Attachments:

Volume 10 – Attachments

Delete the following pages and in lieu thereof replace the accompanying pages:

DELETE	REPLACE	DESCRIPTION
N/A	MRWJ-117-1974 MR Subsurface Investigation	New
N/A	Bethesda Visual Survey Photographs	New

REPORT NO. 18
CONTRACT MODS. NOS. 3Z725K-003, -008 AND -015 (REPORT NO. 117, MRWJ SERIES) SECTION A011, ROCKVILLE ROUTE SUBSURFACE INVESTIGATION

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December 30, 1974

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15. Supplementary Notes

16. Abstracts

Results are summarized herein of 59 deep borings made at the locations of running tunnels, two subway stations in rock and various ancillary structures in Section A011 of Rockville Route, generally following Wisconsin Avenue between Elm Street and the Capital Beltway in Maryland northwest of the District of Columbia. The investigation include photography in a selected group of borings, special laboratory tests of rock drillability and direct shear characteristics of joint planes in addition to the usual unconfined compression and in-situ water pressure testing of the rock. The report includes a continuous geological section along the line of the tunning tunnels through the test borings, logs of these borings, results of laboratory tests on soil samples and on rock cores and summaries of the special rock investigations performed by others.

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December 30, 1974

Mr. Roy T. Dodge, Contracting Officer
Washington Metropolitan Area Transit Authority
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Washington, D.C. 20001

Re: Report No. 117, Contract Mods. Nos. 3Z725K-003, -008 and -015, Section A011, Rockville Route, Subsurface Investigation

Dear Mr. Dodge:

In accordance with the terms of Modifications Nos. 003, -008 and - 015 of Contract No. 3Z725K, we submit herewith fourteen copies of this report covering fifty nine borings made at the location of running tunnels, two subway stations and ancillary structures of Section A011 of Rockville Route. This work was done at the request of the Section Designer, Mathews-Chatelain-Beall, and one copy of the report is being sent directly to their Rockville, Maryland office. Because considerable delay had been occasioned by the rather complicated investigations contained in this study, a final draft of this report was issued on October 31, 1974 which was circulated to MCB to assist them in completing their geotechnical report. At the present time a group of supplementary borings requested by the Section Designer at the location of a planned parking facility in the Pooks Hill area is currently in progress. This work is to be covered by an additional modification and will be reported separately when field work is completed.

Several separate reports by special consultants have been authorized in this investigation and basic conclusions from these reports have been reprinted and assembled following the text

and tables. Each one of these reports is fairly voluminous and an original is being submitted to your office so that they may be reproduced as needed as information for bidders. We believe that this submittal completes all of the work required under the three Contract Modifications.

Very truly yours,

MUESER, RUTLEDGE, WENTWORTH & JOHNSTON

By James P. Gould
James P. Gould

JPG:ig

REPORT NO. 18
CONTRACT MODS. NOS. 3Z725K-003, 008 & 015
(REPORT NO. 117, MRWJ SERIES)
SECTION A011, ROCKVILLE ROUTE
SUBSURFACE INVESTIGATION

1. INTRODUCTION

1.1 Authorization

Contract No. 3Z725K between the Washington Metropolitan Area Transit Authority (WMATA) and Mueser, Rutledge, Wentworth & Johnston (MRWJ) provides for boring investigations, laboratory testing and summary reports relating to certain sections of the Rapid Transit System. A series of three Modifications to that Contract covered exploration work requested by Mathews-Chatelain-Beall, designers of Section A011, to provide information for their planning and design of contract work in that section. These modifications are as follows:

1. Modification No. 003 provided for 54 borings to be made generally throughout the section to supplement earlier data and to cover changes of alignment.

2. Modification No. 008 provided for 10 borings chiefly in connection with a change in location of the planned Medical Center and its ancillary facilities.

3. Modification No. 015 provided for four borings to be made on the median strip of Wisconsin Avenue along the centerline of Medical Center Station at its final planned position.

The Section Designer stipulated that special testing of rock cores be carried out to obtain information on the practicability of drilling with a tunnel boring machine and to determine typical friction angles on joint planes along with the usual rock compression and water pressure tests.

Several earlier investigations had been made in this area which are summarized in the following MRWJ reports:

1. Preliminary Subsurface Investigation, Adopted Regional System 1968, dated February 1969 (MRWJ Series Report No. 33) covering borings of the 7-series.

2. Final Report, Subsurface Investigation, Rockville Route, Stations 221 (A009) to 590 (A013), dated March 1972 (MRWJ Series Report No. 58) covering borings of the A-series.

Borings from these earlier studies that are pertinent to the locations currently investigated have been utilized herein. In addition to the reports specifically concerned with Section A011, MRWJ Report No. 82 of April 18, 1973 covers supplementary work in Section A009 which abuts A011 on the south. Additional exploration in Section A013 which abuts A011 on the north has recently been completed and will be included in MRWJ Report No. 121.

1.2 Scope of Work

A total of 59 test borings of the AM-series covered by the three contract modifications were performed by Empire Soils Investigations, Inc. working continuously from September 1973 to August 1974 under the inspection of MRWJ resident engineers. While as many as four rigs were stipulated in the contract for field operations, difficulties with obtaining access permits and numerous changes of location occasioned by planning decisions caused the work to extend far beyond the expected time. At the date of this report a group of seven supplementary borings requested by the Section Designer were in progress at a planned parking facility at Pook's Hill. Five observation wells were placed in boreholes for continuing measurement of ground water levels. Casings were left in place through the overburden and seated in rock to prepare for photography in five selected borings at the two stations. Overburden sampling included the standard 1-1/2 inch diameter split-spoon and 3-inch undisturbed samples, all of which were delivered to our New York laboratory for examination, check of field classification and performance of identification and engineering properties test. Rock drilling was of NX-size with cores of 2-1/8 inch diameter, except that three borings were made with a larger barrel yielding 4-inch diameter cores. Special field investigations included borehole photography, performance of water pressure tests in a number of borings and routine falling-head permeability testing in any borings as conditions permitted. Selected rock core specimens were subjected to the following categories of tests: conventional unconfined compression, petrographic analysis of thin sections; hardness tests relating to drillability characteristics; and direct shear tests on certain rock joints.

Because of the length of time over which this investigation extended it impinged to a significant degree on the work of the Section Designer and consequently it was necessary to meet with the designer on a number of occasions to examine rock cores obtained, to review borehole photography

results and to discuss basic design criteria. These meetings were summarized in a number of letters and memoranda from our office.

2. BORING AND FIELD TEST PROGRAMS

2.1 Presentation of Boring Data

Locations of all available borings of the several series are plotted on strip maps in ten segments on four drawings, Nos. F-A-86 through -89. Information from the 59 supplementary borings is plotted on a series of ten geological section drawings Nos. F-A-90 through -99, providing a continuous longitudinal profile through Section A011. The sections commence at the north end of the line near the Capital Beltway and continue to the south limit at Elm Street with the direction of view toward the east. On two of these drawings incorporating Medical Center and Bethesda Stations two parallel longitudinal sections have been drawn, one for the east side and one for the west side of the station. In addition a group of four natural scale cross-sections at each of the two stations are presented on four drawings, Nos. F-A-100 through F-A-103. Boring and sampling data and bedrock index properties from borings of the AM-series are shown in symbol form on these sections in the manner employed in earlier investigations. Detailed information from borings of the A-series and 7-series covered by earlier referenced reports are not repeated on these sections.

Logs of all AM-series borings made in the current investigation are given on Drawings Nos. F-A-105 through F-A-122. These logs are based on our laboratory examination and identification testing of samples, and, in a number of cases, on selected review of the rock cores and they differ in certain interpretations from the original field boring logs copies of which will be placed on file with WMATA. Coordinate locations of the borings are listed in Table No. 1. General Information Drawing No. F-1 presents notes and legends applicable to the geological section and boring log drawings.

In an effort to maximize core recovery and retain the core as much as possible in an undisturbed condition, a split-barrel diamond drill coring device was stipulated in the specifications. This comprises an outer coring barrel and an inner retaining tube both split longitudinally with the inner tube secured by tapes. After a core run is complete the barrel is removed and the outer and inner tubes opened. A semi-cylindrical cardboard holder is placed over the core and that holder with the core is turned over and transferred to the core box. In this manner the relative position of rock pieces is maintained and broken or weathered fragments are

kept as far as practicable in their original arrangement and orientation.

2.2 Borehole Photography

In accordance with the Section Designer's request and to provide additional details relating to joint attitude of bedrock, borehole photography was carried out within the rock sections of five of the supplementary borings, two at Medical Center Station and three within the planned Bethesda Station. This work was performed between June 6 and 8, 1974 by a field party of the U.S. Army Corps of Engineers, Southwestern Division Laboratory of Dallas, following a request to the Department of the Army for these services from WMA TA. In order to obtain an independent expert interpretation of the photographic results, MRWJ retained the services of Mr. Robert J. Nesbitt, Consulting Engineering Geologist, formerly Chief Geologist in the office of Chief of Engineers, Department of the Army, who has been instrumental in the development of the borehole photography technique. His report dated August 20, 1974 includes a summary made by Southwestern Division Laboratory which gives a brief commentary on the character of the bedrock, detailed photologs, polar diagrams of joint frequency versus attitude and plots on which the joint planes noted in the borings are projected to the tunnel cross-sections. That complete information is on file at WMA TA and should be consulted for a comprehensive record of the results. The text of Mr. Nesbitt's summary has been reprinted and included with this volume. On September 4, 1974 he reviewed his interpretation in a meeting with the Section Designer at the rock core storage in WMA TA warehouse.

Photographs were taken utilizing the Republic Engineering and Manufacturing Company NX-borehole camera. The camera is enclosed in a probe 2-3/4 inch in diameter and 30 inches long which is lowered in the hole to take a series of pictures on a 16mm color film strip at 3/4 inch vertical intervals for the full length of the borehole in rock. The pictures projected on a flat screen exhibit the series of annular sections which represent a 360^{o} view of the 3/4 inch high portion of the walls of the hole with an arrow indicating magnetic north photographed within the interior circle. If this annulus is projected onto a cylindrical screen, using procedures developed in the office of Chief of Engineers, the strike of structural features and a dip angle can be determined. It should be noted that the summary of Southwestern Division Laboratory and Nesbitt's report refer to magnetic north as viewed directly in the photography. Declination of magnetic north at this longitude is approximately 7^{o} west of true north which is used as a basis for the project grid and the mapping coordinates.

Three borings at Bethesda Station, Nos. AM-3U, -4 and -60 were cased through overburden down to the depth at which continuous coring started for the photography. Despite protracted cleaning, the water in AM-3U remained cloudy, probably because of sloughing of fines from weathered bedrock directly beneath the casing, and the photographs were unsatisfactory. At Medical Center Station Borings Nos. AM-68 and -70 were prepared for photography. The same difficulty with fines continuously sloughing from beneath the casing was encountered in No. AM-68 and its pictures were unsatisfactory.

The significance of the data obtained from the borehole photography is discussed in later sections on subsurface conditions.

2.3 Falling-Head Permeability Tests

During the supplementary exploration a total of 58 falling-head permeability tests were performed in the field in cased boreholes and in standpipes of the observation wells. Information regarding conditions of the test and computed permeability coefficients are listed on two sheets of Table No. 3. Tests were performed by raising the water level and observing the time rate of return to an equilibrium position. The differential head thus obtained plotted on a logarithmic scale against elapsed time on an arithmetic scale should form a straight line. A coefficient of permeability is computed by dividing the straight line slope by a shape factor whose value depends on the flow pattern to the borehole. The principal stratum opposite the opening in the borehole, which is assumed to control inflow to the opening during the test, is listed in Table No. 3. These tests were chiefly performed in portions of the bedrock which were open below the casing which had been carried through overburden.

The median value of all these tests equals 2×10^{-4} ft. per minute which indicates the generally tight nature of the rock encountered. This result is similar to median values obtained in similar tests in adjacent Section A009. There are several instances where water could not be added to the borehole fast enough to create an observable rise in the water level and in these instances the permeability is estimated to be greater than 1×10^{-2} ft. per minute. Borings exhibiting unusually high permeability included Nos. AM-13, AM-23 and AM-46 in the deeply weathered upper portions of bedrock where a series of zero RQD values were obtained in the coring. It should be noted that the permeability values are not necessarily a realistic indication of the quality of rock since in the falling head tests fine particles can move outward into voids and joints, reducing their apparent overall permeability. Joints which are weathered to the extent that they contain a coating of soil may exhibit a low permeability and little flow potential in the tests but they would respond in quite a different manner to inflow of seepage after the disturbance

of the joint system during excavation.

2.4 Water Pressure Tests

A total of 53 individual water pressure tests were performed below drill casing within bedrock sections of the boreholes and basic information and permeability values computed from these tests are noted on seven pages of Table No. 4. The purpose of such a test was to investigate variations in bedrock permeability to ascertain if highly pervious jointed zones existed where intense inflow of seepage might occur. It was expected that zones exhibiting high permeability might also be a location of poor quality rock which could lead to structural difficulties in construction. After the NX-size borehole was cased to the top of rock and completed to the planned bottom elevation, the hole was cleaned until wash water appeared to be clear of fines. Then a pipe containing two hard rubber packers with a perforated pipe section about 5 feet long between packers was lowered to a predetermined depth below top of bedrock. The test was performed by pumping water into the space between packers through the pipe which extended through the upper packer to the surface. Gage pressure on the water pipe was build up to maximum values between 30 and 90 psi in the tests. After reaching this pressure the total quantity of inflow into the hole was measured by a calibrated water meter and recorded at 1 to 5 minute intervals over a total testing time of typically 30 minutes to one hour. From these records the average time rate of inflow into the opening was determined and permeability was computed by applying a shape factor to the physical qualities obtained during the test.

Of 53 tests a total of 22 accepted no measurable inflow of water for the duration of test. Median permeability of the other 31 tests equals 2×10^{-4} ft. per minute, essentially equal to the falling-head test results. Test values of coefficient of permeability in feet per minute are noted in the geological sections at a position on the boring which represents the length exposed between packers. Unfortunately, because many of the borings were made before the final grade of the rock tunnels were established, a number of the tests are for depths below the tunnel opening.

3. LABORATORY TESTING PROGRAM

3.1 Soil Testing

In this supplementary investigation of Section A011 the character of overburden soils was primarily of interest in connection with shaft and

entrance construction and for the retained cut and cut-and-cover excavation at the north end of the section. Thin-tube sampling was confined to recovery of 3-inch undisturbed tubes all of which were transported to our New York laboratory for tests of engineering properties. These included determination of water content and occasional grain size and Atterberg limit tests, plus measurement of shear strength by unconfined compression, unconsolidated-undrained triaxial shear and direct shear tests. Results of all testing performed on undisturbed samples are summarized in Table No. 2. Split-spoon samples were examined in the laboratory, field classifications were checked and water contents determined on all fine-grained materials. Unified Classification of each soil sample and the average natural water content are noted on the geological sections at the location of the particular sample in the boring.

Overburden soils throughout A011 comprise material residual from decomposition of the bedrock and fill composed chiefly of this decomposed rock. Six Atterberg limit tests were performed on the residual soil and the fill with results summarized on a plasticity chart of Plate No. 1. Grain-size characteristics of the decomposed rock are quite regular and are portrayed by a series of 15 gradation curves in Plates Nos. 2, 3 and 4.

3.2 Strength of the Residual Soil Stratum of the Decomposed Rock

Unconsolidated-undrained (UU) triaxial tests are carried out in the triaxial cell, the confining pressure applied without permitting drainage, followed by shear while increasing axial load, also with no drainage. The confining pressure has the effect of restraining failure which might occur at too low stresses due to the presence of sand pockets or partings, or fractures and cracks, and it compensates in part for possible sample disturbance. Ideally undisturbed, homogeneous, saturated specimens of particularly clayey soil from a single sample sheared undrained under different chamber pressures should all exhibit the same deviator stress at failure and therefore the Mohr's envelope for such a group of tests would plot as a horizontal straight line. A total of 48 of these triaxial tests were performed in this study on samples of decomposed rock of Stratum D or, in several instances, on the overlying fill derived from this material and these tests are summarized in sixteen Mohr's envelope diagram in Plates Nos. 5 through 20. The overall average values of shear strength from these triaxial tests are as follows:

8 tests on fill: average = 2.6 ksf
40 tests on decomposed rock: average = 2.3 ksf

In a number of instances the decomposed rock samples are coarse enough to act essentially as a friction producing material in the triaxial tests, exhibiting

a significant increase in strength with confining pressure. Eight Mohr's circle diagrams with this characteristic give the following strength parameters:

Angle ϕ = 24°
Apparent cohesion = 0.3 tsf

These values suggest that small to medium positive pore water pressures are developed in the decomposed rock during shear. They are to be compared with the following results of seven drained direct shear tests recorded on Plates Nos. 21 through 27:

Angle ϕ = 30°
Cohesion = 0.2 tsf

It must be recalled that the thin-tube sampling could recover only the upper thoroughly decomposed residual soil. In fact no undisturbed samples were obtained below 24-foot depth. Below some such level the material becomes denser, coarser and increasingly rock-like. The samples tested are undoubtedly softer than the lower, less thoroughly decomposed, material. In the residual soil above about 20-foot depth the shear strength may be expressed by an equivalent friction angle of 32°. In the transition zone between the decomposed rock and weathered rock a friction angle of 36° is suggested.

3.3 Unconfined Compression Tests on Rock Cores

Results of 76 unconfined compression tests performed on specimens selected from NX-rock cores of the AM-series borings are summarized in Table No. 5. These specimens were taken from a range of elevations to represent material that would appear within or directly above the tunnel opening and since the choice was made in later stages of the boring program the core positions correspond fairly well with final tunnel locations. NX cores of 2-1/8 inch diameter were cut in lengths of 4-1/4 to 4-1/2 inches and tested without confining pressure in a controlled stress rate machine wherein stresses were increased at an average rate of 35 psi per second until failure. Test values of peak compressive strength range from 500 psi to 27,500 psi and reflect both differences in basic rock type and in the degree of weathering or alteration of the rock. Individual values in kips per sq.in. are noted at the position of the core tested on the geological sections within a rectangular symbol. The average of all 76 compressive strength tests equals 8,700 psi. To put these data in perspective they may be considered with results of similar compression testing on earlier designs of Rockville Routes.

These results are generally as follows:

Section	Boring Series	No. of Tests	Average Compressive Strength, psi	Average RQD of Tested Cores
A006	III-Series	127	6,400	not taken
A006	RP-Series	45	7,500	75
A009	A-Series	82	7,500	70
A011	A-Series	34	9,600	65
A011	AM-Series	76	8,700	79

The unusually high values that were obtained in certain tests apply to indistinctly foliated quartz-hornblende diorite and the lower values apply to schistose rock with strong foliation and comparatively high percentage of hornblende or chloritic minerals. It should be recognized that the rock compression test is primarily an index or classification test, indicating relative quality of rock from various locations and depths. Even the weaker test strengths cannot be applied directly in design since they would show that the rock has a quality of mediocre strength concrete. While foliation and weakening of inter-particle bonds by weathering undoubtedly influences many test values of compressive strengths, the crucial material which controls loads applied to the temporary or permanent supports of the underground structures has been broken in the coring and cannot be tested or is missing entirely in the recovered cores.

3.4 Tests Relating to Drillability Characteristics of Rock

To evaluate the feasibility of using a tunnel boring machine on A011 contract work, the Section Designer requested a special series of tests relating to rock drillability be undertaken at the University of Illinois. A group of 38 core specimens were selected for drillability tests from the AM-series borings and delivered to the University of Illinois laboratory. A preliminary report by P.J. Tarkoy and E.J. Cording was submitted on September 17, 1974 and their final report, entitled, "Feasibility of Using a Tunnel Boring Machine on Project A-11, METRO, Washington, D.C." was dated December 10, 1974.

Since tunnel boring machines have been utilized in the running tunnel contract of Section A006, an important body of field experience is available which may be relevant to other sections of Rockville Route. In order to be able to utilize this experience in comparison with Section A011, we asked P.J. Tarkoy to select a series of samples from the A006 core boxes, 22 of which were collected by our field staff and delivered to their laboratory.

A complete series of their index properties tests consist of determination of rock unit weight, unconfined compressive strength, sonic velocity, and four parameters relating to hardness. A combination of two of these latter parameters in the "total hardness" appears to be the most useful factor in establishing an empirical relationship with TBM rates of penetration. Total hardness has been determined for all drillability samples from A006 and A011 and the complete set of index properties performed on certain samples selected from both groups. The locations of all core pieces selected for drillability tests in A011 are not noted by the symbol "DR" on the geological sections. Results of these tests are noted in Tables IIa, IIb and III of their December 10 report. In general the rock types of Section A011 exhibit more uniform and a somewhat higher average total hardness value than the samples of Section A006. Overall characteristics are similar enough to expect a TBM operation in A011 comparable to the rather favorable experience in A006. For identification, the title page and several summary pages of their text are bound in this volume at the end of our report. Their full report will be available for bidder's information. Included with their report as Appendix A are a series of petrographic analyses for sixteen rock chips from cores taken chiefly in the Medical Center Station area. These were performed by R. Kern of the University of Illinois in connection with A011 rock studies and that data was provided to assist in evaluation of drillability characteristics.

3.5 Rock Joint Shear Test

Pursuant to the Section Designer's request, a group of seven rock core specimens were selected from the AM-series borings for direct shear tests on natural rock joint planes to be performed at University of Illinois. These specimens each consisted of two adjacent core pieces meeting at a prominent joint. The joints are principally in diorite or meta-diorite with smooth but not slickensided surface containing little or no clay gouge but thin talc coatings. These were chosen because of the difficulty of preserving joint specimens with appreciable clay gouge and in consideration of the fact that gouge-filled joints had been tested previously by University of Illinois in Section A006. Their preliminary report of September 27, 1974 summarized test results on joint specimens taken previously in Sections A004b and A006. A final report by A.S. Nieto and E.J. Cording, entitled, "Direct Shear Tests on Natural Fractures in NX Core from Project A-11, Washington, D.C. METRO,"

of December 11, 1974 gives details on the results of direct shear tests on 5 joint specimens from Section A011. The title page and certain summary pages from each of these two reports are bound in this volume. The complete data will be available for bidder's information. They conclude that a conservative estimate of the shear strength for shear zones could be obtained with a total friction angle of 15^{o}.

4. OVERALL SUBSURFACE CONDITIONS AND GEOLOGIC SETTING

4.1 Principal Rock Types

The igneous and metamorphic bedrock complex in the Washington, D.C. area originated in the upgrading by metamorphism of broad areas of clayey and sandy sediments of lower Paleozoic Wissahickon formation. This material is part of an extensive band of ancient rocks extending from New England to Alabama and represented by such materials as the Manhattan group of New York City and Wissahickon schist in Philadelphia. The principal types represented in Section A011 are as follows:

(1) Typical schistose gneiss of the country rock comprising chiefly quartz and mica with lesser hornblende and including related chloritic rocks.

(2) Quartz-diorite gneiss, generally comprising metamorphics derived from coarser parent materials than the schistose gneiss. These also include meta-diorites and diorites of indistinct foliation which exhibit less metamorphism than the diorite gneiss but comprise similar mineral aggregates.

(3) A group of amphibolites including hornblende schist or schistose gneiss and chlorite schist ordinarily represents the weakest materials derived from the finest grained sediment.

A geologic study of a nearby area was recently completed by F.D. Patton, consulting engineering geologist,for Sections B009, B010 and B011 of Glenmont Route and presented in his report to WMATA dated July 29, 1974. That report included a geologic map of an area adjacent to Glenmont Route north of the District boundary. A portion of his data has been utilized in our map of Plate No. 28 which illustrates the general banding of rock types and principal topographic features between Glenmont and Rockville Routes.

4.2 Attitude of Rock Structure

Plate No. 28 shows that Section A011 following Wisconsin Avenue lies on the west of the drainage pattern to Rock Creek, at a position near the head of a number of streams draining in echelon on lines directed N60°E to N40°E, separated by low ridges similarly oriented. The diorite gneiss group is the dominant rock within Section A011. Schistose gneiss and amphibolites cover much less of the length of section but represent weaker and more difficult materials. Locations of poorer bedrock quality or deeper weathering typically correspond with topographic lows.

In general the bedrock structure mapped by Patton in the Glenmont area has a strong north-northeast to south-southwest grain in the Piedmont north of the District boundary. Foliation and the principal faults shears and joints on Glenmont Route correspond to this lineation. Available mapping in the literature and borehole photography in this study indicate foliation and principal joints in Section A011 strike a few degrees west of north and dip steeply west. Information from several sources on attitudes of the joint sets in the general area or specifically within Rockville Route is summarized in Table No. 6. The order of the joint sets is that established by University of Illinois investigations in the rock tunnels of A004.

4.3 Conditions of Weathering

Section A011 in the upper reaches of Rock Creek drainage exhibits a substantial cover of materials that comprise the products of weathering in-situ. In an effort to avoid misunderstandings as to the character of these materials, a system of designations has been adopted for the overburden which is described in the following subsections:

4.301 Decomposed Rock. Overburden above bedrock in the profile of weathering has been grouped in the boring logs in one broad category as "decomposed rock" which is derived from decay of parent rock in-situ. Decomposed rock is primarily silty sand with scattered rock fragments in its upper portion, becoming coarser, fresher, denser and more rock-like with increasing depth. Borings were advanced in this overburden by driving a casing and washing and chopping inside the casing or in advance of the casing as the materials became more compact; or by rotary drilling with a roller bit for which casing was lowered in the hole to the level at which caving was no longer a threat. A borehole was carried by these methods to the level at which practical refusal was reached which is traditionally designated as the "top of bedrock". In the geological sections and the text of this report certain alterations have been made in these conventional interpretations.

4.302 Residual Soil. In this study the decomposed rock is divided into two categories, an upper "residual soil" which is expected to consist almost entirely of soil-like material and a lower "transition" zone which is expected to contain chiefly rock-like remnants surrounded and separated by soil. This distinction reflects the fact that weathering progresses downward on joint planes and zones of weakness, expanding in all directions from these loci as seeping water and oxidation has weakened the crystalline matrix. In the transition zone "core stones" may be surrounded by soil but the percentage of these core stones increases with depth as the thickness of soil between them decreases. The division between residual soil and the transition zone is important for any excavations for shafts or entrance structures which extend down to the rock tunnels. The estimated approximate dividing line between the residual soil and transition zone is plotted as a long dash-dot line in the sections and is noted by symbol on the boring logs and is distinguished as follows:

1. If a casing can be advanced by ordinary washing and chopping either within the casing or several feet in advance of casing, the material penetrated is still residual soil. Where casing reaches practical refusal and an open hole can be continued with a roller bit without caving the transition zone may have been entered.

2. Standard sampler penetration resistance at the base of the residual soil passes from a fairly high blow count to a very high blow count, changing rather abruptly from less than 100 blows per foot to much more than 100 blows per foot. Deere and Patton have suggested a penetration resistance of 100 blows per foot as the single criterion for the base of residual soil. We feel that this is perhaps the most important single indicator but the judgement should be weighed with other factors.

3. A split-spoon sample recovered from the lower residual soil consists of a solid chunk of very compact silty sand, usually deep red-brown in color, and showing much relic rock structure. Generally the sample will have natural moisture content exceeding 20 per cent but in some cases as low as about 15 per cent. The sample can be crumbled in the hand without great difficulty, the materials molded by hand pressure, and the sample is generally free of hard rock fragments. Spoon samples which can be obtained in the transition zone generally have moisture contents below 15 per cent but in some cases as high as about 20 per cent. Color of the sample may be gray or slightly greenish with mica fragments and iron staining less extensive than in the residual soil. Often the sample cannot be broken easily by hand pressure but requires a considerable exertion. When a roller bit is utilized the spoon sample may consist of cuttings and debris that have accumulated in the bottom of the hole before the sampler is driven.

4. While an attempt has been made to core with the diamond drill as high as practicable in the transition zone, often there is no core recovery and usually the core consists of only a few friable pieces. However the presence of these hard fragments does indicate that the transition zone was reached.

4.303 Transition Zone. From the base of residual soil, as defined above, the transition zone extends to a level designated on the geological sections as the: "approximate top of 'weathered bedrock'". Below this level diamond drill coring is essentially continuous and soil is much the lesser constituent. Core recovery at this division line is required to exceed about 50 per cent and RQD about 10 per cent. In some cases this corresponds to the level of top of bedrock conventionally taken where continuous coring commences. Deere has suggested that the base of the transition zone be taken at RQD exceeding 25 per cent. However, in Section A011 this would result in abrupt dips in the interpreted bedrock surface in many locations.

4.304 Bedrock Zone WR: Weathered and Jointed Bedrock. In this exploration and in earlier METRO investigations zone WR comprises the uppermost portion of the bedrock and is distinguished by pronounced effects of weathering and by relatively closely spaced joints. This is intended to include cores in which weathering has had a visible effect on the mineral fabric of the rock, weakening mineral contacts and leading to markedly lower compressive strengths than the original intact material. Rock quality designation (RQD) values generally are less than 50 per cent in materials included in WR materials. Significantly weathered rock extends to depths of 20 to 40 feet beneath nominal top of bedrock. Generally the effects of weathering and consequent weakening of the mineral fabric decreases continuously with depth. Evidence of intense weathering sometimes appears at greater depths in shear zones or in locations rich in chlorite or hornblende constituents.

4.305 Bedrock Zone J: Moderately Jointed to Jointed Bedrock. Those bedrock zones which are distinguished by joints spaced closer than about 1 foot apart are grouped in Stratum J on the geologic sections. Weathering in these materials is confined largely to staining or talc deposits in joint plans and has not visibly altered the mineral fabric of the rock mass. RQD values generally are in the range of about 50 to 75 per cent. Where the rock is essentially unweathered but joints are more closely spaced and RQD values are less than 50 per cent the bedrock is designated as "highly jointed".

4.306 Bedrock Zone R: Relatively Sound, Occasionally Moderately Jointed Bedrock. Stratum R material is that portion of the bedrock below the obviously weathered and extensively jointed upper zones with joints usually spaced at vertical intervals greater than 1 foot. Rock

quality designation ordinarily exceeds 75 per cent and occasionally reaches values of 90 or 95 per cent. Unconfined compressive strengths tend to be highest in core specimens taken from these materials because there is the least deterioration of mineral contacts. The term relatively sound is not intended to imply that the material is free of joints and weathering effects. It must be recognized that the methods of tunnel excavation can significantly alter the jointing condition where planes of weakness are incipient, sealed or cemented in the recovered core.

4.4 Ground Water Conditions

As Plate No. 28 indicates, Section A011 lies in the upper reaches of drainage directed northeast to Rock Creek and consequently the line crosses a series of highs and lows formed by the drainage channels. These drainage channels are now marked by culverts passing beneath Wisconsin Avenue in areas where comparatively thick fill has been placed to smooth street grades. Water levels observed in the borings are portrayed by symbol on the geological sections and the estimated average ground water table for the date of field operations is shown as a short dashed line on the sections. The water table generally forms a subdued reflection of surface topography and always intersects the drainage structures beneath Wisconsin Avenue. Reliable measurements of water levels in these deep borings could generally be obtained since there was ample opportunity to make equilibrium overnight readings. There is no consistent indication of a distinct perched water condition in the overburden or depressed or artesian conditions in the bedrock. However, in any built-up area such as borders Wisconsin Avenue it is inevitable that streets and drainage structures can concentrate runoff and return it to the ground at positions many feet above the underlying permanent water table. Thus in shafts or open excavations continuously flowing seepage related to this shallow recharge may be encountered and no amount of systematic drawdown of the lower water table will effect flow from these perched water levels.

5. SUMMARY OF DESIGN AND CONSTRUCTION PROBLEMS

5.1 General Considerations

It is expected that Section A011 construction will include a contract for continuous running tunnels from the south limit of the line at Elm Street to a portal near Pooks Hill. Bethesda and Medical Center Stations will be let in a separate contract. The circular tunnels will be approximately 20 feet in diameter with cast-in-place reinforced concrete lining and presumably will be bid on a lineal foot price without distinction as to type of

support or ground conditions. A series of vertical fan or vent shafts and station entrance structures are included.

In discussions with the Section Designer it has been agreed that both station arches will be designed at normal working stresses for an average vertical pressure of 3 kips per sq. ft., distributed in the form of a tent-shaped diagram as shown in basic design criteria. That loading has been checked by evaluating the stability of a number of discreet overbreak blocks bounded by typical conjugate joints with friction angles of 15^{o} which apply relatively high pressures over limited portions of the station arch in directions not normal to the arch line. These analyses have been processed by computer in a two-dimensional treatment of the stations. We have expressed the opinion that this design is probably exacting enough for the poorest conditions revealed in the borings and is distinctly conservative for the more favorable conditions of the stations' roof rock. Circular running tunnels have been designed for an average vertical load of 1 kip per sq. ft. at normal working stresses. We understand that the lining chosen will accommodate double this loading with both steel and concrete below yield point stresses throughout the section. Under a 3 ksf load yield in tension would occur on the outside of the concrete and thus it was concluded that the design contained a substantial allowance for local conditions much poorer than those assumed.

In the geological sections the top of tunnel opening has been plotted as well as the top of rail so that conditions within the roof rock may be better visualized. It must be recalled that except at the stations these borings have been projected from either side of Wisconsin Avenue onto a common plane and there are obvious distortions in an attempt to plot average profile conditions on a median plane. Under these circumstances the delineating of various qualities of rock by straight lines connecting borings on the sections is simply a device to visualize overall conditions and reliance cannot be placed upon the accuracy of the rock zone lines. It has been found to be excessively complicated to distinguish most of the detailed changes of lithology on the drawings so the overall rock type is merely noted at the bottom of the drawings.

In the following text the particular rock conditions relating to design and construction are discussed within successive lengths of Section A011, commencing at the north end near the Capital Beltway on Drawing No. F-A-90 and proceeding to the south limit of the line.

5.2 Stations 515 to 510, Retained Cut

The bottom of the retaining wall falls almost everywhere within fill except near Station 510. This fill is made largely from residual soil without

an admixture of refuse or organic materials and it is anticipated that the walls may be placed on spread footings on the fill at bearing intensities not to exceed about 1-1/2 tons per sq. ft. Specifications should provide for undercut below nominal subgrade level, replacement with select granular material compacted in place, and proof-rolling of the entire subgrade to eliminate erratic soft spots beneath the bearing surface. At the south end of these walls, near Boring No. AM-26 weathered rock will be reached at subgrade and bearing pressures could be taken conservatively at 3 tsf.

5.3 Stations 510 to 502+50, Cut-and-Cover Boxes

The base of these structures will be in weathered hornblende schistose gneiss on the north grading to jointed and slightly weathered quartz-diorite gneiss near Station 504. The boxes could be designed with wall footings at bearing capacities from about 5 tsf on the north to 15 tsf on the south with a pressure-relieved slab between footings. It is anticipated that cofferdam soldier piles would have to extend to depths of typically 4 feet below subgrade at the north end of the box to 2 feet below subgrade at the south. Boring No. AM-22 suggests the sort of difficulty that will be encountered in pre-coring soldier pile holes. Bedrock exposed behind the soldier piles is mixed in quality between country rock and amphibolite and the characteristic foliation and principal jointing pattern will strike roughly parallel to the cofferdam walls and dip steeply toward the west so that the east face will be distinctly less stable. Bidders should be warned that cofferdam design must consider pressures generated by failure on westward dipping planes of weakness.

5.4 Stations 502+50 to 450, Single-Track Rock Tunnels

The portal commences in moderately to highly weathered rock at a depth of 45 feet below the surface and 22 feet below the water table. The portal design must assume that full overburden pressures are applied to the tunnel tops. If support by the intermediate pillar is disregarded, as has been suggested by the Section Designer, it probably would be satisfactory to accept 25 or 30 per cent elevation of stresses beyond normal working values. Between Borings Nos. AM-20 and AM-45U, near the location of Bellevue Drive Fan Shaft, a culvert crosses in an old drainage channel where the surface of residual soil is at the lowest level in the area. Apparently the presence of this channel reflects a significant weakenss in the bedrock evidenced by a band of chlorite schist near the base of running tunnel. This body appears in all of the west-side borings from No. AM-21 through AM-19 and does not appear in No. AM-45U east of the line. It may be presumed that this body follows the foliation strike and dip and passes through the tunnels low on the west and high on the east. Its presence makes particularly suspect the condition of the intermediate pillar and the rock

which will be exposed on the portal face.

Near Station 498 tunneling conditions are expected to improve toward the south and continue in relatively sound cover to about Station 478. At this point the tunnel passes beneath another old drainage channel marked by a shallow topographic low which now contains a box culvert draining to Rock Creek. While there is no abrupt change in the bedrock character the rock generally evidences a higher percentage of hornblende between Stations 478 and 469, then grading to diorite and meta-diorite that dominates at Medical Center Station.

Because the recent AM-series borings showed consistently poorer quality rock than borings of the A-series in this area, a special review was made of cores of both sets of borings that resulted in some relatively minor alterations in assigned RQD values of borings of the A-series between Nos. A-89 and A-92. The most striking contrast is between Nos. AM-15 and A-90 where AM-15 was advanced by rotary drilling methods with a driven spoon sampler to Elev. 180 before rock coring commenced. It was concluded that this procedure had broken through material which should have been categorized as weathered bedrock. A check boring, AM-74, was made in December 1974 within several feet of the questionable Boring No. AM-15. This appeared to confirm the supposition that weathered rock in AM-15 had been broken by rotary drilling. In any case weathered and jointed rock extends almost to the position of top of rail at AM-15 and AM-74.

In the entire length between Stations 477 and 468 the roof rock appears moderately to highly weathered. Deep weathering may be associated with a shear zone that could connect Borings Nos. AM-14, AM-15, AM-74 and A-90, striking at a flat angle east of north. Extremely unfavorable conditions are evidenced in Boring No. AM-14 at a level just beneath the tunnel. This could connect with the deep rotary drilling in AM-15, intersecting the tunnels between these borings on a steep dip to the west. Unfavorable cover at AM-17 might be associated with this shear zone although it is not in evidence in Boring No. A-91.

Continuing south of Station 468 bedrock grades to quartz-diorite gneiss or meta-diorite with lesser amphibolites. Rock cover generally ranges from jointed to relatively sound except broken and possibly sheared zones develop between Borings Nos. AM-36 and AM-40. The position of the more prominent shears are noted on Drawing No. F-A-94. These generally exhibit the characteristic steep dip associated with the foliation and thus presumably strike on a flat angle west of north. This attitude and the boring arrangement makes a considerable distinction between east side and west side conditions so that two profiles have been drawn for the top of relatively sound rock on either side of Wisconsin Avenue. Although rock is unweathered at the top of tunnel there probably will be a pattern of shears crossing the tunnels between AM-36 and AM-38. Badly broken

rock should appear in the tunnels west of AM-41 and A-87 that may be part of this movement pattern. While there is little evidence of weathering of the mineral fabric markedly low compressive strengths are obtained in cores comparatively high in hornblende and chlorite within this disturbed area.

5.5 Medical Center Station

Conditions at Medical Center Station are portrayed on two longitudinal sections, for west side borings in Drawing No. F-A-95A and for the east side on Drawing No. F-A-95B. Four natural scale sections across the long axis of the station looking north are presented on Drawings Nos. F-A-100 and -101. A plan of principal features on a horizontal plane at Elev. 200 is shown in the upper panel of Drawing No. F-A-104. The interpretation of Medical Center conditions was assisted by R.A. Robinson, formerly of the University of Illinois field staff, who undertook a review of cores with our project geologist, V.V. Tepordei, in an effort to apply techniques for correlation of cores with field evidence which were developed at Dupont Circle Station. Rock at Medical Center Station consists chiefly of hard and brittle quartz-hornblende-biotite diorite and meta-diorite indistinctly foliated. Penetration of weathering from the surface is relatively shallow and the cover is unusually thick of rock unweathered except for staining and alteration of joints. Compression strengths are distinctly higher than average. Because the igneous origin of the diorite was not encountered in previous exploration, samples for drillability, thin section petrographic analysis and joint shear tests were concentrated to some extent in this material. Nevertheless the brittle diorite is at places highly jointed and blocky, as evidenced on Section B-B, and rock cover quality over a portion of the northern half of the station is distinctly unfavorable. Because of the appearance of this highly jointed zone, a series of four supplementary borings were requested to be drilled in the median strip of Wisconsin Avenue to document conditions directly above the tunnel.

Evidence of shear in the diorite is scattered and discontinuous, only one shear zone being correlated through several borings with characteristic strike and dip. This is shown west of the opening in the plan of Drawing No. F-A-104. Robinson notes that it is characteristic of tunnels now opened and exposures along Rock Creek that the rock is blockier where shear zones are the least important and that large well defined blocks bounded by planer, smooth joints become more common. The predominate lithology through the station is a light to dark color, fine to medium grained diorite varying in composition. The range of mineral content is illustrated by the thin section reports in Part 1 of the drillability report. The only distinct lithologic variations are the zenoliths of schistose

gneiss of the Wissahickon country rock plus a granodiorite dike crossing the station apparently on a line that intersects Borings Nos. AM-64, -65 and -70. The diorite is divided into a ligher colored zone relatively high in quartz on the south and a darker zone high in hornblende on the north with a complex contact near the center of the station and a mixed zone crossing from east to west. The mineral composition, texture and lithologic arrangement all suggest an igneous intrusive origin and while the contacts appear to be of no great structural significance the rock quality and the degree of jointing may be a function of this general pattern. The intensely broken material at the north third point of this station may be related to stresses produced by the intrusion of the granodiorite dike. At least five distinct sets of joints could be seen in the cores, three of these steeply dipping and corresponding to the principal sets of Table No. 6 and two near horizontal sets.

Nesbitt in his comments on the borehole photography makes particular note of potential difficulties from the horizontal jointing pattern in Borings Nos. AM-68 and AM-70. Photography in No. AM-70 exhibited a primary joint set striking N55° to 85°W with a 65° to 75°NE dip and this corresponds to sets 3 or 3-4 distinguished in Section A004. It may be postulated that Medical Center Station will provide problems in the excavation somewhat similar to blocky quartz-diorite gneiss in the northern stations of A006.

5.6 Stations 442 to 396, Single-Track Rock Tunnels

Conditions are depicted on Drawings Nos. F-A-96, -97 and -98. Throughout this length the cover rock directly above the opening is essentially unweathered except for alteration and staining on joint planes and a substantial proportion is jointed to relatively sound with typical RQD values in the range of 70 to 85. The bedrock is predominately quartz-diorite gneiss except that it grades generally toward meta-diorite at the north at Medical Center Station and it includes bands and zones of schistose gneiss of the country rock which in places are high enough in hornblende and chlorite to be categorized with the amphibolite group. Relatively unfavorable conditions first appear in a band between Stations 430 and 435 where moderate jointing in borings east of Wisconsin Avenue reaches the tunnel opening. This condition does not appear in Boring No. AM-30 directly opposite on the west side and it seems likely that this jointed zone includes chiefly steeply west dipping planes. A highly broken zone directly above the tunnel top appears in Boring No. AM-42 which may mark a boundary between quartz-diorite gneiss on the south and materials high in hornblende in the jointed zone immediately north.

South of A-73 cover rock continues in hard, brittle predominately quartz-diorite gneiss to Station 410 at which point materials relatively high in hornblende begin to appear above the tunnel top commencing in the space between Borings Nos. A-68 and A-69. In the reach between Borings Nos. AM-10 on the east and AM-11 on the west zones of badly broken or highly jointed material with a comparatively high proportion of chlorite schist appear with evidence of shear on the characteristic strike and dip of the primary joint system. The shears appear to pass off to the west north of AM-12. While evidence of shear in this location is not as strong as in several less favorable sections north of Medical Center Station the lithology is highly variable and the rock quality here is the poorest in the length between the two subway stations.

5.7 Bethesda Station

Conditions at Bethesda Station are portrayed on two longitudinal sections, for west side borings in Drawing No. F-A-99A and on the east side for Drawing No. F-A-99B. Four natural scale cross-sections perpendicular to the long axis of the station and looking north are presented on Drawings Nos. F-A-102 and -103. A plan view of principal features evidenced on a horizontal plane at Elev. 220 is shown on the lower panel of Drawing No. F-A-104. Rock at Bethesda Station consists of two of the principal classes of material in Section A011, quartz-diorite gneiss on the south and east and a band of hornblende schist and gneiss with chlorite inclusions crossing above the northwest corner of the station on a near north-south strike with a contact deeply dipping to the west at angles between 60° and 75°. The presence of this softer rock in the northwest quadrant of the station appears to have produced substantially deeper weathering in this quadrant and inferior conditions at the locations of the north vent shaft and the station entrance. In addition to deep weathering in this corner, weathered rock approaches as near as about 10 feet to the top of the station opening on the line between Nos. AM-3U and A-63U. In other locations the cover rock provides 10 or 15 feet of relatively sound material with RQD values above 75.

The borehole photography record indicates primary and secondary joint sets corresponding closely to the two identified in tunnels on lower Connecticut Avenue. Several of the particular features pointed out in Nesbitt's commentary have been identified on the cross-sections. In contrast to Medical Center Station, the foliation is pronounced and on the typical regional attitude, conforming to the primary joint set. A fairly sustematic group of broken zones with some slick joints and evidence of gouge is noted at similar elevations on the east side borings, generally following the foliation. One zone in particular indicates continuity that

intersects the entire station low on the east wall and may continue past AM-10 and AM-11. This is plotted in the plan of Drawing No. F-A-104.

We judge that conditions at Bethesda Station may be somewhat superior to those at Dupont Circle Station because the total depth of rock is substantially greater. However the minimum cover of unweathered rock is roughly of the order of that encountered at Dupont Circle Station. In places rock bolt anchorage will fall in moderately weathered materials and there undoubtedly will be special problems with roof support where weathering approaches close to the opening.

5.8 Ancillary Structures

Ancillary structures include seven vent and fan shafts which have been identified in Table No. 7. Each shaft will be carried by braced excavation through the complete profile of weathering and therefore an effort has been made to interpret the elevation of the base of residual soil and the top of weathered bedrock which have been summarized in Table No. 7. In general we expect the following performance characteristics in the rock zones to be common to each one of these shaft locations:

1. A compact H-pile can be driven deeply into the residual soil by a high energy hammer but near the base of the residual soil layer it could meet practical refusal. It certainly cannot be driven a substantial distance into the transition zone and should not be expected to reach the top of weathered bedrock by impact driving. To pre-core a hole below the depth of refusal would doubtless require churn drills or other percussion or pneumatic drilling equipment and could not be accomplished with the ordinary caisson auger for overburden.

2. Depending on the size and location of the shaft it may be necessary to require that soldier piles be carried through the transition zone to bottom in weathered bedrock. Whatever requirement is set up on this point should be made absolutely clear to the bidders or it will doubtless be a subject of later misunderstandings.

3. The decomposed and weathered rock in the transition zone very likely would need close support by lagging or ring beams between soldier piles. Rock bolting in this transition zone would be an uncertain and unpredictable means of stabilizing the wall but might be effective in conjunction with shotcrete or gunite and wire mesh. The same may be said of the upper part of the weathered bedrock which could be equally unrealiable for support by rock bolts alone. Specifications should make perfectly clear to bidders what loading assumptions are to be made in analyzing stability of the cofferdam.

If soldier piles are not carried to the base of shaft the potential failure of wedges of rock with unfavorable dip should be evaluated including an allowance for the effect of vertical loads transmitted to such a wedge by the soldier piles.

4. While the lines dividing the different bedrock zones on the geological sections may suggest well defined boundaries between materials, the profile of weathering represents gradual and not entirely consistent changes with depth and no abrupt or fixed dividing lines separating materials with different performance characteristics should be envisioned.

TABLE NO. 1, SURVEY DATA FOR BORINGS

BORING NUMBER	HORIZONTAL CONTROL COORDINATES:		VERTICAL CONTROL: GROUND SURFACE ELEVATION (FT)	STATUS OF OBSERVATION WELLS		
	EAST	NORTH		INSTALLED	TYPE	PRESENT CONDITION
AM-1	E 773,461	N 418,560	+350.3			
AM-2	E 773,333	N 418,595	+346.9			
AM-3U	E 773,410	N 418,707	+347.9			
AM-4	E 773,280	N 418,736	+347.6			
AM-5	E 773,351	N 418,888	+346.8			
AM-6U	E 773,193	N 418,908	+344.2			
AM-7	E 773,275	N 419,122	+348.3			
AM-8	E 773,161	N 419,134	+348.3	2-22-74	1-1/2"	F
AM-9U	E 773,068	N 419,332	+350.6			
AM-10	E 773,148	N 419,752	+355.5			
AM-11	E 772,998	N 419,890	+352.7			
AM-12	E 772,930	N 420,259	+351.1			
AM-13	E 772,383	N 426,070	+266.1			
AM-14	E 772,225	N 426,260	+265.2			
AM-15	E 772,346	N 426,511	+260.6			
AM-16	E 772,195	N 426,716	+251.5			
AM-17	E 772,311	N 427,099	+234.0			
AM-18	E 772,188	N 428,766	+283.6			
AM-18A	E 772,049	N 429,152	+253.4			
AM-19	E 771,977	N 429,303	+243.0			
AM-20	E 771,907	N 429,505	+242.3			
AM-21	E 771,827	N 429,653	+247.2			
AM-22	E 771,753	N 429,835	+251.6			
AM-23	E 771,718	N 429,921	+247.4			
AM-24	E 771,655	N 430,068	+241.6			
AM-25	E 771,585	N 430,213	+237.7			

TABLE NO. 1, SURVEY DATA FOR BORINGS

BORING NUMBER	HORIZONTAL CONTROL COORDINATES:		VERTICAL CONTROL: GROUND SURFACE ELEVATION (FT)	STATUS OF OBSERVATION WELLS		
	EAST	NORTH		INSTALLED	TYPE	PRESENT CONDITION
AM-26	E 771,593	N 430,415	+235.4			
AM-27	E 771,510	N 430,573	+234.1			
AM-28	E 771,395	N 430,770	+230.7			
AM-29	E 771,308	N 430,890	+235.2			
AM-30	E 772,498	N 422,888	+310.4			
AM-34	E 772,574	N 423,630	+312.3			
AM-35	E 772,406	N 423,962	+322.4			
AM-36	E 772,476	N 424,753	+320.5	11-6-73	1-1/2"	F
AM-37U	E 772,458	N 425,080	+311.6			
AM-38	E 772,304	N 425,239	+313.6			
AM-40	E 772,278	N 425,579	+290.4			
AM-41U	E 772,402	N 425,773	+274.0	3-19-74	1-1/2"	F
AM-42	E 772,685	N 422,537	+329.0			
AM-43U	E 772,305	N 427,624	+250.7			
AM-44U	E 772,164	N 428,097	+285.7	6-12-74	1-1/2"	F
AM-45U	E 772,083	N 429,421	+237.5			
AM-46U	E 772,451	N 426,177	+264.9			
AM-47	E 772,327	N 424,607	+318.8			
AM-48	E 773,256	N 418,472	+343.6			
AM-58U	E 772,603	N 423,868	+328.0			
AM-59U	E 772,858	N 421,490	+353.2			
AM-60	E 773,053	N 419,166	+346.0			
AM-61	E 772,551	N 423,854	+320.8			
AM-62	E 772,520	N 424,143	+322.4			
AM-63	E 772,395	N 424,225	+320.3			
AM-64	E 772,515	N 424,298	+321.2			
AM-65	E 772,382	N 424,375	+321.6	2-5-74	1-1/2"	

TABLE NO. 1, SURVEY DATA FOR BORINGS

BORING NUMBER	HORIZONTAL CONTROL COORDINATES:		VERTICAL CONTROL: GROUND SURFACE ELEVATION (FT)	STATUS OF OBSERVATION WELLS		
	EAST	NORTH		INSTALLED	TYPE	PRESENT CONDITION
AM-66	E 772,505	N 424,461	+320.7			
AM-67	E 772,345	N 424,745	+325.7			
AM-68	E 772,482	N 423,967	+321.5			
AM-69	E 772,455	N 424,183	+322.8			
AM-70	E 772,443	N 424,337	+323.5			
AM-71	E 772,429	N 424,489	+323.5			
AM-74	E 772,341	N 426,500	+259.0			

NOTE:

Borings Nos. AM-72-73 and -75 to -79 were in progress in December 1974 and are not included in this report.

Legend: F = still functioning in 1974

TABLE NO. 2

SUMMARY OF LABORATORY TEST DATA

SAMPLE IDENTIFICATION				CLASSIFICATION PROPERTIES								PHYSICAL PROPERTIES													
									UNIFIED CLASSIFICATION SYSTEM			STRENGTH								CONSOLIDATION					
												UNCONFINED COMPRESSION			TRIAXIAL COMPRESSION										
BORING NO.	SAMPLE NO.	DEPTH FT.	STRATUM DESIGNATION	NATURAL WATER CONTENT %(W) AVERAGE OF ENTIRE SAMPLE	LIQUID LIMIT (W_L)	PLASTICITY INDEX (I_p)	NATURAL WATER CONTENT OF LIMIT SAMPLE %(W)	SPECIFIC GRAVITY OF SOLIDS (G)	SOIL TYPE	% SAND (<#4,>#200 SIEVE)	% FINES (<#200 SIEVE)	COMPRESSIVE STRENGTH TSF	WATER CONTENT AT END OF TEST %	STRAIN AT FAILURE %	TYPE OF TEST	DEVIATOR STRESS ($\sigma_1 - \sigma_3$) TSF	CONFINING PRESSURE (σ_3) TSF	NATURAL WATER CONTENT %	WATER CONTENT AT END OF TEST %	NATURAL WATER CONTENT %	EXISTING OVERBURDEN STRESS TSF	ESTIMATED PROBABLE PRECONSOLIDATION STRESS - TSF	COMPRESSION INDEX C_c	SWELLING INDEX C_s	VOID RATIO AT START OF SWELL, e_r
AM-3U	2U	3.6	D	15					SM						Q	1.36	0.5	15	15						
															Q	1.83	1.0	13	13						
															Q	2.59	2.0	16	16						
	4U	8.2	D	10					SM	72	28	Direct Shear Test ϕ = 31.8° C = 0.1 TSF			Q	1.51	0.5	10	10						
															Q	2.45	1.0	10	9						
															Q	3.88	2.0	10	10						
	6U	13.7	D	20					SM																
	8U	19.0	D	21					SM	74	26	Direct Shear Test ϕ = 30° C = 0.2 TSF			Q	1.63	0.5	21	21						
															Q	3.16	2.0	-	-						
	10U	24.0	D	26					SM			0.52	32	4											
AM-6U	2U	3.2	F	29	48	16	29		CL&ML			0.90	23	4	Q	1.81	1.0	30	30						
															Q	2.00	2.0	32	32						
	3U	5.5	F	27					ML			1.53	25	5	Q	2.01	0.5	29	29						
	4U	7.8	D	22					SM						Q	1.65	0.5	21	21						
															Q	1.87	1.0	24	23						
															Q	2.90	2.0	23	22						
	6U	11.8	D	24	35	4	24		SM			Direct Shear Test ϕ = 24° C = 0.45 TSF			Q	2.05	1.0	24	23						
															Q	3.04	2.0	24	23						
	7U	14.2	D	17					SM	72	28				Q	1.69	0.5	17	17						
															Q	2.22	0.5	16	15						
	9U	18.1	D	25					SM						Q	2.00	1.0	22	22						
															Q	2.81	2.0	23	22						
	10U	20.5	D	26					SM						Q	1.26	0.5	23	24						
															Q	0.90	1.0	26	27						
															Q	1.77	2.0	30	29						
AM-9U	1U	1.5	D	19					SM						Q	2.68	2.0	20	19						
	2U	3.6	D	12					SM	72	28	Direct Shear Test ϕ = 37° C = 0.3 TSF			Q	1.44	0.5	12	12						
															Q	2.60	1.0	12	11						
AM-25U	2U	6.0	D	10					SM						Q	2.57	1.0	8	-						
AM-37U	2U	4.0	D	15					ML						Q	1.88	0.5	17	16						
															Q	4.63	2.0	19	18						

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TABLE NO. 2

SUMMARY OF LABORATORY TEST DATA

SAMPLE IDENTIFICATION				CLASSIFICATION PROPERTIES								PHYSICAL PROPERTIES													
									UNIFIED CLASSIFICATION SYSTEM			STRENGTH								CONSOLIDATION					
												UNCONFINED COMPRESSION			TRIAXIAL COMPRESSION										
BORING NO.	SAMPLE NO.	DEPTH FT.	STRATUM DESIGNATION	NATURAL WATER CONTENT %(W) AVERAGE OF ENTIRE SAMPLE	LIQUID LIMIT (W_L)	PLASTICITY INDEX (I_p)	NATURAL WATER CONTENT OF LIMIT SAMPLE %(W)	SPECIFIC GRAVITY OF SOLIDS (G)	SOIL TYPE	% SAND (<#4,>#200 SIEVE)	% FINES (<#200 SIEVE)	COMPRESSIVE STRENGTH TSF	WATER CONTENT AT END OF TEST %	STRAIN AT FAILURE %	TYPE OF TEST	DEVIATOR STRESS ($\sigma_1 - \sigma_3$) TSF	CONFINING PRESSURE (σ_3) TSF	NATURAL WATER CONTENT %	WATER CONTENT AT END OF TEST %	NATURAL WATER CONTENT %	EXISTING OVERBURDEN STRESS TSF	ESTIMATED PROBABLE PRECONSOLIDATION STRESS - TSF	COMPRESSION INDEX C_c	SWELLING INDEX C_s	VOID RATIO AT START OF SWELL, e_r
AM-41U	2U	3.0	D	23					SM																
	3U	6.0	D	24					SM						Q	2.38	0.5	22	25						
															Q	3.10	1.0	22	22						
															Q	2.71	2.0	27	27						
AM-44U	2U	3.0	F	29					ML						Q	1.88	1.0	29	29						
	4U	9.0	D	27					ML	41	59	Direct Shear Test $\phi = 26^\circ$ C = 0.3 TSF			Q	2.64	2.0	29	29						
															Q	2.49	0.5	25	25						
	6U	16.0	D	38					ML						Q	1.82	0.5	29	28						
															Q	1.13	1.0	40	40						
															Q	2.21	2.0	35	35						
AM-45U	4U	15.8	D	26					ML			0.75	26	5											
AM-46U	2U	1.6	F	18					CL						Q	3.32	0.5	20	20						
															Q	3.35	1.0	17	17						
															Q	3.91	2.0	16	16						
AM-58U	4U	13.0	D	18					SM	72	28	Direct Shear Test $\phi = 36^\circ$ C = 0			Q	2.84	0.5	17	17						
	5U	16.0	D	15					SM	74	26				Q	2.55	1.0	18	18						
															Q	4.22	2.0	15	15						
AM-59U	2U	4.0	D	12					SM & ML	58	41	Direct Shear Test $\phi = 27^\circ$ C = 0.2 TSF			Q	3.75	2.0	12	12						
	4U	11.0	D	19					SM						Q	1.64	0.5	18	18						
															Q	3.16	1.0	20	20						

NOTES

1. ALL TESTS SUMMARIZED ABOVE WERE PERFORMED IN THE SOILS LABORATORY OF MUESER, RUTLEDGE, WENTWORTH & JOHNSTON.
2. THE SAMPLE DEPTH LISTED ABOVE IS THE AVERAGE DEPTH OF THE SAMPLE RECOVERED.
3. FOR GROUND SURFACE ELEVATIONS AT THE BORINGS SEE TABLE NO. 1 . FOR GENERALIZED STRATA DESCRIPTIONS SEE DRAWING NO. F-1.
4. "NATURAL WATER CONTENT OF ENTIRE SAMPLE" IS A WEIGHTED AVERAGE OF ALL MATERIAL TYPES RECOVERED.
5. THE TRIAXIAL COMPRESSION TESTS PERFORMED WERE:
   Q - QUICK TESTS (UU - UNCONSOLIDATED UNDRAINED TESTS)
   Q_c - CONSOLIDATED QUICK TESTS (CU - CONSOLIDATED UNDRAINED TESTS)
6. STRENGTH TESTS WERE PERFORMED ON PISTON TYPE SAMPLES (U) APPROXIMATELY 2.9 INCHES IN DIAMETER AND ON SHELBY TYPE SAMPLES (S) APPROXIMATELY 1.8 INCHES IN DIAMETER. THE RATIO OF HEIGHT TO DIAMETER OF ALL STRENGTH TEST SPECIMENS WAS APPROXIMATELY 2.0.
7. THE TRIAXIAL COMPRESSION TESTS WERE PERFORMED AT A RATE OF STRAIN OF APPROXIMATELY 1 PER CENT PER MINUTE.
8. THE DIRECT SHEAR TESTS WERE PERFORMED AT A CONSTANT RATE OF STRAIN EQUAL TO A HORIZONTAL DISPLACEMENT OF 0.02 INCHES PER HOUR. THE SPECIMENS WERE OF APPROXIMATELY 1/2 INCH THICKNESS.
9. COMPRESSION INDEX C_c - STRAIGHT LINE PORTION OF THE VIRGIN CURVE OF CONSOLIDATION TEST: $e = e_o - C_c \log P/P_o$
10. SWELLING INDEX C_s - STRAIGHT LINE PORTION OF THE REBOUND CURVE OF CONSOLIDATION TEST: $e = e_o - C_s \log P/P_o$

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TABLE No.3, SUMMARY OF FALLING HEAD PERMEABILITY TESTS IN BORE HOLES AND OBSERVATION WELLS (1)

Boring No.	AM-2	AM-4	AM-5	AM-7	AM-8	AM-9U	AM-10	AM-11	AM-12	AM-12	AM-13	AM-13	AM-13	AM-14	AM-16
Elevation of top and bottom of opening tested	+301.1 +185.9	+302.6 +186.3	+311.8 +207.3	+303.3 +191.3	+288.3 +188.3	+289.6 +190.6	+345.5 +185.5	+312.7 +181.7	+245.1 +211.6	+290.1 +191.1	+241.1 +186.5	+225.1 +159.2	+241.1 +219.3	+210.2 +149.2	+196.5 +119.0
Length of opening, feet	115.2	116.3	104.5	112	100	99	160	131	133.5	99	54.6	45	21.8	36.4	77.5
Computed permeability, feet/minute	6.7×10^{-4}	4.5×10^{-4}	1.3×10^{-4}	2.5×10^{-4}	1.5×10^{-4}	3.9×10^{-4}	1.3×10^{-4}	2.4×10^{-4}	1.1×10^{-4}	1.9×10^{-4}	$>1\times10^{-2}$	2×10^{-3}	$>1\times10^{-2}$	4.5×10^{-4}	5.1×10^{-4}
Stratum tested	WR, J & R	WR J & R	WR, J & R	WR, J & R	WR, J & R	WR, J & R	D, WR J & R	D, WR J & R	J & R	WR, J & R	D, WR & J	WR & J	D & WR	WR, J & R	WR, J & R

Boring No.	AM-17	AM-18	AM-18A	AM-20	AM-21	AM-21	AM-21	AM-21	AM-22	AM-23	AM-23	AM-24	AM-26	AM-30	AM-34
Elevation of top and bottom of opening tested	+186.0 +149.6	+242.6 +235.1	+198.4 +153.4	+204.3 +152.3	+235.4 +207.7	+228.2 +185.7	+228.2 +181.2	+228.2 +167.2	+242.6 +181.6	+227.4 +212.4	+227.4 +177.4	+221.6 +177.9	+235.4 +196.9	+300.4 +140.4	+287.3 +147.3
Length of opening, feet	36.4	7.5	45	52	11.8	42.5	47	61	61	15	50	43.7	38.5	160	140
Computed permeability, feet/minute	4.5×10^{-4}	1.0×10^{-3}	2.7×10^{-3}	3.9×10^{-4}	6.4×10^{-5}	3.9×10^{-4}	3.3×10^{-4}	9.6×10^{-5}	8.6×10^{-5}	2.2×10^{-3}	1.0×10^{-3}	2.1×10^{-3}	7.1×10^{-5}	1.6×10^{-4}	3.3×10^{-5}
Stratum tested	WR, J & R	D & WR	WR, J & R	WR & J	D & WR	D & WR	D, WR	D, WR & R	D, WR & J	D, WR	D, WR & J	D, WR & J	D & WR	D, WR & R	WR, J & R

TABLE No.3, SUMMARY OF FALLING HEAD PERMEABILITY TESTS IN BORE HOLES AND OBSERVATION WELLS

Boring No.	AM-34	AM-42	AM-42	AM-43	AM-44U	AM-44U Observ. Well	AM-45U	AM-46U	AM-47	AM-58U	AM-59U	AM-60	AM-61	AM-61	AM-62
Elevation of top and bottom of opening tested	+287.3 +133.8	+314.0 +289.0	+289.0 +232.0	+209.7 +121.3	+235.7 +125.7	+164.2 +150.7	+199.5 +143.6	+213.9 +165.3	+278.3 +159.8	+283.0 +188.0	+296.2 +185.6	+247.0 +181.0	+265.8 +176.8	+265.8 +168.4	+277.4 +173.8
Length of opening, feet	153.5	25	57	88.4	110	13.5	55.9	48.6	118.5	95	110.6	66	89	97.4	103.6
Computed permeability, feet/minute	3.5×10^{-5}	2.7×10^{-4}	1.3×10^{-4}	4.3×10^{-5}	2.5×10^{-5}	1.4×10^{-4}	3.2×10^{-4}	$>1\times10^{-2}$	1.4×10^{-4}	3.0×10^{-4}	3.0×10^{-4}	4.1×10^{-5}	7.6×10^{-5}	9.7×10^{-5}	1.3×10^{-4}
Stratum tested	WR, J & R	D, WR	WR, J & R	WR, J & R	D, WR & R	D, WR & R	WR, J & R	WR, J & R	J, R	WR, J & R	J, R	J, R	R	R	J & R

Boring No.	AM-62	AM-63	AM-63	AM-64	AM-65	AM-65	AM-66	AM-66	AM-67	AM-68	AM-69	AM-70	AM-71		
Elevation of top and bottom of opening tested	+277.4 +137.4	+280.3 +190.8	+280.3 +135.3	+301.2 +173.1	+297.6 +170.6	+297.6 +148.6	+300.7 +180.7	+300.7 +128.7	+291.8 +186.3	+279.5 +131.5	+288.3 +134.3	+300.5 +133.9	+280.5 +134.0		
Length of opening, feet	140	89.5	145	128.1	127	149	120	172	105.5	148	154	166.6	146.5		
Computed permeability, feet/minute	1.2×10^{-4}	3.2×10^{-4}	2.4×10^{-4}	1.0×10^{-4}	2.6×10^{-5}	1.8×10^{-5}	3.5×10^{-5}	8.6×10^{-5}	1.9×10^{-4}	1.4×10^{-4}	1.5×10^{-4}	4.0×10^{-4}	1.4×10^{-4}		
Stratum tested	J & R	D, WR, J & R	D, WR, J & R	D, WR, J & R	D, WR & J	D, WR J & R	D, WR J & R	D, WR J & R	D, WR & R	WR, J & R	WR, J & R	D, WR J & R	WR, J & R		

Table No. 4 - Summary of Water Pressure Tests in Rock

Boring No.	AM-1	AM-1	AM-1	AM-1	AM-4	AM-4	AM-4	AM-8
Test No.	1	2	3	4	1A	1	2	1
Elev. Bott. of Top Packer	200.3	210.3	220.3	238.3	234.6	202.6	226.6	208.3
Elev. Top of Bott. Packer	195.3	205.3	215.3	233.3	229.6	197.6	221.6	203.3
Maximum Pressure Gage Reading, PSI	60	40	85	45	90	90	40	60
Total Net Head on Opening, Ft. of Water	139	92	196	104	208	208	92	139
Average Flow G.P.M.	1.72	3.74	2.47	4.49	2.47	0.75	8.23	0
Computed Permeability Ft./Min.	1.3×10^{-4}	3.9×10^{-4}	1.4×10^{-4}	4.2×10^{-4}	2.0×10^{-4}	4.1×10^{-5}	8.7×10^{-5}	Very Low $<1\times10^{-7}$
Average RQD Value of Surrounding Rock	80	82	86	85	85	95	0	95

Table No. 4 - Summary of Water Pressure Tests in Rock

Boring No.	AM-8	AM-8	AM-8	AM-18	AM-18	AM-19	AM-19	AM-19
Test No.	2	3	4	3	4	1	2	3
Elev. Bott. of Top Packer	213.3	218.3	223.3	212.6	193.6	169.5	174.5	179.5
Elev. Top of Bott. Packer	208.3	213.3	218.3	207.6	188.6	164.5	169.5	174.5
Maximum Pressure Gage Reading, PSI	75	75	60	60	40	90	30	90
Total Net Head on Opening, Ft. of Water	173	173	139	139	92	208	68	208
Average Flow G.P.M.	0	0	0	1.50	0.07	13.46	22.44	17.20
Computed Permeability Ft./Min.	Very Low $< 1x10^{-7}$	Very Low $<1x10^{-7}$	Very Low $<1x10^{-7}$	$1.0x10^{-4}$	$6.6x10^{-6}$	$7.5x10^{-4}$	$3.2x10^{-3}$	$9.6x10^{-4}$
Average RQD Value of Surrounding Rock	91	95	85	23	59	32	50	55

Table No. 4 - Summary of Water Pressure Tests in Rock

Boring No.	AM-19	AM-20	AM-20	AM-20	AM-20	AM-35	AM-35	AM-35
Test No.	4	1	2	3	4	1	2	3
Elev. Bott. of Top Packer	184.5	172.3	182.3	192.3	202.3	158.4	163.4	168.4
Elev. Top of Bott. Packer	179.5	167.3	177.3	187.3	197.3	153.4	158.4	163.4
Maximum Pressure Gage Reading, PSI	90	66	50	46	45	90	90	85
Total Net Head on Opening, Ft. of Water	208	152	115	106	104	208	208	196
Average Flow G.P.M.	11.97	0.37	8.23	9.72	11.59	0	0.15	0
Computed Permeability Ft./Min.	6.7×10^{-4}	2.7×10^{-5}	7.6×10^{-4}	9.6×10^{-4}	1.2×10^{-3}	Very Low $<1\times10^{-7}$	8.4×10^{-6}	Very Low $<1\times10^{-7}$
Average RQD Value of Surrounding Rock	35	45	74	80	20	98	95	92

Table No. 4 - Summary of Water Pressure Tests in Rock

Boring No.	AM-35	AM-36	AM-36	AM-36	AM-36	AM-38	AM-38	AM-38
Test No.	4	1	2	3	4	1	2	3
Elev. Bott. of Top Packer	173.4	146.5	151.5	161.5	166.5	140.4	145.4	150.4
Elev. Top of Bott. Packer	168.4	141.5	146.5	156.5	161.5	135.4	140.4	145.4
Maximum Pressure Gage Reading, PSI	85	80	80	30	90	90	90	80
Total Net Head on Opening, Ft. of Water	196	185	185	68	208	208	208	185
Average Flow G.P.M.	0	5.24	2.69	5.39	2.39	0.45	0.30	0.75
Computed Permeability Ft./Min.	Very Low $<1\times10^{-7}$	3.3×10^{-4}	1.7×10^{-4}	7.8×10^{-4}	1.3×10^{-4}	2.5×10^{-5}	1.6×10^{-5}	4.5×10^{-5}
Average RQD Value of Surrounding Rock	98	22	20	10	73	83	87	90

Table No. 4 - Summary of Water Pressure Tests in Rock

Boring No.	AM-38	AM-40	AM-40	AM-40	AM-41U	AM-41U	AM-41U	AM-41U
Test No.	4	1	2	3	1	2	3	4
Elev. Bott. of Top Packer	155.4	141.4	146.4	151.4	124.0	137.0	150.0	164.0
Elev. Top of Bott. Packer	150.4	136.4	141.4	146.4	119.0	132.0	145.0	159.0
Maximum Pressure Gage Reading, PSI	85	90	90	90	50	40	42	70
Total Net Head on Opening, Ft. of Water	139	208	208	208	116	92	97	162
Average Flow G.P.M.	0.15	0	0	0	0	0	0	0
Computed Permeability Ft./Min.	1.2×10^{-5}	Very Low $<1 \times 10^{-7}$	Very Low $<1 \times 10^{-7}$	Very Low $<1 \times 10^{-7}$	Very Low $<1 \times 10^{-7}$	Very Low $<1 \times 10^{-7}$	Very Low $<1 \times 10^{-7}$	Very Low $<1 \times 10^{-7}$
Average RQD Value of Surrounding Rock	95	65	89	88	39	28	35	50

Table No. 4 - Summary of Water Pressure Tests in Rock

Boring No.	AM-62	AM-62	AM-63	AM-63	AM-66	AM-66	AM-66	AM-67
Test No.	1	2	1	2	1	2	3	1
Elev. Bott. of Top Packer	174.9	182.9	158.9	171.9	157.4	164.4	182.4	162.3
Elev. Top of Bott. Packer	169.9	177.9	153.9	167.9	152.4	159.4	177.4	157.3
Maximum Pressure Gage Reading, PSI	80	80	80	80	90	90	90	90
Total Net Head on Opening, Ft. of Water	185	185	185	185	208	208	208	208
Average Flow G.P.M.	0	0	0.64	0	0	1.50	0	0.22
Computed Permeability Ft./Min.	Very Low $<1\times10^{-7}$	Very Low $<1\times10^{-7}$	4.0×10^{-5}	Very Low $<1\times10^{-7}$	Very Low $<1\times10^{-7}$	8.4×10^{-5}	Very Low $<1\times10^{-7}$	1.2×10^{-5}
Average RQD Value of Surrounding Rock	60	66	45	90	75	63	60	94

Table No. 4 - Summary of Water Pressure Tests in Rock

Boring No.	AM-67	AM-68	AM-68	AM-70	AM-71			
Test No.	2	1	2	3	2			
Elev. Bott. of Top Packer	171.3	166.5	186.5	148.5	155.5			
Elev. Top of Bott. Packer	166.3	161.5	181.5	143.5	150.5			
Maximum Pressure Gage Reading, PSI	80	90	90	75	72			
Total Net Head on Opening, Ft. of Water	185	208	208	173	166			
Average Flow G.P.M.	0	0	0	1.57	0.28			
Computed Permeability Ft./Min.	Very Low $< 1 \times 10^{-7}$	Very Low $< 1 \times 10^{-7}$	Very Low $< 1 \times 10^{-7}$	1.2×10^{-4}	2.2×10^{-5}			
Average RQD Value of Surrounding Rock	92	100	100	33	89			

TABLE NO. 5 , SUMMARY OF UNCONFINED COMPRESSION STRENGTHS ON ROCK CORES

Sheet 1

Boring Number	Core Number	Sample Depth Feet	Peak Compressive Strength, PSI	R.Q.D. Value of Core Run %
AM-1	6C	79.0	2,710	65
AM-1	9C	97.0	3,340	70
AM-1	14C	118.0	5,570	90
AM-1	16C	130.0	5,330	95
AM-3U	6C	71.0	3,820	40
AM-3U	9C	87.0	4,780	70
AM-3U	13C	102.0	5,100	75
AM-3U	18C	127.0	5,800	75
AM-4	7C	72.0	2,610	65
AM-4	8C	76.0	1,500	90
AM-4	12C	94.0	1,620	95
AM-6U	6C	70.0	2,550	65
AM-6U	11C	90.0	9,490	98
AM-6U	15C	109.0	5,480	65
AM-8	10C	78.0	860	50
AM-8	14C	96.0	1,270	90
AM-8	20C	123.0	4,590	75
AM-9U	21C	122.0	960	45
AM-9U	24C	136.0	7,040	90
AM-12	17C	121.0	5,890	80
AM-12	19C	129.0	5,100	70
AM-12	21C	139.0	5,480	60
AM-18	11C	85.0	7,040	75
AM-18	13C	94.0	3,820	70
AM-30	18C	94.0	9,240	80
AM-30	21C	106.0	8,700	80
AM-34	13C	77.0	9,300	90
AM-34	16C	88.0	13,020	85
AM-34	18C	92.0	13,180	45
AM-34	27C	133.0	10,190	90
AM-35	9C	74.0	17,200	90
AM-35	14C	92.0	11,150	55
AM-35	18C	110.0	7,170	85
AM-35	26C	143.0	10,250	85

TABLE NO. 5 , SUMMARY OF UNCONFINED COMPRESSION STRENGTHS ON ROCK CORES (CONT.)

Boring Number	Core Number	Sample Depth Feet	Peak Compressive Strength, PSI	R.Q.D. Value of Core Run %
AM-36	16C	101.0	5,730	85
AM-36	20C	120.0	480	95
AM-38	21C	102.0	1,080	85
AM-38	24C	114.0	5,730	95
AM-38	26C	126.0	8,310	95
AM-40	18C	89.0	1,270	65
AM-40	19C	93.0	5,250	90
AM-43	13C	79.0	8,920	95
AM-43	17C	100.0	8,340	95
AM-60	9C	79.0	570	40
AM-60	16C	114.0	6,720	40
AM-61	24C	122.0	16,880	98
AM-62	15C	81.0	20,700	90
AM-62	23C	119.0	13,380	55
AM-63	25C	143.0	15,100	90
AM-64	11C	65.0	2,930	60
AM-64	14C	78.0	5,760	45
AM-64	21C	110.0	8,380	50
AM-65	28C	131.0	29,300	70
AM-65	39C	167.0	18,470	85
AM-66	13C	76.0	9,550	60
AM-66	19C	100.0	20,380	98
AM-66	22C	113.0	15,920	90
AM-66	29C	146.0	18,470	70
AM-68	14C	85.0	11,810	80
AM-68	21C	116.0	8,440	100
AM-68	26C	135.0	5,920	100
AM-69	12C	84.0	7,520	85
AM-69	20C	116.0	9,400	80
AM-69	26C	139.0	9,940	75
AM-70	19C	96.0	6,770	70
AM-70	28C	136.0	3,100	85
AM-70	33C	156.0	6,110	75

TABLE NO. 5 , SUMMARY OF UNCONFINED COMPRESSION STRENGTHS ON ROCK CORES

Boring Number	Core Number	Sample Depth Feet	Peak Compressive Strength, PSI	R.Q.D. Value of Core Run %
AM-71	12C	75.0	11,460	100
AM-71	25C	127.0	22,290	100
AM-71	33C	164.0	14,330	90
A-79	8C	79.0	11,110	70
A-79	14C	109.0	22,290	40
A-79	18C	126.0	21,660	85
A-80	17C	101.0	9,550	95
A-80	21C	124.0	10,200	98
A-80	27C	153.0	16,240	90

NOTE: Five (5) additional rock cores from Borings AM-6U, AM-9U, AM-10 & AM-14 could not be tested due to damage in transit.

TABLE NO. 6, ATTITUDES OF PRINCIPAL BEDROCK JOINTS, PIEDMONT IN NORTHWEST WASHINGTON DC AND MONTGOMERY CO.

JOINT SET *	1	2	3	3 - 4	4
FELLOWS (1950)		N 42° E / 68° SE	N 40° W / 68° NE	N 72° W / Vertical ← STRIKE / DIP	
JOHNSTON (1964)	N - S / 60° W to Vert. (Lineation)	N 30° to 50° E / 35° to 65° SE			N 70° W N 70° E / Vertical to 65°
CLOOS (1964)		N 20° E / 68° SE		N 70° W / 70 NE	
MRWJ A 006 (1967)	N 7° W / 55° W	N 20° E / 44° SE		N 73° W / 53° NE	
MRWJ A 009 (1973)	N 5° to 10° W / 60° to 75° W	N 50° E / 50° to 70° SE (Variable)		N 60° W / 70° to 90° N	
MRWJ BETHESDA STA. (1974)	N 5° to 10° W / 40° to 70° W (also foliation)	N 40° E / 30° to 65° SE			
MRWJ MEDICAL CENTER STA. (1974)	Horizontal jointing and indistinct foliation are characteristic.			N 60° to 90° W / 65° to 75° NE (Primary)	N 5° W / 50° to 75° E (Secondary)

NOTES:

* Joint sets are numbered in order of importance established by U of Ill. from exposures in A 004 tunnels (data from R.A. Robinson).

Determinations by Mueser, Rutledge, Wentworth & Johnston are from borehole photography investigations in sections of Rockville Route.

TABLE NO. 7

ZONES OF THE WEATHERED PROFILE AT LOCATIONS OF A011 SHAFTS

Shaft Designation	Applicable Boring	Elevations of Principal Zones	
		Base of Saprolite = Top of Transition	Base of Transition = Top Weathered Bedroc
Locust Hill Road Vent Shaft	AM-44	244	235
Medical Center South Vent Shaft	AM-61 (AM-58U)	298	288
Bellevue Drive Fan Shaft	AM-45	220	210
North Drive Fan Shaft	AM-46 (A-89)	236	215
West Virginia Avenue Fan Shaft	AM-59	328	320
Bethesda Station North Vent Shaft	AM-60	310	304
Medical Center North Vent Shaft	AM-47	307	287

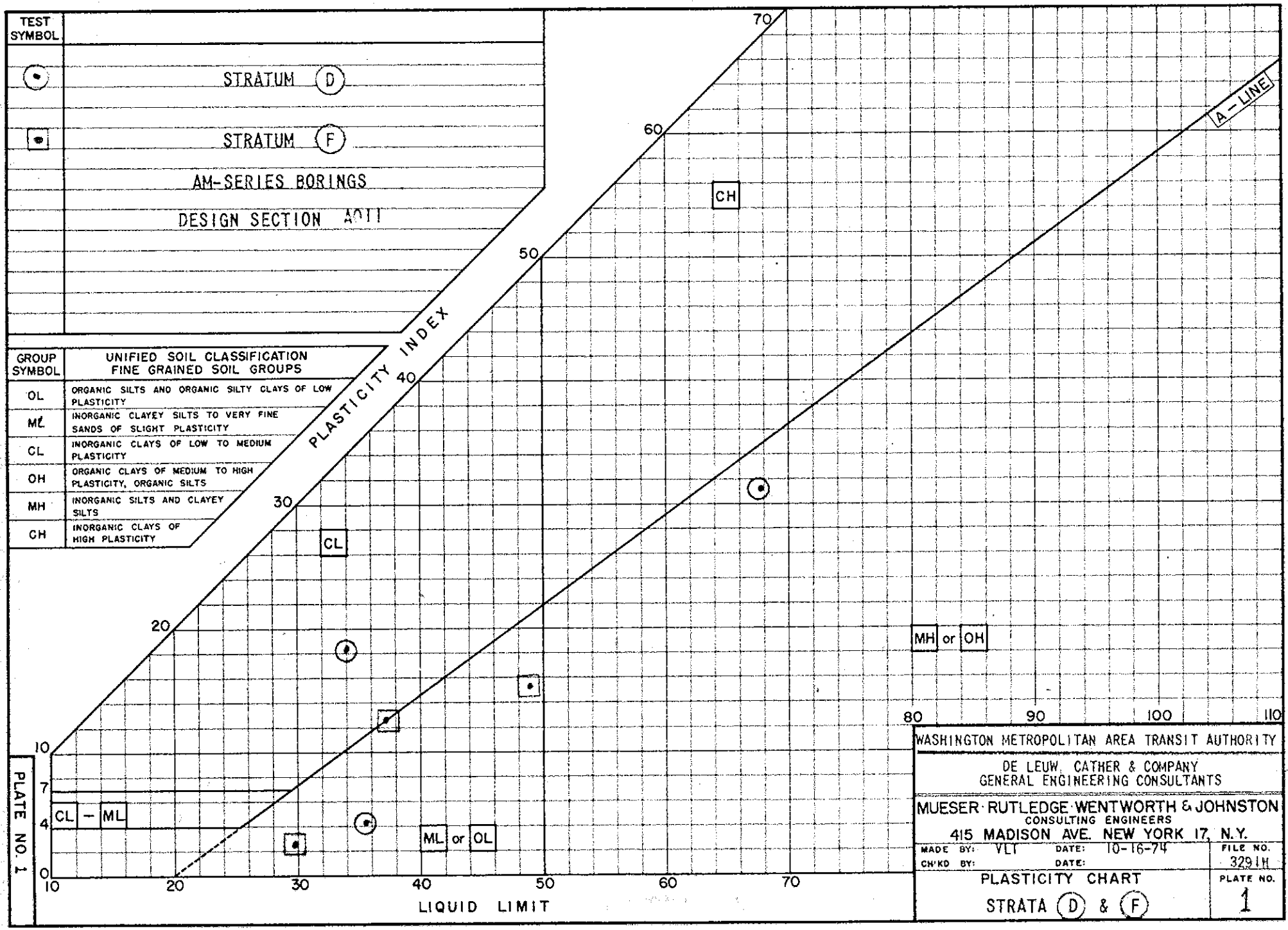

PLATE NO. 1

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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MADE BY: VLT	DATE: 10-16-74	FILE NO. 3291H
CH'KD BY:	DATE:	PLATE NO. 1

PLASTICITY CHART
STRATA (D) & (F)

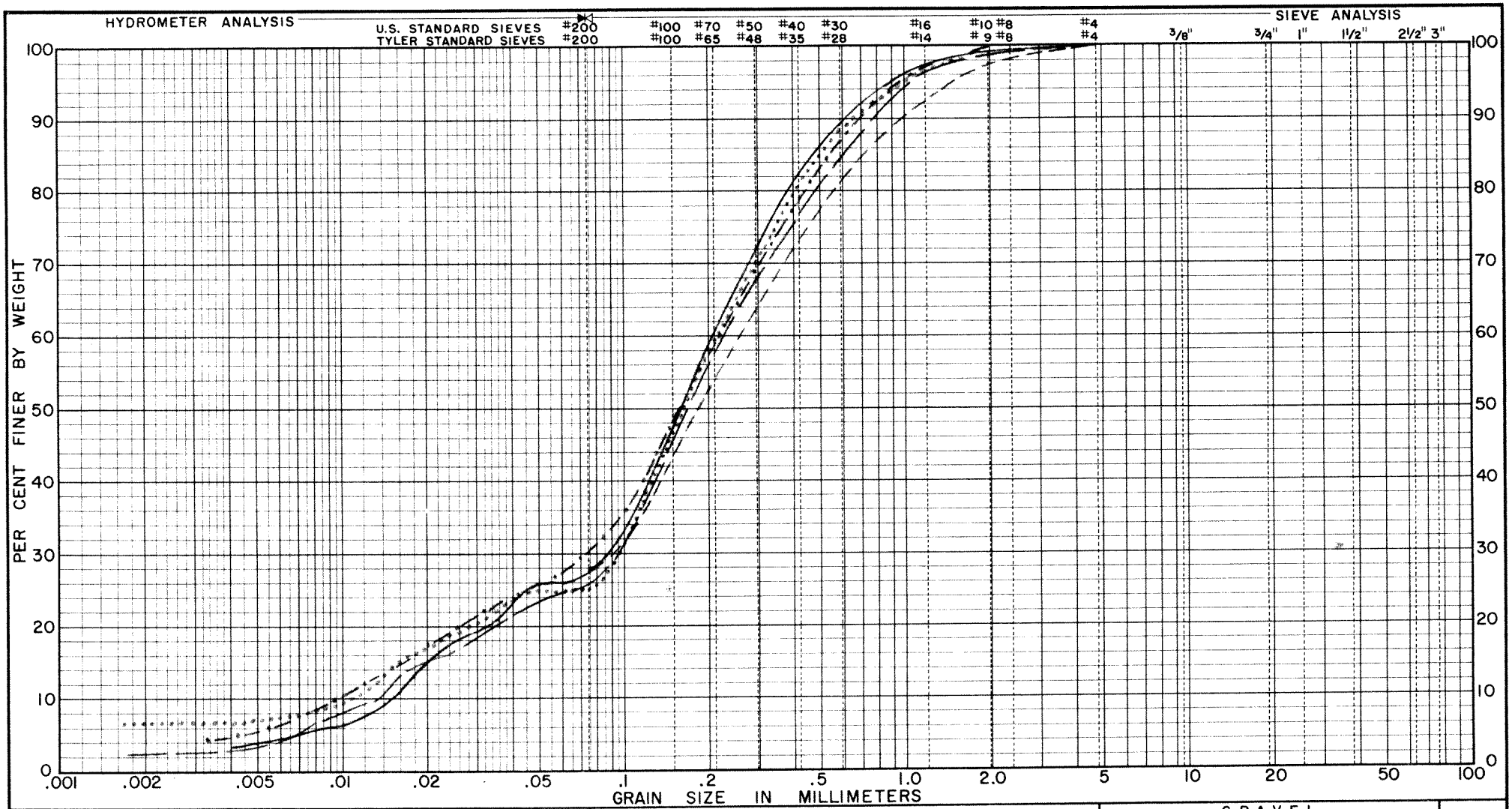

PLATE NO. 2

SYMBOL	BORING	SAMPLE	DESCRIPTION OF SAMPLE
———	AM-3U	4U	STRATUM (D)
— — —	AM-3U	8U	
- - - -	AM-6U	7U	
.....	AM-6U	12U	
— · — · —	AM-9U	2U	

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MADE BY: AR DATE: 10-23-74
CH'KD BY: DATE:

FILE NO. 3291H

GRADATION CURVES
STRATUM (D)

PLATE NO. 2

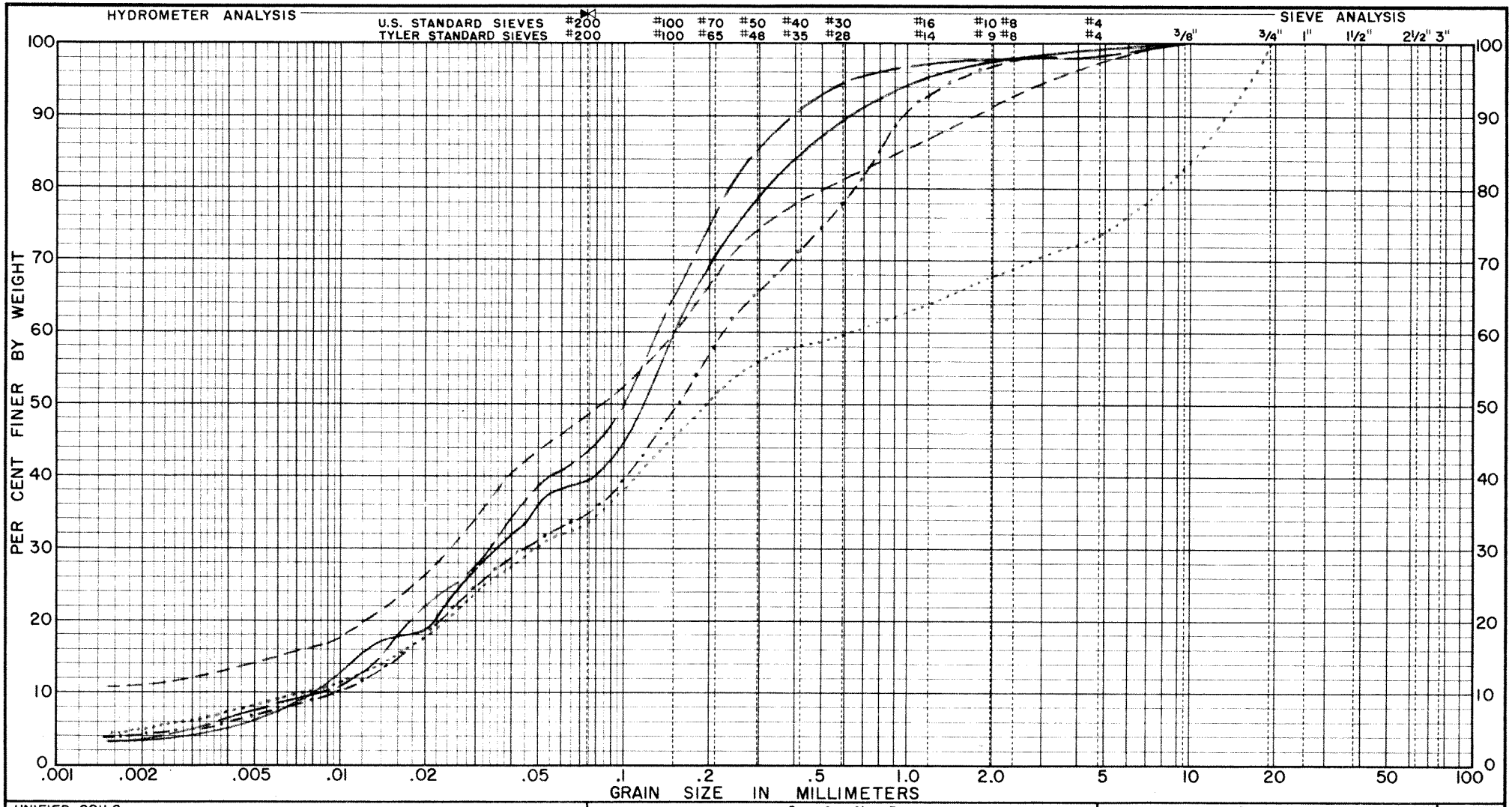

PLATE NO. 3

SYMBOL	BORING	SAMPLE	DESCRIPTION OF SAMPLE
———	AM-9U	6D	STRATUM (D)
— — —	AM-184	3D	
- - - -	AM-28	3D	
.....	AM-29	2D	
-.-.-	AM-30	3D	

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CH'KD BY: VLT DATE: 10-29-74

FILE NO. 3291H

GRADATION CURVES
STRATUM (D)

PLATE NO. 3

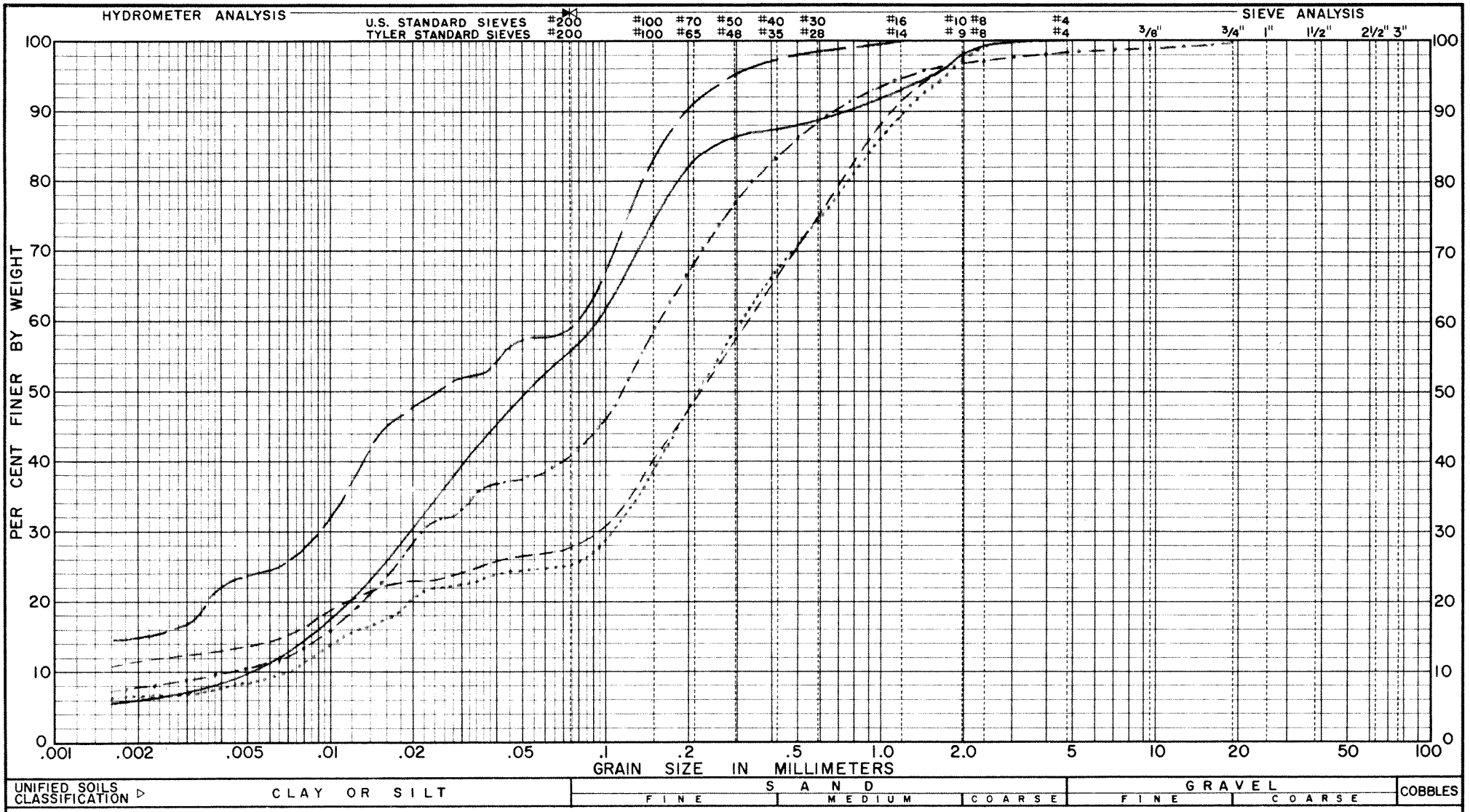

PLATE NO. 4

SYMBOL	BORING	SAMPLE
———	AM-36	2D
— — —	AM-44U	4U
- - - -	AM-58U	4U
.....	AM-58U	5U
—·—·—	AM-59U	2U

DESCRIPTION OF SAMPLE

STRATUM (D)

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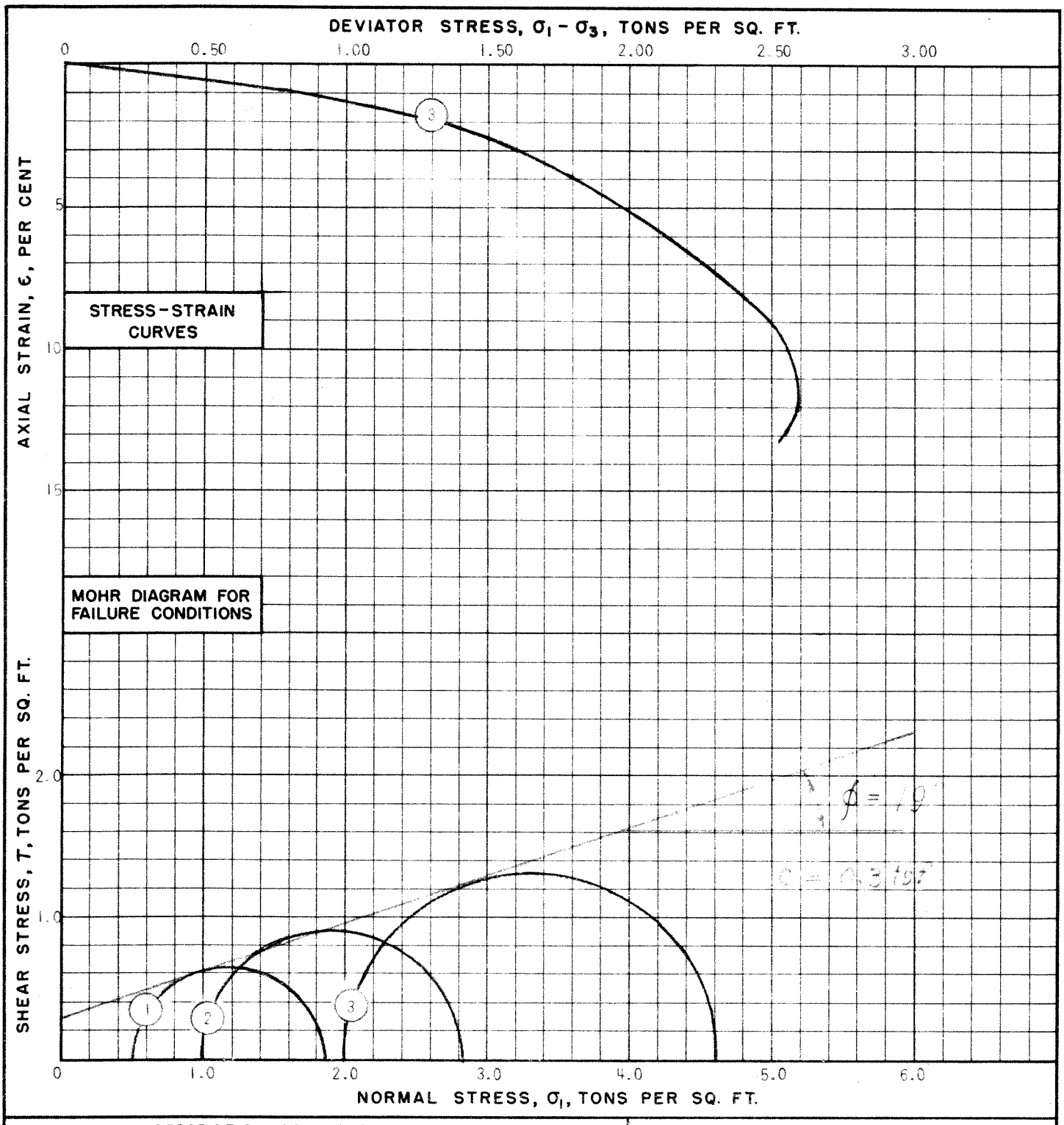
MADE BY: AR DATE: 10-23-74
CH'KD BY: VLT DATE: 10-24-74
FILE NO. 3291H

GRADATION CURVES
STRATUM (D)

PLATE NO. 4



DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPE
BROWN SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND STRATUM (D)	Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F	AXIAL STRAIN %
(1)	3U	2U	SM	Q	0.5	16	16			1.36	13
(2)	3U	2U	SM	Q	1.0	13	13			1.83	14
(3)	3U	2U	SM	Q	2.0	15	15			2.59	8

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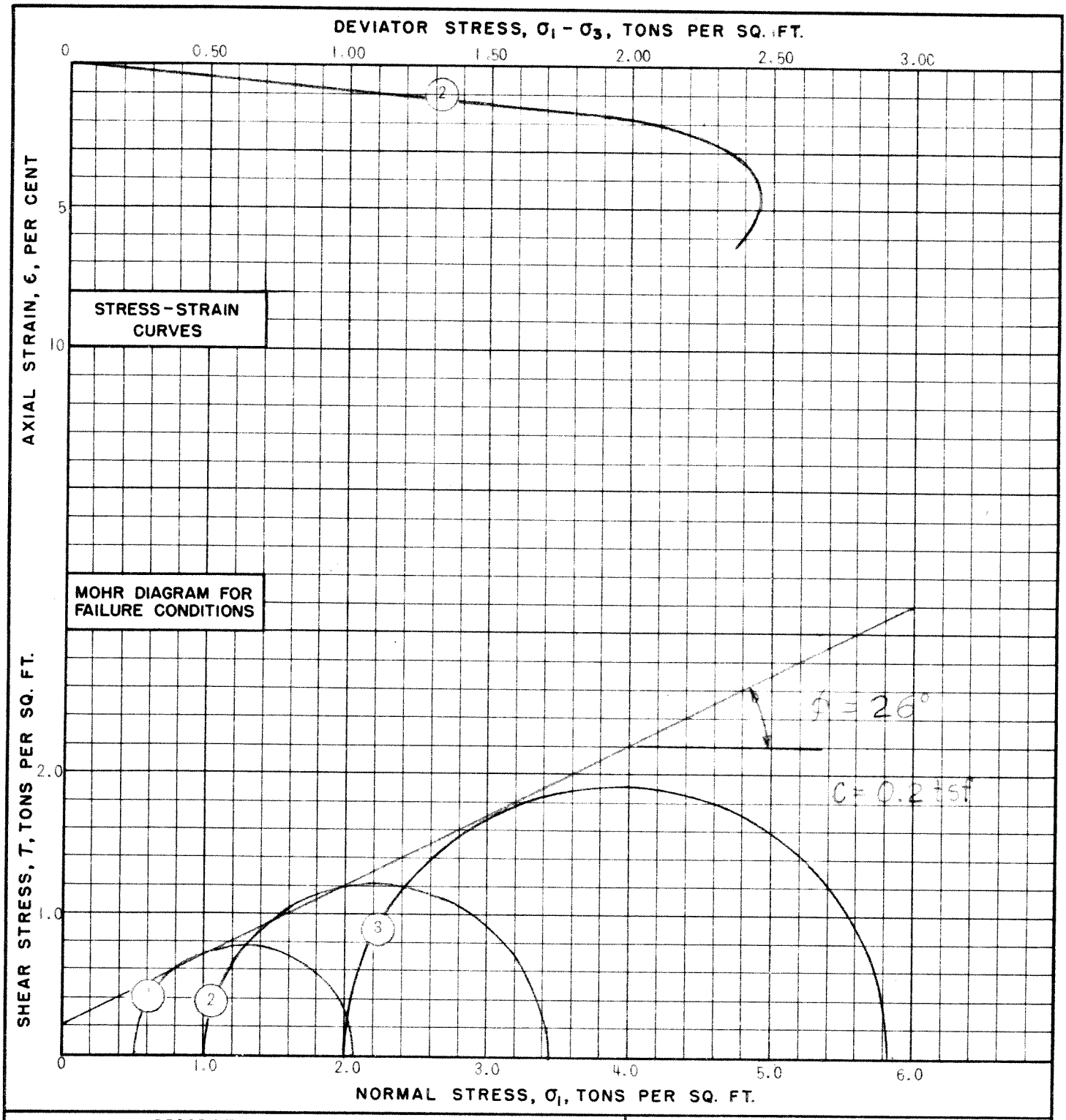
MADE BY:	AAK	DATE:	6-6-74	FILE NO.
CH'KD BY:	VLT	DATE:	10-10-74	329TH

SUMMARY OF STRENGTH TESTS
BORING AM-3U SAMPLE 2U

PLATE NO. 5



DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPE
BROWN SILTY FINE SAND, TRACE COARSE SAND STRATUM (D)	Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
(1)	3U	4U	SM	Q	0.5	10	10			1.51	2
(2)	3U	4U	SM	Q	1.0	10	9			2.45	4
(3)	3U	4U	SM	Q	2.0	10	10			2.83	6

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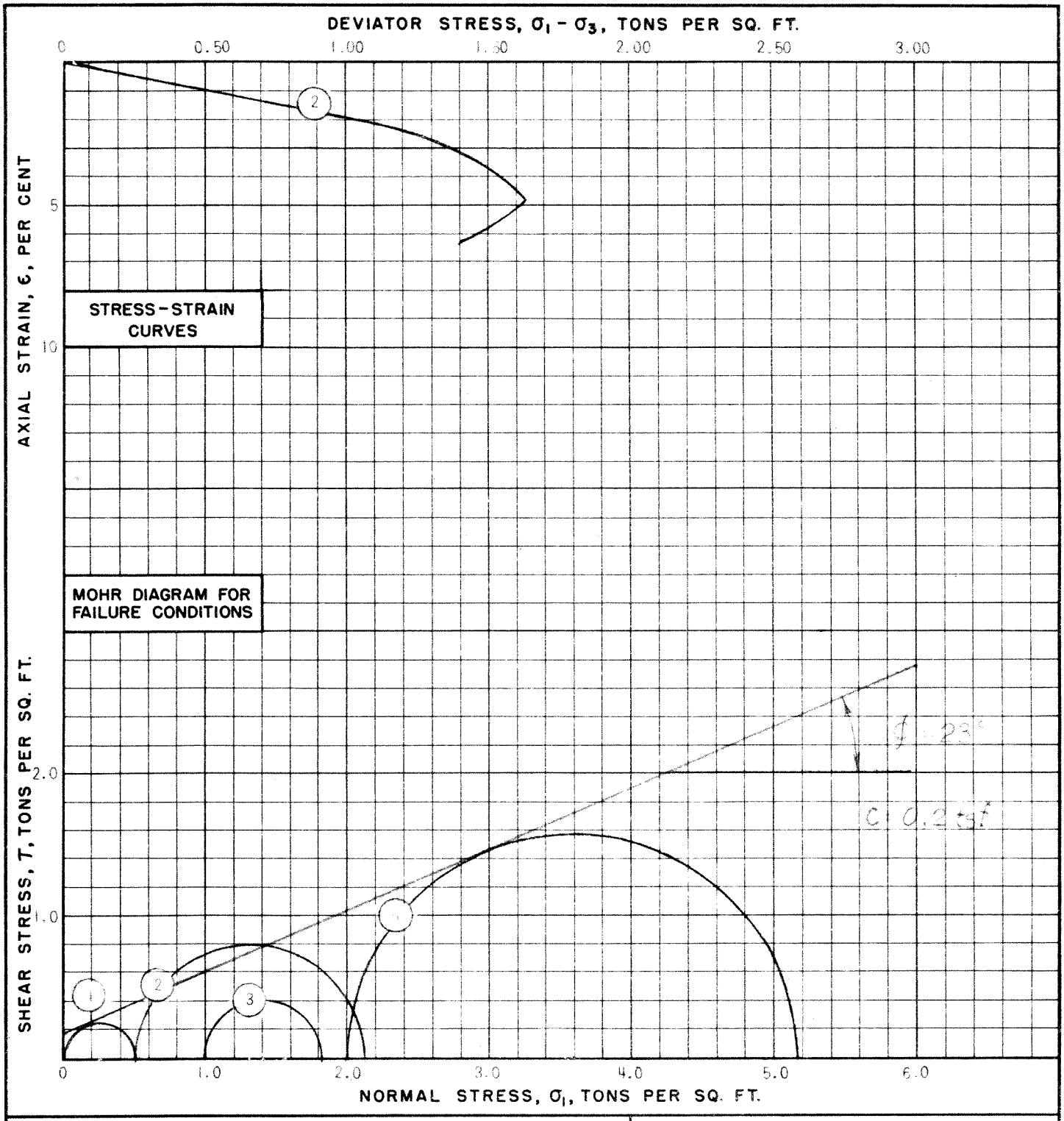
CH'KD BY: VLT DATE: 10-10-74

FILE NO. 3291H

SUMMARY OF STRENGTH TESTS
BORING AM-3U SAMPLE 4U

PLATE NO. 6



DESCRIPTION OF MATERIAL TESTED

BROWN SILTY FINE TO MEDIUM SAND, TRACE COARSE SAND
STRATUM (D)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

U - UNCONFINED COMPRESSION TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
1	3U	10U	SM	U	-	33	32			0.52	4
(2)	3U	8U	SM	Q	0.5	21	21			1.63	5
(3)	3U	10U	SM	Q	1.0	18	16			0.82	5
(4)	3U	8U	SM	Q	2.0	-	-			3.16	8

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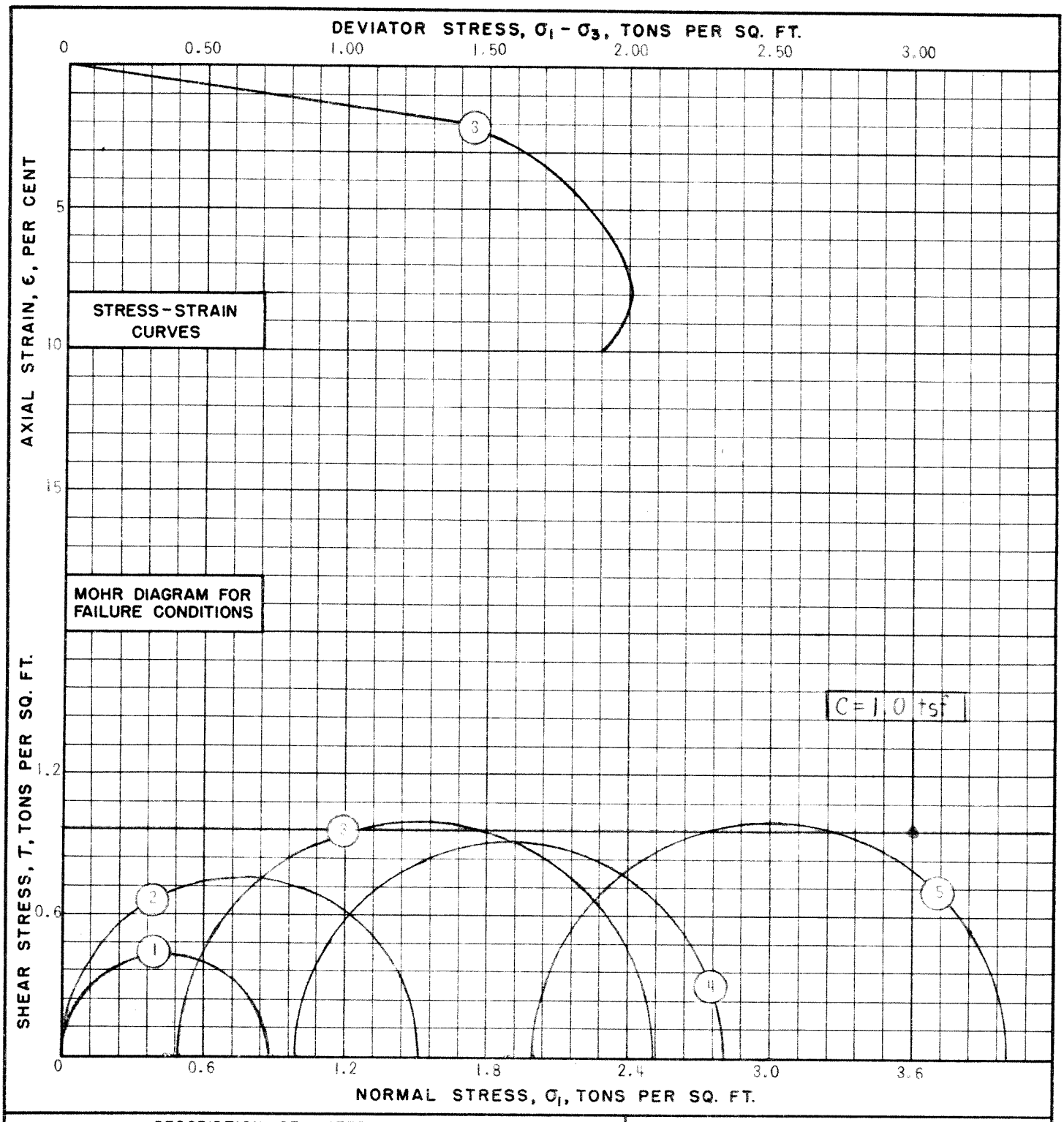
FILE NO. 3291H

SUMMARY OF STRENGTH TESTS
BORING AM-3U SAMPLE 8U & 10U

PLATE NO. 7



DESCRIPTION OF MATERIAL TESTED

STIFF BROWN CLAYEY SILT AND SILTY CLAY, SOME FINE SAND, TRACE GRAVEL

STRATUM (F)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

U - UNCONFINED COMPRESSION TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
(1)	6U	2U	ML	U	-	23	23			0.90	4
(2)	6U	3U	ML	U	-	25	25			1.51	5
(3)	6U	3U	ML	Q	0.5	29	-			2.01	8
(4)	6U	2U	CL	Q	1.0	30	30			1.81	19
(5)	6U	2U	CL	Q	2.0	32	32			2.00	15

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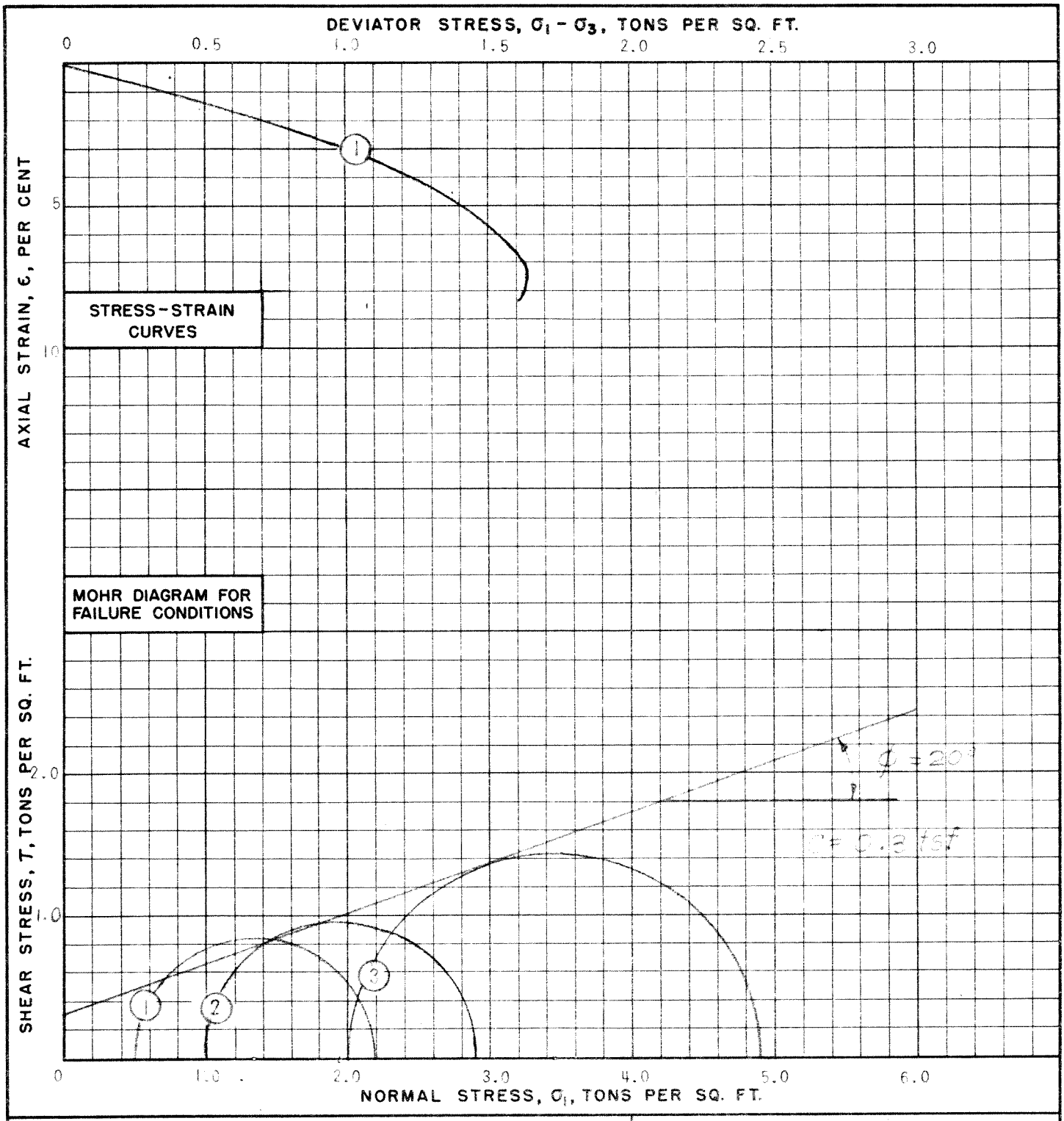
CH'KD BY: VLT DATE: 6-3-74

FILE NO. 3291H

SUMMARY OF STRENGTH TESTS
BORING AM-6U SAMPLE 2U & 3U

PLATE NO. 8



DESCRIPTION OF MATERIAL TESTED	SYMBOLS FOR TEST TYPE
BROWN SILTY FINE SAND STRATUM (D)	Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
1	6U	4U	SM	Q	0.5	21	21			1.65	7
2	6U	4U	SM	Q	1.0	24	23			1.87	13
3	6U	4U	SM	Q	2.0	23	22			2.00	10

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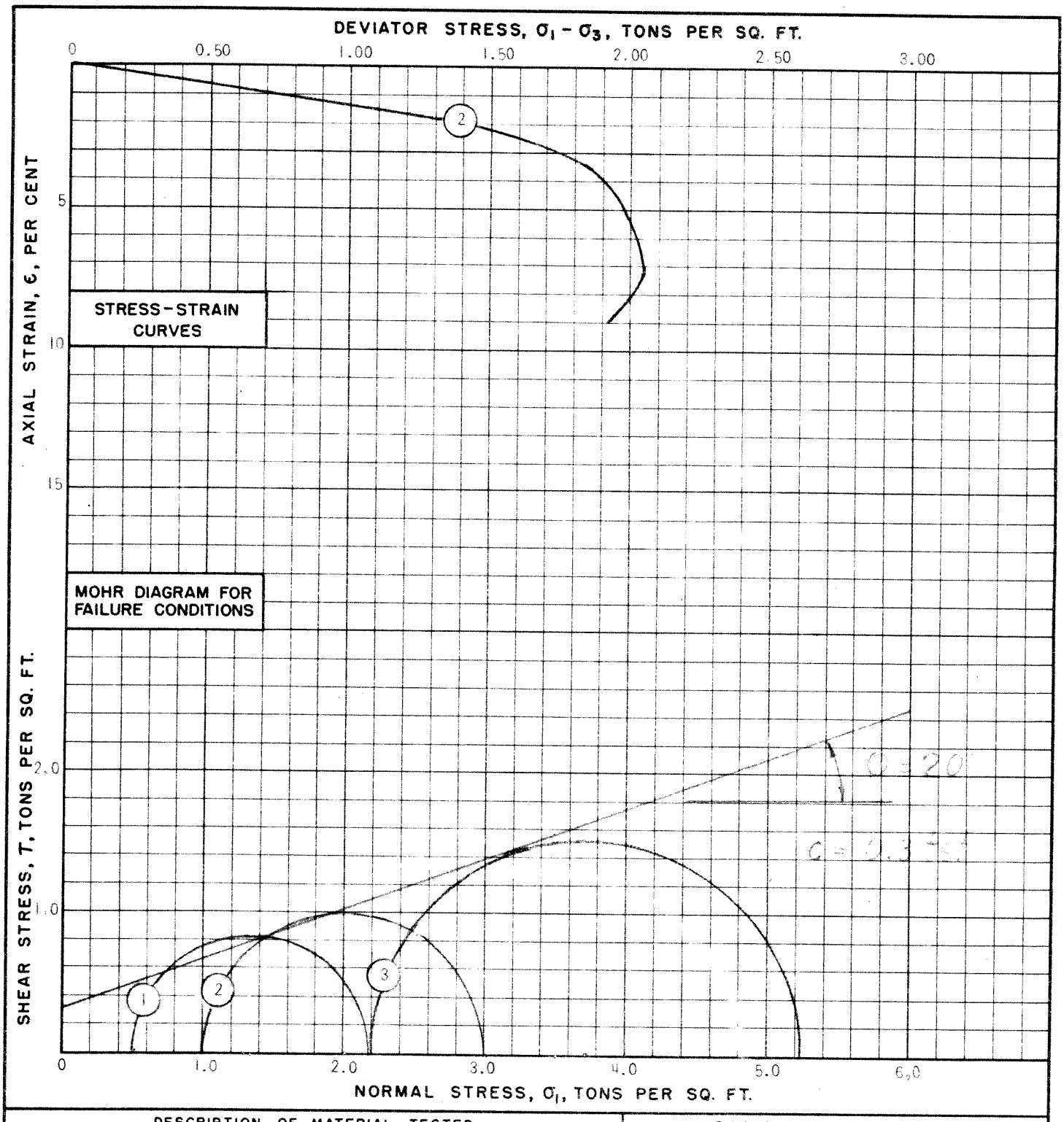
CH'KD BY: KSW DATE: 4-26-74

FILE NO. 320 UH

SUMMARY OF STRENGTH TESTS
BORING AM-6U SAMPLE 4U

PLATE NO. 9



DESCRIPTION OF MATERIAL TESTED

BROWN-GRAY SILTY FINE TO MEDIUM SAND
TRACE COARSE SAND
STRATUM (D)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F	AXIAL STRAIN %
1	6U	7U	SM	Q	0.5	17	17			1.69	4
2	6U	6U	SM	Q	1.0	24	23			2.05	7
3	6U	6U	SM	Q	2.0	24	23.			3.04	6

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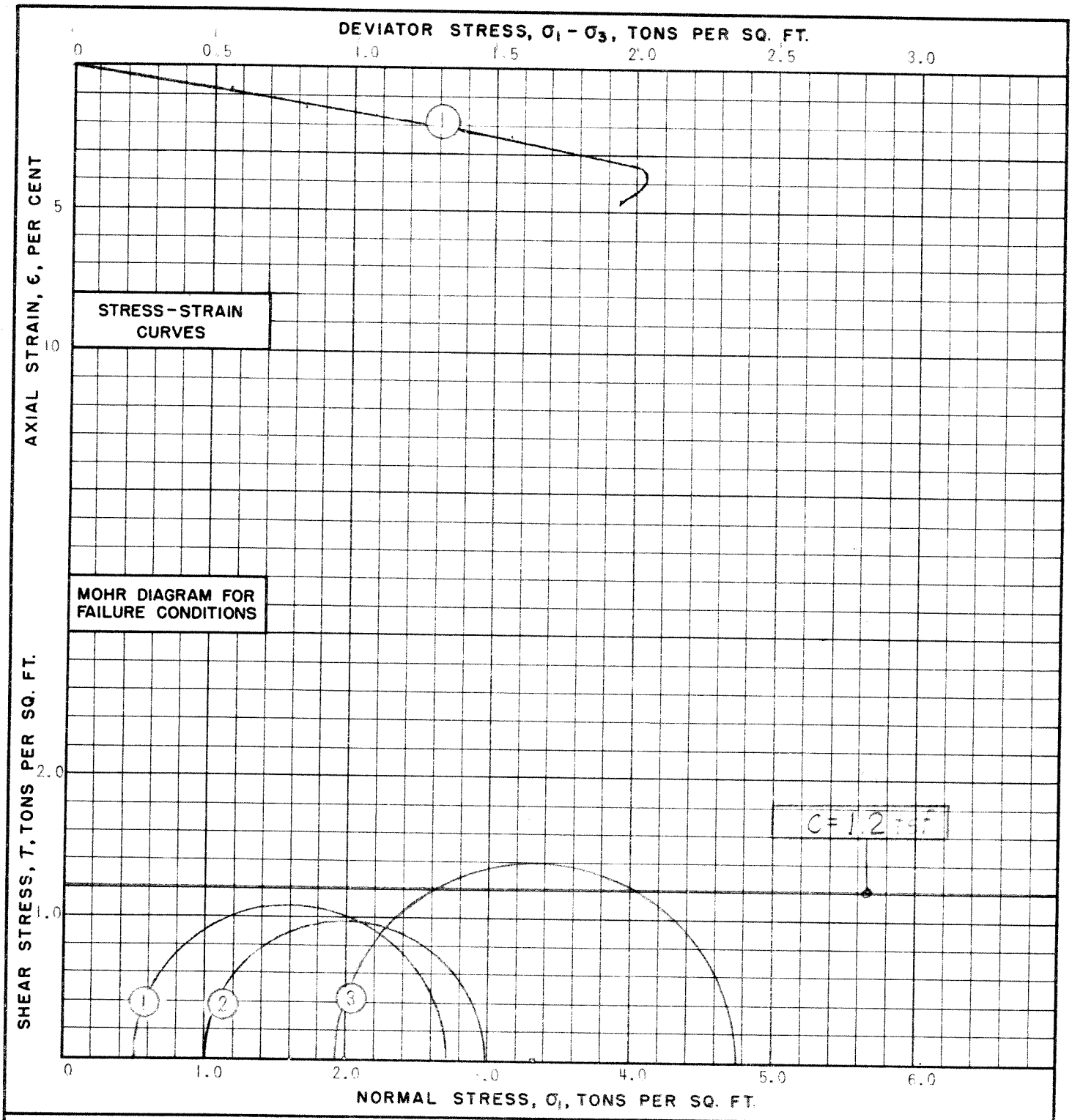
CH'KD BY: VLT DATE: 10-10-74

FILE NO. 3291H

SUMMARY OF STRENGTH TESTS
BORING AM-6U SAMPLE 6U & 7U

PLATE NO. 10



DESCRIPTION OF MATERIAL TESTED

BROWN SILTY FINE SAND

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
1	6U	7U	SM	Q	0.5	16	15			2.22	4
2	6U	9U	SM	Q	1.0	22	22			2.00	9
3	6U	9U	SM	Q	2.0	23	22			2.81	7

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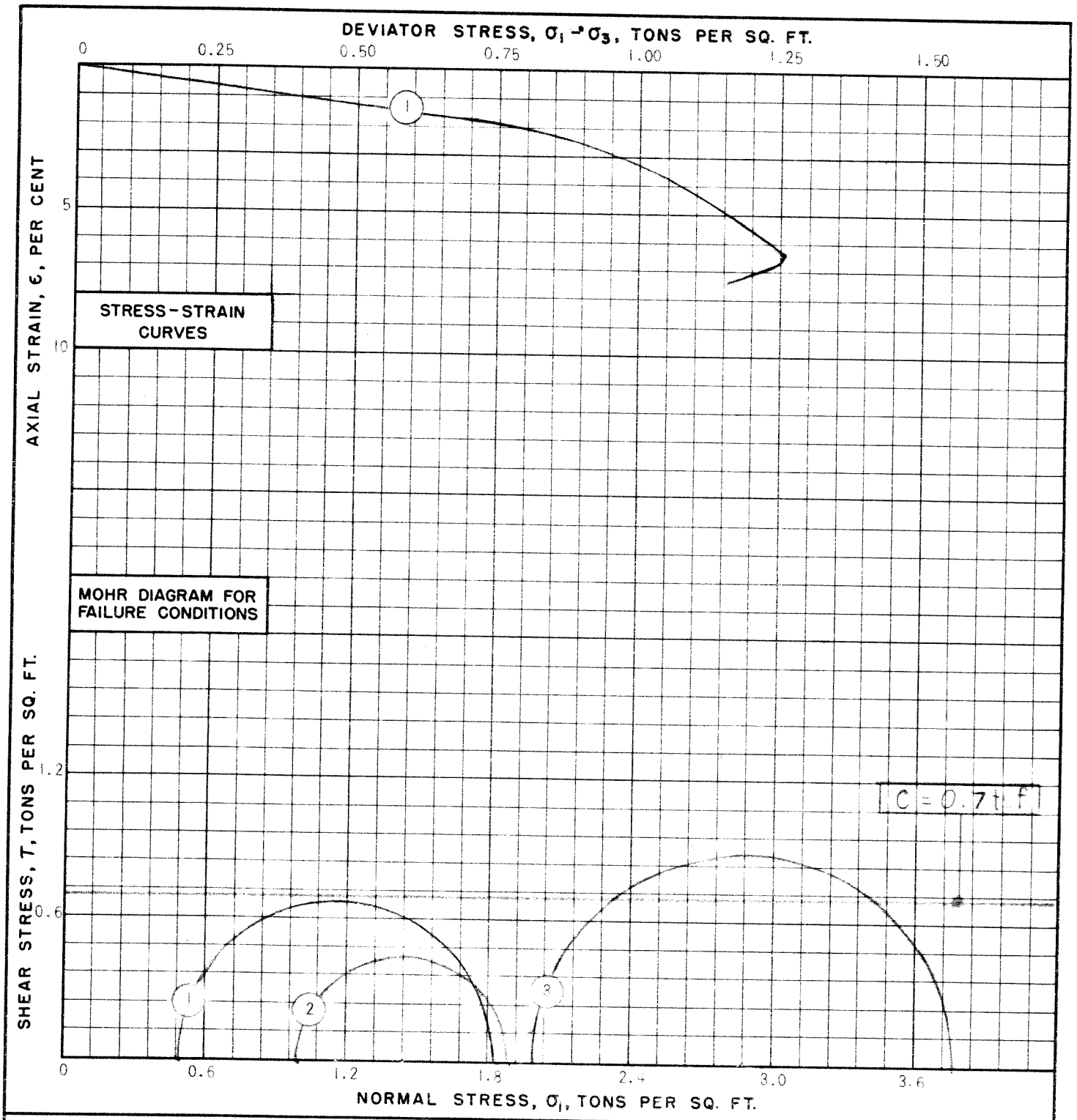
CH'KD BY: RSW DATE: 4-26-74

FILE NO. 329.IW

SUMMARY OF STRENGTH TESTS
BORING AM-6U SAMPLES 7U & 9U

PLATE NO. 11



DESCRIPTION OF MATERIAL TESTED

BROWN-GRAY SILTY FINE TO MEDIUM SAND
TRACE COARSE SAND AND GRAVEL
STRATUM (D)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
(1)	6U	10U	SM	Q	0.50	23	24			1.26	6
(2)	6U	10U	SM	Q	1.00	26	27			0.90	4
(3)	6U	10U	SM	Q	2.00	30	29			1.77	6

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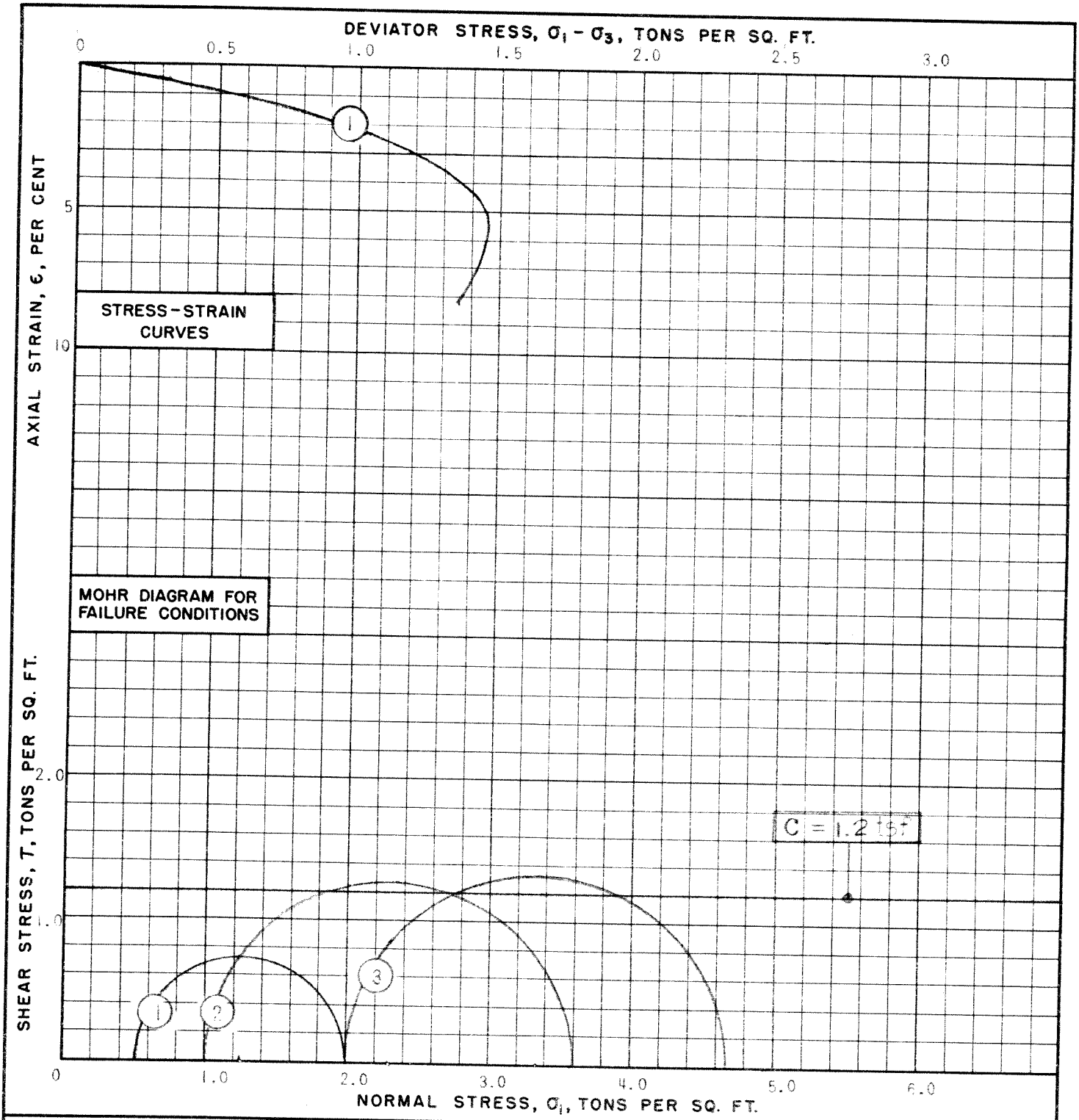
CH'KD BY: VLT DATE: 10-10-74

FILE NO. 329TH

SUMMARY OF STRENGTH TESTS
BORING AM-6U SAMPLE 10U

PLATE NO. 12



DESCRIPTION OF MATERIAL TESTED

BROWN SILTY FINE-MEDIUM SAND, TRACE GRAVEL
STRATUM (D)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNCONFINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
1	9U	2U	SM	Q	0.5	12	12			1.44	6
2	9U	2U	SM	Q	1.0	12	11			2.60	6
3	9U	1U	SM	Q	2.0	20	19			2.68	14

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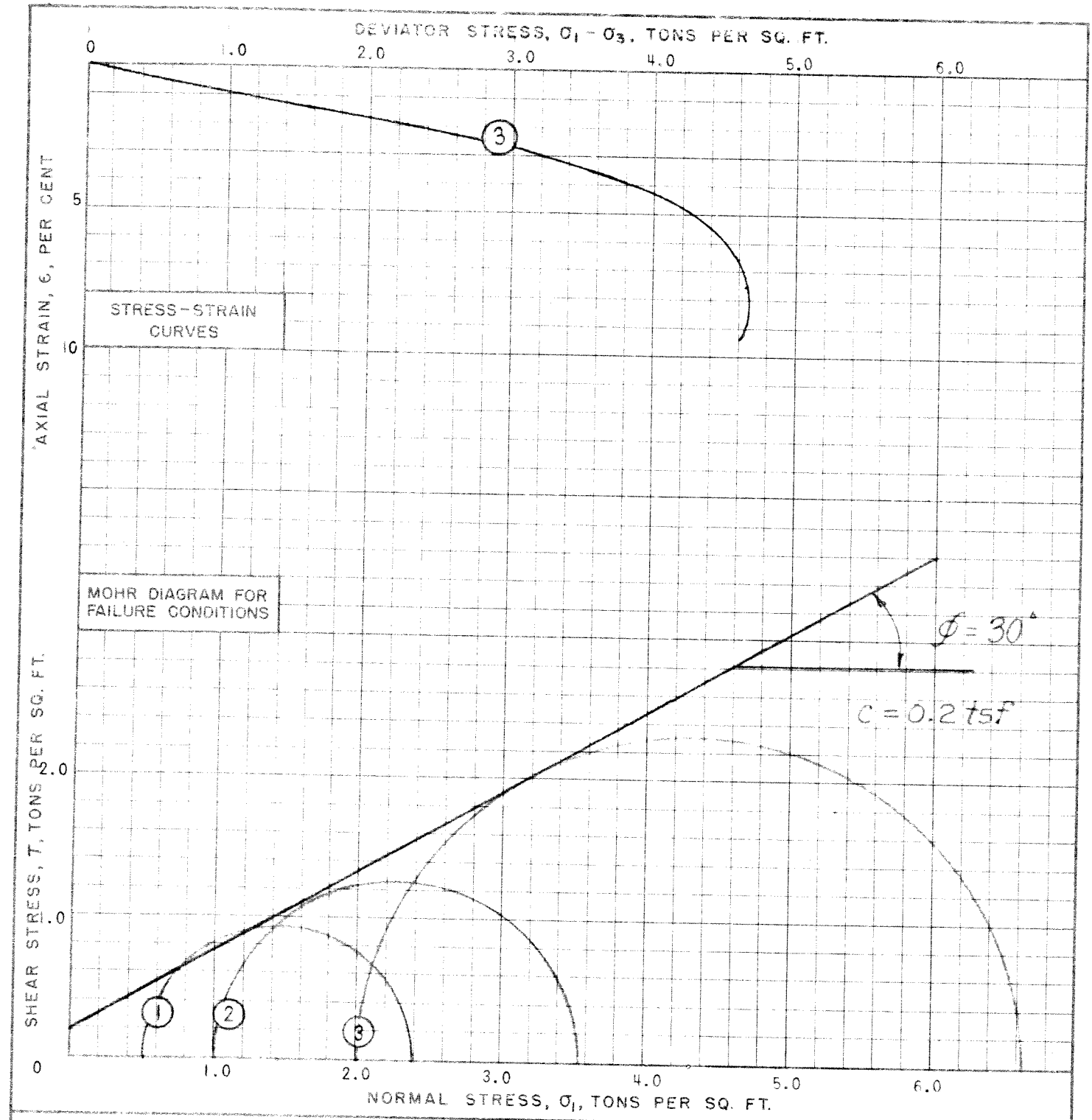
CH'KD BY: KSW DATE: 4-26-74
FILE NO. 3291-H

SUMMARY OF STRENGTH TESTS
BORING AM-9U SAMPLES 1U & 2U

PLATE NO. 13



DESCRIPTION OF MATERIAL TESTED

BROWN SILTY FINE SAND STRATUM D

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNCONFINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
1	37U	2U	SM	Q	0.5	16	16			1.88	6
2	25U	2U	SM	Q	1.0	8	-			2.57	10
3	37U	2U	SM	Q	2.0	9	18			4.65	8

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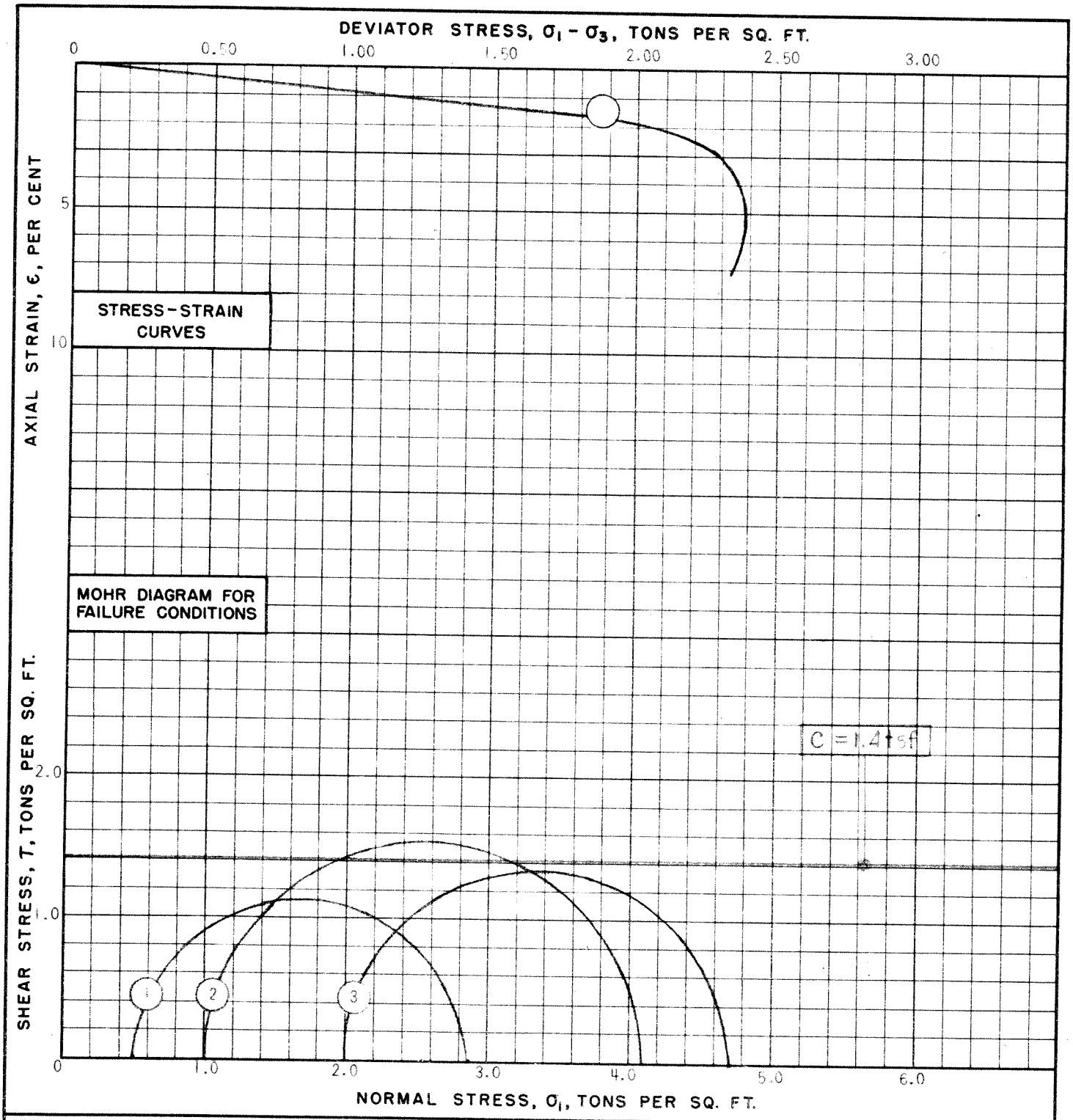
MADE BY: DG DATE: 1-29-74
CH'KD BY: JMc DATE: 2-1-74

FILE NO. 3291H

SUMMARY OF STRENGTH TESTS
BORING AM-25U SAMPLE 2U
BORING AM-37U SAMPLE 2U

PLATE NO. 14



DESCRIPTION OF MATERIAL TESTED

BROWN SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND
STRATUM (D)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
(1)	41U	3U	SM	Q	0.5	22	21			2.38	5
(2)	41U	3U	SM	Q	1.0	22	22			3.10	5
(3)	41U	3U	SM	Q	2.0	27	27			2.71	12

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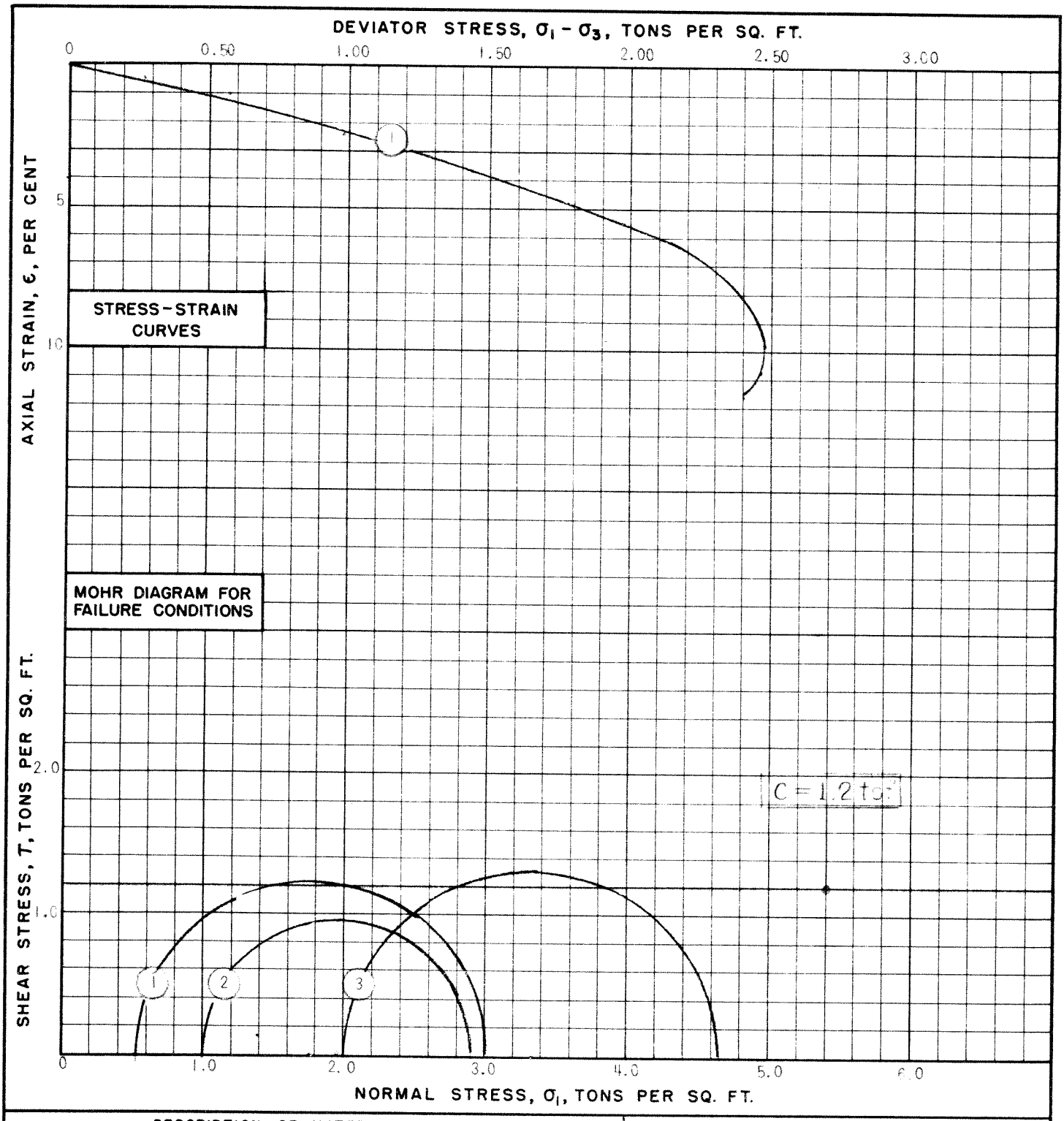
MADE BY:	AAK	DATE:	6-11-74	FILE NO.
CH'KD BY:	V.J	DATE:	10-10-74	3291H

SUMMARY OF STRENGTH TESTS
BORING AM-41U SAMPLE 3U

PLATE NO. 15



DESCRIPTION OF MATERIAL TESTED

STIFF BROWN CLAYEY SILT, SOME FINE SAND AND RED-BROWN FINE SANDY SILT, SOME CLAY
STRATA (D) & (F)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
(1)	44U	4U	ML	Q	0.5	25	25			2.49	9
(2)	44U	2U	ML	Q	1.0	29	29			1.88	13
(3)	44U	2U	ML	Q	2.0	29	29			2.64	13

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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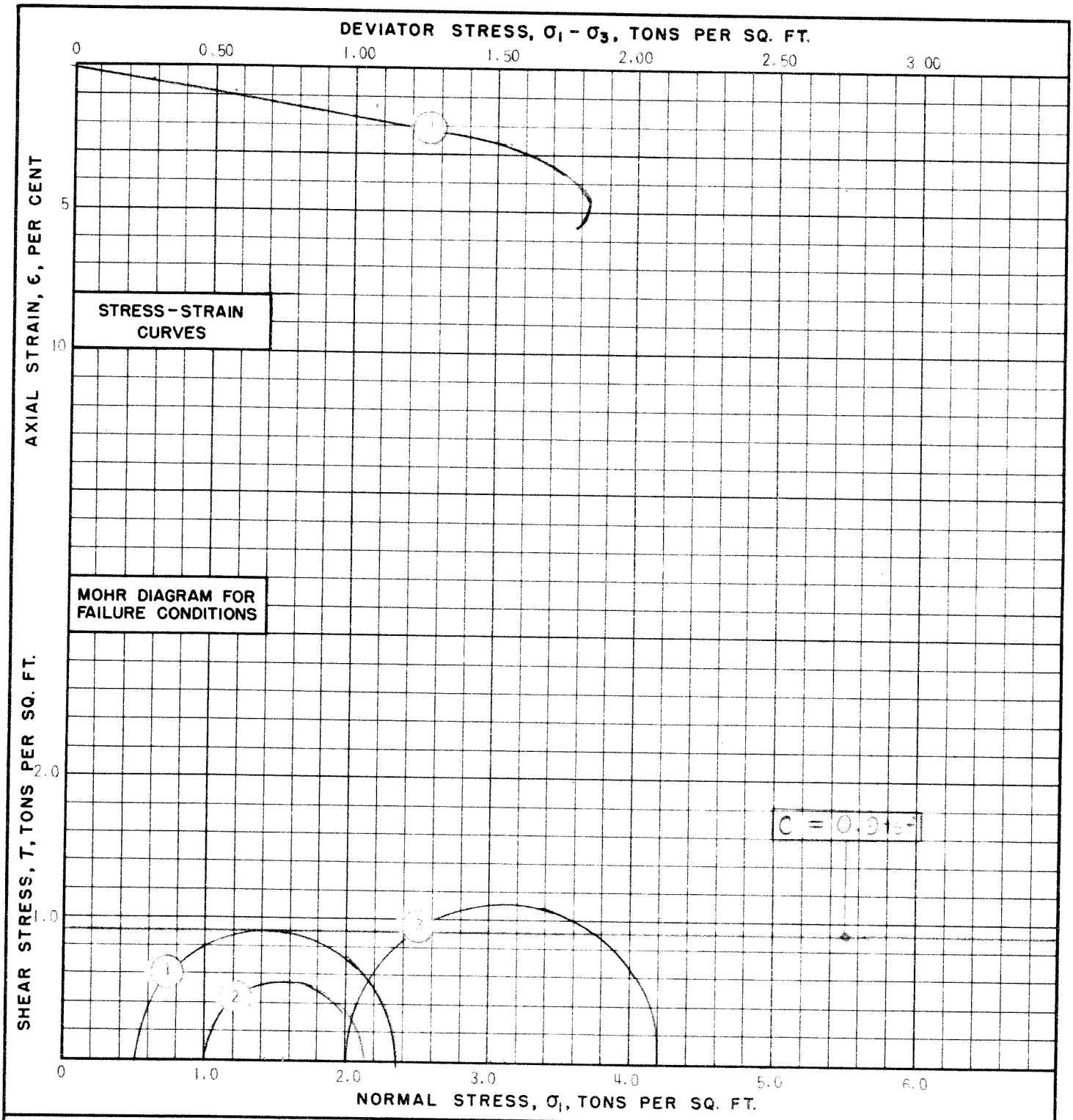
MADE BY: VLT DATE: 10-25-74
CH'KD BY: DATE:

FILE NO. 329.1H

SUMMARY OF STRENGTH TESTS
BORING AH-44U SAMPLE 2U & 4U

PLATE NO. 16



DESCRIPTION OF MATERIAL TESTED

RED-BROWN FINE SANDY SILT, TRACE COARSE SAND AND GRAVEL

STRATUM (D)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
1	44U	4U	ML	Q	0.5	29	28			1.62	5
2	44U	5U	ML	Q	1.0	40	40			1.13	9
3	44U	6U	ML	Q	2.0	35	35			2.21	10

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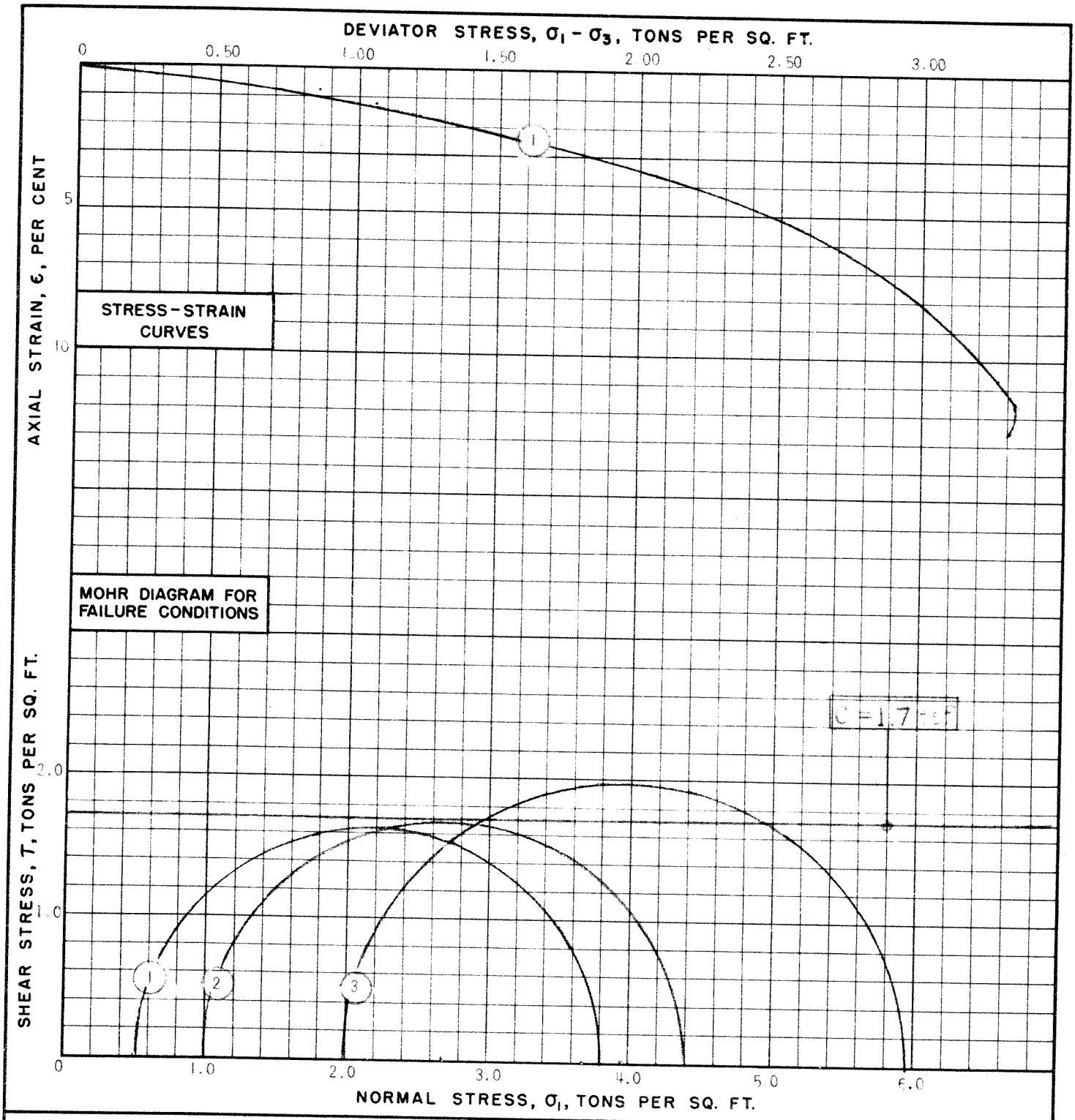
FILE NO. 329.1H

SUMMARY OF STRENGTH TESTS
BORING AM-44U SAMPLE 4U & 6U

PLATE NO. 17



DESCRIPTION OF MATERIAL TESTED

STIFF BROWN SILTY CLAY, SOME FINE SAND, TRACE ROOTS

STRATUM (F)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
1	46U	2U	CL	Q	0.5	20	20			3.32	12
(2)	46U	2U	CL	Q	1.0	17	17			3.35	14
(3)	46U	2U	CL	Q	2.0	16	16			3.91	16

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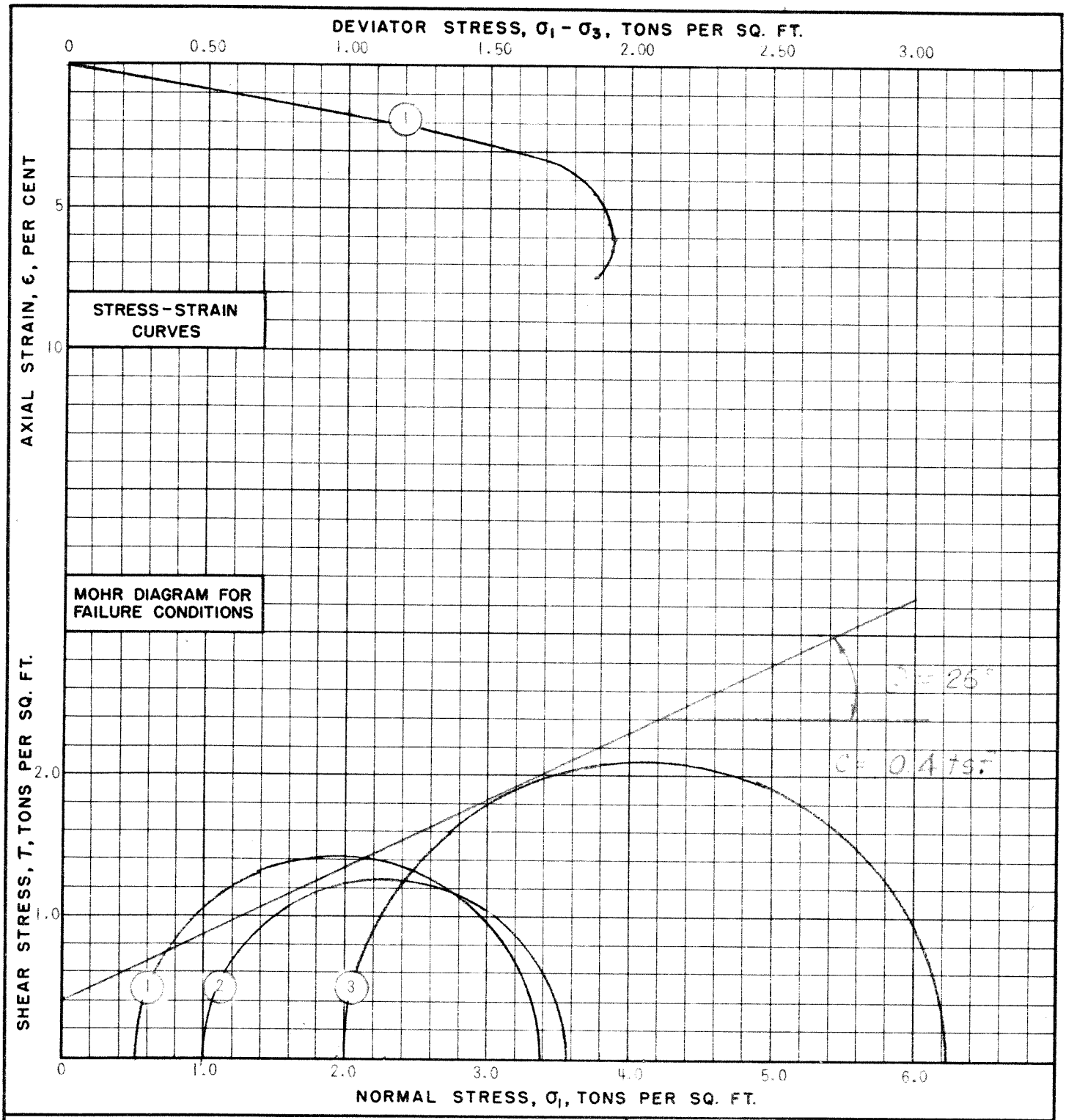
CH'KD BY: DATE:

FILE NO. 3291H

SUMMARY OF STRENGTH TESTS
BORING AM-46U SAMPLE 2U

PLATE NO. 18



DESCRIPTION OF MATERIAL TESTED

BROWN SILTY FINE TO MEDIUM SAND, TRACE COARSE SAND
STRATUM (D)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
(1)	58U	4U	SM	Q	0.5	17	17			2.84	6
(2)	58U	4U	SM	Q	1.0	18	18			2.55	9
(3)	58U	5U	SM	Q	2.0	15	15			4.22	5

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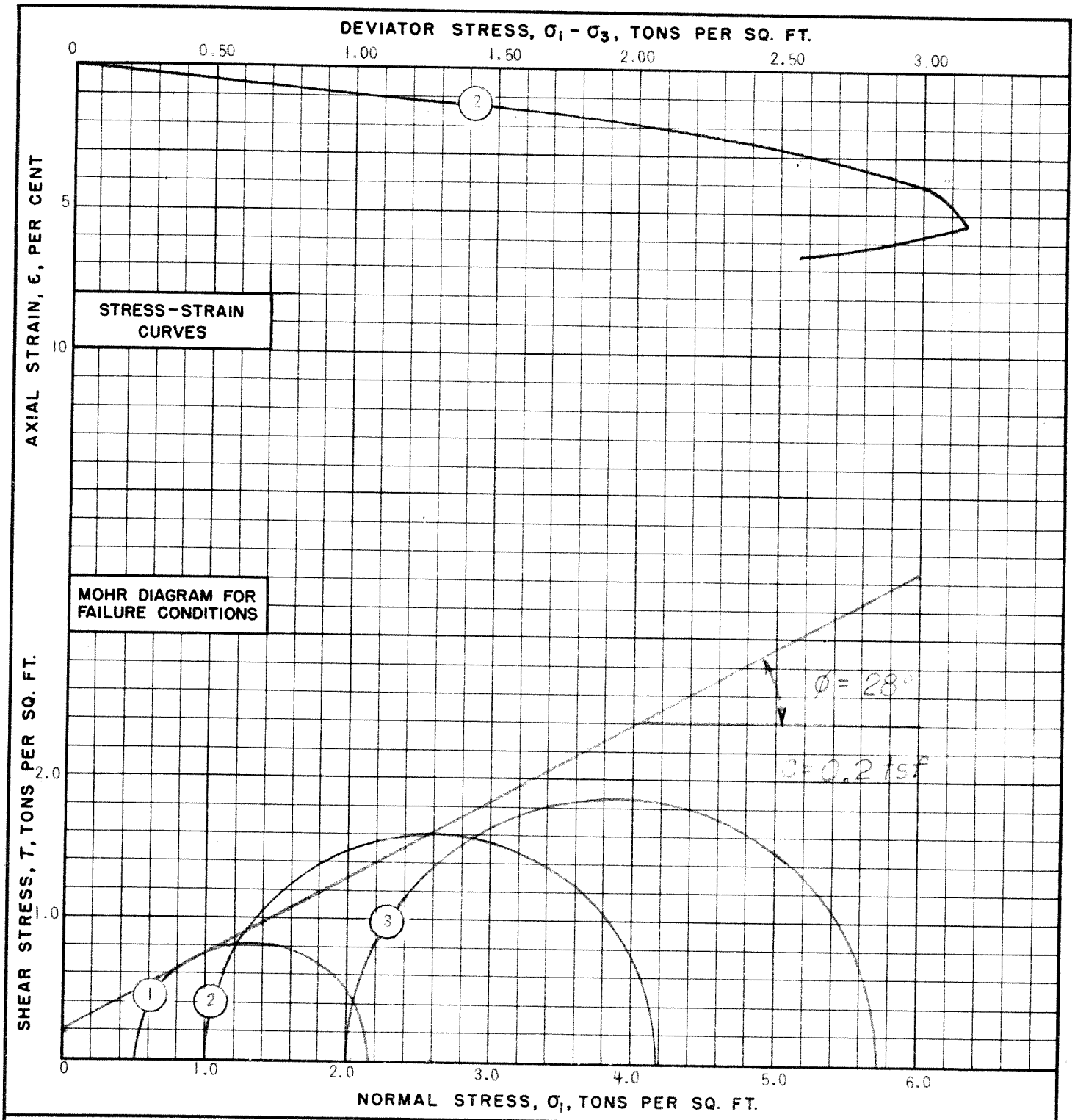
MADE BY: VLT DATE: 10-25-74
CH'KD BY: DATE:

FILE NO. 329 IH

SUMMARY OF STRENGTH TESTS
BORING AM-58U SAMPLE 4U & 5U

PLATE NO. 19



DESCRIPTION OF MATERIAL TESTED

BROWN-GRAY SILTY FINE TO MEDIUM SAND
TRACE COARSE SAND
STRATUM (D)

SYMBOLS FOR TEST TYPE

Q - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

KEY	BORING NO.	SAMPLE NO.	SOIL TYPE	TEST TYPE	LATERAL PRESSURE T.S.F.	WATER CONTENT - % INITIAL	WATER CONTENT - % FINAL	DEGREE OF SATURATION - % INITIAL	DEGREE OF SATURATION - % FINAL	DEVIATOR STRESS T.S.F.	AXIAL STRAIN %
(1)	59U	4U	SM	Q	0.5	18	18			1.64	4
(2)	59U	4U	SM	Q	1.0	20	20			3.16	5
(3)	59U	2U	SM	Q	2.0	12	12			3.75	9

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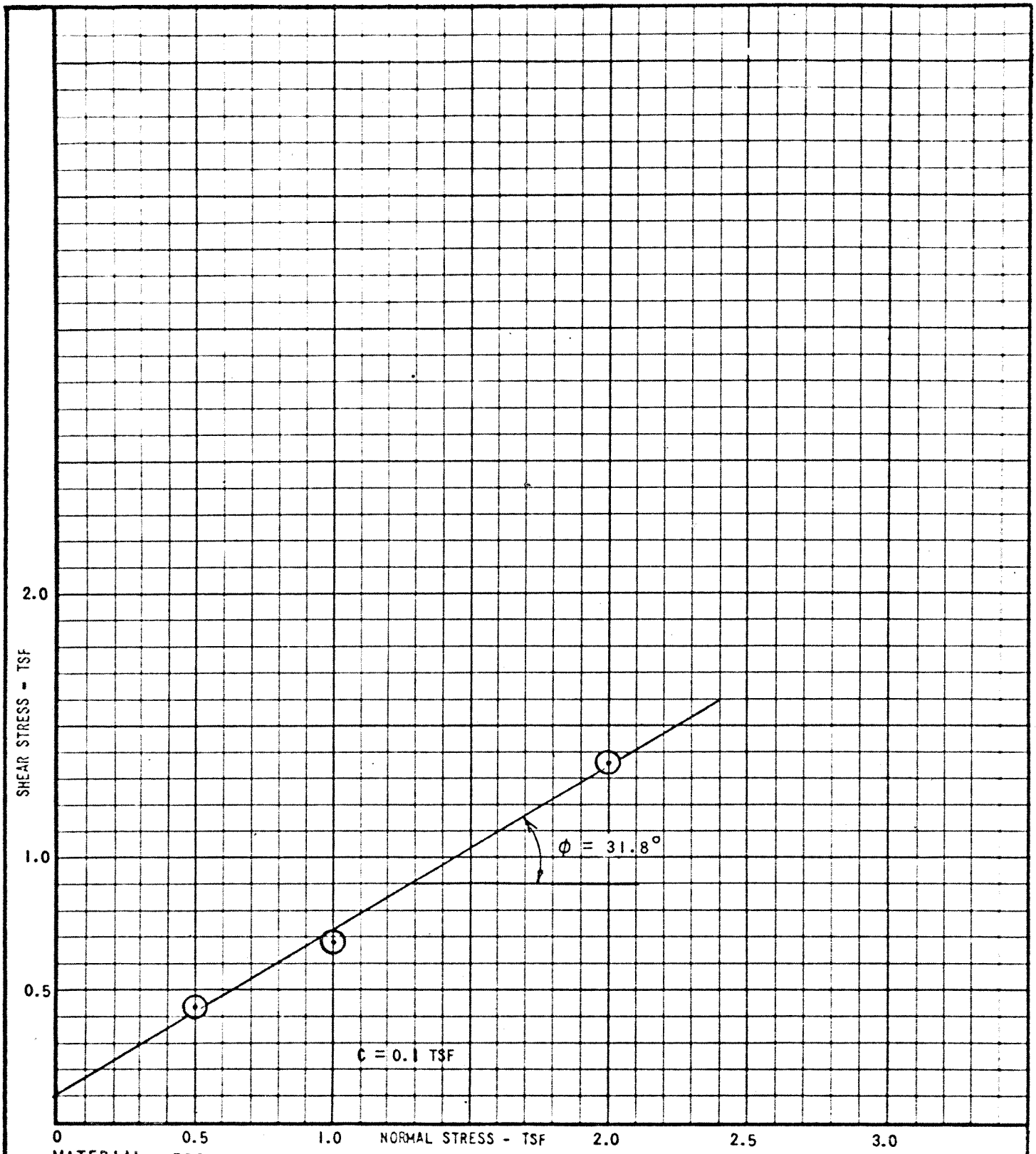
MADE BY: AAK DATE: 8-15-74
CH'KD BY: VLT DATE: 10-16-75
FILE NO. 3291H

SUMMARY OF STRENGTH TESTS
BORING AM-59U SAMPLE 2U & 4U

PLATE NO. 20



MATERIAL: BROWN FINE SANDY SILT

STRATUM (D)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
AM-3U	4U	25 29 30	100+	0.5 1.0 2.0	0.44 0.68 1.35

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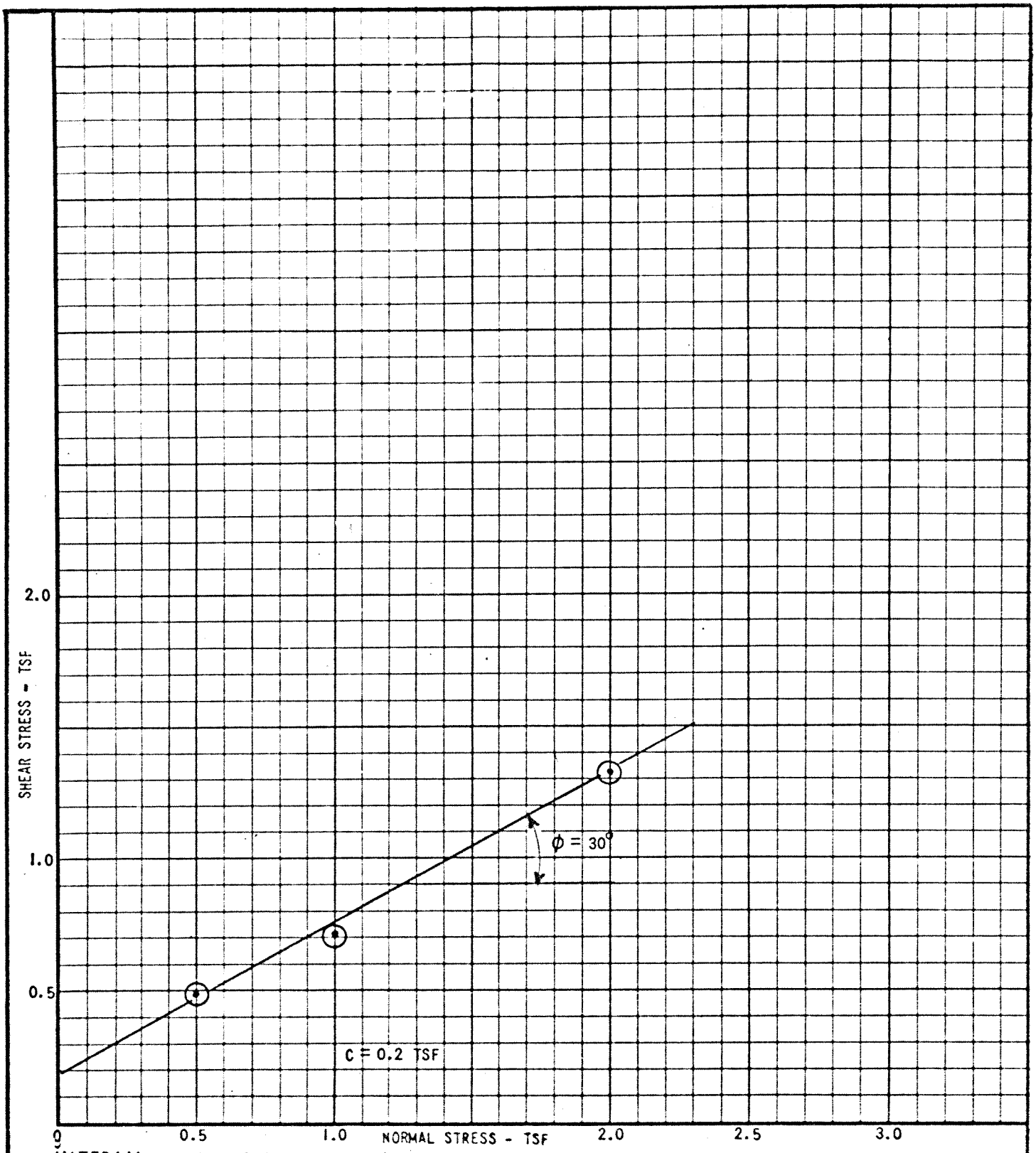
415 MADISON AVE. NEW YORK 17, N.Y.

BASE BY:	AAK	DATE:	6-18-74	FILE NO. 3291H
CHKD BY:	VLT	DATE:	10-9-74	

DIRECT SHEAR TEST
BORING AM-3U SAMPLE 4U

PLATE NO. 21



MATERIAL: BROWN SILTY FINE SAND, TRACE COARSE SAND STRATUM (D)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
AM-3U	8U	31	100+	0.5	0.49
		30		1.0	0.71
		34		2.0	1.32

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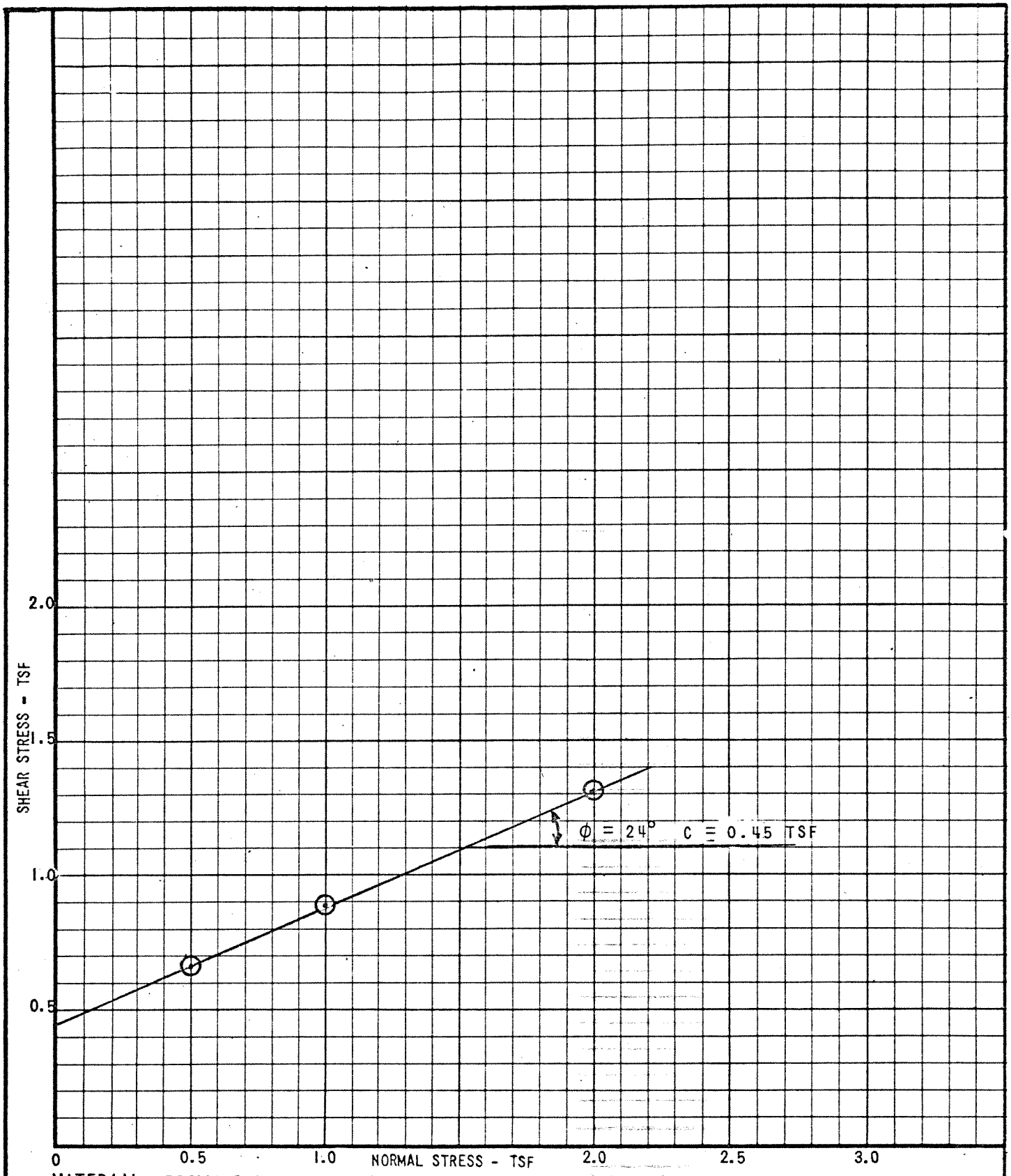
FILE NO. 3291H

DIRECT SHEAR TEST
BORING AM-3U SAMPLE 8U

PLATE NO. 22



MATERIAL: BROWN SILTY FINE SAND, TRACE MEDIUM TO COARSE SAND STRATUM D

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
AM-6	7U	28	100+	0.5	0.67
		27		1.0	0.89
		27		2.0	1.31

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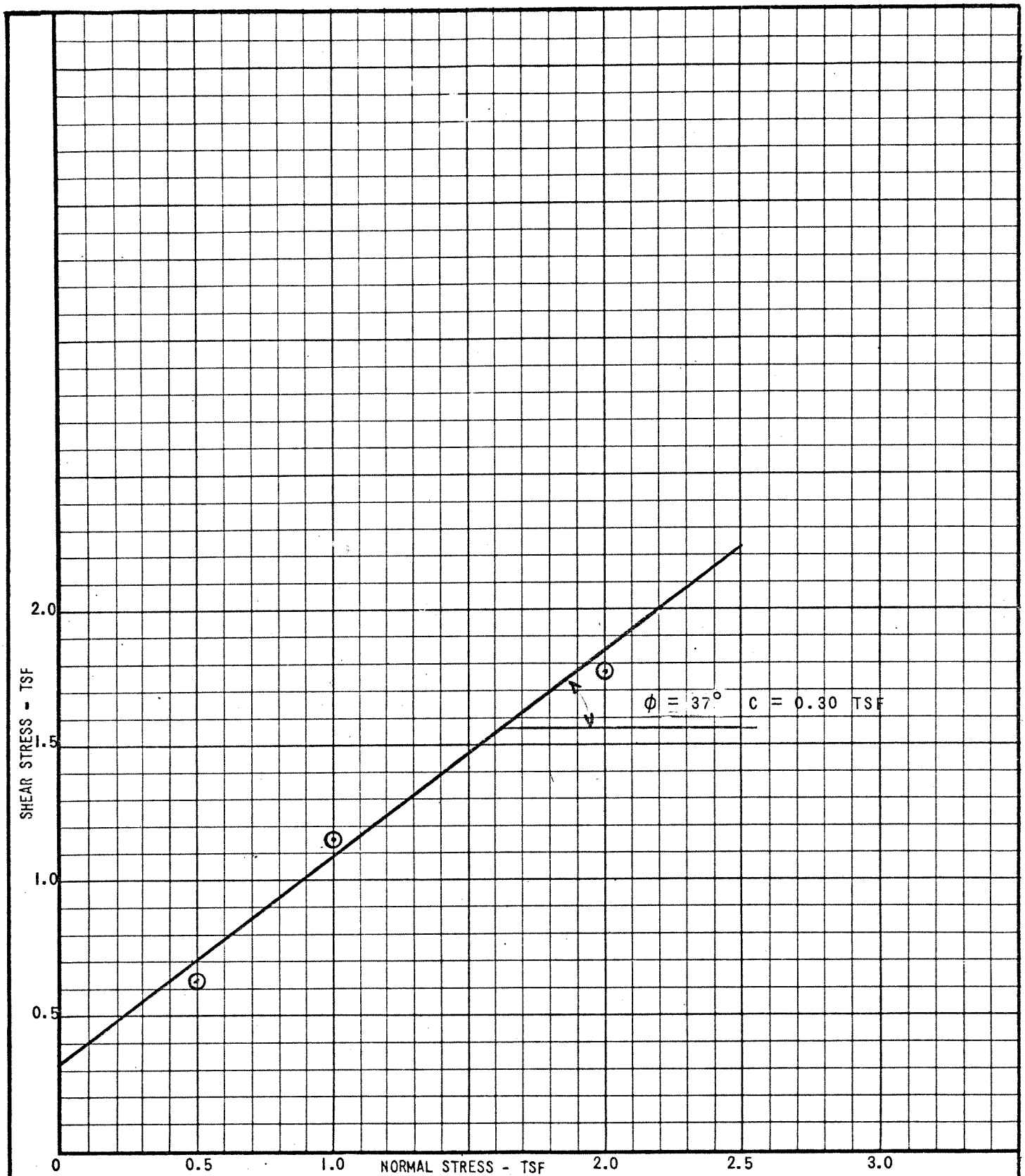
MADE BY: AAK DATE: 6-4-74
CH'KD BY: VLT DATE: 6-6-74

FILE NO. 3291H

DIRECT SHEAR TEST
BORING AM-6 SAMPLE 7U

PLATE NO. 23



MATERIAL: BROWN FINE TO MEDIUM SAND, SOME SILT
TRACE COARSE SAND STRATUM (D)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
AM-9U	2U	24	100+	0.5	0.63
		27		1.0	1.15
		25		2.0	1.77

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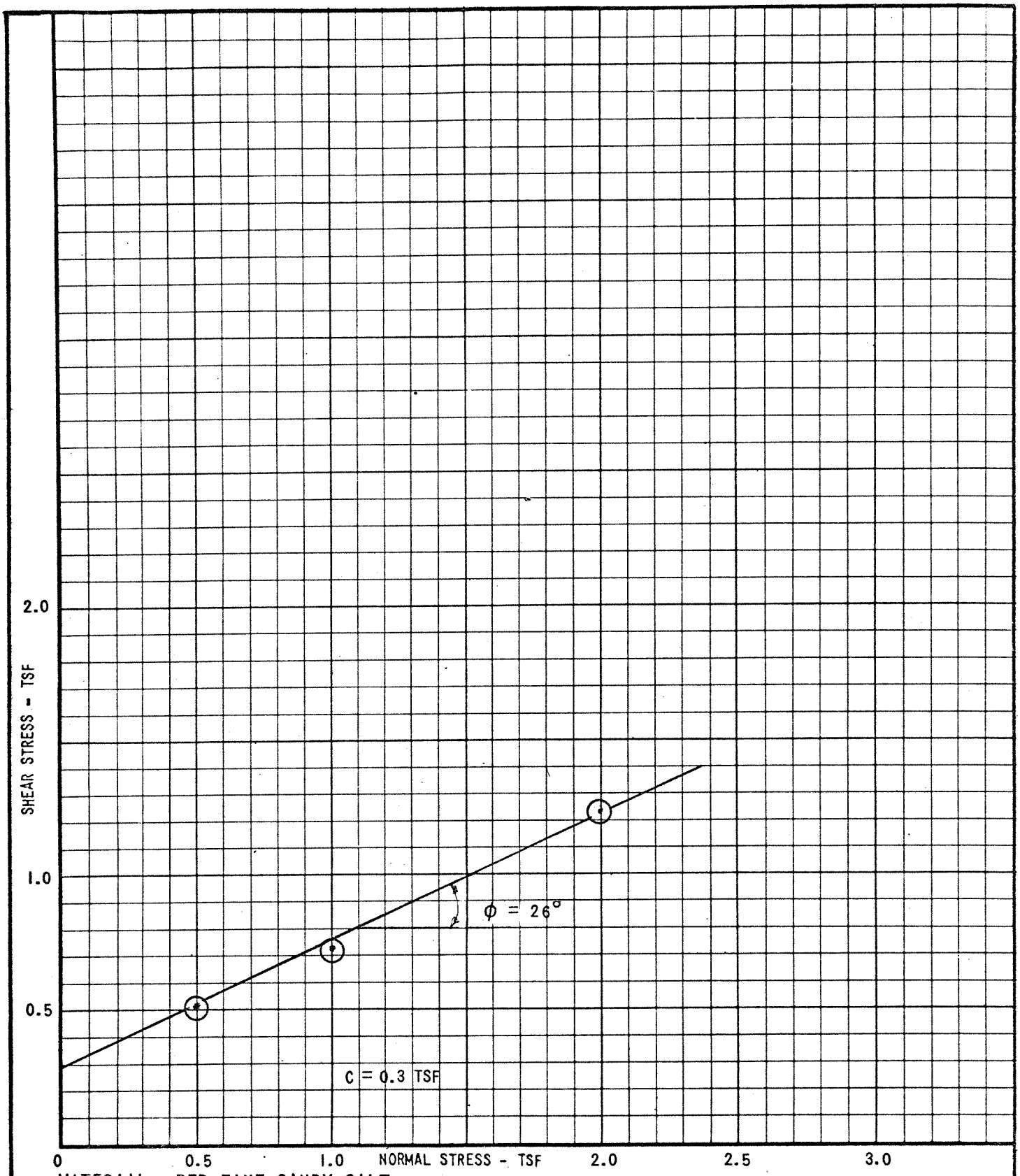
MADE BY: AAK DATE: 6-5-74
CH'KD BY: VLT DATE: 6-6-74

FILE NO. 3291H

DIRECT SHEAR TEST
BORING AM-9U SAMPLE 2U

PLATE NO. 24



MATERIAL: RED FINE SANDY SILT

STRATUM (D)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
AM-44U	4U	46	100+	0.5	0.51
		43		1.0	0.73
		42		2.0	1.24

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MADE BY: VLT DATE: 10-8-74
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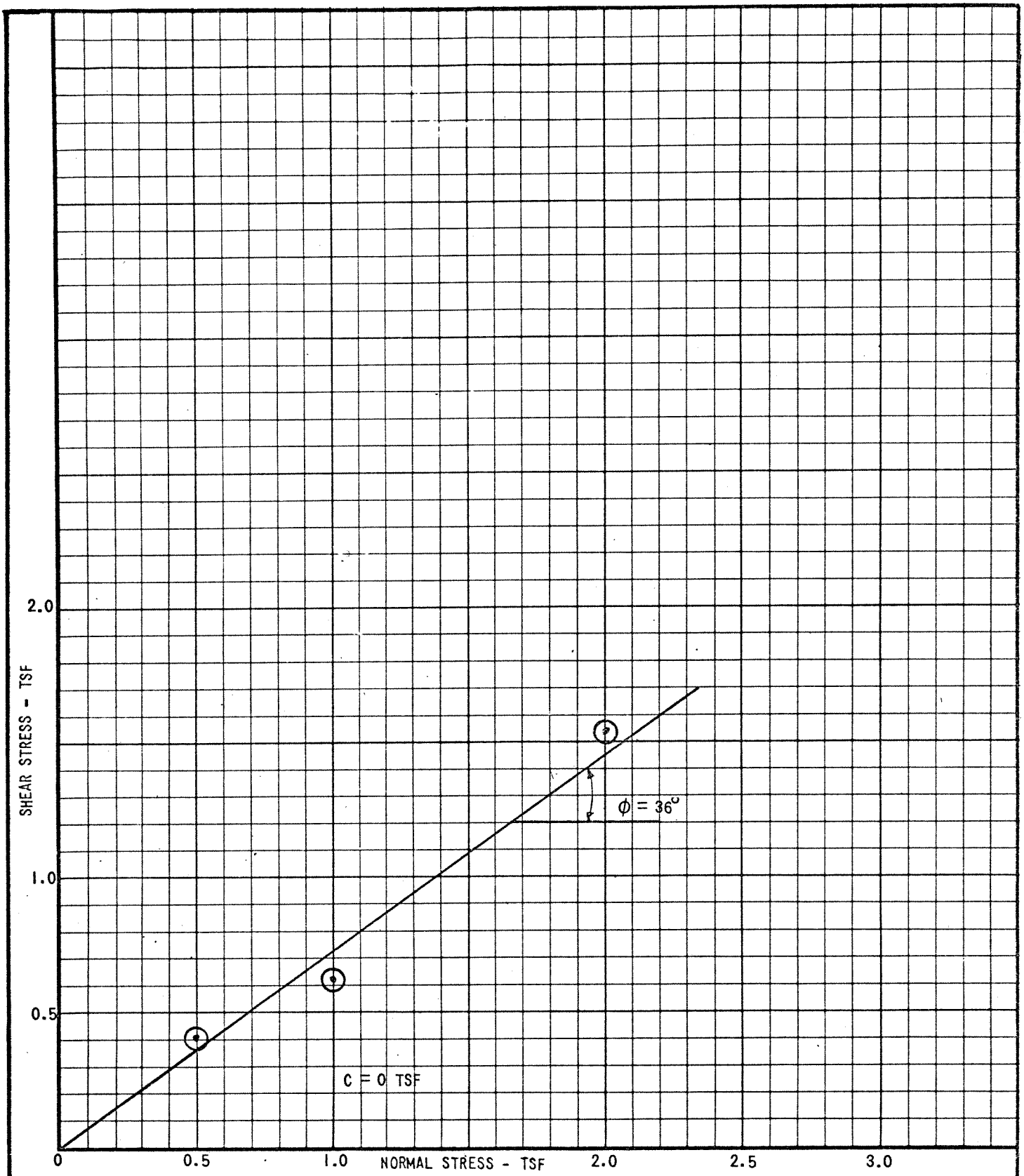
FILE NO. 3291H

DIRECT SHEAR TEST
BORING AM-44U SAMPLE 4U

PLATE NO. 25



MATERIAL: BROWN AND GRAY SILTY FINE TO MEDIUM SAND, TRACE COARSE SAND STRATUM (D)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
AM-58U	4U	27	100+	0.5	0.41
	4U	25		1.0	0.63
	5U	30		2.0	1.55

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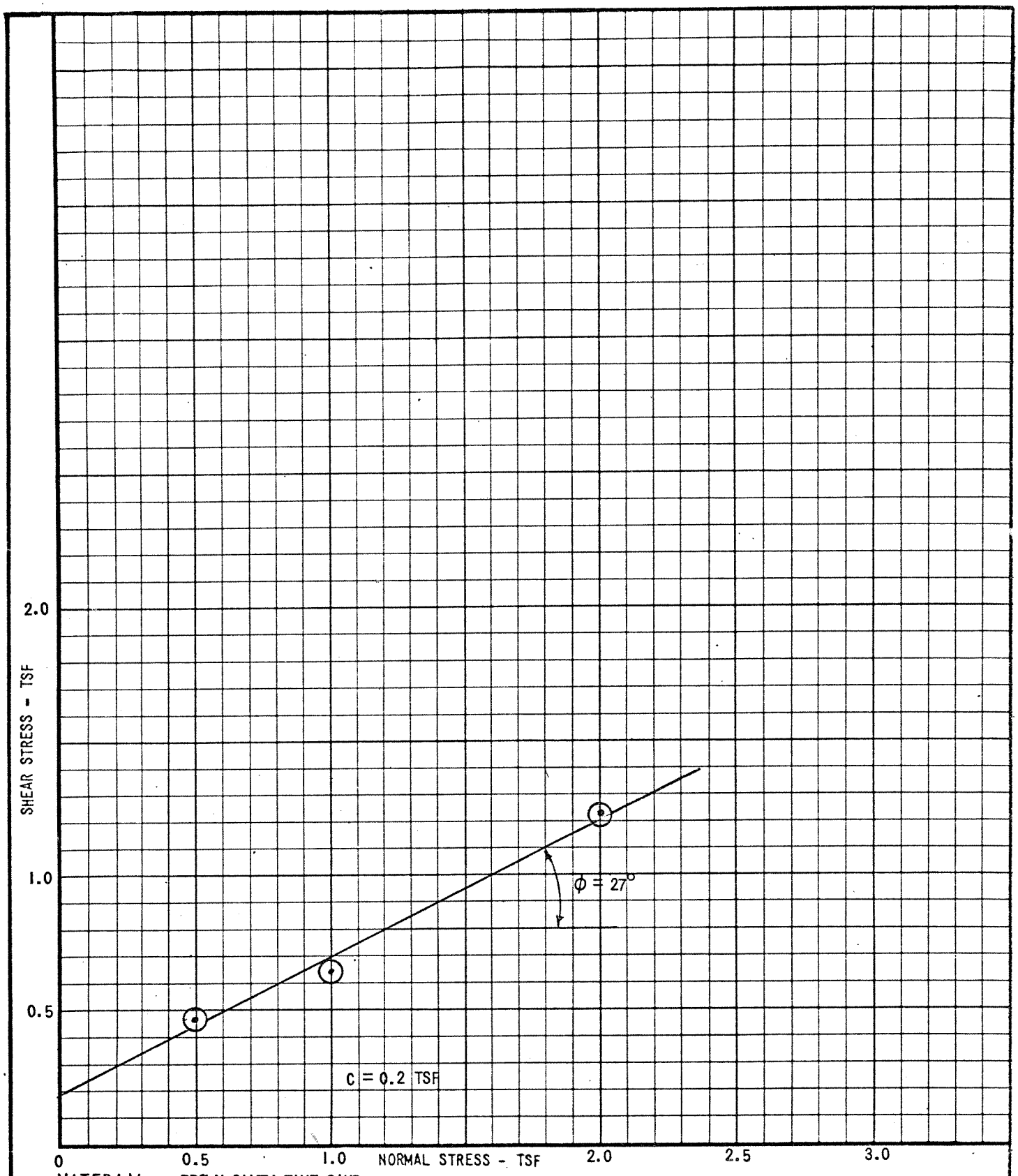
FILE NO. 3291H

DIRECT SHEAR TEST
BORING AM-58U SAMPLES 4U & 5U

PLATE NO. 26



MATERIAL: BROWN SILTY FINE SAND

STRATUM (D)

BORING NUMBER	SAMPLE NUMBER	FINAL CONDITION			
		WATER CONTENT	PER CENT SATURATION	NORMAL STRESS TSF	SHEAR STRESS TSF
AM-59U	2U	35	95	0.5	0.48
		34		1.0	0.65
		35		2.0	1.23

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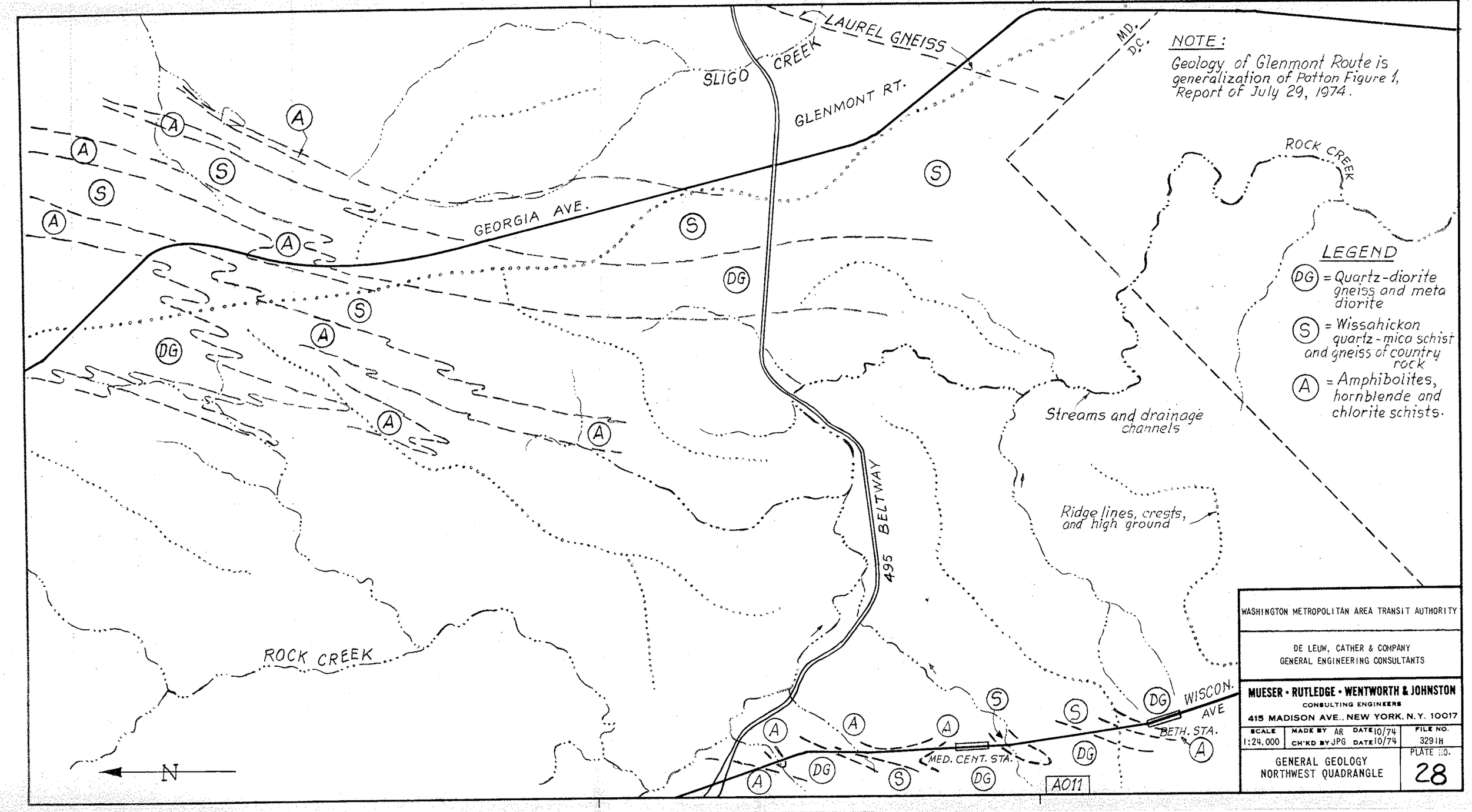
DIRECT SHEAR TEST
BORING AM-59U SAMPLE 2U

PLATE NO. 27


LAUREL GNEISS
SLIGO CREEK
GLENMONT RT.
MD.
D.C.
NOTE:
Geology of Glenmont Route is generalization of Patton Figure 1, Report of July 29, 1974.
ROCK CREEK
GEORGIA AVE.
LEGEND
DG = Quartz-diorite gneiss and meta diorite
S = Wissahickon quartz-mica schist and gneiss of country rock
A = Amphibolites, hornblende and chlorite schists.
Streams and drainage channels
Ridge lines, crests, and high ground
495 BELTWAY
ROCK CREEK
WISCON. AVE
BETH. STA.
MED. CENT. STA.
N
A011
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SCALE 1:24,000
MADE BY AR DATE 10/74
CH'KD BY JPG DATE 10/74
FILE NO. 329 IH
GENERAL GEOLOGY NORTHWEST QUADRANGLE
PLATE NO. 28

GENERAL NOTES

1. THIS DRAWING CONTAINS REFERENCE INFORMATION FOR ANY SUBSURFACE INVESTIGATION PERFORMED FOR THE WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY (WMATA). SPECIFIC DETAILS WHICH PERTAIN TO INDIVIDUAL INVESTIGATIONS ARE CONTAINED ON BORING LOG DRAWINGS OR GEOLOGICAL SECTIONS IN A SERIES OF TECHNICAL REPORTS.

2. THE BORINGS WHOSE DETAILED LOGS ARE CONTAINED IN THESE REPORTS WERE MADE BY A BORING CONTRACTOR UNDER THE CONTINUOUS INSPECTION OF RESIDENT ENGINEERS OF MUESER, RUTLEDGE, WENTWORTH & JOHNSTON (MRWJ). THESE DETAILED LOGS WERE DERIVED FROM MRWJ FIELD BORING LOGS AFTER EXAMINATION AND CHECK OF SOIL CLASSIFICATION IN THE LABORATORY. SOIL DESCRIPTIONS MAY NOT AGREE WITH THE ORIGINAL MRWJ FIELD LOGS OR WITH THE BORING CONTRACTOR'S LOGS, COPIES OF WHICH ARE ON FILE AT WMATA. THESE SOURCES SHOULD BE CONSULTED FOR ADDITIONAL DETAILS REGARDING BORING OPERATIONS AND THE NATURE OF MATERIALS ENCOUNTERED.

3. SOIL SAMPLES AND ROCK CORES RECOVERED IN BORINGS MADE FOR WMATA WHICH REMAINED AFTER LABORATORY TESTING HAVE BEEN STORED IN WASHINGTON D.C. AT THE WMATA WAREHOUSE AT 1st AND L STREET N.E. AND ARE AVAILABLE FOR INSPECTION.

4. ELEVATIONS SHOWN ON THE DRAWINGS OR NOTED ON THE BORING LOGS REFER TO USC&GS MEAN SEA LEVEL DATUM OF 1929, WHICH IS DESIGNATED AS PROJECT DATUM. COORDINATES LISTED FOR BORING LOCATIONS REFER TO THE COORDINATE SYSTEMS EMPLOYED ON THIS PROJECT WHICH GENERALLY COMPRISE THE MARYLAND STATE PLANE COORDINATE SYSTEM OR THE VIRGINIA STATE PLANE COORDINATE SYSTEM, ADJUSTED FOR SCALE AND ELEVATION TO THE PROJECT GRID.

5. THE PLAN AND PROFILE ON GEOLOGICAL SECTION DRAWINGS GENERALLY SHOW THE CENTERLINE OF THE SUBWAY OUTBOUND TRACK, STATIONING ON THAT CENTERLINE, THE POSITION OF TOP OF RAIL IN PROFILE, AND, IN SOME INSTANCES, THE TOP AND BOTTOM OF THE EXTERIOR OF THE SUBWAY STRUCTURE IN PROFILE. THESE DATA WERE OBTAINED FROM THE DE LEUW, CATHER AND COMPANY GENERAL PLANS WHICH WERE AVAILABLE AT THE DATE OF THE REPORT. THE SUBWAY PLAN AND PROFILE WHICH ARE SHOWN IN REPORTS MADE PRIOR TO CONSTRUCTION ARE SUBJECT TO CHANGE IN FINAL PLANS.

6. GEOLOGICAL SECTION DRAWINGS DEPICT THE OVERALL SUBSURFACE STRATITICATION, DIVIDING MATERIALS INTO THE BROAD CATEGORIES LISTED UNDER "GENERALIZED STRATA DESCRIPTIONS". THE LINES SEPARATING STRATA ARE NECESSARILY INTERPOLATED BETWEEN BORINGS AND MAY OR MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.

7. IN CERTAIN INSTANCES THE SUBSURFACE INVESTIGATIONS FOR WMATA HAVE UTILIZED BORING DATA AND REPORTS PREPARED BY OTHER ORGANIZATIONS FOR OTHER PROJECTS. COPIES OF THESE ORIGINAL DATA AND REPORTS ARE ON FILE AT WMATA AND SHOULD BE CONSULTED FOR FURTHER DETAILS.

8. THE GROUND WATER LEVELS NOTED ON THE DETAILED BORING LOGS AND PLOTTED ON THE GEOLOGICAL SECTIONS REPRESENT AVERAGE OR TYPICAL VALUES OBSERVED DURING THE PERIOD OF THE BORING OPERATION OR SHORTLY AFTER COMPLETION OF A BORE HOLE. THESE OBSERVATIONS DO NOT REFLECT SEASONAL CHANGES IN THE WATER TABLE OR THE EFFECTS OF INTENSE RAINFALL OR RUNOFF. IN ANY EXCAVATION TRICKLING FLOW OR SEEPAGE MAY BE ENCOUNTERED FROM PERCHED WATER WHICH IS AT LEVELS ABOVE THE WATER TABLE OBSERVED IN THE BORINGS.

9. OBSERVATION WELLS OR PIEZOMETERS CONSISTING OF A STEEL STANDPIPE WITH A POROUS OR PERFORATED INTAKE POINT HAVE BEEN INSTALLED IN CERTAIN OF THE TEST BORINGS, AS NOTED ON THE BORING LOGS. MEASUREMENTS OF WATER LEVELS HAVE BEEN MADE IN CERTAIN OF THESE STANDPIPES AT VARIOUS TIMES. THESE DATA ARE ON FILE AT WMATA AND SHOULD BE CONSULTED FOR AN INDICATION OF SEASONAL FLUCTUATIONS OF GROUND WATER LEVELS.

UNIFIED CLASSIFICATION SYSTEM

COARSE GRAINED SOILS (MORE THAN HALF LARGER THAN NO.200 SIEVE)	GRAVELS AND GRAVELLY SOILS (MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO.4)	CLEAN (LESS THAN 5% SMALLER THAN NO.200)	GW	WELL GRADED GRAVEL, LITTLE OR NO FINES.
			GP	SINGLE-SIZE, NARROWLY GRADED GRAVEL, FEW FINES
			GP-GM	GRAVEL WITH MODERATE FINES, 5% TO 12% PASSING NO.200.
		DIRTY (MORE THAN 12% SMALLER THAN NO.200)	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES.
			GC	GLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURES.
			GM-GC	GRAVEL-SAND MIX WITH SILTY CLAY OR CLAYEY SILT FINES.
	SANDS AND SANDY SOILS (MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO.4)	CLEAN (LESS THAN 5% SMALLER THAN NO.200)	SW	WELL GRADED SAND, LITTLE OR NO FINES.
			SP	SINGLE-SIZE NARROWLY GRADED LEVEL, FEW FINES.
			SP-SM	SAND WITH MODERATE FINES, 5% TO 12% PASSING NO.200.
		DIRTY (MORE THAN 12% SMALLER THAN NO.200)	SM	SILTY SAND, SAND-SILT MIXTURES.
			SC	CLAYEY SAND, SAND-CLAY MIXTURES
			SM-SC	SAND WITH SILTY CLAY OR CLAYEY SILT FINES.
FINE GRAINED SOILS (MORE THAN HALF SMALLER THAN NO.200 SIEVE)	SILTS AND CLAYS LL<50	ML	INORGANIC SILT, ROCK FLOUR, CLAYEY SILT (LIMITS PLOT BELOW A-LINE)	
		CL	INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY (LIMITS PLOT ABOVE A-LINE)	
		OL	ORGANIC SILT AND SILTY CLAY OF LOW PLASTICITY LIMITS PLOT BELOW A-LINE)	
	SILTS AND CLAYS LL>50	MH	INORGANIC SILT, SPONGY, TALCY, MICACEOUS SILT (LIMITS PLOT BELOW A-LINE)	
		CH	INORGANIC PLASTIC CLAY, TOUGH AND FAT CLAY (LIMITS PLOT ABOVE A-LINE)	
		OH	ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY (LIMITS PLOT BELOW A-LINE	
	PEAT AND HIGHLY ORGANIC	PT	PEAT, HIGHLY ORGANIC SOIL, SPONGY, COMPRESSIBLE, DARK COLOR, FIBROUS, DISTINCT ORGANIC ODOR (LIMITS PLOT BELOW A-LINE)	

NOTES AND LEGEND FOR PLANS AND GEOLOGICAL SECTIONS

SYMBOLS UTILIZED ON LOCATION PLANS AND STRIP MAPS

1. BORINGS MADE IN THIS INVESTIGATION FOR WMATA UNDER THE CONTINUOUS INSPECTION OF MRWJ RESIDENT ENGINEERS ARE SHOWN THUS:

ON LOCATION PLANS AND STRIP MAPS:
BORINGS WITHOUT UNDISTURBED SAMPLES:
BORINGS WITH UNDISTURBED SAMPLES:

ON GEOLOGICAL SECTIONS:
BORINGS WITHOUT UNDISTURBED SAMPLES:
BORINGS WITH UNDISTURBED SAMPLES:

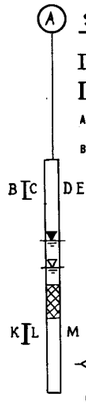
2. BORINGS WHICH HAVE BEEN MADE BY OTHER ORGANIZATIONS FOR OTHER PROJECTS AND ARE UTILIZED IN THIS INVESTIGATION ARE SHOWN THUS:

ON LOCATION PLANS AND STRIP MAPS:
ON GEOLOGICAL SECTIONS:

THE GENERAL LOCATION OF THESE PROJECTS IN PLAN ARE SHOWN WITH A NUMBER DESIGNATION WITHIN A DIAMOND SYMBOL: (5)

3. LOCATION AND ORIENTATION OF GEOLOGICAL SECTIONS GENERALLY ARE SHOWN ON THE PLAN ON WHICH BORING LOCATIONS ARE PLOTTED.

(A) SYMBOLS UTILIZED ON GEOLOGICAL SECTIONS



I = LOCATION AND LENGTH OF SOIL SAMPLE

I = LOCATION AND LENGTH OF ROCK CORE RUN

A = NUMBER AND LOCATION OF BORING.

B = NUMBER AND TYPE OF SOIL SAMPLE:
- SUFFIX "D" = DRY SAMPLE TAKEN WITH 2" OD SPLIT SPOON;
- SUFFIX "S" = SHELBY SAMPLE TAKEN WITH 2" OD THIN TUBE;
- SUFFIX "U" = UNDISTURBED SAMPLE TAKEN WITH 3" OD THIN TUBE USING PISTON SAMPLER;
- SUFFIX "R" = SAMPLE TAKEN WITH OPEN-END DRILL ROD;
- SUFFIX "UD" OR "SD" = THIN TUBE SAMPLE DISTURBED IN SAMPLING;
- "NR" = SAMPLE ATTEMPTED BUT NOT RECOVERED;
- SUFFIX "C" = ROCK CORE RUN USING NX SIZE DOUBLE TUBE DIAMOND CORE BARREL, PRODUCING CORE APPROXIMATELY 2-1/8" ϕ;
- "CORE" = CORING IN OVERBURDEN OR CORING IN BEDROCK WITH SAWTOOTH BIT OR ROTARY DRILLING BIT.

C = SAMPLER PENETRATION RESISTANCE IN BLOWS PER FOOT EXCEPT WHERE SPECIFIC DISTANCE IS NOTED.
SAMPLER DRIVEN WITH 140 LB. HAMMER FALLING 30".
P = THIN TUBE SAMPLE ADVANCED BY PUSHING
T = THIN TUBE SAMPLE ADVANCED BY TAPPING.
WR = SAMPLER ADVANCED UNDER WEIGHT OF RODS
WH = SAMPLER ADVANCED UNDER WEIGHT OF RODS AND HAMMER
(R SAMPLES DRIVEN WITH 300 LB. HAMMER FALLING 18")

D = SAMPLE CLASSIFICATION ACCORDING TO UNIFIED SOIL CLASSIFICATION SYSTEM.

E = SAMPLE NATURAL WATER CONTENT IN PERCENT OF DRY WEIGHT

[F = ATTERBERG LIQUID LIMIT VALUE.

G] = ATTERBERG PLASTIC LIMIT VALUE.

H = SHEAR STRENGTH IN KSF DETERMINED FROM UNCONFINED COMPRESSION TEST FOR SOIL SAMPLES OR COMPRESSIVE STRENGTH IN KSI FOR ROCK CORES.

(J) = SHEAR STRENGTH IN KSF DETERMINED FROM UNCONSOLIDATED-UNDRAINED TRIAXIAL SHEAR TEST.

K = NUMBER DESIGNATION OF NX SIZE ROCK CORE RUN.

L = LENGTH OF ROCK CORE RECOVERY EXPRESSED AS A PERCENT OF LENGTH OF CORE RUN

M = ROCK QUALITY DESIGNATION (RQD) IN PERCENT.

= GROUND WATER LEVELS OBSERVED DURING THE PERIOD OF THIS FIELD INVESTIGATION PROGRAM.

= GROUND WATER LEVELS OBSERVED AT AN EARLIER TIME IN BORINGS NOT MADE FOR THIS INVESTIGATION.

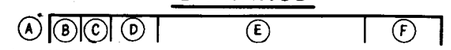
= POSITION OF POROUS BACKFILL SURROUNDING OBSERVATION WELL IN BORINGS MADE FOR WMATA.

M.L. = POSITION OF MATCH LINE BETWEEN GEOLOGICAL SECTIONS.

(S) = CORROSION TEST OF SOIL SAMPLE.

(S) = CORROSION TEST OF WATER SAMPLE.

NOTES AND LEGEND FOR BORING LOG DRAWINGS



A = DEPTH BELOW GROUND SURFACE IN FEET

B = NUMBER OF BLOWS OF 300 LB. HAMMER FALLING 18" REQUIRED TO DRIVE CASING OF THE SIZE NOTED ONE FOOT.

C = NUMBER AND TYPE OF SAMPLE
- SUFFIX "D" = DRY SAMPLE TAKEN WITH 2" OD SPLIT SPOON;
- SUFFIX "S" = SHELBY SAMPLE TAKEN WITH 2" OD THIN TUBE;
- SUFFIX "U" = UNDISTURBED SAMPLE TAKEN WITH 3" OD THIN TUBE USING PISTON SAMPLER;
- SUFFIX "R" = SAMPLE TAKEN WITH OPEN-END DRILL ROD;
- SUFFIX "UD" OR "SD" = THIN TUBE SAMPLE DISTURBED IN SAMPLING;
- "NR" = SAMPLE ATTEMPTED BUT NOT RECOVERED;
- SUFFIX "C" = ROCK CORE RUN USING NX SIZE DOUBLE TUBE DIAMOND CORE BARREL, PRODUCING CORE APPROXIMATELY 2-1/8" ϕ;
- "CORE" = CORING IN OVERBURDEN OR CORING IN BEDROCK WITH SAWTOOTH BIT OR ROTARY DRILLING BIT.

D = SAMPLER PENETRATION RESISTANCE IN BLOWS PER 6" OF DRIVING EXCEPT WHERE SPECIFIC DISTANCE IS NOTED.
SAMPLER DRIVEN WITH 140 LB. HAMMER FALLING 30"
P = THIN TUBE SAMPLE ADVANCED BY PUSHING
T = THIN TUBE SAMPLE ADVANCED BY TAPPING
WR = SAMPLER ADVANCED UNDER WEIGHT OF RODS
WH = SAMPLER ADVANCED UNDER WEIGHT OF RODS AND HAMMER
(R SAMPLES DRIVEN WITH 300 LB. HAMMER FALLING 18")
78/25 = 78 LENGTH OF ROCK CORE RECOVERY EXPRESSED AS A PERCENT OF 25 LENGTH OF CORE RUN
ROCK QUALITY DESIGNATION (RQD) IN PERCENT

E = DESCRIPTION OF INDIVIDUAL SOIL SAMPLE, INCLUDING UNIFIED SOIL CLASSIFICATION SYMBOL, OR DESCRIPTION OF INDIVIDUAL ROCK CORE RUN.

F = DESCRIPTION OF PRINCIPAL SOIL STRATA OR PRINCIPAL DIVISIONS OF BEDROCK. STRATA DIVISION LINES ARE NOTED WITH DEPTH BELOW GROUND SURFACE.

CONSISTENCY OR COMPACTNESS FROM SAMPLER PENETRATION RESISTANCE

THE DEGREE OF CONSISTENCY OR COMPACTNESS OF SAMPLES IS NOT GIVEN IN THE BORING LOG DESCRIPTIONS BUT IS INDICATED BY THE FOLLOWING VALUES OF STANDARD SAMPLER PENETRATION RESISTANCE IN BLOWS PER FOOT:

FINE GRAINED SOILS, SILTS AND CLAYS:		COARSE GRAINED SOILS, SANDS AND GRAVELS:	
LESS THAN 2 BPF	= VERY SOFT	LESS THAN 4 BPF	= VERY LOOSE
2 TO 4 BPF	= SOFT	4 TO 10 BPF	= LOOSE
4 TO 8 BPF	= MEDIUM STIFF	10 TO 30 BPF	= MEDIUM COMPACT
15 TO 30 BPF	= VERY STIFF	30 TO 50 BPF	= COMPACT
GREATER THAN 30	= HARD	GREATER THAN 50	= VERY COMPACT

ABBREVIATIONS

MISCELLANEOUS

BOTTOM	= BOT.
CARBONACEOUS	= CARB.
CAVITIES	= CVTS.
CONCRETIONS	= CONC.
FRAGMENTS	= FGMTS.
LAYERS	= LYRS.
LENSES	= LNS.
MATERIAL	= MTL.
MATTER	= MTR.
MEADOW MAT	= MDW.MT.
MICACEOUS	= MIC.
MISCELLANEOUS	= MISC.
NUMEROUS	= NUM.
OCCASIONAL	= OCC.
ORGANIC	= ORG.
PEAT	= PT.
PIECES, PARTICLES	= PCS.
POCKET	= PKT.
ROOTS	= RTS.
SEAMS	= SMS.
SOME	= SM.
TRACE	= TR.
VEGETAL	= VEG.
WITH	= W/
INTERBEDDED	= INTRBD.

GRAIN SIZE AND SHAPE

ANGULAR	= ANG.
COARSE	= C
COARSE TO FINE	= C-F
COARSE TO MEDIUM	= C-M
FINE	= F
FINE TO COARSE	= F-C
FINE TO MEDIUM	= F-M
MEDIUM	= M
MEDIUM TO COARSE	= M-C
MEDIUM TO FINE	= M-F
SMALL	= SML.

CONSISTENCY

COMPACT	= CPT.
MEDIUM COMPACT	= MED.CPT.
DECAYED	= DEC.
DECOMPOSED	= DEC.
DITTO	= DO
DISINTEGRATED	= DSNTG.
FRACTURED	= FRCT.
HARD	= HD.
MEDIUM	= MED.
RELATIVELY SOUND	= REL.SND.
SOUND	= SND.
VERY	= V.
WEATHERED	= WTHRD.

COLOR

BLACK	= BLK.
BLUE	= BL.
BROWN	= BRN.
DARK	= DK.
GRAY	= GRY.
GREEN	= GRN.
LIGHT	= LT.
MOTTLED	= MTLD.
ORANGE	= OR.
WHITE	= WHT
YELLOW	= YEL.

SOIL OR ROCK TYPE

BOULDER	= BLDR.
BRICK	= BRK.
CINDERS	= CNDR.
CLAY	= CL.
CLAYEY SAND	= CL.SA.
CLAYEY SILT	= CL.SI.
COBBLE	= CBL.
GNEISS	= GNS.
GRANITE	= GRT.
GRAVEL	= GVL.
SAND	= SA.
SANDY CLAY	= SA.CL.
SCHIST	= SCH.
SHALE	= SH.
SHELLS	= SLS.
SILT	= SI.
SILTY CLAY	= SI.CL.

GENERALIZED STRATA DESCRIPTIONS

SYMBOL	DESCRIPTION	UNIFIED SOIL CLASSIFICATION PRIMARY	UNIFIED SOIL CLASSIFICATION SECONDARY	SOURCE AND AGE
(F)	FILL, GENERALLY COMPOSED OF INORGANIC SOIL OBTAINED FROM NEAR-BY NATURAL MATERIALS. MAY BE DERIVED FROM TERRACE, CRETACEOUS SOILS OR DECOMPOSED ROCK.	ML SM	SC CL	MAN-MADE IN HISTORIC TIMES
(A1)	VERY SOFT TO MEDIUM STIFF DARK GRAY AND BROWN ORGANIC CLAY WITH LENSES OF HIGHLY ORGANIC MATERIAL (WHERE LOCATED UNDER WATER). SOFT TO STIFF MOTTLED GRAY-BROWN SLIGHTLY ORGANIC SILTY OR SANDY CLAY (WHERE LOCATED ON LAND).	CL CH OH	OL PT	RIVER ALLUVIUM OF POST-GLACIAL TIMES
(A2)	LOOSE TO MEDIUM COMPACT GRAY OR DARK BROWN SILTY FINE TO MEDIUM SAND WITH OCCASIONAL POCKETS OR LENSES OF SMALL GRAVEL. MAY BE SLIGHTLY TO MODERATELY ORGANIC.	SM	SP	
(T1)	STIFF TO MEDIUM STIFF LIGHT BROWN OR GRAY OR MOTTLED BROWN-GRAY SILTY CLAY OR CLAYEY SILT WITH LENSES OF BROWN SILTY FINE SAND. IN SOME AREAS, SEVERAL SEPARATE LAYERS OF PLEISTOCENE CLAYS HAVE BEEN ENCOUNTERED, WHICH ARE DISTINGUISHED BY A LETTER SUFFIX: T1A, T1C, ETC.	CL ML CH	LENSES OF SM OR SC	PORTIONS OF THE "25-FOOT" "50-FOOT" AND "90-FOOT" TERRACES, DEPOSITED BY RIVERS IN PLEISTOCENE TIMES
(T0)	MEDIUM STIFF TO STIFF DARK GRAY ORGANIC CLAY WITH NUMEROUS WOOD FRAGMENTS. USUALLY FOUND INTERLENSED WITH STRATUM T4.	CL OL	CH OH	
(T2)	MEDIUM COMPACT TO COMPACT BROWN AND RED-BROWN SILTY OR CLAYEY FINE TO MEDIUM SAND WITH TRACE OF GRAVEL AND OCCASIONAL BOULDERS.	SM SC	SP SW	
(T3)	COMPACT TO VERY COMPACT BROWN AND RED-BROWN FINE TO COARSE SAND WITH SOME SILT AND GRAVEL AND VARIABLE AMOUNTS OF COBBLES AND BOULDERS.	SW SM	SP GM	
(T4)	MEDIUM COMPACT TO COMPACT GRAY AND GRAY-BROWN FINE TO MEDIUM SAND WITH SOME SILT AND SMALL GRAVEL, CONTAINING LENSES OF DARK GRAY CLAY, OCCASIONALLY SLIGHTLY ORGANIC.	SM SP	SW	
(T5)	COMPACT TO VERY COMPACT GRAY AND GRAY-BROWN FINE TO COARSE SAND WITH SOME GRAVEL, SOME TO TRACE OF SILT AND VARIABLE AMOUNTS OF COBBLES AND BOULDERS, OFTEN CONCENTRATED AT BASE OF LAYER.	SW SM	SP GM	
(Q1)	LOOSE TO MEDIUM COMPACT LIGHT BROWN SILTY OR CLAYEY FINE TO MEDIUM SAND WITH TRACE OF SMALL GRAVEL.	SM SC		BRANDYWINE FORMATION OF EARLY PLEISTOCENE OR PLIOCENE TIMES
(Q2)	LOOSE TO MEDIUM COMPACT LIGHT BROWN OR TAN SILTY OR CLAYEY MEDIUM TO FINE SAND WITH SOME SMALL GRAVEL.	SM SC	SP	
(C)	MEDIUM COMPACT GRAY AND TAN SILTY FINE SAND OR MEDIUM STIFF TO STIFF DARK GRAY TO OLIVE-GREEN CLAY. CALVERT FORMATION OF MIOCENE AGE.	SM CH	SP CL	MARINE DEPOSITS OF TERTIARY OR UPPER CRETACEOUS PERIODS
(E)	MEDIUM STIFF DARK GREEN OR BROWN CLAY AND SILTY CLAY. AQUIA FORMATION OF EOCENE AGE.	MH CH	ML CL	
(M)	MEDIUM STIFF TO STIFF GREEN OR BROWN SILT AND CLAY. MONMOUTH FORMATION OF UPPER CRETACEOUS AGE.	MH CL	ML CH	
(P1)	HARD MOTTLED RED-BROWN AND GRAY OR LIGHT GRAY AND TAN PLASTIC CLAY WITH OCCASIONAL POCKETS OF FINE SAND. GENERALLY CONSISTS OF PATAPSCO FORMATION BUT MAY INCLUDE RARITAN FORMATION AT UPPER LEVELS.	CH	CL	POTOMAC GROUP OF CRETACEOUS PERIOD
(P2)	COMPACT TO VERY COMPACT LIGHT GRAY OR TAN SILTY OR CLAYEY FINE TO MEDIUM SAND WITH POCKETS OF SILTY CLAY AND TRACE OF SMALL GRAVEL, OCCASIONAL LIGNITE FRAGMENTS. ALSO INCLUDES MAGOTHY FORMATION OF UPPER CRETACEOUS AGE.	SM SP	SP	
(P3)	HARD GRAY-GREEN OR GRAY-BLUE-GREEN SILTY OR SANDY CLAY AND VERY COMPACT SILTY OR CLAYEY FINE TO MEDIUM SAND WITH OCCASIONAL SMALL GRAVEL AND SCATTERED BOULDERS.	CL SC	ML SM	
(P4)	VERY COMPACT MOTTLED LIGHT GRAY, TAN, BUFF OR WHITE SILTY OR CLAYEY FINE TO MEDIUM SAND WITH SOME GRAVEL AND SCATTERED LIGNITE FRAGMENTS, FREQUENTLY WITH DENSE NESTS AND POCKETS OF ANGULAR ROCK FRAGMENTS, COBBLES AND BOULDERS.	SM SW	SP GM	
(D)	DECOMPOSED ROCK: HARD ORANGE-BROWN OR YELLOW-BROWN MICACEOUS FINE SANDY SILT OR VERY COMPACT LIGHT GRAY AND GREEN MICACEOUS SILTY FINE TO MEDIUM SAND WITH VARIABLE AMOUNTS OF HARD, INCOMPLETELY DECOMPOSED ROCK FRAGMENTS AND LENSES. PROPORTION OF HARD ROCK FRAGMENTS INCREASES WITH DEPTH TOWARD THE BEDROCK SURFACE.	ML SM	MH	WEATHERED IN SITU FROM CRYSTALLINE BEDROCK
(WR)	WEATHERED AND JOINTED BEDROCK. WEATHERING ALONG JOINTS AND ALSO AFFECTING THE MINERAL FABRIC. RQD GENERALLY LESS THAN 50%.	REQUIRES DIAMOND CORE DRILLING TO ADVANCE BOREHOLE		BEDROCK, PRIMARILY WISSAHICKON SCHISTOSE GNEISS, WITH LESSER AMOUNTS OF INTRUSIVE IGNEOUS ROCK AND ALTERATION PRODUCTS
(J)	JOINTED TO MODERATELY JOINTED BEDROCK. WEATHERING ON JOINTS BUT RELATIVELY SMALL EFFECT ON MINERAL FABRIC. RQD GENERALLY BETWEEN 50% AND 75%.			
(R)	RELATIVELY SOUND TO SOUND BEDROCK, OCCASIONALLY MODERATELY JOINTED. WEATHERING CONFINED PRINCIPALLY TO JOINTS. RQD GENERALLY GREATER THAN 75%.			

DESIGNED _____ DATE
DRAWN _____ DATE
CHECKED _____ DATE
APPROVED _____ DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐

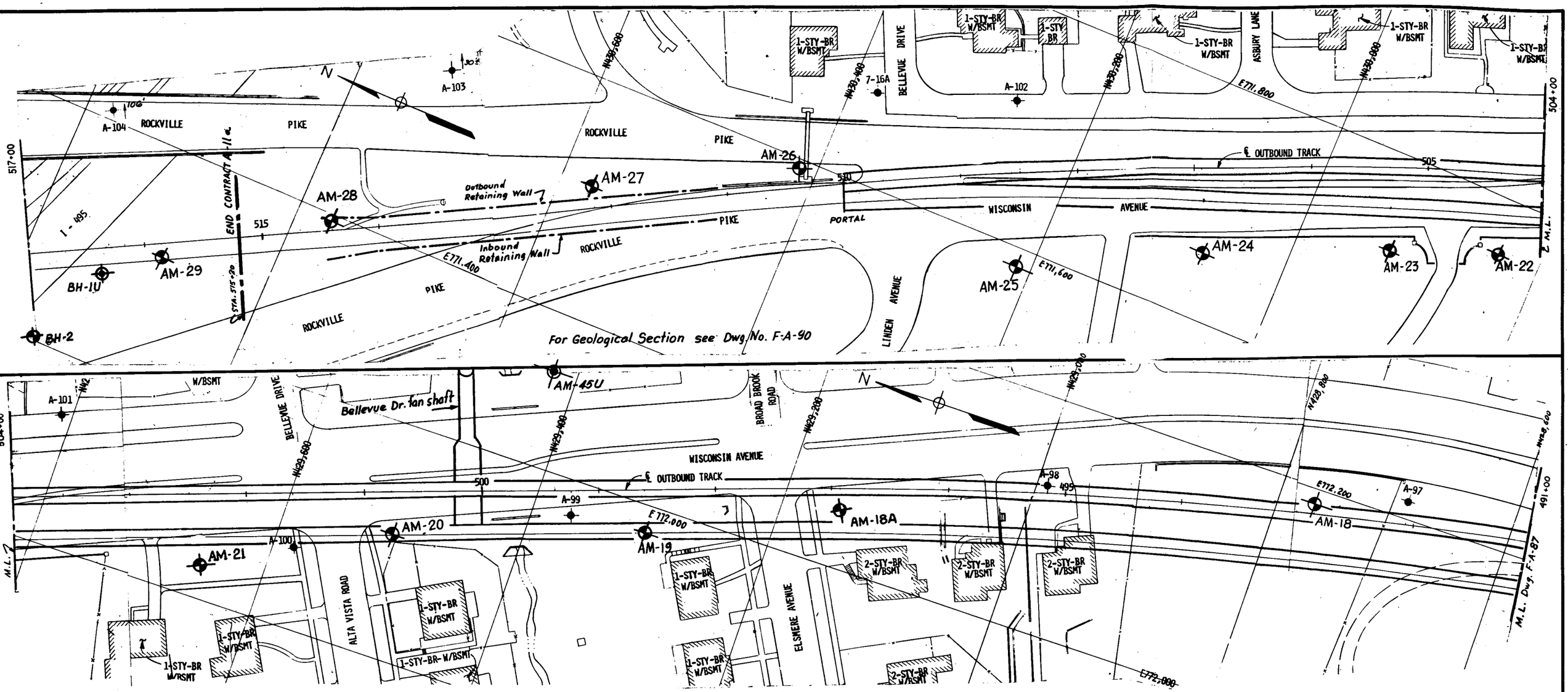
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED _____

SUBSURFACE INVESTIGATION GENERAL INFORMATION DRAWING

SCALE

DRAWING NO. F-1



BORING LEGEND

- "AM" - Dry sample borings made for this investigation.
- "AM" - Undisturbed sample borings made for this investigation.
- "A" - Series borings, see MRWJ Report No. 58, March 1972.
- "7" - Series borings, see MRWJ Report No. 33, February 1969.
- BH - Series borings made for Section A013 to be shown in later Report.

DESIGNED		DATE
DRAWN	AR	DATE 6-74
CHECKED	SLT. & JPG.	DATE 12-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend
	These Drawings and the stationing were provided by the Section Designer.

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

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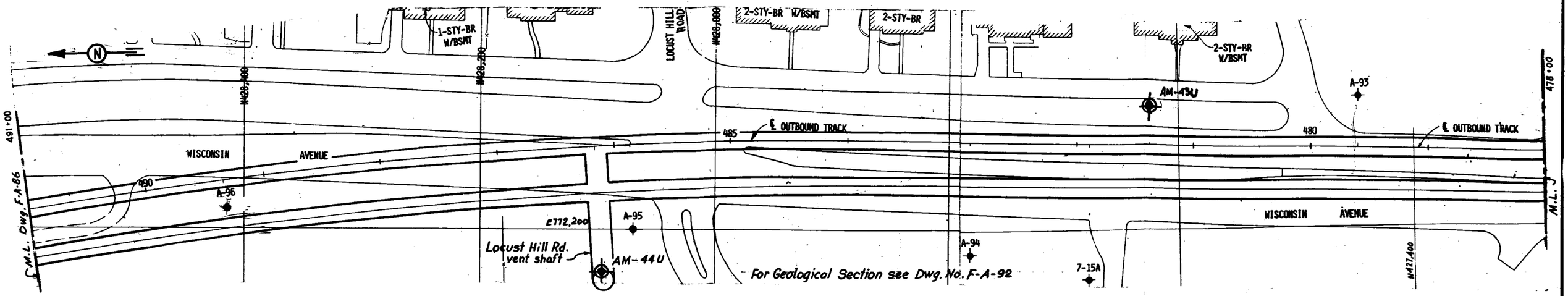
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐
APPROVED

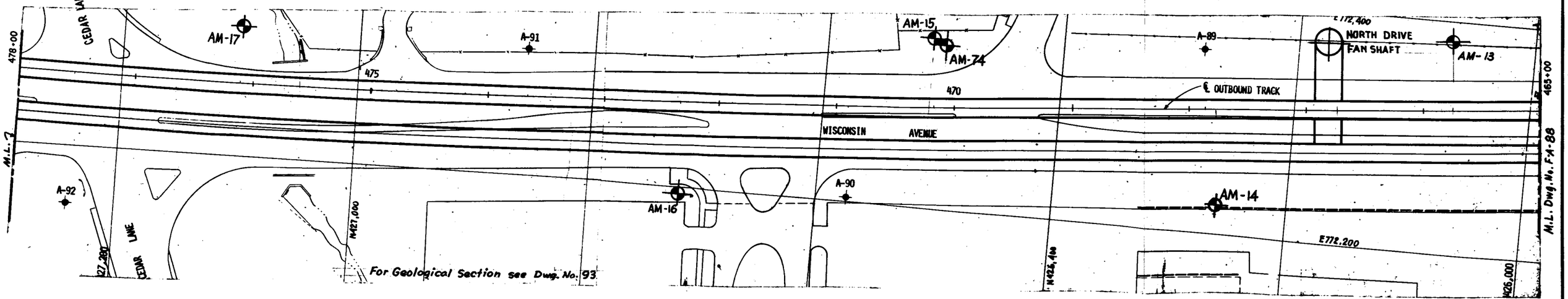
ROCKVILLE ROUTE (A011)
BORING LOCATION PLAN
STA. 491+00 to 517+00

SCALE 0 20' 40' 80'

DRAWING NO. F-A-86



AM-46U



DESIGNED		DATE	
DRAWN	AR	DATE	6-74
CHECKED	SLT. EJPG.	DATE	12-74
APPROVED		DATE	

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F-1	General Notes and Legend

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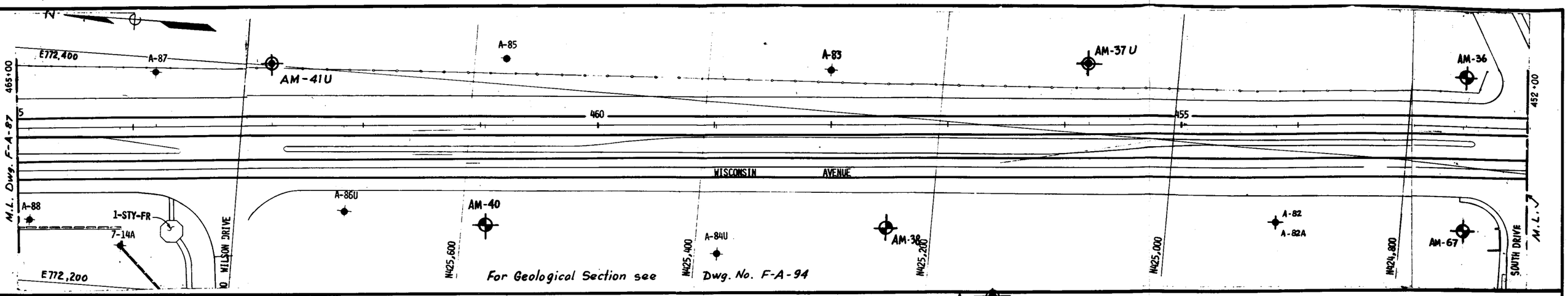
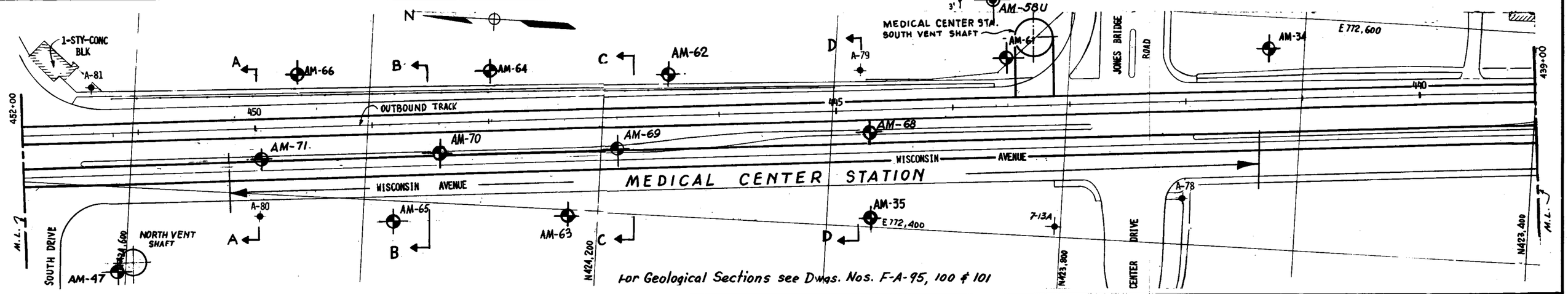
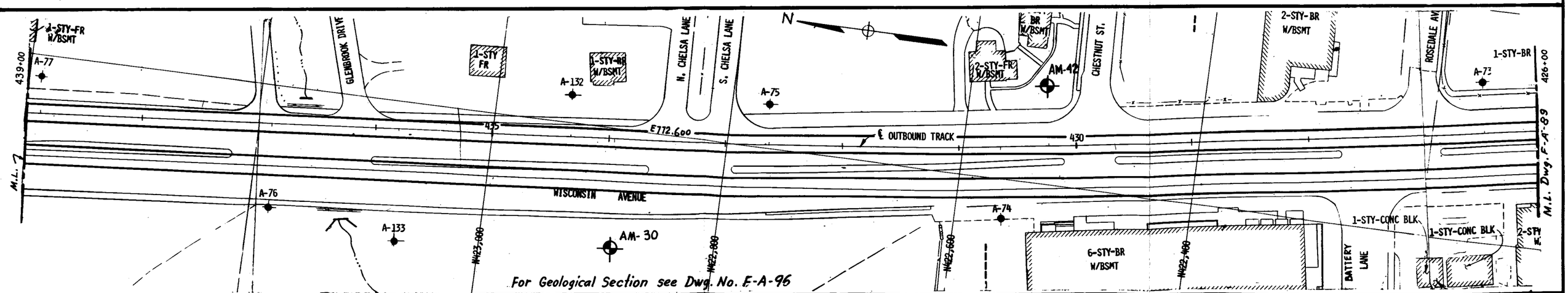
ROCKVILLE ROUTE (A011)
BORING LOCATION PLAN
STA. 465+00 to 491+00

SCALE 0 20' 40' 80'

DRAWING NO. F-A-87







DESIGNED _____ DATE

DRAWN AR 6-74 DATE

CHECKED SLT. & JPG. 12-74 DATE

APPROVED _____ DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-1	General Notes and Legend

REVISIONS		
DATE	BY	DESCRIPTION

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APPROVED _____

ROCKVILLE ROUTE (A011)
BORING LOCATION PLAN
STA. 426+00 to 465+00

SCALE 0 20' 40' 80'

DRAWING NO. F-A-88

W/BSMT
MAPLE
1-STY-CONC BLK
7-12AU
425
1-STY-BR
E 772,800
HIGHLAND AV.
A-72
1-STY-BR W/BSMT
420
WEST VIRGINIA AV.
AM-59U
W. VIRGINIA AV. FAN SHAFT
1-STY-BR W/BSMT
2-STY STUCCO W/BSMT
A-71
1-STY FR W/BSMT
1-STY BR
2-STY STUCCO W/BSMT
CHASE ST.
1-STY-BR W/BSMT
413+00
N 421,600
℄ OUTBOUND TRACK
WISCONSIN AVENUE
M.L.J
A-70
5-STY BR
18-STY BR
3-STY-BR W/BSMT
1-STY-CONC BLK W/BSMT
6-STY-BR W/BSMT
13-STY-CONC W/BSMT
E772,600
N 421,800
CORDELL AVENUE
5-STY-BR W/BSMT
N 421,400
2-STY-BR W/BSMT
2-STY BR W/BSMT
2-STY BR W/BSMT
4-STY-BR W/BSMT
E 772,800
3-STY CONC BLK W/BSMT
2-STY CB W/BSMT
1-STY-BR W/BSMT
HARLING LANE
For Geological Section see Dwg. No. F-A-97
FR
1-STY CONC BLK
3-STY-BR W/BSMT
1-STY-CONC BLK
1-STY-BR
1-STY-CONC BLK W/BSMT
1-STY-BR A-67
MIDDLETON LANE
1-STY-CONC BLK
2-STY-CONC BLK
N 419,800
AVONDALE ST.
W/BSMT
1-STY-BR
AM-10
1-STY-BR
400+00
A-69
A-68
405
℄ OUTBOUND TRACK
WISCONSIN AVENUE
M.L.J
N 420,400
CHELTENHAM DRIVE
2-STY-BR W/BSMT
E 772,800
1-STY
4-STY BR W/BSMT
1-STY-BR W/BSMT
N 420,000
1-STY CONC BLK
1-STY BR
3-STY BR W/BSMT
AM-12
7-11A
2-STY-CONC BLK W/BSMT
1-STY-CONC BLK
1-STY-CONC BLK
N 419,600
AM-11
A-66
E 773,000
COMMERCE LANE
10-STY-CONC W/BSMT
11-STY-CONC W/BSMT
3-STY CONC BLK
For Geological Section see Dwg. No. F-A-98
A-65
400+00
N 419,400
EAST - WEST HIGHWAY
CONC BLK
E
N 419,200
A-64
AM-7
1-STY-BR
5-STY-BR W/BSMT
4-STY-BR W/BSMT
6-STY-BR W/BSMT
7-10
MONTGOMERY LANE
F
3-STY-BR W/BSMT
2-STY-BR W/BSMT
AM-5
2-STY-BR W/BSMT
G
1-STY-BR
H
AM-3U
A-62
AM-1
ELM STREET
E 773,400
2-STY-BR W/BSMT
N 419,400
39°±
A-60
395
390
℄ OUTBOUND TRACK
STA 388+33
E 773,200
BETHESDA STATION
N 419,000
N 418,800
M.L.J
1-STY-BR
3-STY-CONC BLK W/BSMT
OLD GEORGETOWN ROAD
DEANE LANE
AM-9U
AM-8
1-STY-CONC BLK W/BSMT
E
AM-60
2-STY BR W/BSMT
SHAFT
2-STY-BR W/BSMT
℄ Passageway to Mezzanine
POST OFFICE
2-STY-STONE
AM-6U
F
MONTGOMERY LANE
WISCONSIN AVENUE
A-63U
AM-2
AM-4
G
HAMPDEN LANE
6-STY-CONC BLK W/BSMT
H
ELM ST.
ELM ST. CHILLER PLANT
72'
AM-48
A-61U
CONTRACT A-111
1-STY FR
ELM STREET VENT SHAFT
2-STY-BR
F 773,400
For Geological Sections see Dwgs. Nos. F-A-99, 102 & 103

DESIGNED		DATE
DRAWN	AR	DATE 6-74
CHECKED	SLT. & JPG	DATE 12-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA
WILLIAM H. MUESER
4070
REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

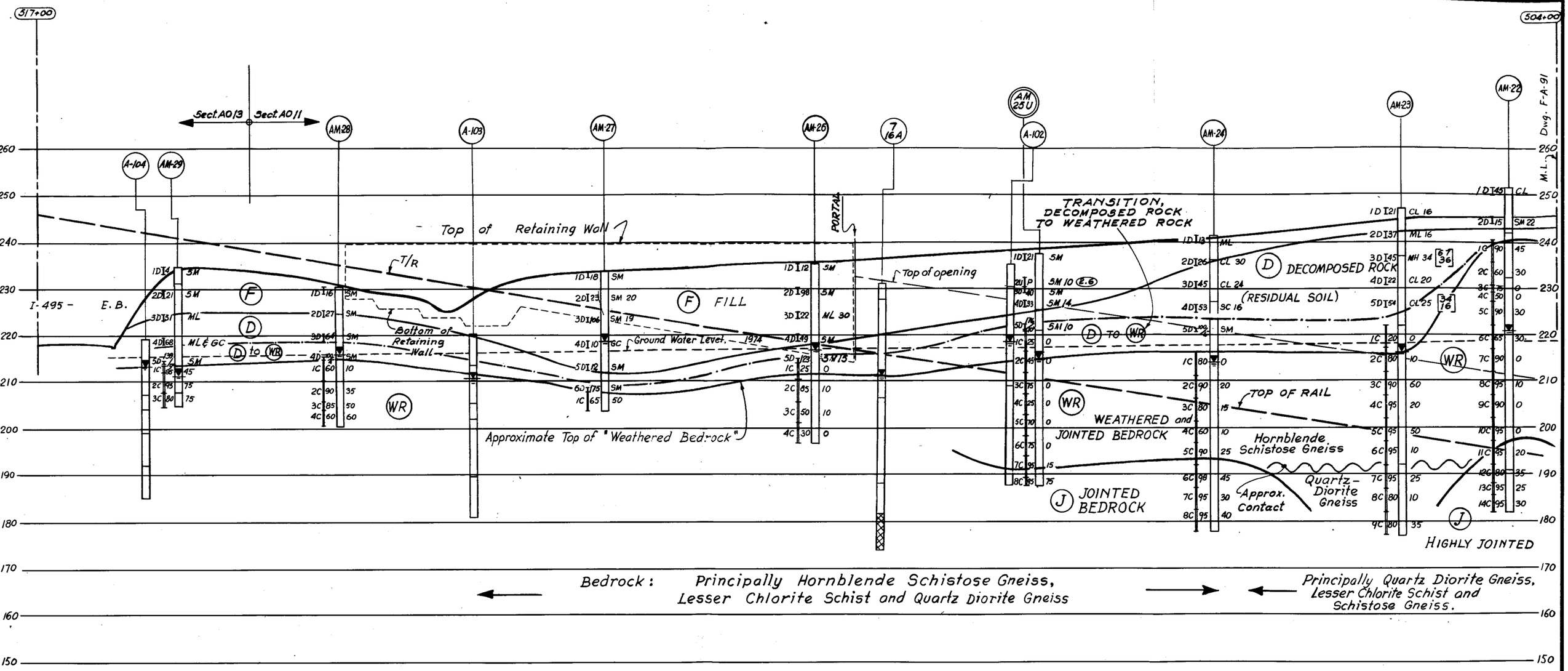
MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N.Y.
SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐
APPROVED

ROCKVILLE ROUTE (A011)
BORING LOCATION PLAN
STA. 388+33 to 426+00

SCALE 0 20' 40' 80'

DRAWING NO. F-A-89



Note: For detailed information on logs of borings
of A-Series see MRWJ Report No. 58, March 1972;
of 7-Series see MRWJ Report No. 33, February 1969.

DESIGNED		DATE
DRAWN	AR. & IHL.	12-73 DATE
CHECKED	SLT. & JPG	12-74 DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-A-86	Boring Location Plan

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. RUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

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HARRY WEESE & ASSOCIATES
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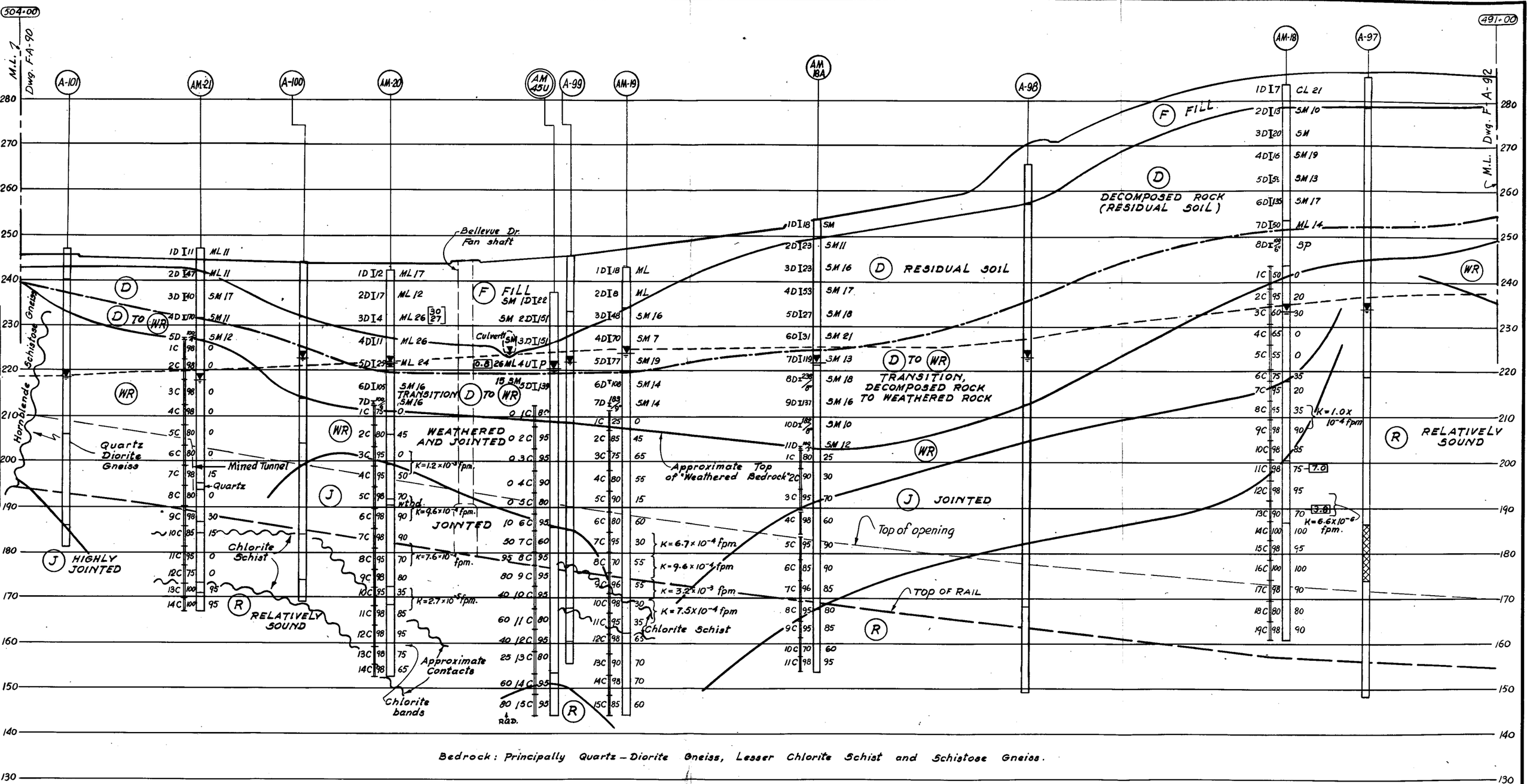
ROCKVILLE ROUTE (AOII)
GEOLOGICAL SECTION
STATION 504+00 to 517+00

SCALE HORIZ. 0 20' 40' 80'
VERT. 0 10' 20'

DRAWING NO. F-A-90



SIGNED		DATE
DRAWN	AR & AG	DATE 12-73
CHECKED	SLT. & JPG.	DATE 12-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-A-86	Boring Location Plan

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. NUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

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HARRY WEESE & ASSOCIATES
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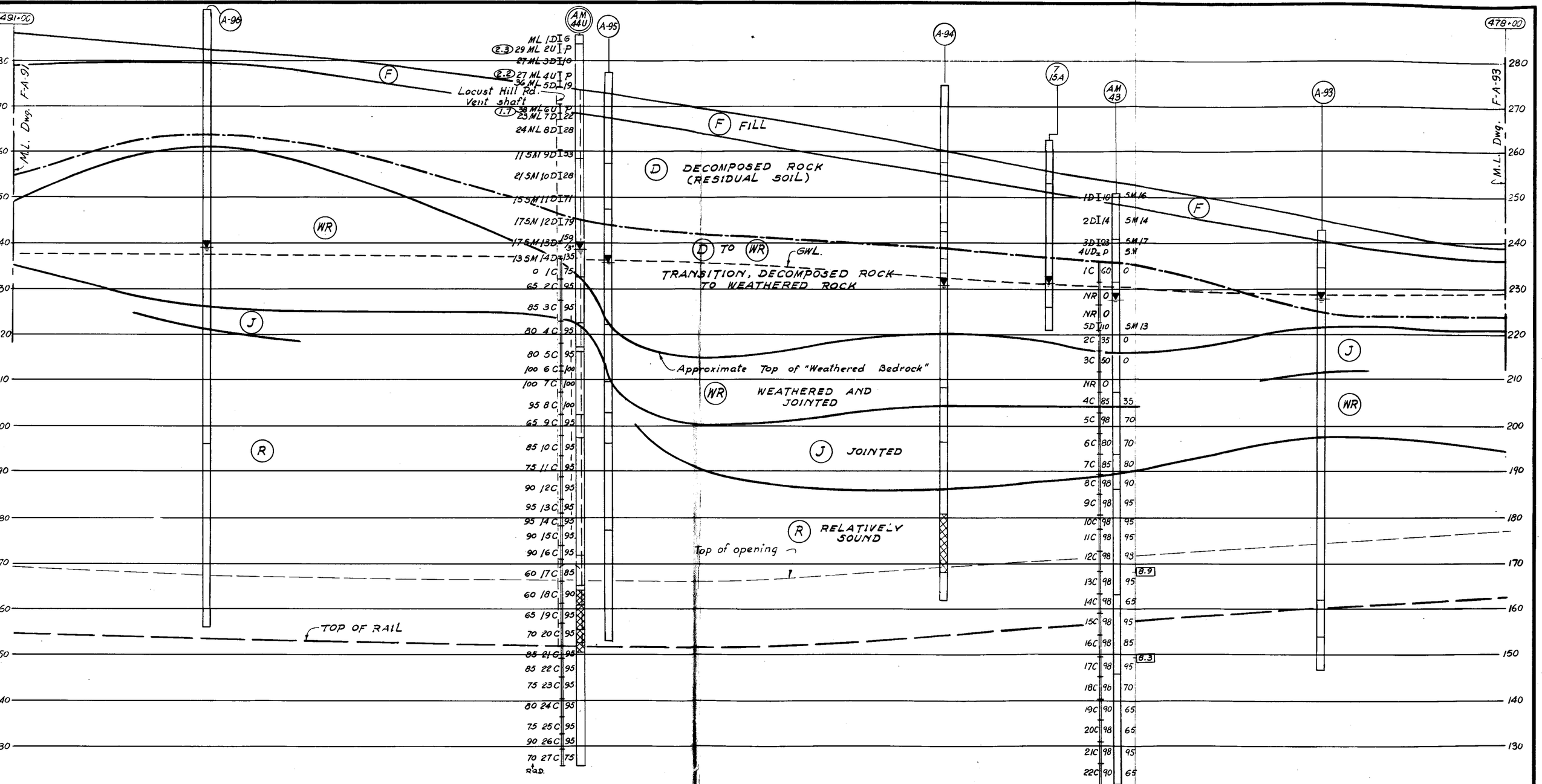
ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 491+00 to 504+00

SCALE HORIZ. 0 20' 40' 80'
VERT. 0 5' 10' 20'

DRAWING NO. F-A-91



Bedrock: Principally Quartz-Diorite Gneiss, with Lesser Chlorite Schist and Schistose Gneiss.

DESIGNED		DATE
DRAWN	AR. & AG	DATE 8-74
CHECKED	SLT. & JPG.	DATE 12-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-A-97	Boring Location Plan

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUSSER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUSSER · RUTLEDGE · WENTWORTH & JOHNSTON
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SUBMITTED William H. Musser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT
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ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 478+00 to 491+00

SCALE HORIZ. 0 20' 40' 80'
VERT. 0 5' 10' 20'

DRAWING NO. F-A-92

478+00

465+00

Projected

M.L. F-A-92

M.L. F-A-94

A-92 · AM-17 · A-91 · AM-16 · A-90 · AM-15 · AM 74 · A-89 · AM-14 · AM A6U · AM 13

F FILL

6'x6' BOX CULVERT

D

D TO WR

Approximate top of "Weathered Bedrock"

WR

Top of opening

gouge

broken

J

HIGHLY JOINTED TO JOINTED

TOP OF RAIL

J TO R

JOINTED TO RELATIVELY SOUND

D DECOMPOSED ROCK (RESIDUAL SOIL)

JOINTED

GWL.

WEATHERED AND JOINTED

Broken and sheared

Poss. Sz.

Broken Poss. Sz.

DR

North Drive Fan shaft

Extensive broken zones in chlorite mtl, probable movement and Shear

% Rec.

RQD.

Note: Soil sampling in Boring No. AM-15 below Sample 9D is thought to be the result of the grinding of weathered and jointed bedrock by rotary drilling used in advancing the bore hole.

Bedrock: Principally Quartz-Hornblende Diorite and Diorite Gneiss with Lesser Chlorite Schist.

DESIGNED		DATE
DRAWN	AR. & AG.	6-74 DATE
CHECKED	SLT. & JPG.	12-74 DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-A-87	Boring Location Plan

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA · WILLIAM H. MUESER · 4070 · REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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GENERAL ENGINEERING CONSULTANT ☐

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED

ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 465+00 to 478+00

SCALE HORIZ. 0 20' 40' 80' VERT. 0 10' 20'

DRAWING NO. F-A-93

465+00 — ℄ M.L. Dwg. F-A-93

A-88 · 7 14A · A-87 · AM 41U · A 86U · AM 40 · A-85 · A 84U · A-83 · AM 38 · AM 37U · A 82A · A-82 · AM-36 · AM-67 · 452-00

El. 314.2 · El. 313.6 · El. 311.6 · El. 322.2 · El. 320.5 · El. 325.7

Approximate Top of "Weathered Bedrock"

West Side of Wisc. Ave.

East Side of Wisc. Ave

F

WR

J JOINTED

R RELATIVELY SOUND, EAST SIDE OF WISC. AVE.

J

R RELATIVELY SOUND, WEST SIDE OF WISC. AVE.

Possible 5ℓ

Poss. 5ℓ

Top of opening

TOP OF RAIL

Probable 5ℓ

Major 5ℓ

Broken

Broken and sheared

RQD 175M 135M

EAST SIDE

No flow at 70 Psi gage pressure

No flow at 42 Psi gage pressure

No flow at 40 Psi gage pressure

No flow at 50 Psi gage pressure

No flow at 90 Psi gage pressure

No flow at 90 Psi gage pressure

No flow at 90 Psi gage pressure

Poss. Shear

K= 1.2 × 10⁻⁵ fpm

K= 4.5 × 10⁻⁵ fpm

K= 1.6 × 10⁻⁵ fpm

K= 2.5 × 10⁻⁵ fpm

K= 1.3 × 10⁻⁴ fpm.

K= 7.8 × 10⁻⁴ fpm

K= 1.7 × 10⁻⁴ fpm

K= 3.3 × 10⁻⁴ fpm

No flow at 80 Psi gage pressure

K= 1.2 × 10⁻⁵ fpm

Bedrock: Hornblende Schistose Gneiss with lesser Chlorite Schist in weaker zones; Quartz-Diorite Gneiss in stronger zones.

Dwg. F-A-95 ℄ M.L.

DESIGNED			DATE
DRAWN	AR & AG.	8-74	DATE
CHECKED	SLT. & JPG.	12-74	DATE
APPROVED			DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-A-88	Boring Location Plan

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA · WILLIAM H. MUESER · 4070 · REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY
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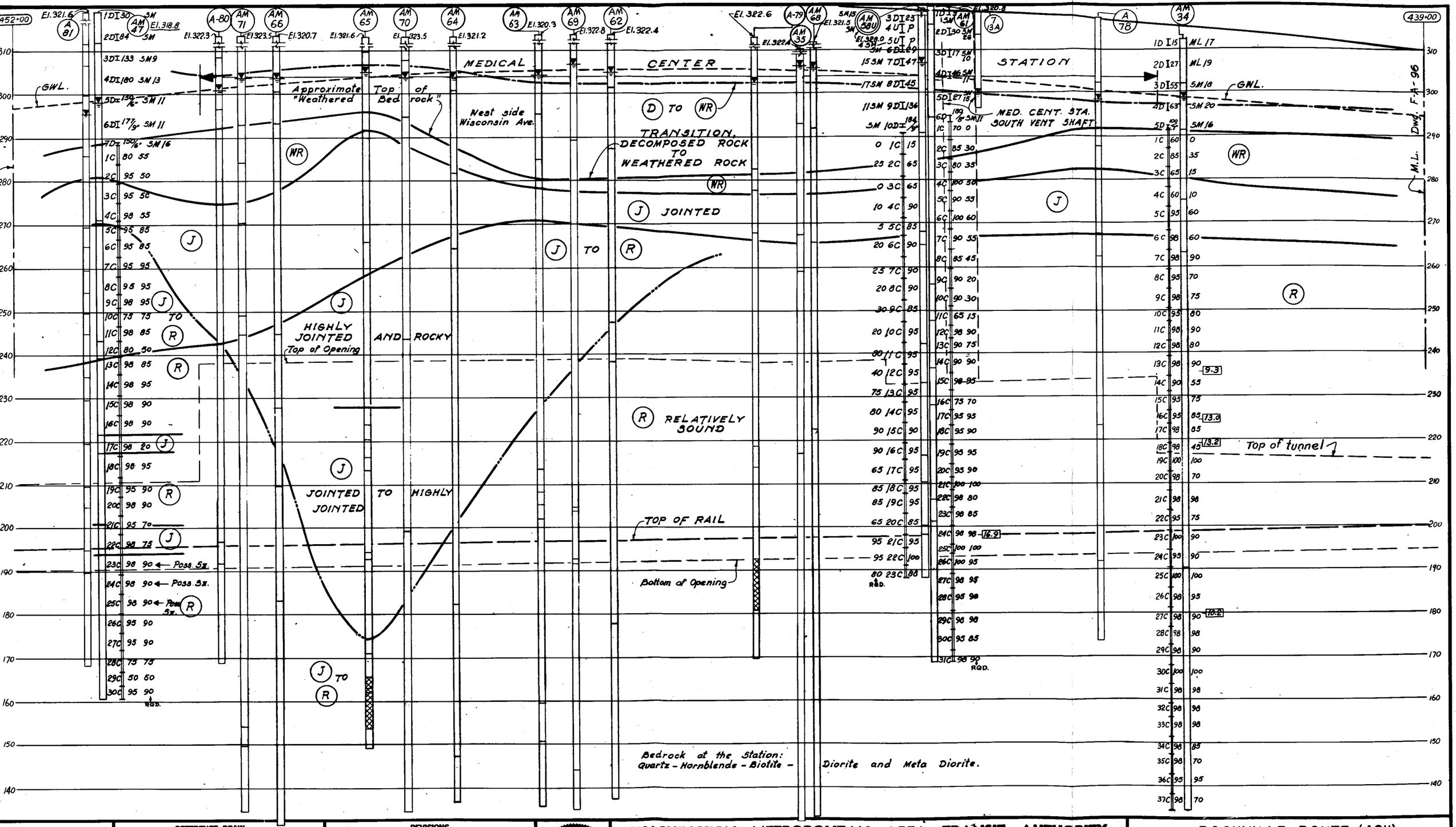
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED

ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 452+00 to 465+00

SCALE HORIZ. 0 20' 40' 80' · VERT. 0 5' 10' 20'

DRAWING NO. F-A-94



DESIGNED		DATE
DRAWN	AR. & AG. 12-73	DATE
CHECKED	SLT. & JPG. 12-74	DATE
APPROVED		DATE

REFERENCE DRAW.

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-A-88	Boring Location Plan

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

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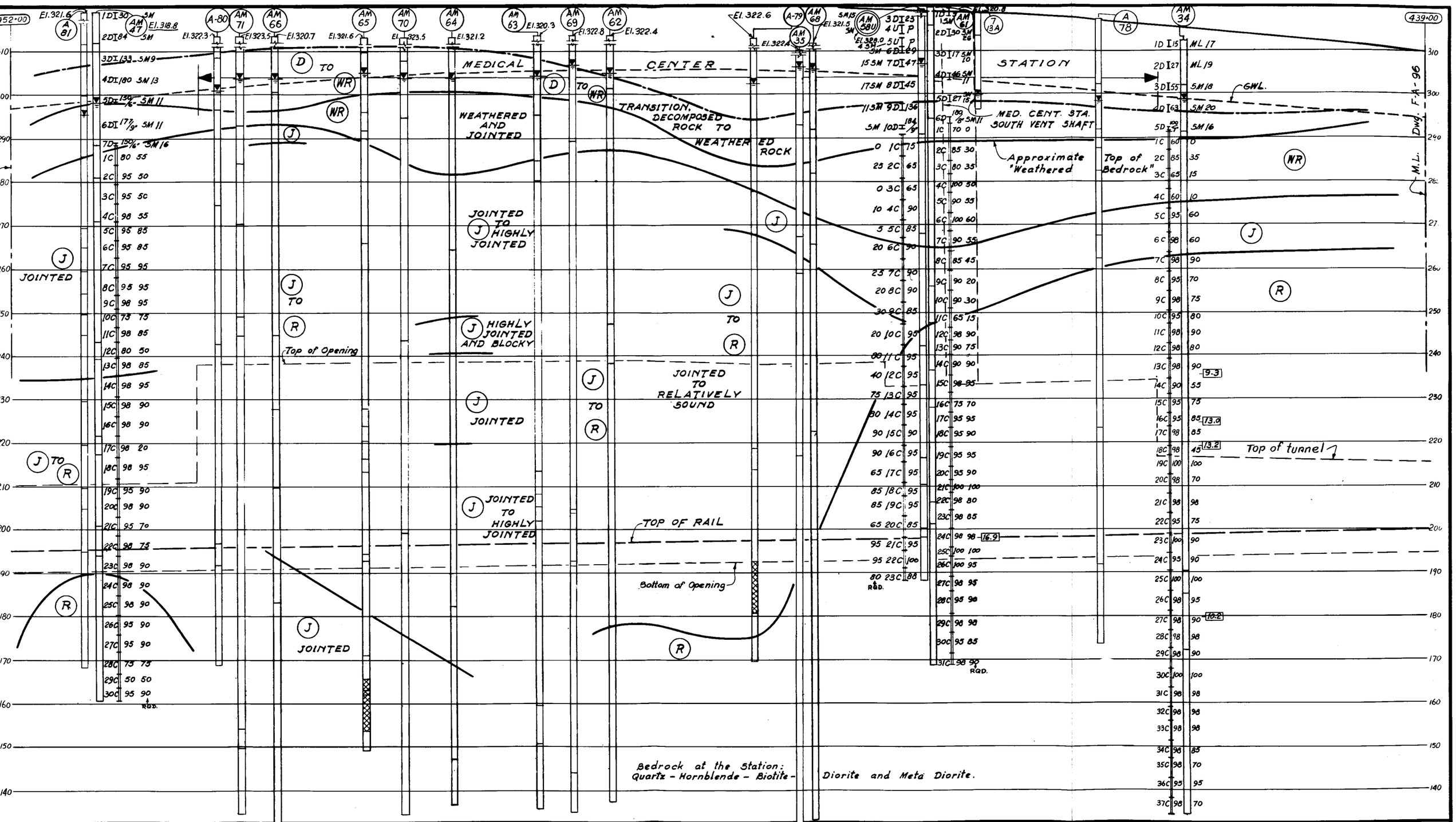
ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 439+00 to 452+00 (WEST SIDE)

SCALE HORIZ. 0 40' 80' VERT. 0 10' 20'

DRAWING NO. F-A-95A



DESIGNED		DATE
DRAWN	AR. & AG.	12-73 DATE
CHECKED	SLT. & JPG.	12-74 DATE
APPROVED		DATE

REFERENCE DRAW.

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-A-88	Boring Location Plan

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER • RUTLEDGE • WENTWORTH & JOHNSTON
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SUBMITTED William H. Mueser

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GENERAL ENGINEERING CONSULTANT ☐

HARRY WEESE & ASSOCIATES
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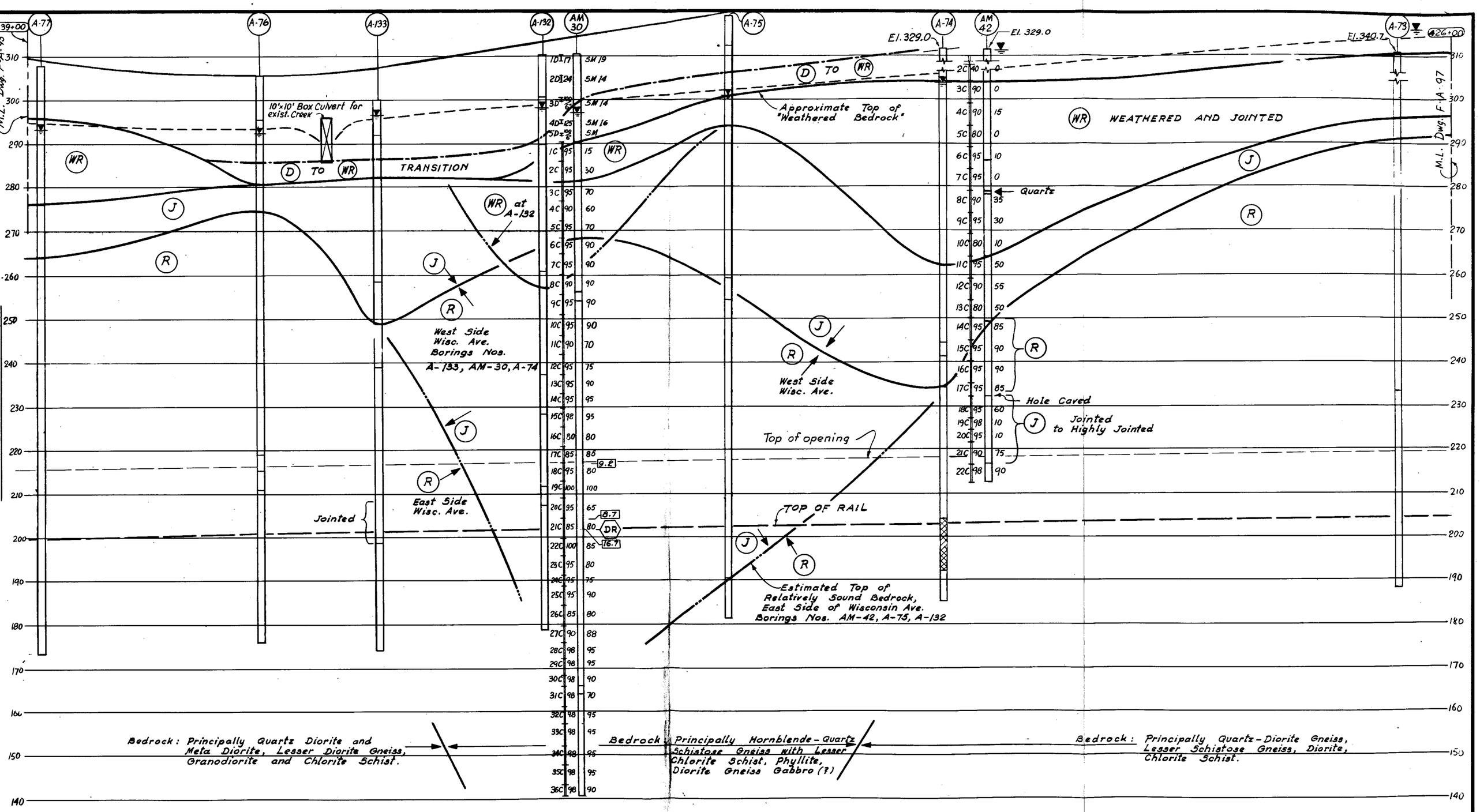
APPROVED

ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 439+00 to 452+00 (EAST SIDE)

SCALE HORIZ. 0 40' 80' VERT. 10 20'

DRAWING NO. F-A-95B



DESIGNED		DATE
DRAWN	AR. & AG.	DATE 12-73
CHECKED	SLT. & JPG.	DATE 12-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend.
F-A-88	Boring Location Plan.
	For data on A-Series Borings, see Dwgs. Nos. F-A-20 & 21, MRWJ. Report 58.

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. WEESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MEESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H. Meeser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED

ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 426+00 to 439+00

SCALE HORIZ. 0 20' 40' 80'
VERT. 0 5' 10' 20'

DRAWING NO. F-A-96

426+00 | 413+00

T-12AU | A-72 El. 350.0 | AM 59U El. 353.2 | West Virginia Ave. Fan shaft | A-71 El. 356,5 | A-70 El. 358,3

M.L. Dwg. F-A-96 | M.L. Dwg. F-A-98

340 330 320 310 300 290 280 270 260 250 240 230 220 210 200 190 180 170

(F) FILL

(D) DECOMPOSED ROCK – RESIDUAL SOIL

(D) TO (WR) TRANSITION, DECOMPOSED ROCK TO WEATHERED ROCK

(WR) WEATHERED ROCK

(J) JOINTED

(J) TO (R) JOINTED TO RELATIVELY SOUND

(R) Chlorite Schist

(J) TO (R)

(R) RELATIVELY SOUND

GWL.

Top of opening

TOP OF RAIL

Highly jointed

HIGHLY JTD. (J) Poss. 5%

3" Chlorite

22.5M	6DI	36	
24.5M	7DI	41	
14.5M	8DI	62	
15.5M	9D	159	
15	1C	90	
20	2C	85	
10	3C	90	
15	4C	75	
0	5C	55	
0	6C	80	
40	7C	95	
98	8C	98	
80	9C	95	
70	10C	95	
95	11C	98	
75	12C	95	
65	13C	95	
75	14C	95	
95	15C	98	
95	16C	98	
95	17C	98	
95	18C	95	
95	19C	98	
98	20C	98	
25	21C	95	
90	22C	98	
95	23C	98	
55	24C	95	
30	25C	95	
90	26C	95	
45	27C	95	
70	28C	95	
80	29C	95	
85	30C	95	
90	31C	98	

Bedrock: Principally Quartz-Diorite Gneiss, Lesser Schistose Gneiss, Diorite, Chlorite Schist.

Bedrock: Hornblende Schistose Gneiss above Elev.+300. Below: Quartz-Diorite Gneiss with Lesser Chlorite Schist.

SIGNED		DATE
DRAWN	AL & AG.	DATE 8-74
CHECKED	SLT. & JPG.	DATE 12-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend.
F-A-89	Boring Location Plan.

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM N. GUTSER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MURPHY · RUTLEDGE · WENTWORTH & JOHNSTON
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415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H Lucas

DE LEUW, CATHER & COMPANY
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HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED

ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 413+00 to 426+00

SCALE VERT. 0 10' 20' HORIZ. 0 40' 80'

DRAWING NO. F-A-97

413+00

A 69

A 68

AM 12

7 11A

A 67

AM 11

A 66

AM 10

400+00

(M.L. Dwg. F-A-97)

(M.L. Dwg. F-A-99)

350 340 330 320 310 300 290 280 270 260 250 240 230 220 210 200 190

F

D

D TO WR

Approximate Top of "Weathered Bedrock"

WR

J

R

WEATHERED AND JOINTED

F FILL

GWL.

J JOINTED

D DECOMPOSED ROCK -RESIDUAL SOIL

D TO WR TRANSITION, DECOMPOSED ROCK TO WEATHERED ROCK

HIGHLY JOINTED

Broken, slickensides

slick joint

slick jts.

Broken Slick jts.

Poss. gouge

Possible Sx

Broken

Highly Broken

Poss. Sx

Top of opening

TOP OF RAIL

Bedrock: Principally Quartz-Diorite Gneiss with lesser Chlorite Schist

Bedrock: Hornblende Schistose Gneiss with numerous Chlorite Schist bands and lesser Quartz-Diorite Gneiss.

SIGNED			DATE
DRAWN	AR. & AG.	8-74	DATE
CHECKED	SLT. & JPG.	12-74	DATE
APPROVED			DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend
F-A-89	Boring Location Plan

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

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ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 400+00 to 413+00

SCALE HORIZ. 0 20' 40' 80'
VERT. 0 5' 10' 20'

DRAWING NO. F-A-98

400+00 | A 65 | AM 9U | A 64 | AM 60 | AM-8 | AM-7 | 7-10 | AM 6U | AM-5 | AM-4 | AM 3U | A 63U | AM-2 | A 62 | AM-1 | AM 4B | A 61U (388+33) | A 60

BETHESDA STATION

Bethesda Sta. North Vent Shaft

LIMIT OF CONTRACT 76'±

Elm Street Vent shaft

Existing Post Office Bldg.

Approximate location of B&O RR Tunnel

Planned Escalatorway

Planned Elevator for the Handicapped

GWL.

TRANSITION, DECOMPOSED ROCK TO WEATHERED ROCK

DECOMPOSED (RESIDUAL ROCK SOIL)

WEATHERED AND JOINTED

JOINTED

JOINTED TO RELATIVELY SOUND

RELATIVELY SOUND

Approximate Top of "Weathered Bedrock", West Side Wisc. Ave.

Contact

Top of opening

Approximate

Bottom of Opening

Bottom of opening

Poss. shear

℄ Passageway

TOP OF RAIL

RQD.

Bedrock: Hornblende-Gneiss above the Relatively Sound Zone, Generally with Quartz-Diorite Gneiss below.

Bedrock: Quartz-Hornblende Diorite Gneiss, little Chlorite Schist and Schistose Gneiss.

SIGNED		DATE
DRAWN	AR. & AG.	DATE 12-73, 8-74
CHECKED	SLT. & JPG.	DATE 12-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend.
F-A-89	Boring Location Plan.
	For detailed information on overburden conditions see Dwgs. Nos. F-A-102 & -103

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. PUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
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SUBMITTED William H. Wentworth

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐

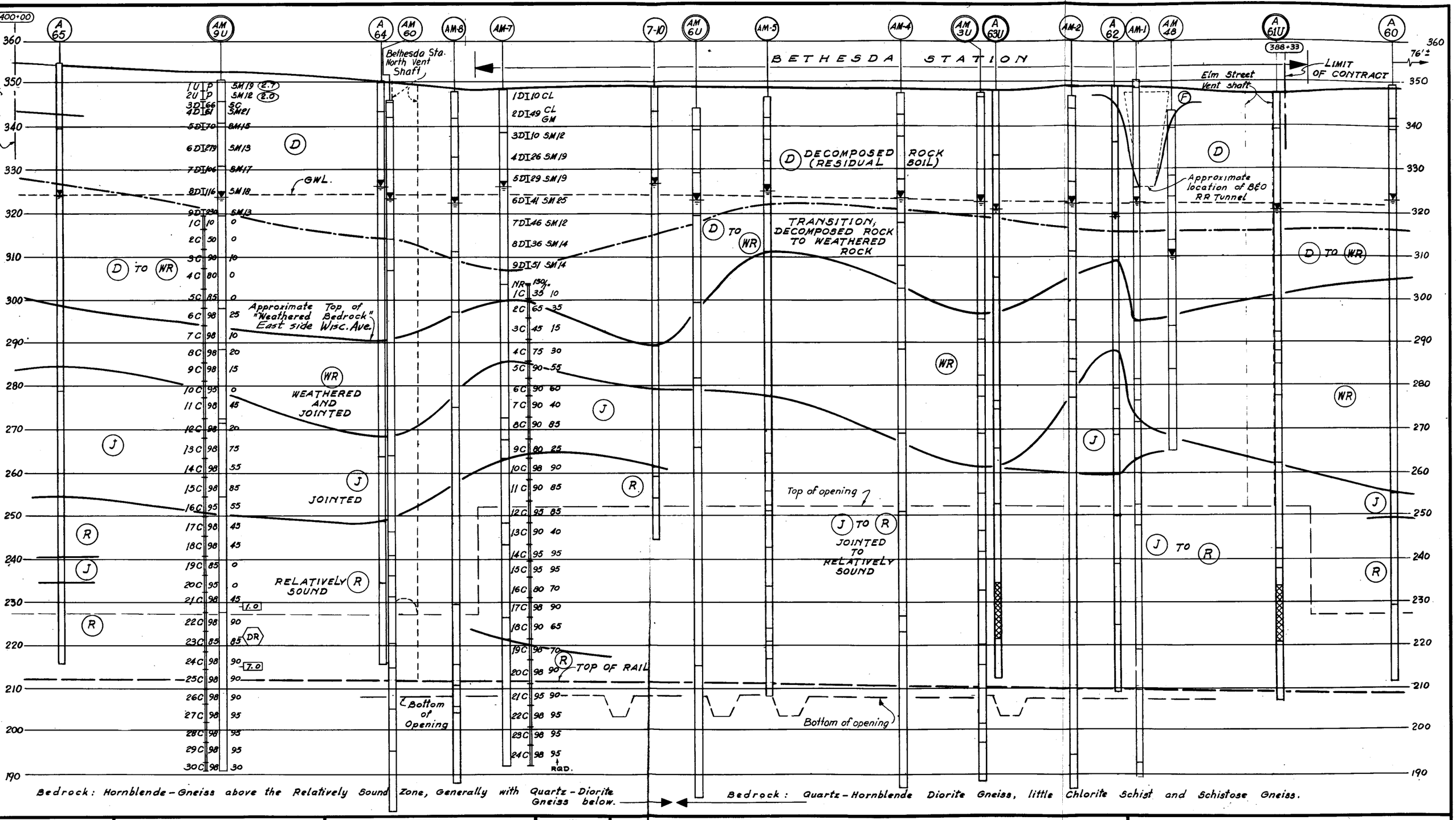
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED

ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 388+00 to 400+00 (WEST SIDE)

SCALE HORIZ. 0 20' 40' 80' VERT. 0 10' 20'

DRAWING NO. F-A-99A



Bedrock: Hornblende-Gneiss above the Relatively Sound Zone, Generally with Quartz-Diorite Gneiss below.

Bedrock: Quartz-Hornblende Diorite Gneiss, little Chlorite Schist and Schistose Gneiss.

DESIGNED		DATE 12-73
DRAWN	AR. & AG.	DATE 6-74
CHECKED	SLT. & JPG.	DATE 12-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend.
F-A-99	Boring Location Plan.
	For detailed information on overburden conditions see Dwgs. Nos. F-A-102 & -103.

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA · WILLIAM H. MUESER · 4070 · REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
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SUBMITTED William H. Wentworth

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐

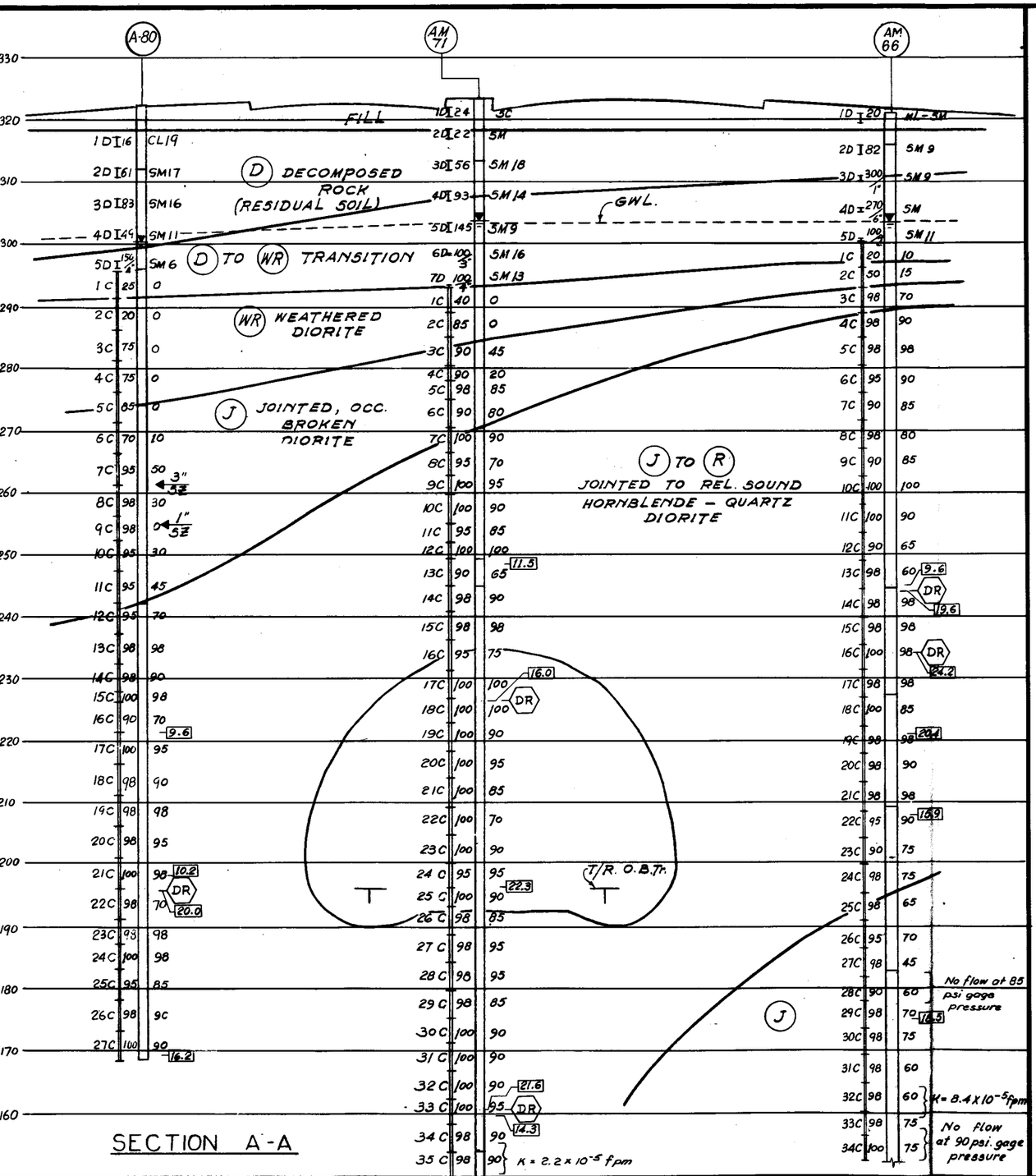
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

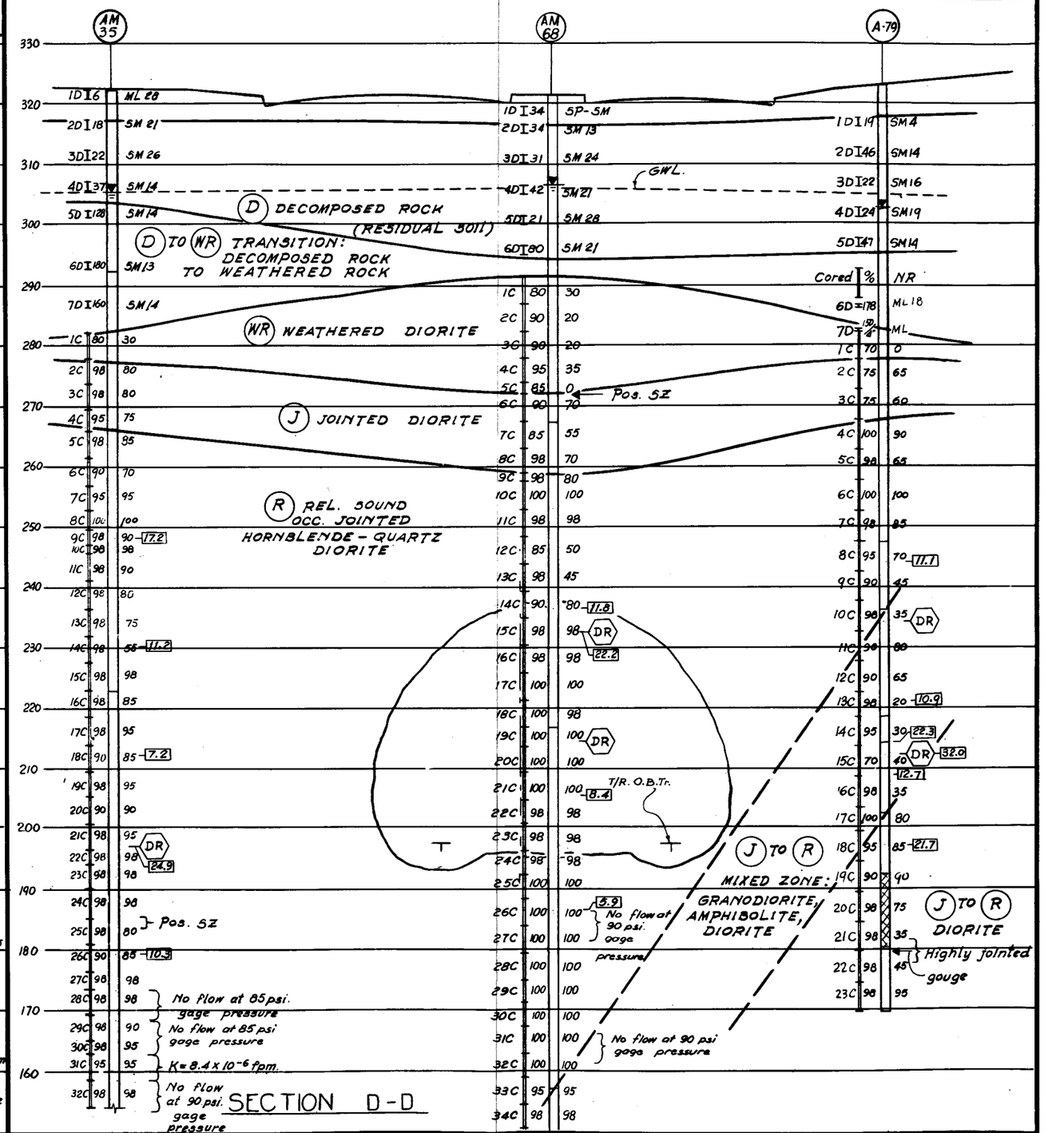
APPROVED

ROCKVILLE ROUTE (A011)
GEOLOGICAL SECTION
STATION 388+00 to 400+00 (EAST SIDE)

SCALE HORIZ. 0 20' 40' 80'
VERT. 0 10' 20' 40'

DRAWING NO. F-A-99 B





REFERENCE DRAWINGS		REVISIONS		
NUMBER	DESCRIPTION	DATE	BY	DESCRIPTION
F-1	General Notes and Legend.			
F-A-88	Boring Location Plan.			

DRAWN AR. & AG. DATE 1-74
CHECKED SLT. & JPG. DATE 12-74
APPROVED DATE

DISTRICT OF COLUMBIA WILLIAM N. LUSER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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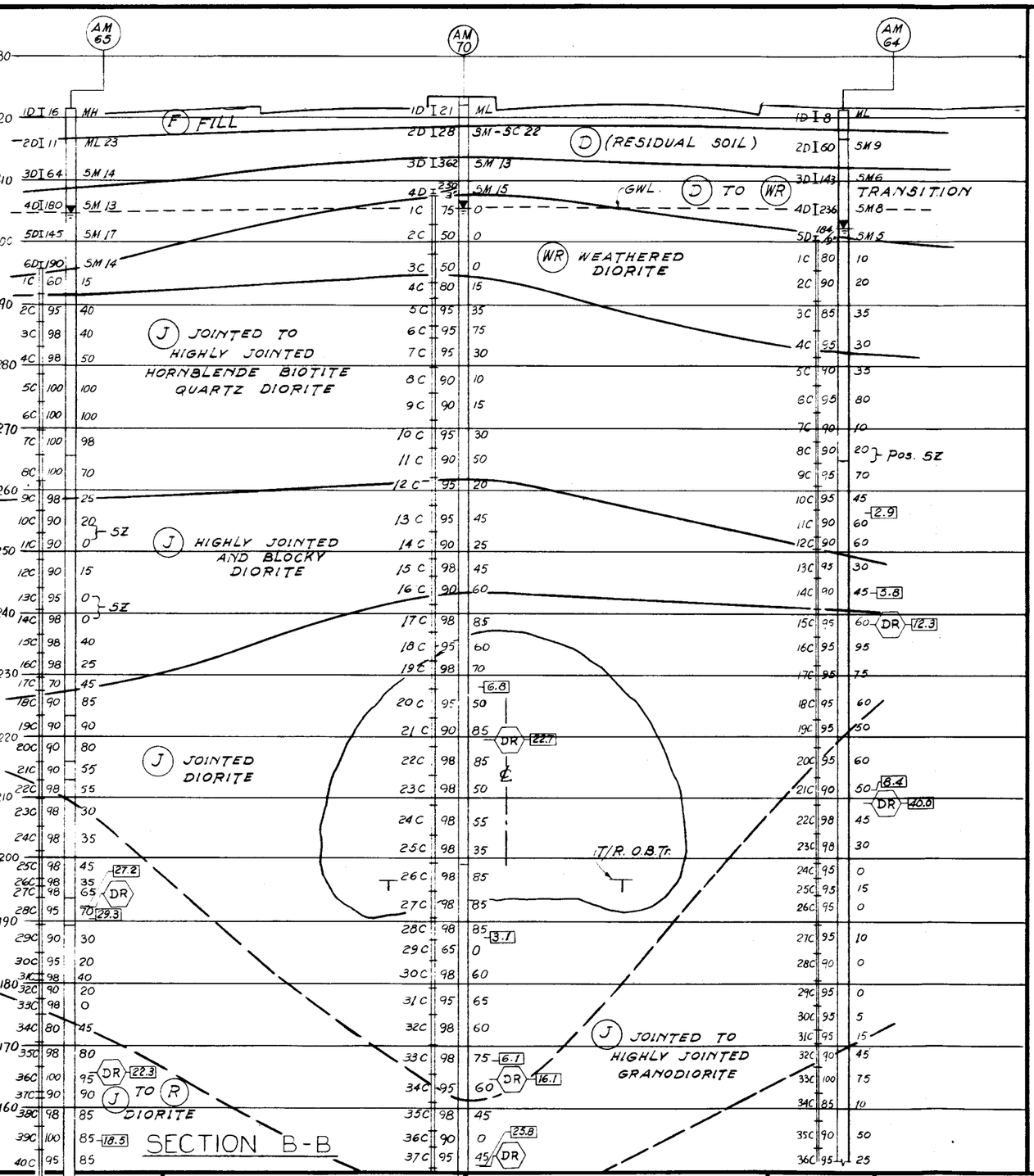
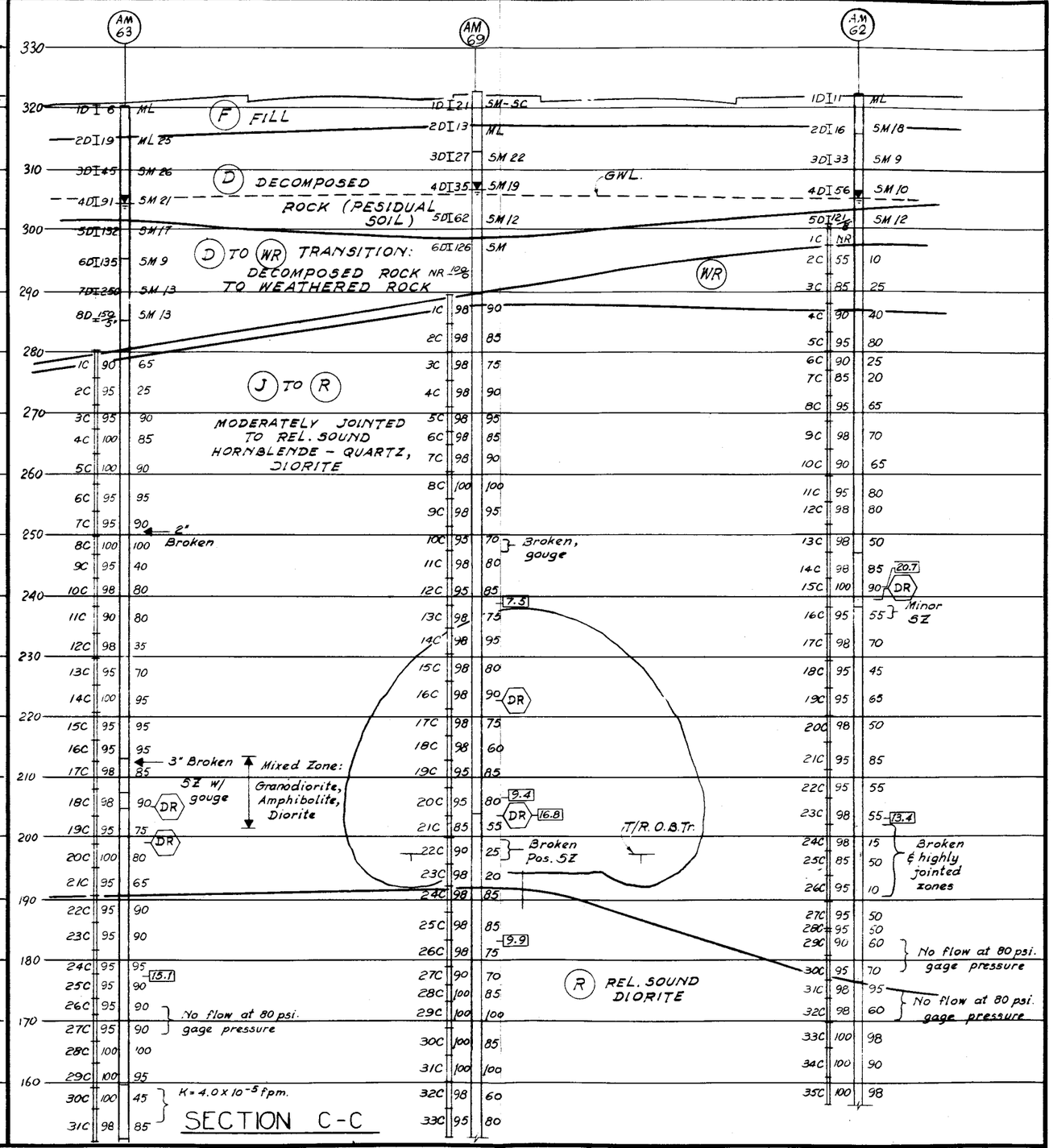
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William A Luser

DE LEUW, CATHER & COMPANY ☐
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES ☐
GENERAL ARCHITECTURAL CONSULTANT
APPROVED

ROCKVILLE ROUTE (A011)
MEDICAL CENTER STATION
GEOLOGICAL SECTIONS A-A and D-D

SCALE HORIZ. & VERT. 0 10' 20'
DRAWING NO. F-A-100





REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-1	General Notes and Legend.
F-A-88	Boring Location Plan.

K = 1.2 x 10⁻⁴ fpm. REVISIONS

DATE	BY	DESCRIPTION

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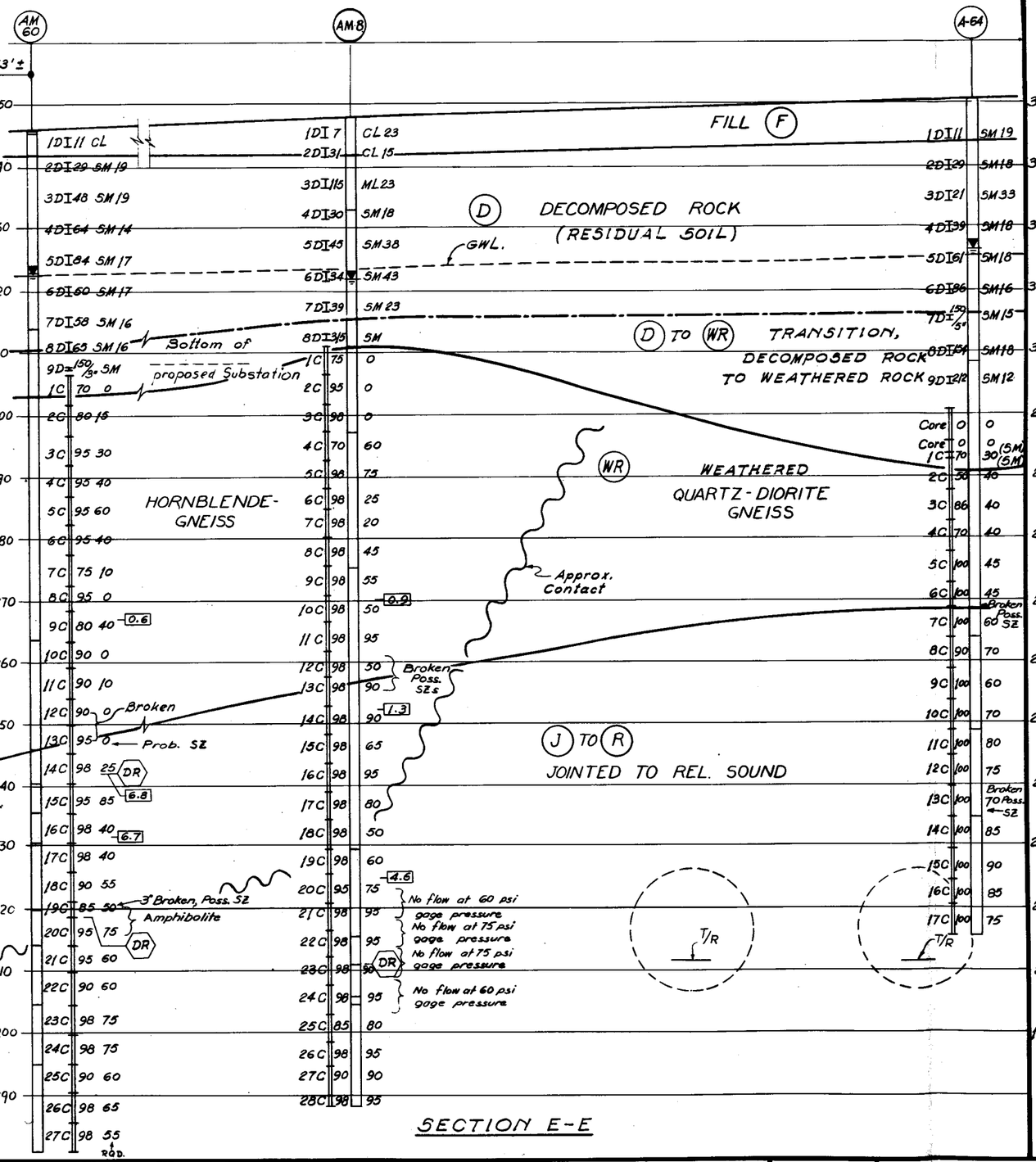
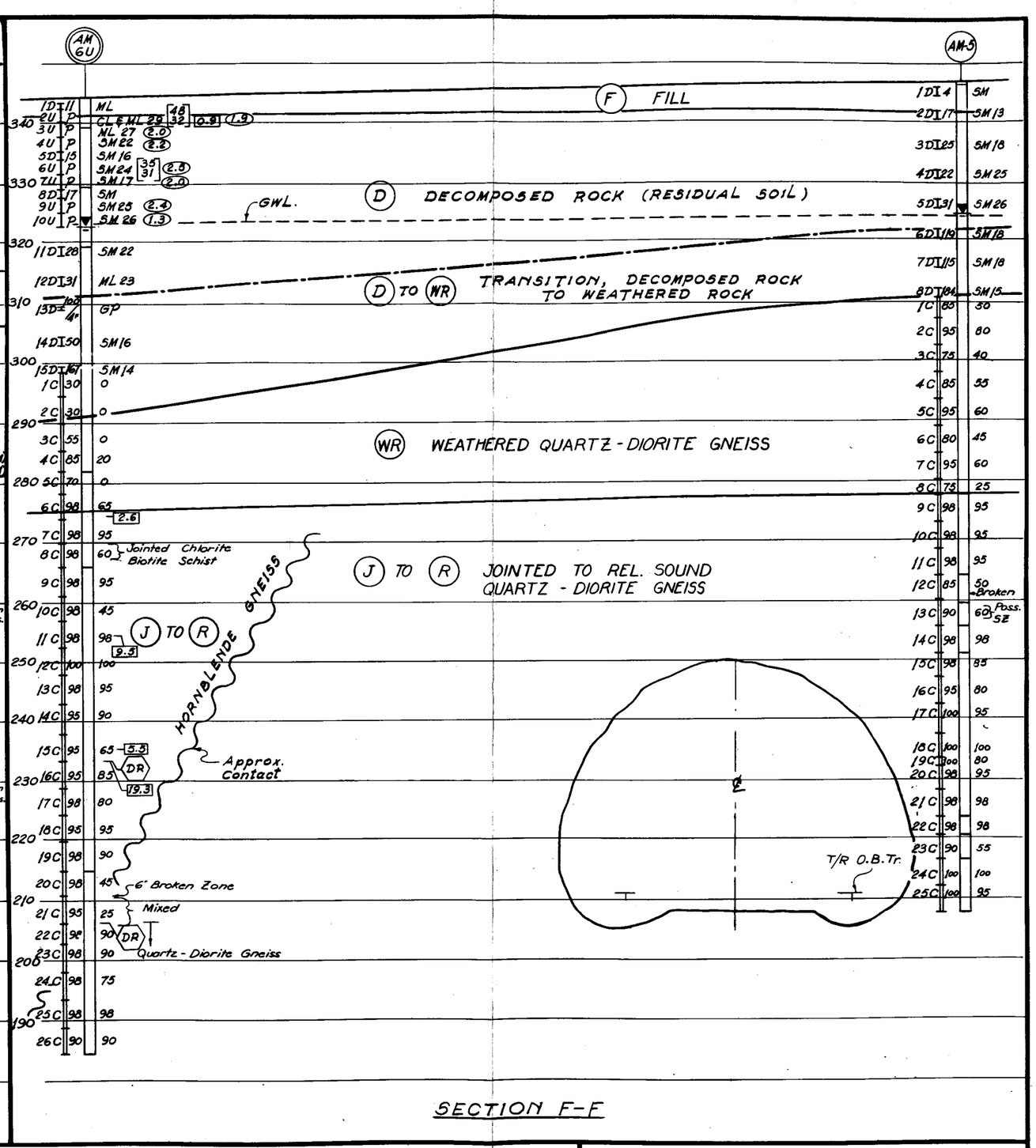
ROCKVILLE ROUTE (A011)
MEDICAL CENTER STATION
GEOLOGICAL SECTIONS B-B and C-C

SCALE HORIZ. & VERT. 0 10' 20'

DRAWING NO. F-A-101



SECTION E-E



SECTION F-F

REFERENCE DRAWINGS		REVISIONS		
NUMBER	DESCRIPTION	DATE	BY	DESCRIPTION
F-1	General Notes and Legend.			
F-A-89	Boring Location Plan.			

DRAWN AR, AG & I.H.L. 8-74 DATE
CHECKED SLT. & JPG. 12-74 DATE
APPROVED _____ DATE

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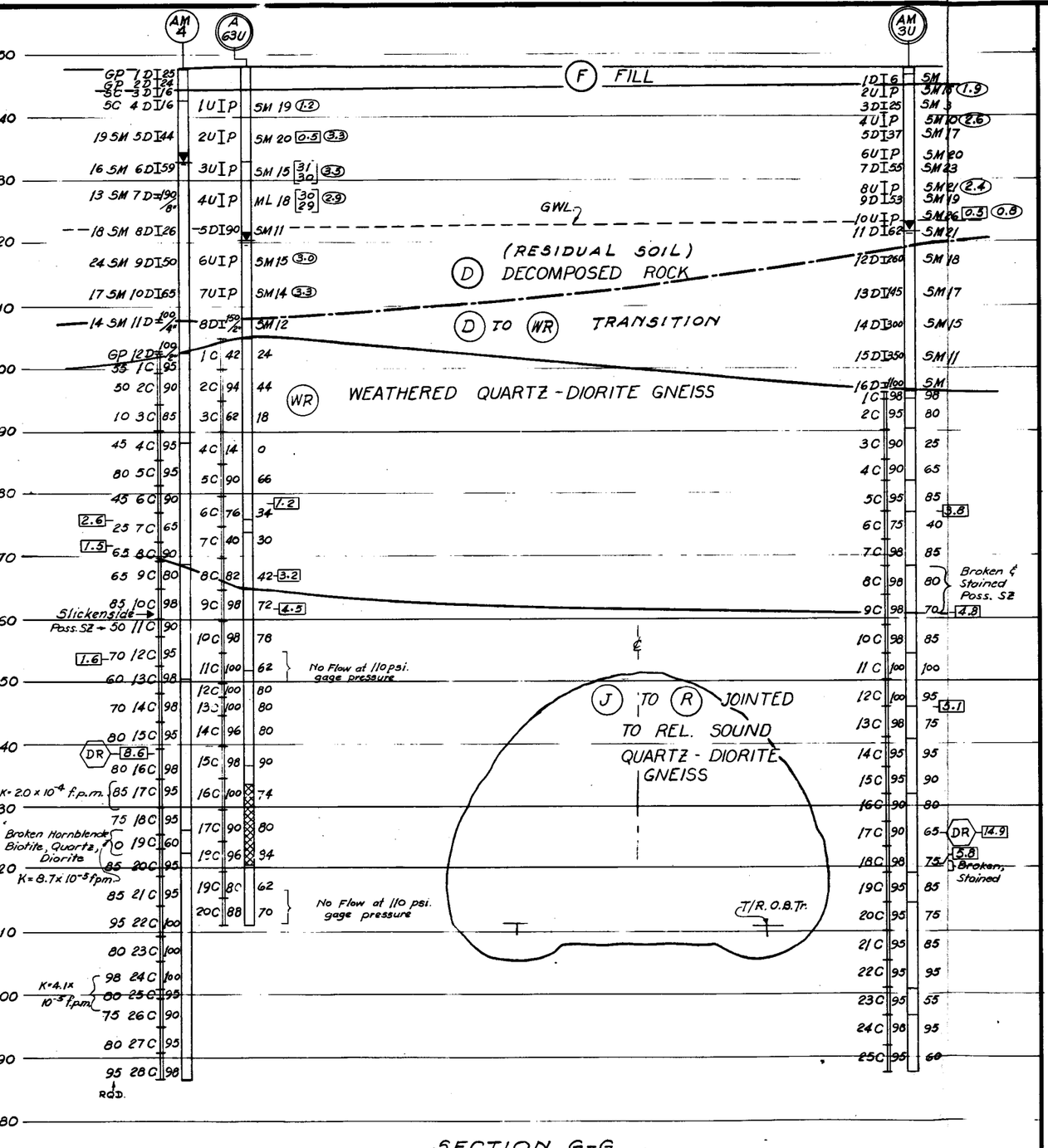
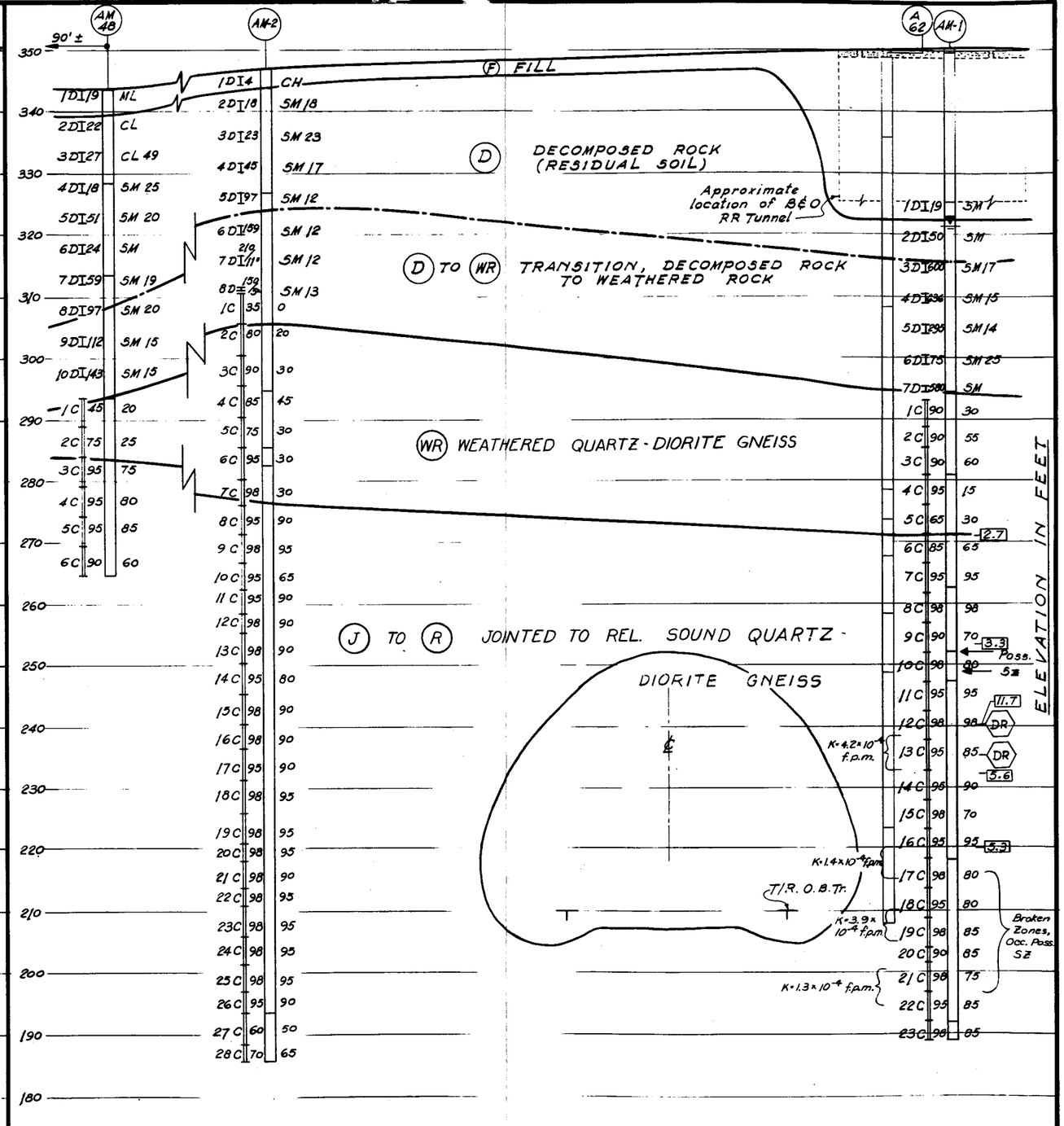
ROCKVILLE ROUTE (A011)
BETHESDA STATION
GEOLOGICAL SECTIONS E-E and F-F

SCALE HORIZ. 0 5' 10' 20
VERT.

DRAWING NO. F-A-102



SECTION G-G



SECTION H-H

DESIGNED			DATE
DRAWN	AG. & I.H.L.	6-74	DATE
CHECKED	SLT. & JPG.	12-74	DATE
APPROVED			DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend.
F-A-89	Boring Location Plan.

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM N. SUESSER — 4070 — REGISTERED PROFESSIONAL ENGINEER

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CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
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GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED

ROCKVILLE ROUTE (AOII)
BETHESDA STATION
GEOLOGICAL SECTIONS G-G and H-H

SCALE HORIZ. & VERT. 0 5' 10' 20

DRAWING NO. F-A-103

N

Dk. Diorite

AM-66

AM-64

Shading is approx. zone of highly jointed rock at El. 240

70°

Dike

Dark Colored Diorite

Light Colored Diorite

AM-62

A-79

45°

Lt. Diorite

450

445

AM-71

MEDICAL CENTER STATION

AM-70

AM-69

AM-68

70°

Granodiorite

Zone

Mixed

E772,405

N424,400

A-80

AM-65

AM-63

45°

2" to 6" Shear Zone

60°

AM-35

Lt. Diorite

PLAN, EL. 200

PLAN, EL. 220

NOTE: All contacts and zone lines are highly approximate

N418,820

E773,400

N

AM-7

AM-5

AM-3U

A-62

AM-1

7-10

395

390

60°

55° ±

BETHESDA STATION

Broken zone, 5' thick with possible multiple shears of limited movement

Quartz-diorite Gneiss, numerous chlorite schist bands and country rock inclusions

A-63U

AM-2

60°

AM-8

AM-60 (Hornblende Gneiss)

AM-6U

AM-4

40° to 70°

Photo: primary joints and foliation

AM-48

SIGNED		DATE
DRAWN	AR	DATE 10-74
CHECKED	JPG	DATE 11-74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes and Legend

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
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APPROVED

ROCKVILLE ROUTE (A011)
MEDICAL CENTER AND BETHESDA STATIONS
GEOLOGY

SCALE 0 20' 40'

DRAWING NO. F-A-104

BORING NUMBER AM-1

Ground surface elevation + 350.3

DEPTH					
0				8" concrete slab	0.7'
5					
10					
15					RAILWAY TUNNEL OPENING
20					
25	8	1D	4,7, 12	Loose brown micaceous si fine sand, some gravel, tr concrete & veg (Fill) (SM)	25.0' FILL & BALLAST 28.0'
	10				
	15				
	72				
30	98			Medium cpt gry-brn micaceous si f-c sand, sm gvl (Poss Fill) (SM)	
	70	2D	12,22 28		
	350				
	374				
35	281			Cpt gry-brn micaceous si f sand, numerous rock fgmts (SM)	BROWN MICACEOUS SILTY FINE SAND, NUMEROUS ROCK FRAGMENTS
	1100	3D	28, 215, 385		
40		4D	35, 136, 500	Cpt brn micaceous si f sa, tr gvl, numerous rock fragments (SM)	
45		5D	28, 115, 180	Very cpt brn micaceous si f sand, some rock fragments (SM)	
50		6D	30,24 51	Medium cpt brn micaceous si f sand, sm c sand & rock fragments (SM)	
55	»	7D	365, 215	Very cpt brn micaceous si fine sand (SM)	56.0'
		1C	90/30	Mod wthrd qtz-biotite-gns 8 diag jts, 5 jts 45°, 1 jt @ 60°, 1 jt @ 30°, 1 jt @ 85°, jts highly iron stained, weak zone @ 59'	QTZ-BIO HORN-BLENDE GNEISS, WEATHERED & JOINTED, MODERATE-LY FOLIATED @ 40°-60°
60		2C	90/55	6 diag jts, 2 40° jts, 1 60°, 3 35°, 1 cross jt 45°-60°, 1 jt approx 60°, vert breaking	69.5'
65		3C	90/60	Hi wthrd, 4 diag jts, 2 45° 2 60° one cross jt, jts w/iron stain, frctd @ 65'	JOINTED QTZ-BIO GNEISS, MODERATE-LY WEATHERED TO SLIGHT-LY WTHRD
70		4C	95/15	Hi wthrd & jtd, crushed mtl along jts @ 71'-71.4', 4 fol jts @ 50°, 5 diag jts, wthrd & iron stained	79.1'
75		5C	65/30	4 diag jts, two parallel jts iron stained & wthrd, hi wthrd @ 75.7'-77.3'	
80		6C	85/60	4 diag jts, 1 70° jt, 1 60° 2 40° jts, jts iron stained & wthrd	MOD JTD-DIO-GNS W/HORN-BLENDE 88.7'
85		7C	95/95	2 diag jts, 1 45° jt, 1 40° jt mod wthrd, jts sli micaceous, qtz occurs freq	
90		8C	98/98	2 diag jts, 1 45° jt, 1 35° jt, chlorite inclusions occur @ bot	RELATIVE-LY SOUND DIORITE-GNEISS 98.3'
95		9C	90/70	4 diag jts, 1 40° jt, 2 50° jts, 1 60° jt, parallel breaking @ 93.5'-94'-hi iron stained & rusted, 3 iron stained @ 98.2'	
100		10C	98/80	3 diag jts, 1 70° jt, 1 80° jt, 1 40° jt, sheared mtl along jts @ 99.3'-99.7'; jts up to 99.7' hi wthrd & iron stained, Hornblende inclusions @ 102.9'-103.1'	MOD JTD-JOINTED DIO-GNS 103.1'
105					

(CONTINUED)

BORING NUMBER AM-1 (CONT'D)

DEPTH					
105		11C	95/95	3 diag jts, 2 25°, 1 15°, 1 jt 25° iron stained, hornblende @ 103.1-103.2'	RELATIVE-LY SOUND DIORITE-GNEISS, MODERATE-LY FOLIATED 40°-60°, UNWEATH-ERED INCLUDING JOINTS
110		12C	98/98	3 diag jts, 1 15° iron stained, wthrd, 1 25°, 1 45°, chlorite & feldspar @ bot	
115		13C	95/85	3 diag joints, 1 20°, 1 18° 1 45°, 1 fol jt @ 45°, 1 vert jt, change to chlorite @ 112.9'-115.2'	
120		14C	95/90	3 diag jts, 1 45° jt with pyrite, 1 60° jt with chlorite, 1 20° jt w/little calc-chlorite inclusions @ 114.5'	
125		15C	98/70	5 diag jts, 1 55° jt, 1 20° jt, 2 15° jts, 1 10° jt, 1 filled, talc on jts @ 122.7', 123.6'	
130		16C	95/95	4 diag jts, 2 20° jts, 2 18° jt, chlorite inclusion @ 128.3'	131.9'
135		17C	98/80	3 diag jts, 1 60° jt, 1 45° jt, 1 25° jt, little calc & talc on jts, frctd @ 133.6-134.6'	QUARTZ-BIOTITE-GNEISS MODERATE-LY JOINTED, UNWEATH-ERED, FOLIATED @ 40°-60°, SEVERAL INTENSELY BROKEN ZONES, POSSIBLY SHEARED
140		18C	95/90	4 diag jts, 2 45° jts, 1 15° jt, 1 70° jt, feldspar coating on 2 jts of 45° fragmented @ 141'-141.5'	
145		19C	98/85	6 diag jts, 1 55° jt, 4 40° jts, 1 80° jt, 1 vert jt, jts w/chlorite & little calc, fragmented zone @ 141.5'-142'	
		20C	90/85	2 diag jts, 2 50° w/little chlorite, chlorite occurs @ 146.8'-147.3'	
150		21C	98/75	4 diag jts, 2 60°jts, 2 80° jts with little talc, hi jtd & bkn @ 151.7'-153.5'	
155		22C	95/85	5 diag jts, 1 45° jt, 2 60° jts, 2 10° jts, talc on jts, chlorite inclusion @ top	
		23C	98/85	5 diag jts, 2 20° jts, 1 30° jt. 1 50° jt, 1 80° jt jts w/talc	161.4'
160					

Boring started 2-18-74 , completed 2-27-74
Final depths:
Boring = 161.4' Casing = 60'
Casing diameter = 3" & 4"
Average depth of ground water observed in the boring = 28.5' = El. +321.8

REMARKS:
8" of concrete at ground surface.
Railway tunnel between 0.7' and 25.0' depth.
Drilled ahead of casing from 35' to 60' depth; casing blows not reported.
Loss of drilling water at 114.6'.depth.
Four water pressure tests with packers run in this borehole.

BORING NUMBER AM-2

Ground surface elevation + 346.9

DEPTH					
0	140				
	11	1D	1,2,2	Soft brown-red plastic silty clay, 2 pieces of rock fragments, (Fill) (CH)	CLAY FILL 3.0'
5	26				
	40				
	115			Red-tan silty fine sand, some mica (SM)	
	112	2D	7,8, 10		
	120				
10	153			Medium stiff red-gray micaceous silty fine sand (SM)	RED-TAN-GRAY MICACEOUS SILTY FINE SAND, RESIDUAL SOIL
	203				
	200				
	105	3D	6,13, 10		
	133				
	271				
15	375			Red-gray- tan micaceous silty fine sand (SM)	
	514				
	77	4D	11,22 23		
	91				
	100				
	103				
	111				20.0'
20	101	5D	19,36 61	Gray-tan silty fine sand (SM)	
	89				
	142				
	188			Red-brown silty fine sand, trace medium sand (SM)	RED-BROWN GRAY SILTY FINE SAND, WEATH-ERED ROCK FRAGMENTS IN BOTTOM
	500				
25	126	6D	40,76 83		
	203				
	300				
	616			Red-brown-gray silty fine sand, trace medium sand, some rock fragments (SM)	
	500				
30		7D	21,60 150/5"		
		8D	150/5"	Do 7D (SM)	36.0'
35				Jtd, wthrd brn schistose gneiss, soft friable, 1 vert jt w/dark stain, crumbles into brown fine sand	
		1C	35/0		
40	»			Do 1C, 5 30° jts, fol 45° to 50°	JOINTED AND WEATH-ERED BROWN SCHISTOSE GNEISS, SOFT, FRIABLE
		2C	80/20		
45				Do 1C, 2 10° open 1/4"jt, 1 60° fol jt, dark brown stain, gouge material, twin 80° jts	
		3C	90/30		
50				Broken, wthrd to 52', 1 60° jt, 1 45° jt w/stain, in 0.5', 3 fol jts in 0.8' open 1/16"-1/2", stain & gouge	52.0'
		4C	85/45		JOINTED GRAY QUARTZ DIORITE GNEISS, IRREGULAR TO 70° FOL
55				Jtd gry quartz diorite gneiss w/inclusions, irregular to 70° fol, 4 20°-30° jts in 0.5', 5 fol jts in 1.5'	61.0'
		5C	75/30		JOINTED WEATHERED
60				jtd & wthrd to 64.0', 4 horiz to 20° jts in 0.7', 4 30° cross fol jts in 0.8' open 1/8"-1/4" with stain, possible gouge, broken & wthrd 65'-66.7'	64.0' JOINTED WITH CHLORITE SCHIST BANDS
		6C	95/30		70.0'
65		7C	98/30	4 10°-20° jts in 0.2', 1 45° jt @ 68', 1 60° jt @ 70' sli stain, chlorite schist bands to 68.5'	
		8C	95/90	Rel snd, 2 45° jts in 0.15' close @ 70.5', 1 30° jt, 1 60° jt rough, 1/8"open thin talc dep, diorite chlorite contact	
70		9C	96/95	Grn-gry quartz diorite gneiss w/chlorite inclusions, 1 30° jt @ 76.5' 1/8" open	AS BELOW
75		10C	95/65	3 30° jts in 0.5', 1 45° jt, 1 80° jt w/stain & gouge, 1/8"open in 1.0'	
		11C	95/90	1 80° jt irregular on fol, rough sli stained, thin talc deposits	
80		12C	98/90	2 30° jts, 1 20° jt in 1', 1 0° jt, 1 20° jt 1/8" open @ 90', 1 20°jt, 1 30° jt in 0.1'	
85		13C	98/90	Rel snd w/irregular to 45° fol, 2 30° cross fol jts in 1', 1 80° jt, rough stains	
90					
95		14C	95/80	3 45°fol jts in 0.5' with iron stains, 1 pc = 2.8', talc deposits on jts, possible gouge	
100					

(CONTINUED)

BORING NUMBER AM-2 (CONTINUED)

DEPTH					
105		15C	98/90	1 fol jt, 1 60° cross fol jt in 1.0', irregular chlorite intrusion 101'to 102.5', possible flow structure	RELA-TIVELY SOUND GRAY QUARTZ DIORITE GNEISS WITH CHLORITE BANDS AND INCLU-SIONS, IRREGU-LAR TO 45° FOLIA-TION, SMOOTH TO OPEN JOINTS, IRON STAINS AND THIN TALC DEPOSITS ON JOINTS, CALCITE DEPOSIT 132.5', SOME EVIDENCE OF POSSIBLE MOVEMENT AT 84' & 100'
110		16C	98/90	1 30° jt @ 106' 1/8" open, 1 45° jt planar, iron stains, thin talc deposit at 108.5'	
115		17C	95/90	1 45° fol jt, 1 30° jt in 0.8', 2 20° cross fol jts, 1 30° planar jt in 0.7'	
120		18C	98/95	1 fol jt rough, 1/8" open @ 115', 1 60° fol jt, 1/8" open, thin pyrite crystals at 117.7'	
125		19C	98/95	1 fol jt rough, open 1/8", no stain, dark chlorite bands & inclusions, 50° to 60° fol	
		20C	98/95	2 fol jts 45°-50° in 2.4' along 1/2" chlorite bands, thin chlorite inclusions	
130		21C	98/90	1 30°fol jt w/talc, 130', 3 30° cross fol jts, 2 rough, thin calcite dep in 0.4' space, open 1/8"	
135		22C	98/95	2 20° cross fol jts open 1/4" to 1/8", thin calcite deposits on joints	
		23C	98/95	Rel snd, 5 dark 1" bands chlorite & inclusions, 3 20°-30°jts open 1/8"	
140		24C	98/95	2 60° fol jts, 1 fol jt, thin calcite dep, tr fine sand, yel-brn stain, 1 60° cross fol jt, rough open 1/8", no stain	
145		25C	98/95	1 fol jt,rough 145.1', 2 fol jts, 1 cross fol jt in 1.2', 0.7' chlorite schist 147.3'-148'	
150		26C	95/90	1 fol jt rough 149.4', 2 10° jts 1/8"-1/4" open, 1 60° jt rough, thin talc deposit, slight stain	153.0' JOINTED, ROUGH OPEN JTS, SLIGHT STAIN AND TALC
155		27C	60/50	Jtd 153'-154.5', 5 10° to 20° jts rough, open 1/8" to 1/4" in 1.5'	161.0'
160		28C	70/65	2 30° cross fol jts in 0.8', 1 20° jt rough open 1/8"-1/4", slight stain at 158', 1 30° jt,smooth	

Boring started 4-24-74 , completed 5-3-74
Final depths:
Boring = 161.0' Casing = 45.8'
Casing diameter = 6"
Average depth of ground water observed in the boring = 25.3' = El. + 321.6

REMARKS:
8" of concrete on 4" of crushed stone at surface.
Drilled ahead of casing from 30' to 45.8' depth; casing blows not reported.
Lost drilling water at 47' depth. Drilling water returned at 157' depth.

NOTES FOR AM-SERIES BORING LOGS

1. A total of 59 borings of the AM-series between Nos. AM-1 and AM-71 were made by Empire Soils Investigations, Inc. from September 1973 to August 1974 under the continuous inspection of Mueser, Rutledge, Wentworth & Johnston engineers. A group of eight supplementary borings, Nos. AM-72 through AM-79, were made by Empire Soils Investigations, Inc. in December 1974 and January 1975 under the continuous supervision of Mueser, Rutledge, Wentworth & Johnston engineers.

2. General notes concerning symbols and the method of presentation of data on boring log drawings and geological section drawings are given on Information Drawing No. F-1. For survey data on coordinate locations and ground surface elevations at the borings see Table No.1 of Mueser, Rutledge, Wentworth & Johnston Report No.117 of December 30, 1974.

3. All rock cores from Borings Nos. AM-1 through AM-71 were recovered in NX-size, triple tube, split core barrels (Christensen No.NWD-3) recovering cores 2-1/8-inch in diameter; except that Borings Nos. AM-7, -23 and -42 were cored with a 4-1/2-inch by 5-inch diamond bit yielding a core approximately 4-inches in diameter.

4. The "Rock Quality Designation" (RQD) is a parameter which reflects the intensity of jointing in the recovered core. For any particular core run the RQD equals the sum of the lengths of pieces of that core longer than 4-inches divided by the total length of core run, expressed as a percentage. General descriptions of rock quality are based primarily on RQD values. For example, "relatively sound rock" is that core wherein the mineral matrix is essentially unweathered and RQD exceeds 75 per cent. This description does not mean that the rock will remain intact and free of joints, fractures or breaks in the process of excavation. For a detailed description of adjectives used to describe rock quality see Mueser, Rutledge, Wentworth & Johnston Report No. 117.

5. The natural materials overlying bedrock are derived from weathering and decomposition of the parent rock in-situ. In this investigation natural overburden materials above bedrock are divided into two catagories:
   Stratum (D): decomposed rock (residual soil)
   Stratum (D) to (WR): transition, decomposed rock to weathered rock
   The upper "residual soil" stratum is composed almost entirely of soil-like material. The lower "transition" stratum is expected to contain both soil and rock-like materials in roughly equal proportions. The division between these two strata is generally taken in the borings at a standard sampler penetration resistance value of approximately 100 blows per foot and in accordance with certain other criteria given in Mueser, Rutledge, Wentworth & Johnston Report No.117. The "approximate top of weathered bedrock" constitutes the boundary between the transition stratum and bedrock which exhibits essentially rock-like characteristics. This boundary generally is taken where rock core recoveries exceed approximately 50 per cent and/or RQD values exceed approximately 10 per cent.

On the geological sections the top of the transition stratum (D) to (WR) is shown thus: 25

& the top of "weathered bedrock" shown thus: 35

ABBREVIATIONS

The following additional abbreviations have been utilized in the logs of Borings of the AM-Series:

BROKEN	brkn, bkn	JOINT, JOINTED, JOINTS, JOINTING	jt, jtd, jts jting
CALCITE	calc	MODERATELY	mod
DEPOSIT	dep	QUARTZ	qtz
DIAGONAL	diag	RELATIVELY SOUND	rel snd
DIORITE	dio	SCHIST	sch
FOLIATION, FOLIATED	fol	SLIGHTLY	sli
FRACTURES, FRACTURED	fract, frctd	UNWEATHERED	unwthrd
GNEISS	gns	VARIABLE	var
HIGHLY	hi	VERTICAL	vert
HORNBLENDE	horn	WEATHERED	wthd, wthrd
INCLUSIONS	inclu		

DESIGNED ____ DATE
DRAWN IHL & AR 12/74
CHECKED SLT & JPG 12/74
APPROVED ____ DATE

REFERENCE DRAWINGS NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to F-A-104	Plans & Geological Sections

REVISIONS DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. MUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY ☐
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES ☐
GENERAL ARCHITECTURAL CONSULTANT
APPROVED ____

ROCKVILLE ROUTE (A011)
LOGS OF AM-SERIES BORINGS Nos. AM-1 to AM-2

SCALE VERT. 0 3' 6' 12'
DRAWING NO. F-A-105

BORING NUMBER AM-3U
Ground surface elevation +347.9

DEPTH BELOW GROUND SURFACE, FEET				
0	7			Med stiff brn micaceous si f sand, tr gvl (Fill) (SM)
	10	1D	2,2,4	
	10	2U	P	Stiff brn si f sand, residual soil (SM)
5	12			
	40	3D	7,12, 13	Vy stiff brn micaceous si f sand (SM)
	44			
	52	4U	P	Brn micaceous si f sand (SM)
	76			
10	131			
	50	5D	12,17 20	Do 4U (SM)
	69			
	70	6U	P	Do 4U (SM)
	34			
15	44			
	50	7D	12,29 26	Do 4U (SM)
	37			
	34	8U	P	Do 4U (SM)
	39			
20	41			
	28	9D	12,22 31	Do 4U (SM)
	47			
	64	10U	P	Brown micaceous si f sand, tr rock fragments (SM)
	96			
25	104	11D	20,22 40	Do 10D (SM)
	345			
	475			
	990			
	1429			Very compact brown micaceous silty fine sand, numerous rock fragments (SM)
30	875	12D	60, 200	
35		13D	46,49 96	Do 12D (SM)
40		14D	60, 140, 160	Do 12D (SM)
45		15D	140, 170, 180	Do 12D (SM)
			200,	
50		16D	900	Do 12D (SM)
		1C	98/98	Gry-grn hornblende-biotite gneiss, iron stained
55		2C	95/80	Do 1C, 4 jts @ 45°-70°, stained, calc & micaceous jts
60		3C	90/25	Do 1c, wthrd & jtd; hi wthrd, closely jtd & soft @ 58.5'-62'
		4C	90/65	Gry diorite-gneiss, wthrd & jtd; hi wthrd @ top 62.1' to 63.6', 5 jts stained w/mica & calc
65		5C	95/85	Rel snd, 5 jts @ 25°-50°, jts micaceous & stained
70		6C	75/40	Wthrd & jtd, 4 jts 15°-40°, jts stained & micaceous; soft rock @ 72.5'-73.5'
75		7C	98/85	Wthrd & jtd, 5 jts @ 40°-70°, jts micaceous & stained, sheared mtl @ top
80		8C	98/80	Mod jtd to jtd, 1 45° jt, 1 30° jt, 1 20° jt, poss shearing @ 81.1', 82' & 82.5'
85		9C	98/70	Mod jtd to jtd, 1 45° jt, 2 20° jts, jt micaceous & stained, poss sheared mtl @ 84.9'-85.9' & 87.5'
90		10C	95/85	1 60° jt, 1 30° jt, jts micaceous & stained, schistose @ bottom, 1 brk @ 92.5', qtz occurs
95		11C	100/ 100	Rel snd, two jts, micaceous
100		12C	100/ 95	Rel snd, 1 80° jt, 1 40° jt, 1 30° jt, 1 25° jt, jts micaceous & stained, chlorite occurs

(CONTINUED)

COMPACT TO VERY COMPACT BROWN MICACEOUS SILTY SAND WITH ROCK FRAGMENTS INCREASING WITH DEPTH, DECOMPOSED ROCK TO WEATHERED ROCK				
	51.4'			
MOD JTD GNEISS	57.2'			
WEATHERED & JOINTED QUARTZ-DIORITE-GNEISS	65.7'			
REL SND QTZ-DIO-GNS	70.5'			
SLIGHTLY WEATHERED-HIGHLY WEATHERED, MODERATELY JOINTED QUARTZ-BIOTITE-DIORITE-GNEISS, 40°-60° FOLIATION	87.0'			
RELATIVELY SOUND DIORITE-GNEISS, FOLIATION JOINTS AT 40° TO 60°	101.8'			

BORING NUMBER AM-3U (CON'T)

100		13C	98/75	Mod jtd to jtd; hi jtd @ 102.4'-102.9'; jts mica & stained, mostly in chloritic zones
105		14C	95/95	Rel snd, hornblende-biogns, 2 jts per 4.5', sm banding
110		15C	95/90	4 jts per 4', stained from 114'-114.2', sm chloritic lenses
115		16C	90/80	Unwthrd inclusion jts, mod jtd, 6 jts per 3.9'
120		17C	90/65	8 jts per 3.6', 1 jt 60°, 2 jts 30°, 3 horiz jts, secondary minerals present in jts
125		18C	98/75	Indistinct fol, 9 jts per 4', jts are irreg, iron stained in 6 jts from 127.3'-128.2'
130		19C	95/85	Rel snd, 3 jts per 4.6', 2 50° jts, 1 horiz jt, jts are irreg, tight with secondary mineralization
135		20C	95/75	6 jts per 4.2', 1 20° jt, 5 horiz jts @ 136.4'-137.5', iron stained, 3 jts per 1.1', all jts irreg
140		21C	95/85	Rel snd bio-gns, unwthrd incl jts, 5 jts per 4.5', 3 jts @ 30°, 2 horiz jts, jts are rough & straight
145		22C	95/95	Do 21C, no open joints
150		23C	95/55	Mod jtd to jtd, 11 per 4.3', 1 60° jt, 2 30° jts, 8 horiz jts, jts are rough & straight
155		24C	98/95	Do 21C, 4 jts per 4.8', 2 jts @ 60°, 2 horiz jts, jts are unwthrd, rough & straight
160		25C	95/60	7 jts per 4', 1 jt @ 85°, 1 jt @ 70°, 1 jt @ 40°, 1 jt @ 10°, 3 horiz jts, jts filled with secondary minerals

Boring started 2-26-74 , completed 4-12-74
Final depths:
Boring = 160.0' Casing = 65'
Casing diameter = 3" & 4"
Average depth of ground water observed in the boring = 25.2' = El. +322.7

REMARKS:
4" of concrete on 8" of gravel base at surface.
Drilled ahead of casing from 30' to 65' depth; casing blows not reported.
Undisturbed Sample 6U pushed 16" and met refusal at 14.4' depth.
Casing was left in place for borehole photography.

MOD JTD GNEISS	106.6'			
RELATIVELY SOUND GNEISS, 1 JOINT PER FOOT	115.6'			
MODERATELY JOINTED GNEISS, 4 JOINTS PER FOOT	128.2'			
RELATIVELY SOUND GNEISS, 40°-60° FOLIATION, 1 JOINT PER FOOT	146.5'			
MOD JTD WEAKER ZONE	151.0'			
RELATIVELY SOUND, 1 JOINT PER FOOT, DIORITE GNEISS	160.0'			

BORING NUMBER AM-4
Ground surface elevation + 347.6

0	43	1D	64,14 11	Lt gry to gry m-c sa gravel, sm tar (Fill) (GP)
	38		13,12	
	40	2D	12	Do 1D (Fill) (GP)
	27		11,9,	
5	28	3D	7	Dark gry cl sand, tr rock fragments (SC)
	41	4D	15,9, 7	Dark gry-brown cl f-c sand, tr rock fgmts (Fill) (SC)
	42			
	44			
	77			
	120			
10	179	5D	17,19 25	Cpt brn si f sand, tr rock fragments (SM)
	213			
	205			
	176			
	205			
15	175	6D	21,28 31	Cpt red-brn si f sandy micaceous silt (SM)
	267			
	407			
	520			
20	500	7D	90,100	Do 5D, very compact, numerous rock fragments (SM)
25		8D	9,11, 15	Do 5D (SM)
30		9D	26,31, 19	Do 5D (SM)
35		10D	21,41 24	Do 5D (SM)
40		11D	100/4"	Very cpt brn micaceous si f sand, tr m sand, numerous rock fragments (SM)
45		12D	100/3"	Do 11D w/decomposed rock fragments (GP)
50		1C	95/55	Lt brn hi wthrd & jtd qtz-mica-dio-gns, rel distinct fol @ 50°-60°, broken zone @ 46.1'-46.3'
		2C	90/50	Do 1C, 70° jt, iron stain, 2 fol jts in top, highly jtd in bot
55		3C	85/10	Jtd-wthrd, vrt jting in top to 55', 4 diag jts @ 70°-80°, dark stains
60		4C	95/45	Jtd-sli wthrd lt gry qtz-dio-gns w/chlorite inclusions, 50° fol, 2 fol jts, 4 horiz jts
65		5C	95/80	2 fol jts, 3 jts @ 10°-20°, 1 dia jt @ 70° @ 65.5' w/iron stains, chlorite inclusions
		6C	90/45	Mod jtd, wthrd to 67.5', 3 diag jts @ 70° w/iron stain 2 horiz jts
70		7C	65/25	Sli wthrd, 4 horiz jts, 1 diag jt @ 60° @ 72.5', av. 2 jts per ft
75		8C	90/65	10° jointing, 6 jts @ 20° to 45°, sli wthrd, iron stains on jt
80		9C	80/65	2 fol jts @ 45°, 1 diag jt @ 60° @ 80' w/iron stains, 3 cross jts @ 10°-20°
85		10C	98/85	Mod jtd, 1 diag jt @ 70° @ 84.6', 1 30° jt @ 82.2' iron stains, 2 fol jts @ 83.5', 84.5'
90		11C	90/50	Mod jtd, 1 70° jt @ 86.7'-87' w/gouge mtl, poss shear 2 fol jts 87.7'-87.9'
		12C	95/70	Rel snd, 60° fol, 2 fol jts, iron stained, 1 diag jt @ 70° @ 88.4', 3 horiz to 10° jts
95		13C	98/60	Jtd lt gry-grn, 2 fol jts @ 50°, 2 20° jts @ 94'-94.2' w/iron stains, 7 10°-20° jts, no stains
100		14C	98/70	Jtd-unwthrd, 3 fol jts in top, 3 30° jts, 4 10°-20° jts
105				

(CONTINUED)

SAND & GRAVEL, FILL	7.0'			
COMPACT BROWN SILTY SAND WITH VARYING ROCK FRAGMENTS, DECOMPOSED ROCK	45.2'			
HI WTHRD & JTD LT BRN QTZ-DIO-GNS, 50°-60° FOLIATION, HORIZONTAL JOINTS @ 80°	59.6'			
MODERATELY WTHRD & JOINTED LIGHT BROWN QUARTZ-DIORITE-GNEISS, 50°-60° FOLIATION, 10°-80° JOINTS	79.0'			
WEATHERED EXCLUDING JOINTS JOINTED GRAY QUARTZ-DIORITE-GNEISS	97.0'			

BORING NUMBER AM-4 (CONT'D)
Ground surface elevation +

105		15C	95/80	2 fol jts @ 50°-60° w/thin talc deposits, 3 30° jts, no stains
110		16C	98/80	1 45° jt, 4 20°-30° jts, no stains, thinly laminated quartz inclusions, lt grn chlorite inclusions
115		17C	95/85	Some chlorite inclusions, 2 horizontal jts @ 10°-20°
120		18C	95/75	1 horiz jt @ 10°, 1 60° jt @ 121.2' dio-chlorite alt, 1 70° jt @ 121.4'
125		19C	60/0	Grn-gry unwthrd incl jts, bkn dio-chlorite
130		20C	95/85	Do 19C, up to 125', lt gry unwthrd incl jts, sm chlorite pebbles, fol 50°, 2 jts 40°, 1 jt 50°
135		21C	95/85	Do 20C, Fol 50°-60°, 1 horiz jt, 2 jts @ 10°, 1 jt @ 30°, 1 cross jt @ 133°
140		22C	100/ 95	Do 20C, fol 40°-60°, 1 horiz jt, 2 jts @ 10°, 1 jt @ 30°, 1 jt 40°
145		23C	100/ 80	Fol 50°-70°, 2 jts @ 10°, 2 jts @ 30°, 2 jts @ 60°
150		24C	100/ 98	Fol 70°, 2 jts @ 10°, 1 jt @ 30°, 1 fol jt
		25C	95/80	Fol 50°, 1 jt @ 40°
155		26C	90/75	Fol 50°-70°, 2 jts @ 10°, 3 fol jts
		27C	95/80	Fol jt 50°-60°, 1 horiz jt, 2 jts @ 30°, 2 jts @ 45°
160		28C	98/95	Do 21C, fol 50°-80°, 2 jts @ 10°, 1 fol jt @ 80°

UNWTHRD, INCLUDING JOINTS, MOD JTD, GRAY QUARTZ-DIORITE-GNEISS, 40°-50° FOLIATION 0°-70° JOINTS	121.2'	
BROKEN DIORITE-CHLORITE	125.0'	
UNWEATHERED, INCLUDING JOINTS, RELATIVELY SOUND GRAY QUARTZ-DIORITE-GNEISS, 40°-80° FOLIATION, HORIZONTAL JOINTS @ 80°, SMALL CHLORITE INCLUSION	161.3'	

Boring started 2-14-74 , completed 3-1-74
Final depths:
Boring = 161.3' Casing = 45'
Casing diameter = 4"
Average depth of ground water observed in the boring = 24.5' = El. +323.1

REMARKS:
Drilled ahead of casing from 20' to 45' depth; casing blows not reported.
Three water pressure tests with packers run in this borehole.

BORING NUMBER AM-5
Ground surface elevation +346.8

0	9			4" concrete pavement
	7	1D	2,2,2	Loose brn micaceous silty fine sand, trace gravel (SM)
	5			
	9			
	35			
	50	2D	9,8,9	Loose brown silty fine sand, micaceous silt, trace gravel (SM)
	76			
	84			
	109			
10	16			
	22	3D	10,11 14	Medium compact brown micaceous silty fine sand, tr rock fgmts (SM)
	40			
	42			
	30			
15	45			
	70	4D	6,9, 13	Do 3D (SM)
	91			
	77			
	68			
20	42			
	51	5D	7,10, 21	Do 3D (SM)
	72			
	73			
	80			
	81			
25	75	6D	24,50 69	Do 3D, increasing rock fragments (SM)
	100			
	110			
	125			
30	100			
	138	7D	38,35 80	Very cpt brn micaceous si f sand, numerous rock fgmt (SM)
	250			
	269			
	299			
35	750			
		8D	17,34 150	Do 7D (SM)
40		1C	85/50	Grn hi wthrd gns, 1 diag jt @ 50°, 4 50°-60° jts
		2C	95/80	Do 1C, 2 diag jts, 1 30° jt, 1 45° jt, fol 50°, sheared zone 41.1'-41.4'
45		3C	75/40	3 diag jts, 1 30° jt, 2 45° jts, dio hornblende contact @ 47.1', chlorite @ 46.8', crushed mtl @ 45.1'-45.3'
50		4C	85/55	1 diag jt @ 60°, iron stained, micaceous
55		5C	95/60	7 diag jts, 3 60° jts, 4 45° jts iron stained, chlorite @ 56.1'-56.5', hi wthrd & frctd @ 55'-55.5'
60		6C	80/45	1 diag jt, 30°, 5 fol jts @ 60° w/talc & iron stained
65		7C	95/60	5 diag jts, 1 30° jt, 3 25° jts, 1 fol jt @ 45°, chlorite @ 64.5' & 66.6'-66.9'
		8C	75/25	4 diag jts, 30°-60°, 1 filled & iron stained, chlorite @ 67'-68', qtz dio contact @ 69.2'-69.5'
70		9C	98/95	Gry snd qtz-dio-gns, 3 diag jts, 1 45° jt w/calc, 1 30° jt, 1 60° jt iron stained
75		10C	98/95	1 diag jt @ 30°, 1 fol jt with iron stain
80		11C	98/95	2 diag jts @ 60°, little talc & chlorite on jts, core rusted @ 78.5'
85		12C	85/30	4 diag jts, 4 60° jts, iron stained, chlorite occurs @ 83.4', 84.2' & 84.8'
90		13C	90/60	4 diag jts, 2 80° jts, 2 40° jts, jts @ 80° w/little talc, frctd zone @ 87.8'-88.5', poss shear
95		14C	98/98	4 diag jts, 2 30° jts, 2 25° jts w/little calc & talc, hornblende inclusion @ 96'
100		15C	98/85	2 diag jts, 1 60° jt @ 97.7', 1 45° jt w/little calc @ 96.7'

BROWN MICACEOUS SILTY SAND, BECOMING MORE COMPACT, COARSER & ROCK-LIKE WITH DEPTH	36.0'	
GREEN QUARTZ-BIOTITE-SCHISTOSE GNEISS WEATHERED & JOINTED, MODERATELY FOLIATED 40°-60°, BIOTITE SCHIST INCLUSIONS	69.5'	
RELATIVELY SOUND TO SOUND GRAY-QUARTZ-DIORITE-GNEISS	83.0'	
MOD JTD-JTD DIO GNS	87.0'	
WTHRD & JTD DIO GNS	91.5'	
REL SND-SND GRY DIO GNS	95.0'	

(CONTINUED)

BORING NUMBER AM-5 (CONT'D)

105		16C	95/80	2 diag jts @ 60°, talc on 1 jt, pyrite vein @ 103.1'-103.4', chlorite @ 103.4'
110		17C	100/ 95	3 mech breaks, hornblende @ 104.5'-104.7', chlorite & pyrite vein @ 106.1'-106.4'
		18C	100/ 100	1 diag jt @ 40° @ 110.5', pyrite occurs @ 110.8'
115		19C	100/ 80	2 diag jts, 1 45° jt, 1 30° jt, calcite & pyrite on jts
		20C	98/95	2 diag jts, 1 45° jt, 1 60° jt, chlorite @ 116.6'-116.8'
120		21C	98/98	2 diag jts, 1 30° jt, 1 80° jt, calcite on 80° jt, pyrite @ 120', 121.5'
125		22C	98/98	3 diag jts, 1 45° jt, 1 50° jt, 1 30° jt, chlorite @ 124.8'-125.1'
		23C	90/55	3 diag jts, 2 30° jts, 1 45° jt, core jtd @ 127.9'-128.2', 129'-129.4', chlorite inclusions
130		24C	100/ 100	Hornblende & chlorite inclusions, 3 diag jts, 2 30° jts, 1 45° jt, calcite
135		25C	100/ 95	Hornblende & chlorite on jts, 3 diag jts, 1 40° jt, 1 10° jt, 1 30° jt

MODERATELY JTD TO RELATIVELY SOUND, MODERATE FOLIATION @ 40°, UNWEATHERED INCLUDING JOINTS, HORIZONTAL TO 30° DOMINANT JTS, DIORITE-GNEISS WITH HORNBLENDE & CHLORITE	123.5'	
REL SND DIO W/CHL	126.5'	
WTHRD & JTD DIORITE	130.5'	
RELATIVELY SOUND GRAY-GREEN DIORITE W/HORNBLENDE	139.5'	

Boring started 2-7-74 , completed 2-15-74
Final depths:
Boring = 139.5' Casing = 70'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 22.0' = El. +324.8

REMARKS:
5" of concrete at ground surface.
Drilled ahead of casing from 35' to 70' depth; casing blows not reported.
Caving in of borehole started at 135' depth. This caused drill rods to become stuck in the hole. After trying to recover rods over the period of a week the rods were detached at 80' depth, leaving remainder in the hole.

DESIGNED _____ DATE
DRAWN IHL & AR 12/74 DATE
CHECKED SLT & JPG 12/74 DATE
APPROVED _____ DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
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REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. MUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

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APPROVED _____

ROCKVILLE ROUTE (A011)
LOGS OF AM-SERIES BORINGS Nos. AM-3U to AM-5

SCALE VERT. 0 3' 6' 12'
DRAWING NO. F-A-106

BORING NUMBER AM-6U

Ground surface elevation + 344.2

DEPTH BELOW GROUND SURFACE, FEET					
0					
	1D	5,6	Medium stiff red-brn cl silt, (Fill) (ML)	CLAYEY SILT, FILL	5.0'
	2U	P	Red micaceous clay & silt, tr sand (Fill) (CL & ML)		
5	3U	P	Do 2U (CL & ML)		
	4U	P	Red-brn micaceous silty fine sand (SM)		
	5D	3,7,8	Do 4U (SM)		
10	6U	P	Brown micaceous silty fine sand (SM)	BROWN MICACEOUS CLAYEY & SILTY FINE SAND, RESIDUAL SOIL	
	7U	P	Do 6U (SM)		
	8D	5 8,9	Do 6U (SM)		
15	9U	P	Do 6U (SM)		
	10U	P	Do 6U (SM)		25.0'
	11D	7,11, 17	Stiff gray-brown micaceous silty fine sand (SM)		
20					
	12D	8,12, 19	Brown micaceous fine sandy silt (ML)	GRAY-BROWN MICACEOUS SILTY FINE SAND, QUARTZ & ROCK FRAGMENTS, DECOM-POSED ROCK	
	13D	100/4"	Quartz fragments (Prob wash from Rock Ledge) (GP)		
25					
	14D	17,25 25	Brown silty fine sand (SM)		45.0'
	15D	67, 100	Very compact light brown silty fine sand w/some rock fragments (SM)		
	1C	30/0	Hi jtd & wthrd friable brn schistose-gns, dk stains on jts, steep 80°-90° fol jt.	HIGHLY JOINTED & WEATHERED QUARTZ-BIOTITE-GNEISS (SCRIST-OSE), JOINT STAINED 80° FOL	
30	2C	30/0	Do 1C w/vert jts, caved at 51' w/borehole at 85'		
	3C	56/0	Do 1C w/horiz jts, 2 45° jts		62.7'
	4C	85/20	Jtd-wthrd brn-gry, 4 30° jts w/iron stains, 1 45° jt, 2 fol jts, gouge mtl @ 60.2'	MODERATE-LY JOINTED TO RELA-TIVELY SOUND GNS, SLI WTHRD ON JTS, IRON STAINS ON JOINTS 60° FOLIATION	
60	5C	70/0	Jtd-wthrd gry, 3 horiz jts, 1 30° jt, 3 fol jts @ 60°, slickensides @ 65.8'		
	6C	98/65	Mod jtd sli wthrd, 3 30° jts, 4 fol jts, iron stains		
70	7C	98/65	Rel snd, 1 horizontal jt, 1 15° jt @ 71.3' w/iron stains, 60° fol		
	8C	98/60	3 45° jts @ 76', iron stains on jts , 60° fol, 75.6'-77.3' altered schist		
80	9C	98/95	2 60° fol jts w/iron stains thin talc, poss gouge @ 79.2'		83.2'
	10C	98/45	Jtd 83.2'-85.5', 5 fol jts 70°-80°, iron stains		
85					
	11C	98/98	1 30° jt, 2 45° jts, thin lamination		
90					
	12C	100/ 100	Schist, thinly laminated w/thin qtz veins, 2 fol jts		
95					
	13C	98/95	1 45° fol joint		
100					

(CONTINUED)

BORING NUMBER AM-6U (CONTINUED)

100					
	14C	95/90	3 fol jts @ 35°, thin talc & calcite, 1 50° diagonal jt @ 106', possible gouge @ 105.5'	MODERATE-LY JOINTED-RELATIVE-LY SOUND LIGHT GRAY QUARTZ-BIOTITE-SCHIST, THINLY LAMINATED WITH CALCITE & THIN TALC DEPOSITS ON JOINTS, 45°-60° FOLIATION, JOINTING 40°-70° MOSTLY ON FOLIATION	
105	15C	95/65	Jointed, 8 30° jts w/talc deposits, 1 80° jt @ 106.3' to 107', 1 fol jt, 2 cross (diag) jts		
	16C	95/85	Rel sound, 1 30° jt @ 112', 3 30° jts @ 113.5'-113.7', 1 45° diag jt @ 115.4'		
110					
	17C	98/80	3 30° joints		
115					
	18C	95/95	2 30° joints @ 120.3' & 123', 1 70° jt @ 124.2'-124.6'		
120					
	19C	98/90	Mod jtd to rel sound, 6 fol jts.30° 2/thin talc deposits		
125					
	20C	98/45	1 80° diag jt @ 124.8'-125.5', 5 fol jts, 1 30° jt @ 132.6', gouge material		
130					
	21C	95/25	Hi jtd mixed schist & gns, contact @ 134.4', talc on jt @ 138'		
135					
	22C	98/90	Rel sound lt gray diorite, unfol, 2 10° jts, 1 30° jt, calcite on jt @ 140.3'		
140					
	23C	98/90	Do 22C, 1 45° joint with talc @ 145'		
145					
	24C	98/75	Mod jtd, 4 45°-50° diag jts, calc, pyrite crystals on joints, chlorite schist bands & inclusions		
150					
	25C	98/98	3 60° joints w/calcite & little talc on joints		
155					
	26C	90/90	Hornblende inclusion, 2 60° jts w/calcite on jts		160.0'
160					

Boring started 1-31-74 , completed 2-15-74
Final depths:
Boring = 160' Casing = 49'
Casing diameter = 4" & 3-1/2"
Average depth of ground water observed in the boring = 21.5' = El. +322.7

REMARKS:
Top 1 ft of boring composed of asphalt pavement, concrete and gravel.
Drilled ahead of casing from 40' to 49' depth; casing blows not reported.
Loss of drilling water at 67' depth.
Hole caved at 51' depth.
No permeability tests could be performed in this borehole because water level could not be raised above 21.5' depth.

BORING NUMBER AM-7

Ground surface elevation + 348.3

0					
	1D	3,4,6	Light brown silty clay, tr medium-fine sand (Fill) (CL)	CLAY, SAND AND GRAVEL, FILL	10.0'
5	2D	4,10, 39	5.0'-5.9': Gry & brn si clay w/m-f sa (CL) 5.9'-6.5': Gry & brn m-f sand & gvl, sm si (GM)		
	3D	4,4,6	Brn micaceous si f sand, tr gvl (Dec Rock) (SM)		
10					
	4D	10,11 15	Brn micaceous si f sand (Dec Rock) (SM)		
15					
	5D	6,12 17	Do 4D (SM)		
20					
	6D	17,20 21	Brn micaceous silt & f sand, trace gvl (Dec Rock) (SM)	DECOMPOSED ROCK, SILTY SAND WITH VARYING AMOUNTS OF ROCK FRAGMENTS	
25					
	7D	18,20 26	Brn micaceous silt & fine sand (Dec Rock w/sm Rock Fgmts) (SM)		
	8D	10,15 21	Do 7D (SM)		
30					
	9D	12,21 30	Do 7D (SM)		45.1'
35					
	NR	150/ 1	Weathered Rock		
	1C	35/10	Jtd & hi wthrd schistose-gneiss, badly jtd		
40					
	2C	65/35	Jtd & hi wthrd-mod wthrd, contorted fol, 10 jts per 3.0', 3 70° jts, 2 30° jts, 1 20° jt iron stained	WEATHERED & JOINTED SCHISTOSE GNEISS	
45					
	3C	45/15	Do 2C, fol 75°, jts are wthrd & iron stained		
50					
	4C	75/30	Jtd & hi wthrd schistose-gneiss to 61', sli wthrd chlorite-hornblende-bio to 63'		63.0'
55					
	5C	90/55	Jtd, unwthrd, cross jtd schistose-gneiss, 8 jts per 4', jts are rough, straight & iron stained	JOINTED, UNWEATH-ERED, CROSS JOINTED SCHISTOSE GNEISS	
60					
	6C	90/60	6 jts per 3.5', jts are straight, rough & iron stained, badly jtd from 68.2'-69'		
65					
	7C	90/40	13 jts per 4.4', jts are rough, irregular & iron stained		76.0'
70					
	8C	90/85	Rel sound, unwthrd, cross jtd schistose-gneiss, 7 jts per 4.2', jts are rough, irregular & iron stained	REL SND GNEISS	81.0'
75					
	9C	80/25	Jtd, unwthrd, cross jtd schistose-gneiss, 16 jts per 3.6', jts appear to be rough & irregular	JTD GNS	85.6'
80					
	10C	98/90	Relatively sound-sound, 6 jts per 5', jts are rough, irregular, secondary mineralization	RELATIVE-LY SOUND QUARTZ-HORN-BLENDE-SCHISTOSE GNEISS	
85					
	11C	90/85	5 jts per 4.5', jts are rough, irregular, iron stained, contorted fol, badly jtd 91.5'-92'		
90					
	12C	95/85	Rel sound schistose-gneiss, unwthrd, inclsion jts, 4 jts per 4.7'		100.6'
95					
100					

(CONTINUED)

BORING NUMBER AM-7 (CONT'D)

100					
	13C	90/40	6 jts per 5', jts are smooth, straight, coated with secondary minerals	JTD GNS	105.6'
105					
	14C	95/95	2 jts per 3.6', 1 jt @ 80° 1 jt @ 60°, jts are smooth, straight with secondary mineralization	RELATIVE-LY SOUND SCHISTOSE GNEISS	
110	15C	95/95	3 jts per 3.3', 1 jt @ 40°, 2 jts @ 60°, jts are straight, smooth		
115					
	16C	80/70	3 visible jts per 3', 2 jts @ 75°, 1 jt @ 30°, jts are straight, slick (talc)		
120					
	17C	98/90	6 jts per 4.4', 4 jts @ 70° 1 jt @ 50°, jts are tight & smooth, straight & filled		122.5'
125					
	18C	90/65	Mod jtd, 5 jts per 4' from 122.5'-126.5', badly jtd from 126.5'-127.5', poss shear zone, jts are slick, irregular w/talc, chlorite	JOINTED, SHEAR ZONE 126.5' TO 127.5'	127.5'
130	19C	98/70	5 jts per 5', 5 jts @ 70°, jts are irregular, slick		
135					
	20C	98/90	Rel sound, hornblende-bio-gneiss, 4 jts per 5.5', 1 jt @ 80°, 1 jt @ 45°, 1 jt @ 40°, 1 jt @ 30°, jts are smooth	RELATIVE-LY SOUND TO SOUND LIGHT TO DARK GRAY QUARTZ-HORN-BLENDE-DIORITE-GNEISS, IRREGULAR ORIENTATION OF DARK MINERALS, 45° FOLIATION	
140	21C	95/90	Rel sound to sound light gry qtz-dio-gneiss, 2 fol jts, 3 irreg 10° jts 1/4", 1 45° jt @ 138.7', 1 30° jt @ 141.5'		
145					
	22C	98/95	2 fol jts @ 45°, thin chlorite bands @ 146' to 147.2'		
150	23C	98/95	2 fol jts @ 45° in 0.2' spacing, 2 cross fol jts, irreg to curved, hornblende biotite bands		
155					
	24C	98/95	Lt gry to 54.2', 2 fol jts @ 45°-60°, 1 perp fol jt @ 154.5', rough, irregular, 1/16"-1/4", feldspar bands @ 154.2'		157.0'

Boring started 4-2-74 , completed 4-22-74
Final depths:
Boring = 157.0' Casing = 45'
Casing diameter = 6"
Average depth of ground water observed in the boring = 22.5' = El. +325.8

REMARKS:
10" of asphalt at surface.
Drilled ahead of casing from 20' to 45' depth; blows not indicative of soil consistency.
Hard drilling and "chattering" of the drill rods at 44' depth.
Rock core drilled with 4" x 5-1/2" diamond bit yielding core approximately 4" diameter.

BORING NUMBER AM-8

Ground surface elevation + 348.3

0			20° concrete pavement		
	1D	3,3,4	Medium stiff red-brown silty clay, trace fine sand, trace mica (Probable Fill) (CL)	RED-BROWN SILTY CLAY, FILL	6.0'
5	2D	8,15, 16	Do 1D (Probable Fill) (CL) with brown silty & clayey fine sand @ 6.0' (SM)	BROWN SILTY CLAYEY FINE SAND	
	3D	47,54 61	Very hard red-brown fine sandy silt, trace gravel & vegetation material (ML)		15.0'
10					
	4D	11,12 18	Hard red-brown micaceous silty fine sand (SM)		
15					
	5D	11,17 28	Do 4D (SM)	BROWN-RED-GREEN MICACEOUS SILTY FINE SAND, ROCK FRAG-MENTS AT BASE	
20					
	6D	8,12, 22	Hard brown-red micaceous silty fine sand (SM)		
25					
	7D	8,12, 27	Compact brown-red & green micaceous silty fine sand, trace rock fragments (SM)		37.0'
30					
	8D	150, 165	Very hard green micaceous silty fine sand, numerous rock fragments (SM)	JOINTED WTHRD DARK GREEN HORN-BLENDE SCHISTOSE GNEISS AND CHLORITE SCHIST	
35	1C	75/0	Jtd & wthrd soft dk green hornblende schistose gneiss & chlorite schist		
	2C	95/0	Do 1C, highly weathered		50.9'
40					
	3C	98/0	Do 1C, jointed, highly to moderately weathered		
45					
	4C	70/60	Jtd in top, mod to sli wthrd gry-grn hornblende gneiss, 4 fol jts		
50					
	5C	98/75	4 fol jts, 3 30° jts, 2 diag cross jts w/iron stains, gouge material at 57.2', 1 60° jt @ 59'	JOINTED, SLIGHTLY WTHRD GRAY-GREEN HORN-BLENDE GNEISS AND CHLORITE SCHIST, FOLIA-TION 40° TO IRREGULAR	
55					
	6C	98/25	Jtd, 5 fol jts, 7 10°jts, jtd in bot, iron stains		72.9'
60	7C	98/20	Hi jtd, 6 45° jts, 4 60° jts, iron stains on jts, irregular fol		
65					
	8C	98/45	Mod jtd, 5 50° diag jts, 4 30° jts, wthrd at 69.5', looks like gouge		
70					
	9C	98/55	Jtd, 1 70° jt iron stain, 5 20°-45° jts, 1 50° jt 76.3', horiz jt, iron staining	JOINTED GREEN CHLORITE SCHIST WITH HORN-BLENDE INCLU-SIONS, POSSIBLE SHEAR ZONES	
75					
	10C	98/50	4 horiz to 10° jts, 1 fol jt 45°, 2 45°-60° diag jts at 81.5', irregular fol		
80					
	11C	98/95	2 fol jts at 82.5', 1/4" feldspar, 50° contact, 3 45° jts, gouge material at 85", possible shear		
85					
	12C	98/50	Jtd, soft, hi wthrd, contact at 87.8', gouge material 89.5', possible shear 89.5' to 91'		
90					90.6'
	13C	98/90	Jtd, wthrd 90.6' to 91', rel snd, 3 fol jts, gouge possible shear 2" @ 93.3', 1 10° jt @ 94.8'		
95					
	14C	98/90	Rel snd, 3 fol jts 80°to 45°, 1 60° jt, contact with diorite at 99.5'		
100					

(CONTINUED)

BORING NUMBER AM-8 (CONT'D)

100					
	15C	98/65	Jtd grn chlorite schist, quartz diorite gneiss 100.3'-101', 2 45° jts, 2 15° jts, 3 horiz jts		
105					
	16C	98/95	3 30° jts, 1 50° jt 106', dk grn hornblende schist thinly laminated		
110					
	17C	98/80	Rel snd grn hornblende schist, 3 60° jts, 4 45° jts, iron stains on jts		
115					
	18C	98/50	Calcite & feldspar bands, 4 45°fol jts, 3 diag jts 40°-50° w/iron stain		
120					
	19C	98/60	Mod jtd, lt gry quartz diorite gneiss, 6 fol jts, 1 70° diag jt at 121.8', 2 horiz jts		118.3'
125	20C	95/75	3 diag jts, 3 fol jts contact at 126', thin quartz veins, folded	MODERA-TELY JOINTED TO SOUND LIGHT GRAY QUARTZ DIORITE GNEISS, 45° FOL	
	21C	98/95	Snd quartz diorite gneiss, 1 20° jt iron stains at 127.4'		132.5'
130					
	22C	98/95	2 30° jts, 1 45° jt, 1 60° jt, chlorite schist with thin quartz at 132.5' to 137'	SOUND CHLORITE SCHIST	137.0'
135					
	23C	98/90	Chlorite schist to 137', 3 30° fol jts, quartz diorite gneiss	SOUND QUARTZ DIORITE GNEISS	142.2'
140					
	24C	98/95	3 30° jts, 1 80° diag jt with talc, chlorite schst 142.2'-143.5'		143.5'
145					
	25C	85/80	3 40°-50° fol jts, chlorite schist band 146.4' to 147'	RELA-TIVELY SOUND UNWEATH-ERED QUARTZ DIORITE GNEISS WITH BANDS OF CHLORITE SCHIST	
150					
	26C	98/95	3 10° jts, quartz vein 150.6'-151.2' irregular fol		
155					
	27C	90/90	1 70° diag jt at 157', talc deposit on jt		
	28C	98/95	1 30° jt, 2 diag jts at 159.8', iron stains on joints		160.0'
160					

Boring started 2-12-74 , completed 2-22-74
Final depths:
Boring = 160.0' Casing = 90'
Casing diameter = 4" & 3-1/2"
Average depth of ground water observed in the boring = 28.0' = El. +320.3

REMARKS:
1.8' of concrete at surface.
Drilled ahead of casing to 90' depth; no casing blows reported.
Hole caved in at 50' depth.
Observation well consisting of 1-1/2" steel pipe installed with tip at 150' depth.
Four water pressure tests with packers run in this borehole.

DESIGNED		DATE
DRAWN	IHL & AR	DATE 12/74
CHECKED	SLT & JPG	DATE 12/74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to F-A-104	Plans & Geological Sections

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐
APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-6U to AM-8

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-107

BORING NUMBER AM-9U
Ground surface elevation + 350.6

1U	P		Loose brown fine to coarse sand (SM)	BROWN FINE TO COARSE SAND
2U	P		Compact silty fine to coarse sand (SM)	
3D	21,30	36	Compact brown clayey fine to coarse sand (SC)	5.0'
4D	21,27	34	Brown micaceous silty fine to medium sand (SM)	BROWN-GRAY MICACEOUS SILTY FINE SAND
5D	24,31	39	Compact brown-gray micaceous silty fine sand, thin streaks of red-brown fine sand (SM)	
6D	50,81	198	Very compact brown micaceous silty fine to medium sand (SM)	20.0'
7D	16,39	67	Do 6D (SM)	BROWN MICACEOUS SILTY FINE SAND AND ROCK FRAGMENTS
8D	28,45	71	Very compact gray-red-brown silty fine sand, some rock fragments (SM)	31.5'
9D	53,80	150	Do 8D, numerous rock fragments (SM)	
1C	10/0		Hd, mod wthrd brn foliated hornblende gneiss, 45°fol	MODERATELY JOINTED TO JOINTED SOFT WEATHERED BROWN HORNBLENDE GNEISS
2C	50/0		Do 1C, 10 fol jts, staining on jts, 60° fol	
3C	90/10		Mod jtd, soft wthrd, 2 60° diag jts @ 40'& 43', 2 45° jts, 3 horiz jts to 15° jts, staining on jts, calcite inclusions	
4C	80/0		Mod jtd,wthrd, 6 30° to 45° jts, 1 diag jt at 44', stains on jts	
5C	85/0		3 fol jts, 1 45° diag jt at 51.5', 2 horiz jts, 2 20°-30° jts	53.0'
6C	98/25		Jtd, mod wthrd,~45°-50° fol, 4 60° jts, 3 fol jts, stain on jts	JOINTED, MODERATELY WEATHERED SCHISTOSE GNEISS
7C	98/10		7 45° jts, 4 45°-60° diag jts, iron stained, thin feldspar bands 60'-60.8'	
8C	98/20		1 90° diag jt 61.6'- 62.5', wthrd clayey gouge 62.6' to 63.3', possible shear	63.0'
9C	98/15		Jtd, mod wthrd gry-brn schistose gneiss, iron stains, 2 60° diag jts, 6 fol jts, 2 10° jts	JOINTED MOD WTHRD HORNBLENDE GNEISS W/ GRY-GRN DIORITE
10C	95/0		Hi jtd, wthrd brn, 12 fol jts, 45° fol, iron stains on jts	78.4'
11C	98/45		Jtd, mod wthrd on jts, 1 70° jt @ 73.8', talc stains, gouge material, 1 horiz jt, 5 15°-30°jts, 1 70° diag jt at 78.0'	QUARTZ 79.5'
12C	98/20		Hi jtd w/quartz veins to 79.5', 60° contact, 3 60° jts, 4 15°-30° jts	MODERATELY JOINTED WEATHERED ON JOINTS BROWN-GRAY SCHISTOSE GNEISS
13C	98/75		Mod jtd to rel snd, 1 60° jt, 1 15° jt, 1 horiz jt, gouge material at 85.5', stained & wthrd 87'-87.6'	
14C	98/55		4 fol jts, 60° fol, gouge material at 89.0'	92.0'
15C	98/85		Rel snd lt gry quartz diorite gneiss	REL SND LT GRY QUARTZ DIO GNS
16C	95/55		3 45° jts, 2 30° jts, jtd & wthrd 98'-99', 2"quartz vein @ 99.5'	96.6'

(CONTINUED)

BORING NUMBER AM-9U (CONT'D)

17C	98/45		Jtd, mod wthrd on jts, 1 70° diag jt @ 101.4', 4 fol jts, 45° fol to 104.5'	HIGHLY JOINTED TO JOINTED LIGHT GRAY QUARTZ DIORITE GNEISS, 45° FOL, IRON STAINS ON JOINTS SHEAR ZONES 114' to 117' & 123'
18C	98/45		2 60° -70° diag jts 105.7' to 106.1' w/iron stains, 2 45° jts, 2 15° jts	
19C	85/0		Hi jtd, iron stains on vert jts & fol jts, talc w/gouge material in bottom vert jts through core	
20C	95/0		Vert jtg 114.9'-117', gouge material on jt, fol 70°, 5 jts stained	
21C	98/45		Jtd, sli wthrd on jts, 2 45° jts, 2 horiz jts, 2 70° jts w/stains gouge material at 123'	123.3'
22C	98/90		Rel snd, 2 diag jts 60°-to 80° w/thin talc, 1 fol jt @ 123.5'	
23C	85/85		Sound, 1 fol jt, 2 pcs, 1/2" quartz chlorite bands at 128.6'-129.8'	RELATIVELY SOUND LIGHT GRAY QUARTZ DIORITE GNEISS, GRADING TO META-DIORITE WITH DEPTH, FOL 30° TO 45° OR INDISTINCT
24C	98/90		Rel snd, 2 diag jts 60°, 134'-134.5', 1 45° fol jt at 135.8', thin talc deposit	
25C	98/90		Rel snd, lt gray, 4 fol jts 30°, thin talc, 2 diag jts w/iron stain	
26C	98/90		Rel snd, 4 fol jts 30°, thin talc deposits on jts, 2 diag jts w/iron stains	
27C	98/95		3 fol jts, 1 60° jt, 1 80° jt, thin talc deposit on jt	
28C	98/95		Snd, 1 45° jt, 2 30° jts	
29C	98/95		3 horiz jts to 10° jts, 1 30° jt at 157.3' with thin talc deposit	
30C	98/30		Jtd, 2 10° jts, 3 60° jts with thin talc deposit	160.0'

Boring started 1-28-74 , completed 2-6-74
Final depths:
Boring = 160.0' Casing = 61'
Casing diameter = 4" & 3-1/2"
Average depth of ground water observed in the boring = 27.3' = El. +323.3

REMARKS:
6" of concrete at surface.
Drilled ahead of casing to 61' depth; no casing blows reported.

BORING NUMBER AM-10
Ground surface elevation + 355.5

1D	1,2,5		Medium stiff brown fine sandy silt with clay seams (Fill) (ML)	FILL 7.0'
2D	6,8,7		Do 1D, (Possible Fill) (ML)	
3D	34,33	46	Very compact brown silty fine sand, trace green silt, trace clay (SM)	VERY COMPACT BROWN-GRAY SILTY FINE SAND, TRACE CLAY WITH DECOMPOSED ROCK FRAGMENTS, AMOUNT INCREASING WITH DEPTH
4D	30,60	71	Very compact brown-green silty fine sand, trace clay (SM)	
5D	60, 142,	180	Do 4D (SM)	
6D	30,	162	Very compact brown-green silty fine sand, trace clay, trace decomposed rock fragments (SM)	
7D	191,	248	Do 6D, numerous rock fragments (SM)	35.0'
8D	200/2"		Do 7D (SM)	
1C	95/25		Hi wthrd & jtd chlorite hornblende gneiss w/iron stains on jts, 3 horiz jts, 3 75° jts	HIGHLY WEATHERED AND JOINTED HORNBLENDE BIOTITE DIORITE AND DIORITE GNEISS
2C	95/40		3 horiz jts, 3 75° jts, 1 85° jt	
3C	80/35		2 horiz jts, 3 45° jts, 1 75° jt	
4C	65/10		2 horiz jts, 1 10° jt, 1 80° jt, broken zone 49.8' to 51'	
5C	5/0		Do 1C, fragments	
6C	85/25		Jtd & broken up to 60', 4 horiz jts, 1 45° jt, 2 75° jts, 2 85° jts	
7C	85/30		1 horiz jt, 3 45° jts, 2 75° jts	
8C	90/30		5 45° jts, 3 75° jts	
9C	85/35		4 10° jts, 3 75° jts	75.0'
10C	90/50		Mod wthrd to 76.4', sli wthrd to 80.2' hornblende schistose gneiss, 2 45° jts, 3 85° jts	UNWEATHERED AND JOINTED HORNBLENDE SCHISTOSE GNEISS
11C	90/50		Do 10C, 80.2'-81.2' hi wthrd & broken zone from 81.1', unwthrd except at joints	
12C	95/50		Unwthrd & jtd hornblende schistose gneiss, 1 horiz jt, 6 45° jts	
13C	95/35		Do 12C, 1 horiz jt, 2 45° jts, 4 75° jts	
14C	95/50		Do 12C, 4 horiz jts, 3 45° jts, 3 75° jts	
15C	90/65		Slightly wthrd, hi wthrd jts, 2 horiz jts, 3 45° jts, 3 80° jts	

(CONTINUED)

BORING NUMBER AM-10 (CONT'D)

16C	95/60		Do 12C, sli wthrd between 103' & 105.2', 2 45° jts, 6 70°-80° jts	110.5'
17C	95/75		Do 12C, 3 45° jts	UN WTHRD, EX JT HORNBLENDE SCHISTOSE GNEISS
18C	100/	100	Gray unwthrd, except at jts, hornblende schistose gneiss, 1 horiz jt	117.0'
19C	100/	90	Do 18C, 2 45° jts, 2 85° jts	UNWEATHERED AND JOINTED HORNBLENDE SCHISTOSE GNEISS
20C	98/80		Do 18C, 4 45° jts, wthrd jts w/possible gouge mtl	
21C	90/65		Do 18C, 1 cross jt, 3 10° jts, 3 75° jts	127.0'
22C	90/25		Hi broken & jtd gray hornblende schistose gneiss, 127'-129'	129.0'
23C	90/50		2 45° jts, 1 60° jt, iron stains & talc on jts between 130.9'-132.4', probable shear zone 131.9' to 132.4'	UNWEATHERED AND JOINTED DIORITE GNEISS
24C	85/65		Diorite w/chlorite inclusions, 2 40° jts, 1 30° jt, fol 4 50°, 1 70° quartz bands, jts w/calcite & little talc pyrite	
25C	100/	85	Layers of diorite & chlorite schist, 6 fol jts, 2 50°, 4 45° jts, sheared zone @ 143.8', jt @ 143.8' w/talc	
26C	95/50		Quartz diorite gneiss & chlorite schist, 2 40° jts, 1 70° jt, fol 1 60°, 9 50° sheared zones 145.8'-146.5' & 147.7'-148.1'	149.0'
27C	100/	100	Diorite gneiss w/chlorite schist, 1 30° jt, 1 45°jt	UNWEATHERED AND JOINTED TO RELATIVELY SOUND DIORITE GNEISS WITH CHLORITE INCLUSIONS, POSSIBLE SHEAR AT 146' AND 148'
28C	98/98		Dark gry diorite gneiss, 1 30° jt, 2 45° jts, jts w/calcite, 1 jt micaceous	
29C	98/98		Diorite gneiss w/chlorite layers, 1 25° jt	
30C	98/90		Quartz diorite gneiss, 2 45° jts, 2 60° jts, jts w/calcite, chlorite inclusions	
31C	50/50		Do 30C, 2 45° jts, 2 60° jts, jts with talc, little calcite	170.0'

Boring started 2-25-74 , completed 3-5-74
Final depths:
Boring = 170' Casing = 35'
Casing diameter = 4"
Average depth of ground water observed in the boring = 30.3' = El. +325.2

REMARKS:
Drilled ahead of casing from 10' to 35' depth; no casing blows reported.

BORING NUMBER AM-11
Ground surface elevation +352.7

1D	8,7,8		Tan fine to medium sand & gravel, trace silt (Fill) (GP)	SAND AND GRAVEL, FILL 5.0'
2D	5,6,9		Light brown micaceous silty fine sand, residual soil (SM)	LT BRN MICACEOUS SILTY FINE SAND 10.0'
3D	9,11,	26	Yellow-brown fine sandy silt (ML)	YELLOW-BROWN SANDY SILT 16.0'
4D	20,19	27	Top: Do 3D to 16' (ML) Bot: Gray-brown micaceous silty fine sand (SM)	GRAY-BROWN MICACEOUS SILTY FINE SAND, RESIDUAL SOIL
5D	12,12	15	Gray-brown micaceous silty fine sand (SM)	30.0'
6D	7,11,	12	Do 5D (SM)	
7D	31,49	132	Tan silty fine sand,trace mica, some rock fragments (SM)	RED-BRN SILTY FINE SAND, TRACE MEDIUM SAND, MANY ROCK FRAGMENTS
8D	31,62,	85	Red-brown silty fine sand, trace medium sand, numerous rock fragments (SM)	42.5'
9D	92,	160/5"	Do 8D (SM)	
1C	70/0		Jtd & wthrd red-brown schistose gneiss, f-m laminations, soft, 7 30° jts, 1 50° jt in 4', 1/8" calcite vein at 45.5'	HIGHLY JOINTED AND WEATHERED RED-BROWN SCHISTOSE GNEISS, PROBABLE GOUGE MATERIAL @ 55.5' TO 55.5'
2C	98/0		Do 1C	61.7'
3C	90/10		Do 1C	UNWTHRD HIGHLY JOINTED QUARTZ DIORITE GNEISS, STAINED ON JTS, CHLORITE BAND,QTZ AUGENS
4C	98/10		Do 1C, gouge mtl at 55'-55.5' indicates possible shear	75.5'
5C	95/30		Jtd quartz diorite gneiss wthrd on jts, chlorite bands & inclusions,quartz augens	UNWTHRD JOINTED CHLORITE SCHIST, BROKEN ZONE 76' TO 78.4'
6C	90/15		Do 1C, 12 jts, 1 close jt, fol 45°, 9 horiz jts, 3 >80° jts. hi stained & rusted	84.7'
7C	90/55		Do 5C, 8 jts, fol 40°, 5 JF, 2 horiz jts, 1 x F	INT-LYRD GNS,QTZ& SCHIST 87.8'
8C	90/20		Unwthrd jtd chlorite schist, foliated 60°, 5 JF, hi jtd & broken zone @ 76'-78.4'	GRAY UNWTHRD, UNSTAINED JOINTED QUARTZ DIORITE GNEISS, VEINS OF CHLORITE SCHIST & QUARTZ AUGENS, ROCK MASS UNFOLIATED AT 99' TO 115.3'
9C	95/50		Fol 45°, 7 JF, quartz diorite gneiss 84.3'-85.2'	
10C	90/30		Jtdquartz diorite gneiss, layer chlorite schist,from 87.6'-88.3', quartz at 85.8'-87.6', 6 jts	
11C	95/55		Quartz diorite gneiss, occ thin band chlorite schist, sli talc on some jts, 60° fol, 1 JF, 2 vert jts @ 93.6'-94.6'	
12C	95/65		Do 11C, 7 jts	
13C	95/60		Do 12C, fine grained rock, jts unstained & unwthrd, non-foliated, 7 jts 30°to 45°	
14C	95/85		Fine grained non-foliated quartz diorite gneiss, 2 jts 45°, 1 jt 10°, 2 jts per 2', thin calcite & talc deposit, 2 jts 50° & 80°	

BORING NUMBER AM-11 (CONTINUED)

15C	95/60		Do 14C, vert jt @ 110'-111' 2 jts 60°,80°, 3 jts in 2.5'	115.3'
16C	95/60		Do 14C, jts unstained, chlorite schist veins, vert jt @ 113'-114', 2 horiz jts, close vert frac @ 112', open jt 114.8' possible gouge @ 114.9'	REL SOUND GNEISS
17C	95/85		Gry quartz diorite gneiss, 4 jts 10°-40°, 4 jts per 5', inclusion of chlorite schist veins & quartz augens	119.7'
18C	95/60		Gry-grn mod fol chlorite schist, intrusion of quartz, 11 fol jts,fol 45° 1 open jt @ 121' 1" wide	GRAY, SLIGHTLY GREEN CHLORITE SCHIST, MODERATELY JOINTED, SLIGHT STAINING ALONG JOINTS, IRREGULAR FOLIATED, FELDSPAR VEIN AND TALC ON JOINTS AT 155' TO 170', GOUGE WITH POSSIBLE SHEAR 139' AND 142'
19C	90/55		Do 18C, 6 jts @ 30°-45° vert fracture 128.3'-129.6' 6 jts per 4'	
20C	90/55		Do 18C, 6 jts @ 45°, vert fracture 129.6'-130.4', 6 jts per 4', sli staining along jts	
21C	90/55		Do 18C. F30° 5 fol jts, 1 vert jt 80°, 2 xF 60°. thin talc & clay deposit on jts	
22C	95/50		Gry chlorite schist @ top 139.1'. gouge w/30° jt, at 142' to 142.3' gouge w/30° jts, 5 30° jts, 2 60° jts	
23C	95/65		4 45° jts, 3 30° jts, sli staining on jts, mod fol, 40° fol	
24C	95/60		3 jts 45°, 2 jts 20°, 1 jt 70°, 8 jts per 4',sli fol, 40° fol	
25C	90/75		3 jts 15°, 4 jts 30°, 1 jt 45°, 8 jts per 4.5', sli staining on jts, unfoliated, occ quart augens	
26C	95/30		Irregular fol 30°, 2 jts 70°, 1 jt 45°, 5 fol jts, 9 jts per 4.5', feldspar jt planes at 70°	
27C	95/80		Feldspar veins & feldspar on jt planes, healed jt 164'-165', 6 fol jts, fol 30°, 6 jts per 4.8', sli staining on jts	
28C			40°fol, irregular, 9 fol jts, 1 jt 60°, slight staining on jts, occ augen or veins of feldspar	171.1'

Boring started 5-7-74 , completed 5-13-74
Final depths:
Boring = 171.1' Casing = 40'
Casing diameter = 3" & 4"
Average depth of ground water observed in the boring = 28.7' = El. +324.0

REMARKS:
5" of asphaltic concrete at surface.
Drilled ahead of casing from 15' to 40' depth; no casing blows reported.

DESIGNED _____ DATE _____
DRAWN I.H.L & A.G. DATE 12/74
CHECKED S.L.T & J.P.G. DATE 12/74
APPROVED _____ DATE _____

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to F-A-104	Plans & Geological Sections

REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. NUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

NUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N.Y.
SUBMITTED William H. Nueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐
APPROVED _____

ROCKVILLE ROUTE (A011)
LOGS OF AM-SERIES BORINGS Nos. AM-9U to AM-11

SCALE VERT. 0 3' 6' 12'
DRAWING NO. F-A-108

BORING NUMBER AM-12
Ground surface elevation + 351.1

DEPTH BELOW GROUND SURFACE, FEET						
0	16	1D	5,8, 11	Red-brown micaceous silty fine sand, trace clay, trace asphalt (Possible Fill) (SM)	YELLOW-RED-BROWN MICACEOUS SAND, TR ASPHALT & ROCK FRAG-MENTS FILL 10.0'	
	18					
	24					
	40					
5	46					
	60	2D	4,6,8	Medium stiff yellow-brown micaceous silty fine sand, trace rock fragment (Possible Fill) (SM)		
	66					
	70					
	75					
10	24	3D	10,12 24	Very stiff green-gray fine sand, some micaceous silt, residual soil (SM)		
	20					
	18					
	26					
15	28	4D	8,14 19	Hard brown-gray fine sand, some micaceous silt, trace gravel (SM)	COMPACT GREEN-BROWN AND GRAY MICACEOUS SILTY FINE SAND 30.0'	
	40					
	48					
	53					
	70					
20	36	5D	6,13, 24	Compact green-brown micaceous silty fine sand (SM)		
	38					
	40					
	34					
25	37	6D	9,16 30	Do 5D (SM		
	31					
	35					
	35					
30	57					
		7D	18,33 43	Very compact green-gray micaceous silty fine sand (SM)		
35						
		8D	35,41 48	Very compact green-gray micaceous silty fine sand, numerous rock fragments (SM)	VERY COMPACT GREENISH GRAY MICA-CEOUS SILTY FINE SAND WITH NUMEROUS ROCK FRAG-MENTS 55.0'	
40		9D	150/6"			
		10D	150/6"	Hard dark gray micaceous silty fine sand & rock fragments (SM)		
45						
		11D	150/2"	Very compact dark gray micaceous silty fine sand, trace gravel and rock fragments (SM)		
50						
		1C	60/0	Gry-grn biotite gneiss, hi wthrd, frag, iron stained, 2 diag jts,gouge mtl 56'-57.2'	GREEN-GRAY BIOTITE GNEISS, WEATH-ERED AND JOINTED 65.0'	
55						
		2C	95/30	Do 1C, 2 diag jts,chlorite inclusion, rock fragmented at 59.5'-60', highly weathered		
60						
		3C	90/70	Do 1C w/chlorite inclusions, 5 diag jts, iron stained	MODERA-TELY JOINTED TO JOINTED DIORITE GNEISS, CONTAIN-ING BIOTITE & QUARTZ 80.0'	
65						
		4C	90/70	Gry-grn diorite gneiss w/chlorite, 2 diag jts		
70						
		5C	90/70	Do 4C, w/chlorite inclusion, 1 diag jt 70°, calcite on joint		
75		6C	90/70	3 diag jts, jts iron stained, calcite on 1 jt, little talc, micaceous face @ 76.3'		
		7C	100/ 100	1 jt filled @ 81.8', pyrite & garnet apparent	GRAY DIORITE GNEISS, RELA-TIVELY SOUND TO SOUND, WITH CHLORITE INCLU-SION 100.0'	
80						
		8C	95/90	2 diag jts, 1 45° jt, sli micaceous & iron stained, 1 30° jt at bot, chlorite prominant		
85						
		9C	98/90	2 diag jts, 1 50°, 1 25°, jts sli micaceous & talcy, pyrite & garnet occurance, chlorite @ 90.5'-91.2'		
90						
		10C	98/95	2 diag jts, 1 40°, 1 30°, calcite on jts of 40°, chlorite inclusions		
95						
		11C	96/80	Chlorite inclusions prominant, 3 diag jts with secondary mineral		
100		12C	98/55	2 diag jts at bot, 1 40°, 1 30°, chlorite inclusion		

(CONTINUED)

BORING NUMBER AM-12 (CONT'D)

105	13C	75/70	1 diag jt 40° slickensided, clacite on joint, chlorite prominent	MOD JTD TO JTD DIORITE GNEISS 107.0'	
	14C	98/85	1 diag jt 48° w/slight calcite, chlorite inclusions occur		
110	15C	100/ 100	1 pc w/ occasional chlorite patches, garnets occur	RELA-TIVELY SOUND GRAY QUARTZ DIORITE GNEISS WITH CHLORITE INCLU-SIONS 121.4'	
115	16C	95/85	2 diag jts, 2 30° jts, sli micaceous, chlorite inclusion		
	17C	98/80	5 diag jts, 2 40°, 2 20°, 1 10°, jts w/ chlorite, calcite & pyrite, chlorite inclusions prominant		
120	18C	95/70	Chlorite inclusions, 4 diag jts, 1 cross jt, clacite, chlorite & pyrite on joints	MODERA-TELY JOINTED TO JOINTED DIORITE GNEISS WITH CHLORITE, FELDSPAR, HORN-BLENDE AND QUARTZ 139.4'	
125	19C	98/70	7 diag jts, jts w/calcite & chlorite, pyrite also occurs, possible shear at 130'		
	20C	90/65	5 diag jts, calcite, mica & little talc on jts, 2 jts filled between 131.3' to 132.3'		
130	21C	96/60	Gry-grn, 3 diag jts, 3 parallel jts, calcite on jts, little talc,pyrite occurance		
135	22C	98/95	Gray-grn quartz hornblende gneiss, 1 diag jt, 1 filled jt starting @ 140.6', calcite & pyrite on jts	RELA-TIVELY SOUND TO SOUND GRAY DIORITE GNEISS WITH QUARTZ AND PINK FELDSPAR 158.5'	
	23C	98/98	Gray diorite gneiss, 1 diag jt, 1 parallel jt, calcite on jt, chlorite also occurs		
140	24C	98/98	2 diag jts, jts w/calcite & pyrite, chlorite occurs		
145	25C	98/90	5 diag jts, 1 filled jt at top, calcite & pyrite on jts		
	26C	95/80	4 diag jts, calcite on jts, rock jtd at top, possible slickenside at 150.4', quartz occurs		
150	27C	98/60	1 diag jt w/little calcite pyrite on broken faces	JOINTED 160.0'	
155					
160					

Boring started 3-5-74 , completed 3-22-74
Final depths:
Boring = 160' Casing = 61'
Casing diameter = 3" & 4"
Average depth of ground water observed in the boring = 26.5' = El. +324.6

REMARKS:
6" of asphalt at surface.
Drilled ahead of casing from 30' to 61' depth; no casing blows reported.
Loss of drilling water at 99' depth. Drilling water returned at 112' depth.

BORING NUMBER AM-13
Ground surface elevation + 266.1'

DEPTH BELOW GROUND SURFACE, FEET						
0	23	1D	9,13, 16	Brown silty fine sand (Fill) (SM)	BROWN-TAN SILTY FINE SAND, TRACE MEDIUM SAND 10.0'	
	36					
	53					
	39					
5	41					
	41	2D	7,7, 11	Tan silty fine sand, trace medium sand (Prob Residual Soil) (SM)		
	55					
	59					
10	84					
	173					
	81	3D	32,48 47	Brown silty fine sand, some rock fragments (SM)	BROWN SILTY FINE SAND, TRACE FINE GRAVEL, TRACE MEDIUM SAND 24.0'	
	44					
	63					
	89					
15	127					
	47	4D	15,34 37	Brown, trace white silty fine-medium sand, few rock fragments (SM)		
	57					
	55					
	73					
20	197					
	56	5D	22,23 57	Do 4D (SM)		
	51					
	64					
	69					
25	179					
		1C	10/0	Highly jointed & weathered brown quartz-diorite-gneiss	HIGHLY JOINTED & WEATHERED QUARTZ-DIORITE-GNEISS WITH IRON STAINS ON JOINTS, 65° FOLIATION 45.0'	
30						
		2C	10/0	Do 1C		
35		3C	45/0	Highly jointed & weathered gray-brown quartz-diorite-gneiss, 45° foliation & jointing, vertical joints		
40		4C	65/0	Do 3C, highly jointed & weathered		
		5C	65/0	Highly jointed & weathered gray-brown quartz-diorite-gneiss		
45						
		6C	90/0	Highly jointed to moderately weathered gray quartz diorite-gneiss, vertical & horizontal joints	HIGHLY JOINTED, MODERATE-LY TO SLIGHTLY WEATHERED GRAY QUARTZ-DIORITE-GNEISS 60.0'	
50						
		7C	55/20	Highly jointed & slightly weathered, 1" feldspar bands 52.3' & 53'		
55						
		8C	70/0	Highly jointed & slightly weathered, chlorite & feldspar inclusions, 5 60° diagonal joints w/iron stains, vert jt 58'-58.8'	JTD TO MODERATE-LY JOINTED GREEN-GRAY QUARTZ-DIORITE-GNEISS WITH CHLORITE INCLUSIONS UNWTHRD EXCEPT JOINTS 75.0'	
60						
		9C	98/55	Jointed with chlorite inclusions, 4 45° jts, 4 20°-30° jts, 1 60° jt @ 65' with calcite/talc on joint, wthrd along joints		
65						
		10C	95/65	Moderately jointed, chlorite 66'-67.8'; 2 45° joints, 5 15°-30° jts, little talc on jts		
70						
		11C	98/30	Jointed, 4 45° joints, 1/4" calcite vein along joint @ 70.5', 2 60° joints @ 73' & 74', thin talc deposits on joints		
75						
		12C	98/45	1 80° jt 75.3'-76'; 2 30° joints; 2 15° joints, 3 45° joints, calcite filled 78'-78.5'	HI JTD UNWTHRD LT GRAY QUARTZ DIORITE GNEISS W/THIN CALCITE-FILLED JOINTS 86.9'	
80		13C	98/50	5 10°-15° joints, 1 30° joint, 2 60° joints, 1 80° joint 81.2'-82'		
		14C	98/50	Highly jointed in top, 2 irregular 70° joints with calcite veins 83.3'-84.8'; 3 45° joints		
85						
		15C	98/80	Rel snd, 1 20° jt, 1 30° jt @ 88.3', 2 45° jts; 1 70° jt @ 89.3'-89.5'		
90						
		16C	90/40	Highly jointed with chlorite inclusions, 6 20° to 30° joints, 2 45° joints	JOINTED TO HIGHLY JOINTED GREEN-GRAY QUARTZ DIORITE GNEISS WITH CHLORITE BANDS 106.7'	
95						
		17C	90/55	Moderately jointed, 3 45° joints, 3 horizontal joints, 1 irregular vertical joint 96.6'-97.1'		
100		18C	98/60	2 45° joints, 2 60° joints 100.5'-102.2'; 1 horizontal jt, 3 15°-20° joints		
105		19C	90/25	Diagonal joint 103.2'-104.4', 6 45° joints, 2 30° joints, chlorite band 104.8'-105.5'		

Boring started 11-19-73 , completed 11-28-73
Final depths:
Boring = 106.7' Casing = 25'
Casing diameter = 4"
Average depth of ground water observed in the boring = 9.4' = El. +256.7

REMARKS:
Boring bit was broken off at 106.7' depth, so hole was abandoned.

BORING NUMBER AM-14
Ground surface elevation + 265.2

DEPTH BELOW GROUND SURFACE, FEET						
0	13	1D	2,3,4	Brown medium stiff fine sandy silt & silty fine sand, trace mica (Fill) (SM)	FILL 2.0'	
	39					
	43					
	25					
5	26					
	26	2D	3,7,10	Brown-red clayey silt, trace fine to medium sand, trace of org. & mica, residual soil (ML)	MEDIUM TO VERY COMPACT BROWN AND GRAY-BROWN F-M SAND AND SANDY SILT, MAINLY DECOM-POSED GNEISS 20.5'	
	31					
	39					
	46					
10	66					
	75	3D	7,12, 15	Medium compact gray-red-brown silty fine sand, some silt layers, trace medium sand (SM)		
	115					
	120					
	162					
15	253					
		4D	27,39, 88	Very compact gray-brown fine to medium sand, little silt (SM)		
		5D	98/6"	Do 4D, numerous rock fragments (SM)		
20						
		1C	45/0	Soft brn hi wthrd, jtd, partly decomposed diorite gneiss, heavy iron staining		
25						
		2C	45/0	Hi wthrd, jtd, partly sheared at top of run, iron stained	HIGHLY WEATH-ERED AND JOINTED HORN-BLENDE QUARTZ DIORITE GNEISS, OCCA-SIONAL CHLORITE, SOME TALC AND MUCH IRON STAINING, VARIABLE FOLIA-TION, WEATH-ERING DE-CREASES W/DEPTH, INTENSE METAMOR-PHISM FROM 46' TO 70' W/ NUMEROUS FACIES CHANGES & FRACTUR-ING 67.0'	
30						
		3C	65/10	Hi wthrd & jtd, partially decomposed at 34', silty clay		
35						
		4C	90/10	Mod wthrd, hi jtd, gry-grn color, hi oxidized iron, talc on jts		
40						
		5C	90/10	Mod wthrd, mod jtd, variable fol, vert jt 40'-40.5', 7 diag jts, 3 fol jts, vert jt 41.5' to 42.5'		
45						
		6C	95/15	Sli jtd, to wthrd & jtd, 10 diag jts & 5 fol jts, sli wthrng 43'-43.5' & 45'-46.5'		
50		7C	95/10	Sli wthrd, jtd, some crushing/shear @ 51'-51.5' iron staining & talc,vert jts at different angles at 48', 49', 51'		
55		8C	95/15	Rel snd, hi jtd, unwthrd quartz diorite gneiss, indistinct fol, some talc at joints		
		9C	96/15	Change 57' to hornblende schistose gneiss severely jtd & wthrd, 60.5'-61' coarse grained, well fol, occ chlorite veins,70° fol	REL SOUND, UNWTHRD, MOD JTD DIORITE AND GRANITIC GNEISS W/QUARTZ AND FELDSPAR VEINS & OCC CHLORITE SCHIST BANDS, PROBABLE SHEAR 68'-69' 90.0'	
60		10C	98/30	Change 61'-62.5' to granitic gneiss, change 62.5' to 65' horn sch gneiss & chlorite sch, poss.fault		
65		11C	96/25	Change @ 66.5': rel snd chlorite schsit, mod jtd talc veins, sm shear 68' to 69', mostly diag & vert jts, 75° fol, sli wthrng 68'-69'		
70		12C	98/30	Do 11C, rel snd, mod jtd, 3 fol jts, 8 diag jts, mainly chlorite schist, occ feldspar veins		
75		13C	95/50	Do 11C rel snd, mod jtd, gry qtz diorite gneiss w/ occ qtz & feldspar veins, 70° fol, 3 fol jts, 8 diag jts		
80		14C	98/40	Do 13C, rel snd,mod jtd quartz diorite		
85		15C	98/50	Do 13C, feldspar vein 1" thick, frgmtd @ 82.5', thin lenses chlorite @ 84.5'& 86', shattering 86'-86.5'		
90		16C	98/35	Do 13C, finely fol, rel snd, mod jtd, unwthrd, changing to chlorite schist @ 90', shearing 90.5'-91.5'		
95		17C	90/20	Grn-gry hi fract schistose & dioritic gns, occ bands of chlorite schist, sli wthrng 95'-95.5'		
100		18C	98/35	Do 17C, chlorite schist 96'-98.5', vert jt 99.2' to 100', fol variable & indistinct, sm qtz veins		

(CONTINUED)

BORING NUMBER AM-14 (CONTINUED)

100	19C	100/30	Do 17C, hi jtd mtl, sm pink feldspar 0.5', chlorite bands @ 100.5'to 103', shear evidence 103'-103.5'	GREENISH-WHITE HIGHLY FRACTURED & SHEARED DIORITIC GNEISS AND ALTERED CHLORITE SCHIST W/SEVERAL FELDSPAR & QUARTZ VEINS, FOLIATION INDISTINCT, EVIDENCE OF INTRUSION/SHEARING/DECOMPO-SITION, POSSIBLE HI-ANGLE MULTIPLE FAULT OR SHEAR ZONES, JT ATTITUDE CHIEFLY THAT OF FOLIA-TION 139.5'	
105	20C	100/10	Do 17C, hi jtd & fragmtd mtl, chlorite & feldspar band 105'-107.5', fol indistinct, sheared & crushed mtl 108'-108.5'		
110	21C	98/15	Grn chloritic schist, partly wthrd, hi jtd, evidence of shear, crushing & decomposition 110.5', 111.5' & 112'		
115	22C	90/15	Do 21C, mtl wthrd,crushed & sheared 114.0'-115.5', snd dioritic gneiss 116.5'-116.5'-118' crushed & sheared chlorite		
120	23C	75/0	Alt band diorite gneiss & chlorite schist, crushed mtl 119'-119.5'& 121'-121.5'		
	24C	70/0	Chlorite schist crushed & wthrd @ 124.5'-126', rock quality very poor,hi jtd		
125	25C	85/0	Do 24C, hi jtd, crushed & sheared w/sm wthrng 126'to 126.5', 127'-128' & 129'-130', sm schistose dioritic 130'-130.5'		
130	26C	90/10	Do 24C, hi jtd, partly wthrd @ top & 133.5' to 134.5', complex structure & lithology		
135	27C	96/35	Do 24C, jtd & fol chlorite schist,sli wthrd & crushed 137'-138', decomposed & weathered 139'-139.5'		

Boring started 10-8-73 , completed 10-11-73
Final depths:
Boring = 139.5' Casing = 45'
Casing diameter = 3-1/2" & 4"
Average depth of ground water observed in the boring = 16.0' = El. +249.2

REMARKS:
Drilled ahead of casing from 15' to 45' depth; no casing blows reported.

DESIGNED			
DRAWN	IHL & AR	12/74	
CHECKED	SLT & JPG	12/74	
APPROVED			

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A05 to FA-104	Plans & Geological Sections

REVISIONS		
DATE	BY	DESCRIPTION

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APPROVED

ROCKVILLE ROUTE (A011)
LOGS OF AM-SERIES BORINGS Nos. AM-12 to AM-14

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-109

BORING NUMBER AM-15

Ground surface elevation +260.6

DEPTH					
0	10	1D	3	3,4	Medium compact brown fine sandy silt (Fill) (ML)
	18				
	14				
	24				
	35				
5	30	2D	13	20	Compact brown silty fine sand (Residual Soil) (SM)
	50		29		
	59				
	60				
	40				
10	26	3D	6	12	Do 2D (SM)
	30		18		
	50				
	54				
	97	4D	20	42	Do 2D, very compact (SM)
15	170		60		
	136				
	50				
	92				
	100				
20	91	5D	20	17	Do 2D (SM)
	78		27		
	57				
	37				
	40				
25	50	6D	20	34	Do 2D (SM)
	47		50		
	42				
	40				
30	65	7D	18	35	Do 2D, transition to weathered rock (SM)
	77		31		
	86				Very compact brown silty medium-fine sand, trace coarse sand, some rock fragments (SM)
	100				
	125	8D	150/6"		
35	105				
	115				
	100				
	110				
	65/6"				
40		9D	34	42	Brown silty fine sand (SM)
			69		
		10D	140/6"		Brown silty coarse-fine sand, numerous rock fragments (SM)
45					
					Very compact green-brown silty fine sand with some rock fragments (SM)
50		11D	150/4"		
		12D	150/6"		Do 11D (SM)
55					
60		13D	150/6"		Do 11D (SM
		Core	NR		Attempted core-soft rock
		14D	150/6"		Do 11D (SM)
65					
70		NR	150/2"		Probably Do 11D (SM)
75		NR	150/1"		Probably Do 11D (SM)
		Core	NR		Attempted core-soft rock
80		1C	20/0		Highly jointed green chlorite-schist, small pieces, jts weathered
85		2C	90/45		Green-gray chlorite & diorite-gneiss, 1 80° joint 84'-85'; 2 45° joints @ 86.5'; 6 horizontal joints 89.5'-90.4'; 3 horizontal joints; 1 70° joint 91.4'-92' with talc & calcite deposits
90		3C	98/70		
95		4C	98/45		Thin hair-line calcite filled joints thru-out 45° to 60°, 1 45° joint with calcite & talc 96.4', 3 15° joints
100		5C	98/65		Jointed green-gray, 3 30° joints with thin calcite deposit, 1 45° joint 98.4'-1 60° joint 98.4'-99.3' with 1-1/2" calcite band
105		6C	98/80		Moderately jointed, 4 15° joints with thin calcite deposit, 3 45° joints, 1 60° joint 103'
		7C	0/0		Stuck core BBL after completing run, twisted off drill rods
110					

COMPACT TO VERY COMPACT BROWN SILTY FINE SAND RESIDUAL SOIL FROM UNDER-LYING ROCK — 35.0'

VERY COMPACT GREEN SILTY FINE SAND AND GREENISH-BROWN SILTY FINE SAND WITH VARYING AMOUNTS OF WEATHERED ROCK FRAGMENTS — 81.0'

HIGHLY JOINTED TO JOINTED GREEN-GRAY QUARTZ-DIORITE-GNEISS WITH CHLORITE SCHIST, LENSES THIN CALCITE FILLED JOINTS UNWTHRD EXCEPT JOINTS — 109.9'

Boring started 10-5-73 , completed 10-16-73
Final depths:
Boring = 132.5' Casing = 55'
Casing diameter = 3-1/2" & 4"
Average depth of ground water observed in the boring = 15.0' = El. +236.5

REMARKS:
Drilled ahead of casing from 19' to 55' depth; casing blows not reported.
Rock cores were attempted from 30' to 35' depth and 35' depth to 39.5' depth but there was no recovery, presumably because of the soft friable nature of the rock.

BORING NUMBER AM-16 (CONTINUED)

DEPTH					
105	16C	96/65			Unweathered, moderately jointed, 5 diagonal joints, 2 foliation joints, 1 vertical joint 104'-104.5'
	17C	95/85			Relatively sound, unweathered, moderately jtd, 5 diagonal joints, 2 vertical joints, quartz veins, jts relatively fresh
110	18C	85/55			Mod jtd, core in long pcs, broken during drilling operation, rel fresh jts
	19C	96/90			Sound, unweathered, slightly jointed, upper joints to 114.5'
115	20C	95/65			Unweathered, jointed, 1 joint only @ 120', 1 vert frct @ 119.8'-120.5'
	21C	95/95			Sound, unweatherd, 1 fresh joint due to coring
120	22C	98/95			Sound unweathered, 3 relatively fresh joints
125	23C	96/60			Change to jointed, 10 joints slightly weathering & crushing 129'-130', calcite & talc
130					

& WITH FEW JOINTS, MOST FRESH JOINTS & FRACTURES SUGGEST BREAKING OF CORES DURING DRILLING, HENCE SOUND ROCK INDICATED, SOME PYRITE EVIDENT — 132.5'

Boring started 11-19-74 , completed 11-27-74
Final depths:
Boring = 109.9' Casing = 49'
Casing diameter = 4"
Average depth of ground water observed in the boring = 12.0' = El. +248.6

REMARKS:
Losing drill water from 0' to 45' depth.
Drilled ahead of casing from 10' to 49' depth; therefore casing blows recorded from 10' to 39.5' are not indicative of soil consistency.
Core barrel twisted off and left in hole at 109.9' depth, therefore boring was abandoned at that depth.
Below 42' depth the drilling of hole with rotary bit is thought to have been carried through weathered bedrock.

BORING NUMBER AM-16

Ground surface elevation +251.5

DEPTH					
0	12	1D	3	2,2	Soft to medium stiff brown sandy silt (Fill) (ML)
	12				
	10				
	11				
5	12				
	25	2D	4	6,9	Medium compact red silty fine sand, little mica & hornblende (SM)
	50				
	50				
	100				
	70				
10	40	3D	17	13,	Medium compact brown-gray silty fine sand (SM)
	48		10		
	46				
	49				
	57				
15	100				
	50	4D	7	11,	Do 3D, trace clay (SM)
	117		15		
	154				
	160				
20		5D	12	18,	Compact brown-gray silty fine sand (SM)
			28		
25		6D	20	36,	Very compact gray silty fine sand, some hornblende (SM)
			70		
		7D	70,		Do 6D (SM)
30			100/4"		
		Core	NR		Probable decomposed hornblende-schistose-gneiss
35					
		Core	NR		Probably as above
			50,		
40		8D	100/3"		Very compact gray-brown silty fine-medium sand (SM)
		1C	10/0		Brn-grn fgmtd, wthrd small bits rec, highly wthrd & jtd, highly oxidized
45		2C	96/0		Soft brn wthrd & jtd, iron staining, vert jt 46.5'-47.5'
		3C	98/0		Highly wthrd & jtd, iron stained, much shearing, vert jting @ 49.5'-50.5'
50		4C	85/0		Highly wthrd & jtd sli dec 51'-52', vert & diag jting, prom iron staining & shattering w/sm talc
55		5C	90/25		Mod wthrd & jtd, indistinct foliation, qtz veins, talc & iron staining, diag & fol jts
60		6C	85/15		Gry-grn gneiss, indistinct fol, sm wthring & shearing 60.8'-61.2' & 63.1'-63.4', iron staining & talc on joints
65		7C	95/50		Some crushing @ 65' & 68', rel snd material, indistinct fol, changes to unwthrd sounder mtl @ 68'
70		8C	98/65		Unweathered qtz-dio, indistinct fol, mod jtd, talc & iron staining
		9C	98/60		Unwthrd, mod jtd, indistinct fol, 10 diag jts, 3 fol jts, slightly talc joints
75					
80		10C	90/65		Unwthrd, mod jtd, 7 diag jts, 3 fol jts, slightly talc @ jts, fol indistinct
		11C	75/60		Unwthrd, mod jtd, 6 diag jts, 2 fol jts, slightly talc sm jts, fol indistinct
85		12C	96/60		Unwthrd, mod jtd, 8 diag jts, fol indistinct, slightly talc, sm frcting @ 87'-87.5'
90		13C	75/60		Unweathered quartz-diorite
95		14C	98/90		Light gray, fine grained diorite-gneiss, unweathered relatively sound, moderately jointed, 3 foliation joints & 3 diagonal joints, relatively fresh joints
100		15C	95/90		Relatively sound, unwthrd, mod jtd, 2 diag jts, 1 fol jt, fol 50°, jts rel fresh

FILL — 3.0'

MEDIUM TO VERY COMPACT BROWN & GRAYISH-BROWN SILTY & CLAYEY FINE SAND (DECOMPOSED SCHISTOSE GNEISS & HORNBLENDE SCHIST) — 30.0'

BROWN & GREENISH-BROWN, HORNBLENDE-MICA QUARTZ-DIORITE DECOMPOSED FROM 30' TO 40' HIGHLY FERRUGINEOUS, VERTICAL JOINTING; SHEARING & SLIGHT DECOMPOSITION TO 55' — 68.0'

HARD RELATIVELY SOUND, UNWEATHERED & MODERATELY JOINTED QUARTZ-DIORITE & DIORITE GNEISS WITH SOME TALC AT JOINTS — 90.0'

LIGHT GRAY FINE GRAINED QUARTZ-DIORITE & DIORITE GNEISS, SOUND, UNWEATHERED

(CONTINUED)

BORING NUMBER AM-17

Ground surface elevation +234.0'

DEPTH					
0	4	1D	3	3,5	Medium stiff red-brown fine sandy silt, little red clay, trace mica (Fill) (ML)
	10				
	10				
	13				
5	5				
	10	2D	10	17	Very compact gray silty fine sand, little clay, trace 1 pc medium gravel, trace organics (Possible Fill) (SC-SM)
	68		64		
	117				
	468				
	550				
10	110	3D	14	14	Medium compact light gray-brown silty fine sand, residual soil (SM)
	340		15		
	675				
	735				Very compact light gray-brown silty fine sand, little fine mica, trace hornblende (SM)
15	38		66,		
	61	4D	139,		
	195		174		
	340				
	400	Core	NR		Soft rock
20	1400				
		5D	38,	61	Do 4D (SM)
			66		
		Core	NR		Fine sand ground from rock
25		6D	67,	61	Do 4D (SM)
			54		
		NR	150/3"		Fine sand from rock
30					
		Core	NR		Soft rock
35		7D	150/2"		Very compact brown fine sand, some silt (SM)
		Core	NR		Soft rock
40					
		1C	35/0		Jtd & wthrd quartz diorite gneiss, vert jt in top, 2 diag jts, 6 horiz jts, several small pieces, crumbles into sand
45		2C	70/0		Jtd-mod wthrd, 2 diag jts, 1" feldspar band
		3C	98/30		Hi jtd-mod wthrd, 10 horiz jts, (1) 70° jt at 53', (2) 70° jts at 54.5' with iron stains & thin talc deposit
50		4C	98/40		Do 3C, (2) 45° jts, (1)30° jt,(1)80° jt w/iron stains 56'-57', horiz jtg at 54.5' & 57'
55		5C	90/60		Do 3C, sli wthrd, (4)60°jts w/sli stains, trace thin talc deposit on joints
60		6C	90/90		Sound light gray quartz diorite gneiss, 1 piece
65		7C	98/80		Rel sound, (3) 15°-20°jts, (2)45° jts, thin talc deposit on joints
70		8C	98/98		Light gray diorite gneiss
		9C	98/50		Jointed, (3)20°jts,(1)60° jt 71'-71.4' thru 0.2' qtz vein,(2)45° jts w/talc & iron stains, jtd at 73.9
75		10C	98/95		Sound, irregular vertical quartz vein 74.6'-75.8'
		11C	98/80		(2)45° jts at 78.8',(1)60° jt at 79' with thin talc
80		12C	98/65		Rel sound (2)20°jts (2)45° jts, (1)60°jt at 83.5'with talc deposit, (1)80° jt
85		13C	98/95		(2) 45° jts at 86.5', 3 old calcite filled jts at 87'
90		14C	98/90		(2)45° jts at 90.1' & 91.1', (4)10°-20° jts 91.1'-91.5' with calcite deposit
95		15C	95/70		Hi jtd, near vert—85° jt 93.6'to 96'with 1/16" to 1/8" talc deposit,possible shear zone
100		16C	100/80		Mod jtd, 1 elliptical vert jt 98.1'-99.4', (1)30° jt 99.7', 1 horiz jt 99', quartz-feldspar veins @ bot
		17C	98/85		Rel sound to sound, (1)60° jt 102.2'-102.6'(feldspar) (1)60°jt at 103',chlorite bands 103.3'-103.7'
105					

M STIFF BRN SILT, FILL — 4.5'

COMPACT GRAY-BROWN SILTY FINE SAND, RESIDUAL SOIL — 15.0'

VERY COMPACT LIGHT GRAY-BROWN FINE SAND WITH WEATHERED ROCK LENSES — 30.2'

VERY COMPACT BROWN FINE SAND AND WEATHERED ROCK — 40.5'

HIGHLY JOINTED AND MODERATELY WEATHERED GRAY-BROWN QUARTZ-HORN-BLENDE-DIORITE GNEISS — 62.6'

HIGHLY JOINTED TO REL SOUND UNWEATHERED QUARTZ-DIORITE GNEISS — 73.9'

RELATIVELY SOUND OCCASIONALLY HIGHLY JOINTED LIGHT GRAY QUARTZ-DIORITE GNEISS

(CONTINUED)

BORING NUMBER AM-17 (CONTINUED)

DEPTH					
105	18C	98/30			Highly jointed,vertical jointing 104.4' to 108.0', 1 60° joint, talc joints
110	19C	95/90			Rel sound, 1 60° jt 112.8', green chlorite bands at 109'-110', calcite veins
115	20C	100/	100		Relatively sound, 1 60° joint at 118.0', thin talc calcite veins
120	21C	100/	100		Sound gray quartz diorite gneiss

108.8' — RELATIVELY SOUND TO SOUND LIGHT GRAY QUARTZ-DIORITE GNEISS — 120.0'

Boring started 11-14-73 , completed 11-20-73
Final depths:
Boring = 120.0' Casing = 42'
Casing diameter = 3-1/2" & 4"
Average depth of ground water observed in the boring = 4.6' = El. +229.4

REMARKS:
Drilled ahead of casing from 20' to 42' depth; no casing blows reported.
Four rock cores were attempted at various depths between 16.5' and 35' depths but without recovery.
Dry samples at these depths indicate very compact decomposed rock.
Quartz diorite gneiss recovered in rock core sample16C crumbles easilyinto fine sand.

BORING NUMBER AM-18

Ground surface elevation +283.6

DEPTH					
0	10	1D	2	3,4	Medium stiff red-brown silty clay, trace fine-coarse sand (Fill) (CL)
	18				
	43				
	60				
5	78				
	48	2D	6	6,7	Red-brown silty fine sand (Residual Soil) (SM)
	77				
	90				
	100				
10	100				
	10	3D	6,	10,	Brown silty fine sand (SM)
	14		10		
	17				
	21				
15	23				
	25	4D	4,	7,9	Do 3D (SM)
	25				
	43				
	48				
20	55				
		5D	13,	23	Do 3D (SM)
			36		
25		6D	35,		Very compact tan & gray silty fine sand (SM)
			100		
30		7D	23,	17	Tan & white fine sandy silt (ML)
			33		
35		8D	100/6"		Rock fragments (SP)
		Core	NR		Attempted core, transition to weathered bedrock
40					
		1C	50/0		Jointed-weathered gry-brn quartz-hornblende-gneiss, 30° foliation, 12 fol joints
45		2C	95/20		Highly jointed & weathered gry-brn , 30° foliation, 12 foliation joints
		3C	60/30		4 Horizontal jts, 3 fol jts w/iron stains on jts, lost water at 50'
50		4C	65/0		6 Foliation jts, 1 45° jt at 55.7'; 1 60° jt at 56.5' iron stains on joints
55		5C	55/0		Highly jtd to disintegrated gray-brown with many joints
60		6C	75/35		Jtd to moderately wthrd, 4 horizontal jts, 3 45° jts
65		7C	95/20		Jtd light gray quartz-diorite-gneiss, wthrd on jts, 45° fol to 70.5'
70		8C	95/35		3 45° jts, 4 horizontal jts 6 jts at 15°-30°, iron stains on jts, 7 small pieces 72.0'-72.3'
75		9C	98/90		Relatively sound light gray 3 45° joints
		10C	98/85		3 45° joints, 1 10° joint; 4" chlorite band at 81.5' to 81.8'
80		11C	98/75		Moderately jtd light gray, 3 diag jts from 45°-60°, 2 20° joints; 1 horizontal jt
85		12C	98/95		Sound, 2 45° joints; 1 30° joint
90		13C	90/50		Jointed light gray, 3 45° diag jts w/talc; 5 horizontal joints; 1 30° joint
95		14C	100/	100	Sound light gray diorite gneiss, 1 piece
100		15C	98/95		1 30° jt; 1 70° jt at 104.5' w/ thin talc deposit feldspar vein & thin chlorite-phyllite bands 101.0' to 101.5'
105					

RED-BROWN SILTY CLAY (FILL) — 5.0'

BROWN SILTY FINE SAND, RESIDUAL SOIL, BECOMING COARSER AND MORE ROCK-LIKE WITH DEPTH — 30.0'

TAN-WHITE SILT WITH ROCK FRAGMENTS — 40.0'

HIGHLY JOINTED & WEATHERED GRAY-BROWN QUARTZ-HORN-BLENDE GNEISS, 30° FOLIATION — 65.5'

JOINTED TO RELATIVELY SOUND QUARTZ-DIORITE-GNEISS 30°-45° FOLIATION, IRON STAINS ON JOINTS — 83.0'

MODERATELY JOINTED TO SOUND LIGHT GRAY DIORITE-GNEISS — 96.5'

(CONTINUED)

BORING NUMBER AM-18 (CONTINUED)

DEPTH					
105	16C	100/	100		Sound green-light gray 1 30° joint at 108.0', 2 pieces
110	17C	98/90			2 45° joints at 111.6' & 112.5', 1 30° joint at 113.0'
115	18C	80/80			1 45° joint at 114.7'; 1 30° joint at 117.5'; 1 20° joint with thin calcite deposits
120	19C	98/90			2 60° joints at 120.4' & 122.0'; 3 15° joints; 3 30° joints; green-gray chlorite inclusions

SOUND LIGHT GRAY DIORITE-GNEISS WITH THIN CHLORITE-PHYLLITE BANDS & INTRUSIONS — 122.5'

Boring started 11-13-73 , completed 12-12-73
Final depths:
Boring = 122.5' Casing = 65'
Casing diameter = 3-1/2" & 4"
Average depth of ground water observed in the boring = 50' = El. +233.6

REMARKS:
Drilled ahead of casing from 20' to 65' depth; casing blows not reported.
Lost drilling water at 50' depth.
Four water pressure tests with packers run in this borehole.

DESIGNED — DATE
DRAWN IHL DATE 12/74
CHECKED SLT & JPG DATE 12/74
APPROVED — DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to	Plans & Geological Sections
F-A-104	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐
APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-15 to AM-18

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-110

BORING NUMBER AM-18A

Ground surface elevation +253.4

DEPTH				
0	17	1D	6,9,9	Brown silty fine-medium sand with some clay, top-soil & pieces of gravel (Fill) (SM)
	43			FILL 4.0'
	49			
	51			
	46			
5	41	2D	9,11, 12	Gray-green silty fine sand (Dec Rock - Schistose gneiss) (SM)
	72			
	68			
	79			
	103			
10	76	3D	6,10, 13	Gray-green & brown-red silty fine sand and residual soil from decomposed schistose gneiss (SM)
	132			
	102			
	87			
	110			MEDIUM TO VERY COMPACT BROWN & REDDISH BROWN SILTY FINE SAND & SANDY SILT - FORMED BY DECOMPOSITION OF SCHISTOSE-GNEISS, OFTEN SHOWING RESIDUAL FOLIATION, BECOMING COARSER & MORE ROCK-LIKE WITH DEPTH
15		4D	8,22, 31	Do 3D (SM)
20		5D	9,12, 15	Do 3D (SM)
25		6D	9,13, 18	Do 3D (SM)
30		7D	29,41 18	Do 3D, very compact, transition to weathered bedrock (SM)
35		8D	88, 150/2"	Do 7D (SM)
	Core	NR		Core run probably weathered fragments
40		9D	37, 100	Do 7D, trace rock fragment (SM)
45		10D	82, 100/3"	Do 9D, very compact (SM)
50		11D	100/3"	Do 9D (SM)
		1C	80/25	Brn-gry & gry-grn wthrd & jtd schistose-gneiss, sheared at 50.5'-51.5'; partly decomposed 54.5' to 55'
55		2C	90/30	Wthrd & sheared 55'-57'; granitic mtl @ 55'-55.5', several bands feldspar 1/8"-1/2"; sounder mtl @ 58'-59.5'
60		3C	95/70	Gry-grn f laminated chl-feldspar-schist-gns, rel snd, unwthrd; 7 fol jts; 6 diag jts; fol 45° change to 60° @ 61'
65		4C	98/60	Rel snd unwthrd mod jtd; 4 fol & 4 diag jts change @ 68.5' to qtz-dio, fine fol 50°
70		5C	95/90	Rel snd & fol dio-gns, unwthrd, mod jtd, 3 fol jts 2 diag jts, changes to dk gray-green chloritic gneiss
75		6C	85/90	Do 5C, change @ 77.3' to light gray diorite-gneiss; 2 fol, 1 vert & 1 diag jt
80		7C	96/85	Do 5C, change to fol hornblende-qtz-gns @ 80', rel snd, unwthrd, 3 fol jts; 2 diag jts; change to chloritic gneiss @ 83.5'
85		8C	95/80	Do 7C change 86' to rel snd, mod jtd, 2 fol jts & 4 diag jts
90		9C	95/85	Do 7C mod jtd, 2 diag jts & 3 fol jts; hornblende-schistose-gneiss
95		10C	70/ 0	Do 7C, mod jtd, unwthrd; 3 diag, 1 fol jt, rel snd
100		11C	98/95	Do 7C, relatively sound, unweathered, moderately jointed, 2 fol, 1 diag jt
				REL SND, MOD JTD, UNWTHRD QTZ-DIO, CHLORITE-SCHISTOSE GNEISS, HORNBLENDE-GNEISS, RAPID FACIES CHANGES 86.0'
				RELATIVELY SND, MODERATELY JTD, UNWEATHERED HORNBLENDE GNEISS, VARYING FINE FOLIATION 100.0'

Boring started 9-24-73 , completed 9-28-73
Final depths:
Boring = 100.0' Casing = 55'
Casing diameter = 3-1/2" & 4"
Average depth of ground water
observed in the boring = 32.0' = El. +221.4

REMARKS:
Drilled ahead of casing from 15' to 55' depth; casing blows not reported.
Caving in of boring occured at approximately 65' depth.

BORING NUMBER AM-19

Ground surface elevation +243.0

DEPTH				
0	0	1D	9,9,9	Medium compact red-brown fine-medium sandy silt with some topsoil, bits asphalt, trace clay (Fill) (ML)
	8			REDDISH BROWN SILTY FINE-MEDIUM SAND (FILL) 9.0'
	10			
	10			
	21			
5	24	2D	5,3,5	Do 1D, loose, trace rock fragments (Fill) (ML)
	32			
	38			
	40			
	58			
10	60	3D	18,20, 28	Compact green-brown silty & clayey fine sand, trace rock fragments (Decomposed Schistose-gneiss) (SM)
	60			
	113			
	200			
	396			VERY COMPACT GREENISH-BROWN SILTY & CLAYEY FINE-MEDIUM SAND (DECOMPOSED SCHISTOSE GNEISS)
15		4D	29,32, 38	Very compact brown silty fine-medium sand (SM)
20		5D	21,29, 48	Do 4D (SM)
25		6D	23,30, 78	Do 4D (SM)
30		7D	83, 100/3"	Do 4D (SM)
		1C	25/0	Brown weathered schistose-gneiss, jointed & sheared, iron stained on joints, quartz fragments on bot 31.5'
35		2C	85/45	Wthrd, mod jtd, 6" quartz vein 40.5'-41', fgmtd, 3 fol, 4 diag jts & long vert jt 38'-40.5'
40		3C	75/65	Wthrd, mod jtd 5" quartz vein 45'-45.3'; partial dec 43.5' (coarse sand); 5 diagonal & 2 fol jts
45		4C	80/55	Mod jtd, wthrd 3" qtz vein @ top, 1/2" calcite vein 48.5', 3 fol, 2 diag jts
50		5C	90/15	Jtd, weathered, 3 fol jts, long vertical jt 51'-53', iron stains, sm shearing 50'
55		6C	80/60	Mod jtd, 2 fol, 1 vertical & 3 diag jts, iron stained, sm shearing @ bottom of run 57.5'-58.5'
60		7C	95/30	Wthrd, jtd, major vertical jt 61.3'-62.3', 11 fol, 8 diag jts, sl decomposed 60', sm shearing 62'-63'
65		8C	70/55	Wthrd, mod jtd, change in foliation, sl dec & sheared @ bottom, 4 fol, 8 diag jts
70		9C	90/55	Wthrd, jtd 4" qrtz vein 67.5'-67.8', long vertical jt & fine-hair crack 69'to 72', 5 foliation & 6 diag jts
75		10C	98/30	Mod jtd, wthrd, 6 foliation jts, 1 vert jt, 10 diag jts phyllite between 75'-76', chlorite schist 76'
80		11C	95/35	Gry & grn chlorite- amphibolite-schist w/sm 1/4"-1" feldspar bands, some dec & sheared gns @ 80'-81', variable fol; 8 fol jts, 7 diagonal jts
85		12C	98/65	Gry, unwthrd, mod jtd qtz-dio-gns, 4 fol jts & 8 diag jts
90		13C	90/70	Mod jtd, 3 fol jts, 5 diag jts, chlorite schist 89'-90' and 90'-93'
		14C	98/70	Mod jtd, 3 fol jts, 4 diag jts, variable fol
95		15C	85/60	Mod jtd, 5 fol & 5 diag jts, vert jts @ 95.5'-96.5' & 98'-98.5'
				BROWN & GREENISH-BROWN WEATHERED AND JOINTED HORNBLENDE-MICA-SCHISTOSE GNEISS WITH OCCASIONAL VEINS OF QUARTZ, BANDS OF CHLORITE SCHIST, PHYLLITE & AMPHIBOLITE AT LOWER DEPTHS 81.0'
				GRAY RELATIVELY SOUND UNWEATHERED & MODERATELY JOINTED QUARTZ-DIORITE GNEISS, OCCASIONAL CHLORITE-SCHIST VEINS 99.0'

Boring started 10-1-73 , completed 10-4-73
Final depths:
Boring = 99.0' Casing = 50'
Casing diameter = 3-1/2" & 4"
Average depth of ground water
observed in the boring = 19.2' = El. +223.8

REMARKS:
Drilled ahead of casing from 5' to 50' depth; casing blows not reported.
Four water pressure tests with packers run in this borehole.

BORING NUMBER AM-20

Ground surface elevation +242.3

DEPTH				
0	10	1D	2,5,7	Medium stiff brown-red clayey, fine sandy silt (Fill) (ML)
	20			FILL: MEDIUM STIFF BROWN-RED CLAYEY & FINE SANDY SILT, TRACE FINE GRAVEL 15.0'
	45			
	33			
5	40			
	42	2D	7,8,9	Medium stiff brown fine sandy silt, trace to some fine gravel, trace mica (Fill) (ML)
	63			
	35			
	43			
	20			Soft red-brown moist slightly plastic micaceous clayey silt, trace fine sand (Prob Fill) (ML)
10	26	3D	2,2,2	
	31			
	20			
	20			
	20			Medium stiff red-brown clayey silt, trace fine sand, trace mica (Residual Soil) (ML)
15	18	4D	3,4,7	
	16			
	20			
	21			Do 4D to 21' (ML)
	20			Light gray-white & brown silty fine sand w/red clay lenses 21'-21.5' (SM)
20	35	5D	13,12 13	
	41			
	65			
	80			
25		6D	28,35 70	Hard red-brown fine sand with weathered rock fragments (SM)
		7D	100/6"	Very compact brown silty fine-medium sand, trace mica (SM)
30		1C	75/0	Jtd & wthrd brn qtz-dio-gns
35		2C	80/45	Highly wthrd to 36.3' Gry-grn 36.3'-39' Granite intrusions 35.3'-35.7'
40		3C	95/0	Highly jtd-moderately wthrd to 42', wthrd 42'-43', several small pieces, 6 diagonal jts, 14 20° jts
45		4C	95/50	Jtd, unwthrd, grn-gry alt chlorite 45.6'-47.3', 12 30° jts, 2 diagonal jts 43.5'
50		5C	98/70	Mod jtd light gray, 2 60° jts 48.3' & 50.5', wthrd zone 50.8'-52'
55		6C	98/90	Rel sound, 2 horizontal jts, 1 60° jt 54.8', 2 10° jts, slightly brown stains on joints, no foliation
60		7C	98/90	Relatively sound, 1 horizontal jt, 6 diag jts, 1 45° jt @ 59', wthrd 62' to 62.5'
65		8C	95/70	Mod jtd-rel sound light gray, 70° jt with iron stains 61', slightly irregular foliation
70		9C	98/80	Rel sound, 3 10° jts, light-dk gray inclusions, old jts filled, 45° diag jt 68.5'-70'
75		10C	95/35	Jtd gry-grn diorite w/ chlorite bands, 7 fol jts, 3 diag jts, 1 70° jt 72.6'; 25°-30° foliation
80		11C	98/85	1 70° jt 76.2'; 2 fol jts; 2 diagonal joints
85		12C	98/95	5 foliation joints, 45° foliation, 6 pieces
90		13C	98/75	Grn-gry dio-gns w/chlorite bands 86.3'-87'; 60° jts 83', 84' & 85'; 2 fol jts
		14C	98/65	Thin chlorite bands 87.7'-89'; 4 fol jts; vertical jt 89'-90'
				HIGHLY JTD & WEATHERED QUARTZ-DIO-GNS 36.3'
				HIGHLY JTD & MOD WTHRD QTZ-DIO-GNEISS 43.0'
				JOINTED UNWEATHERED GRN-GRY DIORITE-GNEISS 50.8'
				WEATHERED 52.0'
				MOD JTD TO RELATIVELY SOUND LIGHT GRAY QUARTZ-DIORITE-GNEISS, IRON STAINING ON JOINTS 70.0'
				JOINTED QUARTZ-DIORITE 74.0'
				MOD JTD TO RELATIVELY SOUND GREEN-GRAY QUARTZ-DIORITE-GNEISS WITH CHLORITE BANDS 90.0'

Boring started 11-7-73 , completed 11-12-73
Final depths:
Boring = 90.0' Casing = 30'
Casing diameter = 3-1/2" & 4"
Average depth of ground water
observed in the boring = 20.0' = El. +222.3

REMARKS:
Drilled ahead of casing from 10' to 30' depth; casing blows from 10' to 25' depth not indicative of soil consistency.
Four water pressure tests with packers run in this borehole.

BORING NUMBER AM-21

Ground surface elevation +247.2

DEPTH				
0	10	1D	4,5,6	Medium stiff brown fine sandy silt (Fill) (ML)
	15			MEDIUM STIFF TO HARD BROWN SILT AND SAND, RESIDUAL SOIL (FILL AT TOP) 15.0'
	50			
	100			
5	94			
	130	2D	10,18 29	Hard brown fine sandy silt (ML)
	175			
	173			
	180			
	67			
10	60	3D	15,17 23	Brown silty fine sand (SM)
	56			
	60			
	81			
	85			
15	122	4D	70, 100	Very compact brown silty fine sand (Dec Rock) (SM)
	150			BROWN SILTY FINE SAND 20.3'
	300			
	375			
20		5D	100/4"	Do 4D, transition to bedrock (SM)
		1C	98/0	Highly jtd & wthrd gry-brn quartz-diorite-gneiss
25		2C	98/0	Highly jtd-mod wthrd, 45° fol, 3 10° jts, 1/8" qtz-feldspar vein 60° @ 24.7'; 1 80° diagonal jt @ 28'
30		3C	98/0	Jointed-weathered brn-gry, 1/4" feldspar 50° @ 31.8'; 5 10° jts, 2 thin 60°-70° jts @ 31.5', highly wthrd from 32.4'-33'
35		4C	98/0	Several small pieces, 90° vertical joint 36'-38', highly weathered
40		5C	80/0	Highly jointed-weathered to disintegrated, 60° fol, 10°-60° joints with iron stains
45		6C	80/0	Gray-green schistose-gneiss 70°-80° foliation with slickensides
50		7C	98/15	Do 6C, jointed-weathered gray-green, soft 50.5'-52', 6" quartz vein 52'-52.5'
55		8C	80/0	Quartz in top to 53.5'; green chlorite-schist, 60° to 70° foliation, 2 70° joints, diagonal joints 54', 54.5'-55'
60		9C	98/30	5 10°-30° joints, 1 45° diagonal joint, chlorite to 60.5', diorite to 63', 45° foliation @ 59', sli iron stained
65		10C	85/15	8 Horizontal-10° joints, 3 45° joints @ 62', chlorite @ 63'
70		11C	95/0	Highly jointed-weathered green chlorite-schist, 18 horizontal to 10° joints, 2" qtz vein jtd @ 66.5', 2 70° diagonal joints
75		12C	75/0	7 horizontal-10° joints, 5 45° joints, 1 70° diag jt @ 71', sli wthring on jts
80		13C	100/ 95	Sound quartz-diorite, irregular vertical quartz vein 74'-76.2'
		14C	100/ 95	2 30° joints, 1 45° joint, 1 80° joint 79.5'-80' filled with thin talc
				HIGHLY JOINTED-WEATHERED GRAY-BROWN QUARTZ-DIORITE-GNEISS AND GRAY-GREEN SCHISTOSE GNEISS, 60°-70° FOLIATION 52.0'
				QUARTZ 53.5'
				HIGHLY JOINTED-WEATHERED CHLORITE-SCHIST 60.5'
				DIORITE 63.0'
				HIGHLY JOINTED-WEATHERED GREEN CHLORITE-SCHIST 74.0'
				QUARTZ 76.2'
				SOUND QTZ-DIORITE 80.0'

Boring started 11-13-73 , completed 11-16-73
Final depths:
Boring = 80.0' Casing = 19'
Casing diameter = 4"
Average depth of ground water
observed in the boring = 28.0' = El. +219.2

BORING NUMBER AM-22

Ground surface elevation +251.6

DEPTH				
0	67	1D	8,17, 28	Stiff brown-red silty clay, some fine sand, trace rock fragments & roots (Fill) (CL)
	79			GRAY-BROWN & RED SILTY SAND WITH RED CLAY 10.0'
	120			
	176			
	152			
5		2D	7,6,9	Medium compact gray-brown & red silty fine sand, with clay seams (SM)
10		1C	90/45	Slightly weathered jointed gray hornblende-gneiss, 65° foliation, 4 foliation joints, 4 diagonal joints
15		2C	60/30	Jointed with clay seams in top & bottom, 3 diagonal joints & 3 foliation joints
20		3C	75/0	Jointed gray gneiss & quartz fgmts w/cl seams
		4C	50/0	Weathered soft, red-brown gneiss
25		5C	90/30	Highly jointed & weathered
30		6C	65/30	Highly jointed brown-gray, 6 foliation joints, clay seams in bottom
35		7C	90/0	Gray-brown highly jointed, moderately weathered, many small pieces, 45° foliation 20 diagonal & foliation joints iron stained
40		8C	95/10	8 Diagonal joints, highly jointed, possibly gouge zone
45		9C	90/0	Highly weathered-jointed feldspar-quartz in top, small pieces to 46', vertical foliation, iron stained
50		10C	95/0	Generally unweathered, highly jointed, 9 foliation joints, 4 diagonal joints, iron stains, thin talc deposits
55		11C	95/20	Highly jointed dark gray
60		12C	80/35	Do 10C, small pieces 58.5' to 59.5', 10 foliation joints, little iron staining on joints, finely laminated, medium grained 61.0'
65		13C	95/25	Jointed light gray granite diorite-gneiss, 10 joints with iron stains
70		14C	95/30	Do 13C, light gray, 8 joints, vertical joints 65'-66' & 69'-70' 70.0'
				JOINTED & WEATHERED HORNBLENDE-GNEISS, CLAY SEAMS 19.5'
				HIGHLY JOINTED, WEATHERED TO MODERATELY WEATHERED GRAY HORNBLENDE-GNEISS, THIN TALC DEPOSITS, EXTENSIVE IRON STAINING
				JOINTED GRANITE-GNEISS, IRREGULAR FOLIATION

Boring started 9-13-73 , completed 9-19-73
Final depths:
Boring = 70.0' Casing = 9'
Casing diameter = 6"
Average depth of ground water
observed in the boring = 31.0' = El. +220.6

REMARKS:
Drilled ahead of casing from 5' to 9' depth; casing blows not reported.
Drilling water at 23.5' to 28.5' became brown-yellow in color.
Intrusive ridge of granite diorite gneiss indicated near surface.

BORING NUMBER AM-23

Ground surface elevation +247.4

DEPTH				
0	62	1D	8,11, 10	Stiff red silty clay, trace fine sand (Fill) (CL)
	73			RED CLAY AND FINE SANDY SILT, FILL AT TOP 10.0'
	110			
	125			
5	130			
	99	2D	10,15, 22	Hard red fine sandy silt, little clay, trace rock fragments & Mica (ML)
	142			
	156			
	210			
	217			
10	98	3D	13,19, 26	Hard red plastic clayey silt (MH)
	100			YELLOW AND RED-BROWN SANDY SILT AND CLAY, RESIDUAL SOIL 25.0'
	111			
	113			
15	129			
	132	4D	8,10, 12	Stiff fine sandy clay, trace silt (CL)
	140			
	157			
	182			
20	176			
		5D	11,21, 33	Hard yellow-red mottled fine sandy clay, trace mica, trace silt, decomposed rock (CL)
				HIGHLY WTHRD GNEISS 29.0'
25		1C	20/0	Jtd, hi wthrd soft brown-gray hornblende gneiss, 1 vert jt, 1 fol jt 60°, 1 diag jt in granitic gneiss 29' to 30' 31.0'
30		2C	80/10	1 vert jt 30'-31', jtd wthrd, gray-brown
35		3C	90/60	Jtd, mod wthrd gray-brown, 3 fol jts 45°, 3 diag jts @ 36.5', thin red clay deposit
40		4C	95/20	6 fol jts, 7 diag jts, some iron stain, thin to medium laminated, coarse grained in bottom
45		5C	95/50	Jtd dark gray, 6 fol jts, 7 diag jts, wthrd 49.5' to 50'
50		6C	95/10	Hi jtd & wthrd, dark brown-gray, many small pieces
55		7C	95/25	Jtd gray diorite gneiss, sli wthrd, 6 fol jts, 5 diag jts, 2 vert jts
60		8C	80/10	Jtd gray, sli wthrd on jts, vert jt-80° 65' to 68'
65		9C	80/35	Light gray, 4 fol jts, 3 diag jts, 80° diag jt 66' to 67.5', talc deposits with iron stain
70				JOINTED TO HIGHLY JOINTED, MODERATELY WEATHERED GRAY-BROWN HORNBLENDE GNEISS 55.0'
				JOINTED; SLIGHTLY WEATHERED DIORITE GNEISS, IRREGULAR FOLIATION 70.0'

Boring started 10-20-73 , completed 10-28-73
Final depths:
Boring = 70.0' Casing = 25'
Casing diameter = 6"
Average depth of ground water
observed in the boring = 31.0' = El. +216.4

REMARKS:
Drilled ahead of casing from 20' to 25' depth; casing blows not reported.
Thin clay deposits observed on joint of rock core No. 1C.
Rock core drilling by 4" x 5-1/2" diamond drill bit, providing core approximately 4" in diameter.

DESIGNED
DRAWN IHL DATE 12/74
CHECKED SLT & JPS DATE 12/74
APPROVED DATE

REFERENCE DRAWINGS		
NUMBER	DESCRIPTION	
F-1	General Notes & Legend	
F-A-86	Plans & Geological Sections	
to F-A-104		

REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. MUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐
APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-18A to AM-23

SCALE VERT. 0 3" 6" 12"

DRAWING NO. F-A-111

BORING NUMBER AM-24

Ground surface elevation +241.6

15 22 18 17 19	1D	4,6,7	Medium stiff brown clayey silt, trace mica, some organic material (Fill) (ML)	BROWN SILT FILL	5.0'
42 45 51 63 79	2D	5,7, 19	Stiff brown-red silty clay, trace mica (CL)	BRN-RED SILTY AND FINE SANDY CLAY, TRACE MICA	
68 92 137 263	3D	15,20 25	Hard mottled brown-red silty clay, some fine sand (CL)		14.0'
	4D	17,23 30	Brown-red clayey fine to medium sand & medium gravel, angular, trace silt (SC)	BRN-RED F-M SAND AND ROCK	18.0'
	5D	100/6"	Hard brown silty fine sand, transition to bedrock (SM)	BRN F SA, TRANSITION TO ROCK	25.0'
	1C	80/0	Jtd, mod wthrd, gray-brown hornblende gneiss, 60° fol, quartz & garnet inclusion		
	2C	90/20	Do 1C, jtd, wthrd, 2 diag jts at 32'	HIGHLY JOINTED TO JOINTED, MODERATELY WEATHERED GRAY HORNBLENDE GNEISS	
	3C	80/15	Hi jtd, mod wthrd gray, vert jt 35.5' to 37', 2 70° diag jts, 7 fol jts		
	4C	60/10	Do 3C, 5 fol jts, 5 diag jts, jts wthrd & soft, 45° fol		48.0'
	5C	90/25	Do 3C, folding in thin layers at 46', wthrd 46.5' to 47.5', 10 fol jts, 1 vert jt		
	6C	98/45	Jointed gray granite hornblende gneiss, 10 fol jts, 3 diag jts, slightly wthrd at 53', 45° fol	JOINTED LIGHT GRAY GRANITE HORNBLENDE GNEISS, IRON STAINS ON JOINTS	
	7C	95/30	Hi jtd, 7 fol jts, 5 diag jts, little iron staining		
	8C	95/40	7 diag jts, 3 fol jts, 45° fol		63.7'

Boring started 10-11-73 , completed 10-12-73
Final depths:
Boring = 63.7' Casing = 20'
Casing diameter = 4"
Average depth of ground water observed in the boring = 27.0' = El. +214.6

REMARKS:
Drilled ahead of casing from 14' to 20' depth; casing blows not reported.

BORING NUMBER AM-25

Ground surface elevation +237.7

45 52 28 24 21	1D	9,12, 9	Orange-brown silty fine to medium sand with topsoil, some clay, trace gravel (Fill) (SM)	M COMP ORANGE-BROWN SILTY F-M SAND, SOME CLAY, TR GRAVEL, FILL	12.0'
37 79 140 118 100	2U	P	Do 1D, (Fill) (SM)		
	3D	16,20 20	Do, 1D, no topsoil (Fill) (SM)		
72 77 111 153 278	4D	18,18 15	Do 1D (Fill) (SM)	SILTY FINE SAND	16.5'
	5D	44,76 100/3"	Brown-green silty fine sand (SM)		
	1C	25/0	Wthrd & decomposed schistose gneiss, silty & clayey fine sand(SM-SC)	HIGHLY JOINTED, WEATHERED TO MODERATELY WEATHERED, BROWN TO BROWN-GRAY QUARTZ DIORITE GNEISS, WITH IRON STAINS AND THIN CALCITE DEPOSITS ON JOINTS	
	2C	45/0	Jtd, wthrd gray-brown diorite gneiss, 1 70° jt at 21.5', thin vert jts at 22', 30° fol		
	3C	75/0	Do 2C, hi jtd, wthrd, 4 70° diag jts at 26', 26.5', 28', 1 vert jt at 28.5'-29.2', iron stains, 7 10°-20° jts		
	4C	25/0	Do 2C, 45° fol, several small pcs, hi feldspar content, few medium quartz fragments		
	5C	70/0	Do 2C, brn-gry, 5 60° diag jts, very highly jtd, many small pcs, mod wthrd		46.0'
	6C	75/0	Do 5C, 4 45° jts, hi jtd thru-out w/iron stains		
	7C	95/15	Jtd, mod wthrd brown-gray 7 10°-30° jts, thin irregular jts w/calcite	JOINTED DIORITE GNEISS	50.0'
	8C	95/75	6 45°-60° diag jts, jtd, lt gray, 2 70° jts, slight stain, thin jts with calcite		

Boring started 11-7-73 , completed 11-8-73
Final depths:
Boring = 50.0' Casing = 15'
Casing diameter = 4-1/2"
Average depth of ground water observed in the boring = 22.7' = El. +215.0

BORING NUMBER AM-26

Ground surface elevation +235.4

	1D	3,5,7	Green-brown silty fine sand with some topsoil, roots, gravel (Fill) (SM)	MEDIUM TO VERY COMPACT SILTY F-M SAND & SA SILT, OCC LYRS ASPHALT & GRAVEL, PIECES BRICK CHIPS	17.0'
	2D	13,12, 86	Brown-black silty fine to coarse sand with some asphalt, gravel, pebbles (Fill) (SM)		
	3D	8,10, 12	Brown-gray sandy silt, trace clay & gravel (Fill) (ML)		
	4D	12,15, 34	Do 3D, with some pieces brick chips, asphalt, gravel (Possible old roadbed) (Fill) (SM)		
	5D	37, 86/6"	Brown-green silty fine sand, decomposed schistose gneiss (SM)	DECOMPOSED HORNBLENDE SCHISTOSE GNEISS	24.0'
	1C	25/0	Soft brn wthrd & jtd hornblende schistose gneiss, partially decomposed top		
	2C	85/10	Do 1C, 4 vert, 4 fol & 9 diag jts, 45° fol, iron staining	WEATHERED AND JOINTED HORNBLENDE SCHISTOSE GNEISS	
	3C	50/10	Do 1C, 3 vert & 8 fol jts, pcs quartz vein at bottom		
	4C	30/0	Do 1C, jtd & sheared, quartz 34° & possibly 35.3°, 3 prominent vert jts		38.5'

Boring started 10-21-73 , completed 10-24-73
Final depths:
Boring = 38.5' Casing = 21'
Casing diameter = 4"
Average depth of ground water observed in the boring = 18.7' = El. +216.7

REMARKS:
Drilled ahead of casing to 15' depth; casing blows not reported.

BORING NUMBER AM-27

Ground surface elevation +234.1

13 16 19 20 23	1D	3,8, 10	Green-brown silty fine to medium sand with some gravel, trace clay, topsoil & roots (Fill) (SM)	MEDIUM TO VERY COMPACT SILTY FINE SAND WITH SOME GRAVEL, BRICK FRAGMENTS AND HIGHLY DECOMPOSED SCHISTOSE GNEISS AT BOTTOM, FILL	26.0'
31 32 38 43 59	2D	9,10, 13	Do 1D (Fill) (SM)		
42 458 78 36 40	3D	6, 100/6"	Brown silty fine sand, trace clay layers & gravel (Fill) (SM) Gravel & cobbles 11' to 11.5'		
41 62 52 40 44	4D	4,5,5	Brown gravel, some clay (Mainly Wash) (Fill) (GC)		
53 50 37 123 123	5D	3,7,5	Brown silty fine sand, some gravel (Mainly Wash) (Fill) (SM)	WEATHERED GNEISS	30.0'
	6D	45, 130/6"	Green-brown silty fine to medium sand with/sm gravel & brick fragments (decomposed schist) (SM)		
	1C	65/50	Hard green & brown hornblende schistose gneiss, finely foliated, slightly weathered		

Boring started 10-20-73 , completed 10-20-73
Final depths:
Boring = 30.0' Casing = 25.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 15.0' = El. +219.1

REMARKS:
Probable compact gravel and coarse sand fill at 11' to 11.5' depth.
Dry sample 4D and 5D each required 3 attempts to recover one jar of sample soil which appeared to be possible wash material.
Considerable brick and gravel fragments in wash down to approximately 23' depth.

BORING NUMBER AM-28

Ground surface elevation +230.7

33 65 69 43 41	1D	2,8,8	Dark green-brown silty fine to medium sand, some clay, bits decomposed rock (Fill) (SM) Top: Do, 1D (Fill) (SM) Bot: Gray-brown silty fine to medium sand, some gravel & rock fragments, trace clay layers (Fill) (SM)	SILTY FINE TO MEDIUM SAND, FILL	5.5'
197 112 104 83 95	2D	35,13 14		MEDIUM TO VERY COMPACT DECOMPOSED CHLORITE SCHIST, SILTY FINE SAND	15.5'
	3D	20,33 31	Brown-green silty fine sand, trace rock fragments (SM)		
	4D	100/4"	Do 3D (SM) Soft green hi wthrd chlorite schist, well jtd & fol, iron staining, & talc, s11 decomp 19.5'-20'	WTHRD AND JOINTED CHLORITE SCHIST AND HORNBLENDE MICA-QUARTZ-SCHISTOSE GNEISS	
	1C	60/10	Gray-green quartz hornblende schistose gneiss, 9 diag & 3 fol jts, partial wthrng 22.5', iron staining		
	2C	90/35	Do 2C, 1 fol jt, 4 diag jts, 3" quartz vein at 25', fairly sound 25.5'-25.6'		30.0'
	3C	85/50	Do 2C, 2 fol, 1 diag, 1 vert jt, rel sound, slight iron staining at joints		
	4C	60/60			

Boring started 9-19-73 , completed 9-19-73
Final depths:
Boring = 30.0' Casing = 10.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 14.5' = El. +216.2

BORING NUMBER AM-29

Ground surface elevation +235.2

7 28 34 43 37	1D	1,2,2	Brown-green silty fine to medium sand with some asphalt, gravel & roots (Fill) (SM)	FILL	3.5'
55 54 61 54 53	2D	10,11 10	Green-brown micaceous silty f-m sand, trace quartz, trace rock fgmts (Possible Fill) (SM)	MEDIUM TO VERY COMPACT GREEN-BROWN DECOMPOSED QUARTZ MICA SCHIST, VARYING BETWEEN SILTY SAND AND SA SILT	21.0'
40 47 46 50 50	3D	10,15 16	Red-brown fine sandy silt, trace clay with some quartz fragments (ML)		
	4D	34,29 39	Brown fine sandy silt, trace clay & brown clayey gravel & rock fragments (ML & GC)		
	5D	37, 100/3"	Brown silty fine sand, trace rock fragments (SM)	WEATHERED CHLORITE SCHIST	27.0'
	1C	95/45	Grn-brn wthrd chlorite schist, fol & jtd, 50° fol, 8 diag jts		
	2C	95/75	7 fol & 8 diag jts, iron staining, wthrd	MOD JTD GNEISS	30.0'
	3C	80/75	Rel snd, mod jtd, hornblende-mica schistose gneiss, 7 diag & 1 fol jts		

Boring started 9-17-73 , completed 9-18-73
Final depths:
Boring = 30.0' Casing = 20'
Casing diameter = 4"
Average depth of ground water observed in the boring = 23.5' = El. +211.7

REMARKS:
Drilled ahead of casing from 15' to 20' depth; casing blows not reported.

DEPTH BELOW GROUND SURFACE, FEET

DESIGNED		DATE
DRAWN	IHL	12/74 DATE
CHECKED	SLT & JPG	12/74 DATE
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86	Plans & Geological Sections
to F-A-104	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER • RUTLEDGE • WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H. Mueser

DE LEUW, CATHER & COMPANY ☐
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GENERAL ARCHITECTURAL CONSULTANT
APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-24 to AM-29

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-112

BORING NUMBER AM-30

Ground surface elevation +310.4

10 12 26 47 65	1D	3,6, 11	Medium compact brown silty fine sand, little fine mica (SM)	BROWN SILTY FINE SAND, LITTLE FINE MICA, TRACE HORN-BLENDE, FELDSPAR FRAGMENTS DECOM-POSED ROCK 20.0'
127 156 230 328 451	2D	12,12, 12	Do 1D, trace hornblende fragments (SM)	
	3D	100/6"	Very compact brown silty fine to medium sand (SM)	
	4D	25,100	Do 3D, with some silt layers, traces of horn-blende & feldspar frag-ments (SM)	
	5D	100/6"	Do 3D, numerous rock fragments (SM)	
	1C	95/15	Hi jtd & wthrd brown & lt gry diorite, horiz jtg, thin "poker-chip" pcs 20'-21.5', 22.2'-22.8'	HIGHLY JOINTED AND WEATH-ERED QUARTZ DIORITE 29.0'
	2C	95/30	Wthrd in top on horiz jts at 27', no fol, 5 angular jts, iron stain in top, jtd pcs in bot	
	3C	95/70	Jtd lt gry diorite gneiss 3 horiz jts, 2 angular jts w/iron stain	JOINTED LIGHT GRAY QUARTZ DIORITE GNEISS, SOME IRON STAINING ON JOINTS 42.0'
	4C	90/60	6 diag jts, 3 horiz jts, iron stain on jts	
	5C	95/70	3 diag jts, 2 horiz jts, iron stain on jts, quartz inclusion	
	6C	95/90	Rel sound quartz diorite gneiss, 2 jts	RELA-TIVELY SOUND LIGHT GRAY QUARTZ DIORITE GNEISS, CHLORITE INCLU-SIONS 54.3'
	7C	95/90	Rel sound lt gray diorite gneiss, 4 horiz jts, chlorite inclusions	
	8C	90/90	2 horiz jts (3 pcs) chlorite band at 54.3', altered	
	9C	95/90	2 horiz jts, 3 diag jts, iron stain on diag at 59.2'	CHLORITE 56.3'
	10C	95/90	3 horiz jts, 2 diag jts	SLIGHTLY JOINTED TO RELA-TIVELY SOUND LIGHT GRAY DIORITE QUARTZ-DIORITE GNEISS WITH THIN CHLORITE BANDS AND INCLU-SIONS, TRACE GRANETS, IRREGULAR FOLIA-TION 89.5'
	11C	90/70	4 horiz jts, 3 diag jts	
	12C	95/75	3 horiz jts, 5 diag jts, irregular foliation, chlorite 72'-73'	
	13C	95/90	2 horiz jts, 6 diag jts. talc on jt at 73.3'	
	14C	95/95	Rel sound rock, looks crystalline, not foliated very hard rock, 1 ft/hr drilling rate	
	15C	98/95	Rel snd lt gry diorite gneiss, chlorite band 81' to 81.6', 4 horiz jts, tr garnet, chlorite inclusions	
	16C	80/80	1 diag jt @ 85.2', thin talc deposit, chlorite band 87.4'-87.7'	
	17C	85/85	Rel sound lt gry-grn quartz diorite gneiss, 2 horiz jts	
	18C	95/80	Rel sound lt gry, dark minerals, biotite horn-blende, in core, tr garnet 4 horiz jts	
	19C	100/ 100	Sound light gray, 1 jt almost horizontal	

(CONTINUED)

BORING NUMBER AM-30 (CONTINUED)

20C	95/65	Mod jtd, 3 horiz jts, 1 irregular jt 101.9' to 103' w/thin talc deposit, 2 diag jts @ 104', 105.5' thin talc deposit	SLIGHTLY JOINTED TO RELA-TIVELY SOUND LIGHT GRAY DIORITE AND QUARTZ DIORITE GNEISS WITH THIN CHLORITE BANDS AND INCLU-SIONS, JOINTING IS HORI-ZONTAL TO DIAGONAL
21C	85/80	Rel snd, 2 horiz jts, 3 diag jts w/thin talc deposit on diag, chlorite inclusion	
22C	100/ 85	1 diag jt at 110.5', 2 diag jts at 112', 112.4'	
23C	95/80	5 diag jts, 1 horiz jt	
24C	95/75	Mod jtd, 4 diag jts, 1 horiz jt w/thin talc deposit	
25C	95/90	Sound, 2 diag jts, 2 horiz jts, chlorite inclusion, dip 45°	
26C	85/80	Rel snd, 2 diag jts, 2 horiz jts, thin chlorite veins (1/16")@ 60°, some pyrite, 60° fol	
27C	90/88	2 horiz jts, 1 diag jt angular inclusion, 2" chlorite band at 132'	
28C	98/95	Rel snd, 2 horiz jts, 1 diag jt	144.5'
29C	98/95	2 horiz jts, 2 diag jts, rectangular inclusions	JOINTED 146.5'
30C	98/90	1 horiz jt, 2 20° diag jts 2 50° jts @ 144' & 144.5' with thin talc	
31C	98/70	Mod jtd, hi jtd 144.5'-146.5', 5 diag jts with 1/4"-1/2" calcite deposit thin talc	
32C	98/95	Sound massive gray diorite gneiss	RELA-TIVELY SOUND LIGHT GRAY DIORITE GNEISS
33C	98/95	2 horiz jts, 2 diag jts, lenticular inclusions, thin jt plane 154', calcite filled, slight fol 45°-60°	
34C	98/95	Sound, 3 diag jts, 1 at 162.5' w/thin calcite deposit, no definite fol, very few inclusions, thin pyrite dep on jt faces	
35C	98/95	Rel snd, 3 diag jts, 1 piece = 3.3'	
36C	98/90	2 horiz jts, 2 diag jts, thin horiz calcite filled joints	170.0'

Boring started 10-4-73 , completed 10-16-73
Final depths:
Boring = 170.0' Casing = 22'
Casing diameter = 3-1/2" & 4"
Average depth of ground water observed in the boring = 13.4' = El. +297.0

REMARKS:
Drilled ahead of casing from 10' to 22' depth; casing blows not reported.
Very hard rock coring at approximately 77' depth, drilling rate equals 1 foot per hour.

BORING NUMBER AM-34

Ground surface elevation +312.3

26 100 100 100 126	1D	7,7,8	Medium stiff red-brown silt, trace fine sand, trace clay (ML)	MEDIUM STIFF TO STIFF RED-BROWN SILT 10.0'
132 136 141 192 200	2D	5,13, 14	Stiff gray-brown-red micaceous fine sandy silt, little clay (ML)	
30 30 42 61 100	3D	15,23 32	Compact gray-green silty fine sand with streaks of brown silty fine sand, along weathered joint planes (SM)	COMPACT GRY-BRN SILTY FINE SAND, SOME ROCK FRAG-MENTS 21.0'
100 184 246 300 1150	4D	15,25 38	Do 3D, gray (SM)	
	5D	100/7"	Do 3D, gray, numerous rock fragments (SM)	
	1C	60/0	Jtd & wthrd gry-grn diorite w/chlorite 5 30° jts, silty fine sand on jts	HIGHLY WEATH-ERED, JOINTED GRAY-GREEN HORN-BLENDE DIORITE, POORLY FOLIA-TED 37.0'
	2C	85/35	Do 1C, 9 horiz jts, 3 diag jts	
	3C	65/15	Do 1C, 7 horiz jts, 4 diag jts, staining at jts	
	4C	60/10	Wthrd to 36', friable gry-grn diorite w/chlorite 4 horiz jts, 3 diag jts, staining at jts	SLIGHTLY WEATH-ERED, JOINTED GREEN DIORITE WITH CHLORITE 49.0'
	5C	95/60	Jtd sli wthrd gry-grn diorite w/chlorite, 5 horiz jts, 7 diag jts	
	6C	98/60	5 horiz jts, 4 diag jts, staining & weathering at 45'	
	7C	98/90	Unwthrd gry-grn quartz diorite w/4 horiz & 2 diag jts, staining at jts	
	8C	95/70	Darker minerals, granitic intrusion at 57', 3 horiz jts, 2 diag jts, talc at jts	UNWEATH-ERED, MODERA-TELY JOINTED TO RELA-TIVELY SOUND GRAY-GREEN QUARTZ DIORITE WITH LESSER DARKER MINERALS LIKE BIOTITE; PRESENCE OF PYRITE CALCITE AND HORN-BLENDE, GRANITIC INTRU-SIONS MOSTLY AT 88.5' TO 95', POORLY FOLIATED, MEDIUM GRAINED, JOINTING 20° TO 40°
	9C	98/75	9 horiz jts, 1 diag jt, staining & intrusion of quartzite at jts	
	10C	95/80	3 horiz jts, 2 diag jts, pyrite & hornblende at jts clay on core @ 64'	
	11C	98/90	2 horiz jts, 3 diag jts, talc at joints	
	12C	98/80	3 horiz jts, 4 diag jts	
	13C	98/90	Darker minerals as biotite, 4 horiz jts, 1 diag jt	
	14C	90/55	4 diag jts, 4 vert jts, calcite & talc at jts, fracturing zone 80' to 81'	
	15C	95/75	6 horiz jts, 2 diag jts, diorite 80' to 82'	
	16C	95/85	Quartz diorite core white with black spots, presence of biotite, 3 horiz jts, 1 diag jt	
	17C	98/85	Blocky, 7 horiz jts, granitic intrusion from 89' to 91.5'	
	18C	98/45	6 horiz jts, 1 diag jt, granitic intrusion from 93' to 95'	
	19C	100/ 100	2 horiz jts, 2 diag jts	
	20C	98/70	3 horiz jts, 3 diag jts, thin calcite veins at jts, broken @101.5' to 102', hornblende increases below 101'	

(CONTINUED)

BORING NUMBER AM-34 (CONT'D)

21C	98/98	Jtd, 3 diag jts	122.0'
22C	95/75	1 horiz jt, 6 diag jts, calcite veins at jts, fractured 110'to 111'	RELA-TIVELY SOUND GRAY-GREEN QUARTZ DIORITE WITH PROMINENT GRANITIC INTRU-SION, SOME PYRITE MEDIUM GRAINED, POORLY FOLIA-TED, TYPICALLY 1 JOINT PER FOOT, DIPPING 10° TO 60°
23C	100/ 90	2 horiz jts, 3 diag jts	
24C	95/90	5 diag jts	
25C	100/ 100	Rel snd, 1 horiz jt, 1 diag jt	
26C	98/95	Rel snd, 2 diag jts	
27C	98/90	More biotite, 1/2" quartz vein @ 132.8', 4 horiz jts, 1 diag jt	
28C	98/98	Increased biotite, 2 horiz jts, 2 diag jts	
29C	98/90	Increased biotite, 2 diag jts, 2 horiz jts, talc & pyrite at jts, fol 45°, intrusion of quartz	
30C	100/ 100	Rel sound rock	
31C	98/98	2 diag jts, 1 horiz jt, calcite, pyrite & chlorite at jts	
32C	98/98	2 diag jts, 2 horiz jts, traces of pyrite at jts	
33C	98/98	3 diag jts, trace of pyrite	
34C	98/85	3 diag jts, trace of pyrite & talc at jts	
35C	98/70	Aplite intrusion 165'-166' 5 diag jts, 3 horiz jts, pyrite in jts, 7 jts between 167'- 168'	
36C	95/95	3 diag jts, 3 horiz jts, talc & pyrite at jts	
37C	98/70	6 diag jts, 1 horiz jt, pyrite & talc at jts, presence of quartzite	178.5'

Boring started 11-26-73 , completed 12-10-73
Final depths:
Boring = 178.5' Casing = 25'
Casing diameter = 4".
Average depth of ground water observed in the boring = 13.6' = El. +298.7

REMARKS:
Drilled ahead of casing from 10' to 25' depth; casing blows not indicative of soil consistency.

BORING NUMBER AM-35

Ground surface elevation +322.4

4 6 12 20 31	1D	1,3,3	Stiff red-brown fine sandy silt, trace clay, trace mica (ML)	RED-BRN F SA SILT FILL 5.0'
35 38 81 170 208	2D	7,8, 10	Brown silty fine to medium sand, little mica (SM)	MEDIUM COMPACT BROWN FINE TO MEDIUM MICACEOUS SILTY SAND, RESIDUAL SOIL, GRADING TO SOFT ROCK
	3D	8,11, 11	Do 2D (SM)	
	4D	11,16, 21	Compact brown micaceous silty fine to medium sand (SM)	
	5D	28, 100	Do 4D (SM)	
	Core	NR	Probably soft rock (SM)	
	6D	80, 100	Light gray-brown micaceous silty fine sand with rock fragments (SM)	VERY COMPACT LIGHT GRAY-BROWN SAND, DEC. ROCK 30.0'
	7D	60, 100	Do 6D (SM)	
	NR	50/0	Refusal, top of bedrock	JOINTED TO MOD JOINTED LT GRAY QUARTZ DIORITE, UNWEATH ERED EXCEPT JOINTS, IRON STAINED AND COATED 56.3'
	1C	80/30	Jtd unwthrd gray quartz diorite, 9 horiz jts, 2 diag jts (60°)@ 43.7' & 44', little iron stain on jts	
	2C	98/80	Do 1C, jointed, 1 diag jt @ 46.3'(60°), 2 diag jts @ 47.6' (20°), 1 diag jt @ 48.2' (70°)	
	3C	98/80	Do 1C, jointed, 2 diag jts 2 horiz jts	
	4C	95/75	Do 1C, mod jtd, 3 horiz jts, 1 diag 60° jt @ 55' sli wthrd on jts	
	5C	98/85	Rel snd diorite, 2 horiz jts, 1 vert jt, 2 diag jts, 1 @ 60.5'	
	6C	90/70	Do 5C, 1 steep diag jt 60.8'-61.9', 2 diag jts @ 63.3', 1 diag jt 64.8', chlorite inclusions w/talc irregular foliation	MODERA-TELY JOINTED TO RELA-TIVELY SOUND HORN-BLENDE QUARTZ DIORITE, SOME CHLORITE BANDS, INDIS-TINCT FOLIA-TION, MEDIUM GRAINED, UNWEATH-ERED INCLUDING JOINTS 99.0'
	7C	95/95	Rel snd, 3 diag jts 10° to 20°	
	8C	100/ 100	2 pcs, 2 10° diag jts, 1 horiz jt	
	9C	98/90	5 pcs, 2 chlorite lenses	
	10C	98/98	4 pcs, 4 horiz jts	
	11C	98/90	Rel snd, 1 diag jt @ 76.5' 1 horiz jt @ 78.3', no foliation, 2 pcs 1.7',2.9'	
	12C	98/80	4 horiz jtsm 2 diag jts, 1 jt @ 83.5'	
	13C	98/75	Mod jtd, 9 pcs, 1 diag @ 87' (d.4'), 8 horiz joints chlorite & feldspar bands 86.3'-86.5' chlorite from 89.5'-90'	
	14C	98/55	6 horiz jts, 4 diag jts w/talc, 1 45° jt @ 92', 70° diag jt @ 93'	
	15C	98/98	Rel snd, sli altered, some angular inclusions, chlorite band 97.2'-98.3' irregular foliation	
	16C	98/85	3 horiz jts, 2 diag jts, jointing 101.7'-102.5' w/inclusions, chlorite band 100.2'-100.6'	

(CONTINUED)

BORING NUMBER AM-35 (CONT'D)

17C	98/95	Rel snd, 2 horiz jts, 3 10° diag jts, 1 45° jt @ 106.0'	RELA-TIVELY SOUND LIGHT GRAY HORN-BLENDE QUARTZ DIORITE WITH SOME CHLORITE BANDS AND INCLU-SIONS AND XENOLITHS OF COUNTRY ROCK, INDIS-TINCT FOLIA-TION, UNWEATH-ERED INCLUDING JOINTS
18C	90/85	1 horiz jt , horiz fol, 4 10° diag jts, 1 60° diag jt @ 112'	
19C	98/95	1 50° diag jt @ 112.5', 1 15° diag jt @ 113.5' 4 horiz jts, few inclusions	
20C	90/90	1 30° jt @ 117', 1 45° jt @ 118.5' w/talc, irregular to horizontal foliation	
21C	98/95	Rel snd, 3 horiz jts, 1 45° jt @ 123.5'	
22C	98/98	1 30° jt @ 127', 3 horiz jts	
23C	98/98	1 horiz jt, 1 60° jt @ 129.7', 1 30° jt @ 131.1'	
24C	98/98	No joints in core	
25C	98/ 80	1 hor jt rel fractured, 137.6'-138.4' rock fragmented, possible shear zone	
26C	90/85	4 horiz jts, rel fresh hard rock	
27C	98/98	Rel fresh jt @ 146.2'	
28C	98/98	Sound diorite, no jts, no foliation, occasional quartz bands	
29C	98/90	Sound & mod jtd, 4 diag jts, 3 horiz jts, slight talc, chlorite band 155' to 155.3'	
30C	98/95	Jtd, mostly fresh jts caused by drilling breaks	
31C	95/95	Sound, little talc at bot, filled old jts	
32C	98/98	2 jts, 1 horiz, 1 diag, indistinct foliation, minor inclusions	
33C	95/95	Sound, unjtd, 1 long vert jt 169.2'-171.5', rel fresh jt	
34C	98/98	Snd, slightly jtd, 4 horiz jts, rel fresh, core broken by repeated re-coring attempts	
35C	98/95	Broken as in 34C	
36C	98/85	6 fol jts, inclusions, chlorite quartz layers, little talc on joints	
37C	95/95	Sound, 3 horiz jts, quartz veins	
38C	95/90	Sound, 1/2" vert quartz vein 186'-186.8' & 188.8' to 189.2', vert jt 188.8' to 189', 1 horiz jt.	190.0'

Boring started 10-17-73 , completed 11-1-73
Final depths:
Boring = 190.0' Casing = 40'
Casing diameter = 3-1/2" & 4"
Average depth of ground water observed in the boring = 16.8' = El. +305.6

REMARKS:
Drilled ahead of casing from 10' to 40' depth; casing blows not reported.
Four water pressure tests with packers run in this borehole.

DESIGNED		DATE
DRAWN	IHL	DATE 12/74
CHECKED	SLT & JPG	DATE 12/74
APPROVED		DATE

REFERENCE DRAWINGS

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REVISIONS

DATE	BY	DESCRIPTION

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APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-30 to AM-35

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-113

BORING NUMBER AM-36

Ground surface elevation +320.5

DEPTH BELOW GROUND SURFACE, FEET					
0	26	1D	5,8,7	Stiff light gray silty clay, topsoil, grass roots, some fine to medium sand (CL)	
	44				
	59				
	48				
5	55				
	66	2D	10,15, 20	Compact light gray fine sandy silt (decomposed diorite gneiss)(ML)	COMPACT TO VERY COMPACT LIGHT GRAY & LIGHT BROWN SILTY FINE SAND (MAINLY DECOM-POSED DIORITE GNEISS MATERIAL WITH VARYING AMOUNTS OF ROCK FRAGMENTS
	76				
	97				
10	104				
	29	3D	16,18, 22	Do 2D, silty sand (SM)	
	30				
	33				
	29				
15	30	4D	28,32, 33	Do 3D, very compact, trace rock fragments (SM)	
	29				
	19				
	37				
20	21				
	27	5D	17,39, 47	Do 3D, very compact (SM)	
	47				
	74				
	127				
25	183	6D	17,30, 64	Do 3D, very compact (SM)	
	382				
	687				
	288		69,	Do 3D, many rock	
30	488	7D	100/2"	fragments (SM)	31.0'
		1C	60/10	Gry-brn coarse grained wthrd quartz diorite gneiss partly decomposed, hi jtd	GRAY PORHYRITIC QUARTZ DIORITE GNEISS, PARTLY DECOM-POSED AT TOP, WEATHERED, JOINTED, SHEARED
35					
		2C	55/20	hi jtd, sli wthrd, much iron staining at jts only, multiple sets of joints	
40					
		3C	75/10	hi jtd, sm shear & vert jtd 40°-42', slightly decomposed 43'-44.5'	
45					
		4C	75/45	Mod jtd & wthrd, 12 transverse jts, crushing at 45.2'-45.5'	
50					
		5C	98/70	Sli wthrd, mod jtd, iron stain on jts, 2 fol jts, 9 diag jts, sm decomposed 52.7'-53'	53.0'
55				Grn-gry chloritic diorite 53' to 55.3', sli wthrd, mod jtd, iron stained, change back to diorite gneiss	JOINTED, INTER-BEDDED DIORITE GNEISS WITH CHLORITE SCHIST, OCCASION-ALLY WEATHERED
		6C	95/85		
60		7C	98/50	Mod jtd, sli wthrd, change to grn chloritic schist, jtd & wthrd 61'-62'	
		8C	98/50	Grn-brn wthrd, partly decomposed & sheared chloritic schist 62' to 65.5'	68.0'
65				Brn & gry quartz diorite 66.5-68', dark grn-black wthrd & decomposed mica schist 68.5'-69.5', probable shear	
		9C	98/40		
70				Grn chlorite & phyllite 71'-72', change to gray gneiss 72'-73.3', again change to chlorite schist 73.3' down	GREEN CHLORITE SCHIST WITH MICA SCHIST & DIORITE BANDS, STEEPLY FINELY FOLIATED, MANY FOLIATION JOINTS, CRUSHED ZONES 82.5'-83.2' & 92.7'-93'
		10C	95/55		
75					
		11C	95/55	Mica schist band in top of core 6" thick. lt gry-grn chloritic schist w/some talc, few jts	
80					
		12C	100/ 80	Soft lt blue-gry talc, finely fol & greasy 79.5' to 82.5', changing to grn-gry-blk mica schist & chlorite, crushed & jtd 82.5'-83.2'	
85					
		13C	85/75	Gry-grn chlorite schist w/numerous quartz veins, 80°-85° fol, rel snd, mod jtd, 5 diag jts, 1 fol jt	
90		14C	85/80		
				Wavy near vert fol, up to 1/4" quartz veins, possible shear zone, talc & mica schist 92.7'-93'	95.0'
95		15C	90/80	Soft blue-gry talc 93'-93.7' interbedded mica schist, change 95' to gry-blk-grn, fine grained diorite gneiss	
100		16C	100/ 85	Rel snd, mod jtd indistinct fol diorite gneiss, 14 jts 3 fol its	
105		17C	98/50	Gry-grn chlorite schist, well jtd, shear zone & friable mica schist 104.5'-105', gry diorite gneiss 105'-106.8', vert jtd sheared & crushed	

(CONTINUED)

BORING NUMBER AM-36 (CONTINUED)

110		18C	95/20	Grn chlorite schist w/ quartz veins, hard quartz band 107.5'-108.1', near vert fol & jointing	GREENISH CHLORITE SCHIST WITH VEINS OF QUARTZ & BANDS OF PHYLLITE AND DIORITE GNEISS WITH NUMEROUS SHEAR ZONES STEEPLY DIPPING & TIGHT FOLDING, TALCOSE, CHLORITE INDICAT-IVE SEVERE METAMOR-PHISM 133.6'
				Variable fol, well jtd on fol 111'-112.4' quartz veins & pyrite, sli talcy 115'-115.5'	
115		19C	90/45		
		20C	98/95	Blue-grn talcy chlorite schist, evidence severe folding & fol changes, rel snd, mod jtd, 4 jts mainly fol	
120					
		21C	95/90	Grn vert fol chlorite schist w/numerous quartz veinlets, stongly fold, mod jtd, rel snd, only 2 jts	
125		22C	90/45	Grn & white w/large pyrite & quartz crystals, badly sheared, 125.5-126.5' vert jtg & fract 127'-127.5' & 128.5'-129'	
		23C	98/65	Dk grn-blk chlorite schist w/white quartz well jtd & sheared	
130		24C	90/50	Large quartzite from 133.6' unfoliated, mod to well jtd	HARD WHITE QUARTZITE WITH CHLORITE INCLU-SIONS 141.0'
		25C	98/50	Well jtd, unfoliated hard white quartzite 137'-140', remainder grn fol chlorite schist w/some quartz veins	
135					
		26C	98/85	Little quartz inclusion 141.5'-141.6', grn strongly fol chlorite mica schist, 142'-143.6' soft talcose chlorite schist	GREEN STRONGLY FOLIATED CHLORITE & MICA SCHIST, NEAR VERT FOL WITH SOFT TALC, PHYLLITE AND SOME QUARTZ VEINS, MOD JOINTED 158.0'
140					
		27C	95/90	Grn hi folded, vert fol, chlorite schist w/some phyllite & quartz veins 149.5'-150.5' multiple jts	
145					
		28C	95/85	Grn talcose phyllite & chlorite schist, rel snd, mod jtd, little quartz veins	DECOM CHLORITE & PHYLLITE, MAJOR SHEAR 164.0'
150					
		29C	90/70	Grn vert foliated, chlorite & phyllite decomposed to clay at about 158.5', major shear	CHL SCH 166.0'
155					
		30C	20/10	Decomposed chlorite schist washed out. decomposed zone 158.5'-164', grn chlorite schist 1.2' @ bot	HI JTD DIO GNS 169.6'
160					
		31C	85/30	Grn chlorite schist, hi jtd, change at 166' hi jtd gry diorite gneiss	CHLORITE SCHIST W/BANDS OF QUARTZ 175.2'
165					
		32C	98/15	Gry hi jtd diorite gneiss 168.5'-169.5' change to grn-gry, var fol chlorite schist w/bands quartz & pyrite, sheared 170.5'-171' vert jts 171.5'-173'	JOINTED DIORITE GNEISS 180.5'
170					
		33C	95/40	Grn chlorite schist, hi jtd, vert jt 173'-174', 174.2' to 174.5', crushed sheared 174.8'-175.2', change gry-white dark diorite gneiss	
175					
		34C	98/60	Do 33C bot, diorite gneiss hi jtd, change @ 180.5' to dk gry strongly fol quartz mica hornblende schist, well jtd	MOD JTD TO REL SOUND HORN-BLENDE MICA SCHIS-TOSE GNEISS WITH CHLORITE SCHIST INCLU-SIONS 200.0'
180					
		35C	98/70	Mod jtd hornblende mica quarts schistose gneiss, stongly fol 60°, 4 fol jts 5 horiz jts 10°	
185					
		36C	100/ 100	Rel snd, mod jtd, 2 horiz jts 10°, 1 diag jt 20°, bands chlorite schist 190.5'-191'	
190					
		37C	98/90	Rel snd, mod jtd repeated chlorite bands, 5 fol, 3 diag jts	
195					
		38C	98/80	Rel snd, mod jtd 8 horiz jts, 3 fol jts, chlorite bands & hi-angle fol	
200					

Boring started 10-22-73 , completed 10-31-73
Final depths:
Boring = 200.0' Casing = 30'
Casing diameter = 4"
Average depth of ground water
observed in the boring = 20.2' = El. +300.3

REMARKS:
Drilled ahead of casing from 10' to 30' depth; casing blows not indicative of soil consistency.
Observation well consisting of 1-1/2" steel pipe installed with tip at 180' depth.
Four water pressure tests with packers run in this borehole.

BORING NUMBER AM-37U

Ground surface elevation +311.6

0	13	1D	5,6,7	Medium compact brown silty fine sand, tr clay, topsoil, roots (Fill)(SM)	SI F SA FILL 3.0'
	43				
	49				
	51	2U	P	Gray-brown & green sandy & clayey silt (Decomposed Rock) (ML)	GRN-BRN MED TO V COMP SILTY F-M SAND, DECOM-POSED HORN-BLENDE SCHIST 15.5'
5	73				
	202	3D	9,10, 15	Medium compact green & brown silty fine sand (Decomposed hornblende schist) (SM)	
	250				
	247				
	267				
	271				
10	87	4D	47,40, 70	Do 3D (SM)	
	301				
	497				
	1200				
		5D	100/6"	Do 3D, numerous rock fragments (SM)	HIGHLY JOINTED TO MODERA-TELY JOINTED SLIGHTLY WEATH-ERED LIGHT GRAY QUARTZ DIORITE GNEISS 35.0'
15		1C	50/10	Sli wthrd, hi jtd, quartz diorite gneiss 19.5'-20' w/sm broken hornblende schistose gneiss	
		2C	90/60	Do 1C, indistinct hi-angle fol & hornblende gneiss bands, quartz veins, mod jtd, sli wthrd	
20					
		3C	95/85	Do 2C, mod jtd, rel snd, rel unwthrd, 5 horiz jts, 2 45° jts, 2 60° jts at 28.5'	
25					
		4C	85/40	Rel snd, unwthrd, mod jtd, core broken in drilling	
30					
		5C	85/80	Rel snd, unwthrd, mod jtd, 3 diag jts, 2 horiz jts	
35					
		6C	98/98	Rel snd, unwthrd, sli jtd, 3 horiz jts, 1 diag jt	SLIGHTLY JOINTED TO RELA-TIVELY SOUND UNWEATH-ERED GRAY QUARTZ DIORITE GNEISS 54.0'
40					
		7C	98/95	Rel snd, mod jtd, 6 diag jts, vert jt w/quartz vein 43.1'-44.2', fol 80°	
45					
		8C	98/97	Rel snd, unwthrd & mod jtd occ hornblende schistose bands, 5 horiz jts, 3 vert jts 75°-80°, 1 diag jt 50°	
50					
		9C	96/90	Rel snd, sli jtd, 3 quartz & hornblende schist inclusions, 6 horiz jts, chlorite schist band 54.5'-55'	LIGHT GREEN HORN-BLENDE SCHISTOSE GNEISS/ MICA SCHIST 64.0'
55					
		10C	90/80	Well jointed, fractured & strongly foliated, 3 horiz jts, 1 vert jt at 55°, some chlorite inclusions, variable foliation	
60					
		11C	90/50	Well foliated, mod jtd, 4 horiz jts 30°, 3 fol jts 50°, 1 vert jt, talcy chlorite 63'-64.5', probable shear	HI TO MOD JTD LT GRN HORN-BLENDE SCH GNS W/ CHLORITE SCHIST BANDS 73.0'
65					
		12C	90/15	Hi jtd & shattered, fract evidence @ 65.5' & bet 68' to 69', possible fault & contact zone, 6 horiz jts, 8 diag jts	GRN CHLOR SCHIST, PHYLLITE 77.0'
70					
		13C	90/85	Rel snd, mod jtd, w/bands of chlorite schist 69.7' to 70', change to phyllite 72.8', 2 60° fol jts, 3 10°-15° horiz jts	GRY-GRN HORN-BLENDE SCHISTOSE GNEISS W/ CHLORITE SCHIST BANDS 86.0'
75					
		14C	95/40	Chlorite schist & phyllite w/thin qtz & calcite veins well jtd, shear 76.5'-77'	
80					
		15C	95/60	Gry-grn hornblende mica schistose gneiss w/bands chlorite & phyllite, mod jtd, 4 diag jts 30°, 4 horiz jts 10°-15°, 45°-50° foliation	
85					
		16C	95/75	Mod jtd, 10 jts, 5 of fol jts, changes at 86' to schistose gneiss with chlorite inclusions	
90					
		17C	90/0	Schistose gneiss w/several chlorite bands, hi jtd/w slickensides, probable shear zone	
95					
		18C	85/40	Well fol, coarse grained & jtd w/ chlorite inclusions quartz veins, talc on jts 60° fol	
100					
		19C	98/35	Rel snd, jtd, evidence of shear & slickensides 99'-100' w/chlorite & phyllite inclusions, mainly diag jts 10°-60°	
105					
		20C	98/30	Well jtd w/numerous chlorite inclusions, steep fol shear & slickensides 101' to 101.5'	

(CONTINUED)

BORING NUMBER AM-37U (CONTINUED)

105		21C	98/25	Multiple jtg w/slickenside to 106' part of shear noted in core from 20C	JOINTED GREEN-GRAY HORN-BLENDE SCHIS-TOSE GNEISS WITH CHLORITE AND PHYLLITE INCLU-SIONS, QUARTZ VEINS, 60°FOL 125.0'
				Mod jtd, strong fol, 3 fol jts 45°, 3 diag jts 70° 2 horiz jts 10°-15°	
110		22C	70/35	Mod jtd, 6 jts 10°-30°, 1 jt 60° @ 115'-115.5'	
		23C	98/65	Jointed with chlorite & quartz inclusions & veins, 10 jts 15°-45°	
115					
		24C	98/70	Jtd w/quartz veins, long vert jt 121.5'-123' w/talc 8 horiz jts 10°-15°, 50% fresh	
120					
		25C	98/65	Mod jtd w/chlorite & diorite inclusions, 4 horiz jts 10°-20°, 1 vert jt at top, 2 diag jts 30°-45°	
125					
		26C	98/85	Mod jtd w/more diorite & some chlorite, 5 horiz jts 10°-15°, 3 diag jts >30°, phyllite & slate band with vert jt 133.5'-134.5'	MODERA-TELY JOINTED TO RELA-TIVELY SOUND GREEN-GRAY HORN-BLENDE GNEISS AND QUARTZ DIORITE GNEISS 147.0'
130					
		27C	90/90	Alternating hornblende gneiss & quartz diorite gneiss, mod jtd, 6 jts	
135					
		28C	96/90	Alternating hornblende schistose gneiss & quartz diorite gneiss w/chlorite bands, mod jtd, 6 horiz jts 10°-15°	
140					
		29C	92/90	1" quartz pc @ top, mod jtd, 7 horiz jts 10°-15°, 4 fol jts 45°-50°, sm talc on jts	
145					
		30C	98/80	7 15° jts, 1 60° jt @ 149' altered chlorite schist 147'-148', 40°-45° fol	
150					
		31C	96/40	5 horiz jts, thin talc dep on jt @ 151.5', 1/4" quartz veins w/pyrite, 151.5'-152' 75° jt, 7 diag jts	JOINTED GRAY QUARTZ DIORITE GNEISS WITH CHLORITE SCHIST BANDS, 45° FOLIA-TION 169.5'
155					
		32C	95/35	Jtd gry-grn quartz diorite gneiss, tr hornblende, vert jt 156'-156.6', 45° fol, 8 jts 25°, 2 diag jts 159.5'	
160					
		33C	95/55	6 horiz jts, 4 diag jts, several small pieces, tr talc deposit on joints	
165					
		34C	90/20	Jtd gray, 2 horiz jts, 7 10° jts, 1 80° jt 167.8' to 168.7', thin talc deposit with pyrite	
170					
		35C	98/55	3 fol jts, 5 20° jts, 1 vert jt 171.6'-172.2', little grn talc, 3 quartz veins 1/8"-1/4", 80° fol w/pyrite 173'-174'	
175					
		36C	98/70	Mod jtd w/6 horiz jts, vert fol 175'-176.6' with quartz-feldspar intrusions 50° jt 175.5', 4 diag jts	MODERA-TELY JOINTED TO HIGHLY JOINTED GRAY QUARTZ DIORITE GNEISS 190.0'
180					
		37C	98/75	Mod jtd, 8 25° jts, 30°-40° foliation	
185					
		38C	80/75	Hi jtd, 6 fol jts, 8 horiz jts, 4 diag jts, 1 70° jt at 185', chlorite band 187'-187.5'	
190					
		39C	98/25	1 Horiz jt, 7 diag jts, chlorite bands in diorite to 189' altered to 190'	
		40C	98/15		

Boring started 10-30-73 , completed 11-13-73
Final depths:
Boring = 190.0' Casing = 19'
Casing diameter = 3-1/2" & 4"
Average depth of ground water
observed in the boring = 22.5' = El. +289.1

REMARKS:
Drilled ahead of casing from 14' to 19' depth; casing blows not reported.
Mechanical breakdown of drilling rig caused breakage of the rock sample in core No. 3C.

BORING NUMBER AM-38

Ground surface elevation +313.6

0		1D	4,7, 12	Medium compact brown silt & clayey fine sand (decomposed schistose gneiss, micaceous & iron stained) (SM)	MEDIUM TO VERY COMPACT BROWN SILTY FINE SAND, MAINLY DECOM-POSED MICA-CEOUS QUARTZI-TIC AND IRON STAINED SCHIS-TOSE GNEISS, OCCA-SIONAL MICA SCHIST 29.0'
		2D	35,42, 54	Do 1D, very compact (SM)	
5					
		3D	27,40, 61	Do 1D, very compact, numerous rock fragments (SM)	
10					
		1C	80/0	Brown decomposed schistose gneiss, highly micaceous, soft & jointed, part silty fine sand	
15					
		2C	65/0	Do 1C, hi wthrd, jtd, decomposed, sm sandy silt & clayey sand, all broken & crumbled	
20					
		3C	55/0	Do 1C, hi wthrd, jtd, decomposed, mainly mica schist, iron stained	
25					
		4C	70/15	Do 1C, wthrd & mod jtd, dk gray mica & chlorite schist, top of wthrd rock @ 29', gry-grn chlorite mica schist	WEATH-ERED AND JOINTED CHLORITE AND MICA SCHIST 39.0'
30					
		5C	75/50	Sli wthrd, mod jtd, finely foliated 60°	
35					
		6C	85/45	Do 4C, slightly wthrd, mod jtd, 3 fol jts, 6 diag jts, 1 vert jt 37'-38', slight iron staining	
40					
		7C	95/50	Do 4C, rel snd, unwthrd, mod jtd, quartz veins, 11 fol jts, 3 diag jts	UNWEATH-ERED, MODERA-TELY TO HIGHLY JOINTED CHLORITE SCHIST WITH SOME TO SEVERAL QUARTZ VEINS AND INCLU-SIONS 62.5'
45					
		8C	80/20	Do 4C, unwthrd, hi jtd & fractured, multiple jtg 45'-47', probable fault zone	
50					
		9C	90/30	Do 4C, unwthrd, jtd w/bands of quartz inclusions 49.5' to 50', 8 fol jts, 10 diag jts, 50° fol	
55					
		10C	95/40	Do 4C, multiple jt pattern, 6 fol jts, 8 diag jts, 1 vert jt 54.5'-55', little talc on jts, thin qtz veins	
60					
		11C	95/30	Do 4C, unwthrd, jtd, 4 fol jts, 8 diag jts, large quartz inclusion 60.5' to 61.5'	
65					
		12C	85/10	Gry-grn, sli wthrd, jtd chlorite & mica schist, evidence crushing/shearing 62.5'-64.5', possible fault & contact zone	CHLORITE & MICA SCHISTS, FRACT & FAULT/ SHEARED 69.5'
		13C	95/50	Do 12C, jtd, unwthrd, 7 fol jts, 8 diag jts, 2 vert jts, some wthrng 68'-68.7'	
70					
		14C	85/55	Schistose gneiss 69.5'-73', change to gry-grn chlorite schist 73'-74', rel snd, mod jtd, 4 diag jts, 3 fol jts, variable foliation	COMPLEX INTERBEDS, SCHISTOSE GNEISS, MICA SCHIST AND CHLORITE SCHIST, FAULTING 82.0'
		15C	95/60	Schistose gneiss & friable mica schist- probable fault	
75					
		16C	98/80	78'-78.5' grn fine chlorite schist, 78.5'-82' gry-grn schistose gneiss, mod jtd, rel snd	
80					
		17C	98/90	Gry-grn-black schistose gneiss, occ qtz bands, chlorite schist, rel snd, mod jtd, 1 fol jt, 4 diag jts	SCHISTOSE GNEISS W/ SHEAR AT 87.5' TO 88' 88.0'
85					
		18C	98/85	Do 17C, crushing/shear 87.5'-88', change to gray dioritic gneiss 88' down, band chlorite schist 86.5' to 87'	
90					
		19C	98/95	Rel snd, sli jtd, 2 diag jts, rel fresh jts	
95					
		20C	98/90	Rel snd, sli jtd, 4 fol jts, 2 diag jts, 1 vert jt 99'-99.7'	
100					
		21C	85/85	Rel snd, sli jtd, 4 diag jts, 1 fol jt, rel fresh jts, foliation variable	

(CONTINUED)

BORING NUMBER AM-38 (CONTINUED)

105		22C	98/95	Rel snd, mod jtd, 3 diag jts, 1 fol jt, 1 vert jt, 106'-106.5', foliation indistinct & variable	RELA-TIVELY SOUND, SLIGHTLY JOINTED GRAY DIORITE GNEISS WITH OCCA-SIONAL CHLORITE AND MICA SCHIST INTERBEDS, POSSIBLE SHEAR/ FAULT AT 112.5', JOINTS RELA-TIVELY FRESH, QUARTZ VEINS FREQUENT 150.0'
				Rel snd, sli jtd, 2 fol jts, 3 vert jts, sm chlorite & mica schist w/possible shear at 112.5'	
110		23C	98/95		
		24C	98/95	Rel snd, sli jtd, chlorite vein 113'-113.5', 4 diag jts, 2 fol jts, rel fresh jts	
115					
		25C	90/90	Rel snd, sli jtd, 5 diag jts, 2 fol jts	
120					
		26C	98/95	Rel snd, sli jtd, 4 diag jts, 2 fol jts	
125					
		27C	98/80	Rel snd, sli jtd, variable foliation, 5 diag jts, 2 fol jts, 0.2' quartz vein 129.5'-129.7', slight talc sm jts, rest rel fresh	
130					
		28C	98/85	Rel snd, sli jtd, 3 diag jts, 3 fol jts	
135					
		29C	95/80	Lt gry quartz diorite gneiss w/sm hornblende, rel snd & mod jtd, foliation variable, 10 jts	
140					
		30C	95/95	Rel snd, sli jtd, 3 diag jts rel fresh, 1 vert jt at 144.2'-144.5'	
145					
		31C	98/97	Rel snd, mod jtd, 3 fol jts, rel fresh jts	
150					
		32C	98/80	Rel snd, mod jtd, fol & mineral changes 150' to 151.5' to chlorite schist & 152.5'-153', vert jt & crushing 152'-153'	REL SND, MOD JTD HI-ANGLE FOLIATION SHEAR 152.5' TO 153.0', MAINLY CHLORITE SCHIST, GENERALLY DISTURBED 150'-156' 163.5' CHLORITE SCHIST 167.0' REL SND, MOD JTD, STRONGLY FOLIATED, VERTICALLY LAMINATED CHLORITE SCHIST WITH PHYLLITE AND QUARTZ VEINS, MICA SCHIST AND SHEAR 174' TO 175.2' 189.5'
155					
		33C	96/90	Rel snd, mod jtd steep fol 80°, 4 vert jts, 2 @ 153.5' 1 from 154.5'-155.5', 1 from 156'-156.5', 3 diag jts, chlorite band 156.5' to 156.8'	
160					
		34C	98/90	Rel snd, mod jtd, 3 fol jts & 5 diag jts, band chlorite schist 159'-160'	
165					
		35C	90/90	Rel snd, mod jtd, 8 jts, gradual transition to chlorite & mica schist 163.5'	
170					
		36C	95/90	Rel snd, strongly foliated grn chlorite schist, 4 marked fractures 167'-168' 1 fol jt & 1 diag jt	
175					
		37C	98/75	Do 36C, rel snd, hi jtd 174'-175.2' in mica schist probable shear zone 174' to 175.2', fol 85°	
180					
		38C	98/96	Rel snd, sli jtd, 3 diag jts, several thin phyllite bands & quartz veins	
185					
		39C	98/96	Rel snd, sli jtd, 3 fol jts, 2 diag jts, multiple thin quartz veins, 2" thick phyllite band at 180.5'	
		40C	90/90	Rel snd, mod jtd, 3 fol jts, 4 diag jts	

Boring started 10-16-73 , completed 10-24-73
Final depths:
Boring = 189.5' Casing = 25'
Casing diameter = 3-1/2" & 4"
Average depth of ground water
observed in the boring = 25.0' = El. +288.6

REMARKS:
Drilled ahead of casing to 25' depth; casing blows not reported.
Four water pressure tests with packers run in this borehole.

(CONTINUED)

DESIGNED			
DRAWN	IHL	12/74	
CHECKED	SLT & JPG	12/74	
APPROVED			

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86to	Plans & Geological Sections
F-A-104	

REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. NUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

NUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N.Y.
SUBMITTED William H. Nueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-36 to AM-38

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-114

BORING NUMBER AM-40

Ground surface elevation +290.4

0				
20	1D	3,5,7	Stiff brown sandy & clayey silt with some organic material, topsoil, roots (Fill) (ML)	DECOMPOSED GNEISS, SILTY SAND AND 4" TOPSOIL 9.0'
31				
76				
131				
259			Very compact brown silty fine sand (Decomposed Schistose Gneiss) (SM)	
5	2D	38,57, 79		
268				
425				
788				
900				
10	1C	85/10	Brown & green-brown, wthrd & jts coarse grained schistose gneiss, iron stained, 45° fol, 8 fol jts, 10 diag jts	GRY-GREEN WEATHERED AND JOINTED SCHISTOSE GNEISS AND HORNBLENDE SCHISTOSE GNEISS WITH IRON STAINING AT JOINTS SOME CHLORITE VEINS AND TALC EVIDENT, MULTIPLE JOINTING 37.0'
15	2C	90/20	Do 1C, wthrd & jtd, 10 diag jts, 5 fol jts, iron staining & talc on joints	
20	3C	70/0	Do 1C, wthrd & crushed gneiss 19'-20.5', vert jointing 20.5'-21', iron staining, slightly decomposed 23'-23.5', pos shear	
25	4C	95/25	Do 1C slightly wthrd, mod jtd, sheared 23.5'-24', multiple jts 24'-26.5', rel snd unwthrd mtl 26.5' to 28', 60° fol	
30	5C	98/30	Unwthrd jtd hornblende schistose gneiss, 8 fol jts, 11 diag jts, some chlorite veins 29'-30'	
35	6C	98/30	Do 5C, mod jtd, mod wthrd, 10 diag jts, 3 fol jts, slight weathering 36'-36.5'	
40	7C	70/60	Do 5C, rel snd, mod jtd unwthrd, 5 diag jts, 2 fol jts, fol change 39.5° to 40.5° w/evident chlorite & quartz intrusion	GRY-GREEN UNWTHRD REL SND MOD JOINTED HORNBLENDE MICA SCHISTOSE GNEISS W/OCC BANDS OF CHLORITE AND QUARTZ, PROBABLE SHEAR ZONE 59' TO 60' 61.0'
45	8C	95/70	Unwthrd, rel snd, mod jtd 5 diag jts, 1 fol jt & 1 vert jt 45'-45.5'	
50	9C	70/60	Unwthrd, rel snd, mod jtd 2 fol jts, 2 diag jts, slight staining & talc on joints	
55	10C	95/90	Rel snd, unwthrd, slightly jointed, 3 fol jts, 2 diag jts, possible shear 53.0'	
	11C	96/80	Vein chlorite schist 54' to 54.7', 4 fol jts, 4 transverse jts, rel snd, mod jtd	
60	12C	95/50	Gneiss changes @ 61' to chlorite mica schist, shear & quartz vein 59' to 59.5', change in fol, friable & flaky, thin quartz veins in schist	CHLORITE SCHIST & PHYLLITE W/OCC BANDS SCHISTOSE GNEISS, SHEARED 63.5' TO 65.5' 74.0'
65	13C	98/30	Chlorite mica schist, jtd, fract & sheared, wthrng & decomp 65'-65.5', band of gry sch gns 65.5'-67' changes back to chl sch	
70	14C	98/60	Finely laminated phyllite unwthrd, rel snd, mod jtd occ bands schistose gneiss, 71.5'-72' 5 diag jts	REL SND SCHISTOSE GNEISS 81.0'
75	15C	98/80	Phyllite changes to chlorite schist 72.5-74', Gray rel snd, mod jtd sch gns 74'down w/occ chlorite	
80	16C	80/65	Schistose gneiss w/band chlorite & mica schist, steep fol, 8 fol jts, 2 diag jts, slickensides	GREEN CHLORITE SCHIST, PHYLLITE & MICA SCHIST 88.0'
85	17C	85/55	Grn chlorite schist w/sm blk mica schist band & phyllite, unwthrd, mod jtd	
	18C	70/65	possible shear 81'-82'	
90			Do 17C, sm shear 86', phyllite, rel snd, unwthrd mod jtd, changes to schistose gneiss @ 88'	GRAY REL SND DIORITIC AND SCHISTOSE GNEISS W/OCC BANDS & LENSES CHLORITE SCHIST
	19C	98/90	Rel snd, unwthrd, sli jtd dioritic & schistose gns	
95	20C	98/98	Do 19C, band chlorite schist 95'-95.5', phyllite 96'-97'	
100	21C	95/95	Rel snd, mod jtd, unwthrd schistose gneiss, band of chl schsit 99.7'-100' & 102.2'-102.5', 2 fol jts	

(CONTINUED)

BORING NUMBER AM-40 (CONTINUED)

105	22C	98/80	Rel snd, unwthrd, sli jtd schistose gneiss, chlorite schist band 102.2'-103.4' & 106.6'-106.8', 1 fol jt, 2 diag jts, sm slip & cleavage in chlorite schist	108.0'
110	23C	80/70	Rel snd, unwthrd, sli jtd, change @ 108' to hornblende gneiss, fol 60°, 2 diag jts, 1 vert jt, 1 fol jt	REL SND GRY-GREEN HORNBLENDE SCHISTOSE GNEISS, MOD JTD, THIN QUARTZ VEINS 125.0'
115	24C	98/75	Var fol, unwthrd, rel snd, mod jtd, 6 diag jts, 3 fol jts, thin quartz veins	
	25C	95/70	Gray diorite gneiss 116'to 119', gry-grn horn schists w/qtz veins 119'down, rel snd, unwthrd, mod jtd, 9 diag jts, 2 fol jts	
120	26C	98/90	Gry-grn horn sch gneiss w/sm qtz veins, rel snd, unwthrd sl jtd, 7 diag jts var fol jts	
125	27C	98/75	Rel snd, mod jtd, var fol, chlorite schist 125'-127' 7 128'-129', 3 fol jts, 7 diag jts	RELATIVELY SOUND, MODERATELY JOINTED CHLORITE SCHIST 145.0'
130	28C	96/80	Grn chlorite schist, rel snd, unwthrd, mod jtd, 5 fol jts, 3 diag jts fol 50°	
135	29C	90/85	Rel snd, unwthrd, mod jtd, 5 fol jts, 4 diag jts, quartz bands 137'-138'	
140	30C	98/90	Unwthrd, rel snd, mod jtd 4 fol jts, 3 diag jts fol 50°	
145	31C	98/85	Rel snd, mod jtd, unwthrd change 143.2', triple set jts 144'-144.5', 4 fol jts 3 diag jts, coarse grained schistose gneiss 145'-147' fol 50°	REL SND MOD JTD GRAY DIORITIC GNEISS W/SOME QUARTZ VEINS AND CHLORITE BANDS 159.0'
150	32C	70/60	Rel snd, mod jtd, unwthrd, 2 fol jts, 1 diag jt, band chlorite schist 150.5' to 151.3'	
155	33C	90/35	Rel snd, hi jtd, unwthrd, 14 diag jts, 6 fol jts, chlorite & mica schist inclusions 153.5'-154', multiple jt pattern	REL SND MOD JTD GREEN CHLORITE SCHIST 168.5'
	34C	95/90	Rel snd, mod jtd, 2 fol jts, 4 diag jts, fine grained chlorite schist 159', 2 vert jts 158 to 158.5' & 158.5'-159'	
160	35C	95/80	Grn rel snd chlorite schist, mod jtd, some fracturing 159.8'-160.2' & 160.7'-161', 3 fol jts, 8 diag jts	
165	36C	95/85	Do 35C, rel snd, mod jtd, 3 fol jts, 5 diag jts	
170				

Boring started 10-12-73 , completed 10-19-73
Final depths:
Boring = 168.5' Casing = 20'
Casing diameter = 3-1/2" & 4"
Average depth of ground water observed in the boring = 15.2' = El. +275.2

REMARKS:
Drilled ahead of casing from 9' to 20' depth; casing blows not reported.
Four water pressure tests with packers run in this borehole.

BORING NUMBER AM-41U

Ground surface elevation +274.0

0				
10	1D	2,3,5	2"Topsoil, loose brown clayey silt w/roots (Fill) (ML)	FILL 4.0'
8				
4	2U	P	Silty sand(Possible Fill) (SM)	
15				
49				
5	3U	P	Brown silty f-m sand, tr gravel (SM)	
37			Do 3U (SM)	
45				
72	4D	6,12 17		
106				
223			Loose brown fine to coarse micaceous sand, some silt, some gravel (SM)	MICACEOUS SILTY SAND, TRACE GRAVEL, DECOMPOSED ROCK 25.3'
59	5D	12,8, 9		
80	6D	P	Do 5D (SM)	
177				
540			Very compact brown-gray micaceous silty medium to fine sand, some rock fragments (Decomposed Rock) (SM)	
1100				
15	7D	88, 144, 150/2"		
	8D	160/5"	Very compact gray-green micaceous silty medium to fine sand (Decomposed Rock) (SM)	
20				
	9D	150/4"	Do, 8D (SM)	HIGHLY WTHRD & JOINTED HORNBLENDE GNEISS 31.4'
	1C	65/10	Brn hi wthrd & jtd, jts 20°-75°, hornblende gneiss with iron stains	
25			Top: Do 1C	
30	2C	60/5	Bot: Gry-grn unwthrd & mod jtd hornblende gneiss, broken & decomposed horiz zone @ 33.3' to 33.5'	
35	3C	95/25	Gry-grn unwthrd, jtd & mod broken hornblende gneiss	
40	4C	90/45	Do 3C, unwthrd & mod jtd, broken horiz zone with some slickensides at 41.0' to 41.6'	
45	5C	95/55	Do 4C, with 2 small broken horiz zones of 1" to 2" at 44.1' and 48'	
50	6C	100/ 35	Do 4C, with small broken horiz zone of 1" at 50.2'	
55	7C	98/40	Do 4C	UNWEATHERED AND JOINTED TO MODERATELY JOINTED HORNBLENDE GNEISS, TALC ON JOINTS THROUGHOUT WITH NUMEROUS CHLORITE PATCHES AND LENSES
60	8C	100/ 70	Unwthrd, mod jtd hornblende gneiss	
65	9C	98/40	Do 8C with 45° to 65° jts	
70	10C	90/35	Do 8C, with horiz to 25° jt, broken zone between 69' & 71.5'	
75	11C	95/50	Do 8C, with a broken zone, small pieces, at 71.8'-72'	
	12C	95/35	Do 8C, with horizontal joints	
80	13C	85/45	Do 8C, with a broken & weathered zone between 81.6' to 82'	
85	14C	95/60	Do 8C, unweathered & jointed	
90	15C	95/55	Do 8C, unweathered & jointed	
95	16C	95/40	Well jtd hornblende gneiss, secondary minerals in jts, 2 horiz jts, 13 jts @ 40°-60°	
100	17C	90/60	Mod jointed to jointed 6 joints at 40°-60°	

(CONTINUED)

BORING NUMBER AM-41U (CONTINUED)

105	18C	95/30	Well jointed, 13 jts at 30°-40°, 1 at 50°-60°	
	19C	90/45	Do 18C, 3 jts at 50°-60°, 6 at 30°-40°, 2 horiz jts	
110	20C	90/50	Mod jtd to jtd, 3 horiz jts, 2 80° jts, 2 45°jts, soft green chlorite patches 114'-115'	
115	21C	95/10	Well jointed, badly fractured, soft patches at 115'-116' & 118'-119'	
120	22C	85/40	Do 18C	
125	23C	95/35	Do 18C, 12 jts at 40°-60°, 6" patch of well fractured chlorite & hornblende at 124', badly fractured 3" patch at 127'	
130	24C	95/40	Do 18C, 6 jts at 40°-60°, 5 jts at 20°-40°	
135	25C	85/40	Do 18C, 7 jts at 40°-60°, 4 horiz jts, 2" patch of chloritic mineral @137.6'	
140	26C	95/25	Chloritic hornblende gneiss, 10 jts at 40°-60°, 5 jts at 20°-40°	
145	27C	95/55	Do 26C, 2 jts at 70°-80°, 6 jts at 40°-60°, mod jtd to jtd	
150	28C	90/60	Do 26C, 2 jts at 50°-60°, 6 jts at 40°-50°, mod jtd to jtd	
155	29C	95/30	Hornblende gneiss, change at 154.9' to pink granite gneiss, 15 jts, badly fractured chloritic zone at 154.5'-154.9'	154.9' GRANITIC MATERIAL 160.0'
160	30C	95/80	Pinkish feldspar granite gneiss, 1 horiz jt, 4 jts at 40°-60°, soft chlorite seam at 158.4'	

Boring started 3-7-74 , completed 3-19-74
Final depths:
Boring = 160.0' Casing = 14.5'
Casing diameter = 3-1/2"
Average depth of ground water observed in the boring = 9.5' = El. +264.5

REMARKS:
Observation well consisting of 1-1/2" steel pipe installed with tip at 150' depth.
Four water pressure tests with packers run in this borehole.

BORING NUMBER AM-42

Ground surface elevation + 329.0

0				
22	1D	3,4, 11	Stiff brown fine sandy silt w/gray fine sand in bot, tr gravel (Fill) (SM)	GRAY FINE SAND FILL 4.5'
37				
144				
160				
177			Compact light gray-brown silty fine sand, some mica trace hornblende fragments residual soil (SM)	
5	2D	13,16, 22		
204				
240				
285				
320			Light gray-brown silty fine sand & rock fragments (decomposed Schistose gneiss) (SM)	LIGHT GRY-BRN SILTY FINE SAND AND ROCK FRAGMENTS 15.0'
450	3D	150/6"		
72				
102				
155				
167				
210				
10	1C	70/0	Hi jts & wthrd brown quartz-diorite gneiss, several small soft pieces, weathers into f-m sand	
15				
20	2C	40/0	1 piece 0.8', vertical jointing, highly weathered, many small pieces	HIGHLY JOINTED AND WEATHERED BROWN QUARTZ DIORITE GNEISS, 30° FOLIATION, IRON STAINING ON JOINTS
25	3C	90/0	Jtd, wthrd, 30° fol, 7 fol jts, 50° diag jts 26'-28', dark stains on joints	
30	4C	90/15	Mod wthrd, 80° diag jt 30'-32', 9 fol jts, 45° fol, diag jt 33'-34', weathered in bottom	
35	5C	80/0	Hi jtd, 7 fol jts, 6 diag jts, some iron staining on foliation	
40			Mod weathered,	
	6C	95/10	15 fol jts, 7 diag jts w/iron stains, gneiss altered w/gray-brown slate 43'-45'	43.0'
45	7C	95/0	Highly jointed, moderately weathered slate & quartz diorite gneiss	HIGHLY WTHRD QUARTZ DIORITE GNEISS 50.0'
50	8C	90/35	Quartz vein 7" in top jtd, mod to wthrd w/ slate bands 54.5' to 55.0'	50.5' JOINTED MOD WTHRD GRAY QUARTZ DIORITE GNEISS WITH SLATE BANDS 65.0'
55	9C	95/30	12 fol jts, 6 diag jts, slightly weathered on joints w/iron staining	
60	10C	80/10	Highly jointed & weathered 6 fol jts & 2 diag jts in top 2 ft., 4 jts 64'-65'	
65	11C	95/50	Jtd unwthrd gray quartz diorite gneiss, 7 fol jts, 4 diag jts	JOINTED UNWEATHERED GRAY QUARTZ DIORITE GNEISS 45° FOLIATION 80.0'
70	12C	90/55	Finely laminated, 11 fol jts, 5 diag jts	
75				
	13C	80/50	Jtd unwthrd, 7 fol jts, 2 diag jts, 45° fol	
80	14C	95/85	Rel sound to sound light gray diorite gneiss, thinly laminated, thin calcite & filling, 3 fol jts, 1 diag jt	RELATIVELY SOUND GRAY QUARTZ DIORITE GNEISS, THIN CALCITE LAMINATIONS 97.0'
85	15C	95/90	Sound, 3 pieces 2.7', 8.5', 3.5', 2 jts	
90	16C	95/90	Finely laminated, thin calcite fillings along 45° fol, 1 diag jt 92.4' to 93', thin calcite	
95	17C	95/85	Med to lt gry, hi feldspar content, 1 diag jt @ 97', 4 diag jts, 5 horiz jts	
100	18C	95/60	Cave-in at 97' twisted off drill rods in attempting to recover barrel, jointed gneiss, possible shear zone	

(CONTINUED)

BORING NUMBER AM-42 (CONTINUED)

105	19C	98/10	Dark green highly jointed schist layers, 2 diag jts, 5 fol jts, 45° fol	JOINTED TO HIGHLY JOINTED GRAY TO DARK GRAY QUARTZ DIORITE GNEISS 112.5'
	20C	95/10	Highly jointed, 2 diag jts, 6 fol jts, talc on joints	
110	21C	90/75	Mod jtd light to dark gray-green, 3 diag jts w/thin talc	REL SND QUARTZ DIO GNS 116.5'
115	22C	98/90	Relatively sound, 3 diag jts, 2 fol jts	

Boring started 9-28-73 , completed 10-25-73
Final depths:
Boring = 116.5' Casing = 40'
Casing diameter = 6"
Average depth of ground water observed in the boring = 18.0' = El. +311.0

REMARKS:
Casing was pushed from 15' to 40' depth; casing blows not reported.
During time interval between 10-17-73 and 10-25-73 the boring hole caved in at 97' depth, while boring was at 116.5' depth. Boring terminated at this level.
Rock coring was performed by 4" x 5-1/2" diamond drill bit yielding core of approximately 4" in diameter.

SIGNED _____ DATE _____
DRAWN IHL DATE 12/74
CHECKED SLT & JPG DATE 12/74
APPROVED _____ DATE _____

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to	Plans & Geological Sections
F-A-104	

REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. RUTLEDGE 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H. Rutledge

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED _____

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-40 to AM-42

SCALE VERT 0 3" 6" 12"

DRAWING NO. F-A-115

BORING NUMBER AM-43U
Ground surface elevation +250.7

DEPTH BELOW GROUND SURFACE, FEET					
0	1D	4,4,6	Medium compact brown silty fine sand, trace fine mica, some veg mtl, (fill) (SM)	MEDIUM COMPACT BROWN SILTY FINE SAND, TRACE MICA	10.0'
5	2D	4,6,8	Do 1D, with some brown clay pockets, residual soil (SM)		
10	3D	11,12 11	Medium compact red-gray silty fine sand, trace clay lenses (SM)	RED-GRAY SILTY FINE SAND	15.0'
15	4UD	P	Brown medium to fine sand & rock fragments, some silt (SM)		
	1C	60/0	Jtd, mod wthrd pink-light gray grano-diorite, vert jt 15° to 17', jtd & wthrd in bot w/thin red clay seams	JTD MOD WTHRD GRANO-DIORITE	19.5'
20	Core	NR	Soft weathered material	TRANSI-TION, DECOM-POSED TO WEATH-ERED ROCK	30.0'
25	Core	NR	Soft weathered material		
	5D	34,31 79	Very compact brown silty fine sand (SM)		
30	2C	35/0	Jtd, wthrd brown grano-diorite, 5 fol jts at 45°, 1 diag jt at 34', dark stain	HIGHLY JOINTED AND WEATH-ERED BROWN GRANO-DIORITE GNEISS	43.5'
35	3C	50/0	Highly jointed, weathered in top - soft, 1 45° jt at 38.5', wthrd soft brown diorite gneiss		
40	Core	NR			
45	4C	85/35	Highly jtd & wthrd dark green-brown chlorite & diorite gneiss, 1 solid piece 46.5'-48'	JTD AND WTHRD	46.5'
50	5C	98/70	Mod jtd gray-green chlorite diorite with feldspar bands at 49.5' & 51', 4 15° jts, 1 45° jt at 49.8', 60° diag jts 51'-52'	MOD JTD GRAY-GREEN CHLORITE DIORITE GNEISS WITH IRON STAINS	57.0'
55	6C	80/70	4 fol jts, 1 horiz jt, 1 45° jt @ 55.1', vert jt @ 56.5', thin feldspar bands		
60	7C	85/80	Mod jtd lt gray grano-diorite, 1 45° jt @57.8', 2 fol jts, 70° contact at 61'	MOD JTD LT. GRAY DIORITE	61.0'
	8C	98/90	Sound lt gray grano-diorite w/dark diorite gneiss to 64.5'	DARK DIORITE GNEISS	64.5'
65	9C	98/95	Sound gray-green diorite gneiss	RELATIVELY SOUND LIGHT GRAY TO GRAY-GREEN QUARTZ DIORITE GNEISS WITH CHLORITE BANDS AND INCLUS-IONS	87.7'
70	10C	98/95	Sound, 1 vert jt 71.5' to 72.4' with talc, 2 fol jts		
75	11C	98/95	Sound, 5 20° jts, 2 diag jts 73.5': 73.6' w/talc, 1" chlorite inclusion 76', 1-1/2" quartz vein at 76.5'		
80	12C	98/98	Sound lt gray quartz diorite gneiss, 2 20° jts w/thin talc, old 1/8" vert jt 79.5'-83'		
85	13C	98/95	3 15°-20° jts, old vert jts 1/8"/1/4" to 87.3', chlorite inclusions & bands at 84' & 87'		
90	14C	98/65	Mod jtd, 4 diag jts	RELA-TIVELY SOUND LIGHT GRAY QUARTZ DIORITE GNEISS, MODERA-TELY JOINTED TO 92'	
95	15C	98/95	Rel sound, 2 20° jts, 1 30° jt, talc plus some gouge material on jts at 94', 1-1/2" quartz vein at 95'		
100	16C	98/85	1 horiz jt at 79', 1 45° jt at 79', 4 10° jts, 4 horiz jts 100.0'-101.3'		

(CONTINUED)

BORING NUMBER AM-43U (CONTINUED)

105	17C	98/95	Sound, 3 pieces, old filled diag jts at 70°, 1" feldspar band 103.4' at 45°		105.7'
110	18C	98/70	Mod jtd, 1 80° jt 107.5' to 109', 2 45° jts at 107.8', 109.1' chlorite intrusions	MODERA-TELY JOINTED LIGHT GRAY TO GREEN-GRAY QUARTZ DIORITE GNEISS WITH CHLORITE BANDS AND INCLUS-IONS	
115	19C	90/65	Light gray, 6 20°-30° jts, 1 50° jt at 112.3', 1 45° jt at 113', 1 70° jt at 113.5'-114' with thin talc deposit on joints		
120	20C	98/65	Green & light gray, 3 fol jts 117.1'-117.5' with talc deposit, 2 diag jts 119', 4 20°-30° jts		
125	21C	98/95	Gray-green, sound, 3 fol jts, 2" feldspar quartz band 120.8'-121.0', thin feldspar inclusion 121.5' to 122.9'		
	22C	90/65	Light gray quartz diorite gneiss to 127.7', 10 15° to 30° jts, 3 45° jts, chlorite band 127.7' to 128.7'		129.3'

Boring started 11-8-73 , completed 11-15-73
Final depths:
Boring = 129.3' Casing = 41'
Casing diameter = 4"
Average depth of ground water
observed in the boring = 23.5' = El. +227.2

REMARKS:
Drilled ahead of casing to 41' depth; casing blows not reported.

BORING NUMBER AM-44U
Ground surface elevation +285.7

0	1D	2,2,4	Red-brown micaceous clayey silt, trace roots (Fill) (ML)	FILL	2.0'
5	2U	P	Red-brn micaceous silt, residual soil (ML)	MEDIUM STIFF TO STIFF BROWN-RED AND BROWN MICA-CEOUS CLAYEY SILT TURNS TO FINE SANDY SILT AT 20', RESIDUAL SOIL	27.0'
10	3D	3,4,6	Brown micaceous fine sandy silt (ML)		
15	4U	P	Do 2U, trace fine sand(ML)		
	5D	4,8, 11	Brown micaceous fine sandy silt (ML)		
20	6U	P	Red-brown fine sandy silt, micaceous, trace gravel (ML)		
	7D	8,9, 13	Do 6U (ML)		
25	8D	10,12 16	Red-brown micaceous fine sandy silt (ML)		
30	9D	20,29 24	Brown micaceous silty fine sand, trace rock fragments (SM)		
	10D	9,13, 15	Gray micaceous silty fine sand (SM)		
35	11D	17,35 36	Do 10D (SM)		
40	12D	21,37 42	Do 10D (SM)	MEDIUM COMPACT TO VERY COMPACT GRAY MICA-CEOUS SILTY FINE SAND WITH ROCK FRAG-MENTS, DECOM-POSED ROCK	48.8'
45	13D	150/3"	Do 10D, w/rock fragments, transition to weathered rock (SM)		
	Core	NR	Probable soft wthrd rock		
	J4D	135, 100/0"	Dark gray micaceous silty fine sand (SM)		
50	1C	75/0	Mod wthrd & hi stained jointed coarse grained diorite gneiss	MOD - HI WTHRD GNEISS	53.0'
55	2C	95/65	Jtd, unwthrd, 2 60°jts, 5 20° jts, 2 horiz jts, jt slightly stained, 6 jts/4', chlorite mixed with diorite at 57.5'-58'	JOINTED UNWTHRD GRAY DIORITE GNEISS MIXED WITH CHLORITE	63.0'
60	3C	95/85	Mixed w/chlorite schist, 45° fol, 3 40° jts, 2 20° jts, 5 jts/4.8', jts unstained & unwthrd		
65	4C	95/80	Rel sound, fol 50°, 3 45° jts, 1 60° jt, 1 horiz jt quartz vein 63.2'-63.4', widely spaced, 3 jts/4'	RELA-TIVELY SOUND GNEISS	68.3'
70	5C	95/80	Greenish-gray chlorite mixed w/diorite gneiss, rel sound, 60°fol, 2 30° jts, wthrd soft zone 68.3'-69.3'	SOFT	69.3'
	6C	100/ 100	Do 5C, sound	RELA-TIVELY SOUND TO SOUND DIORITE GNEISS MIXED WITH CHLORITE	83.0'
75	7C	100/ 100	Do 5C, 1 20° jt, 1 jt/4.7' poorly foliated		
80	8C	100/ 95	Do 5C, 1 70° jt, wide spacing, 1 jt/4.8', slightly foliated at 45°	JOINTED GNEISS	88.0'
85	9C	95/65	Do 5C, mod jtd, 2 60°jts, 1 70° jt, 1 30° jt, 1 60° jt, healed jts, 4 jts/4.8'		
90	10C	95/85	1 50° jt, 3 20° jt, widely spaced, 1 jt/3.5', quartz feldspar vein at 91.3' to 91.7'	RELA-TIVELY SOUND TO SOUND GRAY DIORITE GNEISS, SOME CHLORITE LAYERS INTER-MIXED WITH DIORITE	
95	11C	95/75	Rel sound, 5 15°-20° jts, 1 50° jt, 4 jts/4'. jts unwthrd & unstained		
100	12C	95/90	2 45° jts, 2 jts/5', slight calcite deposit on joint planes		

(CONTINUED)

BORING NUMBER AM-44U (CONTINUED)

105	13C	95/95	Sound, 1 30° jt, 1 jt/3'		113.8'
110	14C	95/95	2 30° jts, slight talc along jts, 2 jts/3'	MODERA-TELY JOINTED QUARTZ	120.4'
115	15C	95/90	1 60° jt, 1 30° jt, slight calcite deposit, joints widely spaced	MODERA-TELY JOINTED DIORITE GNEISS WITH CHLORITE LENSES	130.0'
120	16C	95/90	Sound, quartz layer 113.5' to 114.8'	MOD JTD QUARTZ	133.0'
125	17C	85/60	Quartz, 2 60° jts, 1 70° jt, 3 20° jts, broken zone 118.5'-119.5', highly jtd 118'-119.6', calcite on jts 119.6'-120.4' jtd quartz, 120.4'-124.4' diorite gneiss w/chlorite, 2 60°jt jts, 1 20° jt, vertical fracture 119.5'-120'		
130	18C	90/60	Jtd gneiss, 1 60° jt, 2 30° jts	RELA-TIVELY SOUND GRAY DIORITE GNEISS WITH CHLORITE LAYERS OR INTER-MIXED WITH DIORITE QUARTZ INTRU-SION AT LOWER PART	160.0'
135	19C	95/65	Jointed quartz at 130° to 133.5'. 3 60° jts, 2 45° jts, 2 30° jts		
140	20C	95/70	Rel sound gneiss, 1 80°jt, 1 horiz jt.		
145	21C	95/85	Gray diorite gneiss, rel sound w/quartz intrusion, 2 30° jts, 1 45° jt at 140.5' open 1/4". possible movement at 140.5'		
150	22C	95/85	3 45° jts, 2 15° jts, 1 70° jt, slight calcite deposit on jts		
155	23C	95/75	3 30° jts, 1 60° jt, 1 10° jt, slight calcite deposit		
160	24C	95/80	2 60° jts, 1 30° jt, 1 20° jt, mod jtd, rel sound, healed jts 152'152.5', jtd 151.5'-153'		
	25C	95/75	2 60° jts, 1 20° jt. 3 jts/3.5', quartz intrusion, chlorite layers		
	26C	95/90			
	27C	75/70	1 30° jt, 1 70° jt, 1 0° jt		

Boring started 6-4-74 , completed 6-11-74
Final depths:
Boring = 160.0' Casing = 50'
Casing diameter = 4" & 3-1/2"
Average depth of ground water
observed in the boring = 47.0' = El. +238.7

REMARKS:
Drilled ahead of casing from 20' depth to 50' depth; casing blows not reported.
Observation well consisting of 1-1/2" steel pipe installed with tip at 132' depth.

BORING NUMBER AM-45U
Ground surface elevation +237.5

0	1D	10,10 12	Medium compact brown silty fine to medium sand & angular gravel (Fill) (SM)	COMPACT BROWN-GRAY SILTY FINE TO COARSE AND FINE TO MEDIUM ANGULAR GRAVEL, TRACE CINDERS, FILL	17.0'
5	2D	39,51 100	Very compact brown & light gray silty fine to coarse sand, medium gravel, trace cinders (Fill) (SM)		
10	3D	16,20 131	Compact to very compact brown silty fine to medium sand & fine gravel (Fill) (SM)		
15	4U	P	Brown fine sandy silt & angular rock fragments (ML)	BROWN SILTY FINE SAND AND ROCK FRAGMENTS	25.0'
20	5D	18,37 102	Very compact brown silty fine sand, trace clay, few rock fragments (Decomposed & Weathered Rock) (SM)		
25	1C	80/0	Jointed, broken & weath-ered brown gneiss, modera-tely weathered from 27'	JOINTED, BROKEN, WEATH-ERED TO MODERA-TELY WEATH-ERED BROWN-GRAY SCHIS-TOSE GNEISS, 80° TO VERTICAL JOINTING	52.0'
30	2C	95/0	Moderately weathered, jointed brown-gray schistose gneiss, 1/8" vertical quartz veins		
35	3C	95/0	Highly jointed gray schistose gneiss 80° to vert jtg through-out, iron stains and wthrd on jts		
40	4C	90/0	Vert jtng & wthrd, 6 45° to 60° jts, gouge material possible shear, 1/2" vert quartz vein at top		
45	5C	80/0	Jtd & wthrd gray-brown finely laminated 80° to vert jtg, iron stains on joints		
50	6C	95/10	Jtd gray, wthrd to mod wthrd, 3 80° jts, 3 30° jts, 2 45° jts, 80° to vert fol.		
55	7C	60/50	Jtd to mod jtd, finely laminated, irregular vert fol, iron stain & talc on 1/8" open curved 80°jt	JOINTED TO MODERA-TELY JOINTED GRAY SCHIS-TOSE GNEISS, FINELY LAMINA-TED AND FOLIATED, THIN QUARTZ VEINS, 70° FOLIATION SHEAR ZONES	84.3'
60	8C	95/85	Rel sound, 1 10° jt at 57.6', vert fol, 1/16" to 1/8"quartz vein, irregular 1/16" open, 3 45° jts		
65	9C	95/80	2 30° jts, vert fol, thin laminated & folded quartz veins 1/32"-1/4", 60.3'to 61.5'		
70	10C	95/40	1 45° jt, 3 50° jts, 1 20° rough iron stain, 1 60°jt, 1 80° jt, 3 vert jts to 80° in 2'		
75	11C	80/60	5 30°-45° jts, rough open 1/8' to 1/4", 2 80° jts slight stain, 80°fol, thin quartz veins		
80	12C	95/40	4 60° fol jts in 2', 2 30° jts, 2 10° jts with quartz veins, 70° f, possible shear & gouge		
85	13C	80/25	Hi jtd 81.2'-84.3', hi quartz content 81'-82.5' 80° to vert fol, gouge mtl, talc deposits & iron stains on jts		
90	14C	95/60	Mod jtd lt gray quartz diorite gneiss, 2 20° rough jts, 1 10° jt, iron stain on jts, hi jtd in bot	MOD JTD TO REL SOUND GRAY QUARTZ DIORITE GNEISS	93.9'
	15C	95/80	Rel sound lt gray, 1 60° jt at 93', slightly rough, dk brown iron stain, gouge, 3 30° jts thin calcite depesit, 1 50° jt, talc deposit at 93'		

Boring started 7-2-74 , completed 7-9-74
Final depths:
Boring = 93.9' Casing = 38'
Casing diameter = 4" & 3"
Average depth of ground water
observed in the boring = 24.0' = El. +213.6

REMARKS:
Drilled ahead of casing from 15' to 38' depth; casing blows not reported.
Lost drilling water at 26' depth.

BORING NUMBER AM-46U
Ground surface elevation +264.9

0	1D	6,11, 14	Red-brown fine sandy silt, trace clay (Fill) (SM)	FILL	5.0'
5	2D	P	Brown silty clay (Fill) (CL)	VERY HARD BROWN AND LIGHT GRAY MICACEOUS SILTY FINE SAND, RESIDUAL SOIL	23.0'
	3D	14,22 31	Compact brown-gray silty fine to medium sand, trace rock fragments, residual soil (SM)		
10	4D	41, 119, 68	Brown & light gray silty fine to medium sand, trace clay pockets (SM)	V COMP SAND & ROCK FRAGMENTS	28.0'
15	5D	19,23 43	Do 4D, some rock fragments (SM)	V COMP GRAY-BROWN SILTY FINE TO MEDIUM SAND, NUMEROUS ROCK FRAG-MENTS	40.6'
20	6D	12,22 25	Compact red-brown silty fine to medium sand (SM)		
25	7D	30,40 22	Brown fine to coarse sand, rock fragments (GP)		
30	8D	25,52 49	Gray slightly micaceous silty fine to medium sand, some rock fragments (SM)	MODERA-TELY TO HIGHLY WEATH-ERED, HIGHLY JOINTED DIORITE GNEISS	56.5'
35	9D	52, 100, 153	Do 8D (SM)		
40	10D	66, 150/1"	Do 8D (SM)		
	1C	45/0	Brown oxidized, highly weathered biotite- horn-blende-quartz diorite gneiss	SLIGHTLY WEATH-ERED, HIGHLY JOINTED DIORITE GNEISS, JOINTS GENERALLY TIGHT	100.0'
45	2C	40/0	Brown hi wthrd & jtd coarse grained diorite gneiss		
50	3C	85/0	Gray-brown mod to hi wthrd fine grained diorite gneiss joints highly stained, vert closed jt 52.5'-54.5', 51.0'-51.5'		
	4C	90/0	Hi jtd, mod wthrd, jts highly stained		
55	5C	90/20	Slightly wthrd, hi jtd, jts hi stained, 6 30° jts, 1 30° jt open, 2 70° jts		
60	6C	90/0	Hi jtd, 8 50° jts, 1 60° jt, intensive staining on joints		
65	7C	90/55	Jtd, staining on jts, 6 jts/2.5', closely spaced	GRAY JTD GNEISS, HIGH ANGLE JOINTS, CALCITE DEPOSIT ON JOINTS	75.5'
	8C	95/60	Slight calcite on joints 7 jts/4.5'		
70	9C	95/70	Jointed, joints unstained vertical healed joint 72.5'-73.5', 7 jts/4.5'	REL SOUND GNEISS	80.4'
75	10C	95/85	Rel sound, 2 60° jts, 1 30° jt, 1 45° jt		
80	11C	95/80	Jointed, 8 60°-70° jts, Occasional feldspar, jts unwthrd, some talc deposit on joints	MODERA-TELY JOINTED, UNWEATH-ERED GRAY DIORITE GNEISS, JOINTS GENERALLY TIGHT	
85	12C	95/75	Mod jtd, 6 jts/4.8', joints contain calcite deposit & unweathered		
90	13C	95/75	Jointed, 8 jts/4.8', joints unweathered		
95	14C	90/85	Moderately jointed, 7 jts/4.8'		
100					

Boring started 5-31-74 , completed 6-14-74
Final depths:
Boring = 99.6' Casing = 51'
Casing diameter = 4" & 3"
Average depth of ground water
observed in the boring = 7.2' = El. +257.7

REMARKS:
Drilled ahead of casing from 15' to 51' depth; casing blows not recorded.

DESIGNED		DATE	
DRAWN	IHL	DATE	12/74
CHECKED	SLT & JPG	DATE	12/74
APPROVED		DATE	

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to	Plans & Geological Sections
F-A-104	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA · WILLIAM H. MUESER · 4070 · REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
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SUBMITTED William H. Mueser

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HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-43U to AM-46U

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-116

BORING NUMBER AM-47

Ground surface elevation +318.8

DEPTH BELOW GROUND SURFACE, FEET						
0	31 47 23 40 45	1D	5,13, 17	Brown silty fine sand, trace roots (Fill) (SM)	BROWN SILTY FINE SAND,FILL 7.0'	
5	40 40 40 220	2D	40,40 44	Brown silty fine sand (Possible Fill) (SM)		
10		3D	33, 100	Gray silty fine sand (SM)	VERY COMPACT GRAY SILTY FINE SAND, TRACE COARSE SAND, NUMEROUS ROCK FRAG-MENTS	
15		4D	50, 130	Do 3D (SM)		
20		5D	150/6"	Do 3D, trace coarse sand (SM)		
25		6D	27, 150/3"	Silty medium to fine sand, some rock fragments (SM)		
30		7D	150/6"	Do 6D (SM)	30.5'	
35		1C	80/55	Jtd & wthrd to 32.5' brn-gry diorite, 1 vert jt, 1 60° jt, 1 45° jt, 2 30° jts	JOINTED AND WTHRD BRN-GRAY QUARTZ DIORITE 38.0'	
40		2C	95/50	Do 1C, 1 70° jt, 3 30°jts 1/16" open, 4 20° jts, iron stained	JOINTED GRAY QUARTZ DIORITE, IRON STAINS ON JOINTS 48.0'	
45		3C	95/50	1 80° jt, heavy iron stain, pyrite crystals & calcite deposit, 1 30°jt 1/8" open, jtd, broken		
50		4C	98/55	5 20° jts, 1 30° jt in 2.2', 1/16" to 1/8"open, iron stained & talc on jts, 1 45° jt		
55		5C	95/85	Rel snd, 2 45° jts in 0.8' 1/16" open, 2 70° jts in 1/2"	RELA-TIVELY SOUND TO SOUND LIGHT GRAY QUARTZ DIORITE, NO FOLIA-TION, JOINTS SMOOTH TO SLIGHTLY ROUGH, 1/8"OPEN TALC, CALCITE DEPOSITS SLICKEN-SIDE AT 61' 76.0'	
60		6C	95/85	2 45° jts, 1 30° jt 1/8" open, iron stain in 0.3' 2 60° jts, 1 45° jt in 2.1'		
		7C	95/95	1 80° jt @ 60.5'-61', slickenside across jt at 25°. 1 30° jt, thin calcite		
		8C	95/95	1 30° jt @ 65'		
65		9C	98/95	1 45° jt, 1 30° jt in 1.0', smooth jts		
70		10C	75/75	30° jt 1/16" open with calcite, 1 45° jt in 2.0', 2" chlorite band		
75		11C	98/85	1 80° jt @ 75',trace talc calcite on jt, 3 60° jts, 1 45° jt, 2 30° jts, 1 20° jt in 0.8', iron stained		
80		12C	80/50	Jtd, 1 70° jt iron stained 1 50° cross jt, 1 50° 1/16" jt open in 0.8' broken 0.5'	JOINTED QUARTZ DIORITE 80.0'	
85		13C	98/85	1 60° jt, 1 45° jt in 0.3' 2 45° jts in 0.1', talc deposit, 1 30° jt, 1 60° jt 2 45° jts in 1.5'	RELA-TIVELY SOUND LIGHT GRAY QUARTZ DIORITE, THIN CALCITE AND TALC DEPOSITS ON JOINTS 97.8'	
90		14C	98/95	1 60° jt, 2 10° jts in 2', 1 30° jt @ 88.4'		
		15C	98/90	1 30° jt thin calcite deposit, 1 70° jt 1/8" open, gouge mtl, talc & calcite along jt		
95		16C	98/90	1 30° jt 1/8" open, 1 20° jt, 1 60° jt in 1.8', 1 20° jt & 1 vert jt in 0.3' @ 97.5'		
100		17C	98/20	Jtd, 1 vert 85° jt curved, 99'-101.5', thin talc & calcite, 5 20° cross jts in 1.5' .	JTD TALC & CALCITE DEPOSITS 102.5'	

(CONTINUED)

BORING NUMBER AM-47 (CONT'D)

105	18C	98/95	Rel snd, 3 jts in 0.5', 1 30° jt, 1 20° jt in 2.0' thin calcite deposits	REL SND LIGHT GRAY QUARTZ DIORITE GNEISS, THIN CALCITE DEPOSIT ON JOINTS NO FOLIA-TION 118.6'	
110	19C	95/90	1 10° jt, 1 45° jt with thin calcite deposit in 0.3', 1 70° jt		
115	20C	98/90	1 80° curved jt, 1 10° cross jt, 1 45° jt in 0.6', thin calcite deposit, trace talc		
120	21C	95/70	3 30° jt, 1 vert jt in 0.6', thin calcite & talc deposits, 1 60° jt		
125	22C	98/75	Mod jtd. 1 30° jt, 1 45° jt talc deposit & stained, 6 10°-20° jts 1/16" open, 1 50° jt (planar) in 4.0'	JOINTED DIORITE, PLANAR TO OPENJOINTS 125.3'	
130	23C	98/90	Rel snd, 2 45° jts, 1 60° jt, 3 20° jts in 0.8', 2 20° jts are 1/2" apart, gouge mtl		
135	24C	98/90	1 45° jt @ 130', 1 10° jt, 1 20° jt, 1 30° jt, 1 45° jt in 0.9', gouge mtl on jts, possible shear	RELA-TIVELY SOUND LIGHT GRAY QUARTZ DIORITE, THIN CALCITE DEPOSITS, SEVERAL THIN GOUGE ZONES INDICATE POSSIBLE MINOR SHEAR	
	25C	98/90	Sound, 1 10° jt rough 1/8" open, 1 70° jt, 1 30° jt in 0.3' with thin gouge		
140	26C	95/90	2 10° jts in 1.3', 2 30° jts in 1/2", gouge mtl, 1 70° jt, 1 50° jt crossing @ 143'		
145	27C	95/90	1 10° jt, 1 20° jt, 1 horiz jt, 1 45° jt in 1.7'		
	28C	75/75	1 30° jt, 1 20° jt @ 152.5' slight iron stain, rough 1/16" open		
150	29C	50/50	1 10° jt, 1 20° jt in 1.2' thin calcite deposit		
155	30C	95/90	1 horiz jt, 1 70° jt in 0.2', planar with calcite deposits	159.0'	

Boring started 6-12-74 , completed 6-19-74
Final depths:
Boring = 159.0' Casing = 40.5'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 21.0' = El. +297.8

REMARKS:
Drilled ahead of casing from 13' to 40.5' depth; casing blows not recorded.

BORING NUMBER AM-48

Ground surface elevation +345.6

0	35 29 31 28 29	1D	8,9, 10	Brown & dark brown fine sandy silt, trace gravel (Fill) (ML)	BROWN SANDY SILT, FILL 7.0'
5	55 62 73 66 70	2D	15,11 11	Stiff yellow-red silty clay, some fine sand, trace gravel (Fill) (CL)	YELLOW-RED SILTY CLAY, TRACE MICA 15.0'
10	80 81 83 120 120	3D	11,12 15	Soft micaceous silty clay (CL)	
15	65 70 67 97 162	4D	8,8, 10	Gray-brown micaceous silty fine sand (SM)	BROWN-GRAY SILTY AND CLAYEY FINE TO MEDIUM SAND, TRACE MICA 30.0'
20		5D	19,21 30	Brown-gray silty fine sand (SM)	
25		6D	20,11 13	Brown-gray silty fine to medium sand, some angular rock fragments (SM)	
30		7D	20,28 31	Brown-gray silty fine sand, some fine mica (SM)	
35		8D	38,41 56	Gray micaceous silty fine sand, few angular rock fragments (SM)	GRAY SILTY FINE SAND, SOME FINE MICA, SOME ANGULAR ROCK FRAG-MENTS 50.0'
40		9D	40,52 60	Gray silty fine sand, numerous rock fragments (SM)	
45		10D	43,61 82	Do 9D (SM)	
50		1C	45/20	jtd, mod wthrd gray-brn diorite gneiss, 2 60° jts, 1 vert jt, 60° fol	JOINTED MOD WTHRD GRAY-BROWN QUARTZ DIORITE GNEISS 60.0'
55		2C	75/25	Do 1C, broken in top, 7 30° jts, 2 50° jts, red & dark stains on jts, 2 60° jts, 1 70° jt, 2 45° jts	
60		3C	95/75	Rel snd gray, 5 30° jts, 2 60° jts, 1 45° jt, smooth planar jts	JOINTED TC RELA-TIVELY SOUND GRAY QUARTZ DIORITE GNEISS, IRON STAINS ON JOINTS, SMOOTH TO 1/8" 78.8'
		4C	95/80	3 30° jts, 2 60° jts, 1 45° jt, smooth planar jts, some iron stain	
65		5C	95/85	1 70° jt, 3 30° jts, 1 45° jt, iron stains on jts, 3.5' spacing, 60° fol	
70		6C	90/60	1 70° jt, 3 30° jts, 4 20° jts, smooth to 1/8" open in 0.8' spacing, iron stain on jt, 80° fol to vert	
75					

Boring started 7-23-74 , completed 7-24-74
Final depths:
Boring = 78.8' Casing = 50'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 34.0' = El. +309.6

REMARKS:
Drilled ahead of casing from 20' to 50' depth; casing blows not recorded.

BORING NUMBER AM-58U

Ground surface elevation +328.0

0	14 14 16 17 18	1D	2,2,2	Brown fine sandy silt, trace roots & gravel (Fill) (ML)	LOOSE TO MEDIUM STIFF BROWN SILT AND CLAY,FILL 10.0'
5	27 30 57 73 144	2D	3,4,6	Red-brown slightly micaceous silty clay, some fine sand (Fill)(CL)	
10	57 79 147 220 388	3D	9,10, 13	Red-brown micaceous silty fine sand (SM)	
		4U	P	Do 3D (SM)	
15	125 177 200 306 500	5U	P	Brown micaceous silty fine sand (SM)	MEDIUM COMPACT TO COMPACT BROWN MICA-CEOUS SILTY FINE SAND BECOMING VERY COMPACT WITH DEPTH, DECOM-POSED ROCK 37.0'
		6D	14,13 16	Do 3D (SM)	
20		7D	18,22 25	Do 3D (SM)	
25		8D	18,22 23	Do 3D (SM)	
30		9D	27,44 92	Brown micaceous fine to medium sand, some silt, trace rock fragments (SM)	
35		10H	84, 100/3"	Do 9D, numerous rock fragments (SM)	
40		1C	15/0	Hi wthrd soft diorite gneiss	HIGHLY WEATH-ERED AND JOINTED BROWN OXIDIZED DIORITE GNEISS 60.0'
45		2C	65/25	Do 1C, 42'-45.6', from 45.5' to 47', jointed unwthrd diorite gneiss	
50		3C	65/0	Hi wthrd & jtd red-brn, jts wthrd & stained	
55		4C	90/10	Diorite & quartz layer @ 53.8'-54.2'	
		5C	85/5	Do 3C	MOD WTHRD GNEISS 63.0'
60		6C	90/20	Do 3C, 60.8'to 63', mod wthrd, 63.8'to 65.8' hi jtd, practically unwthrd, jts hi stained, 12 jts	SLIGHTLY WEATH-ERED HIGHLY JOINTED DIORITE GNEISS OR META DIORITE, HEAVY OXIDA-TION, STAINING OF JOINTS FOLIA-TION INDIS-TINCT, APPROX 60° 86.0'
65		7C	90/25	Hi jtd, sli wthrd, jts stained & oxidized, vert jt 66'-67', 3 60° jts, 2 20° jts, poorly fol at 60°	
70		8C	90/20	Sli wthrd, jts hi wthrd, 7 10° jts, vert jt at 71'-72', 1 60° jt	
75		9C	85/30	Do 8C, 75.8'-78', 78' to 80.8' Jtd & unwthrd	REL SND UNWTHRD DIO GNS 90.4'
80		10C	95/20	Do 8C, 6 10° jts, 2 90° jts, 2 60° jts	
85		11C	95/80	Do 8C, 85.6'-86', 86'-90.4'. rel snd unwthrd jts unstained, 3 jts per 4 feet	JOINTED GNEISS 95.0'
90		12C	95/40	Jtd unwthrd diorite gneiss, 6 60° jts, 2 15° jts, jts generally stained wthrd @ 94.2' to 94.8'	
95		13C	95/75	Do 12C, rel snd, 1 80°jt talc deposit, 1 cross 60° jt, 2 10° jts, 1 30° jt, spacing 4 jts per 4 feet	
100		14C	95/80	Rel snd, 6 jts per 5 feet widely spaced	
105					

(CONTINUED)

BORING NUMBER AM-58U (CONT'D)

105	15C	90/90	Rel snd lt gry w/alt gry-grn chlorite bands & inclusions, 2 30°irregular jts, 1 20° jt rough thin calcite	REL SND GRAY DIORITE GNEISS OR META DIORITE SLIGHT CALCITE DEPOSIT ON JOINT 112.0'	
110	16C	95/90	Rel snd, 1 30° jt, 2 20° jts 1/16", sli wthrd on jts, 2 50° jts		
115	17C	95/65	Mod jtd, vert jt @ 114.5' to 115', 4 10° jts, 1 45° jt, 1 60° jt, jts unwthrd & unstained	MOD JOINTED DIORITE GNEISS 118.0'	
120	18C	95/85	Rel snd, 1 70° jt, 1 50° jt, slight calcite on jts	RELA-TIVELY SOUND GRAY DIORITE GNEISS 128.0'	
125	19C	95/85	1 70° jt, 1 10° jt, 1 60° jt, jts smooth & widely spaced, 3 jts per 4.8 feet		
	20C	85/65	Rel snd from 125.1' to 128', jtd from 128' to 129.1', 6 jts closely spaced in 2 feet, 6 jts @ 15°	JOINTED 130.0'	
130	21C	95/95	Rel snd, 1 10° jt widely spaced 1 jt per 3 feet	RELA-TIVELY SOUND DIORITE GNEISS 140.0'	
135	22C	100/95	Rel snd diorite gneiss, 1 60° jt, 2 15° jts		
	23C	80/80	Rel snd		
140					

Boring started 5-24-74 , completed 6-3-74
Final depths:
Boring = 140.0' Casing = 45'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 21.6' = El. +306.4

REMARKS:
Drilled ahead of casing from 20' to45' depth; casing blows not recorded.
Dirty drilling water and low recovery indicate that rock core from 1C was probably soft and highly weathered and therefore washed away during drilling.

DESIGNED		DATE
DRAWN	IHL & AR	12/74
CHECKED	SLT & JPG	12/74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to F-A-104	Plans & Geological Sections

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

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APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-47 to AM-58U

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-117

BORING NUMBER AM-59U

Ground surface elevation +353.2

Depth					
0					
18	1D		3,4,5	Brown silty clay, trace gravel & mica (Fill) (CL)	FILL 2.0'
21					
37	2U		P	Brown micaceous silty fine sand (SM)	
40					
75	3D		4,4,6	Do 2U, residual soil (SM)	
75					
90					MEDIUM COMPACT TO COMPACT BROWN MICA-CEOUS SILTY FINE SAND, BECOMING MORE COMPACT WITH DEPTH, DECOM-POSED ROCK
92					
98					
40					
48	4U		P	Do 2U (SM)	
60	5D		5,7, 10	Do,2U (decomposed rock) (SM)	
88					
122				Brown micaceous silty fine sand, trace rock fragments (SM)	
	6D		14,16 20		
	7D		7,15, 26	Do 6D (SM)	
	8D		23,51 111	Do 6D, becoming rockier (SM)	
	9D		150/4"	Do 6D, numerous rock fragments (SM)	30.3'
	1C		90/15	Highly weathered & jointed quartz diorite gneiss	
	2C		85/20	Do 1C	
	3C		90/10	Do 1C	HIGHLY WEATH-ERED AND JOINTED BROWN DIORITE GNEISS
	4C		75/15	Hi wthrd & jtd, 5 20° jts, 2 60° jts, 1 80° jt, jts highly stained, soft rock breakable with hand	
	5C		55/0	Do 4C, 1 70° jt, 2 50° jts 2 30° jts 50'-53', broken & weathered	
				55'- 57' Do 4C 57'-60', unwthrd hi jtd gray fine grained, 4 60° jts, 5 30° jts, joints stained & filled w/calcite layer	57.0'
	6C		80/0		HIGHLY JOINTED GRAY DIORITE GNEISS
	7C		95/40	Do 6C, 4 60° jts, 3 20°jts, slight staining at jts, 7 jts per 4', thin calcite on jts	65.0'
	8C		98/98	Sound, no joints	REL SND GRAY DIORITE GNEISS
	9C		95/80	Rel sound, 1 60° jt, 4 10°-20° jts, 1 jt per 4' widely spaced	72.0'
	10C		95/70	Mod jtd, 1 60° jt, 2 45° jts, 3 20° jts, jts widely spaced at 72'-75', closely spaced 75'to 76.7'	MOD JOINTED GNEISS 77.0'
	11C		98/95	Rel sound, 1 30°jt, 1 45° jt, 76.7' to 77.3'diorite mixed w/chlorite & fine grained	RELA-TIVELY SOUND DIORITE GNEISS 85.0'
	12C		95/75	Mod jtd, 4 60°jts, 1 10° jt, slight calcite on jts, 1 jt per 3', rel sound 80'4'to 83.5',jtd from 83.5'to 84.6'	
	13C		95/65	Jointed, 8 45° jts, 1 30° jt, 1 70° jt, 9 jts per 4.5'	JOINTED DIORITE GNEISS 91.5'
	14C		95/75	Mostly rel sound, jointed from 90.5'-91.5', 4 30° jts, 1 70° jt, slight calcite deposit on joints	
	15C		98/95	1 20° jt smooth, 1 45°jt thin calcite	
	16C		98/95	1 10° jt 1/8" open, 1 30° jt 1/8" open, iron stains on joint, 50°-60° fol	

(CONTINUED)

BORING NUMBER AM-59U (CONTINUED)

Depth					
100					
	17C		98/95	1 30° jt @ 102.8', looks fresh, tr pyrite, 1 30° 1/8" healed jt, 1/8" calcite deposit on 10° jt, rough at 105.8'	REL SOUND TO SOUND GRAY DIORITE GNEISS, META-DIORITE AND DIORITE WITH INDIS-TINCT FOLIA-TION 118.7'
105					
	18C		98/95	1 45°jt irregular,slightly iron stained 2.3', 1 20° jt irregular, thin calcite dep,0.7'chlorite band,60° contact w/diorite @ 109.7'	
110					
	19C		98/95	Rel sound diorite, 1 30°jt @ 112.2', slightly rough, no foliation	JTD QTZ DIO GNS 121.0'
	20C		98/98	1 30° jt at 116.7', many dk mineral inclusions, no foliation	
115					
	21C		95/25	Jtd,3 60°jts, 2 45°jts,3 30° jts, 1 vert jt, 5 10° jts in 2.9', sli stain on jts, gouge mtl, pos shear	
120					
	22C		98/90	1 60° jt, 1 30°jt, 1 45° jt in 1.2',2 60°jts in 1/2", close, talc & calcite deposits on joints	RELA-TIVELY SOUND DIORITE GNEISS 130.0'
125					
	23C		98/95	1 70° jt, 1 perp jt in 0.5' @ 129.5', 1 60° jt, slightly rough, thin calcite deposits & pyrite	
130					
	24C		95/55	2 50°-60° jts in 0.1', sl rough, thin calcite dep, 2 45°jts, 1 60°-85°jt curved w/talc & calcite dep, 3 20°jts 1/16"open in 4.0', possible shear	JOINTED GNEISS, WAVY JOINTS, POSSIBLE SHEAR ZONE 139.5'
135					
	25C		95/30	Jtd, 2 30°jts, 1 70°jt, iron stained, 2 85°jts 1/16" open w/1-1/2" altered chlorite bands along jt planes, 3.2'spacing @135.8'	
140					
	26C		95/90	Sound, 2 45°jts, 1 10° jt in 2.4'	REL SND DIORITE GNEISS 144.1'
145					
	27C		95/45	Vert fracture @ 144.1'to 145', 8 45°jts, 2 30°jts, 1 45° jt, slight calcite on jts	MOD JOINTED TO JOINTED DIORITE GNEISS 153.0'
150					
	28C		95/70	Moderately jointed, 3 45° jts, 3 30° jts, 1 10° jt	
155					
	29C		95/80	Relatively sound, 4 20°jts, 2 45° jts	RELA-TIVELY SOUND TO SOUND DIORITE GNEISS 167.6'
160					
	30C		95/85	6 20° jts, 1 45° jt, 1 60° jt, 7 jts per 4.8'	
165					
	31C		98/90	1 10° jt, 1 30° jt, 3 jts per 4.8'	

Boring started 6-17-74 , completed 6-19-74
Final depths:
Boring = 167.6' Casing = 57'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 27.3' = El. +325.9

REMARKS:
5" of asphalt at surface.
Drilled ahead of casing from 15' to 57' depth; casing blows not reported.

BORING NUMBER AM-60

Ground surface elevation +326.0

Depth					
0					
48	1D		6,6,5	Brown fine sandy clay, occasional gravel (Fill) (CL)	SA CLAY, FILL 4.0'
50					
37					
29					
38	2D		12,13 16	Orange-brown micaceous silty fine sand (Decomposed Rock) (SM)	
40					
50					
71					
80					
79	3D		15,20 28	Brown micaceous silty fine sand (Decomposed Rock) (SM)	
94					
121					
208					
489					
	4D		22,29 35	Do 3D (SM)	
	5D		15,39 45	Do 3D (SM)	
	6D		20,20 30	Brown micaceous silty fine sand (SM)	
	7D		18,27 31	Do 6D (SM)	COMPACT TO VERY COMPACT BROWN MICA-CEOUS SILTY FINE SAND, RESIDUAL SOIL 32.0'
	8D		20,30 35	Brown micaceous fine to medium sand, some silt, trace rock fragments (SM)	
	9D		150/3"	Do 8D, numerous rock fragments (SM)	
	1C		70/10	Hi wthrd & jtd hornblende schist, occasional quartz vein	V COMP MICACEOUS SI F SAND DECOM-POSED ROCK 39.3'
	2C		80/15	Brn hi wthrd & jtd, quartz augens	
	3C		95/30	Do 2C, coarse grained, feldspar intrusion	BROWN HIGHLY WEATH-ERED AND JOINTED HORN-BLENDE SCHIST, DEGREE OF WEATHER-ING REDUCES FROM 59' AND BECOMING SLIGHTLY TO MODERA-TELY WEATH-ERED ROCK, FOLIA-TION 40° TO 60° 82.2'
	4C		95/40	Do 2C, 54'-56.5', brown, jointed 56.5'-59'	
	5C		95/60	Gry-brn mod wthrd, jtd, Hi wthrd @ 62.8'-63.8'	
	6C		95/40	Brn wthrd schist, rel less wthrd 65'-66'	
	7C		75/10	Sli wthrd schist, broken & hi wthrd 68.6' to 69.4', vert jt 70'-73', jts hi stained, 45° fol	
	8C		95/0	Do 7C, hi wthrd & stained, broken cross jts 66.2' to 77.2'	
	9C		80/40	Sli to mod wthrd & jtd diorite gneiss, 45° fol, 2 fol jts, 1 60° jt, bot 3" schistose chlorite gneiss	SLIGHTLY WEATH-ERED HIGHLY JOINTED CHLORITE MORN-BLENDE SCHIST 100.0'
	10C		90/0	Grn-gry chlorite schist, very closely spaced, hi jtd & mod wthrd, hi wthrd at 86.4' to 86.8'	
	11C		90/10	Do 10C, fractured & broken, Hi broken & wthrd at 91.5' to 91.8'	
	12C		90/0	Sli wthrd, hi jtd, 60° fol, 6 fol jts, rusty, stained	
	13C		95/0	Do 12C, 45° fol, 8 fol jts, wthrd sections & broken 96'-97' & 99'to 100', probable shear	

(CONTINUED)

BORING NUMBER AM-60 (CONT'D)

Depth					
100					
	14C		98/25	Unwthrd, jtd, 45° fol, 10 fol jts, staining on jts	UNWTHRD JOINTED SCHIST 105.4'
105					
	15C		95/85	Rel snd schistose, widely spaced 5 jts at 45° fol	REL SOUND SCHIST 110.2'
110					
	16C		98/40	Schist mixed with diorite, closely spaced, 15 fol jts @ 45°, slight staining on jts, jts coated with calcite & talc	JOINTED SCHIST & DIORITE 115.0'
115					
	17C		98/40	Gry unwthrd jtd diorite, vert jt stained @ 115.4', @ 117.6', 45° fol	GRAY UNWTHRD AND JOINTED DIORITE, FOLIA-TION 45° 126.0'
120					
	18C		90/55	Do 17C, fol 45°, 6 fol jts 2 10° jts, slight staining along jts	GRN-GRAY JOINTED AMPHI-BOLITE 131.8'
125					
	19C		85/60	Do 18C, 45° fol, 3 fol jts stained amphibolite @ 126' to 127', 3" broken at contact, quartz augens	
130					
	20C		95/75	Grn-gry unwthrd amphia-bolite w/ feldspar bands, 7 jts @ 45°-60°, 2 jts @ 10°	GRAY UNWEATH-ERED JOINTED DIORITE, 40° FOL 141.2'
135					
	21C		95/60	Jtd meta diorite, 40° fol, 6 fol jts, 2 10° jts, thin 2" quartz band @133.5'	
140					
	22C		90/60	Gry jtd meta diorite, 40° fol, 2 60° jts, 5 35°jts, chlorite schist from 142' to 143', jts unwthrd & stained	RELA-TIVELY SOUND GRAY UNWEATH-ERED DIORITE 151.0'
145					
	23C		98/75	Widely spaced jts, 4 fol jts, fol 45°, sli talc coating on jts, rel snd	
150					
	24C		98/75	45° fol, 4 fol jts, fractured @ 149.5' to 150'	MODERA-TELY JOINTED GRAY UNWEATH-ERED DIORITE, FOLIA-TION 40°TO 60° 165.0'
155					
	25C		90/60	Mod jtd, 3 jts @ 45°, 1 jt @ 30°, vert jt @ 154'	
160					
	26C		98/65	6 jts @ 45°. vert jt 159.5'-160', chlorite schist alt	
165					
	27C		98/55	2 jts @ 45°. 45° fol, vert jt @ 163'-165'	

Boring started 5-14-74 , completed 5-28-74
Final depths:
Boring = 165.0' Casing = 99'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 23.0' = El. +323.0

REMARKS:
5" of asphalt at surface.
Drilled ahead of casing from 13' to 40' depth; casing blows not reported.
Hole began caving in at 80' depth while drilling at 142' depth, therefore flush joint driven to 99' depth.
38' of 4" casing left in place for borehole photography.

BORING NUMBER AM-61

Ground surface elevation +320.8

Depth					
0					
8	1D		1,2,3	Topsoil & brown micaceous fine sand with silt (Fill) (SM)	SANDY TOPSOIL AND FILL 5.0'
20					
33					
75					
154					
88	2D		15,15 15	Stiff brown micaceous fine sand with silt, possible fill at top (SM)	
97					
116					
125					
130					
23	3D		8,3, 14	White-brown micaceous fine sand, some silt, trace rock fragments (SM)	WHITE-BROWN MICACEOUS FINE SAND WITH SILT, ROCK FRAGMENTS AT BOTTOM, DECOM-POSED ROCK 26.2'
21					
23					
22					
22				Gray-green silty fine to medium sand,(Decomposed Rock) (SM)	
40	4D		21,22 24		
25					
33					
55					
88				White-brown micaceous sand with silt,(Decom-posed Rock (SM)	
66	5D		8,12 15		
185					
440					
333					
595			35,80 100/2"	Do 5D, with rock fragments (SM)	
	6D		100/2"		
	1C		70/0	Decomposed, highly jtd hornblende quartz diorite, 15 horiz jts, 2 diag jts, hi stained mainly at jts	GRAY HIGHLY JOINTED, MODERA-TELY WEATH-ERED HORN-BLENDE QUARTZ DIORITE, POORLY FOLIA-TED, MEDIUM GRAINED, WEATHER-ING DE-CREASES WITH DEPTH TO SLIGHTLY WEATH-ERED AT 41' 65.0'
	2C		85/30	Hi jtd & wthrd in top, 7 fol jts, iron stains to 33'	
	3C		80/35	Mod wthrd, 2 45° jts diag, 2 30° jts, 4 10° jts, 8 small pieces	
	4C		100/ 50	Hi jtd, mod wthrd, 10 diag jts, 2 cross jts, 1 vert jt, 5 horiz jts, mod wthrd, staining at jts	
	5C		90/55	Hi jtd, mod to sli wthrd, 8 diag jts, 3 horiz jts, 1 vert jt, 2 cross jts, staining at jts, quartz at 144'	
	6C		100/ 60	Hi jtd, sli wthrd, 8 diag jts, 7 horiz jts,staining at jts, slickenside 50'to 51.5'	
	7C		90/55	Jtd, sli wthrd, 8 diag jts, 1 vert jt, 4 horiz jts, staining at jts, mod wthrd 55'-56'	
	8C		85/45	Mod jtd, mod wthrd, 4 diag jts, 6 horiz jts, 1 vert jt, staining at jts 56'-57'	
	9C		90/20	Gradual alteration in diorite, hi jtd, sli wthrd, 10 diag jts, 9 horiz jts, 2 cross jts, staining, talc & quartz at jts	
	10C		90/30	Hi jtd & fract 66'-68' w/ slick jts, probable fault, 10 horiz jts, 7 diag jts, 3 cross jts	HI JTD, SLIGHTLY WTHRD DIORITE, BROKEN & SLICK ZONES 73.5'
	11C		65/15	Fract & sli wthrd, 5 diag jts, 3 horiz jts, broken & mod wthrd w/slick jts, possible shear 70'-71' & 73'-73.5'	REL SOUND GRAY-GREEN DIORITE, ROUGH JOINTS 30° AND 60° 84.5'
	12C		98/90	Rel snd, 1 diag jt, 1 horiz jt, 4 jts per 5 feet	
	13C		90/75	3 horiz jts, 1 diag jt	
	14C		90/90	1 diag jt, 2 horiz jts	JOINTED GRAY-GREEN DIORITE 93.0'
	15C		98/95	Jtd, 1 diag jt, 5 horiz jts, typical jts 30°& 60°	
	16C		75/70	Mod jts, 1 diag jt, 3 horiz jts, chlorite inclusion	
	17C		95/95	Rel snd, 1 horiz jt, 2 20° 1 30° jt, 1 45° jt, hornblende inclusion, 0.3' band 93.7'	
	18C		95/90	2 20° jts, 1 60° jt 97.5' with thin clacite deposit, 0.8' quartz vein 99.2'to 100' @ 70°, trace chlorite inclusion	

(CONTINUED)

BORING NUMBER AM-61 (CONT'D)

Depth					
100					
	19C		95/95	With chlorite, 2 horiz jts jts becoming fresh & unstained	REL SOUND GRAY-GREEN DIORITE WITH CHLORITE AND HORN-BLENDE, JOINTS UNSTAINED 5 JOINTS PER 5 FT 115.0'
105					
	20C		95/90	2 horiz jts	
110					
	21C		100/ 100	1 diag jt, 2 horiz jts, pyrite at jts	
	22C		98/80	2 diag jts, 4 horiz jts, pyrite at jts	
115					
	23C		98/85	Gry sli wthrd & jtd dio-rite, 4 diag jts @ 50°, 45°, 60° & 30°, talc on jts	SLIGHTLY WTHRD DIORITE 120.0'
120					
	24C		98/98	Gry-grn rel snd to snd diorite with hornblende inclusions	
125					
	25C		100/ 100	No joint except mechanical break	
	26C		100/ 95	1 diag jt at 45°	
130					
	27C		98/95	Gry-grn diorite, 1 diag jt 45°, little talc on jt	RELA-TIVELY SOUND DIORITE, UNFOLIA-TED, MEDIUM GRAINED
135					
	28C		95/90	2 diag jts, 45°, very little talc on jts	
140					
	29C		98/98	No breaks except one mechanical break, horn-blende inclusions at intervals	
	30C		95/85	Gry-grn diorite, 4 vert jts, 3 diag 50°-60° jts, hornblende inclusions, very little talc on jts	
145					
	31C		98/90	1 diag jt @ 85°, 1 almost vert jt, chloritic mtl on jt, quartz vein @ 150'	152.0'
150					

Boring started 1-4-74 , completed 2-6-74
Final depths:
Boring =152.4' Casing = 25.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 15.7' = El. +305.1

DESIGNED			
DRAWN	IHL	DATE	12/74
CHECKED	SLT & JPG	DATE	12/74
APPROVED		DATE	

REFERENCE DRAWINGS		
NUMBER	DESCRIPTION	
F-1	General Notes & Legend	
F-A-86 to F-A-104	Plans & Geological Sections	

REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. MUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER • RUTLEDGE • WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H Muesser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT

APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-59U to AM-61

SCALE VERT. 0 3" 6" 12"

DRAWING NO. F-A-118

BORING NUMBER AM-62

Ground surface elevation +322.4

DEPTH BELOW GROUND SURFACE, FEET					
0	7 19 34 67 83	1D	3,4,7	Topsoil- Gray-brown micaceous fine sandy silt (Fill) (ML)	STIFF BRN MICACEOUS FINE SA SILT AND TOPSOIL 6.5'
5	67 87 110 159 174	2D	9,7,9	White-brown micaceous silty fine sand, trace rock fragments, probable residual soil (SM)	
10		3D	10,15 18	Do 2D (SM)	WHITE-BROWN MICACEOUS FINE GRAND WITH SILT, DECOMPOSED ROCK 21.2'
15		4D	12,20 36	White-brown micaceous silty fine sand, trace rock fragments (SM)	
20		5D	27, 106 115/2"	White-brown micaceous fine sand with decomposed rock fragments (SM)	
25		1C	0/0	Soft weathered rock	HIGHLY JOINTED AND WEATHERED HORNBLENDE QUARTZ DIORITE 35.0'
		2C	55/10	Hi jtd, hi wthrd hornblende quartz diorite, 11 horiz jts, 3 diag jts, staining at joints	
30		3C	85/25	Do 2C, 9 horiz jts, 6 diag jts, 2 vert jts, staining at jts	
35		4C	90/40	Mod jtd top to 36.4', mod wthrd diorite, 13 horiz jts, 4 diag jts	MOD JOINTED GRAY-GREEN DIORITE SLIGHTLY WEATHERED TO 36' 45.3'
40		5C	95/80	Mod jtd unwthrd, 6 horiz jts, 2 diag jts, pyrite at jts	
		6C	90/25	Do 5C, 2 diag jts, 1 vert jt, pyrite at jts	
45		7C	85/20	Fract & jtd , unwthrd, 9 diag jts, 3 horiz jts, 2 vert jtd, talc, pyrite & calcite at jts, contorted fol, chlorite-biotite schist to 48'	MODERATELY JOINTED UNWEATHERED GRAY-GREEN HORNBLENDE QUARTZ DIORITE WITH PYRITE, TALC AND CALCITE, POORLY FOLIATED, MEDIUM GRAINED, JOINTS TYPICALLY 2 PER 1 FOOT 75.0'
50		8C	95/65	8 diag jts, 2 horiz jts, 1 vert jt, talc, pyrite, quartz & calcite at jts	
55		9C	98/70	11 diag jts, 1 vert jt, talc at jts, calcite vein filled @ 55.8'	
		10C	90/65	6 diag jts, 3 horiz jts, 1 cross jt, talc & pyrite at jts, calcite veins	
60		11C	95/80	6 diag jts, 4 horiz jts, 1 vert jt, talc at jts, calcite veins	
65		12C	98/80	6 diag jts, 1 horiz jt, 2 cross jts, talc & stain at jts, calcite veins	
70		13C	98/50	5 diag jts, 4 horiz jts, 2 cross jts, talc at jts, calcite veins	
75		14C	98/85	Unwthrd, rel snd, 3 diag jts, 3 horiz jts, talc at jts, calcite veins	REL SOUND GRY-GREEN DIORITE, 3 JOINTS PER 2 FEET 84.1'
80		15C	100/90	Rel snd, 2 diag jts, 4 horiz jts, talc at jts	
85		16C	95/55	4 diag jts, 7 horiz jts, 1 cross jt, talc & stain at jts; possible minor shear with 1/2" gouge 87' to 88'	
90		17C	98/70	6 diag jts, 4 horiz jts, 3 cross jts, talc & stain at jts	
95		18C	95/45	5 diag jts, 7 horiz jts, talc at jts, calcite veins	
100		19C	95/60	4 diag jts, 5 horiz jts, talc at jts, calcite veins	

(CONTINUED)

BORING NUMBER AM-62 (CONT'D)

100		20C	98/50	Hi jtd, unwthrd, 6 diag jts, 4 horiz jts, talc at jts, calcite veins	JOINTED UNWEATHERED HORNBLENDE QUARTZ DIORITE WITH PYRITE AND CALCITE AND QUARTZ VEINS, POORLY FOLIATED, MEDIUM GRAINED TO 137', FINE GRAINED BELOW, PRINCIPAL JOINTS DIP 20° TO 40° 145.6'
105		21C	95/85	Rel snd, 2 diag jts, 3 horiz & cross jts, talc at jts	
110		22C	95/55	3 diag jts, 6 horiz jts, talc at jts	
115		23C	98/55	4 diag jts, 9 horiz jts, 1 cross jt, talc at jts	
120		24C	98/15	Hi jts, 7 diag jts, 2 vert jts, 9 horiz jts, 4 cross jts, talc & quartz at jts, 7 jts per foot; broken at 121' & 123'	
125		25C	85/50	Jointed, 3 diag jts, 6 horiz jts, 1 cross jt. talc at jts, 3 jts per foot	
130		26C	95/10	6 diag jts, 12 horiz jts, 5 cross jts, fractured 130' to 132', 7 jts per foot	
135		27C	95/50	9 diag jts, 3 cross jts	
		28C	96/50	Jtd, staining at joints	
140		29C	90/60	3 diag jts, 3 horiz jts, talc at jts	
145		30C	95/70	3 diag jts, 1 horiz jt, talc at jts	
150		31C	98/95	Rel snd, 2 horiz jts	RELATIVELY SOUND DIORITE WITH CHLORITE, QUARTZ, CALCITE, PYRITE AND STAINING AT JOINTS, BIOTITE QUARTZ DIORITE BELOW 167' 185.0'
		32C	98/60	1 vert jt, 5 diag jts, 2 horiz jts, talc, calcite & pyrite at jts; staining jtd & broken below 150'	
155		33C	100/98	1 horiz jt, sound	
160		34C	100/90	2 horiz jts, 1 diag jt, talc, pyrite & staining at jts	
165		35C	100/98	2 diag jts, calcite at jts filled at 165'	
170		36C	98/98	Fractured@166.8', 2 diag jts, 2 horiz jts, calcite veins, gray diorite to 167' light gray biotite quartz diorite below	
175		37C	98/98	Do 36C, bot, one piece 1/2" fill @ 173', pyrite & calcite	
180		38C	98/98	Do 36C, bot, 2 horiz jts, pyrite & calcite, 4" chlorite inclusion	
185		39C	100/ 100	Do 36C, bot, 2 diag jts, inclusion of chlorite 180.5'-182', pyrite & calcite	

Boring started 1-7-74 , completed 1-24-74
Final depths:
Boring = 185.0' Casing = 45.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 17.0' = El. +305.4

REMARKS:
Drilled ahead of casing from 10' to 45' depth; casing blows not reported.
Two water pressure tests with packers run in this borehole.

BORING NUMBER AM-63

Ground surface elevation +320.3

DEPTH BELOW GROUND SURFACE, FEET					
0	5 5 7 7 9	1D	3,3,3	Top: Brown clayey silt & roots (ML) (FILL) Bot: Brown micaceous fine sandy silt (Fill) (ML)	SILT AND SAND FILL 5.0'
5	21 47 139 100	2D	7,8, 11	Yellow-brown silt w/trace fine sand, piece of quartz (ML)	
10		3D	16,18 27	Red-brown micaceous very fine silty sand, trace clay (SM)	RED-BROWN MICACEOUS FINE SILTY SAND WITH CLAY, RESIDUAL SOIL 25.0'
15		4D	18,38 58	Gray-green silty very fine sand (Decomposed Rock) (SM)	
20		5D	34,52 80	Do 4D (SM)	
25		6D	70,77 58	Gray-green silty fine sand (SM)	COMPACT GRAY-GREEN FINE SAND, DECOMPOSED ROCK 35.4'
30		7D	100, 150	Do 6D (SM)	
35		8D	150/4"	Do 6D (SM)	
	Core		NR	Soft weathered rock	SOFT ROCK 40.0'
40		1C	90/65	Jtd, slightly wthrd grn-gray diorite gneiss, 5 diag jts w/iron stains, wthrd on jts, chlorite-phyllite inclusions	
45		2C	95/25	Hi jtd, 6 70° jts, 5 45° jts, 2 20° jts, iron stains, thin talc	
50		3C	95/90	Mod jtd, 2 30° jts, 2 45° jts, some iron stains, 1 jt per foot	
55		4C	100/85	6 diag jts, 2 horiz jts, iron stain at joints	
60		5C	100/90	5 diag jts, 1 jt per foot	JOINTED UNWEATHERED GRAY-GREEN HORNBLENDE QUARTZ-BIOTITE DIORITE WITH CHLORITE AND STAINING AT JOINTS, VERY POORLY FOLIATED, MEDIUM GRAINED, PRINCIPAL JOINTING 40° TO 70° 90.5'
65		6C	95/95	With chlorite inclusions, 4 diag jts, 1 vert jt, stains at jts	
70		7C	95/90	With chlorite, 4 diag jts, 1 vert jt, stain at jts, 2" broken and 1/4" open jt @ 70'	
		8C	100/ 100	With chlorite, 3 diag jts, staining at jts	
75		9C	95/40	Hi jtd, 6 horiz jts, 4 diag jts, stain at joints	
80		10C	98/80	5 diag jts, 1 horiz jt, stain at jts	
85		11C	90/80	With chlorite, 2 diag jts, 3 horiz jts	
90		12C	98/35	Hi jtd, 7 diag jts, 4 horiz jts	RELATIVELY SOUND GREEN-GRAY DIORITE GNEISS
		13C	95/70	Rel snd grn-gry diorite, 3 45° jts w/thin talc deposit, 2 60° jts	
95		14C	100/95	4 45° jts w/calcite & thin talc deposits, 1/8" calcite deposit @ 99'	
100		15C	95/95	2 30° jts, 1 70° jt, thin calcite deposit @ 103'	

(CONTINUED)

BORING NUMBER AM-63 (CONT'D)

100		16C	95/95	1 45° jt @ 105.3', 2 30° jts @ 107', thin calcite	107.0' REL SOUND GRANO-DIORITE 112.7' QUARTZ DIORITE 115.2'
105		17C	98/95	Jtd from 108'-108.4' w/ gray sandy clay, gouge & rock fgmts, possible shear 3 30° jts 111'-112'	
110		18C	98/90	2 45° jts @ 112.7', 2 20° jts @ 116', thin calcite	
115		19C	95/75	Diorite-chlorite contact @ 118.5', 70° jt w/calcite 1 45° jt, 1 60° jt @ 120", 70° jt @ 121'	
120		20C	100/80	3 horiz jts 121.5' & 124.5' 1 70° jt @ 125.3'	
125		21C	95/65	80° jt w/talc- chlorite @ 126'-126.7', 4 10° jts, 2 30° jts	RELATIVELY SOUND GRAY-GREEN HORNBLENDE QUARTZ DIORITE WITH CHLORITE INCLUSIONS, MEDIUM GRAINED, INDISTINCT FOLIATION, PRINCIPAL JOINTS AT 30° AND 60° 161.0'
130		22C	95/90	Rel snd, 3 horiz jts	
135		23C	95/90	Rel snd, 3 diag jts, talc at jts	
140		24C	95/95	Rel snd	
145		25C	95/90	Rel snd, 1 diag jt, 1 horiz jt	
		26C	95/90	1 diag jt, 1 horiz jt, talc at jt	
150		27C	95/90	3 diag jts, talc & calcite at jts	
155		28C	100/ 100	2 diag jts	
160		29C	100/95	4 diag jts, 1 horiz jt, talc & calcite at jts	
		30C	100/45	Jtd, 10 diag jts, 2 horiz jts, 1 cross jt, talc, calcite & stain at jts	JOINTED DIORITE, 3 JOINTS PER FOOT, 50° DIP 170.0'
165		31C	98/85	4 diag jts, 1 horiz jt, talc & stain at jts	
170		32C	100/ 100	3 diag jts, 1 horiz jt, talc & ocher at jts	REL SOUND GRY-GRN DIORITE WITH CHLORITE AND TALC, 1 JOINT PER FOOT, JOINTED BELOW 180' 185.0'
175		33C	95/95	3 diag jts, 1 horiz jt, 1 cross jt, talc & ocher at jts	
180		34C	95/85	6 diag jts, 1 horiz jt, 1 cross jt, talc , calcite & staining at jts	
185		35C	95/75	5 diag jts, 2 cross jts, talc & staining at jts	

Boring started 1-14-74 , completed 1-23-74
Final depths:
Boring = 185.0' Casing = 40'
Casing diameter = 4"
Average depth of ground water observed in the boring = 16.0' = El. +304.3

REMARKS:
Drilled ahead of casing from 9' to 40' depth; casing blows not reported.
Two water pressure tests with packers run in this borehole.

BORING NUMBER AM-64

Ground surface elevation +321.2

DEPTH BELOW GROUND SURFACE, FEET					
0	21 24 44 84 164	1D	4,4,4	Stiff brown sandy silt w/some topsoil, trace clay (Fill) (ML)	STIFF BRN SILT, TR CL & F SA 5.0'
5	210 600 434 485 873	2D	7,26, 34	Medium compact brown silty fine sand w/trace clay (SM)	MEDIUM COMPACT GRAY-BROWN FINE SAND WITH TRACE CLAY AND SILT, DECOMPOSED ROCK 20.9'
10		3D	19,60 83	Do 2D w/numerous decomposed rock fragments (SM)	
15		4D	34,83 153	Do 2D w/numerous decomposed rock fragments (SM)	
20		5D	84, 100/3"	Decomposed diorite geniss (SM)	
25		1C	80/10	Gry-grn diorite w/chlorite Hi wthrd, hi jtd, 7 horiz jts, 7 diag jts	HIGHLY JOINTED & FRACTURED, HIGHLY TO MODERATELY WEATHERED GRAY-GREEN DIORITE WITH CHLORITE INCLUSIONS 39.5'
		2C	90/20	Hi wthrd, hi jtd & fract, 7 diag jts, 6 horiz jts, 2 vert jts, staining & slickensides	
30		3C	85/35	6 diag jts, 9 horiz jts, 1 vert jt, fract, staining & slickenside 31'-32'; wthrng decreases from 33.7'	
35		4C	95/30	Sli wthrd, hi jtd, fract @ 35.5', 36.5', 38.5', 11 diag jts, 7 horiz jts, staining at jts	
40		5C	90/35	Hi jtd, 8 diag jts, 6 horiz jts, staining & slight wthrng at jts; slickenside at 41.5'	HIGHLY JOINTED, SLIGHTLY WEATHERED AT JOINTS, DIORITE 56.9'
45		6C	95/80	6 diag jts, 2 horiz jts, staining at jts, 2 jts per foot	
50		7C	90/10	6 diag jts, 8 horiz jts, hi jtd & fract, staining at jts, 4 jts per foot	
55		8C	90/20	5 diag jts, 7 horiz jts, 1 vert jt, hi jtd, slight staining at jts, slickenside or sheared at 56'	
		9C	95/70	6 diag jts, 6 horiz jts, staining at jts, gouge at 56'	
60		10C	95/45	6 diag jts, 3 horiz jts, calcite & talc at jts	
65		11C	90/60	5 diag jts, 5 horiz jts, talc & slight staining at jts	HIGHLY JOINTED TO JOINTED UNWEATHERED GRAY-GREEN HORNBLENDE QUARTZ DIORITE, BECOMING SOUNDER AT 85' TO 95' DEPTH, POORLY FOLIATED, FINE GRAINED, TYPICAL LOW ANGLE JOINTING 100.0'
70		12C	90/60	2 diag jts, 1 horiz jt	
		13C	95/30	Hi jtd, 7 horiz jts, 5 diag jts, 5 jts per foot	
75		14C	90/45	6 horiz jts, 5 diag jts, talc lined jts, 3 jts per foot	
80		15C	95/60	Jtd, 5 horiz jts, 3 diag jts, 1 vert jt	
85		16C	95/95	Rel snd, 3 diag jts, 3 horiz jts, talc at jts	
90		17C	95/75	Jtd, 2 diag jts, 4 horiz jts, talc at jts, 3 jts per foot	
95		18C	95/60	Do 17C, 5 diag jts, 3 horiz jts, talc at jts	
100		19C	95/50	Do 17C, 7 diag jts, 4 horiz jts, possible gouge at 100', granodiorite below 100'	

(CONTINUED)

BORING NUMBER AM-64 (CONT'D)

100		20C	95/60	Quartz-biotite granodiorite, 3 diag jts, 3 horiz jts	JOINTED TO HIGHLY JOINTED AND BROKEN LIGHT GRAY GRANO-DIORITE FINE GRAINED POORLY FOLIATE JOINTS 30° TO 60° 150.0'
105		21C	90/50	Do 20C, 5 diag jts, 8 horiz jts, pyrite at jts	
110		22C	98/45	Do 20C, 8 diag jts, 7 horiz jts & cross jts, pyrite at jts	
115		23C	98/30	Do 20C, 6 diag jts, 7 horiz jts, 1 vert jt & cross jts, pyrite & calcite at jts	
120		24C	95/0	Do 20C, 4 diag jts, 3 horiz jts, 7 vert jt & cross jts	
125		25C	95/15	Do 20C, 8 horiz jts, 5 diag jts, pyrite & calcite at jts	
130		26C	95/0	Do 20C, hi jtd, 8 diag jts, 7 horiz jts, 2 vert jts, granitic intrusion @128.6' pyrite, calcite & talc @jts	
135		27C	95/10	Hi jtd, 6 diag jts, 11 horiz jts, pyrite & calcite at jts, granodiorite	
140		28C	90/0	Broken & hi jtd, 18 horiz jts, 7 diag jts, 3 vert jts, pyrite & quartz at jts; possible shear 138' to 140'	
		29C	95/0	Hi jtd, fractured, 2" quartz vein at 141.5;	
145		30C	95/5	Hi jtd, cross jts, fractured	
150		31C	95/15	Hi jtd, cross jts, pyrite & talc at jts	
		32C	90/45	Diorite, 5 diag jts, 8 horiz jts, 2 cross jts, talc, pyrite & calcite at jts	
155		33C	100/75	5 diag jts, 4 horiz jts, talc at jts	
160		34C	85/10	Fine grained, hi jtd, 8 diag jts, 10 horiz jts; possible shear 162'-163'	
165		35C	90/50	4 diag jts, 7 horiz jts, 1 vert jt & cross jts	
170		36C	95/25	4 diag jts, 7 horiz jts, 1 vert jt, 3 cross jts.	
175		37C	95/75	2 diag jts, 3 horiz jts	174.9'
		38C	98/80	Rel snd, 2 diag jts, 2 horiz jts, 3 jts per 2 feet	RELATIVELY SOUND DIORITE
180		39C	98/80	2 diag jts, 4 horiz jts, talc at joints	
185		40C	95/70	2 diag jts, 1 horiz jt	185.0'

Boring started 12-12-73 , completed 1-2-74
Final depths:
Boring = 185.0' Casing = 20'
Casing diameter = 4"
Average depth of ground water observed in the boring = 17.7' = El. +303.5

REMARKS:
Drilled ahead of casing from 10' to 20' depth; casing blows not reported.
Caving in of the boring hole at depth of 185' forced its termination at that depth.

DESIGNED _____ DATE
DRAWN IHL DATE 12/74
CHECKED SLT & JPG DATE 12/74
APPROVED _____ DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86to	Plans & Geological Section
F-A-104	

REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA · WILLIAM H. ROESER · 4070 · REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H. Roeser

DE LEUW, CATHER & COMPANY ☐
GENERAL ENGINEERING CONSULTANT
HARRY WEESE & ASSOCIATES ☐
GENERAL ARCHITECTURAL CONSULTANT
APPROVED _____

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-62 to AM-6

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-119

BORING NUMBER AM-65

Ground surface elevation + 321.6

1D	3,8,8	Topsoil, stiff brown micaceous fine sandy silt (Fill) (ML)	STIFF SILT, FILL	5.0'
2D	4,4,7	Brown completely decomposed residual soil, fine sandy silt (ML)	SANDY SILT	10.0'
3D	20,30 34	Brown-green compact micaceous fine sand with some silt (Decomposed Rock) (SM)	BRN-GRN COMPACT MICACEOUS FINE SAND WITH SOME SILT AND DECOMPOSED ROCK FRAGMENTS	26.0'
4D	28,80 100	Do 3D, with some rock fragments (SM)		
5D	45, 100	Do 3D, with numerous rock fragments (SM)		
6D	50, 140	Do 3D, with numerous rock fragments (SM)		
1C	60/15	Wthrd, hi jtd diorite, 7 horiz jts, 3 diag jts, staining at jts	WTHRD, JOINTED DIORITE	30.0'
2C	95/40	Jtd, sli wthrd diorite, 7 horiz jts, 3 diag jts, staining at joints	JOINTED DIORITE, UNWEATHERED WITH STAINING AT JOINTS	43.0'
3C	98/40	1 vert jt, 8 diag jts, 3 cross jts, hi jtd, unwthrd except for stain at jts		
4C	98/50	Jtd, 6 diag jts, 7 horiz jts, shear @ 39.5'		
5C	100/ 100	Rel snd, 1 diag jt, stain & talc at jts	RELATIVELY SOUND GRAY-GREEN DIORITE GNEISS	56.0'
6C	100/ 100	Do 5C, 1 diag jt, 1 horiz jt, stain at jts		
7C	100/98	Do 5C, 3 diag jts, calcite & pyrite at jts		
8C	100/70	Mod jtd, 4 diag jts, 2 vert jts, 2 horiz jts, staining & calcite at jts		
9C	98/25	Jtd, fract, possible shear @ 63', 6 diag jts, 2 vert jts, 2 horiz jts, stain & calcite at jts		
10C	90/20	Jtd, fract, shear 67.5'to 69.5', 2 vert jts, 7 diag jts, 3 horiz jts, stain & calcite at jts	JOINTED TO HIGHLY JOINTED GRAY-GREEN DIORITE, SEVERAL PROMINANT SHEAR ZONES, POORLY FOLIATED	
11C	90/0	4" clay seam @ 69', 2 vert jts, 5 horiz jts, 2 diag jts, talc at jts		
12C	90/15	Hi jtd & fract, 8 horiz jts, 9 diag jts, 2 vert jts, clacite, talc & quartz at jts		
13C	95/0	Hi jtd & fract, shear & clay seam, 79'to 83'		
14C	98/0	Hi jtd, fract, shear to 83', broken @ 84', calcite at jts		
15C	98/40	4 diag jts, 3 horiz jts, fractured		94.0'
16C	98/25	Hi jtd, 11 diag jts, 4 horiz jts, quartz & talc at jts	MOD JTD DIORITE	98.0'
17C	70/45	2 diag jts, 1 vert jt, talc & calcite at jts		
18C	90/85	3 diag jts, calcite & talc at jts	REL SND DIORITE 1D1.5'	
19C	90/90	1 cross jt, 3 diag jts mostly @ 45°, calcite & talc on jt planes		

(CONTINUED)

BORING NUMBER AM-65 (CONT'D)

20C	90/80	Mod jtd, 3 diag jts 45° & 60°	WEATHERED AND JOINTED	108.5'
21C	90/55	3 diag jts @ 30°,45°,60°, 1 vert jt, calcite on jts, veins at 106.5'-107.3'		
22C	98/55	3 diag jts @ 30° & 60°, horiz calcite coating on joint at 109'		
23C	98/30	Jts @ 30°, 60° & 75°, 1 vert jt, calcite & talc on jt planes		
24C	98/35	8 diag jts @ 30°to 60°, calcite & talc on jts	LIGHT COLORED GRAY-GREEN JOINTED GRANODIORITE, POORLY FOLIATED, FINE GRAINED, SOME JOINTS STAINED OR COATED, BROKEN AT 116', 138',139', 142' TO 144' AND 146'	
25C	98/45	9 diag jts @ 50° to 70°, 1 vert jt, calcite & talc on jt plane		
26C	96/35	Diag jts mainly @10° & 80°		
27C	88/65	4 diag jts, 1 cross jt 40° to 60°		
28C	95/70	Mod jtd to jtd, 7 diag jts mostly @ 38°,45° & 50°		
29C	90/30	11 diag jts mostly 30° to 60°, 1 cross jt @ 135.8', talc on jts		
30C	95/20	2 diag jts @ 45° & 60°, talc at jts, broken at 138'-139'		
31C	98/40	3 diag jts @ 45°, calcite on jts		
32C	90/20	4 diag jts @ 45°& 55°, 2 vert jts		
33C	98/0	2 diag jts, 1 vert jt, talc on jt		146.0'
34C	80/45	5 jts @ 80° to 85°		
35C	98/80	Mod jtd to jtd diorite, 2 diag jts @ 45° & 50°, calcite, talc & iron staining at jts	JOINTED TO RELATIVELY SOUND HORNBLENDE BIOTITE QUARTZ DIORITE, MEDIUM GRAINED WITH CHLORITE SCHIST AUGENS	
36C	100/95	2 diag jts, calcite & staining on 1 jt, calcite vein at 151'		
37C	90/90	Jtd diorite, 1 diag jt @ 45°, calcite & talc on jt		
38C	98/85	Mod jtd diorite, 2 diag jts @ 60°		
39C	100/85	3 diag jts, 2 @ 80° & 1 @ @ 45°, calcite & iron staining on jts		
40C	95/85	3 diag jts, 1 60°, 2 45°, calcite on jts		173.0'

Boring started 1-24-74 , completed 2-5-74
Final depths:
Boring = 173.0' Casing = 24'
Casing diameter = 3"
Average depth of ground water observed in the boring = 17.0' = El. +304.6

REMARKS:
Drilled ahead of casing from 9' to 24' depth; casing blows not reported.
Caving in occured at 166' to 168' depth.
Observation well consisting of 1-1/2" steel pipe was installed with tip at 166.5' depth.

BORING NUMBER AM-66

Ground surface elevation + 320.7

1D	7,10, 10	Stiff brown fine sandy silt & medium compact silty fine sand (Fill) (ML & SM)	STIFF BRN F SAND & SILT,FILL	5.0'
2D	7,32, 50	Very compact gray-brown silty fine sand (SM)	VERY COMPACT GRAY-BROWN SILTY FINE SAND, DECOMPOSED ROCK	20.2'
3D	184, 300/1"	Do 2D, with numerous weathered rock fragments (SM)		
4D	270/6"	Very compact moist gray-brown fine sand & rock fragments (SM)		
5D	100/2"	Do 4D, more rock fragments (SM)	MOD WTHRD GRAY-GREEN DIORITE WITH CHLORITE	27.7'
1C	20/10	Wthrd & broken gry-green diorite with chlorite		
2C	50/15	7 jts almost horiz, sm staining at jts		
3C	98/70	Sli wthrd at jts, 3 diag jts, 4 horiz jts, staining at jts, chlorite inclusions		
4C	98/90	3 diag jts, talc & some pyrite at jts, unwthrd, rel snd		
5C	98/98	Do 4C, 2 horiz jts	GRAY-GREEN HORNBLENDE QUARTZ DIORITE, SLIGHTLY WEATHERED, RELATIVELY SOUND TO MODERATELY JOINTED, UNFOLIATED, WITH QUARTZ AND FELDSPAR VEINS AND BIOTITE AUGENS	
6C	95/90	Do 4C with 2 diag jts, 1 horiz jt, calcite vein		
7C	90/85	3 diag jts, talc at jts		
8C	98/80	3 diag jts, 1 horiz jt, talc at jts, possible movement at 52.5'		
9C	90/85	3 diag jts, 1 horiz jt, talc & pyrite at jts, calcite vein at 55.7'		
10C	100/ 100	3 diag jts, 1 horiz jt, talc at jts		
11C	100/ 90	with 3 diag jts		76.2'
12C	90/65	Mod jtd, 4 diag jts, 3 horiz jts, talc at jts, some with calcite	RELATIVELY SOUND DIORITE, JOINTS 30° TO 60° WITH CALCITE FILLING, AVERAGE SPACING: 2 JOINTS PER 3'	
13C	98/60	Mod jtd, 3 diag jts, 4 horiz jts, talc at jts, some with calcite		
14C	98/98	Fine grained from 76.2' to 78', 3 diag jts		
15C	98/98	5 diag jts, 1 horiz jt, talc at jts, filled jt at 84.4'		
16C	100/ 98	3 horiz jts, 2 diag jts		
17C	98/98	3 diag jts, 1 horiz jt		
18C	100/ 85	5 diag jts, 1 horiz jt, talc & pyrite at jts		93.7'
19C	98/98	3 diag jts, 1 horiz jts, talc & pyrite at jts	MODERATELY JOINTED TO RELATIVELY SOUND	
20C	98/90	3 diag jts, 3 horiz jt, pyrite, calcite & talc at jts		

(CONTINUED)

BORING NUMBER AM-66 (CONT'D)

21C	98/98	2 diag jts, 1 horiz jt, pyrite, calcite & talc on jts	GRAY-GREEN DIORITE, UNFOLIATED WITH TALC, PYRITE & CALCITE	111.7'
22C	95/90	5 diag jts, pyrite & talc at jts, 2 jts smooth & probably slickensided		
23C	90/75	Mod jts, 6 diag jts, 2 horiz jts, pyrite, talc & calcite on jts, jts filled at 117.6'	MODERATELY JOINTED TO HIGHLY JOINTED GRAY-GREEN DIORITE WITH TALC, PYRITE AND CALCITE, JOINTS DIP 20°, 45°,60°, UNFOLIATED	
24C	98/75	Mod jtd, 6 diag jts, 7 horiz jts, talc & pyrite on jts		
25C	98/65	Jtd, 9 diag jts, 6 horiz jts, 1 vert jt, talc & pyrite at jts, filled at 126.4'		
26C	95/70	Mod jtd, 9 diag jts, 5 horiz jts, 1 vert jt, talc at jts		
27C	98/45	Hi jtd, 6 diag jts, 2 horiz jts, 2 vert jts, talc & pyrite at jts		
28C	90/60	5 diag jts, 3 horiz jts, sm staining at jts, quartzite intrusion at 140.2'		138.2'
29C	98/70	3 diag jts, 6 horiz jts, talc & calcite at jts		
30C	98/75	4 diag jts, 4 horiz jts, 2 vert jts, staining, pyrite & talc at jts	JOINTED GRAY-GREEN HORNBLENDE QUARTZ DIORITE WITH SOME STAINING AT JOINTS, OCCASIONAL INTRUSION OF QUARTZITE, PRESENCE OF CALCITE, PYRITE AND TALC ON JOINTS, INDISTINCTLY FOLIATED	
31C	98/60	with chlorite inclusions, 5 diag jts, 2 horiz jts		
32C	98/60	6 diag jts, 1 horiz jt, talc & pyrite at jts		
33C	98/75	4 diag jts, 3 horiz jts, fractured at 161', staining & calcite at jts,		
34C	100/ 75	4 diag jts, 3 horiz jts, 1 vert jt, talc & quartz at jts		
35C	98/80	7 horiz jts, 3 diag jts, filled at 169.8'		
36C	98/60	9 horiz jts, 7 diag jts, 2 vert jts, 1/2" quartz vein at 175.5', jtd & fractured		
37C	98/65	4 diag jts, 4 horiz jts, 1 vert jt, quartz & talc at jts		
38C	95/50	Hi jtd, 5 diag jts, 5 horiz jts, 1 vert jt, quartz vein at 184.3', pyrite & calcite jts		
39C	98/50	Hi jtd, 3 diag jts, 10 horiz jts, 1 vert jt, fractured between 187' & 188'		190.2'

Boring started 11-30-73 , completed 12-27-73
Final depths:
Boring = 190.2' Casing = 20'
Casing diameter = 4"
Average depth of ground water observed in the boring = 17.7' = El. +303.0

REMARKS:
At beginning of waork day 12-11-73 the boring had to be offset 3 feet south because of debris in the hole then 15.5' deep.
Drilled ahead of casing from 5' to 20' depth; casing blows not reported.
Three water pressure tests with packers run in this borehole.

BORING NUMBER AM-67

Ground surface elevation + 325.7

1D	2,5,5	Medium stiff brown-red clayey silt, trace fine sand, trace mica (Fill) (ML)	M STIFF BRN-RED SILT,FILL	5.0'
2D	21,25 27	Stiff brown-red clayey silt, trace fine sand, trace mica, residual soil (ML)	BROWN-RED CLAYEY SILT, TRACE FINE SAND	15.0'
3D	7,8,9	Medium stiff brown micaceous silty fine sand, trace clay (SM)		
4D	6,10, 13	Medium compact gray-brown micaceous silty fine sand (SM)	COMPACT WHITE-BROWN FINE SAND, SOME SILT, NUMEROUS ROCK FRAGMENTS	35.5'
5D	10,13 14	Do 4D, trace rock fragments (SM)		
6D	10,28 35	Compact white-brown fine sand, some silt (Kaolinite) (SM)		
7D	40, 100	Very compact dark brown fine to medium sand, some silt, numerous rock fragments (SM)	GRAY-BRN FINE TO MEDIUM SAND	40.1'
8D	100	Do 7D (SM)		
1C	25/0	Hi jtd, slightly wthrd light gray-white diorite gneiss	HIGHLY JOINTED TO RELATIVELY SOUND DIORITE WITH CHLORITE INCLUSIONS	53.0'
2C	98/0	Hi jtd gray-green, altered diorite, 7 45° jts, 8 10° to 20° jts, 1 70° jt 42.4' to 43' w/thin calcite, vert jt 43'-43.5', possible shear zone		
3C	65/30	Do 2C	JOINTED DIORITE	57.5'
4C	98/95	Sound gry-grn altered fine grained, 2 45°jts 48'-48.3'		
5C	98/95	2 30° jts, 2 45°jts, iron stain, small rock fgmts on jt @ 52.7', gouge mtl on possible shear		
6C	95/75	2 45° jts, 2 30° jts, jointed diorite	RELATIVELY SOUND UNWEATHERED GRAY-GREEN DIORITE GNEISS WITH TALC ON JOINTS	80.0'
7C	95/90	Rel sound diorite gneiss 2 30° jts w/ calcite, 2 60° jts		
8C	95/90	3 diag jts, 1 horiz jt		
9C	100/ 95	2 diag jts, 2 horiz jts, talc at joint		
10C	90/80	3 horiz jts, 2 diag jts		
11C	98/95	1 diag jt	MOD JTD TO JTD GRY GREEN DIORITE GNEISS, ALTERED AND FRACTURED IN JOINT ZONES	92.0'
12C	90/70	Rel sound to mod jtd, 2 horiz jts		
13C	98/50	6 horiz jts, 2 diag jts, alteration & fracture at 86.5'		
14C	40/40	2 horiz jts		
15C	80/80	Rel sound diorite gneiss, 1 horiz jt		
16C	100/ 90	2 horiz jts, 1 diag jt		
17C	100/ 98	1 horiz jt, 1 diag jt, talc & pyrite on jts		
18C	90/75	4 horiz jts, 1 diag jt, talc & pyrite on jts, presence of calcite noted		

(CONTINUED)

BORING NUMBER AM-67 (CONTINUED)

19C	95/65	1 diag jt, 3 horiz jts	RELATIVELY SOUND TO SOUND GRAY-GREEN DIORITE GNEISS WITH CHLORITE, TALC, PYRITE AND CALCITE ON JOINTS, NUMEROUS CHLORITE INCLUSIONS AND INTERBEDS	
20C	80/75	4 horiz jts, 1 diag jt, quartz vein at joint		
21C	95/35	5 horiz jts, 3 diag jts 1 vert jt, 1 cross jt.		
22C	98/80	With chlorite inclusions, 5 horiz jts, 1 diag jt, quartzite & calcite on jts		
23C	98/95	With chlorite inclusions, 2 horiz jts		
24C	98/95	With chlorite inclusion, 1 horiz jt		
25C	95/90	Pyrite & talc at joints, 2 horiz jts, 1 diag jt		136.0'
26C	90/70	Diorite gneiss with chlorite inclusions,1 diag jt, 4 horiz jts, 1 cross jt, calcite & talc at jts		
27C	90/85	With chlorite inclusions, 4 horiz jts		
28C	90/70	With chlorite inclusions, 7 diag jts, 3 horiz jts		
29C	85/35	With chlorite inclusions, 3 diag jts, 4 horiz jts		
30C	100/ 60	2 vert jts, 5 horiz jts	MODERATELY JOINTED TO JOINTED GRAY-GREEN DIORITE GNEISS WITH CHLORITE INCLUSIONS, PARTICULARLY ABOVE 153' DEPTH	
31C	80/70	3 horiz jts, calcite on jts, 1 diag jt		
32C	100/ 85	2 diag jts, 3 horiz jts		
33C	90/60	4 horiz jts, 2 diag jts		
34C	100/ 80	3 diag jts, 3 horiz jts		
35C	90/50	With chlorite inclusions, 4 diag jts, 3 horiz jts, talc on jts		
36C	75/75	1 diag jt, talc on jts		
37C	100/ 60	3 diag jts, talc on jts 4 horiz jts		
38C	100/ 75	Mod jts gray diorite gneiss, thinly laminated, 2 horiz jts, 2 30° jts, 3 10° jts, thin talc deposit on joints, no staining		189.0'

Boring started 12-18-73 , completed 1-2-74
Final depths:
Boring = 189.0' Casing = 34.0'
Casing diameter = 4"
Average depth of ground water observed in the boring = 29.0' = El. +296.7

REMARKS:
Drilled ahead of casing from 30' to 34' depth; casing blows not reported.
Driller was unable to retrieve the casing from this hole.
Three water pressure tests with packers run in this borehole.

DESIGNED		DATE
DRAWN	IHL	DATE 12/74
CHECKED	SLT & JPG	DATE 12/74
APPROVED		DATE

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to	Plans & Geological Sections
F-A-106	

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA — WILLIAM H. MUESER — 4070 — REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William A. Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐
HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐
APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-65 to AM-67

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-120

BORING NUMBER AM-68
Ground surface elevation + 321.5

DEPTH BELOW GROUND SURFACE, FEET					
0	49 47 52	1D	10,16 18	Brown sand & gravel, trace silt (Fill) (SP-SM)	FILL 4.5'
5	50 44 22 84 78	2D	13,14 20	Brown micaceous decomposed rock, silty fine sand (SM)	
10	30 45 53 50	3D	11,15 16	Do 2D (SM)	
15	60 125 42 48 48	4D	18,17 25	Do 2D (SM)	SANDY RESIDUAL SOIL AND DECOMPOSED ROCK
20	70 90 158 278 295	5D	4,9, 12	Do 2D (SM)	
25	86 100 93 30/6"	6D	20,40 40	Do 2D, rock fragments increase (SM) Hard drilling at 28'	26.8'
30		1C	80/30	Sli wthrd & jtd granitic gneiss, indistinct fol, 11 jts per 4', jts are rough, straight & iron stained	WEATHERED AND JOINTED HORNBLENDE BIOTITE QUARTZ DIORITE, POORLY FOLIATED, JOINTS DIP TYPICALLY 40°TO 60°
35		2C	90/20	Do 1C, 15 jts per 4.4', jts rough, irregular & iron stained	
40		3C	90/20	Do 1C, 16 jts per 4.5', jts are rough, & iron stained	
45		4C	95/35	Do 1C, 20 jts per 3.6', joints are rough, straight & iron stained, typical 45° to 60°	
50		5C	85/0	Do 1C, 9 jts per 1.7'.	54.0'
55		6C	90/70	Sli wthrd, 21 jts per 4.4' badly fractured & jtd 52.6' to 54', 4" band of dec rock at 53.7'	MOD JOINTED TO JOINTED DIORITE
		7C	85/55	Unwthrd, extremely jtd to jtd, 7 jts per 3.8', jts are rough straight, iron stained	
60		8C	98/70	Do 7C, 8 jts per 4', soft badly jointed 4" zone at 61.5' to 62.5'	62.5'
		9C	98/80	Unwthrd inc jt, 1 jt per 1.4', jts smooth, straight	
65		10C	100/ 100	Do 9C, 1 jt per 4.5', jt is rough, straight, filled with secondary mineral	
70		11C	98/98	Do 9C, 1 jt closed, jt rough, straight, filled with secondary minerals	
75		12C	85/50	Do 9C, breaks due to drilling action	MODERATELY JOINTED TO RELATIVELY SOUND QUARTZ BIOTITE DIORITE, UNFOLIATED TO POORLY FOLIATED, MEDIUM GRAINED
80		13C	98/45	Do 9C, 6 jts per 4.2', jts are smooth & straight, secondary minerals, 2" calcite vein at 78.4'	
85		14C	90/80	Do, 9C, 10 jts per 4.5', jts are rough & straight, secondary minerals, banded sone at 83'	
90		15C	98/98	Do 9C, 4 jts per 4.3', soft chlorite zone from 86.5' to 86.8'	
95		16C	98/98	Rel snd, 1 jt per 4.5', soft chlorite sone 91'to 91.5'	
100		17C	100/ 100	Do 16C, 3 jts per 4.5', jts are smooth & straight, secondary mineralization, sm dark chlorite patches	

(CONTINUED)

BORING NUMBER AM-68 (CONT'D)

100	18C	100/ 98	Do 16C, 3 jts per 3.8', jts are smooth, straight, secondary mineralization	
105	19C	100/ 100	Sound lt gry quartz biotite diorite, 3 irregular 10° jts 107'-107.8' chlorite, no fol	
110	20C	100/ 100	3 irregular 10°-20° jts, chlorite inclusions 1/2" to 2", rectangular to oval shape	
115	21C	100/ 100	1 30° jt, 2 irregular jt	REL SND QTZ DIORITE WITH CHLORITE SCHIST INCLUSIONS & ALTERED FELDSPAR, HORNBLENDE-BIOTITE BANDS, THIN CALCITE DEPOSITS ON JTS, UNFOLIATED HORNBLENDE ZONE 167' TO 182'
120	22C	98/98	1 30° jt. 1 20° jt, 3 pieces	
125	23C	98/98	3 irregular horiz jts, 3 pieces, 1 piece 4"	
	24C	98/98	1 10° irregular jt at 125.9', 2 horiz jts at 127', 128', 1 30° healed jt at 125'	
130	25C	100/ 100	1 50° jt at 131.5', 2 10° jts, 1 horiz jt at 132.8' 5 pieces	
135	26C	100/ 100	Chlorite bands & inclusions, 135.5' to 136.5', 6 pieces	
140	27C	100/ 100	3 10° jts, irregular, chlorite inclusion 138.6' to 138.9', no foliation	
	28C	100/ 100	2 10° jts in 0.8', angular 60° chlorite inclusion	
145	29C	100/ 100	2 10° jts, 3 pieces	
150	30C	100/ 100	1 horiz jt, 2 20° irregular jts, 4 pieces, 1/4" feldspar band 45° @153.7'	
155	31C	100/ 100	2 10° jts, 2 horiz jts, 1/2" feldspar band 30° @ 157.1'	
160	32C	100/ 100	3 horiz jts, 1 30° jt @ 162.0', irregular inclusion at 160' & 161.6'	
165	33C	95/95	2 20° jts in 1.4', quartz diorite altered 163'to 166' with quartzite and hornblende bands	
170	34C	98/98	4 0°-15° jts in 3.0', 1 60° jt at 167', gry-grn quartz hornblende diorite	
175	35C	100/ 90	Do 34C, 4 0°-10° jts, 2 30° jts in 3', thin calcite on dep	
	36C	100/ 100	Do 34C, 4 10° jts in 2.8'	
180	37C	100/ 100	Do 34C, jts 0°-10° in 3.8' space, quartz-diorite at 182.7'	
185	38C	98/95	Do 37C, bot, 2 60° jts; 1 70° jt in 2.5' yellow stain, thin calc dep	
190	39C	85/85	Do 37C bot, 2 10° jts, 1 30° jt, 1 45° jt in 2'	190.0'

Boring started 3-25-74 , completed 4-29-74
Final depths:
Boring = 190.0' Casing = 42'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 15.0' = El. +306.5

REMARKS:
1.2' of concrete at surface.
Drilled ahead of casing from 5' to 42' depth; casing blows not reported.
Hard drilling at 28' depth, drill bit was lost in attempt to drill casing past 29.5' depth.
Two water pressure tests with packers run in this borehole.

BORING NUMBER AM-69
Ground surface elevation + 322.8

0	10 14 28 30 47	1D	8,12, 9	Gray-brown silty & clayey fine to medium sand, trace coarse sand & gravel (Fill) (SM-SC)	MEDIUM COMPACT GRAY-BRN SILT AND FINE TO MEDIUM SAND, FILL 10.0'
5	48 68 75 96	2D	5,6,7	Red-brown clayey silt, some fine sand (Possible Fill) (ML)	
10		3D	10,12 15	Brown silty fine sand (SM)	
15		4D	15,15 20	Brown-gray silty fine sand (SM)	COMPACT TO VERY COMPACT BROWN-GRAY SILTY FINE SAND, SOME ROCK FRAGMENTS
20		5D	19,24 38	Do 4C (SM)	
25		6D	26, 100	Brown-gray silty fine sand, trace rock fragments (SM)	33.2'
30		NR	100/0"	Probable soft rock	
35		1C	98/90	Jtd gry quartz diorite, unwthrd, 1 horiz jt, 2 30° jts in 2.2', thin talc deposit & stain at 37.2'	RELATIVELY SOUND TO MODERATELY JOINTED GREEN-GRAY ALTERED HORNBLENDE QUARTZ DIORITE WITH CHLORITE, NO FOLIATION, MEDIUM TO FINE GRAINED, THIN CALCITE DEPOSITS AND SLIGHT IRON STAINS ON JOINTS SEMI HEALED TO HEALED JOINTS, SOME GOUGE MATERIAL, POSSIBLE SHEAR ZONES, PREDOMINANT JOINTING AT 60°
40		2C	98/85	6 jts, 30° to 60°, some iron stain & calcite	
45		3C	98/75	2 45° jts, 46'-47' sli wthrd & stain on jts, broken - jtd 46.5'-47.2'	
50		4C	98/90	4 30° jts, thin calcite deposit	
55		5C	98/95	1 30° jt, thin calcite 55.2', thin dark mtl on jt, sli stained at 55.5'	
		6C	98/85	2 20° jts in 0.6' at 57', thin dark gouge material	
60		7C	98/90	2 60° jts in 1.0', 58'-59' thin calcite deposit sli stained, 2 30° jts, 1 horiz jt in 0.7'	
65		8C	100/ 100	1 30° jt w/thin calcite deposit @ 66', 1 piece 4.2' long	
70		9C	98/95	1 30° jt, 1 60° jt in 0.5', pyrite crystals & slight stain on joints	
		10C	95/70	2 30° jts in 0.8' iron stained, 1 60° jt with calcite at 72.5', broken 74'-75' w/1/4" gouge @60°	
75		11C	98/80	7 low angle joints open 1/8" at 79', thin calcite deposit on jts	
80		12C	95/85	1 65° jt, broke on calcite healed joint plane, 1 45° jt, thin calcite, slightly stained 81.2'	
85		13C	98/75	1 85° semi-healed thin jt, thin calcite, 1 60° jt w/calcite deposit @85.4'	
90		14C	98/95	1 30° jt, 2 45° jts in 1.7', 1 85° semi-healed jt 91'to 92', thin calcite deposit, slight stain on jts	
95		15C	98/80	3 30° jts, 2 45° jts in 3.0', 2 70°-80° jts in 0.8' at 92', thin calcite deposits, slight stain	
100		16C	98/90	1 60° jt smooth w/calcite deposit @ 98', 1 70° jt & 1 50° jt, rough with 1/4" calcite	

(CONTINUED)

BORING NUMBER AM-69 (CONT'D)

105	17C	98/75	2 70° jts, 1 50° jt, 1 20° jt w/thin calcite, slight iron stain	
110	18C	98/60	7 45° jts, 1 60° jt, 2 20° jts, 1 30° jt 1/4" in 1.5' 1 horiz jt, 1 10° jt in 0.2'	
	19C	95/85	2 45° jts in 1.6', 1 60° jt, 1 70° jt in 1.2', thin calcite deposit	
115	20C	95/80	2 60° jts in 0.1' @ 114' slight iron stain & calcite deposit, 2 30°jts, 2 45° jts	
120	21C	85/55	9 10° jts 1/16" to 1/8" open, 2 30° jts 1/8'open 1/8" dep at 120.3', 3" shear at 121'	
	22C	90/25	Hi jtd & broken 123'-124', 125'-126', gouge material 123.5' & 125.5'	
125	23C	90/20	Hi jtd, 6 jts in 2', 2" broken at 129'	
130	24C	90/85	Broken 130.1'-130.6', 3 45° jts in 2.5', 3 10° to 15° jts in 3.1', gouge material at 133'	
135	25C	90/85	8 jts in 4.5', 4 45° jts, 1 60° jt, thin healed joints	
140	26C	90/75	2 20° jts, 1 45° jt in 0.5', thin calcite deposit on jts, 2 70° jts, 2 45° jts in 1.4'	
145	27C	90/70	2 45° jts in 2.6', thin calcite deposits on jts	
	28C	100/ 95	3 45° jts, 2 50° jts 1/2" close in 1.7', calcite deposit on jts	
150	29C	100/ 100	1 45° jt at 151.2', trace calcite on jt, 2 pieces	
155	30C	100/ 95	1 30° jt, 1 45° jt, 1 50° jt in 1.1' thin calcite deposit	
160	31C	100/ 100	2 45° jts in 0.5', thin calcite deposit on jts, 1 piece is 4' long	
165	32C	90/60	2 70° jts in 0.1', 2 jts 60°-70°, 1 50° jt, 1 30° jt in 1.9', thin talc on jt	
	33C	95/80	2 30° jts, 1 45° jt, 2 60° jts, 1 70° jt in 3.2', thin talc & calcite on jts	
170	34C	90/80	3 30° jts in 0.2', thin talc deposit on jts, 1 45° jt	
175	35C	95/70	1 45° jt, 1 70° jt in 0.3', thin talc deposit, 1 30° jt, 1 60° jt in 1'	
180	36C	95/70	1 70° jt, 1 80° jt, broken talc deposit, 2 10° jts, 1 45° jts in 2.5'	
185	37C	95/65	3 70° jts slightly curved, 1 45° jts, 1 10° jt in 2.0'	118.5' JOINTED GREEN-GRAY QUARTZ DIORITE WITH CHLORITE 130.5' RELATIVELY SOUND GREEN-GRAY ALTERED HORNBLENDE QUARTZ DIORITE WITH CHLORITE, NO FOLIATION, CALCITE CRYSTALS AND THIN TALC, CALCITE DEPOSITS ON JOINTS, MEDIUM TO FINE GRAINED, JOINTS CHIEFLY 40° TO 60° 178.8' RELATIVELY SOUND GRAY QUARTZ DIORITE 188.5'

Boring started 5-1-74 , completed 5-15-74
Final depths:
Boring = 188.5' Casing = 34.5'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 16.0' = El. +306.8

REMARKS:
Drilled ahead of casing from 9' to 34.5' depth; casing blows not reported.
Caving occured at ±125' depth when bottom of hole was at 143.5' depth.

BORING NUMBER AM-70
Ground surface elevation + 323.5

0	0 20 26 29 56	1D	4,7, 14	Green-brown micaceous sandy & clayey silt, some tan fine to coarse sand, fine gravel (Fill) (ML)	SILT AND SAND, FILL 5.0'
5	246 694 1420 1600	2D	10,14 14	Red-brown micaceous fine sandy silt, some clay (SM-SC)	RED-BROWN CLAYEY FINE SAND 10.0'
10		3D	60, 154, 208	Gray-green silty fine sand, trace mica (SM)	GRY-GRN SAND AND ROCK FRAGMENTS 16.0'
15		4D	254, 250/3"	Do 3D, trace medium sand with rock fragments (SM)	JOINTED, MOD WTHRD TO WTHRD GRAY-GREEN QUARTZ DIORITE 29.0'
20		1C	75/0	Jtd, wthrd gry-grn quartz diorite, 4 60°-70° jts in 2', 3 30° jts in 1', 1/8" open	
		2C	50/0	2 60° jts in 2', 2 30° jts, 6 horiz jts, disintegrated 22.4'-25.6'	
25		3C	50/0	7 horiz jts in 1', 3 45° jts in 1', 1 80° jt	
30		4C	80/15	Hi jtd, mod to sli wthrd	HIGHLY JOINTED GRAY DIORITE, NO FOLIATION, THIN CALCITE, TALC DEPOSITS, POSSIBLE SHEAR 41.6' TO 43.8' 48.0'
35		5C	95/35	3 45° jts in 2', broken 34'-35', no foliation	
		6C	95/75	4 jts in 2', no foliation	
40		7C	95/30	1 80° jt, thin talc, rough, jtd broken from 41.6'-43.8'	
45		8C	90/10	3 80° jts, calcite dep & stains, broken & jtd 46.5'-47.5', 3 10°-20° jts, thin calcite deposit	
50		9C	90/15	2 80° jts in 1.0', calcite deposit & brown staims on jts, 1/2" calcite vein	JOINTED WITH BROKEN ZONES, GRAY QUARTZ DIORITE, THIN CALCITE DEPOSITS AND SLIGHT IRON STAINING ON JOINTS 1/8"OPEN, SLICKENSIDE AND POSSIBLE SHEAR AT 79.5', POORLY FOLIATED, JOINTING 50°TO 70° 80.0' JOINTED TO MODERATELY JOINTED GRAY QUARTZ DIORITE, THIN CALCITE DEPOSITS ON JOINTS, JOINTS OPEN 1/16" TO 1/4", MANY
55		10C	95/30	2 60° jts in 1.5', irregular surface, 5 10°-20°jts in 2', 1 0.4' vert jt @ 54.2', 8 horiz jts in 1'	
		11C	90/50	Broken to 57.3', 3 horiz jts in 0.15', 1 60° jt, 2 45° jts in 1', 5 10° jts in 2'	
60		12C	95/20	Broken & jointed to 62.3' 2 70° jts, 1 80° jt slickenside @ 62.5', 1 60° jt @ 64.5', 4 20°-30° jts	
65		13C	95/45	Broken & jtd 66.1'-67' & 69'-70.3' with calcite deposit	
70		14C	90/25	2 60° jts in 1.5', thin calcite deposit, broken jtd 71.5'-72.5', 1 80°jt @70.3', 1 30° jt, 1 60° jt @ 72.8'-73'	
75		15C	98/45	2 70° jts @75'-76', 4 horiz jts smooth, calcite	
		16C	90/60	1 30° jt @ 78', 2 60°jts in 0.5', broken 79.2'-73', 3 20° jts in 1.2', slickenside 79.5'	
80		17C	98/85	2 60° jts, irregular to plane @ 82.7'-83.2', 1 80° jt @ 84.5', 2 10°jts in 1', thin calcite	
85		18C	95/60	2 70° jts @ 87.5'-90', 3 30° jts in 2.4'	
90		19C	98/70	2 30° jts in 1.5' spacing, 1 70° jt with calcite deposits @ 95'	
95		20C	95/50	2 80° jts in 1', broken 98.5'-99', 1 45° jt open 1/4", irregular at 100'	

(CONTINUED)

BORING NUMBER AM-70 (CONT'D)

100	21C	90/85	3 10° jts in 2.1', 2 45° jts in 0.5', at 104' thin calcite deposits on jts	
105	22C	98/85	Broken top 0.2', 3 10°jts in 2.1', 1 45° jt, 2 50° jts in 0.7', 2 70° jts in 0.4', calcite deposits	
110	23C	98/50	2 horiz jts, 1 30°jt, 1 80° jt in 1.7', thin talc & calcite deposits on jts, broken & jtd from 112.5' to 114.6'	
	24C	98/55	2 30° jts, 2 45° jts in 0.9' @ 145.5', calcite deposit open 1/16"-1/4", 1 45° jt, 2 60° jts in 0.4', 1 10°, 2 30°, 1 50° jts in 1.5', 1/16"-1/4"	
115	25C	98/35	2 30° jts, 2 45° jts, 3 80° jts, 1 70° jts, 2 15° to 25° jts in 3.5', thin calcite deposits on jts	
120	26C	98/85	Rel snd gry, 2 45° jts, 1 10° jt, thin calcite deposit in 4.0'	
125	27C	98/85	2 30° jts, 2 45° jts in 4.0', thin calcite deposit	
130	28C	98/85	Do 26C, 2 50° jts in 0.4'	
135	29C	65/0	Jtd & broken, several small pieces, 45° & vert jts	
140	30C	98/60	Mod jtd, 3 horiz jts, 1 30° jt, 1 45° jt, 1 70°jt	
145	31C	95/65	2 jts per foot, broken & wthrd 145.3' to 146'	
150	32C	98/60	1 80° jt, 1 30° jt, 1 horiz jt, 1 60° jt in 2.1' 2 45° jts, 1 30° jt in 0.4' at 153'	
155	33C	98/75	Rel snd, 3 horiz jts, 3 30° jts, 1 60° jt, talc deposit on joints	
160	34C	95/60	Jtd lt gray finely laminated mixed schist & diorite, 7 horiz to 10° jts, 2 30° jts, 1 70° jt	
165	35C	98/45	3 30° jts, 3 60° jts, 1 45° jt, 4 10°-20° jts smooth to 173'	
170	36C	90/ 100	3 45°jts, 1 70° jt, 5 10° jts, smooth, thin talc deposit on jts	
	37C	95/45	Hi jtd, fine grained, no foliation, 2 45° jts, 2 30° jts, 4 10° jts	
175	38C	60/70	Hi jtd in top, 4 30° jts, 1 70° jt in 0.6', 5 30° jts, 3 80° jts in 1'	
180	39C	60/20	2 30° jts, 1 60° jt in 1', thin calcite deposits	
185	40C	95/50		
	41C	60/60		

Boring started 4-16-74 , completed 5-30-74
Final depths:
Boring = 189.6' Casing = 23'
Casing diameter = 4"
Average depth of ground water observed in the boring = 21.5' = El. +302.0

REMARKS:
1.5' concrete street median strip at surface.
Drilled ahead of casing from 10' to 15' depth; casing blows not reported.
While coring rock at 75' depth the casing dropped from 15' to 23' depth.
Four water pressure tests with packers run in this borehole.

THIN HEALED JOINTS, INDISTINCTLY FOLIATED, FINE GRAINED, UNWEATHERED INCLUDING JOINTS 124.0'

RELATIVELY SOUND GRAY QUARTZ DIORITE, 1 JOINT PER FOOT 136.1'

MODERATELY JOINTED TO JOINTED GRAY QUARTZ DIORITE, MIXED SCHIST AND GNEISS 158' TO 162', FOLLOWED BY LIGHT COLORED GRANODIORITE TO BOTTOM, THIN CALCITE DEPOSITS ON JOINTS, SOME TALC, FINE GRAINED, NO FOLIATION 189.6'

DESIGNED		DATE
DRAWN	I.H.L	12/74 DATE
CHECKED	SLT & JPG	12/74 DATE
APPROVED		DATE

REFERENCE DRAWINGS	
NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86A	Plans & Geological Sections
F-A-104	

REVISIONS		
DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. HUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED Gillian H. Johnston

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APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-68 to AM-70

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-121

BORING NUMBER AM-71

Ground surface elevation + 323.5

0	2 5 17 25 50	1D	20,14 10	Gray-brown clayey fine sand, some silt (Fill) (SM)
5	98 125 125 300	2D	7,8, 14	Compact brown silty fine sand (Possible Fill)(SM)
10		3D	14,28 28	Brown-gray silty fine sand (SM)
15		4D	25,33 60	Do 3D (SM)
20		5D	40,60 85	Do 3D, trace silt (SM)
25		6D	100/3"	Do 3D (SM)
30		7D	100/4"	Brown-gray silty fine sand, trace mica (SM)
		1C	40/0	Jtd & wthrd brn-gry hornblende quartz diorite
35		2C	85/0	Hi jtd & wthrd on jts, broken to 36.5' and 38'to 39'
40		3C	90/45	Jtd, 4 60° jts, 2 45° jts, 1 80° jt curved in 3.3', slightly iron stained
45		4C	90/20	2 60° jts, 1 80° jt curved, thin calcite deposit on jts
		5C	98/85	Jtd, 25° fol, 2 fol jts, 2 50° jts, fine grained
50		6C	90/80	Do 5C
55		7C	100/ 90	Mod jtd, faintly fol, 4 60° jts, slight calcite deposit on jts, unwthrd & unstained
60		8C	95/70	Do 7C, 4 50° jts, 2 10° jts, slight calcite dep on jts
		9C	100/ 95	Rel snd, 2 50° jts
65		10C	100/ 90	2 45° jts, 2 20° jts, slight alteration on jts
70		11C	95/85	2 45° jts smooth, spacing 1.1'
		12C	100/ 100	Jtd, 1 60° jt, 3 45° jts smooth, 3 80° jts, thin calcite deposit 1/16"open in 2.8'
75		13C	90/65	Jointed diorite
80		14C	98/90	3 45° jts, 1 irregular jt in 1.0', 2 45° jts in 0.5' thin healed jts
85		15C	98/98	Sound, 1 horiz jt @86.5', several healed 45° jts
90		16C	95/75	Rel snd, 8 jts in 3.2', thin calcite deposit, slight red-brn stain, broken in bottom
95		17C	100/ 100	Sound, 1 30° jt, thin calcite deposit on jt, chlorite inclusions
100		18C	100/ 100	3 10° jts, 2 50° jts in 3.0', thin calcite deposit on jts
105		19C	100/ 90	2 50° jts in 0.4', thin calcite deposits on jts, 1 60° jt, 1 10° jt in 1.0' thin calcite deposits

CLAYEY F-C SAND, FILL 5.0'

BROWN SILTY FINE SAND 10.0'

VERY COMPACT BROWN-GRAY FINE SAND, TRACE SILT, TRACE RED-BROWN MEDIUM SAND 30.3'

JOINTED AND WTHRD BROWN-GRAY QUARTZ DIORITE 39.0'

JOINTED GREEN AND LT GRAY QUARTZ DIORITE, 3 JOINTS PER 2', 40°TO 60° ROUGH WITH CALCITE 53.0'

RELA-TIVELY SOUND GRAY QUARTZ DIORITE, THIN CALCITE HEALED JOINTS, CALCITE DEPOSITS 74.0'

JOINTED QUARTZ DIORITE 78.5'

(CONTINUED)

BORING NUMBER AM-71 (CONT'D)

105	20C	100/ 95	2 60° jts in 0.8', thin calcite deposit on jts
110	21C	100/ 85	1 15° jt, 1 45° jt, 1 80° jt in 4.0', thin calcite deposit on jts
115	22C	100/ 70	5 jts per 3.2', slightly rough to 1/16" open, thin calcite deposit on jts, few healed jts
120	23C	100/ 90	2 60° jts, thin calcite deposit, 2 10° jts in 0.8' 1 45° jt @122.3', thin calcite deposits
125	24C	95/95	1 20° jt, 1 horiz jt, 1 45° jt smooth, thin calcite deposits
	25C	100/ 90	1 45° jt, 1 10° jt, 1 horiz jt in 1.2', thin calcite deposits
130	26C	98/85	2 45° jts, 1 60° jts, 1 horiz jt, thin calcite & talc deposits, possible gouge at 133'
135	27C	98/95	2 30° jts, 1 open 1/4" in 1/2', smooth, thin calcite deposit on jts
140	28C	98/95	2 horiz jts, 1 30° jt open 1/8" rough, thin calcite deposits
145	29C	98/85	5 horiz jts, 1 60° jt in 4.0', thin calcite deposit on jts
150	30C	100/ 90	2 horiz jts, 2 30° jts, 2 45° jts, thin calcite deposit
155	31C	100/ 90	1 60° jt, 1 45° jt, smooth 2 20° jts, 1 30° jt in 0.2', 2 10° jts in 0.8' possible slickenside at 156.5'
	32C	100/ 90	1 70° jt w/calcite dep & 2 30° jts in 0.3', 1 horiz jt, 3 10° jts in 2.8' 1/16" open
160	33C	100/ 95	2 30° jts, 2 20° jts, 1 45° jt in 2.5', thin calcite deposit
165	34C	98/90	2 10° jts 1 20° jts in 3.5', thin calcite dep, 1/16" open jts 169.5'
170	35C	90/85	1 horiz jt, 1 45° jt in 0.8', thin calcite dep, 1 20° jt, 2 10° jts 1/16" open JOINTED QUARTZ DIORITE 174.0'
175	36C	95/80	1 horiz jt, 1 10° jt, 4 thin healed hts
	37C	98/90	3 60° jts, 1 20° jt in 2.2' 1/16" open, thin calcite deposit, 2 30° jts at 180'
180	38C	100/ 80	2 45° jts, 1 80° jt in 0.8', thin calcite & talc deposits, irregular, 1/16" open
185	39C	98/80	3 60° jts, 1 10° jt in 2.0' slightly rough 1/16"open, thin calcite deposits 189.5'

RELA-TIVELY SOUND GRAY HORN-BLENDE QUARTZ DIORITE, THIN CALCITE DEPOSITS ON JOINTS, FINE GRAINED, NO FOLIA-TION, SMALL IRREGULAR CHLORITE INCLU-SIONS THROUGH-OUT, JOINTS SPACED TYPICALLY 2 PER 3 FEET

RELA-TIVELY SOUND QUARTZ DIORITE

Boring started 5-16-74 , completed 6-11-74
Final depths:
Boring = 189.5' Casing = 43'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 19.8' = El. +303.7

REMARKS:
1.5' of cocnrete at surface.
Drilled ahead of casing from 9' to 43' depth; casing blows not reported.
Three water pressure tests with packers run in this borehole.

BORING NUMBER AM-74

Ground surface elevation + 259.0

0	31 40 28 20 17	1D	1,5,6	Med cpt brn-red si fine sand (Prob Fill) (SM)
5	30 40 59 66 71	2D	3,6,8	Med cpt brn-red cl & si f sand (Residual Soil) (SC-SM)
10	178 207 190 265 327	3D	8,9, 25	Cpt brn si f sand, tr dk minerals (SM)
15		4D	12,12 23	Cpt light gry-brn si f sand (SM)
20		5D	14,19 28	Do 4D, more compact (SM)
25		6D	20,31 44	Brn si f sand, tr rock fgmts (SM)
30		7D	67, 120/4"	Do 6D, numerous rock fragments (SM)
35		1C	65/0	Hi wthrd & dec brn, vy soft diorite, friable, crumbles to sand
		2C	40/0	Vy loose & soft f sand to 40', jtd & bkn qtz-dio
40		3C	65/15	Jtd, mod wthrd granodiorite, 4 jts @ 30°, 2 jt 45°, 2 jts @ 60°, 1 vert jt, 1 jt @ 80°, thin cl seams on jts
45		4C	65/0	Hi jtd & bkn lt gray granodiorite, wthrd & bkn 46'-47', cl seams on jts @ 47.5', 50'-51'
50		5C	65/0	3 jts @ 70°, stains on jts, 15 jts 20°-30°, several small pcs, 1 pc 0.3' @ 52.5'
55		6C	45/10	Lt gry granodiorite & quartzite, several small pieces
60		7C	30/0	0.2' brn cly sm @ 61', jtd & mod wthrd-wthrd dk grn hornblende-diorite, 1 jt @ 10°, 3 jts @ 20°, 2 jts @ 30°, 1 jt @ 45°, smooth to slightly rough
65		8C	65/0	4 Horiz jts, 8 jts @ 10°-20°, 2 jts @ 45°, 1 jt @ 60°, 2 jts @ 80°, smooth, dk stains on jts
70		9C	80/10	Jtd & mod wthrd, grn hornblende diorite, vert jting 71'-73', thin cl & f sand deposits (gouge)
75		10C	60/0	Jtd & bkn, wthrd, brn to 80.6'
80		11C	90/45	Jtd, gry qtz-dio, 1 jt @ 80° @ 81.6', 3 jts @ 20°, 1 horiz jt, 1 30° jt, thin talc dep, 2 jts @ 80° @ 85', 1 jt @ 60° @ 86'
85		12C	85/70	Mod jtd, bkn & wthrd 86.2' to 87.6', 1 horiz jt, 1 60° jt in 0.6'; 1 15° jt & 1 vert jt in 0.2'; 1 30° jt, smooth, thin talc
90		13C	95/80	Rel snd hornblende & qtz-dio, 2 45° jts, smooth, thin talc dep on jts, 1/8" angular qtz veins
95		14C	98/70	Mod jtd, 2 jts 20°, rough, 2 jts 10°, 1 jt 30°, 2 jts 45°, 1 jt 45°, calc dep, 1/4" qtz veins @ 25° & 45°, chlorite inclusions
100		15C	98/85	Rel snd gry, 2 jts @ 10°, 1 jt @ 30°, 1 jt @ 60°, irreg 1/2" qtz veins, 60° & vert fol
105				

MEDIUM COMPACT-COMPACT BROWN-RED SILTY FINE SAND, FILL AT TOP 15.0'

COMPACT LIGHT GRAY-BROWN SILTY FINE SAND WITH ROCK FRAGMENTS 31.0'

HI WTHRD & DEC SOFT DIORITE 40.0'

HI JTD & BKN, MOD WTHRD, LT GRY TO PINK GRANO-DIORITE WTHRD & BKN 46'-47', 20°-70° JOINTING, STAINS & THIN CLAY DEPOSITS ON JOINTS 61.0'

HI JTD, MOD WTHRD TO HI WTHRD GRN HORN-BLENDE-QUARTZ-DIORITE W/GRN-GRY DIORITE BANDS, HORIZ TO VERT JOINTING 80.6'

MOD JTD-REL SND GRN-GRY HORN-BLENDE-QUARTZ-DIORITE, JOINTING CHIEFLY 0°-60°, QUARTZ VEINS 1/8" TO 1/2"

(CONTINUED)

BORING NUMBER AM-74 (CONT'D)

105	16C	95/90	1 jt @ 45°, 4 jts @ 20°, smooth to sli rough, thin talc & calcite deposits on jts 111.0'
110			

Boring started 11-25-74 , completed 12-3-74
Final depths:
Boring = 110.0' Casing = 66'
Casing diameter = 4" & 3"
Average depth of ground water observed in the boring = 12.5' = El. +246.5

REMARKS:
Lost water at 52' depth.
This boring was made after completion of the original program to investigate the deep weathering and jointing which appeared in Boring No. AM-15.

Note: Borings Nos. AM-72 and AM-73 were in progress in the field on Dec. 30, 1974 and logs of these borings will be included on a subsequent revision of this drawing.

		DATE
DESIGNED		
DRAWN	IHL	12/74
CHECKED	SLT & JPG	12/74
APPROVED		

REFERENCE DRAWINGS

NUMBER	DESCRIPTION
F-1	General Notes & Legend
F-A-86 to F-A-104	Plans & Geological Sections

REVISIONS

DATE	BY	DESCRIPTION

DISTRICT OF COLUMBIA WILLIAM H. MUESER 4070 REGISTERED PROFESSIONAL ENGINEER

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

MUESER · RUTLEDGE · WENTWORTH & JOHNSTON
CONSULTING ENGINEERS
415 MADISON AVE., NEW YORK 17, N. Y.
SUBMITTED William H Mueser

DE LEUW, CATHER & COMPANY
GENERAL ENGINEERING CONSULTANT ☐

HARRY WEESE & ASSOCIATES
GENERAL ARCHITECTURAL CONSULTANT ☐

APPROVED

ROCKVILLE ROUTE (A011)

LOGS OF AM-SERIES BORINGS Nos. AM-71 to AM-74

SCALE VERT. 0 3' 6' 12'

DRAWING NO. F-A-122

REPORT NO. 117, MRWJ SERIES
SECTION A011, ROCKVILLE ROUTE
SUBSURFACE INVESTIGATION

APPENDIX A
SUMMARY OF INFORMATION FROM
SUPPLEMENTARY INVESTIGATIONS,
INCLUDING THE FOLLOWING EXCERPTS:

1. Nesbitt, R.H. "Report on Results of Borehole Photography, Washington Metropolitan Area Transit Authority, Design Section A011," pages 1 to 8.

2. Tarkoy, P.J. and E.J. Cording, "Feasibility of Using a Tunnel Boring Machine on Project A-11, METRO Washington, D.C.," December 10, 1974, title page and pages 22, 23 and 24.

3. Cording, E.J. and A.S. Nieto, "Direct Shear Tests on Samples of Clay Gouge and Rock Surfaces from Shear Zones in Washington METRO Tunnels," Sept. 27, 1974, Title page and Application of Results, pages 7 and 8 and Table 1.

4. Nieto, A.S. and E.J. Cording, "Direct Shear Tests on Natural Fractures in NX Core from Project A-11, Washington, D.C. METRO," Dec. 11, 1974, Title page and Summary and Conclusions, pages 1 to 3.

REPORT ON RESULTS OF BOREHOLE PHOTOGRAPHY

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

DESIGN SECTION A011

By

Robert H. Nesbitt
Engineering Geoologist

1. Pursuant to a telephonic communication on May 30, 1974, followed by a letter of the same date, both from Dr. Philip C. Rutledge, Mueser-Rutledge-Wentworth-&-Johnston (MRWJ), the writer agreed to review the borehole photography operations of the Corps of Engineers in Design Section A011 of the Wisconsin Avenue reach of "METRO" in Bethesda, Maryland. Following arrangements with Mr. Arthur M. Mayes (MRWJ), on June 11, 1974 the writer inspected and logged the cores of the five deep borings, made for borehole photography. These included boreholes AM-3U, AM-4, and AM-60 in the Bethesda station and AM-68 and AM-70 in the Medical Center Station. On the following day he made a general reconnaissance of the site. Both the inspection and reconnaissance were made with the effective assistance of Mr. V. Tepordei (MRWJ). On July 9 and 10, 1974 the writer visited the Corps of Engineers Southwestern Division Laboratory in Dallas where, with Mr. William Tanner who photographed and logged the borings, he carefully studied the picture film strip for each boring and discussed the various features to be included in the Laboratory report. Here it should be stated that due to cloudy conditions in the borehole water, the photographs of boreholes AM-3U and AM-68 were too

indistinct to permit logging. In view of the very considerable delay in any attempt to prepare these borings for rephotography, and the considerable uncertainty from past experience that such efforts might be successful, it was concluded by mutual consent with MRWJ that the photographic report would be based on the three borings which provided good pictures. It was noted that correlations between borings AM-4 and AM-60 would partially offset the lack of AM-3U.

2. Scope of Laboratory Report

The principal objective of the borehole photography was to provide information on the structure and orientation of bedrock foliation, jointing and faulting at the location of the five borings in Design Section A-011 of METRO. To accomplish this, the Laboratory report would include:

(a) borehole photo logs,

(b) polar diagrams of joint and foliation structure (faulting if present),

(c) plan and profile plots of joint patterns at each borehole, and

(d) a narrative explaining the illustrative data and summarizing the principal joint and foliation structure at each boring location.

Among the considerations on which our client hoped the photography would provide information was the occurrence of any major shear or fault zone which could create a construction problem. The writer's comments on various elements of the Laboratory report,

together with his opinion on the significance of the data in determining tunnelling conditions at each boring site, follow.

3. Bedrock Geology at the Bethesda and Medical Center Stations is well outlined in the profiles on Drawings F-A-17 and F-A-22, respectively, from the MRWJ report titled "Final Report - Subsurface Investigations Rockville Route, Stations 221+00 (A009) to 590+00 (A013)". These drawings, supplemented by the photography borings, indicate quartz diorite and diorite gneiss and schist to be the dominant rock types. Secondary chloritic or serpentinized and calcitized zones occur here and there through the Section. The occurrences of the latter were scrutinized in the photo study for any possible significance in rock stability. Of obvious importance is the depth of rock decomposition and weathering at each boring, which is considerably greater than was observed in the photographic study of Section A-09 two years ago. Decomposition and severe weathering extend to the following depths for the five borings logged for photography: AM-3U, 63.0 ft; AM-4, 79.6; AM-60, 81 ft; AM-68, 33.0 ft; AM-70, 32.0 ft. Structurally Borings AM-4 and AM-60 show a predominant N-S strike to the foliation with a prevailing steep westward dip. In contrast the photography of Boring AM-70 failed to produce any marked foliation. Joint orientation is well demonstrated in the drawings accompanying the Laboratory report (NOTE: All structure orientations in logs and drawings refer to magnetic north.)

4. Comments on Laboratory Report

The writer studied all the film for the three borings, with Mr. Tanner's preliminary logs as references. During this study we singled out the joints or suspected shear zones considered to be of structural significance and flagged these with asterisks in the left margin of the log. This procedure simplified the construction of the "overlay" profiles, since a drawing of suitable scale could not possibly show all joints that appear on the polar plots. The writer concurs completely with the logging of the photographs and with the procedure used by the Corps Laboratory for illustrating joint structure. There is no attempt to include lithologic information since the latter can be described more accurately in field logs. The reader is referred to the Laboratory report for the procedure used in developing the polar plots and profile and plan "overlay" drawings. A diagram illustrating the trigonometric procedure for translating true dip of joints in the boring to apparent dip on the profiles is attached to the report.

5. Summary of Conditions at Each Boring

a. Boring AM-3U. (No pictures due to cloudy water). Top of tunnel Elev. 248 (depth 100.0 ft). Below a depth of 63 ft (El. 285.0) the gneissic rock has several sound massive-structure zones, such as the thick section which I logged between depths 87.3 and 127.3 (El. 260.7 to 220.7). Another similar sound section extends between depths 128.0 and 136.4 (El. 220.0 to 211.6), which latter depth is just above the base of the tunnel opening. However, this rather favorable picture is offset by the occurrence of

significant fracturing and staining of joints in the Section between depths 80.8 and 87.3 (El. 267.2 to 260.7). On this basis, and considering the size of the Station opening, continuous steel support of the arch is indicated.

b. Boring AM-4. Top of tunnel Elev. 247.6 (depth 100 ft). The top of sound rock in this boring occurs at Elev. 267.7 (Depth 79.6). With the exception of a few high-angle unstained joints between Elev. 260.5 and 257.2 (depth 87.1 to 90.4) and a closely fractured section extending for 7 ft. directly above the top of the tunnel, the gneissic rock possesses massive structure between the sound rock line and the top of the tunnel. As the illustrative data in the Laboratory report indicate, two principal joint sets occur, i.e., a north-south set with 40° to 70° dips to the west, and a northeast striking set with dips of 30° to 65° southeast. The occurrence of the closely-fractured and jointed zone in the 7 ft. section directly above the tunnel roof would indicate continuous rib support of the arch. To add an additional dimension to the information obtained from AM-4, joint structure developed from the later was plotted in relation to AM-60 in the first overlay profile.

c. Boring AM-60. Top of tunnel El. 226.0 (depth 120.0 ft). Moderately to intensely weathered rock occurs in most of the interval from top of weathered rock at El. 306.7 (depth 39.3 ft) to the sound rock line at Elev. 245.4 (depth 100.6). Closely jointed to massive gneissic rock characterizes the section extending

from 20 ft. directly above the top of the tunnel to 6 ft. below the arch. Directly below, between Elev. 220.0 and 219.5, is a serpentinized or chloritized joint striking N 30°E and dipping 60° NW which could be structurally significant in excavation. Below this 1/2 ft. zone the rock is moderately jointed to massive fresh gneiss. As in Boring AM-4 the photography again shows a prominent N-S strike and rather steep westward dip for the foliation of the rock. On the polar plot for this boring the dominant joint set appears related to the schistosity or foliation of the strata. However, random joints, which can be just as troublesome from the rock excavation and support standpoint as the dominant set, do occur and should be kept in mind in evaluating the photo log data.

d. Boring AM-68 (No pictures due to cloudy water). Top of tunnel Elev. 235, (depth 83 ft). Examination of the cores of this boring indicate massive sound fine grained dioritic rock from a depth of 64.5 feet to the bottom of the hole, well below the bottom of the tunnel opening. Very few moderately steep to steep diagonal joints were observed. Most of the core is fractured horizontally. However, only a few steep joints intersecting these horizontal breaks would be necessary to produce buckling of the rock forming the arch of the opening during excavation. This situation should be a determining factor when selecting the type of rock support, bolting versus ribs.

e. Boring AM-70. Top of Tunnel Elev. 238.5 (depth 85.0). The base of intense weathering in this boring occurs at Elev. 291.5 (depth 32.0 ft). From this level down to the top of the tunnel the rock is chiefly hard, gray, closely jointed and blocky fresh diorite. The laboratory report properly recognizes two major joint sets. The dominant set appears to strike N 55° to N 85° W, and dip 65° to 75° NE. The other set strikes N-S and dips 50° to 75° E. However, there is quite a scattering of random joints, particularly open and low angle ones which must be kept in mind in evaluating arch stability. Of structural significance are several closely-space low-angle stained joints between Elev. 66.9 (depth 256.6) and Elev. 254.8 (depth 68.7). Also significant are a flat joint at El. 249.5 (depth 74.0) and two open joints showing broken rock between El. 246.5 (depth 77.0) and El. 245.8 (depth 77.7) (See the log for the details of the above-mentioned joints). From the top of the tunnel down to El. 186.6 (depth 136.9) the hard fine grained diorite is moderately massive with scattered steep joints in several directions. Directly below this interval is a 3 ft. thick blocky zone, followed by a rather massive section down to El. 165.4 (depth 158.1).

6. Conclusions

a. A north-south strike with a steep westward dip characterizes the foliation in borings AM-4 and AM-60 in the Bethesda Station. The dominant joint structure in these two borings corresponds with the same orientation.

b. Core studies for Borings AM-68 and AM-70, and bore photos of the latter, disclosed more massive and unfoliated rock for the Medical Center Station. They also showed considerably shallower covers of decomposed and weathered rock. Horizontal, as opposed to diagonal, fracturing marked much of the massive hard rock in Boring AM-68, and bore photos for Boring AM-70 show a N 55^{o} - 85^{o} W Strike and 65^{o} to 75^{o} NE dip for the dominant joint set, with a subordinate set striking N-S and dipping 50^{o} - 75^{o} E.

c. The "overlay" profiles show a fairly wide orientation range for the open joints emphasized in red. Low-angle stained and open joints, which are prominent in Boring AM-70 and less prominent in Borings AM-4 and AM-60 should be flagged as possible trouble makers (see para. 5.e.).

d. No feature which could be identified as a major fault or shear zone was disclosed by the photography.

e. It is the writer's opinion that frequently reentrant blocky, broken and stained zones within the best rock could be as important in determining excavation and support procedures as the orientation and structure of joints and foliation disclosed by the photography.

Robert H. Nesbitt

August, 1974

Feasibility of Using a Tunnel Boring Machine on Project A-11, METRO Washington, D.C.

- Laboratory Test Results (from Sept. 1974 Report)
- Rock Type and Hardness on Projects A-6 and A-11, Metro
- Effect of Rock Hardness on Penetration Rates

Prepared by

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and
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for

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415 Madison Avenue
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December 10, 1974

effect on rates have been the shear zones which, beside gouge, may consist of fractured and weathered rock. For some machines, penetration rates have been known to drop as low as 1 ft/hr and may average less than one half of the otherwise normal rates, at least while the shear zone intersects the heading. This is generally a result of reduced cutterhead rotation which is required to keep fractured rock from damaging cutters and reduced thrust to keep the cutters from being buried in the face. In soft materials, clogging of the cutterhead is also known to occur.

ROCK CONDITIONS ALONG THE A-11 ALIGNMENT

Available geological information and borings suggest that geological conditions for the twin-tunnels of the A-11 alignment are not unlike conditions encountered in the outbound A-6 tunnel, although zones of the softer chlorite schist on project A-11 do not appear as prominent as at the south end of project A-6. There are the typical varieties of chlorite, hornblende, quartz, and biotite, schists, diorites, and diorite gneisses. Although lithologic relationships are complex and in many cases gradational, general areal distribution of units can be delineated as shown in Figure 7. The map is based on preliminary information transmitted by Mueser, Rutledge, Wentworth, & Johnston (October 1974). Discrepancies between the lithologic map and sample descriptions are a result of inherently complex lithologic inter-relationships both laterally as well as with depth.

Rock Hardness

Samples selected by Mueser, Rutledge, Wentworth, & Johnston from exploratory borings along sections of the A-11 alignment were tested for rock hardness, for unconfined compressive strength, and sonic velocity.

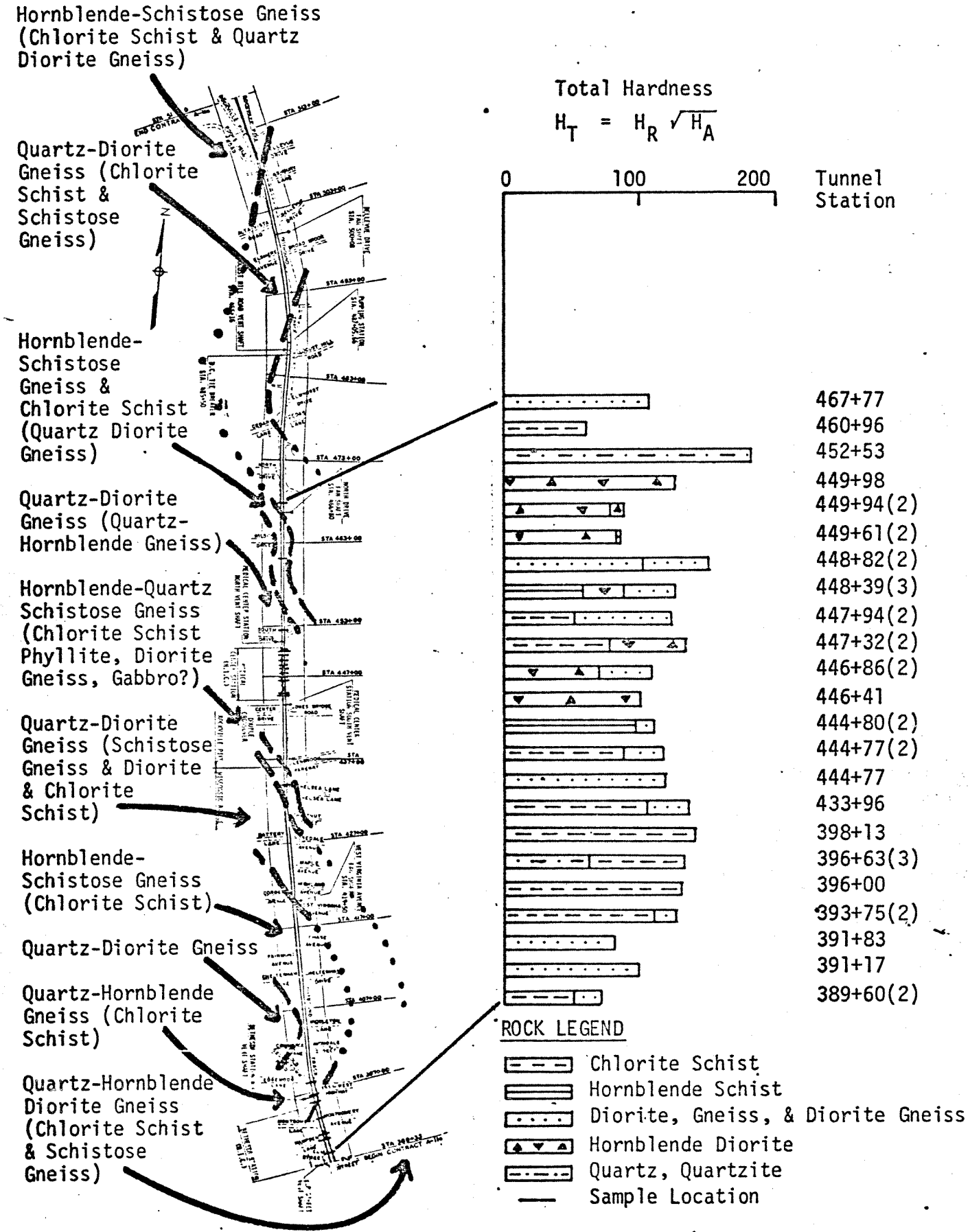

Figure 7. Test Sample Lithology, Rock Hardness, and Location Along the A-11 Alignment.

Results are summarized in Table III in Part 1. Sample locations and respective Total Hardness (H_T) are shown in Figure 7. Comparison of Figures 4 and 7 suggests that samples from A-11 borings were generally harder than the slightly altered schists and chlorite schists which were present in the first 2000 feet of the outbound A-6 tunnel, but had similar ranges of hardness to the rock north of the first 2000 ft of the A-6 tunnel. The mafic lithologies tend to be softer than the felsic rocks as illustrated by rock group averages in Figure 8. Test results indicate that 1) rocks and their hardness along the A-11 alignment are similar to those in A-6 except for the soft chlorite schists in the southernmost 2000 ft section of A-6, 2) schists bored in N.Y.C. are similar in rock type and hardness to expected rock along the A-11 alignment, and 3) the most significant factor, therefore, will be the effect of machine design on penetration rates. Relationships defined between rock hardness and penetration rates for the machine operating in the A-6 (19-ft-diameter) tunnel and the machine which bored the (11-ft-diameter) tunnel in N.Y.C., are valid for machines having the same respective diameters and design parameters. Machine diameter is inversely proportional to cutterhead rotational speed and therefore penetration rates. Other variables, and their effects, such as cutter design have been less well defined.

Direct Shear Tests on Samples of Clay Gouge and Rock Surfaces From Shear Zones in Washington Metro Tunnels

Prepared for

Mueser, Rutledge, Wentworth, and Johnston
415 Madison Avenue
New York, New York 10017

by

E. J. Cording
and
A. S. Nieto

September 27, 1974

5. Application of Results

In applying the laboratory results of tests on clay gouge for estimating the strength along shear zones in the field, it is recommended that the residual angle of friction, rather than the peak angle of friction of the clay be used. The peak angles of friction for the remolded clays are dependent on the method of remolding of the sample and on details of the test and confining pressures in the test. The laboratory peak strengths may thus have little relation to the peak strength of the undistrubed but geologically sheared materials in the field.

It is also recommended that some interference for the clays be assumed, because most of the natural rock surfaces and clay seams are relatively thin with respect to the amplitude of the small-scale irregularities. It is felt that ϕ_r = 11° to 14° is a realistic value for the residual angle of friction under interfering conditions.

Finally, the waviness of the large-scale irregularities may result in interlocking conditions which will cause dilatancy of the shear surfaces as they ride over irregularities. For the sheared surfaces in Washington, such waviness can add inclinations, i, of approximately 0 to 5° to the friction angle.

The total angle of friction along the sheared surfaces could then be taken as:

$$\phi_r + i = (11° \text{ to } 14°) + (o° \text{ to } 5°),$$

or a range of 11° to 19°. It is recommended that $\phi_r + i$ of 15° be used for continuous shears and shear zones whose surfaces are planar to slightly wavy, and which contain thin (1/64 in. to 1/2 in.) clay gouge fillings. Where extremely planar seams with clay gouge filling are present, the lower values for ϕ_{total} would be appropriate.

6. Future Testing

Natural joints from core samples on project A-11 are presently being prepared for testing. It is expected that higher friction values will be obtained than are presented in this report because some of the surfaces have not been previously sheared and many surfaces do not contain clay gouge fillings. For surfaces not previously sheared, peak friction values rather than residual values may more closely represent the field strength conditions.

TABLE 1: WASHINGTON METRO
Drained Direct Shear Tests; Residual Strengths;
Clay Gouge Between Rock Surfaces

By: A. S. Nieto-Pescetto
March, Spril 1974

A. Location: Project A4b, Shear Zone 9

Sample	Type	Thickness inch	Normal Stress psi	Shear Stress psi	t/σ	ϕ'_r	P_w %	L_w %	Description
W-A-1	1	.062	22.82	3.18	.139	8.0°	37.8	65.5	Red plastic clay coating (originally coated WA-3, WA-4) non-interfering
W-A-2	1	.050	42.70	5.90	.139	8.0°	37.8	65.5	Red plastic clay coating non-interfering
W-A-3	1	.080	20.80	3.82	.183	10.4°	39.6	51.8	Reddish gray micaceous clay non-interfering
W-A-4	1	.070	42.70	7.41	.174	9.9°	39.6	51.8	Reddish gray micaceous clay non-interfering
W-B-1	2	.062	42.70	7.41	.174	9.9°	30.4	40.5	Silty, sandy gray clay non-interfering
W-B-2	2	.062	20.95	3.91	.186	10.5°	30.4	40.5	Silty, sandy gray clay non-interfering
B. Location: Project A-6, WT-1 Shaft; shear zone bounding wedge.									
WC-2	3	.062	20.4	5.2	.254	14.3°			interfering
WC-4	3	.062	51.2	10.2	.265	11.3°			non-interfering
WC-1	4	.015	21.2		.240	13.5°			

Type: 1 - Sample sheared between two 4" x 7" slabs of Bedford Limestone.
2 - Sample sheared between two 4" x 7" slabs of Berea Sandstone.
3 - Clay sample sheared between slickensided natural shear surface and sulfaset slab, 4" x 5".
4 - Very thin clay sample of #3 sheared between smooth limestone slab, 2" x 6".

Note: All values represent individual tests, no incremental loading was used.

Direct Shear Tests on Natural Fractures in NX Core from Project A-11, Washington, D.C. Metro

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SUMMARY AND CONCLUSIONS

1. Our previous report, dated Sept. 27, 1974 summarized the results of direct shear tests on clay gouge samples obtained from shear zones in existing Metro tunnels, Projects A-4b and A-6, Connecticut Avenue Route. The gouge samples were tested in the laboratory by shearing them between rock or rock-like surfaces. Residual (or minimum) angles of friction for the clay gouge were in the range of 8° to 14°. The recommended angle of friction to be used for shear zones in the field included the minimum angle of friction (ϕ_r = 8° to 14°) plus a dilatant component of shear strength (i = 5°) to account for the overriding of irregularities typically occurring on the shear planes in the field. Thus the angle of friction for shear zones in the field was extimated to be $\phi_r + i$ = 13° to 19°. A conservative estimate of the shear strength for shear zones was considered to be $\phi_r + i$ = 15°.

2. This report summarizes results of direct shear tests on natural joint surfaces in NX rock core obtained from Project A-11, Connecticut Avenue Route, Washington Metro. Five of seven core segments sent us were tested. Of the five samples, four were unweathered mica-quartz gneisses and one was a partially weathered chlorite schist.

3. Some joints contained no fillings, others were coated with thin layers consisting principally of calcite, although some contained small amounts of clay, pyrite, and chlorite. Most of the coatings were thin (less than 1/32 in. thick) and discontinuous.

4. Two direct shear tests were performed on each sample. Each sample was first tested at an average normal stress of 25 psi, then at a normal stress of 50 psi. (Peak friction angles and dilation angles for the second test would be expected to be lower than for the first because some of the irregularities may be removed during shearing in the first test).

5. The joint surface of the chlorite schist was bounded by platy minerals and exhibited much lower peak and minimum friction angles than the four gneissic samples whose joint surfaces were bounded by equi-dimensional minerals such as quartz and calcite. There was little difference in strength between gneissic samples with coatings (principally calcite) and gneissic samples without coatings.

6. Individual peak friction angles for the gneiss samples ranged from 29° to 38°. The higher peak values were generally associated with samples having rougher surfaces. The average peak friction angle for the schist was about 20°.

7. Nearly all the tests on the gneissic rocks displayed dilatational behavior during the early parts of the test. The values range from about 1° to 6°. Dilation angles for the schist were negative, indicating that compression and crushing of the surface of the joints took place as the sample was sheared.

8. Minimum friction angles for the gneiss specimens were fairly typical for unweathered discontinuities in rocks of this kind and ranged between 24° to 27°. The average minimum friction angle for the schist was about 16.5°. This low value is caused by platy minerals which coat the

foliation lenses or laminae of the schist. A drained test on remolded schist (ground up and sieved through a #70 sieve) yielded an average minimum friction angle of 29°. This high value was a result of the disruption of the foliation lenses containing platy minerals and the presence of quartz in the ground-up sample.

9. It is recommended that the following values of shear strength be used for naturally occurring joints and shear zones in the tunnels on the Connecticut Avenue route; Project A-11:

a) Planar joints, unweathered, either no filling or calcite filling, gneissic rock: $\phi_{minimum} = 27°$

b) As above, but joint is tight, and rough or wavy: add i value of 3° or more, depending on the angle of the irregularity, to the minimum angle of 27°.

c) Planar joints with thin clay fillings or slickensided surfaces in gneissic or schistose rock: $\phi_{minimum} = 15°$

d) All planar joints in schistose rock that are parallel to foliation (No. 1 joints) and are bounded by platy minerals: $\phi_{minimum} = 15°$

e) Shear zones with clay gouge fillings, slightly undulatory (i = 5°): $\phi = 15°$.

10. In addition to the minimum shearing resistance, the waviness, tightness, and continuity of the joint surface is a major factor affecting the stability of the rock block. The relationship shown in Figure 8, of the paper by Cording and Mahar summarizes the effect of waviness on block stability.