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**MUESER RUTLEDGE CONSULTING ENGINEERS**

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RECORDS ADMINISTRATION



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SALTSTONE DISPOSAL  
Z-AREA  
SAVANNAH RIVER PLANT

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October 14, 1986

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October 14, 1986

E.I. du Pont de Nemours & Co., Inc  
Engineering Department  
Louviers Building  
Wilmington, De. 19808  
Attn: Mr. John Guglielmetti

Re: Saltstone Disposal - Z-Area  
Savannah River Plant  
MRCE #6329

Gentlemen:

In accordance with Du Pont's request, we have evaluated subsurface conditions for the saltstone vaults in Z-Area. Presented herein is our summary of subsurface conditions, laboratory test data and recommendations for foundation support.

## EXHIBITS

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PREVIOUS MRCE REPORTS FOR Z-AREA

We have performed recent foundation investigations in areas adjoining the proposed saltstone vaults:

1. Residual Salt Disposal Facility DWPF, Z-Area, Savannah River Plant, dated April 22, 1985. This report included a summary of our foundation investigation for the Residual Salt Disposal Facility and the Primary and Auxiliary Sedimentation Basins in Z- Area.

2. Operations Building, Residual Salt Disposal Facility, Defense Waste Processing Facility, 200-Z-Area, Savannah River Plant, dated April 23, 1985. This report summarized our foundation investigation for the Operations Building.

AVAILABLE INFORMATION

For our use in this investigation, Du Pont provided us with these drawings which were used in preparation of this report.

1. Du Pont Drawing W780541 dated January 10, 1986, titled Z-Area Saltstone Dipsosal Soil Boring Location Plan.
2. Du Pont Drawing W731424, dated February 1, 1983, titled Residual Salt Disposal Facility, Layout, Civil.
3. Du Pont Drawing W780623, dated December 24, 1985, titled Saltstone Surface Disposal Vaults, Sections & Details, Concrete/Steel, Structural.

SITE DESCRIPTION

The Saltstone Disposal Facility is approximately 100 acres, situated east of the intersection of F and 4 Roads, as shown on Drawing No. B-1. The site is on top of a plateau, gently sloping towards the northeast. from about Elev. 295 to Elev. 277. Prior to clearing, the site was a pine forest. New facilities include 21 reinforced concrete vaults; each vault is approximately 100 by 600 feet in plan and 25 feet deep. The vaults include reinforced concrete walls 18 inches thick, partitioning the vaults into concrete cells 100 by 100 feet, supported by a reinforced concrete slab foundation. The base slab is 2½ feet thick and founded about 13 feet below original grade. The partitioned cells will be filled sequentially; it is anticipated the saltstone will be poured like concrete and harden within about 30 days to a strength in excess of 2000 pounds per square inch (psi.) Therefore, the filled vaults will be similar to massive concrete blocks.

Ultimately, the vaults may be backfilled and capped with two feet of clay plus five meters of soil over a poured concrete roof. The maximum bearing pressure anticipated on the foundation is 4.3 kips per square foot (ksf) including the weight of the vaults, saltstone and concrete roof. If the soil cover is placed, the total base slab loading increases to about 6.4 ksf.

The vault closest to F-Road, on the south side of the site, will be constructed first and is intended to contain about one years saltstone production. The adjacent vaults will be built as needed. The vaults are arranged in groups of from one to seven, as shown on Drawing No. B-1.

In accordance with your request, we performed a final foundation investigation for the eight vaults on the site's south side and a preliminary investigation for the 14 remaining vaults forming a future expansion area.

#### SUBSURFACE INVESTIGATION

Previous investigations in nearby S-Area have identified potentially compressible deep clay layers that could cause significant settlements under the heavy net loads imposed by the saltstone vaults. Investigations in F-Area about two miles southwest of Z-Area, have identified highly leached zones of calcareous soils and limestone within the McBean formation about 110 to 130 feet below ground surface; where highly leached zones are present there is the potential for gradual surface subsidence. Therefore, the subsurface investigation included a program of deep borings to determine the properties of deep potentially compressible soils and the nature of the McBean formation beneath the vaults.

The boring program for the initial eight vaults included a basic grid of 17 split-spoon sample borings spaced approximately 200 feet on center and extending through the McBean formation to depths of approximately 160 below ground surface. In the areas of future vaults, the preliminary investigation included six deep split-spoon samples borings, to establish a general soils profile. Undisturbed samples were recovered of potentially compressible soils at selected depths in the initial 23 borings. As the work progressed two borings were added in the vicinity of the initial eight vaults, to recover undisturbed samples of the deep compressible soil layer. Wellpoint piezometer installations were planned at five representative points to determine ground water levels across the site.

At the request of Du Pont, the program included special provisions to determine the permeability of natural soils in the interval extending from vault subgrade to approximately 15 feet below subgrade. In the three piezometers boreholes for the three initial vault groups, field permeability tests were performed in the interval of concern, and undisturbed samples were recovered for laboratory permeability tests.

The borings were made between March 11 and May 22, 1986 by Davis Drilling Company, Inc. under the continuous inspection of our Resident Engineer, Peter E. Bleiweiss. The borings were advanced with rotary drilling techniques using a bentonite based drilling mud to stabilize the borehole. Piezometers were installed in boreholes advanced with rotary drilling techniques without the use of drilling mud. A total of 19 undisturbed samples were recovered for laboratory testing. All of the samples recovered were shipped to our office for review of field classifications and laboratory testing of undisturbed samples.

#### GENERAL SUBSURFACE CONDITIONS

The subsurface conditions are shown in the form of eight schematic geologic sections on Drawings Nos. GS-1 through GS-5. Sections are shown in plan on Drawing No. B-1; the logs of all borings with individual sample descriptions are in the Appendix. Boring information

displayed on geologic sections includes: sample number and type, location, standard penetration resistance in blows per foot, natural water content, and field permeabilities.

The subsurface profile consists of complexly interbedded clayey sands, sand and clay layers. Geologic sections have been stratified into seven layers based on predominant soil types. These soil profiles are not precise representations of the actual subsurface conditions which are more complexly interwoven with usually less distinct changes between strata than shown.

The general strata are summarized in the order of sequence with depth:

BARNWELL FORMATION

Stratum S2 - Sand, Trace Silt: Included in this stratum is a loose to medium compact surface layer of gray brown fine to medium sand, trace silt and a deeper layer of compact to very compact yellow brown to red fine to medium sand, trace clay or silt. The surface layer is two to 10 feet thick. The more compact lower layer of clean sands is generally found below Stratum S1, between Elevs. 255 and 220, averages 18 feet thick. In the surface layer, typical standard penetration resistances (N values) range from three to 12 blows per foot, averaging five blows per foot. The deeper layer is more compact with N values ranging from 21 to greater than 100 blows per foot, averaging 43 blows per foot.

Stratum S1 - Clayey Sand: Medium compact to compact red-brown and gray clayey fine to medium sand to fine to medium sand, some clay with occasional interbedding of fine sandy clay layers. Beneath the shallow layer of Stratum S2 clean sands, all borings penetrated a thick continuous layer of these clayey sands in which all of the vaults will be founded.

Beneath the southern eight vaults, the stratum is 22 to 70 feet thick with its base between Elevs. 250 and 220. Noncontinuous layers of these soils, about five feet thick, were occasionally found below Stratum S2 between Elevs. 220 and 240. In the future expansion area, the layer is 18 to 30 feet thick with its base fairly level at approximately Elev. 255. Standard penetration resistances typically range from eight to 50 blows per foot, averaging 31 blows per foot. Natural water contents vary from 14 to 28 percent of dry weight, averaging 17 percent.

UNDIFFERENTIATED ZONE

Typically at the Savannah River Plant, between the Barnwell and McBean formations, borings penetrate a "marker bed" designated as Stratum C2 consisting of clayey sands interbedded with highly plastic clay layers. At this site, the undifferentiated zone is often characterized by a marked decrease in penetration resistances. We have grouped the more plastic clayey fine sands and clay layers in Stratum C2. Within the same horizon, significantly less plastic sands with some clay are grouped with Stratum S3a.

Stratum C2 - Clayey Sand, Some Clay Layers: Medium compact yellow-brown and light green clayey fine sand, interlayered with stiff yellow-brown silty clay, trace lignite. The surface of this layer varies from Elev. 235 to 225, and layer thickness ranges from five to 20 feet. N-values range from three to 17 blows per foot, averaging nine blows per foot. Natural water contents range from 31 percent in a clayey sand material to 98 percent in clay layers, with a stratum average of 44 percent. Due to concern over potential vault settlement resulting from consolidation of this layer, undisturbed samples were recovered for laboratory testing.

MCBEAN FORMATION

Stratum S3a - Sand, Some Clay: Medium compact to compact light brown to gray fine to medium sand, some clay, trace lignite with occasional sandy clay layers and pockets. Continuous layers of these soils were found between Elev 235 and 170 interbedded with Stratum S3b clean sands and Stratum C2 more plastic soils. Generally over the site's western half and below Stratum C2, layers of Stratum S3a up to 35 feet thick are interbedded with thin discontinuous Stratum S3b layers. Over the site's eastern half, the profile reverses with thin discontinuous layers of Stratum S3a, 5 to 10 feet thick, interbedded with massive layers of Stratum S3b.

Penetration resistances near the Stratum's surface, in the same horizon as Stratum C2, are typically 8 to 15 blows per foot. Below Stratum C2, penetration resistances are generally greater than 20 blows per foot and average 26 blows per foot. An isolated highly plastic clay layer with an N-value of weight of hammer was encountered in Boring Z-211U at Elev. 195. In Boring Z-210, at Elev 193, a void was encountered with a three feet thick rod drop and loss of drilling fluid. However, in subsequent borehole grouting at completion, the grout take was only slightly greater than normal indicating the lateral extent of the void is small.

Natural water contents typically range from 22 to 40 percent. Thin clay layers within the Stratum have water contents as high 98 percent.

Stratum S3b - Sand, Trace Clay and Silt: Compact to very compact light brown and yellow-brown fine to medium sand, trace clay and silt. Over the western half of the site, discontinuous layers of clean sands, five to 15 feet thick are interbedded within Stratum S3a between Elev 215 and 180. Over the eastern half of site within the same horizon, these clean sands predominate with layers up to 25 feet thick. Penetration resistances are significantly higher than Stratum S3a, with a typical range of 40 to greater than 100 blows per foot. N-values greater than 100 blows per foot may indicate sandstone lenses.

Stratum S4 - Calcareous Sand, Some Clay: Compact to very compact light gray-green calcareous fine to medium sand, some clay or silt, trace shells and limestone fragments; interbedded with some limestone and siltstone layers. A calcareous stratum, 30 to 50 feet thick is present beneath the entire site. This layer was identified by presence of calcium carbonate within the soil matrix, often discernible by a chalky appearance, and evidenced by a positive reaction to dilute hydrochloric acid. The surface of Stratum S4 is between Elevs. 190 and 170. Drilling through this stratum was characterized by alternating low and high resistances indicating presence of limestone and siltstone layers within the calcareous sands. Penetration resistances were generally greater than 30 blows per foot; about 50 percent of the N-values are greater than 100 blows per foot indicating that much of the layer is rock like. Water contents range from 14 to 55 percent of dry weight, averaging 29 percent.

Of the 23 borings extended through the calcareous layer, one significant void was encountered at the top of Stratum S4 in Boring Z-217 at Elev. 180. The void was evidenced by an initial loss of drilling fluid followed by a drill rod drop of four feet. At completion, 1000 gallons of cement-bentonite grout were pumped into the borehole without grout return to ground surface. After allowing the grout to set, the borehole was filled with grout. A six inch rod drop occurred in Boring Z-210 at Elev 169; however there was no significant loss of drilling fluid nor unusual grout take.

#### UNDIFFERENTIATED ZONE

Stratum M1 - Clayey Silt: Hard dark gray-green clayey silt grading with depth to a very compact dark gray fine to medium sand, some clay or silt. All of the deep borings were terminated after penetrating approximately 10 feet into this stratum. The layer surface slopes gently downward to the southwest from about Elev 155 to 138. In many of the borings, N-values greater than 100 blows per foot were encountered indicating probable siltstone and sandstone layers. In soil, N-values were typically 40 to 50 blows per foot. Natural water contents of the hard clayey silts were typically 40 to 65 percent.

### GROUNDWATER LEVELS

Ground water level variations across the site were determined by five wellpoint type piezometers, designated with a "PZ" prefix, installed at representative points as shown on Drawing No. B-1. Piezometers were installed in six inch diameter borings advanced without the use of drilling mud. The typical installation included a two inch I.D. PVC riser with a slotted wellpoint, 5 feet long, surrounded by a sand filter, overlain by a bentonite seal. At completion, each wellpoint was flushed with water and falling head tests were performed to confirm the piezometers were operational. A sketch of each piezometer installation and the falling head test data sheets are included with the borings logs in the Appendix.

We have summarized in tabular form on the geologic sections, the water level observations in each piezometer. The groundwater table follows the ground surface topography and slopes to the northeast from Elev 235 at PZ-216U to Elev 216 at PZ-218. Over the period of observation, extending from April to June 1986, water levels varied by approximately one foot.

With the exception of piezometer installations, the borings were advanced with rotary drilling techniques using bentonite drilling mud to stabilize the borehole. Mud levels measured at the completion of each boring are shown on the geologic sections. While these levels are useful in indicating unusual occurrences, such as voids, the mud levels are not usually indicative of the stabilized ground water table as the drilling fluid forms a clogging mud cake on the sides of the borehole.

### FIELD PERMEABILITY TESTS

The permeability of soils was determined in Stratum S1 clayey sands, in the interval extending from vault subgrade to about 15 feet below subgrade. For the initial eight vaults, at three representative locations, (PZ-202U, PZ-210U and PZ-216U) a series of constant head tests were performed in cased boreholes with an uncased portion extending about two feet below the casing. A three inch Shelby tube was used to advance the hole borehole beyond the casing. Where a successful undisturbed sample was recovered, it was retained for laboratory permeability tests. In most cases undisturbed sample attempts were unsuccessful, due to the compact and desiccated nature of the Stratum S1 clayey soils. However, representative soil samples were recovered for index testing. Since the field permeability tests were performed above the groundwater table, the boreholes were presoaked at each test interval until the flow rate was constant, usually for a period of about one hour.

Typically three tests were conducted at each depth interval to confirm results; the boring was then advanced five feet and the tests were repeated. Tests were performed at approximately 5, 10 and 15 feet below vault subgrade. The field data sheets are included with the boring logs in the Appendix. Average permeability test results along with the sample interval are shown on the geologic sections for Borings PZ 216U, PZ-210U and PZ-202U on Drawings Nos. GS-1, GS-2 and GS-3, respectively. Permeability test results had a fairly narrow range

from  $1.4 \times 10^{-5}$  to  $6.3 \times 10^{-5}$  cm/sec. All of the samples were classified as SC (clayey sands) according to the Unified Soil Classification System. These tests determine a permeability which is an approximate average of the vertical and horizontal values.

#### RESULTS OF BOREHOLE GROUTING

All of the borings were grouted upon completion, from the bottom up, using a cement-bentonite grout mix. Careful records were maintained of the volume of grout pumped into each borehole, to aid in determining the presence of significant voids or leached zones. These records are included with the individual boring logs in the Appendix. The volume of grout required to fill the borehole ( $V_g$ ) was compared to the theoretical borehole volume ( $V_t$ ), based on the nominal drill bit size. On the geologic sections, below each boring, the Grout Take Ratio ( $V_g/V_t$ ) is shown. Due to normal variations in actual borehole size, Grout Take Ratios of 1 to 3 are common where no significant voids or leached zones are present. Of the 23 deep borings made in this study, only Boring Z-217 had a Grout Take Ratio greater than 3. In this boring a four foot rod drop occurred at the top of the calcareous stratum, from Elev 180.5 to 176.5, and complete loss of drilling fluid occurred. In subsequent grouting, 1000 gallons was pumped into the borehole without return, which is a Grout Take Ratio greater than 11, indicating the void or leached zone has significant lateral extent. After allowing the grout to set up, the borehole was subsequently filled with grout.

#### LABORATORY TEST DATA

All of the jar samples and 19 undisturbed samples were shipped to our office. All field classifications were checked for conformance with the Unified Soil Classification System and revised when necessary. Natural water contents were determined for all samples with appreciable plastic fines content. Tables Nos. 1 & 2 summarize our laboratory testing. The program included index tests, consolidation tests, triaxial shear tests and permeability tests.

As shown on Table No. 2, permeability tests were performed on three undisturbed samples recovered from the sample interval in which field constant head permeability tests were performed. Laboratory permeabilities of these clayey sands ranged from  $2.1 \times 10^{-5}$  to  $1.1 \times 10^{-6}$  cm/sec. These values, representative of vertical permeability, are two to 10 times lower than the field permeabilities which are approximate averages of the vertical and horizontal permeabilities.

Atterberg limit results are plotted on Plasticity Charts on Plates Nos. 1 & 2. The limits were performed on the soil fraction finer than the No. 40 sieve; i.e. the demarkation between fine and medium sand. Therefore, the test determines the plasticity of a soil which may have a substantial sand content; the actual plasticity of the fines, i.e. the fraction finer than the No. 200 sieve, is substantially greater than the plasticity of the minus No. 40 soil fraction. As shown on Plate No. 1, Stratum S1 clayey sands have characteristics of a clay with low plasticity. The Stratum S3a clayey sands have the properties of clay with significantly greater plasticity. As shown on Plate No. 2, Stratum C2 soils exhibit high plasticity.

Soil Properties Profiles for the borings with undisturbed sampling are shown on Plates Nos. 3 & 4. Consolidation test results are presented on Plates Nos. 5 through 8. The Soil Properties Profile Plates include three panels showing sample location and stratification, water contents, and overburden stresses with consolidation and strength test results. Final stresses resulting from proposed loadings are also shown. As shown on Plate No. 3, the two consolidation tests performed on Stratum C2 soils demonstrated preconsolidations of 2.1 to 4.0 tons per square foot (tsf) above existing overburden stress; these preconsolidated stresses are greater than the stresses imposed by the proposed construction loadings. Based on the blow counts of adjacent split spoon samples, as shown on the geologic sections, these soils appear to be representative of Stratum C2 soils with N-values of 10 to 15 blows per foot. One consolidation test was performed on a sample recovered from Stratum S3a immediately below a split-spoon sample recovered under the weight of rods. The preconsolidation stress of this sample is two tsf below existing overburden stress. We believe this sample represents an isolated weak zone, possibly the result of leaching of calcareous soils. The low preconsolidation stress may reflect arching by stronger soils around this weak zone.

Consolidated undrained triaxial shear tests were performed on samples which visually appeared to have a high clay content. The samples were consolidated to a cell pressure about 0.7 times the effective overburden stress to simulate in-situ conditions. It was intended to confirm preconsolidation of samples not subject to consolidation tests by comparing their shear strength with samples subject to consolidation tests. However, the sandy nature of the samples made this comparison inconclusive. Shear strengths of samples ranged from about 2 to 3 tsf. It should be noted that the weak Stratum S3a sample was actually consolidated in the laboratory beyond its preconsolidation stress. Therefore the sample's measured shear strength is not representative of in-situ conditions.

The preconsolidation value of a Stratum C2 clayey sand sample, shown on Plate No. 4, is about one tsf. above overburden stresses. Within Stratum C2, final stresses for the filled vaults, are about two tsf above overburden stresses, and three tsf above overburden stresses if the 18 feet of fill is placed over the vaults. Therefore, significant virgin compression is likely for soils similar to the sample tested. The penetration resistance for the spoon sample immediately above this test is seven blows per foot. As clayey sands with similar blow counts are common in Stratum C2 clayey sands, significant virgin compression of this soil layer is possible, especially if the 18 feet of fill is placed over the vaults.

Plates Nos. 9 through 16 show the results of gradation tests for the various Strata together with Atterberg limits and natural water contents. As shown on Plates Nos. 9 to 11, Stratum S1 test samples had 18 to 45 percent fines. From the hydrometer analysis and Atterberg limits, essentially all of the fines are plastic. Similarly, as shown on Plates Nos. 12 to 14, clayey sand samples interlayered with clays in Stratum C2, have 18 to 44 percent plastic fines. The sand samples of Stratum S3a, as shown on Plate No. 15, are somewhat coarser, with plastic fines content of 12 to 32 percent. The sand samples tested from



Stratum S3b, as shown on Plate No. 16, are relatively clean with fines content of about 10 percent. However, from the hydrometer analysis, the fines are predominately clay.

#### FOUNDATION DESIGN RECOMMENDATIONS

##### Bearing Capacity

The proposed vaults are founded in the Stratum S1 clayey sands, typically 13 feet below original grade. The maximum bearing pressure for the filled vaults is 2.2 tsf including the weight of the vaults, saltstone and concrete roof. If backfill is placed, the total load on the base slab increases to about 3.2 tsf. The allowable bearing capacity for the Stratum S1 soils under these mat loads, based on a factor of safety of 3 against ultimate shear failure, is in excess of six tsf. This value does not consider differential settlements which may control design.

Allowable bearing capacities for any ancillary structures supported by spread footings founded on natural soils are shown on Table D-1. These bearing capacities include a factor of safety of three and may be increased by 50 percent for temporary live loads such as wind loads.

##### Soil Parameters

Table D-1 summarizes soil parameters for use in design of vault foundations. The design earth pressures are adequate to include the loads from light compaction equipment operated adjacent to walls and occasional loads from medium weight compaction equipment. However, heavy compaction equipment, such as large self-propelled vibratory rollers or sheepsfoot rollers, should be kept at least 10 feet from permanent structural walls. Excavated soils including clean to clayey sands with less than 50 percent fines are suitable for use as general fill around and over the structures. Since the fill is not intended for structural support, it is adequate to compact the fill in level loose lifts, 12 inches thick, to 90 percent of modified Proctor maximum dry density.

##### Slope Stability

Construction excavations will be limited to a maximum of about 13 feet deep in rough grading for vault construction. Temporary construction slopes should be no steeper than 1V:1H (vertical to horizontal). Since these excavation slopes are relatively shallow, the slopes may not need a covering of bituminous emulsion or shotcrete. However, some minor slope sloughing and erosion will probably occur. Care should be taken to direct surface water away from the excavation and the base should be sloped to drain to a low point outside the foundation limits.

##### Groundwater Levels

The groundwater level as measured in the five piezometers installed across the site ranged from Elev. 236 to 216, sloping downward to the northeast. The water levels are 45 to 60 feet below vault subgrade. Therefore the permanent water table should not affect the construction or structural performance of the vaults.

TABLE D-1 SOIL DESIGN PARAMETERS

SALTSTONE DISPOSAL Z-AREA

<u>DESCRIPTION</u>	<u>PARAMETER</u>
1. ALLOWABLE BEARING CAPACITY FOR SURFACE LAYER OF STRATUM S2 STRATUM S1	2 TSF 3 TSF
2. EFFECTIVE UNIT WEIGHTS ABOVE WATER TABLE BELOW WATER TABLE (SEE NOTE 2)	130 PCF 68 PCF
3. ANGLE OF INTERNAL FRICTION -	34
4. COEFFICIENT OF FRICTION BETWEEN CONCRETE AND STRATUM S1 SOILS	0.4
5. EARTH PRESSURE COEFFICIENTS (SEE NOTES 3 & 4) COEFFICIENTS OF ACTIVE EARTH PRESSURE-K COEFFICIENT OF EARTH PRESSURE AT REST-K COEFFICIENT OF PASSIVE EARTH PRESSURE-K	0.28 0.44 3.50
6. EQUIVALENT FLUID PRESSURES (SEE NOTE 5) FLEXIBLE WALLS; ABOVE WATER TABLE RIGID WALLS; ABOVE WATER TABLE	38 PSF/FT 60 PSF/FT
7. COEFFICIENT OF VERTICAL SUBGRADE REACTIONS - $k_s$	200 PCI
8. EXCAVATION SLOPES (MAXIMUM)	1 VERT. ON 1 HORIZ.(1.1)
9. PERMANENT SLOPES (MAXIMUM)	1 VERT. ON 2 HORIZ.(1.2)
10. FROST PENETRATION	5 INCHES
11. POISSON'S RATIO -	0.3
12. SHEAR MODULUS - G	7,000 PSI
13. ELASTIC MODULUS - E	18,000 PSI

NOTES:

1. FOR FOOTING WIDTHS (B) LESS THAN THREE FEET, ALLOWABLE BEARING PRESSURE IS:  
 SURFACE LAYER OF STRATUM S2 -  $1/3 \times B \times 2$  TSF  
 STRATUM S1 -  $1/3 \times B \times 3$  TSF
2. DESIGN WATER LEVEL - MINIMUM WATER TABLE IS LOWER THAN ELEVATION 240.
3. THE LATERAL PRESSURE DUE TO A SURCHARGE LOADING OVER A LARGE AREA ADJACENT TO THE PERMANENT WALL IS: SURCHARGE LOAD  $\times$  K
4. MAJOR COMPACTION EQUIPMENT SHOULD BE KEPT AT LEAST 10 FEET FROM PERMANENT WALLS.
5. STRUCTURAL WALLS RESTRAINED AT THE TOP AND BOTTOM ARE "RIGID". WALLS RESTRAINED AT THE BOTTOM AND FREE AT THE TOP ARE "FLEXIBLE". IT IS ANTICIPATED THAT NO WALLS WILL BE BELOW THE WATER TABLE.

## Settlements

Vault settlements were estimated assuming one dimensional consolidation of the soil profile under applied loads, with excavation treated as a negative loading to determine heave of the excavation bottom. With the exception of Stratum C2 and S4, index tests on samples from Z- and S-Areas indicates that the consolidation properties of the soils are similar. Therefore, consolidation parameters developed for S-Area were utilized in our settlement analyses. The compression properties for Stratum C2 were developed from the consolidation testing and split-spoon sampling performed for this study. Stratum C2 was subdivided into a five foot thick layer of clayey sand preconsolidated to approximately one tsf above existing overburden stresses and five foot thick layer of silty clay preconsolidated to three tsf above existing overburden stresses.

The thick calcareous Stratum S4 was usually absent in S-Area. On the basis of penetration resistances in Z-Area, about one half of the layer appears "rocklike", and is essentially incompressible under proposed loads. The remainder of the Stratum is primarily sand, some clay and is considered for settlement purposes similar to Stratum S3a soils encountered at similar elevations in S-Area.

Our settlement analysis is summarized in plan on Drawings Nos. S-1 through S-4. For the initial eight vaults included in the three vault groups in the vicinity of Geologic Sections 1-1 to 6-6, our analysis has considered settlements at representative points for each vault group for four construction stages. In the future expansion area, in the vicinity of Geologic Section 7-7 & 8-8, settlements have been estimated at representative points for each vault group for only the final loading stages.

The analysis assumes the vaults are flexible structures. Since the filled vaults are relatively rigid mass concrete similar to blocks, actual differential settlements will be less than estimated values.

We understand that several months prior to vault construction, the vault area will be rough graded to the top of the foundation slab, typically requiring a cut of 8 to 12 feet. In our analysis, we have assumed that all swell associated with the cut to rough grades occurs prior to vault construction.

Ranges in settlements of vault groups reflect the different number of vaults included in a group and variations in initial overburden stresses based on rough grades and groundwater levels. The estimated settlements for the various stages of construction are discussed as follows:

Stage 1: Excavation from rough grade, i.e. top of base slab to foundation subgrade, and construction of the base slab, exterior and interior walls of the first vault within a vault group. The gross structural loading for the empty vault is 0.3 tsf with an net loading of 0.1 tsf. The estimated vault settlements for Stage 1 as summarized in plan on Drawing No. S-1, ranges from a maximum 0.3 inches in the vault's center to 0.1 inches at vault's short side.

Maximum differential settlements are estimated at 0.2 inches over 50 feet from the center of a vault cell to the vault's short and long sides.

Stage 2: Complete saltstone filling of the initial vault in a vault group, including roof construction. The gross load of a filled vault is 2.3 tsf. Estimated settlements for this stage as shown on Drawing No. S-2, range from 2.0 inches at the vault's center to 1.2 inches at the vault's short sides. Maximum differential settlements are estimated at 0.7 inches over 50 feet from the center of a vault cell to the vault's short and long sides.

Stage 3: All vaults within a group built and filled with saltstone including roof construction. The gross and net loadings are the same as Stage 2. However, the aerial extent of the loading for multiple vault groups is significantly greater and there is less load decrease with depth. As shown on Drawing No. S-4, estimated settlements beneath the center of a vault group range from 2.0 inches for an isolated vault to 2.9 inches in a multiple group of seven vaults. Estimated settlements at the short side of an end vault range from 1.1 to 1.3 inches. Maximum differential settlements are estimated at 0.9 inches over 50 feet from the center of a vault cell to the vault's short side.

Stage 4: All vaults within a group built, filled with saltstone, backfilled and capped with two feet of clay plus 5 meters of fill. The loadings at vault subgrade under this final stage increases to 3.2 tsf. Estimated settlements as shown on Drawing No. S-4, range from 3.7 to 4.3 inches at the center of a vault group to 2.5 to 3.0 inches at the short side of an end vault. Maximum differential settlements are estimated at 1.2 inches over 50 feet from the center of a vault cell to the vault's short side.

We have compared our estimated settlements with the observed settlements to date at the Vitrification Building in S-Area, about one-half mile to the southwest. To date, at the Vitrification Building, the net loading is approximately two tsf and observed settlements are about 1.2 inches under the building's center. For comparison, we estimate settlements of 2.0 inches for a single vault filled with saltstone, i.e. Stage 2 which has net loading of 2.1 tsf. The major reason for the difference is the presence in Z-Area of a fairly continuous clayey sand layer in Stratum C-2 which may be preconsolidated only an average of one tsf above existing overburden pressures. Therefore, significant virgin compression is anticipated in this layer as the preconsolidation stress is exceeded. Similar soils were encountered in S-Area. However, to date, either the compressible zones are highly localized pockets, or the preconsolidation stress has yet to be exceeded. In Z-Area, the relatively large settlements may occur, especially if the heavy loading increment of the thick soil cover is placed over the vaults. If the soils exhibiting low preconsolidation stresses are in fact isolated pockets, soil arching around weak zones may result in actual settlements of 60 to 70 percent of estimated values.

SUMMARY AND CONCLUSIONS

1. The subsurface investigation, including borings averaging 150 feet deep, has adequately defined soil conditions beneath the eight initial vaults within the southside of the site to allow final foundation design for these structures. The subsurface investigation has also provided definition of soil conditions beneath the 14 vaults in the northly future expansion area for preliminary foundation design.

2. The soils profile is generally similar to conditions in adjacent S-Area and consists of complexly interbedded clayey sand, sand and stiff silty clay. The clayey soils are generally heavily preconsolidated to stresses above pressures induced by the saltstone filled vaults, including the thick soil cover which may be placed over the vaults. Approximately 60 to 70 feet below vault subgrade, the boring penetrated a stratum of interlayered clayey sand and silty clay. Our correlation of standard penetration tests on split-spoon samples, with consolidation tests performed on samples from this layer, indicate the preconsolidation stress of a fairly continuous clayey sand zone is about one tsf greater than the existing overburden stresses.

3. A thick calcareous sand with limestone layers was encountered 80 to 100 feet below vault subgrade. The calcareous layer is typically 25 to 50 feet thick. Of the 23 borings that penetrated this layer, one boring encountered a significant void as evidenced by a drill rod drop of four feet, complete loss of drilling fluid circulation and high grout take. This boring was drilled at the south side of the initial vault planned for construction. There is no evidence of ground subsidence in the vicinity of the saltstone vaults which are on top of a relatively flat plateau. However, where significant voids are encountered, we cannot rule out the possibility of future gradual subsidence over a period of years especially where large area loads are applied. We understand that the saltstone vaults are not considered sensitive to irregular settlements, and any resultant cracking of the saltstone is not considered significant. Therefore, a grouting program to fill any existing voids is not being planned.

4. The permanent ground water table as measured in five piezometers installed across the site is 45 to 60 feet below vault subgrade and will not be a factor in construction.

5. The existing on-site clean sands and clayey sands with a maximum of 50 percent fines are suitable for vault backfill and soil cover. As the fill is not intended for structural support, compaction to 90 percent of modified Proctor maximum dry density is adequate.

6. The allowable bearing capacity for shallow footings three to six feet wide supporting any ancillary structures in the vault area, is two tsf for footings founded on shallow clean sands of Stratum S2 and three tsf for footings founded on Stratum S1 clayey sands.

7. All vaults can be supported on mats founded on natural soils at proposed subgrade levels. The allowable bearing capacity for soils supporting the vault mats is in excess of six tsf. which is well above maximum anticipated foundation loads. Maximum estimated settlements of the saltstone filled vaults are approximately three inches without the thick soil cover and 4.5 inches including the soil cover. These estimated settlements reflect the presence of a fairly continuous clayey sand layer with a preconsolidation stress significantly less than final foundation loads. If the weaker zones within this layer are localized, actual settlements may be 60 to 70 percent of estimated values.

Very truly yours,  
MUESER RUTLEDGE CONSULTING ENGINEERS

By 

JLK/EAR/ks

EXHIBITS





SECTION 2-2

SECTION 2-1

SECTION 2-16

SECTION 2-17

SECTION 2-18

SECTION 2-19

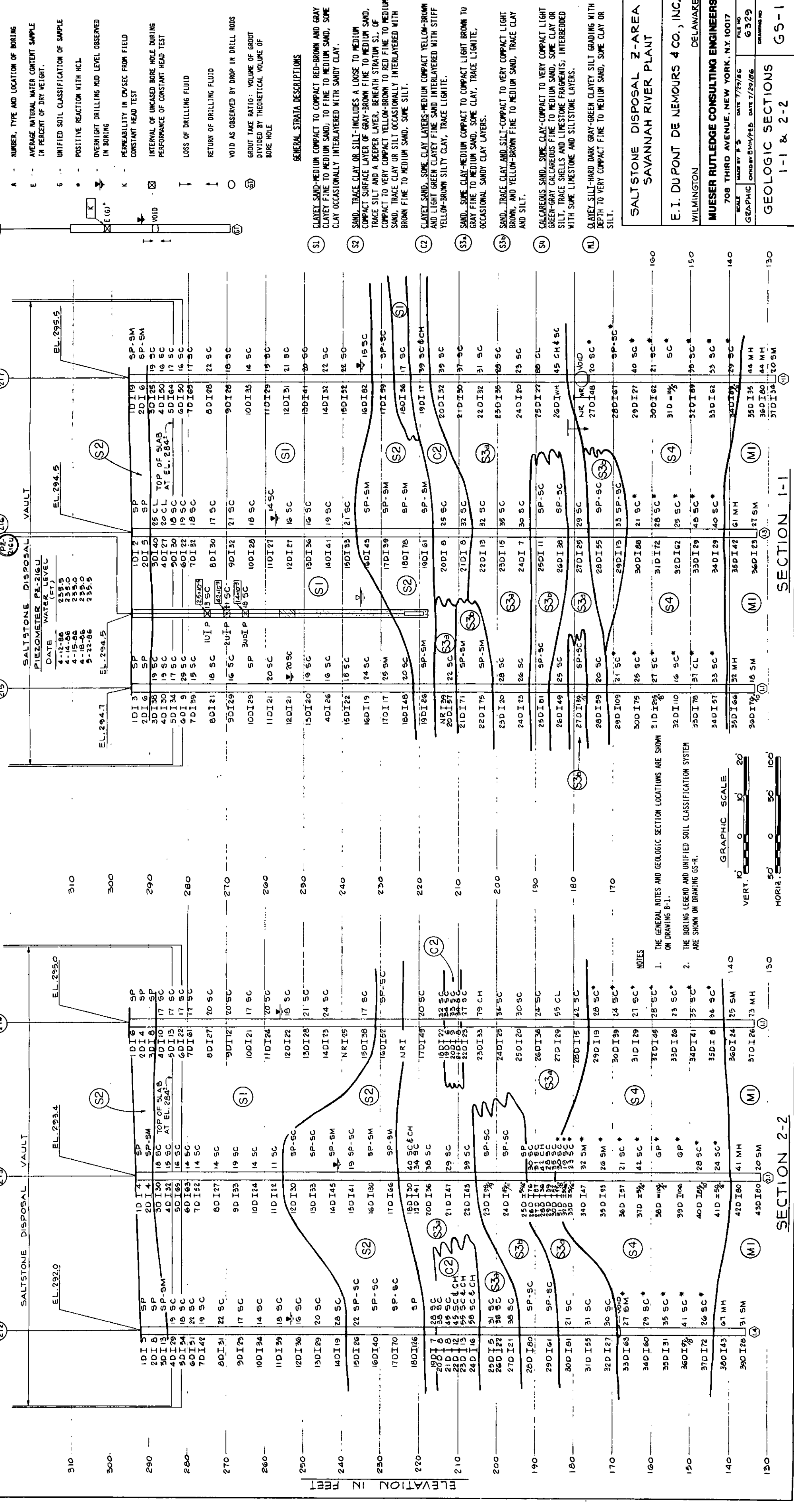
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SECTION 1-1

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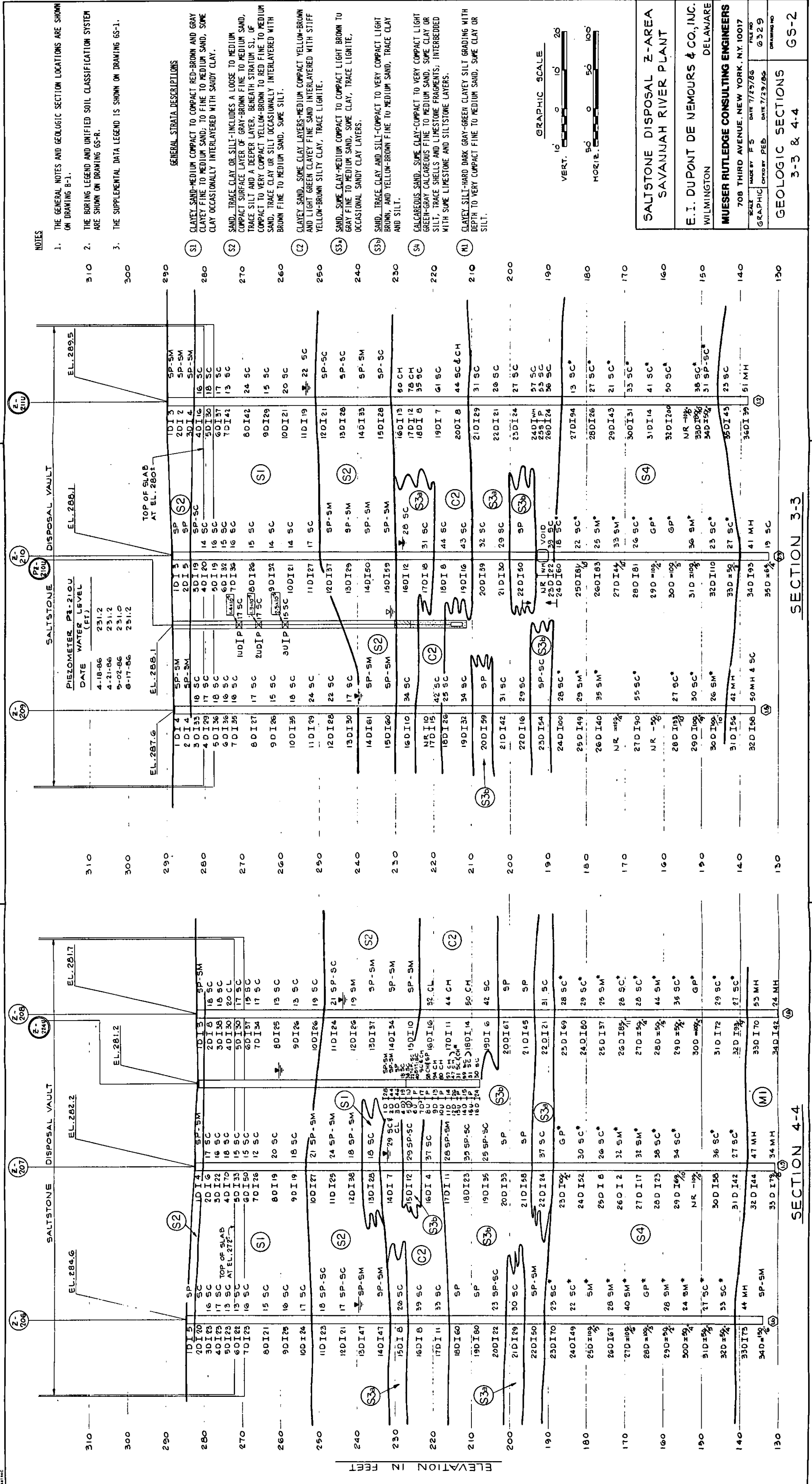
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SECTION 1-230

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**NOTES**

1. THE GENERAL NOTES AND GEOLOGIC SECTION LOCATIONS ARE SHOWN ON DRAWING B-1.
2. THE BORING LEGEND AND UNIFIED SOIL CLASSIFICATION SYSTEM ARE SHOWN ON DRAWING GS-R.
3. THE SUPPLEMENTAL DATA LEGEND IS SHOWN ON DRAWING GS-1.

**GENERAL STRATA DESCRIPTIONS**

(S1) CLAYEY SAND-MEDIUM COMPACT TO COMPACT RED-BROWN AND GRAY CLAYEY FINE TO MEDIUM SAND; TO FINE TO MEDIUM SAND, SOME CLAY OCCASIONALLY INTERLAYERED WITH SANDY CLAY.

(S2) SAND, TRACE CLAY OR SILT-INCLUDES A LOOSE TO MEDIUM COMPACT SURFACE LAYER OF GRAY-BROWN FINE TO MEDIUM SAND, TRACE SILT AND A DEEPER LAYER, BENEATH STRATUM SL, OF COMPACT TO VERY COMPACT YELLOW-BROWN TO RED FINE TO MEDIUM SAND, TRACE CLAY OR SILT OCCASIONALLY INTERLAYERED WITH BROWN FINE TO MEDIUM SAND, SOME SILT.

(C2) CLAYEY SAND, SOME CLAY LAYERS-MEDIUM COMPACT YELLOW-BROWN AND LIGHT GREEN CLAYEY FINE SAND INTERLAYERED WITH STIFF YELLOW-BROWN SILTY CLAY, TRACE LIGHTNITE.

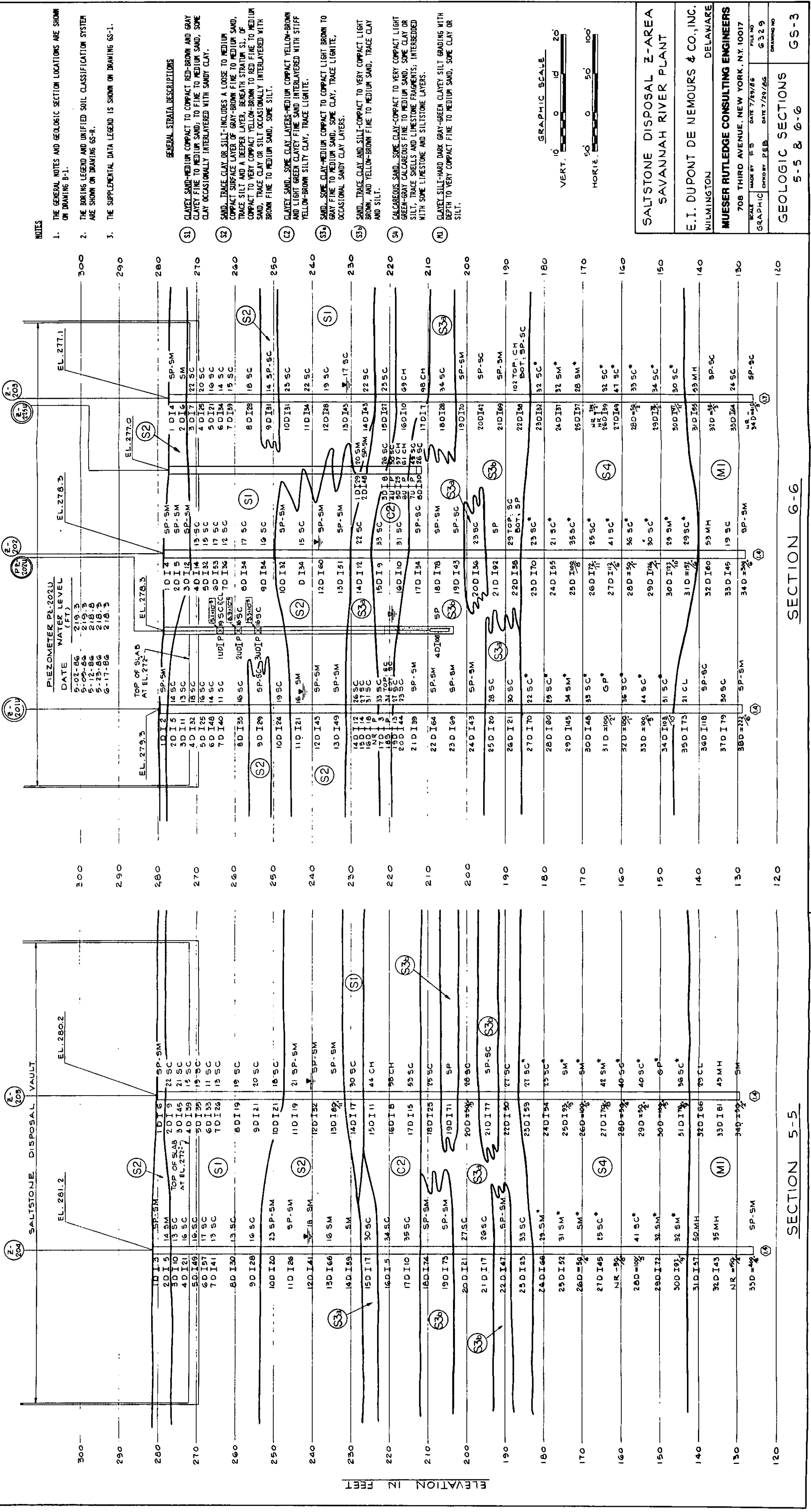
(S3a) SAND, SOME CLAY-MEDIUM COMPACT TO COMPACT LIGHT BROWN TO GRAY FINE TO MEDIUM SAND, SOME CLAY, TRACE LIGHTNITE, OCCASIONAL SANDY CLAY LAYERS.

(S3b) SAND, TRACE CLAY AND SILT-COMPACT TO VERY COMPACT LIGHT BROWN, AND YELLOW-BROWN FINE TO MEDIUM SAND, TRACE CLAY AND SILT.

(S4) CALCAREOUS SAND, SOME CLAY-COMPACT TO VERY COMPACT LIGHT GREEN-GRAY CALCAREOUS FINE TO MEDIUM SAND, SOME CLAY OR SILT, TRACE SHELLS AND LIMESTONE FRAGMENTS, INTERBEDDED WITH SOME LIMESTONE AND SILTSTONE LAYERS.

(M1) CLAYEY SILT-HARD DARK GRAY-GREEN CLAYEY SILT GRADING WITH DEPTH TO VERY COMPACT FINE TO MEDIUM SAND, SOME CLAY OR SILT.

Station	Soil Profile	Soil Description	Notes
Z-206	10I14	SP-SM	
Z-206	20I15	SP-SM	
Z-206	30I16	SP-SM	
Z-206	40I17	SP-SM	
Z-206	50I18	SP-SM	
Z-206	60I19	SP-SM	
Z-206	70I20	SP-SM	
Z-206	80I21	SP-SM	
Z-206	90I22	SP-SM	
Z-206	100I23	SP-SM	
Z-206	110I24	SP-SM	
Z-206	120I25	SP-SM	
Z-206	130I26	SP-SM	
Z-206	140I27	SP-SM	
Z-206	150I28	SP-SM	
Z-206	160I29	SP-SM	
Z-206	170I30	SP-SM	
Z-206	180I31	SP-SM	
Z-206	190I32	SP-SM	
Z-206	200I33	SP-SM	
Z-206	210I34	SP-SM	
Z-206	220I35	SP-SM	
Z-206	230I36	SP-SM	
Z-206	240I37	SP-SM	
Z-206	250I38	SP-SM	
Z-206	260I39	SP-SM	
Z-206	270I40	SP-SM	
Z-206	280I41	SP-SM	
Z-206	290I42	SP-SM	
Z-206	300I43	SP-SM	
Z-206	310I44	SP-SM	
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Z-207	20I16	SP-SM	
Z-207	30I17	SP-SM	
Z-207	40I18	SP-SM	
Z-207	50I19	SP-SM	
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Z-207	70I21	SP-SM	
Z-207	80I22	SP-SM	
Z-207	90I23	SP-SM	
Z-207	100I24	SP-SM	
Z-207	110I25	SP-SM	
Z-207	120I26	SP-SM	
Z-207	130I27	SP-SM	
Z-207	140I28	SP-SM	
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Z-207	160I30	SP-SM	
Z-207	170I31	SP-SM	
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Z-207	220I36	SP-SM	
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Z-207	240I38	SP-SM	
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Z-207	260I40	SP-SM	
Z-207	270I41	SP-SM	
Z-207	280I42	SP-SM	
Z-207	290I43	SP-SM	
Z-207	300I44	SP-SM	
Z-207	310I45	SP-SM	
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Z-208	20I17	SP-SM	
Z-208	30I18	SP-SM	
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Z-208	50I20	SP-SM	
Z-208	60I21	SP-SM	
Z-208	70I22	SP-SM	
Z-208	80I23	SP-SM	
Z-208	90I24	SP-SM	
Z-208	100I25	SP-SM	
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Z-209	290I45	SP-SM	
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Z-210	250I42	SP-SM	
Z-210	260I43	SP-SM	
Z-210	270I44	SP-SM	
Z-210	280I45	SP-SM	
Z-210	290I46	SP-SM	
Z-210	300I47	SP-SM	
Z-210	310I48	SP-SM	



**SALTSTONE DISPOSAL Z-AREA**  
**SAVANNAH RIVER PLANT**

**E.I. DUPONT DE NEMOURS & CO., INC.**  
WILMINGTON DELAWARE

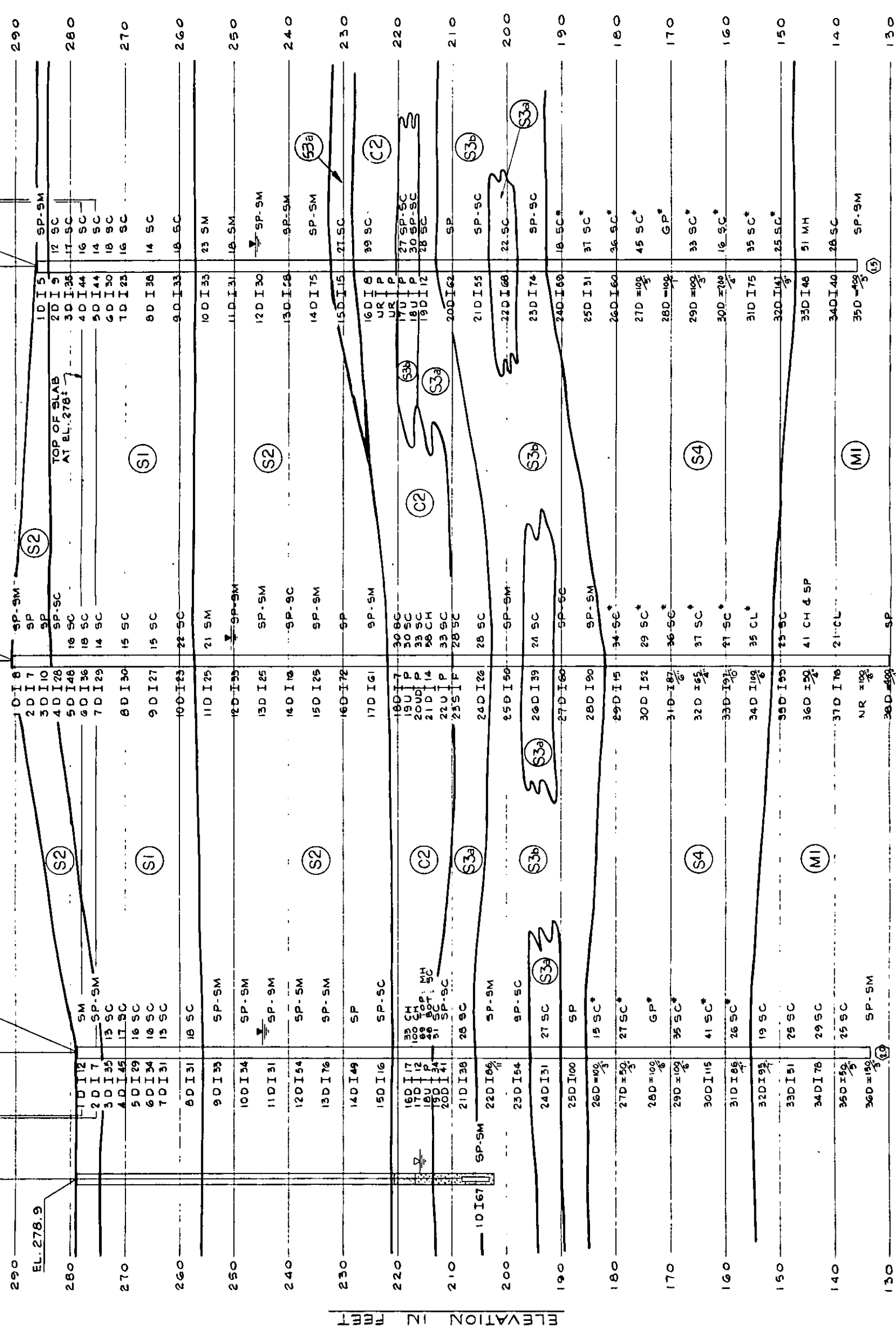
**MUESER RUTLEDGE CONSULTING ENGINEERS**  
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SCALE: MADE BY F.S. DATE 7/29/86 FILE NO. G.32.9  
GRAPHIC: CHECKED BY P.E.B. DATE 7/29/86 DRAWING NO.

**GEOLOGIC SECTIONS**  
**5-5 & 6-6**

**GS-3**

PIEZOMETER PL-218  
 DATE WATER LEVEL  
 (ET)  
 5-23-86 215.3  
 6-17-86 215.8



ELEVATION IN FEET

ELEVATION IN FEET

NOTES  
 1. THE GENERAL NOTES AND GEOLOGIC SECTION LOCATIONS ARE SHOWN ON DRAWING B-1.  
 2. THE BORING LEGEND AND UNIFIED SOIL CLASSIFICATION SYSTEM ARE SHOWN ON DRAWING 6S-R.  
 3. THE SUPPLEMENTAL DATA LEGEND IS SHOWN ON DRAWING 6S-1.

GENERAL STRATA DESCRIPTIONS

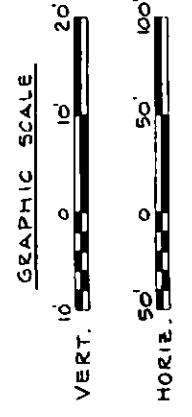
- (S1) CLAYEY SAND-MEDIUM COMPACT TO COMPACT RED-BROWN AND GRAY CLAYEY FINE TO MEDIUM SAND; TO FINE TO MEDIUM SAND, SOME CLAY OCCASIONALLY INTERLAYERED WITH SANDY CLAY.
- (S2) SAND, TRACE CLAY OR SILT-INCLUDES A LOOSE TO MEDIUM COMPACT SURFACE LAYER OF GRAY-BROWN FINE TO MEDIUM SAND, TRACE SILT AND A DEEPER LAYER, BENEATH STRATUM S1, OF COMPACT TO VERY COMPACT YELLOW-BROWN TO RED FINE TO MEDIUM SAND, TRACE CLAY OR SILT OCCASIONALLY INTERLAYERED WITH BROWN FINE TO MEDIUM SAND, SOME SILT.
- (C2) CLAYEY SAND, SOME CLAY LAYERS-MEDIUM COMPACT YELLOW-BROWN AND LIGHT GREEN CLAYEY FINE SAND INTERLAYERED WITH STIFF YELLOW-BROWN SILTY CLAY, TRACE LIGNITE.
- (S3a) SAND, SOME CLAY-MEDIUM COMPACT TO COMPACT LIGHT BROWN TO GRAY FINE TO MEDIUM SAND, SOME CLAY, TRACE LIGNITE, OCCASIONAL SANDY CLAY LAYERS.
- (S3b) SAND, TRACE CLAY AND SILT-COMPACT TO VERY COMPACT LIGHT BROWN, AND YELLOW-BROWN FINE TO MEDIUM SAND, TRACE CLAY AND SILT.
- (S4) CALCAREOUS SAND, SOME CLAY-COMPACT TO VERY COMPACT LIGHT GREEN-GRAY CALCAREOUS FINE TO MEDIUM SAND, SOME CLAY OR SILT, TRACE SHELLS AND LIMESTONE FRAGMENTS; INTERBEDDED WITH SOME LIMESTONE AND SILTSTONE LAYERS.
- (M1) CLAYEY SILT-HARD DARK GRAY-GREEN CLAYEY SILT GRADING WITH DEPTH TO VERY COMPACT FINE TO MEDIUM SAND, SOME CLAY OR SILT.

SALTSTONE DISPOSAL Z-AREA  
 SAVANNAH RIVER PLANT

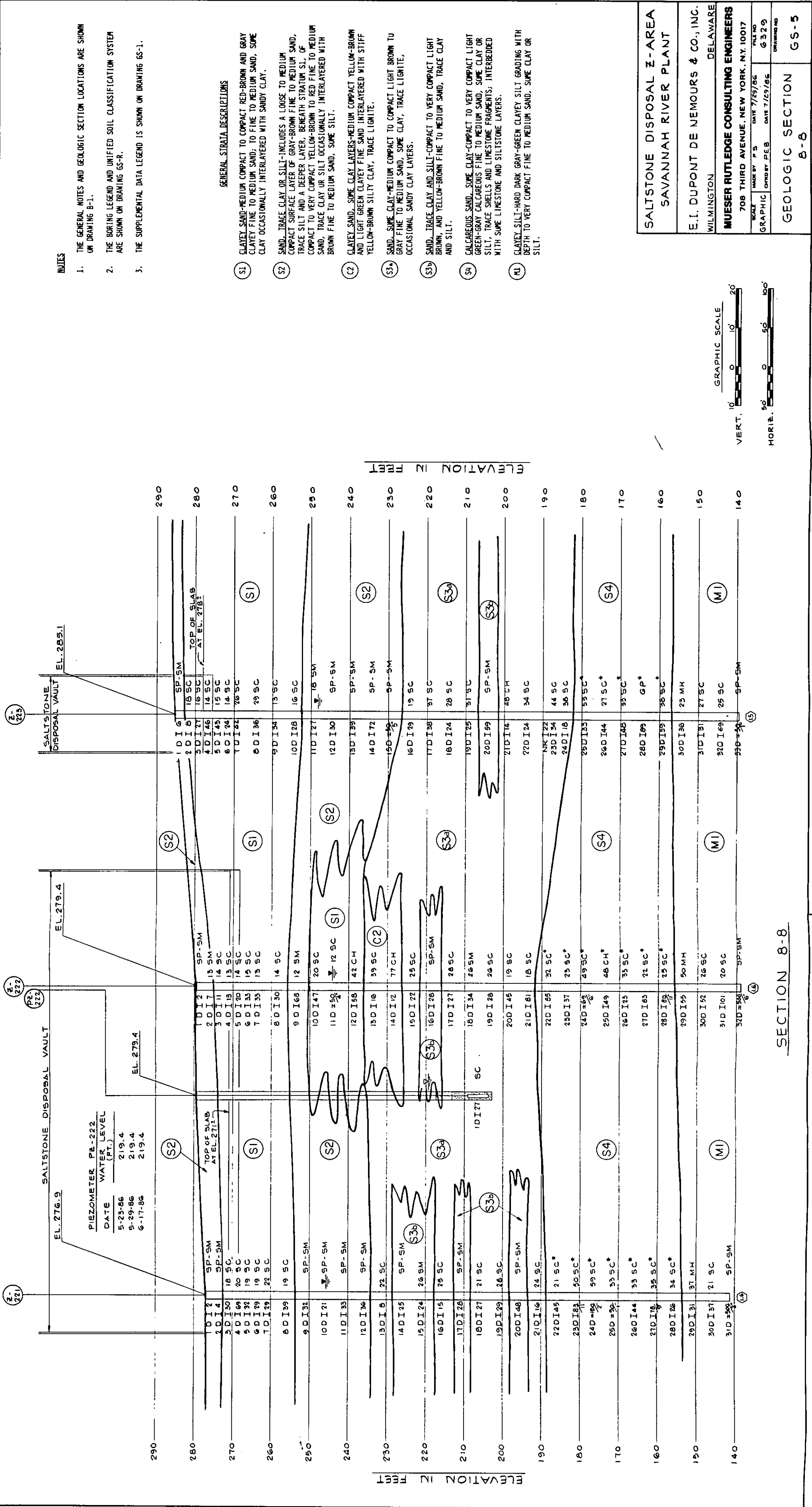
E. I. DUPONT DE NEMOURS & CO., INC.  
 WILMINGTON DELAWARE

MUESER RUTLEDGE CONSULTING ENGINEERS  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017  
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 GRAPHIC CHECKED BY P.E.B. DATE 7/29/86 DRAWING NO.

GEOLOGIC SECTION  
 7-T  
 GS-4



SECTION 7-7



**NOTES**

- THE GENERAL NOTES AND GEOLOGIC SECTION LOCATIONS ARE SHOWN ON DRAWING B-1.
- THE BORING LEGEND AND UNIFIED SOIL CLASSIFICATION SYSTEM ARE SHOWN ON DRAWING GS-R.
- THE SUPPLEMENTAL DATA LEGEND IS SHOWN ON DRAWING GS-1.

**SALTSTONE DISPOSAL VAULT**

EL. 276.9

EL. 279.4

EL. 285.1

ELEVATION IN FEET	SOIL TYPE	DEPTH (FEET)	SOIL TYPE	DEPTH (FEET)	SOIL TYPE	DEPTH (FEET)
290						
280	SP-SM	10 I 2	SP-SM	13 SM	SP-SM	18 SC
270	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
260	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
250	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
240	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
230	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
220	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
210	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
200	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
190	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
180	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
170	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
160	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
150	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC
140	SP-SM	20 I 4	SP-SM	14 SC	SP-SM	14 SC

**SECTION 8-8**

**SALTSTONE DISPOSAL Z-AREA SAVANNAH RIVER PLANT**

E.I. DUPONT DE NEMOURS & CO., INC.

WILMINGTON DELAWARE

**MUESER RUTLEDGE CONSULTING ENGINEERS**

708 THIRD AVENUE, NEW YORK, N.Y. 10017

SCALE: MADE BY P.S. DATE 7/29/86 FILE NO. G-329  
 GRAPHIC: CHECKED BY P.E.B. DATE 7/29/86 DRAWING NO.

**VERT. SCALE**

1" = 10'

**HORIZ. SCALE**

1" = 50'

UNIFIED SOIL CLASSIFICATION (INCLUDING IDENTIFICATION AND DESCRIPTION)

MAJOR DIVISIONS	GROUP SYMBOLS	TYPICAL NAMES	FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 3 IN. AND BASING FRACTIONS ON ESTIMATED WEIGHTS)
GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 200 SIEVE SIZE.	3	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.	WIDE RANGE IN GRAIN SIZES AND SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES.
	GW	POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.	PREDOMINANTLY ONE SIZE OR A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING.
SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE.	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURE.	NONPLASTIC FINES OR FINES WITH LOW PLASTICITY (FOR IDENTIFICATION PROCEDURES SEE CL BELOW).
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES.	PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW).
SANDS EQUIVALENT TO THE NO. 4 SIEVE SIZE.	SM	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.	WIDE RANGE IN GRAIN SIZE AND SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES.
	SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.	PREDOMINANTLY ONE SIZE OR A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING.
FINE-GRAINED SOILS THE NO. 200 SIEVE SIZE IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE.	SM	SILTY SANDS, SAND-SILT MIXTURES.	NONPLASTIC FINES OR FINES WITH LOW PLASTICITY (FOR IDENTIFICATION PROCEDURES SEE CL BELOW).
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES.	PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW).
SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50	ML	INORGANIC SILTS AND SANDY SILTS, ROCK FLOUR, OR CLAYEY SILTS WITH SLIGHT PLASTICITY	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN NO. 40 SIEVE SIZE DRY STRENGTH CHARACTERISTICS DILATANCY (REACTION TO SHAKING) TOUGHNESS (CRUSHING NEAR PL)
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.	NONE TO SLOW NONE TO VERY SLOW MEDIUM TO HIGH SLIGHT TO MEDIUM
SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY.	NONE MEDIUM SLIGHT
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS.	SLIGHT TO MEDIUM SLIGHT TO MEDIUM
HIGHLY ORGANIC SOILS	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS.	HIGH TO VERY HIGH HIGH
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS.	MEDIUM TO HIGH MEDIUM
	Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS.	READILY IDENTIFIED BY COLOR, ODOR, SPONGY FEEL AND FREQUENTLY BY FIBROUS TEXTURE.

(1) BOUNDARY CLASSIFICATIONS: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS.

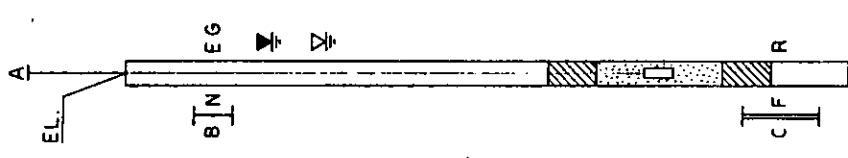
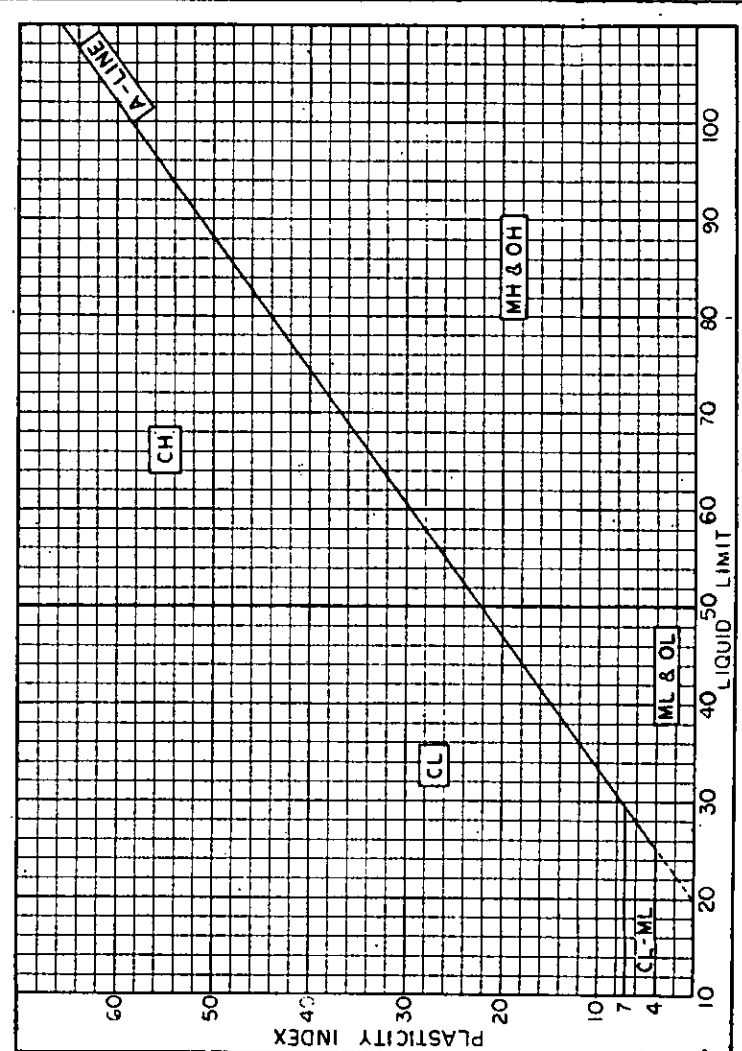
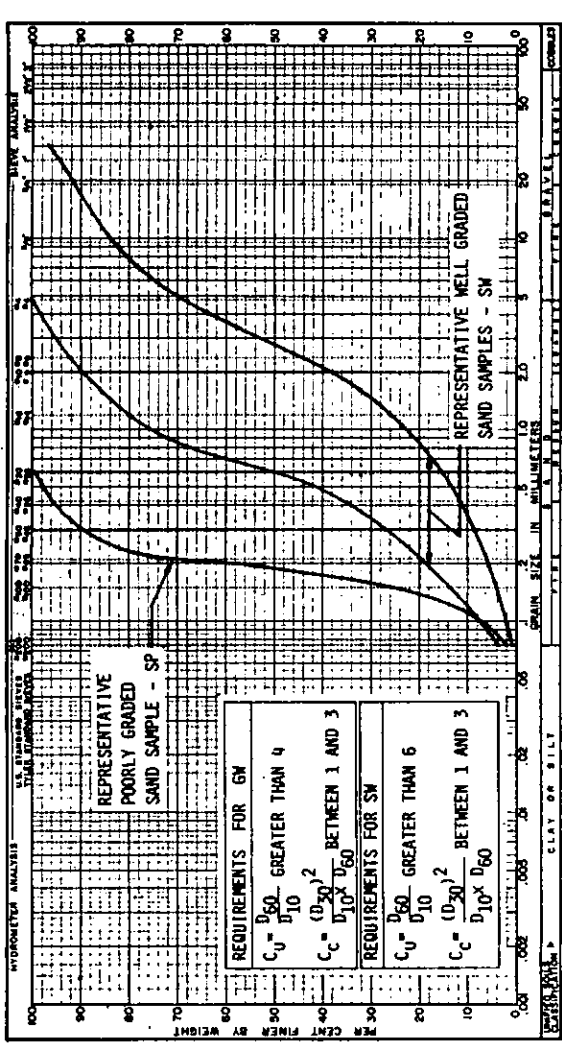
TERMINOLOGY USED FOR SOIL DESCRIPTIONS

DEGREE OF COMPACTION FOR NON-PLASTIC SOIL	DESCRIPTION OF CONSTITUENT PERCENTAGES AS USED IN SOIL SAMPLE CLASSIFICATIONS	CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (L.S.F.)	IDENTIFICATION CHARACTERISTICS
LOOSE	1% TO 12% - "TRACE"	SOFT	LESS THAN 0.5	EASILY REMOLDED WITH SLIGHT FINGER PRESSURE
MEDIUM COMPACT	13% TO 30% - "SOME"	MEDIUM	0.5 TO 1.0	REQUIRES SUBSTANTIAL PRESSURE FOR REMOLDING
VERY COMPACT	31% TO 49% - ADJECTIVE FORM OF SOIL GROUP (I.E. SANDY)	STIFF	1.0 TO 4.0	DIFFICULT TO REMOLD WITH FINGERS.
	50% TO 100% - "SOME"	HARD	GREATER THAN 4.0	CANNOT BE REMOLDED WITH FINGERS.

\* STANDARD PENETRATION RESISTANCE USING 140 LB. HAMMER FREE FALLING 30 INCHES TO DRIVE A 2 INCH O.D. SPLIT SPOON SAMPLER.

+ NONPLASTIC SILTS SHOULD BE DESCRIBED USING DEGREE OF COMPACTION AS PRESENTED ABOVE.

LABORATORY CLASSIFICATION CRITERIA



BORING LEGEND

- A - NUMBER, TYPE AND LOCATION OF BORING.
- EL. - GROUND SURFACE ELEVATION AT BORING.
- B - NUMBER AND TYPE OF SAMPLE.
- D - DRY SAMPLE TAKEN WITH 2 INCH O.D. SPLIT SPOON.
- U - UNDISTURBED SAMPLE TAKEN WITH 3 INCH O.D. FIXED PISTON TYPE SAMPLER.
- UD - UNDISTURBED SAMPLE EXTRUDED IN FIELD AND PLACED IN JAR DUE TO POOR RECOVERY.
- S - UNDISTURBED SAMPLE TAKEN WITH 3 INCH O.D. SHELBY TYPE SAMPLER.
- W - WASH SAMPLE.
- NR - NO RECOVERY.

- I - LOCATION AND LENGTH OF SAMPLE ATTEMPT.
- N - STANDARD PENETRATION RESISTANCE. NUMBER OF BLOWS FROM 140 LB. HAMMER FREE FALLING 30 INCHES, REQUIRED TO DRIVE 2 INCH O.D. SPLIT SPOON SAMPLER ONE FOOT AFTER INITIAL PENETRATION OF 6 INCHES, UNLESS A SPECIFIC PENETRATION IS INDICATED.
- P - PRESSED OR PUSH SAMPLE.
- MH - SAMPLE TAKEN UNDER WEIGHT OF HAMMER AND RODS.
- MR - SAMPLE TAKEN UNDER WEIGHT OF RODS.

- E - AVERAGE NATURAL WATER CONTENT OF SAMPLE IN PERCENT OF DRY WEIGHT.
- G - UNIFIED SOIL CLASSIFICATION SYMBOL OF SAMPLE.
- ▽ - GROUND WATER LEVEL OBSERVED IN BORING.
- ▽ - GROUND WATER LEVEL OBSERVED IN PIEZOMETER.
- C - ROCK CORE.
- I - LENGTH OF CORE.
- F - LENGTH OF CORE RECOVERED EXPRESSED AS A PERCENT OF THE LENGTH OF CORE RUN.
- R - ROCK QUALITY DESIGNATION-THE SUM OF THE LENGTHS OF PIECES OF RECOVERED CORE WHICH ARE EQUAL TO OR GREATER THAN FOUR INCHES IN LENGTH EXPRESSED AS A PERCENTAGE OF THE TOTAL LENGTH OF THE CORE RUN. LENGTHS ARE MEASURED BETWEEN IN-SITU SEPARATIONS, AND BREAKS RESULTING FROM CORING ARE IGNORED.
- IMPERVIOUS SEAL.
- SAND FILTER SURROUNDING PIEZOMETER INTAKE POINT.
- - INTAKE POINT.

MUESER RUTLEDGE CONSULTING ENGINEERS  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017

GEOTECHNICAL REFERENCE STANDARDS

DATE - 8/70  
 REVISED - 4/84  
 DWG. NO. GS-R



**TABLE NO. 1**  
**SUMMARY OF LABORATORY TEST DATA**

SAMPLE IDENTIFICATION					CLASSIFICATION PROPERTIES							PHYSICAL PROPERTIES														
BORING NUMBER	SAMPLE NUMBER	ELEVATION, FT.	STRATUM DESIGNATION	SOIL TYPE	AVERAGE NATURAL WATER CONTENT, w <sub>n</sub> , %	LIQUID LIMIT, w <sub>L</sub> , %	PLASTICITY INDEX, I <sub>p</sub> , %	NATURAL WATER CONTENT OF LIMIT SAMPLE, w <sub>p</sub> , %	SPECIFIC GRAVITY OF SOLIDS, G <sub>s</sub>	UNIFIED SOIL CLASSIFICATION SYSTEM		STRENGTH				CONSOLIDATION										
										GROUP SYMBOL	% SAND (>#200 SIEVE)	% FINES (<#200 SIEVE)	TYPE OF TEST	COMPRESSIVE STRENGTH (σ <sub>1</sub> -σ <sub>3</sub> ), TSF	CONFINING PRESSURE σ <sub>3</sub> , TSF	STRAIN AT FAILURE, %	NATURAL WATER CONTENT, w <sub>n</sub> , %	WATER CONTENT AT END OF TEST, w <sub>f</sub> , %	NATURAL WATER CONTENT, w <sub>n</sub> , %	INITIAL VOID RATIO, e <sub>0</sub>	EXISTING OVERBURDEN STRESS, P <sub>0</sub> , TSF	ESTIMATED PRECONSOLIDATION STRESS, P <sub>c</sub> , TSF	COMPRESSION INDEX, C <sub>c</sub>	SWELLING INDEX, C <sub>s</sub>	VOID RATIO AT START OF SWELL, e <sub>f</sub>	
Z-201U	18S	220.3	C2		31	42	17	29		SC	73	27														
										SC	82	18														
PZ-202U	1UD	263.8	S1		19	49	26	19		SC&CL	69	31														
	2UD	258.8	S1		16	44	21	17		SC	68	32														
	3UD	253.8	S1		16	42	15	16		SC	82	18														
PZ-210U	1UD	270.6	S1		17	45	24	18		SC	72	28														
	2UD	265.6	S1		17	35	12	17		SC	77	23														
	3U	258.6	S1		15	49	26	15		SC	74	26														
Z-211U	25S	192.0	S3a		53	60	36	47	2.77	SC			CU	2.10	3.24	3.0	52.9	46.9	56.3	1.616	4.8	2.7	0.800	0.060	0.909	
PZ-216U	1U	275.0	S1		13	51	24	14		SC	79	21														
	2U	270.5	S1		21	31	7	21		SC	68	32														
	3UD	265.2	S1		17	38	14	17		SC	55	45														
Z-218U	18U	215.1	C2		69	136	35	108		MM		98	CU	2.63	2.88	3.1	68.5	67.6								
			S3a		46					SC	68	32														
Z-219U	19U	218.0	C2		30	62	43	28	2.75	SC&CH									34.3	1.017	4.6	5.3	0.429	0.063	0.516	
					30					SC	67	33														
	22U	211.5	C2		33	68	47	30		SC	87	13														
	23S	209.5	S3a		28	66	44	28		SC	88	12														
Z-220U	17U	219.3	S3b		27					SP-SC	91	9														
	18U	217.8	S3b		30					SP-SC	90	10														
					127		98	104		CH																

**SOIL DESCRIPTION**

**NOTES**

- ① RED-BROWN AND GRAY CLAYEY FINE TO MEDIUM SAND; TO FINE TO MEDIUM SAND, SOME CLAY OCCASIONALLY INTERLAYERED WITH SANDY CLAY.
- ② YELLOW-BROWN AND LIGHT GREEN CLAYEY FINE SAND; TO FINE TO MEDIUM SAND, SOME CLAY, INTERLAYERED WITH STIFF YELLOW-BROWN SILTY CLAY, TRACE LIGNITE, OCCASIONAL LAYERS OF LIGHT GRAY-GREEN CALCAREOUS FINE TO MEDIUM SAND, SOME CLAY, CLAY LAYERS, TRACE SHELLS.
- ③a LIGHT BROWN TO GRAY FINE TO MEDIUM SAND, SOME CLAY, TRACE LIGNITE, OCCASIONAL SANDY CLAY LAYERS.
- ③b LIGHT BROWN, AND YELLOW-BROWN FINE TO MEDIUM SAND, TRACE CLAY.

- All tests summarized were performed in the soils laboratory of Mueser Rutledge Consulting Engineers.
- The sample elevation is the average of the sampling interval.
- GROUND SURFACE ELEVATIONS AT BORINGS ARE:

Boring No.	Elevation Ft.	Boring No.	Elevation Ft.
Z-201U	279.3	Z-218U	278.9
PZ-202U	278.3	Z-219U	290.5
PZ-210U	288.1	Z-220U	286.3
Z-211U	289.5	Z-224U	281.2
PZ-216U	294.5	Z-225U	277.0
- "Average natural water content" is a weighted average of all material types recovered.
- Compression tests performed were: CU - Consolidated Undrained Triaxial Compression.
- Strength tests were performed on samples approximately 2.8 inches in diameter with a height-to-diameter ratio of 2.
- Compression Index, C<sub>c</sub> = the slope of the virgin curve (straight line portion of the consolidation test e-log p plot).  
$$e_2 = e_1 - C_c \times \log (P_2/P_1)$$
- Swelling index, C<sub>s</sub> = the slope of the rebound curve of the consolidation test...  
$$e_2 = e_1 + C_s \times \log (P_1/P_2)$$

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SALTSTONE DISPOSAL  
SAVANNAH RIVER PLANT - Z AREA  
E.I. DUPONT DE NEMOURS & CO., INC.

**TABLE NO. 1**  
**SUMMARY OF LABORATORY TEST DATA**

SAMPLE IDENTIFICATION					CLASSIFICATION PROPERTIES							PHYSICAL PROPERTIES																
BORING NUMBER	SAMPLE NUMBER	ELEVATION, FT.	STRATUM DESIGNATION	SOIL TYPE	AVERAGE NATURAL WATER CONTENT, $w_n$ , %	LIQUID LIMIT, $w_L$ , %	PLASTICITY INDEX, $I_p$ , %	NATURAL WATER CONTENT OF LIMIT SAMPLE, $w_n$ , %	SPECIFIC GRAVITY OF SOLIDS, $G_s$	UNIFIED SOIL CLASSIFICATION SYSTEM		STRENGTH				CONSOLIDATION												
										GROUP SYMBOL	% SAND (>#200 SIEVE)	% FINES (<#200 SIEVE)	TYPE OF TEST	COMPRESSIVE STRENGTH ( $\sigma_1 - \sigma_3$ ), TSF	CONFINING PRESSURE $\sigma_3$ , TSF	STRAIN AT FAILURE, %	NATURAL WATER CONTENT, $w_n$ , %	WATER CONTENT AT END OF TEST, $w_f$ , %	NATURAL WATER CONTENT, $w_n$ , %	INITIAL VOID RATIO, $e_0$	EXISTING OVERBURDEN STRESS, $P_0$ , TSF	ESTIMATED PRECONSOLIDATION STRESS, $P_c$ , TSF	COMPRESSION INDEX, $C_c$	SWELLING INDEX, $C_s$	VOID RATIO AT START OF SWELL, $e_r$			
Z-224U	6U	224.7	C2		22				2.86	SC	81	19																
	8U	221.3	C2		40	84	38	43		SC	62	38																
	10U	218.2	C2		58	114	84	58		CH	34	66	CU	1.87	2.45	4.3	54.8	54.8										
	13U	213.2	C2		80	134	83	63		CH		81	CU	3.12	2.52	2.6	78.8	77.9										
					31	62	36	35		CH		54																
Z-225U	15U	210.5	C2		31	104	83	31	*SC	65	35																	
	4U	219.5	S3a		31	56	36	29	SC	86	14																	
	6U	216.0	C2		61	131	100	58	SC	74	26	CU	2.47	2.74	2.9	62.3	62.6	58.9	1.675	3.8	6.6	1.118	0.214	0.700				
	7U	214.0	C2		49	94	72	54	CH		77	CU	2.98	2.81	4.1	43.9	43.8											
									CH		59																	
								SC		44	CU																	

**SOIL DESCRIPTION**

**NOTES**

- (S1) RED-BROWN AND GRAY CLAYEY FINE TO MEDIUM SAND; TO FINE TO MEDIUM SAND, SOME CLAY OCCASIONALLY INTERLAYERED WITH SANDY CLAY.
- (C2) YELLOW-BROWN AND LIGHT GREEN CLAYEY FINE SAND; TO FINE TO MEDIUM SAND, SOME CLAY, INTERLAYERED WITH STIFF YELLOW-BROWN SILTY CLAY, TRACE LIGNITE, OCCASIONAL LAYERS OF LIGHT GRAY-GREEN CALCAREOUS FINE TO MEDIUM SAND, SOME CLAY, CLAY LAYERS, TRACE SHELLS.
- (S3a) LIGHT BROWN TO GRAY FINE TO MEDIUM SAND, SOME CLAY, TRACE LIGNITE, OCCASIONAL SANDY-CLAY LAYERS.
- (S3b) LIGHT BROWN, AND YELLOW-BROWN FINE TO MEDIUM SAND, TRACE CLAY.

1. All tests summarized were performed in the soils laboratory of Mueser Rutledge Consulting Engineers.
2. The sample elevation is the average of the sampling interval.
3. GROUND SURFACE ELEVATIONS AT BORINGS ARE:

Boring No.	Elevation Ft.	Boring No.	Elevation Ft.
Z-201U	279.3	Z-218U	278.9
PZ-202U	278.3	Z-219U	290.5
PZ-210U	288.1	Z-220U	286.3
Z-211U	289.5	Z-224U	281.2
PZ-216U	294.5	Z-225U	277.0
4. "Average natural water content" is a weighted average of all material types recovered.
5. Compression tests performed were: CU - Consolidated Undrained Triaxial Compression.
6. Strength tests were performed on samples approximately 2.8 inches in diameter with a height-to-diameter ratio of 2.
7. Compression Index,  $C_c$  = the slope of the virgin curve (straight line portion of the consolidation test e-log p plot).
$$e_2 = e_1 - C_c \times \log (P_2/P_1)$$
8. Swelling Index,  $C_s$  = the slope of the rebound curve of the consolidation test...
$$e_2 = e_1 + C_s \times \log (P_1/P_2)$$
9. \* - Sample showed a positive reaction with HCL.

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SALTSTONE DISPOSAL  
SAVANNAH RIVER PLANT - Z AREA  
E. I. DUPONT DE NEMOURS & CO., INC.



TABLE NO. 2

SUMMARY OF LABORATORY PERMEABILITY TEST DATA

BORING NO.	SAMPLE NO.	ELEVATION FT.	STRATA	USC	(<200 SIEVE) % FINES	PERMEABILITY CM/SEC	CONFINING PRESSURE TSF	NATURAL WATER CONTENT %	FINAL WATER CONTENT %	INITIAL DEGREE OF SATURATION %	FINAL DEGREE OF SATURATION %
PZ 210U	3U	258.6	S1	SC	26	$1.1 \times 10^{-6}$	1.51	14.9	14.8	74	100+
PZ 216U	1U	275.0	S1	SC	21	$2.4 \times 10^{-6}$	1.02	16.8	16.0	80	100+
PZ 216U	2U	270.5	S1	SC	32	$2.5 \times 10^{-5}$	1.27	21.4	22.0	98	94

NOTES:

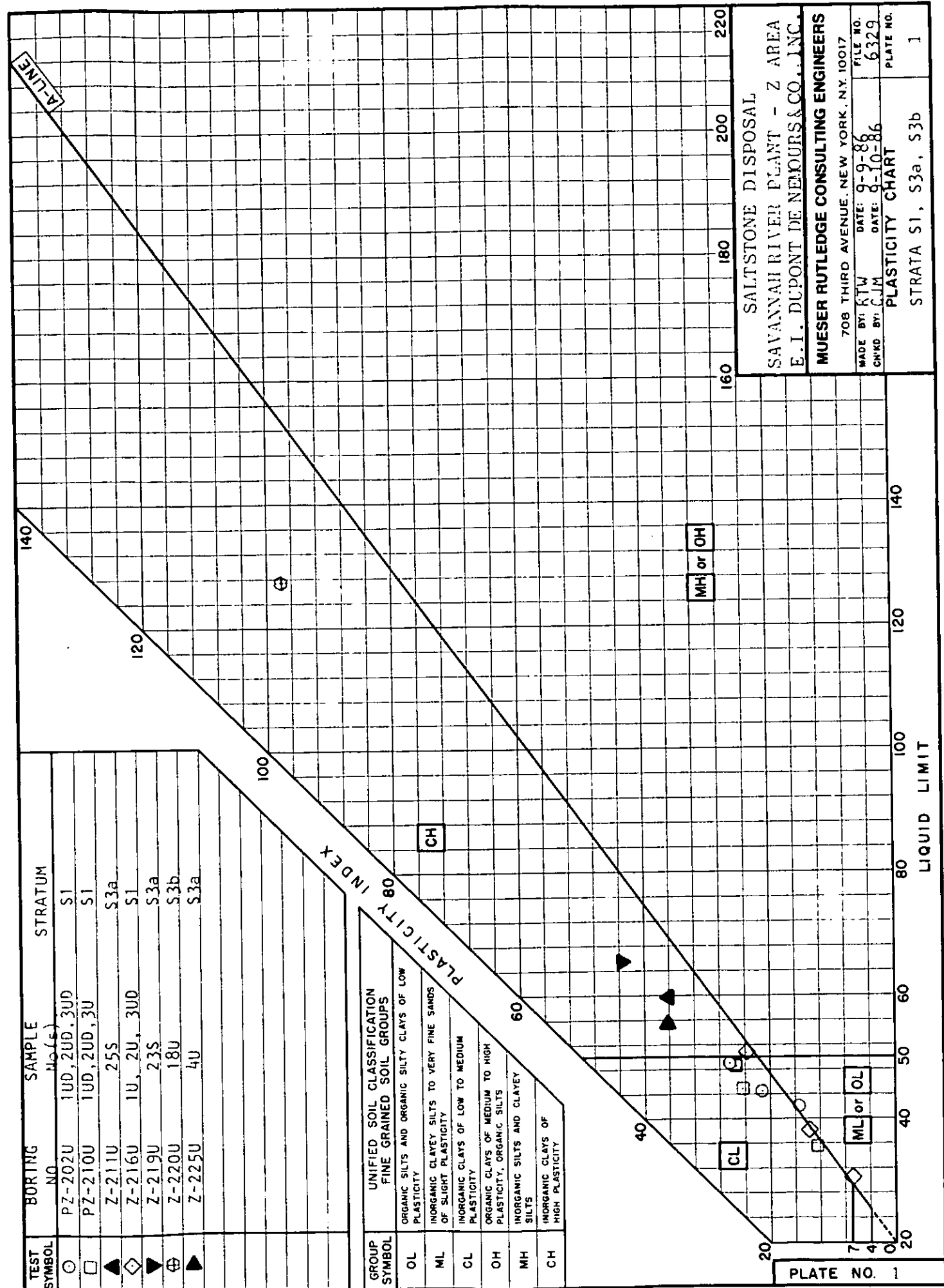
- PERMEABILITIES WERE DETERMINED BY PERFORMING FALLING HEAD TESTS ON UNDISTURBED SAMPLES, APPROXIMATELY 2.8 INCHES IN DIAMETER WITH A HEIGHT TO DIAMETER RATIO OF APPROXIMATELY 2.
- FOR GROUND SURFACE ELEVATIONS AT BORINGS AND SOIL DESCRIPTIONS, SEE TABLE NO.1.

A-LINE

TEST SYMBOL	BORING NO.	SAMPLE No. (s)	STRATUM
○	PZ-202U	1U, 2U, 3U	S1
□	PZ-210U	1U, 2U, 3U	S1
▲	Z-211U	25S	S3a
◇	Z-216U	1U, 2U, 3U	S1
▼	Z-219U	23S	S3a
⊕	Z-220U	18U	S3b
▲	Z-225U	4U	S3a

GROUP SYMBOL	UNIFIED SOIL CLASSIFICATION FINE GRAINED SOIL GROUPS
OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
ML	ORGANIC CLAYEY SILTS TO VERY FINE SANDS OF SLIGHT PLASTICITY
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
MH	INORGANIC SILTS AND CLAYEY SILTS
CH	INORGANIC CLAYS OF HIGH PLASTICITY

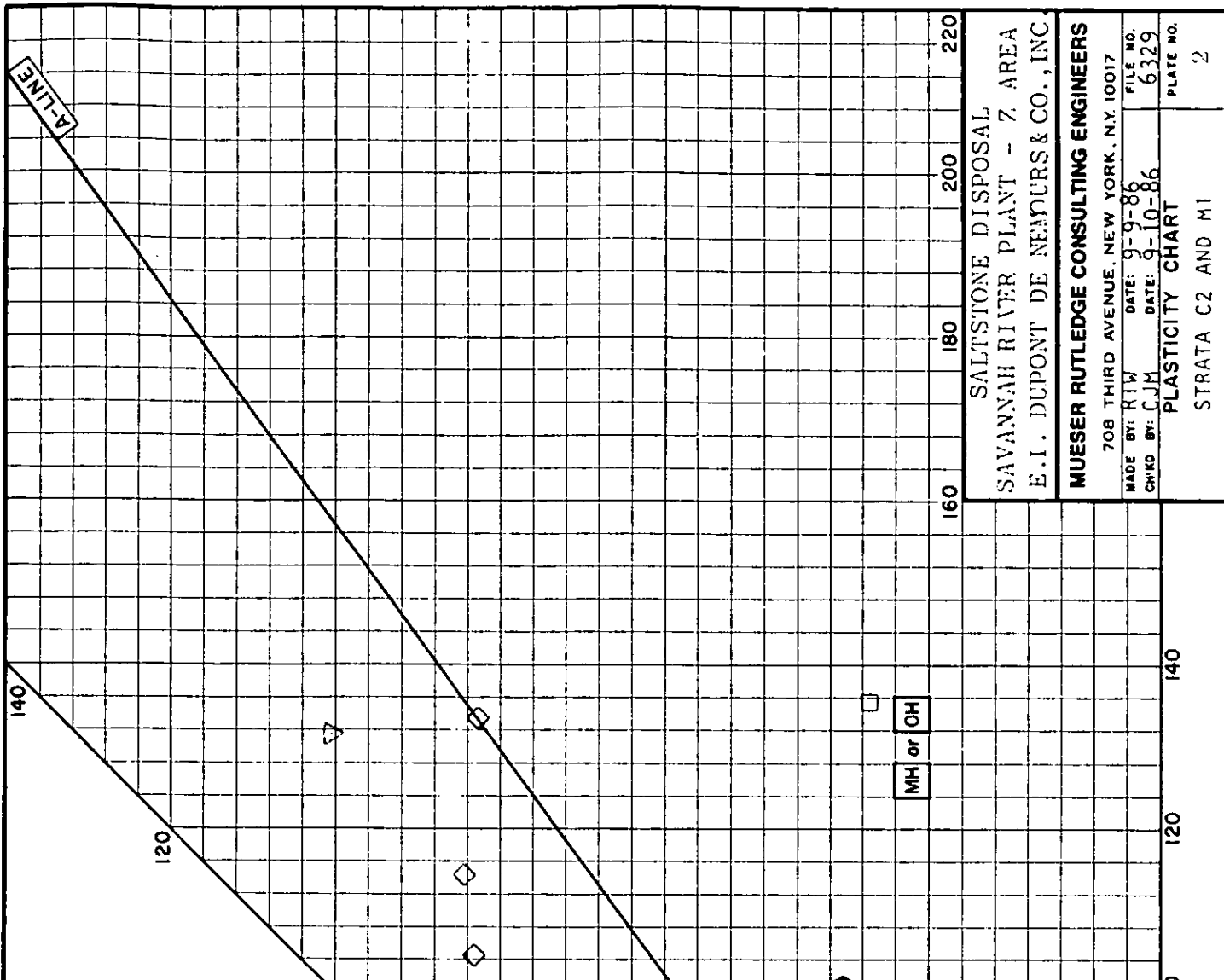
PLASTICITY INDEX



SALTSTONE DISPOSAL  
 SAVANNAH RIVER PLANT - Z AREA  
 E. I. DUPONT DE NEMOURS & CO., INC.  
 MUESER RUTLEDGE CONSULTING ENGINEERS  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017  
 MADE BY: KTW DATE: 9-9-86 FILE NO. 6329  
 CHKD BY: C.J.M DATE: 8-10-86 PLATE NO. 1  
 PLASTICITY CHART  
 STRATA S1, S3a, S3b

PLATE NO. 1

TEST SYMBOL	BORING NO.	SAMPLE NO. (s.)	STRATUM
○	Z-201U	18S	C2
□	Z-218U	18U	C2
△	Z-219U	19U, 22U	C2
◇	Z-224U	6U, 8U, 10U, 13U, 15U	C2
▽	Z-225U	6U, 7U	C2
●	Z-214	37D	M1



SALTSTONE DISPOSAL  
 SAVANNAH RIVER PLANT - 7 AREA  
 E.I. DUPONT DE NEMOURS & CO., INC.

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017

MADE BY: RTW DATE: 9-9-86 FILE NO. 6329  
 CHKD BY: CJM DATE: 9-10-86 PLASTICITY CHART PLATE NO. 2

STRATA C2 AND M1







CURVE NUMBER	PRESSURE INCREMENT FROM (TSF) TO (TSF)	DESCRIPTION OF SPECIMEN	UNIFIED CLASSIFICATION GROUP		SC		PROPERTIES OF SPECIMEN		PROPERTIES OF CONSOLIDATION SPECIMEN		PROPERTIES OF SPECIMEN		STRATUM	S3a	
			LIQUID LIMIT ( $w_L$ )	PLASTIC LIMIT ( $w_p$ )	PLASTICITY INDEX ( $I_p$ )	NATURAL WATER CONT. % ( $w$ )	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	SPECIFIC GRAVITY ( $G_s$ )	PLASTICITY LIMIT	PLASTICITY INDEX	DEPTH OF SPECIMEN (FT.)	ELEVATION OF SPECIMEN			INITIAL VOID RATIO ( $e_0$ ), SHOWN THUS: ---
1	0.733	1.47			60	24	36	47	0.66	2.77				1.616	
2	1.47	2.93			24	36	47	0.66	2.77				1.153		
3	2.93	5.87			36	47	0.66	2.77					2.7		
4													4.8		
5													0.800		
6													0.060		
7															
8															

SALTSTONE DISPOSAL,  
SAVANNAH RIVER PLANT - Z AREA  
E.I. DUPONT DE NEMOURS & CO., INC.

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708 THIRD AVENUE, NEW YORK, N.Y. 10017

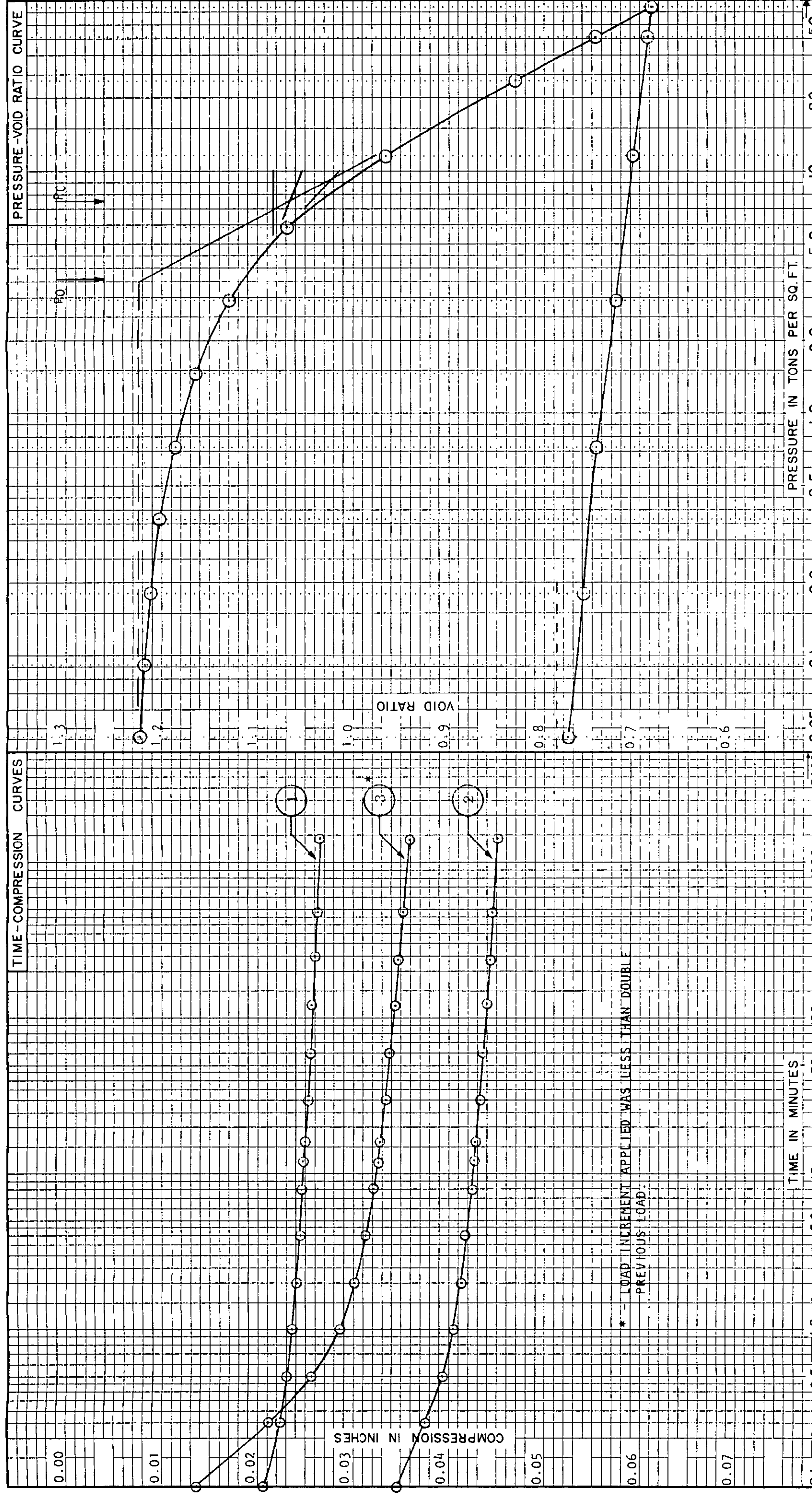
MADE BY: CJM DATE: 8-6-86  
CH'D BY: RJM DATE: 8-11-86

FILE NO. 6329  
PLATE NO. 5

CONSOLIDATION TEST  
BORING NO. 7-211U SAMPLE NO. 25U







CURVE NUMBER	PRESSURE INCREMENT FROM (TSF) TO (TSF) OF SPECIMEN	DESCRIPTION OF SPECIMEN	UNIFIED CLASSIFICATION GROUP	SC	PROPERTIES OF PLASTICITY LIMIT SPECIMEN				PROPERTIES OF CONSOLIDATION SPECIMEN								
					LIQUID LIMIT (w <sub>L</sub> )	PLASTIC LIMIT (w <sub>p</sub> )	PLASTICITY INDEX (I <sub>p</sub> )	NATURAL WATER CONT. % (w)	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	SPECIFIC GRAVITY (G <sub>s</sub> )	DEPTH OF SPECIMEN (FT.)	ELEVATION OF SPECIMEN'	INITIAL VOID RATIO (e <sub>0</sub> )	FINAL VOID RATIO (e <sub>f</sub> )			
1	2.93	5.87	84	84	45	39	43	-0.06	2.86	224.7	56.5	2.50	0.99	36.7	27.4	86.5	101
2	5.87	11.7	45	45	39	43	-0.06	2.86	56.5	2.50	0.99	36.7	27.4	86.5	101	1.213	0.777
3	23.5	35.2	39	39	43	43	-0.06	2.86	2.50	0.99	0.99	36.7	27.4	86.5	101	7.5	3.6
4			43	43	43	43	-0.06	2.86	0.99	0.99	0.99	36.7	27.4	86.5	101	0.476	0.032
5			43	43	43	43	-0.06	2.86	0.99	0.99	0.99	36.7	27.4	86.5	101	0.476	0.032
6			43	43	43	43	-0.06	2.86	0.99	0.99	0.99	36.7	27.4	86.5	101	0.476	0.032
7			43	43	43	43	-0.06	2.86	0.99	0.99	0.99	36.7	27.4	86.5	101	0.476	0.032
8			43	43	43	43	-0.06	2.86	0.99	0.99	0.99	36.7	27.4	86.5	101	0.476	0.032

SALTSTONE DISPOSAL  
SAVANNAH RIVER PLANT - Z AREA  
E. I. DUPONT DE NEMOURS & CO., INC.

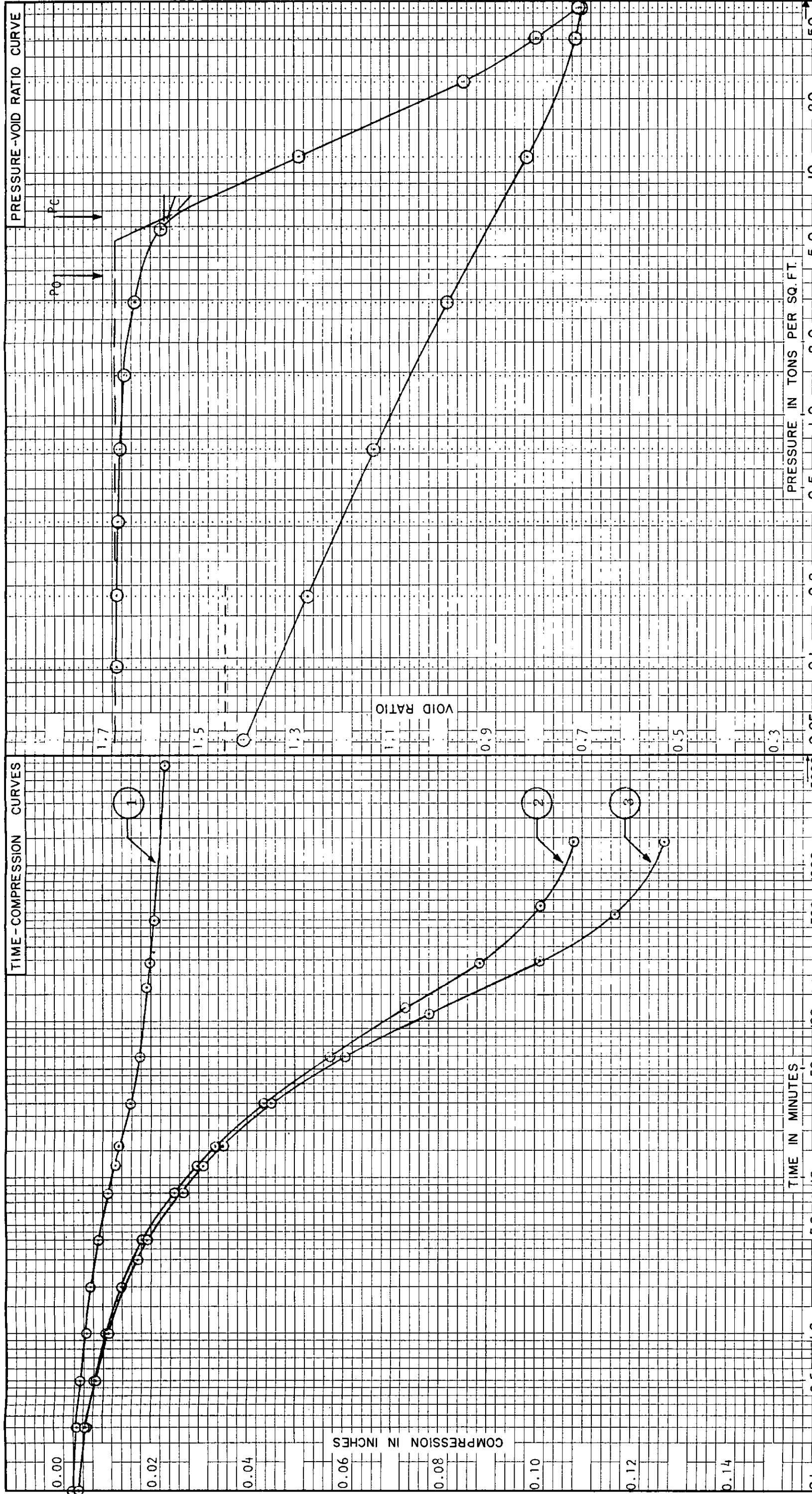
MUESER RUTLEDGE CONSULTING ENGINEERS  
708 THIRD AVENUE, NEW YORK, N.Y. 10017

MADE BY: CJM DATE: 8-6-86  
CHECKED BY: RTW DATE: 8-11-86

FILE NO. 6329  
DATE: 8-6-86  
DATE: 8-11-86

CONSOLIDATION TEST  
BORING NO. Z-224U SAMPLE NO. 6U 7





Curve Number	Pressure Increment from (TSF) to (TSF)	Description of Specimen	Unified Classification Group	Properties of Plasticity Limit	Properties of Consolidation Specimen	Properties of Specimen	Stratum	Pressure in Tons per Sq. Ft.
1	2.93	Stiff mottled red-brown and yellow-brown clay, some fine sand, trace fine sand seams, lignite	CH	Liquid Limit (w <sub>L</sub> ) Plastic Limit (w <sub>P</sub> ) Plasticity Index (I <sub>P</sub> ) Natural Water Cont. % (w) Liquidity Index = $\frac{w-w_p}{I_p}$ Specific Gravity (G <sub>s</sub> )	Elevation of Specimen Depth of Specimen (ft.) Diameter of Specimen (in.) Initial Thickness of Specimen (in.) Initial Water Content % Final Water Content % Initial Degree Saturation % Final Degree Saturation %	216.0 61.0 2.50 0.98 58.9 53.0 98.1 102	C2	1.675 1.444 6.6 3.8 1.118 0.214
2	5.87		131					
3	11.7		31					
4	23.5		100					
5			58					
6			0.27					
7			2.79					
8								

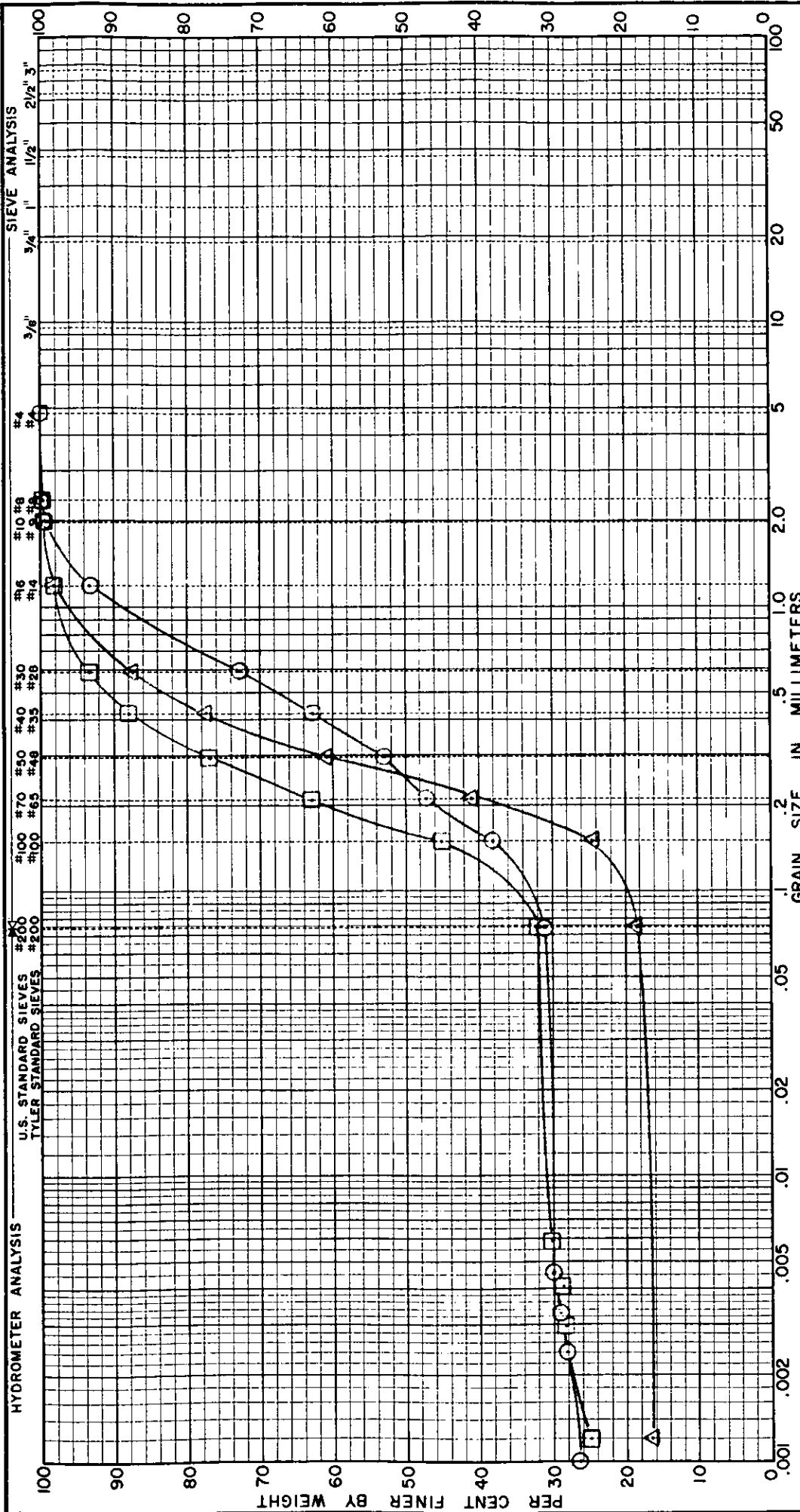
SAITSTONE DISPOSAL  
SAVANNAH RIVER PLANT - Z AREA  
E. I. DUPONT DE NEMOURS & CO., INC.

MUESER RUTLEDGE CONSULTING ENGINEERS  
708 THIRD AVENUE, NEW YORK, N.Y. 10017

MADE BY C.J.M. DATE: 8-6-86  
CH'kd BY RTW DATE: 8-11-86

CONSOLIDATION TEST  
BORING NO. Z-225U SAMPLE NO. 6U

FILE NO. 6329  
PLATE NO. 8

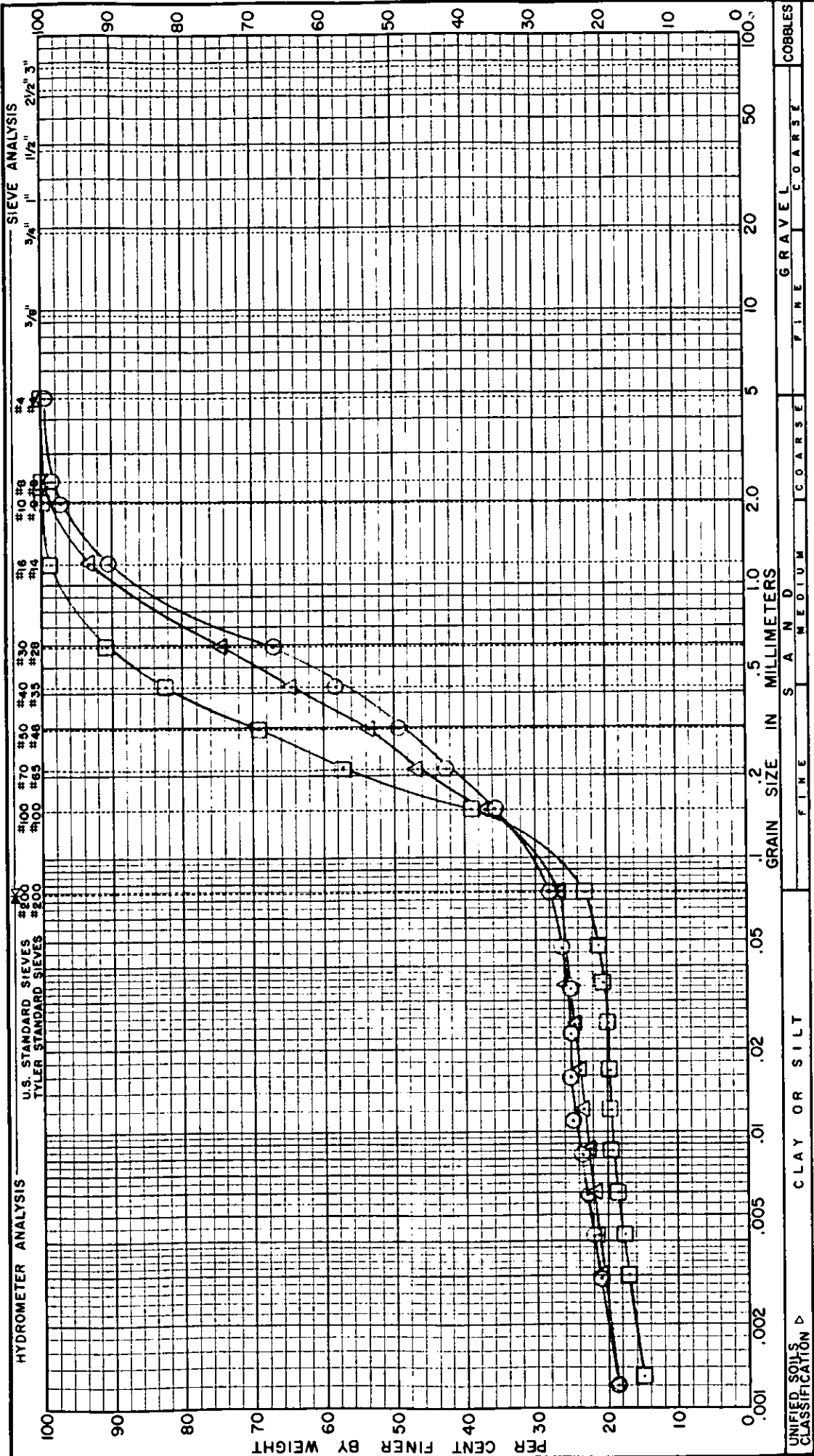


UNIFIED SOILS CLASSIFICATION	CLAY OR SILT			FINE SAND			MEDIUM SAND			COARSE SAND			GRAVEL			COBBLES		
	>		<															

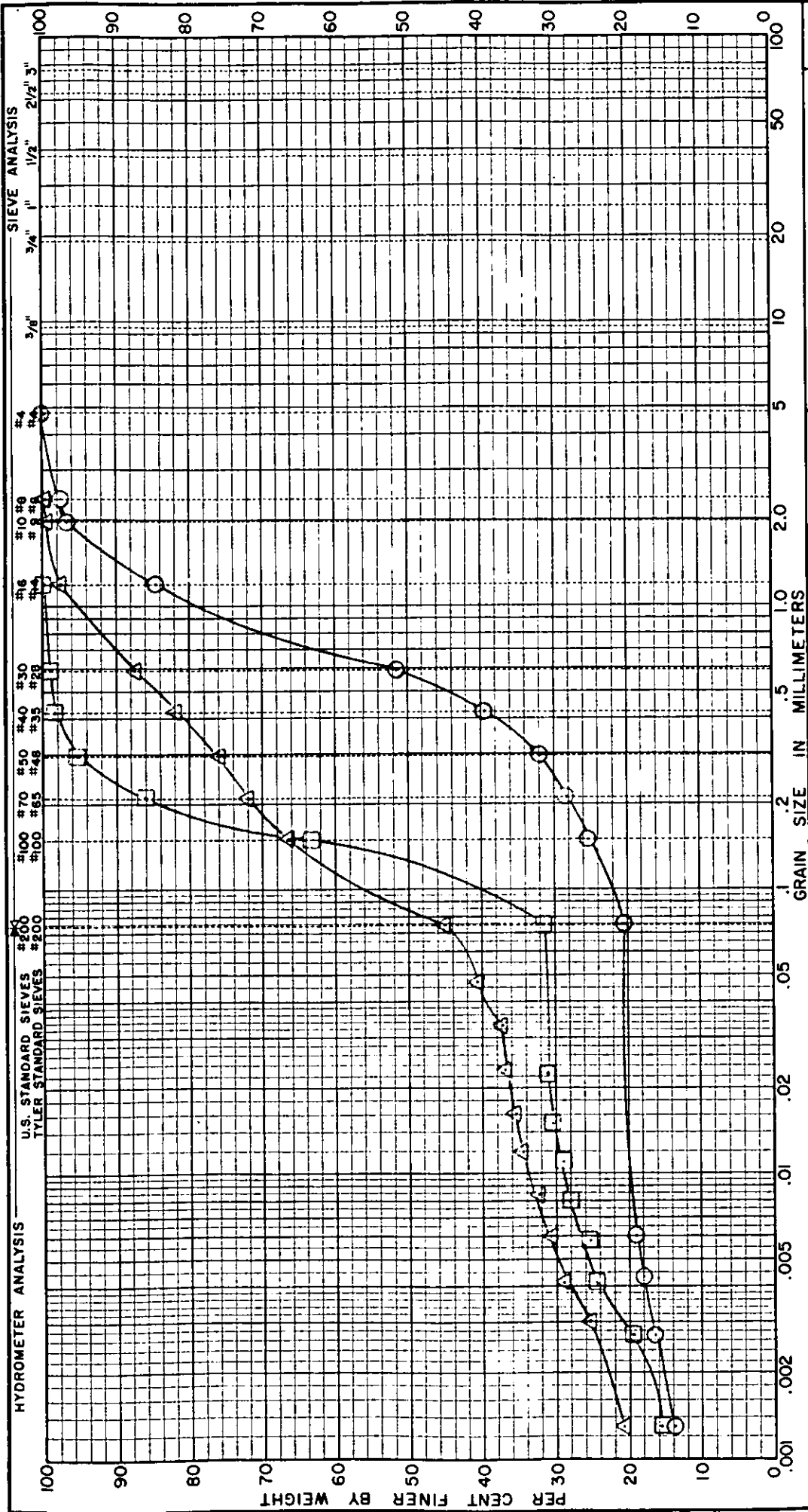
SYMBOL	BORING	SAMPLE	WATER CONTENT-%	LIQUID LIMIT	PLASTICITY INDEX	DESCRIPTION OF SAMPLE
○	PZ-202U	1UD	19	49	26	Red-brown clayey medium to fine sand (SC)
□	PZ-202U	2UD	17	44	21	Red-brown clayey fine to medium sand (SC)
△	PZ-202U	3UD	16	42	15	Orange-brown fine to medium sand, some clay (SC)

SALTSTONE DISPOSAL  
 SAVANNAH RIVER PLANT - Z AREA  
 E. I. DUPONT DE NEMOURS & CO., INC.  
**MUESER RUTLEDGE CONSULTING ENGINEERS**  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017  
 MADE BY: GCB DATE: 8-14-86 FILE NO. 6329  
 CHKD BY: RLW DATE: 8-21-86 PLATE NO. 9  
**GRADATION CURVES**  
 STRATUM S1

PLATE NO. 9



UNIFIED SOILS CLASSIFICATION		CLAY OR SILT		FINE SAND		MEDIUM SAND		COARSE SAND		FINE GRAVEL		COARSE GRAVEL		COBBLES	
SYMBOL	BORING	SAMPLE	WATER CONTENT-%	LIQUID LIMIT	PLASTICITY INDEX	DESCRIPTION OF SAMPLE									
○	PZ-210U	1UD	18	45	24	Mottled red-brown & white medium to fine sand, some clay, trace c sand (SC)									
□	PZ-210U	2UD	17	35	12	Mottled red-brn & yel-brn fine to medium sand, some clay (SC)									
△	PZ-210U	3U	15	49	26	Mottled red-brown & gray fine to medium sand, some clay (SC)									
<p>SAULTSTONE DISPOSAL</p> <p>SAVANNAH RIVER PLANT-Z AREA</p> <p>E.I. DUPONT DE NEMOURS &amp; CO. INC.</p> <p>MUESER RUTLEDGE CONSULTING ENGINEERS</p> <p>708 THIRD AVENUE, NEW YORK, N.Y. 10017</p> <p>MADE BY: GCB DATE: 8-14-86 FILE NO. 6329</p> <p>CHKD BY: RTM DATE: 8-21-86</p> <p>GRADATION CURVES</p> <p>STRATUM S1</p>															
<p>PLATE NO. 10</p>															



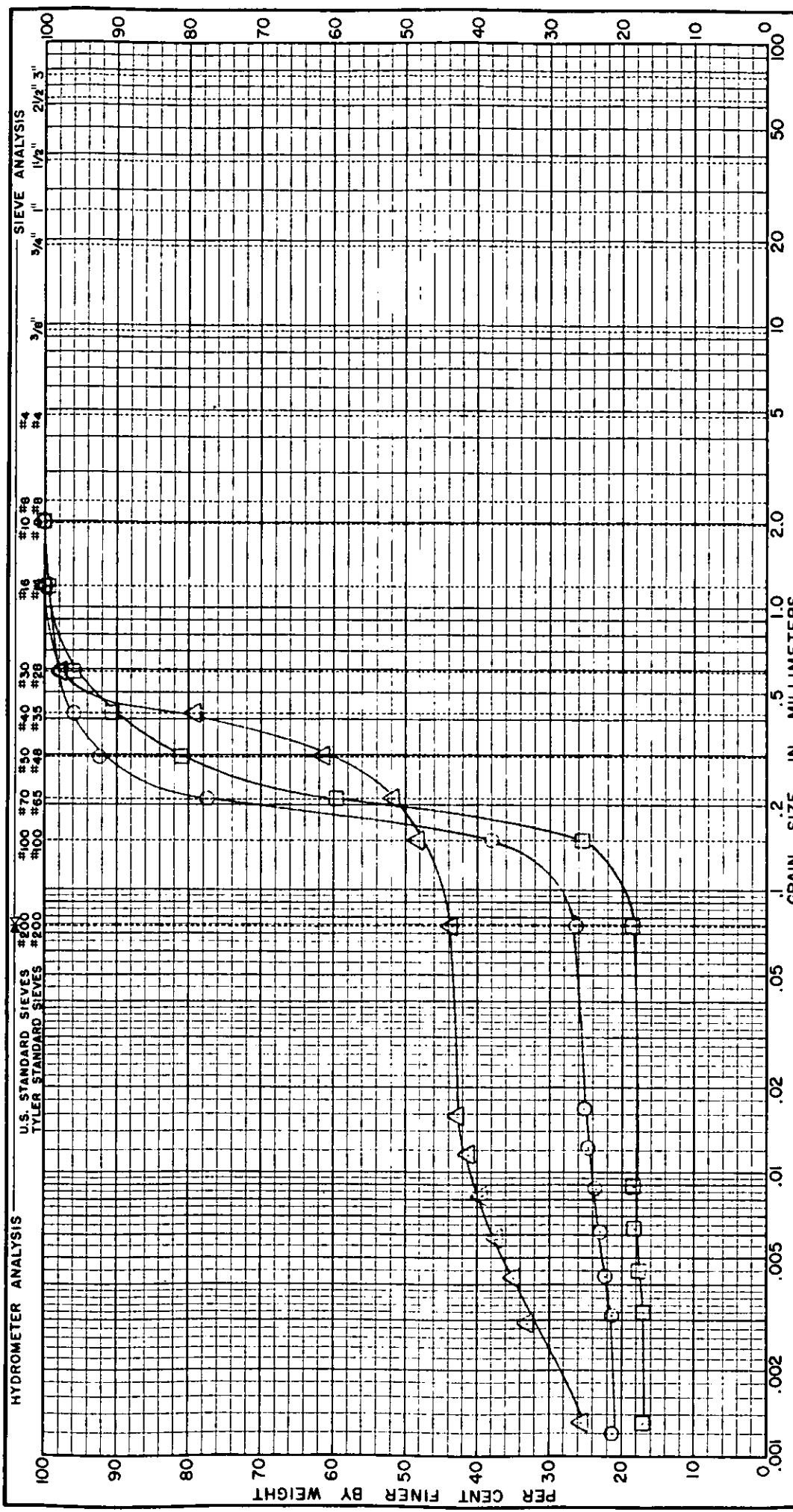
SYMBOL	BORING	SAMPLE	WATER CONTENT-%	LIQUID LIMIT	PLASTICITY INDEX	DESCRIPTION OF SAMPLE	UNIFIED SOILS CLASSIFICATION			
							CLAY OR SILT	GRAVEL	COARSE	COBBLES
○	PZ-216U	1U	14	51	24	Mottled red-brown & purple medium to finesand, some clay, tr c sand (SC)				
□	PZ-216U	2U	21	31	7	Purple clayey fine sand, trace medium sand (SC)				
△	PZ-216U	3UD	17	38	14	Mottled purple & gray clayey fine to medium sand (SC)				

**SALTSTONE DISPOSAL**  
**SAVANNAH RIVER PLANT - 2 AREA**  
**E. I. DUPONT DE NEMOURS & CO. INC.**

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017

MADE BY: GCB DATE: 8-14-86 FILE NO. 6329  
 CHKD BY: RTW DATE: 8-21-86 PLATE NO. 11

**GRADATION CURVES**  
**STRATUM S1**



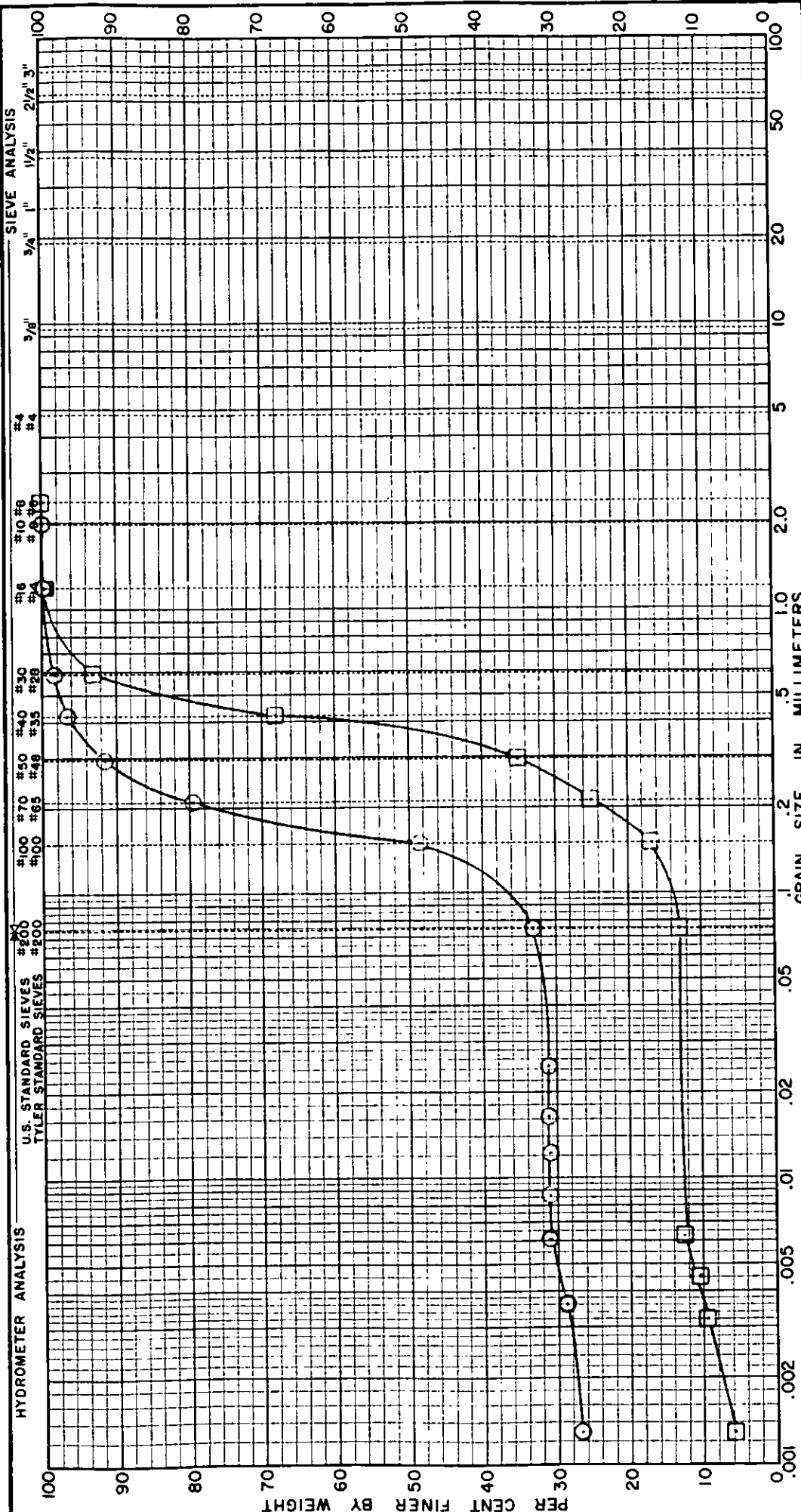
UNIFIED SOILS CLASSIFICATION	CLAY OR SILT			FINE GRAVEL			COBBLES		
	FINE	MEDIUM	COARSE	FINE	GRAVEL	COARSE	COBBLES	COARSE	COBBLES

SYMBOL	BORING	SAMPLE	WATER CONTENT-%	LIQUID LIMIT	PLASTICITY INDEX	DESCRIPTION OF SAMPLE
○	Z-201U	18S Top	29	42	17	Mottled yellow-brown & brown fine sand, some clay, clay pkts, tr med sand (SC)
□	Z-201U	18S Bot				Brown fine to medium sand, some clay, trace clay pockets (SC)
△	Z-225U	7U	54	94	72	Yellow-brown clayey fine to medium sand some clay layers, trace lignite (SC)

SALTSTONE DISPOSAL	
SAVANNAH RIVER PLANT - Z AREA	
E. I. DUPONT DE NEMOURS & CO., INC.	
<b>MUESER RUTLEDGE CONSULTING ENGINEERS</b>	
708 THIRD AVENUE, NEW YORK, N.Y. 10017	
MADE BY: RTW	DATE: 8-21-86
FILE NO. 6329	
CHKD BY: CJM	DATE: 8-26-86
GRADATION CURVES	
STRATUM C-2	
PLATE NO. 11	12

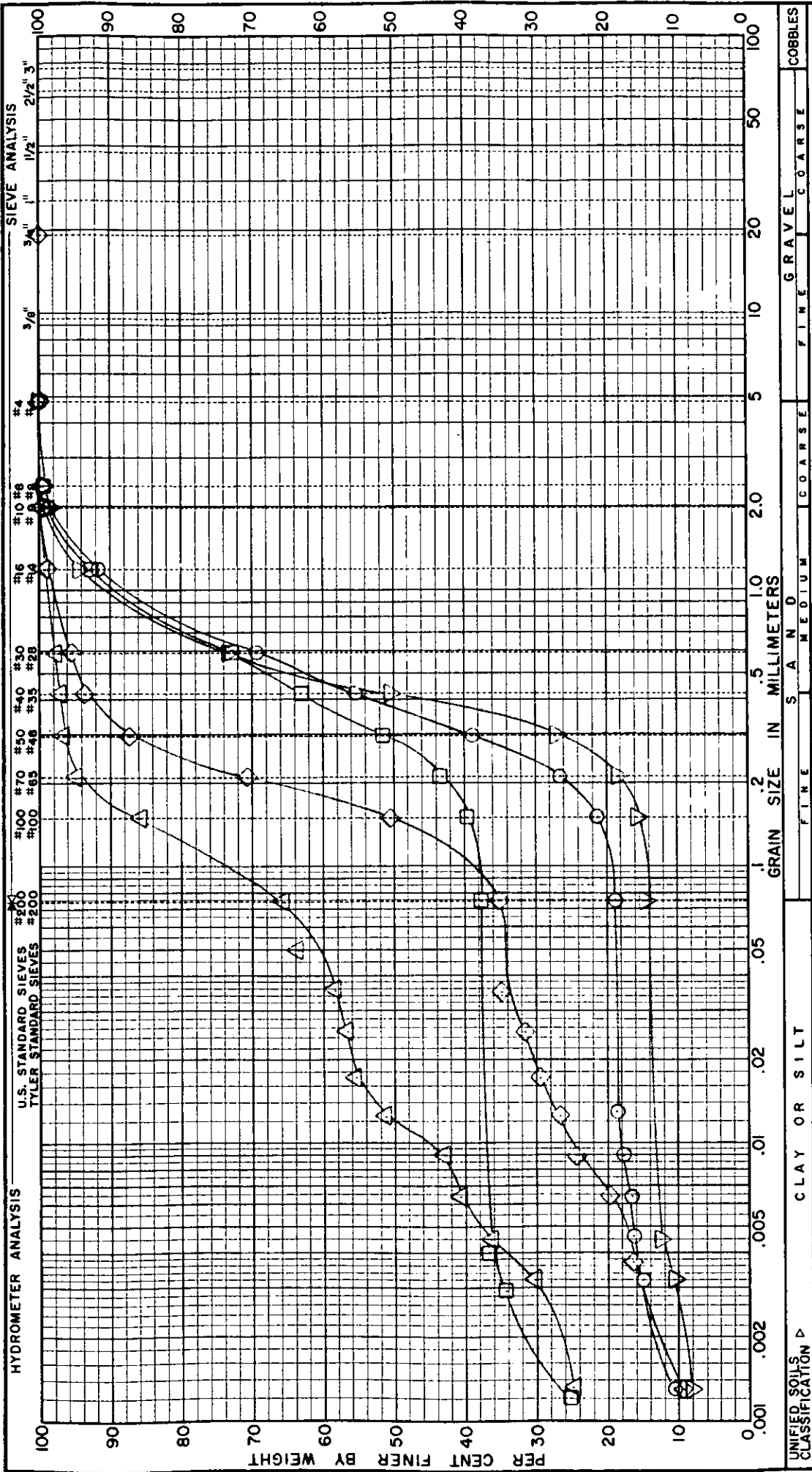


UNIFIED SOILS CLASSIFICATION ▷ CLAY OR SILT FINE GRAVEL COARSE COBBLES

SYMBOL	BORING	SAMPLE	WATER CONTENT - %	LIQUID LIMIT	PLASTICITY INDEX	DESCRIPTION OF SAMPLE
○	Z-219U	19U	28	62	43	Yellow-brown fine sand, some clay, clay layers, tr medium sand, lignite (SC)
□	Z-219U	22U	30	68	47	Yellow-brown fine to medium sand, some clay (SC)

SALTSTONE DISPOSAL,  
SAVANNAH RIVER PLANT - Z AREA  
E. I. DUPONT DE NEMOURS & CO., INC.

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
708 THIRD AVENUE, NEW YORK, N.Y. 10017  
MADE BY: GCB DATE: 8-14-86 FILE NO. 6329  
CHKD BY: RTW DATE: 8-21-86 GRADATION CURVES PLATE NO. 13  
STRATUM: C2

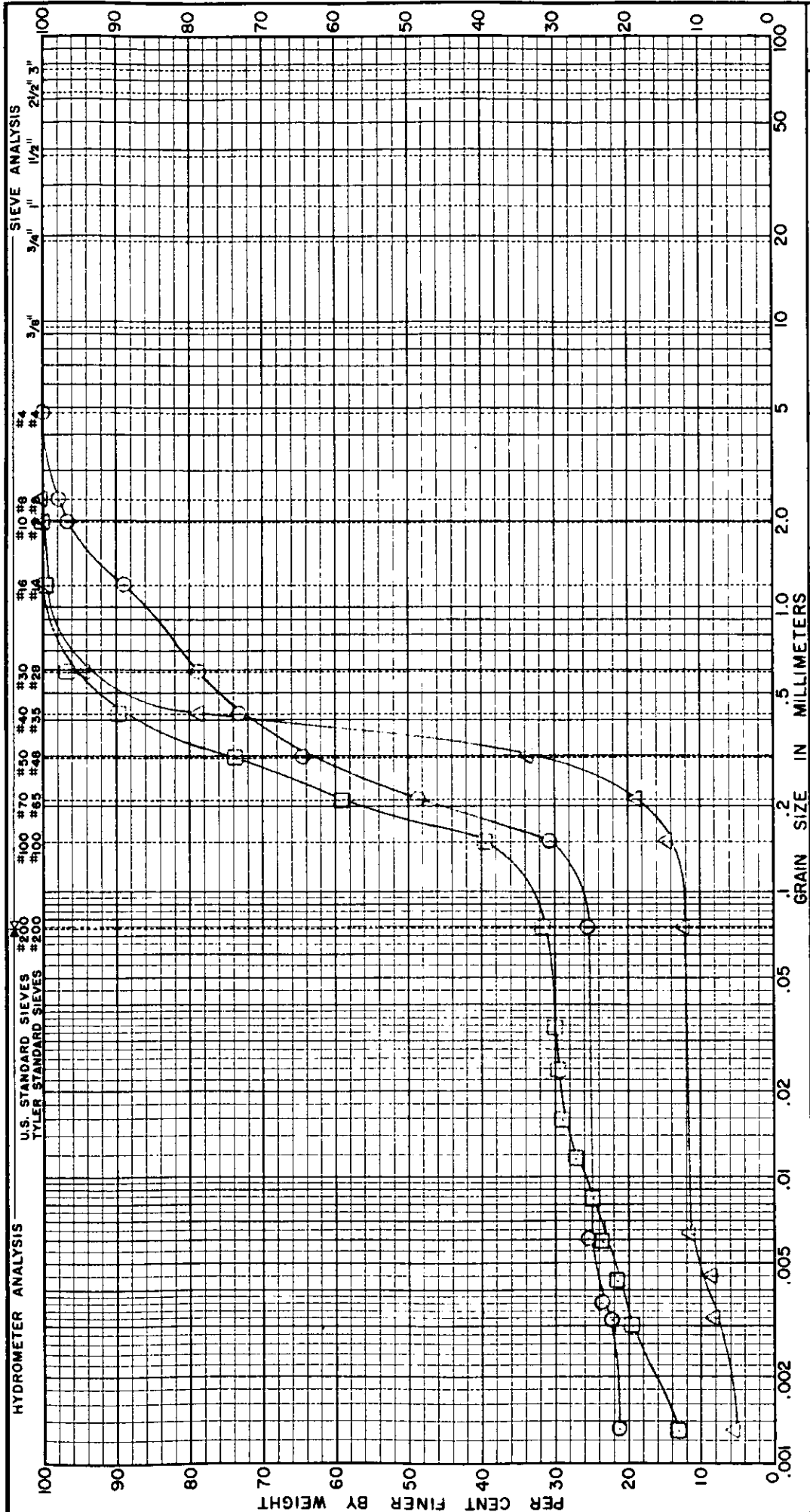


SALTSTONE DISPOSAL,  
 SAVANNAH RIVER PLANT-7 AREA  
 E. I. DUPONT DE NEMOURS & CO., INC.

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017  
 MADE BY: RTW DATE: 8-21-86 FILE NO. 6320  
 CHKD BY: CJM DATE: 8-26-86 GRADATION CURVES PLATE NO. 14  
 STRATUM C:2

SYMBOL	BORING	SAMPLE	WATER CONTENT-%	LIQUID LIMIT	PLASTICITY INDEX	DESCRIPTION OF SAMPLE
○	Z-224U	6U Top	22	-	-	Light gray-green medium to fine sand, some clay (SC)
□	Z-224U	6U Bot	43	84	38	White clayey medium to fine sand (SC)
△	Z-224U	8U	58	114	84	Stiff light gray-green fine sandy clay trace medium sand (CH)
◇	Z-224U	13U	35	62	36	Light gray-green clayey fine to medium sand, trace shells (SC)
▽	Z-224U	15U	31	104	83	Light gray-green m-f sand, some clay (SC)





SYMBOL	BORING	SAMPLE	WATER CONTENT-%	LIQUID LIMIT	PLASTICITY INDEX	DESCRIPTION OF SAMPLE	UNIFIED SOILS CLASSIFICATION	
							CLAY OR SILT	GRAVEL
○	Z-225U	4U	29	56	36	Mottled red-brown & yellow-brown fine to medium sand, some clay, clay partings, trace coarse sand		
□	Z-218U	18U	108	136	35	Yellow-brown fine to medium sand, some clay, clay layers, trace lignite		
△	Z-219U	23S	28	66	44	Light-brown fine to medium sand, some clay		

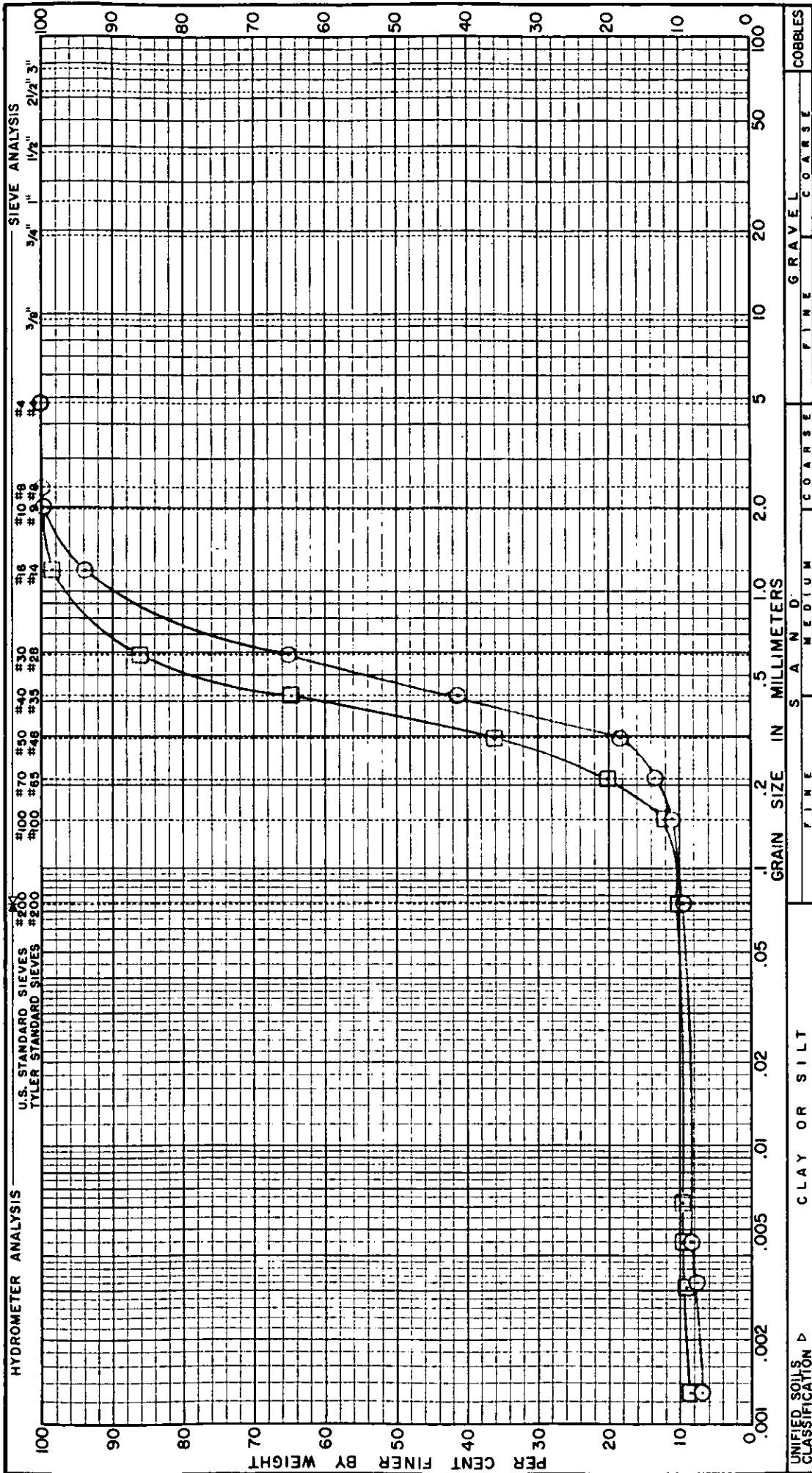
**SALTSTONE DISPOSAL**  
**SAVANNAH RIVER PLANT - Z AREA**  
**E. I. DUPONT DE NEMOURS & CO. INC.**

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017

MADE BY: RTW DATE: 8-21-86 FILE NO. 6329  
 CHKD BY: CJM DATE: 8-26-86 PLATE NO. 15

**GRADATION CURVES**  
 STRATUM S3a





SALTSTONE DISPOSAL,  
 SAVANNAH RIVER PLANT - Z AREA  
 E. I. DUPONT DE NEMOURS & CO. INC.

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017

MADE BY: GCB      DATE: 8-14-86      FILE NO. 6329  
 CHKD. BY: RTW      DATE: 8-21-86

**GRADATION CURVES**  
 STRATUM S3b      PLATE NO. 16

SYMBOL	BORING	SAMPLE	WATER CONTENT-%	LIQUID LIMIT	PLASTICITY INDEX	DESCRIPTION OF SAMPLE
○	Z-220U	17U	27	-	-	Mottled brown & yellow-brown medium to fine sand, trace clay (SP-SC)
□	Z-220U	18U	30	-	-	Mottled yellow-brown and brown fine to medium sand, trace clay (SP-SC)

PLATE NO. 16



**GENERAL NOTES**

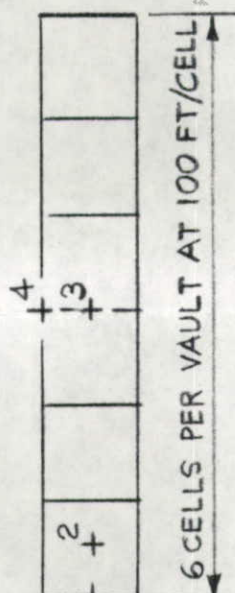
- BORINGS Z-201 THROUGH Z-225U WERE MADE BETWEEN MARCH 11, 1985 AND MAY 22, 1986 BY DAVIS DRILLING CO., INC. UNDER THE CONTINUOUS INSPECTION OF MUESER RUTLEDGE CONSULTING ENGINEERS (MRCE).
- SPLIT-SPOON SAMPLE BORINGS AND UNDISTURBED SAMPLE BORINGS WERE ADVANCED USING DRILLING MUD. THEREFORE MUD LEVELS SHOWN MAY NOT INDICATE STABILIZED GROUND WATER LEVELS. FLUCTUATIONS IN GROUND WATER LEVELS OBSERVED IN PIEZOMETERS ARE TABULATED ADJACENT TO THE PIEZOMETERS ON DRAWINGS GS-1 THROUGH GS-5.
- FINAL COORDINATES AND ELEVATIONS WERE DETERMINED BY E.I. DUPONT DE NEMOURS & CO., INC.
- ELEVATIONS OF TOP OF SLAB AT VAULT LOCATIONS ARE FROM DRAWING M780541 DATED 1-10-86.
- ELEVATIONS REFER TO SAVANNAH RIVER PLANT DATUM WHICH IS EQUAL TO MEAN SEA LEVEL AT SHREVEY HOOK, N.J.
- STRATIFICATIONS SHOWN ARE BY MRCE AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.
- SAMPLE CLASSIFICATIONS SHOWN ARE BY MRCE AND MAY NOT AGREE WITH THE DRILLER'S LOGS. INDIVIDUAL SAMPLE DESCRIPTIONS BY MRCE ARE SHOWN ON BORING LOGS INCLUDED IN THE APPENDIX.

- LEGEND**
- Z-206 SPLIT SPOON SAMPLE BORING MADE BY DAVIS DRILLING CO. IN 1986.
  - Z-211U UNDISTURBED SAMPLE BORING MADE BY DAVIS DRILLING CO. IN 1986.
  - Z-216U PZ - PIEZOMETER INSTALLATION IN OFFSET BORING MADE IN 1986.
  - Z-101 BORINGS MADE BY DAVIS DRILLING COMPANY, INC. UNDER INSPECTION OF MRCE IN 1985.
  - Z-1 BORINGS MADE BY LAW ENGINEERING OF ATLANTA, GEORGIA UNDER SUPERVISION OF WOODWARD-CLYDE CONSULTANTS IN 1983.

**SETTLEMENT LEGEND**  
 (A) + SETTLEMENT POINT  
 (A) ESTIMATED SETTLEMENT IN INCHES FOR STAGE 1 LOADING

**NOTES**

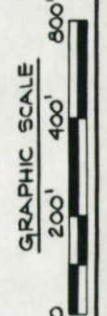
- ESTIMATED SETTLEMENTS FOR STAGE 1 LOADING ARE A RESULT OF EXCAVATION STRESS RELEASE AND STRUCTURAL LOADS OF AN EMPTY VAULT.
- FOUNDATIONS ARE ASSUMED FLEXIBLE FOR SETTLEMENT ESTIMATES.
- ESTIMATED SETTLEMENTS WILL TEND TO OCCUR WITH LOAD APPLICATION AND SHOULD BE ESSENTIALLY COMPLETE WITHIN THREE MONTHS AFTER VAULT CONSTRUCTION.



**VAULT DETAIL**  
 SCALE: 1" = 200 FT.



NO.	DATE	REVISION	BY
2	7/24/86	ADDED BATHMETERS EL. 210.00 & 215.00	P.S.
1	5/23/86	ADDED BORINGS PE-200 & PE-216U	P.S.



**SALTSTONE DISPOSAL Z-AREA**  
 SAVANNAH RIVER PLANT

**E. I. DU PONT DE NEMOURS & CO., INC.**  
 WILMINGTON DELAWARE

**MUESER RUTLEDGE CONSULTING ENGINEERS**  
 708 THIRD AVENUE, NEW YORK, N.Y. 10017

SCALE: MADE BY A.F.O. DATE 10-1-86 FILE NO. G 329  
 GRAPHIC OFF'D BY J.L.K. DATE 10-1-86 DRAWING NO.

**STAGE 1 - VAULT LOADING**  
**SETTLEMENT SUMMARY** S-1



GENERAL NOTES

- BORINGS Z-201 THROUGH Z-225U WERE MADE BETWEEN MARCH 11, 1986 AND MAY 22, 1986 BY DAVIS DRILLING CO., INC. UNDER THE CONTINUOUS INSPECTION OF MUESER RUTLEDGE CONSULTING ENGINEERS (PRICE).
- SPLIT-SPOON SAMPLE BORINGS AND UNDISTURBED SAMPLE BORINGS WERE ADVANCED USING DRILLING MUD. THEREFORE MID LEVELS SHOWN MAY NOT INDICATE STABILIZED GROUND WATER LEVELS. FLUCTUATIONS IN GROUND WATER LEVELS OBSERVED IN PIEZOMETERS ARE TABULATED ADJACENT TO THE PIEZOMETERS ON DRAWINGS GS-1 THROUGH GS-5.
- FINAL COORDINATES AND ELEVATIONS WERE DETERMINED BY E.I. DUPONT DE NEMOURS & CO., INC.
- ELEVATIONS OF TOP OF SLAB AT VAULT LOCATIONS ARE FROM DRAINING #780941 DATED 1-10-86.
- ELEVATIONS REFER TO SAVANNAH RIVER PLANT DATUM WHICH IS EQUAL TO MEAN SEA LEVEL AT SAGEY HOOK, N.J.
- STRATIFICATIONS SHOWN ARE BY PRICE AND MAY NOT AGREE WITH THE DRILLER'S LOGS. INDIVIDUAL SAMPLE DESCRIPTIONS BY PRICE ARE SHOWN ON BORING LOGS INCLUDED IN THE APPENDIX.
- SAMPLE CLASSIFICATIONS SHOWN ARE BY PRICE AND MAY NOT AGREE WITH THE DRILLER'S LOGS. INDIVIDUAL SAMPLE DESCRIPTIONS BY PRICE ARE SHOWN ON BORING LOGS INCLUDED IN THE APPENDIX.

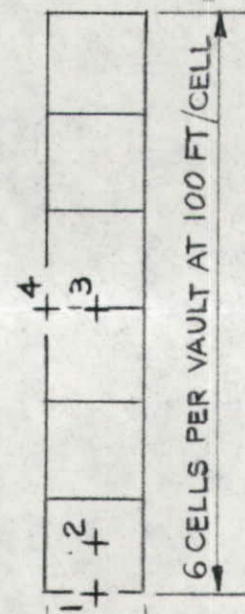
- LEGEND
- Z-202 SPLIT SPOON SAMPLE BORING MADE BY DAVIS DRILLING CO. IN 1986.
  - Z-211U UNDISTURBED SAMPLE BORING MADE BY DAVIS DRILLING CO. IN 1985.
  - Z-218U PZ - PIEZOMETER INSTALLATION IN OFFSET BORING MADE IN 1985.
  - E-101 BORINGS MADE BY DAVIS DRILLING COMPANY, INC. UNDER INSPECTION OF PRICE IN 1985.
  - E-1 SPLIT-SPOON SAMPLE BORING MADE BY DAVIS DRILLING COMPANY, INC. UNDER INSPECTION OF PRICE IN 1985.

SETTLEMENT LEGEND  
(A) + SETTLEMENT POINT

(A) ESTIMATED SETTLEMENT IN INCHES FOR STAGE 2 LOADING

NOTES

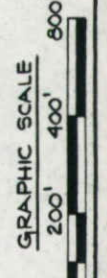
- ESTIMATED SETTLEMENTS FOR STAGE 2 LOADING ARE A RESULT OF EXCAVATION STRESS RELEASE AND STRUCTURAL LOADS OF A VAULT FILLED WITH SALTSTONE.
- FOUNDATIONS ARE ASSUMED FLEXIBLE FOR SETTLEMENT ESTIMATES.
- ESTIMATED SETTLEMENTS WILL TEND TO OCCUR WITH LOAD APPLICATION AND WILL BE ESSENTIALLY COMPLETE THREE MONTHS AFTER THE VAULT IS FILLED WITH SALTSTONE.



VAULT DETAIL  
SCALE: 1/4" = 200 FT.



NO.	DATE	REVISION	BY
2	11-86	REVISED BORING E. CELL & E. 1225U	P.S.
1	10-86	REVISED BORING PE-210U & PE-124U	F.S.



SALTSTONE DISPOSAL Z-AREA  
SAVANNAH RIVER PLANT

E. I. DU PONT DE NEMOURS & CO., INC.  
WILMINGTON DELAWARE

MUESER RUTLEDGE CONSULTING ENGINEERS  
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SCALE: MADE BY A.F.O. DATE 10-1-86  
GRAPHIC CHECKED BY J.L.K. DATE 10-1-86

STAGE 2 - VAULT LOADING  
SETTLEMENT SUMMARY

FILE NO. G329  
DRAWING NO. S-2



GENERAL NOTES

- BORINGS Z-201 THROUGH Z-225U WERE MADE BETWEEN MARCH 11, 1986 AND MAY 22, 1986 BY DAVIS DRILLING CO., INC. UNDER THE CONTINUOUS INSPECTION OF MUESER RUTLEDGE CONSULTING ENGINEERS (MRCE).
- SPLIT-SPOON SAMPLE BORINGS AND UNDISTURBED SAMPLE BORINGS WERE ADVANCED USING DRILLING MUD. THEREFORE MUD LEVELS SHOWN MAY NOT INDICATE STABILIZED GROUND WATER LEVELS. FLUCTUATIONS IN GROUND WATER LEVELS OBSERVED IN PIEZOMETERS ARE TABULATED ADJACENT TO THE PIEZOMETERS ON DRAWINGS 6S-3 THROUGH 6S-5.
- FINAL COORDINATES AND ELEVATIONS WERE DETERMINED BY E.I. DUPONT DE NEMOURS & CO., INC.
- ELEVATIONS OF TOP OF SLAB AT VAULT LOCATIONS ARE FROM DRAWING W780541 DATED 1-10-86.
- ELEVATIONS REFER TO SAVANNAH RIVER PLANT DATUM WHICH IS EQUAL TO MEAN SEA LEVEL AT SANDY HOOK, N.J.
- STRATIFICATIONS SHOWN ARE BY MRCE AND MAY NOT AGREE WITH BETWEEN BORINGS, AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.
- SAMPLE CLASSIFICATIONS SHOWN ARE BY MRCE AND MAY NOT AGREE WITH THE DRILLER'S LOGS. INDIVIDUAL SAMPLE DESCRIPTIONS BY MRCE ARE SHOWN ON BORING LOGS INCLUDED IN THE APPENDIX.

SETTLEMENT LEGEND  
(A) + SETTLEMENT POINT

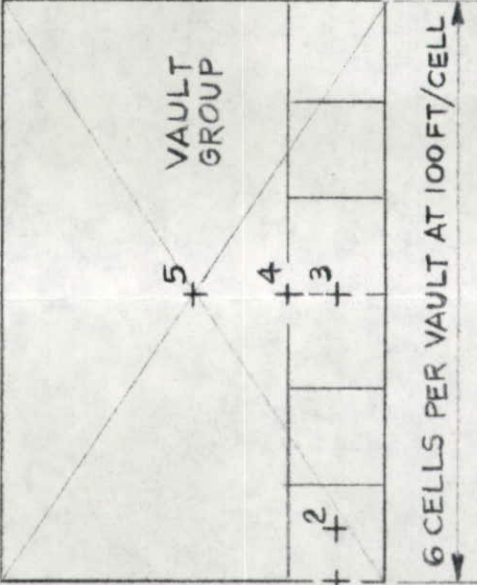
(A) ESTIMATED SETTLEMENT IN INCHES FOR STAGE 3 LOADING

NOTES

- ESTIMATED SETTLEMENTS FOR STAGE 3 LOADING ARE A RESULT OF EXCAVATION STRESS RELEASE AND STRUCTURAL LOADS OF ALL THE VAULTS WITHIN A VAULT GROUP, FILLED WITH SALTSTONE.
- FOUNDATIONS ARE ASSUMED FLEXIBLE FOR SETTLEMENT ESTIMATES.
- ESTIMATED SETTLEMENTS WILL TEND TO OCCUR WITH LOAD APPLICATION AND WILL BE ESSENTIALLY COMPLETE WITHIN THREE MONTHS AFTER THE VAULT GROUP IS FILLED WITH SALTSTONE.

LEGEND

- Z-202 SPLIT SPOON SAMPLE BORING MADE BY DAVIS DRILLING CO. IN 1986.
- Z-211U UNDISTURBED SAMPLE BORING MADE BY DAVIS DRILLING CO. IN 1986.
- Z-216U PZ - PIEZOMETER INSTALLATION IN OFFSET BORING MADE IN 1986.
- Z-101 BORINGS MADE BY DAVIS DRILLING COMPANY, INC. UNDER INSPECTION OF MRCE IN 1985.
- Z-11 BORINGS MADE BY LAW ENGINEERING OF ATLANTA, GEORGIA UNDER SUPERVISION OF WOODWARD-CLYDE CONSULTANTS IN 1983.



- MIDDLE OF SHORT SIDE OF VAULT
- MIDDLE OF END CELL OF VAULT
- MIDDLE OF VAULT
- MIDDLE OF LONG SIDE OF VAULT
- CENTER OF VAULT GROUP

VAULT DETAIL  
SCALE: 1/4" = 200 FT.

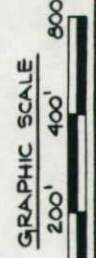
SALTSTONE DISPOSAL Z-AREA  
SAVANNAH RIVER PLANT

E. I. DU PONT DE NEMOURS & CO., INC.  
WILMINGTON DELAWARE

MUESER RUTLEDGE CONSULTING ENGINEERS  
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SCALE: 1/4" = 200 FT. DATE: 10-1-86  
GRAPHIC: JLK DATE: 10-1-86 FILE NO: G329 DRAWING NO: S-3

STAGE 3-VAULT LOADING  
SETTLEMENT SUMMARY



NO.	DATE	REVISION	BY
1	10-1-86	1	JLK
2	10-1-86	2	JLK



**GENERAL NOTES**

- BORINGS Z-201 THROUGH Z-225U WERE MADE BETWEEN MARCH 11, 1986 AND MAY 22, 1986 BY DAVIS DRILLING CO., INC. UNDER THE CONTINUOUS INSPECTION OF MUESER RUTLEDGE CONSULTING ENGINEERS (MRCE).
- SPLIT-SPOON SAMPLE BORINGS AND UNDISTURBED SAMPLE BORINGS WERE ADVANCED USING DRILLING MUD. THEREFORE MUD LEVELS SHOWN MAY NOT INDICATE STABILIZED GROUND WATER LEVELS. FLUCTUATIONS IN GROUND WATER LEVELS OBSERVED IN PIEZOMETERS ARE TABULATED ADJACENT TO THE PIEZOMETERS ON DRAWINGS GS-1 THROUGH GS-5.
- FINAL COORDINATES AND ELEVATIONS WERE DETERMINED BY E.I. DUPONT DE NEMOURS & CO., INC.
- ELEVATIONS OF TOP OF SLAB AT VAULT LOCATIONS ARE FROM DRAINING W780541 DATED 1-10-85.
- ELEVATIONS REFER TO SAVANNAH RIVER PLANT DATUM WHICH IS EQUAL TO MEAN SEA LEVEL AT SANDY HOOK, N.J.
- STRATIFICATIONS SHOWN ARE BY MRCE ARE NECESSARY INTERPOLATIONS BETWEEN BORINGS, AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.
- SAMPLE CLASSIFICATIONS SHOWN ARE BY MRCE AND MAY NOT AGREE WITH THE DRILLER'S LOGS. INDIVIDUAL SAMPLE DESCRIPTIONS BY MRCE ARE SHOWN ON BORING LOGS INCLUDED IN THE APPENDIX.

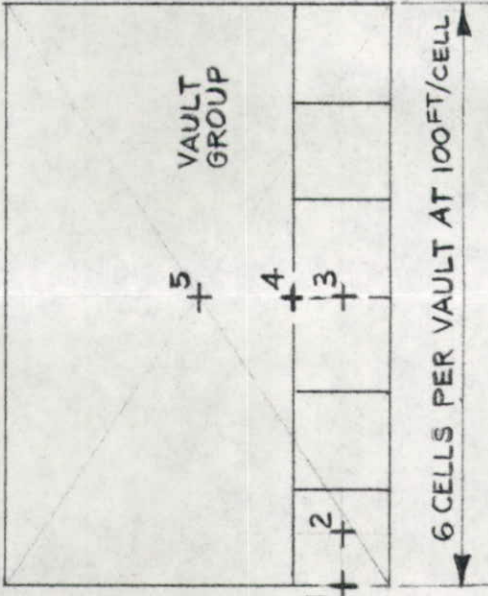
- SETTLEMENT LEGEND**
- (A) **+** SETTLEMENT POINT
- (A) ESTIMATED SETTLEMENT IN INCHES FOR STAGE 4 LOADING

**NOTES**

- ESTIMATED SETTLEMENTS FOR STAGE 4 LOADING ARE A RESULT OF EXCAVATION STRESS RELEASE, STRUCTURAL DEAD LOADS OF THE SALTSTONE FILLED VAULTS, BACKFILL, AND SOIL COVER OVER VAULT ROOFS.
- FOUNDATIONS ARE ASSUMED FLEXIBLE FOR SETTLEMENT ESTIMATES.
- ESTIMATED SETTLEMENTS WILL TEND TO OCCUR WITH LOAD APPLICATION AND WILL BE ESSENTIALLY COMPLETE WITHIN THREE MONTHS AFTER THE BACKFILL AND SOIL CAP ARE PLACED.

**LEGEND**

- Z-206 SPLIT SPOON SAMPLE BORING MADE BY DAVIS DRILLING CO. IN 1986.
- Z-211U UNDISTURBED SAMPLE BORING MADE BY DAVIS DRILLING CO. IN 1986.
- Z-216U PZ - PIEZOMETER INSTALLATION IN OFFSET BORING MADE IN 1986.
- Z-101 BORINGS MADE BY DAVIS DRILLING COMPANY, INC. UNDER INSPECTION OF MRCE IN 1985.
- Z-1 BORINGS MADE BY LAW ENGINEERING OF ATLANTA, GEORGIA UNDER SUPERVISION OF WOODWARD-CLYDE CONSULTANTS IN 1983.



- MIDDLE OF SHORT SIDE OF VAULT
- MIDDLE OF END CELL OF VAULT
- MIDDLE OF VAULT
- MIDDLE OF LONG SIDE OF VAULT
- CENTER OF VAULT GROUP

**VAULT DETAIL**  
SCALE: 1IN = 200 FT.

**SALTSTONE DISPOSAL Z-AREA**  
**SAVANNAH RIVER PLANT**

**E. I. DU PONT DE NEMOURS & CO., INC.**  
WILMINGTON DELAWARE

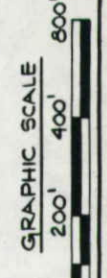
**MUESER RUTLEDGE CONSULTING ENGINEERS**  
708 THIRD AVENUE, NEW YORK, N.Y. 10017

SCALE: GRAPHIC  
MADE BY A.F.O. DATE 10-1-86  
FILE NO. 6329  
CHECKED BY J.L.K. DATE 10-1-86

**STAGE 4-VAULT LOADING**  
**SETTLEMENT SUMMARY**

DRAWING NO. **S-4**

NO.	DATE	REVISION
1	10-1-86	REVISED BORINGS PER 21004 PER 216U
2	10-1-86	REVISED BORINGS PER 21004 PER 216U
3	10-1-86	REVISED BORINGS PER 21004 PER 216U





APPENDIX A

MRCE

BORING LOGS

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-201U

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS  
SURFACE ELEV. 279.3'

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1400  MAY 1, 1986 - SUNNY, CLEAR, 92°F	1D	0.0	1-1	Brown gray fine sand, trace silt, vegetation (SP-SM)	S2		NEG	
		1.5	1			2.0		
	2D	2.5	WH-1	Yellow brown fine to medium sand, some clay (SC)			NEG	
		4.0	4			5		
	3D	5.0	3-5	Do 2D (SC)			NEG	
		6.5	6					
	4D	7.5	9-14	Mottled red-brown & yellow-brown f-m sand, sm cl, tr cl pkts (SC)			NEG	
		9.0	18			10		
	5D	10.0	7-9	Do 4D (SC)	S1		NEG	
		11.5	16					
	6D	12.5	9-17	Red brown fine to medium sand, some clay (SC)			NEG	
		14.0	31			15		
	7D	15.0	11-15	Do 6D (SC)			NEG	
		16.5	25					
8D	20.0	9-16	Brown fine to medium sand, some clay (SC)		20	NEG		
	21.5	17			23			
9D	25.0	9-13	Red-brown fine to medium sand, trace clay (SP-SC)	S2	25	NEG		
	26.5	16			28			
10D	30.0	10-12	Red-brown fine to medium sand, some clay (SC)	S1	30	NEG		
	31.5	12			33			
11D	35.0	7-7	Yellow-brown fine to medium sand, some silt (SM)		35	NEG		
	36.5	14						
12D	40.0	12-20	Light brown fine to medium sand, trace silt (SP-SM)	S2	40	NEG		
	41.5	23						
13D	45.0	12-22	Red-brown fine to medium sand, trace silt (SP-SM)		45	NEG		
	46.5	27			48			
14D	50.0	4-7	Red-brown clayey fine to medium sand, trace lignite (SC)		50	NEG		
	51.5	5						

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-201U

PROJECT LOCATION SAVANNAH RIVER PLANT RES. ENGR.

SURFACE ELEV. 279.3  
PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
MAY 5, 1986 - (CONT'D)	15D	51.5	5-8	Mottled red-brown & yel-brn f-m sand, sm clay, clay layers (SC)	S3a		NEG		
		53.0	6						NEG
	16D	53.0	1-6	Do 15D	S3a		NEG		
		54.5	12				55		
	NR	54.5	P=24"	NO RECOVERY			56.5		
		56.5	R=0"		C2				
	17D	56.5	1-2	Yellow brown f-m sand, some clay clay layers (SC)			NEG		
		58.0	1						
	18S	58.0	P=24"	Yellow-brn & brn f-m sand, some clay, trace clay pockets (SC)	C2	60	NEG		
		60.0	R=24"				61		
	19D	60.0	WR-3	Gray brown fine to medium sand, some clay (SC)			NEG		
		61.5	10						
	20D	61.5	12-21	Gray-brown f-m sand, some clay, trace f-m sandy clay pkts (SC)			65		NEG
		63.0	23						
	21D	65.0	12-19	Light brown fine to medium sand, trace silt (SP-SM)					NEG
		66.5	20						
					S3b	70			
	22D	70.0	23-27	Do 21D (SP-SM)			NEG		
		71.5	37						
						75			
	23D	75.0	31-38	Do 21D (SP-SM)			NEG		
		76.5	31						
						80			
	24D	80.0	18-22	Do 23D (SP-SM)			NEG		
		81.5	21				83		
					S3a	85			
	25D	85.0	6-10	Dark brown fine to medium sand, some clay (SC)			NEG		
		86.5	10						
					90				
26D	90.0	8-10	Yellow brown f-m sand, some clay, trace clay layers, lignite (SC)			NEG			
	91.5	11				93			
				S4	95				
27D	95.0	28-35	White calcareous f-c sand, some clay, limestone fragments (SC)			POS			
	96.5	35							
					100				
28D	100.0	11-24	Light gray-green calcareous fine sand, sm cl, tr calc fgmts (SC)			POS			
	101.5	36							



# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-201U

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 279.3

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 6, 1986 - SUNNY, CLEAR	29D	105.0	54-45	Light gray-green calcareous fine sand, some clay, trace calcareous fragments (SM)	S4	105	POS	
		106.5	100			110		
	30D	110.0	15-21	Light gray-green fine sand, some clay, trace calcareous fgmts(SC)		115	POS	
		111.5	27			120		
	31D	115.0	42-100/2'	Limestone fragments (GP)		125	POS	
		115.7				130		
	32D	120.0	47-100/1'	Gray calcareous fine sand, some clay, trace siltstone fragments, shell fragments (SC)		133	POS	
		120.5				135		
	33D	125.0	100/5"	Gray calcareous fine sand, some clay, shell fragments (SC)		140	POS	
		125.4				145		
	34D	130.0	19-28	Gray calcareous fine sand, some clay, shell fragments (SC)		150	POS	
		131.3	75/4"			150.5		
	35D	135.0	51-36	Hard green-gray clay, some f-m sand (CL)			NEG	
		136.5	37					
36D	140.0	19-43	Gray fine to medium sand, trace clay (SP-SC)		NEG			
	141.5	75						
37D	145.0	29-35	Gray fine to medium sand, some clay (SC)		NEG			
	146.5	44						
38D	150.0	222/6"	Gray fine to medium sand, trace silt (SP-SM)		NEG			
	150.5							

End of boring @ 150.5'.

PROJECT SALTSTONE DISPOSAL E-AREA

MADE BY RSB DATE 5-12-66  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF

GROUTING REPORT - BORING NO. Z-201

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
05-06-66	Grouting	150.5'				1	7.4	0.1	7.3	190	100 PSI	Mud	
						2	7.4	3.7	3.7	30		Mud/grout	
						2	3.7	0.1	3.6	20, 10		grout	
05-09-66	Grouting	33.0'				3	3.7	0.0	3.7			grout	add'l grout

18.3 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT 3 94 LB. BAGS  
BENTONITE 0.3 100 LB. BAGS  
SAND 0 LBS/CU. FT.  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) 7.9 CU. FT.  
GROUT PUMPED (G.P.) 7.3 CU. FT.  
GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
(E.Y.)  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 8.0 BAGS  
(E.Y.)  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.8 BAGS  
(E.Y.)  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
(E.Y.)

COMMENTS: \_\_\_\_\_

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-201U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 76.297 E. 67.210  
SURFACE ELEVATION 279.3' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES 4.0, DEPTH FROM 0.0 TO 14.0  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y

AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N-2-3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER SHELBY  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud	CONDITIONS OF OBSERVATION*
5-2-86	0730	21.5	14.0	-	HOLE DRY
5-5-86	0730	61.5	14.0	26.0	OVER WEEKEND
5-6-86	0730	115.7	14.0	37.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 150.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 150.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 14.0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 1

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.3 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	8.0	0.8	0.0	18.3				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER THOMAS LOWE HELPERS DAVE GOODWIN, GLENN DODSON

REMARKS \_\_\_\_\_

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-12-86

BORING No. Z-201U

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-202

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS  
SURFACE ELEV. 278.3

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1530  APRIL 23, 1986 SUNNY, CLEAR 40°F-70°F	1D	0.0	1-2	Brown fine sand, trace silt (SP-SM)	S2		NEG	
		1.5	2				NEG	
	2D	2.5	2-2	Brown fine to medium sand, trace silt (SP-SM)				
		4.0	3			5		
	3D	5.0	2-5	Brown-red fine to medium sand, trace silt (SP-SM)			NEG	
		6.5	7			7		
4D	7.5	5-6	Yellow brown f-m sand, some clay (SC)		NEG			
	9.0	8		10				
1630  APRIL 24, 1986 - SUNNY, CLEAR 40°F-75°F	5D	10.0	9-15	Yellow brown & red-brown f-m sand, some clay (SC)	S1		NEG	
		11.5	17					
	6D	12.5	15-22	Mottled red brown and yellow brown clayey f-m sand (SC)			NEG	
		14.0	31			15		
	7D	15.0	12-18	Red-brown f-m sand, some clay, trace coarse sand (SC)			NEG	
		16.5	18					
	8D	20.0	9-16	Red brown clayey f-m sand (SC)		20	NEG	
			18					
		21.5				25		
							28	
	9D	25.0	10-17	Red brown f-m sand, some clay (SC)		30	NEG	
		26.5	17					
	10D	30.0	8-16	Red brown f-m sand, some clay (SP-SM)		35	NEG	
		31.5	16					
11D	35.0	9-15	Red brown f-m sand, some clay (SC)	S2	40	NEG		
	36.5	19						
12D	40.0	11-25	Brown red f-m sand, trace silt (SP-SM)					
	41.5	35			45	NEG		
13D	45.0	15-24	Light brown f-m sand, trace silt (SP-SM)					
	46.5	27			50	NEG		
14D	50.0	2-5	Yellow brown fine sand, some clay (SC)					
	51.5	7			51.5	NEG		

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-202

SURFACE ELEV. 278.3

PROJECT LOCATION SAVANNAH RIVER PLANT RES. ENGR.

PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
	15D	55.0 56.5	4-4 5	Yellow-brown clayey m-f sand, some clay (SC)	C2	55	NEG	
	16D	60.0 61.5	7-6 4	Yellow-brown clayey fine sand (SC)			60 63	NEG
	17D	65.0 66.5	13-17 17	Light brown f-m sand, trace clay (SP-SC)		65	NEG	
	18D	70.0 71.5	20-32 46	Light brown fine to medium sand, trace silt (SP-SM)	S3b	70	NEG	
	19D	75.0 76.5	19-21 22	Red-brown & gray fine to medium sand, some clay (SC)			75 78	NEG
	20D	80.0 81.5	10-15 21	Brown gray medium to fine sand, some clay (SC)	S3a	80	NEG	
	21D	85.0 86.5	23-42 50	Light brown fine to medium sand, trace clay (SP-SC)			83 85	NEG
	22D	90.0 91.5	8-17 21	Top: Yel f-m sand, some clay(SC) Bot: Gray f-m sand, tr silt (SP)	S3b	90	NEG	
	23D	95.0 96.5	15-24 46	Light gray-white calcareous clayey f-m sand, trace coarse sand, calc fragments (SC)			93 95	POS
	24D	100.0 101.5	9-20 35	Light gray calcareous fine sand, sm clay, tr c sa, calc cmtd & shl fgmts (SC)	S4	100	POS	

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL, Z-AREA

BORING NO. Z-202

SURFACE ELEV. 278.3

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
APRIL 25, 1986 - SUNNY, CLEAR 50°F-75°F	25D	105.0 106.1	7-50 50/2"	Light gray-green calcareous fine sand, some clay, tr limestone fragments (SC)	(S4)	105	POS	Drilling hard from 116.0'-120.0'.	
	26D	110.0 111.4	13-22 50/5"	Do 25D (SC)		110	POS		
	27D	115.0 116.0	21-62 50/0"	Light gray brown calcareous clayey fine sand, some calcareous fragments (SC)		115	POS		
	28D	120.0 120.5	120-50/1"	Gray clayey fine sand, some calc siltstone fgmts, trace shell fgmts (SC)		120	POS		
	29D	125.0 126.1	21-76 50/1"	Gray calcareous fine sand, some clay, tr shell fragments (SC)		125	POS		
	30D	130.0 131.3	17-27 100/4"	Gray calcareous f-m sand, some silt, shell fgmts, tr lignite (SM)		130	POS		
	31D	135.0 135.5	157/6"	Gray calc f-m sand, some clay, shell fragments (SC)		135	POS		
						138			
	32D	140.0 141.5	16-25 35	Hard dark green-gray clayey silt, some f-m sand layers to parting (MH)		140	NEG		
						145			
	33D	145.0 146.5	13-20 25	Dark green gray f-m sand, some clay (SC)		145	NEG		
						150			
	34D	150.0 150.5	300/6"	Dark gray f-m sand, trace silt (SP-SM)		150	NEG		End of boring @ 150.5'.
						150.5	NEG		

BORING NO. Z-202

PROJECT SALTSTONE DISPOSAL Z-AREA

MADE BY PEB DATE 1-29-86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-202P

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH Ft.	CASING DEPTH	TANK NO.	TRUCK NO.	Batch GROUT NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE PSI	RETURN	REMARKS
9-28-85	Grouting	150.5				1	7.4	0.1	7.3	140	15	mud	
						2	7.4	3.7	3.7	80		mud/grout	
						2	3.7	0.1	3.6	40		grout	
4-30-86	Grouting	30.0				3	3.7	0.1	3.6			grout	add grouting

18.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT 3 94 LB. BAGS  
BENTONITE 3 50 100 LB. BAGS  
SAND 0 LBS/CU. FT.  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
GROUT PUMPED (G.P.) 7.3 CU. FT.  
GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
(E.Y.)  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 7.5 BAGS  
(E.Y.)  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.7 BAGS  
(E.Y.)  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
(E.Y.)

COMMENTS: \_\_\_\_\_

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-202  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 76.107 E 67.272  
SURFACE ELEVATION 278.3 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF: \_\_\_\_\_  
DRILL RODS N- 2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD : LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
4-25-86	0730	101.5'	-	30.0'	OVERNIGHT
4-28-86	0715	150.5'	-	40.0'	OVER WEEKEND

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 150.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 150.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.2 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	7.5	0.7	0	18.2				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER THOMAS LOWE HELPERS GLENN DODSON, DAVE GOODWIN

REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-29-86

BORING No. Z-202



# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. PZ-202U

SURFACE ELEV. 278.3

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	REMARKS
	NO.	DEPTH	BLOWS/6"				
APRIL 24, 1986 - SUNNY, CLEAR, 90°F					(S2)		
						5	
						7	
						10	
	1UD	13.5 15.5	Push=24" Rec=24"	Red-brown m-f sand, some clay & some silty clay layers (SC&CL)	(S1)		
						15	
	2UD	18.5 20.5	Push=24" Rec=24"	Red-brown clayey f=m sand (SC)			
						20	
	3UD	23.5 25.5	Push=24" Rec =24"	Orange brown fine to medium sand, some clay (SC)			
						25	
						28	
					(S2)		
						30	
						35	
						40	
					45		
					48		
					50		

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. PZ-202U

SURFACE ELEV. 278.3

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS		
	NO.	DEPTH	BLOWS/6"							
APRIL 24, 1986 SUNNY, CLEAR 90°F	4D	70.0	22-46	Light brown fine to medium sand, trace silt (SP)	(S3a)	53		End of boring @ 75.0'.		
		71.5	62							
							(C2)		55	
									60	
									63	
									65	
							(S3b)		70	
									75	
									80	
									85	
									90	
									95	
									100	

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET NO. 2 OF 2

FILE 6820

MADE BY PEB DATE 4-29-86

CHECKED BY DATE

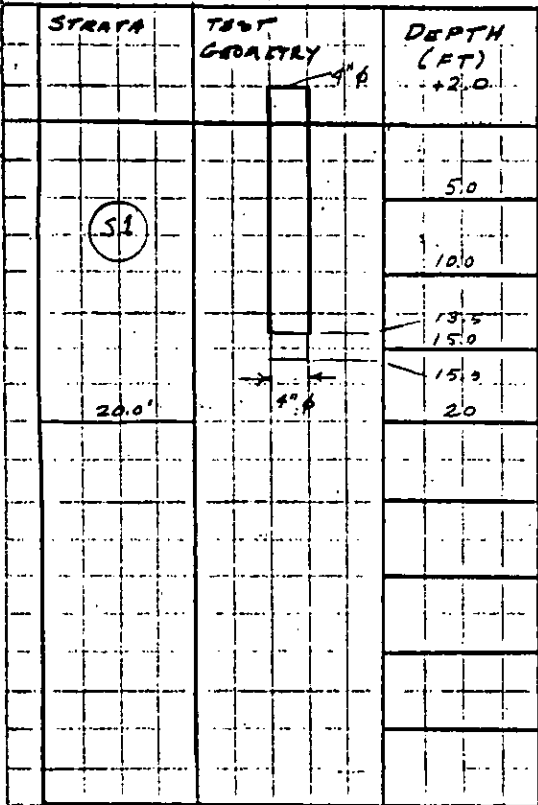
FOR SALTSTONE DISPOSAL Z-AREA S.R.P.

SUBJECT

## CONSTANT HEAD PERMEABILITY TEST

BORE HOLE PZ-202U DATE 4-29-86

LOCATION: SW of PZ-202P RES. ENG P.E. Blaisweiss



### PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAR BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASSED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

SERIES 1

UNCASSED: 13.5' - 15.5'

DATE	CLOCK	$\Delta t$ MIN	ADD'L VOL: OZ	CLOCK	$\Delta t$ MIN	ADD'L VOL:	CLOCK	$\Delta t$ MIN	ADD'L VOL	REMARKS
4-28-86	1410	0.0	0	1445	00	10				
		0.5	8		test 1	13				
	1411	1.0	7	1446		15				
	1412	2.0	13	1447		18				
	1413	3.0	22	1448		17				
	1415	5.0	22	1450		16				
	1420	10.0	40	1455		40				
	1422	12.0	21	1457		15				
	1430	20.0	24	1505		62				
	1435	25.0	45	1510		20				
	1440	30.0	41	1515		42				
			$\Sigma = 273$			$\Sigma = 246$				

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET No. 3 OF 9

FILE 6329

MADE BY PEB DATE 4-29-86

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

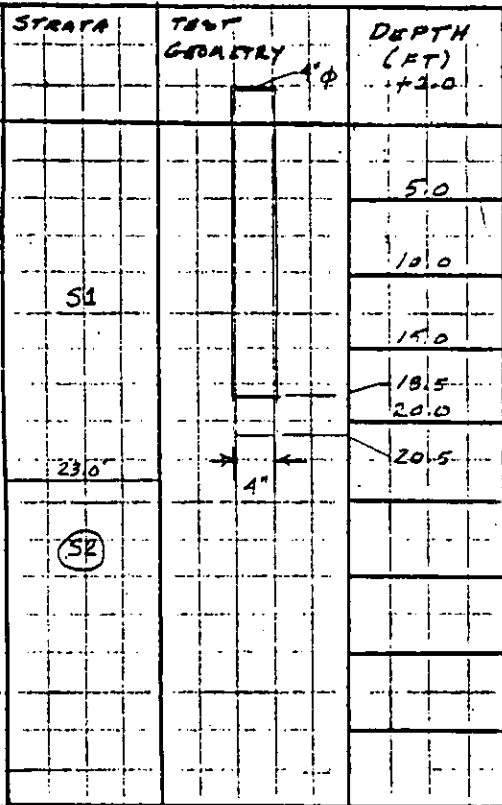
FOR SALTSTONE DISPOSAL Z-AREA S.I.P.

SUBJECT

## CONSTANT HEAD PERMEABILITY TEST

BORE HOLE PZ-202 U DATE 04-29-86

LOCATION: 5' W of Z-202 RES, ENG P.E. Bleiweiss



### PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASSED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

SERIES 2

UNCASSED PORTION: 18.5 - 20.0'

DATE	CLOCK	Δt MIN	ADD'L VOL. OZ	CLOCK	Δt MIN	ADD'L VOL. OZ	CLOCK	Δt MIN	ADD'L VOL. OZ	REMARKS
4-29-86	1050	0	0	1125	00	00	1205	20		
	1052	2	21	1127	05	28	1207	10	24	
	1054	4	23	1129	1	22	1209	1	24	
	1056	6	23	1131		30	1211		24	
	1058	8	24	1133		24	1213		24	
	1060	10	24	1135		29	1215		24	
	1102	12	27	1137		24	1217		24	
	1104	14	24	1139		28	1219		29	
	1106	16	24	1141		24	1221		27	
	1108	18	27	1143		26	1223		27	
	1110	20	24	1145		27	1225		28	
	1112	22	24	1147		24	1227		26	
	1114	24	25	1149		24	1229		27	
	1116	26	27	1151		27	1231		27	
	1118	28	24	1153		24	1233		27	
	1120	30	24	1155		24	1235		26	

Σ = 305

Σ = 385

Σ = 388

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET No. 4 Of 8

FILE 6329

MADE BY PEB DATE 4-29-86

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

FOR SALTSTONE DISPOSAL Z-AREA S.R.P.

SUBJECT

## CONSTANT HEAD PERMEABILITY TEST

BORE HOLE PZ-2020 DATE 4-29-86

LOCATION: 5' W of Z-2020 RES. ENG P.E. Bleiweiss

STRATA	TEST GRAINITY	DEPTH (FT)
		23.0
		5.0
		10.0
		15.0
		20.0
		23.5
		25.0
		25.5

230'

4"

S1

S2

### PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASSED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

SERIES 3

UNCASSED PORTION = 23.5' - 25.5'

DATE	CLOCK	ΔT MIN	ADD'L VOL:	CLOCK	ΔT MIN	ADD'L VOL OZ	CLOCK	ΔT MIN	ADD'L VOL OZ	REMARKS
4-29-86	1510	0		1540	30	0	1620	20		
	1512	2	23	1542	Test	19	1622	Test	16	
	1514	4	18	1544		16	1624	2	16	
	1516	6	18	1546		16	1626		16	
	1518	8	17	1548		16	1628		18	
	1520	10	17	1550		17	1630		16	
	1522	12	16	1552		17	1632		17	
	1524	14	18	1554		16	1634		16	
	1526	16	16	1556		16	1636		16	
	1528	18	20	1558		18	1638		16	
	1530	20	17	1560		16	1640		16	
	1532	22	16	1562		18	1642		19	
	1534	24	17	1564		16	1644		16	
	1536	26	16	1566		16	1646		16	
	1538	28	17	1568		16	1648		16	
	1540	30	17	1570		16	1650		18	

Σ = 263

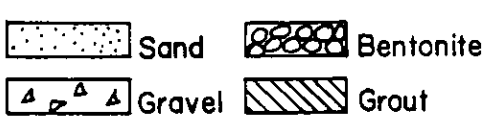
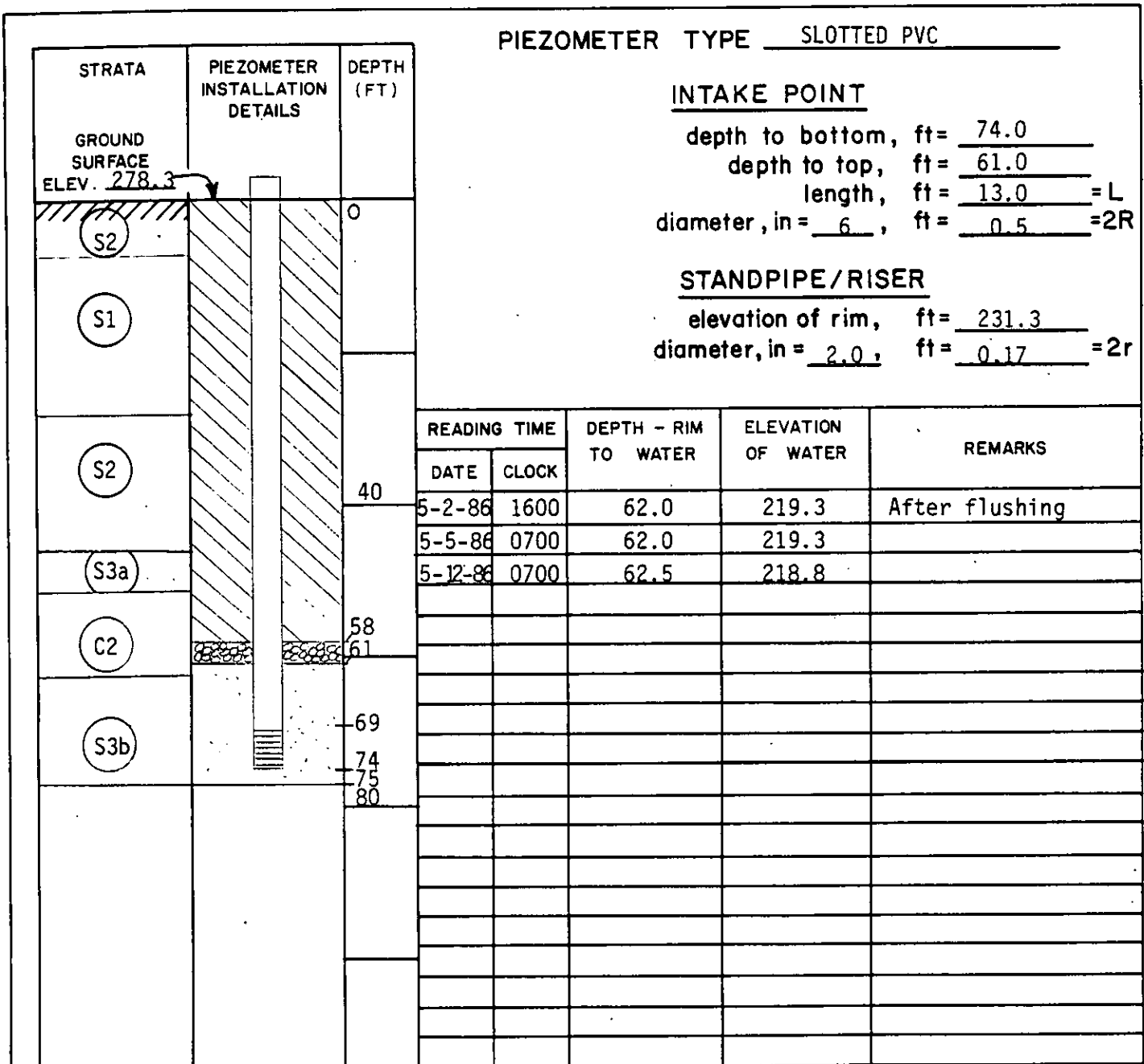
Σ = 249

Σ = 248

MUESER RUTLEDGE CONSULTING ENGINEERS

PIEZOMETER RECORD

PROJECT SALTSTONE DISPOSAL - Z-AREA PIEZOMETER NO. PZ-202U  
 LOCATION 5.0' N of Z-202P  
 PIEZOMETER LOCATION 5.0' N of Z-202P DATE OF INSTALLATION 4-29-86  
 SEE SKETCH ON BACK RES. ENG. P.E. BLEIWEISS









MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. PZ-202U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION 5.0' DUE WEST OF Z-202P  
SURFACE ELEVATION 278.3 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES 4, DEPTH FROM 0.0' TO 25.5'  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 5-7/8"  
TYPE OF DRILLING MUD \_\_\_\_\_  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N-2-3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER SHELBY  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
					PIEZOMETER INSTALLED

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 75.0 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES \_\_\_\_\_ LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 9 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 3

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 12.3 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	6	0.6	0.0	12.3				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER THOMAS LOWE HELPERS GLENN DODSON, DAVE GOODWIN

REMARKS \_\_\_\_\_

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-12-86

BORING No. PZ-202U

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-203

SURFACE ELEV. 277.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
0800                APRIL 24, 1986 -- SUNNY, CLEAR 70°-75°F	1D	0.0	1-2	Brown fine sand, trace silt	(S2)		NEG		
		1.5	2	(SP-SM)			NEG		
	2D	2.5	2-2	Brown fine to medium sand, silt		4			
		4.0	4	(SM)		5			
	3D	5.0	3-3	Mottled yellow-brown & red brown	(S1)		NEG		
		6.5	4	clayey f-m sand (SC)					NEG
	4D	7.5	2-12	Mottled yellow brown & red brown					
		9.0	13	f-m sand, some clay (SC)			10		
	5D	10.0	7-7	Mottled red-brown & yellow clayey					NEG
		11.5	14	fine to medium sand (SC)					NEG
	6D	12.5	7-14	Mottled red-brown & purple f-m					
		14.0	20	sand, some clay (SC)			15		
	7D	15.0	13-17	Do 6D					NEG
		16.5	22	(SC)					
					20				
8D	20.0	11-11	Mottled red-brown & yellow-brown	(S2)		NEG			
	21.5	17	f-m sand, some clay, trace clay			23			
			pockets (SC)						
9D	25.0	11-14	Mottled red-brown & yellow-brown			25	NEG		
	26.5	17	fine to medium sand, trace clay						
			(SP-SC)		28				
10D	30.0	8-13	Yellow brown f-m sand, some clay,	(S1)		NEG			
	31.5	18	trace gray clay partings (SC)						
						35			
11D	35.0	10-17	Yellow-brown fine to medium sand	(S1)		NEG			
	36.5	17	some clay (SC)						
						40			
12D	40.0	7-12	Brown fine to medium sand, some				NEG		
	41.5	16	clay (SC)						
					45				
13D	45.0	13-21	Light brown fine to medium sand,	(S1)		NEG			
	46.5	22	some clay (SC)						
					50				
14D	50.0	10-20	Brown fine to medium sand, some			NEG			
	51.5	23	clay (SC)						

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-203

SURFACE ELEV. 277.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

APRIL 24, 1986 - SUNNY, CLEAR, 70°-75°F

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
					(S1)	53		
	15D	55.0 56.5	6-10 17	Yellow brown f-m sand, some clay, trace coarse sand (SC)	(S3a)	55 58	NEG	
	16D	60.0 61.5	3-4 6	Stiff yellow brown clay, trace fine sand, lignite (CH)	(C2)	60 65	NEG	
	17D	65.0 66.5	3-4 3	Stiff yellow-gray clay, trace lignite layers pockets (CH)		68	NEG	
	18D	70.0 71.5	3-12 16	Mottled gray & yellow f-m sand, some clay (SC)	(S3a)	70 73	NEG	
	19D	75.0 76.5	17-30 40	Red-brown & gray f-m sand, trace silt (SP-SM)		75 80	NEG	
	20D	80.0 81.5	11-19 23	Mottled yellow & gray f-m sand, trace clay, clay pockets (SP-SC)			NEG	
	21D	85.0 86.5	3-23 46	Light gray f-m sand, trace silt (SP-SM)	(S3b)	85 90	NEG	
	22D	90.0 91.5	8-17 21	Top: V stiff yel clay, tr lgnt (CH) Bot: Gray f-m sand, tr cl (SP-SC)		93	NEG	
	23D	95.0 96.5	6-12 20	Light green-gray calc f sand, some clay, tr calc cemented fgmts (SC)	(S4)	95	NEG	
	24D	100.0 101.5	12-16 21	light gray-green calc fine sand, some silt (SM)		100	NEG	

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-203

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 277.1

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
APRIL 30, 1986 - SUNNY, CLEAR	25D	105.0 106.5	12-16 21	Do 23D, some calcareous cemented fragments (SM)	S4	105	POS		
	NR	110.0 110.1	200/2"	NO RECOVERY		110			
	NR	110.1 112.0		NO RECOVERY					
	26D	112.0 113.5	10-16 23	Light green-gray calcareous fine sand, some clay, trace		115	POS		
	27D	115.0 116.5	24-24 25	limestone fragments (SC) Do 26D (SC)			POS		
	28D	120.0 120.7	17-50/2"	Gray & light gray-green calc fine sand, some clay (SC)		120	POS		
	29D	125.0 126.5	21-28 50/5"	Gray calcareous fine sand, some clay, shell fragments (SC)		125	POS		
	30D	130.0 131.4	20-22 75/5"	Do 29D (SC)		130	POS		
						133			
	31D	135.0 136.5	18-25 30	Hard dark gray-green clayey silt, trace fine sand, sand partings (MH)		135	NEG		
	32D	140.0 140.8	65-50/3"	Dark gray green f-m sand, trace clay, clay pockets (SP-SC)		140	NEG		
						145			
	1700 0710	33D	145.0 146.5	18-14 50		Hard dark gray-green clayey f-m sand, trace lignite (SC)		NEG	
		NR	150.0 150.1	100/0"		NO RECOVERY	150		

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-203

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 277.1

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1200	34D	151.0 151.3	410/3"	Brown gray f-m sand, trace clay, clay pockets (SP-SC)		151.3	NEG	End of boring @ 151.3.

BORING NO. Z-203

PROJECT SALTSTONE DISPOSAL Z-AREA

MADE BY PEB DATE 5-2-86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-203

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	CHARGE NO.	TANK VOLUME		VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
							BEFORE	AFTER					
1100													
5-1-86	Grouting	151.3				1	7.4	0.1	7.3	140	10	rued	
						2	7.4	0.1	7.3	60		mod/grout	
						3	7.4	3.7	3.7	40		grout	
						3	3.7	0.1	3.6	10		grout	
5-2-86	grouting	100'				4	2.1	0.0	2.1				add grouting

22.0 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fairing 250  
 ALSO USED IN BORINGS ✓  
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0 LBS/CU. FT.  
 WATER 3.6 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

COMMENTS: no segregation of mix

COMMENTS: first 110.1' required to 6" for pitcher

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-203  
 LOCATION SAVANNAH RIVER PLANT  
 BORING LOCATION N 75.915' E. 67.333  
 SURFACE ELEVATION 277.1 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
 TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 5 7/8" (0.0'-110.1') 3-7/8" (0-0'-151.3)  
 TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
 TYPE AND SIZE OF:  
 DRILL RODS N-2 3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
 S-SAMPLER \_\_\_\_\_ U-SAMPLER PITCHER  
 CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
 CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
 SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

Mud LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
4-25-86	0715	91.5'	-	30.5'	OVERNIGHT
4-30-86	0800	70.0'	-		OPEN HOLE FOR 4 DAYS-HOLE COLLAPSED.
5-01-86	0710	140.0'	-	46.0'	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 151.3 LIN. FT.  
 SPLIT SPOON SAMPLING IN DRILL HOLES 151.3 LIN. FT.  
 REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
 STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
 STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
 NO. OF 3" UNDISTURBED SAMPLES \_\_\_\_\_

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 22.0 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	10	1.0	0	22.0				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER NATE PATTERSON, MIKE HAIRE HELPERS CLAYTON BAILEY, SIDNEY LINDSAY

REMARKS

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-2-86

BORING No. Z-203

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-204

SURFACE ELEV. 281.2

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
0820	1D	0.0	2-1	Brown fine sand, trace silt (SP-SM)	S2		NEG	
		1.5	2					
	2D	2.5	1-2	Brown fine to medium sand, some silt (SM)		4	NEG	
		4.0	3			5		
	3D	5.0	2-4	Brown fine to medium sand, some clay (SC)			NEG	
		6.5	6					
	4D	7.5	5-6	Mottled red-brown & yellow-brown clayey fine to medium sand (SC)			NEG	
		9.0	15			10		
	5D	10.0	10-19	Light gray clayey f-m sand, trace brown fine sand pockets (SC)			NEG	
		11.5	30					
	6D	12.5	16-24	Hard red-brown & light gry clayey f-m sand, tr silty clay pkts (SC)			NEG	
		14.0	33					
	7D	15.0	10-18	Red-brown m-f sand, some clay, trace gray clay pockets (SC)	S1	15	NEG	
16.5		13						
8D	20.0	13-15	Red-brown fine to medium sand, some clay (SC)		20	NEG		
	21.5	15						
9D	25.0	7-14	Yellow-brown f-m sand, some clay (SC)		25	NEG		
	26.5	14			28			
10D	30.0	6-10	Yellow-brown fine to medium sand, trace silt (SP-SM)		30	NEG		
	31.5	10						
11D	35.0	8-13	Do 100 (SP-SM)	S2	35	NEG		
	36.5	13						
12D	40.0	10-20	Red-brown fine to medium sand, some silt (SM)		40	NEG		
	41.5	21						
13D	45.0	13-28	Brown fine to medium sand, some silt (SM)		45	NEG		
	46.5	38						
14D	50.0	10-20	Yellow-brown fine to medium sand, some silt (SM)		50	NEG		
	51.5	39						

APRIL 11, 1986 - COOL, CLEAR 70°F



MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-204

SURFACE ELEV. 281.2

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 17, 1986 (CONT'D)	15D	55.0	3-7	Yellow-brown clayey fine sand, some silty clay pockets, trace lignite (SC)	S3a	53	NEG	
		56.5	10			55		
	16D	60.0	2-1	Yellow-brown clayey fine sand, trace lignite pockets (SC)	C2	60	NEG	
		61.5	4			65		
	17D	65.0	3-4	Yellow-brown clayey fine sand, some clay layers, trace medium sand, lignite (SC)		68	NEG	
		66.5	6			70		
	18D	70.0	17-33	Brown fine to medium sand, trace silt, lignite (SP-SM)	S3b	75	NEG	
		71.5	41			78		
	19D	75.0	18-40	Brown fine to medium sand, trace silt, clay pockets (SP-SM)		80	NEG	
		76.5	33			85		
1600 0930	20D	80.0	6-9	Light brown-gray fine to medium sand, some clay, trace lignite (SC)	S3a	88	NEG	
		81.5	12			90		
21D	85.0 86.5	6-8	Gray medium to fine sand, some clay (SC)		93	NEG		
		9			95			
22D	90.0 91.5	12-22	Light brown fine to medium sand, trace silt (SP-SM)	S3b	98	NEG		
		25			100			
23D	95.0 96.5	4-8	Light gray-green fine sand, some clay, clay pockets, trace lignite medium sand (SC)	S3a	100	NEG		
		25						
24D	100.0 101.5	11-16	Light gry-grn calc f sand, some silt, calc fgmts, tr cl pkts (SM)	S4		POS		
		50						

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-204

SURFACE ELEV. 281.2

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 21, 1986 (CONT'D)  1600 <hr style="width: 50px; margin-left: 0;"/> 1130	25D	105.0 106.5	11-24 28	Light gray-green calcareous fine sand, some silt, trace clay pkts (SM)	S4	105	POS	
	26D	110.0 110.3	50/4"	Light gray-green calcareous fine sand, some silt, cemented fgmts, trace clay (SM)		110	POS	
	27D	115.0 116.5	17-20 25	Light gray-green calcareous fine sand, some clay, trace cemented fragments (SC)		115	POS	
	NR	120.0	50/0"	NO RECOVERY		120		
	28D	125.0 125.3	100/3"	Gray calcareous fine sand, some clay, trace shell fgmts (SC)		125	POS	
	29D	130.0 131.5	13-28 44	Gray calcareous fine sand, some silt, trace shell fragments (SM)		130	POS	
	30D	135.0 136.2	20-47 50/3"	Dark gray fine to medium sand, some silt, shell & calc fgmts (SM)		135	POS	
	31D	140.0 141.5	13-25 32	Hard dark gray-green clayey silt, trace fine sand partings (MH)		138		
	32D	145.0 146.5	12-18 25	Hard dark gray-green clayey silt, some f-m sand, trace fine sand partings (MH)		140	NEG	
	NR	150.0 150.3	150/4"	NO RECOVERY		145		
						150		

APRIL 22, 1986 - SUNNY, CLEAR, 78°F

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-204

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 281.2

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1600	33D	155.0 155.3	400/4"	Dark gray fine to medium sand, trace silt (SP-SM)		155 155.3	NEG	End of boring at 155.3'.
						160		
						165		
						170		
						175		
						180		
						185		
						190		
						195		
						200		

PROJECT SALTSTONE DISPOSAL Z-AREA S.R.P.

MADE BY PEB DATE 4-23-66  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-204

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	TRUCK CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
1930 04-23-66	Grouting	155.3					7.4	0.1	7.3	140	15	mud	
							7.4	3.7	3.7	80	15	mud/grout	
							3.7	0.1	3.6	20	15	grout	
0730 04-23-66	Grouting	200'					3.7	0.1	3.6			grout	add grouting

18.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fairfax 250  
 ALSO USED IN BORINGS   
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 2.9 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

COMMENTS: 1.5 hrs Grout time  
18.2 / 73.6 = 1.34 Grout take ratio = 1.34

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-204  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 76,155 E. 67,098  
SURFACE ELEVATION 281.2 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3 - 7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N-2 3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
4-21-86	0800	81.5	-	30.0	72 HRS. STABILIZATION
4-22-86	0710	116.5	-	35.0	OVERNIGHT
4-23-86	0710	136.3	-	40.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 155.3 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 155.3 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.2 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	7.5	0.6		18.2				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER NATE PATTERSON HELPERS JIM HILTON, SIDNEY LINDSAY

REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-27-86

BORING No. Z-204

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-205

SURFACE ELEV. 280.2

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 21, 1986 - SUNNY, CLEAR 80°F	1000	1D	0.0	3-3	(S2)		NEG	
			1.5	3			2	
		2D	2.5	2-4			NEG	
			4.0	5		5		
		3D	5.0	15-21	(S1)		NEG	
			6.5	24				
		4D	7.5	12-20			NEG	
			9.0	19		10		
		5D	10.0	13-15			NEG	
			11.5	20				
		6D	12.5	12-16			NEG	
			14.0	17		15		
		7D	15.0	9-13			NEG	
			16.5	13		20		
	8D	20.0	7-9	(S1)		NEG		
		21.5	10					
	9D	25.0	5-10			NEG		
		26.5	11		25			
	10D	30.0	6-8	(S2)		NEG		
		31.5	13			30		
	11D	35.0	7-8			NEG		
		36.5	11		33			
	12D	40.0	8-14			NEG		
		41.5	18		35			
	13D	45.0	15-30	(S1)		NEG		
		46.4	50/5"			40		
	14D	50.0	7-9			NEG		
		51.5	8		45			
					48			
					50			

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-205

SURFACE ELEV. 280.2

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
APRIL 21, 1986 (CONT'D)	15D	55.0	3-5	Stiff yellow-brown fine sandy clay, trace lignite, medium sand (CH)	S1	53	NEG		
		56.5	6			55			
	16D	60.0	3-3	Light gray-green fine sandy clay, trace lignite, medium sand (CH)	C2	60	NEG		
		61.5	5			65			
	17D	65.0	4-7	Light gray-green clayey fine sand trace lignite (SC)		68	NEG		
		66.5	8			70			
	18D	70.0	7-11	Light gray-yellow f-m sand, some clay (SC)	S3a	73	NEG		
		71.5	14			75			
	1700 0750	19D	75.0	22-33	Brown fine to medium sand, trace silt (SP)	S3b	78	NEG	
			76.5	38			80		
APRIL 22, 1986 - SUNNY, CLEAR 80°F	20D	80.0	21-50/5"	Light brown-gray f-m sand, some clay, clayey f-m sand pkts (SC)	S3a	83	NEG		
		80.9				85			
	21D	85.0	25-39	Light brown f-m sand, trace clay (SP-SG)	S3b	88	NEG		
		86.5	38			90			
	22D	90.0	16-27	Brown fine to medium sand, some clay (SC)	S3a	93	NEG		
		91.5	23			95			
	23D	95.0	15-15	Light gray-green calc clayey fine sand, some limestone fgmts (SC)	S4		POS		
		96.5	44			100			
	24D	100.0	10-20	Light green-gray calc clayey f-m sand, some limestone fgmts (SC)			POS		
		101.5	34						

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-205

SURFACE ELEV. 280.2'

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 22, 1986 (CONT'D)	25D	105.0 106.3	7-43 50/3"	Light gray-green calcareous fine sand, some silt, calc fgmts (SM)	S4	105	POS	
	26D	110.0 110.5	100/6"	Do 25D, trace clay pockets (SM)		110	POS	
	27D	115.0 116.1	15-20 50/2"	Do 26D (SM)		115	POS	
	28D	120.0 120.8	7-50/4"	Gray calcareous fine sand, some clay, trace shell fgmts (SC)		120	POS	
	29D	125.0 125.7	50-50/2"	Do 28D, calcareous cemented fragments (SC)		125	POS	
	30D	130.0 130.4	100/5"	Gray calcareous cemented fgmts (GP)		130	POS	
	31D	135.0 136.3	16-26 50/3"	Gray calcareous clayey fine sand, some shell fragments (SC)		135	POS	
						138		
	32D	140.0 141.5	25-24 42	Hard dark gray-green f-m sandy clay, trace calc (CL)		140	POS	
						145		
	33D	145.0 146.5	21-31 50	Hard dark gray-green clayey silt, some f-m sand partings, -pkts (MH)		145	NEG	
						150		
	34D	150.0 150.7	42-50/2"	Dark gray f-m sand, some silt, trace lignite, clay pockets (SM)		150	NEG	End of boring at 150.7'.

1700  
0750

APRIL 23, 1986  
SUNNY, COOL  
40°F

BORING NO. Z-205



PROJECT SALTSTONE DISPOSAL Z-AREA S.R.P.

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-205

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH Ft.	GAGE PRESSURE Psi	RETURN	REMARKS
7:30 AM 04-25-64	Grouting	150.7'				1	7.9	0.1	7.3	140'	10	mud/grout	
						2	7.4	3.7	3.7	80'	10	grout	
						2	3.7	0.1	3.6	10	10		
7:30 AM 04-25-64	grouting	20'					3.7	"	3.6				* see comments odd grouting req'd

10.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Failing 1500  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT 3 94 LB. BAGS  
BENTONITE 0.3 100 LB. BAGS  
SAND 0 LBS/CU. FT.  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) 2.9 CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT \_\_\_\_\_ 94 LB. BAGS  
BENTONITE 100 LB. BAGS  
SAND \_\_\_\_\_ LBS/CU. FT.  
WATER \_\_\_\_\_ GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_  
(E.Y.)  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 7.5 BAGS  
(E.Y.)  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.7 BAGS  
(E.Y.)  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
(E.Y.)

COMMENTS: 1-25-66 Grout 547 settled

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-205  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 75965 E. 67,610  
SURFACE ELEVATION 180.2 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL - H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N - 2 3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud	CONDITIONS OF OBSERVATION*
4-22-86	0730	76.5	-	25.0	OVERNIGHT
4-23-86	0750	141.5	-	40.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 150.7 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 150.7 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.2 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	7.5	0.7		18.2				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER THOMAS LOWE HELPERS DAVE GOODWIN, GLENN DODSON  
REMARKS GROUT TIME: 1.5 HRS.  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-23-86

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-206

SURFACE ELEV. 284.6

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
0730  APRIL 16, 1986 - SUNNY, BREEZY 80°F	1D	0.0	1-3	Brown fine sand, trace silt, trace vegetation (SP)	S2		NEG		
		1.5	2				1.5		
	2D	2.5	2-3	Mottled red-brown & brown f-m sand, some clay, trace clay pkts (SC)			NEG		
		4.0	17				5		
	3D	5.0	5-10	Mottled red-brown & purple f-m sand, some clay (SC)			NEG		
		6.5	13						
	4D	7.5	8-9	Do 3D, trace clay pockets (SC)			NEG		
		9.0	14				10		
	5D	10.0	5-10	Do 3D (SC)			NEG		
		11.5	13						
	6D	12.5	5-10	Do 3D, purple & gray (SC)			NEG		
		14.0	12				15		
	7D	15.0	7-11	Do 6D (SC)		S1			NEG
		16.5	12						
8D	20.0	7-10	Do 6D, trace clay pockets (SC)		NEG				
	21.5	11			20				
9D	25.0	8-12	Red-brown fine to medium sand, some clay (SC)		NEG				
	26.5	13			25				
10D	30.0	7-12	Yellow-brown fine to medium sand, some clay (SC)		NEG				
	31.5	12			30				
11D	35.0	8-11	Yellow-brown fine to medium sand, trace clay (SP-SC)		NEG				
	36.5	12			33				
12D	40.0	8-10	Do 11D (SP-SC)	S2			NEG		
	41.5	11					35		
13D	45.0	11-23	Red-brown fine to medium sand, trace silt (SP-SM)				NEG		
	46.5	24					40		
14D	50.0	15-22	Do 13D (SP-SM)			NEG			
	51.5	25				45			
						50			

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-206

PROJECT LOCATION SAVANNAH RIVER PLANT RES. ENGR.

SURFACE ELEV. 284.6  
PETER E. BLEIWEISS

APRIL 16, 1986 (CONT'D)

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
					(S2)	53		
	15D	55.0 56.5	4-4 4	Red-brown f-m sand, some clay, trace clay layers (SC)	(S3a)	55	NEG	
						58		
	16D	60.0 61.5	2-3 5	Yellow-brown clayey fine sand, trace clay layers, lignite (SC)		60	NEG	
					(C2)			
	17D	65.0 66.5	3-5 6	Yellow-brown clayey fine to medium sand (SC)		65	NEG	
						68		
	18D	70.0 71.5	19-27 31	Brown fine to medium sand, trace silt, clay partings (SP)		70	NEG	
					(S3b)			
	19D	75.0 76.5	25-37 43	Do 18D (SP)		75	NEG	
	20D	80.0 81.5	8-11 11	Light brown-yellow f-m sand, tr clay, clay pockets (SP-SC)		80	NEG	
						83		
	21D	85.0 86.5	15-14 15	Light brown yellow f-m sand, sm clay & clayey f-m sand lys (SC)	(S3a)	85	NEG	
						88		
	22D	90.0 91.5	15-29 21	Light brown fine sand, trace silt (SP-SM)	(S3b)	90	NEG	
						93		
	23D	95.0 96.5	21-20 50	Light gray-green calcareous clayey f-c sand, some calcareous fragments (SC)	(S4)	95	POS	
	24D	100.0 101.5	21-29 20	Light gray-green calcareous fine sand, sm clay, calc fgmts (SC)		100	POS	

1630  
0730

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-206

SURFACE ELEV. 284.6

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS		
	NO.	DEPTH	BLOWS/6"							
APRIL 17, 1986 - SUNNY, CLEAR 80°F	25D	105.0 105.9	23-100/5"	Light gray-green fine sand, some silt, calcareous fragments, trace clay pockets (SM)	S4	105	POS			
	26D	110.0 111.5	11-17 50	Light gray-green calcareous fine sand, some clay, trace calcareous fragments (SC)		110	POS			
	27D	115.0 115.5	100/6"	Gray calcareous fine sand, some silt, tr clayey sand pockets, shell fragments (SM)		115	POS			
	28D	120.0 120.3	100/3"	Gray calc cemented fragments (GP)		120	POS			
	29D	125.0 125.7	44-50/2"	Gray calcareous fine sand, some silt, trace shell fragments (SM)		125	POS			
	30D	130.0 130.8	44-50/4"	Gray calcareous fine sand, some shell fragments, silt (SM)		130	POS			
	31D	135.0 135.9	32-50/5"	Gray calcareous silty fine to medium sand & shell fragments, some clay (SC)		135	POS			
	32D	140.0 140.8	35-50/4"	Gray-green calcareous clayey f-m sand, some shell fragments (SC)		140	POS			
	33D	145.0 146.5	17-29 44	Hard dark green clayey silt, tr fine to medium sand partings (MH)		143	NEG			
						145				
	1630					150	NEG			
	0730					150.5				
	APRIL 17 1986	34D	150.0 150.5	150/6"		Dark gray f-m sand, tr si, lignite pkts, silty clay pkts (SP-SM)				End of boring at 150.5'.

1630  
0730  
APRIL 17  
1986  
SUNNY  
CLEAR 80°

PROJECT SALTSTONE DISPOSAL Z-AREA

MADE BY PEB DATE 1/22/86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-206

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
09-18-86	Grouting	150.5'				1	7.4	0.1	7.3	1400	10	None	
						2	7.4	3.0	4.4	800	"	Mud/grout	
						2	3.0	0.1	2.9	400	"		
09-22-85	Add grouting	300'				3	7.4	2.7	4.7				Add grouting

19.3 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fairing 1500  
ALSO USED IN BORINGS   
CEMENT 3 94 LB. BAGS  
BENTONITE 0.25 100 LB. BAGS  
SAND 0 LBS/CU. FT.  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) 7.1 CU. FT.  
GROUT PUMPED (G.P.) 7.3 CU. FT.  
GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT \_\_\_\_\_ 94 LB. BAGS  
BENTONITE \_\_\_\_\_ 100 LB. BAGS  
SAND \_\_\_\_\_ LBS/CU. FT.  
WATER \_\_\_\_\_ GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
(E.Y.)  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 8.0 BAGS  
(E.Y.)  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.7 BAGS  
(E.Y.)  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.0 CU. FT.  
(E.Y.)

COMMENTS: Settlement of grout surf. 100'. add'l work

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-206  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 76202 E. 66.924  
SURFACE ELEVATION 284.6 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
4-17-86	0730	96.5	-	30.0	OVERNIGHT
4-18-86	0730	146.5	-	45.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 150.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 150.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 19.3 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	8.0	0.7		19.3				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER THOMAS LOWE HELPERS DAVE GOODWIN, GLENN DODSON

REMARKS \_\_\_\_\_

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-22-86

BORING No. Z-206

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-207

SURFACE ELEV. 282.2

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
1230	1D	0.0	2-2	Brown f-m sand, trace silt (SP-SM)	S2		NEG		
		1.5	2			1.5			
	2D	2.5	1-3	Yellow-brown f-m sand, some clay, trace cemented sand fgmts (SC)	S1		NEG		
		4.0	3			5			
	3D	5.0	3-7	Yellow-brown f-m sand, some clay, trace c sand, cemented sand(SC)			NEG		
		6.5	15						
	4D	7.5	8-45	Mottled red-brown & brown f-m sand, some clay, gry cl pkts. (SC)			NEG		
		9.0	25			10			
	5D	10.0	5-12	Red-brown f-c sand, some clay, trace clay pockets (SC)		S1			NEG
		11.5	21						
	6D	12.5	11-22	Do 5D (SC)					NEG
		14.0	28				15		
	7D	15.0	4-11	Do 5D (SC)					NEG
		16.5	15						
8D	20.0	7-9	Brown f-m sand, some clay, trace white clay partings (SC)				NEG		
	21.5	10		20					
9D	25.0	5-9	Mottled brown & red-brown f-m sand, trace some clay (SC)		NEG				
	26.5	10		22					
10D	30.0	9-14	Brown fine sand, trace silt (SP-SM)		NEG				
	31.5	13		25					
11D	35.0	10-12	Gray fine sand, trace silt, medium sand, clay partings (SP-SM)	S2			NEG		
	36.5	13			30				
12D	40.0	13-18	Red-brown fine to medium sand, trace silt, clay partings(SP-SM)			NEG			
	41.5	20			35				
13D	45.0	10-15	Red-brown fine to medium sand, some clay (SC)			NEG			
	46.5	13			40				
14D	50.0	3-2	Yellow brown clayey fine sand & silty clay layers (SC&CL)		C2		NEG		
	51.5	5				43			
						45			
						48			
						50			

APRIL 14, 1986 - SUNNY, HUMID 87°F



MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-207

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS  
SURFACE ELEV. 282.2

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 14, 1986 (CONT'D)	15D	55.0	2-8	Yellow brown f-m sand, trace clay lignite (SP-SC)	C2	53	NEG	
		56.5	4			S3b		
	16D	60.0	1-2	Yellow-brown f-m sand, some clay, trace silt, clay layers (SC)	C2	58	NEG	
		61.5	2			60		
	17D	65.0	3-5	Yellow brown f-m sand, trace silt, clay layers (SP-SM)		63	NEG	
		66.5	6			65		
	18D	70.0	6-8	Yellow brown fine sand, trace clay, clay pockets, lignite (SP-SC)		70	NEG	
		71.5	15			75		
	19D	75.0	13-16	Brown m-f sand, trace clay, clay pockets, coarse sand (SP-SC)	S3b	80	NEG	
		76.5	19			85		
20D	80.0	17-13	Brown & gray f-m sand, trace silt (SP)		88	NEG		
	81.5	20			90			
21D	85.0	10-30	Brown & gray f-c sand, trace silt (SP)		93	NEG		
	86.5	28			95			
22D	90.0	2-6	Mottled gray-green & brown clayey f-m sand (SC)	S3a	100	NEG		
	91.5	18			S4			99
23D	95.0	100/2"	White calcareous cemented fragments (GP)	S4	100	POS		
	95.1				100			
APRIL 15, 1986 - CLEAR, BREEZY, 80°F	24D	100.0	17-23	Light green-gray calcareous clayey f-m sand, some limestone fgmts (SC)		100	POS	
		101.5	29					

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-207

SURFACE ELEV. 282.2

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 15, 1986 (CONT'D)	25D	105.0 106.5	4-5 3	Light gray calc f-m sand, some clay, limestone fgmts & shell fragments (SC)	S4	105	POS	
	26D	110.0 111.5	4-1 1	Light gray-green calcareous fine sand, some silt (SM)		110	POS	
	27D	115.0 116.5	8-6 11	Light gray-green calcareous f sand, some silt, trace clay pockets, calcareous cemented fgmts (SM)		115	POS	
	28D	120.0 121.5	8-8 15	Light gray-green calcareous fine sand, calc cemented fgmts (SC)		120	POS	
	29D	125.0 126.3	9-19 50/4"	Gray calcareous fine sand, some clay, shell fgmts and calc cemented fragments (SC)		125	POS	
	NR	130.0 130.0	100/0"	NO RECOVERY		130		
	30D	135.0 136.5	9-24 34	Gray calcareous fine sand, some shell fragments, clay (SC)		135	POS	
	31D	140.0 141.5	21-20 22	Dark gray-green calcareous fine sand, some clay, shell fgmts(SC)		140 143	POS	
	32D	145.0 146.5	14-18 26	Hard dark gray-green clayey silt, trace fine sand partings (MH)		145	NEG	
	33D	150.0 151.1	7-29 50/2"	Hard dark gray-green clayey silt, trace f-c sand (MH)		150 151.1	NEG	End of boring at 151.1'.

1630  
0720

APRIL 16, 1986  
SUNNY, BREEZY

BORING NO. Z-207

PROJECT SALTSTONE DISPOSAL, Z-AREA S.R.P

MADE BY RS DATE 1/20/64  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-207

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	Batch CHECKED NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE (PSI)	RETURN	REMARKS
04-14-64	Grouting	151.1				1	7.4	0.1	7.3	140	15 psi	mud	
						2	7.4	3.8	3.6	80	"	mud/grout	
						3	3.8	0.1	3.7	40	"	grout	
04-18-64	Grouting	38'					7.4	3.3	4.1			"	* grouting upon settlement of grout surface

18.7 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Failing 250  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT 3 94 LB. BAGS  
BENTONITE 0.25 100 LB. BAGS  
SAND 0.0 LBS/CU. FT.  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) 2.4 CU. FT.  
GROUT PUMPED (G.P.) 7.3 CU. FT.  
GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT \_\_\_\_\_ 94 LB. BAGS  
BENTONITE \_\_\_\_\_ 100 LB. BAGS  
SAND \_\_\_\_\_ LBS/CU. FT.  
WATER \_\_\_\_\_ GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

COMMENTS: Grouted to surf. on 4-16-64 req'd add'l grout

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-207  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 76,012 E. 66,987  
SURFACE ELEVATION 282.2' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8 O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
4-15-86	0720	66.5	-	35.0	OVERNIGHT
4-16-86	0730	135.0	-	50.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 151.1 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 151.1 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50-LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.7 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	7.7	0.7		18.7				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER NATE PATTERSON HELPERS JAMES HILTON, JEROME HULL  
REMARKS 1.5 HRS. GROUT TIME.  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 04-18-86

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-208

PROJECT LOCATION SAVANNAH RIVER PLANT RES. ENGR.

SURFACE ELEV. 281.7  
PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
0930	1D	0.0	1-1	Brown fine sand, trace silt, roots (SP-SM)	(S2)	1.5	NEG		
		1.5	2			5	NEG		
	2D	2.5	3-3	Brown clayey f-m sand, trace coarse sand, cemented sand fgmts (SC)		5	NEG		
		4.0	5						
	3D	5.0	10-17	Mottled light gry & brn clayey f-m sand, some clay pockets (SC)			NEG		
		6.5	21						
	4D	7.5	8-9	Hard red-brown silty clay, some f-m sand, tr f-m sand pkts (CL)			NEG		
		9.0	21			10			
	5D	10.0	10-13	Mottled red-brown & gray clayey f-m sand (SC)			NEG		
		11.5	17						
	6D	12.5	9-15	Do 5D (SC)			NEG		
		14.0	22			15			
	7D	15.0	10-16	Red brown f-m sand, some clay, clay pockets (SC)		(S1)			NEG
		16.5	18						
8D	20.0	9-12	Red-brown & gray f-m sand, some clay, trace clay partings (SC)	20	NEG				
	21.5	13							
9D	25.0	8-12	Red-brown & gray f-m sand, some clay (SC)	25	NEG				
	26.5	14							
10D	30.0	10-12	Red-brown & purple fine sand, some clay (SC)	30	NEG				
	31.5	14							
11D	35.0	7-12	Yellow-brown fine to medium sand, trace clay (SP-SC)	(S2)			NEG		
	36.5	12							
12D	40.0	8-13	Yellow-brown f-m sand, some silt (SM)		40		NEG		
	41.5	13							
13D	45.0	10-16	Yellow-brown f-m sand, trace coarse sand, silt (SP-SM)		45		NEG		
	46.5	21							
14D	50.0	13-18	Do 13D (SP-SM)		50	NEG			
	51.5	16							

APRIL 14, 1986 - SUNNY, WARM

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-208

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS  
SURFACE ELEV. 281.7

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 14, 1986 - (CONT'D)	15D	55.0	9-6	Do 13D  (SP-SM)	S2		NEG	
		56.5	4					
	16D	60.0	5-8	Very stiff gray-green fine to coarse sandy clay, trace lignite (CL)		55	NEG	
		61.5	8			58		
	17D	65.0	3-5	Stiff light gray-green clay, sm fine sand, trace lignite (CH)	C2	60	NEG	
		66.5	6			65		
	18D	70.0	4-5	Do 17D  (CH)		70	NEG	
		71.5	9					
	19D	75.0	6-3	Mottled gray & white clayey f-m sand, some clay layers, trace lignite (SC)		75	NEG	
		76.5	3			78		
	20D	80.0	15-32	Brown m-f sand, trace coarse sand, lignite, silt (SP)	S3b	80	NEG	
		81.5	35					
	21D	85.0	14-20	Do 20D  (SP)		85	NEG	
		86.5	25			88		
	22D	90.0	4-9	Brown clayey f-m sand (SC)	S3a	90	NEG	
		91.5	12			93		
	23D	95.0	24-30	Gray-green fine sand, some clay, trace limestone fgmts (SC)	S4	95	POS	
		96.5	39					
	24D	100.0	12-24	Light gray calcareous clayey f-m sand, sm limestone fgmts (SC)		100	POS	
		101.5	56					

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-208

SURFACE ELEV. 281.7

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
4-14-86 (CONT'D)  1630 0730            APRIL 15, 1986 - SUNNY, WINDY 80°F	25D	105.0	7-13	Gray-green fine sand, some silt, trace limestone fragments (SM)	S4	105	POS	
		106.5	24			110		
	26D	110.0	19-35	Light gray-green calcareous fine sand, some clay, cemented fgmts (SC)		115	POS	
		111.4	50/5"			120		
	27D	115.0	8-50/4"	Light gray-green calcareous clayey fine sand, trace calc cemented fragments (SC)		125	POS	
		115.8				130		
	28D	120.0	14-50/5"	Gray calcareous fine sand, some silt, clayey f sand lyrs, tr shell fragments (SM)		135	POS	
		120.9				140		
	29D	125.0	50-50/2"	Gray fine sand, some clay, trace shell & cemented fragments (SC)		143	POS	
		125.7				145		
	30D	130.0	100/3"	Gray calcareous cemented fgmts (GP)		150	POS	
		130.3				155		
	31D	135.0	11-20	Gray calc f-m sand, some clay, shell fragments (SC)		M1	POS	
		136.5	52					
32D	140.0	23-43	Do 31D, trace clay pockets (SC)	165	POS			
	141.3	50/3"		170				
33D	145.0	12-20	Hard dark gray-green clayey silt, trace fine sand partings (MH)	175	NEG			
	146.5	50		180				
34D	150.0	8-17	Hard dark gray-green clayey silt, some f-m sand (MH)	185	NEG			
	151.5	25		190				

End of boring at 151.5'.

PROJECT SALTSTONE DISPOSAL Z AREA

MADE BY REB DATE 4/15/86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-208

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	Batch CHANGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
04-15-86	Grouting	151.5				1	7.9	0.1	7.3	140	10psi		
						2	7.4	3.6	3.8	100	"	med/grout	
						2	3.6	0.1	3.5	50		grout	
04-18-86	Grouting	42.0				3	7.9	2.0	5.9				add'l grouting

20.0 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Failing 1500  
ALSO USED IN BORINGS   
CEMENT 3 94 LB. BAGS  
BENTONITE 0.25 100 LB. BAGS  
SAND 0 LBS/CU. FT.  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
GROUT PUMPED (G.P.) 7.3 CU. FT.  
GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT \_\_\_\_\_ 94 LB. BAGS  
BENTONITE 100 LB. BAGS  
SAND \_\_\_\_\_ LBS/CU. FT.  
WATER \_\_\_\_\_ GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
(E.Y.)  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 6.2 BAGS  
(E.Y.)  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.7 BAGS  
(E.Y.)  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
(E.Y.)

COMMENTS: After initial grouting on 4-15-86 settlement of grout surface occurred



MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-208  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N75, 823 E. 67, 049  
SURFACE ELEVATION 281.7' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N-2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_ AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140 AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud	CONDITIONS OF OBSERVATION*
4-15-86	0730	106.5	-	38.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 151.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 151.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 20.0 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
	8.2	0.7	0					
TOTAL	8.2	0.7	0	20.0				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER THOMAS LOWE HELPERS DAVID GOODWIN, GLEN DODSON

REMARKS 1.5 HRS. GROUTING TIME

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-18-86

BORING No. Z-208

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

BORING NO. Z-209

PROJECT SALTSTONE DISPOSAL - Z AREA

SURFACE ELEV. 287.6

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
0730	1D	0.0	2-2	Gray & light brown, fine sand, trace silt, vegetation (SP-SM)	(S2)		NEG	
		1.5	2					
	2D	2.5	1-2	Brown fine sand, trace silt, medium sand (SP-SM)			NEG	
		4.0	2					
	3D	5.0	4-13	Mottled brown & gray fine sand, some clay, tr m sand (SC)			NEG	
		6.5	20					
	4D	7.5	6-13	Mottled yellow-brown & gray fine to medium sand, some clay (SC)			NEG	
		9.0	16					
	5D	10.0	10-16	Mottled red-brown & white clayey fine sand (SC)			NEG	
		11.5	20					
	6D	12.5	8-16	Mottled purple & red-brown clayey fine to medium sand (SC)			NEG	
		14.0	20					
	7D	15.0	7-21	Do 6D, trace gray clay pockets (SC)			NEG	
		16.5	14					
8D	20.0	9-13	Red-brown fine to medium sand, some caly, trace coarse sand(SC)		NEG			
	21.5	14						
9D	25.0	9-13	Do 8D, red-brown & gray (SC)		NEG			
	26.5	13						
10D	30.0	9-16	Mottled gray & red-brown fine to medium sand, some clay (SC)		NEG			
	31.5	19						
11D	35.0	12-15	Dark gray-brown fine sand, some clay, trace medium sand (SC)		NEG			
	36.5	14						
12D	40.0	12-13	Mottled brown & purple fine to medium sand, some clay (SC)		NEG			
	41.5	15						
13D	45.0	8-14	Brown fine to medium sand, some clay (SC)		NEG			
	46.5	16						
14D	50.0	17-24	Red-brown fine to medium sand, trace silt (SP-SM)		NEG			
	51.5	37						

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z AREA

BORING NO. Z-209

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS  
SURFACE ELEV. 287.6

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
15D	50.0 51.5	18-32 28	Red-brown fine to medium sand, trace silt (SP-SM)	S2	55	NEG		
16D	60.0 61.5	2-5 5	Red-brown clayey fine to medium sand (SC)	S3a	60 63	NEG		
NR	65.0 66.5	2-4 6	NO RECOVERY	C2	65			
17D	66.5 68.0	WH-5 10	Yellow-brown clayey fine sand (SC)		69 70	NEG		
18D	70.0 71.5	9-12 14	Brown fine to medium sand, some clay (SC)	S3a		NEG		
19D	75.0 76.5	14-16 16	Mottled yellow-brown & gray f-m sand, some clay (SC)		75 78	NEG		
20D	80.0 81.5	29-30 29	Light brown fine to medium sand, trace silt (SP)	S3b	80 83	NEG	Losing 50% of drilling fluid.	
21D	85.0 86.5	29-19 23	Brown fine to medium sand, some clay, trace lignite (SC)	S3a	85	NEG		
22D	90.0 91.5	3-4 12	Brown fine to medium sand, some clay (SC)		90 93	NEG	Fluid loss minimal.	
23D	95.0 96.5	11-23 31	Light brown fine to medium sand, trace clay (SP-SC)	S3b	95 98	NEG		
24D	100.0 101.5	26-50 50	Light brown-white calc f-c sand, some clay, cemented fgmts (SC)	S4	100	POS		

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z AREA

BORING NO. Z-209

SURFACE ELEV. 287.6

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
	25D	105.0 106.5	13-16 33	Light gray-green calc fine sand, some silt (SM)	S4	105	POS	Drilling hard possible limestone layers.	
	26D	110.0 111.5	9-14 26	Do 25D (SM)		110	POS		
	NR	115.0 115.3	100/4"	NO RECOVERY		115			
	27D	120.0 121.5	17-50 40	Light gray-green calc fine sand, some clay, cemented fgmts. (SC)		120	POS		
	NR	125.0	50/0"	NO RECOVERY		125			
	28D	130.0 131.3	28-33 100/4"	Gray calc fine sand, some clay, shell fragments (SC)		130	POS		
	29D	135.0 136.3	25-50 50/3"	Do 30D (SC)		135	POS		
	30D	140.0 141.3	31-50 50/4"	Gray calc, fine sand, some silt, shell fragments, trace clay (SM)		140	POS		
	31D	145.0 146.5	27-25 31	Hard gray-green clayey silt, tr fine sand partings (MH)		M1	145		NEG
	32D	150.0 151.5	17-27 31	Do 31D, some pockets fine sand, some clay (MH&SC)		150	NEG		END OF BORING @ 151.5.
						151.5			

BORING NO. Z-209

PROJECT SALTSTONE DISPOSAL Z-ARBA

MADE BY PEB DATE 1/19/86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-209

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
09-17-86	Grouting	151.5				1	7.4	0.1	7.3	190	10 psi		
						2	7.4	3.7	3.7	60	"	mud/grout	
						2	3.7	0.1	3.6	20		grout	
1208 09-18-86	Grouting	10.0				3	7.4	3.0	4.3			grout	* add'l grouting req'd

18.9 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fading 250  
 ALSO USED IN BORINGS ✓  
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.25 100 LB. BAGS  
 SAND 0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 7.5 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.6 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
 (E.Y.)

COMMENTS: After initial grouting, add'l grouting req'd

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL Z-AREA BORING NO. Z-209  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 76122, E 66.680  
SURFACE ELEVATION 287.6' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8" TRI CONE  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF: N: 2-3/8"  
DRILL RODS \_\_\_\_\_ D-SAMPLER 2.0" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_ AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140 AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO Mud.	CONDITIONS OF OBSERVATION*
4-11-86	0730	66.5'	-	26.0'	OVERNIGHT
4-12-86	0800	115.3'	-	48.0'	OVERNIGHT
4-14-86	0730	146.5'	-	38.0'	24 HOUR STABILIZATION

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 151.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 151.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.9 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
4-14-86	6	0.5	0.0	14.6				
4-18-86	1.4	0.2						
TOTAL	7.4	0.7		18.9				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER NATE PATTERSON HELPERS JEROME HULL, JIM HILTON

REMARKS GROUT SURFACE SETTLED WITHIN 1 HOUR OF MOVING RIG FROM HOLE.

RESIDENT ENGINEER PETER E. BLEISWEISS DATE 4-14-86

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-210

SURFACE ELEV. 288.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HGL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
0900	1D	0.0	1-2	Dark brown-gray fine sand, trace silt (SP)	S2		NEG	
		1.5	1					
	2D	2.5	2-3	Light brown fine sand, trace silt medium sand (SP)		4.5	NEG	
		4.0	2			5		
	3D	5.0	3-6	Mottled red-brown & gray-brown fine sand, trace clay (SP-SC)			NEG	
		6.5	13					
	4D	7.5	8-9	Mottled red-brown & gray fine sand, some clay (SC)			NEG	
		9.0	11			10		
	5D	10.0	6-7	Mottled red-brown & light brown fine to medium sand, some clay (SC)			NEG	
		11.5	12					
	6D	12.5	9-13	Mottled gray & brown fine to medium sand, some clay, trace coarse sand (SC)			NEG	
		14.0	19			15		
	7D	15.0	11-14	Mottled gray & purple clayey fine to medium sand, some sand, trace coarse sand (SC)	S1		NEG	
		16.5	22					
8D	20.0	9-9	Mottled red-brown & light gray fine to medium sand some clay, trace coarse sand (SC)			NEG		
	21.5	17						
9D	25.0	8-14	Brown fine to medium sand, some clay, trace clay pockets (SC)			NEG		
	26.5	18						
10D	30.0	8-11	Mottled light gray & yellow brown fine sand, some clay (SC)			NEG		
	31.5	10						
11D	35.0	10-13	Red brown fine sand, some clay (SC)			NEG		
	36.5	14			38			
12D	40.0	7-19	Brown fine to medium sand, trace silt, clay pockets, cemented sand fragments (SP-SM)	S2		NEG		
	41.5	18				45		
13D	45.0	10-11	Yellow-brown fine to medium sand, trace silt, clay partings, cemented fragments (SP-SM)			NEG		
	46.5	18						
14D	50.0	15-20	Yellow-brown fine to medium sand, trace silt, clay partings (SP-SM)			NEG		
	51.5	30						

APRIL 7, 1986 - SUNNY, HUMID

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-210

SURFACE ELEV. 288.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	FGL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
	15D	55.0 56.5	21-31 28	Red-brown fine to medium sand, trace silt, coarse sand (SP-SM)	(S2)	55	NEG	
						58		
	16D	60.0 61.5	3-4 8	Red-brown clayey fine to medium sand, trace lignite (SC)	(S3a)	60	NEG	
						65		
	17D	65.0 66.5	5-6 12	Brown fine sand, some clay (SC)		68	NEG	
						70		
	18D	70.0 71.5	3-3 5	Brown clayey fine sand (SC)	(C2)	75	NEG	
						78		
	19D	75.0 76.5	4-6 10	Brown-light brown clayey fine sand, trace lignite (SC)		80	NEG	
						85		
	20D	80.0 81.5	10-19 20	Mottled brown & gray fine to medium sand, some clay, trace lignite (SC)	(S3a)	88	NEG	
						90		
	21D	85.0 86.5	11-14 16	Mottled brown & gray fine to medium sand, some clay, trace lignite (SC)		95	NEG	
						98		
	22D	90.0 91.5	16-21 29	Brown gray medium sand, trace clay (SP)	(S3b)		NEG	Began to lose drilling fluid at 91.0'.
	NR	95.0 98.0	WH/3'	NO RECOVERY	VOID			
						98		
	23D	98.0 99.5	4-7 15	Light brown clayey fine sand, trace medium sand (SC)	(S3a)	100	NEG	Maintaining return of drilling fluid.
	24D	100.0 101.5	4-30 30	Light brown calc c-f sand, limestone fragments (SC)	(S4)		POS	



MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-210

SURFACE ELEV. 288.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
	25D	105.0 106.3	17-31 50/4"	Do 24D, light gray-green (SC)		105	POS	
	26D	110.0 111.5	12-27 56	Light gray-green calc, fine sand, some silt, trace clay pockets, calc cemented fragments (SM)		110	POS	
	27D	115.0 116.3	17-31 50/4"	Do 26D (SM)		115	POS	
	28D	120.0 121.5	12-31 50	Light gray-green calc, fine sand, some clay (SC)	(S4)	120	POS	Drilling hard below 123.0'.
	29D	125.0 125.3	100/4"	Gray calc cemented fragments (GP)		125	POS	
	30D	130.0 130.3	100/3"	Do 19D (GP)		130	POS	
	31D	135.0 135.9	42-100/5"	Gray calc fine sand, some silt, trace shell fragments (SM)		135	POS	
	32D	140.0 141.5	23-32 78	Gray calc, fine sand, some clay, shell fragments (SC)		140	POS	
	33D	145.0 145.7	70-50/2"	Gray calc fine to medium sand, some clay, shell fragments (SC)		145	POS	
						148		
	34D	150.0 151.5	21-29 64	Hard gray-green clayey silt, tr silt, some silt pockets (MH)	(M1)	150	NEG	

BORING NO. Z-210

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-210

SURFACE ELEV. 288.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1120	35D	155.0 155.8	21-64/4"	Dark gray-green fine to coarse sand, some clay (SC)	M1  155.8	155  160  165  170  175  180	NEG	End of boring @ 155.8.

PROJECT SALTSTONE DISPOSAL Z-AREA

MADE BY PEB DATE 1/10/68  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 8

GROUTING REPORT - BORING NO. Z-210P

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH CHARGE NO.	TANK VOLUME		VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
							BEFORE	AFTER					
1200h 04/10/68	Grouting	155.8'				1	7.4	0.1	7.3	140	10psi		
						2	7.4	0.1	7.3	110	"		
						3	7.4	0.1	7.3	80	"		
						4	7.4	0.1	7.3	60	"	mud/grout	
						5	7.4	0.1	7.3	20	"	grout	

36.5 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fealing 1500  
 ALSO USED IN BORINGS ✓  
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.25 100 LB. BAGS  
 SAND 0.0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

COMMENTS: Est. Req'd grout = 13.5  
7.35  
Est. Total = 2.71

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 15 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 1.25 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
 (E.Y.)

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-210  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 75,933 E. 66,743  
SURFACE ELEVATION 288.1 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL, H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N-2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_ AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140 AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud	CONDITIONS OF OBSERVATION*
4-08-86	0730	61.5'	-	35.0'	OVERNIGHT
4-09-86	0720	98.0'	-	43.0'	OVERNIGHT
4-10-86	0715	141.5'	-	60.0'	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 155.8 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 155.8 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	15	1.25	36.5					36.5 FT <sup>3</sup>

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER THOMAS LOWE HELPERS DAVE GOODWIN, GLEN DODSON  
REMARKS 2.5 HOURS GROUT TIME  
RESIDENT ENGINEER PETER E. BLEISWEISS DATE 04-10-86

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 9

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. PZ-210U

SURFACE ELEV. 288.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 10, 1986 - SUNNY, 70°F  1600 0800					(S2)	4.5		Note: no ..... sampling to 16.5 Ref: boring plan B-1 for procedure followed for this borehole.
						5		
						10		
						15		
						20		
						25		
						30		
						35		
						38		
						40		
APRIL 11, 1986 CLEAR, SUNNY 70°F  1600 0800		16.5	Push=24"	Mottled red-brown and white medium to fine sand, some clay (SC)	(S1)		Drove casing from 15.5' to 16.5' with 140 lb/30" drop.	
		18.5	Rec=24"					
		21.5	Push=24"			Mottled red-brown and yellow-brown fine to medium sand, some clay (SC)		
		23.5	Rec= 24"					
		25						
		30						
		35						
		38						
		40						
		45						
50								
55								
APRIL 11, 1986 CLEAR, SUNNY 70°F  1600 0800		28.5	Push=24"	Mottled red-brown and gray fine to medium sand, some clay (SC)	(S2)		Failed w/shelby @ 26.5 washed to 28.5. 96 blows 140 lb/30" 3rd series of tests 28.5'-30.5' 3" Ø hole.	
		30.5	Rec=24"					
		35						
		38						
		40						
		45						
		50						
		55						
		60						
		65						

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 9

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. PZ-210U

SURFACE ELEV. 288.1

PROJECT LOCATION \_\_\_\_\_ RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS	
	NO.	DEPTH	BLOWS/6"						
APRIL 12, 1986- SUNNY, OVERCAST, 85°F                1730					(S2)				
							55		
							58		
						(S3a)	60		
							65		
							68		
						(C2)	70		
							75		Installed piezometer at 75.5'
							76.5		End of boring at 76.5'.
							80		
							85		
							90		
							95		
							100		

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET No. 2 of 8

FILE: 6329

MADE BY: PEB DATE: 09-10-86

FOR: SALTSTONE DISPOSAL Z-AREA S.R.P

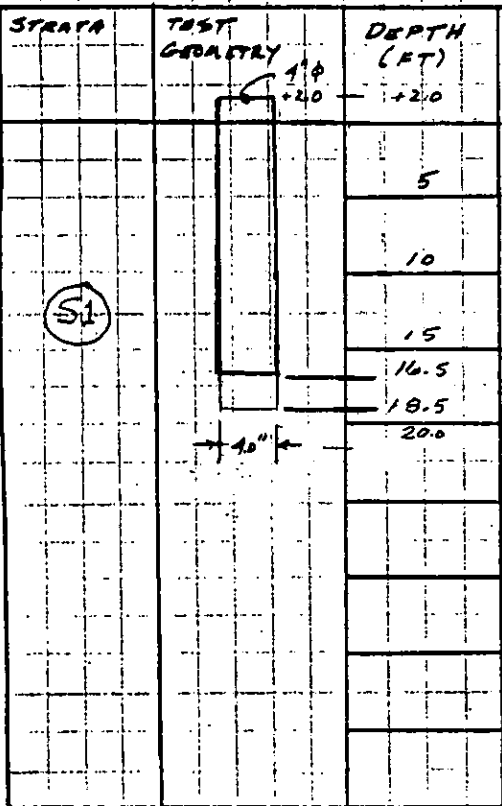
CHECKED BY: DATE:

SUBJECT

## CONSTANT HEAD PERMEABILITY TEST

BORE HOLE: PZ-210U DATE: 04-10-86

LOCATION: 5' N. Z-216 RES. ENG. P.E. BLOIWEISS



### PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2;
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASING PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

SERIES #2 (16.5 - 18.5) uncased

TEST # 1

TEST # 2

TEST # 3

DATE	CLOCK	Δt MIN	ADD'L VOL. OZ.	GLOBA	Δt MIN	ADD'L VOL. OZ.	CLOCK	Δt MIN	ADD'L VOL. OZ.	REMARKS
04-10-86	0915	0.0	-	1000			1040 hr			
		0.5	-		0.0	3.0		0.0	1.0	
	0916	1.0	1	1001	Test	2.0	1041	Test	1.5	
	0917	2.0	1	1002	#1	2.0	1042	#1	1.5	
	0918	3.0	1.5	1003		3.0	1043		2.0	
	0920	5.0	3.5	1005		5.0	1045		4.5	
	0925	10.0	23.0	1010		12.0	1050		8.0	
	0927	12.0	12.0	1012		4.0	1052		4.0	
	0935	20.0	28.0	1020		16.0	1100		26.0	
	0940	25.0	19.0	1025		9.0	1105		16.0	
	0945	30.0	16.0	1030		8.0	1110		16.0	
			Σ=110.0			Σ=64.0			Σ=84.5	

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET NO. 3 OF 8  
FILE 6329

MADE BY PEB DATE 04-10-86

FOR SALTSTONE DISPOSAL - Z AREA S.R.P

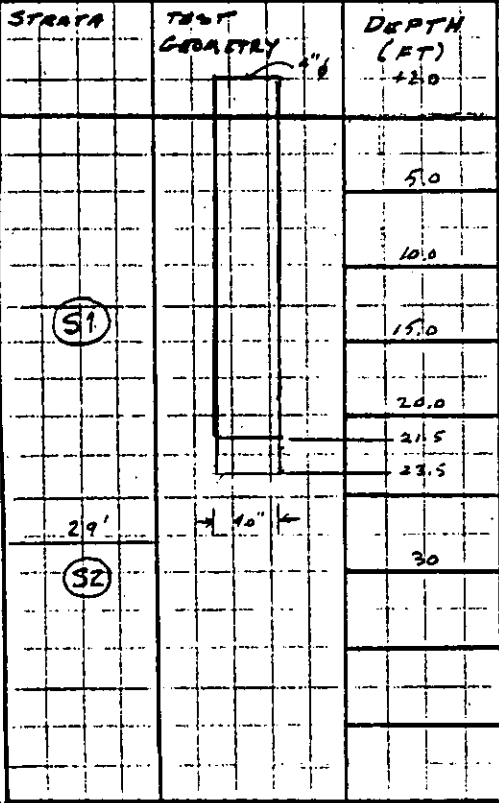
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

SUBJECT

## CONSTANT HEAD PERMEABILITY TEST

BORE HOLE PZ-210U DATE 04-11-86

LOCATION: 50' N of Z-210P RES. ENG P.E. Bleiweiss



### PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASSED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

SERIES #2 (21.5' - 23.5') uncased

test # 1

test # 2

test # 3

DATE	CLOCK	Δt MIN	ADD'L VOL. OZ	CLOCK	Δt MIN	ADD'L VOL. OZ	CLOCK	Δt MIN	ADD'L VOL. OZ	REMARKS
04-11-86	1535	0.0		1610			1645			
		0.5	2.0		0.0	2.0		2.0		
	1536	1.0	2.0	1611	test # 1	2.0	1646	1.5		
	1537	2.0	3.5	1612	# 2	2.0	1647	3.0		
	1538	3.0	3.5	1613		3.0	1648	2.0		
	1540	5.0	6.0	1615		7.0	1650	8.0		
	1545	10.0	16.0	1620		15.0	1655	14.0		
	1547	12.0	7.0	1622		6.0	1657	5.0		
	1553	20.0	23.0	1630		24.0	1705	21.0		
	1600	25.0	14.0	1635		16.0	1710	13.0		
	1605	30.0	12.0	1640		15.0	1715	13.0		
			Σ=89			Σ=92		Σ=82.5		



# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET No. 4 Of 8

FILE: 6329

MADE BY PEB DATE 04-12-86

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

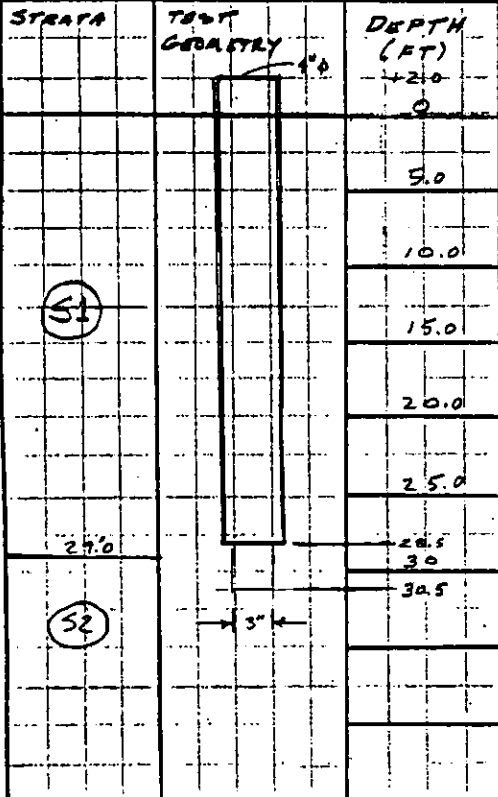
FOR SALTSTONE DISPOSAL - Z-DREA S.R.P.

SUBJECT

## CONSTANT HEAD PERMEABILITY TEST

BORE HOLE PZ-210U DATE 04-12-86

LOCATION 5' N of Z-210P RES. ENG. P.E. Blumweiss



### PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASD PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

SERIES # 3 (28.5' - 30.5') uncased

test # 1

test # 2

test # 3

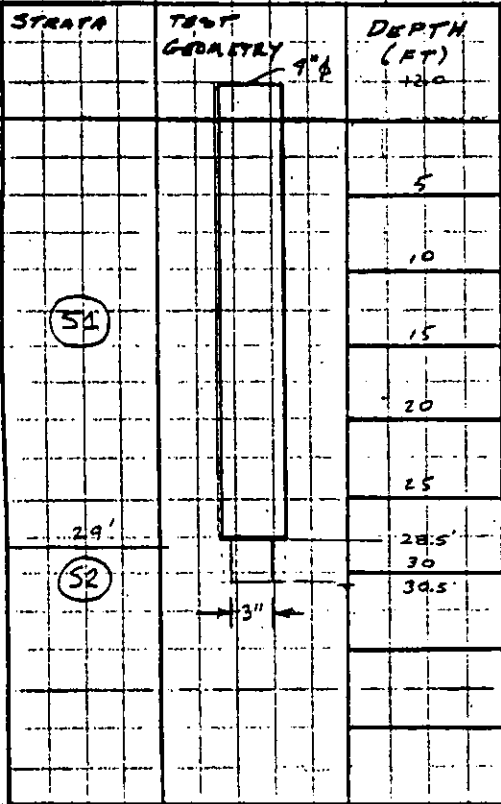
DATE	CLOCK	Δt MIN	ADD'L VOL. (GZ)	CLOCK	Δt MIN	ADD'L VOL. (GZ)	CLOCK	Δt MIN	ADD'L VOL. (GZ)	REMARKS
04-12-86	1120	0.0		1155			1230			
		0.5	8.0	1155	20	6.0	1230	00	3.0	
	1121	1.0	8.0	1156	1st	4.0	1231	test # 1	1.5	
	1122	2.0	13.0	1157	# 2	8.0	1232		5.5	
	1123	3.0	13.0	1158		8.0	1233		1.0	
	1125	5.0	24.0	1200		15.0	1235		9.0	
	1130	10.0	34.0	1205		30.0	1240		22.0	
	1132	12.0	16.0	1207		14.0	1242		8.0	
	1140	20.0	64.0	1215		45.0	1250		32.0	
	1145	25.0	39.0	1220		24.0	1255		72.0	
	1150	30.0	32.0	1220		28.0	1300		72.0	
			Σ=271			Σ=184			Σ=229	

SUBJECT

**CONSTANT HEAD PERMEABILITY TEST**

BORE HOLE PZ-210U DATE 02-12-86

LOCATION: 5' N of 2-210P RES. ENG P.E. Blowers



**PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST**

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2;
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASSED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR;
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER;

SERIES 3 CONT. (28.5'-30.5') uncased

Test # A

DATE	CLOCK	$\Delta t$ MIN.	ADD'L VOL. OZ.	CLOCK	$\Delta t$ MIN.	ADD'L VOL.	CLOCK	$\Delta t$ MIN.	ADD'L VOL.	REMARKS
04-12-86	1305	0.0								
		0.5	8.0							
	1306	1.0	10.0							
	1307	2.0	13.0							
	1308	3.0	10.0							
	1310	5.0	22.0							
	1315	10.0	44.0							
	1317	12.0	15.0							
	1325	20.0	62.0							
	1330	25.0	27.0							
	1335	30.0	24.0							
			$\Sigma 235$							

MUESER RUTLEDGE CONSULTING ENGINEERS

PIEZOMETER RECORD

PROJECT SALTSTONE DISPOSAL - Z-AREA PIEZOMETER NO. PZ-210U

LOCATION SAVANNAH RIVER PLANT

PIEZOMETER LOCATION 5.0 N OF Z-210P DATE OF INSTALLATION 4-12-86

SEE SKETCH ON BACK

RES. ENG. PETER E. BLEIWEISS

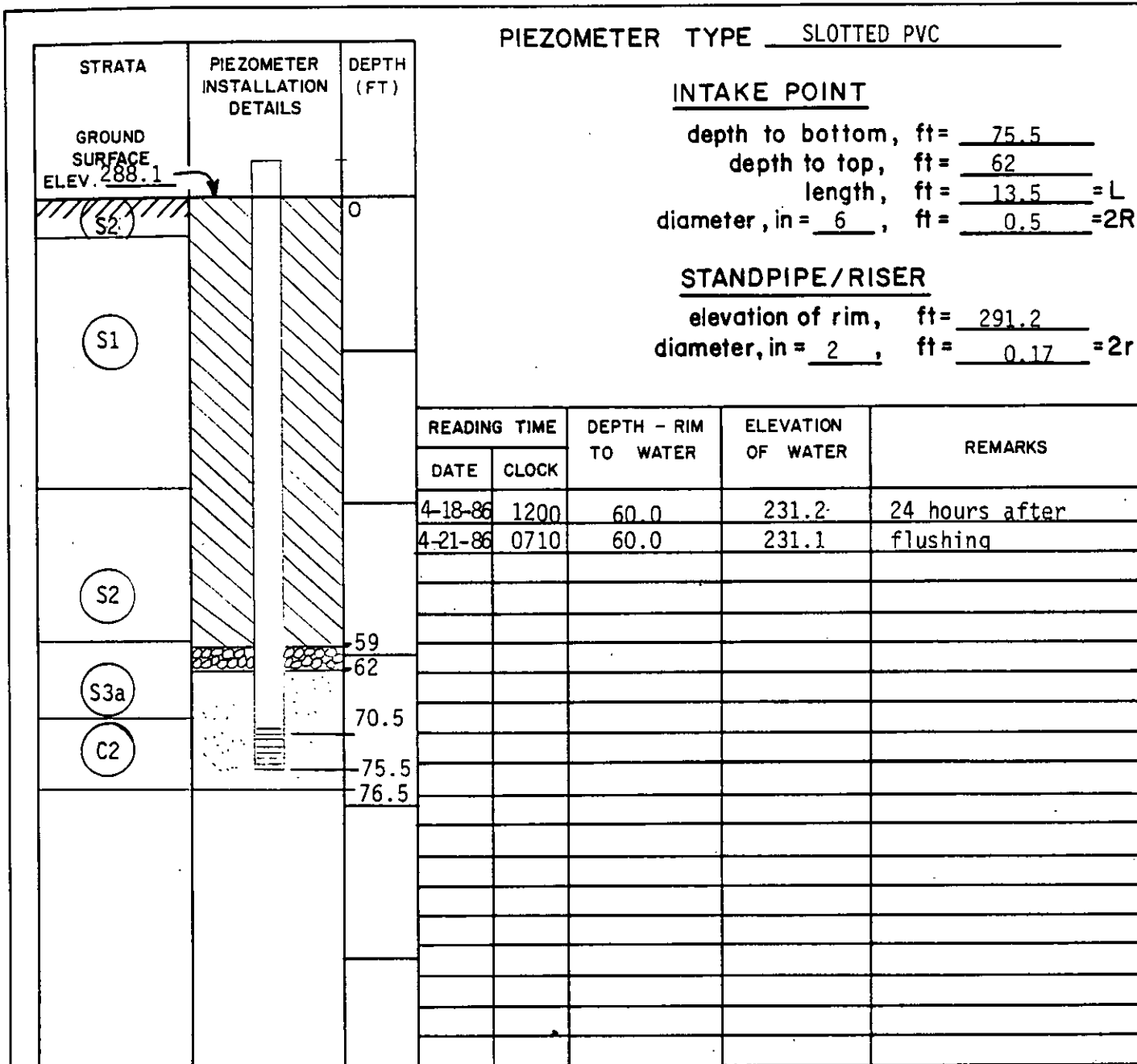
PIEZOMETER TYPE SLOTTED PVC

INTAKE POINT

depth to bottom, ft = 75.5  
 depth to top, ft = 62  
 length, ft = 13.5 = L  
 diameter, in = 6, ft = 0.5 = 2R

STANDPIPE/RISER

elevation of rim, ft = 291.2  
 diameter, in = 2, ft = 0.17 = 2r



GROUND SURFACE ELEV. 288.1

PIEZOMETER NO. PZ-210U



MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 9 of 9  
File No. 6329

PROJECT SALTSTONE DISPOSAL Z-AREA BORING NO. PZ-210U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION 5' NORTH OF Z-210P  
SURFACE ELEVATION 288.1 DATUM U.S.G.S.

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES 4.0, DEPTH FROM 0.0' TO 31.0'  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES \_\_\_\_\_  
TYPE OF DRILLING MUD \_\_\_\_\_  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N 2-3/8" D-SAMPLER \_\_\_\_\_  
S-SAMPLER \_\_\_\_\_ U-SAMPLER SHELBY  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30  
SAMPLER HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION*

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 76.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 0.0 LIN. FT.  
REDRILLING OF GROUTED HOLES \_\_\_\_\_ HOURS. CASING UTILIZED 31.0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 9.0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 3

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	3	0.25	7.4					7.4

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER THOMAS LOWE HELPERS GLEN DODSON, DAVE GOODWIN

REMARKS PZ. REQUIRED FLUSHING

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-18-86

BORING No. PZ-216U

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-211U

SURFACE ELEV. 289.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HGL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
APRIL 4, 1986, SUNNY & WARM, 88°F	0730	1D	0.0	1-1	S1		NEG		
			1.5	2				NEG	
		2D	2.5	1-1		Do 1D			
			4.0	1		(SP-SM)	5		
		3D	5.0	1-2		Light brown fine sand, trace silt		NEG	
			6.5	2		vegetation (SP-SM)			
		4D	7.5	2-7		Light brown & red-brown f-m sand		NEG	
			9.0	9		some clay (SC)	10		
		5D	10.0	7-13		Mottled gray & red-brown clayey		NEG	
			11.5	17		f-m sand, tr m sand (SC)		NEG	
		6D	12.5	13-19		Do 5D			
			14.0	23		(SC)	15		
		7D	15.0	10-20		Red-brown f-m clayey sand, trace		NEG	
			16.5	22		coarse sand, gravel (SC)	20		
	8D	20.0	8-20	Do 7D, trace white clay pockets		NEG			
		21.5	22	(SC)	25				
	9D	25.0	8-16	Mottled light brown, gray & purple		NEG			
		26.5	13	f-m sand, some clay (SC)	30				
	10D	30.0	9-12	Purple f-m sand, some clay	S2	NEG			
		31.5	9	(SC)		35			
	11D	35.0	6-9	Yellow-brown f-m sand, some clay		NEG			
		36.5	10	(SC)	38				
	12D	40.0	6-11	Yellow-brown f-m sand, trace clay		NEG			
		41.5	10	(SP-SC)	40				
	13D	45.0	7-13	Yellow-brown m-f sand, trace clay		NEG			
		46.5	15	coarse sand (SP-SC)	45				
	14D	50.0	9-15	Brown-yellow f-m sand, trace silt		NEG			
		51.5	18	coarse sand (SP-SM)	50				

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL, Z-AREA

BORING NO. Z-211U

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS  
SURFACE ELEV. 289.5

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
APRIL 4, 1986	15D	55.0	9-12	Red-brown f-m sand, trace clay, yel-brn f-m sand pockets and seams (SP-SC)		55	NEG		
		56.5	16						
	16D	60.0	4-6	Stiff yellow silty clay, some fine sand, trace lignite (CH)		60	NEG		
		61.5	7						
1630 0715	17D	63.0	3-5	Stiff yellow silty clay, trace fine sand, lignite (CH)		65	NEG		
	18D	64.5	7						
APRIL 7, 1986	18D	65.0	4-3	Yellow-gray clayey fine sand (SC)		70	NEG	Note: Washed to 96.5' attempt to push shelby tube 25U (success) upon retrieval of tube winch clutch failed to engage.	
		66.5	5						
	19D	70.0	3-3	Stiff yellow-gray fine sandy clay, trace brn f-m sand layers, lignite (CH)		75	NEG		
		71.5	4						
	SUNNY & WARM, 89°F	20D	75.0	2-3	Light brown f-m sand, some clay, clay pockets (SC&CH)		80		NEG
			76.5	5					
APRIL 7, 1986	21D	80.0	9-14	Brown m-f sand, some clay (SC)		85	NEG		
		81.5	15						
	22D	85.0	12-12	Light brown f-m sand, trace clay, clay seams (SP-SC)		90	NEG		
		86.5	9						
23D	90.0	5-8	Dark brown-gray f-m sand, trace clay, coarse sand, clay pkts (SP-SC)		95	NEG			
	91.5	16							
	24D	95.0			1-WH/12"		Mottled white & gray clayey f-m sa, tr brn f-m sa pkts, lignite (SC)		NEG
	25S	96.5			Push=24"		Gry brn clayey f-m sand w/white clay layers and pockets (SC)		NEG
26D	98.5	Rec=24"	Light brn-yel f-m sand, some clay, trace white clay layers (SC)		100	NEG			
	99.5	4-8							
	26D	100.0	16						

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-211U

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 289.5

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 7, 1986 1600 0730 APRIL 8, 1986 - T. STORMS, CLEARING 70°F	27D	105.0 106.5	48-55 39	Light gray calcareous clayey f-c sand, some cemented particles & shells fragments (SC)		105	POS	Bit is drilling hard.
	28D	110.0 111.5	10-10 16	Light gray-white calcareous f-m sand, sm cl, cemented particles (SC)		110	POS	
	29D	115.0 116.5	13-22 21	Do 28D (SC)		115	POS	
	30D	120.0 121.5	14-16 15	Gray-light brn calcareous fine sand, sm cl, cemented particles (SC)		120	POS	
	31D	125.0 126.5	5-9 5	Gray calcareous fine sand, some clay (SC)		125	POS	
	32D	130.0 131.5	35-100 100	Gray calcareous fine sand, some clay, cemented particles, trace shells (SC)		130	POS	
	NR	135.0 135.0	100/0"	NO RECOVERY		135		
	33D	137.5 138.8	12-30 50/4"	Gray calcareous fine sand, some clay, trace shell frgmts (SC)		140	POS	
	34D	140.0 140.8	24-50/4"	Do 33D, trace clay (SP-SC)			POS	
	35D	145.0 146.5	12-19 24	Dark gray-green clayey f-m sand (SC)		145	NEG	
APRIL 9, 1986 COOL, BREEZY, 70°F 1330	36D	150.0 151.5	15-19 20	Hard dark gray-green clayey silt trace f-m sand partings (MH)		150	NEG	End of boring at 151.5'.

Note: Possibly limestone @ 135.0'

Note: Loosing 0.5 vol. of drilling fluid @ 137.0'. Shell fragments in wash @ 137.5'.



PROJECT SALTSTONE DISPOSAL, Z AREA, S.R.P

MADE BY PEB DATE 4/9/66  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-211U

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	Batch CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
1880 04-09-66	Grouting	157.5	0.0			1	7.9	0.1	7.5	140	10	mud	
						2	7.9	2.4	5.0	80	"	mud/grout	
						2	2.9	0.1	2.3	40	"	grout	

1.6 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fairing 250  
ALSO USED IN BORINGS   
CEMENT 3 94 LB. BAGS  
BENTONITE 0.25 100 LB. BAGS  
SAND 0 LBS/CU. FT.  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
GROUT PUMPED (G.P.) 7.3 CU. FT.  
GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT \_\_\_\_\_ 94 LB. BAGS  
BENTONITE \_\_\_\_\_ 100 LB. BAGS  
SAND \_\_\_\_\_ LBS/CU. FT.  
WATER \_\_\_\_\_ GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_  
(E.Y.) \_\_\_\_\_  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 6 BAGS  
(E.Y.) \_\_\_\_\_  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.5 BAGS  
(E.Y.) \_\_\_\_\_  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.0 CU. FT.  
(E.Y.) \_\_\_\_\_

COMMENTS: Grout req'd = 13.0 ft<sup>3</sup>, Req'd = 1.13, Time for rig = 1.5 hr

BORING NO. Z-211U

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-211U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 75,741; E. 66,805  
SURFACE ELEVATION 289.5' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8" TRICONE  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N-2 3/8" O.D. D-SAMPLER 2.0" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER SHELBY  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud	CONDITIONS OF OBSERVATION*
04-07-86	0715	64.5'	-	30.0'	OVER WEEKEND
04-08-86	0730	111.5'	-	33.0'	OVER NIGHT
04-09-86	0715	135.0'	-	36.0'	" "

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 151.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 151.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0.0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 1

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 14.6 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	6	0.50	0	14.6				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER NATE PATTERSON HELPERS JEROME HULL

REMARKS GROUTING TIME WAS 1.5HRS, GROUT TAKE RATIO = 1.13

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 04-09-86

BORING No. Z-211U

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-212

SURFACE ELEV. 292.0'

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MARCH 25, 1986 - SUNNY 80°F  1700 0730	1D	0.0	1-1	Dark brown fine sand, trace silt, vegetation (SP)	(S2)		NEG	
		1.5	2					
	2D	2.5	2-3	Brown fine sand, trace silt (SP)			NEG	
		4.0	5			5		
	3D	5.0	3-6	Brown fine sand, trace silt (SP-SM)			NEG	
		6.5	7			7		
	4D	7.5	7-12	Mottled gray & red-brown clayey f-m sand, trace cemented sand fragments (SC)			NEG	
		9.0	17			10		
	5D	10.0	11-21	Do 4D (SC)			NEG	
		11.5	33					
	6D	12.5	15-22	Do 4D (SC)			NEG	
		14.0	29			15		
	7D	15.0	11-19	Do 4D (SC)			NEG	
		16.5	23					
MARCH 26, 1986 - SUNNY, CLEAR 78°F	8D	20.0	10-14	Mottled purple & red-brown clayey fine sand (SC)	(S1)		NEG	
		21.5	17		20			
	9D	25.0	6-9	Mottled purple red-brown & gray clayey f-m sand (SC)		NEG		
		26.5	14		25			
	10D	30.0	8-15	Mottled purple & light gray sand, some clay, trace coarse sand (SC)		NEG		
		31.5	19		30			
	11D	35.0	11-19	Do 10D (SC)		NEG		
		36.5	20		35			
	12D	40.0	10-16	Do 10D (SC)		NEG		
		41.5	20		40			
	13D	45.0	10-12	Mottled purple & red-brown f-m sand, some clay (SC)		NEG		
		46.5	17		45			
	14D	50.0	8-7	Red-brown f-m sand, some clay (SC)		NEG		
		51.5	12		48			
				(S2)		50	NEG	

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-212

SURFACE ELEV. 292.0

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MARCH 26, 1986, CONT'D	15D	55.0	9-13	Yellow-Brown fine to medium sand, trace clay (SP-SC)		55	NEG	
		56.5	13					
	16D	60.0	14-18	Yellow-brown fine to medium sand, trace clay (SP-SC)	S2	60	NEG	
		61.5	22					
	17D	65.0	19-34	Yellow brown fine to medium sand, trace clay (SP-SC)		65	NEG	
		66.5	36					
	18D	70.0	32-57	Mottled red-brown & yellow m-f sand, trace clay (SP)		70	NEG	
		71.5	69					
	19D	75.0	4-2	Medium red-brown m-f sand, some clay, trace coarse sand (SC)	S3a	75	NEG	
		76.5	5					
	20D	76.5	4-5	Mottled light gray & brown clayey m-f sand (SC)		76.5	NEG	
		78.5	3-4					
	21D	78.5	3-2	Brown-yellow clayey fine sand, trace lignite (SC)		80	NEG	
		80.5	6-6					
	22D	80.5	5-5	Interlayered yellow-brown fine sand, sm cl. & sandy clay (SC&CH)	C2		NEG	
		82.5	7-10					
	23D	82.5	4-6	Do 22D (SC&CH)		85	NEG	
		84.5	7-10					
	24D	85.0	6-7	Do 22D, trace lignite (SC&CH)		88	NEG	
		87.0	9-10					
	25D	90.0	2-1	Mottled gray, brown f-m sand, some clay, trace lignite (SC)		90	NEG	
		91.5	4					
	26D	91.5	5-11	Mottled gray & yellow brown f-m sand, some clay (SC)	S3a	95	NEG	
		93.5	11-11					
	27D	95.0	3-7	Mottled yellow-brown & gray m-f sand, some clay (SC)		98	NEG	
		96.5	14					
	28D	100.0	17-36	Mottled yel-brn, lt brn f-m sand tr cl, clayey f sa llys (SP-SC)	S3b	100	NEG	
		101.5	44					

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-212

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS  
SURFACE ELEV. 292.0

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
3-26-86 CONT'D 1630 0720	29D	105.0	17-27	Mottled yellow-brown & light brown m-f sand, trace clay (SP-SC)	(S3b)		NEG	Started drilling hard @ 117.0'.  Rod dropped 0.5' At 123.0' calc fgmts. in wash.
		106.5	34			105		
	30D	110.0	21-31	Mottled gray & brown f-c sand, some clay (SC)	(S3a)		NEG	
		111.5	50			108		
	31D	115.0	15-35	Mottled brown & gray f-m sand, some clay, trace cemented fgmts (SC)	(S3a)		NEG	
		116.5	20			110		
	32D	120.0	14-12	Mottled yellow-brown & light gray fine sand, some clay, fine sandy clay layers (SC)	(S3a)		NEG	
		121.5	15			115		
MARCH 27, 1986 - SUNNY, 78°F	33D	125.0	12-28	Gray-green calcareous fine sand some silt, fine sandy clay lyrs (SM)	VOID		POS	
		126.5	35			120		
	34D	130.0	21-26	Gray-green fine sand, some clay calcareous cemented fragments (SC)	(S4)		POS	
		131.5	34			123		
	35D	135.0	5-10	Gray-green calcareous clayey fine sand, trace calcareous fragments (SC)	(S4)		POS	
		136.5	21			123.5		
	36D	140.0	16-47	Do 35D (SC)	(S4)		POS	
		141.1	50/2"			125		
1740 0730	37D	145.0	18-33	Gray calcareous fine sand, some clay, shell fragments (SC)	(S4)		POS	
		146.5	39			130		
3-28-86 SUNNY, WINDY	38D	150.0	8-16	Hard gray-green clayey silt, trace f-m sand (MH)	(M1)		NEG	
		151.5	27			135		

BORING NO. Z-212

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-212

SURFACE ELEV. 292.0

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
3-28-86 CONT'D  1100	39D	155.0	9-9	Gray-green silty f-m sand, trace coarse sand, lignite (SM)	M1	155	NEG	End of boring @ 156.5'.
		156.5	19			156.5		
						160		
						165		
						170		
						175		
						180		
						185		
						190		
						195		
						200		

PROJECT SALTSTONE DISPOSAL, Z-AREA S.R.P.

MADE BY PEB DATE 9/28/48  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-212

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	TANK CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
03-28-48	Grouting	156.5				1	7.9	0.1	7.3	190	15 psi	Mud	
"						2	7.9	0.1	7.3	190	"	grout	
"						3	7.4	3.7	3.6	50'		grout	

18.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. 1

ALSO USED IN BORINGS \_\_\_\_\_

CEMENT 3 94 LB. BAGS

BENTONITE 1/4 100 LB. BAGS

SAND \_\_\_\_\_ LBS/CU. FT.

WATER 30 GALS.

W./W.O. 3% CaCl<sub>2</sub> *Prepared*

ESTIMATED YIELD (E.Y.) 22.2 CU. FT.

GROUT PUMPED (G.P.) 18.1 CU. FT.

GROUT WASTED (G.W.) 3.9 CU. FT.

TRUCK NO. \_\_\_\_\_

ALSO USED IN BORINGS \_\_\_\_\_

CEMENT \_\_\_\_\_ 94 LB. BAGS

BENTONITE \_\_\_\_\_ 100 LB. BAGS

SAND \_\_\_\_\_ LBS/CU. FT.

WATER \_\_\_\_\_ GALS

W./W.O. 3% CaCl<sub>2</sub>

ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.

GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.

GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

COMMENTS: *Vol. of hole = 13.4*

*Grout take ratio = 18.2 / 13.4 = 1.35*

*3.9 ft<sup>3</sup> grout wasted*

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_

(E.Y.)

BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 21.0 BAGS

(E.Y.)

BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.75 BAGS

(E.Y.)

CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.0 CU. FT.

(E.Y.)

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No. 6329

PROJECT SALTSTONE DISPOSAL, Z-AREA BORING NO. Z-212  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 76049, E. 66, 463  
SURFACE ELEVATION 292.0 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8" TRICONE  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUDDLEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud	CONDITIONS OF OBSERVATION*
3-26-86	0730	16.0	-	-	OVERNIGHT
3-27-86	0730	106.0	-	30.0	OVERNIGHT
3-28-86	0720	146.5	-	39.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 156.5' LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 156.5' LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES \_\_\_\_\_

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50/lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
-	9	0.75	0.0					
TOTAL	9	0.75	0.0	18.2				18.2 FT <sup>3</sup>

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER THOMAS LOWE

HELPERS DAVID EDWARDS, GLENN DODSON

REMARKS GROUTING TIME: 1.5 HRS.

RESIDENT ENGINEER PETER E. BLEIWEISS

DATE 3-20-86



# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-213

SURFACE ELEV. 293.4

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
MARCH 19, 1986 - OVERCAST	0900	1D	0.0	1-3	(S2)		NEG		
			1.5	1			NEG		
		2D	2.5	1-2	Do 1D	4	NEG		
			4.0	2	(SP-SM)	5			
		3D	5.0	6-15	Mottled gray & yellow brown fine to medium sand, some clay (SC)		NEG		
			6.5	15			NEG		
		4D	7.5	8-12	Do 3D, trace coarse sand (SC)		NEG		
			9.0	20		10			
		5D	10.0	18-31	Mottled light gray & red-brown fine to medium sand, some clay, trace coarse sand (SC)	(S1)	NEG		
			11.5	38					NEG
		6D	12.5	18-28	Red brown medium to fine sand, some clay, trace coarse sand (SC)		15		NEG
			14.0	35					NEG
		7D	15.0	14-25	Do 6D		NEG		
			16.5	27	(SC)				
	8D	20.0	9-12	Mottled purple & gray fine to medium sand, some clay (SC)		NEG			
		21.5	15						
	9D	25.0	10-16	Do 8D, red-brown & purple (SC)		NEG			
		26.5	17						
	10D	30.0	10-12	Mottled red-brown & purple m-f sand, some clay (SC)		NEG			
		31.5	12						
	11D	35.0	10-11	Do 10D		NEG			
		36.5	11	(SC)					
	12D	40.0	10-13	Yellow-brown fine to medium sand, trace clay (SP-SC)	(S2)	NEG			
		41.5	17						
	13D	45.0	9-12	Yellow-brown & purple fine to medium sand, trace clay (SP-SC)		NEG			
		46.5	21						
	14D	50.0	16-23	Mottled brown & purple f-m sand, trace silt (SP-SM)		NEG			
		51.5	22						

BORING NO. Z-213

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - 7-AREA

BORING NO. Z-213

SURFACE ELEV. 293.4

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1300 0730								
	15D	55.0 56.5	12-20 21	Brown yellow m-f sand, trace clay (SP-SC)	S2	55	NEG	
	16D	60.0 61.5	29-60 70	Red brown-yellow f-m sand, trace silt, clay pockets (SP-SM)		60	NEG	
	17D	65.0 66.5	23-31 35	Yellow f-m sand, trace silt, coarse sand (SP-SM)		65	NEG	
						68		
	18D	70.0 71.5	10-13 17	Mottled gray-green & brown f-m sand, some clay, clay layers, lignite seams (SC&CH)	S3a	70	NEG	
	19D	71.5 73.0	9-13 28	Gry & brn clayey f sand, trace clay seams (SC)		75	NEG	
	20D	75.0 76.5	9-16 20	Do 19D, some clay layers (SC)			NEG	
						80		
	21D	80.0 81.5	15-18 29	Light brown fine sand, some clay, trace lignite (SC)			NEG	
	22D	85.0 86.5	12-18 25	Mottled light gray, yellow f-m sand, some clay, trace clay lysrs, lignite (SC)	S3b	85	NEG	
						88		
	23D	90.0 91.2	12-48 50/3"	Mottled light gray & light brn f-m sand, trace clay, lignite (SP-SC)		90	NEG	
	24D	95.0 96.4	24-65 50/5"	Mottled brown & yellow f-m sand, trace clay, coarse sand (SP-SC)			NEG	
	25D	100.0 100.8	47-50/4"	Mottled brown & yellow f-m sand, trace clay, coarse sand (SP-SC)		100	NEG	

MARCH 21, 1986 - COOL, WINDY, SUNNY

MUESER RUTLEDGE CONSULTING ENGINEERS

DOUBLE SCALED PAGE

SHEET 3 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-213

SURFACE ELEV. 293.4

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
March 21, 1986 (CONT'D)	26D	101.5 103.0	42-42 34	Mottled brown & gray clayey f-m sand (SC)	S3b	101	NEG		
	27D	103.0 104.5	11-38 49	Do 26D, some layers of yellow f-m sand (SC)				NEG	
	28D	104.5 106.0	19-17 19	Hard mottled gray & light brown clay, some clayey fine sand lys (SC)	S3a	105	NEG		
	29D	106.0 107.5	9-14 25	Mottled yellow & light gry fine sand, some clay, tr lignite (SC)				NEG	
	30D	107.5 109.0	19-25 27	Gray-green fine sand, some clay, trace lignite (SC)		109	NEG		
	31D	109.0 110.1	16-27 50/2"	Gray-green fine sand, some clay, tr medium sand, trace calc fgmts (SC)	S4	110	POS		
	32D	110.5 111.3	29-50/4"	Light gray-light yellow calc clayey f-m sand, cemented part (SC)				POS	
	33D	112.0 112.8	45-50/4"	Light gray-yellow calcareous clayey f-m sand, trace shell fragments (SC)			115	POS	
	34D	115.0 116.5	10-14 33	Light gray-green calc fine sand, some silt, fine sandy clay pkts (SM)				POS	
	March 24, 1986 --	35D	120.0 121.5	20-46 47	Light gray calcareous fine sand, some silt, trace clay partings, calcareous fragments (SM)		120	POS	
36D		125.0 126.5	12-28 29	Light gray-green calcareous fine sand, some clay, calc cmtd fgmts (SC)		125	POS		

BORING NO. Z-213

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-213

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS  
SURFACE ELEV. 293.4

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
MARCH 24, 1986 (CONT'D)	37D	130.0 130.8	36-50/4"	Light brown calcareous clayey fine sand with limestone fgmts (SC)	S4	130	POS	From 134 - 142 drilling as if rock.	
	38D	135.0 135.1	100/2"	Light brown-gray siltstone fgmts trace calcareous sand (GP)		135	POS		
	39D	140.0 141.5	20-32 74	Do 38D (GP)		140	POS		
	40D	145.0 146.3	17-35 50/4"	Gray-white calc clayey fine sand (SC)		145	POS		
	41D	150.0 150.8	31-50/4"	Do 40D (SC)		150	POS		
	42D	155.0 156.5	20-30 50	Hard dark gray-green clayey silt, trace fine sand, silt partings (MH)		M1	NEG		
	43D	160.0 161.5	15-32 48	Dark gray silty f-m sand (GM)		NEG	End of boring at 161.5'.		
						160			
						161.5			
						165			
						170			
						175			

1700

BORING NO. Z-213

PROJECT SALTSTONE DISPOSAL, Z-AREA

MADE BY PEB DATE 03-25-68  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE OF

GROUTING REPORT - BORING NO. Z 2/3

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
03-25-68	Grouting	161.5	—	—	—	1	7.4	0.1	7.3	150'	15.0	Mud	
						2	7.4	0.1	7.3	130	15.0	Grout	
						3	7.4	0.1	7.3	100	15.0	Grout	
						4	7.4	0.1	7.3	50	15.0	Grout	

29.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT 12 94 LB. BAGS  
BENTONITE 1 100 LB. BAGS  
SAND 0 LBS/CU. FT.  
WATER 144 GALS.  
W./W.O. 3% CaCl<sub>2</sub>

ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT \_\_\_\_\_ 94 LB. BAGS  
BENTONITE \_\_\_\_\_ 100 LB. BAGS  
SAND \_\_\_\_\_ LBS/CU. FT.  
WATER \_\_\_\_\_ GALS.  
W./W.O. 3% CaCl<sub>2</sub>

ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

RATIO OF (G.P.) = \_\_\_\_\_ (E.Y.)  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ BAGS  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ BAGS  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ CU. FT.

COMMENTS: Vol. Req'd to fill hole = 13.8 ft<sup>3</sup>, Ratio of Grout Used to Grout req'd = 2.1

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-213  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 75,861 E. 66,524  
SURFACE ELEVATION 293.4 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8" TRICONE  
TYPE OF DRILLING MUD FLORIGEL, H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N 2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
3-21-86	0730	51.5'	-	40.0'	48 HOUR STABILIZATION
3-24-86	0730	111.3'	-	52.0'	72 HOUR STABILIZATION

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 161.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 161.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
-	12.0	1.0		29.2				
TOTAL	12.0	1.0	0.0	29.2				29.2 FT <sup>3</sup>

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER THOMAS LOWE HELPERS DAVE GOODWIN, EDWARD DODSON  
REMARKS 3 HOURS GROUT TIME  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 3-25-86

BORING No. Z-213

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-214

SURFACE ELEV. 295.0

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1030	1D	0.0	3-3	Light gray-brown fine sand, trace silt (SP)	S2		NEG	
		1.5	3					
	2D	2.5	3-2	Do 1D (SP)			NEG	
		4.0	2				5	
	3D	5.0	3-4	Light brown fine sand, trace silt (SP)			NEG	
		6.5	4				7	
	4D	7.5	4-4	Mottled brown & red-brown f-m sand, some clay (SC)			NEG	
		9.0	6				10	
	5D	10.0	4-5	Do 4D, brown & gray, trace gravel (SC)			NEG	
		11.5	8					
	6D	12.5	3-8	Mottled brn-yel & gry f-m sand, some clay (SC)			NEG	
		14.0	14				15	
7D	15.0	19-28	Mottled red-brown & yel f-c sand, some clay (SC)		NEG			
	16.5	33						
8D	20.0	7-11	Mottled red-brown & purple fine sand, some clay (SC)		NEG			
	21.5	16						
9D	25.0	WH-4	Mottled purple & red-brown clayey fine sand, trace medium sand (SC)	S1		NEG		
	26.5	8						
10D	30.0	6-9	Mottled purple & light gray f-m sand, some clay (SC)			NEG		
	31.5	12				30		
11D	35.0	8-12	Do 10D, trace coarse sand, clay seams (SC)			NEG		
	36.5	12				35		
12D	40.0	7-11	Mottled red-brown & purple f-m sand, sm clay, tr c sand (SC)			NEG		
	41.5	11				40		
13D	45.0	10-13	Mottled red-brown & purple fine sand, sm cl, tr m sand (SC)			NEG		
	46.5	15				45		
14D	50.0	8-12	Yellow-brown fine to medium sand, some clay (SC)			NEG		
	51.5	11				50		

MARCH 19, 1986 - OVERCAST, WINDY, RAIN, 65°F

1300  
0800

MARCH 21, 1986

2 attempts.

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-214

SURFACE ELEV. 295.0

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS		
	NO.	DEPTH	BLOWS/6"							
MARCH 21, 1986 - SUNNY, 80°F	NR	55.0 56.5	11-12 13	NO RECOVERY	S1	55		2 attempts.		
	15D	60.0 61.5	13-17 21	Mottled red-brown & yellow brown f-m sand, some clay (SC)		60	NEG			
	16D	65.0 66.5	15-27 25	Brown fine sand, trace clay, medium to coarse sand (SP-SC)		S2	65		NEG	Losing some water.
	NR	70.0 71.5		NO RECOVERY			70 71			
	17D	75.0 76.5	5-11 38	Mottled red-brown & yellow brown f-m sand, some clay (SC)	S3a	75	NEG			
	18D	80.0 81.5	8-11 11	Top:Rd-brn clayey f-m sand (SC) Bot:Yel-brn f-m sa, sm cl (SC)		C2	80	NEG		
	19D	81.5 83.0	3-3 3	Yellow-brown fine sand, some clay (SC)	81.5					
	20D	83.0 84.5	4-5 4	Do 19D (SC)	S3a	85	NEG			
	21D	84.5 86.0	4-4 4	Do 19D (SC)		86	NEG			
	22D	86.0 87.5	10-11 12	Brown f-m sand, some clay (SC)	S3a	90	NEG			
	23D	90.0 91.5	11-13 20	Yellow-brown clay, some fine sand (CH)			NEG			
	24D	95.0 96.5	6-10 15	Mottled brown & yellow f-m sand, some clay, trace lignite (SC)		95	NEG			
	25D	100.0 101.5	4-10 10	Mottled brown & yellow-brown m-f some clay, trace lignite (SC)	100	NEG				



# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-214

SURFACE ELEV. 295.0

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
MARCH 28, 1986 - SUNNY, 80°F	26D	105.0	12-17	Mottled gray & brown m-f sand, some clay, tr c sand (SC)	(S3a)	105	NEG		
		106.5	21			110			
	27D	110.0	15-18	Mottled white & yellow-brown f sandy clay, trace lignite (CL)		115	NEG		
		111.5	11			117			
	28D	115.0	4-5	Mottled white & yellow brown clayey f-m sand (SC)		120	NEG		Limestone fgmts in wash @ 117.0'.
		116.5	10			125			
	29D	120.0	9-10	Light gray-green calcareous fine sand, some clay, calc fgmts (SC)		130	POS		
		121.5	21			135			
	30D	125.0	9-18	Light gray-green calcareous clayey f-c sand, some cemented fragments (SC)		140	POS		
		126.5	21			145			
31D	130.0	16-15	Light gray-green calcareous fine sand, some clay, trace shell (SC)	150	POS				
	131.5	14		155					
32D	135.0	7-16	Light gray-green calcareous fine sand, some clay, limestone fragments (SC)	160	POS				
	136.5	29		165					
33D	140.0	11-15	Light gray-green fine sand, some clay, calcareous fragments (SC)	170	POS				
	141.5	11		175					
34D	145.0	7-21	Light gray-green calcareous fine sand, some clay (SC)	180	POS				
	146.5	20		185					
35D	150.0	3-3	Light green-gray fine sand, some clay (SC)	190	NEG				
	151.0	5		195					

1800  
1030

MARCH 29, 1986 - CLEAR, 85°F

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL, Z-AREA

BORING NO. Z-214

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 295.0'

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MARCH 29, 1986 SUNNY, CLEAR 85°F	36D	155.0	8-11	Dark gray-green f-c sand, some silt (SM)	S4	153	NEG	End of boring at 161.5'.
		156.5	13			155		
1300	37D	160.0	6-11	Dark gray green clayey silt, trace fine sand (MH)	M1	160	NEG	
		161.5	15			161.5		
						165		
						170		
						175		
						180		
						185		
						190		
						195		
						200		

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
<u>03-31-68</u>	<u>Grouting</u>	<u>161.5</u>	<u>—</u>			<u>1</u>	<u>7.9</u>	<u>- 1</u>	<u>7.3</u>	<u>140'</u>	<u>15psi</u>	<u>grout</u>	
						<u>2</u>	<u>7.9</u>	<u>.1</u>	<u>7.3</u>	<u>50'</u>	<u>"</u>	<u>grout</u>	

BATCH DETAILS

TRUCK NO. \_\_\_\_\_ SUB TOTAL CU. FT. 14.6

TRUCK NO. \_\_\_\_\_ ALSO USED IN BORINGS \_\_\_\_\_

MATERIALS USED

CEMENT 3 94 LB. BAGS RATIO OF (G.P.) = \_\_\_\_\_ (E.Y.) = \_\_\_\_\_

BENTONITE 0.25 50 LB. BAGS BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.5 BAGS

SAND 0 LBS/CU. FT. BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 BAGS

WATER 36 GALS. WATER \_\_\_\_\_ GALS. BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ BAGS

W./M.O. 3 1/2 CaCl<sub>2</sub> 13.8 3 100 100 W./M.O. 3 1/2 CaCl<sub>2</sub> BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ BAGS

ESTIMATED YIELD (E.Y.) 19.6 CU. FT. ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT. BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ BAGS

GROUT PUMPED (G.P.) 14.6 CU. FT. GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT. CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.

GROUT WASTED (G.W.) 0.2 CU. FT. GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT. (E.Y.) = \_\_\_\_\_

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No. 6324

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-214  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 75.669 E. 66.587  
SURFACE ELEVATION 295.0' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8" TRICONE  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N-2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud	CONDITIONS OF OBSERVATION*
3-21-86	0730	41.5	-	-	
3-28-86	0730	96.5	-	33.0'	OVERNIGHT
3-29-86	0730	131.5	-	39.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 161.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 161.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 14.6 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
	6	0.5	0					
TOTAL	6	0.5	0	14.6				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER NATHANIEL PATTERSON HELPERS JEROME HAIL, E.C. TUCKER

REMARKS \_\_\_\_\_

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 3-31-86

BORING No. Z-214

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-215

SURFACE ELEV. 294.7'

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1430	1D	0.0	1-1	Light brown f-m sand, trace silt, vegetation (SP)	S2		NEG	
		1.5	2				NEG	
	2D	2.5	2-3	Do 1D (SP)		4		
		4.0	3			5		
	3D	5.0	8-17	Mottled red-brown & brown clayey fine to medium sand (SC)			NEG	
		6.5	21					
	4D	7.5	8-12	Mottled purple & red-brown clayey fine to medium sand (SC)		10	NEG	
		9.0	18					
	5D	10.0	11-16	Mottled red-brown & yellow fine to medium sand, some clay (SC)			NEG	
		11.5	18					
	6D	12.5	1-3	Mottled red-brown & yellow f-m sand, some clay (SC)			NEG	
		14.0	6			15		
	7D	15.0	7-18	Red-brown fine to medium sand, some clay (SC)			NEG	
		16.5	21					
	8D	20.0	5-9	Do 7D (SC)		20	NEG	
		21.5	12					
	9D	25.0	4-14	Mottled brown & purple f-m sand, some clay w/sm purple cl. lvs (SC)	S1	25	NEG	
		26.5	15					
	10D	30.0	7-11	Mottled red-brown & yellow brown m-f sand, trace clay partings (SP)		30	NEG	
		31.5	18					
	11D	35.0	3-9	Mottled red-brown & purple clayey fine sand, trace wht cl partings (SC)		35	NEG	
		36.5	12					
	12D	40.0	6-10	Mottled red-brown & purple f-m sand, sm cl, wht cl partings (SC)		40	NEG	
		41.5	11					
	13D	45.0	6-9	Do 12D (SC)		45	NEG	
		46.5	11					
	14D	50.0	8-13	Do 12D (SC)		50	NEG	
		51.5	13					

MARCH 31, 1986  
SUNNY, WARM

1700  
0900

APRIL 1, 1986 - SUNNY, 89°F

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-215

SURFACE ELEV. 294.7

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 2, 1986 (CONT'D)	15D	55.0 56.5	8-11 11	Do 12D (SC)	S1	55	NEG	2 attempts
	16D	60.0 61.5	6-9 10	Yellow brown fine to medium sand, some clay (SC)		60	NEG	
	17D	65.0 66.5	3-7 10	Mottled yellow-brown & purple f-m sand, some silt, tr clay (SM)	65	NEG		
	18D	70.0 71.5	12-25 23	Yellow-brown fine to medium sand, some clay (SC)	70	NEG		
	19D	75.0 76.5	10-13 13	Yellow-brown fine to medium sand, trace silt (SP-SM)	75	NEG		
	NR	80.0 81.5	9-20 19	NO RECOVERY	S3a	80		
	20D	81.5 83.0	4-17 40	Brown fine to medium sand, some clay (SC)	84	NEG		
	21D	85.0 86.5	13-33 38	Yellow brown & red-brown fine to medium sand, tr silt, clay pckts (SP-SM)	85	NEG		
	22D	90.0 91.5	19-35 40	Yellow-brown fine to medium sand, trace silt (SP-SM)	90	NEG		
	23D	95.0 96.5	4-8 12	Mottled red-brown & brown clayey fine to medium sand (SC)	95	NEG		
	24D	100.0 101.5	7-10 13	Brown-yellow medium to fine sand, some clay (SC)	S3a	100	NEG	

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-215

SURFACE ELEV. 294.7

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 2, 1986 (CONT'D)             APRIL 3, 1986 - SUNNY, SLIGHTLY CLOUDY, 89°F	25D	105.0	23-39	Mottled red-brown & yellow-brown fine to medium sand, tr c (SP-SC)	(S3b)	103	NEG	
		106.5	42			105		
	26D	110.0	22-31	Red-brown fine to medium sand, some clay (SC)	(S3a)	108	NEG	
		111.5	18			110		
	27D	115.0	22-80	Red-brown fine sand, trace clay, medium sand, lignite (SP-SC)	(S3b)	113	NEG	
		116.4	100/5"			115		
	28D	120.0	13-18	Light gray-green fine to medium sand, some clay, tr clay pockets (SC)	(S3a)	118	NEG	
		121.5	31			120		
	29D	125.0	5-80	Light gray-green calcareous fine sand, some clay, calc fgmts (SC)		123	POS	
		126.5	29			125		
	30D	130.0	50-42	Light gray-green calcareous fine sand, some clay w/calc fgmts (SC)	(S4)	130	POS	
		131.5	33			135		
	31D	135.0	21-105	Light gray-green calc clayey fine sand w/limestone fragments (SC)		140	POS	
		136.1	100/2"			145		
32D	140.0	11-50	Do 31D (SC)		150	POS		
	141.5	60			150			
33D	145.0	26-40	Light gray-green calcareous fine sandy clay, some limestone fgmts (CL)			POS		
	146.5	38						
34D	150.0	31-27	Gray green & white calcareous clayey f-m sand, tr c sand (SC)			POS		
	151.5	30						

BORING NO. Z-215

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-215

SURFACE ELEV. 294.7

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 3, 1986 (CONT'D)	35D	155.0	18-30	Hard dark-gray clayey silt, some fine sand (MH)	(S4)	153		
		156.5	36			155	NEG	
1600	36D	160.0	7-20	Dark gray silty fine to coarse sand (SM)	(M1)	160		End of boring at 161.3'.
		161.3	50/4"			161.3	NEG	
						165		
						170		
						175		
						180		
						185		
						190		
						195		
						200		



PROJECT SALTSTONE DISPOSAL - Z AREA S.R.P

MADE BY PEB DATE 09-01-86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

GROUTING REPORT - BORING NO. Z-215

PAGE 5 OF 6

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	Batch CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH Ft.	GAGE PRESSURE	RETURN	REMARKS
0730 09-01-86	Grouting	161.5	0			1	7.9	0.1	7.3	150	10 psi	mud	
						2	7.4	3.6	3.8	80	"	mud	
						2	3.6	0.1	3.5	90		grout	

14.6 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT 3 94 LB. BAGS  
BENTONITE 0.25 100 LB. BAGS } Batch  
SAND 0.0 LBS/CU. FT. } M.I.X.  
WATER 36 GALS.  
W. / W.O. 3% CaCl<sub>2</sub>

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT \_\_\_\_\_ 94 LB. BAGS  
BENTONITE 100 LB. BAGS  
SAND \_\_\_\_\_ LBS/CU. FT.  
WATER \_\_\_\_\_ GALS.  
W. / W.O. 3% CaCl<sub>2</sub>

MATERIALS USED  
RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_ (E.Y.)  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 6 BAGS (E.Y.)  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.5 BAGS (E.Y.)  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.0 CU. FT. (E.Y.)  
t<sub>grout</sub> = 1.5 hrs

ESTIMATED YIELD (E.Y.) 13.8 CU. FT.  
GROUT PUMPED (G.P.) 14.6 CU. FT.  
GROUT WASTED (G.W.) 0.2 CU. FT.

COMMENTS: \_\_\_\_\_

COMMENTS: Vol of grout req'd ~ 13.8 ft<sup>3</sup>, req'd grout Vol pumped = 1.1,

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-215  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 75.987 E. 66.275  
SURFACE ELEVATION 294.7 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8" TRI-CONE  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N- 2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
4-02-86	0730	86.5	0.0	36.0	OVERNIGHT
4-03-86	0730	126.5	0.0	38.0	OVERNIGHT
4-04-86	0715	161.5	0.0	41.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 161.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 161.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
-	6	0.5						
TOTAL	6	0.5	0.0	14.6				14.6 FT <sup>3</sup>

BORING CONTRACTOR DAVIS DRILLING CO. INC.  
DRILLER NATE PATTERSON HELPERS JEROME HULL  
REMARKS GROUT TIME = 1.5 HR.  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-04-86

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-216

SURFACE ELEV. 294.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MARCH 28, 1986 - SUNNY, CLEAR 80°F	1D	0.0	2-1	Light brown fine sand, trace silt, vegetation (SP)	(S2)		NEG	
		1.5	1				NEG	
	2D	2.5	1-2	Light brown fine sand, trace silt (SP)		4		
		4.0	3			5		
	3D	5.0	11-16	Mottled light gray & red-brown silty clay, some fine sand (CL)			NEG	
		6.5	24					
	4D	7.5	9-10	Mottled gray & red-brown fine sandy clay (CL)			NEG	
		9.0	17			10		
	5D	10.0	9-14	Red-brown clayey fine sand (SC)			NEG	
		11.5	16					
	6D	12.5	9-9	Red-brown fine sand, some clay (SC)			NEG	
		14.0	13			15		
	7D	15.0	10-14	Do 6D (SC)			NEG	
		16.5	18			20		
8D	20.0	8-15	Mottled gray & purple m-f sand, some clay, trace clay pockets (SC)		NEG			
	21.5	15						
9D	25.0	8-15	Mottled purple & gray fine sand, some clay (SC)	(S1)	25	NEG		
	26.5	17						
10D	30.0	6-11	Do 9D, fine to medium sand (SC)		30	NEG		
	31.5	17						
11D	35.0	6-12	Do 10D (SC)		35	NEG		
	36.5	15						
12D	40.0	9-13	Do 10D, trace coarse sand (SC)		40	NEG		
	41.5	14						
13D	45.0	11-18	Mottled red-brown & medium gray sand, some clay (SC)		45	NEG		
	46.5	18						
14D	50.0	12-20	Mottled light purple & red-brown f-m sand, some clay (SC)		50	NEG		
	51.5	21						

1700

MARCH 29, 1986  
SUNNY, CLEAR  
80°F

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-216

PROJECT LOCATION SAVANNAH RIVER PLANT RES. ENGR.

SURFACE ELEV. 294.5  
PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MARCH 31, 1986 (CONT'D)	15D	55.0	13-18	Mottled yellow-brown & purple fine to medium sand, some clay (SC)	S1	55	NEG	
		56.5	15			58		
	16D	60.0	18-19	Brown yellow fine to medium sand, trace silt, clay pockets (SP-SM)		60	NEG	
		61.5	24			65		
	17D	65.0	14-18	Do 16D, trace coarse sand (SP-SM)	S2	70	NEG	
		66.5	21			75		
	18D	70.0	17-35	Mottled yellow-brown & light gray -brown f-m sand, trace silt, coarse sand (SP-SM)		78	NEG	
		71.5	43			80		
	19D	75.0	19-32	Do 18D, trace clay seams (SP-SM)	C2	85	NEG	
		76.5	29			88		
	20D	80.0	3-3	Red brown clayey fine to medium sand (SC)		90	NEG	
		81.5	5			95		
21D	85.0	2-3	Yellow-brown fine sand, some clay (SC)		100	NEG		
	86.5	5						
22D	90.0	6-7	Brown fine sand, some clay (SC)	S3a	95	NEG		
	91.5	6						
23D	95.0	4-6	Brown-gray fine sand, some clay (SC)		100	NEG		
	96.5	9						
24D	100.0	2-3	Mottled brn-yel & gray f-m sand, some clay (SC)			NEG		
	101.5	4						

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-216

SURFACE ELEV. 294.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MARCH 31, 1986 (CONT'D)	25D	105.0	6-4	Mottled yellow-brown & gray m-f sand, trace clay (SP-SC)	S3a	103	NEG	
		106.5	7			105		
	26D	110.0	13-18	Do 25D (SP-SC)	S3b	110	NEG	
		111.5	20			113		
	27D	115.0	4-8	Mottled brown & yellow brown f-m sand, some clay (SC)	S3a	115	NEG	
		116.5	17			118		
	28D	120.0	24-24	Mottled brown & yellow brown f-m sand, trace clay (SP-SC)	S3b	120	NEG	
		121.5	31			125		
	29D	125.0	2-4	Gray-green fine sand, trace clay (SP-SC)	S3b	128	NEG	
		126.5	9			130		
	30D	130.0	25-43	Light gray-brown calcareous fine sand, some clay, calcareous fragments (SC)	S4	135	POS	
		131.5	45			140		
	31D	135.0	18-40	Gray-green fine sand, some clay, trace calcareous fragments (SC)	S4	145	POS	
		136.5	32			150		
32D	140.0	20-23	Light green-gray calcareous f-m sand, some clay, limestone fgmts (SC)	S4	145	POS		
	141.5	39			150			
33D	145.0	4-12	Light green calcareous clayey fine sand, trace cemented fgmts (SC)	S4	150	POS		
	146.5	17			150			
34D	150.0	4-8	Light gray-green calcareous f sand, some clay, shell fgmts (SC)	S4	150	POS		
	151.5	21			150			

1700  
0730

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-216

SURFACE ELEV. 294.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
APRIL 1, 1986	35D	155.0	12-14	Hard dark gray-green clayey silt, trace fine sand, calcareous fgmts (MH)	S4	153		End of boring at 161.5'.	
		156.5	28			155			NEG
	36D	160.0	6-9		Dark gray-green silty f-c sand, some clay (SM)	M1	160		NEG
		161.5	14				161.5		
							165		
							170		
							175		
							180		
							185		
							190		
					195				
					200				

PROJECT SALTSTONE DISPOSAL Z-AREA

GROUTING REPORT - BORING NO. Z-216P

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	Batch CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH Ft.	GAGE PRESSURE	RETURN	REMARKS
04-01-86	grouting	161.5				1	7.4	0.1	7.3	190.0	10 psi.	mud	
						2	7.4	0.1	7.3	80	10 psi.	grout	
						3	7.4	3.7	3.7	90	10 psi.	grout	

183 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO.       
ALSO USED IN BORINGS   
CEMENT 3 94 LB. BAGS  
BENTONITE 0.25 100 LB. BAGS } *batch*  
SAND 0 LBS/CU. FT. } *mix*  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>     \*  
ESTIMATED YIELD (E.Y.) 183 CU. FT.  
GROUT PUMPED (G.P.) 183 CU. FT.  
GROUT WASTED (G.W.) 3.7 CU. FT.

MATERIALS USED

RATIO OF (G.P.) =      =       
(E.Y.)  
BAGS CEMENT x (G.P.) =      x      = 7 BAGS  
(E.Y.)  
BAGS BENTONITE x (G.P.) =      x      = 0.75 BAGS  
(E.Y.)  
CU. FT. SAND x (G.P.) =      x      = 0 CU. FT.  
(E.Y.)

COMMENTS: \* vol. excess (Hops.)     GROUT TAKE RATIO =  $\frac{183}{19.3} = 1.32$

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 36  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-216  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 75,797 E. 66,337  
SURFACE ELEVATION 294.5' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N-2-3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_ AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140 AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
3-28-86	0730	41.5	-	20.0	OVERNIGHT
3-31-86	0730	81.5	-	33.0	48 HOUR STABILIZATION
4-01-86	0730	146.5	-	37.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 161.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 161.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.3 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
	9	0.75	00					
TOTAL	9	0.75	0.0	18.3				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER THOMAS LOWE HELPERS DAVID EDWARDS, GLENN DODSON

REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-01-86

BORING No. Z-216



# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 10

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. PZ-216U

SURFACE ELEV. 294.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS	
	NO.	DEPTH	BLOWS/6"						
APRIL 2, 1986 - SUNNY, 88°F  1630					(S2)	4.5		Drilled without sampling from 0.0' - 18.5'.	
						5			
						10			
						15			
		1U	18.5 20.5	Push=24" Rec=24"	Mottled red-brown and purple med to fine sand, some clay, trace coarse sand (SC)		20		
						(S1)			
		2U	23.5 25.5	Push=24" Rec=10"	Purple clayey fine sand (SC)		25		
							30		
		3UD	28.5 30.0	Push=24" Rec=16"	Mottled purple and gray clayey fine to medium sand (SC)		35		
							40		
APRIL 3, 1986 - SUNNY, 86°F						45			
						50			

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 10

PROJECT SALTSTONE DISPOSAL - Z-AREA

FILE NO. 6329

BORING NO. PZ-216U

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 294.5

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
	NO.	DEPTH	BLOWS/6"					
APRIL 3, 1986 - SUNNY, 86°F  1700					S1			
						55		
						58		
						S2	60	
					65			
					70			
					75			
					76.5			
					80			
					85			
					90			
					95			
					100			

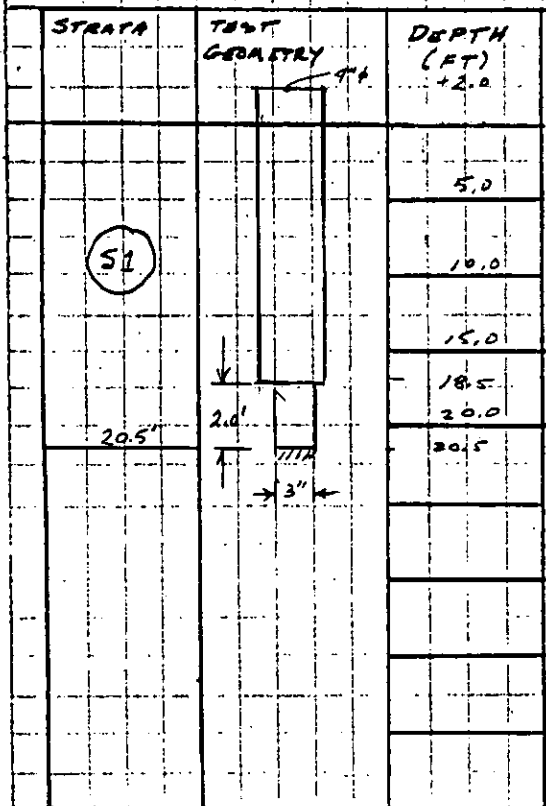
Installed piezometer at 75.5'.  
End of boring at 76.5'.

SUBJECT

**CONSTANT HEAD PERMEABILITY TEST**

BORE HOLE PZ-216U DATE 04-02-86

LOCATION 5' N of 2-116 RES. ENG P.E. Bleiweis



**PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST**

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASIED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

Series 1: (18.5 - 20.5) uncased

TEST # 1

TEST # 2

TEST # 3 ✓

DATE	CLOCK	Δt MIN	ADD'L VOL: (OZ)	CLOCK	Δt MIN	ADD'L VOL:	CLOCK	Δt MIN	ADD'L VOL OZ	REMARKS
04-02-86	1111	0.0	0.0	1145		0.0	1240		0.0	
		0.5	0.0		0.0	0.0		0.0	0.0	After
	1112	1.0	1.0	1146	test	0.0	1241	test #1	0.0	test # 2
	1113	2.0	2.0	1147	# 2	0.5	1242		1.0	hole collapsed
	1114	3.0	1.5	1148		1.0	1243		3.0	to 19.8'
	1116	5.0	2.0	1150		1.5	1245		6.5	depth
	1121	10.0	1.5	1155		2.0	1250		20.0	
	1123	12.0	2.0	1157		1.0	1252		7.0	
	1131	20.0	1.5	1205		3.0	1300		32.0	
	1136	25.0	3.0	1210		3.0	1305		16.0	
	1141	30.0	2.0	1215		3.0	1310		17.0	
			Σ=15.5			Σ=15.0			102.5	
			X			X				

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET No. 3 Of 10

FILE 6329

MADE BY PEB DATE 04-02-86

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

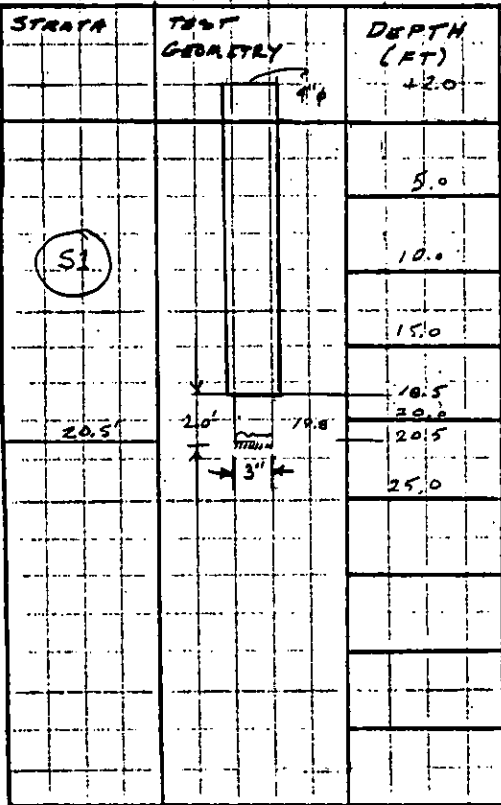
FOR SALTSTONE DISTONE DISPOSAL, Z-AREA

SUBJECT

## CONSTANT HEAD PERMEABILITY TEST

BORE HOLE PZ-216U DATE 04-02-86

LOCATION: 50' N of Z-216 PRES. ENG. P.E. Blaweiss



### PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASSED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

SERIES 1 CONT.

TEST # 4

DATE	CLOCK	$\Delta t$ MIN	ADD'L VOL. OZ.	CLOCK	$\Delta t$ MIN	ADD'L VOL.	CLOCK	$\Delta t$ MIN	ADD'L VOL.	REMARKS
04-02-86	1315	0.0	0.0							
		0.5	0.0							
	1316	1.0	2.0							
	1317	2.0	4.0							
	1318	3.0	6.0							
	1320	5.0	7.0							
	1325	10.0	13.0							
	1327	12.0	10.0							
	1335	20.0	20.0							
	1340	25.0	13.0							
	1345	30.0	13.0							
			$\Sigma = 88.0$							

SUBJECT CONSTANT HEAD PERMEABILITY TEST

BORE HOLE PZ-216-U DATE 04-02-86

LOCATION: 5' N. of Z-216 RES. ENG P.E. Bleiwies

STRATA	TEST DEPTH (FT)	DEPTH (FT)
SI	5.0	5.0
	10.0	10.0
	15.0	15.0
	20.0	20.0
	23.5	23.5
	25.0	25.0
	25.5	25.5

25.5' (circled)  
22'  
4.0'

PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASSED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

SERIES 2: (23.5 - 25.5) UNCASSED

TEST # 1

TEST # 2

TEST # 3

DATE	CLOCK	Δt MIN	ADD'L VOL OZ	CLOCK	Δt MIN	ADD'L VOL OZ	CLOCK	Δt MIN	ADD'L VOL OZ	REMARKS
04-02-86	1000h	0.0	0.0	1045	00		1120			
		0.5	8.0		TEST	6.5		00	6.0	
	1001	1.0	8.0	1046	#1	4.0	1121	TEST # 1	6.0	
	1002	2.0	9.0	1047		9.0	1122		9.0	
	1003	3.0	13.0	1048		13.0	1123		8.0	
	1005	5.0	20.0	1050		20.0	1125		23.0	
	1010	10.0	40.0	1055		53.0	1130		70.0	
	1012	12.0	46.0	1057		60.0	1132		74.0	
	1020	20.0	100.0	1105		68.0	1140		64.0	
	1025	25.0	48.0	1110		32.0	1145		40.0	
	1030	30.0	49.0	1115		61.0	1150		64.0	
			Σ=311.0			Σ=285.5			Σ=314.0	

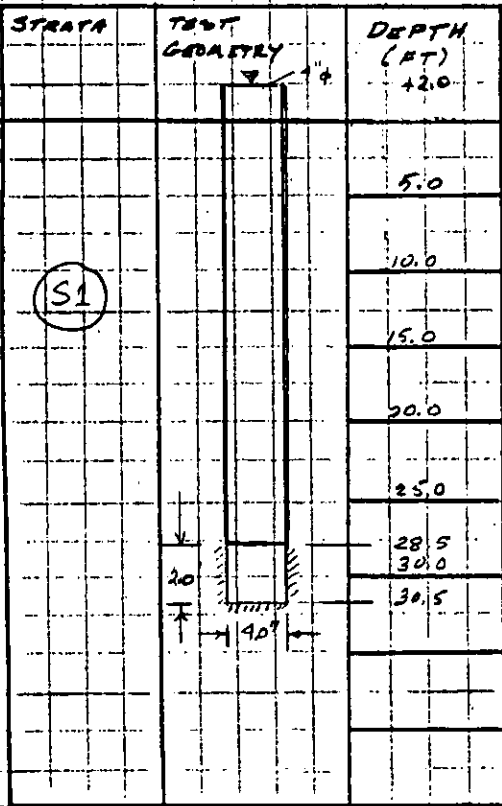
FOR SALTSTONE DISPOSAL, Z-AREA S.R.P.

SUBJECT

CONSTANT HEAD PERMEABILITY TEST

BORE HOLE PZ-216U DATE 04-03-86

LOCATION: 50' N of Z-216 PRES. ENG P.E. Bleiweiss



Note: 4.0" flush joint casing

PROCEDURE FOR CONSTANT HEAD PERMEABILITY TEST

1. ADVANCE OFFSET PIEZOMETER BORING USING CASING TO SHALLOWEST DEPTH SHOWN ON TABLE 2.
2. CLEAN BORING TO BOTTOM OF CASING AND TAKE A 3 INCH DIAMETER UNDISTURBED SAMPLE.
3. SOUND BORING TO VERIFY LENGTH OF UNCASIED PORTION OF HOLE.
4. PRESOAK THE SOIL BY FILLING WITH CLEAN WATER AND MAINTAINING A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HOUR.
5. CONDUCT THE TEST BY ACCURATELY MEASURING THE VOLUME OF WATER NEEDED TO MAINTAIN A CONSTANT WATER LEVEL FOR APPROXIMATELY ONE HALF HOUR.
6. PERFORM STEP 5 A MINIMUM OF 3 TIMES OR UNTIL THE FLOW RATE IS CONSTANT. *Sound hole after each completion of step 5*
7. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
8. ADVANCE THE CASING 5 FEET AND REPEAT STEPS 2 THROUGH 6.
9. ADVANCE THE BORING TO THE PIEZOMETER INTAKE DEPTH AND INSTALL THE PIEZOMETER.

Series 3 : (28.5' - 30.5') uncased

DATE	CLOCK	Δt MIN	ADD'L VOL: OZ	CLOCK	Δt MIN	ADD'L VOL: OZ	CLOCK	Δt MIN	ADD'L VOL OZ	REMARKS
04-03-86	1420	0		1455			1525			
		0.5			0.5	2.0		0.5	0.5	
	1421	1.0	2.0	1456	1.0	3.0	1426	1.0	1.0	
	1422	2.0	3.0	1457		4.5	1527		2.0	
	1423	3.0	5.0	1458		5.0	1528		3.0	
	1425	5.0	13.0	1500		8.0	1530		5.0	
	1430	10.0	21.0	1505		16.0	1535		10.0	
	1432	12.0	8.0	1507		9.0	1537		12.0	
	1440	20.0	36.0	1515		34.0	1545		20.0	
	1449	25.0	27.0	1520		22.0	1550		25.0	
	1450	30.0	23.0	1525		22.0	1555		30.0	
			Σ=138.0			Σ=125.5			Σ=108.5	

MUESER RUTLEDGE CONSULTING ENGINEERS

PIEZOMETER RECORD

PROJECT SALTSTONE DISPOSAL Z-AREA PIEZOMETER NO. PZ-216U  
 LOCATION SAVANNAH RIVER PLANT  
 PIEZOMETER LOCATION 5.0' OF Z-216P DATE OF INSTALLATION 4-03-86  
 SEE SKETCH ON BACK RES. ENG. PETER E. BLEIWEISS

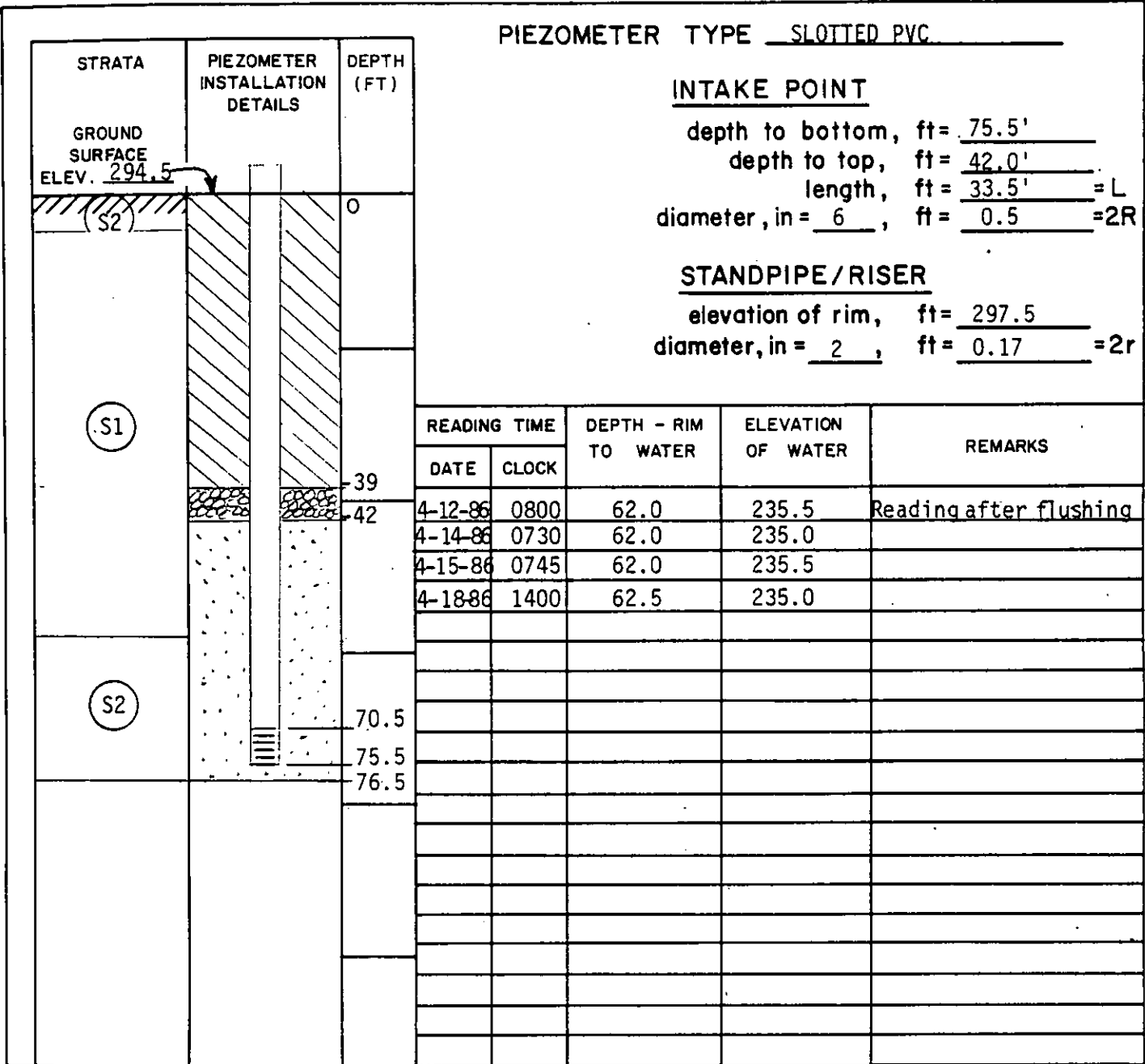
PIEZOMETER TYPE SLOTTED PVC

INTAKE POINT

depth to bottom, ft = 75.5'  
 depth to top, ft = 42.0'  
 length, ft = 33.5' = L  
 diameter, in = 6, ft = 0.5 = 2R

STANDPIPE / RISER

elevation of rim, ft = 297.5  
 diameter, in = 2, ft = 0.17 = 2r



Sand    Bentonite  
 Gravel    Grout

GROUND SURFACE ELEV. 294.5'

PIEZOMETER NO. PZ-216U









MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 10 of 10  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. PZ-216U  
 LOCATION SAVANNAH RIVER PLANT  
 BORING LOCATION 5.0' NORTH OF 7-216P  
 SURFACE ELEVATION 294.5' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
 TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES 4.0", DEPTH FROM 0.0' TO 28.5'  
 DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES \_\_\_\_\_  
 TYPE OF DRILLING MUD \_\_\_\_\_  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
 TYPE AND SIZE OF:  
 DRILL RODS N 2-3/8" O.D. D-SAMPLER \_\_\_\_\_  
 S-SAMPLER \_\_\_\_\_ U-SAMPLER SHELBY  
 CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
 CASING HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30"  
 SAMPLER HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION*
					PIEZOMETER INSTALLED

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 76.5' LIN. FT.  
 SPLIT SPOON SAMPLING IN DRILL HOLES 0.0 LIN. FT.  
 REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
 STANDBY TIME FOR DRILL RIG AND CREW 8.0 HOURS.  
 STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
 NO. OF 3" UNDISTURBED SAMPLES 3

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 7.3 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	3	0.25	0.0	7.3				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
 DRILLER THOMAS LOWE HELPERS DAVID GOODWIN, GLEN EDWARDS  
 REMARKS PIEZOMETER WAS "SILTED IN" HAD TO BE FLUSHED  
 RESIDENT ENGINEER PETER E. BLEIWEISS DATE 4-18-86

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 7

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-217

SURFACE ELEV. 295.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1200	1D	0.0	8-10	Light brown fine sand, trace silt, vegetation (SP-SM)	S2		NEG	
		1.5	9					
	2D	2.5	2-3	Light brown f-m sand, trace silt, vegetation (SP-SM)		4	NEG	
		4.0	3			5		
	3D	5.0	5-10	Mottled brown and gray clayey fine to medium sand (SC)			NEG	
		6.5	15					
	4D	7.5	18-28	Red-brown f-m sand, some clay (SC)			NEG	
		9.0	32			10		
	5D	10.0	16-28	Do 4D (SC)			NEG	
		11.5	36					
	6D	12.5	12-24	Red-brown clayey fine to medium sand (SC)			NEG	
		14.0	26			15		
	7D	15.0	19-27	Red-brown & purple m-f sand, some clay, trace coarse sand (SC)			NEG	
		16.5	38					
8D	20.0	11-13	Mottled purple & light gray fine sand, some clay (SC)			NEG		
	21.5	15			20			
9D	25.0	9-11	Mottled red-brown & purple clayey fine to medium sand (SC)	S1		NEG		
	26.5	17				25		
10D	30.0	9-16	Red-brown & light purple m-f sand, some clay (SC)			NEG		
	31.5	17			30			
11D	35.0	10-12	Do 10D (SC)			NEG		
	36.5	17			35			
12D	40.0	10-14	Do 10D, trace light gray clay partings seams (SC)			NEG		
	41.5	17			40			
13D	45.0	14-18	Mottled red-brown & light purple fine sand, some clay (SC)			NEG		
	46.5	23			45			
14D	50.0	11-17	Mottled red-brown, purple & yellow f-m sand, some clay (SC)			NEG		
	51.5	15			50			

MARCH 12, 1986 - SUNNY, CLEAR 80°F

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 7

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-217

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR.

SURFACE ELEV. 295.5  
PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MARCH 12, 1986 - SUNNY, CLEAR 80°F	15D	55.0	10-20	Do 14D, trace lignite (SC)	S1	55	NEG	Lignite in wash at 54.0'.
		51.5	32					
	16D	60.0	21-31	Red-brown-yellow f-m sand, some clay (SC)		60	NEG	
		61.5	51			63		
	17D	65.0	22-28	Yellow-brown f-m sand, trace clay (SP-SC)	S2	65	NEG	
		66.5	31			68		
	18D	70.0	20-15	Yellow-brown fine to coarse sand, some clay (SC)	S1	70	NEG	
		71.5	21			73		
	19D	75.0	5-7	Interlayered yellow & brown clayey fine sand & clay, trace lignite partings (SC&CH)	C2	75	NEG	
		76.5	10			78		
	20D	80.0	10-13	Gray-brown fine sand, some clay (SC)		80	NEG	
		81.5	19					
21D	85.0	6-14	Yellow-brown f-m sand, some clay, trace lignite (SC)	S3a	85	NEG		
	86.5	16						
22D	90.0	10-12	Yellow brown f-m sand, some clay (SC)		90	NEG		
	91.5	20						
23D	95.0	14-15	Do 22D (SC)		95	NEG		
	96.5	20						
24D	100.0	7-9	Brown m-f sand, some clay (SC)		100	NEG		
	101.5	11						

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 7

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-217

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 295.5

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
MARCH 13, 1986 - (CONT'D)	25D	105.0	1-9	Very stiff light gray-tan f-m sandy clay, trace lignite seams (CL)	(S3a)	105	NEG	Loosing drilling fluid @ 114' to bottom of hole.  Note: rods dropped 4' to 119' depth @ 115' SPT.	
		106.5	13						
	26D	110.0	WH/18"	Light gray-brown clay, some fine sand, clayey fine sand lys (CH&SC)		110	NEG		
		111.5							
	NR	115.0	WR/4.0	NO RECOVERY		VOID	115		
		119.0							
	27D	119.0	18-16	Light green-gray calcareous f-c sand, some clay, trace limestone fragments (SC)		119	POS		
		120.5	32						
	MARCH 17, 1986 - SUNNY, 70°F	28D	125.0	35-33		Light gray-green calcareous fine sand, trace clay, clay pkts, calcareous cemented fine sand lenses (SP-SC)	125		POS
			126.5	34					
29D		130.0	9-9	Light gray-green calcareous fine sand, some clay, trace calcareous cemented fine sand (SC)	(S4)	130	POS		
		131.5	18						
30D		135.0	19-39	Light gray-green calcareous fine sand, some calcareous cemented fine sand fragments (SC)		135	POS		
		136.5	23						
31D		140.0	100/3"	Light gray-green calcareous f-m sand, some clay with cemented calcareous fine sand fgmts (SC)		140	POS		
		140.3							
32D		145.0	50-50	Light gray-green calcareous clayey fine sand, some limestone fragments (SC)		145	POS		
		146.5	39						
33D	150.0	17-20	Gray calcareous fine sand, some clay w/shell fragments (SC)	150		POS			
	151.5	42							

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 7

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-217

SURFACE ELEV. 295.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS		
	NO.	DEPTH	BLOWS/6"							
MARCH 17, 1986 (CONT'D)  1700 MARCH 18, 1986 0715 SUNNY 75°-82°F 1030	34D	155.0 156.4	28-39 50/6"	Gray-green calcareous f-m sand, some clay w/shell fragments (SC)	S4	155	POS	End of boring at 167.5'.		
						158				
						160				
	35D	160.0 161.5	14-16 19	Hard gray-green clayey silt, tr fine sand, lignite (MH)	M1		NEG			
	36D	163.0 164.5	19-30 50			Hard gray-green clayey silt, tr fine sand, fine sand pockets (MH)				NEG
									165	
	37D	166.0 167.5	10-15 19	Gray-green silty fine to medium sand (SM)		167.5	NEG			
						170				
						175				
						180				
						185				
				190						
				195						
				200						

PROJECT SALTSTONE DISPOSAL, Z-AREA Bor.No Z-217

MADE BY PEB DATE 3/18/82  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

GROUTING REPORT - BORING NO. Z-217 PAGE OF

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED (CY)	GROUT PIPE DEPTH (FT)	GAGE PRESSURE	RETURN	REMARKS
03-18-86 1130 hrs	GRROUTING	167.5	0.0	1	1	1	7.4	0.1	7.3	140	200psi	No Ret.	Batch mix as below
	"	"		"	"	2	"	"	"	140	"	"	"
	"	"		"	"	3	"	"	"	140	"	"	"
	"	"		"	"	4	"	"	"	140	"	"	"
	"	"		"	"	5	"	4	"	140	"	"	"
	"	"		"	"	6	"	"	"	110	"	"	"
	"	"		"	"	7	"	"	"	110	"	"	"
	"	"		"	"	8	"	"	"	110	"	"	"
	"	"		"	"	9	"	"	"	110	"	"	"
	"	"		"	"	10	"	"	"	110	"	"	"
1430 hrs	"	"		"	"	11	"	"	"	110	"	"	4m 605 gal pumped
	"	"		"	"	12	"	"	"	70	"	"	"
	"	"		"	"	13	"	"	"	"	"	"	"
	"	"		"	"	14	"	"	"	"	"	"	"
	"	"		"	"	15	"	"	"	"	"	"	"
	"	"		"	"	16	"	"	"	"	"	"	"
	"	"		"	"	17	"	"	"	"	"	"	"
	"	"		"	"	18	"	"	"	"	"	"	"
03-18-86 1100 hrs	"	"		"	"	19	"	"	"	"	"	"	"

$\Sigma = 138.7$  SUB TOTAL CU. FT.

BATCH DETAILS/ea. batch (1-19 above)

TRUCK NO. \_\_\_\_\_

ALSO USED IN BORINGS \_\_\_\_\_

CEMENT \_\_\_\_\_ 94 LB. BAGS

BENTONITE \_\_\_\_\_ 100 LB. BAGS

SAND \_\_\_\_\_ LBS/CU. FT.

WATER \_\_\_\_\_ GALS

W./W.O. 3% CaCl<sub>2</sub>

ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT. +

GRROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.

GRROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) =  $\frac{1473}{1473} \approx 1.0$   
(E.Y.)

BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 57 BAGS  
(E.Y.)

BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 4.8 BAGS  
(E.Y.)

CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.0 CU. FT.  
(E.Y.)

COMMENTS: 1:1 = Yield/batch (55gal/24hr) COMMENTS: 1000 gallons grout failed to close hole due to void



PROJECT SALTSTONE DISPOSAL - Z AREA S.R.P.

MADE BY PEB DATE 4/9/66  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5a OF 6

GROUTING REPORT - BORING NO. Z-217

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	Batch CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED (cu. ft.)	GROUT PIPE DEPTH (ft.)	GAGE PRESSURE	RETURN	REMARKS
08-15-66	Grouting	80.0				20	7.4	0.1	7.3	75	10psi	mud	
						21	7.4	0.1	7.3	70	"	mud	
						22	7.4	0.1	7.3	40	"	mud/gout	
						23	7.4	0.1	7.3	30,20	"	gout	

29.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. FALLING 1500  
ALSO USED IN BORINGS   
CEMENT 3 94 LB. BAGS  
BENTONITE 0.25 100 LB. BAGS  
SAND 0 LBS/CU. FT.  
WATER 36 GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
GROUT PUMPED (G.P.) 7.3 CU. FT.  
GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
ALSO USED IN BORINGS \_\_\_\_\_  
CEMENT \_\_\_\_\_ 94 LB. BAGS  
BENTONITE \_\_\_\_\_ 100 LB. BAGS  
SAND \_\_\_\_\_ LBS/CU. FT.  
WATER \_\_\_\_\_ GALS.  
W./W.O. 3% CaCl<sub>2</sub>  
ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
(E.Y.)  
BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 12 BAGS  
(E.Y.)  
BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 1 BAGS  
(E.Y.)  
CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
(E.Y.)  
*Time: 2.5 hr rig time*

COMMENTS: Returned bore hole to complete grouting. Hole grouted

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 7 of 7  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-217  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION PER PLAN N 75608.0 E. 66400.0  
SURFACE ELEVATION 295.5 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8" O.D. TRICONE  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS 2-3/8 O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_ AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140 AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
3-13-86	0800	81.5	-	45.0	OVERNIGHT
3-17-86	0730	85.0	-	-	HOLE COLLAPSED TO 85.0'
3-18-86	0715	161.5	-	60.0	

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 167.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 0 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
-	57	4.8	0.0	138.7				
TOTAL	57	4.8	0.0	138.7				138.7ft <sup>3</sup>

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER L.T. LOWE

HELPERS DAVE GOODWIN, EDWARD DODSON

REMARKS 5.5 HOURS GROUTING TIME

RESIDENT ENGINEER PETER E. BLEIWEISS

DATE 3-18-86

BORING No. Z-217

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-218U

SURFACE ELEV. 278.9

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 12, 1986 - SUNNY, CLEAR, HUMID 90°F	1D	0.0	3-6	Light gray fine sand, some silt, trace coarse sand (SM)	S2		NEG	
		1.5	6					
	2D	2.5	2-3	Brown fine to medium sand, trace silt (SP-SM)		4.5	NEG	
		4.0	4			5		
	3D	5.0	7-15	Mottled red-brown & light brown fine to medium sand, some cl(SC)			NEG	
		6.5	20					
	4D	7.5	20-23	Mottled red-brown & gray f-m sand, some clay (SC)			NEG	
		9.0	22			10		
	5D	10.0	9-10	Brown & red-brown f-m sand, some clay (SC)	S1		NEG	
		11.5	19					
	6D	12.5	12-15	Red-brown fine to medium sand, some clay (SC)			NEG	
		14.0	19			15		
	7D	15.0	12-16	Do 6D (SC)			NEG	
		16.5	15					
					20			
8D	20.0	12-16	Yellow brown f-m sand, some clay, trace clay partings (SC)			NEG		
	21.5	15			23			
					25			
9D	25.0	10-15	Mottled red-brown & yellow-brown f-m sand, tr silt, clay partings (SP-SM)			NEG		
	26.5	18						
					30			
10D	30.0	11-16	Brown fine to medium sand, trace silt (SP-SM)	S2		NEG		
	31.5	18						
11D	35.0	12-16	Do 10D (SP-SM)			NEG		
	36.5	15			35			
12D	40.0	15-23	Red-brown fine to medium sand, trace silt (SP-SM)			NEG		
	41.5	31						
					45			
13D	45.0	16-36	Yellow brown f-m sand, trace silt (SP-SM)			NEG		
	46.5	40						
14D	50.0	18-23	Red-brown fine to medium sand, trace silt (SP)			NEG		
	51.5	27			50			

BORING NO. Z-218U

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-218U

SURFACE ELEV. 278.9

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 12, 1986 -CONT'D  1600 1000          TUESDAY, MAY 13, 1986 - OVERCAST, HUMID 82°F	15D	55.0 56.5	3-7 9	Mottled gray & brown f-m sand, trace clay (SP-SM)	(S2)	55 58	NEG	Lost 1/2 vol. (mud tub) @ 50'.
	16D	60.0 61.5	5-8 9	Very stiff yellow-brown f-m sandy clay, trace lignite (CH)	(C2)	60	NEG	
	17D	61.5 63.0	3-5 7	Stiff yel-brn clay, sm fine sand, pokets, trace lignite (CH)		65		
	18U	63.0 65.0	P=24" REC=19	Top: Stiff yel-brn clayey si (MH) Bot: Yel clayey f-m sand (SC)	(S3a)	70	NEG	
	19D	65.0 66.5	5-14 20	Yel-brn fine to medium sand, sm clay (SC)		73	NEG	
	20D	66.5 68.0	14-22 19	Yellow-brown fine to medium sand, trace clay (SP-SC)	(S3b)	75	NEG	
	21D	70.0 71.5	18-21 17	Yellow-brown fine to medium sand, some clay (SC)		80	NEG	
	22D	75.0 76.4	28-36 50/5"	Brown fine to medium sand, trace silt (SP-SM)	(S3a)	85	NEG	
	23D	80.0 81.5	17-26 28	Brown fine to medium sand, trace clay (SP-SC)		88		
	24D	85.0 86.5	12-16 15	Brown fine to medium sand, some clay, trace lignite (SC)	(S3b)	90		
	25D	90.0 91.5	33-50 50	Brown fine to medium sand, trace silt (SP)		93		
	26D	95.0 95.3	100/3"	Light gray calc f-m sand, some clay, limestone fragments (SC)	(S4)	95	POS	
	27D	100.0 100.7	39-50/5"	Light gray green calcareous f-m sand, some cl, tr calc fgmts (SC)		100	POS	

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-218U

SURFACE ELEV. 278.9

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 14, 1986 OVERCAST, HUMID T. STORM  1545 1000	28D	105.0	100/3"	Limestone fragments  (GP)	S4	105	POS	
		105.5						
MAY 16, 1986 - OVERCAST, 80° - 90°F  1000	29D	110.0	102/6"	Light gray green calc f-m sand, some clay, limestone fragments(SC)	M1	110	POS	
		110.5						
	30D	115.0	50-35 80	Do 29D  (SC)	M1	115	POS	
		116.5						
	31D	120.0	30-36 50/1"	Gray f-m sand, some clay, shell fragments (SC)	M1	120	POS	
		121.0						
	32D	125.0	75-45 50/1"	Dark gray-green clayey fine to medium sand (SC)	M1	125	NEG	
		126.0						
	33D	130.0	13-21 30	Dark gray green fine to medium sand, some clay (SC)	M1	130	NEG	
		131.5						
	34D	135.0	49-40 38	Dark gray-green clayey fine to medium sand, some clay layers(SC)	M1	135	NEG	
		136.5						
	35D	140.0	19-50/5"	Dark gray-green fine to medium sand, some clay (SC)	M1	140	NEG	
		140.9						
	36D	145.0	127-150/3"	Gray-brown fine to medium sand, trace silt (SP-SM)	M1	145	NEG	End of boring at 145.7'.
		145.7						
						150		

PROJECT SALTSTONE DISPOSAL Z AREA S.R.P.

MADE BY PEB DATE 5-27-86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

Z-218P

GROUTING REPORT - BORING NO. Z-218P

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH NUMBER NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
05-16-86	Grouting	145.7				1	7.4	0.1	7.3	130	10	mud	
						2	7.4	0.1	7.3	80	10	mud/grout	
						3	7.4	3.7	3.7	40		grout	
						3	3.7	0.1	3.6	20,10		grout	
05-27-86	add grouting	300'				4	3.7	0.1	3.6			grout	add grouting

24.5 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fairing 1500  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0.0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./M.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 11 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 1.0 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
 (E.Y.)

COMMENTS:

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-218U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N. 77.297 E. 67,251  
SURFACE ELEVATION 278.9 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8 O.D. D-SAMPLER 2.0" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER G.U.S.  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30"

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
5-13-86	0700	63.0	-	20.0'	OVERNIGHT
5-15-86	0700	110.0	-	34.0'	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 145.7 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 145.7 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 1

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 24.5 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
	11	1.0	0					
TOTAL	11	1.0	0	24.5				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER THOMAS LOWE MIKE HAIRE HELPERS GLEN DODSON, CLAYTON BAILEY

REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-27-86

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 4

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. PZ-218

SURFACE ELEV. 278.9

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS		
	NO.	DEPTH	BLOWS/6"							
MAY 19, 1986 - SUNNY, CLEAR, WARM 90°F 1700	1D	73.0	20-32	Light brown fine to medium sand, trace silt (SP-SM)	S2			Installed wellpoint at 75.0' depth.  End of boring at 76.5'.		
		74.5	35			4.5				
									5	
									58	
									60	
									C2	
										65
									S3a	
										70
										73
									S3b	
										75
										76.5
										80
										85
										90
										95
										100



MUESER RUTLEDGE CONSULTING ENGINEERS

PIEZOMETER RECORD

PROJECT SALTSTONE DISPOSAL - Z-AREA PIEZOMETER NO. PZ-218

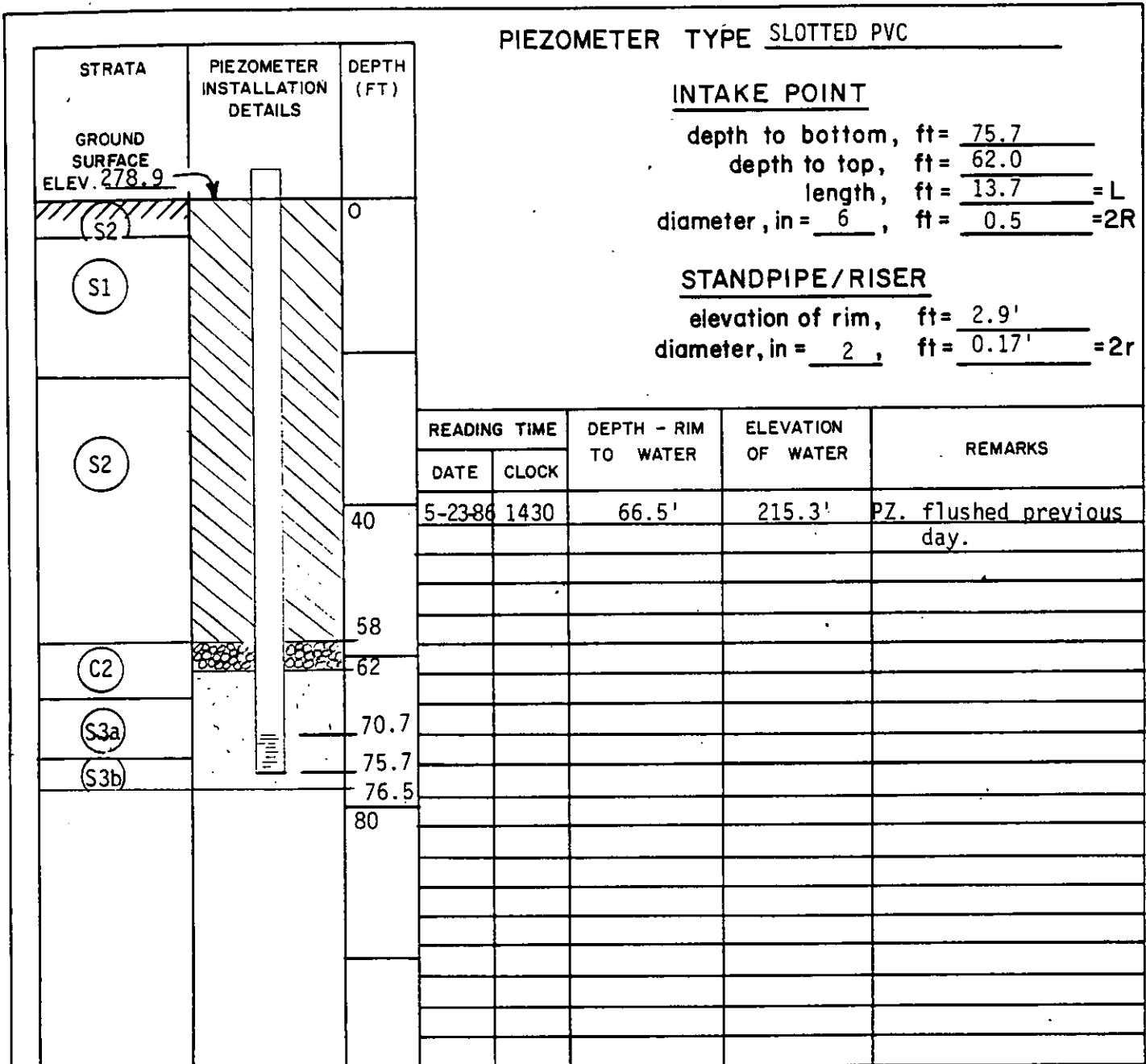
LOCATION SAVANNAH RIVER PLANT

PIEZOMETER LOCATION \_\_\_\_\_ DATE OF INSTALLATION 5-23-86

SEE SKETCH ON BACK

RES. ENG. P.E. BLEIWEISS

PIEZOMETER TYPE SLOTTED PVC



INTAKE POINT

depth to bottom, ft = 75.7  
 depth to top, ft = 62.0  
 length, ft = 13.7 = L  
 diameter, in = 6, ft = 0.5 = 2R

STANDPIPE / RISER

elevation of rim, ft = 2.9'  
 diameter, in = 2, ft = 0.17' = 2r



GROUND SURFACE ELEV. 278.9

PIEZOMETER NO. PZ-218



PROJECT SALTSTONE DISPOSAL Z AREA S.R.P

MADE BY PEB DATE 5-23-64  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

GROUTING REPORT - BORING NO. PZ-218 PAGE OF

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	TRUCK NO. <small>Before</small>	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH (ft.)	GAGE PRESSURE (psi)	RETURN	REMARKS
5-19-64	Grouting	58.0'				1	7.9	0.1	7.3	30.5	0	mud/grout	
5-22-64	Add'l grouting	18.0				2	9.7	0.1	3.6		0	grout	

10.9 SUB TOTAL CU. FT.

**BATCH DETAILS**

TRUCK NO. Fairing 1500  
 ALSO USED IN BORINGS   
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>

ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

**MATERIALS USED**

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 4.5 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.5 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
 (E.Y.)

COMMENTS: \_\_\_\_\_

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 4 of 4  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. PZ-218  
 LOCATION SAVANNAH RIVER PLANT  
 BORING LOCATION 5.0' WEST OF Z-218P  
 SURFACE ELEVATION 278.9' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
 TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 5-7/8"  
 TYPE OF DRILLING MUD \_\_\_\_\_  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
 TYPE AND SIZE OF:  
 DRILL RODS N 2-3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
 S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
 CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
 CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
 SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION*

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 76.5' LIN. FT.  
 SPLIT SPOON SAMPLING IN DRILL HOLES 1.5' LIN. FT.  
 REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
 STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
 STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
 NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 10.9 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	4.5	0.5	0.0	10.9				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
 DRILLER THOMAS LOWE HELPERS GLENN DODSON

REMARKS \_\_\_\_\_  
 RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-23-86

BORING No. PZ-218

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-219U

SURFACE ELEV. 290.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
0730	1D	0.0	2-4	Brown-gray fine sand, trace silt (SP-SM)	S2		NEG		
		1.5	4						
	2D	2.5	2-3	Light brown fine to medium sand, trace silt (SP)				NEG	
		4.0	4			5			
	3D	5.0	3-4	Do 3D (SP)				NEG	
		6.5	6			7			
	4D	7.5	7-13	Mottled brown & gray f-m sand, trace clay (SP-SC)				NEG	
		9.0	15			10			
	5D	10.0	12-23	Red-brown f-m sand, some clay, tr yel-gry clayey sand pockets (SC)				NEG	
		11.5	25						
	6D	12.5	11-15	Do 5D (SC)				NEG	
		14.0	21			15			
	7D	15.0	10-12	Red-brown fine to medium sand, some clay (SC)				NEG	
		16.5	17						
8D	20.0	9-13	Mottled red-brown & purple f-m sand, some clay (SC)	S1		NEG			
	21.5	17			20				
9D	25.0	8-10	Do 8D (SC)				NEG		
	26.5	17			25				
10D	30.0	9-12	Brown fine to medium sand, some clay (SC)				NEG		
	31.5	11			30				
11D	35.0	9-13	Yellow-brown fine to medium sand, some silt, trace clay pockets (SM)				NEG		
	36.5	12			35				
12D	40.0	9-13	Yellow-brown f-m sand, trace silt, clay partings (SP-SM)		S2		NEG		
	41.5	20				40			
13D	45.0	8-12	Red-brown fine to medium sand, trace silt (SP-SM)					NEG	
	46.5	13				45			
14D	50.0	7-7	Brown fine to medium sand, trace clay, clay partings (SP-SC)					NEG	
	51.5	9				50			

MAY 7, 1986 - SUNNY, CLEAR

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL, Z-AREA

BORING NO. Z-219 U

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR.

SURFACE ELEV. 290.5  
PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 7, 1986 - CONT'D	15D	55.0	10-10	Light brown fine to medium sand, trace silt (SP-SM)	S2	55	NEG	
		56.5	15			60		
	16D	60.0	18-27	Light brown fine to medium sand, trace coarse sand, silt (SP)		65	NEG	
		61.5	45			68		
	17D	65.0	14-28	Light yellow-brown fine to medium sand, trace silt (SP-SM)		70	NEG	
		66.5	33			75		
	18D	70.0	1-2	Red brown clayey f-m sand, some clay layers (SC)		C2	NEG	
		71.5	5					
	19U	71.5	Push=24"	Yel-brn & red-brn f-m sand, some clay, clay layers (SC)			NEG	
		73.5	Rec=24"					
20UD	73.5	Push=24"	Red brn clayey f sand, trace gravel (SC)	NEG				
	75.5	Rec=2"			90			
21D	75.5	3-5	Stiff yel-brn clay, trace fine sand, lignite (CH)	NEG				
	77.0	9			95			
22U	78.0	Push=24"	Yel-brown f-m sand, some clay (SC)	NEG				
	80.0	Rec=24			100			
23S	80.0	Push=24	Light brown f-m sand, some clay, trace clay seams (SC)	S3a	NEG			
	82.0	Rec=24"				105		
24D	85.0	7-11	Yellow gray fine to medium sand, some clay, trace lignite (SC)		NEG			
	86.5	15				110		
25D	90.0	18-26	Brown fine to medium sand, trace silt (SP-SM)		S3b	NEG		
	91.5	24					115	
26D	95.0	17-20	Gray-brown fine to medium sand, some clay (SC)		S3a	NEG		
	96.5	19					120	
27D	100.0	18-30	Light brn-gray f-m sand, tr cl, fine to medium sandy clay pockets lignite pockets (SP-SC)			NEG		
	101.5	30					125	

1700  
0710

MAY 8, 1986 - SUNNY, CLEAR 92°F

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 6

FILE NO. 6329

BORING NO. Z-219U

SURFACE ELEV. 290.5

PROJECT SALTSTONE DISPOSAL - Z-AREA

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS		
	NO.	DEPTH	BLOWS/6"							
MAY 8, 1986 CONT'D	28D	105.0	41-40	Light brown fine to medium sand, trace silt (SP-SM)	S3b		NEG			
		106.5	50			105				
	29D	110.0	9-7	Light gray-green fine sand, some clay, trace calc (SC)					POS	
		111.5	8			108	110			
	30D	115.0	14-24	Light gray-green calc f-m sand, some clay, limestone fgmts (SC)					POS	
		116.5	28			115				
	31D	120.0	24-87	Light gray-green calc f-m sand, some clay, limestone fgmts (SC)		S4			POS	
		121.0					120			
	32D	125.0	17-65/4"	Do 31D (SC)						POS
		125.8					125			
33D	130.0	24-47	Gray calc f-c sand, some clay, shell fragments (SC)				POS			
	131.3	50/4"		130						
34D	135.0	20-50	Stiff gray calc silty clay, some fine sand, trace shells, lignite (CL)				POS			
	136.0	50/0		135						
35D	140.0	13-19	Dark gray green clayey f-m sand, trace lignite (SC)				NEG			
	141.5	34		138	140					
36D	145.0	37-50/4"	Hard dark gray green clay, some f-m sand layers (CH&SP)	M1		NEG				
	145.8				145					
37D	150.0	13-26	Hard dark gray green f-m sandy clay (CL)				NEG			
	151.5	50			150					

1700  
0710

MAY 9, 1986 - SUNNY, CLEAR, 85°F

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 4 OF 6

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-219U

SURFACE ELEV. 290.5

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 9, 1986 CONT'd 1400	NR	155.0 155.5	100/6"	NO RECOVERY	M1	155		End of boring at 160.3'.
	38D	160.0 160.3	400/4"	Gray fine to medium sand, trace silt, clay layers (SP)		160 160.3		
						165		
						170		
						175		
						180		
						185		
						190		
						195		
						200		



PROJECT SALTSTONE DISPOSAL Z AREA

MADE BY PEB DATE 5-12-84  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-219

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH (Ft)	CASING DEPTH	TANK NO.	TRUCK NO.	Batch CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE (psi)	RETURN	REMARKS
1600 5-09-86	Grouting	100.3				1	7.1	0.1	7.3	190	10	Mud	
						2	7.1	3.7	3.7	80	"	grout	
						2	3.7	0.1	3.6	10,20	"	grout	
2750 5-12-84	Grouting	330'				3	3.7	0.1	3.6			grout	

1/8.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. \_\_\_\_\_ TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_ ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT 3 94 LB. BAGS CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND 0.0 LBS/CU. FT. SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER 36 GALS. WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub> W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 7.4 CU. FT. ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT. GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT. GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 7.5 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.0 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
 (E.Y.)

BORING NO. N-219

COMMENTS: \_\_\_\_\_

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 6 of 6  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-219U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 77.012' E. 67.029'  
SURFACE ELEVATION 290.5 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES 4.0", DEPTH FROM 0.0 TO 10.0  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" O.D. . D-SAMPLER 2.0" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ . U-SAMPLER G.U.S. & SHELBY  
CORE BARREL \_\_\_\_\_ . CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
5-08-86	0710	80.0'	10.0'	30.0'	OVERNIGHT
5-09-86	0715	131.3'	10.0'	40.0'	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 160.3 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 160.3 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 10.0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 3

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.2 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	7.5	0.8	0.0	18.2				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER THOMAS LOWE HELPERS GLENN DODSON, DAVE GOODWIN

REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-12-86

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-220U

SURFACE ELEV. 286.3

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS		
	NO.	DEPTH	BLOWS/6"							
MAY 2, 1986 SUNNY, CLEAR 92°F	0720	1D	0.0	2-2	S2		NEG			
			1.5	3		Light brown fine to medium sand, trace silt (SP-SM)			2	
	2D		2.5	2-5		Light brown fine to medium sand, some clay (SC)			NEG	
			4.0	4			5			
	3D		5.0	6-14		Mottled brown & gray f-m sand, some clay, trace clay pockets (SC)			NEG	
			6.5	21						
	4D		7.5	17-19		Mottled red brown & gray f-m sand, some clay, trace clay pockets (SC)			NEG	
			9.0	25			10			
	0900	5D		10.0		12-18	Red brown f-m sand, some clay, trace coarse sand (SC)			NEG
				11.5		26				
	1000	6D		12.5		11-14	Mottled red-brown & purple clayey fine to medium sand (SC)			NEG
				14.0		16			15	
	MAY 6, 1986 - SUNNY, CLEAR, 90°F	7D		15.0		10-12	S1			NEG
				16.5		11			Mottled light brown & gray fine to medium sand, some clay (SC)	
8D			20.0	11-18	Brown fine to medium sand, some clay (SC)	20		NEG		
			21.5	20						
9D			25.0	10-12	Light brown f-m sand, some clay, trace gray clay partings (SC)	25		NEG		
			26.5	21		28				
10D			30.0	12-15	Yellow-brown & red-brown f-m sand, some silt, trace clay partings (SM)	30		NEG		
			31.5	18						
11D			35.0	13-15	Do 10D (SM)	35		NEG		
			36.5	16						
12D			40.0	11-13	Brown fine to medium sand, trace silt (SP-SM)	40		NEG		
			41.5	17						
13D			45.0	15-25	Red brown fine to medium sand, trace silt (SP-SM)	45		NEG		
			46.5	33						
14D		50.0	20-35	Do 13D (SP-SM)	50	NEG				
		51.5	40							

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-220U

SURFACE ELEV. 286.3

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 6, 1986 CONT'D 1730 0715	15D	55.0	12-7	Red-brown fine to medium sand, some clay, trace lignite (SC)	S3a	53	NEG	
		56.5	8			55		
	16D	60.0	3-3	Yellow-brown clayey fine sand, tr cl lysr, lignite (SC)	C2	60	NEG	
		61.5	5			65		
	NR	62.0	Push=24	NO RECOVERY				
		64.0	Rec=0					
	NR	64.0	Push=24	NO RECOVERY				
		66.0	Rec=0					
	17U	56.0	Push=24	Mottled brown & yellow-brown m-f sand, trace clay (SP-SC)		66	NEG	
		68.0	Rec=24					
18U	68.0	Push=24	Mottled yel-brn & brn f-m sand, tr cl, cl lysr, lignite (SP-SC)	(S3b)		NEG		
	70.0	Rec=8			70			
19D	70.0	7-6	Yellow brown fine to medium sand, some clay (SC)	(S3a)		NEG		
	71.5	6			73			
MAY 7, 1986 - SUNNY, CLEAR, 95°F	20D	75.0	22-25	Brown fine to medium sand, trace silt, lignite (SP)	(S3b)	75	NEG	
		76.5	37			80		
	21D	80.0	23-26	Yellow brown f-m sand, trace clay (SP-SC)		80	NEG	
		81.5	29			83		
	22D	85.0	17-25	Yellow brown & gray f-m sand, some clay, tr coarse sand, gvl (SC)	(S3a)	85	NEG	
		86.5	43			88		
	23D	90.0	24-36	Brown & yellow brn f-m sand, trace clay, lignite (SP-SC)	(S3b)	90	NEG	
		91.5	38			93		
	24D	95.0	40-31	Light gray calc fine to medium sand, some clay, tr c sand (SC)	(S4)	95	POS	
		96.5	28					
25D	100.0	18-14	Light gray-green calc f-m sand, sm clay, tr calc fragments (SC)		100	POS		
	101.5	17						

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-220U

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 286.3

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 8, 1986 - SUNNY, CLEAR 90°F 1700 0710	26D	105.0 106.5	11-19 41	Do 25D  (SC)	S4	105	POS	
	27D	110.0 110.4	100/5"	Do 25D, some calcareous fragments (SC)		110	POS	
	28D	115.0 115.1	100/1"	Gray calcareous siltstone fgmts (GP)		115	POS	
	29D	120.0 120.3	100/3"	Gray calcareous fine sand, some clay, trace shell fragments, siltstone (SC)		120	POS	
	30D	125.0 125.3	200/4"	Gray calcareous fine sand, some clay, shell fragments, limestone fragments (SC)		125	POS	
	31D	130.0 131.5	19-26 49	Gray calcareous fine sand, some clay, shell fragments (SC)		130	POS	
	32D	135.0 136.3	22-47 100/3"	Do 31D  (SC)		135	POS	
	33D	140.0 141.5	14-22 26	Hard dark gray-green clayey silt, trace silt partings (MH)		138		
	34D	145.0 146.5	16-18 22	Dark gray-green clayey sand (SC)		140	NEG	
	35D	150.0 150.3	400/3"	Gray fine to medium sand, trace silt (SP-SM)		M1	145	NEG
MAY 9, 1986 SUNNY, CLEAR 90°F 1300					150	NEG		
					150.3		End of boring at 150.3'.	

PROJECT SALTSTONE DISPOSAL AREA

MADE BY PEB DATE 5-12-86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-220

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
5-9-86	Grouting	150.3				1	7.4	0.1	7.3	140	10	mud	
						2	7.4	3.7	3.7	80	10	mud, grout	
						2	3.7	0.1	3.6	40, 20	10	grout	
5-12-86	add'l grouting	30.0'				3	3.7	0.1	3.6			grout	add'l grout

18.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fairing 250  
 ALSO USED IN BORINGS   
 CEMENT 3 94 LB. BAGS  
 BENTONITE 43 100 LB. BAGS  
 SAND 0.0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 8.0 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.8 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ CU. FT.  
 (E.Y.)

COMMENTS: \_\_\_\_\_

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-220U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 76,729 E 66,808  
SURFACE ELEVATION 286.3 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER G.U.S.  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud.	CONDITIONS OF OBSERVATION*
5-7-86	0705	68.0'	-	22.0'	OVERNIGHT
5-8-86	0710	115.1'	-	31.0'	OVERNIGHT
5-8-86	0700	141.5'	-	40.0'	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 150.3 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 150.3 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 2

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.2 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	8.0	0.8	0.0	18.2				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER MIKE HAIRE HELPERS CLAYTON BAILEY, SIDNEY LINDSAY

REMARKS \_\_\_\_\_

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-12-86

BORING No. Z-220U

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-221

SURFACE ELEV. 276.9

PROJECT LOCATION SAVANNAH RIVER PLANT RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 19, 1986 - OVERCAST, HUMID, DRIZZLE	1300	1D	0.0	1-1	S2		NEG	
			1.5	1				NEG
		2D	2.5	1-2	S2	4		
		4.0	2			5		
		3D	5.0	6-14	S2		NEG	
			6.5	16				NEG
		4D	7.5	18-32	S2			
			9.0	37			10	
		5D	10.0	16-14	S1		NEG	
			11.5	18				NEG
		6D	12.5	14-15	S1			
			14.0	14			15	
		7D	15.0	12-14	S1		NEG	
			16.5	15				
	8D	20.0	16-17	S1				
		21.5	22			20	NEG	
	9D	25.0	9-15	S2		NEG		
		26.5	17					
	10D	30.0	8-9	S2		NEG		
		31.5	12					
	11D	35.0	10-14	S2		NEG		
		36.5	19					
	12D	40.0	12-16	S2		NEG		
		41.5	20					
	13D	45.0	3-4	S3a		NEG		
		46.5	4					
	14D	50.0	8-12	S3b		NEG		
		51.5	13					



MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-221

SURFACE ELEV. 276.9

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 19, 1986 CONT'D 1700 0710	15D	55.0	10-11	Yellow-brown fine to medium sand, some silt (SM)	S3b	55	NEG	
		56.5	13			58		
MAY 20, 1986 - SUNNY, WARM 90°F	16D	60.0	3-6	Yellow-brown fine to medium sand, some clay, trace lignite (SC)	S3a	60	NEG	
		61.5	9			63		
	17D	65.0	11-13	Yellow-brown fine to medium sand, trace silt (SP-SM)	S3b	65	NEG	
		66.5	15			68		
	18D	70.0	8-10	Brown fine to medium sand, some clay, trace lignite (SC)	S3a	70	NEG	
		71.5	17			75		
	19D	75.0	11-14	Brown fine to medium sand, some clay (SC)		75	NEG	
		76.5	15			78		
	20D	80.0	17-25	Brown fine to medium sand, trace si, cl partings, lignite (SP-SM)	S3b	80	NEG	
		81.5	23			83		
	21D	85.0	7-9	Yellow-gray fine to medium sand, some clay, trace lignite (SC)	S3a	85	NEG	
		86.5	7			88		
22D	90.0	11-19	Light gray-green calc fine sand, some clay, limestone fgmts (SC)		90	POS		
	91.5	26			95			
23D	95.0	30-33	Light gray-green calc clayey fine sand, some limestone fgmts (SC)	S4	95	POS		
	96.4	50/5"			100			
24D	100.0	150/2"	Do 23D (SC)		100	POS		
	100.2							

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-221

SURFACE ELEV. 276.9

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 20, 1986 - CONT'D	25D	105.0	67-50/1"	Gray calc fine sand, some clay, shell fragments (SC)	S4	105	POS	
		105.6						
	26D	110.0	14-20	Do 25D (SC)		110	POS	
		111.5				24		
	27D	115.0	13-28	Do 25D (SC)		115	POS	
		116.3				50/3"		
	28D	120.0	8-13	Dark gray-green clayey fine sand trace shell fragments (SC)		120	POS	
		121.5				13		
	29D	125.0	12-16	Hard dark gray-green clayey silt some f-m sand partings (MH)		125	NEG	
		126.5				15		
	30D	130.0	13-14	Dark gray-green fine to medium sand, some clay (SC)		130	NEG	
		131.5				23		
31D	135.0	150-500/2'	Dark gray fine to medium sand, trace silt (SP-SM)	135	NEG			
	135.7			135.7				
				140				
				145				
				150				

MAY 20, 1986 - CONT'D

1700

MAY 21, 1986  
SUNNY, HOT  
90°F

End of boring at 135.7.

PROJECT SALTSTONE DISPOSAL, E. AREA S.R.P.

MADE BY PEB DATE 5-27-81  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 9

GROUTING REPORT - BORING NO. Z-221

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
05-21-86	Grouting	155.7				1	7.9	0.1	7.3	120		Mud	
						2	7.4	3.7	3.7	80		Mudflow	
						2	3.7	0.1	3.6	20		grout	
05-22-86	Grouting	270				3	3.7	0.1	3.6	0		grout	add'l grouting

1/8.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Failing 250  
 ALSO USED IN BORINGS   
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 2.4 CU. FT.  
 GROUT PUMPED (G.P.) 2.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

COMMENTS:

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-221  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 77,711 E. 66,519  
SURFACE ELEVATION 276.9 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL, H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO mud	CONDITIONS OF OBSERVATION*
5-20-86	0700	61.5	-	22.0'	OVERNIGHT
5-21-86	0710	126.5	-	31.0'	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 135.7 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 135.7 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.2 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	9.0	1.0	0	18.2				

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER MIKE HAIRE HELPERS CLAYTON BAILEY

REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-27-86

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. 7-222

SURFACE ELEV. 279.4'

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

MAY 19, 1986 - OVERCAST  
HUMID, 85°F

MAY 20, 1986 - SUNNY, HUMID, 90°F

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1600	1D	0.0	1-1	Gray-brown f-m sand, trace silt, vegetation (SP-SM)	(S2)		NEG	
		1.5	WH				NEG	
	2D	2.5	1-3	Red-brown f-m sand, some silt, trace vegetation (SM)		4		
		4.0	4			5		
	3D	5.0	3-5	Red-brown f-m sand, some clay (SC)			NEG	
		6.5	6					
	4D	7.5	3-5	Do 3D (SC)	(S1)		NEG	
		9.0	8			10		
	5D	10.0	3-8	Do 3D (SC)			NEG	
		11.5	12					
	6D	12.5	10-16	Mottled red-brown & yellow-brown f-m sand, some clay (SC)			NEG	
		14.0	17			15		
	7D	15.0	10-12	Red-brown fine to medium sand, some clay (SC)			NEG	
		16.5	21			20		
8D	20.0	5-12	Red-brown fine to medium sand, some clay (SC)			NEG		
	21.5	18			23			
9D	25.0	9-26	Red-brown fine to medium sand, some silt (SM)	(S2)	25	NEG		
	26.5	42			28			
10D	30.0	13-19	Mottled yellow-brown & red-brown clayey f-m sand (SC)	(S1)	30	NEG		
	31.5	28						
11D	35.0	34-50/4"	Red-brown f-m sand, some clay (SC)		35	NEG		
	35.8							
12D	40.0	5-29	Hard mottled white & yellow-brown clay, tr f-m sand, silt partings (CH)		40	NEG		
	41.5	29			43			
13D	45.0	3-6	Mottled light gray & yellow-brown clayey f-m sand, trace lignite (SC)	(C2)	45	NEG		
	46.5	10						
14D	50.0	4-4	Stiff yellow-brown clay, trace fine sand (CH)		50	NEG		
	51.5	8						

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-222

SURFACE ELEV. 279.4'

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 20, 1986 (CONT'D)	15D	55.0	6-9	Yellow-brown f-m sand, some clay, trace clay pockets, gravel, c. sa (SC)	C2	53	NEG	
		56.5	13			S3a		
	16D	60.0	9-13	Brown f-m sand, trace silt, clay pockets (SP-SM)	S3b	60	NEG	
		61.5	15			63		
	17D	65.0	4-11	Yellow-brown f-m sand, some clay (SC)		65	NEG	
		66.5	16			70		
	18D	70.0	11-16	Brown fine to medium sand, some silt (SM)	S3a	75	NEG	
		71.5	18			80		
	19D	75.0	9-11	Mottled gray & yellow f-m sand, sm cl, tr cl pkts, lignite (SC)		85	NEG	
		76.5	17			87		
	20D	80.0	12-21	Mottled brown & white f-m sand, some clay, white clay pkts, trace cemented fragments (SC)		90	NEG	
		81.5	24			95		
21D	85.0	23-46	Mottled brown & white f-m sand, some clay, cemented fgmts (SC)		100	NEG		
	86.5	35						
22D	90.0	13-40	Light gray-green calc f sand, sm clay, limestone fragments (SC)	S4	95	POS		
	91.5	45						
23D	95.0	8-11	Do 22D (SC)		100	POS		
	96.5	26						
24D	100.0	69/6"	Light gray-green calc f sand, some limestone fragments, clay (SC)			POS		
	100.5							

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-222

SURFACE ELEV. 279.4

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 20, 1986 (CONT'D)	25D	105.0	10-23	Hard gray-green clay, trace limestone fragments, clay (CH)	S4	105	POS	
		106.5	26			110		
	26D	110.0	5-8	Light gray-green calc fine sand, some clay, limestone fgmts (SC)		115	POS	
		111.5	15			120		
	27D	115.0	10-23	Gray calc fine sand, some clay, shell fragments (SC)		123	POS	
		116.5	60			125		
	28D	120.0	15-30	Do 28D (SC)		130	POS	
		121.4	50/5"			135		
	29D	125.0	5-19	Hard green-gray clayey silt, tr fine to medium sand (MH)		140	NEG	
		126.5	36			145		
	30D	130.0	7-22	Dark green-gray f-m sand, some clay (SC)		150	NEG	
		131.5	30					
31D	135.0	13-29	Dark green-gray fine to medium sand, some clay (SC)		NEG			
	136.5	72						
32D	140.0	500/6"	Gray fine to medium sand, trace silt (SP-SM)	140.5	NEG			
	140.5							
				145			End of boring at 140.5'.	
				150				

MAY 21, 1986  
SUNNY, COOL  
60° - 82°F  
1100

PROJECT SALTSTONE DISPOSAL Z AREA S.R.P.

MADE BY PSB DATE 5-27-86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-222P

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	CHARGE NO.	TANK VOLUME		VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
							BEFORE	AFTER					
05-21-86	Grouting	140.5				1	7.4	0.1	7.3	130	10	fluid	
"						2	7.4	3.7	3.7	80	10	mud/grout	
"							3.7	0.1	3.6	10,20		grout	
05-27-86							3.7	0.1	3.6			grout	add 1 grout

18.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fauling 1500  
 ALSO USED IN BORINGS   
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0.0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 24 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 8 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 1 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
 (E.Y.)

COMMENTS: \_\_\_\_\_



MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-222  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 77,585 E. 66,139  
SURFACE ELEVATION 279.4' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3 - 7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" D-SAMPLER 2" O.D. SPLI  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
5-20-86	0700	21.5'	-	-	OVERNIGHT
5-21-86	0700	136.5'	-	35.0'	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 140.5' LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 140.5' LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 18.2 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	8.0	1.0	0	18.2				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER JAMES DAVIS HELPERS GLEN DODSON

REMARKS

RESIDENT ENGINEER PETER E. BLEIWEISS

DATE 5-27-86

BORING No. Z-222

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. PZ-222

PROJECT LOCATION SAVANNAH RIVER PLANT

SURFACE ELEV. 279.4

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
1300								Note: drilled ahead. No sampling 0.0' - 72.0'
						10		
						20		
						30		
						40		
1600	1D	72.0 73.5	5-11 16	Dark brown fine to medium sand, some clay (SC)	(S3a)	70 72 76.5 80    90   100	NEG	Note: Installed well point @ 75.8' (bottom). End of boring at 76.5'.

MAY 23, 1986 - SUNNY, WARM, 92°F

MUESER RUTLEDGE CONSULTING ENGINEERS

PIEZOMETER RECORD

PROJECT SALTSTONE DISPOSAL - Z-AREA PIEZOMETER NO. PZ-222  
 LOCATION SAVANNAH RIVER PLANT  
 PIEZOMETER LOCATION 5.0' EAST OF Z-222 DATE OF INSTALLATION 5-21-86  
 SEE SKETCH ON BACK RES. ENG. P.E. BLEIWEISS

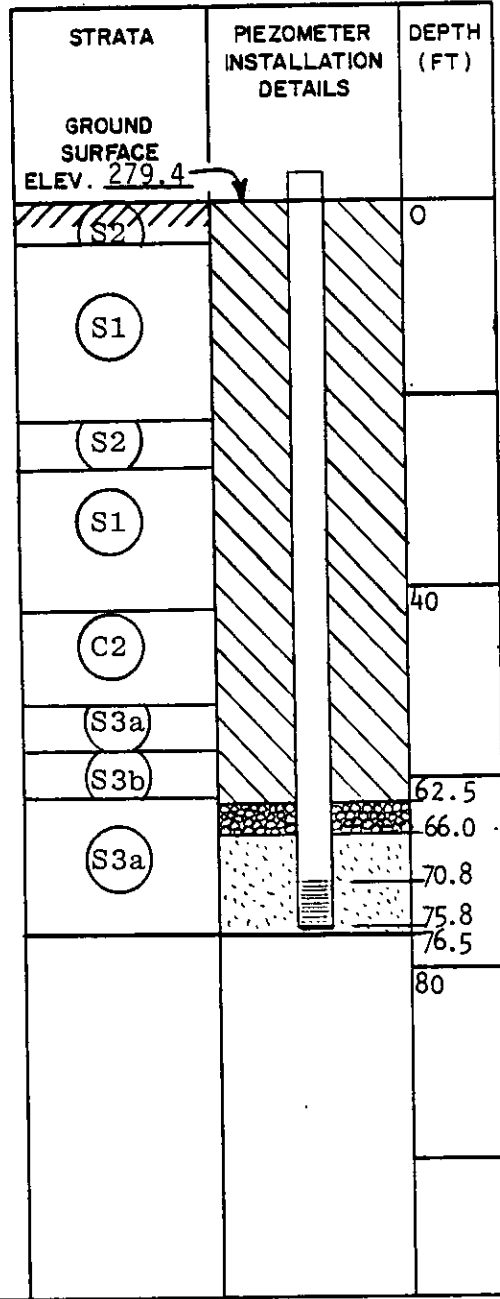
PIEZOMETER TYPE SLOTTED PVC

INTAKE POINT

depth to bottom, ft = 75.8  
 depth to top, ft = 66.0  
 length, ft = 9.8 = L  
 diameter, in = 6, ft = 0.5 = 2R

STANDPIPE/RISER

elevation of rim, ft = 282.40  
 diameter, in = 2, ft = 0.17 = 2r



READING TIME		DEPTH - RIM TO WATER	ELEVATION OF WATER	REMARKS
DATE	CLOCK			
5-23-86	1600	63.0'	219.4	1 day after flushing
5-29-86	0705	63.0'	219.4	

- Sand
- Bentonite
- Grout
- Gravel



PROJECT SALTSTONE DISPOSAL AREA S.P.A.

MADE BY \_\_\_\_\_ DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

GROUTING REPORT - BORING NO.

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	Batch Charge No.	TANK VOLUME		VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
							BEFORE	AFTER					
5-23-86	grouting	76.5					7.4	0.1	1.3	40.10	0	mis/grav	
5-28-86	grouting	10.0					3.7	2.0	1.7			grout	Add grout

10.0 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Finlay 1500  
 ALSO USED IN BORINGS   
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 24 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_ (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 4 BAGS (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.5 BAGS (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT. (E.Y.)

COMMENTS:

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL Z-AREA BORING NO. PZ-222  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION 5.0' EAST OF Z-222  
SURFACE ELEVATION 279.4 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
NO  DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 5-7/8"  
TYPE OF DRILLING MUD \_\_\_\_\_  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N:2-3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION*
5-23-86	1600	76.5'		60.0'	IN PIEZOMETER

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 76.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 1.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 LB. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	4	0.6	0	10.0				10.0 FT <sup>3</sup>

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER JAMES DAVIS HELPERS GLENN DODSON  
REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-29-86

BORING No. PZ-222

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-223

SURFACE ELEV. 285.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER F. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS		
	NO.	DEPTH	BLOWS/6"							
MAY 22, 1986 - SUNNY, CLEAR 90°F	0900	1D	0.0	1-2	(S2)	2	NEG			
			1.5	4		SP-SM				
		2D	2.5	3-3		Yellow-brown f-m sand, some clay,			NEG	
			4.0	5		trace vegetation (SC)	5			
		3D	5.0	5-12		Mottled yellow-brown & red-brown			NEG	
			6.5	15		fine to medium sand, sm clay (SC)				
		4D	7.5	13-20		Red brown fine to medium sand,			NEG	
			9.0	26		some clay (SC)	10			
		5D	10.0	11-21		Do 4D			NEG	
			11.5	22		(SC)				
		6D	12.5	7-10		Mottled red-brown & yellow-brown	(S1)		NEG	
			14.0	14		fine to medium sand, some clay (SC)			15	
		7D	15.0	12-20		Mottled red-brown & yellow-brown				NEG
			16.5	22		clayey fine to medium sand (SC)				
	8D	20.0	7-18	Mottled red-brown & yellow-brown		NEG				
		21.5	18	clayey f-m sand, trace white clay						
				seams (SC)	25					
	9D	25.0	8-16	Mottled yellow-brown & purple f-m		NEG				
		26.5	18	sand, some clay (SC)						
	10D	30.0	10-13	Do 9D		NEG				
		31.5	15	(SC)	33					
	11D	35.0	9-12	Mottled brown & gray f-m sand,	(S2)	NEG				
		36.5	15	some silt (SM)						
	12D	40.0	9-15	Yellowbrown fine to medium sand,			NEG			
		41.5	15	trace silt (SP-SM)						
	13D	45.0	9-18	Do 12D			NEG			
		46.5	21	(SP-SM)		50				
	14D	50.0	16-30	Red-brown fine to medium sand,		NEG				
		51.5	42	trace silt (SP-SM)						

BORING NO. Z-223

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-223

SURFACE ELEV. 285.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
MAY 22, 1986 - SUNNY, CLEAR, 90°F	15D	55.0	20-50/5"	Red-brown fine to medium sand, trace silt, clay partings (SP-SM)	S2	55	NEG		
		55.9				58			
	16D	60.0	16-18	Red brown f-m sand, some clay, trace coarse sand (SC)			60	NEG	
		61.5					11		
	17D	65.0	6-13	Mottled red & yellow-brown clayey f-m sand, trace lignite (SC)	S3a		65	NEG	
		66.5					25		
	18D	70.0	14-14	Yellow-brown f-m sand, some clay, trace lignite seams (SC)			70	NEG	
		71.5					10		
	19D	75.0	5-7	Yellow-brown f-m sand, some clay (SC)			75	NEG	
		76.5					18		
	20D	80.0	18-26	Brown fine to medium sand, trace silt, lignite (SP-SM)	S3b		80	NEG	
		81.5					33		
	21D	85.0	3-6	Stiff light brown clay, some f-m sand, trace lignite (CH)	S3a		85	NEG	
		86.5					8		
22D	90.0	8-9	Mottled brown & light gray f-m sand, some clay (SC)			90	NEG		
	91.5					15			95
NR	95.0	8-9	NO RECOVERY			95			
	96.5					13			
23D	97.0	5-11	Light brown gray fine sand, some clay (SC)			97	NEG		
	98.5					23			100
1730	24D	100.0	6-8	Light gray-green fine sand, some clay (SC)			NEG		
		101.5							10



# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 3 OF 5

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-223

SURFACE ELEV. 285.1

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 23, 1986 - SUNNY, WARM 90°F	25D	105.0	6-8	Light brown calc fine sand, some clay, cemented fragments (SC)	S4	103	POS	
		106.5	25			105		
	26D	110.0	33-26	Gray-green calc clayey fine sand, some limestone fragments (SC)		110	POS	
		111.5	18					
	27D	115.0	16-28	Light gray-green calc f-m sand, some clay, limestone fgmts (SC)		115	POS	
		116.5	20					
	28D	120.0	13-50	Limestone fragments (GP)		120	POS	
		121.5	39					
	29D	125.0	11-27	Gray calc fine sand, some shell fragments, clay (SC)		125	POS	
		126.5	32			128		
30D	130.0	9-16	Hard dark green-gray clayey silt, some fine sand (MH)	130	NEG			
	131.5	20						
1330 0830	31D	135.0	7-14	Dark green-gray fine to medium sand, some clay, trace lignite (SC)	M1	135	NEG	
		136.5	17					
32D	140.0	12-19	Dark green-gray clayey fine to medium sand (SC)	140		NEG		
	141.5	50						
1300	33D	145.0	118-50/1"	Gray fine to medium sand, trace silt (SP-SM)		145	NEG	End of boring at 145.5'.
		145.6						
							150	

MAY 23, 1986 - SUNNY, WARM 90°F

1330  
0830

MAY 27, 1986  
OVERCAST

1300

PROJECT SALTSTONE DISPOSAL E-AREA, S.R.P

MADE BY PEB DATE 5-28-61  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 5 OF 6

GROUTING REPORT - BORING NO. Z-223

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	BATCH CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
1100 5-27-61	Grouting	145.5				1	7.4	0.1	7.3	130	10	md	
						2	7.4	3.7	3.7			md/grout	
						2	3.7	0.1	3.6	40, 10		grout	
1300 5-28-61	Grouting	18.0				3	3.7	0.1	3.6	0		grout	add grouting

18.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Fairing 350  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT 3.0 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0.0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 7.5 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 1.0 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
 (E.Y.)

COMMENTS:

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 5 of 5  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-223  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 77,476 E.65,810  
SURFACE ELEVATION 285.1 DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7.8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" O.D. D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
5-23-86	0700	98.5	-	27.0'	OVERNIGHT
5-27-86	0710	136.5'	-	37.0'	72 HR. STABILIZATION

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 145.5' LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 145.5' LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 0

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	7.5	1.0	0	18.2				18.2FT <sup>3</sup>

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER MIKE HAIRE HELPERS CLAYTON BAILEY

REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-28-86

BORING No. Z-223

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 4

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-224U

SURFACE ELEV. 281.2'

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
1100								Note: Washed ahead to 48.0 without sampling	
						5			
						10			
						15			
						20			
						25			
						30			
						35			
						40			
						45			
		1D	48.0	10-14	Yellow-brown f-m sand, trace silt	S2	48		NEG
			49.5	14	clay partings (SP-SM)				
		2D	49.5	12-21	Red-brown & yel-brn f-m sand, tr		50		NEG
			51.0	23	silt, clay pockets (SP-SM)				

MAY 27, 1986 -- OVERCAST, HUMID

# MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 4

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-224U

SURFACE ELEV. 281.2

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS	
	NO.	DEPTH	BLOWS/6"						
MAY 27, 1986 - OVER CAST, HUMID  1630 0710  MAY 28, 1986 - SUNNY, WARM 93°F  1130	3D	51.0 52.5	15-23 23	Red-brown fine to medium sand, trace silt (SP)	S2		NEG		
	4D	52.5 54.0	6-9 10	Mottled red-brown & yellow-brown f-m sand, some clay, trace lignite (SC)			NEG		
	5D	54.0 55.5	2-4 6	Light gray-green clayey f-m sand, trace lignite (SC)			NEG		
	6U	55.5 57.5	Push=24 Rec=24	Top: Light grn m-f sand, sm cl (SC) Bot: White clayey m-f sand (SC)	C2	54 55	NEG		
	7D	57.5 59.0	6-8 9	Yellow-gray f-m sand, some clay, clay layers, tr lignite (SC&CH)			NEG		
	8U	59.0 61.0	Push=24" Rec=20"	Stiff light gry clay, sm f sand pkts & lyrs, tr lignite (CH&SP)			60	NEG	
	9D	61.0 62.5	4-6 7	Stiff light gray-green clay, tr fine sand, lignite (CH)				NEG	
	10U	62.5 64.5	Push=24" Rec=14"	Stiff light gry-grn clay, sm fine sand lyrs, trace lignite (CH)				NEG	
	11D	64.5 66.0	3-5 9	Stiff light gray-green clay, tr fine sand, lignite (CH)			65	NEG	
	12D	66.0 67.5	9-12 14	Stiff light gray-green clay, some fine sand, trace lignite (CH)			NEG		
	13U	67.5 68.5	Push=12" Rec=12"	Light gray-green calcareous f-m sand, sm cl, cl lyrs, tr shls (SC&CH)			POS		
	14D	68.5 70.0	5-7 8	Light gray-green clayey f-m sand (SC)		70	NEG		
	15U	70.0 72.0	Push=24 Rec=15	Light gray-green m-f sand, some clay, tr cl lyrs, lignite (SC)		73.5	NEG		
	16D	72.0 73.5	5-8 16	Gray fine to medium sand, some clay (SC)			NEG	End of boring at 73.5'.	
						75			

BORING NO. Z-224U

PROJECT SALTSTONE DISPOSAL AREA S.R.P.

MADE BY PEB DATE 5-28-82  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 3 OF 4

Z-224U

GROUTING REPORT - BORING NO.

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PUMPED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
1300 05-28-86	Grouting	73.5				1	7.4	0.1	7.3	50	10	mud/grout	
						2	7.4	0.1	7.3	10	"	grout	
1600 05-28-86	Grouting	23.0'				3	3.7	0.1	3.6	5.0	"	grout	

18.2 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Earling 1579  
 ALSO USED IN BORINGS   
 CEMENT 3.5 94 LB. BAGS  
 BENTONITE 0.3 100 LB. BAGS  
 SAND 0.0 LBS/CU. FT.  
 WATER 36 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 2.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED

RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 (E.Y.)  
 BAGS CEMENT x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 8.0 BAGS  
 (E.Y.)  
 BAGS BENTONITE x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 1.0 BAGS  
 (E.Y.)  
 CU. FT. SAND x (G.P.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.  
 (E.Y.)

COMMENTS:

BORING NO. Z-224U

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 4 of 4  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-224U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 75.847 F 67.041  
SURFACE ELEVATION 281.2' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" O.D. O-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER \_\_\_\_\_  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

MUD LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO MUD	CONDITIONS OF OBSERVATION*
5-28-86	0705	66.0	-	21.0	OVERNIGHT

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 73.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 73.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 5

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	8.0	1.0	0.0	18.2				TOTAL GROUT 18.2 FT <sup>3</sup>

BORING CONTRACTOR DAVIS DRILLING CO., INC.  
DRILLER JAMES DAVIS HELPERS JAMES HILTON

REMARKS \_\_\_\_\_  
RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-28-86

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 4

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL -Z-AREA

BORING NO. 7-225U

SURFACE ELEV. 277.0

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR. PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
						5		
						10		
						15		
						20		
						25		
						30		
						35		
						40		
						45		Note: no sampling from 0-0'-48.0'
						48		
1D	48.0	11-14		Red-brown & yel-brn f-m sand, some silt (SM)	S1	50	NEG	
2D	49.5	15						
	49.5	15-24		Mottled red-brn & yel-brn f-m sand, trace silt (SP-SM)			NEG	
	51.0	24						



MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 2 OF 4

FILE NO. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA

BORING NO. Z-225U

PROJECT LOCATION SAVANNAH RIVER PLANT

RES. ENGR.

SURFACE ELEV. 277.0  
PETER E. BLEIWEISS

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	HCL TEST	REMARKS
	NO.	DEPTH	BLOWS/6"					
MAY 22, 1986 - SUNNY, CLEAR WARM, 92°F  1700					(S1)	53		
	3D	55.0	3-3	Red-brown clayey fine to medium sand (SC)	(S3a)	55	NEG	
	4U	56.5	5	Redbrn and yel-brn f-m sand, sm cl, cl lys, tr c sand (SC)				NEG
		58.5	Push=24 Rec=24"			58.5	NEG	
	5D	58.5	4-6	Very stiff mottled yellow-brown & red-brn clay, tr f sa, lignit(CH)	(C2)	60	NEG	
	6U	60.0	19	Stiff red-brn and yel-brn clay, sm f sand, tr lignite (CH)				NEG
		62.0	Push=24 Rec=24			64	NEG	
	7U	62.0	Push=24	Yellowbrn clayey f-m sand, sm cl lys, trace lignite (SC)	(S3a)	65	NEG	
	8D	64.0	10-13	Yel-gray f-m sand, some clay, trace lignite (SC)			65.5	NEG
		65.5	17					

PROJECT SALTSTONE DISPOSAL AREA S.R.P.

MADE BY PEB DATE 5-28-86  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

PAGE 2 OF 3

GROUTING REPORT - BORING NO. Z-225U

TIME AND DATE	WORK PERFORMED	OPEN HOLE DEPTH	CASING DEPTH	TANK NO.	TRUCK NO.	CHARGE NO.	TANK VOLUME BEFORE	TANK VOLUME AFTER	VOLUME PURIFIED	GROUT PIPE DEPTH	GAGE PRESSURE	RETURN	REMARKS
5-22-86	Grouting	65.5				1	7.4	3.7	3.7	10	10	mud/grout	
							3.7	3.6	3.6	5	10	grout	
5-28-86	add'l grouting	15.0					3.7	0.1	3.6	0	0	grout	

10.9 SUB TOTAL CU. FT.

BATCH DETAILS

TRUCK NO. Laing-1500  
 ALSO USED IN BORINGS   
 CEMENT 3 94 LB. BAGS  
 BENTONITE 0.2 100 LB. BAGS  
 SAND 0 LBS/CU. FT.  
 WATER 30 GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) 7.4 CU. FT.  
 GROUT PUMPED (G.P.) 7.3 CU. FT.  
 GROUT WASTED (G.W.) 0.1 CU. FT.

TRUCK NO. \_\_\_\_\_  
 ALSO USED IN BORINGS \_\_\_\_\_  
 CEMENT \_\_\_\_\_ 94 LB. BAGS  
 BENTONITE \_\_\_\_\_ 100 LB. BAGS  
 SAND \_\_\_\_\_ LBS/CU. FT.  
 WATER \_\_\_\_\_ GALS.  
 W./W.O. 3% CaCl<sub>2</sub>  
 ESTIMATED YIELD (E.Y.) \_\_\_\_\_ CU. FT.  
 GROUT PUMPED (G.P.) \_\_\_\_\_ CU. FT.  
 GROUT WASTED (G.W.) \_\_\_\_\_ CU. FT.

MATERIALS USED  
 RATIO OF (G.P.) = \_\_\_\_\_ = \_\_\_\_\_  
 BAGS CEMENT x (G.P.) / (E.Y.) = \_\_\_\_\_ x \_\_\_\_\_ = 5 BAGS  
 BAGS BENTONITE x (G.P.) / (E.Y.) = \_\_\_\_\_ x \_\_\_\_\_ = 0.5 BAGS  
 CU. FT. SAND x (G.P.) / (E.Y.) = \_\_\_\_\_ x \_\_\_\_\_ = 0 CU. FT.

COMMENTS: \_\_\_\_\_

MUESER RUTLEDGE CONSULTING ENGINEERS

Sheet 4 of 4  
File No. 6329

PROJECT SALTSTONE DISPOSAL - Z-AREA BORING NO. Z-225U  
LOCATION SAVANNAH RIVER PLANT  
BORING LOCATION N 75939 - E 67,325  
SURFACE ELEVATION 277.0' DATUM U.S.G.S. (MEAN SEA LEVEL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG:  TRUCK,  SKID,  TRIPOD,  OTHER \_\_\_\_\_  
TYPE OF FEED DURING CORING:  MECHANICAL,  HYDRAULIC,  OTHER \_\_\_\_\_  
 CASING UTILIZED: DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
DIAMETER, INCHES \_\_\_\_\_, DEPTH FROM \_\_\_\_\_ TO \_\_\_\_\_  
 DRILLING MUD UTILIZED: DIAMETER OF ROTARY BIT, INCHES 3-7/8"  
TYPE OF DRILLING MUD FLORIGEL H-Y  
 AUGER UTILIZED: TYPE AND DIAMETER, INCHES \_\_\_\_\_  
TYPE AND SIZE OF:  
DRILL RODS N: 2-3/8" D-SAMPLER 2" O.D. SPLIT SPOON  
S-SAMPLER \_\_\_\_\_ U-SAMPLER G.U.S.  
CORE BARREL \_\_\_\_\_ CORE BIT \_\_\_\_\_  
CASING HAMMER: WEIGHT, POUNDS \_\_\_\_\_, AVERAGE FALL, INCHES \_\_\_\_\_  
SAMPLER HAMMER: WEIGHT, POUNDS 140, AVERAGE FALL, INCHES 30

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION*
					NO OBSERVATIONS MADE

\* Note reliability of observation, rainfall, elevation of nearby open water, tide gauge or other factors affecting water level recorded.

PAY QUANTITIES

DRILLING FOR SOIL SAMPLING AND GROUTING 65.5 LIN. FT.  
SPLIT SPOON SAMPLING IN DRILL HOLES 17.5 LIN. FT.  
REDRILLING OF GROUTED HOLES 0 HOURS. CASING UTILIZED 0 LIN. FT.  
STANDBY TIME FOR DRILL RIG AND CREW 0 HOURS.  
STANDBY TIME FOR GROUT MACHINE AND CREW 0 HOURS.  
NO. OF 3" UNDISTURBED SAMPLES 3

MATERIALS FOR MIXING GROUT

GROUTING OF DRILL HOLES

SHEET NO.	CEMENT 94LB. BAGS	BENTONITE 50 lb. BAGS	SAND CUBIC FEET	VOLUME PUMPED IN CUBIC FEET				TOTAL GROUT 10.9 FT <sup>3</sup>
				WITHOUT CaCl <sub>2</sub>		WITH CaCl <sub>2</sub>		
				0-200	>200	0-200	>200	
TOTAL	5	0.3	0	10.9				

BORING CONTRACTOR DAVIS DRILLING CO., INC.

DRILLER JAMES DAVIS HELPERS GLENN DODSON

REMARKS 0.75 HR GROUT TIME

RESIDENT ENGINEER PETER E. BLEIWEISS DATE 5-28-86