DESIGN MEMORANDUM

Dalecarlia Water Treatment Plant and Georgetown Reservoir Residuals Collection and Treatment

U.S. Army Corps of Engineers
Baltimore District
Washington Aqueduct Division

GEOTECHNICAL INVESTIGATION REPORT

BOOK 3 OF 5

WR&A
Whitman, Requardt and Associates

WHITMAN, REQUARDT AND ASSOCIATES

Engineers and Planners

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Baltimore, Maryland 21218
(410) 235-3450
Fax: (410) 243-5716

August 12, 1996

Mr. Howard Callender
U.S. Army COE, Baltimore District Engineering Division
P.O. Box 1715, Room 10700
Baltimore, Maryland 21203-1715

RE: GEOTECHNICAL INVESTIGATIONS REPORT
FINAL - AUGUST 1996 - Dalecarlia WTP Residuals
Design Memorandum Book 3 of 5
Contract No. DACW31-94-C-0141

Dear Mr Callender,

Transmitted herein are six copies of the revised and final *GEOTECHNICAL INVESTIGATIONS REPORT*, dated August 1996. This report, Book 3 of 5, has been finalized pursuant to COE Design Memorandum review comments, as clarified and documented via WR&A July 29, 1996 Responses (under separate cover). This final Design Memorandum Book 3 of 5 Report concludes our work associated with the modified contract scope, WR&A work order 13072, Task Item No. 4.

WR&A has been honored to serve the U.S. Army Corps of Engineers throughout the duration of this project. Please advise if there are any questions regarding the completed Design Memorandum documents submitted.

Yours very truly,
WHITMAN, REQUARDT AND ASSOCIATES

Michael L. Pindak

Enclosures

cc: Dave MacGregor - WAD w/encl.
COE Out, WR&A Document D047.1 file w/encl.

13040/coe-bk3.fnl

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FINAL

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FOR

DALECARLIA WATER TREATMENT PLANT AND GEORGETOWN RESERVOIR RESIDUALS COLLECTION AND TREATMENT

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FOR

DALECARLIA WATER TREATMENT PLANT AND GEORGETOWN RESERVOIR RESIDUALS COLLECTION AND TREATMENT

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GEOTECHNICAL INVESTIGATION REPORT

FOR

DALECARLIA WATER TREATMENT PLANT AND GEORGETOWN RESERVOIR RESIDUALS COLLECTION AND TREATMENT

I. INTRODUCTION

A subsurface investigation was conducted for the United States Army Corps of Engineers - Washington Aqueduct Division (USACE-WAD) at the Dalecarlia Water Treatment Plant by Whitman, Requardt and Associates. Drilling services for the investigation were provided by Geomatrix, Incorporated. The investigation was conducted in three phases beginning in July of 1995 in order to address the scope of work with respect to providing suitable recommendations for the proposed project.

The Geotechnical investigations are part of a larger design project. The design project proposes additions and modifications to the existing Dalecarlia water treatment facilities to improve water quality in the Potomac River by elimination of residuals discharge to the River from the Plant in accordance with federal rules and regulations set forth by the United States Environmental Protection Agency. The Dalecarlia Water Treatment Plant is located at the border of Montgomery County (Maryland) and the District of Columbia on MacArthur Boulevard. Design of the proposed construction in the following areas required geotechnical investigations:

- *Dewatering Facility Area*: Proposed facilities to include a Dewatering Building, Four Gravity Thickeners, a Thickened Residuals Pumping Station, Perimeter Road, and a Stormwater Management Pond.

- *Dalecarlia Forebay Area*: The proposed structure is a residuals equalization basin and pumping station.

- *Tunnel Area*: Two proposed force mains through an existing railroad tunnel beneath MacArthur Boulevard to link the forebay structure with the Dewatering Building.

- *Dalecarlia Sedimentation Basin Area*: The proposed structure is a residuals pumping station.

- *Georgetown Reservoir Area*: An equalization basin and an attached pumping station are planned in Basin 1 of the reservoir. Additional retrofitting of the existing embankment is planned to allow transfer of a dredge between Basin 1 and Basin 2. The bottom of Basin 2 will be modified to allow efficient removal of settled residuals by dredging.

II. PROJECT DESIGN REQUIREMENTS

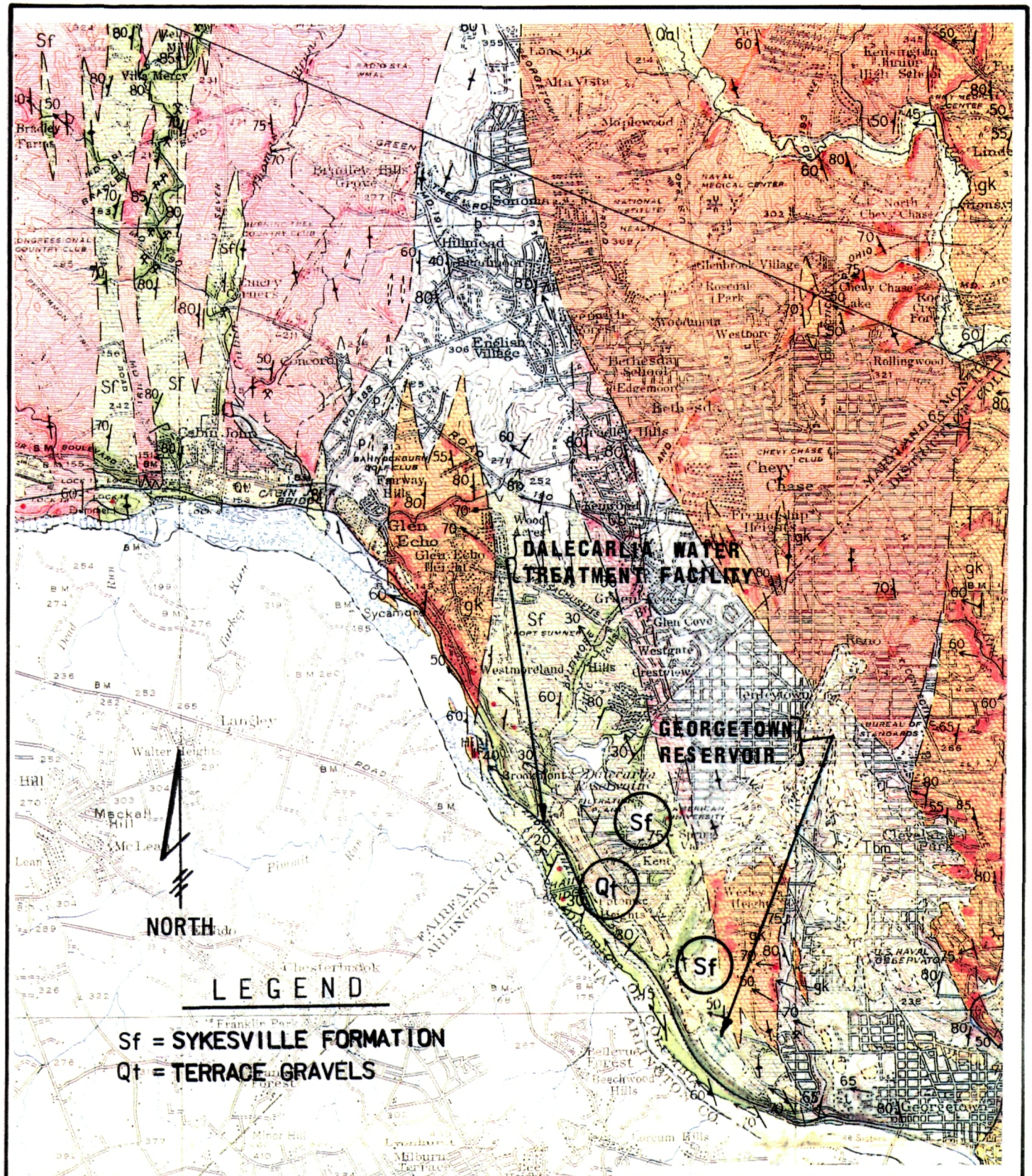
The project design requirements are outlined in the Supplemental Instructions for Geotechnical Design included in Appendix A. This report describes subsurface to the extent to meet and/or exceed work scope requirements stipulated by the USACE-WAD for a geotechnical design memorandum.

III. GEOLOGICAL SETTING

The project area is within the Piedmont Province, which is the region between the Appalachian Mountains and the Coastal Plain. The Piedmont is a region of complex crystalline geology, and includes Precambrian recrystallized plutonic basement rocks, metamorphosed sedimentary rocks, and intrusive igneous rocks. The area surrounding the project sites are made up of gneiss, quartzites, schists, and granites.

The Piedmont has undergone folding, faulting, uplift and tilting, the effects of which are seen in the weathering, erosion, and drainage patterns. The project sites are within the "fall line or zone," which is the boundary separating the Piedmont Plateau from the Coastal Plain. The Coastal Plain lies approximately 2 miles to the east. The surface of the Piedmont has been weathered and eroded. Sediments have been deposited onto the basement rock east of the fall line, to form the more recent Coastal Plain deposits.

Both the Dalecarlia Water Treatment Plant and the Georgetown Reservoir lie within the outcrop area of the Sykesville Formation, as shown on the Geologic Map of Montgomery County and the District of Columbia, published by the State of Maryland Department of Geology, Mines and Water Resources in 1953. The Sykesville Formation is metamorphic rock described as granitic looking schistose rock containing numerous inclusions, quartz pebbles and garnets. Situated at the confluence of the deeply incised Potomac River and the Little Falls Branch, the project sites are near an area of river terraces deposits. Figure No. 1 is a geologic map of the project area.



PORTION OF GEOLOGIC MAP
OF MONTGOMERY COUNTY AND
THE DISTRICT OF COLUMBIA
- 1953 -

BY MD. DEPT. OF GEOLOGY, MINES
AND WATER RESOURCES

WHITMAN, REQUARDT AND ASSOCIATES

SCALE:
1" = 1 MILE

FIGURE NO. 1

IV. SUBSURFACE EXPLORATION

A. ***Preliminary Evaluation***: Preliminary evaluation of subsurface conditions included conducting: an initial field reconnaissance and a review of the available literature.

1. **Initial Field Reconnaissance** - A field reconnaissance was made in June of 1995 in order to preliminarily evaluate the sites, locate rock outcrops, and signs of old and fresh disturbance, and identify access for drilling equipment.

2. **Review of Available Data** - Relevant available data for this project included geologic maps published by the Maryland Geological Survey, a geotechnical report entitled "Solids Recovery Facilities Dalecarlia Water Treatment Plant" by Rebull and Associates, dated October 1981, and a design memorandum prepared by Camp, Dresser and McKee, Inc., dated November 1979. A plan provided by the WAD showing original topography of the proposed Dewatering Facilities area was used to estimate the thickness of dumped fill. The original topographic plan is Drawing No. 40.16-14.2-4, dated January, 1967. The data presented in these documents was reviewed and used in identifying the locations and estimating the required depths of new geotechnical boreholes. Many of the previous borings in the Dewatering Facility Area were of limited value because they did not penetrate through the fill, that has been placed since 1967, and reach the underlying rock.

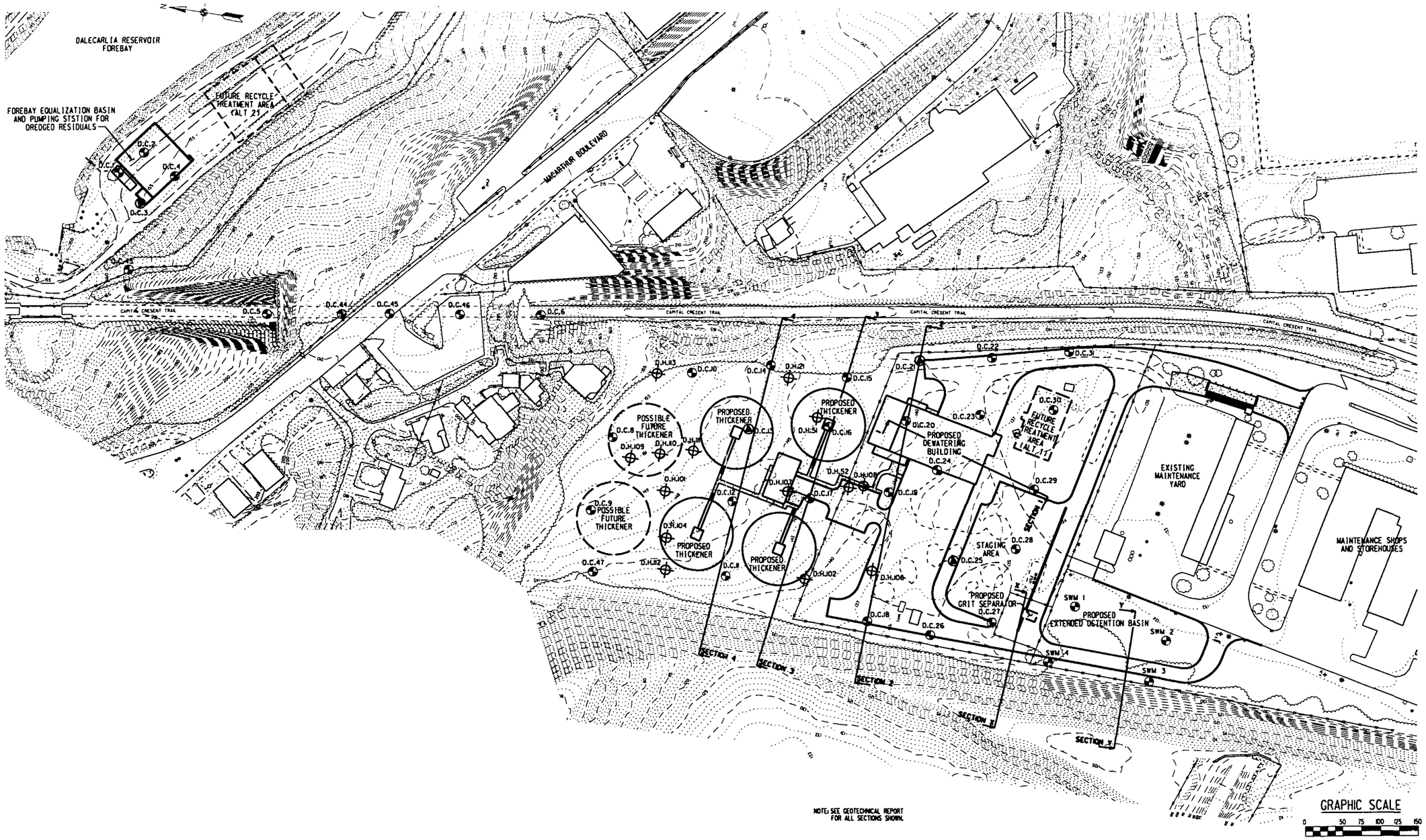
B. ***Subsurface Investigation***: A subsurface investigation program was planned for the purpose of delineating the type and condition of subsurface materials. The investigation was performed in three phases. Appendix B contains copies of the boring logs, conducted by Geomatrix, Inc., of Hyattsville, Maryland.

All boreholes were advanced into the soil with hollow stem augers. Standard Penetration Tests were performed at regular intervals of 5 feet in soil using a 140 pound hammer freely falling through a height of 30 inches. Two inch ID split spoon

samples were taken at each of these intervals. Blow counts were recorded for 6 inch increments as the spoon penetrated 18 inches. Spoon refusal was considered to be reached when the blow count for less than 6 inches of penetration exceeded 50 blows. The top of hard rock was defined in the borings by auger refusal. Borings were advanced in rock using NX size, double tube core barrels with diamond bits. Rock quality designation (RQD) values were recorded by adding pieces of rock core recovered greater than or equal to 4 inches in length, and dividing by the length of the run. Individual rock core runs were typically 5 feet in length. Field inspection services were conducted by a WR&A geotechnical engineer, throughout the test borings program.

Phase I of the investigation was conducted in July of 1995. Borings at the proposed dewatering facility area, forebay area, tunnel area and sedimentation basin area were taken during this phase. Borings were laid out in an approximate 100-foot grid pattern at the dewatering facility area and at approximate corner locations for the structures at the forebay and sedimentation basin areas. Borings in the tunnel area were taken to establish the subsurface profile for two pipelines and a duct bank proposed to connect the forebay to the dewatering facility area. Figure 2 includes the boring location plans for the Dewatering Facility area and the Forebay and Tunnel area. Figure 3 includes the boring location plans for the Sedimentation basin area and the Georgetown Reservoir area. Borings in the tunnel were drilled with a skid mounted rig. Borings at other locations were drilled with either truck mounted or all terrain mounted rigs. Two drilling rigs were operated simultaneously to expedite the drilling.

Phase II of the investigation was conducted in October of 1995. The four borings of the SWM Series, SWM-1,2,3, and 4 were taken during this phase. The west end of the Proposed Dewatering Facility Site drops sharply in elevation. This slope was created by the uncontrolled filling in the 1970's during WMATA subway construction. Borings SWM-3 and SWM-4 were taken near the slope on the west side of the Dewatering Facility Area to provide information for slope stability analysis. Borings SWM-1 and SWM-2 were taken to provide information for the Stormwater



U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

WASHINGTON AQUEDUCT DIVISION

DALECARLIA WTP AND GEORGETOWN RESERVOIR RESIDUALS COLLECTION AND TREATMENT

DALECARLIA FOREBAY, TUNNEL AND DEWATERING FACILITY AREAS

BORING LOCATION PLAN

WHITMAN, REQUARDT AND ASSOCIATES ENGINEERS
BALTIMORE, MARYLAND
(410) 239-3450

DRAWING NUMBER

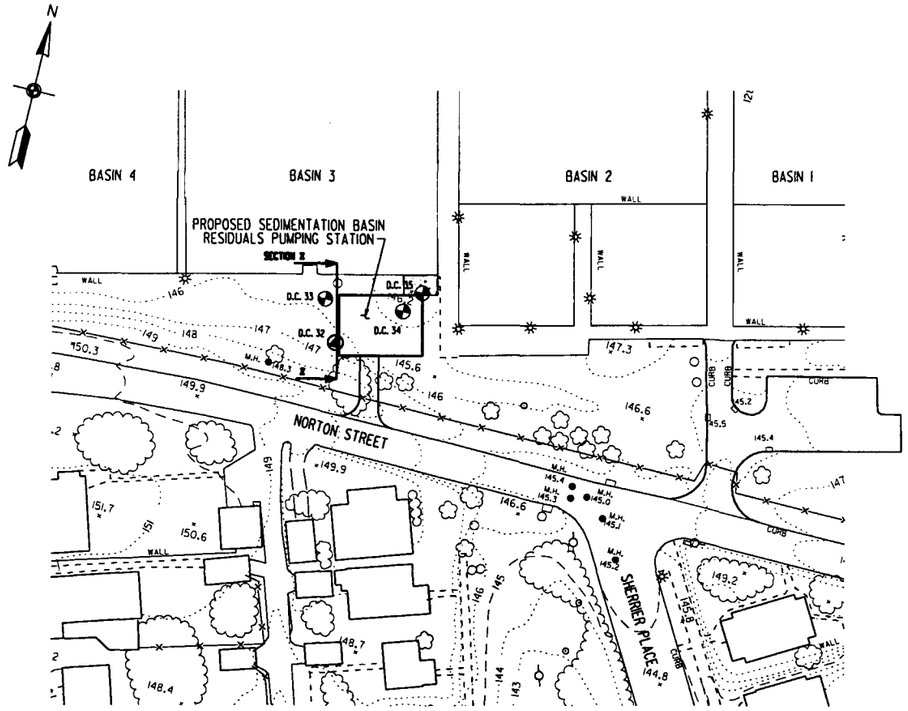
PLATE

SCALE: 1" = 50'

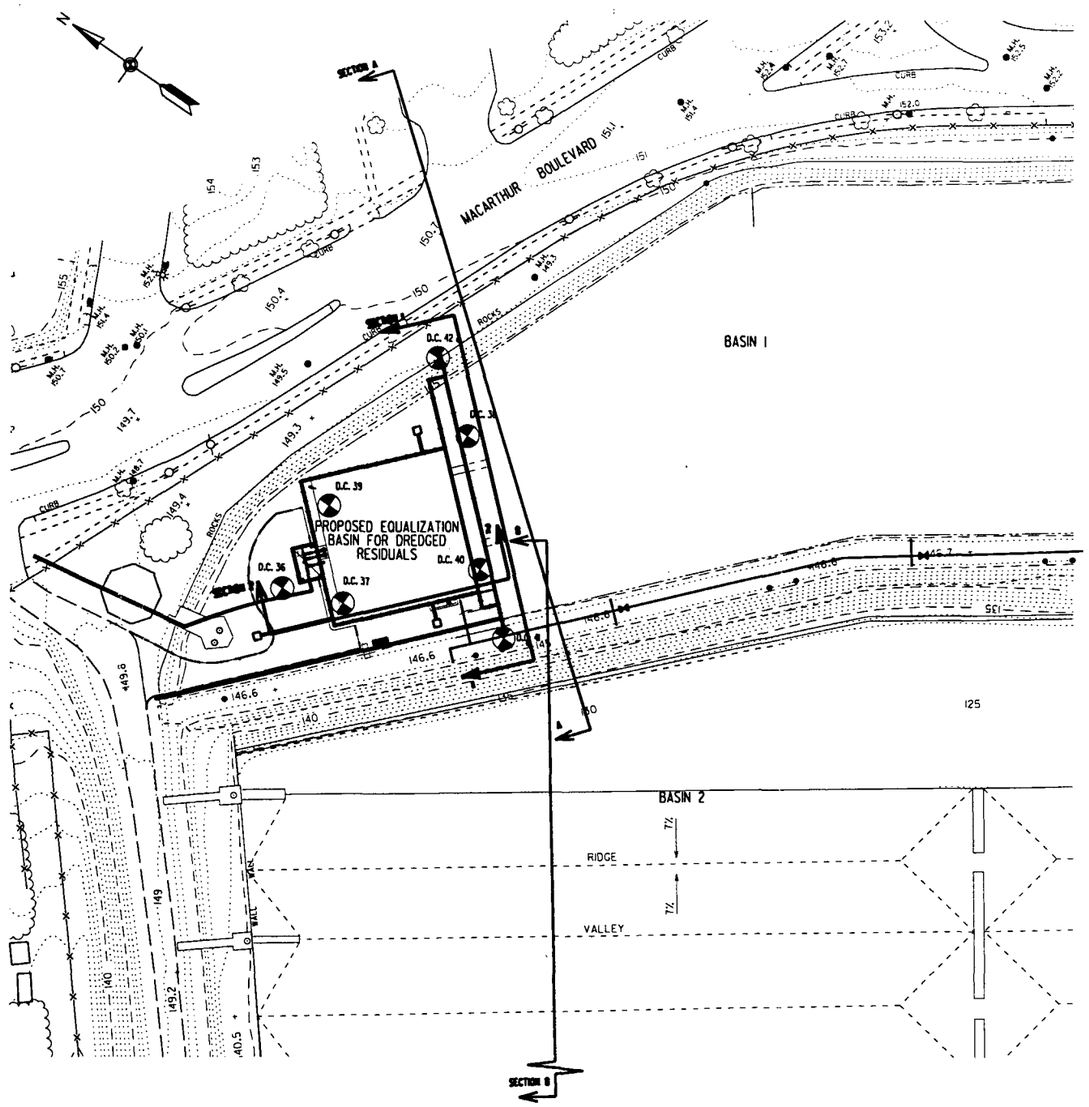
FIGURE 2 | SHEET C-12

WR&A \ 13044 \ DALEC12.DGN

DESIGN MEMORANDUM - (35%) FINAL SUBMISSION



SEDIMENTATION BASIN AREA



GEORGETOWN RESERVOIR AREA

NOTE: SEE GEOTECHNICAL REPORT FOR ALL SECTIONS SHOWN.

GRAPHIC SCALE

0 10 20 30 60 90

SCALE: 1" = 30'-0"

LEGEND

- SOIL BORINGS IN CURRENT SUBSURFACE INVESTIGATION
- GROUNDWATER MONITORING WELLS IN CURRENT SUBSURFACE INVESTIGATION

US Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

WASHINGTON AQUEDUCT DIVISION

DALECARLIA WTP AND GEORGETOWN RESERVOIR RESIDUALS COLLECTION AND TREATMENT

GEORGETOWN RESERVOIR AREA AND SEDIMENTATION BASIN AREA

BORING LOCATION PLAN

WILLIAM B. REGUARDT AND ASSOCIATES ENGINEERS BALTIMORE, MARYLAND (410) 235-3450	DRAWING NUMBER	PLATE
SCALE: 1" = 30'	FIGURE 3	SHEET C-13

WR&A \ 13044 \ DALEC13.DGN

DESIGN MEMORANDUM - (35% FINAL SUBMISSION

management design at the Dewatering Building site. Rock was not cored in this phase. The boring location plan for this phase is shown in Figure 2.

Phase III of the investigation was delayed until November of 1995 when Basin 1 of the Georgetown Reservoir was drained. Seven borings of the DC Series (DC-36 through DC-42) were taken during this phase at the Georgetown reservoir basin area. Five borings were taken in the bottom of Basin 1. Two borings (DC-41 and DC-42) were taken on the embankments. The boreholes were grouted with neat cement grout and topped off with a concrete patch upon completion to prevent reservoir leakage. The boring location plan for Phase III is shown in Figure 3.

V. LABORATORY SOIL TESTING PROGRAM

A laboratory soil testing program was developed to test samples of soil and rock obtained during the three phase operations of subsurface exploration. Test samples were selected to provide a representation of soil and rock at various depths and locations throughout the site. Penniman and Browne, Inc., of Baltimore, Maryland was sub-contracted with to perform the laboratory tests. Appendix C provides laboratory test results and a certification that Penniman and Browne, Inc. has been inspected and approved by the USACOE Baltimore District Construction Division. Tests were performed on the samples following ASTM Standards in order to determine the particle size distribution and Atterberg limits. Soil samples at the existing grades at the forebay area and dewatering facility area were tested for moisture - density relationship using modified Proctor test. An undisturbed soil sample from boring SWM-4 was tested for strain controlled, direct shear strength to provide parameters for slope stability analyses. Rock core specimens were tested for unconfined compressive strength. One sample from the existing grade of the dewatering facility area was tested for California Bearing Ratio (CBR) for pavement design parameters.

VI. DISCUSSION OF SUBSURFACE CONDITIONS

A. *Dewatering Facilities Area*: Twenty-five borings (DC-8 through DC-31 and DC-47) were taken at the proposed dewatering facilities site. In addition, four borings of the SWM series were taken for the proposed Stormwater management pond. All of the borings at the proposed dewatering facility site initially encountered a layer of fill with thickness varying from ten feet to fifty-five feet. The borings along the eastern end of the site encountered less fill than the other borings. Borings in the central and western portions of the site encountered deep thick fill deposits. This was expected considering the original contours of the site that indicated the existence of a stream valley subsequently filled. It has been reported by the USACE-WAD staff that much of the fill consisted of excavated spoil dumped from subway construction projects of the Washington Metropolitan Area Transit Authority. The layer of fill consisted of a variety of dumped un-compacted materials including sand, clay, silt, pieces of wood, decomposed root matter, glass, iron nails, and concrete pieces. Though some of the samples of fill were tested, the results should be used conservatively in ascribing soil parameters for the fill as a whole. Soil strata cannot be mapped within this fill because of extensive variability of soil type from sample to sample both in terms of area and depth. Blow counts in this layer varied from as low as three blows per foot to as high as over fifty blows per foot. However, the relevance of blow counts in fills is vastly reduced and high blow counts should not necessarily be interpreted as stable material. Boring DC-21 was offset and redrilled at DC-21A and DC-31 was offset and redrilled at DC-31A and DC-31B. These borings were offset because of obstructions encountered in the fill or at the base of the fill. Auger refusal continued to occur even after offsetting. Rock coring was not performed at DC-31. Auger refusal at DC-31, 31A, and DC-31B occurred at depths of fifteen feet. The split spoon sample driven under high blow counts showed little recovery that consisted of rock pieces, quartz fragments and possible rubble. A similar situation at boring DC-32 necessitated relocating it to DC-32A. Samples in the layer of fill at thirty feet

depth in borings DC-12 and DC-19 gave a gasoline or petroleum product related smell (smell was evident while drilling was in progress from auger cuttings).

Beneath the fill the borings penetrated through a layer of brown or gray micaceous sandy silt which is a layer of residual soils formed by the in-place weathering of underlying rock. The layer contained substantial amounts of rock fragments which made auguring difficult. The layer was medium dense to dense on average.

Borings encountered hard rock beneath the residual soil layer. The rock was visually classified as a schistose gneiss. The geologic map classifies rock in this area as a granitized schist. Rock coring was done for ten feet into the rock. Lengths of the individual rock core runs were typically five feet. The Rock Quality Designation (RQD) values obtained range from a low of 8% to a high of 100%. Average RQD's of the rock core samples at this site is approximately 30%. Visual observation of the rock indicated that it was layered, jointed and fractured with thin weathered zones at some places. The rock quality generally improves with depth. Unconfined compressive strength tests were run on six rock core samples in the laboratory. Test results are included in Appendix C. The arithmetic mean for the samples is 6,969 psi and the standard deviation is 2,119.5. The lowest value of unconfined compressive strength of the rock is 4,035 psi and highest value is 10,230 psi. A safety factor of 3.0 was applied to the laboratory strength of the rock in the design of pile foundations to accommodate possible jointing and bedrock fractures. Top of rock elevations are variable but generally decrease from east to west in agreement with the original site topography. All the borings except DC-21, DC-31, DC-31A, and DC-31B terminated in rock.

B. ***Forebay Area of Dalecarlia Reservoir***: Four borings, DC-1, DC-2, DC-3, and DC-4, were drilled at the site of the proposed equalization basin structure. Borings at this site initially encountered a layer of fill consisting of brown sand mixed with burnt trash and brick pieces in the upper ten to fifteen feet. The fill layer was followed by a layer

formed by in-place weathering of the underlying bedrock. Blow counts indicate that the layer of fill is loose (2 to 4 blows per foot). The residual soil stratum is dense to very dense with blow counts ranging from eleven blows per foot to over fifty blows per six inches. Ground water was encountered at depths of ten to fifteen feet while drilling. The elevation at which water was encountered in the borings is consistent with the top of water elevation in the reservoir. The depth to rock was consistently twenty-five feet to twenty-seven feet. Based on auger refusal in the borings, top of rock elevation is expected to vary from El.125 to El.128 approximately. Rock encountered in the borings is of poor quality with the rock quality designation (RQD) values falling between 0% to 13%. Boring DC-43 was drilled to identify rock elevation for the proposed pipelines between the forebay and dewatering site. Rock was encountered at approximately El.141 in boring DC-43 and the RQD value at this boring was relatively higher (30%). No ground water was encountered while drilling boring DC-43.

C. ***Tunnel Area Borings***: Five borings, DC-5, DC-6, DC-44, DC-45, and DC-46, were taken at the tunnel area on the hiker and biker trail. The borings were taken to establish the rock elevations for the proposed pipelines from the forebay area to the dewatering facilities area. The tunnel is an old railroad tunnel under the MacArthur Boulevard. The railroad right-of-way has recently been converted into a hiker and biker trail. Borings were drilled through asphalt pavement ranging in thickness from six inches to one foot. Asphalt was underlain by crusher run stone ranging in thickness from six inches to one foot except at borings DC-45 and DC-46 where the pavement was underlain by twelve to sixteen inches of cinders. The borings then encountered a residual soil layer of brown, weathered micaceous sand or silty sand. This layer was very dense and ranged in thickness from three feet to nine feet. Rock was encountered at fairly shallow depths ranging from approximately four to ten feet. Rock cores indicate very fractured rock with weathered seams. The RQD values were very low ranging from 0% to 14%. No ground water was encountered in any

of the borings in this area. The borings were backfilled and the pavement was repaired with cold patch asphalt.

D. ***Sedimentation Basins Area***: Four borings, DC-32, DC-33, DC-34, and DC-35, were taken in the area of the proposed residuals pumping station. Boring DC-32 was considered a false start after the augers reached refusal on an obstruction at nine feet. The hole was offset eleven feet northeast and called DC-32A. All the borings initially encountered a layer of fill consisting of silty sand with pieces of brick, nails, and wood to a depth of twenty feet to twenty-five feet. The layer of fill was followed by a layer of residual soils consisting of either micaceous, brown, medium to coarse sand or gray fine sand with rock fragments. Blow counts indicate that the residual soil layer is medium dense to dense. Auger refusal occurred and rock coring began at this site at approximately El.107. The cored rock in three of the borings had high RQD values and was fairly intact with minimal fractures. Rock at Boring DC-32A however, was decomposed with an RQD value of 10%.

E. ***Georgetown Reservoir Area***: Seven borings, DC-36 through DC-42 were drilled in order to provide subsurface information for the proposed equalization basin. Borings at the basin bottom (DC-36 through DC-40) initially encountered a layer of wet, brown or gray clay to a depth of five to seven feet. Boring DC-38, however, encountered sandy silt in the upper five feet. The borings then penetrated through a layer of residual soils, consisting mainly of red or brown, micaceous sandy silt or silty sand, with pebbles and quartz fragments. Blow counts in this layer indicate that the residual soil is medium dense to dense in the upper fifteen to twenty feet and progressively changes to very dense in the lower part of the stratum. Auger refusal occurred in the borings at elevations ranging from El.92 at boring DC-37 to El.109 at boring DC-38. The rock cores obtained at higher elevations showed less recovery than rock cores below El. 100.

Boring DC-41 was drilled on the embankment between Basin 1 and Basin 2 and boring DC-42 was drilled on the embankment adjacent to MacArthur Boulevard. Both of these borings initially encountered medium plasticity, gray or brown, medium stiff to stiff clay for approximately fifteen feet. Boring DC-41 then encountered a layer of sandy silt with quartz pieces until auger refusal at El.102. Boring DC-42 encountered a layer of silty sand with quartz fragments. Auger refusal in boring DC-42 occurred at approximately El.96.

VII. GROUND WATER CONDITIONS EVALUATION

Ground water was encountered at substantial depths at the proposed dewatering facility area. Twenty-four hour water level readings measured in the boreholes may not be accurate because of the water used in coring rock. More accurate information can be inferred from water levels encountered while drilling, and elevations of ground water measured in monitoring wells.

Three ground water monitoring wells were installed at the proposed dewatering facilities area in borings DC-13, DC-21, and DC-25. One well was installed in the forebay area in boring DC-3 and one at the sedimentation basin area in boring DC-32. Monitoring of these ground water wells for water table elevations was performed by personnel of USACE-WAD. Appendix D contains the well details, the well completion reports and the monitoring records. Based on the above site factors, ground water can be assumed to range from El. 88 to El. 114 in the dewatering facilities area. Ground water is estimated to be at an approximate elevation of 138 at the forebay area and at an approximate elevation of 106 at the sedimentation basin area. The bidders for the resulting construction project should be advised to apply their own judgment relative to dewatering operations and the necessity to conduct construction phase dewatering operations as may be required. The Contractor would be required to design and submit a dewatering/excavation system. These submittals would be reviewed on a "For Information Only" basis with Contractor required to design and certify via MD and/or DC licensed Geotechnical Engineer.

VIII. EARTH PRESSURE RECOMMENDATIONS

Earth pressure diagrams that are the basis of the design of each of the proposed structures are included in the presentation of the Design Calculations in Appendix E.

Based on the subsurface investigation the following parameters have been used in calculating earth pressures for design. Earth pressure loads for design of temporary excavation support systems should be specified to be determined by the Contractor's geotechnical engineer.

A. *Dewatering Facilities*

1. Dewatering Building:

Layer 1: Fill

Total unit weight	=	γ	=	110 pcf
Buoyant unit weight	=	γ_b	=	55 pcf
Angle of internal friction	=	ϕ	=	20°
Active pressure coefficient	=	K_A	=	0.49
At-rest pressure coefficient	=	K_o	=	0.66

It is recommended that the structural design criteria employ a ground water level at elevation 143 (for design of structure, not excavation support system).

2. Gravity Thickeners

Layer 1: Fill

Total unit weight	=	γ	=	110 pcf
Buoyant unit weight	=	γ_b	=	55 pcf
Angle of internal friction	=	ϕ	=	20°
Active pressure coefficient	=	K_A	=	0.49

Layer 2: Residual Soils

Total unit weight	=	γ	=	110 pcf
Buoyant unit weight	=	γ_b	=	55 pcf
Angle of internal friction	=	ϕ	=	35°
Active pressure coefficient	=	K_A	=	0.27

It is recommended that the structural design criteria employ a ground water level at elevation 144.5 (for design of structure, not excavation support system).

3. Thickened Residual Pumping Station

Layer 1: Fill

Total unit weight	=	γ	=	110 pcf
Buoyant unit weight	=	γ_b	=	55 pcf
Angle of internal friction	=	ϕ	=	20°
Active pressure coefficient	=	K_A	=	0.49
At-rest pressure coefficient	=	K_o	=	0.66

It is recommended that the structural design criteria employ a ground water level at elevation 146 (for design of structure, not excavation support system).

B. *Dalecarlia Forebay Area Equalization Basin*

1. Forebay Area Equalization Basin

Layer 1: Fill

Total unit weight	=	γ	=	110 pcf
Buoyant unit weight	=	γ_b	=	55 pcf
Angle of internal friction	=	ϕ	=	20°
Active pressure coefficient	=	K_A	=	0.49

Layer 2: Residual Soils

Total unit weight	=	γ	=	115 pcf
Buoyant unit weight	=	γ_b	=	57.5 pcf

Angle of internal friction = ϕ = 35°

Active pressure coefficient = K_A = 0.27

It is recommended that the structural design criteria employ a ground water level at elevation 154.

2. Equalization Basin Pumping Station

Layer 1: Fill

Total unit weight = γ = 110 pcf

Buoyant unit weight = γ_b = 55 pcf

Angle of internal friction = ϕ = 20°

At-rest pressure coefficient = K_o = 0.66

It is recommended that the structural design criteria employ a ground water level at elevation 154.

C. *Dalecarlia Sedimentation Basin Residuals Pumping Station*

Layer 1: Fill

Total unit weight = γ = 110 pcf

Buoyant unit weight = γ_b = 55 pcf

Angle of internal friction = ϕ = 25°

Active pressure coefficient = K_A = 0.41

At-rest pressure coefficient = K_o = 0.58

Layer 2: Residual Soils

Total unit weight = γ = 115 pcf

Buoyant unit weight = γ_b = 55 pcf

Angle of internal friction = ϕ = 35°

Active pressure coefficient = K_A = 0.27

At-rest pressure coefficient = K_o = 0.43

Layer 3: Rock

Total unit weight	=	γ	=	170 pcf
Buoyant unit weight	=	γ_b	=	115 pcf
Angle of internal friction	=	ϕ	=	35°
Cohesion	=	c	=	154 tsf

It is recommended that the structural design criteria employ a ground water level at elevation 145.

D. *Georgetown Reservoir*

1. Equalization Basin and Pumping Station

Structural Backfill

Total unit weight	=	γ	=	125 pcf
Buoyant unit weight	=	γ_b	=	65 pcf
Angle of internal friction	=	ϕ	=	33°
Active pressure coefficient	=	K_A	=	0.29
At-rest pressure coefficient (Pumping Station and Influent Conduit)	=	K_o	=	0.46

It is recommended that the structural design criteria employ a ground water at elevation 147.

2. Equalization Basin and Pumping Station

Excavation Support System

Total unit weight	=	γ	=	120 pcf
Buoyant unit weight	=	γ_b	=	60 pcf
Angle of internal friction	=	ϕ	=	25°
Active pressure coefficient	=	K_A	=	0.41

It is recommended that the structural design criteria employ a ground water at elevation 147.

IX. GEOTECHNICAL EVALUATIONS AND RECOMMENDATIONS

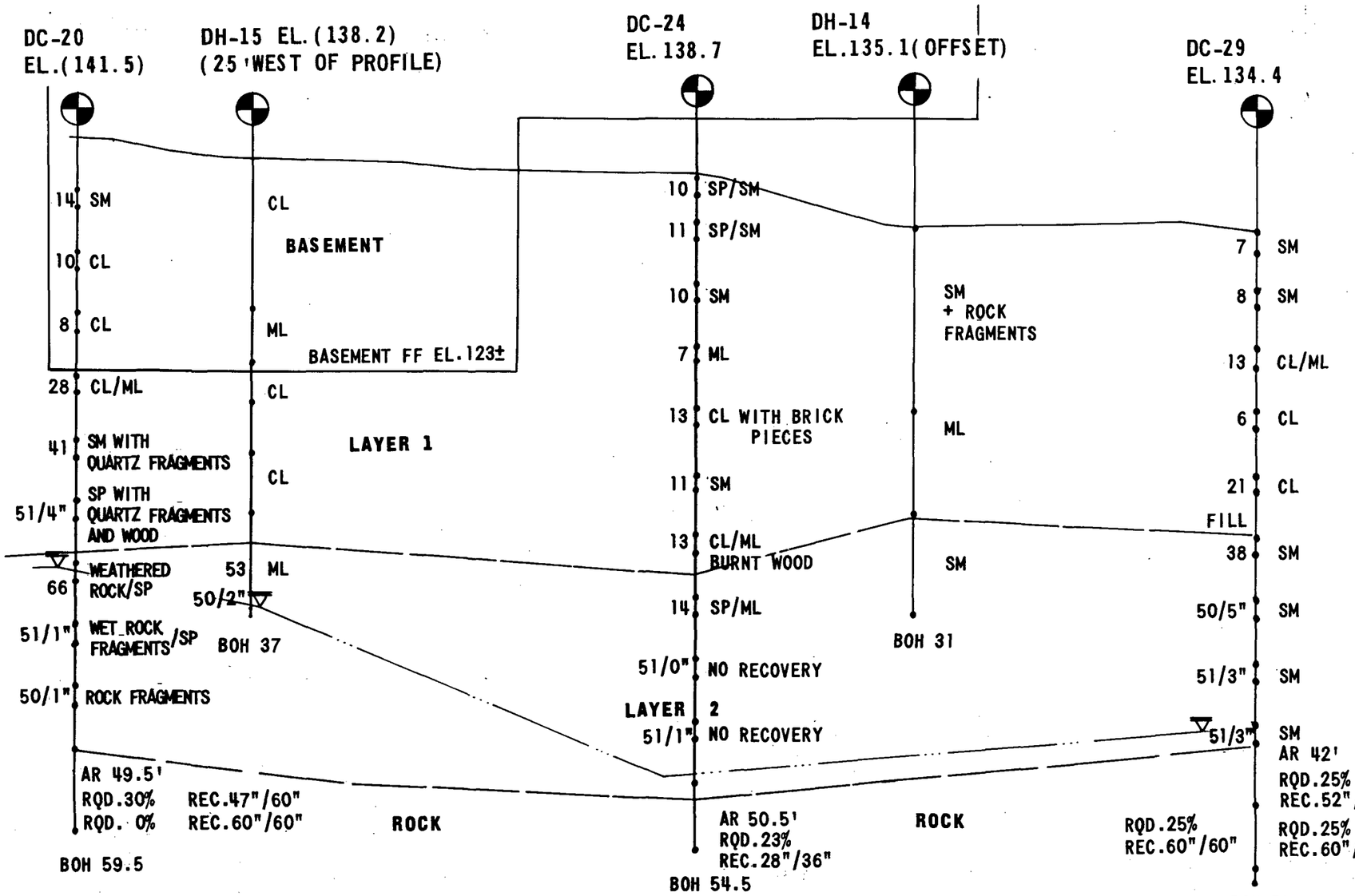
A. *Proposed Dewatering Facility Site:*

The existence of deep fills rules out the use of shallow foundations because of potential settlement and inadequate bearing capacity. Deep foundations through the fill were evaluated and identified as an economical and efficient alternative. Both steel H-piles and drilled piers were evaluated because of the depth of fill and the possibility of encountering obstructions in the fill. Though a majority of the borings did not encounter an obstruction, contract documents should delineate that obstructions exist as a job condition. A bidding Contractor must clearly be advised that he should be prepared to drive the piles or pre-auger through the obstructions as necessary.

Based on the boring logs, only a small percentage, an estimated 5%, of piles are expected to require preaugering. Provisions should be included in the project specifications to attain the required overall tension capacity during construction by driving additional piles as required by obstructions.

Auger cast grouted piles are not suitable for this site because of the questionable ability of the auger cast grouted pile rig to successfully penetrate the relatively thick layer of fill and weathered rock layer at the Dalecarlia Residuals Treatment Facility Site. The auger cast grouted pile rig is not equipped with a downward hydraulic feed mechanism, and relies on the dead weight of the augers and the rotational drive head assembly. H-piles are capable of withstanding high driving stresses. Drilled piers can be installed past obstructions by suitable equipment to desired depth. Both the H-piles and drilled piers require placement sufficiently deep to fully penetrate the fill and bear on very dense decomposed rock or rock. H-piles should be point reinforced if obstructions are encountered. Drilled piers would require a socket of at least two feet into rock. H- piles would have an allowable compression capacity of 60 tons and drilled piers would have an allowable compression capacity of 240 tons.

1. **Dewatering Building**: Figures 4 and 5 show subsurface profiles at the proposed dewatering building oriented in the north-south and east-west direction, respectively. An economic analysis was conducted which determined that H-Piles would be less expensive than the drilled piers in terms of cost per unit capacity. The analysis is included in Appendix E. Based on



SUBSURFACE PROFILE 1-1
DEWATERING BUILDING

SCALE: 1" = 20'(H)
1" = 10'(V)

LEGEND

REC = RECOVERY
RQD = ROCK QUALITY DESIGNATION
BOH = BOTTOM OF HOLE
AR = AUGER REFUSAL

LAYER 1: FILL, CONSISTS OF SAND, CLAY & SILT FOUND IN VARYING PERCENTAGES. ALSO CONTAINS WOOD, TRACE ORGANICS.

LAYER 2: MICACEOUS SILTY SAND OR SANDY SILT. WEATHERED ROCK, ALSO TRACE GRAVEL.

ROCK: GRANITISED SCHIST, OCCASIONALLY LAYERED WITH SMALL MUDSEAMS, JOINTED, INTERBEDDED WITH QUARTZ.

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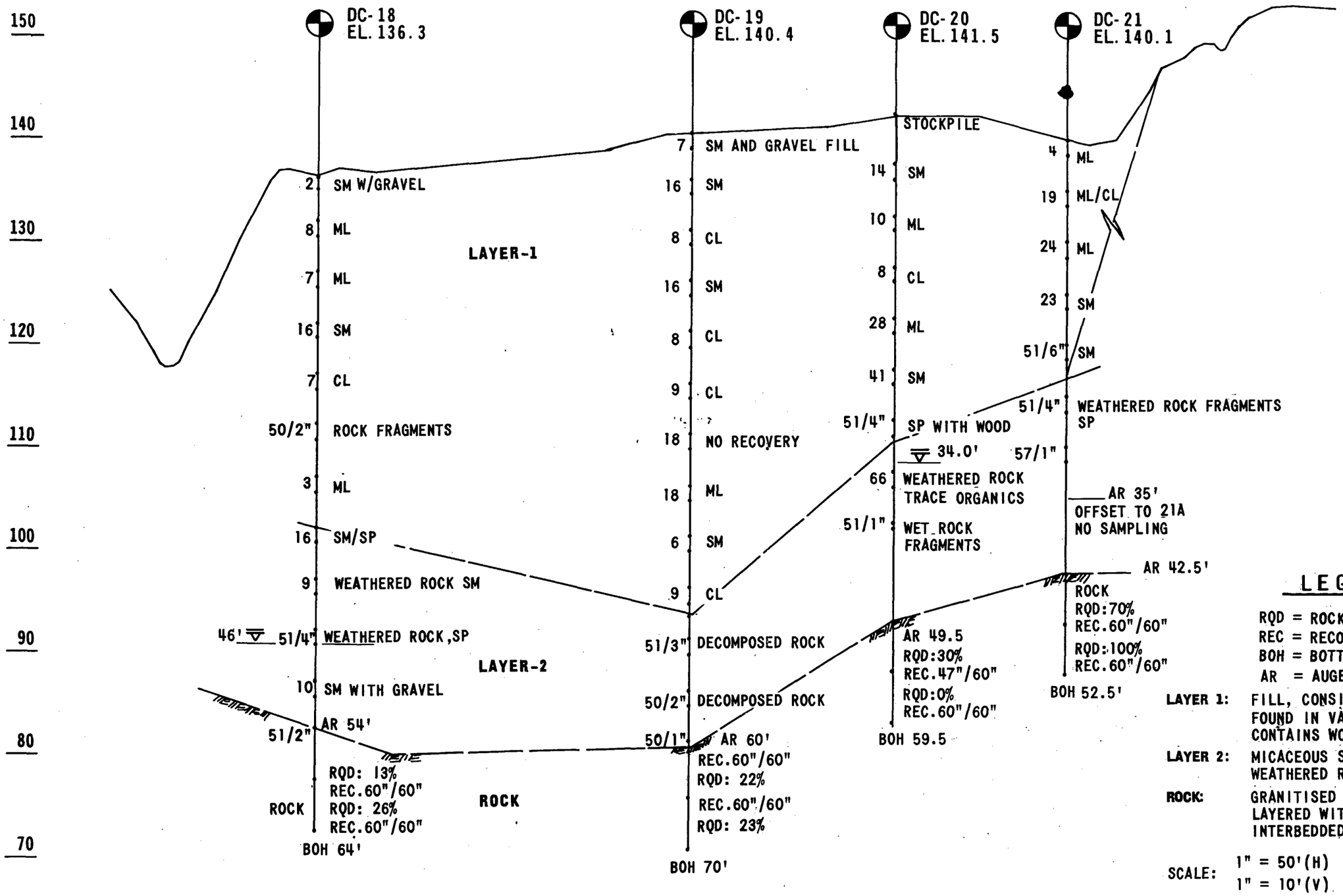
FIGURE NO. 4



LEGEND

RQD = ROCK QUALITY DESIGNATION
REC = RECOVERY
BOH = BOTTOM OF HOLE
AR = AUGER REFUSAL

LAYER 1: FILL, CONSISTS OF SAND, CLAY & SILT FOUND IN VARYING PERCENTAGES. ALSO CONTAINS WOOD, TRACE ORGANICS.

LAYER 2: MICACEOUS SILTY SAND OR SANDY SILT. WEATHERED ROCK, ALSO TRACE GRAVEL.

ROCK: GRANITISED SCHIST, OCCASIONALLY LAYERED WITH SMALL MUDSEAMS, JOINTED, INTERBEDDED WITH QUARTZ.

SCALE: 1" = 50'(H)
1" = 10'(V)

SUBSURFACE PROFILE 2-2 DEWATERING BUILDING

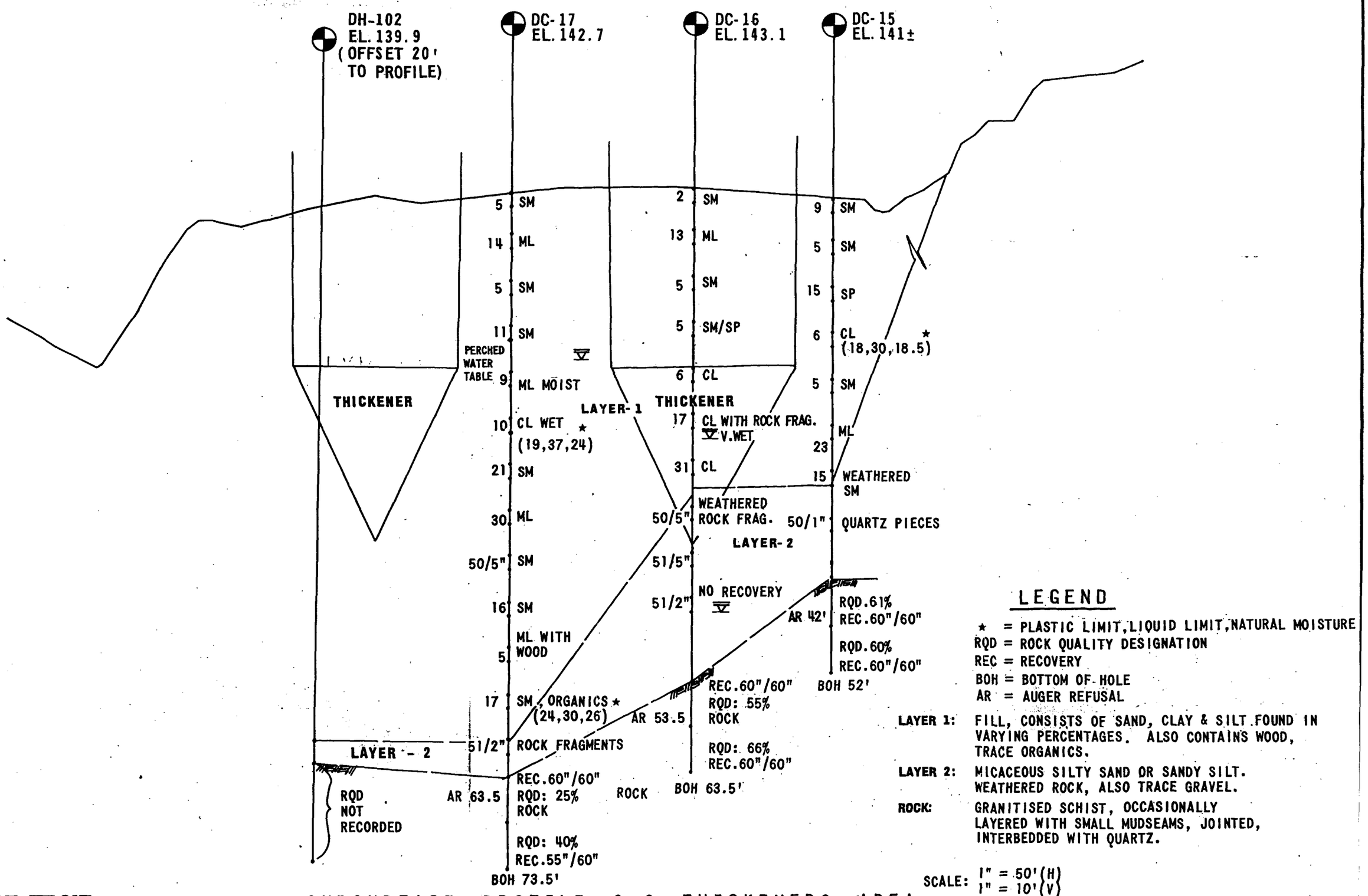
WHITMAN, REQUARDT AND ASSOCIATES

FIGURE NO. 5

the economic analysis, it is recommended that steel HP 14x73 piles be used for the dewatering building. The recommended design tension capacity of these pile is 25 tons. The earth pressure computations for the basement walls of the Dewatering Building are included in Appendix E. Lateral earth pressures for design of the basement walls are based on the at-rest earth pressure coefficient (K_o).

2. **Gravity Thickeners**: Figures 6 and 7 both show subsurface profiles oriented in the east-west direction at the proposed site of the four gravity thickeners. The base slabs of each of the gravity thickeners slope from a finished floor elevation of 125 at the outer wall to an approximate elevation of 105 at the center pier. The slabs would therefore be partly in the fill layer and partly in the layer of weathered rock and residual soil. Shallow foundations in the fill are not recommended for support of the gravity thickeners because differential settlements could cause substantial damage to the structures.

Steel HP 14 x 73 piles are recommended for support of the gravity thickeners, with a design compression capacity of 40 tons. Variable pile lengths are anticipated at this location due to varying elevations of base slabs of the structures and the top of intact rock. No pile less than ten feet in length should be permitted. If a pile encounters refusal on rock at a depth of less than 10 feet, then that pile should be socketed and grouted into the rock for a minimum of 3 feet so that no pile is less than 10 feet in length. Based on the available subsurface information, this situation is likely to happen with only a small number of piles, at the bottom of the thickeners. Tension capacities of the piles will vary, depending on the length of piles. Generally, the design tension capacity of the piles supporting the two easternmost gravity thickeners is estimated to be 12 tons, and the design tension capacity of the piles supporting the two westernmost gravity thickeners is estimated to be 16 tons.



LEGEND

★ = PLASTIC LIMIT, LIQUID LIMIT, NATURAL MOISTURE
RQD = ROCK QUALITY DESIGNATION
REC = RECOVERY
BOH = BOTTOM OF HOLE
AR = AUGER REFUSAL

LAYER 1: FILL, CONSISTS OF SAND, CLAY & SILT FOUND IN VARYING PERCENTAGES. ALSO CONTAINS WOOD, TRACE ORGANICS.

LAYER 2: MICACEOUS SILTY SAND OR SANDY SILT. WEATHERED ROCK, ALSO TRACE GRAVEL.

ROCK: GRANITISED SCHIST, OCCASIONALLY LAYERED WITH SMALL MUDSEAMS, JOINTED, INTERBEDDED WITH QUARTZ.

SCALE: 1" = 50' (H)
1" = 10' (V)

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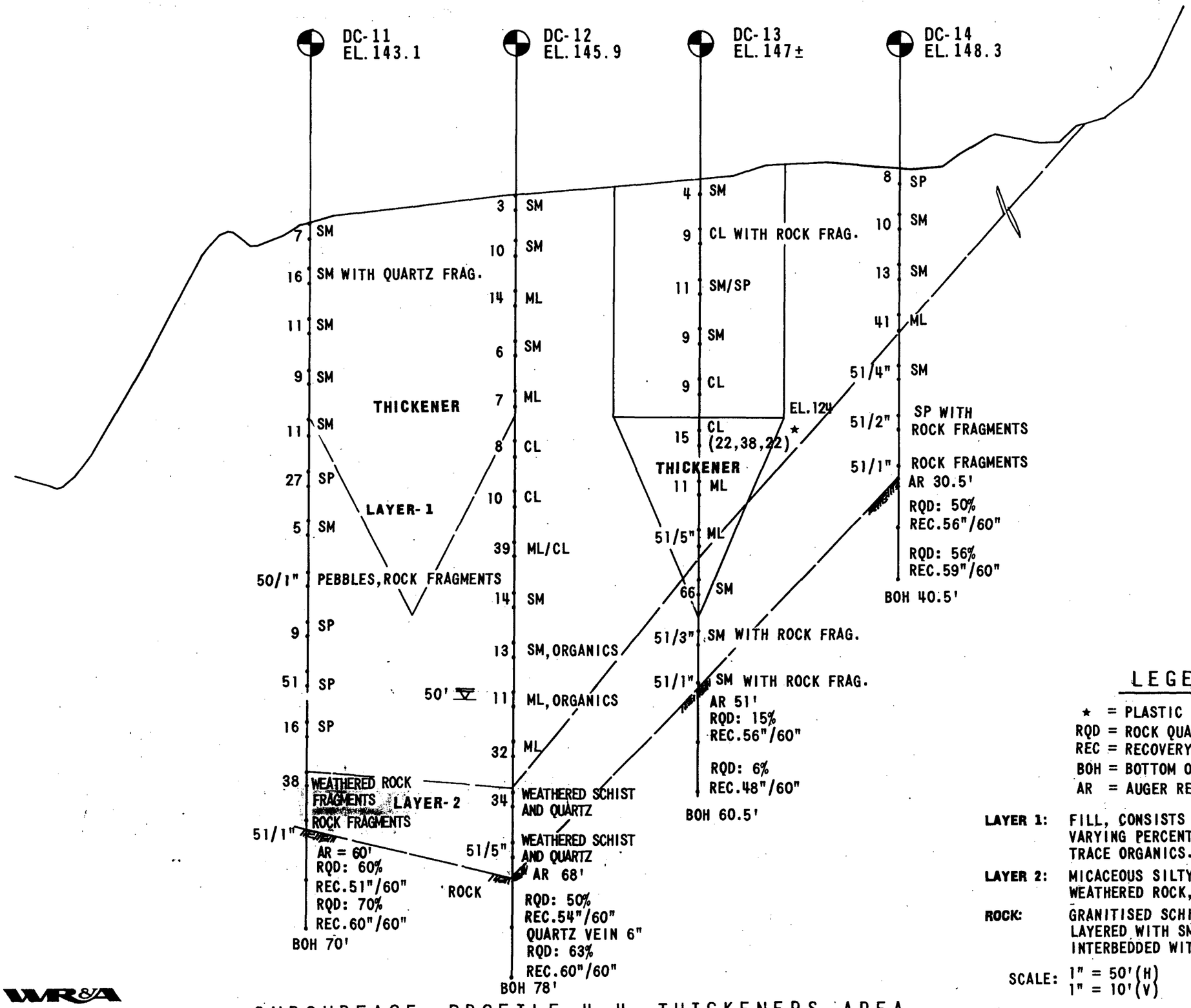
SUBSURFACE PROFILE 3-3 THICKENERS AREA

FIGURE NO. 6



LEGEND

★ = PLASTIC LIMIT, LIQUID LIMIT, NATURAL MOISTURE
RQD = ROCK QUALITY DESIGNATION
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ROCK: GRANITISED SCHIST LAYERED WITH SMALL MUDSEAMS, JOINTED, INTERBEDDED WITH QUARTZ.

SCALE: 1" = 50'(H)
1" = 10'(V)

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SUBSURFACE PROFILE 4-4 THICKENERS AREA

FIGURE NO. 7

It is recommended that both compression and tension pile load tests be conducted during construction to verify the design capacities at both the dewatering building site and at the gravity thickener site. A safety factor of 2 has been used in design of the piles. Pile load tests are recommended to be conducted in accordance with COE design practice. Pile design calculations are included in Appendix E.

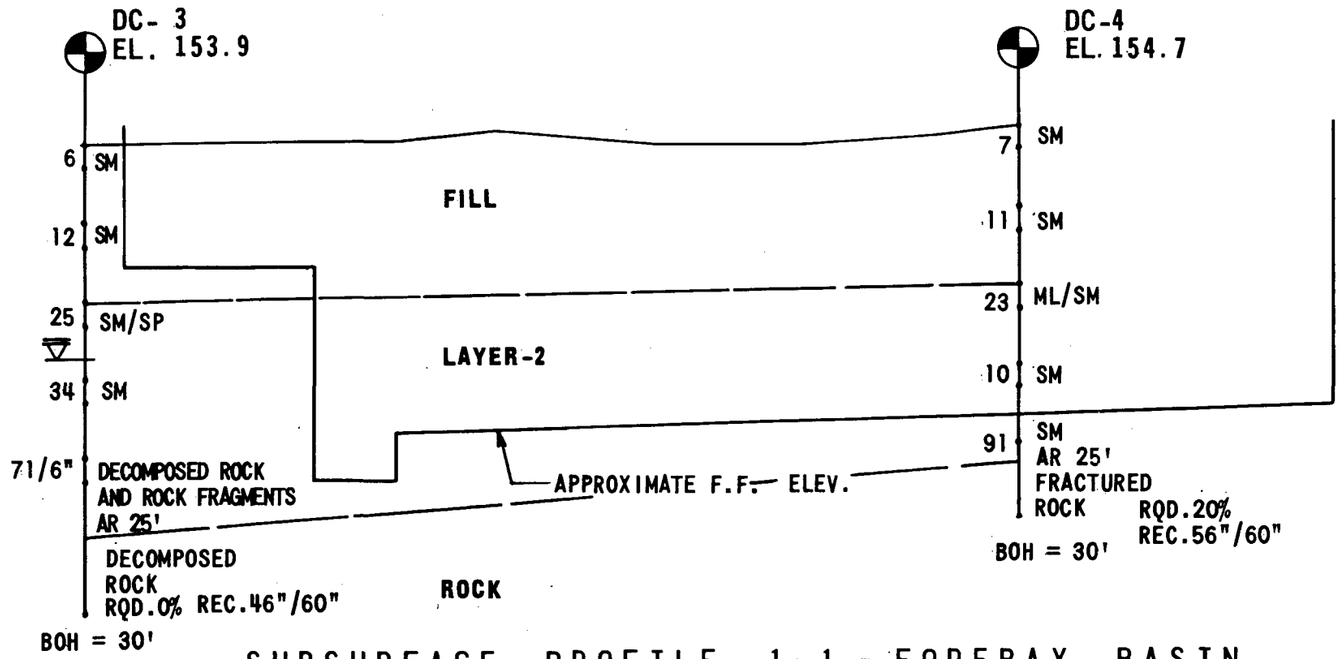
Lateral earth pressure computations based on the recommendations of Section VIII of this report are included in Appendix E. Active earth pressure coefficients should be used for design of the unbraced walls of the thickeners. It is proposed that the final design utilize the ground water table at E1.144.5 for hydrostatic pressure.

3. **Thickened Residuals Pumping Station**: The borings indicate that the proposed finish floor elevation of 102 for this structure will be in the lower part of the fill layer. The base slab of the structure is expected to be underlain by approximately five feet of fill and ten feet of residual soil. Therefore, this structure can be supported on shallow foundations if the existing fill is completely removed from beneath the structure and the undercut excavation is backfilled with controlled and compacted backfill of dense graded aggregate material. The undercut and backfill should extend at least 5 feet beyond the limits of the base slab. Fill material should be Maryland State Highway Administration Graded Aggregate Base. Thickened slabs should be used to resist flotation. Recommended allowable bearing capacity is 4,000 pounds per square foot. Lateral earth pressure computations based on the recommendations of Section VIII of this report are included in Appendix E. Final design should consider the water table at E1.146 for hydrostatic pressure.

B. ***Tunnel Area:*** Two force mains (10 inches and 30 inches) and an electrical duct bank are proposed to be placed within a common trench along the tunnel centerline. Proposed trench subgrade is 6.5 feet beneath existing grade and is eight inches beneath the pipe inverts. Rock or weathered and decomposed rock is expected at a depth of about approximately five feet, but should be capable of being excavated using ordinary excavating equipment.

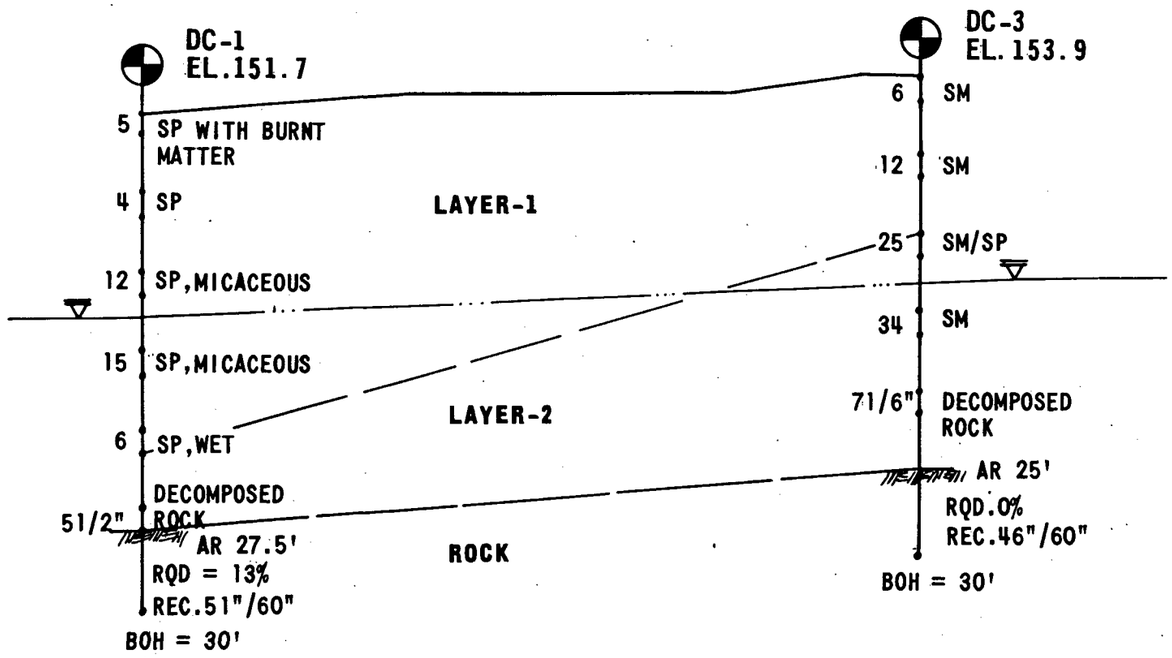
Using a bedding of No. 57 stone, the trench should be backfilled to the top with dense graded aggregate compacted in six inch lifts to 95 percent of maximum dry density as determined by modified Proctor test. The backfilled trench should be paved with a bituminous concrete section similar to the existing pavement section.

C. ***Proposed Dalecarlia Forebay Residuals Equalization Basin and Pumping Station Site***: Figures 8 and 9 present subsurface profiles at the forebay area of the Dalecarlia reservoir. Finished floor elevations of the proposed structure range from El.134 to El.129 for the basin. The proposed pumping station has a higher finished floor elevation of approximately El.145. These proposed finished floor elevations indicate that the base slabs of the equalization basin will be constructed on rock or very dense weathered rock and the base slab of the pumping station will be in the fill layer. Therefore, proof rolling and subgrade improvements should be undertaken before the base slab of the pumping station is poured. Subgrade will be acceptable if existing fill is completely removed from beneath the structure and the undercut excavation is backfilled with controlled and compacted backfill of dense graded aggregate material. The undercut and refill should extend at least 5 feet beyond the limits of the base slab. Fill material should be Maryland State Highway Administration Graded Aggregate Base. The depth of undercut is estimated to be approximately 7 feet. The structure is recommended to be designed to resist flotation with ground water at El.154. An economic analysis was made between two possible alternatives to resist flotation, namely using rock anchors or thickened slabs. It was determined, based on the economic analysis, that the thickened slabs were a better option in terms of cost per



SUBSURFACE PROFILE 1-1 - FOREBAY BASIN

FIGURE NO. 8



SUBSURFACE PROFILE 2-2 - FOREBAY BASIN

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LEGEND

RQD = ROCK QUALITY DESIGNATION
REC = RECOVERY
BOH = BOTTOM OF HOLE
AR = AUGER REFUSAL

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LAYER 2: MICACEOUS SILTY SAND OR SANDY SILT. WEATHERED ROCK, ALSO TRACE GRAVEL.

ROCK: GRANITISED SCHIST LAYERED WITH SMALL MUDSEAMS, JOINTED, INTERBEDDED WITH QUARTZ.

SCALE: 1" = 10'(H)
1" = 10'(V)

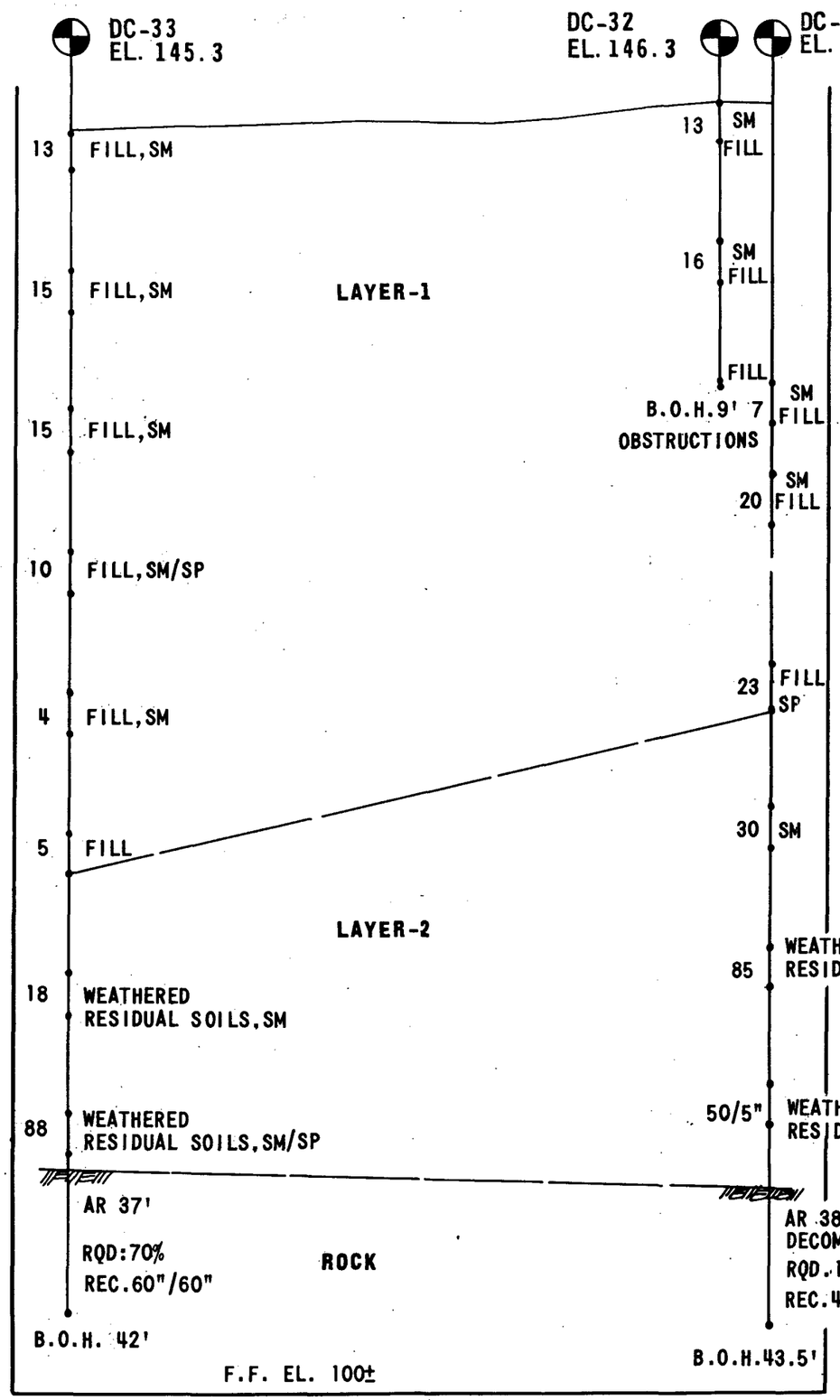
FIGURE NO. 9

unit capacity. It is recommended, therefore, to thicken the slabs of this structure to resist flotation.

The lateral earth pressure computations for the final design stage are included in Appendix E. Lateral earth pressures during the construction phase and the design of temporary excavation earth support structures should be determined by the Contractor's geotechnical engineer using the parameters given in the earth pressure recommendations section.

The Contractor should be alerted to existing utility structures in this area. A 9-foot diameter brick bypass conduit exists approximately in the middle of the proposed structure with an invert elevation of approximately 134. The conduit, which is partially filled with silt, is no longer in active use by the Washington Aqueduct Division, and may be demolished. Other utilities may be encounter during excavation. Excavation at this site will mainly include removal of fill and residual soils but may also include some quantities of rock. The measured water table elevation of approximately 141 and the proximity of the site to the Forebay indicate the need for dewatering during construction.

D. ***Proposed Dalecarlia Sedimentation Basin Residuals Pumping Station***: Figure 10 presents the subsurface profile at the proposed residuals pumping station. The base slab of the proposed pumping station has a finished floor elevation 103'. Therefore, the base will be poured against rock. An allowable bearing capacity of 10,000 pounds per square foot on the rock should be used for the design. Walls should be designed to resist an at-rest lateral earth pressure given by $K_0 = 0.58$ for the fill layer and $K_0 = 0.43$ for the residual soil layer for final design. Given the close proximity of the existing sedimentation basins, it is recommended that the computation of lateral earth pressures for final design assume the ground water table at E1.145 (this is 1 foot higher than the adjacent basin's operating level of 144' elev). Since existing utilities do not provide clearance for external pilasters, thickened slabs are recommended to resist flotation. Earth pressure computations for final design are included in Appendix E.



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ROCK: GRANITISED SCHIST, OCCASIONALLY LAYERED WITH SMALL MUDSEAMS, JOINTED, INTERBEDDED WITH QUARTZ.

SCALE: 1" = 5' (H)
1" = 5' (V)

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SUBSURFACE PROFILE - SEDIMENTATION BASIN PS.

FIGURE NO.10

Precaution should be exercised at time of construction to shore the existing structures, support the existing pipelines to remain in service, and make adequate provisions to dewater the excavation. Some major utilities are proposed for relocation. It should also be noted that the temporary excavation support system of the existing Sedimentation Basin 2 was left in place approximately 11 feet from the basin. The excavation support system of the existing 36-inch storm drain may possibly exist under the structure. Excavation at this area should be planned and executed with caution because of the numerous existing underground structures are utilities in close proximity. The main utilities include a 36-inch storm drain with an invert El. 109.5 under the proposed structure, an 8-inch diameter pipe with an invert El.107 at the south end of the structure, and an abandoned 78-inch steel penstock that exists at the outer edge of the south wall of the proposed pumping station. The existing 78-inch penstock has an invert elevation of approximately 128.3. The 78-inch penstock should be demolished and removed from the ground before construction of the temporary excavation support system for the proposed pumping station. An existing 24-inch water transmission force main, which must remain in service, crosses over the 78-inch penstock, approximately 11 feet from the southwest corner of the proposed structure. The 24-inch water line has an invert El.138.1. This utility line will be relocated.

The Contractor should be aware that there may be other utilities and underground structures, not discussed above. Possible additional utilities that may exist include a 36-inch reinforced concrete pipe encased in concrete, a concrete plug, and an 8-inch perforated drain. The 8-inch under drain may contain a significant flow of basin leakage and necessitates extensive preparations. The Final Design will need to furnish provisions to alert bidders. In addition to design planning, extensive Contractor subsurface geotechnical planning will be necessary.

The Contractor will need to verify the existence and accuracy of the locations of all underground utilities and structures and their effect on excavation conditions to his full satisfaction. The Contractor should develop a detailed construction sequence and submit the construction sequence for approval by the Government. Excavation

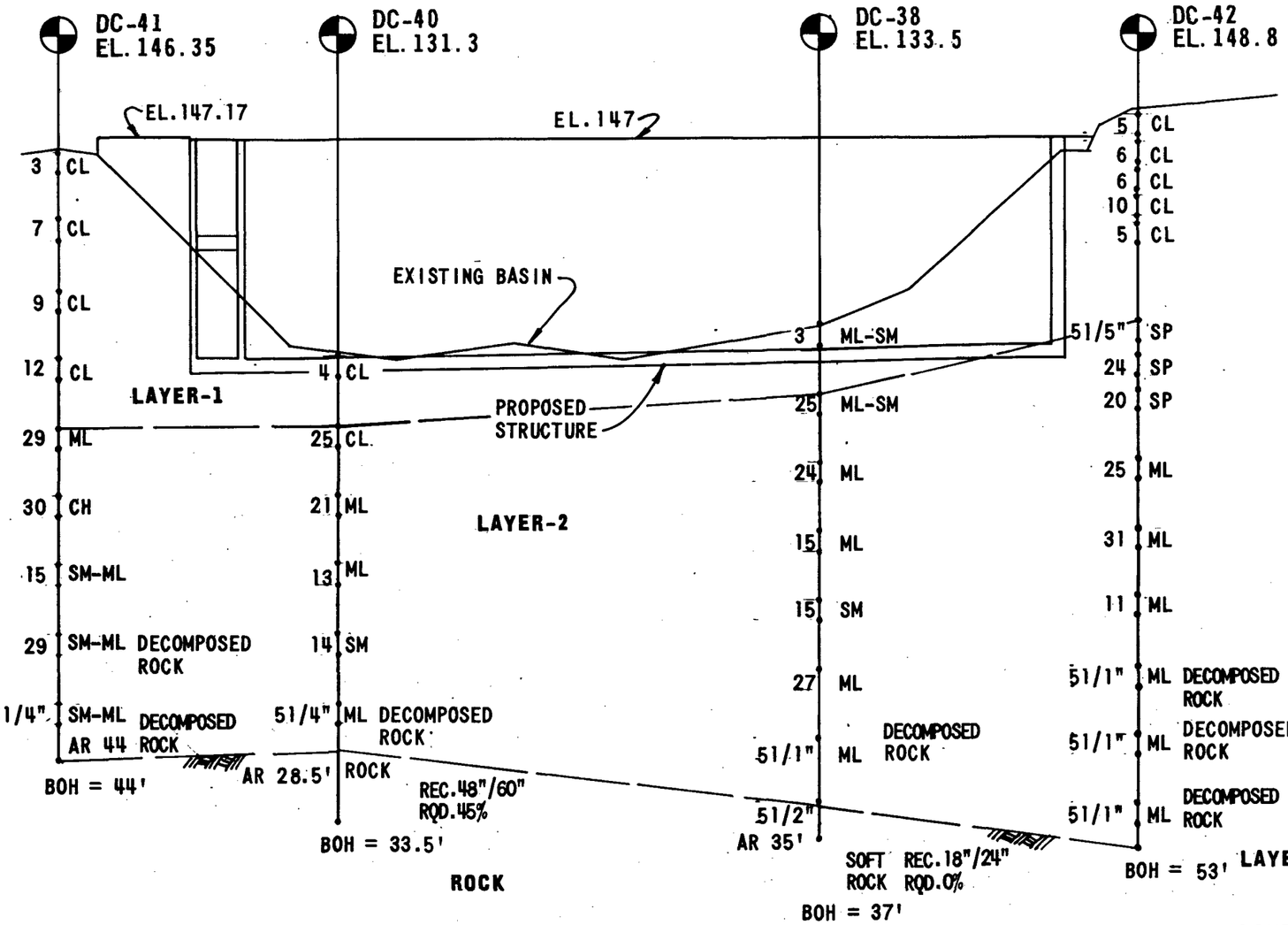
for this structure will include rock excavation. Hydraulic rock splitters or other alternatives to blasting should be used for rock excavation. Blasting of rock should be prohibited because of potential damage to the existing structures and utilities. The existing sedimentation basins must remain in service and the Contractor must take care not to contaminate the water in the basins.

E. *Georgetown Reservoir Site*

Equalization Basin: Figures 11 and 12 show the subsurface profiles at the proposed Equalization Basin in Basin 1 of the Georgetown Reservoir. The structure consists of a residuals equalization basin, influent conduit extension, influent distribution channel, and a residuals pumping station. The finished floor elevation of the basin slopes from El. 131.5 at the south end to El. 126.25 at the sump; finished floor of the influent conduit slopes from El. 132.75 to El. 131.15; finished floor of the influent distribution channel slopes from El. 131.5 to El. 130; and finished floor of the pumping station is at El. 138.5.

The finished floor elevations place the subgrades for the proposed structures in fill (medium stiff to stiff clay and loose sandy silt). The structures should be designed to resist flotation when emptied. An economic analysis for the foundation to resist flotation was made between a thickened slab, piles, and rock anchors and is included in Appendix E. Based on the economic analysis it is recommended to use HP 12 x 53 steel H-piles, with a tension capacity of 15 tons. The piles are more than adequate to support the compressive loads of the structures. The piles for these structures should be driven to refusal in rock.

The lateral earth pressure design computations for these structures use a water table elevation of 147. These computations are included in Appendix E. Earth pressure diagrams for excavation support systems should be developed by the Contractor's geotechnical engineer using the parameters in the earth pressure recommendations section.



SUBSURFACE PROFILE 1-1 GEORGETOWN RESERVOIR AREA

LEGEND

RQD = ROCK QUALITY DESIGNATION
REC = RECOVERY
BOH = BOTTOM OF HOLE
AR = AUGER REFUSAL

LAYER 1: FILL, CONSISTS OF SAND, CLAY & SILT FOUND IN VARYING PERCENTAGES. ALSO CONTAINS WOOD, TRACE ORGANICS.

LAYER 2: MICACEOUS SILTY SAND OR SANDY SILT. WEATHERED ROCK, ALSO TRACE GRAVEL.

ROCK: GRANITISED SCHIST, OCASSIONALLY LAYERED WITH SMALL MUDSEAMS, JOINTED, INTERBEDDED WITH QUARTZ.

SCALE: 1" = 20' (H)
1" = 10' (V)

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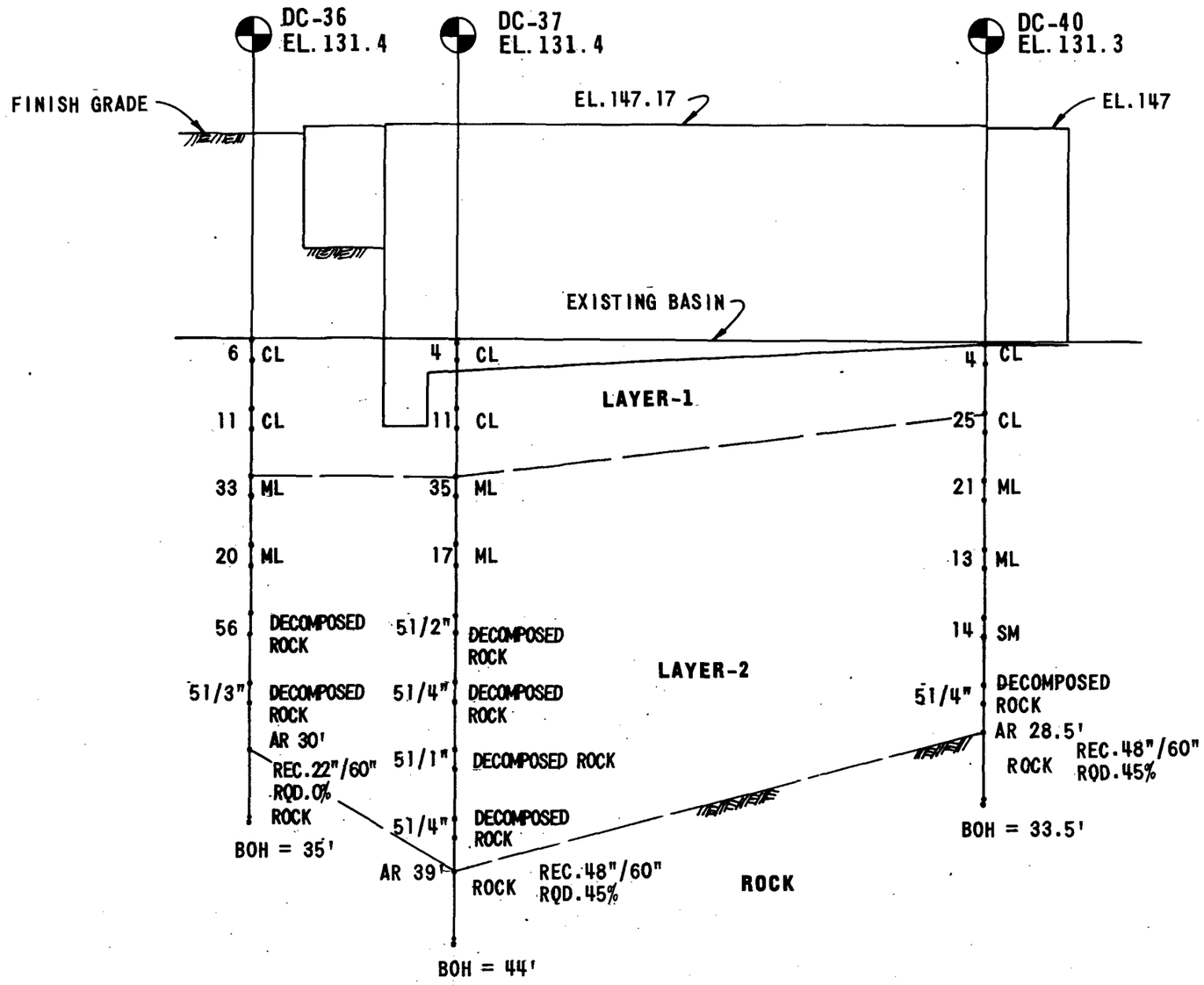
FIGURE NO. 11



SUBSURFACE PROFILE 2 - 2 GEORGETOWN RESERVOIR AREA

LEGEND

RQD = ROCK QUALITY DESIGNATION
REC = RECOVERY
BOH = BOTTOM OF HOLE
AR = AUGER REFUSAL

LAYER 1: FILL CONSISTS OF SAND, CLAY & SILT FOUND IN VARYING PERCENTAGES. ALSO CONTAINS WOOD, TRACE ORGANICS.

LAYER 2: MICACEOUS SILTY SAND OR SANDY SILT. WEATHERED ROCK, ALSO TRACE GRAVEL.

ROCK: GRANITISED SCHIST, OCCASIONALLY LAYERED WITH SMALL MUDSEAMS, JOINTED, INTERBEDDED WITH QUARTZ.

SCALE: 1" = 20'(H)
1" = 10'(V)

An 84-inch brick by-pass conduit with an invert of approximately El.132 is present in the east embankment of Basin 1 of Georgetown Reservoir. The by-pass conduit is approximately 20 feet from the northeast corner of the proposed equalization basin, approximately halfway between the fence and top of slope. The Contractor must protect the conduit and any other existing utilities from damage during construction.

Based on the borings, the material from the excavation for the basin and channels will primarily consist of clay material, with some silty sand, sandy silt, and gravel. Excavated material may be used in backfills and controlled fills only if the moisture content is controlled and the material is considered suitable by the Engineer. Controlled fills and backfills shall be placed in accordance with Section XIII, Earthwork Recommendations, with the additional requirement that no heavy machinery shall operate on top of the influent conduit extension until a minimum of three feet of compacted fill has been placed over it.

The existing concrete floors in Basins 1 and 2 consist of a series of peaks and valleys with the valleys sloped to existing floor drain openings. The proposed dredging operation for these basins would be unable to remove accumulated residuals from the valleys. The existing concrete floors should therefore be demolished and removed. The basin subgrade should then be regraded to create a plane surface to increase the efficiency of dredging operations. Subgrade should be proofrolled and compacted fill should be placed as stated in the earthwork recommendations of this report section. A new concrete liner may then be poured on an approved subgrade.

The earthwork in Basins 1 and 2 should be scheduled for summer. No borings have been made in Basin 2 for this report, however, it is anticipated that the subgrade will consist of fine grained soil as in Basin 1. Control of soil moisture content will be critical to achieve compaction and warm, dry, summer weather will minimize downtime of the basins for reconstruction. For estimation purposes, it is recommended to anticipate that 20% of the soil to be moved in regrading the basins may be unsuitable for use as compacted fill due to excessive moisture content or organic content.

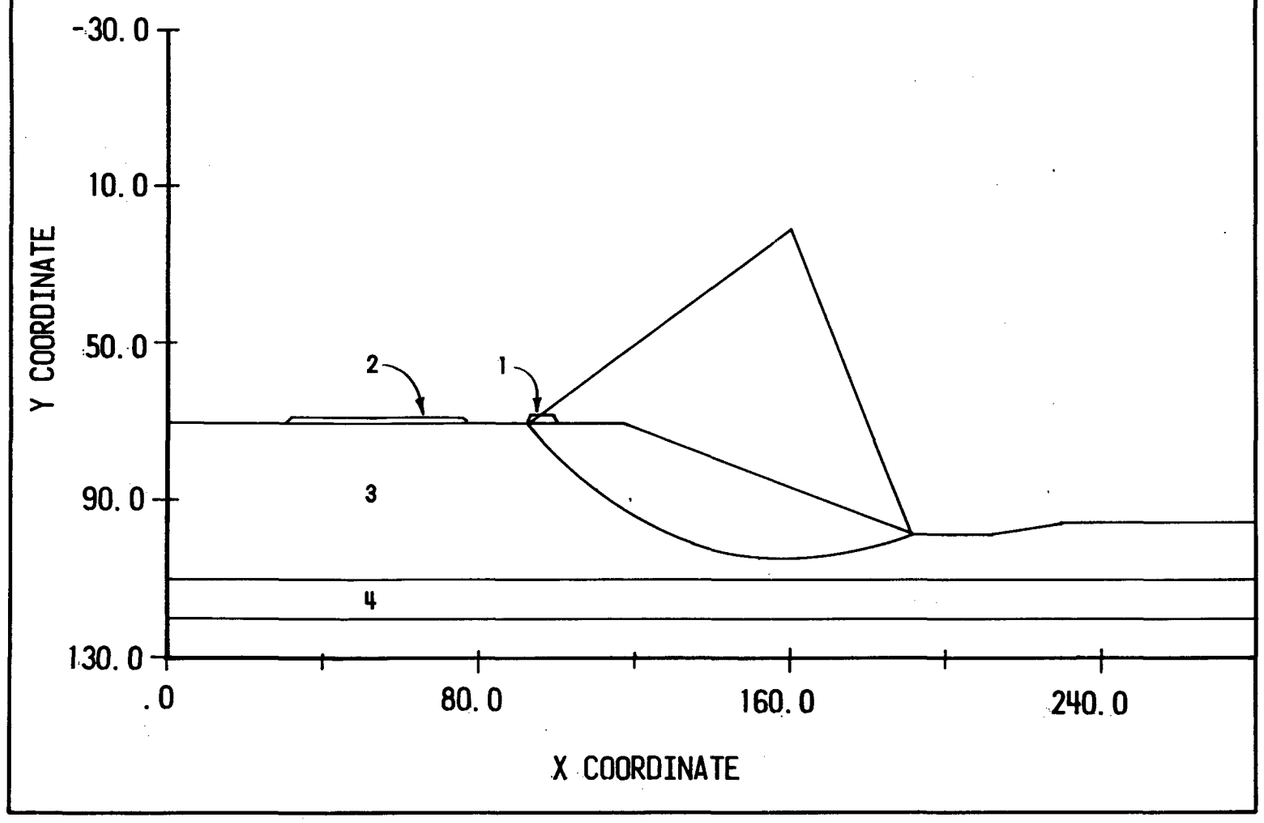
X. SLOPE STABILITY ANALYSES

Two borings, SWM-3 and SWM-4, were taken near the top of the existing fill slope at the west side of the proposed dewatering facilities site in order to determine the factor of safety of the slope with the proposed facilities including the perimeter road and Stormwater management pond. Rock was not cored in these borings as their primary purpose was to categorize the extent and quality of fill material. Two attempts were made in each boring to obtain an undisturbed sample by pushing a thin walled shelby tube. Only one attempt was successful in recovering a sample. An undisturbed sample was taken from a depth of 13 feet to 15 feet from SWM-4 and tested for strain controlled, direct shear strength parameters. A computer program was then utilized to search run the critical slip circle under worst case situations. The program, STABR/G, is the PC version of a program called STABR developed at the University of California, Berkeley. The program calculates the factors of safety for specified circles using either the ordinary method of slices or modified Bishop method. The program searches for the circular slip surface having the minimum factor of safety using the modified Bishop method. The program was used to evaluate slope stability at two slope sections. The section shown in Figure 13 includes the effects of the Stormwater management pond on the existing slope. The section shown in Figure No. 14 includes the effects of the stockpiled residual material behind a proposed low retaining wall and dump trucks on the perimeter road. Soil parameters of the fill were based on the direct shear laboratory test result which is considered to be consistent with the observed blow counts of the fills. A seismic coefficient of 0.05 was used in the analysis.

The search for the critical slip circle at the slope section including the Stormwater management pond yielded a factor of safety of 1.77. The section with the retained fill load and dump trucks yielded a factor of safety of 1.5. Both of these factors may be on the conservative side because the sections neglect the additional weight of soil near the toe of the slope. The output files of the critical circle runs are included in Appendix E.

LAYER	COHESION	FRICTION ANGLE	DENSITY
1	.0	.0	4375.0
2	.0	.0	937.5
3	.0	33.0	110.0
4	.0	35.0	115.0

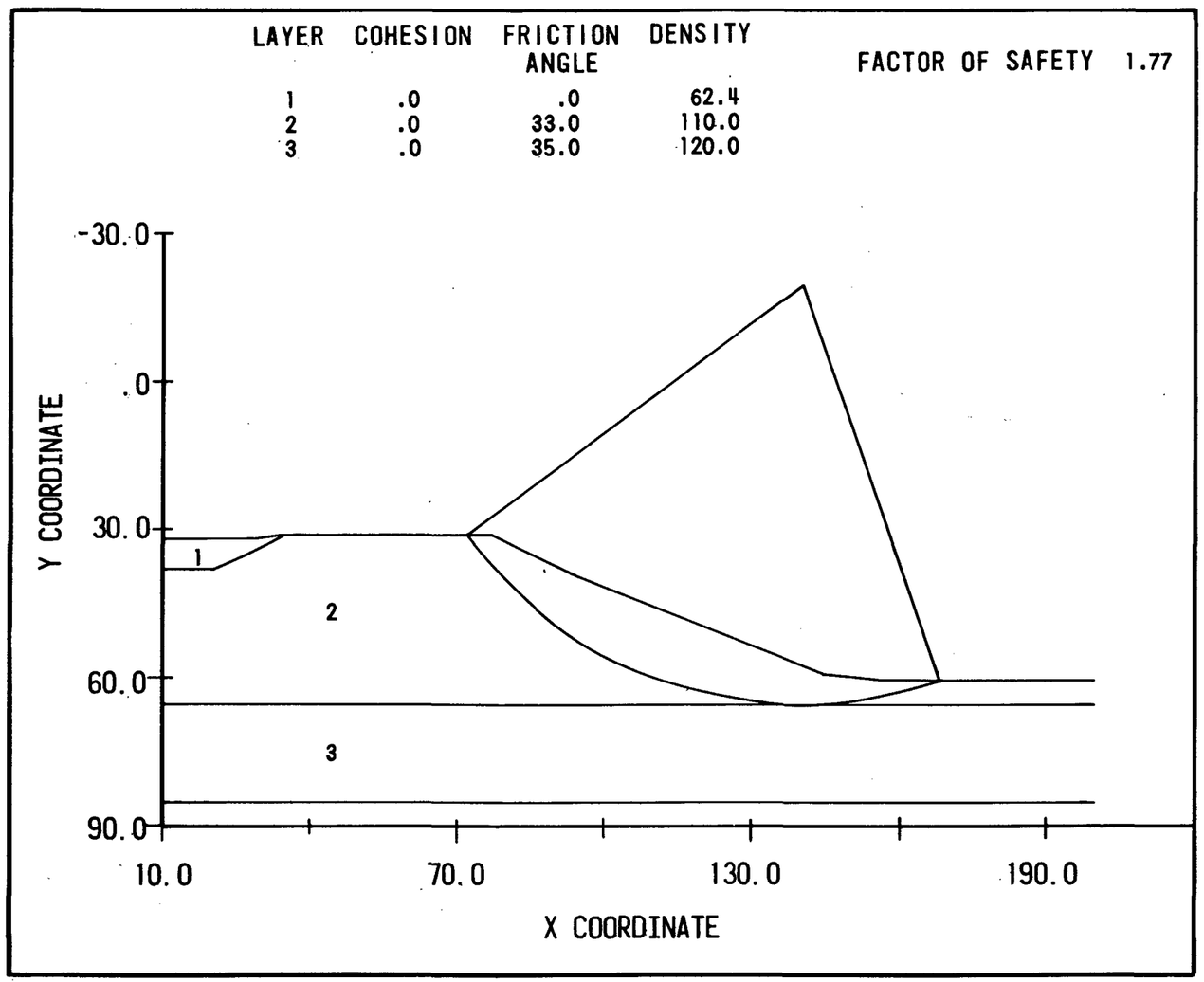
FACTOR OF SAFETY 1.50



SLOPE STABILITY SECTION X-X

LAYER	COHESION	FRICTION ANGLE	DENSITY
1	.0	.0	62.4
2	.0	33.0	110.0
3	.0	35.0	120.0

FACTOR OF SAFETY 1.77



SLOPE STABILITY SECTION Y-Y

XI. STORMWATER MANAGEMENT POND

Borings SWM-1 and SWM-2 were taken to identify the soil for possible Stormwater management options at the proposed dewatering facility site. The borings indicate the presence of fill material to a depth of approximately 35 feet. The fill included material consisting of sand, silt, clay with organics, burnt wood, and brick pieces. Soil encountered in boring SWM-1 from depths of 20 feet to 25 feet gave strong petroleum odors.

Presence of the thick layer of fill rules out infiltration as a Stormwater management option. Therefore, a Stormwater management pond is recommended. The Stormwater management pond is proposed to be located approximately 45 feet from the top of slope at the west side of the proposed dewatering facility site. Seepage from the pond could negatively influence the stability of the slope by saturating the fill layer. The pond should be lined to prevent seepage into the fill layer.

XII. PAVEMENT DESIGN

A. *Pavement Design*

A representative sample of surficial fill material from the proposed dewatering facilities site was tested to determine the California Bearing Ratio (CBR) for pavement design. The test results are included in Appendix C. The material tested was brown silty clay with a maximum dry density of 117.4 pounds per cubic foot and an optimum moisture content of 12.7% as determined by modified Proctor test.

All pavement subgrades should be proof rolled by at least six passes of a vibratory roller capable of exerting a dynamic force of at least 10 tons. Soft areas should be undercut and replaced with controlled, compacted fill. Proof rolling and undercutting should be performed under the direction of a geotechnical engineer. Provided that subgrades have been prepared as described above, pavement sections should be designed for a minimum CBR of 6, which corresponds to a density of 92.4% of maximum dry density determined in the CBR test.

Traffic volumes for pavement design are published in Appendix B of the Residuals Disposal Study" by Whitman, Requardt and Associates, dated November 1995, for the U.S. Army Corps of Engineers, Dalecarlia Water Treatment Plant and Georgetown Reservoir Residuals Disposal Facilities. Pavement sections have been designed using technical manuals TM5-822-5, June 1992, and TM5-822-2. Pavement design calculations are included in Appendix E. Based on the procedures in these technical manuals, the following pavement section is recommended:

2 1/2 inches bituminous concrete surface course (Band SC)
2 1/2 inches bituminous concrete base course (Band BF)
10 1/2 inches dense graded aggregate (GA Base)

Monitoring wells were installed in five borings for this project. Wells installed in borings DC-21 and DC-25 are located in areas that will be paved. Ground water in these two wells is at elevation 109 and 90, respectively, far below the existing and finish grades

(well readings are in Appendix D). Therefore, subsurface drainage of the pavement is considered to be not necessary. Surface water should be controlled by site grading and Stormwater management.

XIII. EARTHWORK RECOMMENDATIONS

The preliminary design concept indicates that the quantity of excavated material will exceed the quantity of fill material required. Primary areas of excavation are the gravity thickeners, the forebay residuals equalization basin, the sedimentation basin residuals pumping station, and the Stormwater management pond. Fill areas include grading to finished grades at the proposed dewatering site, backfill around the Georgetown reservoir residuals equalization basin, and backfilling of the other structural excavations. Information from the subsurface exploration indicates that the majority of excavated material will be from the existing fill layers at the proposed dewatering facility site. Excavations at the forebay and at the sedimentation basins will include fill, weathered or decomposed rock, and rock. The fill layers contain a heterogeneous mixture and at some places, unsuitable material such as pieces of brick, glass, iron nails, and organic matter. Moisture contents in this layer generally range from 16.5 to 26 percent. Some samples had moisture contents as low as 9 percent. The excavated site material can be used in the fill operations only when it is free of unsuitable material and the moisture content is controlled to within 3% of the optimum moisture content as determined by modified Proctor test. This on-site material can be used only when inspected and approved by the geotechnical engineer. It is anticipated that approximately 25 percent of the on-site material could be material suitable for use in controlled fills.

Areas to receive fill should be stripped and cut areas should be excavated to slab subgrade. Excavations should extend at least five feet beyond the structure footprint. Sites should be proof rolled and densified by at least 6 passes of a large vibratory roller capable of exerting a dynamic force of at least 10 tons. Soft areas should be removed as directed by a geotechnical engineer or his qualified representative and replaced with controlled, compacted fills. Controlled, compacted fill should be constructed using suitable material, placed in lifts not exceeding eight inches in thickness and compacted to at least 95 percent of maximum dry density for cohesionless soils and 92 percent for cohesive soils, as determined by ASTM D-1557. Cohesionless soils are hereby defined as granular soils having less than 15 percent material by weight, passing through the No. 200 sieve. The moisture content of compacted fill material should be within 3 percent of its optimum moisture content at the time of

XIV. CONCLUSIONS

A. *Dewatering Facility Area*

1. **Dewatering Building**: Steel HP 14x73 H-piles are recommended with a design compression capacity of 60 tons. Piles should be driven through the existing fill to bear on very dense decomposed rock or rock. Fill thickness is estimated to range from 25 feet to 35 feet. Residual soil thickness is estimated to be 15 to 20 feet. Recommended design tension capacity of the piles is 25 tons. Pile load tests should be conducted to verify both the compression and tension design capacities. The basement walls should be designed to resist an at-rest earth pressure computed using the parameters provided in Section VIII.

2. **Gravity Thickeners:** Steel HP 14x73 piles are recommended with a design compression capacity of 40 tons. Variable pile lengths are anticipated. The recommended design tension capacity for the piles supporting the two easternmost thickeners is 12 tons, and the recommended design tension capacity of the piles supporting the two westernmost thickeners is 16 tons. No piles should be shorter than 10 feet in length. One pile load test is recommended to verify the design capacities. Lateral earth pressures on the walls should be computed using the active earth pressure coefficient K_a and the parameters in Section VIII.

3. **Thickened Residuals Pumping Station**: The Thickened Residuals Pumping Station to be located between the thickeners should be constructed on a shallow foundation or a mat foundation after the existing fill beneath the structure has been completely removed and replaced with compacted fill of dense graded aggregate in accordance with earthwork recommendations of Section XIII of this report. Recommended allowable bearing capacity is 4,000 lbs. per square foot. Exterior walls of the pumping station should be designed

to resist an at-rest earth pressure computed by using the parameters in Section VIII. Thickened slabs are recommended to resist flotation.

B. ***Proposed Dalecarlia Forebay Equalization Basin***: The equalization basin will be a slab on residual soil or decomposed rock with thickened slabs to resist flotation. Contractor should carefully consider the existing utilities in this area. Active earth pressure coefficient should be used for computing the earth pressures on the exterior walls of the equalization basin and at-rest pressures for the walls of Pumping Station in accordance with the parameters outlined in Section VIII. The pumping station is recommended to have shallow foundations or slab on grade. The subgrade for the pumping station should be proof rolled and subgrade improved by replacing the underlying fill, approximately 7 feet thick, with Maryland State Highway Administration graded aggregate, in accordance with the procedures stated in the earthwork recommendations section.

C. ***Proposed Dalecarlia Sedimentation Basin Residuals Pumping Station***: Base slab should be poured on rock with an allowable bearing capacity of 10,000 pounds per square foot. Existing utilities do not provide clearance for external pilasters. Thickened slabs are required to resist flotation. The Contractor should be aware of the number of underground utilities in and around the proposed pumping station including a 78-inch Penstock and a high service 24-inch water main. The Contractor should develop a detailed sequence of construction for comment by the Engineer. The walls should be designed to resist an at-rest earth pressure computed using K_o = 0.58 for the fill layer and K_o = 0.43 for the residual soil layer and using the soil properties outlined in Section VIII, earth pressure recommendations.

D. ***Georgetown Reservoir Site***: Basin 2: Steel HP 12x53 H-piles are recommended for the proposed residuals equalization basin and pumping station. Structures should be designed to resist flotation. Recommended design tension capacity of the piles is 18 tons. All piles should be driven to refusal on rock. Lateral earth pressure

computations for the structures should use water table at El.147 and the parameters in Section VIII, earth pressure recommendations. Existing utilities at this site include an 84-inch brick bypass conduit with an invert at approximately El.132. Controlled fills shall be placed under supervision of a geotechnical engineer in accordance with the earthwork recommendations, in Section XIII of this report. Backfilling using heavy machinery on top of the influent conduit extension should not be allowed until a minimum of 3 feet of compacted fill has been placed over it.

The existing concrete liner in Basin 2 should be removed and regraded to allow for a more efficient dredge operation. The subgrade should then be proof rolled according to the earthwork recommendations in Section XIII of the report. A new concrete liner should then be poured on approved subgrades.

E. ***Stormwater Management Pond***: Presence of deep fills in the area rules out infiltration as an option. A Stormwater detention pond is recommended. The pond should be lined to prevent seepage into the fill layer.

F. ***Pavement Design:*** Pavement sections have been designed using technical manuals TM5-822-5, June 1992, and TM5-822-2. Based on the procedures in these technical manuals, the following pavement section is recommended:

2 ½ inches bituminous concrete surface course (Band SC)
2 ½ inches bituminous concrete base course (Band BF)
10 ½ inches dense graded aggregate (GA Base)

Subsurface drainage of the pavement is not considered to be necessary. Surface water should be controlled by grading and Stormwater management.

G. ***Temporary Excavation Support Systems:*** Temporary excavation support systems should be designed by the Contractor. Lateral earth pressures for design of temporary excavation support systems should be determined by the Contractor's geotechnical

engineer using the parameters in Section VIII of this report as the minimum basis of design.

H. ***Temporary Dewatering Systems***: Temporary dewatering systems should be designed by the Contractor. Design of the temporary dewatering systems should be based on the Contractor's interpretation of the subsurface conditions as described in this report as the minimum basis of design.

Foundation recommendations for each structure are summarized below in Table 1. Pile load tests are recommended at each pile-supported structure.

TABLE 1

FOUNDATION SUMMARY

No.	Structure	Type of Foundation	Allowable Bearing Capacity or Design Load
1	Dewatering Building	HP 14 x 73	60 Tons (Compression) 25 Tons (Tension)
2	Gravity Thickness	HP 14 x 73	40 Tons (Compression) 12 Tons*, 16 Tons* (Tension)
3	Thickened Residual Pumping Station	Mat Foundation	4,000 Pounds per Square Foot
4	Dalecarlia Forebay Equalization Basin	Thickened Slab or Mat on Grade	2,000 psf on Controlled Fill 7,000 psf on Decomposed Rock
5	Sedimentation Basin Residuals Pumping Station	Slab on Rock	10,000 psf
6	Georgetown Reservoir Equalization Basin (All Structures)	HP 12 x 53	15 Tons (Tension)

Notes:

* 12 tons for easternmost thickeners; 16 tons for westernmost thickeners.

APPENDIX A

SUPPLEMENTAL INSTRUCTIONS FOR GEOTECHNICAL DESIGN

SUPPLEMENTAL INSTRUCTIONS
FOR GEOTECHNICAL DESIGN

1. DESIGN RESPONSIBILITIES OF GEOTECHNICAL ENGINEER : In support of the design for the subject project, the following scope of work shall be performed:

a. Subsurface exploration and laboratory testing: This program will be developed by the geotechnical engineer upon completion of a site plan and topographic mapping. It will provide the necessary soil/rock/groundwater data for the geotechnical design.

b. Geotechnical Reports (Design Memorandum): The geotechnical input to the Design Memorandum shall contain the following:

(1) Project design requirements; i.e., SOW, structural loads, finish floor elevations, etc.

(2) Subsurface exploration and testing program.

(3) Site surface and subsurface design conditions, to include regional and site specific geologic and groundwater conditions.

(4) Design approach and assumptions backed by supporting data and references.

(5) Foundation design recommendations; exclusive of structural design. These shall include but not be limited to the following minimum requirements:

(a) Allowable soil bearing pressure (based on both shear strength and settlement calculations).

(b) Foundation bearing elevations which preclude the need for extensive field testing during construction to verify the design allowable soil/rock bearing capacity.

(c) Lateral earth pressures/sheeting and shoring requirements.

(d) Site and subsurface water drainage requirements.

(e) Associated foundation construction recommendations, equipment and material requirements.

(6) Pavement thickness designs as follows; exclusive of all other pavement design aspects (geometric layout, vertical and horizontal curves, etc.) (If applicable):

(a) Use of Corps of Engineer's criteria for both strength and frost design.

(b) Exterior (rigid) concrete and flexible pavements.

(c) Interior slabs-on-grade subject to vehicular traffic.

(d) Pavement subdrainage recommendations.

(e) Specialty paving such as Roller Compacted Concrete (RCC), pavers (grass, grid, concrete block, etc.), resin modified pavement, etc.

(7) Earthwork recommendations to include the following:

(a) Soil material restrictions.

(b) Compaction and moisture content requirements.

(c) Site and subsurface water drainage requirements.

(d) Excavatability of rock, and blasting requirements.

(e) Temporary/permanent slope stability requirements.

(2) Calculations and substantiating data: All design recommendations shall be supported by calculations and associated soil/rock field and laboratory test data. This supporting information shall be included in the reports as appendices.

d. Drawings :

(1) Boring plan and drilling data: The geotechnical drawing plate(s) shall contain the subsurface exploration logs and notes.

(2) The geotechnical engineer (consultant) will prepare sketches of the following items from which the prime AE will prepare the final drawing details:

(a) Flexible and rigid pavement sections.

(b) Pavement transition sections.

(c) Rigid pavement joint layout and details for both

exterior and interior pavements.

(d) Pavement subdrainage details.

(e) Structural fill, subgrade stabilization, or other earthwork details.

(f) Concrete repair/epoxy injection details.

2. CORPS OF ENGINEER REVIEW OF GEOTECHNICAL ENGINEERING DESIGN: To insure compliance with Corps of Engineers design requirements and criteria, provide the following data for review by the Geotechnical Branch (GB) of the Baltimore District, Corps of Engineers.

a. Project requirements: The AE will furnish a site plan showing a single-line location of the proposed structure, paving, and underground utilities. A brief description of the structure (number of stories, depth of basement, approximate foundation loads, etc.) and the proposed earthwork and paving requirements must accompany this site plan.

b. Site/boring plan: The AE will provide a site plan with topography, showing both existing and proposed contours, on which their geotechnical engineer (consultant) has laid out the proposed subsurface exploration program to include the following:

(1) Boring and test pit designations, and depths.

(2) Sampling intervals and techniques; e.g., cone penetrometer, pressuremeter, SPT, shelbies, CBR's, plate bearing tests, etc..

(3) Groundwater monitoring program.

(4) Rock coring program, if required.

(5) Percolation tests/borings for storm water management.

c. Laboratory testing program: In conjunction with the subsurface exploration sampling plan, submit a coordinated soil/rock laboratory testing program to include the following:

(1) Certification that the laboratory proposed for performing the testing has been inspected and approved by the South Atlantic Division (SAD) Laboratory in accordance with ER-1110-1-261, Quality Assurance of Laboratory Testing Procedures. SAD is located in Marietta, GA. If the proposed lab does not have an up to date inspection and approval, arrangements must be made with SAD to inspect and approve the proposed lab prior to performing any work.

(2) Classification tests (water contents, Atterberg limits, mechanical analysis, loss on ignition, USDA, etc.). Include the appropriate number of each type of test to be performed on representative samples and an indication of how these tests will bee distributed across the site (e.g., approximate number of building areas, paved areas, borrow areas, etc.) and within the proposed depth of exploration for each feature of work.

(3) Foundation design tests (unconfined compression, direct shear, triaxial, consolidation, etc.). Discuss anticipated foundation system alternatives and corresponding approximate number of each type of test to be performed to provide representative shear strength design parameters for each anticipated bearing strata, and other underlying strata within the zone of influence.

(4) Pavement design tests (undisturbed CBR, remolded CBR, compaction tests, etc.). Include anticipated number of each type of test.

APPENDIX B

BORING LOGS

[redacted]
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-1
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/12/95
START:	07/12/95 END: 06/26/95	ELEVATION:	151.7
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	18	Brownish gray to gray,dry to wet, very loose, silty sand with some rock fragments & small boulders (fill)	1	0	1.5	2	2	3	16"
18	27.5	Gray, wet, loose to very dense, silty sand & rock fragments (decomposed to weathered rock)	2	5.0	6.5	4	2	2	3"
27.5	30.5	Brown, soft partially weathered rock	3	10.0	11.5	2	2	10	12"
30.5	32.5	Gray, medium to hard fractured rock	4	15.0	16.5	24	11	4	14"
			5	20.0	21.5	2	2	4	12"
			6	25.0	25.1	55@1/2"			2"
			7	27.5	32.5	RQ		13%	51
		*At completion water at 10 Ft., caved 22 Ft.							
		*Encountered water at 10 Ft.							
		*Bottom 32.5 Ft.							

Water 10.5 Ft. After 24 Hours Caved 11.7 Ft. Sheet No. 1 of 1

GEOMATRIX, INC.
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HYATTSVILLE, MD 20784
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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-2
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/12/95
START:	07/12/95 END: 06/26/95	ELEVATION:	151.9
DRILLER:	Dave Cole	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	12	Brown to gray, dry to wet, soft to very soft, silty clay with trace of brick & concrete fragments & small boulders (fill)	1	0	1.5	2	4	2	18"
12	25.5	Brownish gray, wet, very loose micaceous silty sand with trace of rock fragments (possible fill)	2	5.0	6.5	1	1	1	18"
25.5	30.5	Gray, medium very fractured rock.	3	9.5	11.0	18	4	4	3"
			4	15.0	16.5	2	1	1	14"
			5	20.0	21.5	3	5	6	12"
			6	25.0	25.3	51/3"			3"
			7	25.5	30.5	RQD	0%		54"
		*Hard grinding 8.5 to 10.0 Ft. (Boulder)							
		*Auger refusal at 25.5 Ft.							
		*Water at completion							
		*Encountered water at 2.50 Ft.							
		*Bottom 30.5 Ft.							
		*Hard augering 23 to 25.5 Ft.							

Water 11.8 Ft. After 24 Hours Caved 17.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-3
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/13/95
START:	07/13/95 END: 07/14/95	ELEVATION:	153.9
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	18.0	Tan, dry to wet, loose to dense, silty sand with trace of brick & rock fragments (fill)	1	0	1.5	2	2	4	10"
18.0	25.0	Tan, dry, very dense, micaceous silty sand (decomposed rock)	2	5.0	6.5	11	6	6	6"
25.0	30.0	Gray, medium to hard fractured rock	3	10.0	11.5	7	10	17	16"
			4	1.5	16.5	10	21	12	18"
			5	18.5	20.0	22	20	27	18"
			6	20.0	20.5	71/6"			6"
			7	25.0	25.1	51/1"			0"
			8	25.0	26.5	RQD	0%		13"
				26.5	30.0	RQD	0%		33"
		*Encountered water at 12.5 Ft.							
		*Auger refusal 25 Ft.							
		*Bottom at 30 Ft.							
		*After 48 hours inside of well 14'3"							
		*After 17 hours inside augers 13 Ft.							
		*Installed 2" well to 24 Ft.							

Water _____ Caved 8 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-4
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/17/95
START:	07/17/95 END: 07/19/95	ELEVATION:	154.7
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	4.0	Gray, moist, soft, silty dlay with trace of brick fragments (fill)	1	0	1.5	1	3	4	6"
4.0	12.0	Tan, loose to medium dense, micaceous silty sand (possible fill)	2	5.0	6.5	5	4	5	14"
12.0	25.0	Tan, loose to very dense, silty sand (with layers of boulders & cobbles from 17 to 23 Ft.)	3	10.0	11.5	7	8	15	16"
25.0	30.0	Gray, medium to hard rock (with lenses of quartz)	4	15.0	16.5	4	4	6	128"
			5	20.0	21.5	33	30	57	18"
			6	25.0	25.0	51/8"			0"
			7	25.0	30.0	RQD	20%		56"
		*Encountered water at 13.5 Ft.							
		*Auger refusal 25.0 Ft.							
		*Bottom at 30.0 Ft.							

Water 14 Ft. after 48 hours Caved 17 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-5
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/19/95
START:	07/19/95 END: 07/19/95	ELEVATION:	Ft.
DRILLER:	Dave Cole	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	1.5	Eight inches asphalt, 10" crushed stone	1	5.0	5.1	51/2"			2"
1.5	9.0	Tan to gray, dry very dense micaceous silty sand & rock fragments (decomposed to weathered rock)	2	9.0	9.0	51/0"			0"
9.0	14.0	Gray, soft to medium, very fractured rock	3	9.0	14.0	RQD	0%		35"
		*Bottom 14.0 Ft.							
		*Auger refusal at 9.0 Ft.							
		*No water encountered							

Water _____ Caved _____ Sheet No. 1 of 1

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7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-6
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/20/95
START:	07/20/95 END: 07/20/95	ELEVATION:	Ft.
DRILLER:	Dave Cole	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2.5	Six inches asphalt, 24" crushed stone	1	5.5	5.5	51/0"			0"
2.5	5.5	Gray, dry, very dense silt with rock fragments (weathered rock)	2	5.5	10.5	RQD	0%		36"
5.5	10.5	Gray, soft, very fractured rock							
		*Bottom 10.5 Ft.							
		*Auger refusal at 5.5 Ft.							
		*No water encountered							
		*Boring offset 4 Ft. east							

Water _____ Caved _____ Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-8
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/11/95
START:	07/11/95 END: 07/11/95	ELEVATION:	152.2 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	17.0	Tan, dry, very loose to medium dense to loose, silty sand, with trace of roots (fill)	1	0	1.5	1	2	2	18"
17.0	22.0	Gray, damp, medium stiff organic clay (fill)	2	4.5	6.0	3	4	5	18"
22.0	50.5	Tan, dry, loose to very dense micaceous silty sand, (decomposed rock)	3	9.5	11.0	7	8	9	18"
50.5	60.5	Gray, medium to hard, fractured rock	4	14.5	16.0	3	4	5	18"
			5	19.5	21.0	10	5	5	18"
			6	24.5	26.0	3	4	4	12"
			7	29.5	31.0	35	50/3		12"
			8	34.5	36.0	31	50/3		12"
			9	39.5	41.0	50/4			4"
			10	44.5	46.0	50/2			2"
		WR&A Note: Strong petroleum-like odors from 5 to	11	49.5	51.0	50/2			2"
		*Auger refusal 50.5 Ft. 10 feet.	12	50.5	55.5	RQD	40%		60"
		*No water encountered while drilling	13	55.5	60.5	RQD	43%		60"
		*Hard augering from 18.5 Ft. to 19.5 Ft.							
		*Bottom at 60.5 Ft.							

Water Dry After 24 Hours Caved 39.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-9
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/12/95
START:	07/12/95 END: 07/12/95	ELEVATION:	149.4 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	7.0	Tan, dry, very loose to loose, clayey silt (fill)	1	0	1.5	1	2	2	16"
7.0	22.0	Tan, dry, medium dense to loose, silty sand with trace of gravel (fill)	2	4.5	6.0	2	3	7	18"
22.0	57.0	Tan, dry, medium dense, clayey silt, with trace of brick & rock fragments & layers of silty sand (fill)	3	9.5	11.0	11	9	10	18"
57.0	61.0	Tan, dry, very dense, silty sand (decomposed rock)	4	14.5	16.0	4	5	5	18"
61.0	71.0	Gray, medium to hard, fractured rock	5	19.5	21.0	3	3	50/6	10"
			6	24.5	26.0	11	10	9	18"
			7	29.5	31.0	10	17	17	6"
			8	34.5	36.0	2	4	12	18"
			9	39.5	41.0	4	6	8	5"
			10	44.5	46.0	5	9	12	3"
			11	49.5	51.0	7	21	9	6"
			12	54.5	56.0	4	5	13	12"
		*Encountered water at 60.0 Ft.	13	59.5	61.0	50/3"			3"
		*Hard augering from 26 Ft. to 28 Ft.	14	61.0	66.0	RQD	20%		60"
			15	66.0	71.0	RQD	10%		60"

ater Dry Caved 53.0 Ft. Sheet No. 1 of 1

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-10
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/07/95
START:	07/07/95 END: 07/07/95	ELEVATION:	152.4
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2.0	Tan, dry, loose micaceous silty sand (fill)	1	0	1.5	1	2	3	17"
2.0	7.0	Brown, damp, medium stiff, clay (fill)	2	4.5	6.0	3	3	4	14"
7.0	12.0	Tan & brown, dry, medium dense silty sand with trace of rock fragment (fill)	3	9.5	11.0	8	6	5	18"
12.0	31.0	Tan to brown, dry, dense to very dense, micaceous silty sand (decomposed rock)	4	14.5	16.0	8	17	24	18"
31.0	34.0	Gray, medium hard, rock	5	19.5	21.0	6	20	34	18"
34.0	36.0	Tan weathered to decomposed rock	6	24.5	26.0	33	50/5"		11"
36.0	41.0	Gray medium hard rock	7	29.5	29.7	50/2"			2"
			8	31.0	36.0	RQD	7.5%		55"
			9	36.0	41.0	RQD	49%		60"
		*Auger refusal 31 Ft.							
		*No water encountered							
		*Bottom at 41 Ft.							

Water Dry after 24 hours Caved 19.5 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecariia Water Treatment Plant	BORING NO.:	DC-11
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/18/95
START:	07/18/95 END: 07/18/95	ELEVATION:	143.1 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	4.0	Tan, dry, loose, silty sand with trace of roots (fill)	1	0	1.5	2	3	4	9
4.0	7.0	Tan, dry, very stiff clay with gravel & rock fragments (fill)	2	4.5	6.0	5	12	14	12
7.0	27.0	Tan, dry, , medium dense, micaceous silty sand (fill)	3	9.5	11.0	3	6	5	12
27.0	32.0	Tan, loose, clayey silt (fill)	4	14.5	16.0	3	3	6	12
32.0	60.0	Tan, dry, very dense to medium dense to very dense, micaceous silty sand with some rock fragments (decomposed to weathered rock)	5	19.5	21.0	5	4	7	10
60.0	70.0	Gray, medium to hard fractured rock	6	24.5	26.0	11	13	14	18
			7	29.5	31.0	3	2	3	8
			8	34.5	36.0	50/1			1
			9	39.5	41.0	3	4	5	8
			10	44.5	46.0	18	42	9	12
			11	49.5	51.0	25	9	9	18
		*Bottom 70.0 Ft.	12	54.5	56.0	8	9	24	7
		*Encountered water at 59.0 Ft.	13	59.5	61.0	50/1			1
			14	60.0	65.0	RQD	40%		51"
		*After 24 hours water 49 Ft., caved 51 Ft.	15	65.0	70.0	RQD	70%		60"

Water 49.0 Ft. at completion Caved 51.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-12
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/06/95
START:	07/06/95 END: 07/06/95	ELEVATION:	145.9
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	18.0	Brown, dry, very loose to loose, micaceous clayey silt with trace of roots & gravel (fill)	1	0	1.5	1	1	2	12"
18.0	32.0	Gray, damp, medium stiff, clay with trace of roots (fill)	2	4.5	6.0	3	4	6	10"
32.0	60.0	Tan, dry, dense to medium dense to dense, micaceous silty sand with trace of gravel (fill)	3	9.5	11.0	4	5	9	5"
60.0	68.0	Tan, wet, very dense, micaceous silty sand (decomposed rock)	4	14.5	16.0	3	3	3	4"
68.0	78.0	Gray, medium to hard, rock (6" quartz layer 70 Ft. to 70.5 Ft.)	5	19.5	21.0	2	2	5	12"
			6	24.5	26.0	3	4	4	18"
			7	29.5	31.0	3	5	5	18"
		WR&A Note: Gray clay has petroleum-like odor.	8	34.5	36.0	5	19	20	18"
			9	39.5	41.0	4	5	9	18"
			10	44.5	46.0	4	5	8	8"
			11	49.5	51.0	4	4	7	12"
			12	54.5	56.0	6	12	20	18"
		*Auger refusal 68 Ft.	13	59.5	61.0	9	17	17	6"
		*Encountered water at 50 Ft.	14	64.5	66.0	18	35	50/55	18"
		*At completion water at 15 Ft., caved 20 Ft.	15	68.0	73.0	RQD	50%	50%	54"
			16	73.0	78.0	RQD	63%	63%	60"

Water Dry after 24 hours Caved 26.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-13
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/11/95
START:	07/11/95 END: 07/12/95	ELEVATION:	147.9
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	19	Brown to gray, dry to wet, soft to very soft, silty clay with trace of brick & concrete fragments & small boulders (fill)	1	0	1.5	2	2	2	5"
19	33.0	Brownish gray, wet, very loose micaceous silty sand with trace of rock fragments (possible fill)	2	5.0	6.5	7	10	14	18"
33.0	50.5	Gray, medium very fractured rock.	3	10.0	11.5	6	7	4	18"
50.5	52.5		4	15.0	16.5	8	5	4	12"
52.5	60.5		5	20.0	21.5	8	6	8	8"
			6	25.0	26.5	5	7	5	5"
			7	30.0	31.5	10	8		5"
			8	35.0	35.5	51/5"		27	4"
		*No water encountered	9	40.0	41.5	17	41		12"
		*Void from 58.5 to 59.5 Ft.	10	45.0	45.2	51/3"			3"
		*Installed 2" well to 51.5 Ft.	11	50.0	50.1	51/2"			2"
		*Boring offset 6 Ft. west	12	50.5	55.5	RQD	15%		56"
		*Bottom 60.5 Ft.	13	55.5	60.5	RQD	6%		48"
		*Strong solvent odor at 10 Ft. WR&A Note: Also noticed odors.							
		*Hard grinding of augers 8 to 10.0 Ft.							

Water After 14 Hours Dry Caved (Inside Augers) Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-14
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/10/95
START:	07/10/95 END: 07/10/95	ELEVATION:	148.3
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	8.0	Brown, dry, soft, silty clay with trace of gravel	1	0	1.5	1	4	4	12"
8.0	30.5	Tan to whitish gray, dry, medium dense to very dense, silty sand (decomposed rock)	2	4.5	6.0	3	5	5	12"
30.5	40.5	Gray, medium to hard fractured rock	3	9.5	11.0	5	6	7	0"
			4	14.5	16.0	8	6	21	0"
			5	19.5	21.0	50	51/4		8"
			6	24.5	26.0	50/2			2"
			7	29.5	31.0	50/0			0"
			8	30.5	35.5	RQD	50%		58"
			9	35.5	40.5	RQD	33%		60"
		*Water at 21 Ft. caved 22 Ft.							
		*Auger refusal 30.5 Ft.							
		*No water encountered while drilling							
		*Bottom at 40.5 Ft.							

Water 20 Ft. at completion Caved 22.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-15
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/10/95
START:	07/10/95 END: 07/10/95	ELEVATION:	141.8
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	12.0	Tan, dry to loose to medium dense silty sand with trace of gravel (fill)	1	0	1.5	4	4	5	15"
12.0	23.5	Gray to tan, damp, medium stiff to soft clay with trace of gravel & brick fragments (fill)	2	4.5	6.0	2	3	2	17"
23.0	42.0	Reddish brown to tan, dry, medium dense to very dense, micaceous silty sand (decomposed rock)	3	9.5	11.0	8	11	4	18"
42.0	52.0	Gray, medium to hard, rock	4	14.5	16.0	3	3	3	12"
			5	19.5	21.0	2	2	3	18"
			6	24.5	26.0	3	14	9	18"
			7	29.5	31.0	10	9	6	18"
			8	34.5	36.0	36	50/6		12"
			9	39.5	41.0	45	50/3		9"
			10	42.0	47.0	RQD	61%		56"
		*No water encountered while augering	11	47.0	52.0	RQD	81%		60"
		*Auger refusal 42 Ft.							
		*Bottom at 52 Ft.							
		*After 24 hours, water at 33 Ft. caved at 34 Ft.							

Water 21 Ft. at completion Caved 41 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-16
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/03/95
START:	07/03/95 END: 07/03/95	ELEVATION:	143.6 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	4.0	Tan, dry, very loose, silty sand & wood fragments (fill)	1	0	1.5	1	1	2	12"
4.0	8.0	Brown, damp, stiff, silty clay with trace of brick fragments (fill)	2	4.5	6.0	5	5	8	12"
8.0	17.0	Brown, dry, loose, silty sand with trace of gravel (fill)	3	9.5	11.0	5	3	2	12"
17.0	22.0	Gray, moist, soft, clay (fill)	4	14.5	16.0	1	1	4	10"
22.0	27.0	Tan, dry, medium dense to dense, silty, sand, with trace of rock fragments (fill)	5	19.5	21.0	3	2	4	12"
27.0	53.5	Brown, dry, to wet, dense to very dense, micaceous silt, with trace of rock fragments (decomposed to weathered rock)	6	24.5	26.0	7	7	10	18"
53.5	63.5	Gray, medium to hard, rock	7	29.5	31.0	6	12	19	
			8	34.5	36.0	21	50/5"		
			9	39.5	40.4	36	50/5"		
			10	44.5	44.6	50/2"			1/2"
			11	49.5	49.6	50/2"			2"
			12	53.5	58.5	RQD	55%		60"
		*Encountered water at 46.0 Ft.	13	58.5	63.5	RQD	66%		60"
		*Auger refusal at 53.5 Ft.							

Water 11 Ft. After 24 hours (hard rain over night) Caved 12.5 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-17
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/05/95
START:	07/05/95 END: 07/05/95	ELEVATION:	142.7 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration				Rec/ Att
From	To		No.	From	To					
0	57.0	Brown to gray, moist to wet, very soft to hard to soft, clay with layers of silty sand & trace of gravel (fill - trace to a little wood & roots from 47 Ft. to 57 Ft.)	1	0	1.5	1	2	2		6"
57.0	63.5	Gray, dry, very dense silty sand & rock fragments (weathered rock)	2	4.5	6.0	5	6	8		12"
63.5	73.5	Gray, medium to hard, rock	3	9.5	11.0	5	2	2	3	6"
			4	14.5	16.0	1	3	4	4	6"
			5	19.5	21.0	4	3	5		8"
			6	24.5	26.0		5	5		6"
			7	29.5	31.0		14	14		16"
			8	34.5	36.0	1		16		8"
			9	39.5	41.0	6	6			5"
			10	44.5	46.0	2	2	10		12"
			11	49.5	51.0	12	3	3		12"
		*Bottom at 73.5 Ft.	12	54.5	56.0	5		14		6"
		*Encountered water at 18'8"	13	59.5	61.0	50/2				2"
		*Auger refusal at 63.5 Ft.	14	63.5	68.5	RQD	25%			60"
		*Hard augering 33 Ft. to 34 ft. and 61 Ft. to 63.5 Ft.	15	68.5	73.5	RQD	40%			55"

Water 13 Ft. After 24 hours Caved 16.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-18
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/03/95
START:	07/03/95 END: 07/04/95	ELEVATION:	136.3 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration				Rec/ Att
From	To		No.	From	To					
0	3.0	Tan, dry, very loose, silty sand (fill)	1	0	15.0	WOH/6	1	1		12"
3.0	13.0	Gray, damp, medium stiff clay with trace of brick fragments (fill)	2	4.5	60.0	3	4	4		12"
13.0	17.0	Tan & gray, dry, medium dense silty sand (fill)	3	9.5	11.0	3	3	5	3	18"
17.0	32.0	Gray to tan, damp, soft to very soft, silty clay, with trace of brick & rock fragments (fill)	4	14.5	16.0	4	9	7	4	12"
32.0	54.0	Brown, dry, medium dense to loose to very dense, micaceous silty sand with trace of rock fragments (decomposed to weathered rock)	5	19.5	21.0	3	3	4		12"
54.0	64.0	Gray, medium to hard, rock	6	24.5	26.0	12	11	50/2		15"
			7	29.5	31.0	2	2	1		12"
			8	34.5	36.0	6	6	10		16"
			9	39.5	41.0	3	3	3		3"
			10	44.5	46.0	8	21	50/4		11"
			11	49.5	51.0	4	4	6		2"
		*Bottom at Ft.	12	54.5	54.7	50/2				2"
		*At completion water at 44 Ft. Caved 46 Ft.	13	54.0	59.0	RQD	8%			52"
		*Auger refusal at Ft.	14	59.0	64.0	RQD	21%			60"
		*Hard augering (24 to 29 Ft.) (32 to 34 Ft.) (43.5 to 44.5 Ft.)								

Water 44 Ft. After 24 hours Caved 45.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-19
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/26/95
START:	06/26/95 END: 06/26/95	ELEVATION:	
DRILLER:	Jeff Stouffer	DRILL RIG:	CME 55

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	17	Brown, dry, loose to medium dense, silty sand with layers of clay (fill)	1	0	1.5	3	3	4	
17	38	Gray to tan, dry, medium stiff to very stiff, clay with traces of gravel (fill	2	4.5	6.0	3	9	7	
38	47	Tan, moist, medium stiff, silty clay (possible fill)	3	9.5	11.0	4	4	4	
47	53	Tan, dry, very dense, silty sand with trace of rock fragment (possible fill)	4	14.5	16.0	3	7	9	
53	60	Greenish gray, wet, very dense silty sand and rock fragments (weathered rock)	5	19.5	21.0	5	3	5	
60	70	Gray, hard rock	6	24.5	26.0	3	4	5	
			7	29.5	31.0	7	9	9	0"
			8	34.5	36.0	4	7	11	
			9	39.5	41.0	2	2	4	
		WR&A Note: Sample has petroleum product smell.	10	44.5	46.0	3	3	6	
			11	49.5	50.2	31	50/3"		
		*Hard augering from 47 Ft.	12	54.5	54.6	50/2"			2"
		*No water encountered	13	59.5	59.6	50/1"			1"
		*Bottom 70 Ft.	14	60.0	65.0	RQ	D	20 0/0	62"
			15	65.0	70.0	RQ	D	25 0/0	60"

Water_____ Caved _____ Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-20
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/28/95
START:	06/28/95 END: 06/28/95	ELEVATION:	14.5 Ft.
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2.5	Crushed rock (CRG)	1	0	1.5	3	8	13	11"
2.5	12.0	Light brown to brown, dry to moist, medium dense to loose, micaceous clayey silt (fill)	2	5	6.5	3	4	10	14"
12.0	26.0	Brown to reddish brown, dry, medium stiff to very stiff, clay with trace of gravel (fill)	3	10	11.5	4	4	5	12"
26.0	33.0	Brown, dry, dense to very dense, micaceous silty sand with trace of roots (fill)	4	15	16.5	5	4	4	11"
33.0	49.5	Brown, dry to wet, very dense, micaceous silty sand with rock fragments (decomposed to weathered rock)	5	20	21.5	23	11	17	16"
49.5	54.5	Brown to gray, soft to hard rock with layers of decomposed rock	6	25	26.5	49	19	22	14"
54.5	59.5	Gray,hard very fractured rock	7	30	30.3	51/4"			4"
			8	35	36.5	29	30	36	12"
			9	40	40.1	51/1"			1"
			10	45	45.5	100/6"			6"
			11	49.5	54.5	RQ	D	27%	47"
		*Auger refusal at Ft.	12	54.5	59.5	RQ	D	0%	60"
		*Encountered water at 37 Ft.							
		*Very hard grinding of augers from 37 Ft. to Ft.							
		*Bottom 59.5 Ft.							

Water 35' 3" Caved 37 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-21
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/30/95
START:	06/30/95 END: 06/30/95	ELEVATION:	Ft.
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	13.0	Brown & red, moist, very soft to very stiff, silty clay with trace of roots & gravel (fill)	1	0	1.5	1	1	3	12"
13.0	42.5	Tan, dry to wet, medium dense to very dense, silty sand, decomposed rock	2	5.0	6.5	5	8	11	14"
42.5	52.5	Gray, medium hard rock	3	10.0	11.5	24	14	10	6"
			4	15.0	16.5	8	11	12	16"
			5	20.0	20.5	51/6"			6"
			6	25.0	26.2	6	25	5 2/3"	14"
			7	30.0	30.1	51/1"			0"
			8	35.0	35.0	51/0"			0"
			9	42.5	47.5	Run #1	RQD %	0/0	60"
			10	47.5	52.5	Run #2	RQD 100%		60"
		*Bottom 52.5 Ft.							
		*Two-inch monitoring well installed to 40 Ft.							
		*Encountered water at 33.0 Ft.							

Water _____ Caved ___Ft._____ Sheet No. ___1 of 1___

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-22
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/29/95
START:	06/29/95 END: 06/29/95	ELEVATION:	138.2 Ft.
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	9.0	Brown, dry, loose, micaceous silty sand (fill)	1	0	1.5	1	3		7"
9.0	24.0	Brown, damp, hard to very stiff to hard, silty clay, with a little rock fragments (fill)	2	5.0	6.5	4	6	4	8"
24.0	45.5	Brown, dry to wet, very dense, micaceous silty sand (decomposed to weathered rock)	3	10.0	11.5	30	23	4	4"
45.5	55.5	Gray medium to hard rock	4	15.0	16.5	12	8	14	13"
			5	20.0	21.5	30	24	9	4"
			6	25.0	26.5	24	29	19	11"
			7	30.0	30.0	51/0"		30	0"
			8	35.0	35.1	100/1"			0"
			9	40.0	40.0	51/0"			0"
			10	45.0	45.1	51/1.5"			1.5"
		*Bottom 55.5 Ft.	11	45.5	50.5	RQD	37%		48"
		*Slight to hard grinding of augers from 28 Ft. to 30 Ft. and 44 Ft. to 45.5 Ft.	12	50.5	55.5	RQD	83%		60"
		*Encountered water at 28.0 Ft.							
		*Auger refusal at 45.5 Ft.							
		*At completion water 22 Ft; Caved 44 Ft.							

Water _____ Caved ___Ft.___ Sheet No. ___1 of 1___

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-23
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/26/95
START:	06/26/95 END: 06/28/95	ELEVATION:	138.3 Ft.
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	13.0	Brown, dry, medium dense, micaceous, silty sand with clay layers (fill)	1	0	1.5	2	3	8	9"
13.0	23.0	Brown, dry, stiff, clay with trace of rock fragment & silty sand (fill)	2	5.0	6.5	12	8	6	14"
23.0	45.0	Reddish brown to brown, dry to wet, medium dense to very dense, micaceous silty sand, with rock fragments from 34.5 Ft. to 37 Ft. and 44 Ft. to 45 Ft. (decomposed to weathered rock)	3	10.0	11.5	3	2	5	16"
45.0	55.0	Gray & brown to gray, soft to hard rock	4	15.0	16.5	4	9	4	12"
			5	20.0	21.5	3	6	9	15"
			6	25.0	26.5	2	7	13	18"
			7	30.0	30.0	51/5"			5"
			8	35.0	35.1	74/1"			0"
			9	40.0	40.0	51/1"			1"
			10	45.0	45.0	51/0"			0"
		*Auger refusal 45 Ft.	11	45.0	50.0	RQD	20%		54"
		*Bottom 55 Ft.	12	50.0	55.0	RQD	88%		41"
		*Encountered water at 43.0 Ft.							

Water 33.4 Ft. Caved 44.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-24
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/05/95
START:	07/05/95 END: 07/05/95	ELEVATION:	138.7 Ft.
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	33.0	Brown & gray, damp, medium stiff to stiff, clay with trace of silty sand, gravel & brick fragment (fill)	1	0	1.50	2	4	6	18"
33.0	51.0	Tan to gray, medium dense to very dense, micaceous silty sand (decomposed to weathered rock)	2	5.0	6.5	4	6	7	18"
51.0	54.5	Gray, medium to hard rock	3	10.0	11.5	5	6	9	16"
			4	15.0	16.5	2	2	5	12"
			5	20.0	21.5	6	6	7	12"
			6	25.0	26.5	16	6	5	18"
			7	30.0	31.5	4	5	8	18"
			8	35.0	36.5	4	5	9	18"
		*Boring offset 7 Ft. north	9	40.0	40.0	51/0"			0"
		*Slight grinding of augers 39 Ft. to 42 Ft.	10	45.0	45.1	51/1"			1"
		*Auger refusal 51 Ft.	11	50.0	50.1	51/1"			1"
		*Bottom at 54.5 Ft.	12	51.0	54.5	RQD			28"
		*At completion water at 44 Ft. Caved 46 Ft.							
		*Core barrel locked up & broke off at 54.5 Ft.							
		*No water encountered							

Water 14' 5" After 24 hours Caved 14' 8" Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-25
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/06/95
START:	07/06/95 END: 07/07/95	ELEVATION:	136.2
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2.0	Brownish gray to gray, dry to wet, very loose, silty sand with some rock fragments & small boulders (fill)	1	0	1.5	3	6	7	12"
2.0	43.0	Gray, wet, loose to very dense, silty sand & rock fragments (decomposed to weathered rock)	2	5.0	6.5	5	7	13	18"
43.0	55.0	Brown, soft partially weathered rock	3	10.0	11.5	4	9	14	18"
55.0	65.0	Gray, medium to hard fractured, rock	4	15.0	16.5	10	8	13	3"
		Gray soft to medium hard fractured rock	5	20.0	21.5	8	7	7	18"
			6	25.0	26.5	7	10	14	18"
			7	30.0	31.5	7	9	14	8"
			8	35.0	36.5	14	12	12	18"
			9	40.0	41.5	20	10	13	12"
			10	45.0	46.5	20	30	32	16"
		*Installed 2" monitoring well to 54 Ft.	11	50.0	51.5	29	30	36	18"
		*Bottom at 65.0 Ft.	12	55.0	55.6	51/2"			0"
		*Boring offset 7 Ft. south	13	55.5	60.0	RQD	17%		60"
		*Encountered water at 45.5 Ft.	14	60.0	65.0	RQD	23%		50"

Water 44' 9" after 24 hours inside of augers Caved _____ Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-26
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	05/27/95
START:	05/27/95 END: 06/28/95	ELEVATION:	135.6 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	33.0	Brown to gray, damp, soft to very stiff, silty clay with trace of gravel and brick fragments (fill)	1	0	1.5	2	2	3	
33.0	39.0	Grayish tan, dry, medium dense, silty sand with gravel and rock fragments (fill)	2	4.5	6.0	5	11	8	
39.0	48.0	Greenish gray, dry, medium dense silty sand & rock fragments	3	9.5	11.0	2	6	8	
48.0	53.0	Tan, wet, medium dense, sand & gravel	4	14.5	16.0	4	6	10	
53.0	55.5	Gray, wet, very dense, weathered rock	5	19.5	21.0	3	6	8	
55.5	65.5	Gray, hard, rock	6	24.5	26.0	3	4	7	
			7	29.5	31.0	6	8	7	
			8	34.5	36.0	24	13	7	
			9	39.5	41.0	9	8	10	
			10	44.5	46.0	3	5	9	
			11	49.5	51.0	2	5	6	
		*Bottom 65.5 Ft.	12	54.5	56.0	50/2			
		*Encountered water at 50.0 Ft.	13	55.5	60.5	RQD	10%		53"
		*Hard augering 37 Ft. to 38 Ft.		60,5	65.5	RQD	81%		60"

Water 44.0 Ft. Caved 47.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-27
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	05/26/95
START:	05/26/95 END: 05/27/95	ELEVATION:	135.1 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	7.0	Brown to gray, damp, soft to very stiff, silty clay with trace of gravel and brick fragments (fill)	1	0	1.5	3	3	4	
7.0	12.0	Grayish tan, dry, medium dense, silty sand with gravel and rock fragments (fill)	2	4.5	6.0	3	3	3	
12.0	17.0	Greenish gray, dry, medium dense silty sand & rock fragments	3	9.5	11.0	4	6	13	
17.0	28.0	Tan, wet, medium dense, sand & gravel	4	14.5	16.0	3	6	6	
28.0	43.5	Gray, wet, very dense, weathered rock	5	19.5	21.0	3	5	9	
43.0	54.5	Gray, hard, rock	6	24.5	26.0	3	3	6	
54.5	64.5		7	29.5	31.0	9	9	13	
			8	34.5	36.0	7	5	13	
			9	39.5	41.0	4	9	8	
			10	44.5	46.0	10	31	36	
			11	49.5	51.0	4	8	8	
		*Bottom 64.5 Ft.	12	54.5	59.5	RQD	50%		60"
		*Encountered water at 50.0 Ft.	13	59.5	64.5	RQD	47%		60"
		*Auger refusal 54.5 Ft.							
		*After 24 hours, 38' 10", caved 39 Ft.							

Water 37.0 Ft. at completion Caved 44.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-28
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	05/29/95
START:	05/28/95 END: 05/29/95	ELEVATION:	134.8 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2.0	Crushed stone (CRG)	1	4.5	6.0	3	3	4	
2.0	37.0	Brown to gray to brown, dry, medium stiff to stiff, silty clay, with trace of asphalt & brick fragment (fill)	2	9.5	11.0	4	9	9	
37.0	50.5	Brown, dry to wet, medium dense to very dense, micaceous silty sand with rock fragments from 49 Ft. to 49.6 Ft. (Decomposed to weathered rock)	3	14.5	16.0	4	4	6	
50.5	60.5	Gray hard rock	4	19.5	21.0	2	4	5	
			5	24.5	26.0	4	5	6	
			6	29.5	31.0	3	4	6	
			7	34.5	36.0	5	5	7	
			8	39.5	41.0	5	9	13	
			9	44.5	46.0	50/6			
			10	49.5	51.0	50/2			
			11	50.5	55.5	RQD	50%		39"
		*Bottom 60.5 Ft.	12	55.5	60.5	RQD	41%		30"
		*Encountered water at 42.0 Ft.							
		*Auger refusal 50.5 Ft.							
		*After 24 hours, 42.5', caved 43 Ft.							

Water 43.0 Ft. at completion Caved 45.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-29
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/30/95
START:	06/30/95 END: 06/30/95	ELEVATION:	134.4 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	23.0	Brown & gray, dry to damp, medium stiff to stiff, to medium stiff, clay with layers of silty sand (fill)	1	0	1.5	3	3	4	12"
23.0	42.0	Tan, dry to wet, dense to very dense, micaceous silty sand (decomposed to weathered rock)	2	4.5	6.0	2	3	5	18"
42.0	52.0	Gray, medium to hard rock	3	9.5	11.0	3	5	8	18"
			4	14.5	16.0	2	2	4	14"
			5	19.5	21.0	4	9	12	18"
			6	21.5	26.0	10	18	20	18"
			7	29.5	31.0	15	50/5		11"
			8	34.5	36.0	50/6			6"
			9	39.5	41.0	13	50/5		9"
			10	42.0	42.1				
		*Auger refusal 42 Ft.	11	42.0	47.0	RQD	25%		1"
		*Bottom at Ft.	12	47.0	52.0	RQD	25%		54"
		*At completion water at 20 Ft. Caved 34 Ft.							60"
		*Encountered water at 40 Ft.							

Water 10.5 Ft. After 24 hours Caved 11 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-30
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/30/95
START:	06/29/95 END: 06/30/95	ELEVATION:	135.4 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	23.0	Brown, damp medium stiff to stiff, clay with layers of silty sand & rock fragment (fill)	1	0	1.5	2	3	4	5"
23.0	40.5	Gray to tan, very dense, micaceous silty sand with trace of rock fragment (decomposed to weathered rock)	2	4.5	6.0	3	5	5	6"
40.5	50.5	Gray, medium to hard rock	3	9.5	11.0	4	4	7	5"
			4	14.5	16.0	5	5	5	8"
			5	19.5	21.0	9	12	5	8"
			6	24.5	26.0	6	24	15	12"
			7	29.5	31.0	19	50/5	43	14"
			8	34.5	36.0	15	50/5		12"
			9	39.5	40.0	50/6			1"
			10	40.5	45.5	RQD	70%		54"
		*Auger refusal 40.5 Ft.	11	45.5	50.5	RQD	30%		62"
		*Bottom at 50.5 Ft.							
		*At completion water at 28 Ft. Caved 37 Ft.							

Water 31 Ft. After 24 hours Caved 35 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-31
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/29/95
START:	06/29/95 END: 06/29/95	ELEVATION:	136.5 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	12.5	Reddish brown to brown, dry to moist, medium stiff to stiff, clayey silt with trace of gravel & rock fragments (fill)	1	0	1.5	2	3	4	9"
			2	5	6.5	1	5	7	10"
			3	10	11.5	9	7	5	10"
		*Bottom 12.5 Ft.							
		*Hard grinding of augers 12 Ft. to 12.5 Ft.							
		*Auger refusal 12.5 Ft.							

Water Dry at completion Caved 45.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-31A
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	06/29/95
START:	06/29/95 END: 06/29/95	ELEVATION:	Ft.
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	14.2	Reddish brown to brown, dry to moist, clayey silt with trace of gravel & rock fragments (fill)	1	14.2	15.2	19	19		4"
14.2	15.2	Rock & concrete							
		*Bottom 15.2 Ft.							
		*Hard grinding of augers 13 Ft. to 14.2 Ft.							
		*Auger refusal 14.2 Ft.							

Water Dry at completion Caved 45.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-31B
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/03/95
START:	07/03/95 END: 07/03/95	ELEVATION:	
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	8.0	Tan, dry, micaceous silty sand	1	0	5.0	Auger Cut		6	6"
8.0	14.3	Tan, dry, micaceous silty sand with some gravel & small cobbles (fill)	2	5	10.0	Auger Cut		7	6"
14.3	15.8	Tan, dry, very dense silty clay & sand with gravel brick & rock fragments (fill)	3	14.3	15.8	40.0	33	56	12"
		*Auger refusal 14.3 Ft.							
		*Bottom at 15.8 Ft.							
		*Spoon glancing off below augers sample #3							
		*No water encountered							

Water Dry at completion Caved 11.0 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-32
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/17/95
START:	07/17/95 END: 07/17/95	ELEVATION:	146.3
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	9.5	Brown, dry, medium dense, silty sand, with trace of wood & brick fragments & boulders (fill)	1	0	1.5	4	5	8	18"
			2	5.0	6.5	4	6	10	10"
			3	9.0	9.5	15	51/1"		4"
		*No water encountered while drilling							
		*Auger refusal 37 Ft.							
		*Bottom at 42 Ft.							

Water Dry After 24 hours Caved 8 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-32A
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/17/95
START:	07/18/95 END: 07/18/95	ELEVATION:	145.3 (Approx.)
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	18.0	Tan to gray & tan, dry, soft t very stiff, silty clay (fill)	1	10.0	11.5	5	3	4	12"
18.0	38.5	Greenish tan to orangish tan, dry, medium dense to very dense, micaceous silty sand (decomposed rock)	2	15.0	16.5	7	8	10	6"
38.5	43.5	Gray, soft to medium, rock with soil lenses	3	20.0	21.5	8	11	12	10"
			4	25.0	26.5	9	12	18	12"
			5	30.0	31.5	25	35	50	18"
			6	35.0	36.4	10	10	51/5"	17"
			7	38.5	38.5	51/0"			0"
			8	38.5	43.5	RQD	10%	10%	44"
		*No water encountered while drilling							
		*Auger refusal 38.5 Ft.							
		*Bottom at 43.5 Ft.							
		*Installed 2" well to 37.5 Ft.							

Water Dry After 24 hours Caved 35 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-33
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/18/95
START:	07/18/95 END: 07/18/95	ELEVATION:	
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	23.0	Tan, dry to damp, medium stiff to very soft, silty clay with trace of brick & concrete fragments (fill)	1	0	1.5	5	8	5	10"
23.0	37.0	Tan to tan & white, dry, very loose to very dense, micaceous silty sand (decomposed rock)	2	5.0	6.5	7	8	7	16"
37.0	42.0	Gray, medium to hard rock	3	10.0	11.5	7	9	6	10"
			4	15.0	16.5	3	5	5	4"
			5	20.0	21.5	2	2	2	18"
			6	25.0	26.5	1	1	14	18"
			7	30.0	31.5	3	6	12	18"
			8	35.0	36.5	45	42	46	18"
			9	37.0	42.0	RQD	70%		60"
		*No water encountered while drilling							
		*Auger refusal 37 Ft.							
		*Bottom at 42 Ft.							

Water Dry After 24 hours Caved 35 Ft. Sheet No. 1 of 1

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-34
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/19/95
START:	07/19/95 END: 07/19/95	ELEVATION:	145.9 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	23.0	Brown, dry to damp, medium stiff, silty clay with trace of rock fragments (fill)	1	0	1.5	4	4	4	6"
23.0	33.0	Tan, dry, very dense, micaceous silty sand (decomposed to weathered rock)	2	4.5	6.0	3	3	2	10"
33.0	38.0	Gray, medium to hard, rock	3	9.5	11.0	3	3	4	18"
			4	14.5	16.0	6	5	4	9"
			5	19.5	21.0	2	3	5	3"
			6	24.5	26.0	5	25	30	18"
			7	29.5	31.0	27	50/3		10"
			9	33	33.0	51/0"			0"
			10	33	38.0	RQD	73%		57"
		*Bottom 38.0 Ft.							
		*Auger refusal at 33.0 Ft.							
		*No water encountered while drilling							
		*After 24 hours, water at 17.5 Ft., caved at 19 Ft.							

Water 11 Ft. at completion Caved 16 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-35
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/19/95
START:	07/19/95 END: 07/19/95	ELEVATION:	145.8 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	34.5	Tan, dry to moist, medium stiff, silty clay with trace of roots & rock fragments (fill)	1	0	1.5	4	4	5	6"
34.5	39.0	Concrete core	2	4.5	6.0	10	8	9	12"
39.0	39.5	Gray, medium to hard rock	3	9.5	11.0	8	8	8	2"
			4	14.5	16.0	2	4	4	"
			5	19.5	21.0	2	1	2	9"
			6	24.5	26.0	2	2	2	12"
			7	29.5	31.0	2	2	2	12"
			8	34.5	39.5	RQD	100%		
									56"
		*Bottom 39.5 Ft.							
		*Auger refusal at Ft.							
		*No water encountered while drilling							
		*After 24 hours water at 27.5 Ft., caved at 30 Ft.							

Water 27 Ft. Caved 30 Ft. Sheet No. 1 of 1

SOIL BORING LOG

Client Whitman Requardt — Boring # DC-36
Project Name Dalecarlia WTP Georgetown Reservior — Job # D38-0695 (Phase III)
Location McArthur Blvd.

Datum — Driller P. Suit — Hammer Type Safety — Boring Method 4.25" ID HSA
Surf. Elev. Ft. — Inspector — Sampler Type Standard — Borehole Diameter 8" In.
Date Started 10/30/95 — Date Completed 10/30/95 — Rod Size AW — Rock Core Size 3"

STRATA DEPTH	SOIL DESCRIPTION Color, Moisture, Density, Size, Lithology	ELEV	SOIL SYMBOL	SAMPLE DEPTH	SAMPLE No.	SAMPLE Type	SAMPLE Blows/6"	SAMPLE Rec.	SAMPLE PID (ppm)	BORING & SAMPLING NOTES
	Light gray, wet, medium stiff clay. **(FILL)**				1	SPT	1-2-4	3"		
				5	2	SPT	3-3-4	18"		
7.0	Gray and tan, moist, dense to medium dense, clayey sand.			10	3	SPT	10-17-16	18"		
				15	4	SPT	6-10-10	18"		
18.0	Brown, dry, very dense, micaseous silty sand.			20	5	SPT	9-35-27	10"		
				25	6	SPT	51/3	3"		
30.0	Brown, very soft rock. **(VOID FROM 32'-33'.5)**			30	7	SPT	51/0	0"		
					8	RC	RQD 0%	22"		
35.0	Auger refusal at 30.0 ft. Bottom of the boring at 35.0 ft. Backfilled with cuttings to 22.0 ft, portland cement to 1.0 ft, concrete patch to surface.			35						
				40						
				45						

BORING METHOD
HSA - HOLLOW STEM AUGERS
HA/TR-HAND AUGER & TRIPOD
DC - DRIVING CASING
MD - MUD DRILLING
AR - AIR ROTARY/AIR HAMMER

SAMPLER TYPE
SPT - STANDARD PENETRATION TEST SPLIT SPOON
ST - SHELBY TUBE
AS - AUGER SAMPLE
RC - ROCK CORE

GROUNDWATER DEPTH
AT COMPLETION ____ FT.
AFTER ____ HRS. ____ FT.
AFTER 24 HRS. ____ FT.
CAVED AT ____ FT.

GEOMATRIX, INC.
Hyattsville, Maryland
(301)-306-9677

SPT-Standard Penetration Test: Driving 2 Inch OD Sampler 1.0 foot with 140 pound Hammer Falling 30 inches; Blow Count Recorded at 6 inch Intervals
PID - PhotoIonization Detector (parts per million)

SOIL BORING LOG

Client Whitman Requardt — Boring # DC-37
Project Name Dalecarlia WTP Georgetown Reservior — Job # D38-0695 (Phase III)
Location McArthur Blvd.

Datum — Driller P. Suit — Hammer Type Safety — Boring Method 4.25" ID HSA
Surf. Elev. Ft. — Inspector — Sampler Type Standard — Borehole Diameter 8" In.
Date Started 10/29/95 — Date Completed 10/29/95 — Rod Size AW — Rock Core Size 3"

STRATA DEPTH	SOIL DESCRIPTION Color, Moisture, Density, Size, Lithology	ELEV	SOIL SYMBOL	SAMPLE DEPTH	SAMPLE No.	Type	Blows/6"	Rec.	PID (ppm)	BORING & SAMPLING NOTES
	Gray, wet, soft to stiff clay (FILL)				1	SPT	1-2-2	10"		
				5	2	SPT	3-5-6	14"		
6.5	Brown and gray, moist, hard to very stiff, clay with a little sand.			10	3	SPT	21-15-20	4"		
				15	4	SPT	4-3-3	18"		
19.0	Brown and gray, wet, very dense, micaceous silty sand.			20	5	SPT	35-51/3	8"		
				25	6	SPT	51/5	5"		
				30	7	SPT	51/1	1"		
				35	8	SPT	51/4	4"		
39.0					9	SPT	51/1	0"		
	Gray, medium rock.			40	10	RC	RQD 45%	48"		
44.0										
	Auger refusal at 39.0 ft. Encountered water at 19.0 ft. Bottom of the boring at 44.0 ft. Backfilled with cuttings to 9.0 ft, portland cement to 1.0 ft, concrete patch to surface.			45 50						

BORING METHOD
HSA - HOLLOW STEM AUGERS
HA/TR-HAND AUGER & TRIPOD
DC - DRIVING CASING
MD - MUD DRILLING
AR - AIR ROTARY/AIR HAMMER

SAMPLER TYPE
SPT - STANDARD PENETRATION TEST SPLIT SPOON
ST - SHELBY TUBE
AS - AUGER SAMPLE
RC - ROCK CORE

GROUNDWATER DEPTH
AT COMPLETION ____ FT.
AFTER ____ HRS. ____ FT.
AFTER 24 HRS. ____ FT.
CAVED AT ____ FT.

GEOMATRIX, INC.
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(301)-308-9877

SPT-Standard Penetration Test: Driving 2 Inch OD Sampler 1.0 foot with 140 pound Hammer Falling 30 inches; Blow Count Recorded at 6 inch Intervals
PID - PhotoIonization Detector (parts per million)

SOIL BORING LOG

Client Whitman Requardt — Boring # DC-38
Project Name Dalecarlia WTP Georgetown Reservior — Job # D38-0695 (Phase III)
Location McArthur Blvd.

Datum — Driller D. Cole — Hammer Type Safety — Boring Method 4.25" ID HSA
Surf. Elev. Ft. — Inspector — Sampler Type Standard — Borehole Diameter 8" In.
Date Started 10/31/95 — Date Completed 10/31/95 — Rod Size AW — Rock Core Size 3"

STRATA DEPTH	SOIL DESCRIPTION Color, Moisture, Density, Size, Lithology	ELEV	SOIL SYMBOL	SAMPLE DEPTH	SAMPLE No.	Type	Blows/6"	Rec.	PID (ppm)	BORING & SAMPLING NOTES
	Dark gray, wet, very loose, to mostly dense, clayey sand. (FILL)				1	SPT	1-1-2	10"		
				5	2	SPT	9-12-13	18"		
6.5	Gray and tan, moist, mostly dense clayey sand.									
				10	3	SPT	8-11-13	16"		
				15	4	SPT	5-7-8	18"		
				20	5	SPT	5-6-9	16"		
24.0	Brown, moist, mostly dense to very dense, micaseous silty sand.			25	6	SPT	9-11-16	10"		
				30	7	SPT	51/1	1"		
35.0				35	8	SPT	51/2	2"		
37.0	Gray, medium to soft rock.				9	RC	RQD 0%	18"		
	Auger refusal at 35.0 ft. Bottom of the boring at 37.0 ft. Boring grouted with portland cement from 37.0 to 1.0 ft. Concrete patch to surface.			40						
				45						

BORING METHOD
HSA - HOLLOW STEM AUGERS
HA/TR-HAND AUGER & TRIPOD
DC - DRIVING CASING
MD - MUD DRILLING
AR - AIR ROTARY/AIR HAMMER

SAMPLER TYPE
SPT - STANDARD PENETRATION TEST SPLIT SPOON
ST - SHELBY TUBE
AS - AUGER SAMPLE
RC - ROCK CORE

GROUNDWATER DEPTH
AT COMPLETION _____ FT.
AFTER _____ HRS. _____ FT.
AFTER 24 HRS. _____ FT.
CAVED AT _____ FT.

GEOMATRIX, INC.
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(301)-306-9677

SPT-Standard Penetration Test: Driving 2 Inch OD Sampler 1.0 foot with 140 pound Hammer Falling 30 inches; Blow Count Recorded at 6 inch Intervals
PID - PhotoIonization Detector (parts per million)

SOIL BORING LOG

Client Whitman Requardt — Boring # DC-39
Project Name Dalecarlia WTP Georgetown Reservior — Job # D38-0695 (Phase III)
Location McArthur Blvd.

Datum — Driller P. Suit — Hammer Type Safety — Boring Method 4.25" ID HSA
Surf. Elev. Ft. — Inspector — Sampler Type Standard — Borehole Diameter 8" In.
Date Started 10/31/95 — Date Completed 10/31/95 — Rod Size AW — Rock Core Size 3"

STRATA DEPTH	SOIL DESCRIPTION Color, Moisture, Density, Size, Lithology	ELEV	SOIL SYMBOL	SAMPLE DEPTH	SAMPLE No.	Type	Blows/6"	Rec.	PID (ppm)	BORING & SAMPLING NOTES
	Gray and tan to reddish brown, moist to wet, mostly dense to loose clayey sand.			5	1	SPT	5-6-8	18"		
				10	2	SPT	9-12-19	18"		
				15	3	SPT	3-12-12	18"		
				20	4	SPT	1-3-5	14"		
23.0	Brown wet, mostly dense to very dense, micaseous silty sand.			25	5	SPT	9-12-17	18"		
29.0	Brown, very soft rock with a trace of quartz.			30	6	SPT	51/2	0"		
					7	RC	RQD 0%	16"		
34.0	Auger refusal at 29.0 ft. Bottom of the boring at 34.0 ft. Boring grouted with portland cement from 34.0 to 1.0 ft. concrete patch to surface.			35						
				40						

BORING METHOD
HSA - HOLLOW STEM AUGERS
HA/TR-HAND AUGER & TRIPOD
DC - DRIVING CASING
MD - MUD DRILLING
AR - AIR ROTARY/AIR HAMMER

SAMPLER TYPE
SPT - STANDARD PENETRATION TEST SPLIT SPOON
ST - SHELBY TUBE
AS - AUGER SAMPLE
RC - ROCK CORE

GROUNDWATER DEPTH
AT COMPLETION ____ FT.
AFTER ____ HRS. ____ FT.
AFTER 24 HRS. ____ FT.
CAVED AT ____ FT.

GEOMATRIX, INC.
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(301)-306-9677

SPT-Standard Penetration Test: Driving 2 Inch OD Sampler 1.0 foot with 140 pound Hammer Falling 30 inches; Blow Count Recorded at 6 inch Intervals
PID - PhotoIonization Detector (parts per million)

SOIL BORING LOG

Client Whitman Requardt — Boring # DC-40
Project Name Dalecarlia WTP Georgetown Reservior — Job # D38-0695 (Phase III)
Location McArthur Blvd.

Datum — Driller P. Suit — Hammer Type Safety — Boring Method 4.25" ID HSA
Surf. Elev. Ft. — Inspector — Sampler Type Standard — Borehole Diameter 8" In.
Date Started 10/30/95 — Date Completed 10/30/95 — Rod Size AW — Rock Core Size 3"

STRATA DEPTH	SOIL DESCRIPTION Color, Moisture, Density, Size, Lithology	ELEV	SOIL SYMBOL	SAMPLE DEPTH	SAMPLE No.	Type	Blows/6"	Rec.	PID (ppm)	BORING & SAMPLING NOTES
	Gray, wet, soft to very stiff clay. (FILL)				1	SPT	1-1-3	16"		
7.0				5	2	SPT	16-11-14	4"		
	Gray and tan, wet, very stiff to stiff, clay with a little sand.			10	3	SPT	6-7-13	18"		
				15	4	SPT	16-6-7	10"		
18.0										
	Gray, wet, mostly dense clayey sand.			20	5	SPT	2-6-6	12"		
22.0										
	Tan, dry, very dense, micaceous silty sand.			25	6	SPT	17-51/4	10"		
28.5					7	SPT	51/0	0"		
	Gray, medium rock.			30	8	RC	RQD 45%	50"		
33.5										
	Auger refusal at 28.0 ft. Encountered water at 18.0 ft. Bottom of the boring at 33.5 ft. Backfilled with cuttings to 5.0 ft, portland cement to 1.0 ft, concrete patch to surface.			35						
				40						
				45						
				50						

BORING METHOD
HSA - HOLLOW STEM AUGERS
HA/TR-HAND AUGER & TRIPOD
DC - DRIVING CASING
MD - MUD DRILLING
AR - AIR ROTARY/AIR HAMMER

SAMPLER TYPE
SPT - STANDARD PENETRATION TEST SPLIT SPOON
ST - SHELBY TUBE
AS - AUGER SAMPLE
RC - ROCK CORE

GROUNDWATER DEPTH
AT COMPLETION ____ FT
AFTER ____ HRS ____ FT
AFTER 24 HRS ____ FT
CAVED AT ____ FT

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SPT-Standard Penetration Test. Driving 2 Inch OD Sampler 1.0 foot with 140 pound Hammer Falling 30 inches; Blow Count Recorded at 6 inch Intervals
PID - PhotoIonization Detector (parts per million)

SOIL BORING LOG

Client Whitman Requardt — Boring # DC-41
Project Name Dalecarlia WTP Georgetown Reservior — Job # D38-0695 (Phase III)
Location McArthur Blvd.

Datum — Driller P. Suit — Hammer Type Safety — Boring Method 4.25" ID HSA
Surf. Elev. Ft. — Inspector — Sampler Type Standard — Borehole Diameter 8" In.
Date Started 11/8/95 — Date Completed 11/8/95 — Rod Size AW — Rock Core Size —

STRATA DEPTH	SOIL DESCRIPTION Color, Moisture, Density, Size, Lithology	ELEV	SOIL SYMBOL	SAMPLE DEPTH	SAMPLE No.	Type	Blows/6"	Rec.	PID (ppm)	BORING & SAMPLING NOTES
	Brown and gray, moist, very soft to stiff, clay with a little sand. **(FILL)**				1	SPT	1-1-2	4"		
				5	2	SPT	3-3-3	8""""		
				10	3	SPT	3-3-5	10"		
				15	4	SPT	3-4-7	14"		
18.0	Gray, wet, mostly sand and gravel. **(FILL)**			20	5	SPT	7-14-14	10"		
23.0	Brown and gray to gray, moist, mostly dense clayey sand and gravel. **(FILL)**			25	6	SPT	6-12-14	18"		
				30	7	SPT	6-8-7	10"		
34.0										
35.5	Gray, wet, dense sand and gravel.			35	8	SPT	38/17/12	12"		
	Brown, dry, very dense, micaceous silty sand.			40	9	SPT	51/4	4"		
44.0										
	Auger refusal at 44.0 ft. Encountered water at 20.0 and 35.0 ft. Bottom of the boring at 44.0 ft. Grouted with portland cement to 1.0 ft, concrete patch to surface.			45 50						

BORING METHOD
HSA - HOLLOW STEM AUGERS
HA/TR-HAND AUGER & TRIPOD
DC - DRIVING CASING
MD - MUD DRILLING
AR - AIR ROTARY/AIR HAMMER

SAMPLER TYPE
SPT - STANDARD PENETRATION TEST SPLIT SPOON
ST - SHELBY TUBE
AS - AUGER SAMPLE
RC - ROCK CORE

GROUNDWATER DEPTH
AT COMPLETION _____ FT.
AFTER _____ HRS. _____ FT.
AFTER 24 HRS. _____ FT.
CAVED AT _____ FT.

GEOMATRIX, INC.
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SPT-Standard Penetration Test: Driving 2 Inch OD Sampler 1.0 foot with 140 pound Hammer Falling 30 inches; Blow Count Recorded at 6 inch Intervals
PID - Photolonization Detector (parts per million)

SOIL BORING LOG

Client Whitman Requardt — Boring # DC-42
Project Name Dalecarlia WTP Georgetown Reservior — Job # D38-0695 (Phase III)
Location McArthur Blvd.

Datum — Driller D. Cole — Hammer Type Safety — Boring Method 4.25" ID HSA
Surf. Elev. Ft. — Inspector — Sampler Type Standard — Borehole Diameter 8" In.
Date Started 11/4/95 — Date Completed 11/4/95 — Rod Size AW — Rock Core Size —

STRATA DEPTH	SOIL DESCRIPTION Color, Moisture, Density, Size, Lithology	ELEV	SOIL SYMBOL	SAMPLE DEPTH	SAMPLE No.	Type	Blows/6"	Rec.	PID (ppm)	BORING & SAMPLING NOTES
	Tan and gray to tan, damp to wet, loose to mostly dense to loose, clayey sand. **(FILL)**			5	1	SPT	2-2-3-4	16"		
					2	SPT	2-3-3-4	18"		
					3	SPT	2-3-3-4	14"		
					4	SPT	2-4-6-8	18"		
				10	5	SPT	2-2-3-3	12"		
14.0										
	Gray to tan, moist to wet, very dense to mostly dense, sand and gravel with a trace of rock fragments and a trace to a little clay. **(FILL)**			15	6	SPT	5-18-51/5	17"		
					7	SPT	38-15-10	4"		
				20	8	SPT	12-11-9	12"		
23.0										
	Gray and tan, moist, mostly dense to loose, clayey sand.			25	9	SPT	10-11-13	6"		
				30	10	SPT	10-14-17	18"		
				35	11	SPT	5-6-5	18"		
38.0										
	Brown, dry, very dense silty sand.			40	12	SPT	51/0	0"		
53.0										
	Auger refusal at 53.0 ft. Encountered water at [illegible] ft. Bottom of the boring at 53.0 ft. Grouted with portland cement to 10 ft, concrete patch to surface.			55						

BORING METHOD
HSA - HOLLOW STEM AUGERS
HA - HAND AUGER & TRIPOD
DC - DRIVING CASING
MD - MUD DRILLING
AR - AIR ROTARY/AIR HAMMER

SAMPLER TYPE
SPT - STANDARD PENETRATION TEST SPLIT SPOON
ST - SHELBY TUBE
AS - AUGER SAMPLE
RC - ROCK CORE

GROUNDWATER DEPTH
AT COMPLETION ____ FT
AFTER ____ HRS ____ FT
AFTER 24 HRS ____ FT
CAVED AT ____ FT

GEOMATRIX, INC.
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SPT-Standard Penetration Test Driving Joint 18 Sampler with 140 pound Hammer Falling 30 inches. Blow Count Recorded at 6 inch Intervals
PID - Photoionization Detector - parts per million

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-43
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/14/95
START:	07/14/95 END: 07/14/95	ELEVATION:	173.2
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Aft
From	To		No.	From	To				
0	27.5	Tan, dry, medium dense to very dense, micaceous silty sand (decomposed to weathered rock)	1	0	1.5	4	6	6	12"
27.5	32.5	Gray to tan to gray, medium to soft to hard rock	2	3.5	5.0	4	5	5	12"
			3	8.5	10.0	5	8	21	18"
			4	13.5	15.0	51/5"			5"
			5	18.5	20.0	12	16	23	14"
			6	23.5	23.5	51/0"			0"
			7	27.5	27.5	51/0"			0"
			8	27.5	32.5	RQD	30%		36"
		*No water encountered while drilling							
		*Auger refusal 27.5 Ft.							
		*Bottom at 32.5 Ft.							
		*Hard augering 24 to 27.5 Ft.							

Water 26.5 Ft. after 48 hours Caved 27 Ft. Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-44
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/19/95
START:	07/19/95 END: 07/19/95	ELEVATION:	145.9 Ft.
DRILLER:	Dave Cole	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2.0	Ten inches asphalt 14" crushed stone	1	5.0	5.0	51/0"			0"
2.0	10.0	Gray, dry, very dense, silt & rock fragments (weathered rock)	2	10.0	15.0	RQD	0%		40"
10.0	15.0	Gray, soft to medium, very fractured rock							
		*Bottom 15.0 Ft.							
		*Auger refusal at 10.0 Ft.							
		*No water encountered while drilling							

Water _____ Caved _____ Sheet No. 1 of 1

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BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-45
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/20/95
START:	07/20/95 END: 07/20/95	ELEVATION:	Ft.
DRILLER:	Dave Cole	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2.1	Ten inches asphalt 16" cinders & stone	1	4.5	4.5	51/0"			0"
2.1	4.5	Tan to gray, dry, very dense silt & rock fragments (weathered rock)	2	4.5	8.2	RQD	9%		45"
4.5	9.5	Gray, soft to medium, fractured rock	3	8.2	9.5	RQD	25%		13"
		*Bottom 9.5 Ft.							
		*Auger refusal at 4.5 Ft.							
		*No water encountered while drilling							

Water _____ Caved _____ Sheet No. 1 of 1

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-46
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	07/20/95
START:	07/20/95 END: 07/20/95	ELEVATION:	Ft.
DRILLER:	Dave Cole	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2.1	Twelve inches asphalt, 12" cinders & stone	1	4.0	4.0	51/0"			0"
2.0	4.0	Gray, dry, very dense silt & rock fragments (weathered rock)	2	4.0	9.0	RQD	9%		5"
4.0	9.0	Gray, soft, very fractured rock with quartz layers (soil layer 6.5 to 7 Ft.)							
		*Bottom 9.0 Ft.							
		*Auger refusal at 4.0 Ft.							
		*No water encountered							

Water _____ Caved _____ Sheet No. 1 of 1

[redacted]EON[redacted]RIX, [redacted]
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant	BORING NO.:	DC-47
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	02/17/95
START: 07/17/95	END: 07/17/95	ELEVATION:	144.7 Ft.
DRILLER:	Jeff Stouffer	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	22.0	Tan, dry, loose to medium dense to loose, silty sand (fill)	1	0	1.5	2	3	4	6
22.0	27.0	Tan, dry, stiff, silty clay (possible fill)	2	4.5	6.0	3	7	14	12
27.0	53.0	Tan, dry, medium dense to very dense to medium dense, silty sand with trace of rock fragments	3	9.5	11.0	3	8	5	10
53.0	58.0	Gray, soft rock with void from 54 Ft. to 55 Ft.	4	14.5	16.0	6	6	6	6
58.0	63.0	Gray, very soft weathered to decomposed rock	5	19.5	21.0	6	4	7	8
			6	24.5	26.0	6	5	14	12
			7	29.5	31.0	8	9	3	8
			8	34.5	36.0	10	10		7
			9	39.5	41.0	4	4	5	8
			10	44.5	46.0	10	9	9	16
			11	49.5	51.0	11	9	9	6
		*Bottom 63.0 Ft.	12	53.0	53.0	51/6"			0
		*Encountered water at 53.0 Ft.	13	53.0	58.0	RQD	25%		32"
			14	58.0	63.0	RQD	0%		9"
		*After 24 hours caved 45 Ft., dry							

Water 49.0 Ft. at completion Caved 51.0 Ft. Sheet No. 1 of 1

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant - Phase II	BORING NO.:	SWM-1
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	10/2/95
START:	10/2/95 END: 10/2/95	ELEVATION:	
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2	Brow, dry medium stiff silty clay with trace of sand (fill)	1	0	1.5	1	3	6	6"
2	14	Tan, dry, medium dense sand with trace of clay and gravel and trace of brick fragments (fill)	2	2.5	4.0	5	6	5	8"
14	44	Brown to gray to tan, dry, medium dense to dense, clayey sand, (with trace of roots and trace of silt((fill)	3	5.0	6.5	4	8	6	10"
44	54	Grayish tan to tan, wet to dry, loose to very dense, micaceous silty sand (decomposed rock)	4	10.0	11.4	5	11	51/4"	12"
			5	15.0	16.5	30	6	9	12"
			6	20.0	21.5	9	13	18	16"
			7	25.0	26.5	12	9	14	18"
			8	30.0	31.5	10	10	12	10"
			9	35.0	36.5	7	10	12	18"
		WR&A Note: Odors from 15 feet to 20 feet depth.	10	40.0	40.6	30	51/1"		5"
			11	45.0	46.5	4	3	4	18"
		*Strong petroleum odor on Sample No. 5	12	50.0	50.3	51/4"			3"
		*Encountered water at 45 Ft.	13	54.0	54.1	51/1"			1"
		*Bottom 54.0 Ft.							

Water Dry after 48 Hours Caved 39.0 Ft. Sheet No. 1 of 1

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant - Phase II	BORING NO.:	SWM-2
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	10/2/95
START:	10/2/95 END: 10/2/95	ELEVATION:	
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	2	Brow, dry soft, silty clay (fill)	1	0	1.5	2	2	3	7"
2	4.5	Tan, dry, medium dense, silty sand (fill)	2	2.5	4.0	5	5	6	16"
4.5	3544	Brown and gray, dry, very stiff to stiff to very stiff clay with a little roots, brick and asphalt fragments and trace of sand (fill)	3	5.0	6.5	3	6	10	18"
			4	10.0	11.5	5	7	7	18"
			5	15.0	16.5	6	10	14	18"
			6	20.0	21.5	1	5	7	14"
			7	25.0	26.5	14	7	7	18"
			8	30.0	31.5	10	13	15	18"
			9	35.0	35.2	51/3"			1"
		*Hit obstruction at 35.0 Ft.							
		*No water encountered							
		*Bottom 35.0 Ft.							

Water 31.5 Ft. after 48 Hours Caved Dry Sheet No. 1 of 1

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant - Phase II	BORING NO.:	SWM-3
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	10/3/95
START:	10/3/95 END: 10/3/95	ELEVATION:	
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	7.0	Brown to tan, dry, loose to dense, silty sand with trace of gravel (fill)	1	0	1.5	1	4	6	8"
7.0	38.0	Brown, dry to moist, stiff to very stiff to medium stiff, silty clay with trace of roots and brick fragments (fill)	2	2.5	4.0	10	12	13	12"
38.0	43.0	Gray, dry, medium dense, silty sand (possible fill)	3	5.0	6.5	32	24	12	14"
43.0	49.0	Tan, dry, dense, micaceous silty sand with trace of rock fragments	4	10.0	11.5	4	4	7	10"
			5	15.0	16.5	4	5	7	12"
			6	20.0	21.5	4	4	12	12"
			7	25.0	26.5	4	12	13	12"
			8	30.0	31.5	2	2	5	12"
			9	35.0	36.4	4	4	51/4"	16"
			10	40.0	41.5	6	11	12	10"
			11	45.0	46.5	6	17	19	18"
		*No water encountered	12	49.0	49.0	51/0"			0"
		*Auger refusal 49.0 Ft.							
		*Bottom 49.0 Ft.							

Water Dry after 24 Hours Caved 41 Ft. Sheet No. 1 of 1

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant - Phase II	BORING NO.:	SWM-3A
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	10/3/95
START:	10/3/95 END: 10/3/95	ELEVATION:	
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration			Rec/ Att
From	To		No.	From	To				
0	11.0	Tan to brown, dry, stiff clay with trace of sand & gravel (fill)	1	7.5	9.0	7	7	8	10"
		*No water encountered							
		*Bottom 11 Ft.							

Water Dry after 24 Hours Caved 9.5 Ft. Sheet No. 1 of 1

GEOMATRIX, INC.
7050 CHESAPEAKE ROAD, SUITE 205
HYATTSVILLE, MD 20784
PHONE (301) 306-9677 FAX (301) 306-9632

BORING REPORT

PROJECT:	Dalecarlia Water Treatment Plant - Phase II	BORING NO.:	SWM-4
LOCATION:	5900 Mac Arthur Blvd., Brookmount, MD	DATE:	10/3/95
START:	10/3/95 END: 10/3/95	ELEVATION:	
DRILLER:	Paul Suit	DRILL RIG:	

Depth (In Ft.)		Soil Description	Sample (In Ft.)			Blows / 6" Penetration				Rec/ Att
From	To		No.	From	To					
0	7.0	Brown, dry, loose to medium dense, clayey sand (fill)	1	0	1.5	3	4	6		10"
7.0	12.0	Tan, dry, stiff, clayey silt with trace of sand (fill)	2	2.5	4.0	9	10	10		14"
12.0	15.0	Tan, dry, medium dense, micaceous silt	3	5.0	6.5	6	9	9		10"
15.0	18.0	Orangish tan, dry, dense, coarse sand & gravel (fill)	4	10.0	11.5	4	7	8		14"
18.0	35.5	Gray, dry to damp, very stiff to stiff, silty clay, with trace of roots & concrete fragments (fill)	5	12.0	14.00	100 psi *	→→ *	→→ *	200 psi *	24"
			6	15.0	16.5	8	20	18		10"
			7	20.0	21.5	7	10	13		12"
			8	25.0	26.5	1	5	8		10"
			9	30.0	31.5	5	5	6		18"
			10	35.0	35.2	51/3"				3"
		*No water encountered								
		*Auger refusal 49.0 Ft.								
		*Bottom 49.0 Ft.								

Water Dry after 24 Hours Caved 33 Ft. Sheet No. 1 of 1

* Pushed Shelby Tube Feed Pressure in psi.

APPENDIX C

LABORATORY TEST RESULTS

U.S. ARMY CORPS OF ENGINEERS
NORTH ATLANTIC DIVISION
BALTIMORE DISTRICT
CONSTRUCTION DIVISION

LABORATORY TESTING CAPABILITIES

LABORATORY NA PENNIMAN & BROWNE INC.
CITY: BALTIMORE
STATE: MD
INSPECTED ON: 08/25/94

DATE ISSUED/REVISED: 1/18/ 95

METHOD		CONCRETE	METHOD		AGGREGATE
ASTM: C1077	Concrete Testing	C	ASTM: C117	Material Finer Than No. 200	C
ASTM: C31	Making & Curing	C	ASTM: C136	Gradation, Fine & Course	C
ASTM: C143	Slump	C	ASTM: C127	SPG. & ABS., Course Agg.	C
ASTM: C29	Unit Weight	C	ASTM: C128	SPG. & ABS., Fine Agg.	C
ASTM: C138	Unit Weight	C	ASTM: C40	Organic Impurities	C
ASTM: C231	Air by Pressure	C	ASTM: C88	Soundness of Aggregates	C
ASTM: C173	Air by Volume	C	ASTM: C131	L.A. Abrasion	C
ASTM: C617	Capping Cylinders	C	ASTM: C142	Clay Lumps & Friable Part.	C
ASTM: C39	Compressive Strength	C	ASTM: C123	Lightwieght Pieces In Aggr	C
ASTM: C78	Flexural Strength	C			
ASTM: C192	Concrete Mix Design	C			
METHOD		SOILS	METHOD		ASPHALT
ASTM: D3740	Soils Testing	C	ASTM: D3666	Asphalt Testing	C
ASTM: D422	Grain-Size Analysis	C	ASTM: D2726	Bulk SPG & Density at SSD	C
ASTM: D4318	Atterberg Limits	C	ASTM: D2950	Nuclear Density (Backscatter)	C
ASTM: D854	Specific Gravity	C	ASTM: D2172	Extraction	C
ASTM: D698	Standard Compaction	C	ASTM: D1559	Marshall Stability	C
ASTM: D1557	Modified Compaction	C	MILSTD: 620A	Asphalt Concrete Mix Design	C
ASTM: D1556	Sand-Cone Density	C			
ASTM: D2922	Nuclear Density	C			
			OTHER TESTING CAPABILITIES		
			ASTM, CRDC,MILSTD, RTH, AASHTO		
			CRD-C-119,C90,C109,C270,C426,C495,C1231		C
			D1883,D1194,D2435,D3080		C

KEY: A = Alternate test is used
C = Capable of performing test
D = Deficiant in equipment and/or procedure
N = Not capable

TOTAL P.02

PENNIMAN & BROWNE, INC.
CHEMISTS / ENGINEERS / INSPECTORS

6252 FALLS ROAD / P.O. BOX 65309 / BALTIMORE, MARYLAND 21209-0509 / TELEPHONE 410-825-4131 / FAX 410-321-7384

August 4, 1995

Whitman, Requardt & Associates
2315 St. Paul Street
Baltimore, Maryland 21218

Attention: Srinivas S. Pulapaka

Re: Dale Carlia - Unconfined Compression of Rock Cores
Lab No.: 95-40-0350

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS ASTM D 2938

CORE	DIA,IN	LENGTH, IN	AREA, IN^2	L/D	CORREC-TION	LOAD	CORREC-TED PSI
DC-1*	1.988	3.450	3.10	1.7	.975	23,394	7,355
DC-4	1.977	3.992	3.07	2	-	22,365	7,285
DC-5*	1.975	1.731	3.06	1	.87	15,365	4,370
DC-6*	1.954	2.061	3.00	1	.87	13,921	4,035
DC-8*	2.042	3.767	3.27	1.8	.985	32,075	9,660
DC-9*	2.041	3.385	3.27	1.6	.970	34,488	10,230
DC-13*	1.984	3.147	3.09	1.6	.970	24,541	7,705
DC-15	2.047	4.001	3.29	1.95	.995	33,123	10,015
DC-16	2.046	4.011	3.29	1.95	.995	19,518	5,900

continued....

Whitman, Requardt & Associates
Lab No.: 95-40-0350

August 4, 1995

CORE	DIA,IN	LENGTH, IN	AREA, IN^2	L/D	CORRECTION	LOAD	CORRECTED PSI
DC-26*	2.035	2.777	3.25	1.35	.940	19,221	5,560
DC-33	1.987	4.037	3.10	2	-	21,930	7,075
DC-34	2.050	4.019	3.30	1.95	.995	23,789	7,170
DC-45	1.982	4.014	3.08	2	-	13,071	4,245

* NOTE: DC-5 was less than 1:1 and other cores were less than the recommended 2.0 to 2.5:1 per ASTM D 4543

Respectfully,

PENNIMAN & BROWNE, INC.

Thomas W. Grubb

Thomas C. Simon, P.E.
Engineering
TWG/TCS/msm

PENNIMAN & BROWNE, INC.
CHEMISTS / ENGINEERS / INSPECTORS

6252 FALLS ROAD / P.O. BOX 65309 / BALTIMORE, MARYLAND 21209-0509 / TELEPHONE 410-825-4131 / FAX 410-321-7384

SEP 07 1995

Whitman Requardt and Associates
2315 St. Paul Street
Baltimore, MD 21218

ATTN: Mr. Srinivas S. Pulapaka

RE: Dale Carlia W.T.P.

LAB NO.: 95-40-0366

Atterberg Limits, ASTM D4310

	DC32A 15.0'-16.5'	DC17 24.5'-26.0'	DC17 54.5'-56.0'	DC13 25.0'-26.5'
Plastic Limit	18	19	24	22
Liquid Limit	30	37	30	38
Plasticity Index	12	18	6	16
Natural Moisture %	18.5	23.9	26.2	21.9

Respectfully,

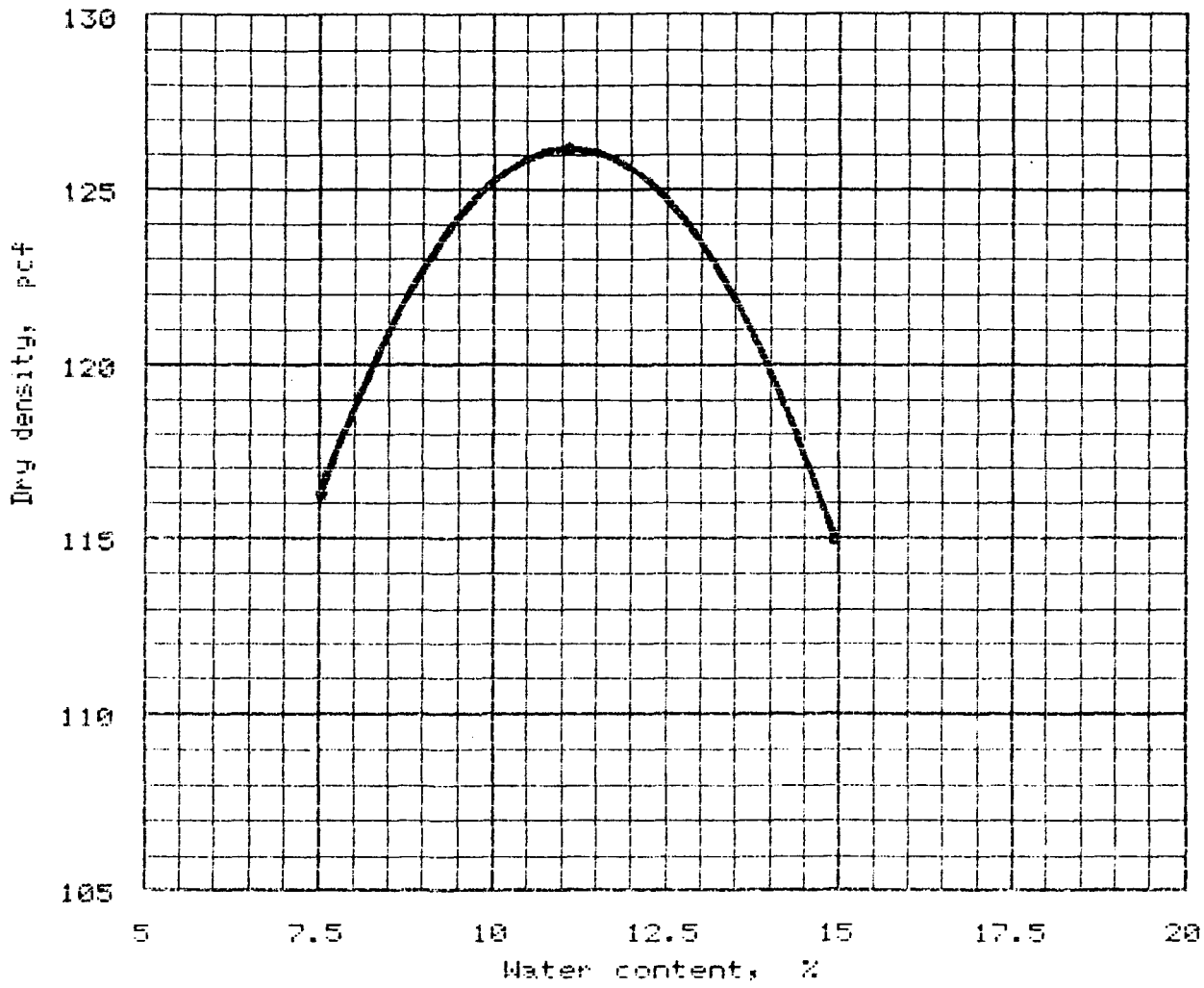
PENNIMAN & BROWNE, INC.

Thomas W. Grubb

Thomas C. Simon, P.E.

Engineering

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 1557-78 Method A, Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
-	-	-	- %	-	-	-	- %	- %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 126.2 pcf Optimum moisture = 11.1 %	LT. BROWN SILTY CLAY

Project No.: 0366(95-40)
Project: W.R.A., DALE CARLIA W.T.P.
Location: FOREBAY AREA

Date: 8-23-1995

Remarks:

MOISTURE-DENSITY RELATIONSHIP TEST

PENNIMAN & BROWNE, INC.

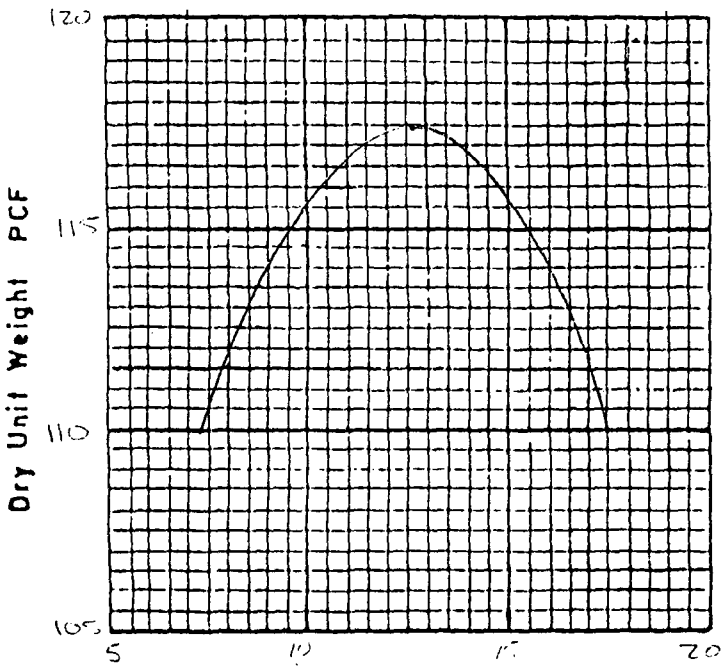
Fig. No. -

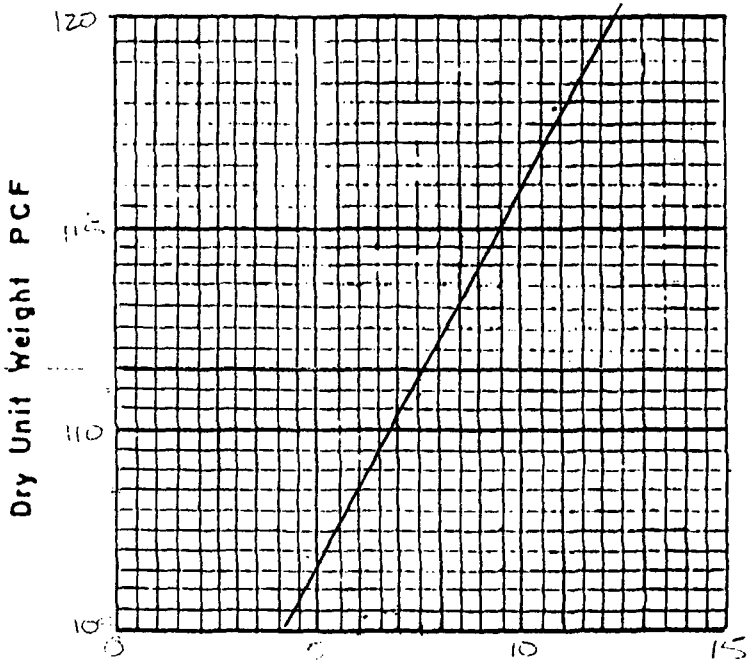
COMPACTION TEST - CBR

Project DALE CARDINAL WTP **Date** 8-23-95

Client WHITNAM ZELLWEGER & ASSOC. **Lab No.** 95-40-0366

Test Method ASTM D1883 & ASTM D1557





Sample No. -
Location DALE CARDINAL WTP, DEWATERING FACILITY
Description BROWN SILTY CLAY

Classification -
Maximum Dry Density 117.4 PCF
Optimum Moisture Content 12.7%

CORRECTED CBR @ 95% =

BLOWS/LAYER 56

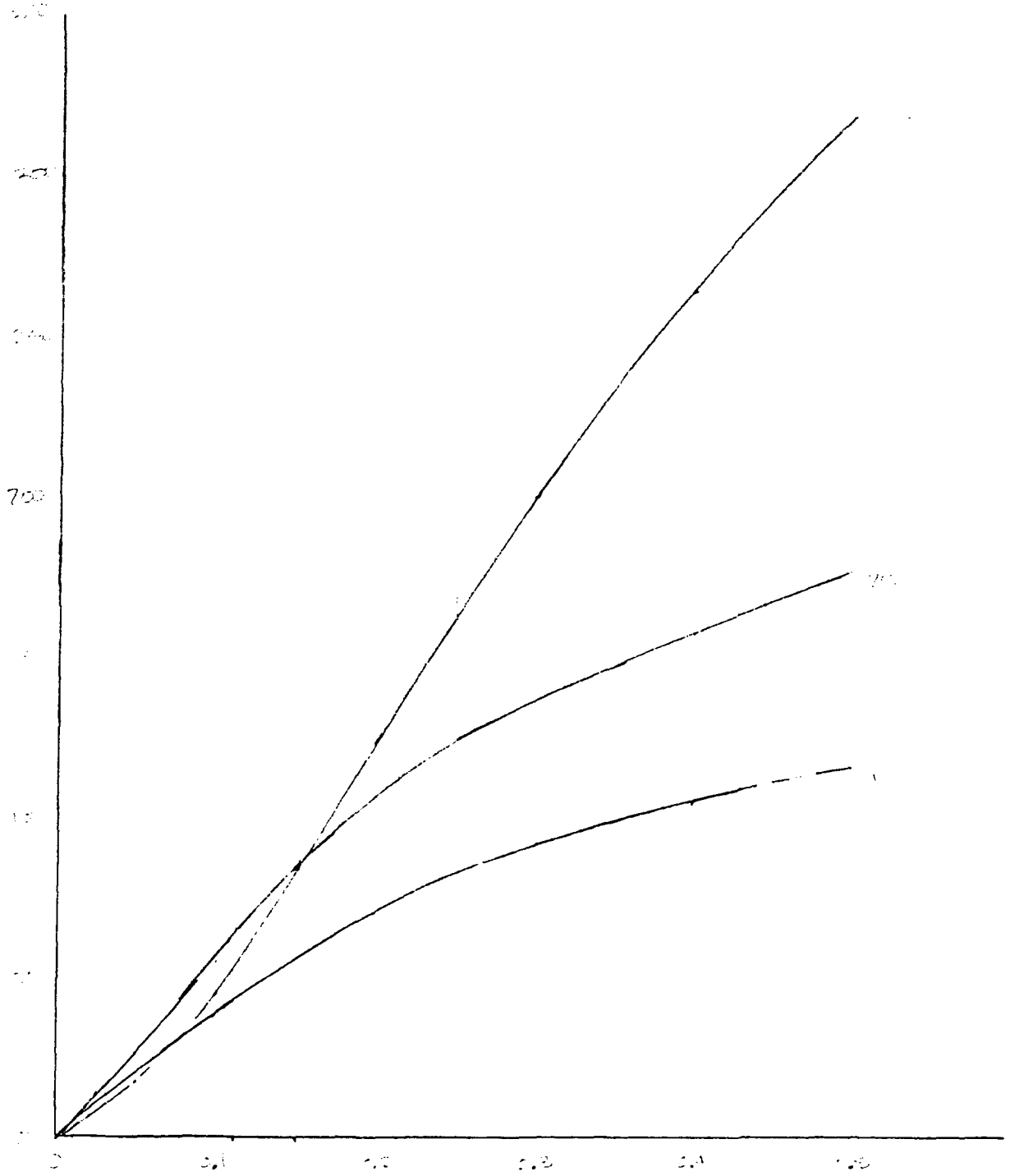
% SHRINK/SWELL 0.5% SWELL

PENNIMAN & BROWNE, INC.
CHEMISTS / ENGINEERS / INSPECTORS
6252 FALLS ROAD BALTIMORE, MD 21209
PHONE: 410-825-4131

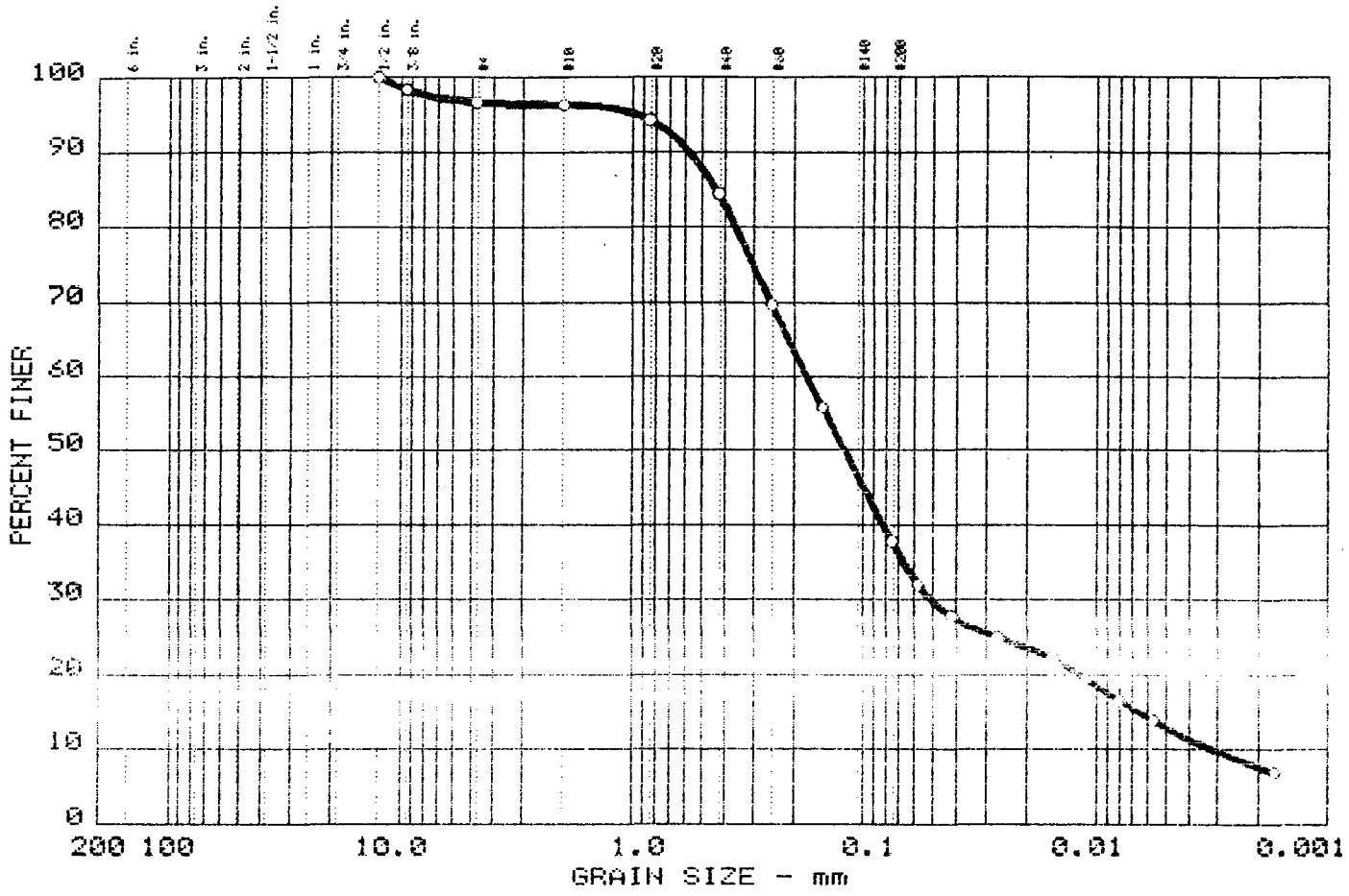
PROJECT _____

SUBJECT DALE [illegible] SHEET NO. 2 OF 2

BY T. [illegible] DATE [illegible]



PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	11	0.0	3.3	59.0	30.1	7.6	-		

SIEVE inches size	PERCENT FINER ○		
0.5	100.0		
0.375	98.4		
	GRAIN SIZE		
D_{60}	0.174		
D_{30}			
D_{10}	0.0032		
	COEFFICIENTS		
C_c	4.73		
C_u	55.6		

SIEVE number size	PERCENT FINER ○		
4	96.7		
10	96.3		
20	94.3		
40	84.4		
60	69.7		
100	55.8		
200	37.8		

Sample information:
○ DC 2 15.0-16.5

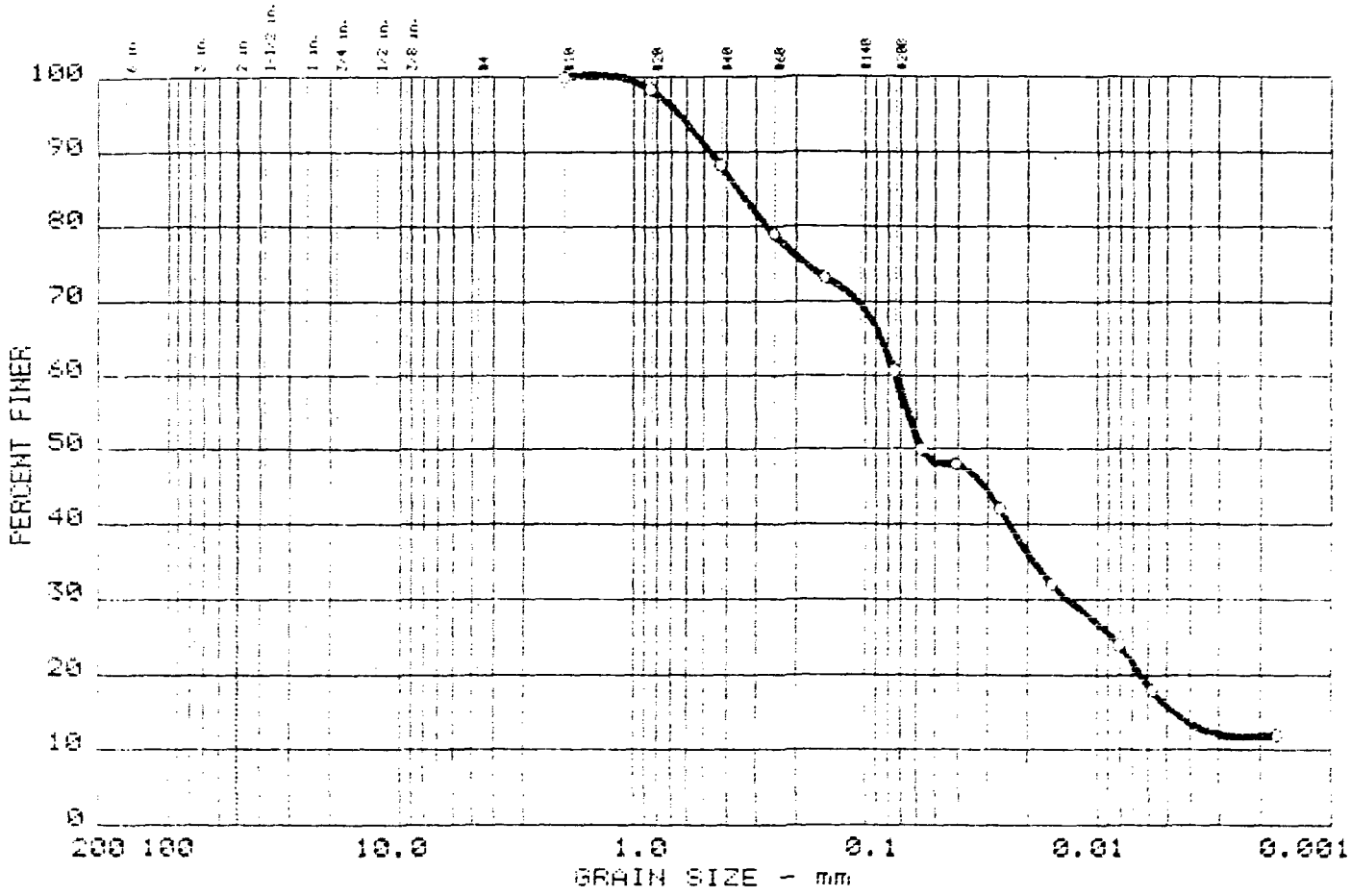
Remarks:
AS REC. MOIST. - 25.9 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-17-1995 Data Sheet No. ——

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
3	0.0	0.0	39.2	49.0	11.8	CL	38	16

SIEVE size	PERCENT FINER
10	100.0
20	98.4
40	88.2
60	79.0
100	73.2
200	60.8

Sample information:
DC 13 25-26.5

	GRAIN SIZE
D60	
D30	
D10	

	COEFFICIENTS
Cu	
Cc	

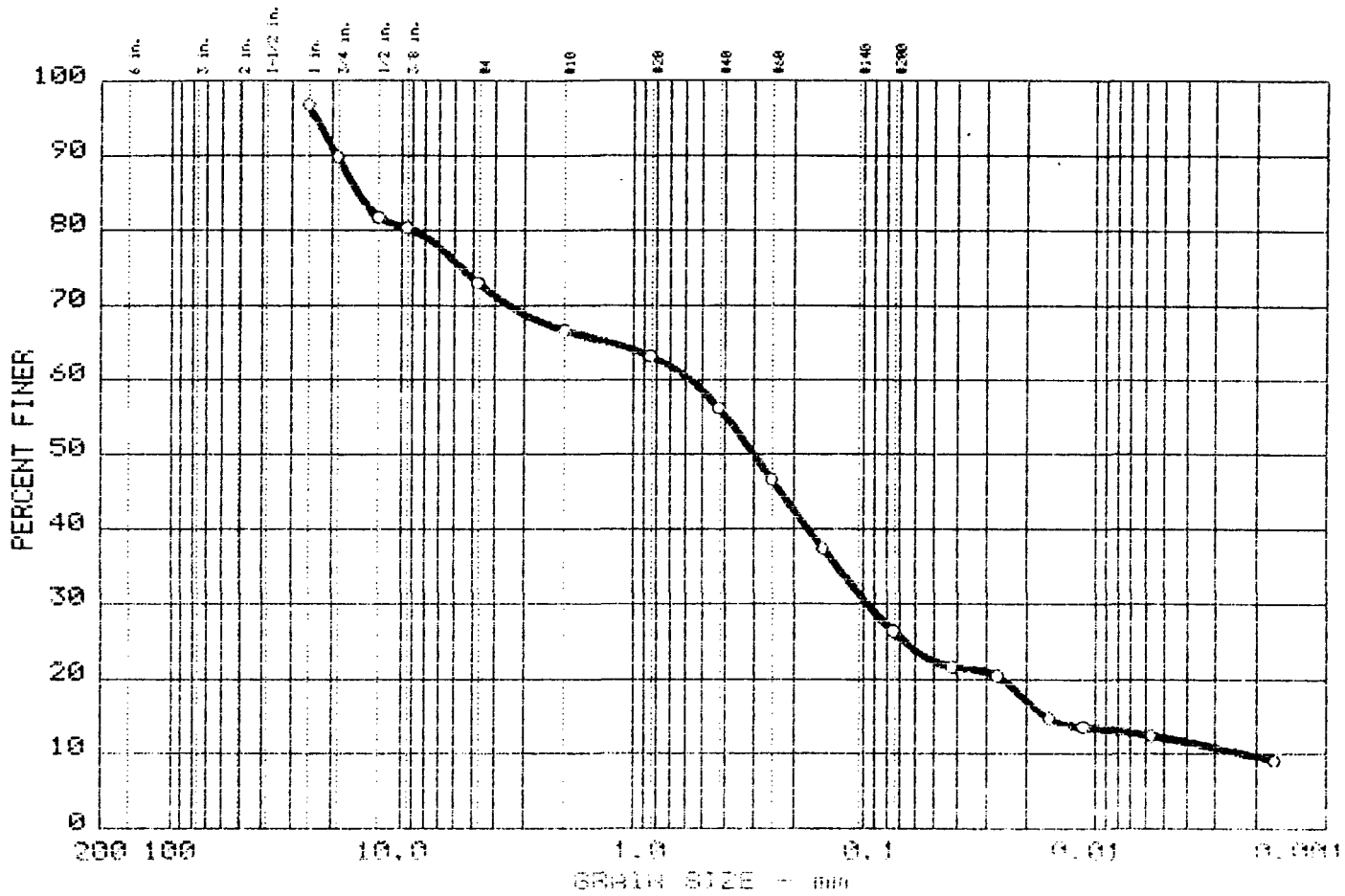
Remarks:
AS REC. MOIST. = 21.9 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: N.R.A.; DALE CARLIA WTP

Date: 08-08-1995 Data Sheet No. ____

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	4	0.0	27.0	46.7	16.7	9.6	SM	30	6

SIEVE inches size	PERCENT FINER ○			SIEVE number size	PERCENT FINER ○		
1	96.8			4	73.0		
0.75	89.8			10	66.7		
0.5	81.7			20	63.3		
0.375	80.4			40	56.3		
				60	46.6		
				100	37.4		
				200	26.4		
	GRAIN SIZE						
D_{60}	0.562						
D_{30}							
D_{10}	0.0022						
	COEFFICIENTS						
C_c	7.40						
C_u	251.5						

Sample information:
○ DC 17 54.5-56.0

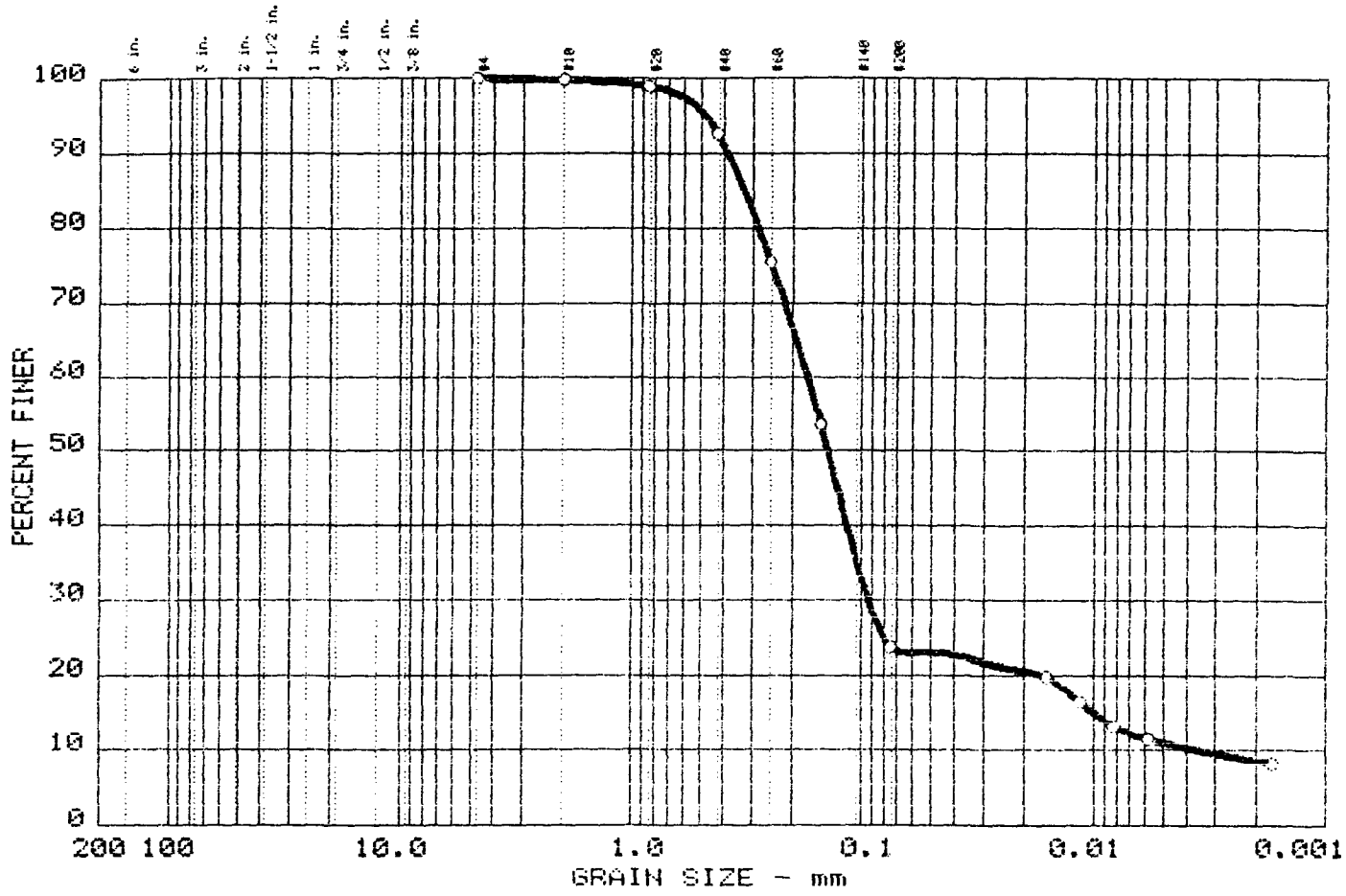
Remarks:
AS REC. MOIST. - 26.2 %
SIEVE SIZES +20 HAVE WOOD CHIPS

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-08-1995 Data Sheet No. ——

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	9	0.0	0.0	76.2	15.2	8.6	-		

SIEVE inches size	PERCENT FINER ○

GRAIN SIZE	
D_{60}	0.172
D_{30}	
D_{10}	0.0035
COEFFICIENTS	
C_c	14.50
C_u	48.8

SIEVE number size	PERCENT FINER ○
4	100.0
10	99.8
20	97.6
40	92.6
60	75.5
100	53.6
200	23.8

Sample information:
○ DC 18 14.5-16.0

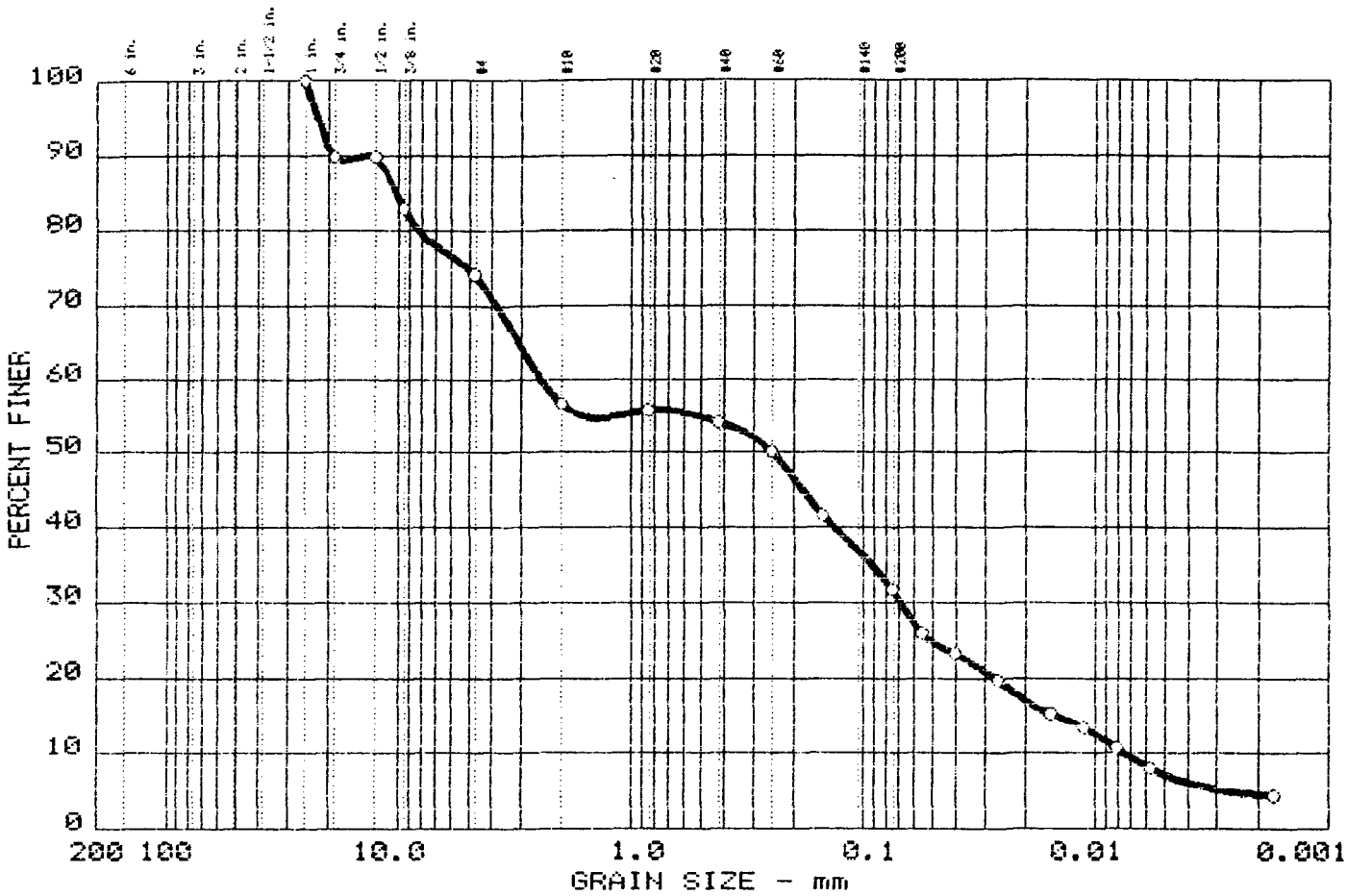
Remarks:
AS REC. MOIST. - 9.4 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-17-1995 Data Sheet No. ----

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	5	0.0	25.8	42.5	27.1	4.6	-		

SIEVE inches size	PERCENT FINER ○		
1	100.0		
0.75	89.8		
0.5	89.8		
0.375	82.9		
GRAIN SIZE			
D_{60}	2.43		
D_{30}			
D_{10}			
COEFFICIENTS			
C_c	0.28		
C_u	331.1		

SIEVE number size	PERCENT FINER ○		
4	74.2		
10	56.6		
20	55.8		
40	54.1		
60	50.1		
100	41.5		
200	31.7		

Sample information:
○ DC 19 24.5-26.0

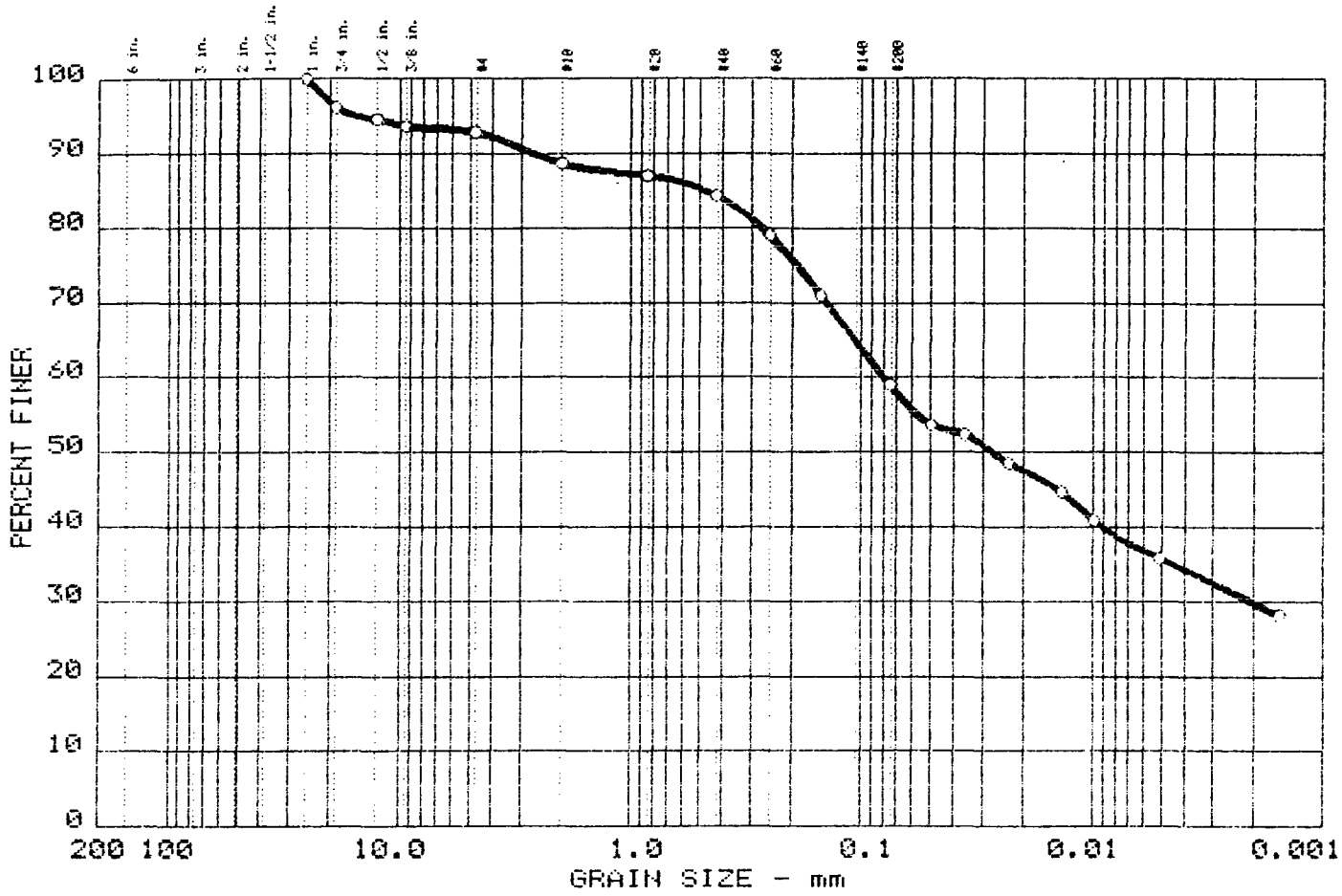
Remarks:
AS REC. MOIST. - 16.8 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-08-1995 Data Sheet No. ——

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	14	0.0	7.2	33.8	29.2	29.8	-		

SIEVE inches size	PERCENT FINER ○
1	100.0
0.75	96.1
0.5	94.5
0.375	93.7

SIEVE number size	PERCENT FINER ○
4	92.8
10	88.6
20	87.0
40	84.3
60	79.1
100	71.0
200	59.0

GRAIN SIZE

D_{60}

D_{30}

D_{10}

C_c

C_u

Sample information:
○ DC 24 30.0-31.5

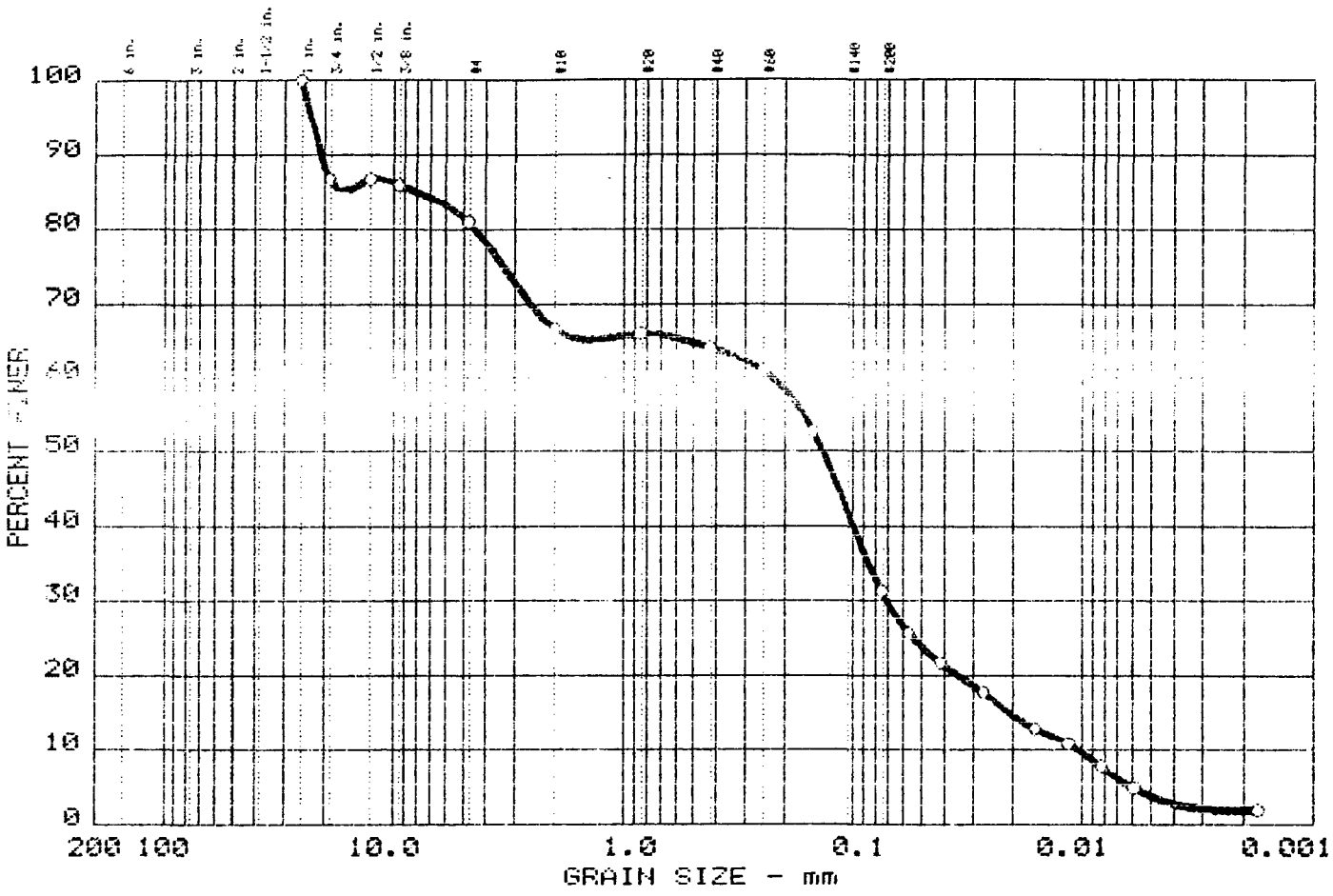
Remarks:
% PEC. Visit. 25.9 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-17-1995 Data Sheet No. ——

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	6	0.0	19.0	49.8	29.3	1.9	-		

SIEVE inches size	PERCENT FINER ○
1	100.0
0.75	86.7
0.5	86.7
0.375	85.9

GRAIN SIZE	
D_{60}	0.221
D_{30}	
D_{10}	0.0102

COEFFICIENTS	
C_c	2.25
C_u	21.7

SIEVE number size	PERCENT FINER ○
4	81.0
10	66.6
20	66.1
40	64.1
60	61.1
100	52.7
200	31.3

Sample information:
○ DC 26 24.5-26.0

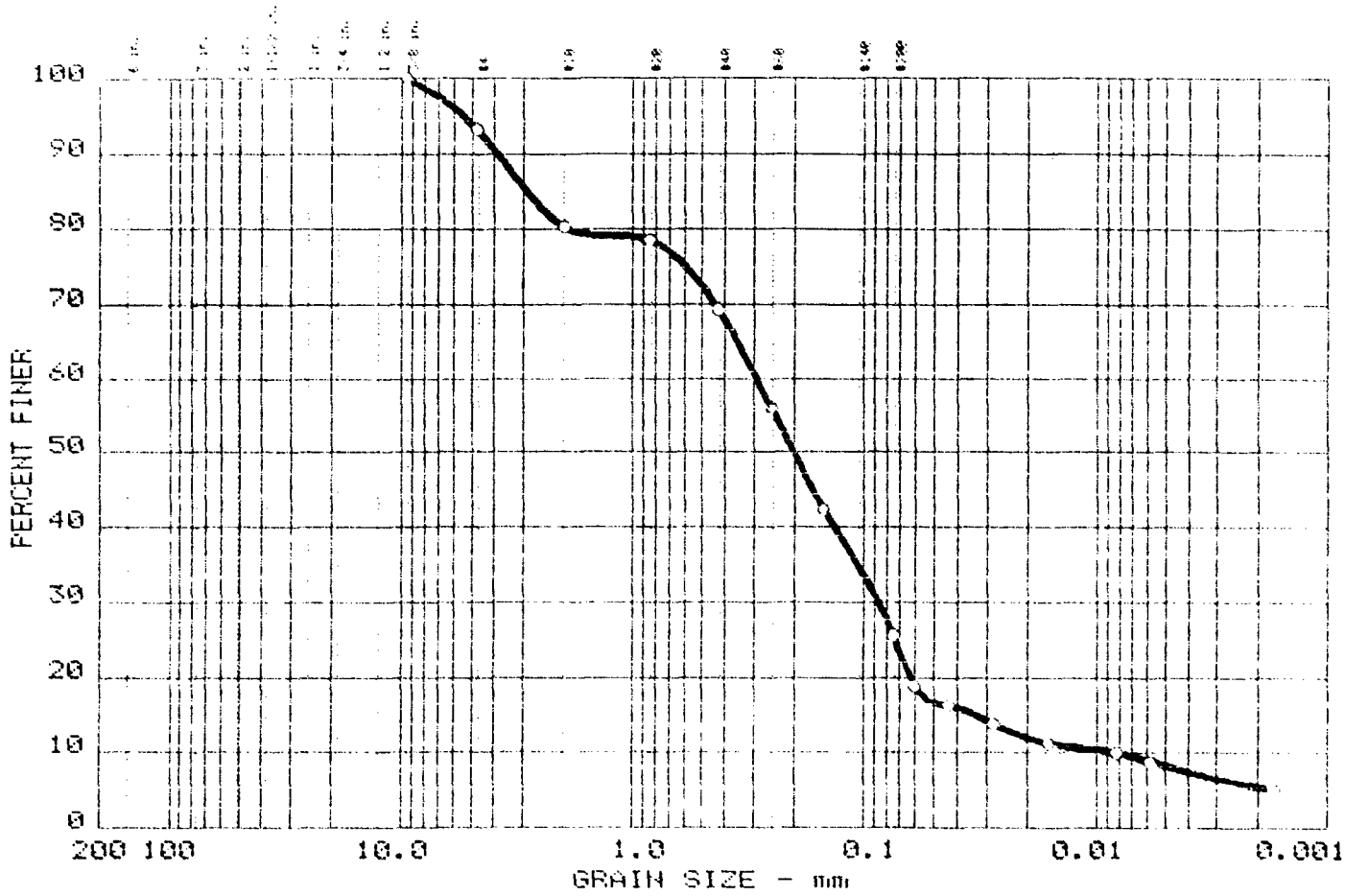
Remarks:
AS REC. MOIST. - 19.7 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-08-1995 Data Sheet No. ——

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	7	0.0	6.8	67.7	20.2	5.3	-		

SIEVE	PERCENT FINER
0.375	100.0

SIEVE	PERCENT FINER
4	93.2
10	80.3
20	70.5
40	59.2
60	55.9
100	42.3
200	25.6

GRAIN SIZE	
D_{60}	
D_{30}	
D_{10}	

COEFFICIENTS	
C_c	3.20
C_u	35.9

Sample information:
DC 31 10.0-11.5

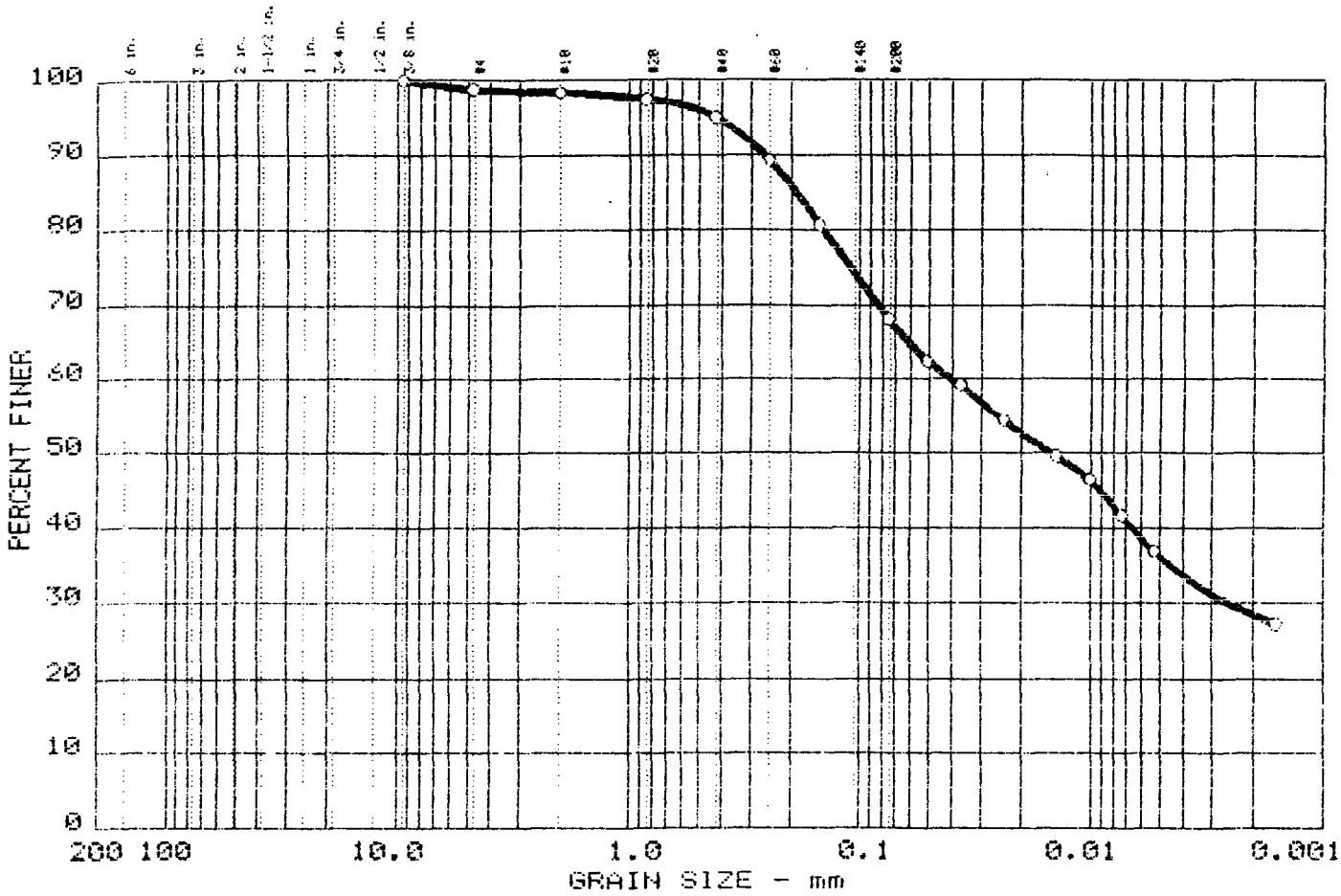
Remarks:
AS REC. MOIST. - 13.2 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A., DALE CARLIA WTP

Data Sheet No.

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	LL	PI
15	0.0	1.2	30.6	[illegible]	[illegible]	32	12

SIEVE number size	PERCENT FINER (%)
0.375	100.0

GRAIN SIZE	
D_{60}	
D_{30}	
D_{10}	

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER (%)
4	98.8
10	98.5
20	97.5
40	95.1
60	89.3
100	80.7
200	68.2

Sample information:
○ DC 32A 15.0-16.5

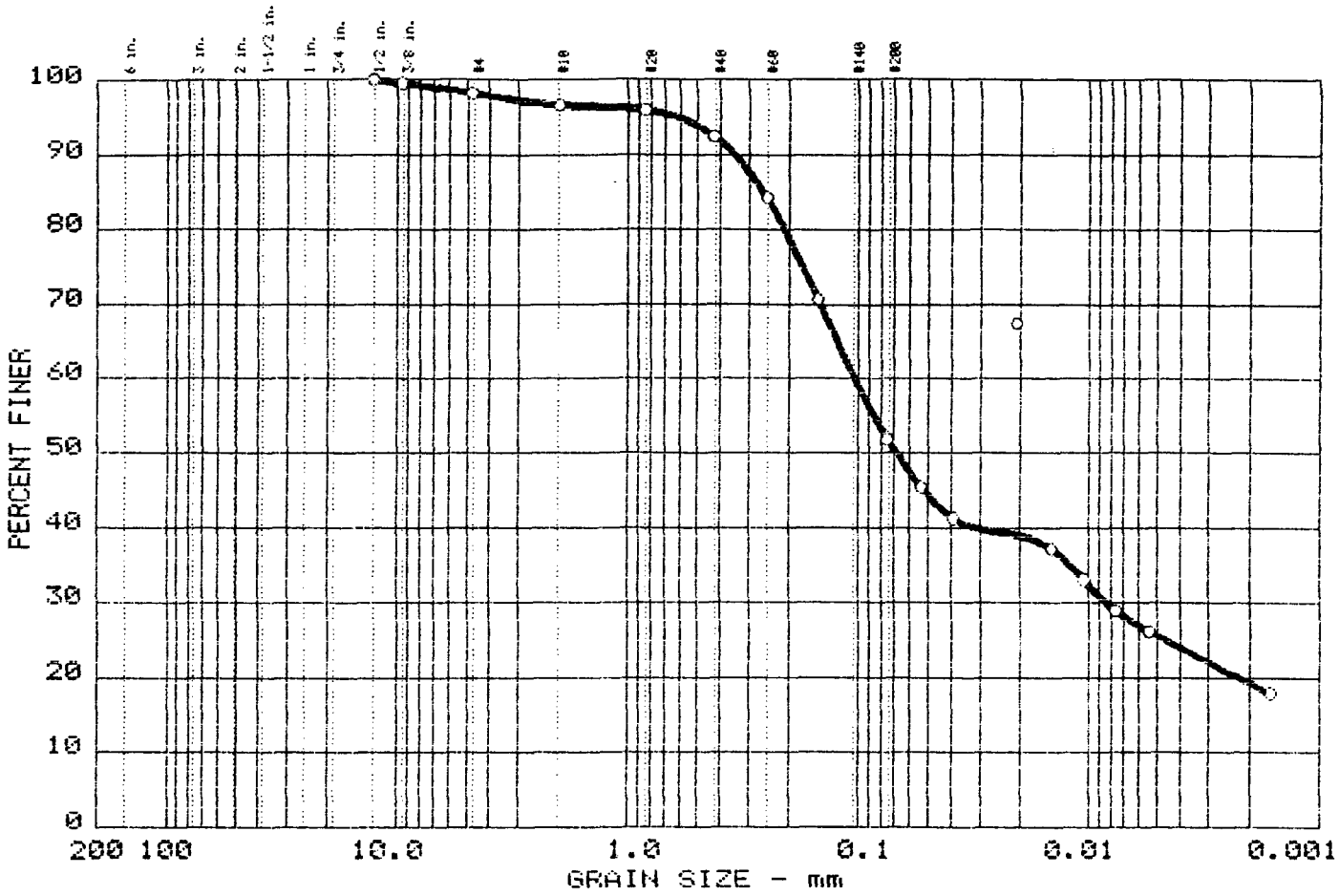
Remarks:
AS REC. MOIST. - 18.5 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-17-1995 Data Sheet No. ——

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	12	0.0	1.8	46.3	32.6	19.3	-		

SIEVE inches size	PERCENT FINER ○		
0.5	100.0		
0.375	99.5		
	GRAIN SIZE		
D_{60}	0.103		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
4	98.2		
10	96.6		
20	95.9		
40	92.5		
60	84.2		
100	70.7		
200	51.9		

Sample information:
○ DC 35 19.5-21.0

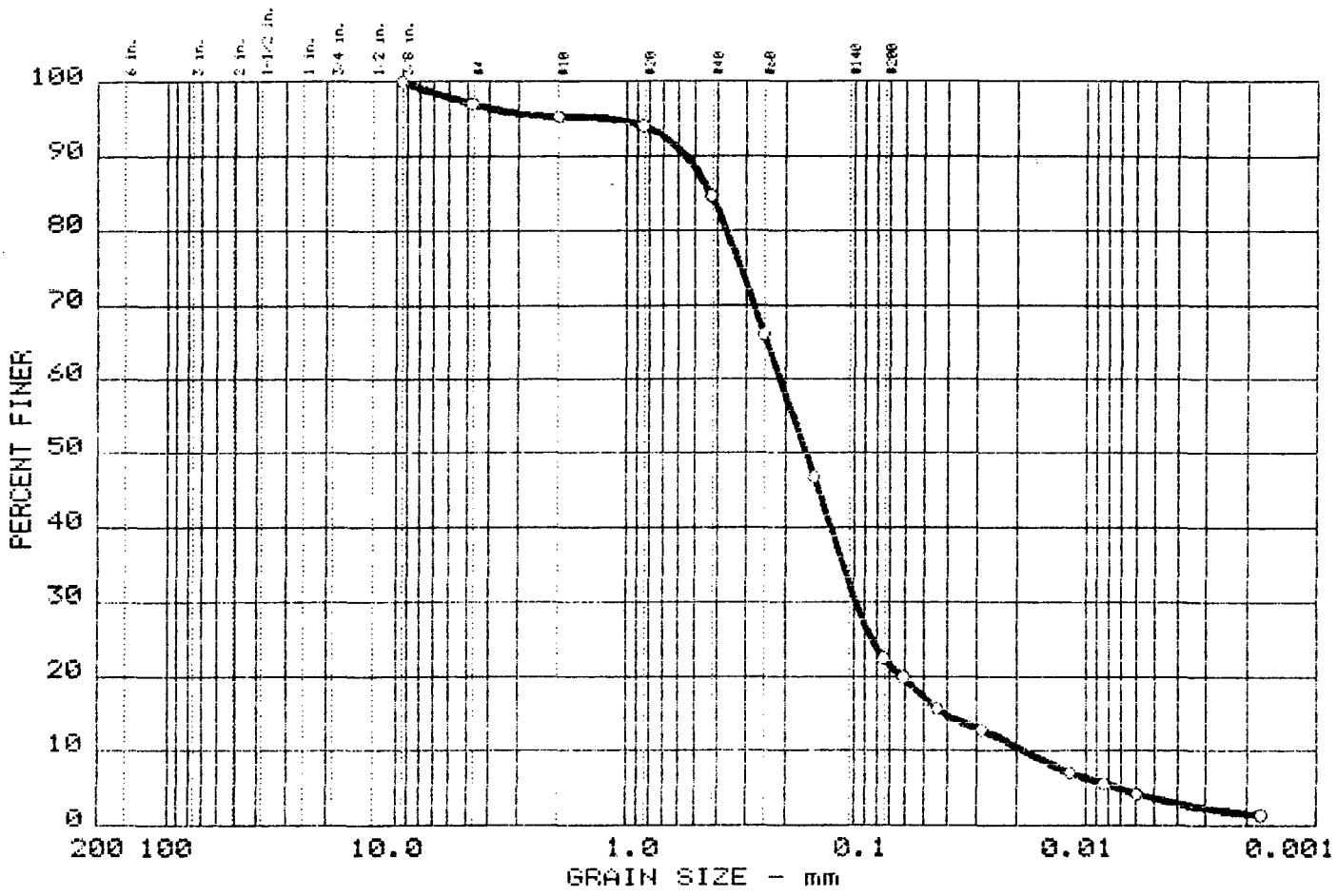
Remarks:
AS REC. MOIST. - 16.6 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-17-1995 Data Sheet No. ———

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	8	0.0	3.0	74.5	20.8	1.7	-		

SIEVE inches size	PERCENT FINER ○		
0.375	100.0		
	GRAIN SIZE		
D_{60}	0.211		
D_{30}			
D_{10}	0.0164		
	COEFFICIENTS		
C_c	2.51		
C_u	11.5		

SIEVE number size	PERCENT FINER ○
4	97.0
10	95.3
20	94.0
40	84.6
60	66.1
100	46.8
200	22.5

Sample information:
○ DC 43 18.5-20.0

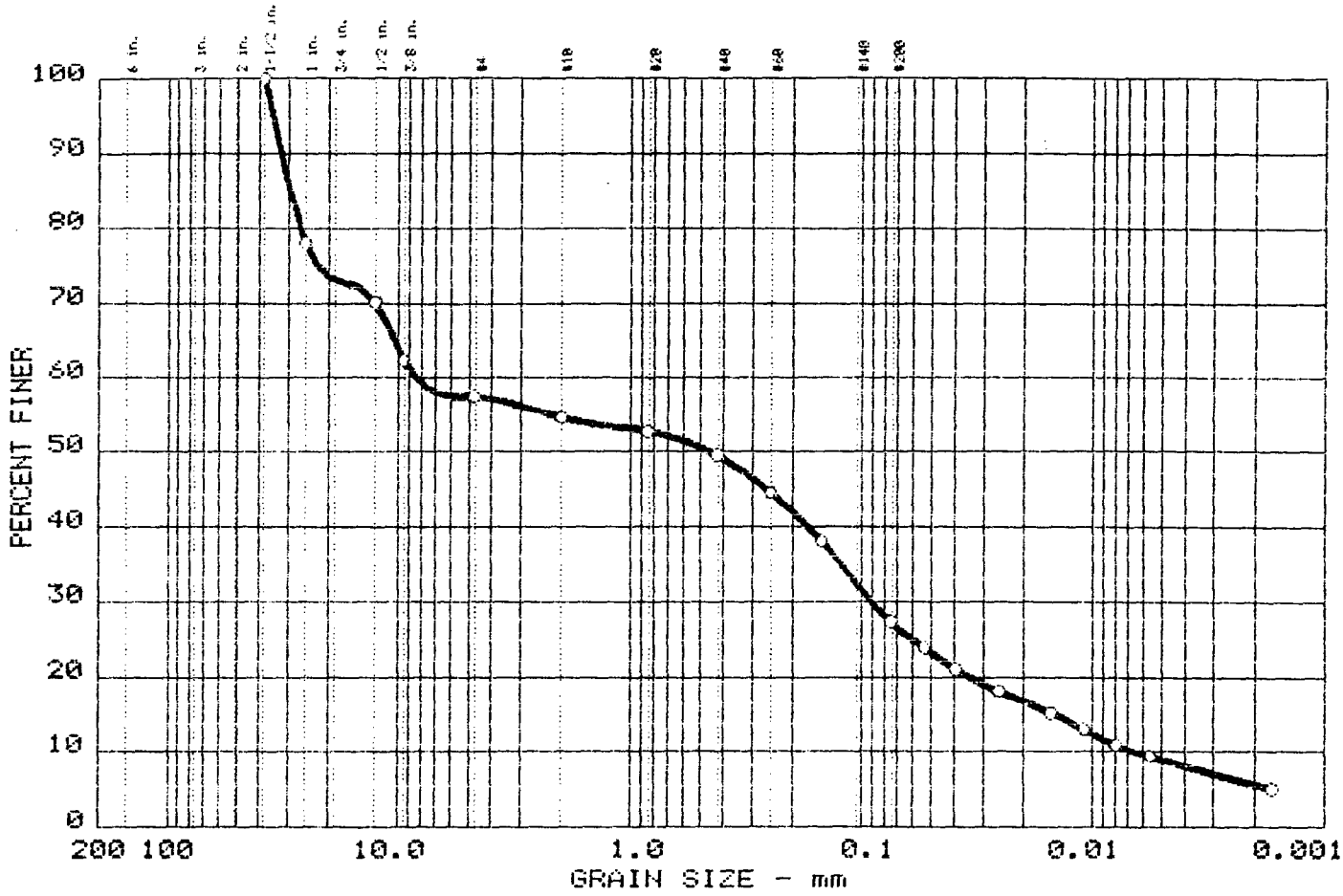
Remarks:
AS REC. MOIST. - 10.7 %

PENNIMAN & BROWNE, INC.

Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

Date: 08-08-1995 Data Sheet No. ——

PARTICLE SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
○	10	0.0	42.5	30.2	21.6	5.7	-		

SIEVE inches size	PERCENT FINER ○		
1.5	100.0		
1	78.1		
0.5	70.2		
0.375	62.4		
	GRAIN SIZE		
D_{60}	8.38		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c	0.15		
C_u	1288.		

SIEVE number size	PERCENT FINER ○		
4	57.5		
10	54.6		
20	52.7		
40	49.5		
60	44.5		
100	38.1		
200	27.3		

Sample information:
○ DC 47 49.5-51.0

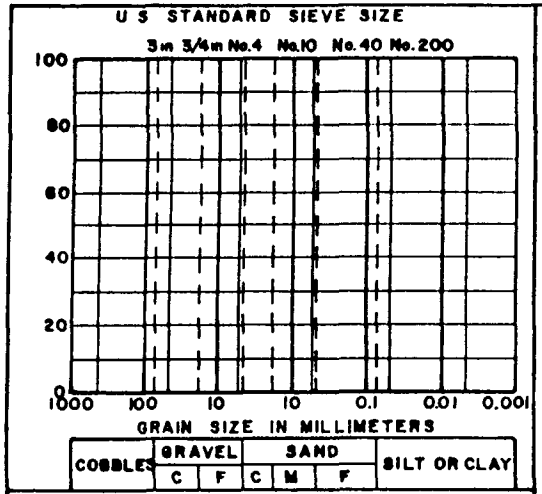
Remarks:
AS REC. MOIST. - 7.8 %

PENNIMAN & BROWNE, INC.

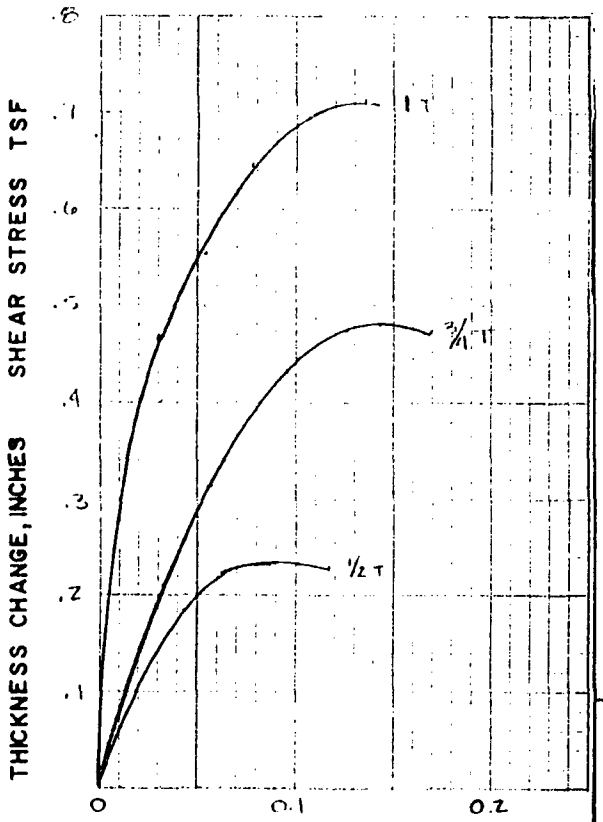
Project No.: 0366(95-40)
Project: W.R.A.,DALE CARLIA WTP

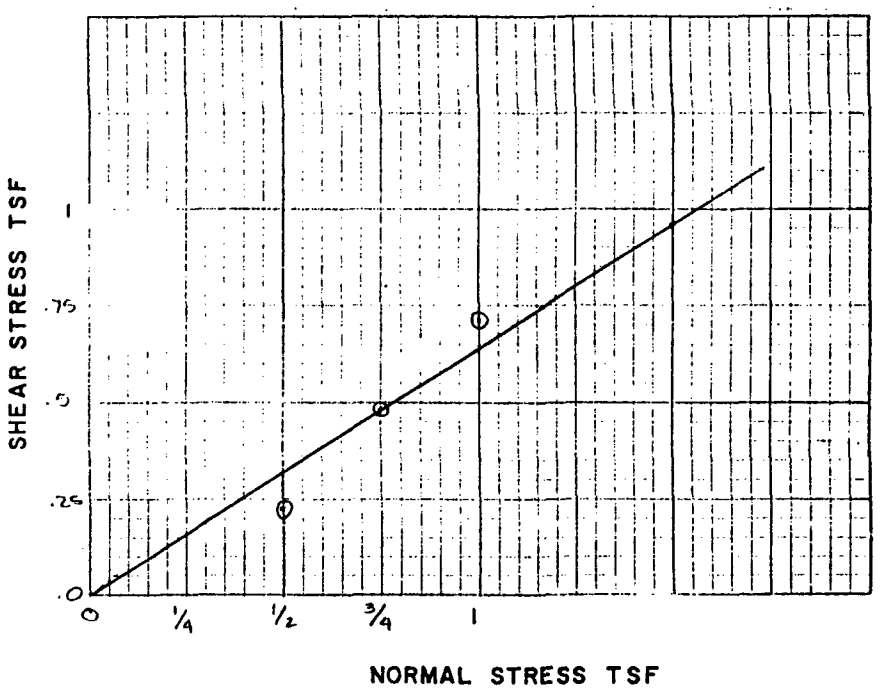
Date: 08-17-1995 Data Sheet No. ——

1



Classification					
LL	Sp. G				
PI	D_{10}				
Test No					
Initial Water Content, Wo %					
Dry Density PCF					
Void Ratio, e_o					
Saturation S_o %					
Duration of Test					
WC after Test W_F %					
Normal Stress σ TSF					
Max. Shear Stress τ TSF					





Remarks: BROWN MIC. SILTY CLAY

NATURAL MOISTURE = 19.1%

Type of Test	Type of Specimen
Control	UNDISTURBED
Consolidated	2.42" DIA in square
Drained	1 in thickness

SHEAR VALUES	ø	TAN. ø	C, TSF
Maximum	33	0.65	0
Ultimate			

Project: DALE CARLIA WTP

CLIENT: WHITMAN, REQUARDT AND ASSOCIATES

Area:

Boring No. SWM 4 Sample No. S-5 (SHELBY TUBE)

Elev. or Depth 13' - 15' Date: OCTOBER 25, 1995

DIRECT SHEAR TEST REPORT

PENNIMAN & BROWNE, INC.

APPENDIX D

WELL DETAILS, WELL COMPLETION REPORTS AND MONITORING RECORDS

WELL DETAILS

GEOMATRIX, INC.

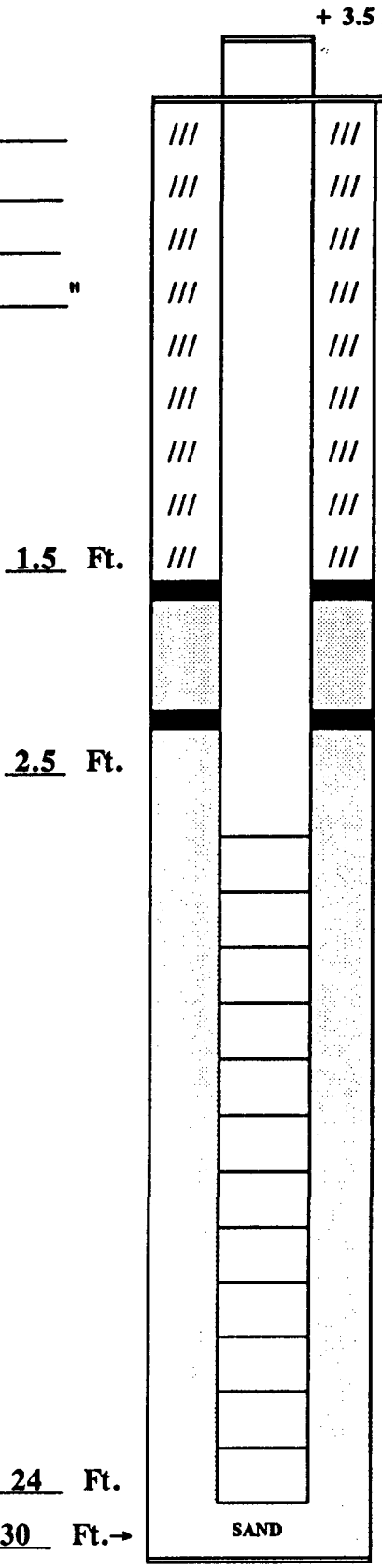
DALECARLIA WTP WELL LOG

Date: 7/14/95

Job No.: D38-0695

Well No.: DC-3

Size: 2 "



Protective Cover: Yes

Stickup X or

Flushment ___

Riser From 0 ' to 4.0 '

Grout From 0 ' to 1.5 '

Bentonite Seal From 1.5 ' to 2.5 '

Pellets X Slurry ____

Sand Packed From 2.5 ' to 30 '

Screen From 4 ' to 24 '

GEOMATRIX, INC.

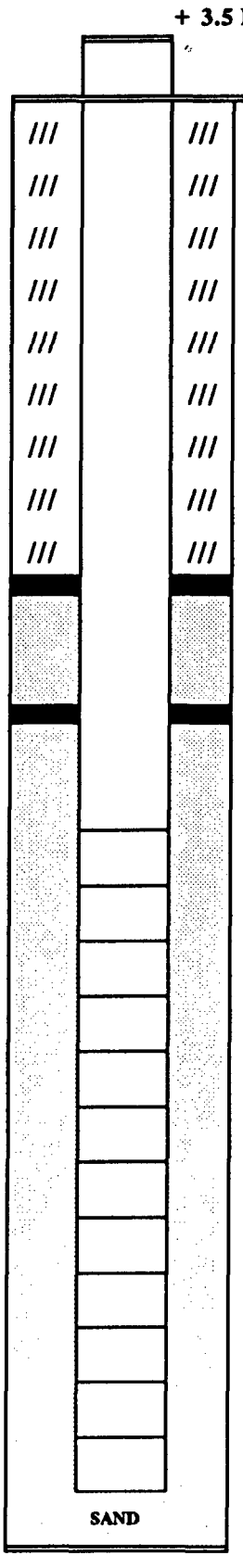
DALECARLIA WTP WELL LOG

Date: 7/11/95

Job No.: D38-0695

Well No.: DC-13

Size: 2 "



Protective Cover: Yes

Stickup X or

Flushment ___

Riser From 0 ' to 31.5 '

Grout From 0 ' to 25 '

Bentonite Seal From 25 ' to 26 '

Pellets X Slurry ____

Sand Packed From 26 ' to 60.5 '

Screen From 31.5 ' to 51.5 '

GEOMATRIX, INC.

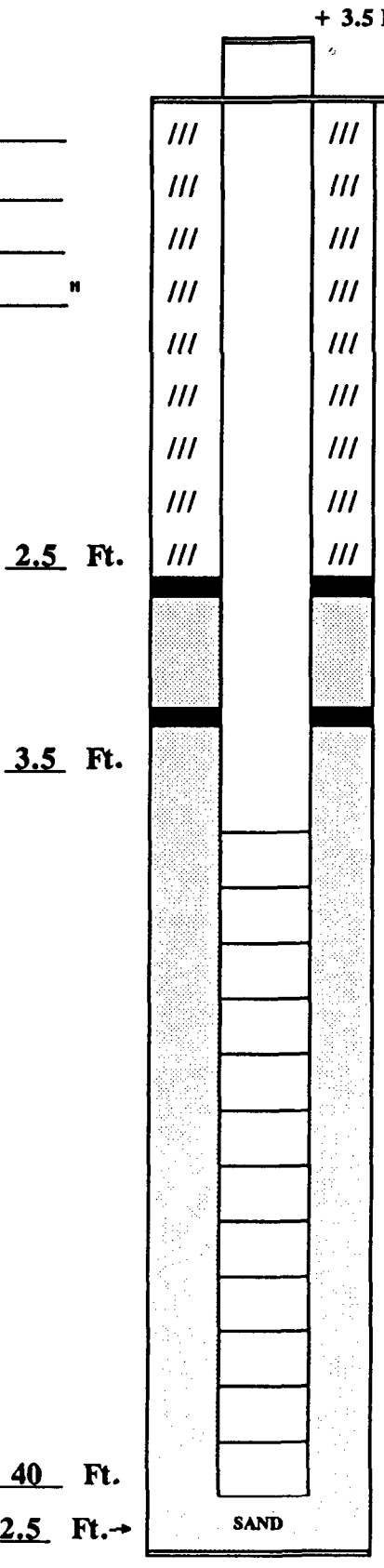
DALECARLIA WTP WELL LOG

Date: 7/01/95

Job No.: D38-0695

Well No.: DC-21

Size: 2 "



Protective Cover: Yes

Stickup X or

Flushment ___

Riser From 0 ' to 20 '

Grout From 0 ' to 2.5 '

Bentonite Seal From 2.5 ' to 3.5 '

Pellets X Slurry ____

Sand Packed From 3.5 ' to 40 '

Screen From 20 ' to 40 '

GEOMATRIX, INC.

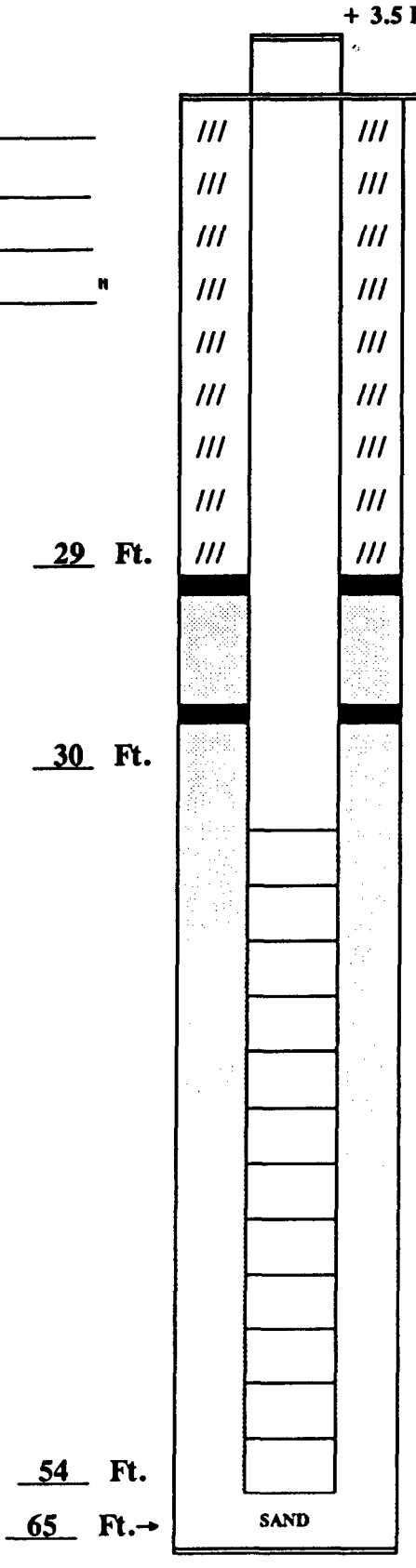
DALECARLIA WTP WELL LOG

Date: 7/10/95

Job No.: D38-0695

Well No.: DC-25

Size: 2 "



Protective Cover: Yes

Stickup X or

Flushment ___

Riser From 0 ' to 34 '

Grout From 0 ' to 29 '

Bentonite Seal From 29 ' to 30 '

Pellets X Slurry ____

Sand Packed From 30 ' to 65 '

Screen From 34 ' to 54 '

GEOMATRIX, INC.

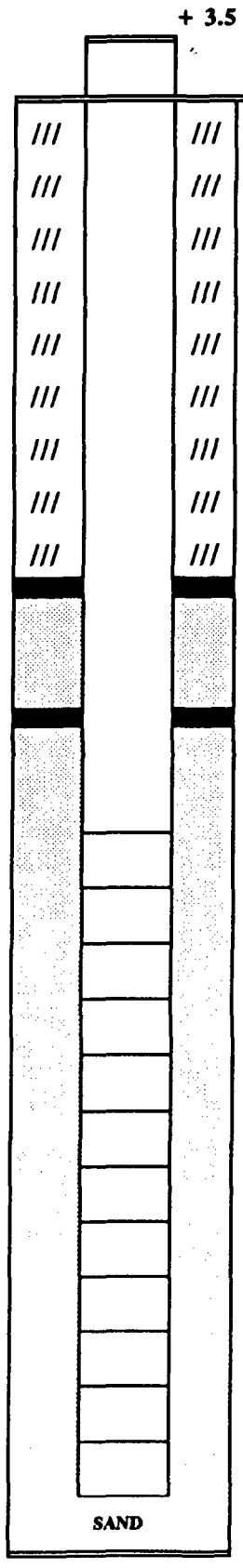
DALECARLIA WTP WELL LOG

Date: 7/18/95

Job No.: D38-0695

Well No.: DC-32A

Size: 2 "



Protective Cover: Yes

Stickup X or

Flushment ___

Riser From 0 ' to 17.5 '

Grout From 0 ' to 9.5 '

Bentonite Seal From 9.5 ' to 10.5 '

Pellets X Slurry ____

Sand Packed From 10.5 ' to 42.5 '

Screen From 17.5 ' to 37.5 '

WELL COMPLETION REPORTS

CT 3252 — SEQUENCE NO. (DENV USE ONLY)
(THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER 950705000

ST/CO USE ONLY
DATE Received

DATE WELL COMPLETED 07/19/95 DC-13

Depth of Well 52 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" 90-93-0606

OWNER U.S ARMY CORPS OF ENGINEERS WASHINGTON AQUEDUCT DIVISION
STREET OR RFD 4900 MacArthur Blvd TOWN Brookmont
SUBDIVISION SECTION LOT

WELL LOG
Not required for driven wells
STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	Check if water bearing
TAN, DRY, SILTY SAND WITH ROCK + BRICK FRAG. (FILL)	0'	19'	
GRAY, DAMP, CLAY W/TRACE GRAVEL (FILL)	19'	33'	
TAN, DRY, ARGILLACEOUS SILTY SAND (DECOMPOSED ROCK)	33'	53'	

IF HARD ROCK AREAS, IDENTIFY SPECIFICALLY WHERE SATURATED FRACTURES WERE OBSERVED.

WELL HYDROFRACTURED — yes [Y] no [N]

CIRCLE APPROPRIATE LETTER
A. WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
B. ELECTRIC LOG OBTAINED
C. TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS IDENT. NO. MD413
DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)
DRILLER SUPERVISOR (sign, if driller or journeyman permittee is responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box) yes [Y] no [N]
TYPE OF GROUTING MATERIAL
CEMENT [CM] BENTONITE CLAY [BC]
NO. OF BAGS 4 NO. OF POUNDS 92
GALLONS OF WATER 24
DEPTH OF GROUT SEAL (to nearest foot)
from 0 ft. to 26 ft.
(enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below
STEEL [ST] CONCRETE [CO] PLASTIC [PL] OTHER [OT]

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
PL	2	32

OTHER CASING (if used)

EACH CASING	diameter inch	depth (feet) from	to

SCREEN RECORD
screen type or open hole insert appropriate code below
STEEL [ST] BRASS BRONZE [BR] OPEN HOLE [HO] PLASTIC [PL] OTHER [OT]

C2

EACH SCREEN	DEPTH (nearest ft.)	
1	32	52
2		
3		

SLOT SIZE 020 2 3
DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK from 26' to 61'
IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 66

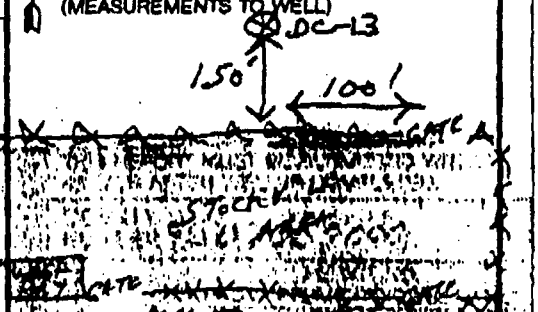
MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)
T (E.R.O.S.) WC
TELESCOPE CASING LOG INDICATOR OTHER DATA

C3

PUMPING TEST
HOURS PUMPED (nearest hour)
PUMPING RATE (gal. per min. to nearest gal.)
METHOD USED TO MEASURE PUMPING RATE
WATER LEVEL (distance from land surface)
BEFORE PUMPING
WHEN PUMPING
TYPE OF PUMP USED (for test)
air [A] piston [P] turbine [T]
centrifugal [C] rotary [R] other (describe below) [O]
jet [J] submersible [S]

PUMP INSTALLED
DRILLER WILL INSTALL PUMP (CIRCLE) (YES or NO) YES (NO)
IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS EXCEPT HOME USE
TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX - SEE ABOVE:
CAPACITY: GALLONS PER MINUTE (to nearest gallon)
PUMP HORSE POWER
PUMP COLUMN LENGTH (nearest ft.)
CASING HEIGHT (circle appropriate box and enter casing height)
above [+] below [−] LAND SURFACE (nearest foot) 3

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND/OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



C 1 3253 — SEQUENCE NO. (DENV USE ONLY)
(THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER 950705 900/

ST/CO USE ONLY
DATE Received

DATE WELL COMPLETED 07 06 95

BORING DC-21

Depth of Well 40 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" MO-93-0602

OWNER US ARMY CORPS OF ENGINEERS, WASHINGTON AQUEDUCT DIVISION
STREET OR RFD 5900 MacArthur Blvd. TOWN Brookmont
(last name / first name)
SUBDIVISION _____ SECTION _____ LOT _____

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	Check if water bearing
BROWN + RED, MOIST, SILTY CLAY W/TRACE ROOTS + GRAVEL (FILL)	0'	13'	
TAN, DRY TO WET, SILTY SAND	13'	43'	✓

IN HARD ROCK AREAS, IDENTIFY SPECIFICALLY WHERE SATURATED FRACTURES WERE OBSERVED.

WELL HYDROFRACTURED — yes [Y] no [N]

CIRCLE APPROPRIATE LETTER
- A — A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- E — ELECTRIC LOG OBTAINED
- P — TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS IDENT. NO. MWD 413
DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)
SITE SUPERVISOR (sign. of driller or journeyman)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box) yes [Y] no [N]
TYPE OF GROUTING MATERIAL
CEMENT [CM] BENTONITE CLAY [BC]
NO. OF BAGS 1 NO. OF POUNDS 94
GALLONS OF WATER 6
DEPTH OF GROUT SEAL (to nearest foot)
from 0 ft. to 4 ft.
(enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below
[ST] STEEL [CO] CONCRETE [PL] PLASTIC [OT] OTHER

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
PL	2	20

OTHER CASING (if used)

EACH CASING	diameter inch	depth (feet) from	to

SCREEN RECORD
screen type or open hole — insert appropriate code below
[ST] STEEL [BR] BRASS [HO] OPEN HOLE [BRONZE] [PL] PLASTIC [OT] OTHER

C 2

EACH SCREEN	DEPTH (nearest ft.)			
1	PL	20	40	
2				
3				

SLOT SIZE 1 020 2 ____ 3 ____
DIAMETER OF SCREEN 2 (NEAREST INCH)
GRAVEL PACK from 4' to 53'
IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

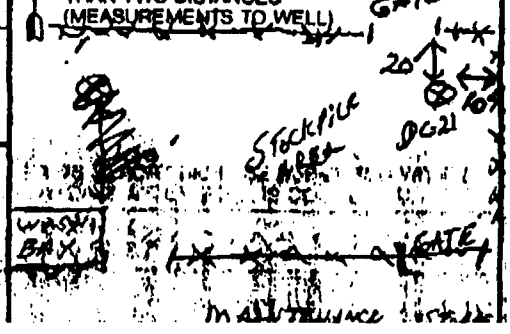
MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)
T ____ (E.R.O.S.) ____ W ____
TELESCOPE CASING ____ LOG INDICATOR ____ OTHER DATA ____

C 3

PUMPING TEST
N/A
HOURS PUMPED (nearest hour)
PUMPING RATE (gal. per min. to nearest gal.)
METHOD USED TO MEASURE PUMPING RATE
WATER LEVEL (distance from land surface)
BEFORE PUMPING
WHEN PUMPING
TYPE OF PUMP USED (or last)
- [A] air
- [P] piston
- [T] turbine
- [C] centrifugal
- [R] rotary
- [O] other (describe below)
- [J] jet
- [S] submersible

PUMP INSTALLED
DRILLER WILL INSTALL PUMP (CIRCLE) (YES or NO) YES (NO)
IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS EXCEPT HOME USE
TYPE OF PUMP INSTALLED
PLACE (A,C,J,P,R,S,T,O) IN BOX - SEE ABOVE:
CAPACITY: GALLONS PER MINUTE (to nearest gallon)
PUMP HORSE POWER
PUMP COLUMN LENGTH (nearest ft.)
CASING HEIGHT (circle appropriate box and enter casing height)
[+] above [−] below LAND SURFACE
3 (nearest foot)

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND/OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



C 1 3254 SEQUENCE NO. (DENV USE ONLY)
(THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

STATE OF MARYLAND
WELL COMPLETION REPORT
FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

THIS REPORT MUST BE SUBMITTED WITHIN 45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER 9507059001

ST/CO USE ONLY
DATE Received

DATE WELL COMPLETED 6/7/0/9/5

DC-25

Depth of Well 54 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" 10-93-0618

OWNER US ARMY CORPS OF ENGINEERS, WASH AQUEDUCT DIVISION
STREET OR RFD 5900 McArthur Blvd (last name / first name) TOWN BROOKMONT
SUBDIVISION SECTION LOT

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	Check if water bearing
BROWN TO GRAY DRY TO DAMP, SILTY CLAY WITH LAYERS OF SILTY SAND (FILL)	0'	43'	
TAN, DRY TO WET, SILTY SAND WITH TRACE ROCK FRAGMENTS	43'	55'	W

IN HARD ROCK AREAS, IDENTIFY SPECIFICALLY WHERE SATURATED FRACTURES WERE OBSERVED.

WELL HYDROFRACTURED yes [Y] no [N]

CIRCLE APPROPRIATE LETTER
- A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- E ELECTRIC LOG OBTAINED
- P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS IDENT. NO. MD0413

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

SITE SUPERVISOR (sign, of driller or journeyman responsible for afterwork if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box) yes [Y] no [N]
TYPE OF GROUTING MATERIAL
CEMENT [C M] BENTONITE CLAY [B C]
NO. OF BAGS 4 NO. OF POUNDS 92
GALLONS OF WATER 24
DEPTH OF GROUT SEAL (to nearest foot)
from 0 ft. to 30 ft.
(enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below
[S T] STEEL [C O] CONCRETE [P L] PLASTIC [O T] OTHER

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
PL	2	34

EACH CASING — OTHER CASING (if used)

diameter inch	depth (feet) from	to

SCREEN RECORD
screen type or open hole insert appropriate code below
[S T] STEEL [B R] BRASS BRONZE [H O] OPEN HOLE [P L] PLASTIC [O T] OTHER

C 2

EACH SCREEN

	TYPE	DEPTH (nearest ft.)	
1	PL	37	53
2			
3			

SLOT SIZE .020
DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK from 30' to 65'
IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

MDE USE ONLY (NOT TO BE FILLED IN BY DRILLER)
T (E.R.O.S.) W Q
TELESCOPE CASING LOG INDICATOR OTHER DATA

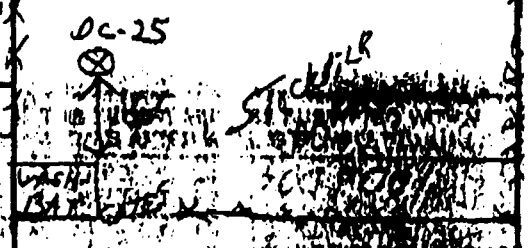
C 3

N/A

PUMPING TEST
HOURS PUMPED (nearest hour)
PUMPING RATE (gal. per min. to nearest gal.)
METHOD USED TO MEASURE PUMPING RATE
WATER LEVEL (distance from land surface)
DURING PUMPING
WHEN PUMPING
TYPE OF PUMP USED (for test)
[A] air [P] piston [T] turbine [C] centrifugal [R] rotary [O] other (describe below) [J] jet [S] submersible

PUMP INSTALLED
DRILLER WILL INSTALL PUMP (CIRCLE) (YES or NO) YES (NO)
IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS EXCEPT HOME USE
TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX - SEE ABOVE:
CAPACITY: GALLONS PER MINUTE (to nearest gallon)
PUMP HORSE POWER
PUMP COLUMN LENGTH (nearest ft.)
CASING HEIGHT (circle appropriate box and enter casing height) + above / − below LAND SURFACE (nearest foot) 3

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND/OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



MONITORING RECORDS

OBSERVATION WELL NO. D.C. - 3 (FOREBAY)

TOP OF CASING ELEVATION $153.9^{\pm} + 3.5' = 157^{\pm}$

READING NO.	DATE	TIME	MEASUREMENT	GROUND WATER DEPTH
1	08 - 08 - 95	0800	80' - 9" MINUS 65' - 0" =	15' - 9"
2	08 - 15 - 95	1118	81' - 0" MINUS 65' - 0" =	16' - 0"
3	08 - 22 - 95	0915	80' - 5" MINUS 65' - 0" =	15' - 5"
4	08 - 29 - 95	1452	80 - '6" MINUS 65' - 0" =	15' - 6"
5	09 - 05 - 95	0950	81' - 0" MINUS 65' - 0" =	16' - 0"
6	09 - 12 - 95	1310	79' - 7" MINUS 65' - 0" =	14 ' - 7"
7	09 - 19 - 95	1325	80' - 6" MINUS 65' - 0" =	15 ' - 6"
8	09 - 27 - 95	1013	79' - 10" MINUS 65' - 0" =	14' - 10"
9	10 -03 - 95	1038	79' - 11" MINUS 65' - 0" =	14' - 11"
10	10 - 10 - 95	0940	80' - 2" MINUS 65' - 0" =	15' - 2"
11	10 - 19 - 95	1029	80' - 11" MINUS 65' - 0" =	15' - 11"
12	10 - 24 - 95	1010	81' - 6" MINUS 65' - 0" =	16' - 6"
13	10-31-95	1040	81'-3" MINUS 65'-0" =	16'-3"
14	11-9-95	1329	81'-0" " 65'-0" =	16'-0"
15	11-16-95	1315	81-11" " 65'-0" =	16'-11"
16	11-21-95	1400	81-9 " " =	16'-9"
17	11-30-95	1305	81'-0" " " =	16'-0"
18	12-7-95	1305	81'-9" " " =	16'-9"
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

OBSERVATION WELL NO. D.C. - 13 (MAINT. AREA)

TOP OF CASING ELEVATION 147.5 + 3.5 = 151±

READING NO.	DATE	TIME	MEASUREMENT	GROUND WATER DEPTH
1	08 - 08 - 95	0750	119' - 9" MINUS 65' - 0" =	54' - 9"
2	08 - 15 - 95	1051	119' - 9" MINUS 65' - 0" =	54' - 9"
3	08 - 22 - 95	0900	119' - 9" MINUS 65' - 0" =	54' - 9"
4	08 - 29 - 95	1435	119' - 10" MINUS 65' - 0" =	54' - 10"
5	09 - 05 - 95	1027	119' - 9" MINUS 65' - 0" =	54' - 9"
6	09 - 12 - 95	1350	120' - 0" MINUS 65' - 0" =	55' - 0"
7	09 - 19 - 95	1355	119 - 10" MINUS 65' - 0" =	54' - 10"
8	09 - 27 - 95	1102	119' - 10" MINUS 65' - 0" =	54' - 10"
9	10 -03 - 95	1115	119' - 10" MINUS 65' - 0" =	54' - 10"
10	10 - 10 - 95	1035	119' - 11" MINUS 65' - 0" =	54' - 11"
11	10 - 19 - 95	1005	120' - 0" MINUS 65' - 0" =	55' - 0"
12	10 - 24 - 95	1110	120' - 3" MINUS 65' - 0" =	55' - 3"
13	10-31-95	11:22	120'-0" MINUS 65'-0" =	55'-0"
14	11-9-95	13:53	120'-0" " 65'-0" =	55'-0"
15	11-16-95	13:52	120'-0" " 65'-0" =	55'-0"
16	11-21-95	1443	119'-5" " " =	54'-5"
17	11-30-95	13:32	120'-1" " " =	55'-1"
18	12-7-95	13:45	120'-0" " " =	55'-0"
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

OBSERVATION WELL NO. D.C. - 21 (MAINT. AREA)

TOP OF CASING ELEVATION 140.1 + 3.5 = 143.6

READING NO.	DATE	TIME	MEASUREMENT	GROUND WATER DEPTH
1	08 - 08 - 95	0730	99' - 10" MINUS 65' - 0" =	34' - 10"
2	08 - 15 - 95	1042	104' - 4" MINUS 65' - 0" =	39' - 4"
3	08 - 22 - 95	0845	100' - 2" MINUS 65' - 0" =	35' - 2"
4	08 - 29 - 95	1425	100' - 7" MINUS 65' - 0" =	35' - 7"
5	09 - 05 - 95	1016	100' - 8" MINUS 65' - 0" =	35' - 8"
6	09 - 12 - 95	1340	101' - 3" MINUS 65' - 0" =	36' - 3"
7	09 - 19 - 95	1401	101 - 6" MINUS 65' - 0" =	36' - 6"
8	09 - 27 - 95	1053	101' - 5" MINUS 65' - 0" =	36' - 5"
9	10 -03 - 95	1107	101' - 6" MINUS 65' - 0" =	36' - 6"
10	10 - 10 - 95	1025	101' - 6" MINUS 65' - 0" =	36' - 6"
11	10 - 19 - 95	0959	101' - 9" MINUS 65' - 0" =	36' - 9"
12	10 - 24 - 95	1115	102' - 0" MINUS 65' - 0" =	37' - 0"
13	10-31-95	11:16	101'-1" MINUS 65'-0" =	36'-1"
14	11-9-95	14:02	108-2 " 65'-0" =	43'-2"
15	11-16-95	14:04	101'-6" " 65'-0" =	36'-6"
16	11-21-95	1435	99'-11" " " =	34'-11"
17	11-30-95	1338	102'-3" " " =	35'-3"
18	12-7-95	1340	99'-10" " " =	34'-10"
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

OBSERVATION WELL NO. D.C. - 25 (MAINT. AREA)

TOP OF CASING ELEVATION 136.2 + 3.5 = 139±

READING NO.	DATE	TIME	MEASUREMENT	GROUND WATER DEPTH
1	08 - 08 - 95	0720	113' - 6" MINUS 65' - 0" =	48' - 6"
2	08 - 15 - 95	1031	113' - 7" MINUS 65' - 0" =	48' - 7"
3	08 - 22 - 95	0830	113' - 9" MINUS 65' - 0" =	48' - 9"
4	08 - 29 - 95	1418	113' - 8" MINUS 65' - 0" =	48' - 8"
5	09 - 05 - 95	1008	113' - 9" MINUS 65' - 0" =	48' - 9"
6	09 - 12 - 95	1400	114' - 0" MINUS 65' - 0" =	49' - 0"
7	09 - 19 - 95	1408	114' - 0" MINUS 65' - 0" =	49' - 0"
8	09 - 27 - 95	1045	114' - 4" MINUS 65' - 0" =	49' - 0"
9	10 - 03 - 95	1103	114' - 8" MINUS 65' - 0" =	49' - 8"
10	10 - 10 - 95	1018	114' - 5" MINUS 65' - 0" =	49' - 5"
11	10 - 19 - 95	0954	114' - 10" MINUS 65' - 0" =	49' - 10"
12	10 - 24 - 95	1055	114' - 7" MINUS 65' - 0" =	49' - 7"
13	10-31-95	11:10	114'-0" MINUS 65'-0" =	49'-0"
14	11-9-95	2:08	114'-9" " 65'-0" =	49'-9"
15	11-16-95	2:02	114'-6" " 65'-0" =	49'-6"
16	11-21-95	1428	114'-2" " "	49'-2"
17	11-30-95	1342	114'-4" " " =	49'-4"
18	12-7-95	1330	114'-6" " " =	49'-6"
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

OBSERVATION WELL NO. D.C. - 32 (BASIN NO. 3)

TOP OF CASING ELEVATION $146^{\pm} + 3.5' = 149^{\pm}$

READING NO.	DATE	TIME	MEASUREMENT	GROUND WATER DEPTH
1	08 - 08 - 95	0700	105' - 4" MINUS 65' - 0" =	40' - 4"
2	08 - 15 - 95	1023	105' - 4" MINUS 65' - 0" =	40' - 4"
3	08 - 22 - 95	0810	105' - 8" MINUS 65' - 0" =	40' - 8"
4	08 - 29 - 95	1510	105' - 7" MINUS 65' - 0" =	40' - 7"
5	09 - 05 - 95	0935	105' - 5" MINUS 65' - 0" =	40' - 5"
6	09 - 12 - 95	1330	97' - 2" MINUS 65' - 0" =	32' - 2"
7	09 - 19 - 95	1340	105' - 9" MINUS 65' - 0" =	40' - 9"
8	09 - 27 - 95	1030	105' - 9" MINUS 65' - 0" =	40' - 9"
9	10 -03 - 95	1052	105' - 7" MINUS 65' - 0" =	40' - 7"
10	10 - 10 - 95	1000	105' - 7" MINUS 65' - 0" =	40' - 7"
11	10 - 19 - 95	1045	105' - 9" MINUS 65' - 0" =	40' - 9"
12	10 - 24 - 95	1000	105' - 10" MINUS 65' - 0" =	40' - 10"
13	10 - 31 - 95	1030	105' - 7" " " 65' - 0" =	MUD 40' - 7"
14	11-9-95	1342	106'-0" " 65'-0" =	41'-0"
15	11.16-95	1340	105'-9" " 65'-0" =	40'-9"
16	11-21-95	1416	105-7 " " =	40'-7"
17	11-30-95	1317	105-9" " " =	40'-9"
18	12-7-95	1315	105'-9" " " =	40'-9"
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

APPENDIX E

DESIGN CALCULATIONS

PILE CALCULATIONS

S.S.P Revised 2/20/96

12.26.95

TABULATION OF COST ESTIMATES
DEWATERING FACILITIES.

At DC-24 (Average case situation)

	FOUNDATION ELEMENT	Allowable capacity	EXPECTED LENGTH	UNIT COST $/ft	EXPECTED COST/ELEMENT	COST PER CAPACITY $/TON
1.	14HP73.	75T	36'	$ 27.25	$ 981	$ 13.08
2.	Drilled Piers	240T	36' soil 2' Rock	$ 225/VLF (soil) $ 575/VLF (rock)	$ 8,100 $ 1,150 $ 9250	$ 38.54

Notes

- Pile costs do not include pilecap costs
- Piers length in weathered rock layers ($\bar{N} \geq 50$/ft) is taken as length in rock for cost estimates, based on previous experience.
- Preliminary estimate prices, based on Mears and Past local experience
- Calculations for capacities done 7.31.95.

RMC/ESP
1/4/96

Pile Capacity Summary

Structure	Pile	Capacity
Dewatering Building	HP 14x73	60^T compression 25^T tension
Gravity Thickeners East Side	HP 14x73	40^T compression 12^T tension
West Side	HP 14x73	40^T compression 16^T tension
Georgetown Equalization Basin	HP 12x53	15^T tension

S.S.P Dewatering Building
11.9.95.

1. Worst case situation. @ Dc-29. El 134.4.

Assume Pile cap @ El. 120. (with basement).

Fill thickness = 10 feet. (24-14); Weath. Soil: 18 feet.

Q_{S1} : $500^{\#}/ft^2 \times (4.67)' \times (10') = 11.65^T$

Q_{S2} : $1500^{\#}/ft^2 \times (4.67)' \times (18') = 63.04^T$

ΣQ_{Suit} : 74.69^T : 75^T

Tip resistance

From unconfined compressive strength $q_{um(Avg)}$: 6969 psi

(Ref:- Poulos and Davis.)

Use $0.3\, q_{um}$ as q_{ba} (Allowable bearing capacity)

q_{ba} = 0.3 (6900) psi : 2070 psi.

Allowable Tip load : (2070 psi) (Area of Tip)

= (2070 psi) (21.4 in²) : 22.15^T : 22^T.

Allowable Skin friction : $\frac{75^t}{2}$ $\left(\Sigma \frac{Q_S : Q_{S1} + Q_{S2}}{F.S}\right)$: 37.5^T

Total Allowable load : $22^T + 37.5^T$: 59.5^T say $\underline{60^T}$

If pile tip does not reach intact Rock, but resistance is reached in the weathered rock zone. (Silt + San

Use USACE design manual procedure. (EM 1110-2-2906)

S.S.P
11.9.95

Dewatering Building

Use D_c : 20 B.

For 14" H pile B: 1.17' D_c : 20(1.17') : 23.3'
Say 23'.

For ϕ : 35°. N_q (from figure 4-4 USACE manual) : 50.

For ϕ : 10°. N_q : 2.5, γ : 110 pcf d_c : 10 feet

For a 23' pile length, assume embedment in fill : 10 feet
and embedment in weathered soil : 13 feet (5 feet higher than rock El.

$Q_{tip} = (\Sigma \sigma_v' (N_q)) A_{tip}$.

$= [(110\text{ pcf})(10\text{ft})(2.5) + (125\text{ pcf})(13\text{ feet})(50)] A_{tip}$

$: (2750^{\#/ft^2} + 81,250^{\#/ft^2}) \left(\frac{13.61'' \times 14.59''}{144}\right)$

$(84,000^{\#}/ft^2)(1.4\,ft^2) := 58.8^T$

(Use A_p : Block Area per USACE). $: 59^T$ (say).

Skin friction

$Q_{s_1} : (500^{\#}/ft^2)(4.67')(10') : 11.65^T$.

$Q_{s_2} : (1500^{\#}/ft^2)(4.67')(13') : 45.5^T$

$\Sigma Q_s = Q_{s_1} + Q_{s_2} : 11.65^T + 45.5^T : 57.2^T$.

∴ Total Capacity (Ultimate) : $57.2^T + 59^T = 116^T$ (use safety factor of 2)

Allowable bearing capacity : $\underline{\underline{58^T}}$.

S.S.P
11.9.95

Dewatering Building

Best case situation

[without basement] F.F. El. Approx 143.

At DC-29. (El. 130.41±).

$Q_{S_1} = (500^{\#}/ft^2)(24')(4.67 ft') = 28^T$

$Q_{S_2} = (1500^{\#}/ft^2)(18')(4.67 ft^2) = 63^T$

$Q_{sult} = \Sigma Q_S = Q_{S_1} + Q_{S_2}$

$Q_{sult} = 91^T$

$Q_{ALL} = 45.5^T$

End bearing (same as worst case situation): 37.5^T

$Q_{ALL} = \underline{83^T}$ $(37.5^T + 45.5^T)$.

If pile tip does not reach intact rock but reaches refusal in the weathered rock zone, then length will be shorter than above situation, and compression capacity will be less than 83^T but greater than 60^T.

→ Drive Piles to rock, use 60^T design capacity.

S.S.P
12.7.95

Tension capacity of piles.

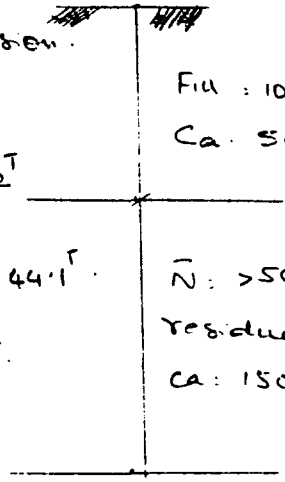
Dewatering Building.

1. (worst case situation).

@ Dc-29. (with basement).

Assume 70% of skin friction as tension.

f: 0.67'



$Q_{s(fill)}$: 500#/ft² × (4.67') × 10' × 0.7 : 8.2^T

$Q_{s(res\text{-}soil)}$: 1500#/ft² (4.67') (18') (0.7) : 44.1^T

$\Sigma Q_{s(ultimate)}$: 44.1^T + 8.2^T : 52.3^T

Use safety factor : 3.

$\Sigma Q_{s(All)}$: $\frac{52.3}{3}$: 17^T say $\underline{\underline{15^T}}$ → If using load test S.F : 2

ΣQ_{SAll} : $\frac{52.3}{2}$ = 26^T say 25^T (with load test)

Allowable tension capacity : 15^T (without load test)
: 25^T (with load test)

2. Worst case situation (without Basement).

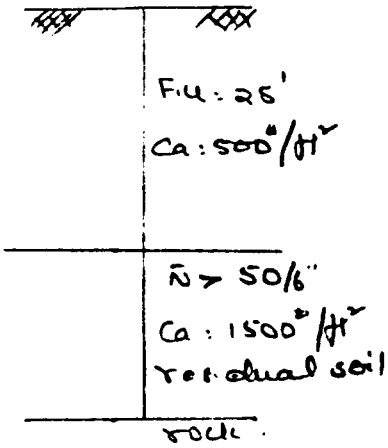
$Q_{s(fill)}$: 500#/ft² × (4.67') × 25' × 0.7 : 20.4^T

$Q_{s(res\text{-}soil)}$: 44.1^T

$\Sigma Q_{s(ult)}$: 64.5^T

$\Sigma Q_{(All)}$ tension : $\frac{64.5}{3}$: 21.3^T say 20^T.

$\Sigma Q_{(All)}$ tension : $\frac{64.5}{2}$: 32.25^T say 30^T



For tension capacity of piles at Dewatering Building.

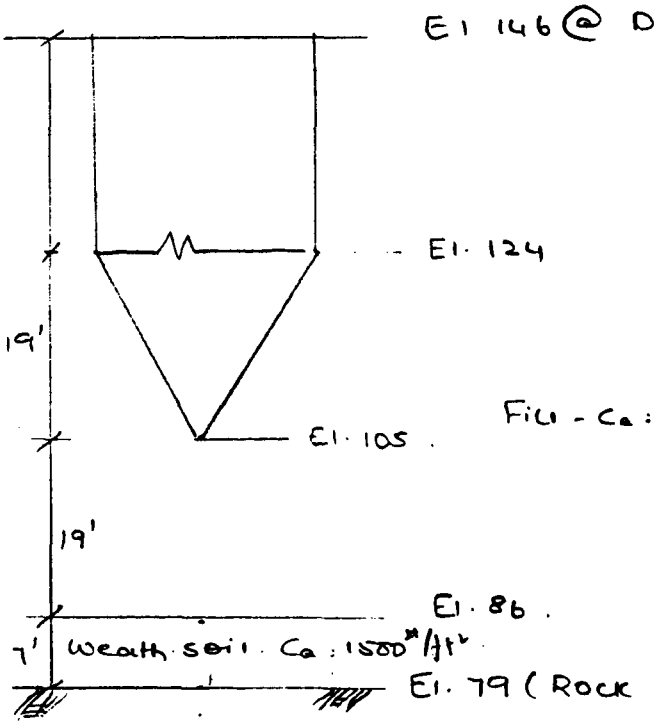
Use 15^T – 20^T without load test @ 25^T - 30^T (with load test).

S.S.P
12.7.95

Dalcanlia WTP
Pile Tension Capacities -. Sludge thickeners

For West side thickeners -:

Worst case situation - Thickener #3 between Dc-11 and Dc-12



(Figure scale : (1" : 20') vert)

At thickener bottom [El. 105] → worst case

$Q_{s(fill)} = (500^{\#}/ft^2) \times (4.67') \times 19' \times 0.7 = 15.5^{T}$

$Q_{s(residual)} = (1500^{\#}/ft^2) \times (4.67') \times 7' \times 0.7 = 17.2^{T}$

$\Sigma Q_{s(ultimate)} = 15.5^{T} + 17.2^{T} \approx 32^{T}$

$Q_{s(Allowable)} = \frac{32^{T}}{3} = 10.67^{T}$ Say 10^{T}.

If load test is performed, then safety factor = 2
$Q_{s(All)} = 32^{T} \div 16^{T}$ (with load test).

13072

7 10

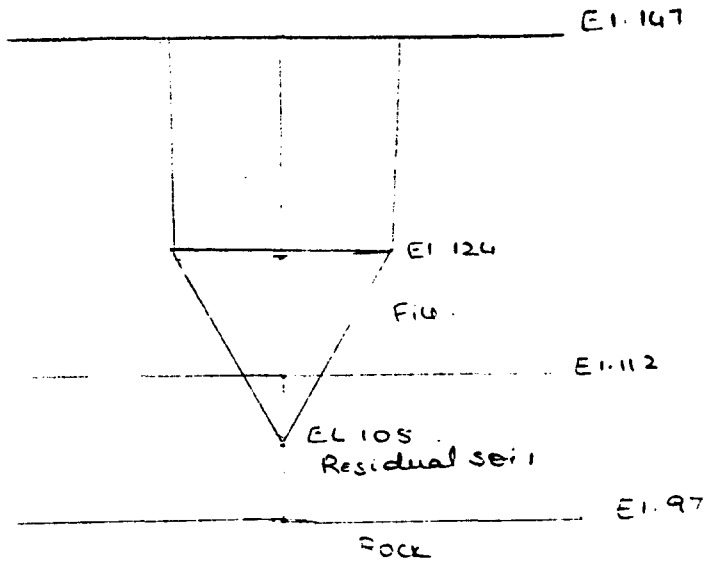
O.S.P.
12.7.95

Dalcarlia water treatment plant.
Gravity Thickener

For East side Thickeners.

Profile between DC-12, DC-13 and DC-14

Refer DC-13.



Worst case situation. @ bottom of sloping slab

Say if Pile : 10' in length.

$Q_{S_{ultimate}}$: (4.67') (1500 #/ft²) (10') (0.7) : 24.5 T

Use safety factor of 2. (Very important to use load test).

$Q_{S(ALLOW)}$: (w/ Load test) : $\frac{24.5^T}{2}$: 12.25 T

$Q_{S(ALLOW)}$: (without load test) : $\frac{24.5^T}{3}$: 8 T.

13072

8

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12.7.95

Dalcanbia water treatment plant - Gravity Sludge thickeners - uplift capacity.

At El. 124 → pile has best uplift capacity. (longer pile).

$Q_{s(fill)} = (500^{\#}/ft^2) \times (4.67') \times 38' \times 0.7 = 31^T$

$Q_{s(res.soil)} = (1500^{\#}/ft^2) \times (4.67') \times 7' \times 0.7 = 17^T$

$\Sigma Q_{sultimate} = 48^T$.

Without load test $Q_{s(All)} = \frac{48}{3} = 16^T$

With load test $Q_{s(All)} = \frac{48}{2} = 24^T$.

S S P
12.8.95

Dalcahue WTP, Compression capacities.
Gravity Thickener - East side thickeners

Refer figure for tension capacities (12.8.95).

Worst case situation.

Say Pile is 10' in length.
14" pile – P = 4.67" (4 x 14"/12")

$Q_{s(ultimate)}$: 4.67" (1500#/ft²) x (10') : 35^T

With load test assume safety factor : 2

$Q_{s(Allowable)}$: $\frac{35^T}{2}$: 17.5^T

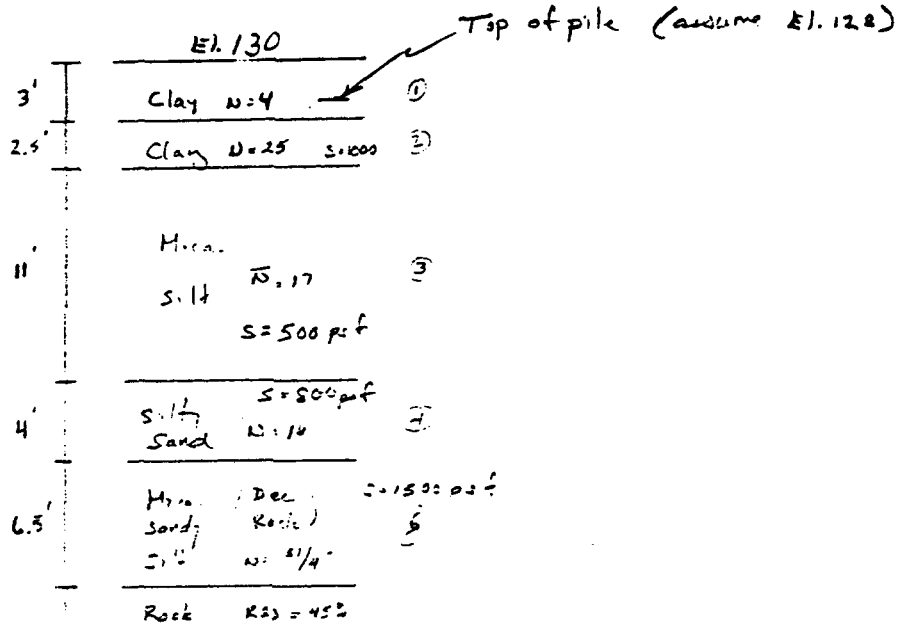
$Q_{end(Allowable)}$: (2070 psi)(21.4 in²) : 22.15^T

Total capacity : 22.15^T + 17.5^T : <u>40^Tons</u>

RWC
11/29/95

Dalecarlia - Georgetown Equalization Basin
Tension Pile calculations

Use Boring DC-40



Use H-piles : HP14X73 driven to rock.
What tension capacity is available?
$\rho = 4.7'$, tension reduction to skin friction : 30%

$$T = (4.7')(0.7)[3.5'(1000\ psf) + 11'(500\ psf) + 4'(800\ psf) + 6.5'(1500\ psf)]$$
$$= 72{,}215.5^{\#} \Rightarrow 36.1^{T}$$

w/ F.S. : 3 $\Rightarrow \frac{36.1}{3} = 12^{T}$ capacity
: 2 $\Rightarrow 18^{T}$

For HP12x53 $\rho = 4'$

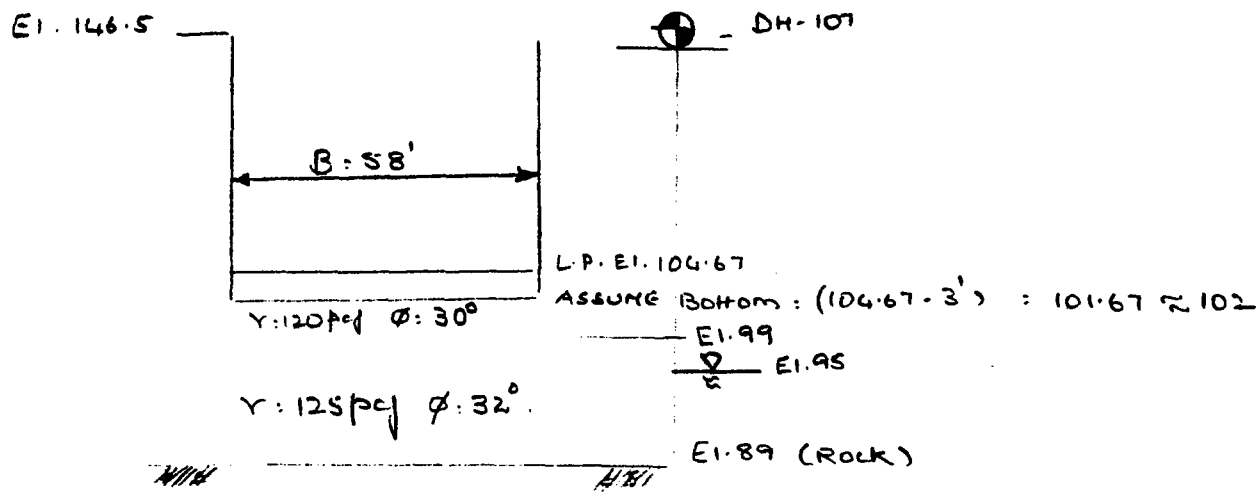
$$T = 4'(0.7)(21950\ ^{\#}/_{ft}) = 61460^{\#} = 30.7^{T}$$

w/ FS : 3 $\Rightarrow \frac{30.7}{3} = 10^{T}$
FS : 2 $\Rightarrow 15^{T}$

SHALLOW FOUNDATIONS

S.S.P.
12.15.95.

Dalecarlia WTP. Res. PS.
Bearing capacity option



(figure not to scale)

Groundwater conditions → Assume 2 cases ① from wells ② At surface

- Interpolate between GWR readings @ DC-13 and DC-25.

  El. 96 @ 13 and El. 91 @ DC-25

- Assume GWL at El. 95 (conservative and closer to DC-13).

- Adopting Procedure outlined in EM 1110-1-1905.

$$q_u = \cancel{cN_c i_c}^{0} + 0.5 B' \gamma' N_\gamma \zeta_\gamma + \sigma'_0 N_q \zeta_q.$$

- Assuming 3' undercut to original ground + surface densification + controlled backfill with approved cohesionless backfill.

  (γ: 120 pcf, ϕ: 30°) for controlled cohesionless fill.

  γ: 125 pcf ϕ: 35° for residual soil with $\bar{N} > 30$

S.S.P
12.15.95

Dalcanlia W.T.P. Res. P.S.
Bearing capacity calculations.

Stratum Identifications :

layer.	Description	Depth (in feet).	$\bar{N}$.	γ pcf	ϕ' (Deg)	N_γ (M)	N_q (M)
1	Existing fill (El.146.5 - El.102)	44.5	20	110	20°	2.9	6.4
2.	Cohesionless control Fill (El.102 - El.98)	4'	-	120	30°	15.7	18.4
3.	Residual soil (El.98 - El.95)	3'	34	125	32°	22	23.2
4.	Residual soil, saturated (El.95 - El.89	6'	> 30	(125-62.4) : 62.6)	32°	22	23.2

(M) → Meyerhoff Bearing capacity factors

Correction factors

$\tau_c = 1$ $\tau_i = 1$ (No eccentricity, No inclination).

τ_{qd} $1 + 0.1 (N_\phi)^{1/2} \cdot \frac{D}{B}$

for $\phi_{eq} = 20°$

$N_\phi = 2.0$

τ_{rd} $1 + 0.1 (\sqrt{2.0}) \left(\frac{44.5'}{58'}\right) = 1.11$

$\tau_{rd} = 1 + 0.1 (N_\phi)^{1/2} \frac{D}{B}$

for $\phi = 31°$ (Avg) → $N_\phi = 3.12$

$\tau_{rd} = 1 + 0.1 (\sqrt{3.12}) \cdot \frac{44.5'}{58'} = \underline{\underline{1.14}}$.

S.S.P. Dalcarlia W.T.P. Res P.S.

12.15.95

$\tau_c = 1$

$\tau_r = 1.14 \times 1 \times 1 = 1.14$

$\tau_q = 1.11 \times 1 \times 1 = 1.11$

$\gamma_{eq} = \frac{120 \times 4 + 135 \times 3 + 62.6 \times 6}{13'}$

$= 95$ pcf.

$N\gamma_{eq} = \frac{18.4(4) + 23.2(9)}{13}$

$= 21.7$

Substituting values in bearing capacity equation.

$$q_u = CN\cancel{\tau_c}^{0} + 0.5 B' \gamma N\gamma \tau_r + \sigma_D' N_q \tau_q .$$

$$q_u = 0.5(58')(\gamma_{eq})(N\gamma_{eq})(\tau_r) + \sigma_D' N_q \tau_q .$$

Correction factor for large footings and mats.

(1) Settlement of original ground not a concern since residual soil is precompressed. (existing fill since 1960).

(2) $\gamma_r = 1 - 0.25 \log_{10} \frac{B}{6}$

$\gamma_r = 1 - 0.25 \log_{10} \left(\frac{58}{6}\right) = 0.75$

Applying correction factor.

$q_u = (0.5)(58')(95^{\#/ft^3})(21.7)(1.14) + 110^{\#/ft^3}(44.5')(6.4)(1.11)(0.75)$

$q_u = 68,153 + 26,080$

$q_u = 94,233$ psf.

Using safety factor = 3 $q_{all} = 31,411$ psf $\approx 31^{ksf}$

S.S.P
12.15.95

Dalcarlia WTP. Res. P.S.
Bearing capacity computations

Case-②

- Assume GWT at existing grades.

$q_u = cN_c\tau_c + 0.5\,B'\gamma' N_\gamma \tau_\gamma + \sigma'_D N_q \tau_q$.

for wedge.

$\gamma_{sat} : \gamma_{eq} = \dfrac{(576\ ^{\#}/ft^3)(4') + 62.6(9')}{13'} : 61$ pcf.

for surcharge load

$\gamma_{sat} : \gamma_{eq} : 110 - 62.4 : 48$ pcf.

$q_u : (0.5)(58')(61\text{pcf})(21.7)(1.14) + (48)(44.5')(6.4)(1.11)$ (0.75)

$q_u : 43,761 + 11,380$ psf

$q_{All} : \dfrac{55,142}{3} : 18,380$ psf. or 18^{Ksf}.

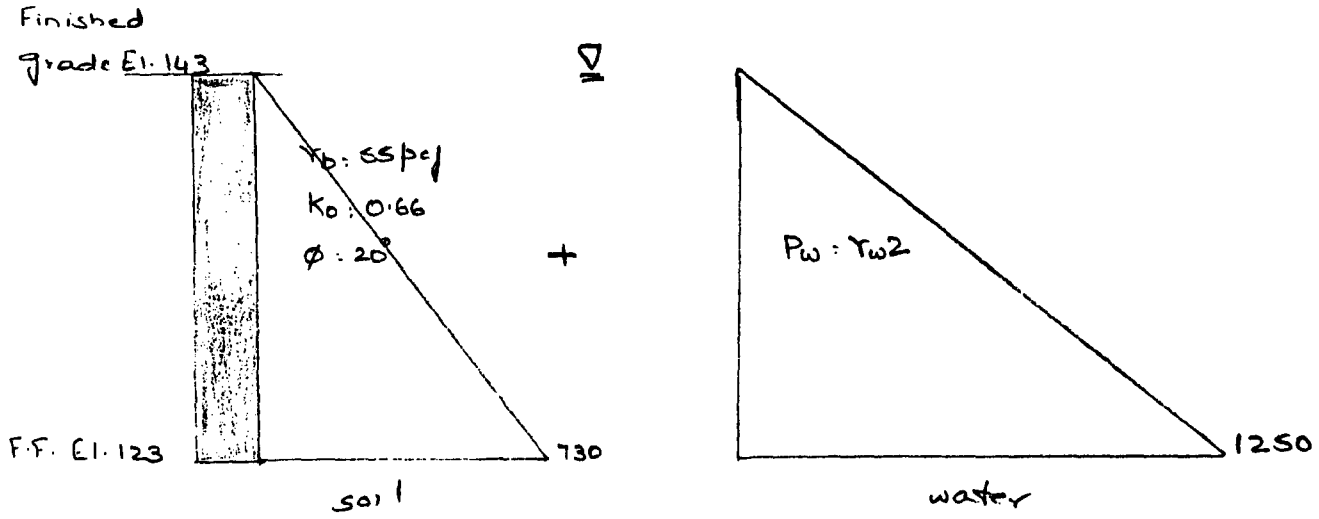
Referring to Table 4-8 and local experience.

q_{All} (Limit) to 4^{Ksf} or $\underline{\underline{4,000}}$ psf.

EARTH PRESSURE DIAGRAMS

S.S.P
1.S.95

Dalcanlia WTP. Earth Pressure computations.
Basement walls - Dewatering Building.



From Profiles drawn through Dewatering Building area (figures 6 and 7 of report), Basement FF expected in the fill layer.

- Use K_o for basement walls (rigid, braced structure).
- Use water @ El 143.

Earth pressure : (0.66)(55 pcf)(20') : 726 psf, say 730 psf

Hydrostatic pressure : (62.4)(20') : 1248 psf, say 1250 psf

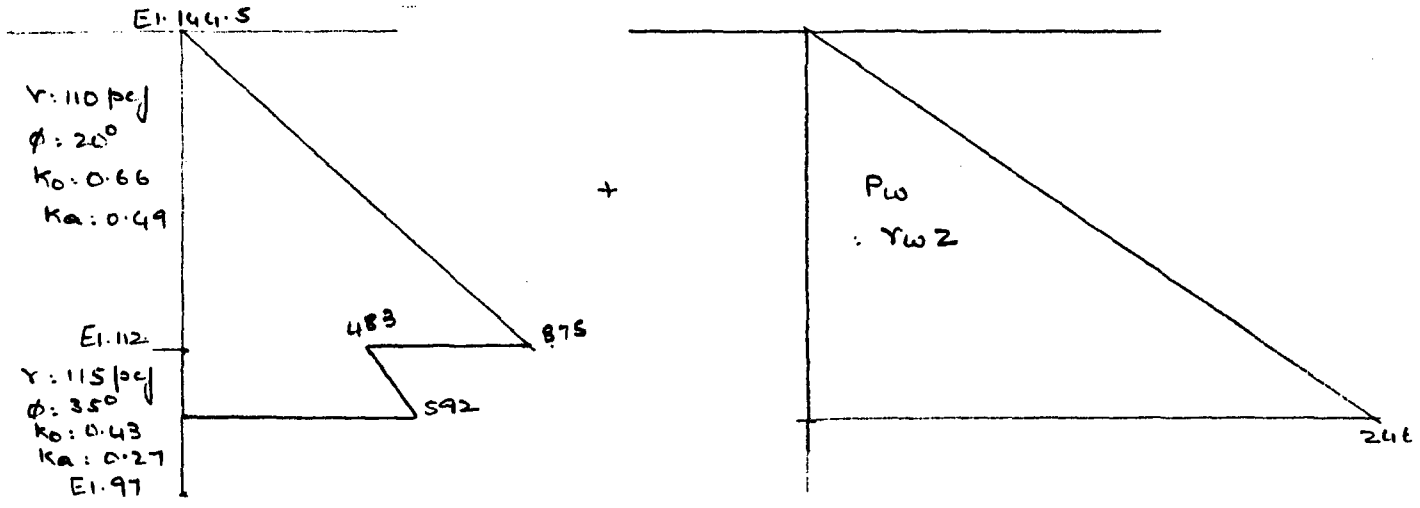
S.S.P.
12 26 95

Gravity Thickeners (East Side)
Earth Pressure computations.

East side thickeners.

Profile between Dc-12, 13 and 14
Refer Dc-13.

pressures in psf



- Assume GWT @ 144.5 (for final design).

Layer ①: (55 pcf)(32.5')(0.49) : 876 psf (bottom of fill layer)

Layer ②: (55pcf)(32.5')(0.27) : 483 psf (top of residual layer).

Bottom of slab. El. 105 ⇒ (El. 112 − El. 105) : 7' in residual lay

$P_{(bottom)}$: 483 psf + (57.5 pcf)(7')(0.27) : 592 psf.

\+ Add hydrostatic pressure : 2.465 (psf)

S.S.P.
12.26.98

Gravity Thickeners (West Side)
Earth pressure computations (final design).

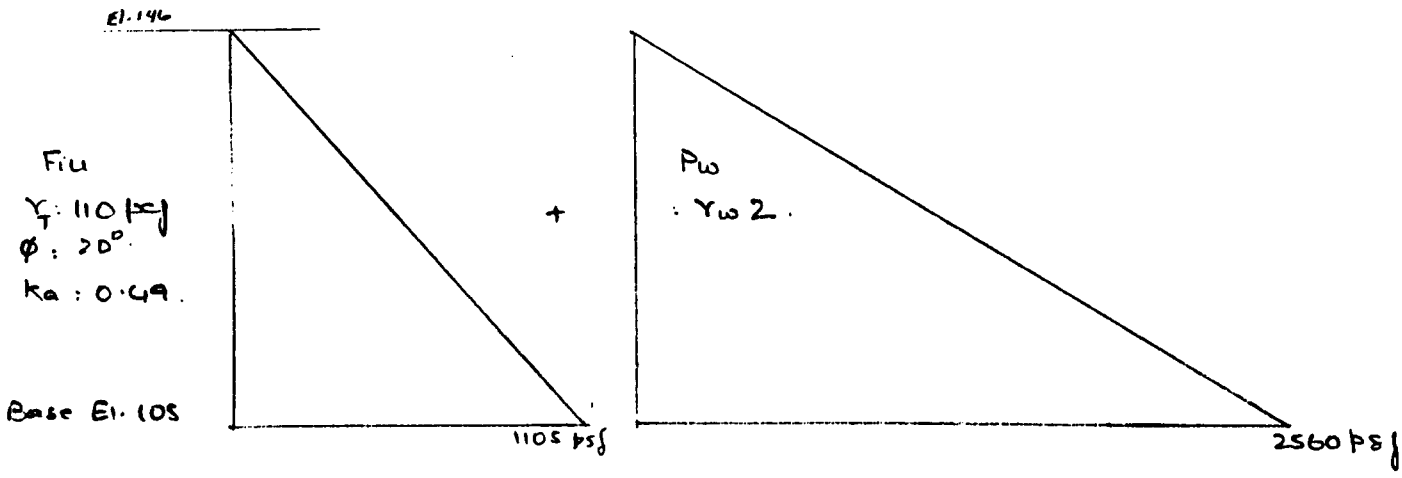
West side Thickeners.

Thickener between DC-11 and DC-12.

Refer DC-12.

Layer ① : (55 pcf) x 41' x 0.49 = 1105 psf.

hydrostatic pressure : (62.4 pcf) x (41') = 2558.4 ≈ 2560 psf.

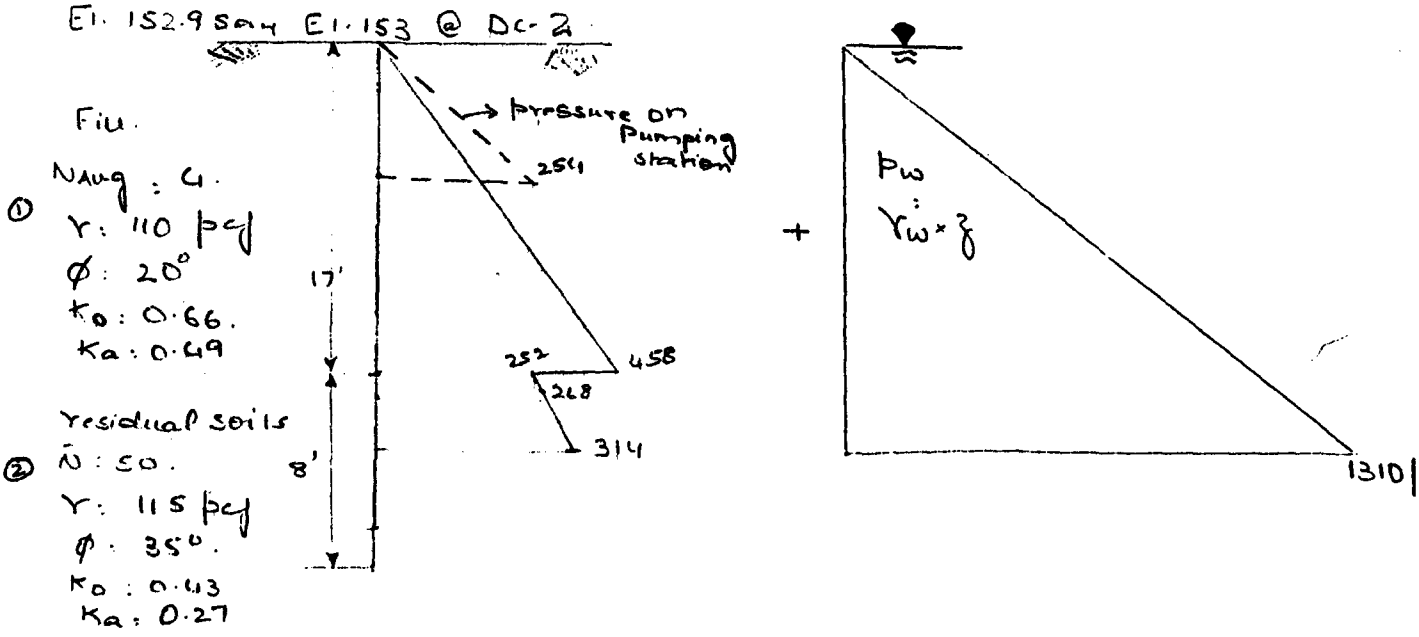


S.S.P.
12.5.95

Dalecarlia water treatment plant.
Forebay. Area. Equalization basin. Earth Pr

Earth Pressure diagrams. FOREBAY AREA.

- All borings consistent in terms of layer thickness
- DC-2 is taken as typical boring for earth pressure determinat



Post construction / Structural elevations.

- Use watertable at the surface. (Proximity to forebay)
- Assume FF El. Avg @ El 135 (wet wells part to El. 132).
- Use K_a for basin (Non-rigid walls); K_o for P.S.

Layer ① : (55 pcf)(17')(0.49) : 458 psf (bottom of layer)
(55 pcf)(1')(0.66, : 254 psf (bottom of PS use Ko)

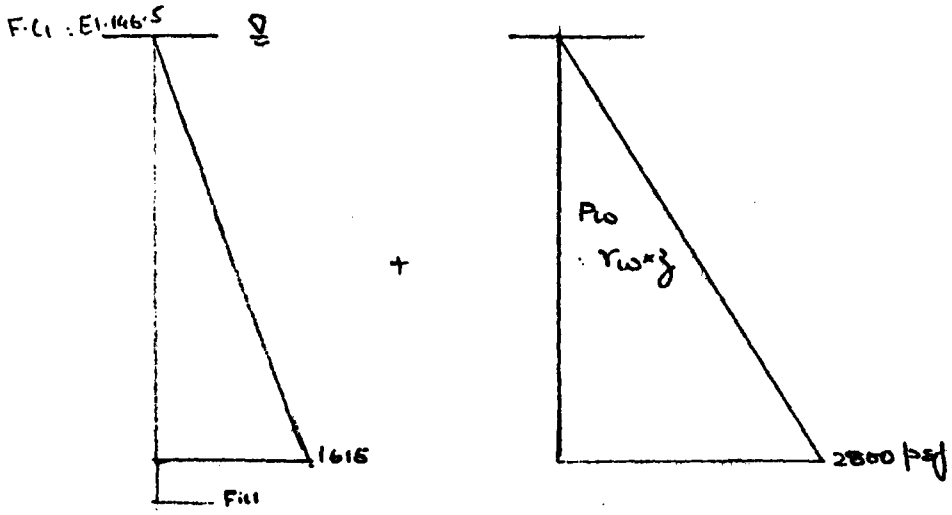
Layer ② : (55 pcf)(17')(0.27) : 252 psf (top)

Layer ② : 252 psf + 1(57.5)(0.27) : 268 psf. (to FF of basin) (El.
252 psf + 4(57.5)(0.27) : 314 psf. (to FF of wet wells) (El.

S.S.P
12.26.95.

Dalcouria WTP.
Earth Pressure computations / Thickened Residual PS

At DH - 107



- Use At-rest pressures (Rigid walls).
- Assume GWT @ El. 146.5
- Slab in fill.

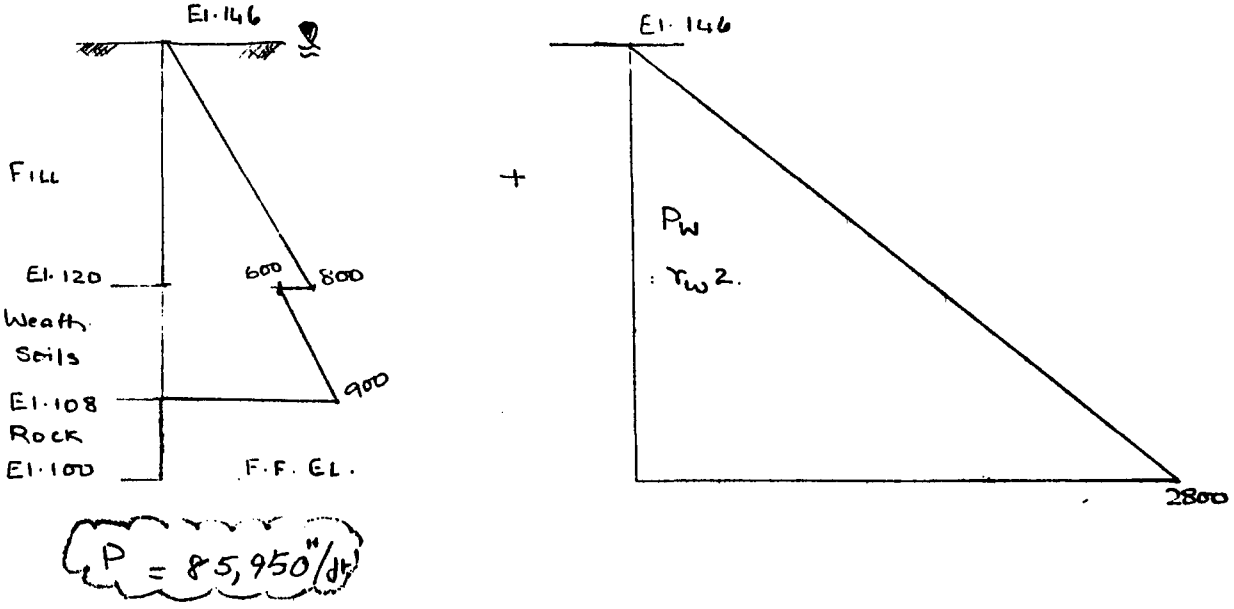
- (55pcf) x (44.5 feet) (0.66) = 1615 psf.
- Hydrostatic (for final design): (62.4) x (44.5) = 2777 psf.

S.S.P
10-24-95*

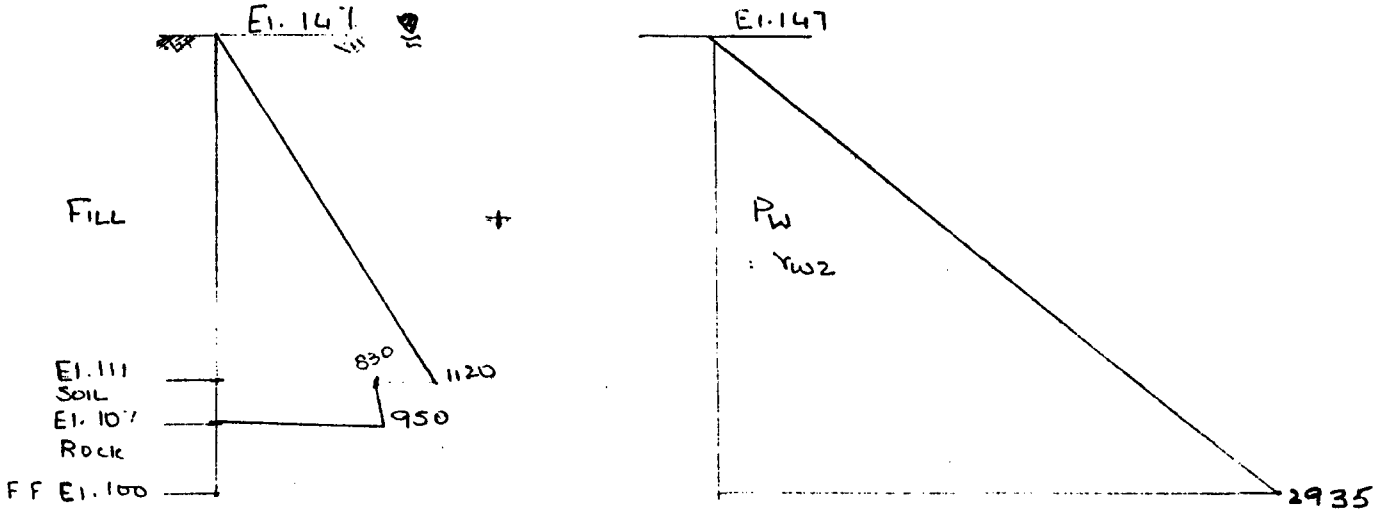
Dalecarlia WTP
Sed. Basin P.S. Earth pressures.

* Revised 8/8/96 to delete @ rest rock pressures.

Case ① At DC-33.



Case ② at DC-35



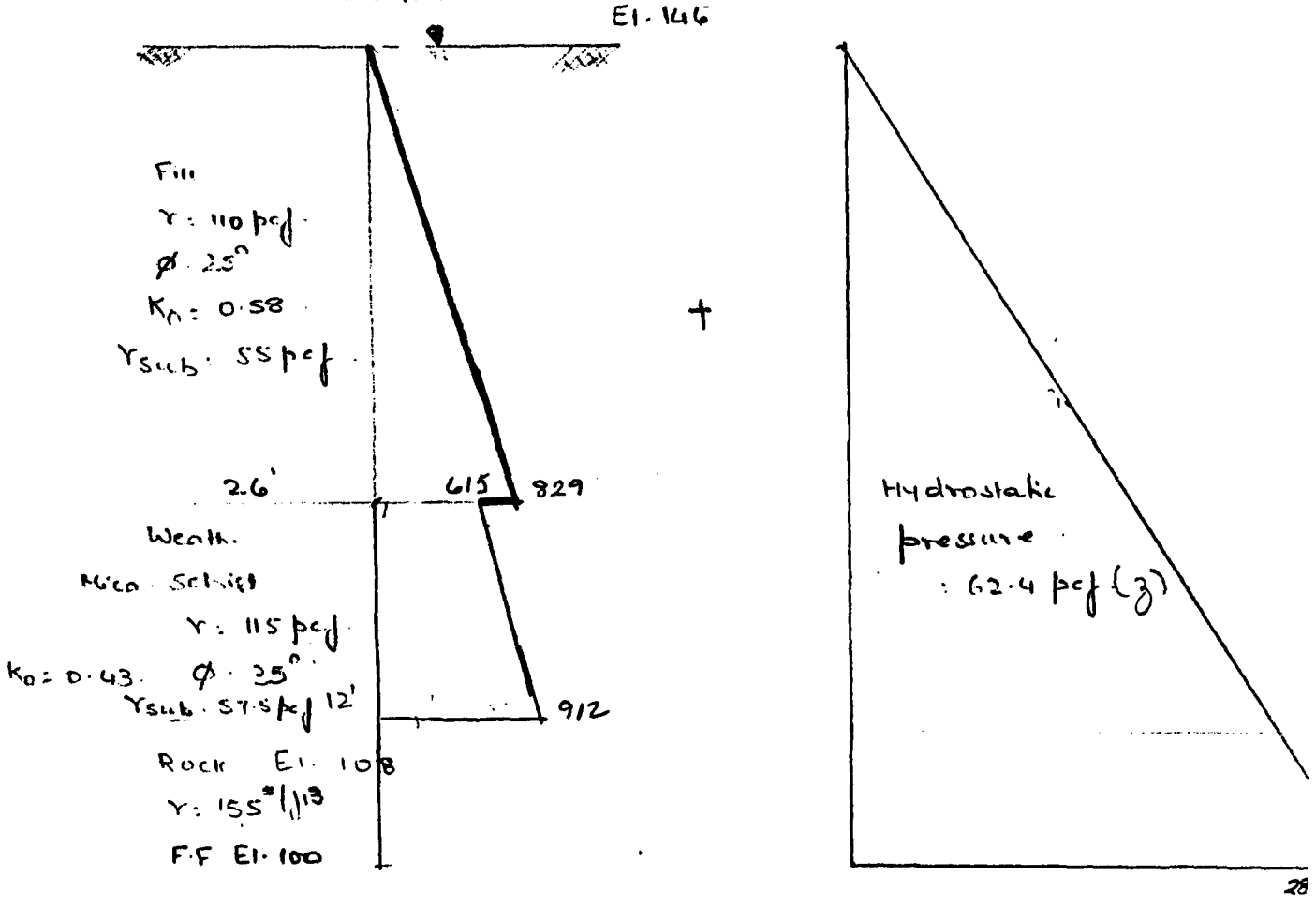
CC: S. DAVE.

S.S.P
10.17.95

Dalecarlia Water treatment plant
Sedimentation basin, Pumping station layout.

EARTH PRESSURE DIAGRAMS.

* Revised 8/8/96 to delete @ rest rock pressures. At DC-33.
* ASSUME GWT AT SURFACE (ACCORDING TO WWOF).



Case ① Assumption: Water table @ Surface

layer ① = (55)(26)(0.58) = 829 psf (bottom)
layer ② = (55)(26)(0.43) = 615 psf
layer ② = (615) + 12'(57.5)0.43 = 912 psf

Case ① pressure

P: $\left[\left\{\frac{1}{2}\cdot(829)(26')\right\} + \left\{\frac{12}{2}(615+912)\right\}\right.$
$10777 + 9162$ = 19,939 #/ft

Add Hydrostatic pressure = (0.5)(2870)(46) = 66,010 = 85,949 #/ft

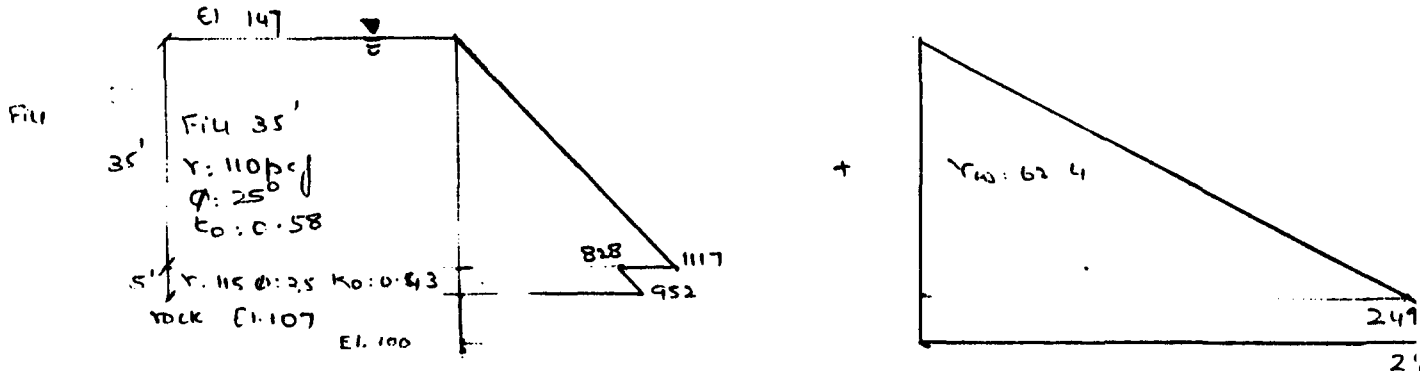
S.S.P Sed. Basin P.S. Earth Pressures

10.17.95/10/23/revised 8/8/96 – Deleted Rock Pressures.

Use P: 85,950 #/ft.

Resultant not @ 2/3 height → needs to be determined individually.

At DC – 35'.



layer ① $(55^{\#}/ft^3) \times 35' \times 0.58 =$ 1117 psf bottom

layer ② : $(55^{\#}/ft^3) \times 35' \times 0.43$: 828 psf top

layer ③ : $\{828 + (57.5)(0.43)(5')\}$ 952 psf bottom

Hydrostatic pressure : (62.4)(47') : 2933 psf.

Area under pressure diagram:

$P = \frac{1}{2}\times(1117^{\#}/ft^3)\times 35' + \{\frac{1}{2}(\frac{5}{2})(828+952)\} + \{\text{hydrostatic pressure } (0.5)(2935)(47)\}$

P : 19,508 + 4,450 + 68,972 : 92970 #/ft (93,000)

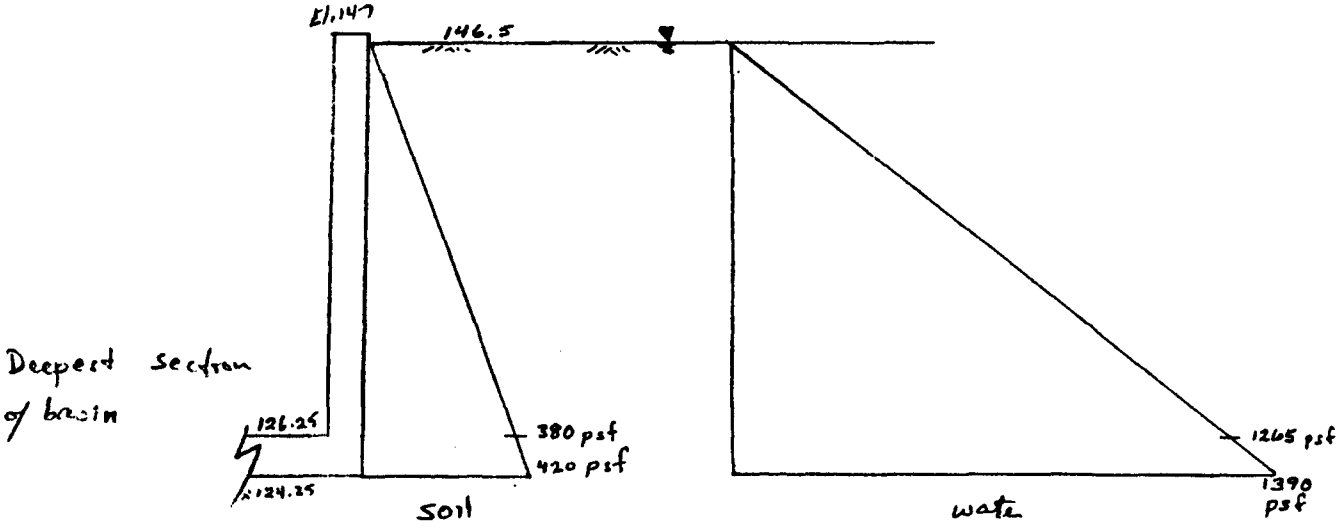
Earth pressure:

Use P: 93,000 psf for overall design @ Sed. Basin.

RWK
12/26/95

Dalecarlia - Georgetown Reservoir
Earth Pressure Diagrams

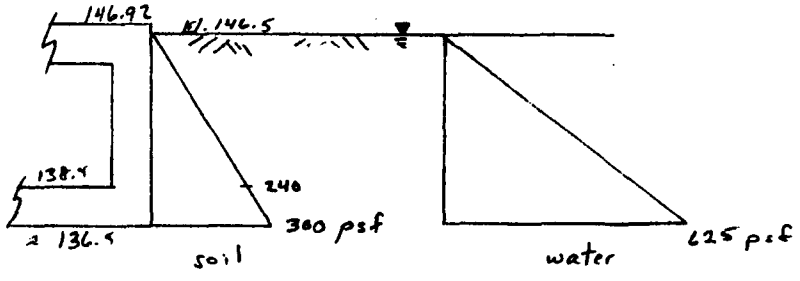
Basin Pressure Diagram



$P = (22.25'\times 65\ ^{\#}/_{ft^3}\times 0.29) = 419.4\ ^{\#}/_{ft^2}$ say $420\ ^{\#}/_{ft^2}$

$water = 22.25'(62.4\ ^{\#}/_{ft^3}) = 1388\ ^{\#}/_{ft^2}$ say $1390\ ^{\#}/_{ft^2}$

Pumping Station Pressure Diagram



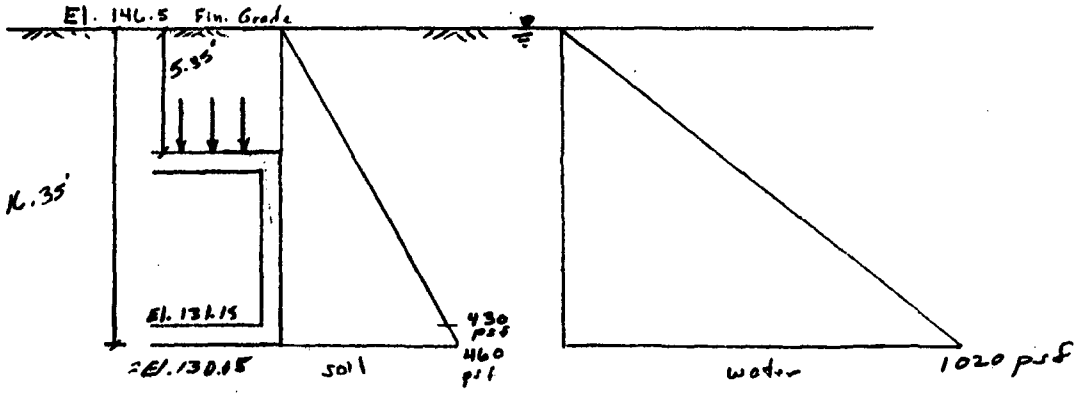
$P = (10'\times 65\ ^{\#}/_{ft^3}\times 0.46) = 299\ ^{\#}/_{ft^2}$ say $300\ ^{\#}/_{ft^2}$

$water = (10'\times 62.4\ ^{\#}/_{ft^3}) = 624\ ^{\#}/_{ft^2}$ say $625\ ^{\#}/_{ft^2}$

KWSC
12/26/95

Dalecarlia - Georgetown Reservoir
Earth Pressure Diagrams

Influent Conduit Pressure Diagram



$P = (16.35')(65\ \#/ft^3)(.46) = 489\ \#/ft^2$ say 490 psf

water $= 16.35'(62.4\ \#/ft^3) = 1020\ \#/ft^2$

PAVEMENT DESIGN

Date: 7 December 1995 **FLEXIBLE PAVEMENT DESIGN** Page 1
Sheet 1 of #2

Project: Dalecarlia Sludge Facility

Location: Dalecarlia Water Treatment Facility

Design By: RWC Checked By: ___

SECTION 1: PAVEMENT DESIGN

1. Strength Design: (Ref: TM 5-822-5 unless otherwise noted)

   a. Road Class = _ (Table 1 or 2 in TM 5-822-2)

   b. Traffic Category = E (Para 3-2a & b) Slow moving trucks, may have to stop

   c. Design Index = 5 (Para 3-2c)

   d. CBR = 6 (Laboratory Test Results)

   e. Design Thickness = 16 inches (Fig. 8-1 - Flexible Pavement Design Curve for Roads Streets, Open Storage and Parking Areas.

2. Frost Design: (Ref: TM 5-822-5)

   a. Limited Subgrade Frost Penetration Method (LSFP): (NOTE: All quantities in parentheses are to be assumed if more exacting values are not known or are not available.)

      (1) Design Freezing Index = 200 (Fig 18-2)

      (2) Base Course Water Content = (5%)

      (3) Dry Unit Weight of Base = 145 pcf

      (4) Total Frost Penetration = a = 23 inches (Fig 18-3)

      (5) Surface Course Thickness = p = 4 inches (Table 6-1)

      (6) Base Thickness for Zero Frost Penetration into Subgrade C = a - p = 19 inches

      (7) Ratio of Subgrade Water Content to Base Water Content = r = ≥3. Use 3

      (8) Design Base Thickness = b = 10.5 inches (Fig 18-4)

      (9) Subgrade Frost Penetration = a - 2.67 inches (Fig 18-4)

      (10) Design Thickness = b + p = 10.5 + 4 = 14.5 inches

      (11) Depth of Subgrade Preparation = 1/2(a)-(b+p) = -5 (0) inches

   b. Reduce Subgrade Strength Method (RSS):

      (1) Design Index = 5 (from 1c above)

      (2) Soil Frost Group = F3 F4 (Table 18-2)

(3) Frost Area Soil Support Indice = 3.5 (Table 18-3)

(4) Design Thickness = 21 inches (Enter Fig. 8-1, Flexible Pavement Design Curve for Roads, Streets, Open Storage and Parking Areas with Frost Area Soil Support Indice as the abscissa)

(5) Depth of Subgrade Preparation = 1/2(a)-RSS Design Thickness = 11.5 - 21 = -9.5 (0) inches

The frost design is controlled by either 2a(10) or 2b(4), whichever is less, but in no case will the pavement section be less than that required by the strength design. For this pavement the (RSS) (LSFP) method governs for the frost design.

3. Final Pavement Section: The final pavement design section will be the thicker of the Strength Design section (1) and the governing section for the Frost Design method (2). For this pavement, the (RSS) (LSFP) (STRENGTH) design provides the stronger section.

"BITUMINOUS CONCRETE (ROAD) (DRIVE) (PARKING AREA) PAVEMENT SECTION":

2½ " Bituminous Concrete Wearing Course
Tack Coat (if more than two days between placement of wearing and binder courses)
2½ " Bituminous Concrete (Wearing) (Binder) Course
Prime Coat (only if prolonged time between placement of base course & binder course)
10½ " Dense Graded Aggregate (DGA) Base Course
— " Rapid Drainage Material (RDM) Base Course
— " Dense Graded Aggregate (DGA) Base Course

SECTION 2: SUBGRADE AND SUBDRAINAGE REQUIREMENTS FOR INCORPORATION INTO PLANS & SPECIFICATIONS

1. Subgrade Preparation Requirements:

a. Compaction Requirements: (Ref: TM 5-822-5, Design Index = __ , Fig 2)

(1) **COHESIVE SOILS:** (Soils with PI > 5 and LL > 25)

Percent Compaction:	(Fig 2) Depth Below Pavement Surface (inches)	Total Pavement Thickness (inches)	Req'd Depth of Subgrade Compaction to % Shown (inches)	Depth of Subgrade Compaction In-place (6" max)	Depth of Subgrade Removal and Recompaction (inches)
100%				---	
95%					
90%					
85%					
80%					

Total depth of cohesive subgrade removal & recompaction: _____

SLOPE STABILITY ANALYSES

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*         SLOPE STABILITY ANALYSIS        *
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"Dalecarlia WTP slope stability under retained fill load SECTION X-X"

CONTROL DATA

NUMBER OF SPECIFIED CENTERS	0
NUMBER OF DEPTH LIMITING TANGENTS	0
NUMBER OF VERTICAL SECTIONS	18
NUMBER OF SOIL LAYER BOUNDARIES	5
NUMBER OF PORE PRESSURE LINES	0
NUMBER OF POINTS DEFINING COHESION PROFILE	0

SEISMIC COEFFICIENT S1,S2 = .05 .00

SEARCH STARTS AT CENTER (140.0, 30.0),WITH FINAL GRID OF 10.0

ALL CIRCLES PASS THROUGH THE POINT (192.0, 98.0)

GEOMETRY

SECTIONS	.0	20.0	30.0	31.0	76.0	77.0	90.0	92.0	93.0	99.0	100.0	117.0	140.0	180.0	192.0	210.0	230.0	280.0
T. CRACKS	70.0	70.0	70.0	69.0	69.0	70.0	70.0	70.0	68.0	68.0	70.0	70.0	78.5	93.5	98.0	98.0	95.0	95.0
W IN CRACK	70.0	70.0	70.0	69.0	69.0	70.0	70.0	70.0	68.0	68.0	70.0	70.0	78.5	93.5	98.0	98.0	95.0	95.0
BOUNDARY 1	70.0	70.0	70.0	69.0	69.0	70.0	70.0	70.0	68.0	68.0	70.0	70.0	78.5	93.5	98.0	98.0	95.0	95.0
BOUNDARY 2	70.0	70.0	70.0	69.0	69.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	78.5	93.5	98.0	98.0	95.0	95.0
BOUNDARY 3	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	78.5	93.5	98.0	98.0	95.0	95.0
BOUNDARY 4	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0
BOUNDARY 5	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0

SOIL PROPERTIES

LAYER	COHESION	FRICTION ANGLE	DENSITY
1	.0	.0	4375.0
2	.0	.0	937.5
3	.0	33.0	110.0
4	.0	35.0	115.0

NUMBER	TANGENT	RADIUS	(X) CENTER	(Y) CENTER	FS(BISHOP)	FS(OMS)
1	115.6	85.6	140.0	30.0	2.530	2.200
2	105.2	75.2	160.0	30.0	1.629	1.412
3	99.1	69.1	180.0	30.0	1.698	1.623
4	107.7	87.7	100.0	50.0	2.272	1.951
5	103.6	93.6	160.0	10.0	1.576	1.427
6	100.7	90.7	170.0	10.0	1.885	1.793
7	104.3	84.3	160.0	20.0	1.503	1.308
8	101.0	81.0	170.0	20.0	1.860	1.749
9	105.2	75.2	160.0	30.0	1.629	1.412
10	108.6	88.6	150.0	20.0	1.981	1.780
11	101.5	71.5	170.0	30.0	1.854	1.718
12	109.9	79.9	150.0	30.0	1.937	1.686
13	107.5	97.5	150.0	10.0	2.002	1.835
14	100.7	90.7	170.0	10.0	1.885	1.793

F.S. MINIMUM= 1.503 FOR THE CIRCLE OF CENTER (160.0, 20.0)

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* STABRG *
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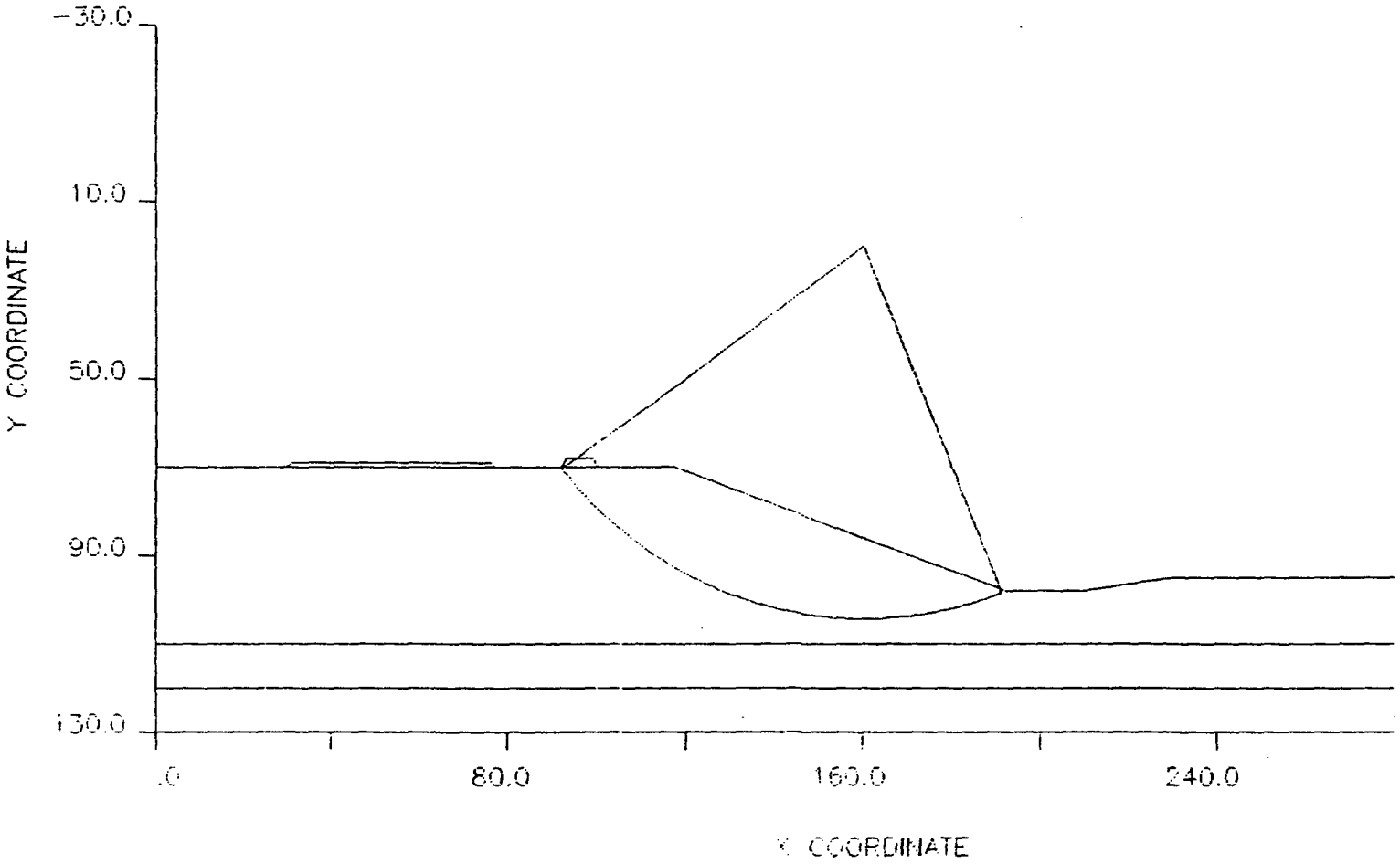
LAYER	COHESION	FRICTION ANGLE	DENSITY
1	.0	.0	4375.0
2	.0	.0	937.5
3	.0	33.0	110.0
4	.0	35.0	115.0

FACTOR OF SAFETY 1.50



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"Dalecarlia WTP slope stability with SWM SECTION Y-Y"

CONTROL DATA

NUMBER OF SPECIFIED CENTERS	0
NUMBER OF DEPTH LIMITING TANGENTS	1
NUMBER OF VERTICAL SECTIONS	16
NUMBER OF SOIL LAYER BOUNDARIES	4
NUMBER OF PORE PRESSURE LINES	0
NUMBER OF POINTS DEFINING COHESION PROFILE	0

SEISMIC COEFFICIENT S1,S2 = .05 .00

SEARCH STARTS AT CENTER (100.0, 30.0),WITH FINAL GRID OF 10.0

ALL CIRCLES TANGENT TO DEPTH, 65.0,

GEOMETRY

SECTIONS	10.0	20.0	25.0	30.0	35.0	45.0	51.0	51.5	58.5	59.0	70.0	77.0	100.0	144.5	156.0	200.0
T. CRACKS	32.0	32.0	32.0	32.0	31.0	31.0	31.0	29.0	29.0	31.0	31.0	31.0	41.5	59.0	60.0	60.0
W IN CRACK	32.0	32.0	32.0	32.0	31.0	31.0	31.0	29.0	29.0	31.0	31.0	31.0	41.5	59.0	60.0	60.0
BOUNDARY 1	32.0	32.0	32.0	32.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	41.5	59.0	60.0	60.0
BOUNDARY 2	38.0	38.0	36.0	33.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	41.5	59.0	60.0	60.0
BOUNDARY 3	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
BOUNDARY 4	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0

SOIL PROPERTIES

LAYER	COHESION	FRICTION ANGLE	DENSITY
1	.0	.0	62.4
2	.0	33.0	110.0
3	.0	35.0	120.0

NUMBER	TANGENT	RADIUS	(X) CENTER	(Y) CENTER	FS(BISHOP)	FS(OMS)
1	65.0	35.0	100.0	30.0	2.825	2.195
2	65.0	35.0	120.0	30.0	2.231	1.830
3	65.0	35.0	140.0	30.0	2.099	1.848
4	65.0	35.0	160.0	30.0	6.605	6.120
5	65.0	15.0	140.0	50.0	2.770	2.168
6	65.0	55.0	140.0	10.0	1.921	1.751
7	65.0	55.0	160.0	10.0	3.901	3.637
8	65.0	55.0	120.0	10.0	1.924	1.689
9	65.0	75.0	140.0	-10.0	1.798	1.664
10	65.0	75.0	160.0	-10.0	2.920	2.738
11	65.0	75.0	120.0	-10.0	1.945	1.789
12	65.0	95.0	140.0	-30.0	1.783	1.680
13	65.0	95.0	150.0	-30.0	1.908	1.793
14	65.0	85.0	140.0	-20.0	1.773	1.654
15	65.0	85.0	150.0	-20.0	1.986	1.860
16	65.0	75.0	140.0	-10.0	1.798	1.664
17	65.0	85.0	130.0	-20.0	1.813	1.694
18	65.0	75.0	150.0	-10.0	2.077	1.937
19	65.0	75.0	130.0	-10.0	1.785	1.646
20	65.0	95.0	130.0	-30.0	1.858	1.754
21	65.0	95.0	150.0	-30.0	1.908	1.793

F.S. MINIMUM= 1.773 FOR THE CIRCLE OF CENTER (140.0, -20.0)

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*     STABRG     *
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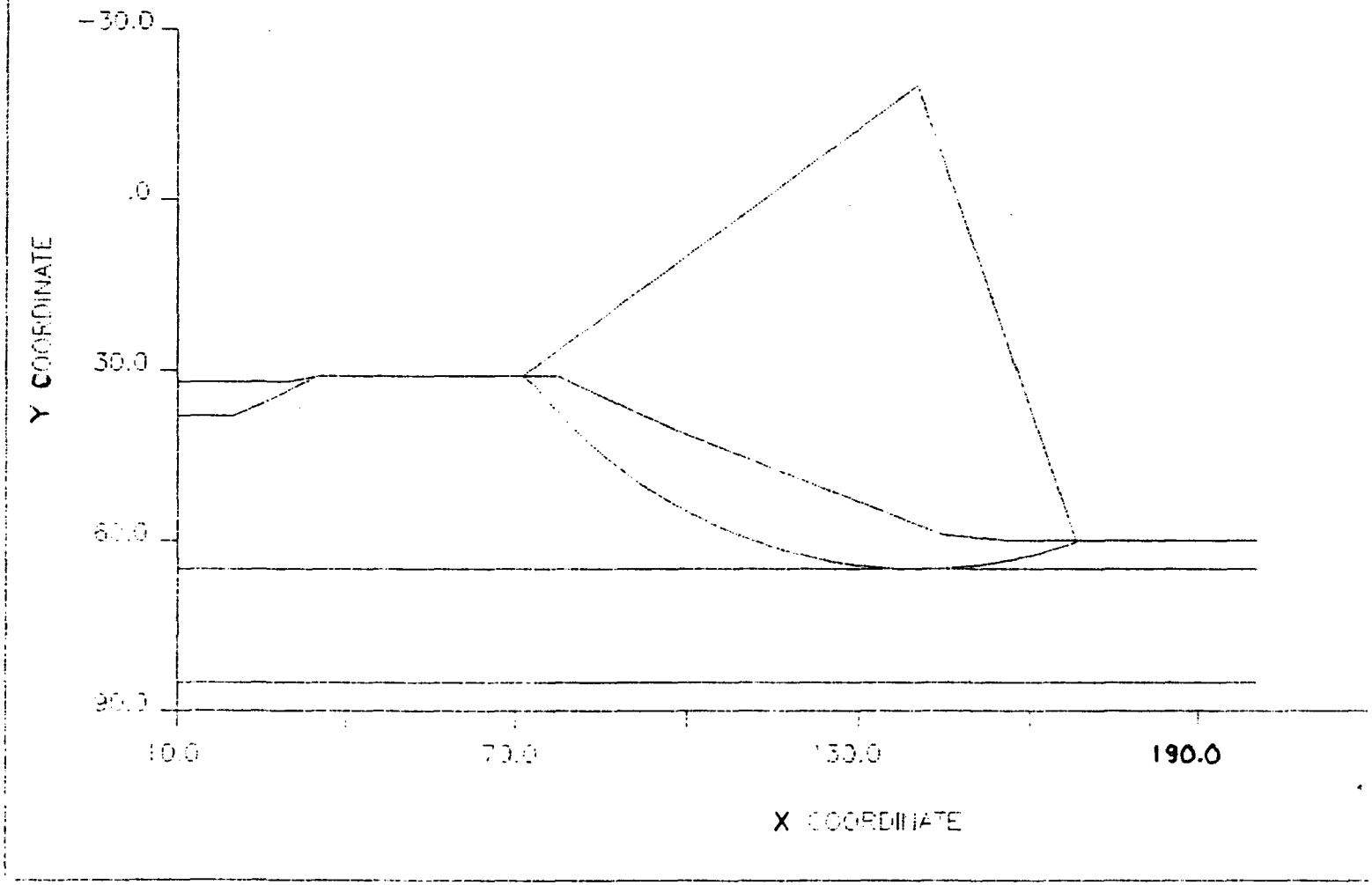
LAYER	COHESION	FRICTION ANGLE	DENSITY
1	.0	.0	62.4
2	.0	33.0	110.0
3	.0	35.0	120.0

FACTOR OF SAFETY 1.77

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