Date: July 31st, 2019

Prepared by: **GCME, Inc.**

TO: RS&H, Inc.
3125 W Commercial Boulevard, Suite 130
Fort Lauderdale, FL 33309

Attention: Mr. Paul Heeg, P.E.
Senior Transportation Engineer

SUBJECT: **Geotechnical Report – Borehole Permeability Tests**
PD&E Study – SW 10th Street / SR-869
From Powerline Road to West of Military Trail
Broward County, Florida
FPID No.: 439891-1-22-02
GCME Project No.: 2000-01-17003

Dear Mr. Heeg,

GCME, Inc. has completed borehole permeability tests (BHP) along SW 10th Street / SR-869 in reference to the scope of services detailed in Optional Services (OPT) #11 Dated February 8, 2019.

This entire project corridor runs along SW 10th Street / SR-869 from west of Powerline Road to west of Military Trail, a distance of about 2.0 miles. In order to evaluate the soil permeability along the roadway alignment, the scope of work included performing nine (9) borehole permeability tests at three (3) locations. At first, three (3) SPT borings, each 30 feet deep were drilled at these three (3) locations to verify the subsurface soil stratum. The locations of these tests were provided by your office. At each location, three BHP tests were performed with different test intervals (i.e., 0 to 10 feet, 10 to 20 feet, and 20 to 30 feet) and the horizontal distance between each BHP test was about 10 feet.

The numbering schedule and location of the BHP tests and soil borings for the proposed improvements of the roadway corridor are as follows:

- Along South of SR-869: Three (3) Borings, numbered BHP-1, BHP-2 and BHP-3
  Nine (9) BHP tests:
  BHP-1A, BHP-2A and BHP-3A. Test Interval 20’ – 30’
  BHP-1B, BHP-2B and BHP-3B. Test Interval 10’ – 20’
  BHP-1C, BHP-2C and BHP-3C. Test Interval 0’ – 10’

The approximate locations of the BHP tests and the soil borings are presented on Plate 1, titled ‘Approximate Boring Location Plan’. For this report, the boring location plans are presented on

Google Earth maps for your review. The station, offset and elevation information at the test / boring locations were not available at the time of writing this report.

The subsurface geologic profiles encountered at the boring location along with the SPT results, are presented in Figure 1. The soil profiles are drawn with reference to depth.

The SPT boring was advanced using mud rotary procedures. The boring was drilled to depth of 30 feet below grade. Samples of the in-place materials were recovered with a standard split barrel advanced with a 140-pound hammer falling 30 inches (the SPT after ASTM D 1586). Soil samples were field classified, placed in sealed containers and transported to our laboratory for further analysis by a soils engineer. Classification of the subsoils found in the borings followed the Unified Soil Classification System (ASTM D 2487). The borehole was filled with cement grout at the completion of the drilling activities.

Index property tests such as moisture content, organic content and grain size distribution are being performed on representative samples from the SPT borings. All the available laboratory test results are provided in Table – 1.

Borehole Permeability Test (BHP) were performed using the usual open-hole, constant head methodology. The boreholes were 10, 20 and 30 feet deep and completed as an open well with gravel pack (6-20 silca sand). The well screen slot width was 0.020 inches. Water from the drill rig tank was then pumped into the open well, and the amount of water required to maintain a constant head in the pipe was recorded. The BHP results are presented in Table – 2.

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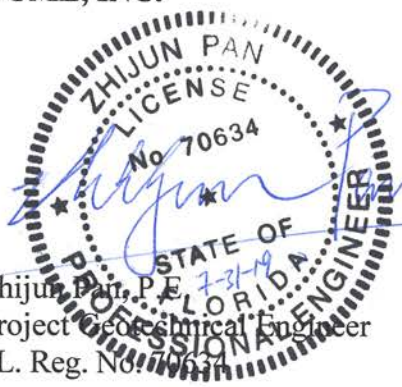
We are pleased to be of continued service to RS&H and the Florida Department of Transportation (FDOT). If you have any questions or comments regarding the contents of the following report, please call.

Very truly yours,

GCME, INC.



Zhijun Pan, P.E.
Project Geotechnical Engineer
FL. Reg. No. 70634

Partha Ghosh, P.E.
Principal Engineer
FL Registration No. 51377

Appendices:

Plate – 1	Approximate Boring Location Plan
Figure – 1	Report of Core Borings
Table – 1	Summary of Laboratory Testing Results
Table – 2	Borehole Permeability Test Results

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ENGINEER OF RECORD:
PARTHA GHOSH, P.E. LICENSE NO. 51377
GCME, INC.
1730 W. 10TH STREET
RIVIERA BEACH, FLORIDA 33404
CERTIFICATE OF AUTHORIZATION NO. 9076

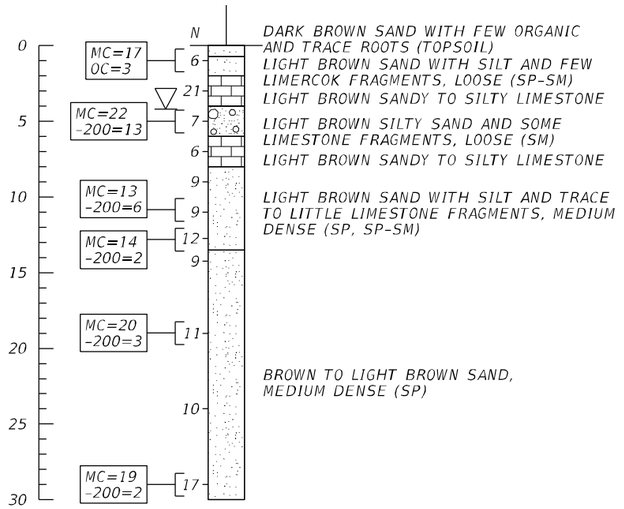
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR-869	BROWARD	439891-1-22-02

APPROXIMATE BORING LOCATION PLAN
PLATE-1

SHEET NO.

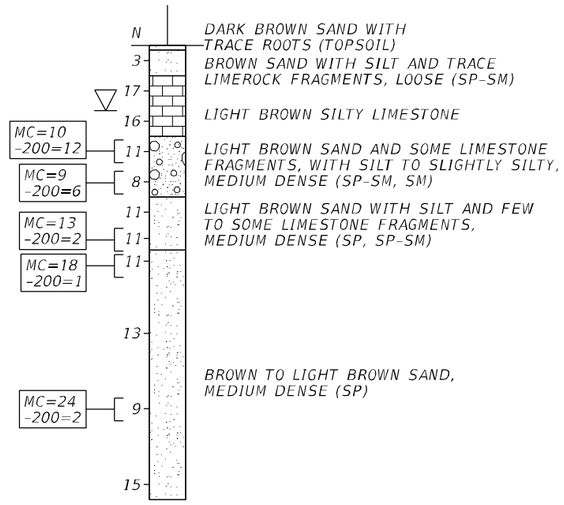
BOR # BHP-101
DATE 2/18/2019
HAMMER Auto
RIG CME-55
COORDINATES 26.3039°
-80.1432°



Boring Terminated at Depth of 30ft

Casing is 28 feet below grade

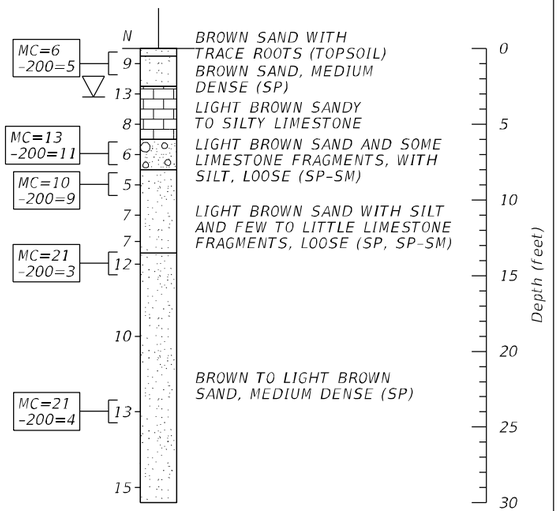
BOR # BHP-102
DATE 2/18/2019
HAMMER Auto
RIG CME-55
COORDINATES 26.3040°
-80.1419°



Boring Terminated at Depth of 30ft

Casing is 28 feet below grade

BOR # BHP-103
DATE 2/18/2019
HAMMER Auto
RIG CME-55
COORDINATES 26.3040°
-80.1408°



Boring Terminated at Depth of 30ft

Casing is 28 feet below grade

LEGEND

(SP)	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL
N	STANDARD PENETRATION RESISTANCE IN BLOWS PER 12 inches UNLESS OTHERWISE NOTED. 50/5 INDICATES (50) BLOWS REQUIRED TO DRIVE A SAMPLING SPOON 5 INCHES.
→	LOSS OF CIRCULATION
2/18/19	WATER LEVEL WITH DATE OF READING
WR	SAMPLER DROPPED DUE TO WEIGHT OF ROD
WH	SAMPLER DROPPED DUE TO WEIGHT OF HAMMER
NR	NO RECOVERY
HA	DRILLED WITH A HAND AUGER IN ORDER TO CLEAR LOCATION FROM UNDERGROUND UTILITIES

STATION / OFFSET / ELEVATION / COORDINATE INFORMATION ARE PROVIDED BY SURVEYORS.

MC=	NATURAL MOISTURE CONTENT (%)
-200=	FINES PASSING #200 SIEVE (%)
OC=	ORGANIC CONTENT (%)
LL=	LIQUID LIMIT (%)
PI=	PLASTICITY INDEX (%)
NP=	INDICATES NON-PLASTIC

NOTES: STRATA BOUNDARIES ARE APPROXIMATE AND MAY VARY BETWEEN OR AWAY FROM BORING LOCATIONS.

DRILLER: JAIME

STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 inches
SPOON OUTSIDE DIA.	2.0 inches
AVG. HAMMER DROP	30.0 inches
HAMMER WEIGHT	140.0 pounds

SPT CONSISTENCY CHART

SILTS AND CLAYS-	AUTOMATIC HAMMER
CONSISTENCY	SPT (BLOWS/1.0 ft)
VERY SOFT	LESS THAN 1
SOFT	1 - 3
FIRM	3 - 6
STIFF	6 - 12
VERY STIFF	12- 24
HARD	GREATER THAN 24

SPT DENSITY CHART

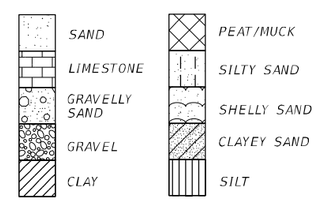
GRANULAR MATERIALS-	AUTOMATIC HAMMER
RELATIVE DENSITY	SPT (BLOWS/1.0 ft)
VERY LOOSE	LESS THAN 3
LOOSE	3 - 8
MEDIUM DENSE	8 - 24
DENSE	24 - 40
VERY DENSE	GREATER THAN 40

ENVIRONMENTAL CLASSIFICATION:

SUBSTRUCTURE: MODERATELY AGGRESSIVE (STEEL)
MODERATELY AGGRESSIVE (CONCRETE)

SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE

SOIL TYPE SYMBOLS:



SCALE: 1"=10'V

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ENGINEER OF RECORD:
PARTHA GHOSH, P.E. LICENSE NO. 51377
GCME, INC.
1730 W. 10TH STREET
RIVIERA BEACH, FLORIDA 33404
CERTIFICATE OF AUTHORIZATION NO. 9076

DRAWN BY-FP	12-2018
CHECKED BY-ZP	12-2018
DESIGNED BY-	XXX MM-YY
CHECKED BY-	XXX MM-YY

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
869	BROWARD	439891-1-22-02

SHEET TITLE: REPORT OF CORE BORINGS

REF. DWG. NO.

PROJECT NAME: SW 10TH STREET PD&E STUDY

SHEET NO.

fpler 7/31/2019 12:45:50 PM X:\CADD\MicroStation Drawing\2017\7003\BHP\Boring_BHP-101&102&103.dgn

GCME PROJECT NO. 2000-01-17003

NOTICE: THE OFFICAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C

FIGURE: 1

TABLE - 1

SUMMARY OF LABORATORY TESTING RESULTS [DRAINAGE]

Project Name: PD&E Study - SW 10th Street From Powerline Road to Military Trail

Boring No.	Sample Depth (ft)			USCS Symbol	Natural Moisture Content (%)	Organic Content (%)	Atterberg Limits			Sieve Analysis								
							LL (%)	PL (%)	PI (%)	3/4"	3/8"	#4	#10	#20	#40	#60	#100	#200
BHP-101	0.0	-	2.0	SP-SM	16.9	3.0												
BHP-101	4.0	-	6.0	SM	21.9					93.4	76.7	70.9	67.1	61.7	48.7	25.8	16.5	12.9
BHP-101	10.0	-	12.0	SP-SM	13.1					100.0	99.2	95.2	93.0	90.2	68.3	26.0	9.8	6.0
BHP-101	12.0	-	13.5	SP	14.2					85.2	78.6	74.9	72.6	71.0	61.6	25.3	4.9	2.4
BHP-101	18.0	-	20.0	SP	19.6					100.0	100.0	100.0	99.9	98.2	83.0	40.1	10.2	3.2
BHP-101	28.0	-	30.0	SP	19.0					100.0	100.0	100.0	100.0	99.6	88.6	34.6	4.4	1.6
BHP-102	6.0	-	8.0	SP-SM	10.0					88.8	74.3	68.5	64.7	60.2	42.9	21.8	14.2	11.7
BHP-102	8.0	-	10.0	SP-SM	9.4					85.4	74.4	61.4	53.5	49.0	34.1	13.7	8.1	6.3
BHP-102	12.0	-	13.5	SP	13.2					86.1	74.0	68.8	67.7	66.9	64.0	20.5	3.4	1.9
BHP-102	13.5	-	15.0	SP	17.9					100.0	100.0	100.0	100.0	98.7	84.0	26.6	3.5	1.4
BHP-102	23.0	-	25.0	SP	24.2					100.0	100.0	100.0	100.0	99.6	95.3	59.4	6.4	1.7
BHP-103	0.0	-	2.0	SP	5.8					100.0	97.7	95.7	94.8	92.9	74.3	32.8	12.8	4.6
BHP-103	6.0	-	8.0	SP-SM	12.8					81.8	73.5	70.1	66.9	59.3	44.5	24.5	14.1	11.1
BHP-103	8.0	-	10.0	SP-SM	10.4					96.3	89.0	84.8	80.3	74.6	56.1	29.3	13.8	9.3
BHP-103	13.5	-	15.0	SP	20.8					100.0	100.0	100.0	99.9	99.3	89.5	67.3	20.7	3.3
BHP-103	23.0	-	25.0	SP	20.5					100.0	100.0	100.0	100.0	99.5	94.1	37.7	7.9	3.9

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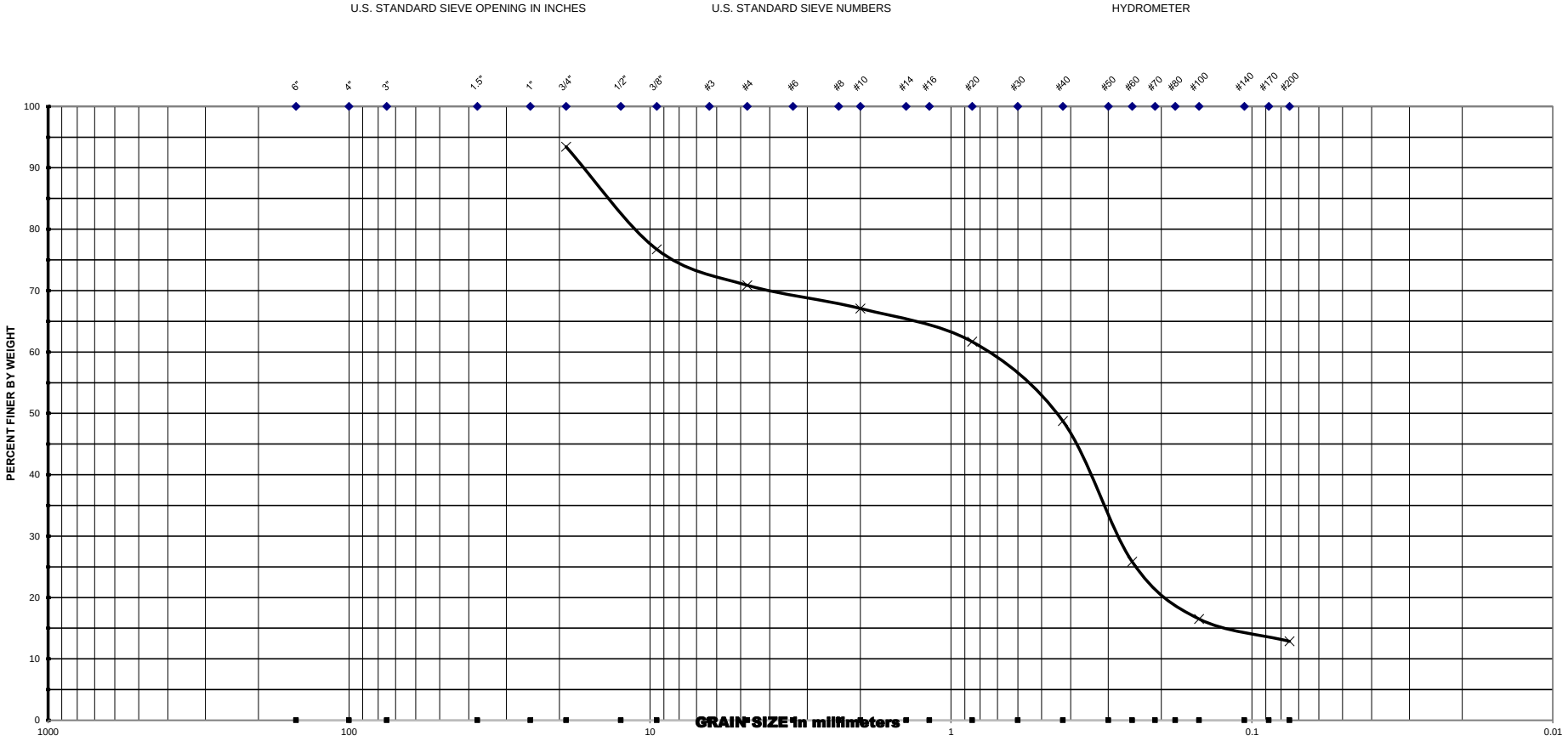

Project Name : PD&E Study - SW 10th Street From Powerline Road to Military Trail

Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-101	4.0 - 6.0	SM	21.9	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	93.4
3/8"	76.7
#4	70.9
#10	67.1
#20	61.7
#40	48.7
#60	25.8
#100	16.5
#200	12.9

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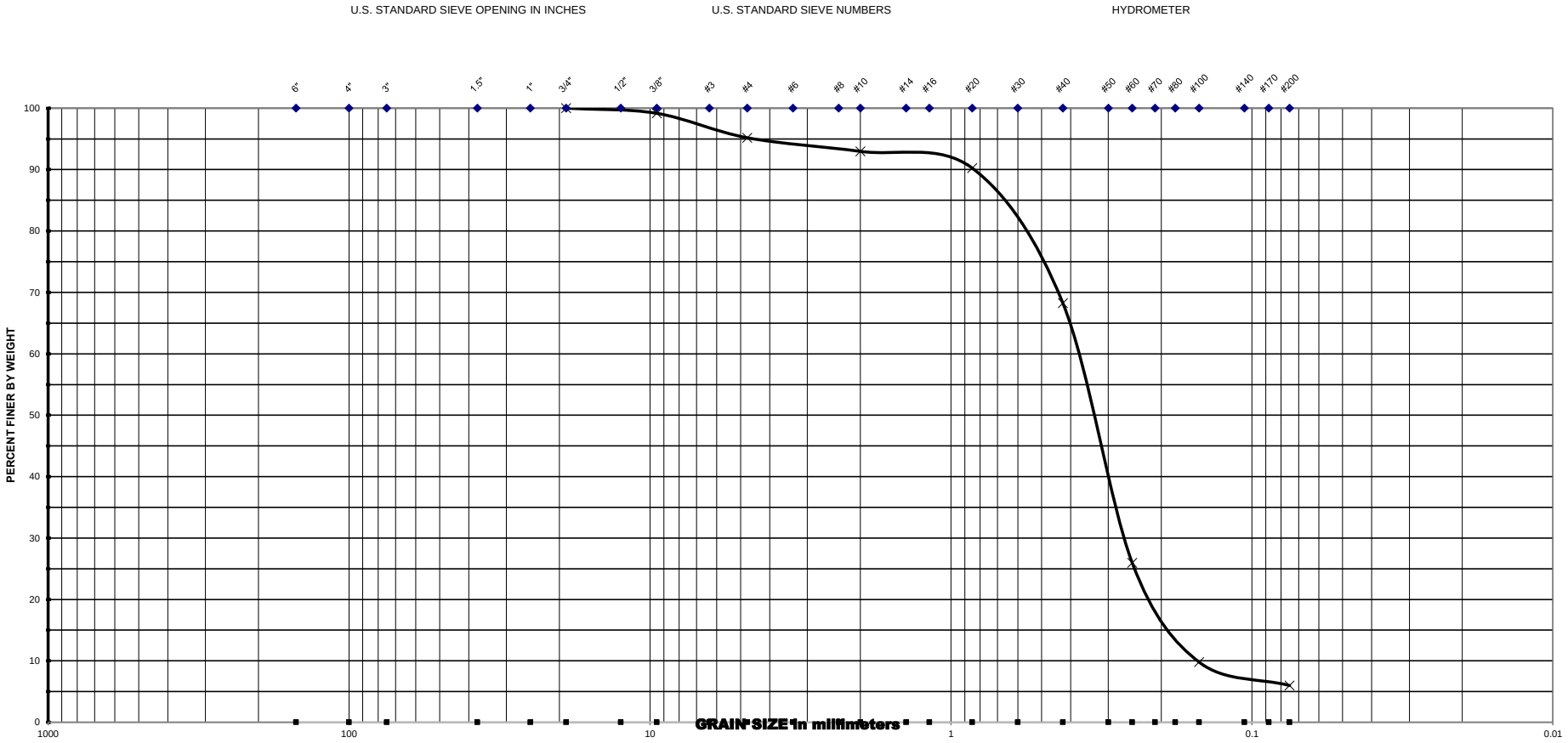

Project Name : PD&E Study - SW 10th Street From Powerline Road to Military Trail

Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-101	10.0 - 12.0	SP-SM	13.1	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	100.0
3/8"	99.2
#4	95.2
#10	93.0
#20	90.2
#40	68.3
#60	26.0
#100	9.8
#200	6.0

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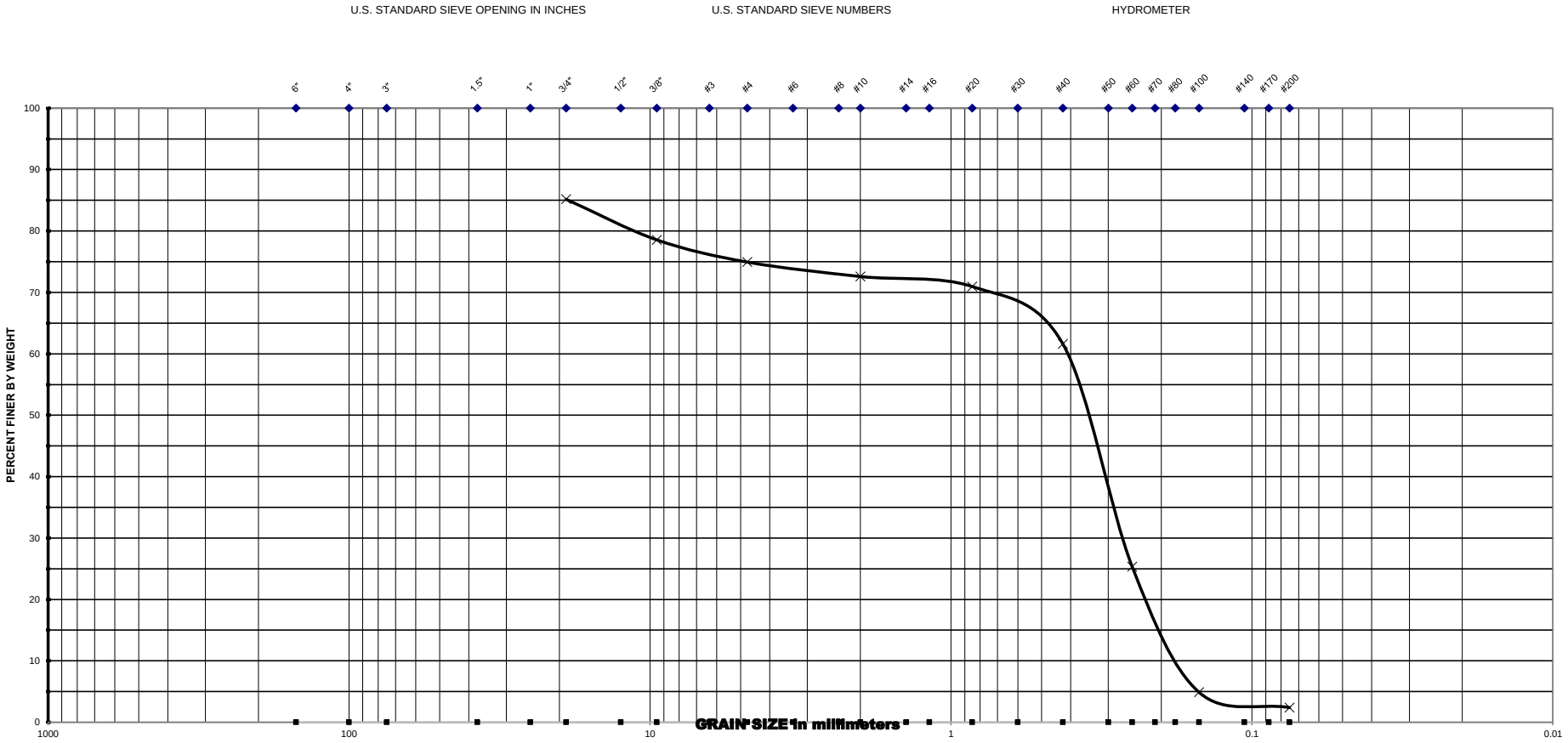

Project Name : PD&E Study - SW 10th Street From Powerline Road to Military Trail

Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-101	12.0 - 13.5	SP	14.2	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	85.2
3/8"	78.6
#4	74.9
#10	72.6
#20	71.0
#40	61.6
#60	25.3
#100	4.9
#200	2.4

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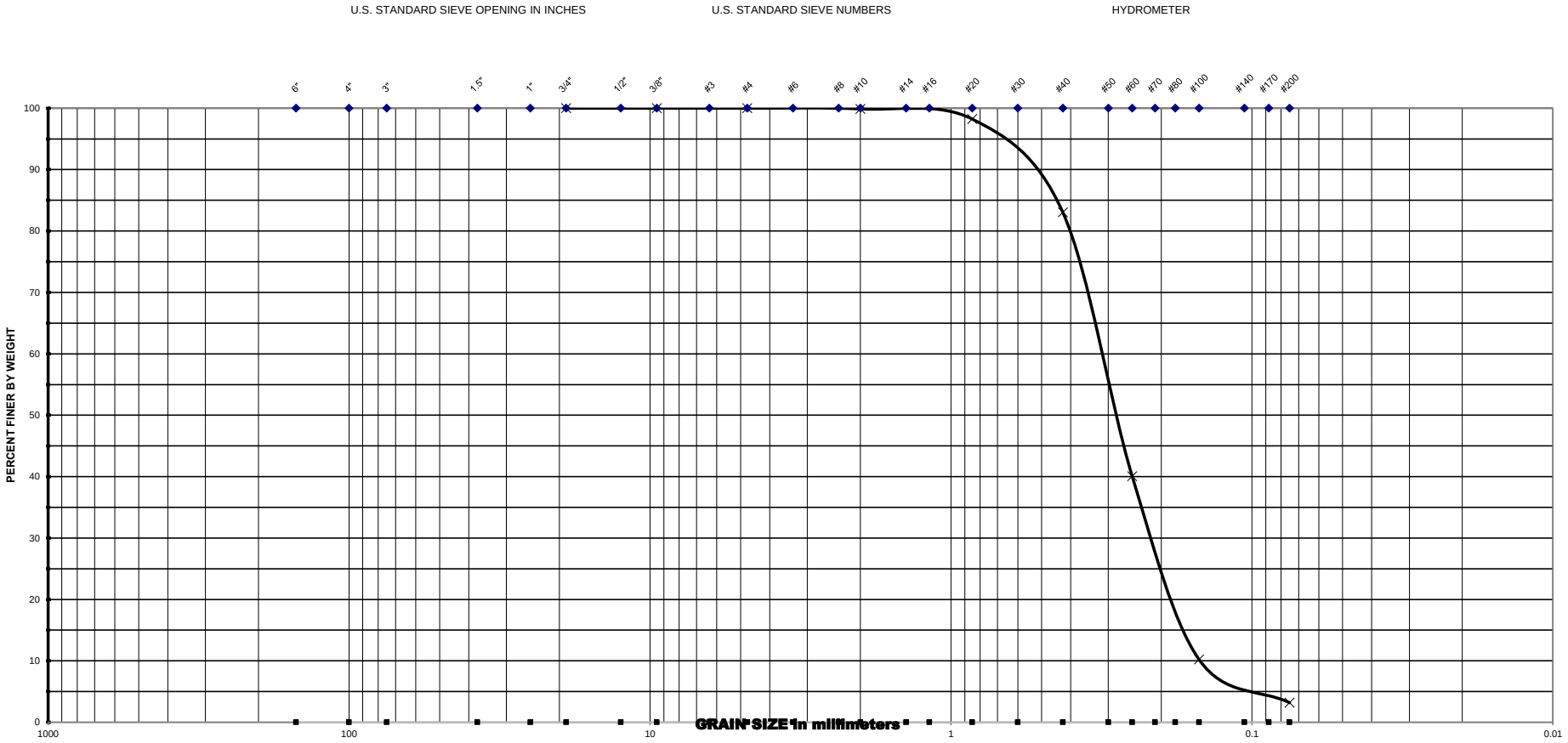

Project Name : PD&E Study - SW 10th Street From Powerline Road to Military Trail

Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-101	18.0 - 20.0	SP	19.6	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	100.0
3/8"	100.0
#4	100.0
#10	99.9
#20	98.2
#40	83.0
#60	40.1
#100	10.2
#200	3.2

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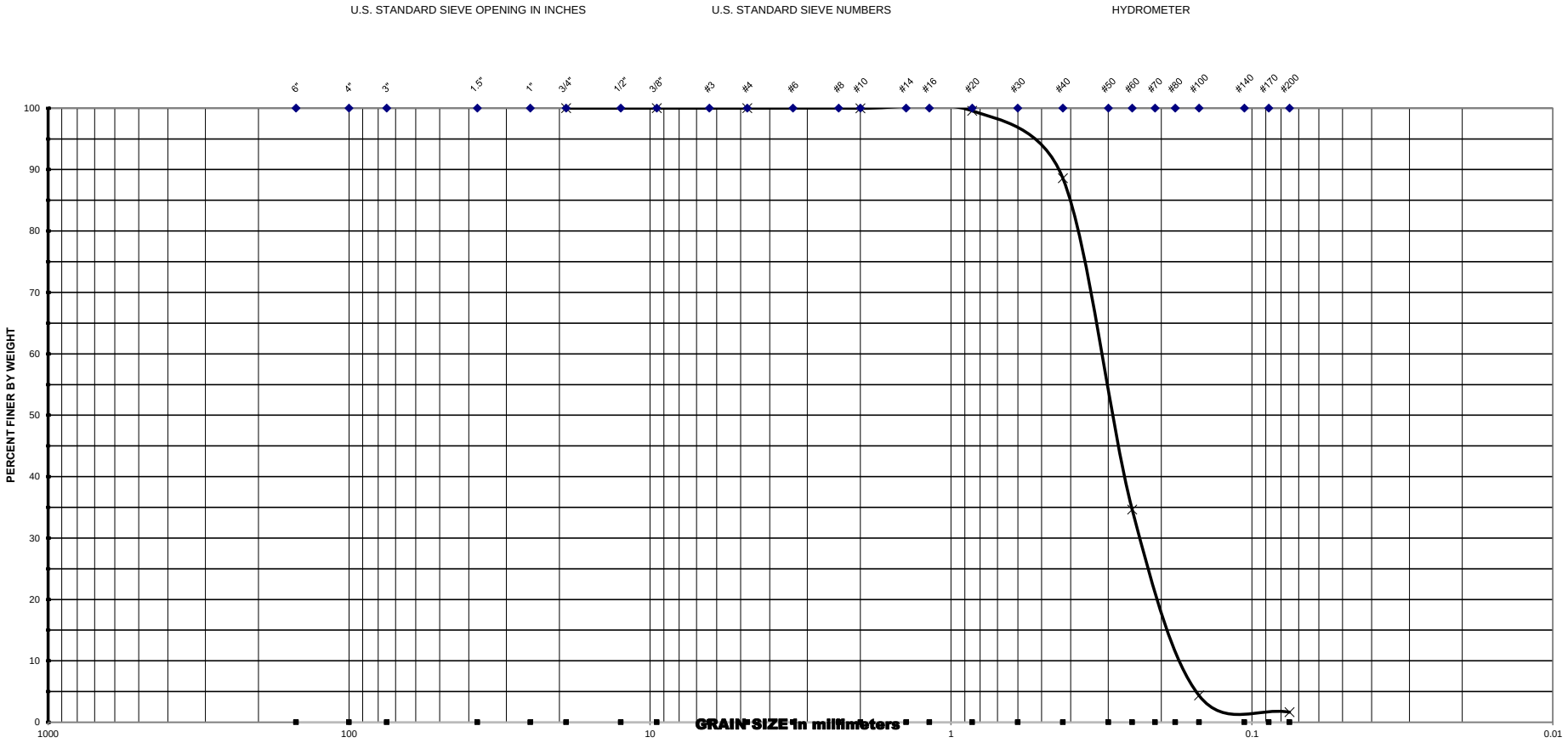

Project Name : PD&E Study - SW 10th Street From Powerline Road to Military Trail

Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-101	28.0 - 30.0	SP	19.0	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	100.0
3/8"	100.0
#4	100.0
#10	100.0
#20	99.6
#40	88.6
#60	34.6
#100	4.4
#200	1.6

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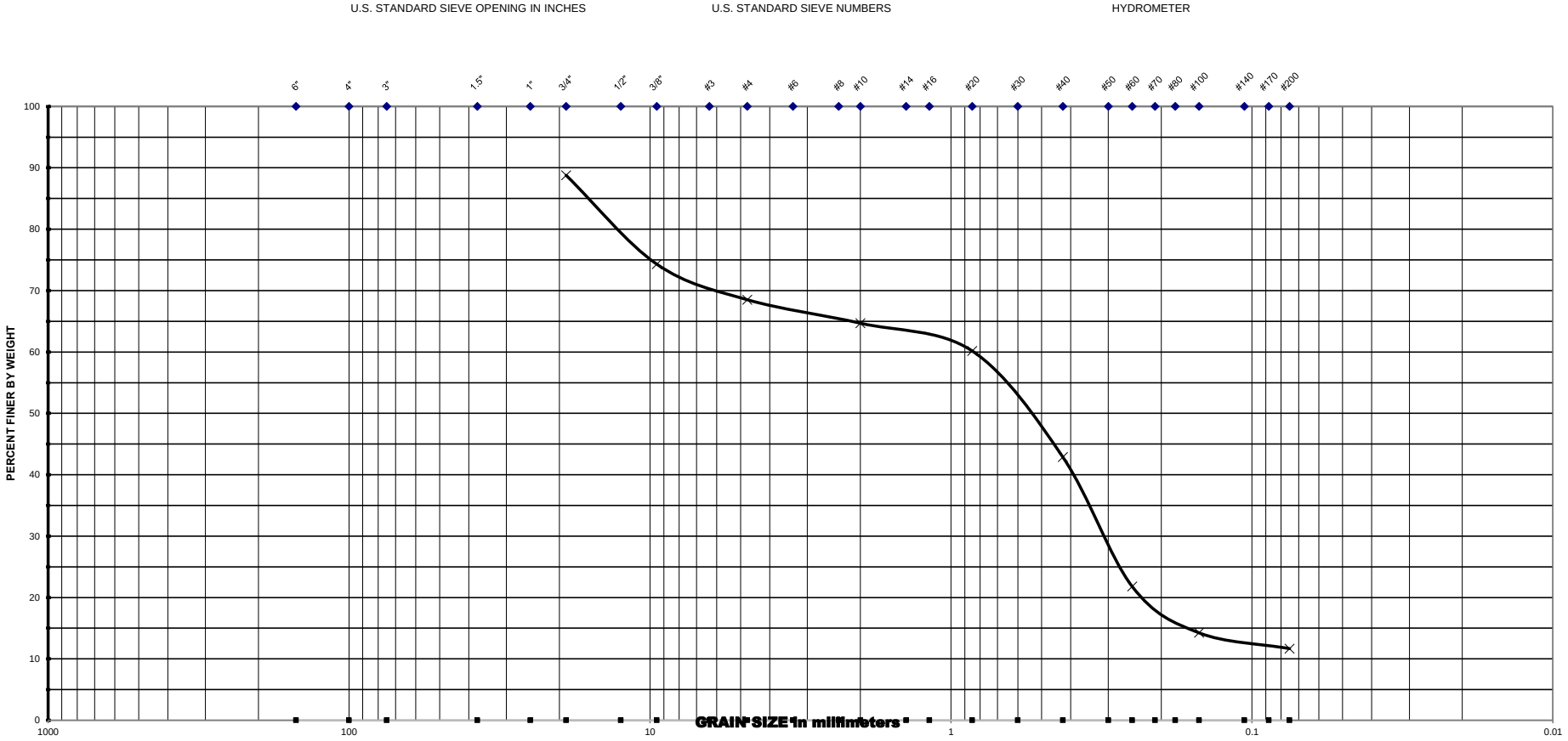

Project Name : PD&E Study - SW 10th Street From Powerline Road to Military Trail

Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-102	6.0 - 8.0	SP-SM	10.0	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	88.8
3/8"	74.3
#4	68.5
#10	64.7
#20	60.2
#40	42.9
#60	21.8
#100	14.2
#200	11.7

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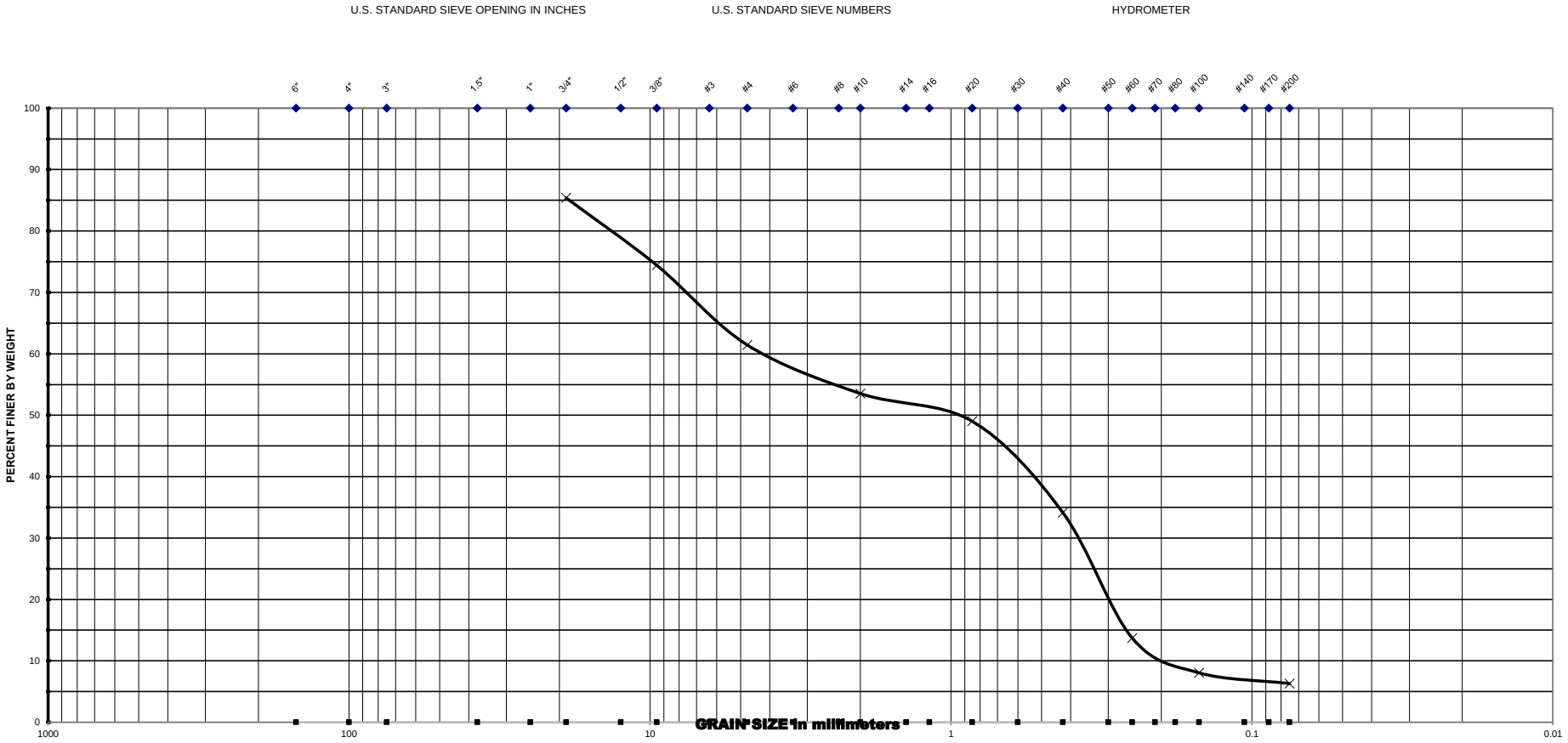

Project Name : PD&E Study - SW 10th Street From Powerline Road to Military Trail

Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-102	8.0 - 10.0	SP-SM	9.4	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	85.4
3/8"	74.4
#4	61.4
#10	53.5
#20	49.0
#40	34.1
#60	13.7
#100	8.1
#200	6.3

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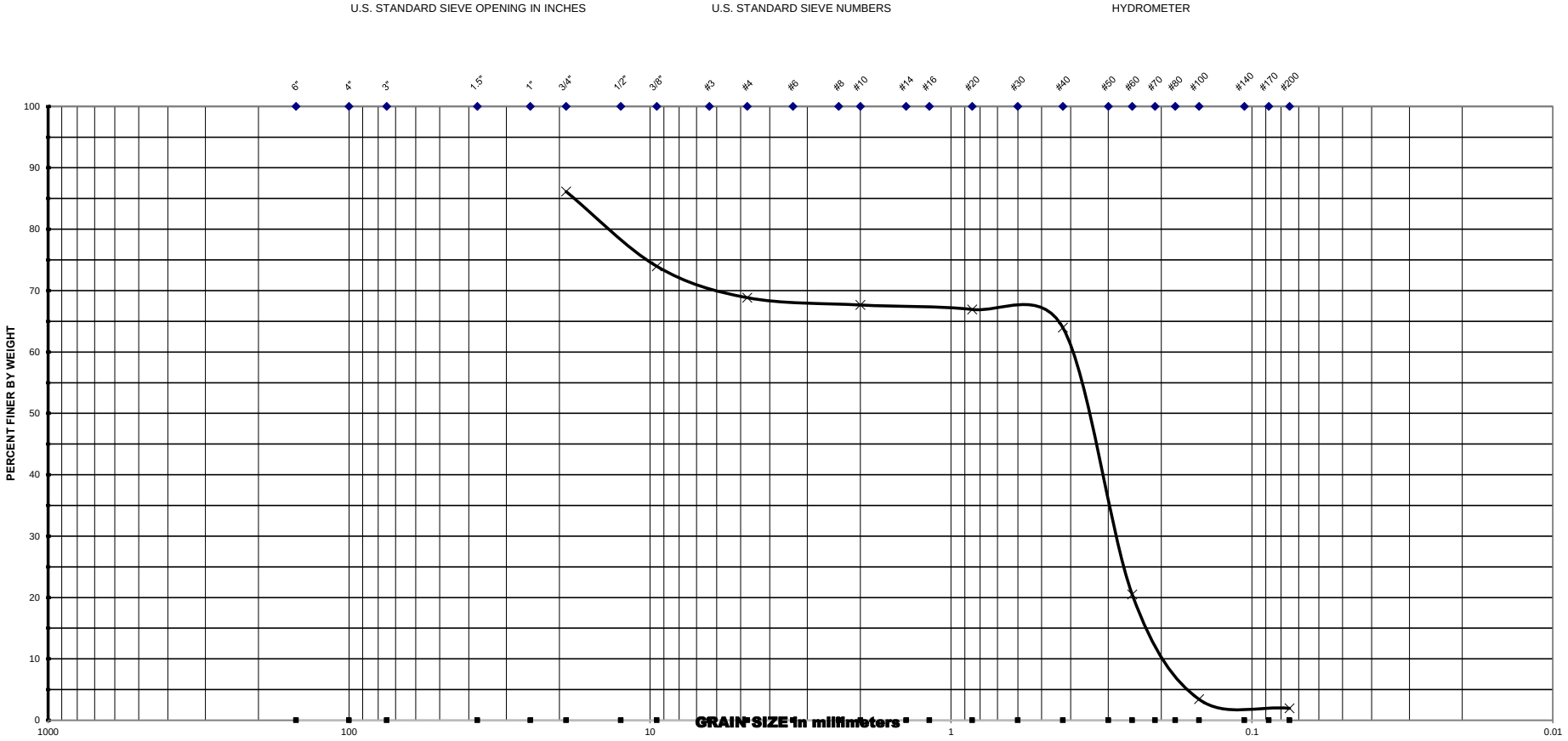

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Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-102	12.0 - 13.5	SP	13.2	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	86.1
3/8"	74.0
#4	68.8
#10	67.7
#20	66.9
#40	64.0
#60	20.5
#100	3.4
#200	1.9

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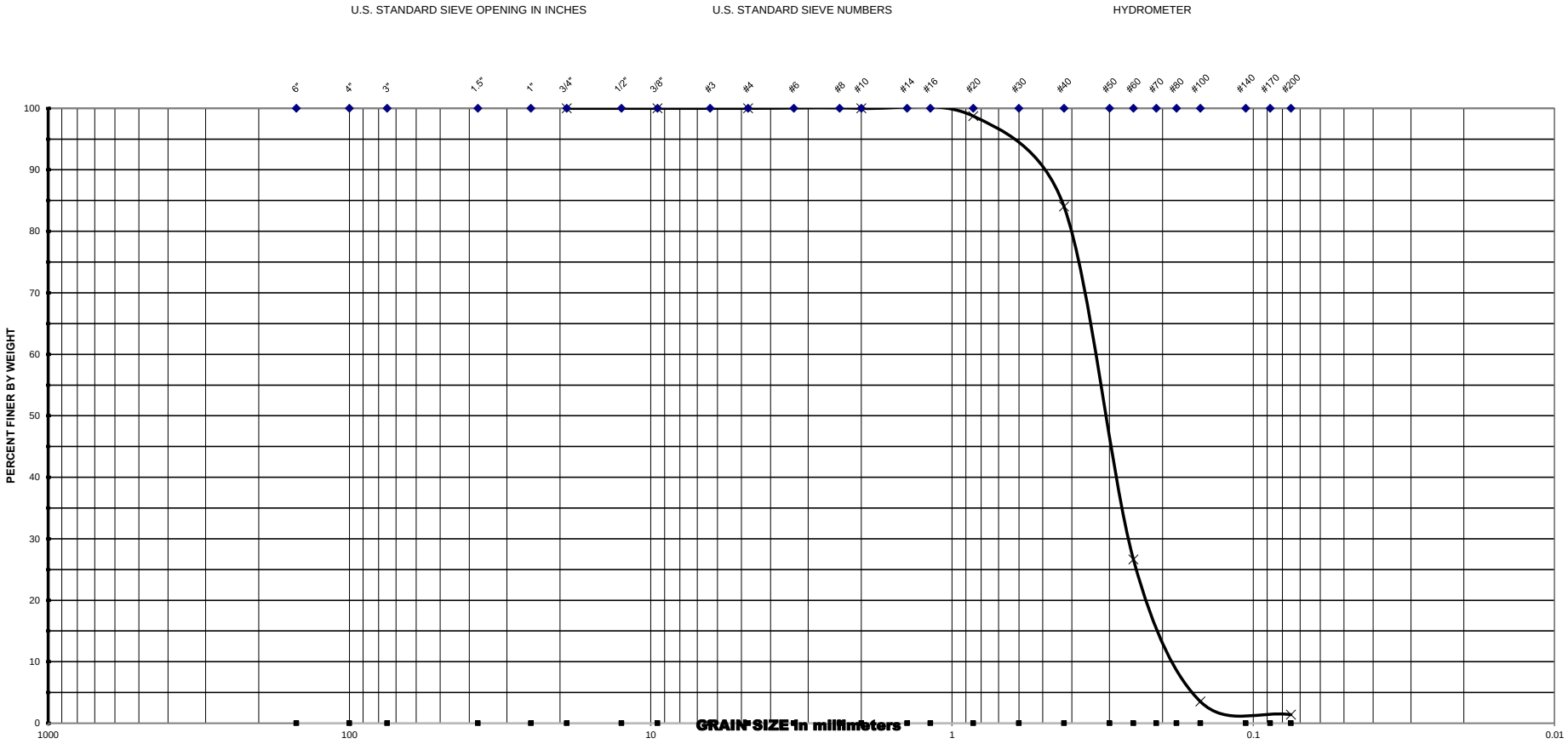

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Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-102	13.5 - 15.0	SP	17.9	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	100.0
3/8"	100.0
#4	100.0
#10	100.0
#20	98.7
#40	84.0
#60	26.6
#100	3.5
#200	1.4

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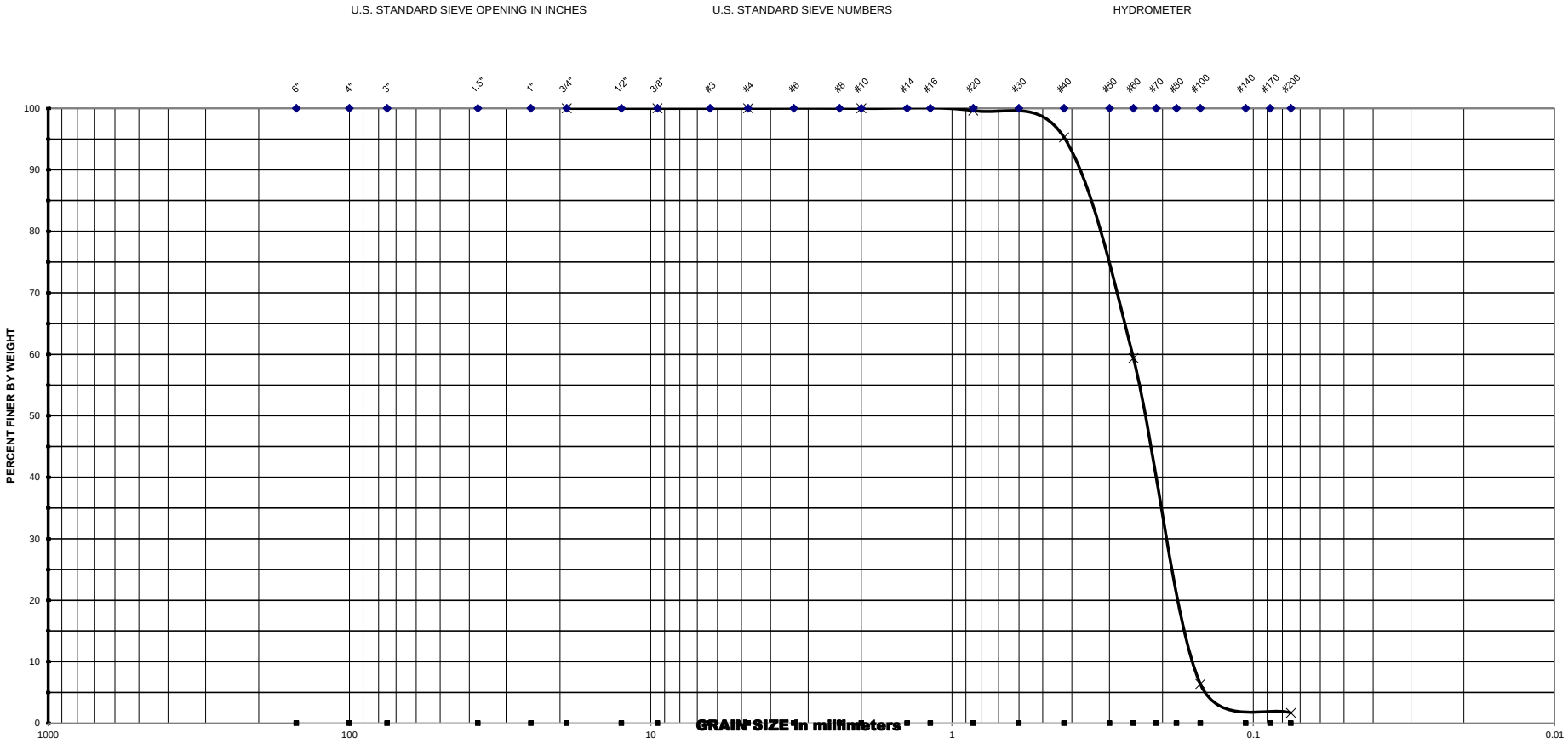

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Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-102	23.0 - 25.0	SP	24.2	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	100.0
3/8"	100.0
#4	100.0
#10	100.0
#20	99.6
#40	95.3
#60	59.4
#100	6.4
#200	1.7

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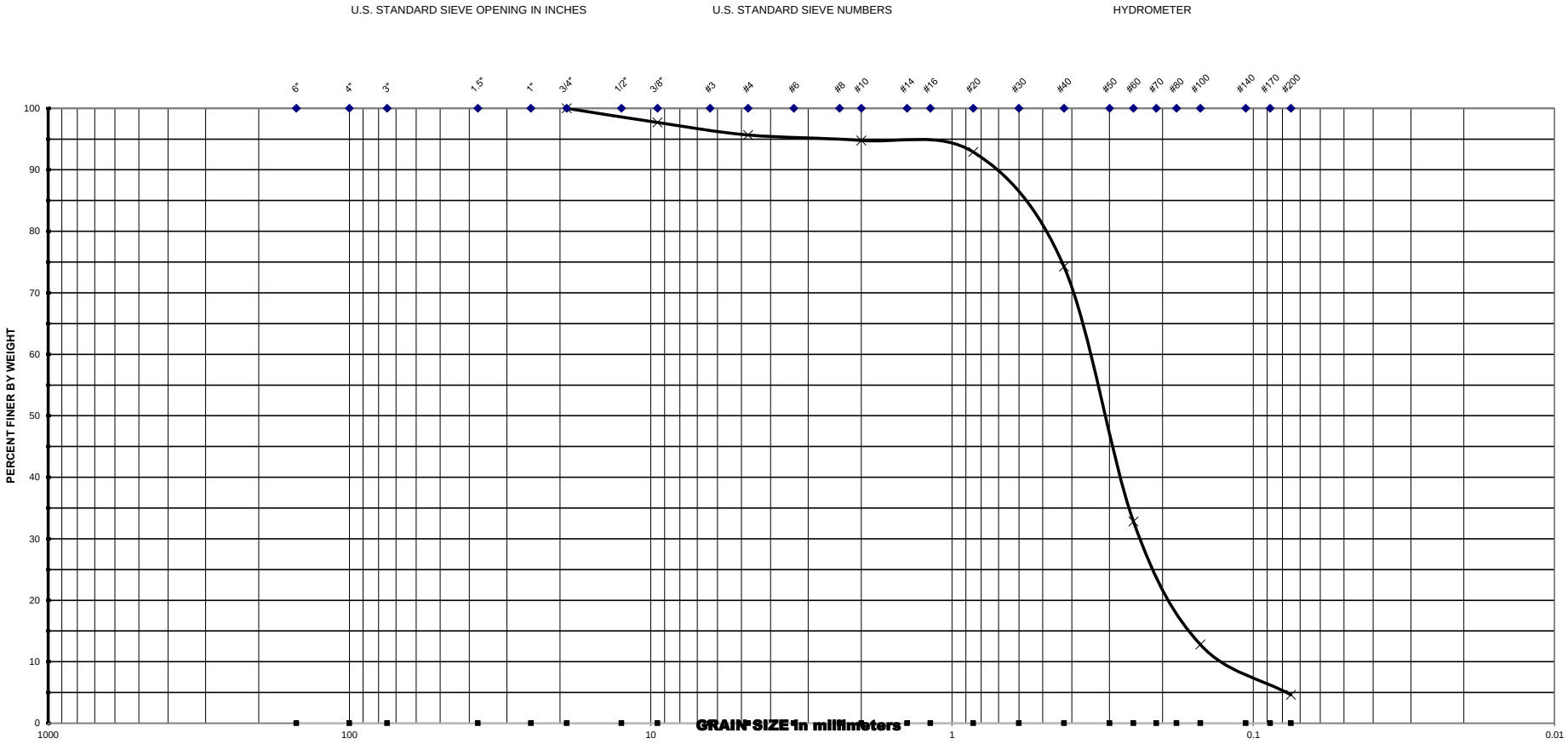

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Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-103	0.0 - 2.0	SP	5.8	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	100.0
3/8"	97.7
#4	95.7
#10	94.8
#20	92.9
#40	74.3
#60	32.8
#100	12.8
#200	4.6

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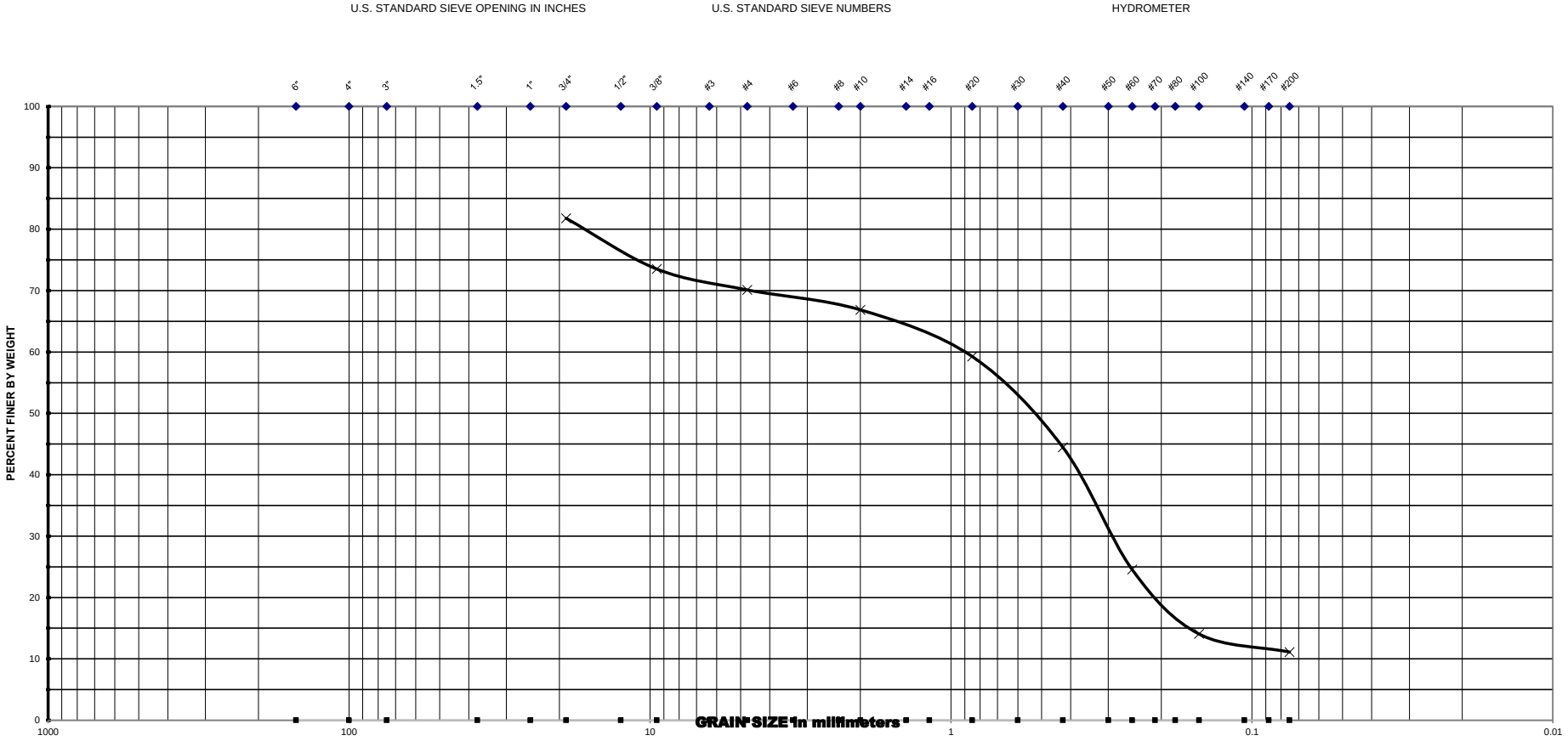
Geotechnical - Consulting - Engineering - Testing



Project Name : PD&E Study - SW 10th Street From Powerline Road to Military Trail

Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-103	6.0 - 8.0	SP-SM	12.8	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	81.8
3/8"	73.5
#4	70.1
#10	66.9
#20	59.3
#40	44.5
#60	24.5
#100	14.1
#200	11.1

GCME

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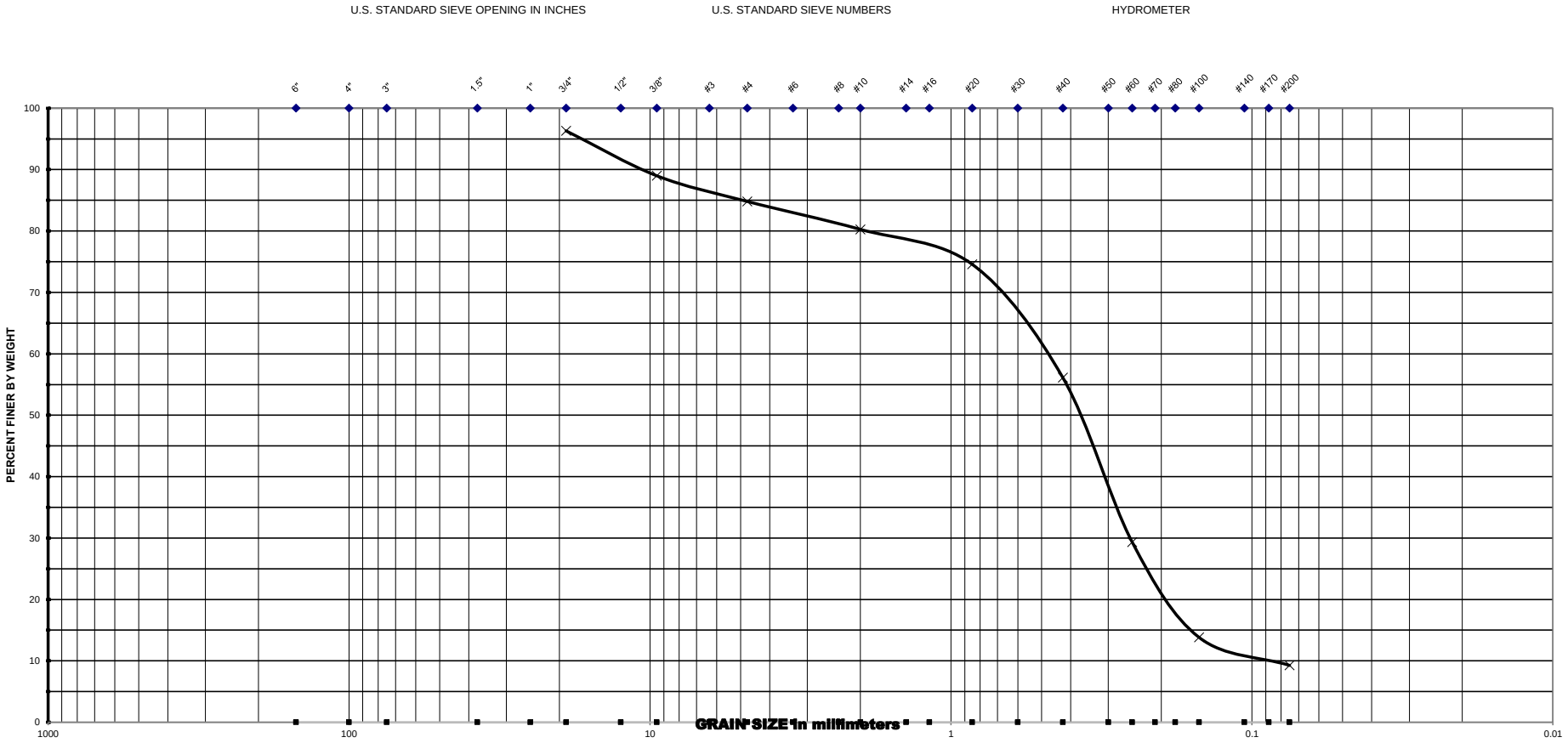

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Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-103	8.0 - 10.0	SP-SM	10.4	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	96.3
3/8"	89.0
#4	84.8
#10	80.3
#20	74.6
#40	56.1
#60	29.3
#100	13.8
#200	9.3

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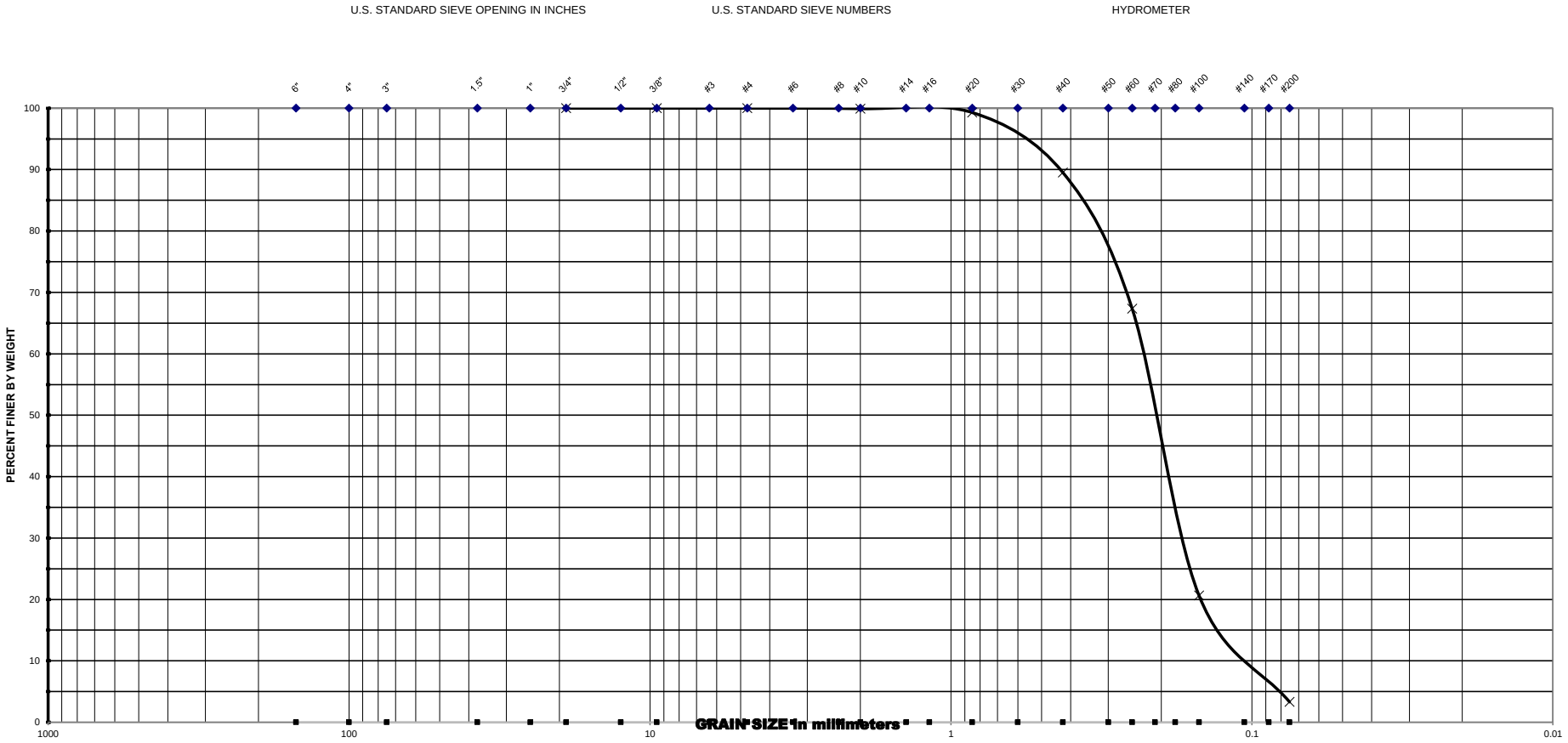

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Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-103	13.5 - 15.0	SP	20.8	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	100.0
3/8"	100.0
#4	100.0
#10	99.9
#20	99.3
#40	89.5
#60	67.3
#100	20.7
#200	3.3

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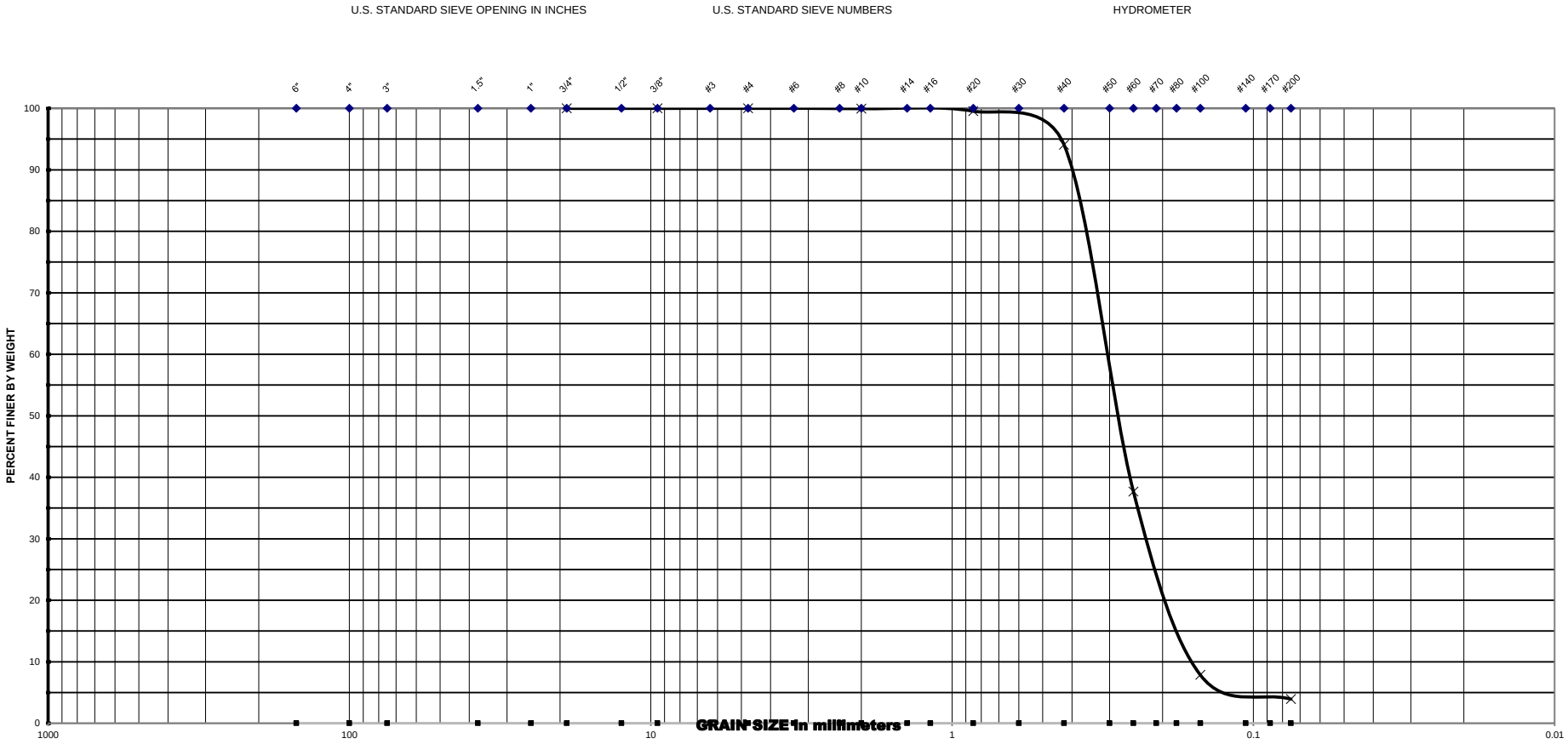

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Project No. : 2000-01-17003 **Date :** 7/8/2019

BORING NO.	DEPTH INTERVAL [FT]	SOIL DESCRIPTION	MC	OC
BHP-103	23.0 - 25.0	SP	20.5	

Note : MC - Moisture Content (%)
OC - Organic Content (%)

U.S SIEVE NO.	CUMM. % PASSING
3/4"	100.0
3/8"	100.0
#4	100.0
#10	100.0
#20	99.5
#40	94.1
#60	37.7
#100	7.9
#200	3.9

TABLE - 2

BOREHOLE PERMEABILITY TEST RESULTS

Project Name: PD&E Study - SW 10th Street From Powerline Road to Military Trail

EARTH MANUAL METHOD

BHP No.	Approx. Station	Approx. Offset	Bore Hole Dia. (in)	Test Interval (ft)	GWT Depth (ft)	Flow Rate Q [gal/min]	K [cfs/ft^2]	K [ft/day]
BHP-101C	Refer Plate-1 for location		8.00	0-10	4.17	3.2000	9.26E-05	**8.0**
BHP-101B	Refer Plate-1 for location		8.00	10-20	4.17	14.0000	4.05E-04	**35.0**
BHP-101A	Refer Plate-1 for location		8.00	20-30	4.17	17.0000	4.92E-04	**42.5**
BHP-102C	Refer Plate-1 for location		8.00	0-10	4.33	2.5000	6.96E-05	**6.0**
BHP-102B	Refer Plate-1 for location		8.00	10-20	4.33	14.0000	3.90E-04	**33.7**
BHP-102A	Refer Plate-1 for location		8.00	20-30	4.33	19.5000	5.43E-04	**46.9**
BHP-103C	Refer Plate-1 for location		8.00	0-10	3.17	2.0000	7.62E-05	**6.6**
BHP-103B	Refer Plate-1 for location		8.00	10-20	3.17	12.3000	4.68E-04	**40.5**
BHP-103A	Refer Plate-1 for location		8.00	20-30	3.17	16.4000	6.25E-04	**54.0**