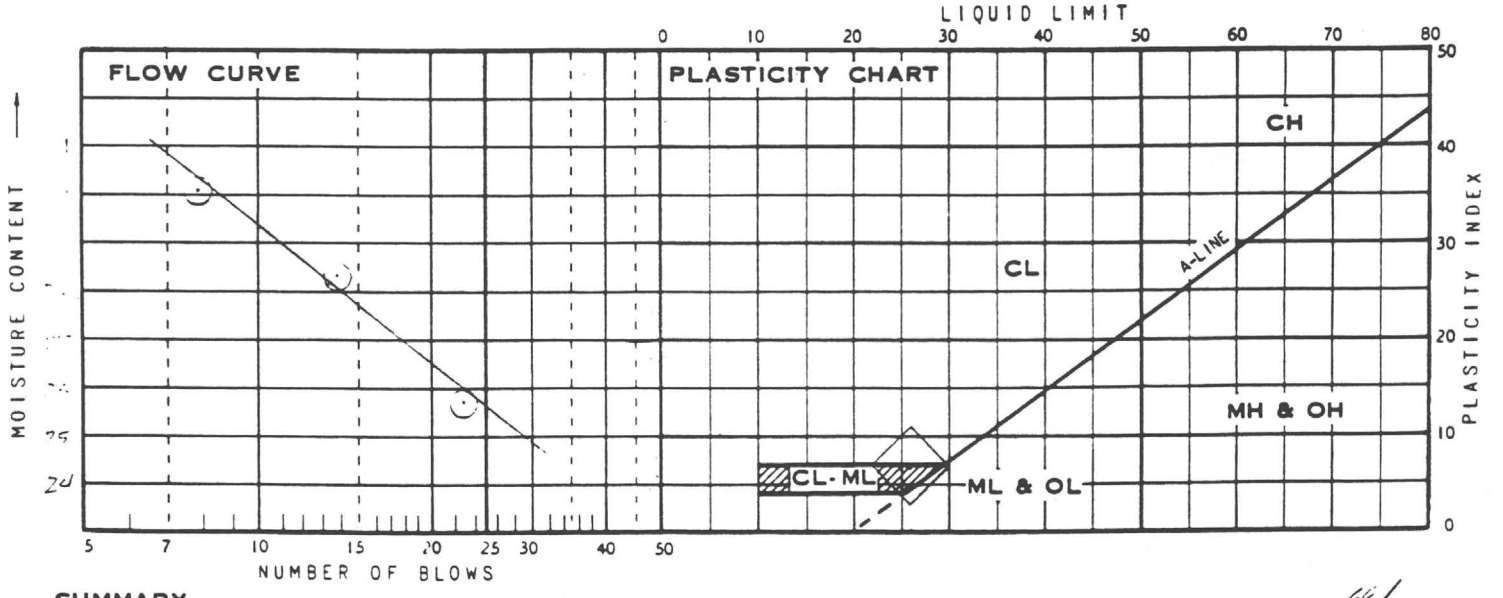
DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL	—	—
WT OF MOISTURE		
WT OF DISH	—	—
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

PLASTIC LIMIT BY JH 3/4/91

DETERMINATION	1	2	3	4	5	6
DISH	26	15				
WT OF DISH + WET SOIL	12.64	10.15				
WT OF DISH + DRY SOIL	10.79	8.76	—	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	—	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	19.70	18.89	av = 19			

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	A-10	A-7	A-6			
NUMBER OF BLOWS	23	14	8			
WT OF DISH + WET SOIL	12.97	13.45	12.93			
WT OF DISH + DRY SOIL	10.60	10.79	10.26	—	—	—
WT OF MOISTURE						
WT OF DISH	1.40	1.40	1.40	—	—	—
WT OF DRY SOIL						
MOISTURE CONTENT	25.76	28.33	30.14			



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		26	19	7	CL-ML	

SM1

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