EBASCO SERVICES INCORPORATED

WATERFORD STEAM ELECTRIC STATION - UNIT NO 3

PROCEDURE FOR: CLAM SHELL FILTER BLANKET TEST FILL	PROCEDURE NUMBER: CP-203

ISSUE SUMMARY

ISSUE/DATE	PREPARED	APPROVED	REMARKS
A/Draft 8/1/75	M. Temchin		
A/9/22/75	M. Temchin	J.O. Booth	

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

c/398

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

1.0 PURPOSE

This procedure outlines a means to determine the optimum construction techniques for the placement and compaction of the shell material to be placed directly on top of the final exposed pleistocene clay foundation.

2.0 SCOPE

The scope of the procedure will cover the construction of a test fill including material and thickness, preliminary material testing, compaction field testing, data compilation, tabulation and analysis. The final analysis of the data will result in a method specification stipulating, material properties, lift thickness, type of compaction equipment, and compaction technique (number of passes, overlap, etc.). Once established, the inspection, documentation and Quality Control of the construction of this shell blanket will be done in accordance with QCIP-I under the jurisdiction of the Senior Quality Control Supervisor.

3.0 REFERENCES

3.1 Ebasco Services, Incorporated
Ebasco Specification
Filter & Backfill
LOU 1564.482
3.2 Waterford SES Unit #3 - QCIP-1
3.3 Waterford SES - Unit #3 - QCIP-2

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

5.1 The Clam Shell Test Fill will be organized, controlled and evaluated under the direction of the Site Soil Engineer.
5.2 The Results of the Test Fill shall be recorded by the Site Soils Engineer on Forms QC-111 and QC-112.

6.0 PROCEDURE

6.1 Material and Thickness

Material shall be locally available clam shell and shall be subject to the approval of the Engineer. It shall be free of vegetation, organic matter, rubbish, debris or other unsuitable material. One layer of material shall be installed, such that the final in-place thickness of the filter blanket shall not be less than twelve (12) inches. Care shall be taken during placement and compaction not to disturb any soil instrumentation which may be in place. Inspection of material condition, placement and compaction shall be recorded on Form QC-93.

6.2 Preliminary Material Testing

A 250 pound representative sample of the clam shell material to be used in the test section shall be sent to a testing laboratory (either on site or off) and the following tests be run under the direction of the Site Soils Engineer. Results of the Laboratory Tests shall be recorded on the appropriate QC Forms as given in QCIP-2.

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

6.2.1 ASTM-D-422-63 - grain size distribution (sieve analysis) - Several tests shall be performed using sieves from +3 inch to #200. From this data, the following indexes shall be calculated: (Form QC-91 and QC-106).

6.2.1.1 Fineness Modulus - Defined in ASTM C-125-68

6.2.1.2 Coefficient of uniformity - defined as the diameter of the particle at which 60% of the material is finer divided by the diameter of the particle at which 10% is finer;

$$Cu = \frac{D_{60}}{D_{10}}$$

6.2.2.2 ASTM D-1557-70 Method D - modified proctor density - five point proctor curve. (Form QC-87 and QC-88).

6.2.3 ASTM D-422-63 - grain size distribution (sieve analysis) - several tests shall be performed on a representative sample of material taken from a blend of material used for the five proctor pills (after compaction gradation). From this data, the fineness modulus and coefficient of uniformity shall be calculated. (Form QC-91 and QC-106).

6.2.4 ASTM D-2049-69 - relative density of cohesionless soils - several maximum and minimum density tests shall be performed. (Form QC-108)

6.2.5 ASTM D-422-63 - grain size distribution (sieve analysis) - several tests shall be performed on a representative sample of material taken from a blend of all material used for the maximum density tests. From this data, the fineness modulus and coefficient of uniformity shall be calculated. (Form QC-91 and QC-106).

6.3 Compaction

The degree of compaction required for the clam shell filter blanket shall be established by a field testing program in accordance with the following procedure:

6.3.1 After excavation to the top of the Pleistocene clays at about elevation - 40ft. MSL, a quantity of clam shell material, sufficient to cover an area of about 50 ft. by 25 ft., shall be placed in the condition in which it would normally be dumped from trucks. The thickness of the material which is put down shall be such that its thickness after compaction shall be about 12 inches.

6.3.2 Three steel plates, 12 inches square by 1/8 inches thick shall be placed on top of the final graded material before compaction as shown in figure No. 1. Their elevations should be read before any compacting is performed and recorded on Form QC-111.

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

6.3.3 Six steel drums - 15 inches in diameter and 6 inches high with one end removed (cut from 5 gallon buckets) and a perforated bottom as shown in figure No. 2 shall be located at the end of each test strip as shown in figure No. 1. These drums should be placed in location prior to the shell placement so that they will be completely imbedded in the shell material during compaction.

6.3.4 Two passes shall be made by a large pneumatic roller (10 Ton ±) and a large dynamic force vibratory smooth drum roller (10 Ton ±) each operating on a separate section (See Figure No. 1). After each set of two passes, the following measurements and tests shall be performed and results recorded on Form QC-111.

6.3.4.1 The elevations of each of the three steel plates in each section should be measured using precise survey techniques.

6.3.4.2 One in place density test should be run in the close proximity of each steel plate. The in place density tests should be performed using any of the following techniques; the results recorded on Form QC-83.

a) Sand cone method ASTM B-1556-68

b) Rubber balloon method ASTM D-2167-66

6.3.4.3 One steel drum shall be removed from each section with a minimum amount of disturbance and carefully stored on the side of the test strip after each set of two passes of the roller. These drums shall be properly labeled and constant head permiability tested at the completion of the compaction phase of the test fill. The permeability testing shall be run by the Site Soils Engineer in accordance with Figure No. 3 and the following procedure and results recorded on Form QC-111:

a) Place the mold with shell on top of the distribution bucket and tape the seam with duct tape or equal.

b) Place the top collar on top of the mold with shell and tape the seam with duct tape or equal.

c) Close valve #2 and open valve #1 to fill the 55 gallon drum. Let water spill out.

d) Open valve #2 until the discharge hose is passing all the water on top of the shell mold.

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

e) Let the system run for two minutes to reach steady state conditions.

f) Slide the 5 gallon bucket under the discharge hose and record the time.

g) Record the time when the 5 gallon discharge bucket is just full.

h) Repeat steps F and G two more times.

Steps 6.3.4.1 through 6.3.4.4 should then be con-continually repeated for sets of two passes concluding with 12 passes or as otherwise directed by the Site Soils Engineer.

6.3.4.4 From each drum of material taken from the test fill, one grain size distribution test and one density test should be run.

6.3.5 The results of all tests and measurements performed will be recorded on test fill summary report forms attached to this procedure.

6.3.6 A series of curves will be plotted by the Soils Engineer on Form QC-112, based on the test results. These curves are as follows:

6.3.6.1 Average settlement (.01 inches) VS number of passes - settlement will be based on the intitial reading on the plates before compacting as a zero datum.

6.3.6.2 Average % compaction VS number of passes - the laboratory standard used as a base for the determination of percent compaction will be either the modified proctor density (ASTM D-1557-70 Method D) or the maximum density (ASTM D-2049-69) whichever has the smaller % of breakdown. The % compaction shall be defined as the in place density (#/ft^3) divided by the base laboratory density (#/ft^3) X 100.

6.3.6.3 Average Fineness Modulus VS number of passes - The fineness modulus should be determined in accordance with ASTM C-125-68 from the grain size distribution tests results previously described in section 6.2.5 of this procedure.

6.3.6.4 Average coefficient of uniformity VS number of passes - the coefficient of uniformity should be determined in accordance with section 6.2.1.2 of this procedure based on the test results previously described in section 6.2.5 of this procedure.

6.3.6.5 Permeability (CM/SEC) Vs number of passes - The permeability shall be determined in accordance with procedure in section 6.3.4.4.

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

6.3.7 All compacting shall be done in the presence of the Site Soils Engineer and shall be subject to his direction and approval. The analysis of the test curves will be made by the Site Soils Engineer and his interpretation of the results shall govern. The Site Soils Engineer may also, at his discretion, require any modifications in the testing program as may seem necessary in order to accomplish the desired results.

6.3.8 After the Site Soils Engineer has made his review of the results of the test program, all work associated with the installation and compaction of the in-place filter blanket shall follow the procedures used during the testing program as closely as practicable, except as specific modifications are called for by the Site Soils Engineer.

6.3.9 The use of shell material of a different type, or from a different source, or the use of a different type or model of compacting equipment, will require new tests to be made to determine the proper number of passes for the filter blanket.

7.0 ATTACHMENTS

7.1 Test Fill Layout

7.2 Clam Shell Permeability Mold

7.3 Permeameter

7.4 Quality Control Forms

a) QC-87 - Laboratory Compaction Tests

b) QC-88 - Compaction Test Graph

c) QC-91 - Sieve Analysis

d) QC-93 - Soils Construction Inspection Report

e) QC-106 - Mechanical Analysis Graph Of Granular Materials

f) QC-108 - Relative Density Determinations of Cohensienless Soil

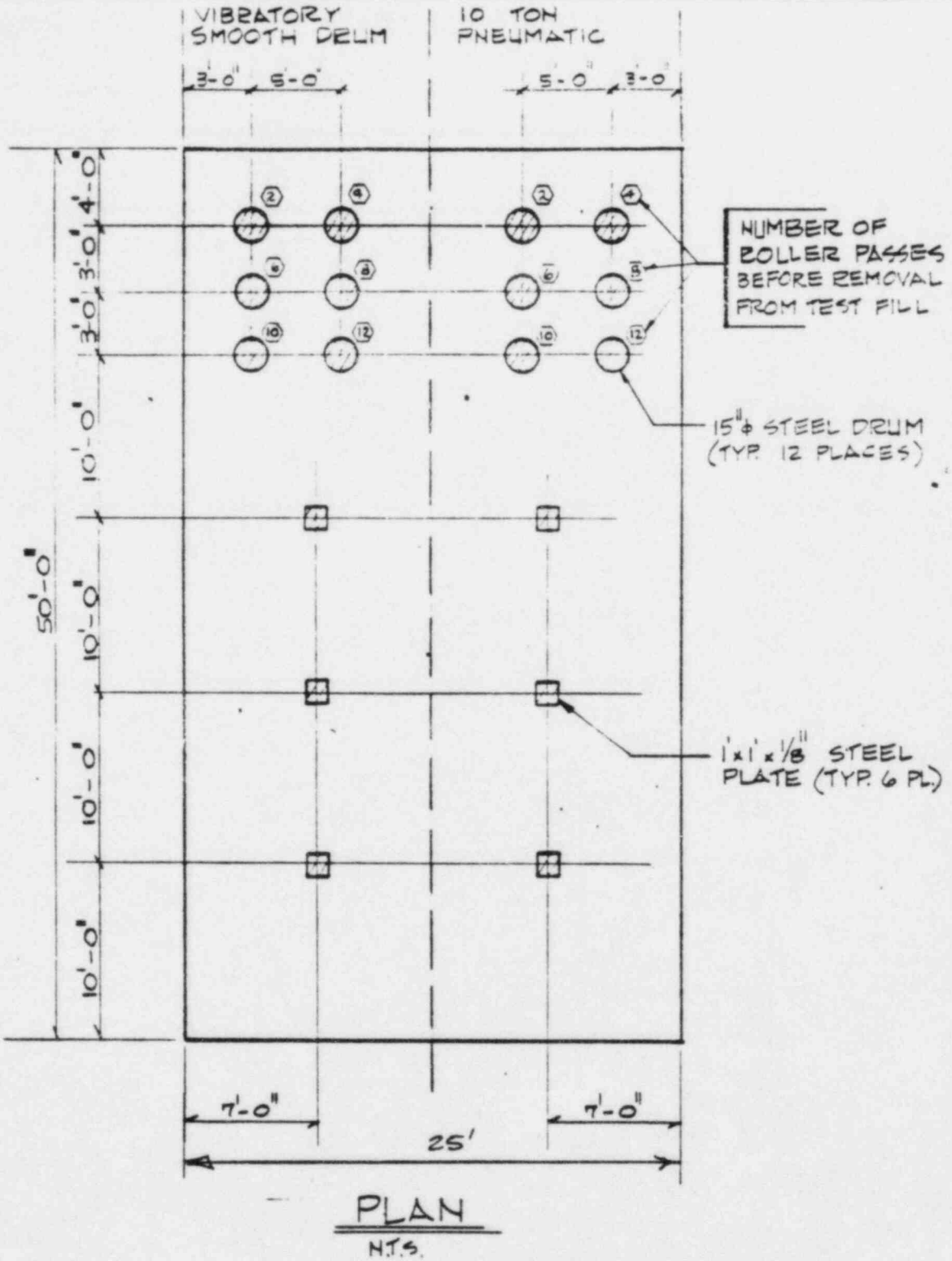
g) QC-111 - Filter Blanket Test Fill Summary

h) QC-112 - Test Fill Curve

i) QC-83 - Rubber Balloon Density Data Sheet

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

7.1



PLAN
N.T.S.

FIGURE # 1

WATERFORD STEAM ELECTRIC STATION
1980 - 1165 MW INSTALLATION - UNIT NO. 3
SOILS CONSTRUCTION
Inspection Report

GENERAL

Date _____ Shift _____ Weather _____ By _____

Area Worked _____

Average Elevation: Start of Shift _____ End of Shift _____ Total Loads _____

Construction Work Accomplished, Crew and Equipment _____

Work of the Construction Engineer for Soils _____

FILL

Origin of Material _____

Type of material, describe (when/where, oversize, frozen, too wet, contaminated, nonuniform, what remedial action was taken) _____

Lift Thickness Required _____ Actually Placed _____

Watering (reason for, how much, when, where) _____

Keying (when, how, how much, where) _____

Placement (leveling, raking, lift thickness; describe) _____

Remarks (include nonconformity to specifications, times and locations of each remark) _____

Form No. QC-93 (9-17-75)

(CONTINUED ON

QC 2 OF 2.

Units used, model, contractor's number, frequency when checked, when malfunctioned, remedial action taken for each

EQUIPMENT NO.	MODEL NO.	FREQUENCY	TIME	FREQUENCY	TIME	FREQUENCY	TIME

Speed of Towing _____ Lift Thickness Compacted _____

Coverages Requested _____ Coverages Give _____

Are areas being missed by compactors? If so, where, when?. What is compaction pattern? Is it satisfactory? If not, why not? (use sketch attached) _____

Tests failing. What remedial action was taken? When was the area retested? How many extra coverages were requested?. In what areas? Was request fulfilled? _____

Remarks (include nonconformity to specifications, times and locations of each remark) _____

SUMMARY

Number of coverages on lift partially compacted last shift _____

Number of lifts placed and compacted this shift _____

Number of coverages on lift partially compacted at end of this shift _____

A sketch may be attached to scale of area being filled and compacted indicating condition of area at end of shift, coverages completed, coverages needed in indicated areas.

Instructions to and conversations with subcontractor(s) _____

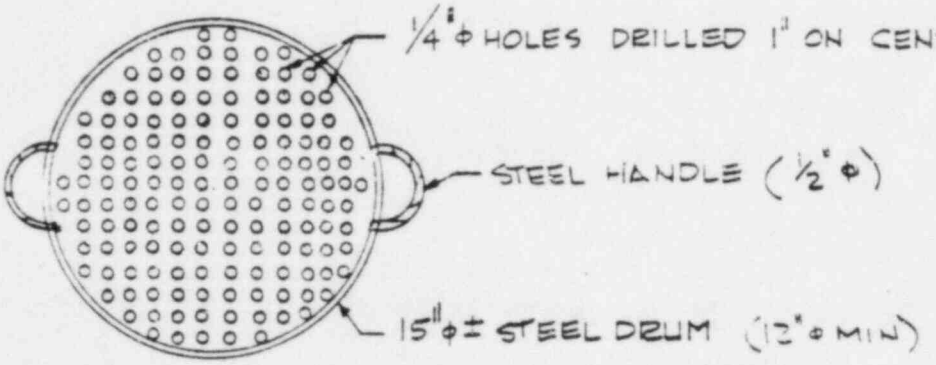
Examinations, discussions, decisions _____

Other important matters (dewatering operations, dredging peizometric readings, etc.) _____

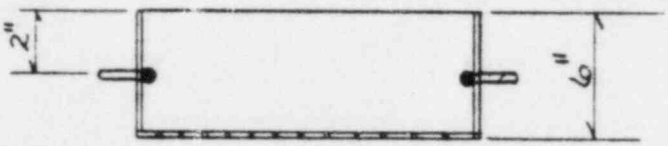
Form No. QC-93 (-17-75)

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

7.2



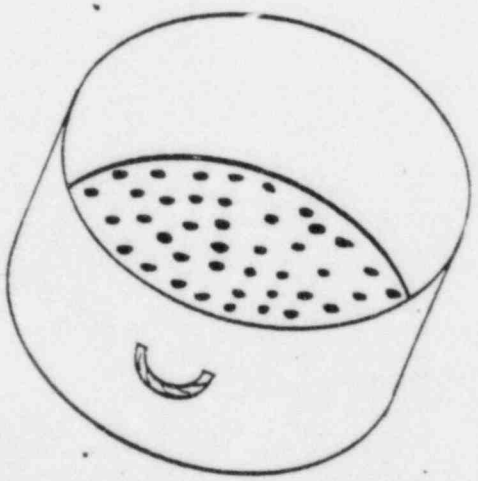
PLAN
N.T.S.



SECTION
N.T.S.

PERMEABILITY MOLD

FABRICATED FROM BOTTOM OF 5 GAL. DRUM OR BUCKET WITH 1/4" ϕ HOLES ONE INCH ON CENTER AND ½" ϕ STEEL HANDLE



ISOMETRIC
NTS

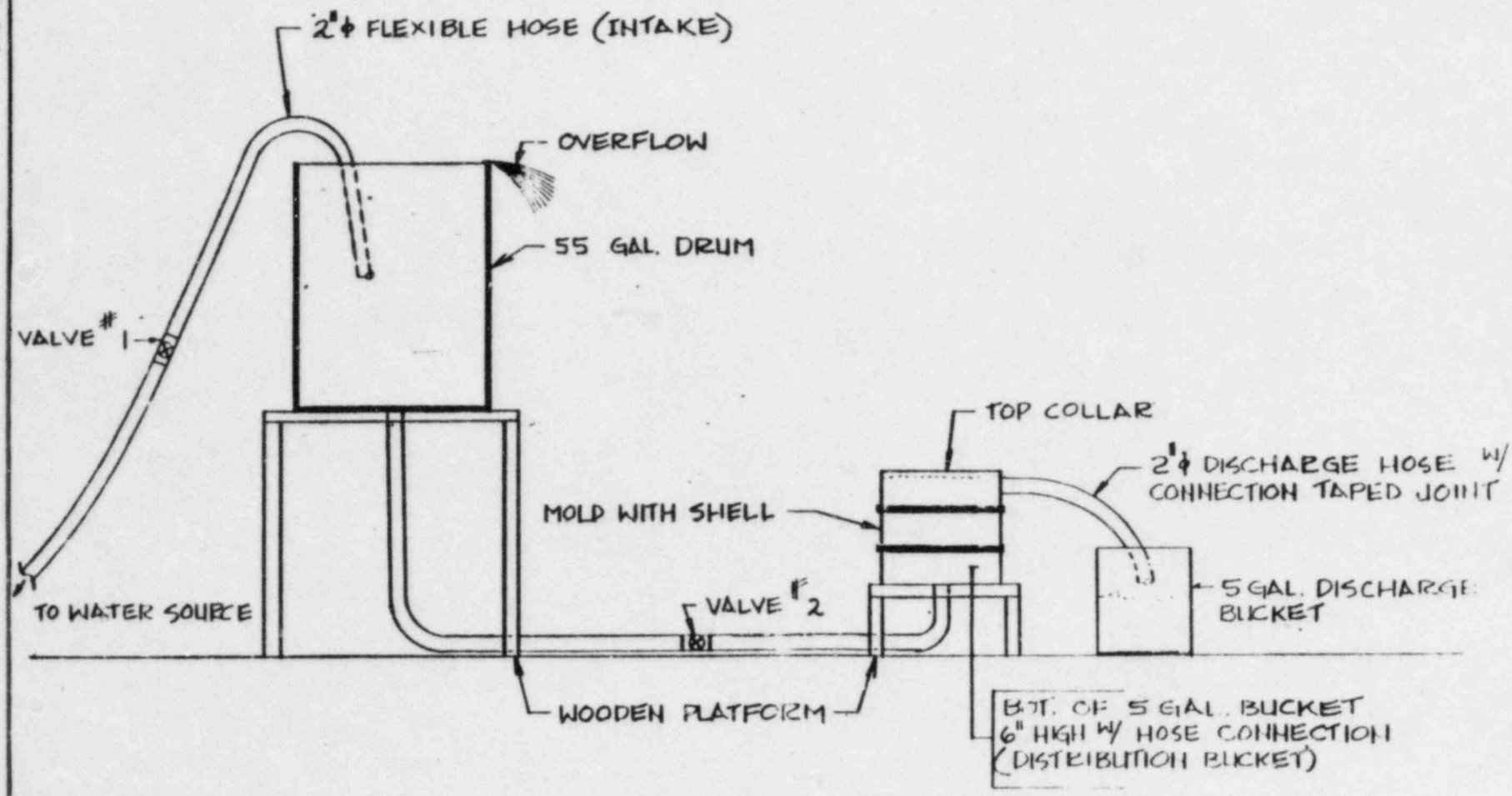
FIGURE # 2

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

FORM NO F-9 (12-12-74)

CONSTANT HEAD PERMEAMETER

7.3



ISSUE: A

EBASCO SERVICES INCORPORATED

WATERFORD STEAM ELECTRIC STATION - UNIT NO 3

NO. CP-203

PAGE: 8 OF 8

TEST NO.	
RUBBER BALLOON APPARATUS	

WATERFORD STEAM ELECTRIC STATION
1080 - 1165 MW INSTALLATION - UNIT NO. 3
DENSITY OF SOIL IN PLACE - RUBBER BALLOON METHOD
(In Accordance With ASTM D2167)

TEST LOCATION _____

TEST ELEVATION _____ TEST DEPTH _____

SOIL DESCRIPTION _____

NO.	DESCRIPTION	QUANTITY
1	Initial Readings with Apparatus on Test Hole Site:	
	a. Volume Indicator	cu ft
	b. Pressure on Liquid (same as for Calib. Check)	psig
	c. Surcharge Weight (same as for Calib. Check)	lb
2	Volume Indicator Reading with Apparatus over Test Hole and Balloon Inflated in Hole	cu ft
3	Volume of Test Hole, (2) - (1)	cu ft
4	Weight of Moist Soil Removed from Test Hole	lb
5	Weight Moisture Content Sample before Drying (Refer to Table II, ASTM D2167 for Min. Wt.)	g
6	Dry Weight of Moisture Content Sample	g
7	Moisture Content, $w = \frac{(5) - (6)}{(6)} \times 100$	%
8	Wet Unit Weight of Soil Removed from Test Hole, $\delta_m = \frac{(4)}{(3)}$	lb/cu ft
9	Dry Unit Weight of Soil Removed from Test Hole, $\delta_d = \frac{(8)}{(7) + 100} \times 100$	lb/cu ft

REMARKS

DATE AND TIME OF TEST	TEST BY	COMPUTED BY (WITH DATE)	CHECKED BY (WITH DATE)

Form No. QC-83 (9-17-75)

TEST OR SAMPLE NO.

WATERFORD STEAM ELECTRIC STATION
1960 - 1165 MW INSTALLATION - UNIT NO. 3
LABORATORY COMPACTION TEST
(In Accordance With ASTM D698 or D1557)

TEST LOCATION _____ TEST ELEVATION _____

MATERIAL DESCRIPTION _____

EQUIPMENT IDENTIFICATION _____

SAMPLE PREPARATION
☐ Natural State ☐ Air Dried ☐ Oven Dried
Date Compacted _____
Date Mixed _____ Scalped on _____ Sieve _____

MOLD
☐ Std 4" ☐ Std 6" ☐ Other
Diameter _____ Height _____ Volume _____ Mold No. _____

TYPE COMPACTION
☐ Std AASHO ☐ Mod AASHO ☐ Other
Dynamic: Hammer _____ lb, Blows/layer _____, Layers _____
Kneading: Spring _____ lb, Temps/layer _____, Layers _____

	TEST NUMBER				
	1	2	3	4	5
% Water Added					
Wgt Wet Soil + Mold in g					
Wgt Mold in g					
Wgt Wet Soil in g					
Wet Density, γ_m in lb/cu ft					

WATER CONTENT	COMPACTION									
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
Container No.										
Wgt Container + Wet Soil in g										
Wgt Container + Dry Soil in g										
Wgt Water in g										
Wgt Container in g										
Wgt Dry Soil in g										
Water Content, %										
Avg Water Content, %										
Dry Density, γ_d, lb/cu ft										

REMARKS:

1) How fast does soil absorb water while mixing? ☐ Fast ☐ Medium ☐ Slow
2) Degree of difficulty in getting uniform water-soil mixture? ☐ Hard ☐ Medium ☐ Easy
3) At what test number is sample: Crumbly _____, Firm _____, Soft _____, Spongy _____
4) Was blooding noticed during test? ☐ Yes ☐ No. If so what test numbers _____
5) Other comments: _____

Calculations: γ_t (in lb/ft³) = Mold Factor x weight wet soil in g. Mold Factor std 4" diam = 0.0661, std 6" diam = 0.0273

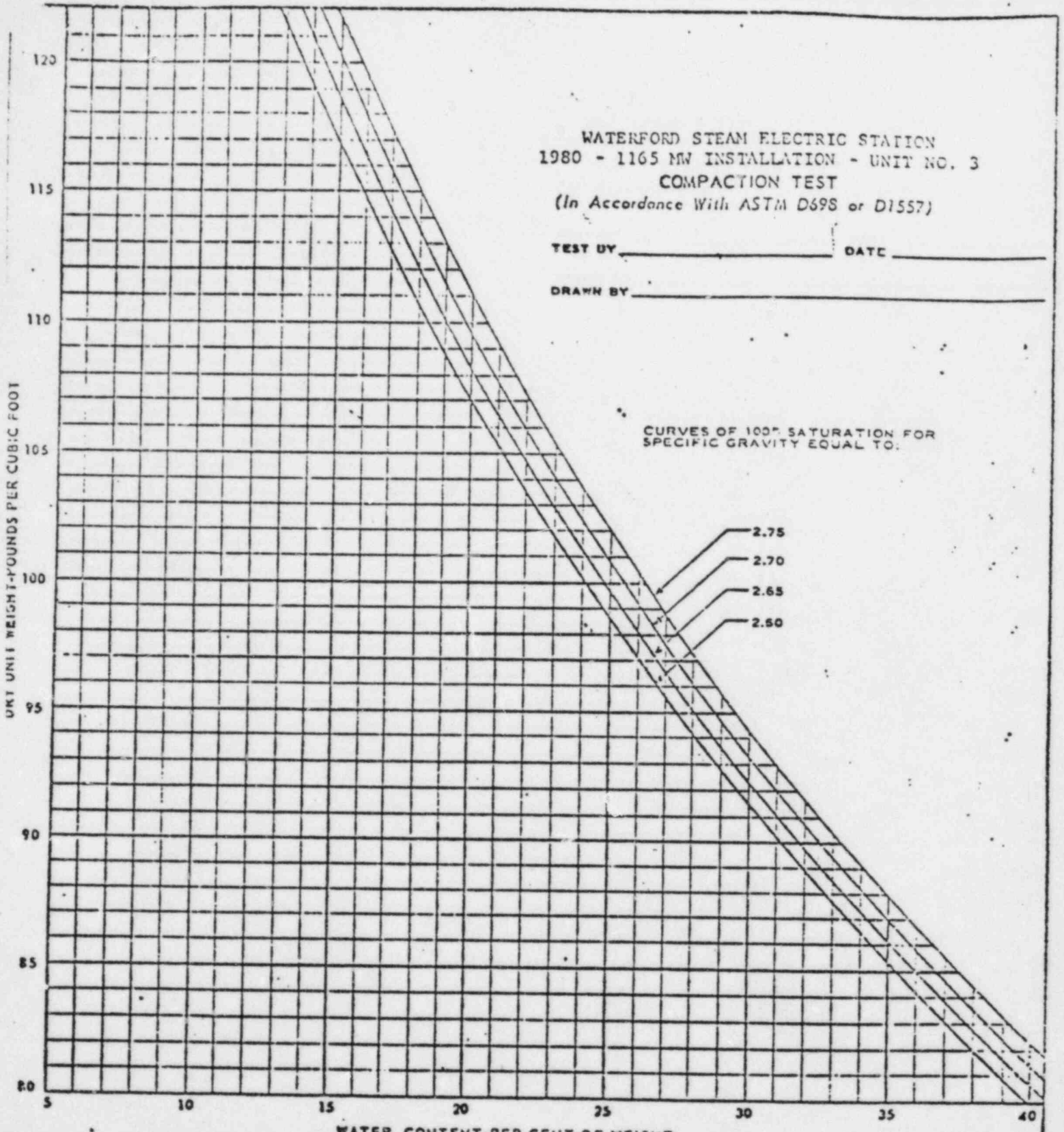
DATE OF TEST	TEST BY	CALCULATED BY (WITH DATE)	CHECKED BY (WITH DATE)

Form No. QC-87 (9-17-75)

WATERFORD STEAM ELECTRIC STATION
1980 - 1165 MW INSTALLATION - UNIT NO. 3
COMPACTION TEST
(In Accordance With ASTM D698 or D1557)

TEST BY _____ DATE _____

DRAWN BY _____



TEST NO.	METHOD OF TEST	MAX. DRY DENSITY PCF	OPTIMUM MOISTURE CONTENT %	SOIL DESCRIPTION OR CLASSIFICATION AND SAMPLE LOCATION

Form No. QC-88 (9-17-75)

TEST OR SAMPLE NO.

WATERFORD STEAM ELECTRIC STATION
1980 - 1165 MW INSTALLATION-UNIT NO. 3
SIEVE ANALYSIS
(In Accordance With ASTM D422)

TEST LOCATION _____ TEST ELEVATION _____

MATERIAL DESCRIPTION _____

EQUIPMENT IDENTIFICATION _____

SAMPLE PREPARATION: ☐ Natural State ☐ Air Dried ☐ Oven Dried — Soil Broken Up by: ☐ Mortar + Pestle ☐ Roller ☐ Both — Soil Soaked: ☐ Yes ☐ No

	WEIGHT OF TEST SPECIMEN	TOTAL SAMPLE	PARTIAL SAMPLE	SOIL RETAINED ON #200 SIEVE
Container Number	Container Number			
Weight Container + Wet Soil in g	Weight Container + Dry Soil in g			
Weight Container + Dry Soil in g	Weight Container in g			
Weight Water, W_w in g	Weight Dry Soil W_s			
Weight Container in g	Weight Dry Soil from Water Content, W_s in g			
Weight Dry Soil, W_s in g	Weight Dry Soil from Hydrometer Test			
Water Content, W in % = $\frac{W_w}{W_s} \times 100$	Factor 100/Dry Weight Soil			

SIEVE NO.	SIEVE OPENING IN MM	WEIGHT SIEVE IN g	WEIGHT SIEVE + SOIL IN g	WGT OF RETAINED SOIL IN, g	CUMULATIVE WGT RETAINED IN g	CUMULATIVE % RETAINED	% FINER N	TOTAL SAMPLE % FINER %
3"	76.2							
1½"	38.1							
3/4"	19.1							
3/8"	9.52							
4	4.76							
10	2.00							
Pan								

Sample washed on #200 Sieve: ☐ Yes ☐ No. Sample from Hydrometer Test: ☐ Yes ☐ No

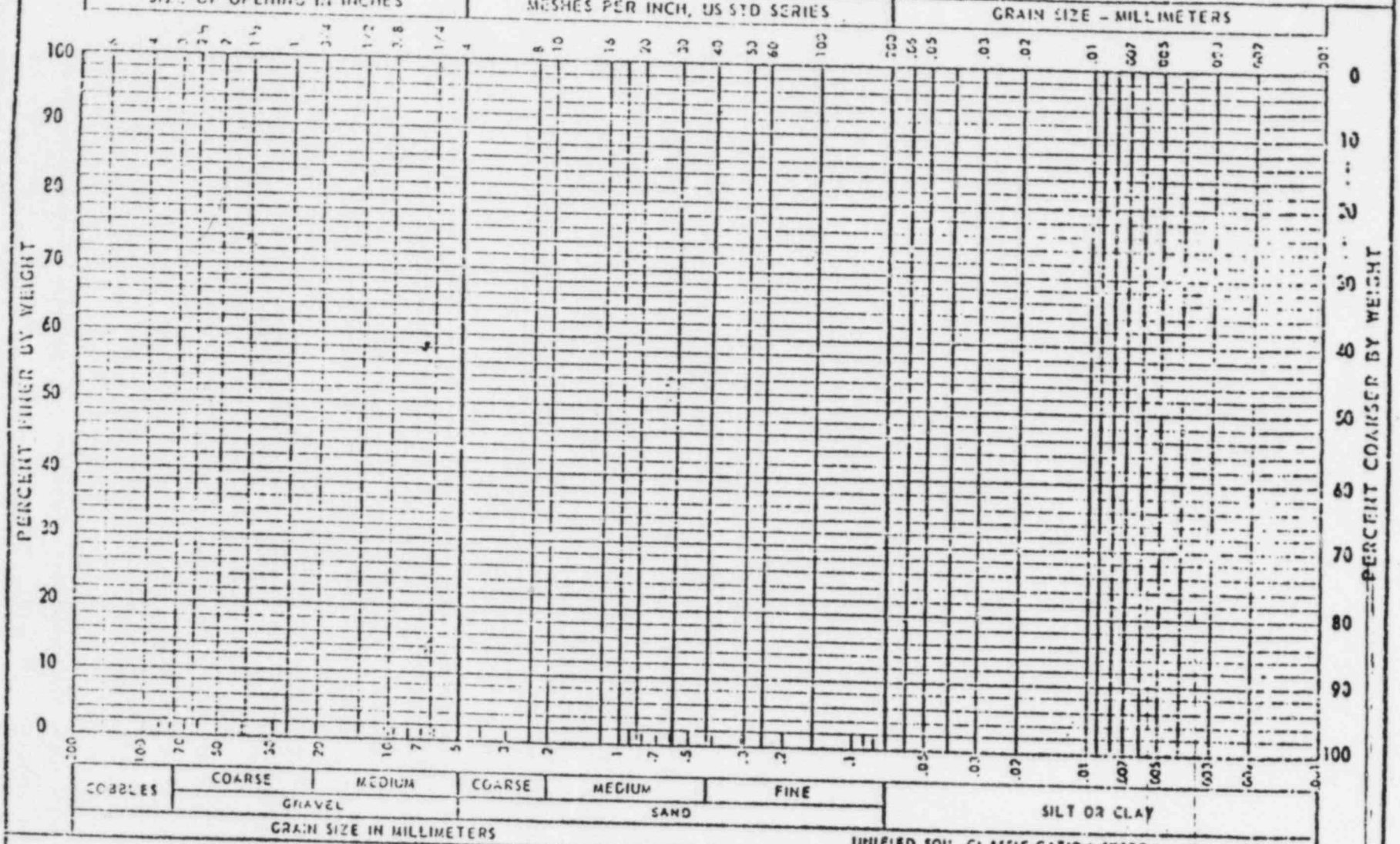
3/8"	9.52							
4	4.76							
10	2.00							
20	0.84							
40	0.42							
60	0.250							
100	0.149							
200	0.074							
Pan								

REMARKS:

DATE OF TEST	TEST BY	COMPUTED BY (INITIAL) DATE	CHECKED BY (INITIAL) DATE

MECHANICAL ANALYSIS GRAPH OF GRANULAR MATERIALS

(In Accordance With ASTM D422, Section 10)



TEST NO.

SAMPLE NO.

SAMPLE LOCATION

SAMPLE ELEVATION

SAMPLE DESCRIPTION

WATERFORD STEAM ELECTRIC STATION
1980-1165 MW INSTALLATION UNIT NO 3

PROJECT

DRAWN BY | CHECKED BY | DATE

FORM . . QC-106 (9-17-75)

TEST OR SAMPLE NO.

WATERFORD STEAM ELECTRIC STATION
1980 - 1165 MW INSTALLATION - UNIT NO. 3
RELATIVE DENSITY DETERMINATIONS OF COHESIONLESS SOIL
(In Accordance With ASTM D2049)

TEST LOCATION _____ TEST ELEVATION _____

SOIL DESCRIPTION _____

EQUIPMENT IDENTIFICATION _____ MOLD SIZE _____

MAXIMUM DENSITY DETERMINATION	☐ Vibrating Table ☐ Other _____ ☐ Wet ☐ Dry
VIBRATING TABLE METHOD	Frequency _____ Cyc/Sec Surcharge _____ lb, _____ lb/in^2 Displacement _____ In Vibration Time _____ Min
MINIMUM DENSITY DETERMINATION	☐ 1 – Inch Funnel ☐ ½ – Inch Funnel ☐ Scoop

MINIMUM DENSITY DETERMINATION (0% RELATIVE DENSITY)

TEST NO.	1	2	3
Weight Soil + Mold, lb			
Weight Mold, lb			
Weight Soil (Ws), lb			
Volume of Mold (Vc), cu ft			
Minimum Density, Ws ÷ Vc, PCF			

RELATIVE DENSITY COMPUTATION

	TEST NO.	1	2	3
1	In Place Density, PCF			
2	Maximum Laboratory Density, PCF			
3	Minimum Laboratory Density, PCF			
4	(1) – (3)			
5	(4) × (2)			
6	(2) – (3)			
7	(5) ÷ (6)			
	Relative Density (1) – (3) ÷ (7) × 100			

NOTES:

MAXIMUM DENSITY DETERMINATION (100% RELATIVE DENSITY)

TEST NO.	1	2	3
Left Gage Read, In			
Right Gage Read, In			
Average Gage Read, R_f			
Initial Gage Read, R_i			
Area Sample Surf (A), sq ft			
Calibration Volume of Mold (Vc), cu ft			
Soil Volume, $V = Vc - \frac{Ri - Rf}{12} \times A$			
Weight Dry Soil + Mold, lb			
Weight Mold, lb			
Weight Dry Soil (Ws), lb			
Maximum Density, Ws ÷ V, PCF			

Mold No. _____ Surcharge Base Plate No. _____

Surcharge Base Plate Thickness _____ In.

Straightedge Thickness _____ In

Left Dial Read _____

Right Dial Read _____

R_f = Average Dial Gage Reading + Surcharge Base Plate Thickness – Straightedge Thickness
= _____ In.

DATE OF TEST	TESTED BY	COMPUTED BY (WITH DATE)	CHECKED BY (WITH DATE)

Form No. QC-108 (9-17-73)

FILTER BLANKET TEST FILL SUMMARY

Date_____

Roller Type_____
6" lift thickness

Number of Passes	Test Result	Plate Location A	B	C	Average Valve
	Initial Reading——				
2	-Settlement				
2	-% Compaction				
2	-Fineness Modulus				
2	-Uniformity Coefficient				
2	-Permeability	___	___	___	
4	-Settlement				
4	-% Compaction				
4	-Fineness Modulus				
4	-Uniformity Coefficient				
4	-Permeability	___	___	___	
6	-Settlement				
6	-% Compaction				
6	-Fineness Modulus				
6	-Uniformity Coefficient				
6	-Permeability	___	___	___	
8	-Settlement				
8	-% Compaction				
8	-Fineness Modulus				
8	-Uniformity Coefficient				
8	-Permeability	___	___	___	
10	-Settlement				
10	-% Compaction				
10	-Fineness Modulus				
10	-Uniformity Coefficient				
10	-Permeability	___	___	___	
12	-Settlement				
12	-% Compaction				
12	-Fineness Modulus				
12	-Uniformity Coefficient				
12	-Permeability	___	___	___	

FILTER BLANKET CLAM SHELL TEST FILL

VERSUS

NUMBER OF PASSES- (#)

TEST RESULT_____-( )

2 4 6 8 10 12

NUMBER OF PASSES- (#)

FORM OC-112 (8-1-75)

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

1.0 PURPOSE

This procedure outlines a means to determine the optimum construction techniques for the placement and compaction of the shell material to be placed directly on top of the final exposed pleistocene clay foundation.

2.0 SCOPE

The scope of the procedure will cover the construction of a test fill including material and thickness, preliminary material testing, compaction field testing, data compilation, tabulation and analysis. The final analysis of the data will result in a method specification stipulating, material properties, lift thickness, type of compaction equipment, and compaction technique (number of passes, overlap, etc.). Once established, the inspection, documentation and Quality Control of the construction of this shell blanket will be done in accordance with QCIP-I under the jurisdiction of the Senior Quality Control Supervisor.

3.0 REFERENCES

3.1 Ebasco Services, Incorporated
Ebasco Specification
Filter & Backfill
LOU 1564.482
3.2 Waterford SES Unit #3 - QCIP-1
3.3 Waterford SES - Unit #3 - QCIP-2

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

5.1 The Clam Shell Test Fill will be organized, controlled and evaluated under the direction of the Site Soil Engineer.
5.2 The Results of the Test Fill shall be recorded by the Site Soils Engineer on Forms QC-111 and QC-112.

6.0 PROCEDURE

6.1 Material and Thickness

Material shall be locally available clam shell and shall be subject to the approval of the Engineer. It shall be free of vegetation, organic matter, rubbish, debris or other unsuitable material. One layer of material shall be installed, such that the final in-place thickness of the filter blanket shall not be less than twelve (12) inches. Care shall be taken during placement and compaction not to disturb any soil instrumentation which may be in place. Inspection of material condition, placement and compaction shall be recorded on Form QC-93.

6.2 Preliminary Material Testing

A 250 pound representative sample of the clam shell material to be used in the test section shall be sent to a testing laboratory (either on site or off) and the following tests be run under the direction of the Site Soils Engineer. Results of the Laboratory Tests shall be recorded on the appropriate QC Forms as given in QCIP-2.

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

6.2.1 ASTM-D-422-63 - grain size distribution (sieve analysis) - Several tests shall be performed using sieves from +3 inch to #200. From this data, the following indexes shall be calculated: (Form QC-91 and QC-106).

6.2.1.1 Fineness Modulus - Defined in ASTM C-125-68

6.2.1.2 Coefficient of uniformity - defined as the diameter of the particle at which 60% of the material is finer divided by the diameter of the particle at which 10% is finer;

$$Cu = \frac{D_{60}}{D_{10}}$$

6.2.2.2 ASTM D-1557-70 Method D - modified proctor density - five point proctor curve. (Form QC-87 and QC-88).

6.2.3 ASTM D-422-63 - grain size distribution (sieve analysis) - several tests shall be performed on a representative sample of material taken from a blend of material used for the five proctor pills (after compaction gradation). From this data, the fineness modulus and coefficient of uniformity shall be calculated. (Form QC-91 and QC-106).

6.2.4 ASTM D-2049-69 - relative density of cohesionless soils - several maximum and minimum density tests shall be performed. (Form QC-108)

6.2.5 ASTM D-422-63 - grain size distribution (sieve analysis) - several tests shall be performed on a representative sample of material taken from a blend of all material used for the maximum density tests. From this data, the fineness modulus and coefficient of uniformity shall be calculated. (Form QC-91 and QC-106).

6.3 Compaction

The degree of compaction required for the clam shell filter blanket shall be established by a field testing program in accordance with the following procedure:

6.3.1 After excavation to the top of the Pleistocene clays at about elevation - 40ft. MSL, a quantity of clam shell material, sufficient to cover an area of about 50 ft. by 25 ft., shall be placed in the condition in which it would normally be dumped from trucks. The thickness of the material which is put down shall be such that its thickness after compaction shall be about 12 inches.

6.3.2 Three steel plates, 12 inches square by 1/8 inches thick shall be placed on top of the final graded material before compaction as shown in figure No. 1. Their elevations should be read before any compacting is performed and recorded on Form QC-111.

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

6.3.3 Six steel drums - 15 inches in diameter and 6 inches high with one end removed (cut from 5 gallon buckets) and a perforated bottom as shown in figure No. 2 shall be located at the end of each test strip as shown in figure No. 1. These drums should be placed in location prior to the shell placement so that they will be completely imbedded in the shell material during compaction.

6.3.4 Two passes shall be made by a large pneumatic roller (10 Ton ±) and a large dynamic force vibratory smooth drum roller (10 Ton ±) each operating on a separate section (See Figure No. 1). After each set of two passes, the following measurements and tests shall be performed and results recorded on Form QC-111.

6.3.4.1 The elevations of each of the three steel plates in each section should be measured using precise survey techniques.

6.3.4.2 One in place density test should be run in the close proximity of each steel plate. The in place density tests should be performed using any of the following techniques; the results recorded on Form QC-83.

a) Sand cone method ASTM B-1556-68

b) Rubber balloon method ASTM D-2167-66

6.3.4.3 One steel drum shall be removed from each section with a minimum amount of disturbance and carefully stored on the side of the test strip after each set of two passes of the roller. These drums shall be properly labeled and constant head permiability tested at the completion of the compaction phase of the test fill. The permeability testing shall be run by the Site Soils Engineer in accordance with Figure No. 3 and the following procedure and results recorded on Form QC-111:

a) Place the mold with shell on top of the distribution bucket and tape the seam with duct tape or equal.

b) Place the top collar on top of the mold with shell and tape the seam with duct tape or equal.

c) Close valve #2 and open valve #1 to fill the 55 gallon drum. Let water spill out.

d) Open valve #2 until the discharge hose is passing all the water on top of the shell mold.

e) Let the system run for two minutes to reach steady state conditions.

f) Slide the 5 gallon bucket under the discharge hose and record the time.

g) Record the time when the 5 gallon discharge bucket is just full.

h) Repeat steps F and G two more times.

Steps 6.3.4.1 through 6.3.4.4 should then be con-continually repeated for sets of two passes concluding with 12 passes or as otherwise directed by the Site Soils Engineer.

6.3.4.4 From each drum of material taken from the test fill, one grain size distribution test and one density test should be run.

6.3.5 The results of all tests and measurements performed will be recorded on test fill summary report forms attached to this procedure.

6.3.6 A series of curves will be plotted by the Soils Engineer on Form QC-112, based on the test results. These curves are as follows:

6.3.6.1 Average settlement (.01 inches) VS number of passes - settlement will be based on the intitial reading on the plates before compacting as a zero datum.

6.3.6.2 Average % compaction VS number of passes - the laboratory standard used as a base for the determination of percent compaction will be either the modified proctor density (ASTM D-1557-70 Method D) or the maximum density (ASTM D-2049-69) whichever has the smaller % of breakdown. The % compaction shall be defined as the in place density (#/ft^3) divided by the base laboratory density (#/ft^3) X 100.

6.3.6.3 Average Fineness Modulus VS number of passes - The fineness modulus should be determined in accordance with ASTM C-125-68 from the grain size distribution tests results previously described in section 6.2.5 of this procedure.

6.3.6.4 Average coefficient of uniformity VS number of passes - the coefficient of uniformity should be determined in accordance with section 6.2.1.2 of this procedure based on the test results previously described in section 6.2.5 of this procedure.

6.3.6.5 Permeability (CM/SEC) Vs number of passes - The permeability shall be determined in accordance with procedure in section 6.3.4.4.

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

6.3.7 All compacting shall be done in the presence of the Site Soils Engineer and shall be subject to his direction and approval. The analysis of the test curves will be made by the Site Soils Engineer and his interpretation of the results shall govern. The Site Soils Engineer may also, at his discretion, require any modifications in the testing program as may seem necessary in order to accomplish the desired results.

6.3.8 After the Site Soils Engineer has made his review of the results of the test program, all work associated with the installation and compaction of the in-place filter blanket shall follow the procedures used during the testing program as closely as practicable, except as specific modifications are called for by the Site Soils Engineer.

6.3.9 The use of shell material of a different type, or from a different source, or the use of a different type or model of compacting equipment, will require new tests to be made to determine the proper number of passes for the filter blanket.

7.0 ATTACHMENTS

7.1 Test Fill Layout

7.2 Clam Shell Permeability Mold

7.3 Permeameter

7.4 Quality Control Forms

a) QC-87 - Laboratory Compaction Tests

b) QC-88 - Compaction Test Graph

c) QC-91 - Sieve Analysis

d) QC-93 - Soils Construction Inspection Report

e) QC-106 - Mechanical Analysis Graph Of Granular Materials

f) QC-108 - Relative Density Determinations of Cohensienless Soil

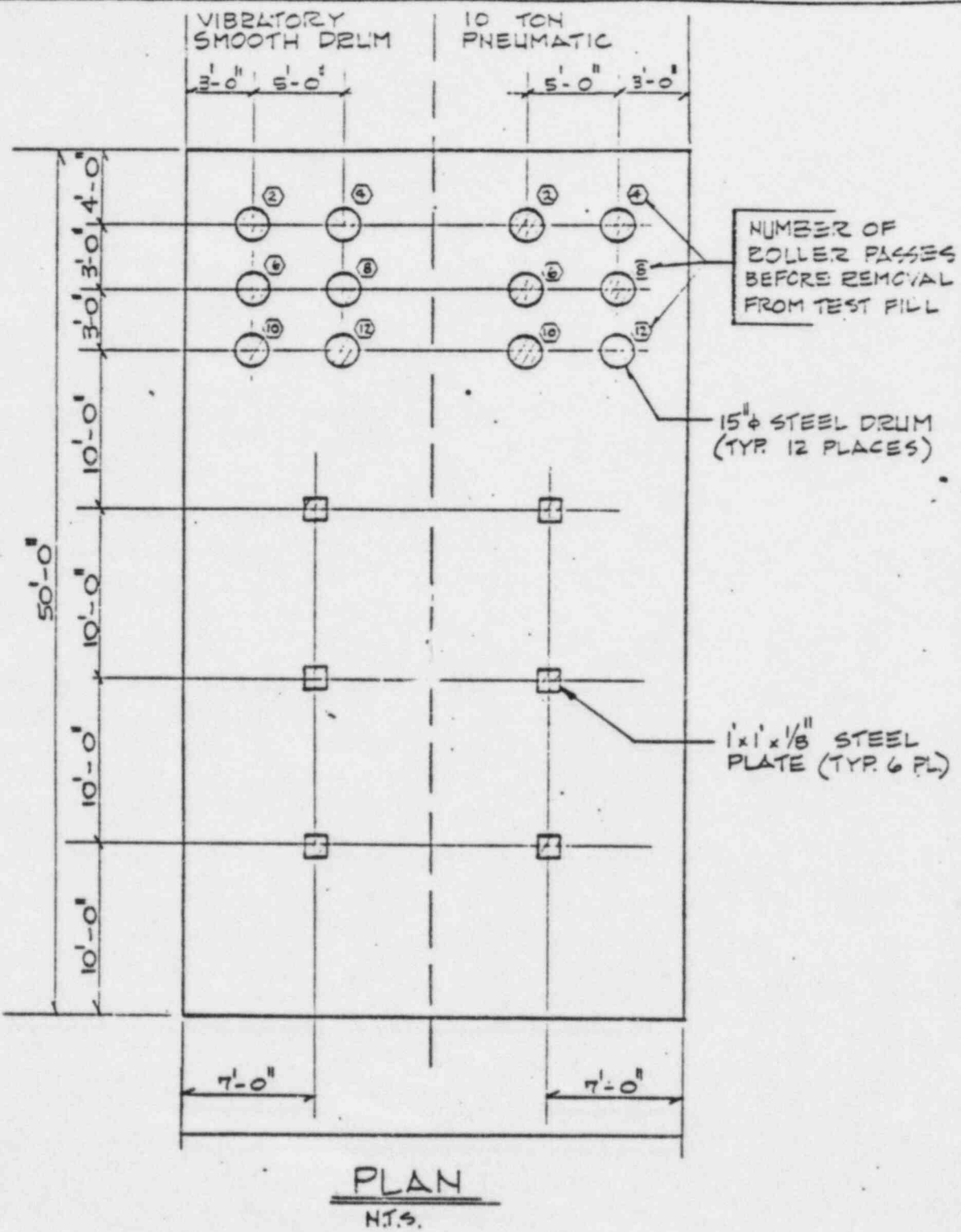
g) QC-111 - Filter Blanket Test Fill Summary

h) QC-112 - Test Fill Curve

i) QC-83 - Rubber Balloon Density Data Sheet

NOTATIONS IN THIS COLUMN INDICATE WHICH CHANGES HAVE BEEN MADE

7.1

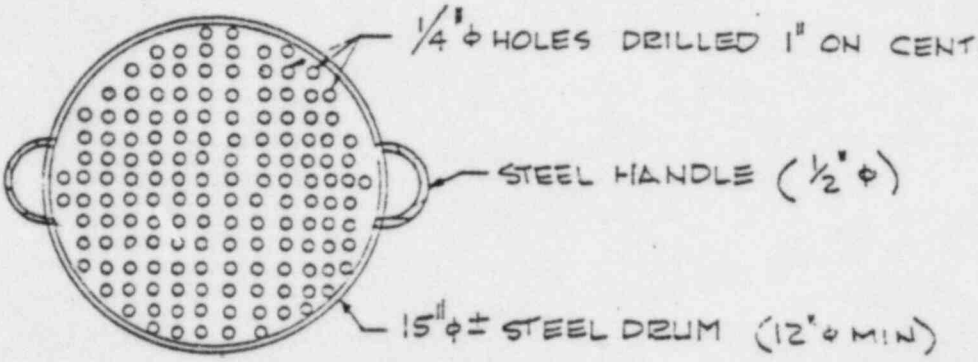


PLAN
N.T.S.

FIGURE # 1

FORM NO. E-2 (12-12-74)

7.2

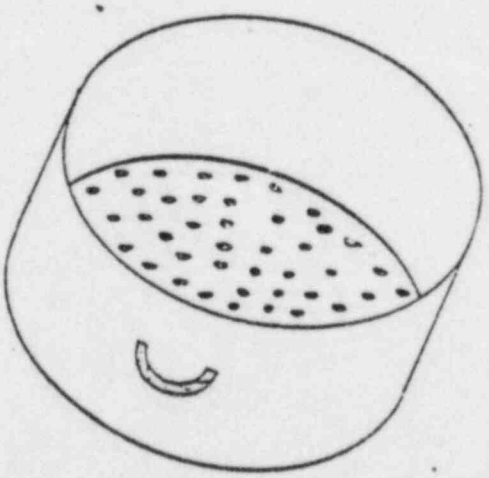


PLAN
N.T.S.

SECTION
N.T.S.

PERMEABILITY MOLD

FABRICATED FROM BOTTOM OF 5 GAL. DRUM OR BUCKET WITH 1/4"ϕ HOLES ONE INCH ON CENTER AND 1/2"ϕ STEEL HANDLE



ISOMETRIC
NTS

FIGURE # 2

CONSTANT HEAD PERMEAMETER

7.3