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CAP EVALUATION SECURED GOVERNMENT FACILITY CATOCTIN MOUNTAIN PARK, MARYLAND NSWC INDIAN HEAD MD
6/1/1997
EMCON

CAP EVALUATION

SECURED GOVERNMENT FACILITY

CATOCTIN MOUNTAIN PARK, MARYLAND

Prepared for

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1 INTRODUCTION

This report presents the findings of a study performed to evaluate the existing cover (cap) material on a government secured landfill site. The evaluation is based on the results of both a field investigation and laboratory testing. The purpose of the investigation was to determine the thickness and properties of the existing soil cover, and to evaluate cap integrity and compatibility with landfill closure requirements.

The field investigation work described in this report was performed on November 5, 1996. The field investigation consisted of a site reconnaissance, excavating 14 test pits, and completing 18 in-place density/moisture content tests and 8 infiltrometer tests. The laboratory work consisted of index testing to classify the soils, and permeability testing to determine hydraulic conductivity of the cover soil.

2 FIELD INVESTIGATION AND TESTING

2.1 General Observations

The landfill facility is located within a wooded landscape and covers an area of approximately 3 acres. The site appears clean with no apparent traces of waste on the ground, leachate seeps, or landfill gas odor. The top of the facility is relatively flat and devoid of any vegetation. The sideslope of the facility is as steep as 2H:1V in some areas. The sideslopes were covered with varying amounts of grass. Several rodent burrows were observed near the top of the facility. Also, large boulders were present on the final cover near the top of the facility. No ponding of water or erosional features were observed. It appears that most of the surface water is percolating through the final cover.

Bedrock outcrops were observed all along the toe of the facility. Absence of seeps along the perimeter of the facility suggests that water percolating through the cover soil is eventually entering the bedrock.

2.2 Test Pits

A total of 14 test pits were excavated within the facility. The first 11 test pits were excavated using a rubber-tired Case 580 backhoe. Due to difficult access, the 3 remaining test pits near the toe of the facility were excavated using a Komatsu C150LC track-mounted backhoe. During the course of excavation for each tests pit, the excavated soil was constantly monitored for volatile organic emissions using a photoionization detector (PID) meter. However, no volatile organics were detected in any of the test pits.

The location of the test pits are shown in Drawing 1. The test pit depths ranged from 1.5 feet to 7.5 feet. Because of refusal due to boulders, the test pits located within the top plateau of the facility could not be excavated to the limit of waste depth.

The excavated material within TP-1 through TP-5 was comprised predominantly of boulders (more than 50 percent). The excavated material appeared relatively dry. The excavation, using the backhoe was difficult because of the presence of boulders. Because of this difficulty, thickness of the cover soil could not be ascertained in these locations. The material filling the voids between the boulders consisted of silty sand with gravel and clay or silty gravel with sand and clay. Attempts to collect undisturbed samples within

these test pit areas using Shelby tube samplers, were not successful from the test pits on the top of the fill area.

Fewer boulders were encountered within the tests pits located on the sideslopes of the facility enabling deeper excavations. Higher moisture contents were encountered in soils excavated from test pits located on the sideslopes of the facility. A total of 5 Shelby tube samples were collected adjacent to these downslope test pits for hydraulic conductivity testing in the laboratory.

Minor amounts of waste materials, mostly construction and demolition (C&D) waste, were observed in test pits TP-5 through TP-14. The C&D debris included pieces of brick, wood, concrete, rebar, and asphalt. Traces of household waste, such as plastic bags and metal cans, were also observed. A small metal jack was excavated in TP-5 at a depth of 5.5 feet. Pieces of plastic bags were observed in TP-9, TP-12, and TP-14 at depths of 4 feet, 5 feet, and 3 feet, respectively. A metal beverage can was observed in TP-14 at a 3-foot depth.

Each test pit was logged at the site by an EMCON geologist. The excavated material was visually examined and classified using the Burmister method. One sample of the excavated soil from each of the test pits was collected in an airtight plastic bag for laboratory testing. In addition, a bulk sample was collected from TP-10 and TP-12 for possible compaction testing. Boulders and cobbles were excluded while collecting the samples. The test pits were photographed and backfilled following completion of logging.

The test pit logs are included in Appendix A.

2.3 In-place Density/Moisture Tests

To estimate the in-place density and moisture content of the existing cover soils, tests using a Troxler gauge were performed at each of the 14 test pit locations. In addition, these tests were performed at four other locations. The dry density values as estimated from these tests ranged from 100 pcf to 130 pcf, except for an anomalous value of 74 pcf at TP-7. The moisture content values ranged from 11 to 24 percent. These values suggest that there is a significant variation in the compaction level of the existing cover soil. However, it should be noted that the measured values correspond to only the upper 1-foot of the cover material. Also, the presence of boulders and cobbles may have influenced the measured values.

The in-place density and moisture test results using the Troxler gauge are included in Appendix B. The location of these tests are shown in Drawing 1.

2.4 Infiltration Tests

To estimate the in-situ hydraulic conductivity of the existing cover material, a total of 8 infiltrometer tests were performed. The location of the infiltrometer tests are shown in Drawing 1. The infiltrometer consisted of a 2.8-inch diameter Shelby Tube installed within a hole excavated on the cover. The annular space between the Shelby Tube and the hole was sealed with bentonite. The Shelby tube was filled with water, and the decline of the water level was recorded over several minutes to hours, depending on the rate of flow. The top of the Shelby tube was covered to minimize evaporation loss.

The hydraulic conductivity was computed using the modified Hvorslev equation applicable to a Boutwell permeameter (see Appendix C). In the use of this equation, it was assumed that the value of horizontal and vertical hydraulic conductivity were the same. This represents a reasonable assumption for compacted fills. The computed hydraulic conductivity values ranged from a low of 1.8×10^{-4} cm/sec to a high of 1.1×10^{-2} cm/sec.

The hydraulic conductivity values measured at the 8 locations are listed below. The infiltrometer readings and calculations are presented in Appendix C.

Infiltrometer	Hydraulic Conductivity (cm/sec)
1	1.8×10^{-4}
2	2.9×10^{-3}
3	5.6×10^{-3}
4	6.4×10^{-3}
5	4.4×10^{-4}
6	1.1×10^{-2}
7	5.1×10^{-3}
8	2.2×10^{-4}

3 LABORATORY TESTING

3.1 Index Testing

All of the samples collected in the air-tight bag during the test pit operation were tested in the laboratory for index properties. The index tests included the following tests:

- Grain-size (sieve and hydrometer) analysis
- Atterberg limits (liquid limit and plastic limit)

The results of these index tests were used to refine the soil classification performed in the field. It should be noted that since large size particles were excluded from the samples collected during the test pit operation, the index properties correspond only to the finer materials collected.

The results of the index testing are included in Appendix D. The results show that all of the samples collected classify either as a silty sand with gravel or silty gravel with sand. The clay fraction was between 14 and 18 percent. The liquid limit ranged from 33 to 46, and the plastic limit ranged from 24 to 31. The range in the plasticity index was between 9 and 6.

3.2 Permeability Testing

As stated previously, a total of 5 Shelby tube samples were collected from areas on the sideslopes. The Shelby tube samples were classified in the laboratory using the Burmister method. The soils were classified as silt & clay to silty gravel with sand. Because of low cohesion of the soil samples collected, it was not possible to extrude and prepare all 5 Shelby tube samples for permeability testing. It was possible to perform the permeability testing on two samples; i.e., samples labeled as ST-3 and Tube #4. The Shelby tube sample ST-3 was collected 30 feet east of Test Pit TP-7, and Tube # 4 was collected next to TP-13.

The permeability testing was performed using a triaxial cell. Back pressure was applied to enable saturation of the test specimens. The test on sample ST-3 yielded a hydraulic conductivity of 1.3×10^{-4} cm/sec and Tube #4 yielded a hydraulic conductivity of 3.8×10^{-6} cm/sec. It should be noted that since the Shelby tube samples could be collected

only from areas where the fraction of coarser material was less, these hydraulic conductivity values should represent lower bound values for the existing cover soil. The results of the permeability testing are presented in Appendix D.

4 EVALUATION OF EXISTING COVER

4.1 Type and Depth of Existing Cover

The existing cover soil consists of gravely sand or sandy gravel with silt and clay, and a varying fraction (from 10 to 50 percent) of boulders and cobbles. Construction debris such as concrete, rebars, and timber were encountered. In almost all cases, these debris were encountered at depths greater than 3 feet. The exact depth of the existing cover in all test pit locations could not be determined due to difficulty in excavating through the boulders. However, it appears that the minimum depth of existing cover is approximately 3 feet in most places. Greater thickness was encountered near the top of the facility. The cover material, especially on the sideslopes, does not appear to have been compacted.

4.2 Hydraulic Conductivity of Existing Cover

The hydraulic conductivity (K) measured using the infiltrometer set up ranged from a minimum of 1.8×10^{-4} cm/sec to a maximum of 1.1×10^{-2} cm/sec. Although these data can not used quantitatively, the data are useful for a qualitative assessment of the range of K. The 2 orders of magnitude difference in the K values is likely because of the variation in the fraction of boulders and cobbles. Since Shelby tube samples could be collected only at a few locations, a direct comparison of the field test data with the laboratory data was not possible, except for Shelby tube sample labeled Tube #4. This sample was collected near infiltrometer location Inf. #5. Tube #4 yielded a K of 3.8×10^{-6} cm/sec in the laboratory compared to the field K of 4.4×10^{-4} cm/sec. The 2 orders of magnitude difference can be explained as follows:

- Since Shelby tube samples could be collected only from locations where the cover was comprised of finer material with some plasticity, it is most likely that the laboratory K would be lower than the field K.

- The infiltrometer tests a larger volume of soil, and thus accounts for the presence of larger structural features providing higher permeability pathways.

- Typically, laboratory tests on Shelby tube samples can result in lower permeability because of sample disturbance during collection, transportation, trimming, and testing.

Therefore, it is assumed that the K measured from field infiltrometers are more reliable than the laboratory values. These values suggest that the existing cover material is relatively pervious.

4.3 Drainage

As stated previously, no ponding of water or erosional features were observed during the field investigation work. Because of the pervious nature of the cover material, it appears that a significant portion of precipitation from this area percolates through the cover material. The presence of rodent burrows may also provide conduits to water flow through the cover soil, depending on their location.

Runoff from the access road to the facility discharges directly at the entrance to the landfill. Because of inadequate drainage slopes, temporary ponding of runoff from the access road could occur at the end of the access road.

5 CONCLUSIONS

5.1 Regulatory Requirements

The existing solid waste facilities in the State of Maryland are regulated by the Department of the Environment. The current regulations appear on Title 26, Subtitle 4, Chapter 7. These regulations became effective on March 7, 1988. The closure and post-closure requirements for existing facilities (i.e., those in operation after the effective date of the regulation) are contained in Sections 21 and 22 of Chapter 7. For existing municipal solid waste facilities, the current State regulation would require the following final cover system:

- A gas venting system.
- A low permeability cap consisting of a minimum 20 mil thick geomembrane or 1-foot of soil liner having a hydraulic conductivity of not greater than 1×10^{-5} cm/sec. The cap must have a minimum 4 percent slope.
- A 6-inch drainage layer having a hydraulic conductivity of not less than 1×10^{-3} cm/sec.
- A final earthen cover of 2-foot thickness, with a minimum slope of 4 percent.

The Maryland regulations do not specifically indicate a maximum slope requirement for caps or earthen covers. However, based on slope stability analyses considerations, the maximum slopes can typically be 33 percent and, in some cases, up to 50 percent.

Rubble landfills and industrial waste (non-hazardous wastes) landfills in Maryland require the same cover system requirements as municipal landfill, with the exception of a gas venting system.

With regards to the permeability of the cap, the existing cap material does not meet the hydraulic conductivity requirements (i.e., not greater than 1×10^{-5} cm/sec), nor is it designed to meet the current regulations. Sloping exceeds 4 percent on a significant portion of the existing cap.

Landfills were regulated by the Department of Health and Mental Hygiene prior to 1980. Rule 10.17.11.04E(e) of those regulations required a placement of 2 feet of cover soil over the waste. This regulation also required that the disposal site be graded and drained to minimize runoff on to the fill and to prevent erosion and ponding within the fill area, and to drain water from the surface of the disposal area.

A site restoration activity was undertaken in the late-1980s which apparently involved removal of certain materials from the surface and site regrading. The site restoration plan called for a minimum of 3 feet of soil cover. The existing cover material generally meets the requirement of pre-1980 State regulatory requirement. However, some of the cap has been eroded allowing rubble to protrude. Some materials around the southern perimeter are inadequately covered.

LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

APPENDIX A

TEST PIT LOGS

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TEST PIT LOGS

Project SPO SECURED SITE | Sheet No. 1 of 7
Client BERNARD JOHNSON YOUNG | Job No. 85732-001.000
Contractor D L GEORGE | Operator Bill Wilson
Equipment: CASE 580 Rubber Tire Backhoe | Inspector: JHK / SPG
Log of Test Pit No. TP-1 Date: 11-5-96 | G.S. Elev.

Piezometer Construction	Depth (feet)	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL		1	Bag (SM)*	Dark yellow brown CLAY & SILT, some(+) cf Sand, some mf Gravel, moist 12.2%, dense 130 pcf dd.
	5			@ 1'2" becomes orange brown BOULDERS, and CF COBBLES, with interstices filled w/ Clayey SILT, some cf Gravel, little cf Sand.
	10			Refusal of test pit @ 1'6" on boulders which were tightly packed
	15			1'6"
				END OF TEST PIT 1'6" →
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	20			No Visible Inflow of water, Stable excavation, Difficult excavation, SOIL SCAN HNU = 0 PPM — No Refuse Encountered

Log of Test Pit No. TP-2 Date: 11-5-96 G.S. Elev.

Piezometer Construction	Depth (feet)	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL		1	Bag (SM)*	Dark yellow brown SILT & CLAY, some(+) cf Sand, some(+) mf Gravel, moist 13.1%, med dense 119 pcf dd
	5			@ 1'0" becomes orange brown BOULDERS, little Clayey SILT, some cf Cobbles, some cf Gravel, little cf Sand.
	10			Refusal of test pit @ 4.0' on boulders which were tightly packed
	15			4'0"
				END OF TEST PIT 4'0" →
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe.	20			No Visible Inflow of Water, Stable excavation Difficult excavation SOIL SCAN HNU = 0 PPM — No Refuse Encountered

* Laboratory classification according to ASTM

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TEST PIT LOGS

Project SPO SECURED SITE | Sheet No. 2 of 7
Client BERNARD JOHNSON YOUNG | Job No. BS732-001.000
Contractor DL GEORGE | Operator Bill Wilson
Equipment: CASE 580 Rubber Tire Backhoe | Inspector: JHK/SPG
Log of Test Pit No. TP-3 | Date: 11-5-96 | G.S. Elev.

Piezometer Construction	Depth (ft)	Samples No.	Samples Type/Depth	Visual Classification
COMPACTED BACKFILL		1	Bag (SM)*	Dark yellow brown CLAY & SILT, some of Sand, some of Gravel, moist 13%, med dense 119 pcf dd occassional small cobble, frequent Roots 0-0'6"
	5			@ 1'0" becomes orange brown BOULDERS, some of Cobbles, little clayey silt, little of Gravel, little of Sand
	10			Refusal of test pit @ 3.0' on boulders which were tightly packed
	15			3'0"
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe.	20			END OF TEST PIT 3'0" → No Visible Inflow of water; Fairly Stable excavation; Difficult excavation; Soil Scan HNV = 0 ppm; No Refuse Encountered

Log of Test Pit No. TP-4 | Date: 11-5-96 | G.S. Elev.

Piezometer Construction	Depth (ft)	Samples No.	Samples Type/Depth	Visual Classification
COMPACTED BACKFILL		1	Bag (SM)*	Dark yellow brown SILT & CLAY, some(+) of Sand, some(-) Inf Gravel, moist 17.4%, med dense 107 pcf dd
	5			@ 0'6" becomes Orange brown BOULDERS, and Cobbles, little(+) Clayey Silt, little of Gravel little(-) of Sand
	10			Refusal of test pit @ 4.0' on boulders (4'x3'x2') which were tightly packed
	15			4'0"
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe.	20			END OF TEST PIT 4'0" → No Visible Inflow of Water; Stable excavation; Difficult excavation; SOIL SCAN HNV = 0 PPM; No Refuse Encountered

* Laboratory classification according to ASTM

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TEST PIT LOGS

Project SPO SECURED SITE | Sheet No. 3 of 7
Client BERNARD JOHNSON YOUNG | Job No. 85732-001.000
Contractor D L GEORGE | Operator Bill Wilson
Equipment CASE 580 Rubber Tire Backhoe | Inspector: JHK/SPG
Log of Test Pit No. TP-5 Date: 11-5-96 | G.S. Elev.

Piezometer Construction	Depth (Feet)	Samples No.	Samples Type/Depth	Visual Classification
COMPACTED BACKFILL	5	1	Bag (SM)*	Orange brown SILT & CLAY, some of Sand, some of Gravel moist 18.2%, med dense 119 pcf dd @0'3" becomes Gray STONE DUST @0'6" on all walls except North becomes BOULDERS, some of Cobbles, some of Gravel, little of Sand, little Silt on North wall from 5 to 6' is 2' wide swath of orange brown Clayey SILT, little of Gravel, trace of Sand Encountered Metal Car Jack and occassional brick @ 5.5' Refusal of test pit @ 6' on boulders which were tightly packed. 6'0"
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	10, 15, 20			END OF TEST PIT 6'0" No visible Inflow of water Stable excavation Difficult excavation SOIL SCAN HNU = 0 PPM

Log of Test Pit No. TP-6 Date: 11-5-96 G.S. Elev.

Piezometer Construction	Depth (Feet)	Samples No.	Samples Type/Depth	Visual Classification
COMPACTED BACKFILL	5	1	Bag (GM)*	Dark yellow brown CLAY & SILT, some (+) of Gravel, some (-) of Sand frequent of Cobbles, trace roots occ piece of burnt log @ 2.5-3' moist 22.5%, med dense 112 pcf dd @3.0' grades to Orange brown Clayey SILT, some of Cobbles, little of Gravel, little of Sand, occassional boulders @3'0" to 3'6" on EAST wall of pit discontinuous layer of Black CF SAND, some mf Gravel, little Silt @6' encountered 1 piece cable & 1 piece of wood 7'0"
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	10, 15, 20			END OF TEST PIT 7'0" No visible Inflow of water Fairly stable excavation Fairly easy excavation SOIL SCAN HNU - 0 PPM Note: Attempted 2 shelby tubes @0'6" BGS but post holes and unable to test

* Laboratory classification according to ASTM

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TEST PIT LOGS

Project SPO SECURED SITE	Sheet No. 4 of 7
Client BERNARD JOHNSON YOUNG	Job No. 85732-001.000
Contractor DL GEORGE	Operator Bill Wilson
Equipment: CASE 580 Rubber Tire Backhoe	Inspector: JHK / SPG
Log of Test Pit No. TP-7 Date: 11-5-96	G.S. Elev.

Piezometer Construction	Depth (feet)	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL	5	1	Bag (GM)*	Orange brown SILT & CLAY, some(+) cf Gravel, some cf Sand occ. cobble, trace roots moist 22% low density 74 pcf dd 0'6"
				(FILL) Black burnt SILT, and cf Sand some f Gravel occassional small cobble 1'6"
	10			Yellow brown SILT & CLAY, some(+) cf Gravel, some cf Sand, occ. cobble, occ boulder
	15			@ 3'6" becomes BOULDERS, some cf Cobbles, some Clayey Silt, little cf Gravel, little cf Sand only on North wall with occassional piece of burnt log & occ piece construction debris (wood) (5%) 6'6"
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	20			END OF TEST PIT 6'6" →

No Visible Inflow of Water
Fairly Stable excavation
Fairly easy excavation
SOIL SCAN HNV - 0 ppm

5% waste
occ burnt log
occ 2x4 const. debris

Log of Test Pit No. TP-8 Date: 11-5-96 G.S. Elev.

Piezometer Construction	Depth (feet)	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL	5	1	Bag (GM)*	Yellow brown CLAY & SILT, some (+) cf Gravel, some cf Sand, frequent cf Cobbles, occ. boulder moist 17.8% med dense 120 pcf
				@ 2.0 becomes orange brown BOULDERS some cf Cobbles, little cf Gravel, little Clayey Silt, trace cf Sand
	10			@ 4-5' on south end pit encountered discontinuous layer black (Asphaltic soil) CF SAND, some cf Gravel, little Silt
	15			@ 4-6'6" on North end of pit encountered a Brown Large BOULDER causing refusal of test pit. 6'6"
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	20			END OF TEST PIT 6'6" →

No Visible Inflow of Water
Fairly Stable excavation
Difficult excavation due to boulder

5% waste
occ Brick
occ Asphalt
SOIL SCAN HNV - 0 PPM

* Laboratory classification according to ASTM

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TEST PIT LOGS

Project SPO SECURED SITE	Sheet No. 5 of 7
Client BERNARD JOHNSON YOUNG	Job No. 85732-601.000
Contractor DL GEORGE	Operator Bill Wilson
Equipment Case 580 Rubber Tire Backhoe	Inspector: JHK / SPG
Log of Test Pit No. TP-9 Date: 11-5-96	G.S. Elev.

Piezometer Construction	Depth (Feet)	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL		1	Bag (GM)*	Yellow brown CLAY & SILT, some ctl c-f Gravel, some c-f Sand occassional cobble moist 15%, med dense 104 pcf dd
				@ 2'0" becomes brown BOULDERS and C-f Cobbles some Clayey SILT, some c-f Gravel, little c-f Sand
	5			@ 2-4' on south wall of pit encountered occassional pieces of wire and plastic 4'0"
	10			END OF TEST PIT 4'0" →
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	15			No Visible Inflow of Water Fairly Stable Excavation Difficult excavation due to boulders SOIL SCAN HNU = 0 ppm MINIMAL WASTE only occ piece of wire & plastic
	20			

Log of Test Pit No. TP-10	Date: 11-5-96	G.S. Elev.

Piezometer Construction	Depth (Feet)	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL		1	Bag (GM)*	Dark yellow brown CLAY & SILT, some c-f Gravel, some c-f Sand, frequent c-f Cobbles, occ Boulder moist 21%, med dense 106 pcf dd
	5			@ 1' encountered 6'x4'x1' wide CONCRETE BLOCK and few pieces of metal rods at 1' depth on south end pit.
				@ 2.0' becomes Orange brown CLAY & SILT, some c-f Gravel, little c-f Sand, Frequent cobbles, frequent boulders (2x2x1') 7'6"
	10			END OF TEST PIT 7'6" →
	15			
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	20			No Visible Inflow of Water Fairly Stable excavation Fairly easy excavation SOIL SCAN HNU = 0 ppm obtained BULK SAMPLE FOR PROCTOR

* Laboratory classification according to ASTM

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TEST PIT LOGS

Project SPO SECURED SITE	Sheet No. 6 of 7
Client BERNARD JOHNSON YOUNG	Job No. 85732-001.000
Contractor D L GEORGE	Operator Bill Wilson
Equipment: CASE 580 Rubber Tire Backhoe	Inspector: JHK / SPG
Log of Test Pit No. TP-11 Date: 11-5-96	G.S. Elev.

Piezometer Construction	Feet	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL	5	1	Bag (SM)*	Orange brown CLAY & SILT, some cf Gravel, some cf Sand frequent Cobbles, occ Boulder moist 17.2%, med dense 105 pcf dd
				@ 1.0' encountered 2'x1'x0.75' concrete SLAB w/ Rebar
				@ 4.0' encountered 2x3x1 BOULDER
	10			@ 5.0' Becomes predominantly construction Debris consisting of concrete, Rebar, wire. 5'0"
				END OF TEST PIT 5'0"
upon completion test pit was backfilled and compacted with backhoe. No photo	15			No Visible Inflow of Water Fairly Stable Excavation Fairly easy Excavation SOIL SCAN HNV = 0 ppm
	20			Pressed 2 shelby tubes S-1 0'6-1'6 and S-2 0-0'9" but upon extrusion at lab, unable to test for permeability

Log of Test Pit No. TP-12 Date: 11-5-96 USED KOMATSU C150 LC TRACK MTD HOE G.S. Elev.

Piezometer Construction	Feet	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL	5	1	Bag (GM)*	Orange brown CLAY & SILT, some(+) cf Gravel, some cf Sand occ. cobble, few boulders moist 18.8%, med dense 107 pcf dd
				@ 5'-5'6" encountered few pieces of waste including black and white plastic & steel rod 5.5'
				@ 5'6' becomes Gray and Orange brown Clayey SILT, some cf Gravel, little cf Sand frequent F-C Cobbles, higher moisture @ 5'6-7' 7'0"
	10			END OF TEST PIT 7'0"
	15			No Visible Inflow of Water but damper Unstable sloughing 2-7' Easy Excavation SOIL SCAN HNV = 0 ppm
upon completion of test pit, photo was taken and then backfilled and compacted with hoe.	20			OBTAINED BULK SAMPLE FOR PROCTOR

* Laboratory classification according to ASTM

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TEST PIT LOGS

Project SPO SECURED SITE	Sheet No. 7 of 7
Client BERNARD JOHNSON YOUNG	Job No. 85732-001.000
Contractor DL GEORGE	Operator Bill Wilson
Equipment KOMATSU C150 LC Track Mounted Backhoe	Inspector: JHK / SPG
Log of Test Pit No. TP-13 Date: 11-5-96	G.S. Elev.

Piezometer Construction	Depth (Feet)	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL	0	Type Shelby	Type Shelby	Red brown pale olive SILT & CLAY, and (-) mf Gravel, some cf Sand, moist 14%, med dense 118 pcf dd @ 0'6" grades to red brown CF GRAVEL and CLAY & SILT some cf Sand, moist 16%, med dense 118.3 pcf dd
		1	Bag (GM)*	Frequent cf Cobbles throughout test pit
	5			Encountered large boulder (2'x2'x2½') at depth of 2' on east side of pit
				5'0"
	10			@ 5.0' Construction Debris consisting predominantly of metal Rods, wood, concrete
				5'6"
	15			END OF TEST PIT 5'6" →
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	20			No Visible Inflow of Water Fairly Stable Excavation Fairly Easy Excavation SOIL SCAN HNV = 0 PPM

Log of Test Pit No. TP-14	Date: 11-5-96 G.S. Elev.

Piezometer Construction	Depth (Feet)	Samples No.	Samples Type/ Depth	Visual Classification
COMPACTED BACKFILL	0	1	Bag (SM)*	Dark yellow brown CLAY & SILT, some cf Sand, some mf Gravel, moist 17.1%, med dense 105 pcf dd
				3'0"
	5			@ 3.0' Refuse / Construction Debris consisting of Metal bars, wire, plastic, metal cans, cobbles, occassional boulder
				4'0"
	10			END OF TEST PIT 4'6" →
	15			No Visible Inflow of Water Fairly Stable Excavation Easy Excavation SOIL SCAN HNV = 0 PPM
Upon completion of test pit, photo was taken and then backfilled and compacted with hoe	20			

* Laboratory classification according to ASTM

APPENDIX B

NUCLEAR DENSITY TESTS

Government Secured Site
Cover Soil and Cap Evaluation
Troxler Gauge Density and Moisture Readings Taken 11-5-96

Location	Depth of Probe (Inches)	Density Counts (Counts)	Wet Density (Pcf)	Dry Density (Pcf)	Moisture (Pounds)	Percent Moisture (Percent)
TP-01	10	437	145.5	130.8	14.7	11.2
TP-01	6	1307	145.5	129.7	15.8	12.2
TP-02	12	296	137.5	119.6	17.8	14.9
TP-03	12	311	135.9	119.1	16.8	14.1
TP-04	12	335	133.1	107.8	25.3	23.5
TP-05	12	314	135.6	119.8	15.8	13.2
TP-06	12	325	134.2	112.3	21.9	19.5
TP-07	12	1444	91.9	74	17.9	24.2
TP-08	12	306	136.5	120.3	16.2	13.4
TP-09	12	458	123.8	104.4	19.4	18.6
TP-10	12	419	126.5	106.5	20	18.7
TP-11	12	449	124.4	105.2	19.2	18.3
TP-12	12	356	131.3	107.4	23.8	22.2
TP-13	12	269	140.4	118.3	22.1	18.6
TP-14	12	369	130.1	105.5	24.6	23.3
TRX-15	12	557	118.2	100.9	17.3	17.1
TRX-16	12	398	128	105.8	22.2	21
INF-1	12	202	151	134.5	16.5	12.2
INF-2	12	390	128.8	110.6	18.1	16.4

TP-01 through TP-14 correspond to TRX-01 through TRX-14 on Drawing 1.
INF-1 and INF-2 correspond to TRX-17 and TRX-18, respectively on Drawing 1.

APPENDIX C

INFILTROMETER TESTS

WEHRAN ENGINEERING
CONSULTING ENGINEERS

VARIABLE HEAD
PERMEABILITY TEST
PIEZOMETER No. Infiltrometer #1

PROJECT: SPO SECURED SITE
CLIENT: BERNARD JOHNSON YOUNG
JOB NO: 85732-001.000
DATE OF TEST: 11-1-96
SCREENED INTERVAL:
3" BGS Red brown Clayey SILT, some of Gravel, little of Sand, occ root.

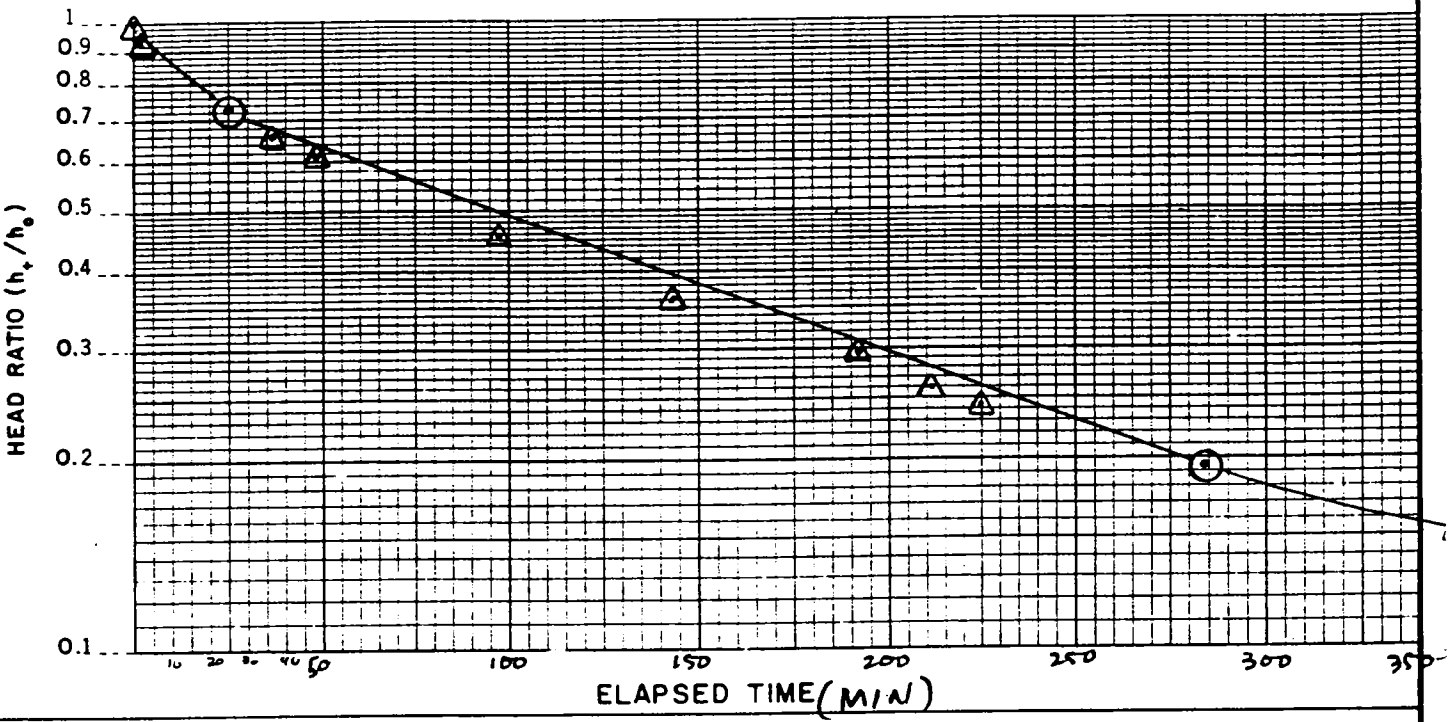
METHOD: BOUWELL

$$K = \frac{\pi d^2}{11\, D\,(t_2 - t_1)} \ln \frac{H_1}{H_2}$$

Note: $K_H = K_V = K$ ← Assumption

TEST DATA

ELAPSED TIME MIN.	HEAD RATIO (h_t / h_o)
0	1.00
2.0	0.929
⊙ 26.83	0.731
38.75	0.664
48.50	0.614
97.50	0.454
144	0.362
192	0.294
212	0.260
225	0.243
⊙ 283	0.193
350	0.151



CALCULATIONS:

$d = 2.875" = 7.3025\,cm$
$D = 7.3025\,cm$
$t_2 = 283\ MIN = 16980\ sec$
$t_1 = 26.83\ MIN\ \ 1610\ sec$
$h_1 = 0.731$
$h_2 = 0.193$

$$K = \frac{\pi\ 7.3025^2}{11(7.3025)(16980 - 1610)} \ln \frac{0.731}{0.193}$$

$K = 1.807 \times 10^{-4}\ cm/sec$

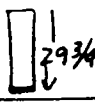
INFILTROMETER ~~TEST~~ - #1

Date of Test = 11-1-96
Diameter of well = 2.875
Diameter of Borehole = N/A = 2.875

Max Head Differential ___ ft
Max Head Volume ___ gal

EMCON

By JHK Date ___
Chkd. by ___ Date ___
Subject Recovery Test Data



Job No. 85732-001.000
Sheet No. ___ of ___

STATIC WATER LEVEL = ___ BGS

TIME	ELAPSED TIME MIN	ELAPSED TIME SEC	DEPTH TO WATER	HT	HT/Ho
			Below Top of Shelby Tube	2.479 - DTW	
8:58:00	0		1½" = 0.125'	2.354	1.000
9:00	2 MIN		2⅛" = 0.177	2.302	0.929
9:24:50	26 MIN 50 SEC		8" = 0.666	1.813	0.731
9:36:45	38 MIN 45 SEC		10" = 0.833	1.646	0.664
9:46:30	48 MIN 30 SEC		11½" = 0.958	1.521	0.614
10:35:30	97 MIN 30 SEC		16¼" = 1.354	1.125	0.454
11:22:00	144 MIN		19" = 1.583	0.896	0.362
12:10:00	192		21" = 1.750	0.729	0.294
12:30:00	212		22" = 1.833	0.646	0.260
12:43:00	225		22½" = 1.875	0.604	0.243
13:41:00	283		24" = 2.000	0.479	0.193
14:48:00	350		25¼" = 2.104	0.375	0.151

WEHRAN ENGINEERING
CONSULTING ENGINEERS

VARIABLE HEAD PERMEABILITY TEST
PIEZOMETER NO Infiltrometer #2

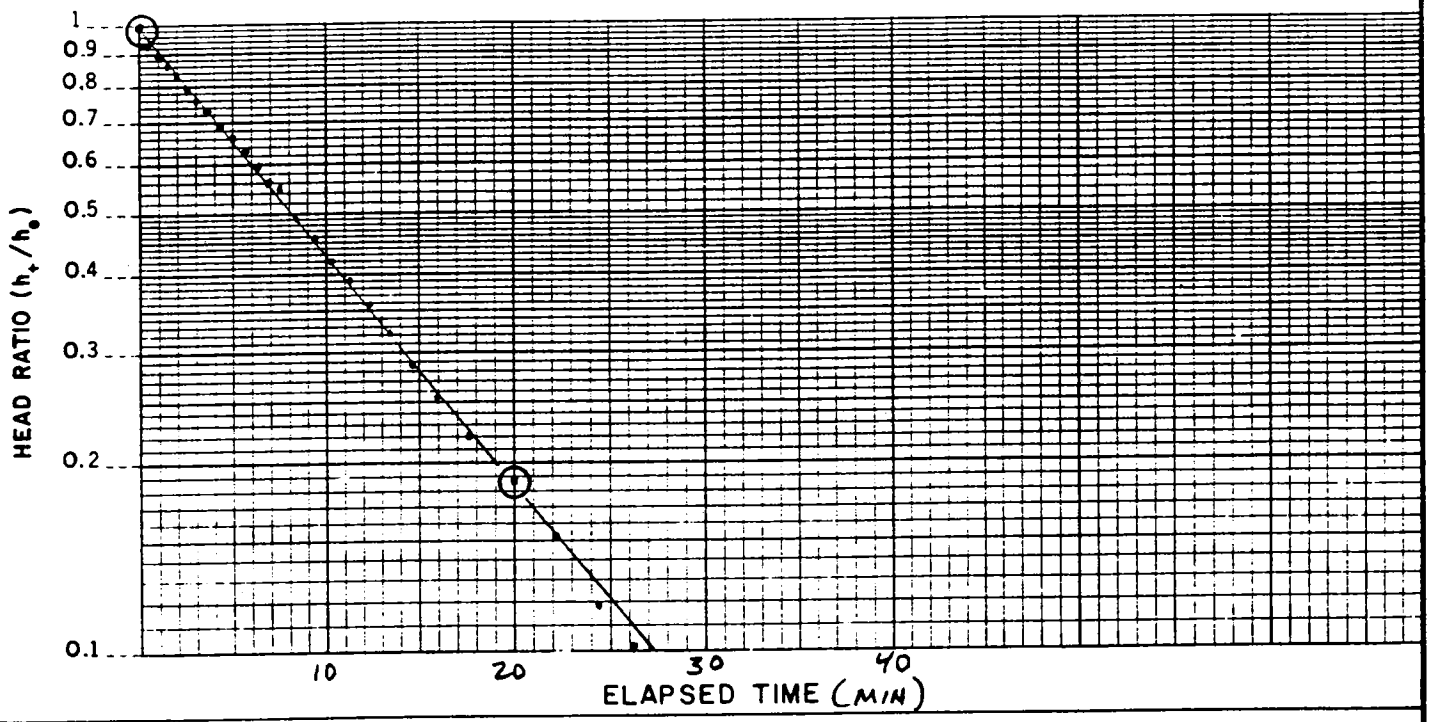
PROJECT: SPO SECURED SITE
CLIENT: BERNARD JOHNSON YOUNG
JOB NO: 85732-001.000
DATE OF TEST: 11-1-96
SCREENED INTERVAL:
3" BGS Red brown SILT & CLAY, little (-) C-f Gravel, trace c-f Sand. Few pieces of coarse Gravel on S.W. corner coupled with root matter may be cause of faster infiltration than initially expected

METHOD: BOUTWELL

$$K = \frac{\pi d^2}{11 D (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

TEST DATA

ELAPSED TIME MIN	HEAD RATIO (h_t / h_o)
① 0	1.00
1	0.898
2.03	0.830
3.08	0.763
4.25	0.695
5	0.661
6.16	0.593
7.66	0.525
9.33	0.459
10.25	0.424
11.33	0.390
12.42	0.356
14.75	0.288
16	0.254
17.83	0.22
① 20	0.186
26.16	0.122



CALCULATIONS:

$d = 2.875'' = 7.3025$ cm
$D = 7.3025$ cm
$t_2 = 20$ MIN $= 1200$ sec
$t_1 = 0$ sec
$h_1 = 1.00$
$h_2 = 0.186$

$$K = \frac{\pi (7.3025)^2}{11 (7.3025)(1200)} \ln \frac{1.00}{0.186}$$

$$K = 2.923 \times 10^{-3} \text{ cm/sec}$$

INFILTROMETER ~~NAW~~ - #2

Date of Test = 11-1-96
Diameter of well = 2.875
Diameter of Borehole = N/A 2.875

Max Head Differential = ___
Max Head Volume = ___ g

EMCON

By JHK Date ___
Chkd. by ___ Date ___
Subject Recovery Test Data

29½" = 2.458

Job No. 85732-001.000
Sheet No. ___ of ___

Below Top of 2.458 DTW STATIC WATER LEVEL = ___ BGS

TIME	ELAPSED TIME MIN	SQRT MIN	DEPTH TO WATER	HT	HT/H₀
9:03	0	0 Sec	1¼" = 0.104	2.354	1.00
9:03:30	30 sec	0.5	2" = 0.166	2.292	0.932
9:04	1 min	1	3" = 0.25	2.208	0.898
9:04:31	1 min 31 sec	1.52	4 = 0.333	2.125	0.864
9:05:02	2 min 2 sec	2.03	5 = 0.416	2.042	0.830
9:05:35	2 35	2.58	6 = 0.50	1.958	0.796
9:06:05	3 05	3.08	7 = 0.583	1.875	0.763
9:06:40	3 40	3.66	8 = 0.666	1.792	0.729
9:07:15	4 15	4.25	9 = 0.75	1.708	0.695
9:08:00	5	5	10 = 0.833	1.625	0.661
9:08:35	5:35	5.58	11 = 0.916	1.542	0.627
9:09:10	6:10	6.16	12 = 1.00	1.458	0.593
9:09:56	6:56	6.93	13 = 1.083	1.375	0.559
9:10:40	7:40	7.66	14 = 1.166	1.292	0.525
9:11:22	8:22	8.36	15 = 1.25	1.208	0.491
9:12:20	9:20	9.33	16 = 1.33	1.128	0.459
9:13:15	10:15	10.25	17 = 1.416	1.042	0.424
9:14:20	11:20	11.33	18 = 1.50	0.958	0.390
9:15:25	12:25	12.42	19 = 1.583	0.875	0.356
9:16:35	13:35	13.58	20 = 1.666	0.792	0.322
9:17:45	14:45	14.75	21 = 1.75	0.708	0.288
9:19:00	16	16.	22 = 1.833	0.625	0.254
9:20:50	17:50	17.83	23 = 1.916	0.542	0.220
9:23:00	20	20	24 = 2.00	0.458	0.186
9:25:15	22:15	22.25	25 = 2.083	0.375	0.152
9:27:40	24:40	24.66	26 = 2.166	0.292	0.119
9:29:10	26:10	26.16	26½ = 2.208	0.25	0.102
9:31:40	28:40	28.66	27 = 2.25	0.208	0.085
9:34:30	31:30	31.5	27½ = 2.292	0.166	0.067
9:38:15	35:15	35.25	28 = 2.333	0.125	0.051
9:44:15	41:15	41.25	29 = 2.416	0.042	0.017

WEHRAN ENGINEERING
CONSULTING ENGINEERS

VARIABLE HEAD
PERMEABILITY TEST
PIEZOMETER No. Infiltrometer # 3

PROJECT: SPO SECURED SITE
CLIENT: BERNARD JOHNSON YOUNG
JOB NO: 85732-001.000
DATE OF TEST: 11-14 96

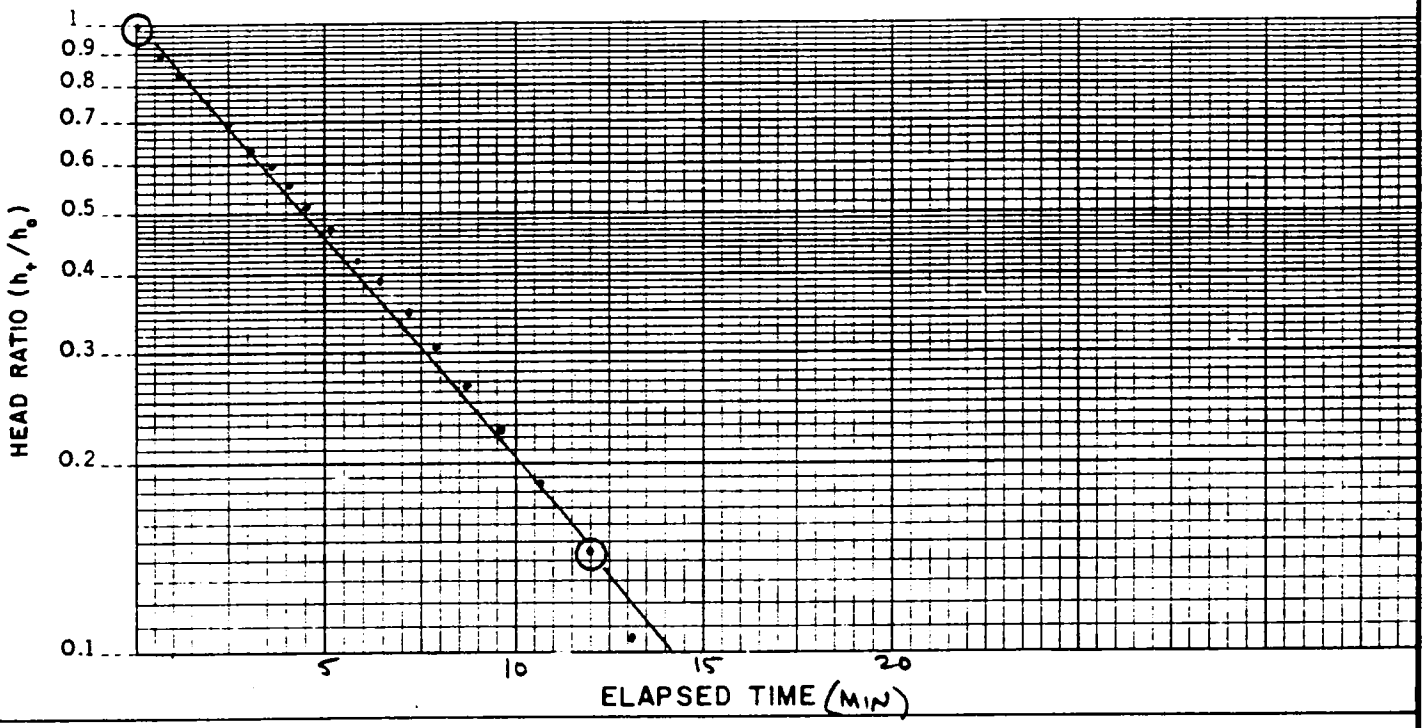
SCREENED INTERVAL:
5" BGS Dark orange brown clayey SILT, some mf Gravel, little c-f Sand, vegetated upper 3"

METHOD: BOUTWELL

$$K = \frac{\pi d^2}{11 D (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

TEST DATA

ELAPSED TIME MIN.	HEAD RATIO (h_t / h_o)
⊙ 0	1.00
0.58	0.898
1.20	0.831
2.50	0.695
3.03	0.634
3.63	0.593
4.03	0.552
4.58	0.512
5.15	0.471
5.82	0.430
6.47	0.390
7.20	0.349
7.95	0.308
8.75	0.268
9.60	0.227
10.66	0.186
⊙ 12.00	0.145
13.08	0.105



CALCULATIONS:

$d = 2.875" = 7.3025 cm$
$D = 7.3025 cm$
$t_2 = 12.00 MIN = 720 sec$
$t_1 = 0$
$h_1 = 1.00$
$h_2 = 0.145$

$$K = \frac{\pi\ 7.3025^2}{11 (7.3025)(720)} \ln \frac{1.00}{0.145}$$

$$K = 5.594 \times 10^{-3}\ cm/sec$$

INFILTROMETER ~~####~~ - #3

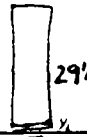
Date of Test = 11-14-96
Diameter of well =
Diameter of Borehole =

Max Head Differential ___ ft
Max Head Volume ___ = ___ gal

EMCON

By JHK Date
Chkd. by Date
Subject Recovery Test Data

Job No. 85732-001.000
Sheet No. ___ of ___



Below Top of Pipe

STATIC WATER LEVEL = ___ BGS

TIME	ELAPSED TIME MIN:SEC	SEC	DEPTH TO WATER	2.458 - DTW = HT	HT/H$_{2.458}$
7:34	10	0	1/4" = 0.104	2.354	1.000
7:34:35	0:35	0.58	3" = 0.25	2.208	0.898
7:35:12	1:12	1.20	5" = 0.416	2.042	0.831
7:36:30	2:30	2.50	9" = 0.750	1.708	0.695
7:37:02	3:02	3:03	0.90	1.558	0.634
7:37:38	3:38	3.63	1.00	1.458	0.593
7:38:02	4:02	4.03	1.10	1.358	0.552
7:38:35	4:35	4.58	1.20	1.258	0.512
7:39:09	5:09	5.15	1.30	1.158	0.471
7:39:49	5:49	5.82	1.40	1.058	0.430
7:40:28	6:28	6.47	1.50	0.958	0.390
7:41:12	7:12	7.20	1.60	0.858	0.349
7:41:57	7.57	7.95	1.70	0.758	0.308
7:42.45	8:45	8.75	1.80	0.658	0.268
7:43:36	9:36	9.60	1.90	0.558	0.227
7:44:40	10:40	10.64	2.00	0.458	0.186
7:46:00	12:00	12.00	2.10	0.358	0.145
7:47:05	13:05	13.08	2.20	0.258	0.105

WEHRAN ENGINEERING
CONSULTING ENGINEERS

VARIABLE HEAD PERMEABILITY TEST

PIEZOMETER No Infiltrometer # 4

PROJECT: SPO SECURED SITE

CLIENT: BERNARD JOHNSON YOUNG

JOB NO: 85732-001.000

DATE OF TEST: 11-14-96

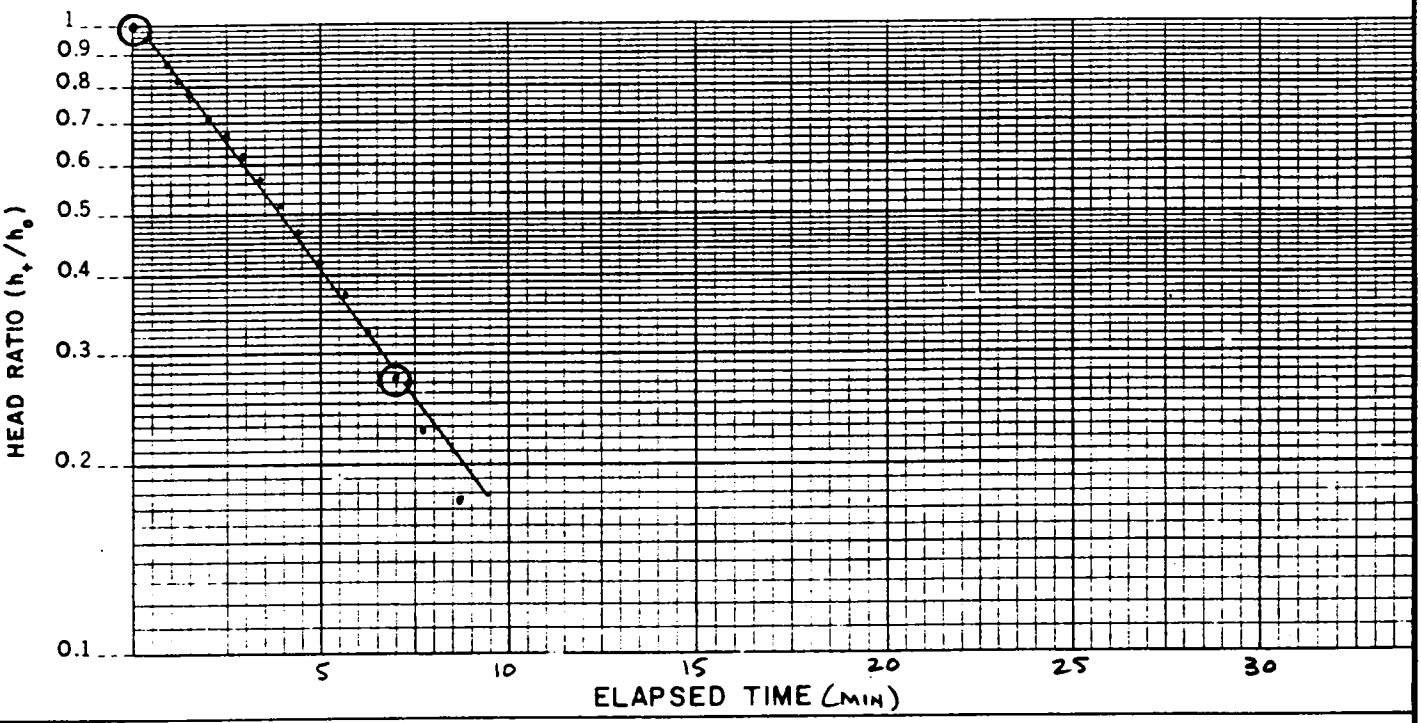
SCREENED INTERVAL:
4" BGS Dark orange brown Clayey SILT, little cf Gravel, little(-) cf Sand, Highly vegetated upper 2"

METHOD: BOUTWELL

$$K = \frac{\pi d^2}{11 D (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

TEST DATA

ELAPSED TIME MIN	HEAD RATIO (h_t / h_o)
⊙ 0	1.00
0.8	0.861
1.166	0.812
1.583	0.763
2	0.714
2.45	0.665
2.916	0.616
3.366	0.567
3.90	0.518
4.416	0.469
5.033	0.420
5.700	0.371
6.25	0.322
⊙ 7.016	0.273
7.733	0.224
8.633	0.175



CALCULATIONS:

$d = 2.875" = 7.3025\ cm$

$D = 7.3025\ cm$

$t_2 = 7.016\ MIN = 420.96 = 421\ sec$

$t_1 = 0$

$h_1 = 1.00$

$h_2 = 0.273$

$$K = \frac{\pi\ 7.3025^2}{11(7.3025)(421)} \ln \frac{1.00}{0.273}$$

$$K = 6.432 \times 10^{-3}\ cm/sec$$

INFILTROMETER ~~#1~~ - # 4

Date of Test - 11-14-96

Diameter of well -

Diameter of Borehole -

Max Head Differential ___ ft

Max Head Volume ___ gal

EMCON

By JHK Date 11/14/96

Chkd. by _____ Date _____

Subject Recovery Test Data

Job No. 85732-001.000

Sheet No. _____ of _____

29½" 2.458

STATIC WATER LEVEL = ~~BGS~~

TIME	ELAPSED TIME MIN	ELAPSED TIME SEC	ELAPSED TIME MIN	DEPTH TO WATER	2.458 - DTW HT	H_T/H_0 2.042
7:43:28				~~BGS~~		
7:44	0	0	0	5' 0.416	2.042 H_0	1.000
7:44:48	0:48	48	0.80	0.70	1.758	0.861
7:45:10	1:10	70	1.166	0.80	1.658	0.812
7:45:35	1:35	95	1.583	0.90	1.558	0.763
7:46:00	2	120	2	1.00	1.458	0.714
7:46:27	2:27	147	2.45	1.10	1.358	0.665
7:46:55	2:55	175	2.916	1.20	1.258	0.616
7:47:22	3:22	202	3.366	1.30	1.158	0.567
7:47:54	3:54	234	3.90	1.40	1.058	0.518
7:48:25	4:25	265	4.416	1.50	0.958	0.469
7:49:02	5:02	302	5.033	1.60	0.858	0.420
7:49:42	5:42	342	5.700	1.70	0.758	0.371
7:50:15	6:15	375	6.25	1.80	0.658	0.322
7:51:01	7:01	421	7.016	1.90	0.558	0.273
7:51:44	7:44	464	7.733	2.00	0.458	0.224
7:52:38	8:38	518	8.633	2.10	0.358	0.175

WEHRAN ENGINEERING
CONSULTING ENGINEERS

VARIABLE HEAD
PERMEABILITY TEST
PIEZOMETER No. Infiltrometer # 5

PROJECT: SPO SECURED SITE
CLIENT: BERNARD JOHNSON YOUNG
JOB NO: 85732-001.000
DATE OF TEST: 11-14-96

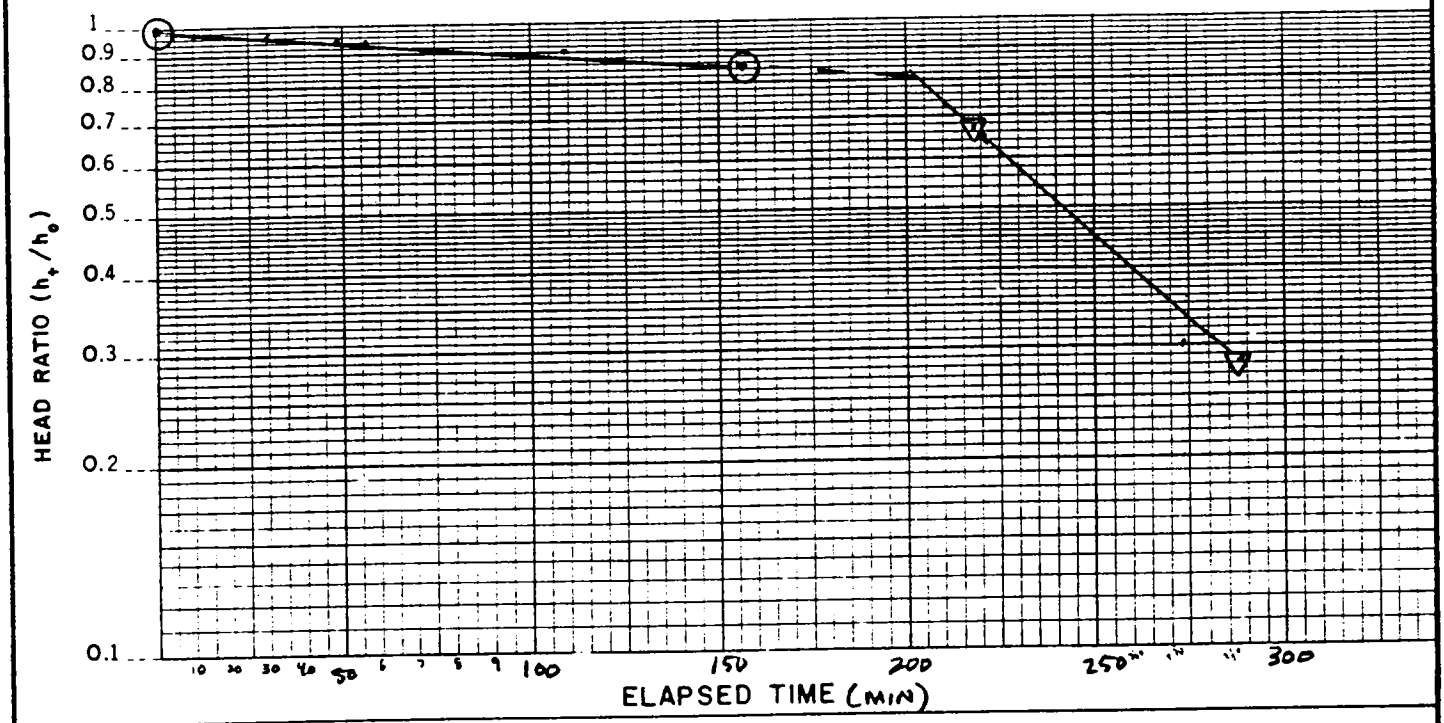
SCREENED INTERVAL:
3½" BGS Dark red brown SILT & CLAY, little cf Gravel, trace cf Sand, occassional small cobble, highly vegetated upper 1"

METHOD: BOUTWELL

$$K = \frac{\pi d^2}{11 D (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

TEST DATA

ELAPSED TIME MIN	HEAD RATIO (h_t / h_o)
⊙ 0	1.00
11.0	0.982
30.0	0.968
49.0	0.955
57.5	0.946
108.0	0.902
⊙ 156.0	0.848
▽ 218.5	0.665
221.0	0.643
221.6	0.633
274.0	0.303
▽ 284.0	0.285



CALCULATIONS:

⊙

$d = 2.875" = 7.3025$ cm
$D = 7.3025$ cm
$t_2 = 156$ min $= 9360$ sec
$t_1 = 0$
$h_1 = 1.00$
$h_2 = 0.848$

$$K = \frac{\pi\ 7.3025^2}{11(7.3025)(9360)} \ln \frac{1.00}{0.848}$$

$K = 3.673 \times 10^{-5}$ cm/sec

▽

$d = 7.3025$ cm
$D = 7.3025$ cm
$t_2 = 284$ min $= 17040$ sec
$t_1 = 218.5$ min 13110 sec $\quad 3930$
$h_1 = 0.665$
$h_2 = 0.285$

$$K = \frac{\pi\ 7.3025^2}{11(7.3025)(3930)} \ln \frac{0.665}{0.285}$$

$K = 4.496 \times 10^{-4}$ cm/sec

INFILTROMETER
MW-#5

Date of Test = 11-14-96
Diameter of well = 2.875"
Diameter of Borehole = 2.875"

Max Head Volume = 9.

EMCON

By JHK Date
Chkd. by Date
Subject Recovery Test Data

Job No. 85732-001.000
Sheet No. of

29.5 = 2.458
-.125

STATIC WATER LEVEL = BGS

24.58 - BTW

TIME	ELAPSED TIME MIN	SQL	DEPTH TO WATER	HT	HT/H₀
7:59:00	0		1½" = 0.125	2.333	1.000
8:10	11		2" = 0.166	2.292	0.982
8:29	30		2⅜" = 0.200	2.258	0.968
8:48	49		2¾" 0.229	2.229	0.955
8:56:30	57.5		3" 0.250	2.208	0.946
9:47:00	108		4¼" 0.354	2.104	0.902
10:35:00	156		5¾" 0.479	1.979	0.848
11:37:30	218.5		10⅛" 0.906	1.552	0.665
11:40	221		11½" 0.958	1.500	0.643
11:40:35	221.58		11¾" 0.979	1.479	0.633
12:33	274		21" 1.750	0.708	0.303
12:43	284		21½" 1.792	0.666	0.285

WEHRAN ENGINEERING
CONSULTING ENGINEERS

VARIABLE HEAD
PERMEABILITY TEST
PIEZOMETER No Infiltrometer #6

PROJECT: SPO SECURED SITE
CLIENT: BERNARD JOHNSON YOUNG
JOB NO: 85732-001.000
DATE OF TEST: 11-14-96

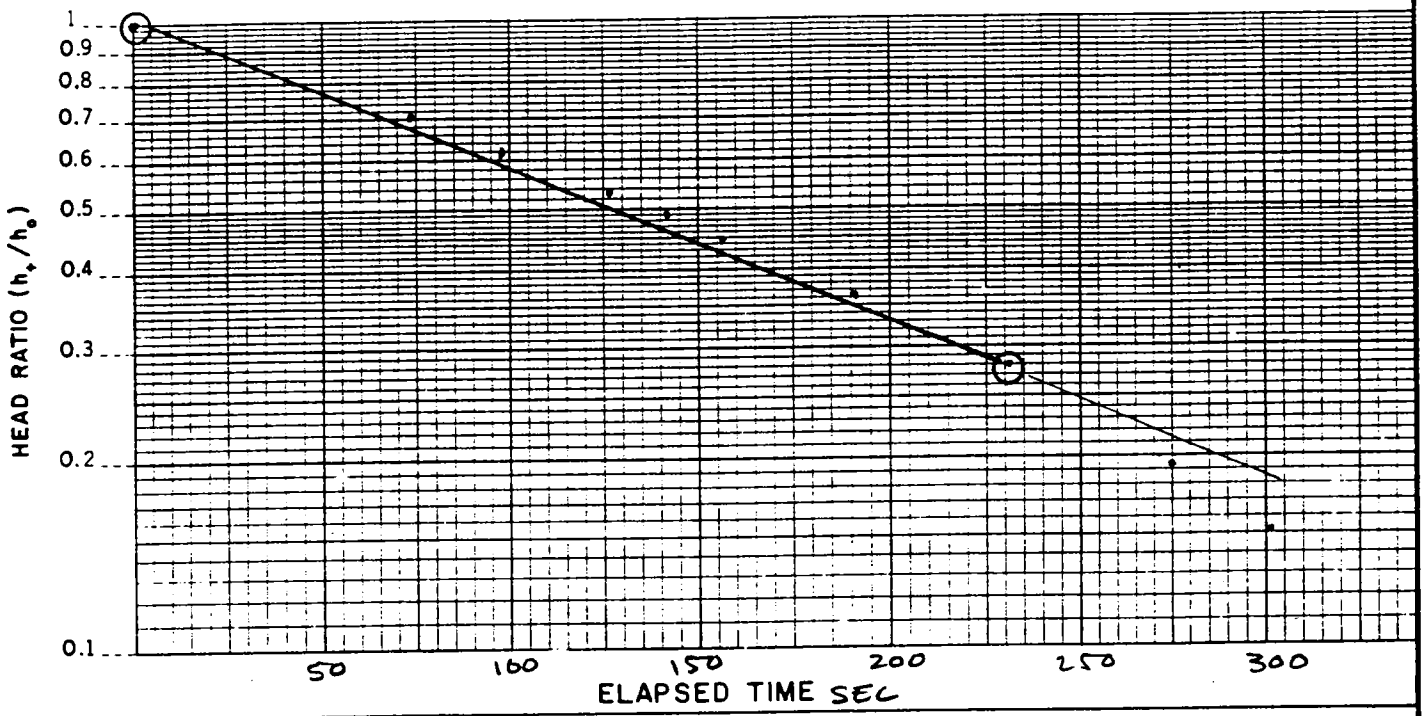
SCREENED INTERVAL:
4" BGS Orange brown SILT & CLAY, little cf Gravel, little c-f Sand, occassional cobble, highly vegetated upper 1"

METHOD: BOUTWELL

$$K = \frac{\pi d^2}{11 D (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

TEST DATA

ELAPSED TIME SEC	HEAD RATIO (h_t / h_o)
⊙ 0	1.00
74	0.703
98	0.618
126	0.533
142	0.491
157	0.448
191	0.363
231	0.279
⊙ 275	0.194
301	0.151



CALCULATIONS:

$d = 2.875" = 7.3025$ cm
$D = 7.3025$ cm
$t_2 = 231$ sec
$t_1 = 0$ sec
$h_1 = 1.00$
$h_2 = 0.279$

$$K = \frac{\pi\ 7.3025^2}{11(7.3025)(231)} \ln \frac{1.00}{0.279}$$

$$K = 1.152 \times 10^{-2}\ \text{cm/sec}$$

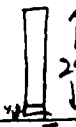
INFILTROMETER #6
~~NAW~~ -

Date of Test - [illegible]

Diameter of Well = 2.875"
Diameter of Borehole = 2.875"

Max Head Volume = ____ gal

EMCON



2.45
- 0.21
2.35

By JHC Date ____
Chkd. by ____ Date ____
Subject Recovery Test Data

Job No. 85732-001.000
Sheet No. ____ of ____

STATIC WATER LEVEL = ____ BGS

2.458 - D

TIME	ELAPSED TIME MIN	ELAPSED TIME SEC	DEPTH TO WATER	HT	HT/H₀
7:54	0	0	1¼" = 0.10	2.35B	1.00
7:55:14	1 min 14 sec	74	0.80	1.65B	0.703
7:55:38	1 min 38	98	1.00	1.45B	0.618
7:56:06	2 min 6	126	1.20	1.25B	0.533
7:56:22	2 min 22	142	1.30	1.15B	0.491
7:56:37	2 min 37 sec	157	1.40	1.05B	0.448
7:57:11	3 min 11 sec	191	1.60	0.85B	0.363
7:57:51	3 min 51	231	1.80	0.65B	0.279
7:58:35	4 min 35	275	2.00	0.45B	0.194
7:59:01	5 min 1 sec	301	2.10	0.35B	0.151

WEHRAN ENGINEERING
CONSULTING ENGINEERS

VARIABLE HEAD
PERMEABILITY TEST
PIEZOMETER No. Infiltrometer # 7

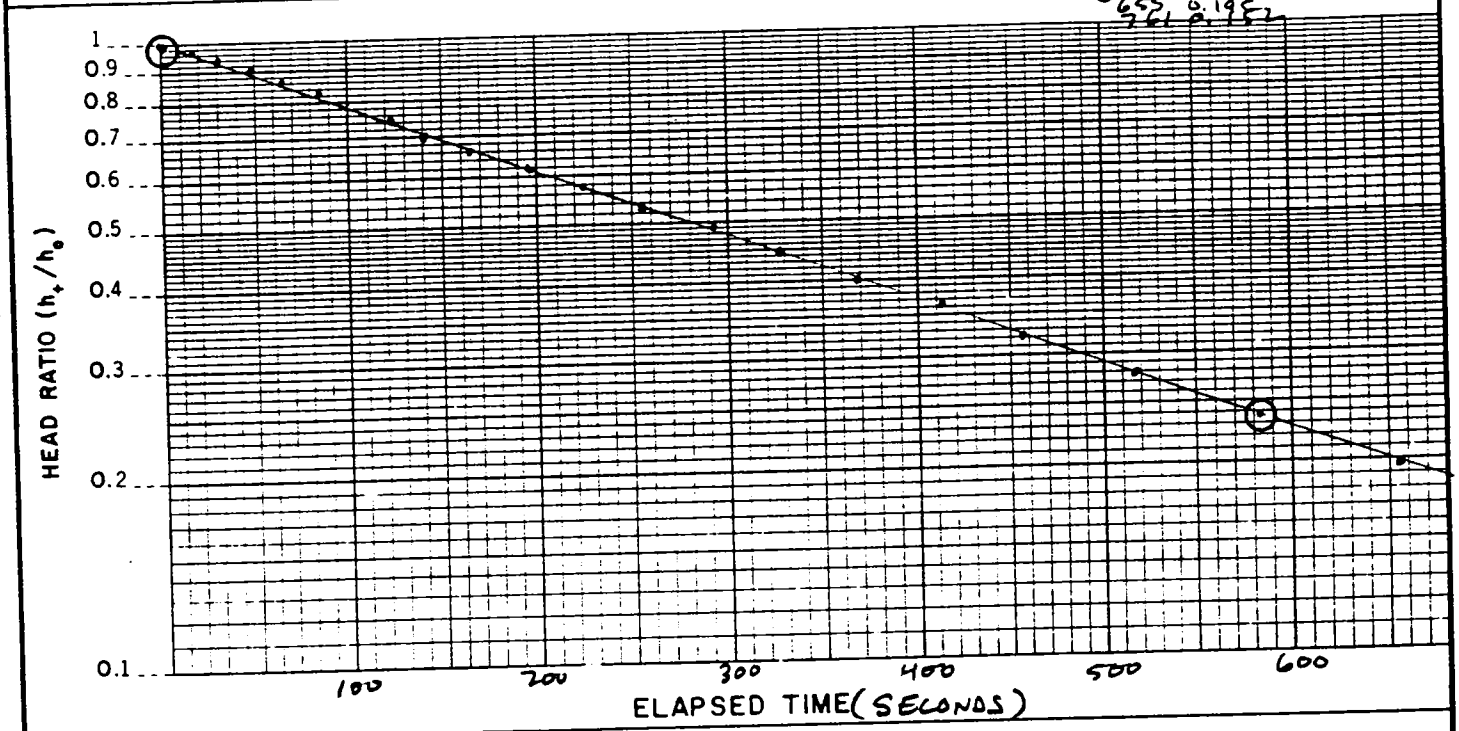
PROJECT: SPO SECURED SITE
CLIENT: BERNARD JOHNSON YOUNG
JOB NO: 85732-001.000
DATE OF TEST: 11-14-96

SCREENED INTERVAL:
4" BGS Dark orange brown SILT & CLAY, little (-) f-c Gravel, trace(-) of Sand, highly vegetated upper 2"
After test removed coarse gravel SE & NW corner permameter low density

METHOD: BOUTWELL

$$K = \frac{\pi d^2}{11 D (t_2 - t_1)} \ln \frac{H_1}{H_2}$$

TEST DATA	
ELAPSED TIME SEC	HEAD RATIO (h_t / h_o)
⊙ 0	1.00
18	0.972
30	0.938
48	0.904
64	0.865
85	0.832
121	0.747
140	0.704
166	0.662
196	0.619
225	0.577
255	0.534
291	0.492
327	0.450
368	0.407
412	0.365
457	0.322
516	0.280
⊙ 582	0.237
655	0.192
761	0.152



CALCULATIONS:

$d = 2.875" = 7.3025 cm$

$D = 7.3025 cm$

$t_2 = 582 sec$

$t_1 = 0$

$h_1 = 1.00$

$h_2 = 0.237$

$$K = \frac{\pi\ 7.3025^2}{11(7.3025)(582)} \ln \frac{1.00}{0.237}$$

$$K = 5.159 \times 10^{-3} cm/sec$$

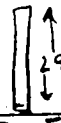
INFILTROMETER ~~MW~~ - # 7

Date of Test - 11-14-16
Diameter of well = 2.875
Diameter of Borehole - 2.871

Max Head Volume ____ gal

EMCON

By JHK Date ____
Chkd. by ____ Date ____
Subject Recovery Test Data



2.458'

Job No. 85732-001.000
Sheet No. ____ of ____

STATIC WATER LEVEL = ~~REF~~

TIME	ELAPSED TIME MIN	ELAPSED TIME SEC	DEPTH TO WATER	2.458 - DTW HT	HT/H0 2.354
8:05:25	0		1 1/4" 0.104	2.354	1.00
805:43	18	50	2" 0.17	2.288	0.972
805:55	30		3" 0.25	2.298	0.938
806:13	48		4" 0.313	2.128	0.904
806:29	64		5" 0.42	2.038	0.865
806:50	85		6" = 0.50"	1.958	0.832
807:26	121		8 1/4" 0.70	1.758	0.747
807:45	140		0.80	1.658	0.704
8:08:11	166		0.90	1.558	0.662
8:08:41	196		1.00	1.458	0.619
809:10	225		1.10	1.358	0.577
809:40	255		1.20	1.258	0.534
8:10:16	291		1.30	1.158	0.492
8:10:52	327		1.40	1.058	0.450
8:11:33	368		1.50	0.958	0.407
8:12:17	412		1.60	0.858	0.365
8:13:02	457		1.70	0.758	0.322
8:14:01	516		1.80	0.658	0.280
8:15:07	582		1.90	0.558	0.237
8:16:20	655		2.00	0.458	0.195
8:18:06	761		2.10	0.358	0.152

WEHRAN ENGINEERING
CONSULTING ENGINEERS

VARIABLE HEAD
PERMEABILITY TEST
PIEZOMETER No. Infiltrometer # B

PROJECT: SPO SECURED SITE
CLIENT: BERNARD JOHNSON YOUNG
JOB NO: 85732-001.000
DATE OF TEST: 11-14-96

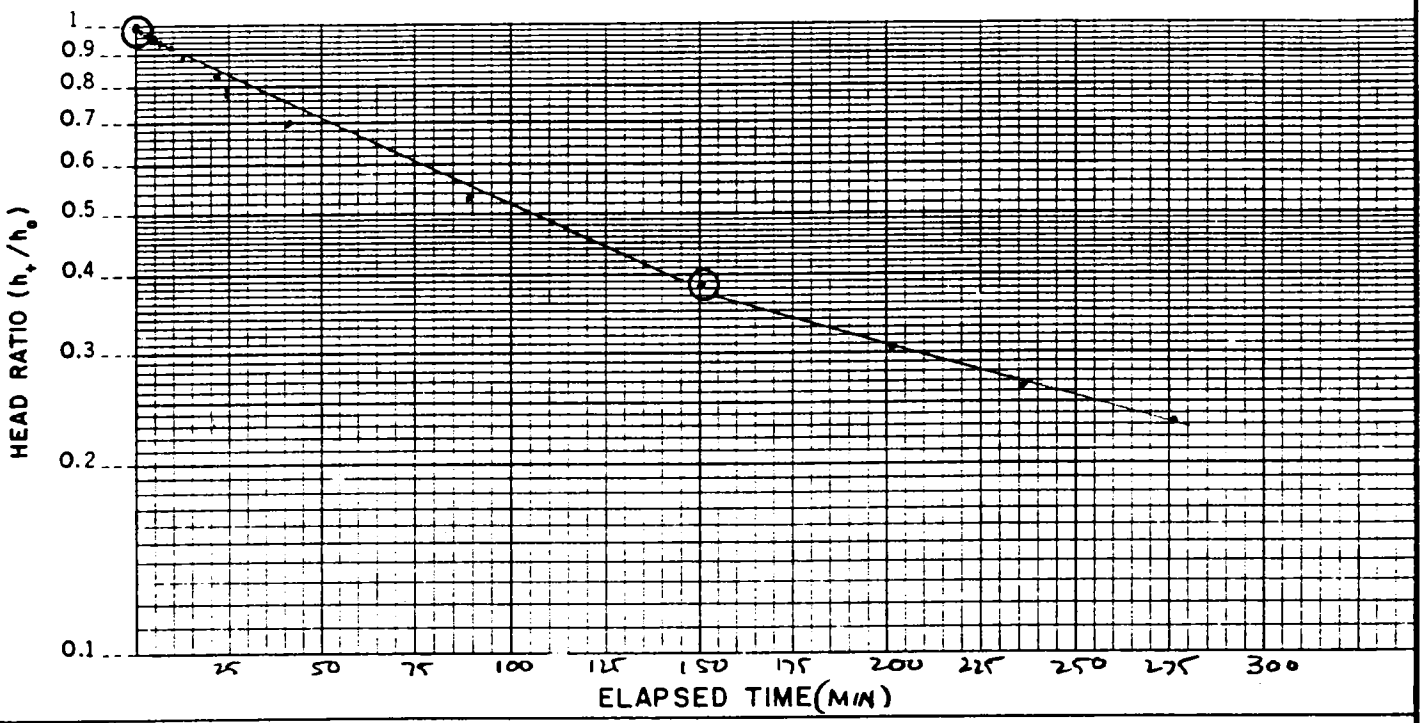
SCREENED INTERVAL:
3½"BGS Dark orange brown SILT & CLAY, some of Gravel, little of Sand, highly vegetated upper 1" Cobble on NE side

METHOD: BOUTWELL

$$K = \frac{\pi d^2}{11D(t_2 - t_1)} \ln \frac{H_1}{H_2}$$

TEST DATA

ELAPSED TIME MIN	HEAD RATIO (h_t / h_o)
⊙ 0	1.00
1.33	0.991
2.66	0.973
3.33	0.964
4.33	0.956
5.33	0.941
6.33	0.938
9.07	0.920
11.75	0.894
22.00	0.832
24.23	0.789
40.5	0.704
89.5	0.534
⊙ 151	0.385
202	0.305
236	0.266
276	0.233



CALCULATIONS:

$d = 2.875'' = 7.3025\,cm$

$D = 7.3025\,cm$

$t_2 = 151\,min = 9060\,sec$

$t_1 = 0\,sec$

$h_1 = 1.00$

$h_2 = 0.385$

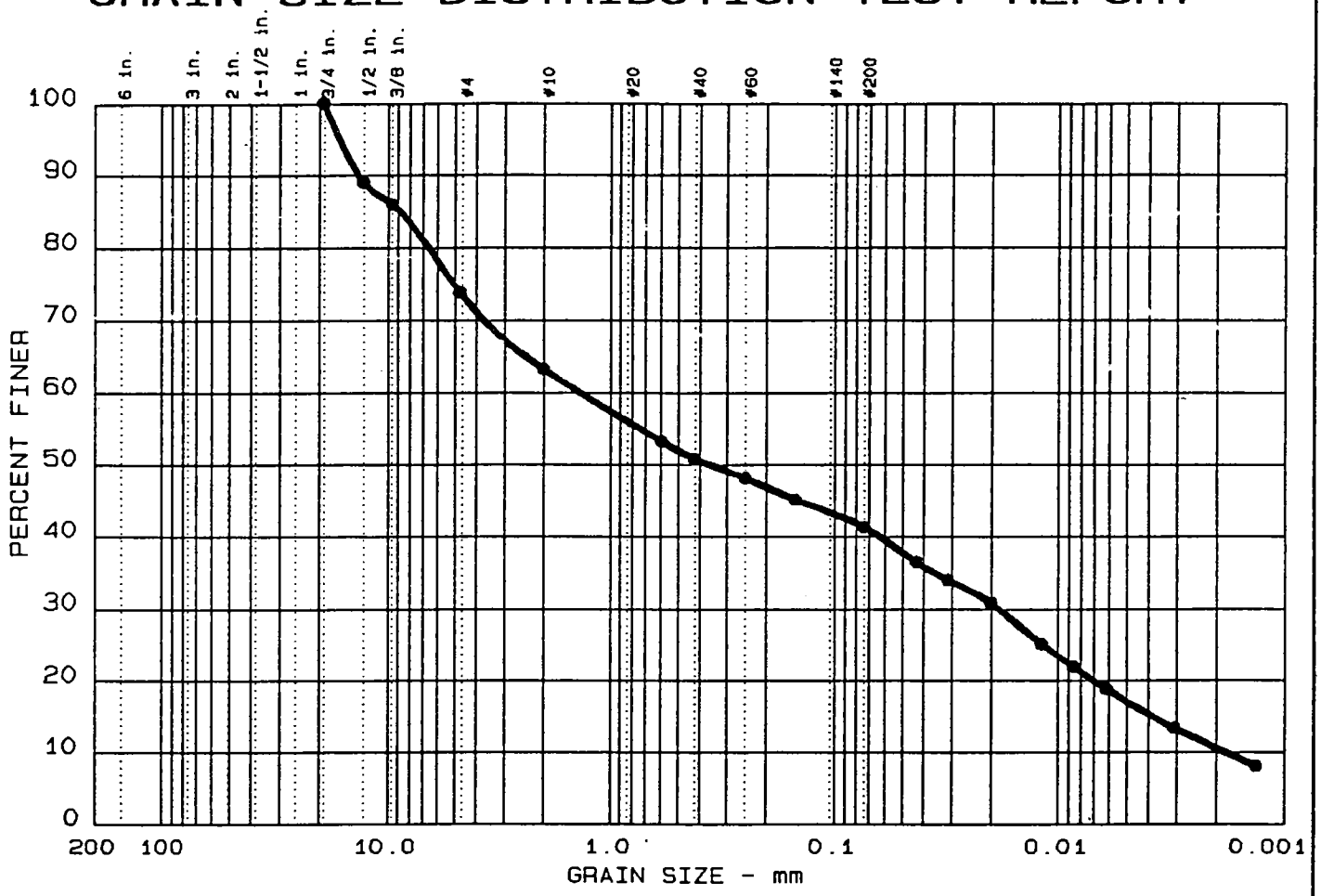
$$K = \frac{\pi\ 7.3025^2}{11(7.3025)(9060)} \ln \frac{1.00}{0.385}$$

$$K = 2.197 \times 10^{-4}\ cm/sec$$

APPENDIX D

LABORATORY TEST RESULTS

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-1	0.0	26.1	32.6	24.2	17.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			8.71	1.36	0.36	0.018	0.0038	0.0018	0.14	749.9

	MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
●	DARK YELLOWISH BROWN TRACE ROOTS Silty sand with gravel	SM		A-4 (1)

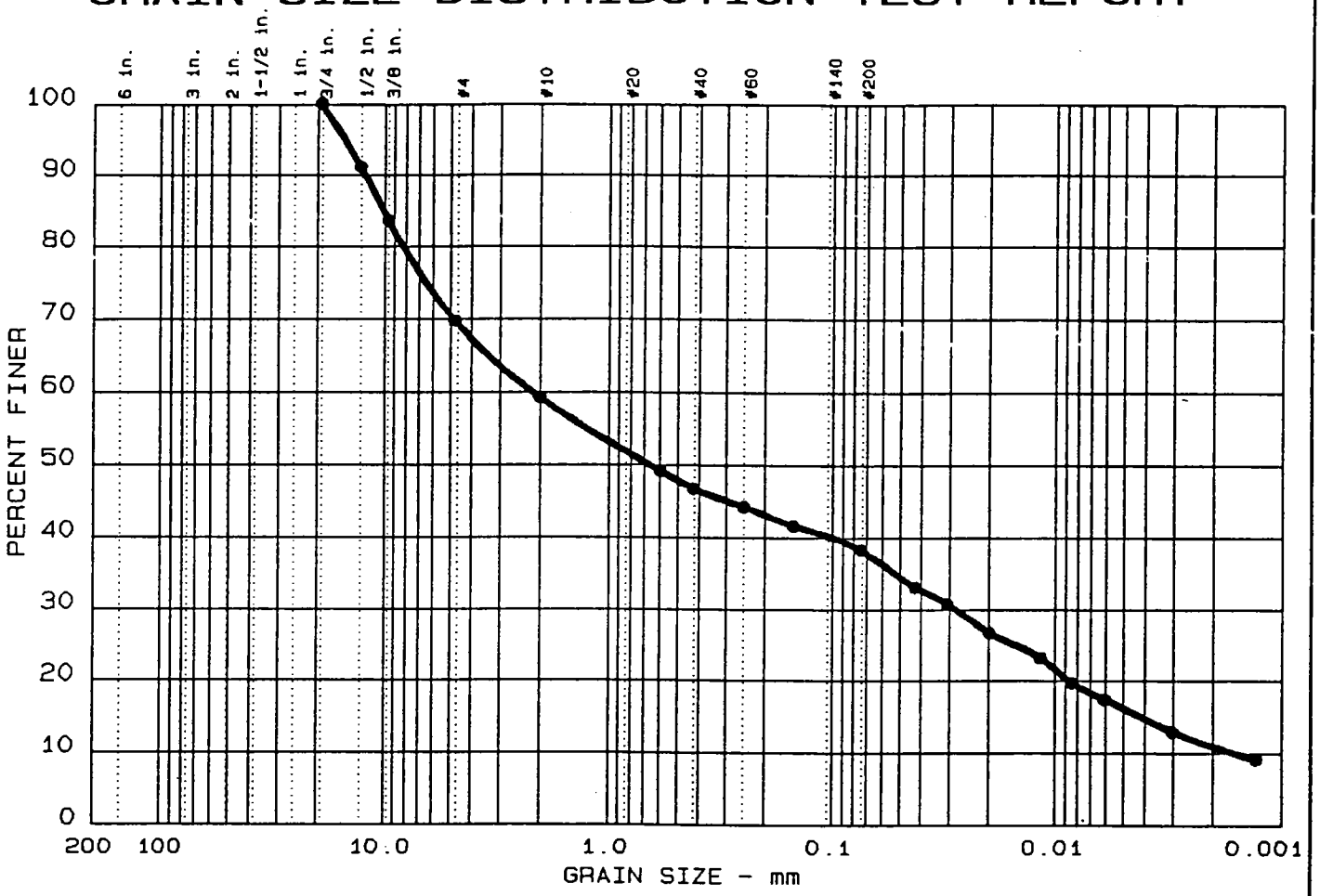
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-1 Sample No.: TP-1

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 12.2%

EMCON

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-2	0.0	30.3	31.5	22.0	16.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			10.00	2.16	0.66	0.028	0.0041	0.0016	0.23	1364.6

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● DARK YELLOWISH BROWN TRACE ROOTS Silty sand with gravel	SM		A-4 (0)

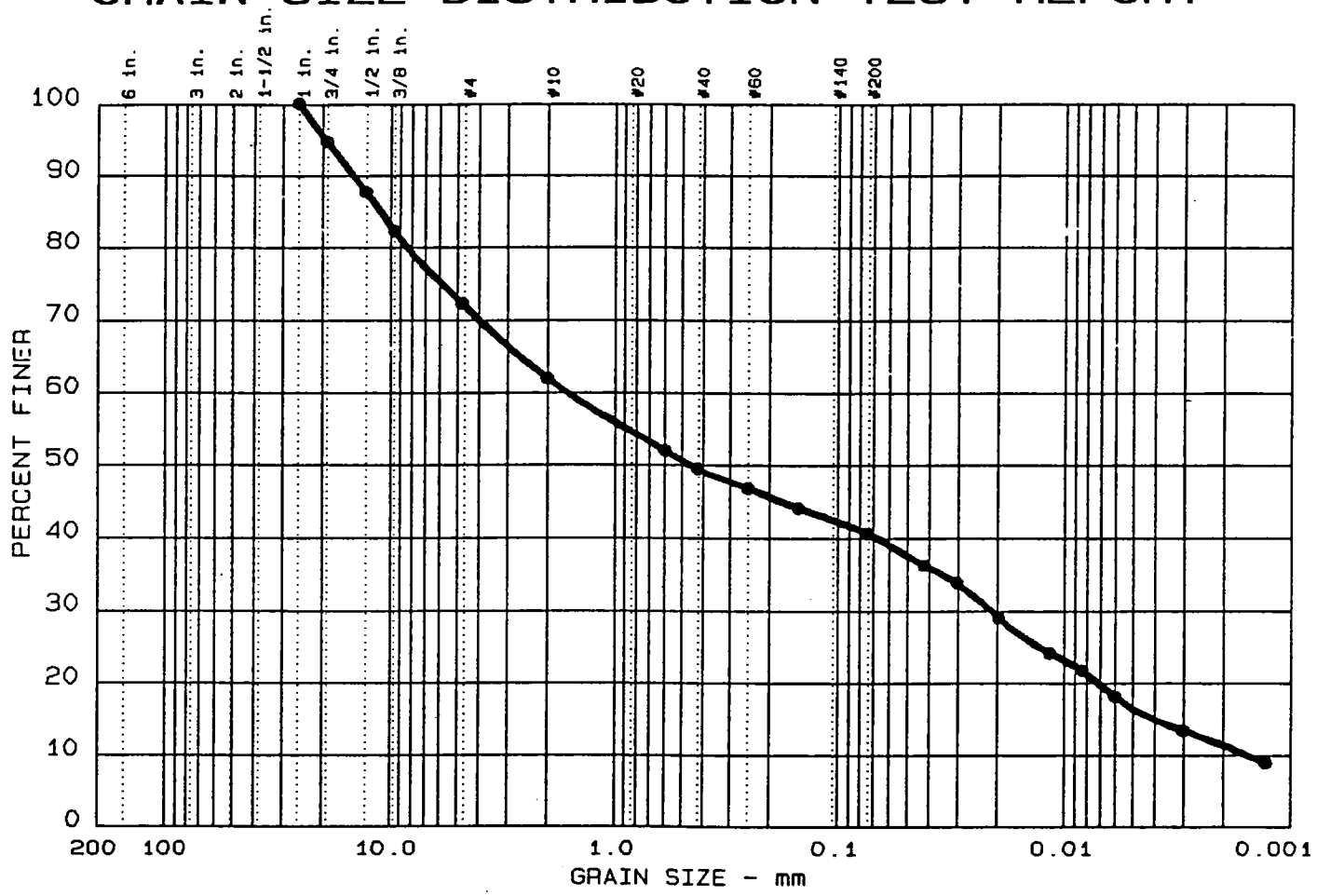
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-2 Sample No.: TP-2

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 13.1%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-3	0.0	27.8	31.7	24.1	16.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
●			10.96	1.62	0.46	0.021	0.0040	0.0015	0.18	1047.1

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● DARK YELLOWISH BROWN TRACE ROOTS Silty sand with gravel	SM		A-6(1)

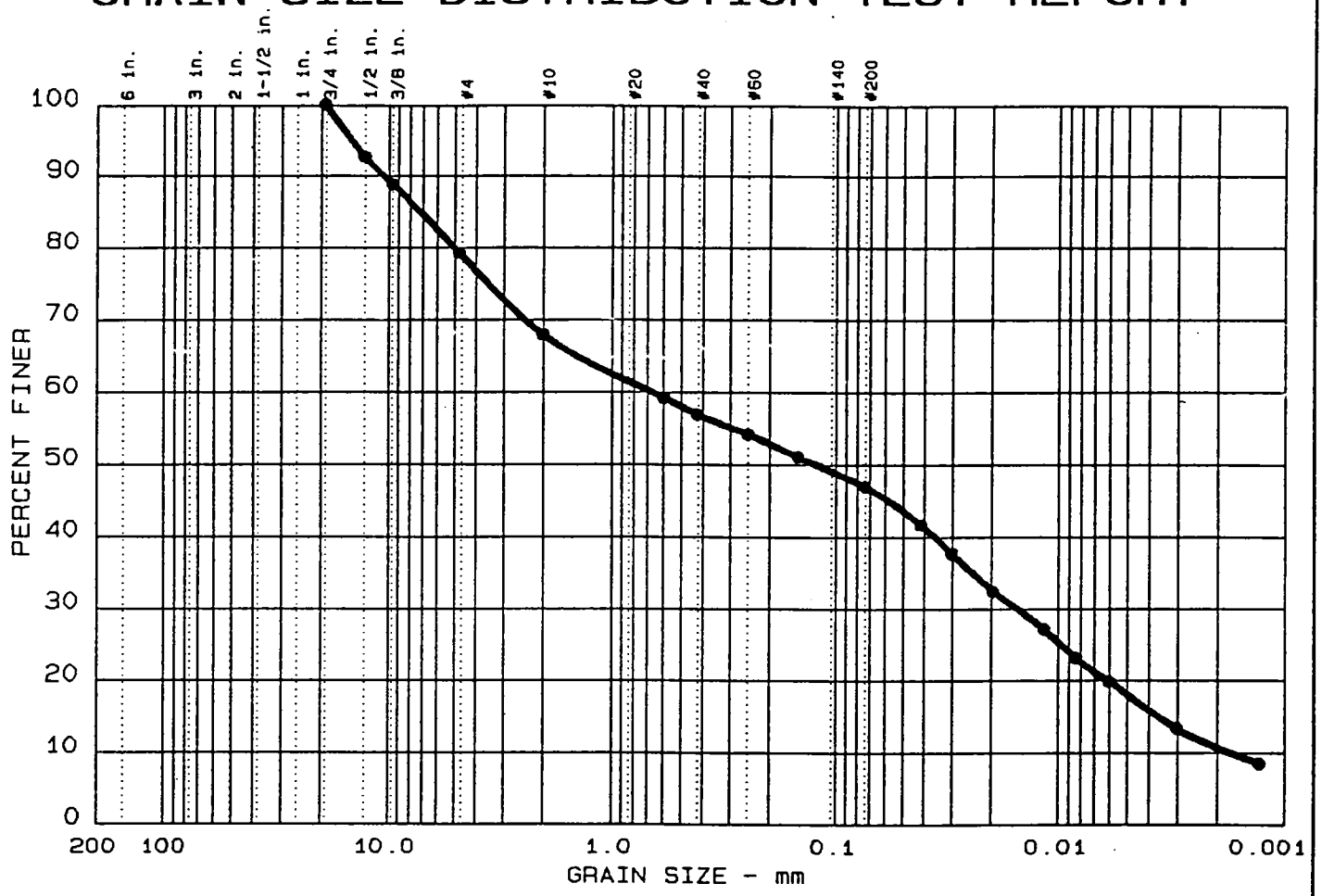
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-3 Sample No.: TP-3

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 13.0%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-4	0.0	20.8	32.3	28.8	18.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			7.16	0.67	0.12	0.015	0.0036	0.0018	0.20	380.2

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● DARK YELLOWISH BROWN TRACE ROOTS Silty sand with gravel	SM		A-4 (2)

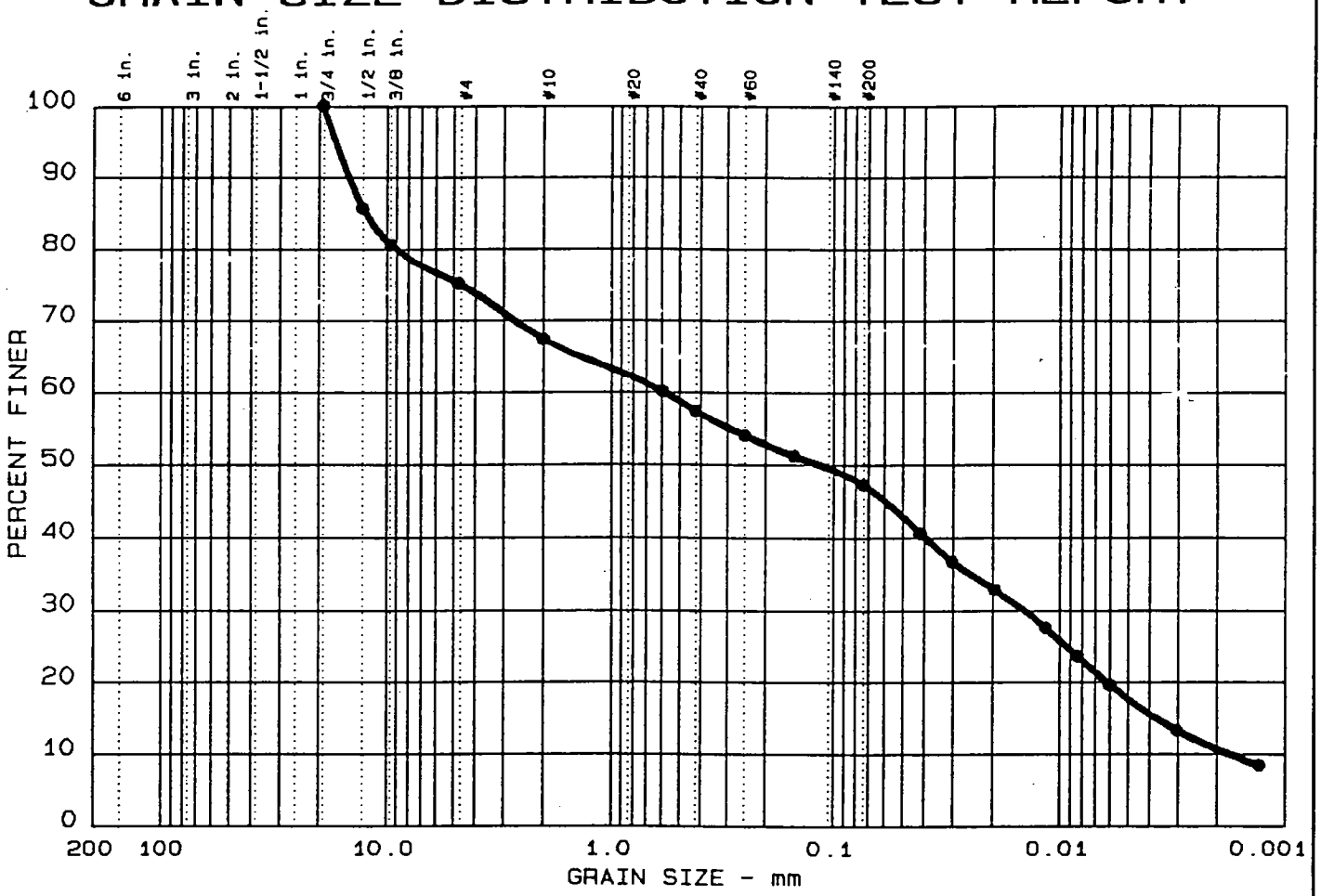
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-4 Sample No.: TP-4

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 17.4%

EMCON

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-5	0.0	24.8	28.0	29.5	17.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			12.30	0.58	0.11	0.014	0.0037	0.0018	0.20	331.1

	MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
●	DARK YELLOWISH BROWN TRACE ROOTS Silty sand with gravel	SM		A-4 (2)

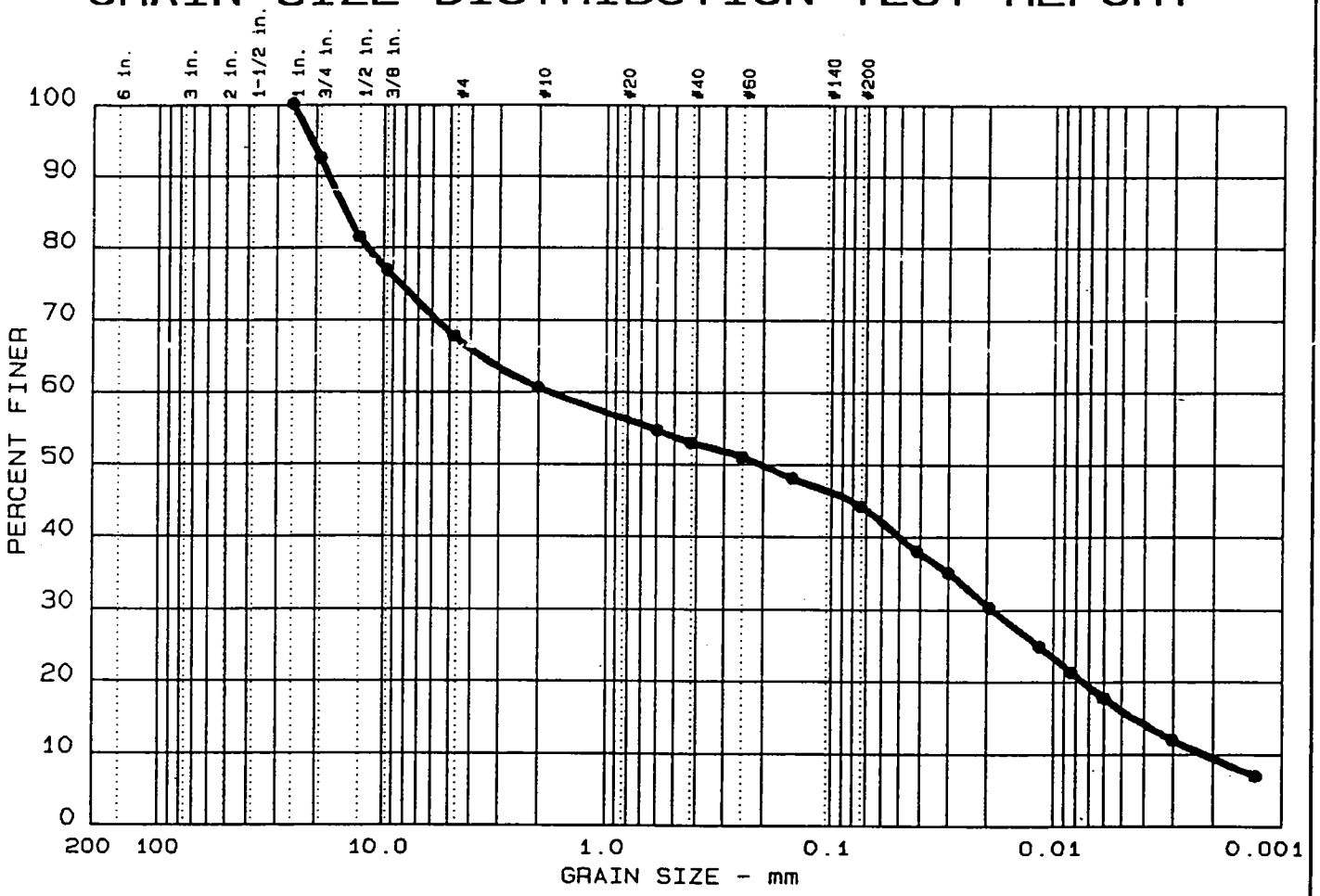
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-5 Sample No.: TP-5

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 18.2%

EMCON

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-6	0.0	32.3	23.6	28.1	16.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
●			14.60	1.78	0.21	0.019	0.0044	0.0021	0.09	831.8

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● DARK YELLOWISH BROWN TRACE ROOTS Silty gravel with sand	GM		A-5 (2)

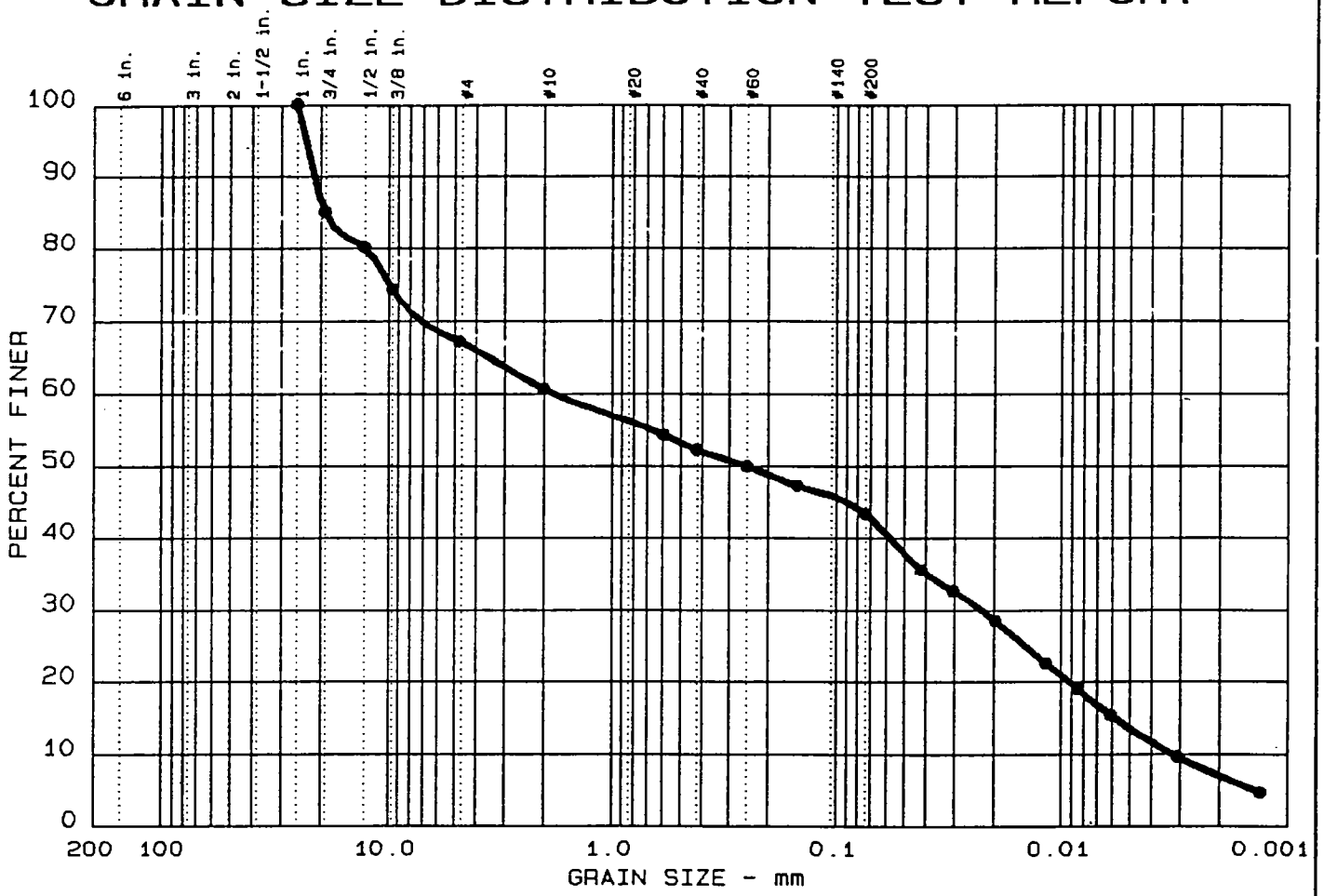
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-6 Sample No.: TP-6

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 22.5%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-7	0.0	32.8	23.9	29.7	13.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			19.01	1.77	0.25	0.023	0.0058	0.0032	0.09	555.9

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● YELLOWISH BROWN TRACE BLACK, TRACE ROOTS Silty gravel with sand	GM		A-4 (1)

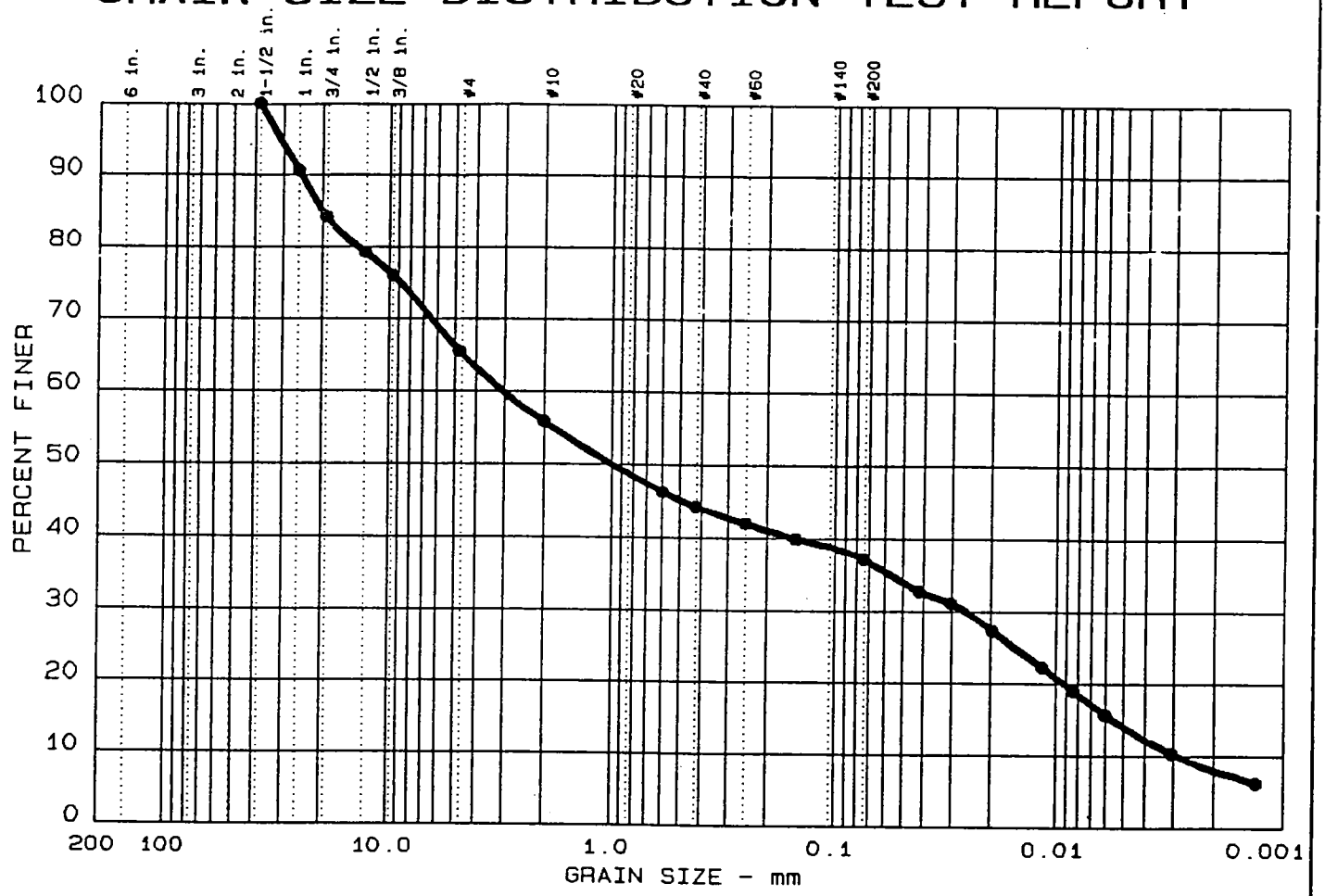
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-7 Sample No.: TP-7

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 22.0%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-8	0.0	34.5	28.4	23.1	14.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			19.72	3.05	1.00	0.026	0.0056	0.0029	0.08	1059.3

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● YELLOWISH BROWN TRACE BLACK, TRACE ROOTS Silty gravel with sand	GM		A-7-5(2)

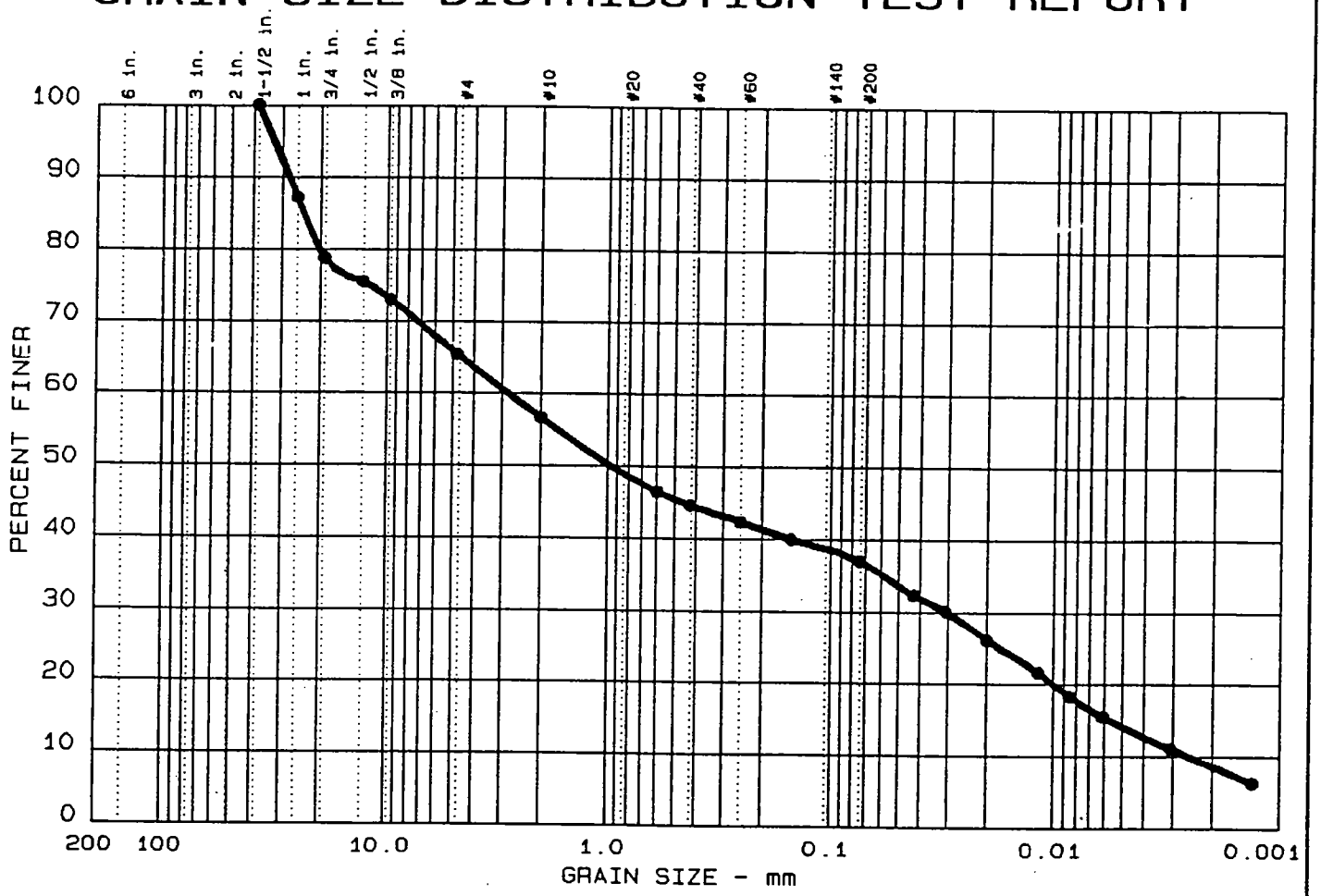
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-8 Sample No.: TP-8

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 17.8%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP-9	0.0	34.6	28.5	22.8	14.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
●			23.71	2.82	0.97	0.030	0.0056	0.0025	0.13	1109.2

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● YELLOWISH BROWN TRACE BLACK, TRACE ROOTS Silty gravel with sand	GM		A-7-5(1)

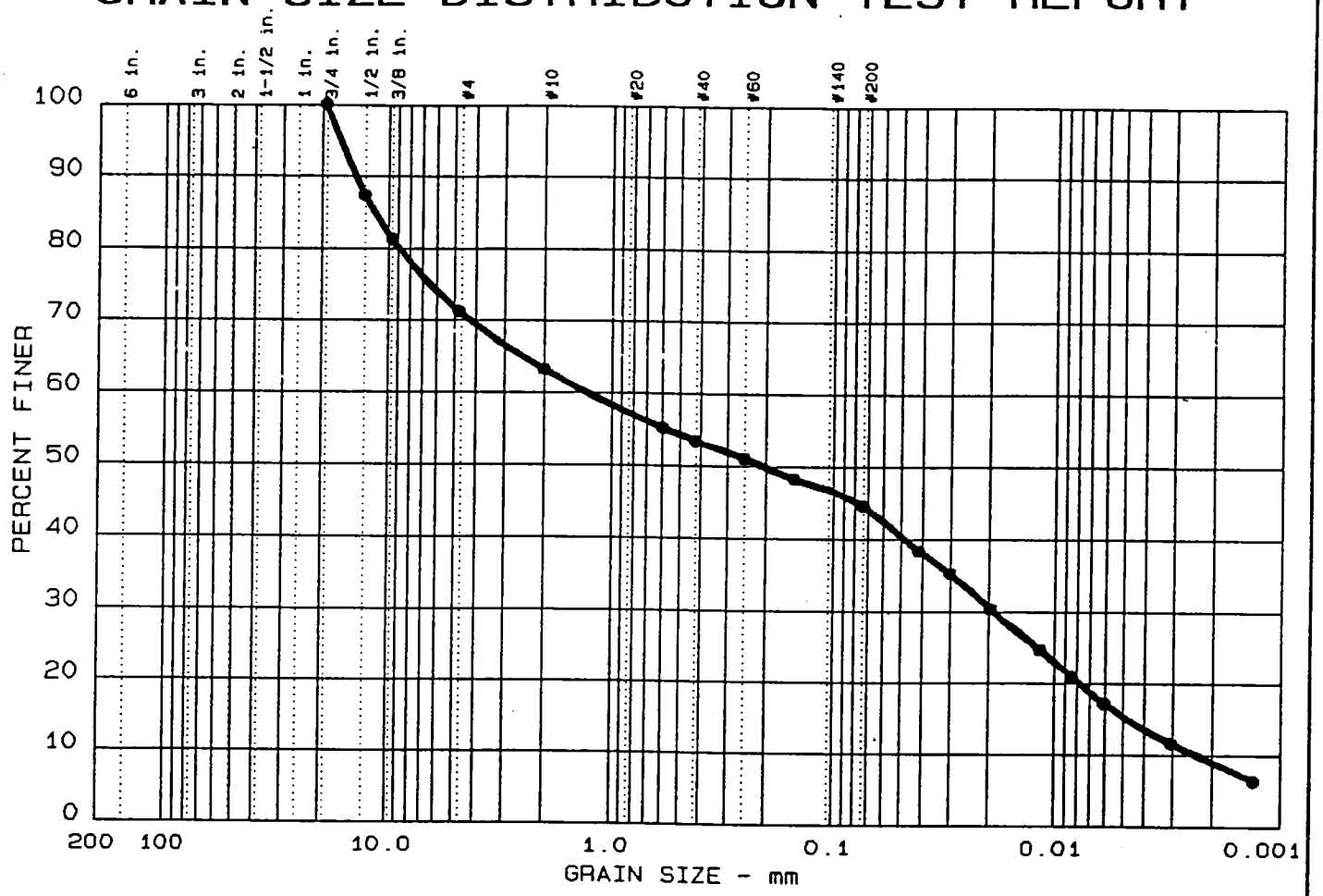
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-9 Sample No.: TP-9

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 15.0%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP10	0.0	28.8	26.7	29.1	15.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			11.48	1.26	0.21	0.019	0.0047	0.0023	0.12	537.0

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● DARK YELLOWISH BROWN Silty gravel with sand	GM		A-7-6 (4)

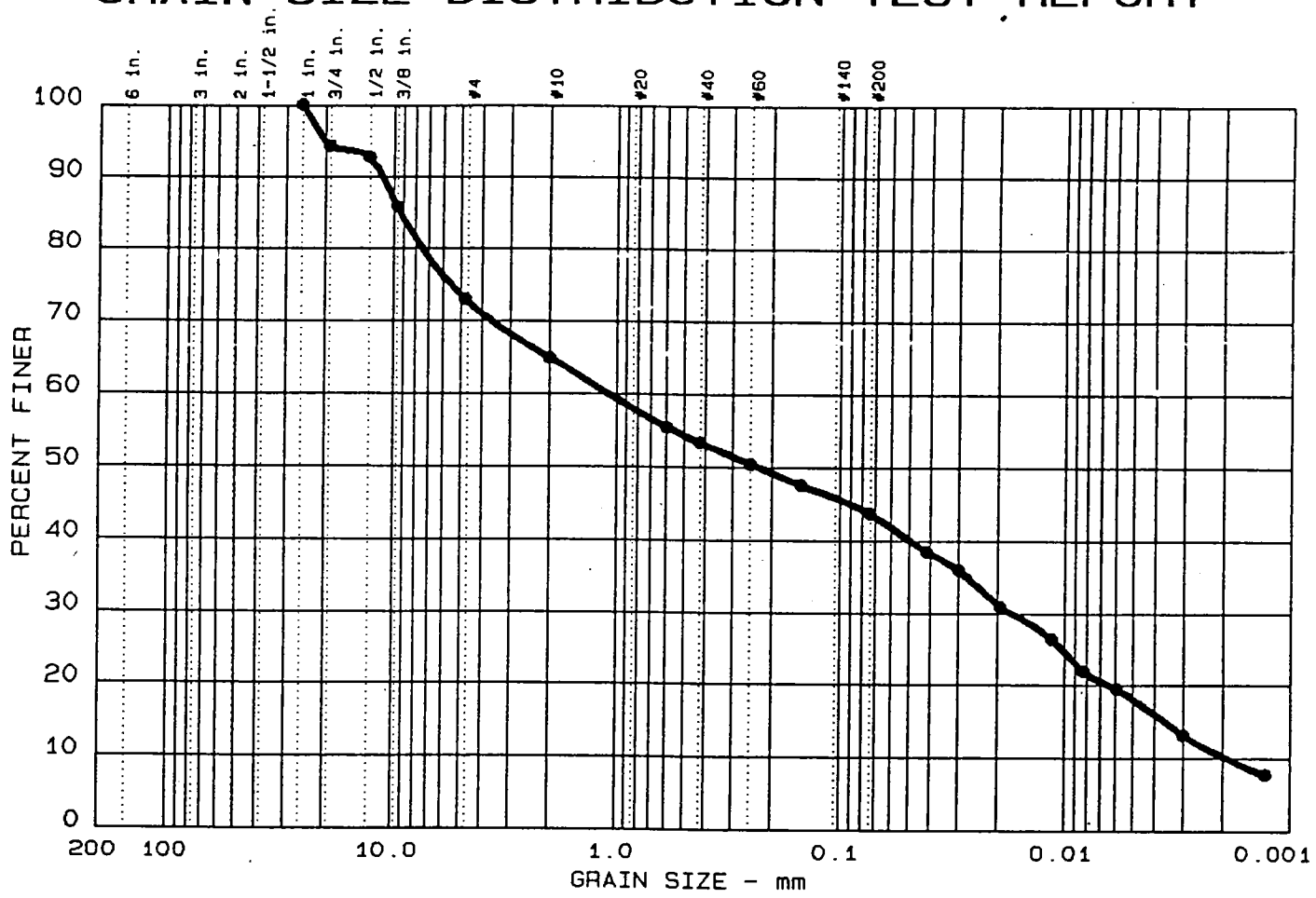
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-10 Sample No.: TP10

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 21.1%

EMCON

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP11	0.0	27.1	29.3	25.5	18.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
●			9.22	1.08	0.23	0.017	0.0036	0.0019	0.14	575.4

	MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
●	BROWN Silty sand with gravel	SM		A-4 (2)

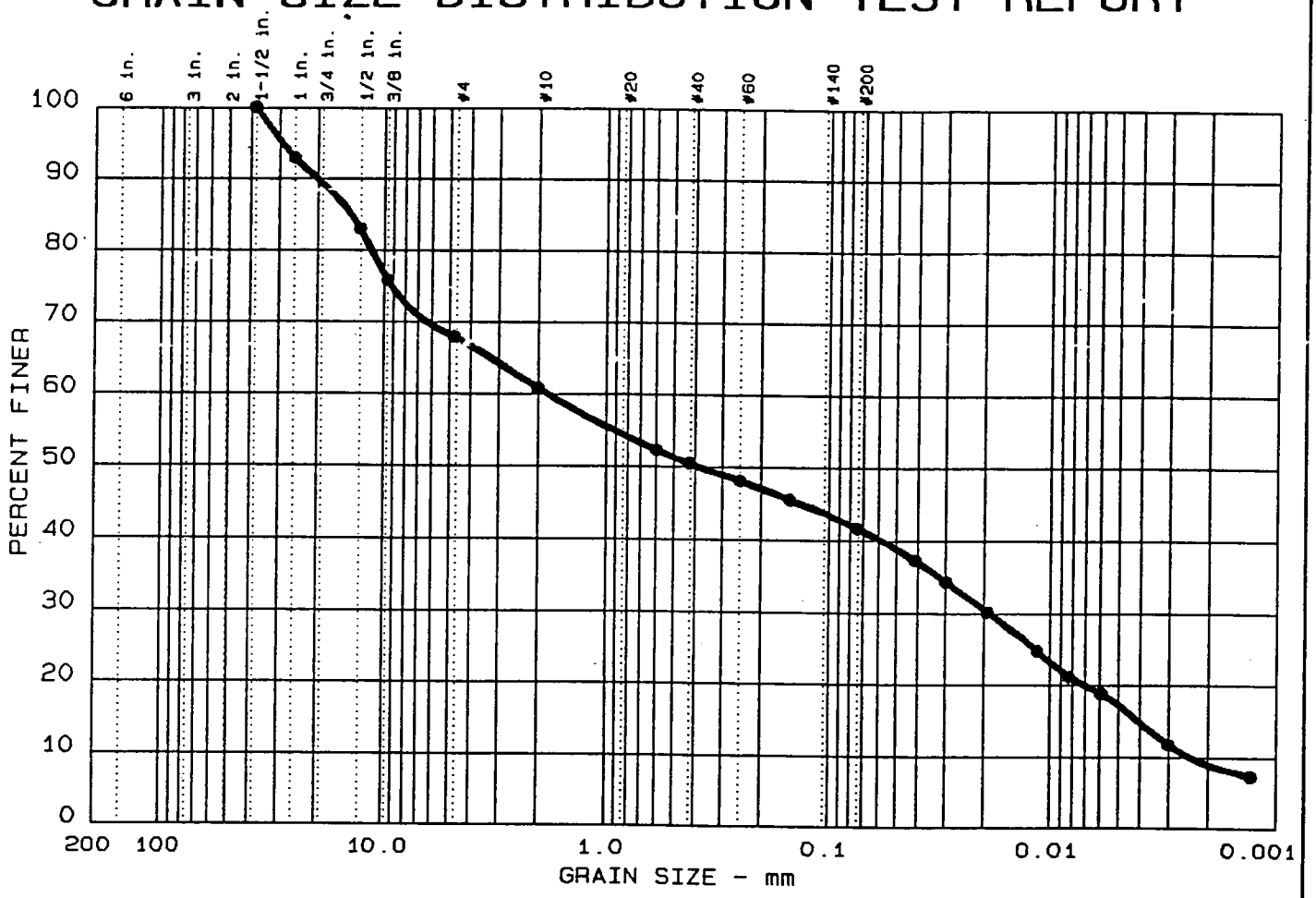
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-11 Sample No.: TP11

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 17.2%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP12	0.0	32.1	26.4	24.3	17.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			13.96	1.78	0.37	0.019	0.0040	0.0024	0.08	749.9

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● DARK YELLOWISH BROWN Silty gravel with sand	GM		A-6 (2)

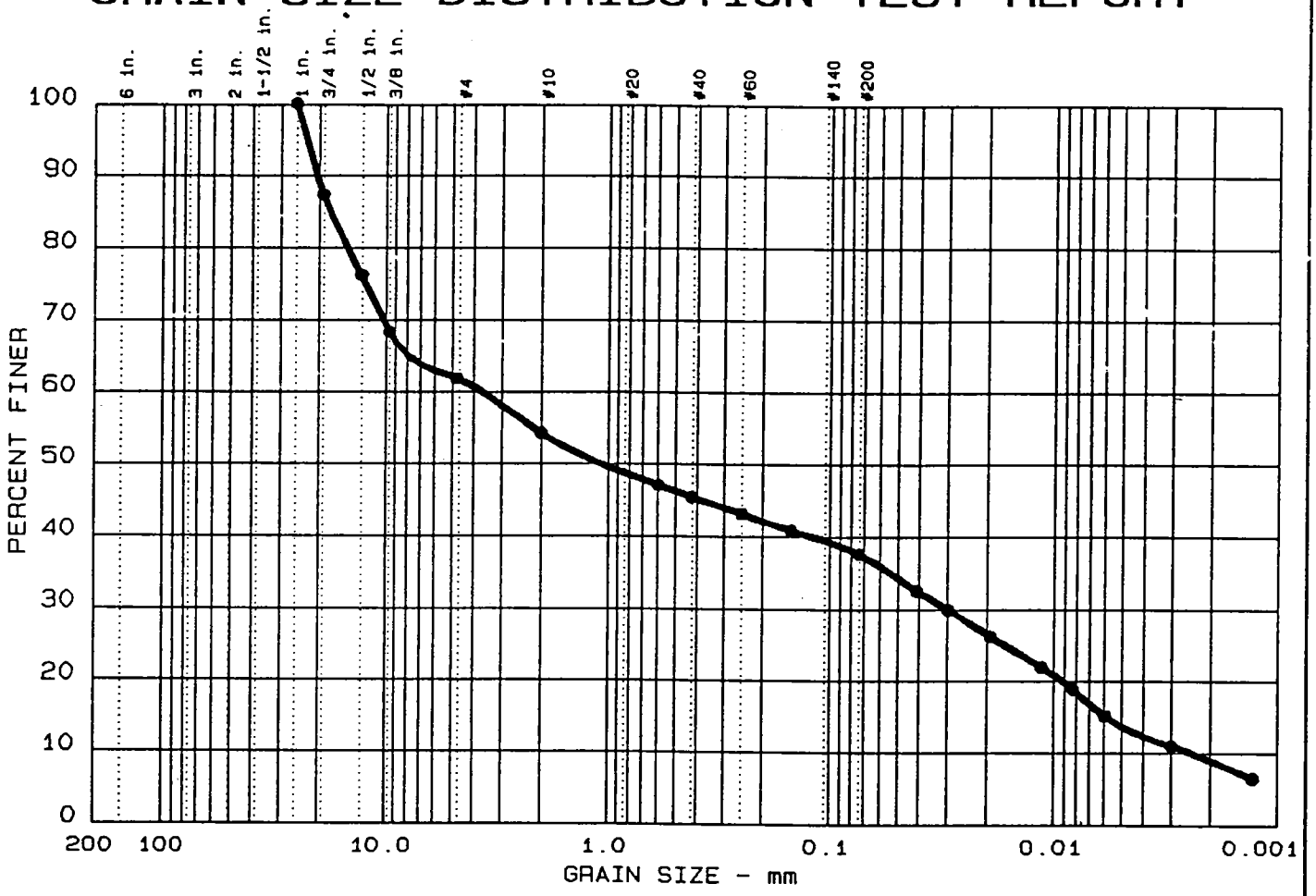
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-12 Sample No.: TP12

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 18.8%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP13	0.0	38.2	24.3	23.9	13.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
●			17.70	3.66	1.09	0.030	0.0058	0.0024	0.10	1548.8

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● BROWN Silty gravel with sand	GM		A-7-5(1)

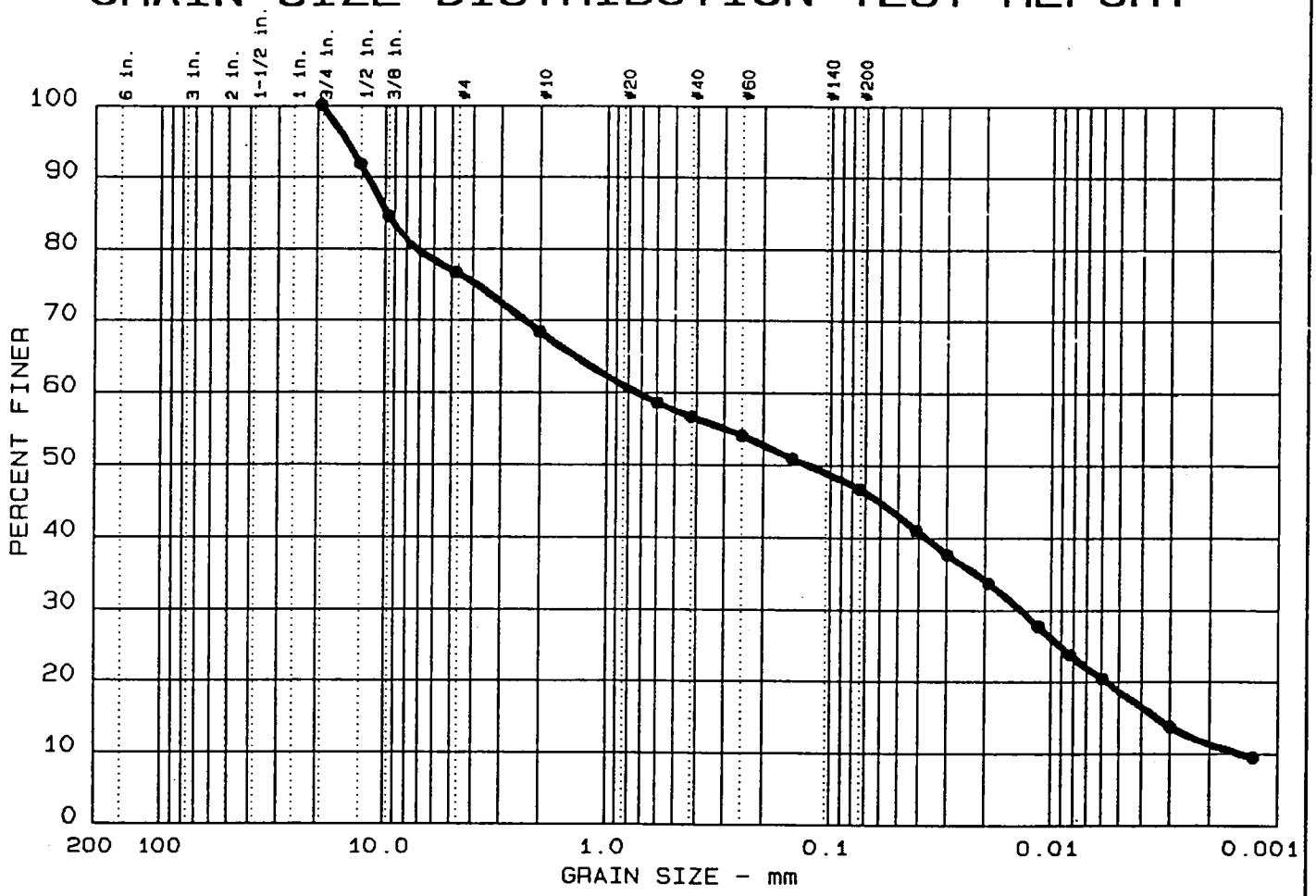
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-13 Sample No.: TP13

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 16.6%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP14	0.0	23.3	30.1	27.9	18.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			9.66	0.73	0.13	0.014	0.0034	0.0015	0.17	501.2

	MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
●	DARK YELLOWISH BROWN TRACE ROOTS Silty sand with gravel	SM		A-4 (2)

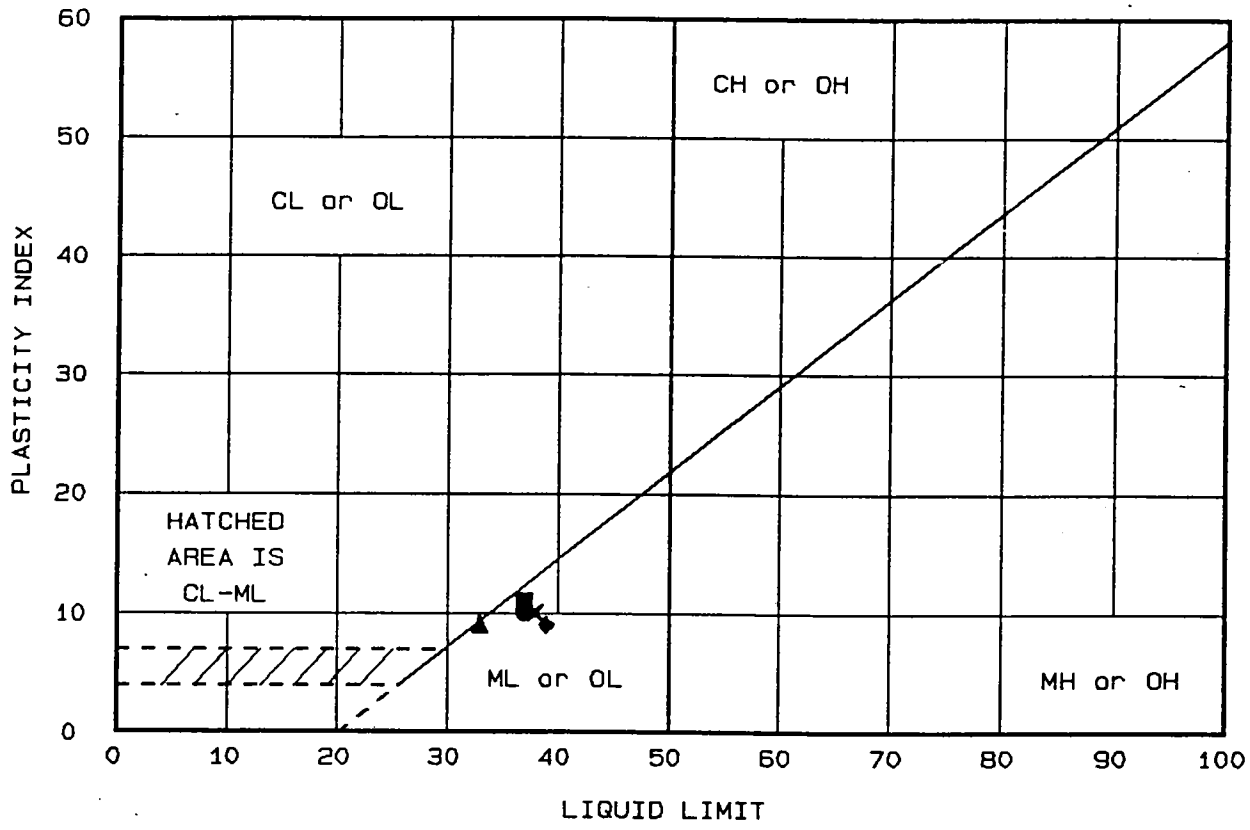
Project No.: 85732001 Date: 12-6-96
Project: MARYLAND
Client: BERNARD, JOHNSON & YOUNG
● Sample: TP-14 Sample No.: TP14

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 17.1%

Figure No.

LIQUID AND PLASTIC LIMITS TEST REPORT



SAMPLE IDENTIFICATION	LL	PL	PI	-200	MATERIAL DESCRIPTION BURMISTER ☐ ASTM D 2487 ☒
● TP-1	37	27	10	41.2	SM, Silty sand with gravel
▲ TP-2	33	24	9	38.2	SM, Silty sand with gravel
■ TP-3	37	26	11	40.5	SM, Silty sand with gravel
◆ TP-4	39	30	9	46.9	SM, Silty sand with gravel
✕ TP-5	38	28	10	47.2	SM, Silty sand with gravel

Project No.: 85732001 Date: 12-6-96
Project: MARYLAND

Client: BERNARD JOHNSON & YOUNG
Location:

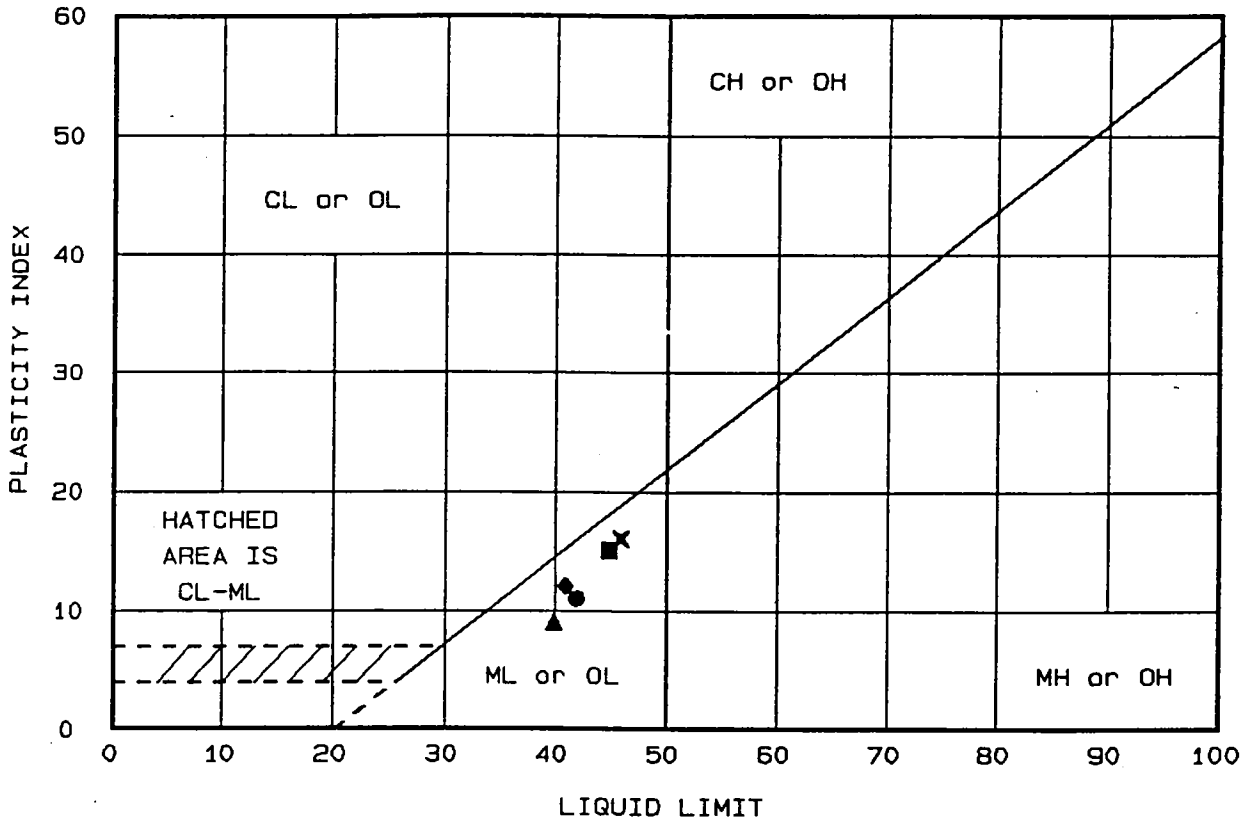
Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.

Remarks:
ASTM-D4318

EMCON

Fig. No. _____

LIQUID AND PLASTIC LIMITS TEST REPORT



	SAMPLE IDENTIFICATION	LL	PL	PI	-200	MATERIAL DESCRIPTION BURMISTER ☐ ASTM D 2487 ☒
●	TP-6	42	31	11	44.1	GM, Silty gravel with sand
▲	TP-7	40	31	9	43.3	GM, Silty gravel with sand
■	TP-8	45	30	15	37.1	GM, Silty gravel with sand
◆	TP-9	41	29	12	36.9	GM, Silty gravel with sand
✕	TP-10	46	30	16	44.5	GM, Silty gravel with sand

Project No.: 85732001 Date: 12-6-96
Project: MARYLAND

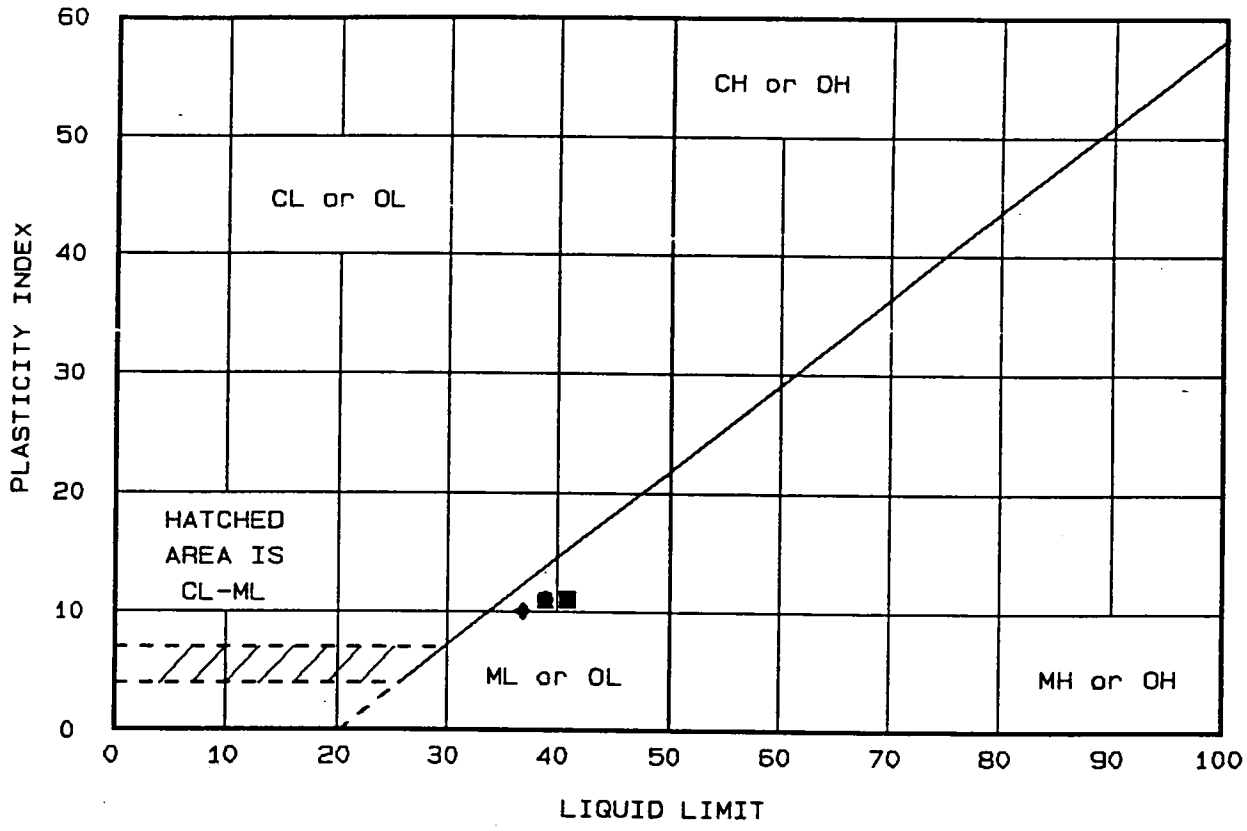
Client: BERNARD, JOHNSON & YOUNG
Location:

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
ASTM-D4318

EMCON

Fig. No. _____

LIQUID AND PLASTIC LIMITS TEST REPORT



SAMPLE IDENTIFICATION	LL	PL	PI	-200	MATERIAL DESCRIPTION BURMISTER ☐ ASTM D 2487 ☒
● TP-11	39	28	11	43.6	SM, Silty sand with gravel
▲ TP-12	39	28	11	41.6	GM, Silty gravel with sand
■ TP-13	41	30	11	37.5	GM, Silty gravel with sand
◆ TP-14	37	27	10	46.6	SM, Silty sand with gravel

Project No.: 85732001 Date: 12-6-96
Project: MARYLAND

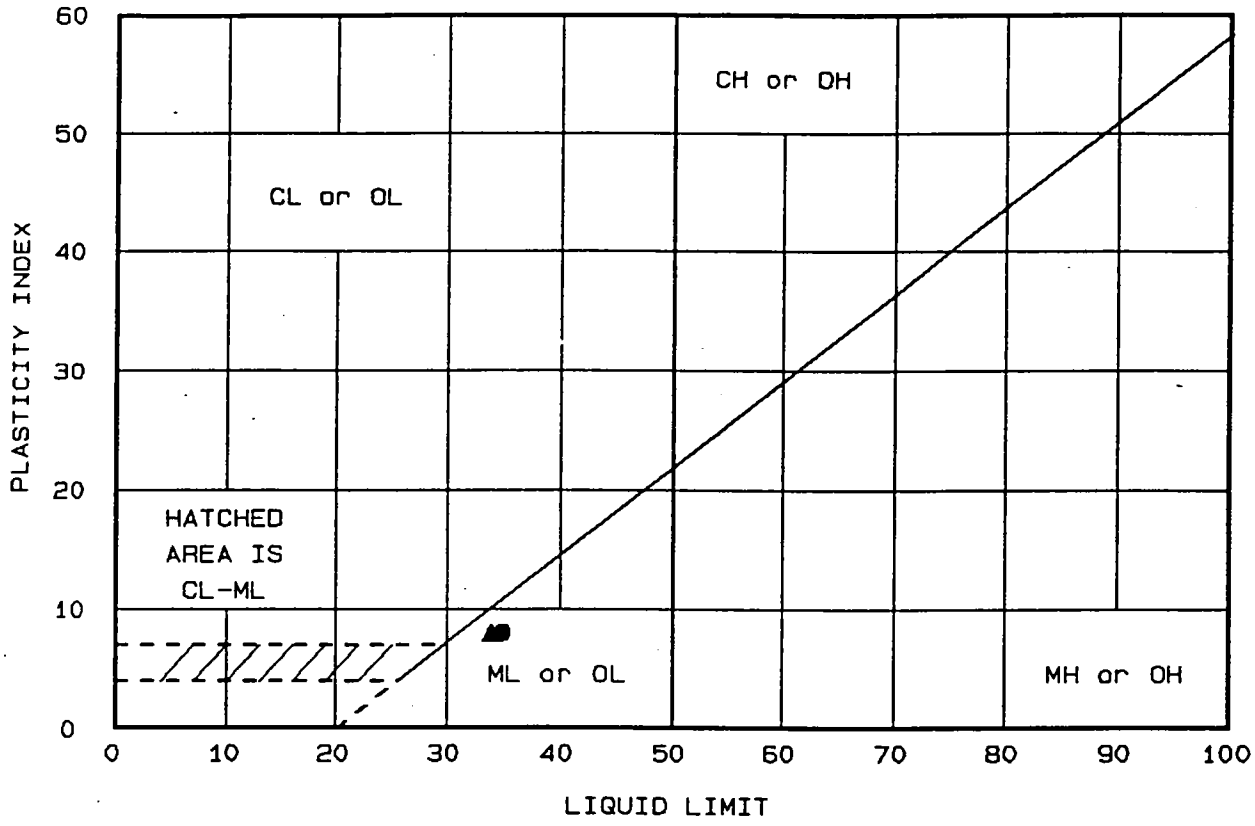
Client: BERNARD, JOHNSON & YOUNG
Location:

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
ASTM-D4318

EMCON

Fig. No. _____

LIQUID AND PLASTIC LIMITS TEST REPORT



	SAMPLE IDENTIFICATION	LL	PL	PI	-200	MATERIAL DESCRIPTION BURMISTER ☐ ASTM D 2487 ☒
●	ST-3	35	27	8	36.9	GM, Silty gravel with sand
▲	TUBE#4 TP-13	34	26	8	38.8	GM, Silty gravel with sand

Project No.: 85732001 Date: 11-13-96
Project: BJY-NAVY SERVICE SITE

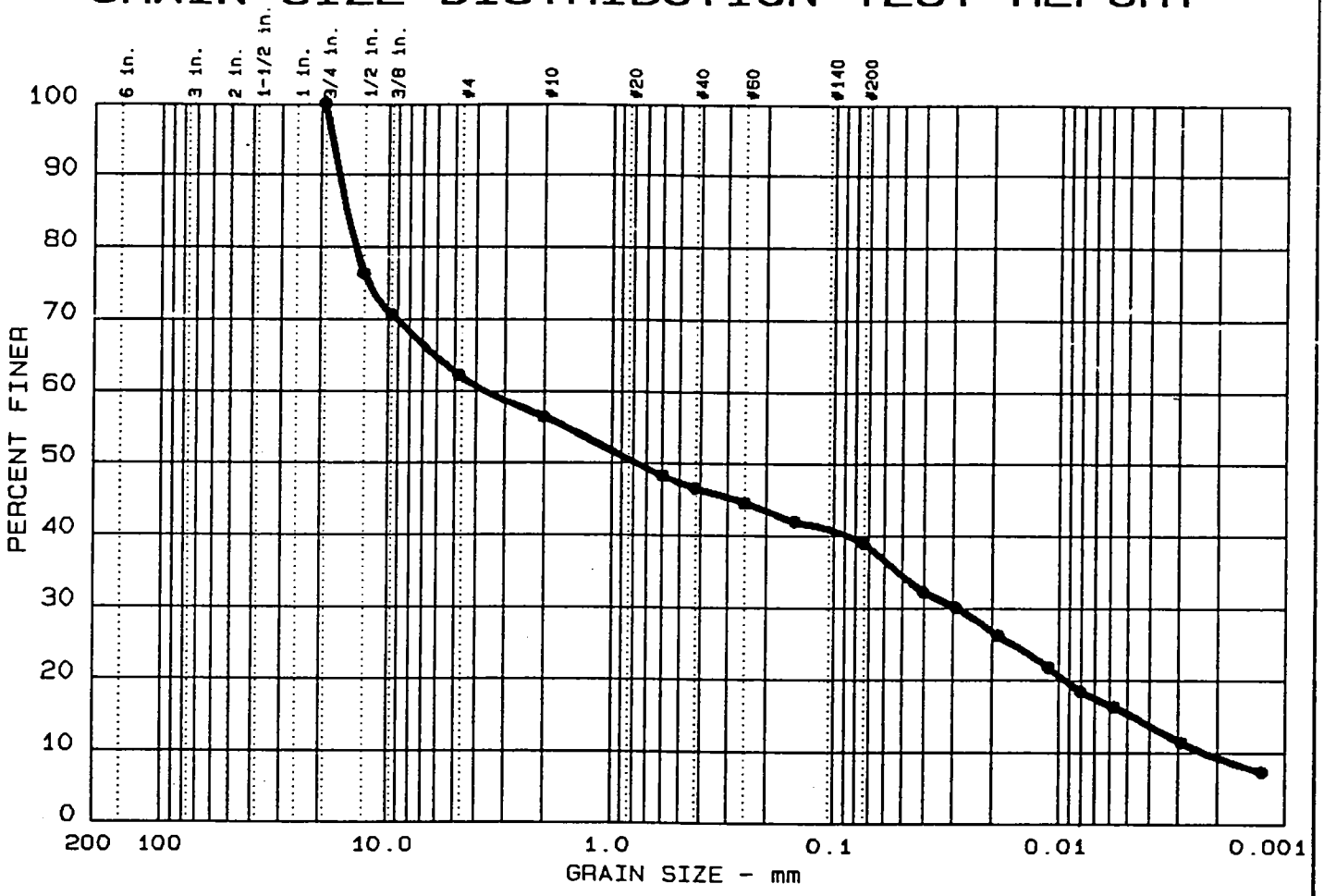
Client: CONFIDENTIAL
Location:

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
ASTM-D4318

EMCON

Fig. No. _____

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	TP13	0.0	37.8	23.3	23.4	15.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			15.14	3.67	0.79	0.029	0.0047	0.0023	0.10	1621.8

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● REDDISH BROWN TRACE PALE OLIVE Silty gravel with sand	GM		A-4 (0)

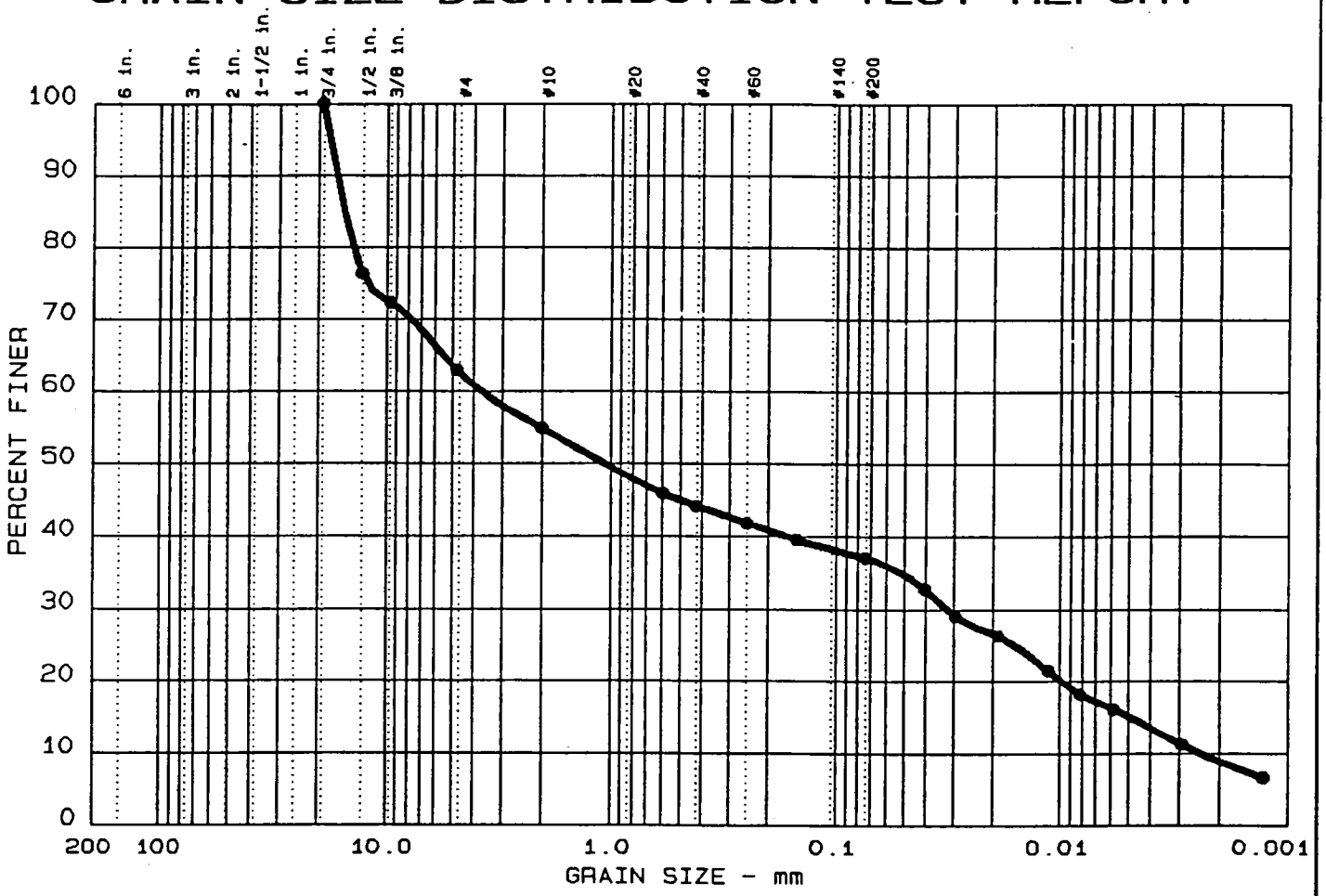
Project No.: 85732001 Date: 11-13-96
Project: BJY-NAVY SERVICE SITE
Client: CONFIDENTIAL
● Sample: TUBE#4 TP-13 Sample No.: TP13

EMCON

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 14.0%

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	S. #	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	ST-3	0.0	37.1	26.0	21.8	15.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			15.26	3.70	1.07	0.032	0.0049	0.0024	0.11	1548.8

MATERIAL DESCRIPTION	ASTM	BURMISTER	AASHTO
● YELLOWISH BROWN TRACE BLACK Silty gravel with sand	GM		A-4 (0)

Project No.: 85732001 Date: 11-13-96
Project: BJY-NAVY SERVICE SITE
Client: CONFIDENTIAL
● Sample: ST-3 Sample No.: ST-3

Performed by: D.L.
Entered by: D.L.
Checked by: R.S.A.
Remarks:
MOISTURE CONTENT= 15.8%

EMCON

Figure No.

EMCON

CONSULTING ENGINEERS

LOG OF UNDISTURBED SOIL SAMPLES

Project:	NAVY SERVICE SITE	Project #	85732.001.000
Client:	CONFIDENTIAL	Diameter:	3"
Sample:	ST-3	Recovery:	12"
Date:	11-7-96	Remarks:	30' East of TP-7

Top of Sample	Inches		Type of Test Performed
	23		
	22		
	21		
	20		
	19		
	18		
	17		
	16		
	15		
	14		
	13	Black, trace Yellow Brown	
	12	cmf Gravel, some cmf Sand (visual)	
	11		
	10		
	9		
	8	Yellow Brown, trace Black Silty gravel with sand, GM	
	7	trace roots	
	6		
	5		
	4		
	3		K
	2		
	1		
Bottom of Sample	0		

EMCON

CONSULTING ENGINEERS

LOG OF UNDISTURBED SOIL SAMPLES

Project: NAVY SERVICE SITE	Project # 85732.001.000
Client: CONFIDENTIAL	Diameter: 3"
Sample: TUBE#4 TP-13	Recovery: 5"
Date: 11-7-96	Remarks:

Top of Sample	Inches		Type of Test Performed
	23		
	22		
	21		
	20		
	19		
	18		
	17		
	16		
	15		
	14		
	13		
	12		
	11		
	10		
	9		
	8		
	7		
	6	Reddish Brown, trace Pale Olive Silty gravel with sand, GM	
	5	trace roots	
	4		
	3		K
	2		
	1		
Bottom of Sample	0		

EMCON

CONSULTING ENGINEERS

LOG OF UNDISTURBED SOIL SAMPLES

Project: NAVY SERVICE SITE	Project # 85732.001.000
Client: CONFIDENTIAL	Diameter: 3"
Sample: ST-5	Recovery: 10"
Date: 11-7-96	Remarks:

Top of Sample	Inches		Type of Test Performed
	23		
	22		
	21		
	20		
	19		
	18		
	17		
	16		
	15		
	14		
	13		
	12		
	11	Yellow Brown trace Black	
	10	CLAY & SILT some cmf Sand, trace (+) cmf Gravel trace roots, peat (visual)	
	9		
	8		
	7		
	6		not suitable for testing
	5		
	4		
	3		
	2		
	1		
Bottom of Sample	0		

EMCON

CONSULTING ENGINEERS

LOG OF UNDISTURBED SOIL SAMPLES

Project:	NAVY SERVICE SITE	Project #	85732.001.000
Client:	CONFIDENTIAL	Diameter:	3"
Sample:	TP-11 S-2 0-9"	Recovery:	6.5"
Date:	11-7-96	Remarks:	

Top of Sample	Inches		Type of Test Performed
	23		
TP-11 S-1	22		
	21		
	20		
	19		
	18		
	17		
	16		
	15		
	14		
	13		
	12		
	11		
	10		
	9		
	8		
TP-11 S-2	7	Yellow Brown trace Pale Olive CLAY & SILT some, cmf Sand, little (+) cmf Gravel,	
	6	trace roots (visual)	not suitable for testing
	5		
	4		
	3		
	2		
	1		
Bottom of Sample	0		

EMCON

CONSULTING ENGINEERS

LOG OF UNDISTURBED SOIL SAMPLES

Project:	NAVY SERVICE SITE	Project #	85732.001.000
Client:	CONFIDENTIAL	Diameter:	3"
Sample:	TP-11 S-1 6"-1'6"	Recovery:	6.5"
Date:	11-7-96	Remarks:	

Top of Sample	Inches		Type of Test Performed
	23		
TP-11 S-2	22		
	21		
	20		
	19		
	18		
	17		
	16		
	15		
	14		
	13		
	12		
	11		
	10		
	9		
	8		
TP-11 S-1	7	Yellow Brown trace Pale Olive CLAY & SILT some, cmf Sand, little (+) cmf Gravel,	
	6	trace roots (visual)	not suitable for testing
	5		
	4		
	3		
	2		
	1		
Bottom of Sample	0		

EMCON

PERMEABILITY TEST BY TRIAXIAL CELL WITH BACK PRESSURE

Constant Head Method

Project:	NAVY SERVICE SITE	Proj. No.	85732.001.000	Tested by:	K.H.
				Entered by:	K.H.
Sample:	ST-3	Date:	11-8-96	Checked by:	R.S.A.

Remarks:

Cell 4
Panel 4

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	4.077	1.	2.875
2.	4.085	2.	2.863
3.	4.081	3.	2.874
4.	4.080	4.	2.868
5.	4.072	5.	2.852

Weight of Specimen:

Initial Weigh	922.8	Grams
	2.033	Lbs.
Final Weight	931.9	Grams
	2.053	Lbs.
Dry Weight	777.4	Grams
	1.712	Lbs.

Avg.	4.079	In	Ave.	2.866	In
	10.361	CM		7.281	CM
Area	6.453	In^2		41.632	CM^2
Volume	26.321891	In^3	0.0152326	Cft.	

Moisture Content:

Initial	18.70	%
Final	19.87	%

Density, Wet Initial	133.56	pcf
Density, Dry	112.51	pcf
Density, Wet Final:	134.87	pcf
Back Pressure:	90	psi
Efft. Confining Pressure	0.5	tsf
Specific Gravity	2.813	
Saturation:	99.8	%

$$K_{20} = \frac{Q \times L \times Rt}{h \times A \times t}$$

	Trial 1	Trial 2	Trial 3	Trial 4
Q cc	1.00	1.00	1.00	1.00
L cms	10.361	10.361	10.361	10.361
Rt (Temp)	1.000	1.000	1.000	1.000
h cms	66.44	66.44	66.44	66.44
A Sq. cms	41.632	41.632	41.632	41.632
t Sec.	28	28	28	28
K_{20} cm/sec	1.338E-04	1.338E-04	1.338E-04	1.338E-04

K_{20} Avg. cm/sec **1.338E-04**

EMCON

PERMEABILITY TEST BY TRIAXIAL CELL WITH BACK PRESSURE

Constant Head Method

Project:	NAVY SERVICE SITE	Proj. No.	85732.001.000	Tested by:	K.H.
				Entered by:	K.H.
Sample:	TUBE#4 TP-13	Date:	11-8-96	Checked by:	R.S.A.
Remarks:				Cell	9
				Panel	4

Dimensions of Specimen:

	Length (Inches)		Diameter (Inches)
1.	2.765	1.	2.840
2.	2.760	2.	2.861
3.	2.765	3.	2.856
4.	2.763	4.	2.802
5.	2.766	5.	2.789

Weight of Specimen:

Initial Weigh	620.8	Grams
	1.367	Lbs.
Final Weight	632.3	Grams
	1.393	Lbs.
Dry Weight	540.2	Grams
	1.190	Lbs.

Avg.	2.764	In	Ave.	2.830	In
	7.020	CM		7.187	CM
Area	6.288	In^2		40.570	CM^2
Volume	17.379869	In^3	0.0100578	Cft.	

Moisture Content:

Initial	14.92	%
Final	17.05	%

Density, Wet Initial	136.07	pcf
Density, Dry	118.41	pcf
Density, Wet Final:	138.59	pcf
Back Pressure:	90	psi
Efft. Confining Pressure	0.5	tsf
Specific Gravity	2.848	
Saturation:	96.9	%

$$K_{20} = \frac{Q \times L \times Rt}{h \times A \times t}$$

	Trial 1	Trial 2	Trial 3	Trial 4
Q cc	0.30	0.20	0.20	0.20
L cms	7.020	7.020	7.020	7.020
Rt (Temp)	1.000	1.000	1.000	1.000
h cms	66.44	66.44	66.44	66.44
A Sq. cms	40.570	40.570	40.570	40.570
t Sec.	191	134	144	146
K_{20} cm/sec	4.091E-06	3.887E-06	3.617E-06	3.568E-06

K_{20} Avg. cm/sec 3.791E-06

DRAWING