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SUSITNA HYDROELECTRIC PROJECT

1980 - 81 GEOTECHNICAL REPORT

VOLUME 2
APPENDIX A-F
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VOLUME 2

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APPENDIX

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APPENDIX A
SELECTED BIBLIOGRAPHY OF PREVIOUS INVESTIGATIONS

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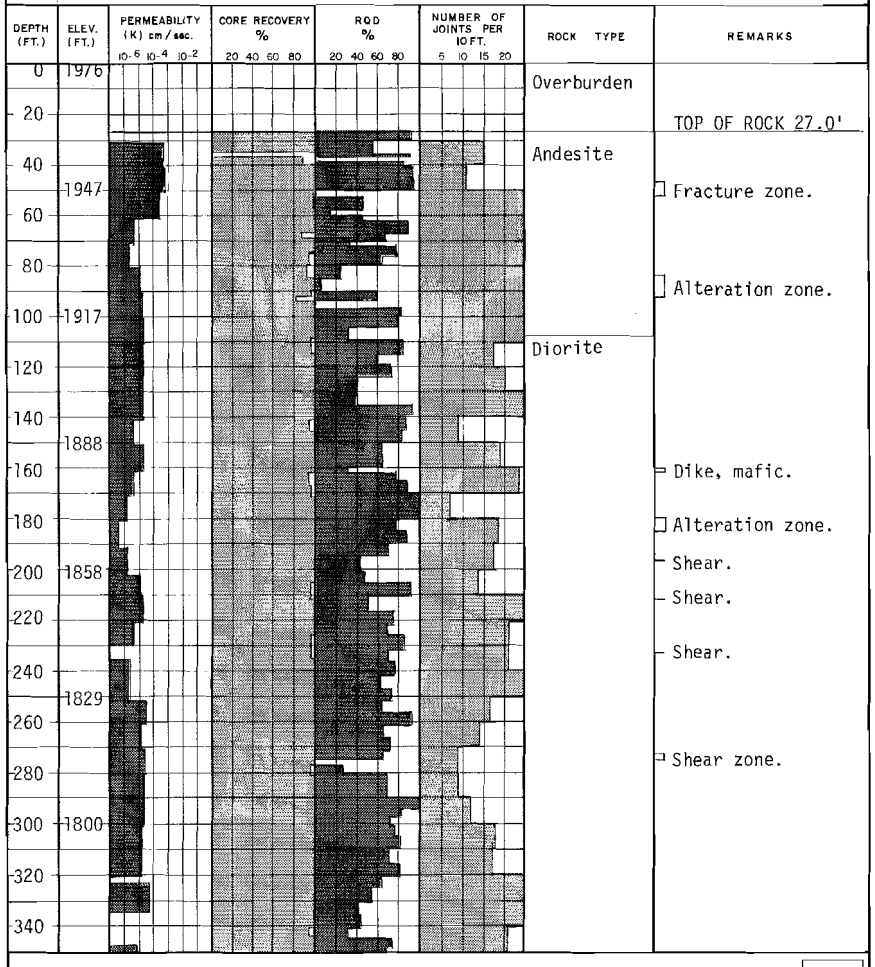
APPENDIX B
WATANA DIAMOND CORE DRILLING LOGS

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana (South Bank)

Job No. P5700.05
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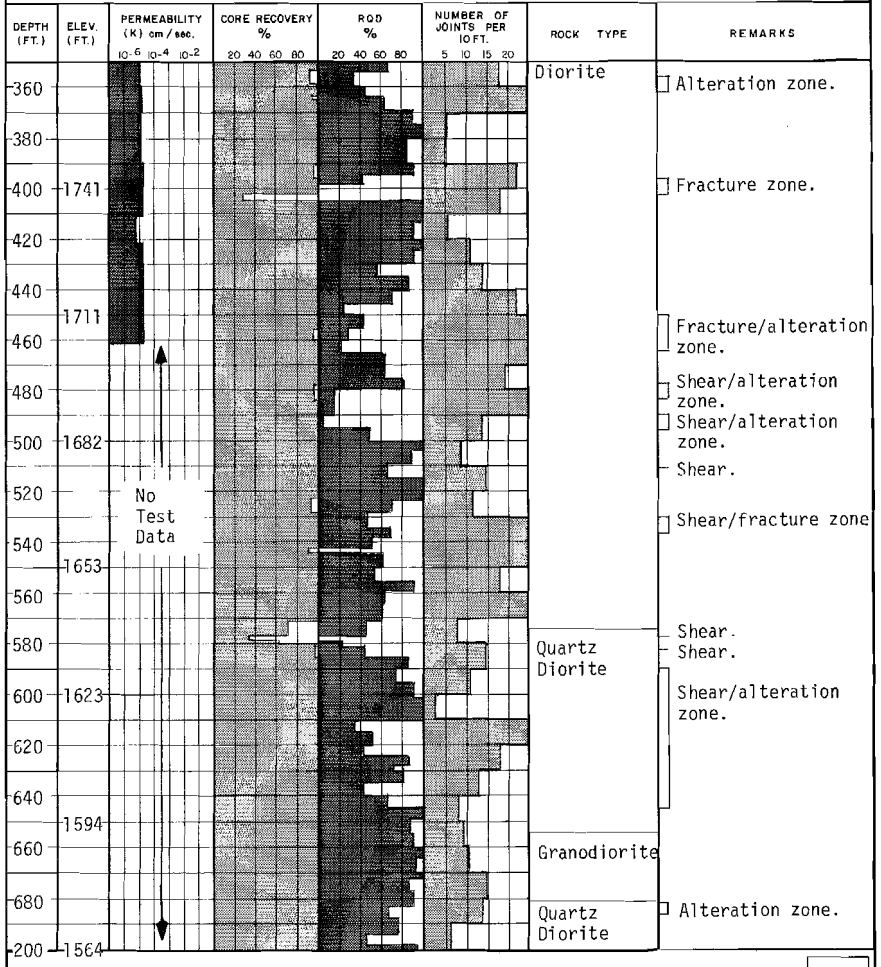
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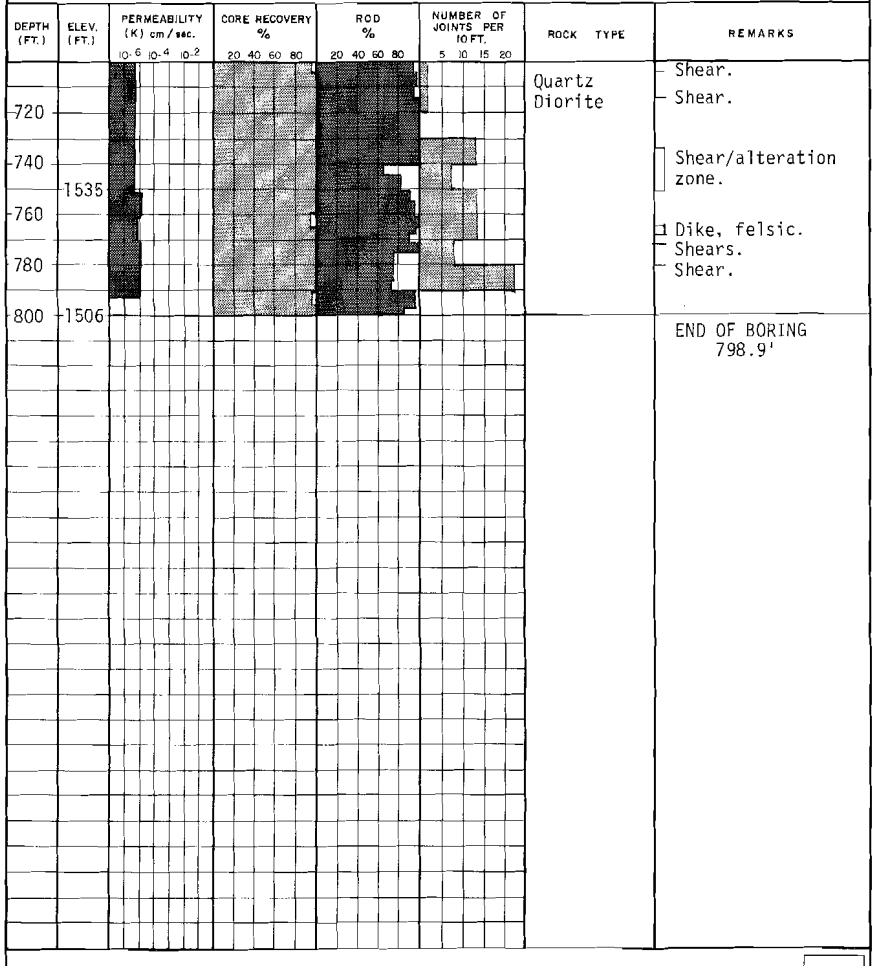


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SUMMARY LOG

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Project Susitna Hydroelectric Project
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DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT 5 10 15 20	ROCK TYPE	REMARKS
0	1459					Overburden	
20							
40							TOP OF ROCK 43.8'
	1409					Quartz Diorite	Shear, breccia.
60							
80							
100	1359						Shear, fracture, alteration zone.
120							Dike, andesite.
140	1319						END OF BORING 122.8'

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.01
Hole No. COE DH-3
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DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1458					Overburden	
20							
40							
	1408						TOP OF ROCK 77.6'
60							
80						Quartz Diorite	
100	1358						
120							
140							
160							
180	1278						END OF BORING 174.5'

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.05
Hole No. COE DH-4
Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10-6 10-4 10-2	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1461					Overburden	
20							
40							
	1411						TOP OF ROCK 70.0'
60							
80						Quartz Diorite	
100	1361						Core loss 4.3'.
120							
							END OF BORING 122.9'
140							

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.05
Hole No. COE DH-5
Sheet No. 1 of 1

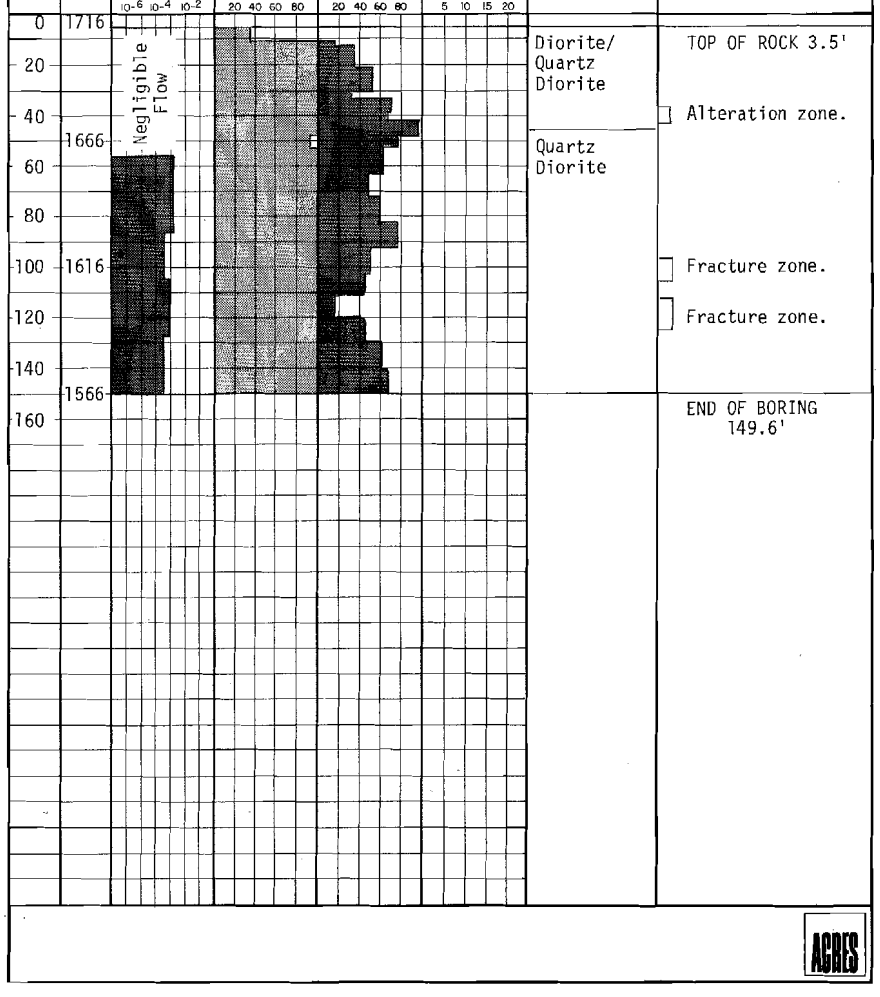
DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10-6 10-4 10-2	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1461					Overburden	
20							
40							
	1411						TOP OF ROCK 59.6'
60						Quartz Diorite/ Grano-diorite	Andesite porphyry(?)
80							
100	1361						Alteration zone.
120							
140	1311						
160							
180							END OF BORING 176.9'

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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** COE DH-6
Site Watana — **Sheet No.** 1 of 1

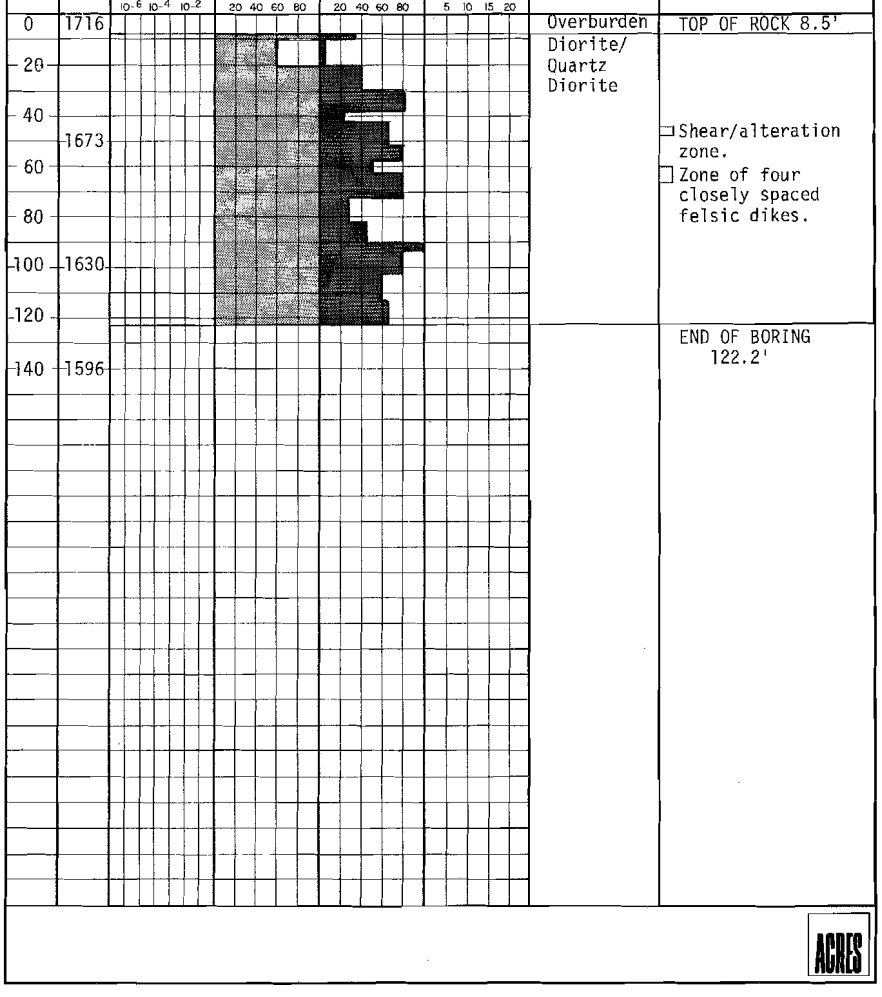


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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** COE DH-7
Site Watana — **Sheet No.** 1 of 1



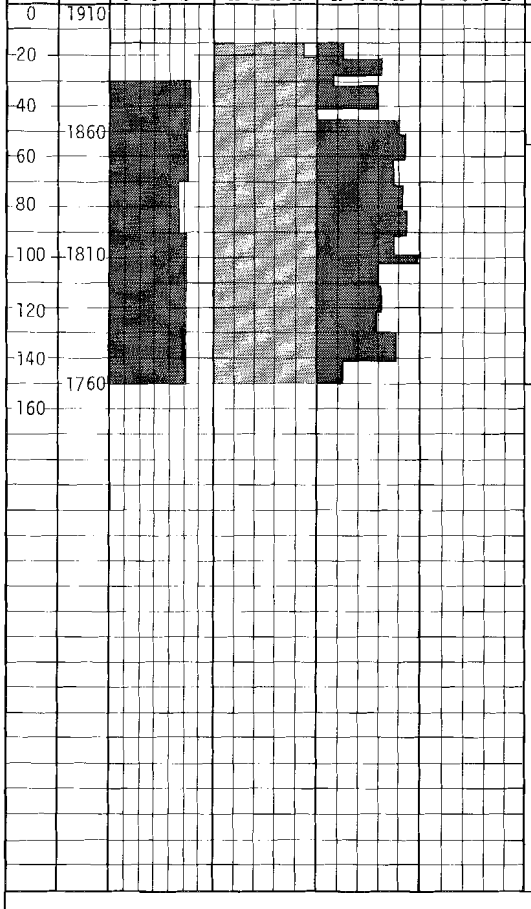
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.05
Hole No. COE DH-8
Sheet No. 1 of 1



ROCK TYPE	REMARKS
Overburden	TOP OR ROCK 16.2'
Quartz Diorite	Breccia healed quartz diorite in andesite matrix.
Diorite	Series of shear zones, (3) 0.5" each.
	END OF BORING 150.0'

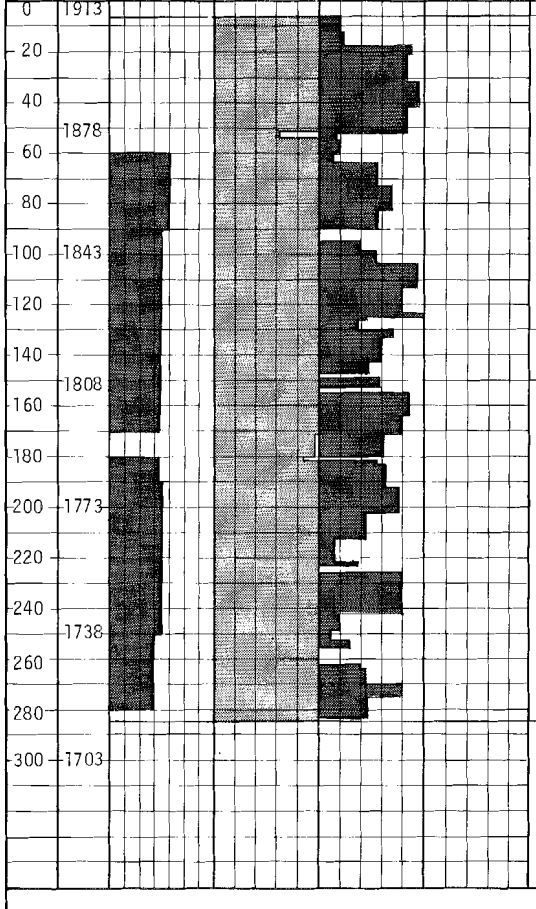
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.05
Hole No. COE DH-9
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ROCK TYPE	REMARKS
Quartz Diorite	TOP OF ROCK 5.6' Breccia, healed with green igneous rock.
	Fracture zone.
	Shear/fracture zone.
	Andesite dike.
Felsic Dike	
Diorite	
	Fracture zone.
	END OF BORING 284.2'

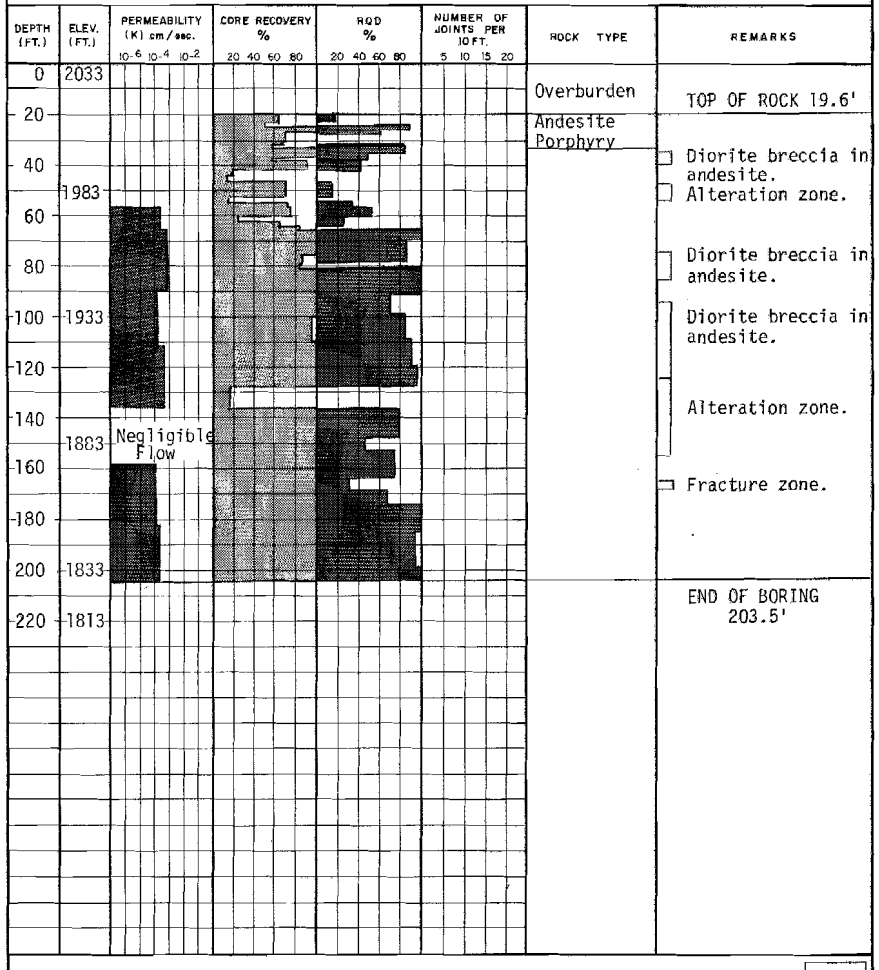
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.05
Hole No. COE DH-10
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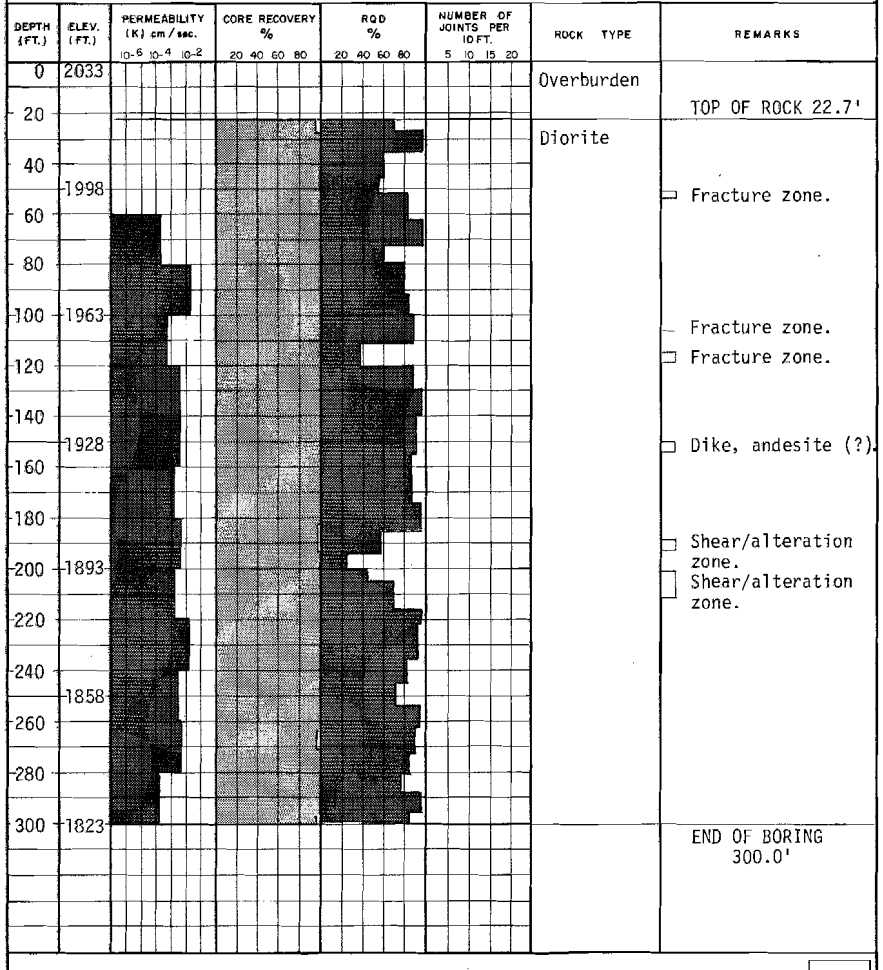


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Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

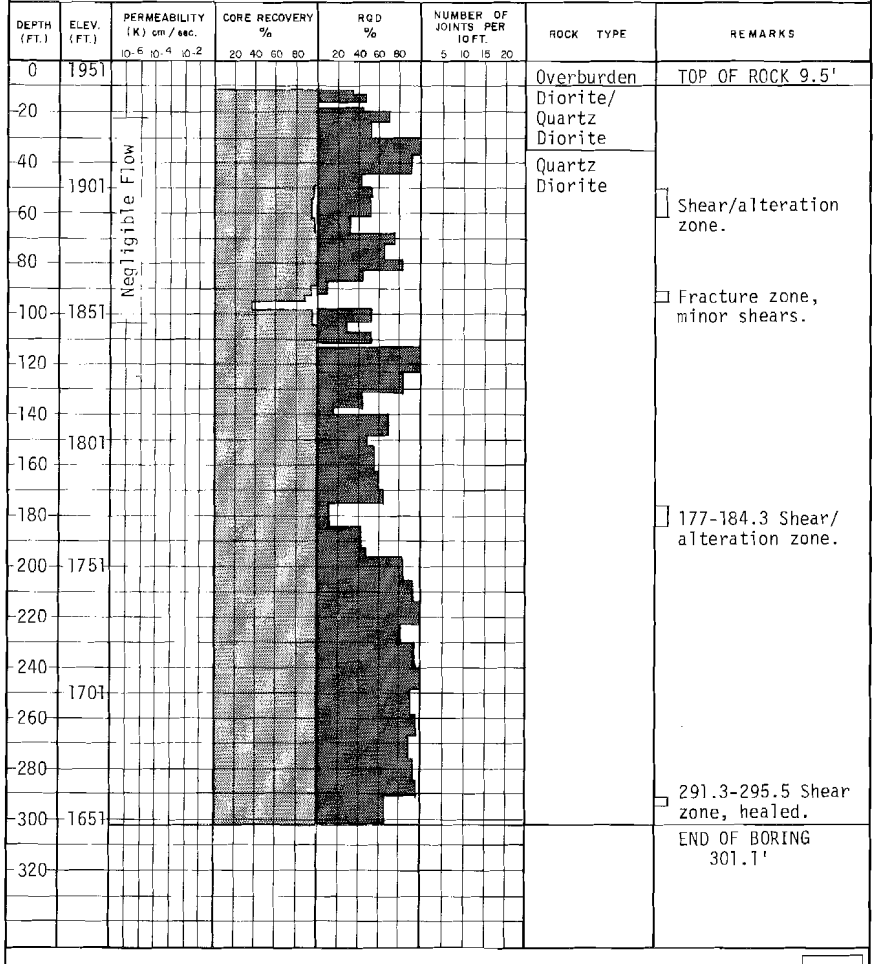
Job No. P5700.05
Hole No. COE DH-11
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SUMMARY LOG

Client ALASKA POWER AUTHORITY **Job No.** P5700.05
Project Susitna Hydroelectric Project **Hole No.** COE DH-12
Site Watana **Sheet No.** 1 of 1

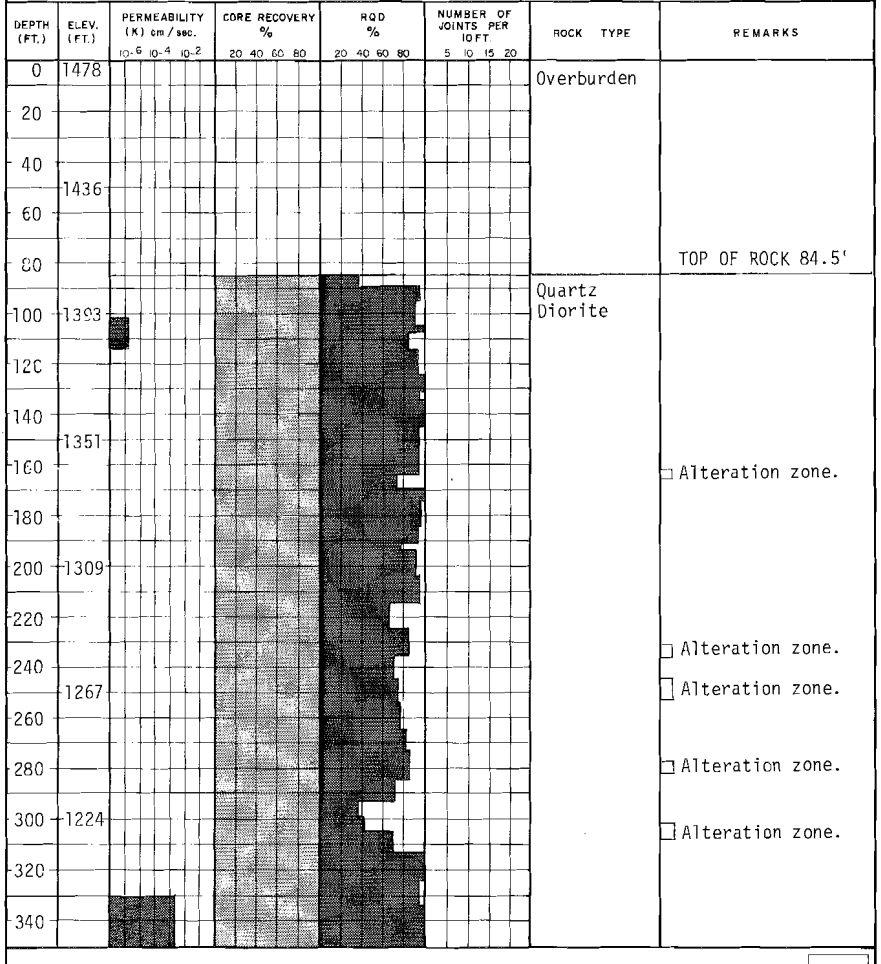


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SUMMARY LOG

Client ALASKA POWER AUTHORITY **Job No.** P5700.05
Project Susitna Hydroelectric Project **Hole No.** COE DH-21
Site Watana **Sheet No.** 1 of 2



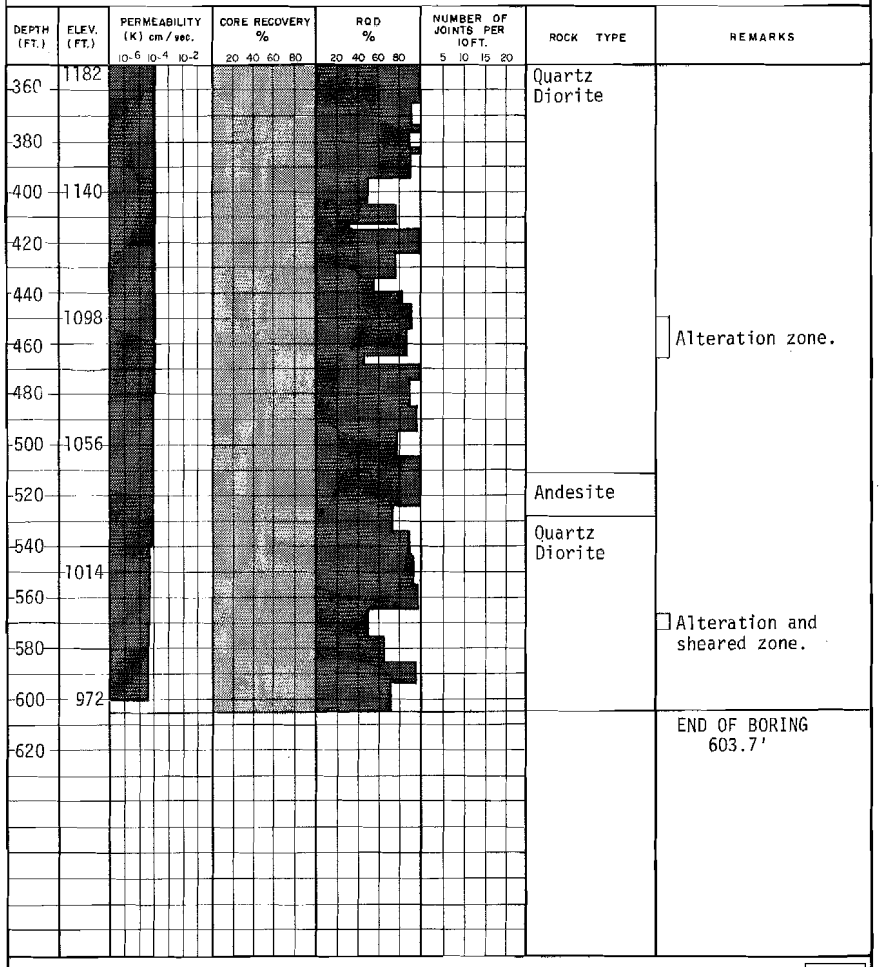
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.05
Hole No. COE DH-21
Sheet No. 2 of 2

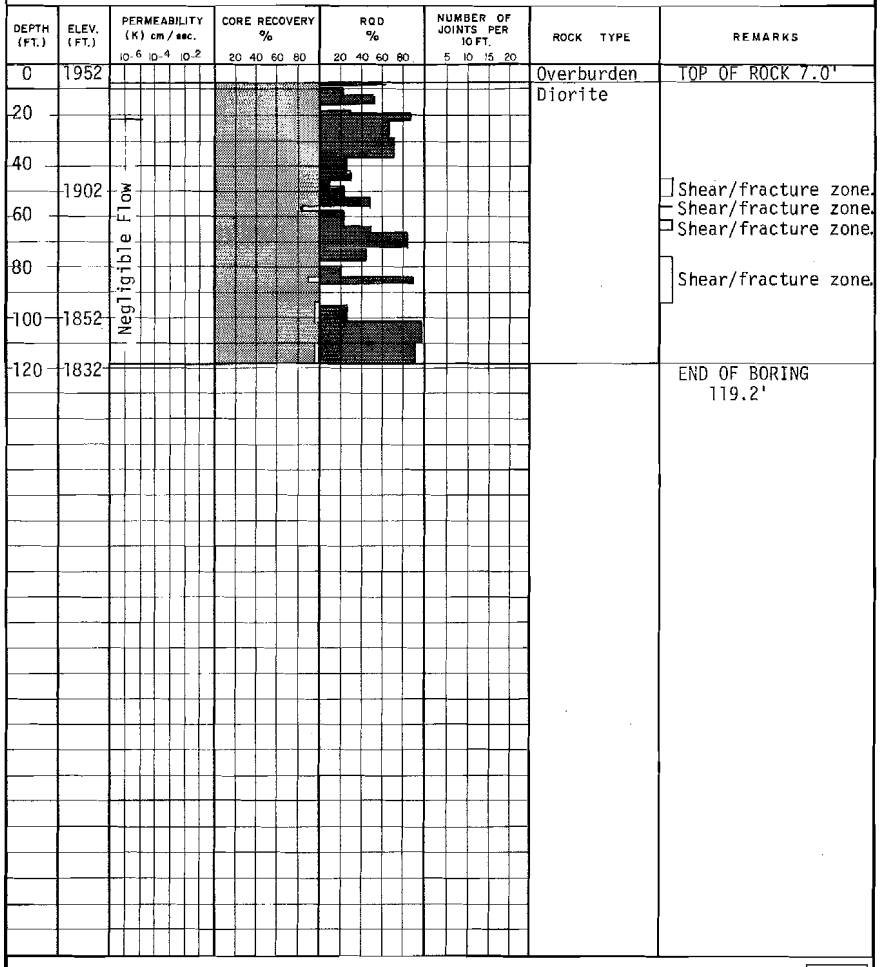


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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

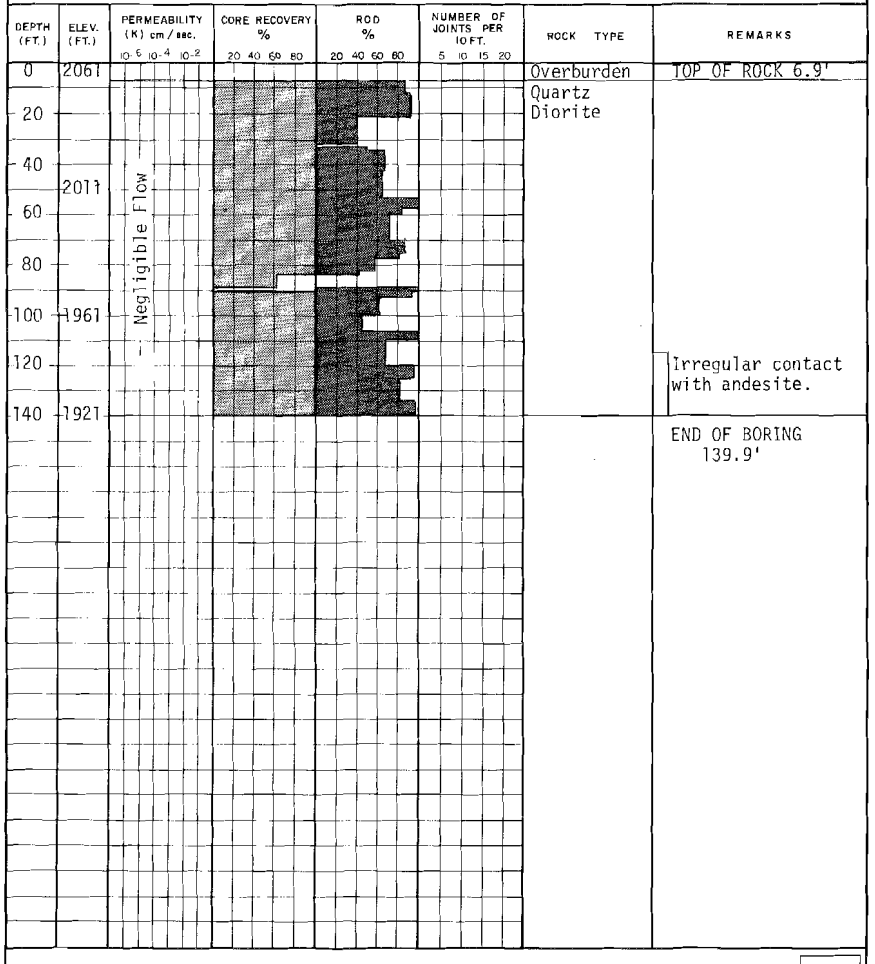
Job No. P5700.05
Hole No. COE DH-23
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SUMMARY LOG

Client ALASKA POWER AUTHORITY **Job No.** P5700.05
Project Susitna Hydroelectric Project **Hole No.** COE DH-24
Site Watana **Sheet No.** 1 of 1

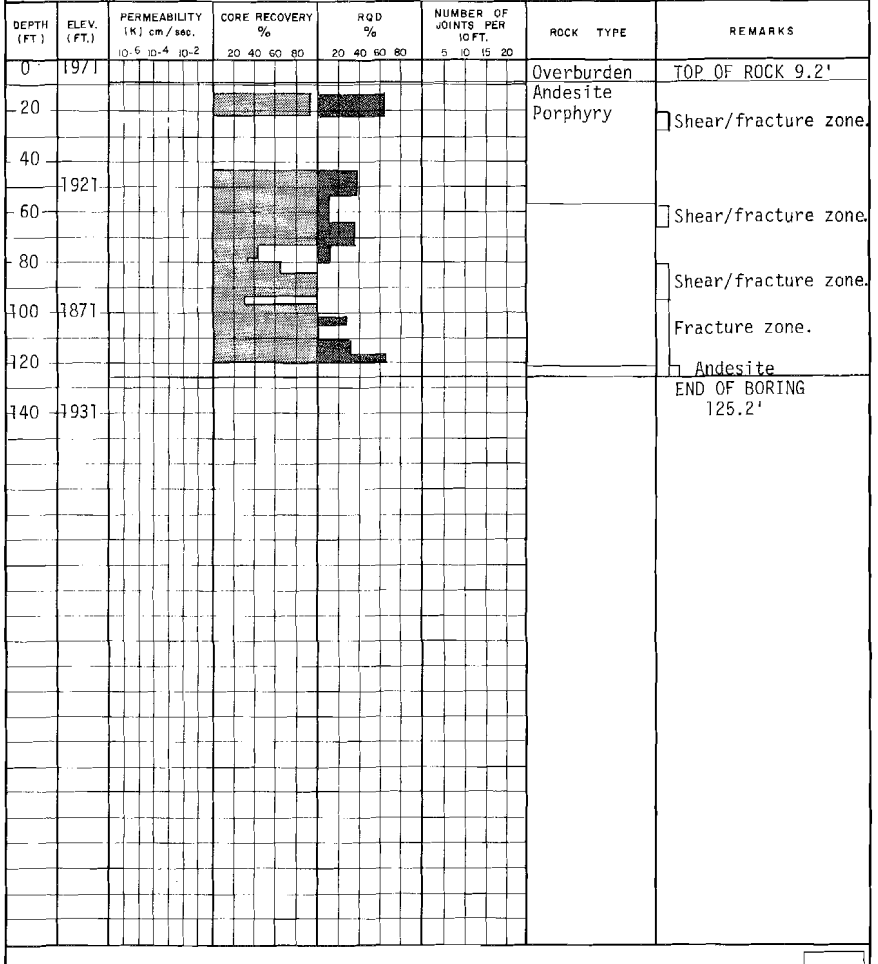


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SUMMARY LOG

Client ALASKA POWER AUTHORITY **Job No.** P5700.05
Project Susitna Hydroelectric Project **Hole No.** COE DH-28
Site Watana **Sheet No.** 1 of 1



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ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-1

SITE: Watana (North Bank) — SHEET NO. 1 OF 10

CONTRACTOR: Interstate Exploration Inc. — DRILLING DATES: August 10 TO August 14, 1981
LOGGED BY: R.R. Henschel — DATE: September 1981

DRILLING METHOD: SOIL: Casing Advancer — CASING DIAMETER: NW (3.0") I.D.
ROCK: Diamond Core - Triple Tube — CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,227,942 — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E743,085 — GROUND SURFACE 2049.7
AZIMUTH 030° — ROCK SURFACE 2032.1
DIP 70° — BOTTOM OF HOLE 1767.9
WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0	Overburden			
10 (9.4)				
18.7 (17.6)		TOP OF ROCK		
20 (18.8)	Quartz Diorite	Medium gray to medium green-gray, medium grained crystalline rock, non-foliated with 10-15% mafics (biotite/hornblende), 10-15%	Run 1 18.7-21.0	100 (87)

APPROVED: [signature] DATE: February 1, 1982

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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Watana (North Bank) — SHEET NO. 2 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	quartz. Fresh to slightly weathered, generally hard to very hard. Joints very close to wide, fresh to slightly weathered with iron oxide staining on surfaces. Carbonate and sulphides common as coating on joints and fractures.	Run 2 21.0 to 26.0	96 (54)
		18.7-41.1 - Slightly weathered with iron oxide staining along joint surfaces. No penetrative weathering. Joints closely spaced.		
		21.2-22.8 - Fracture zones, very close spaced fractures and joints healed with carbonate and iron oxide. Some open fractures very close to close spaced at 0-10°, 20°, and 70°.	Run 3 26.0 to 31.0	92 (74)
30 (28.2)		21.5-21.9 - Core broken by drilling, slickensides on some fragments.		
			Run 4 31.0 to 36.0	94 (88)
		36.95-40.0 - Shear/fracture zone, joints and fractures very close to closely spaced. numerous healed fractures throughout.		
		37.1 - Possible shear, with 0.25 inch layer of clay and rock fragments at 40°.	Run 5 36.0 to 41.0	92 (56)
40 (37.6)		37.4-38.3 - Core broken by drilling, fragments 0.25 to 1.0 inch, average less than 0.50 inch. Core loss of 0.6 feet between 37.4 and 40.6.		
		38.8-39.4 - Shear, 10°, rough, plane with slickensides, chlorite coated, tight. Sulphide mineralization in surrounding rock.	Run 6 41.0 to 46.0	100 (90)
		39.5-39.6 - Shear, 40°, very tight, healed.		
		39.4-40.0 - Some minor hydrothermal alteration with feldspars altering to clay.	Run 7 46.0 to 51.0	100 (86)
		41.1-46.5 - Joints close to moderately closely spaced.		
50 (47.0)		49.4-63.9 - Joints closely spaced.		

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BUFFALO, NEW YORK

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Watana (North Bank) — SHEET NO. 3 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Quartz Diorite		Run 8 51.0 to 56.1	100 (76)
		57.9-59.5 - Felsic dike, light gray, no mafics, very hard.	Run 9 56.1 to 61.0	100 (92)
60 (56.4)		62.2-63.8 - Alteration zone, slightly to moderately hydrothermally altered, core slightly pitted, several healed fractures. Sulphide mineralization on fracture surfaces.	Run 10 61.0 to 66.0	100 (80)
		62.45 - Fracture, 70°-90°, friable on surfaces, clayey.		
		62.75 - Possible shear, 40°-50°, less than 0.12 inches wide, clay filling.	Run 11 66.0 to 71.2	100 (90)
		63.9-87.9 - Joints close to moderately closely spaced.		
70 (65.8)		68.9-87.9 - Joints close to moderately closely spaced.		
		68.0-70.0 - Sulphides along most joints.	Run 12 71.2 to 76.2	100 (94)
		75.9-76.1 - Joints at 50° and 15°, respectively with clay coating, sulphide mineralization.		
		63.2-77.4 - Core is more highly broken mostly by drilling, very close to closely spaced throughout.	Run 13 76.2 to 81.1	100 (88)
80 (75.2)			Run 14 81.1 to 86.2	100 (94)

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BUFFALO, NEW YORK

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Watana (North Bank) — SHEET NO. 4 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Quartz Diorite	86.3-96.5 - Healed breccia, quartz diorite fragments in a fine grained quartz diorite matrix with some minor hydrothermal alteration along joints.	Run 14	
		86.3-86.9 - Mineralized vein, less than 0.25 inch at 86.65, possible shear.	Run 15 86.2 to 91.2	100 (88)
90 (84.6)		89.1-93.1 - Joints very close to close spaced.		
		93.1-96.5 - Fracture/alteration zone, light gray, moderately hydrothermal altered, joints very close to close spaced, moderately hard to hard, friable locally.	Run 16 91.2 to 96.2	90 (62)
		91.2-181.0 - Drilling water return generally less than 50%.		
		94.2-96.2 - Core loss 1.2 feet.	Run 17 96.2 to 101.2	76 (68)
		96.5-99.4 - Occasional healed fractures.		
100 (94.0)		99.4-101.2 - Healed breccia, hard.		
		100.15-101.2 - Core loss 1.05 feet. Some clay at 100.15.		
		101.2-117.2 - Healed breccia, irregular fragments of quartz diorite in a medium green-gray, very fine grained quartz diorite matrix, hard to very hard. Some quartz healed fractures. Minor hydrothermal alteration locally, numerous quartz stringers and pods.	Run 18 101.2 to 103.9	100 (44)
			Run 19 103.9 to 107.0	100 (97)
			Run 20 107.0 to 111.2	98 (86)
110 (103.4)			Run 21 111.2 to 116.3	100 (100)
		115.0-125.0 - Core medium to dark gray, gray-green and light gray due to variation in mafic minerals.		

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Watana (North Bank) — SHEET NO. 5 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 22 116.3 to 121.2	100 (100)
120 (112.8)		120.4-135.0 - Joints close to moderately close.		
		123.5-123.75 - Alteration zone, slightly bleached, slightly hydrothermally altered. Two joints at 30° and 50° with some clay/carbonate coating, slightly friable.	Run 23 121.2 to 126.1	100 (96)
		125.0-125.8 - Healed breccia, quartz diorite fragments in fine grained quartz diorite matrix.		
		126.1-127.3 - Alteration zone, slightly bleached, hydrothermally altered and mineralized band, sulphide healed fractures, tight, hard.	Run 24 126.1 to 131.0	100 (100)
130 (122.2)				
			Run 25 131.0 to 136.0	98 (98)
		135.8-174.2 - Core becoming more fractured. Joints generally very close to close spaced, some drilling induced. Contains a few healed fractures.		
			Run 26 136.0 to 141.0	100 (80)
140 (131.6)				
			Run 27 141.0 to 145.5	100 (100)
		145.5-146.45 - Felsic dike, light gray, fine grained, less than 5% mafic minerals, hard.		
		148.7-148.9 - Joints at 20° and 30°, respectively, clayey material containing some rock fragments. Probably shear plane, no slickensides.	Run 28 145.5 to 149.7	100 (76)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Watana (North Bank) — SHEET NO. 6 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite			
150 (141.0)		150.7-158.4 - Numerous fractures, joints closely spaced at 10°-20° to core axis, some broken by drilling, planar. Healed with carbonate and chlorite. Core loss 1.2 feet.	Run 29 149.7 to 155.9	81 (53)
			Run 30 155.9 to 161.0	76 (55)
160 (150.4)		159.7-174.2 - Shear/alteration zone, moderately to completely hydrothermally altered with localized shearing.		
		159.7-165.4 - Alteration zone, severely to completely altered, core friable, pitted, feldspars altered to clay. Very soft and plastic in upper 2.0 feet. Slickensides observed on soft clay coated remnant joint. Core loss 3.3 feet.	Run 31 161.0 to 166.0	58 (0)
		165.4-171.0 - Moderately hard to hard, bleached white, slightly friable along fractures and joints.		
		171.0-174.2 - Completely hydrothermally altered as above, friable, soft and clayey, plastic.	Run 32 166.0 to 171.0	100 (66)
170 (150.4)		173.6-174.2 - Quartz vein.		
		174.0 - Partially healed shear or breccia zone, 20° to core axis, 0.5 inch wide.	Run 33 171.0 to 176.0	76 (30)
		174.2-222.0 - Fresh and hard, joints very close to moderately close spaced.		
			Run 34 176.0 to 181.0	100 (96)
180 (169.1)				

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Watana (North Bank) — SHEET NO. 7 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 35 181.0 to 186.0	100 (100)
			Run 36 186.0 to 191.0	100 (100)
190 (178.5)			Run 37 191.0 to 196.0	100 (92)
		195.6-196.6 - Joint at 0°-10°, partially open with thin coating of carbonate and chlorite, and sand size rock fragments.	Run 38 196.0 to 199.0	93 (73)
		195.0-205.6 - Several closely spaced low angle joints 0°-15°. Most are tight with irregular surfaces, partially to completely coated with chlorite and carbonate.	Run 39 199.0- 201.0	100 (70)
200 (187.9)			Run 40 201.0 to 203.9	100 (93)
			Run 41	100 (100)
			Run 42 204.8 to 208.4	100 (64)
		207.1-207.3 - Shear, 30°, contains 0.13 inch wide brownish green calcareous clay with some small rock fragments, surrounding core hard.		
		207.6-208.3 - Shear, 10°, 0.06 inch wide, yellow-brown carbonate filling with small rock fragments. Surrounding core is hard.	Run 43 208.4 to 211.0	92 (92)
210 (197.3)			Run 44 211.0- 216.1	100 (76)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Watana (North Bank) — SHEET NO. 8 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	211.0-270.2 - Drilling water return less than 50%.	Run 44 211.0 to 216.1	100 (76)
			Run 45 216.1 to 221.0	100 (82)
220 (206.7)		222.0-224.8 - Alteration zone, moderately to severely hydrothermally altered, feldspars altered to clay. Texture intact. Very friable.	Run 46 221.0 to 226.0	100 (51)
		223.5-224.8 - Alteration zone, moderately hydrothermally altered, cut throughout by irregular fractures and joints, primarily at 0°-10° and 40°. Carbonate healed but altered by hydrothermal solution. Penetrative up to 0.06 inches around fractures. Weakened but moderately hard.	Run 47 226.0 to 231.0	100 (78)
230 (216.1)		224.8-243.0 - Joints close to moderately close spaced.	Run 48 231.0 to 236.0	100 (100)
		226.0-226.5 - Quartz vein, 0.12 inches wide at 20° to core axis, 0.75 inches wide alteration zone above it, moderately hydrothermally altered. Moderately hard.		
		226.3-227.3 - Quartz stringer, 0°-10°, 0.12 inches to 0.25 inches wide.	Run 49 236.0 to 240.9	100 (94)
		227.7-228.2 - Mafic dike, aphanitic, 20°, 0.5 inches wide, hard. Probably andesite.		
240 (225.5)		232.8 - Shear, 25°, less than 0.06 inch wide, hard, tight. Healed with carbonate.		
			Run 50 240.9 to 246.0	100 (90)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Watana (North Bank) — SHEET NO. 9 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	242.5 - Shear, 30°, less than 0.06 inch wide, possibly broken by drilling. Contains thin coating of calcareous clay material.	Run 50	
		244.5-245.4 - Felsic dike, quartz rich, less than 2% mafics, very hard. Upper and lower contacts at 40°.	Run 51 246.0 to 251.0	100 (100)
250 (234.9)		243.0-256.0 - Core is generally very hard. Cut by numerous fractures at 5°-20°, most are healed and tight, some broken by drilling. Contains thin coating of carbonate and chlorite. Fracture spacing close to moderately close spaced.	Run 52 251.0 to 256.0	100 (96)
		256.0-299.9 - Core is very hard with close to moderately close spaced joints.	Run 53 256.0 to 260.9	100 (94)
260 (244.3)			Run 54 260.9 to 265.6	100 (100)
		267.4-269.2 - Joint, 5°, healed with carbonate.	Run 55 265.6 to 270.2	100 (80)
270 (253.7)			Run 56 270.2 to 275.4	96 (96)
			Run 57	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

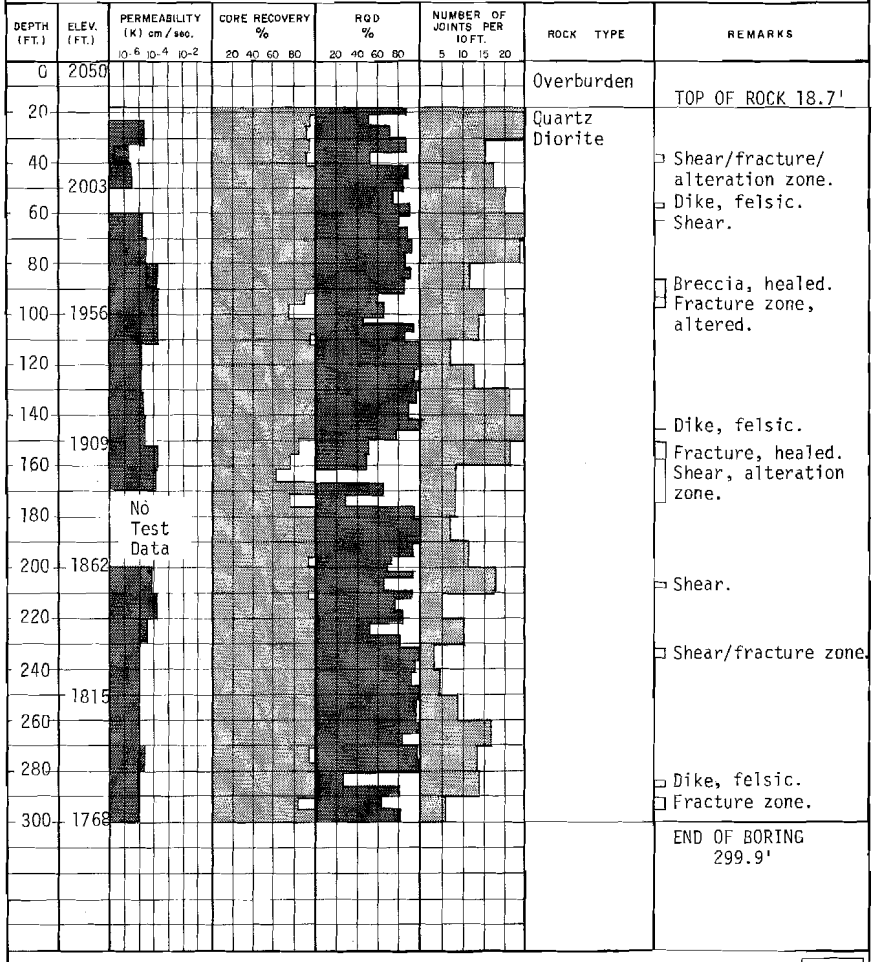
SITE Watana (North Bank) — SHEET NO. 10 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 57 275.4 to 280.4	100 (100)
280 (263.1)		282.5-284.7 - Alteration zone, severely hydrothermally altered, very soft and friable, all feldspars altered to clay, texture partially preserved.	Run 58 280.4 to 285.6	100 (25)
		282.5-283.4 - Contains a thin aphanitic dike, 0.38 inches wide, 20°, sheared and brecciated but intact.		
		284.8-287.2 - Aphanitic dike, quartz rich, less than 5% mafics, very hard. Joints close at 10° and 45°, most have carbonate coating. Numerous healed, irregular fractures throughout.	Run 59 285.6 to 289.0	100 (82)
290 (272.5)		290.2-292.0 - Fracture, 0°-5°, healed with quartz, very tight, hard.	Run 60 289.0 to 295.0	83 (58)
			Run 61 295.0 to 298.8	100 (82)
299.9 (281.8)			Run 62	100 (100)
300 (281.9)		END OF BORING		

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-1
Site Watana (North Bank) — **Sheet No.** 1 **of** 1



ACRES

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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-2

SITE: Watana (North Bank) — SHEET NO. 1 OF 13

CONTRACTOR: The Drilling Company — DRILLING DATES: July 14 TO July 27, 1980
LOGGED BY: K.J. White, M.P. Bruen — DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer; ROCK Diamond Core - Triple Tube — CASING DIAMETER: NW (3.0") I.D.; CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,227,725; DEPARTURE E742,040; AZIMUTH 043°; DIP 55° — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4; GROUND SURFACE 1838.8; ROCK SURFACE 1830.6; BOTTOM OF HOLE 1510.3; WATER TABLE 1768.8 (7-28-80)

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0	Overburden			
10 (8.2)	Andesite Porphyry	TOP OF ROCK Greenish gray to medium gray, fine grained groundmass with fine to medium grained white plagioclase phenocrysts. Flow structures. Contains inclusions of a gray-White, medium grained diorite, a green, very fine grained andesite, and possibly some argillite. Inclusions are generally less than 0.75 inches in diameter. Generally hard, fresh to slightly weathered. Joints are iron stained, some carbonate filling. Disseminated sulphides throughout.	Run 1 10.0 to 15.0	100 (46)
		10.0-23.4 - Joints closely spaced.	Run 2 15.0 to 18.7	100 (57)
20 (16.4)		15.8-16.9 - Core badly broken by drilling, angular fragments 0.5 to 1.0 inches, carbonate filling and iron oxide staining.	Run 2A Run 3	82 (45)

APPROVED: [signature] DATE: February 1, 1982

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 2 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Andesite Porphyry	15.8-16.9 - Core badly broken by drilling, angular fragments 0.5 to 1.0 inches, carbonate filling and iron oxide staining.	Run 3 19.8 to 25.0	100 (58)
		23.4-26.1 - Joints very close to closely spaced.	Run 4	100 (0)
		25.7 - Joint, 30°, trace of clay.	Run 5 25.5 to 30.5	100 (58)
		26.1-30.9 - Joints closely spaced.		
30 (24.6)		29.4 - Fracture, 50°, clay coating.	Run 6 30.5 to 35.5	98 (24)
		30.9-48.25 - Joints very close to closely spaced.	Run 7 35.5 to 40.5	100 (92)
40 (32.8)			Run 8 40.5 to 45.7	96 (53)
			Run 9 45.7 to 50.5	100 (77)
50 (41.0)		51.0 - Flow structure, 50°.	Run 10 50.5-55.7	100 (81)
		51.65-55.9 - Joints very close to moderately close spaced.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 3 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Andesite Porphyry	53.05 - Joint, 30°, less than 0.1 inch wide, rough, irregular, clay coating.	Run 10 50.5 to 55.7	100 (81)
		55.7-60.8 - Core loss 0.7 feet.		
		57.65-70.45 - Joints very close to closely spaced.	Run 11 55.7 to 60.8	100 (55)
60 (49.1)				
			Run 12 60.8-63.7	76 (38)
		64.3 - Joint, 30°, irregular, smooth, slickensides.	Run 13 63.7 to 66.9	88 (28)
			Run 14 66.9-68.9	95 (0)
		69.7-70.5 - Fracture zone, joints very closely spaced, 30° and 60° orientation. Some fractures healed, carbonate filling, some iron staining.	Run 15 68.9-71.2	100 (65)
70 (57.3)		71.2-177.1 - Shear/fracture zone, joints very closely spaced, fracture zones of gouge and breccia. Hole caving, core badly ground in places, grouted. Core loss greater than 20.6 feet.	Run 16	100 (0)
			Run 17 72.0 to 75.5	20 (0)
		71.2-79.6 - Fracture zone, joints very closely spaced at 20° to 60°, fresh to slightly weathered. Clay and carbonate filling, rounded to subangular pieces less than 0.2 feet. Core loss 5.9 feet.	Run 18 75.5-77.5	15 (0)
			Run 19 77.5 to 81.0	57 (11)
80 (65.5)		80.8-81.1 - Fracture zone, joints very closely spaced at 40° to 70°, iron oxide staining.		
			Run 20 81.0 to 84.5	97 (34)
			Run 21	100 (0)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 4 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Andesite Porphyry	81.9-82.3 Rubble		
		83.1-85.0 Fracture zone, joints very closely spaced at 30° to 60°, some are healed. Some iron oxide staining and carbonate filling.	Run 22 85.0 to 90.2	77 (51)
90 (73.7)		88.0-109.6 Shear/fracture zone, joints close to very close spaced at 20° to 80°, with iron oxide staining, carbonate coating and clay gouge, slickensides. Core badly broken. Core loss 11.8 feet.	Run 23 90.2-92.0	67 (0)
			Run 24 92.0 to 95.0	77 (0)
			Run 25	100 (0)
			Run 26	92 (0)
			Run 27 97.8 to 100.1	18 (0)
100 (81.9)			Run 28 100.1-101.8	29 (0)
			Run 29 101.8 to 108.0	3 (0)
		109.6-118.2 Shear/alteration zone, bleached chalky white breccia and gouge, slightly to severely altered hydrothermally throughout, soft, friable, slickensides. Thin gray clay layer at 20° to 50°. Core loss 2.2 feet.	Run 30 108.0-109.6	19 (0)
110 (90.1)			Run 31 109.6 to 115.2	75 (0)
		114.8-118.2 Slightly to moderately altered hydrothermally, bleached. Joints at 20° to 40°, healed fractures and joints throughout. Core loss 0.8 feet.		
			Run 32 115.2-118.2	73 (0)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 5 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
118.2 (96.8)	Andesite Porphyry		Run 32	73 (0)
120 (98.3)	Andesite and Diorite (Transitional Zone)	Very thin to thin layers of green, medium grained crystalline rock and greenish gray, aphanitic igneous rock. Slightly altered hydrothermally, joints very close to closely spaced, iron oxide stained, penetrative to 0.5 inch, carbonate coated, hard. 122.5-123.7 Fracture zone, broken by drilling. Core loss 0.7 feet.	Run 33 118.2 to 121.0	79 (29)
125.7 (103.0)			Run 34 121.0 to 125.7	87 (51)
	Diorite	Green, medium grained, 20-30% mafics (biotite and hornblende). Generally moderately hard, fresh to slightly altered hydrothermally. Joints very close to closely spaced, iron stained, some carbonate coating and sulfide mineralization. 125.7-128.4 Core loss 0.6 feet.	Run 35 125.7 to 128.4	78 (78)
130 (106.5)			Run 36 128.4 to 131.0	92 (46)
		134.2-135.3 Fracture zone, joints very closely spaced at 20° and 60°. 134.9-137.7 Healed breccia, 70% diorite fragments up to 2 inches in diameter in a matrix of dark green fine grained diorite. Hard, sharp contacts.	Run 37 131.0 to 134.8	89 (0)
			Run 38 134.8 to 139.8	94 (70)
140 (114.7)		139.6-141.8 Fracture zone, joints very close to closely spaced at 20° to 30°. Core loss 0.7 ft.	Run 39 139.8 to 141.9	81 (0)
		143.1-163.5 Shear/fracture zone, joints very closely spaced at 0° to 60°, some slickensides. Breccia and clay gouge, some carbonate, friable locally, pieces less than 0.1 feet. Core badly broken, core loss 10.3 feet. 144.4-148.0 Triconed, no core recovered.	Run 40 141.9 to 144.4	68 (52)
			Run 41 144.4 to 148.0	Triconed
			Run 42	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 6 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (122.9)	Diorite		Run 42 148.0-151.0	22 (0)
			Run 43 151.0 to 153.7	48 (0)
			Run 44 153.7-155.7	80 (0)
			Run 45 155.7-158.2	60 (0)
160 (131.1)			Run 46 158.2 to 160.8	46 (15)
		163.5-170.5 Joints closely spaced, iron oxide stained, carbonate filling.	Run 47 160.8-162.8	75 (0)
			Run 48 162.8 to 167.9	90 (43)
170 (139.3)			Run 49 167.9-170.5	100 (88)
		170.5-172.3 Fracture/alteration zone, slightly to moderately altered hydrothermally, joints very closely spaced at 0°-10°, friable, core badly broken. Feldspars altering to clay. Core loss 0.8 ft.	Run 50 170.5 to 175.8	94 (42)
			Run 51 175.8-177.0	67 (0)
180 (147.4)			Run 52 177.0 to 181.0	90 (73)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 7 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	177.1-197.3 Diorite is generally hard to very hard. Joints are moderately close spaced.	Run 53 181.0-182.8	100 (100)
		179.65-179.8 Aplitic dike, gray-white, fine grained, less than 10% mafics. Welded sharp contacts, oriented at 40°.	Run 54 182.8 to 186.7	100 (100)
		186.5-187.1, 191.2-191.7 Aplitic dikes, gray-white, fine grained, less than 10% mafics. Unfractured, welded contacts at 30° and 75°, sharp.	Run 55 186.7-189.0	100 (100)
190 (155.6)		191.0-196.4 Core loss 0.7 feet.	Run 56 189.0-191.0	100 (100)
			Run 57 191.0 to 196.4	80 (59)
		195.2-209.3 Shear/alteration zone, slightly altered hydrothermally, gouge material.		
		195.2-197.4 Breccia, white rock, iron oxide staining, feldspars of diorite bordering this zone are altering to clay minerals. Very soft, friable. Core loss 0.4 feet.	Run 58 196.4 to 201.0	91 (37)
200 (163.8)			Run 59 201.0 to 203.8	100 (32)
		204.6-209.2 Shear zone, joints very closely spaced, moderately intense iron oxide on 20° joints, minor chlorite with clay coating. Core badly broken throughout, core loss 0.4 ft.	Run 60 203.8 to 207.1	100 (15)
		204.6 Joint at 80°, 0.25 inches wide, gray clay		
		205.3-205.7 Breccia/gouge, core badly broken.	Run 61 207.1-209.3	91 (0)
210 (172.0)		207.1-207.4 Core broken, clay on joints. 208.3-208.5 Irregular, dicontinuous vein of carbonate with sulfide mineralization.	Run 62 209.3 to 214.4	100 (49)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 8 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	208.6-209.2 Core badly broken, fragments generally less than 1.0 in., clay on most joints, pieces of breccia and gouge.	Run 62	
		209.7-237.1 Joints generally very close to close spaced, 15° to 80°, iron oxide stained, some carbonate filling.	Run 63 214.4 to 218.5	100 (76)
		213.8-245.8 Generally hard and fresh. Joints are iron stained, some calcite filling.		
		214.4-218.5 Core loss 0.3 feet.		
220 (180.2)			Run 64 218.5 to 223.7	92 (77)
		223.2-223.6 Core loss 0.4 feet.		
			Run 65 223.7 to 228.7	100 (66)
230 (188.4)			Run 66 228.7 to 232.5	100 (68)
			Run 67 232.5 to 237.7	100 (85)
		237.1-237.7 Fracture/alteration zone, bleached, slightly altered hydrothermally, increase in sulfides near joints. Joints very close spaced at 60°-70°.		
			Run 68 237.7 to 241.9	100 (57)
240 (196.6)		241.3-262.0 Shear/alteration zone, moderately to severely altered hydrothermally, highly fractured. Breccia zone, several zones of soft, friable rock, clay gouge, polished surfaces with faint slickensides. Joints very close to close spaced at 20° and 50°, iron stained, with clay on most joints. Carbonate veins and coating.	Run 69 241.9 to 247.2	87 (0)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 9 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	247.0-248.6 Brecciated and clay gouge, irregular fractures and carbonate filling.	Run 69	
245.8 (201.3)	Andesite (?)	Light to medium green aphanitic to fine ground mass, fine and medium grained white phenocrysts of feldspar, less than 10% mafics, primarily has a porphyritic texture, Contains inclusions of the gray-white diorite and a very fine grained mafic rock. Possible flow structure. Upper contact in brecciated zone assumed to be fairly sharp. Joints very close to closely spaced, most carbonate coated, some iron oxide staining. [Note: Resembles both andesite and diorite in places due to variations in grain size.]	Run 70 247.2 to 252.2	100 (0)
250 (204.8)			Run 71 252.2 to 257.4	100 (49)
			Run 72 257.4 to 262.2	100 (28)
260 (213.0)			Run 73 262.2 to 265.0	100 (41)
			Run 74 265.0 to 269.0	100 (50)
			Run 75 269.0-271.0	100 (100)
270 (221.2)		277.7 Lower contact, oriented at 20°, sharp contact of andesite and diorite, single joint with thin clay seam. Rock is fresh and hard on both sides.	Run 76 271.0 to 276.1	100 (84)
			Run 77	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 10 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
277.8 (227.6)	Diorite	Gray-white to gray-green, medium grained rock, 20-30% mafics. Generally very hard and fresh. Joints are closely spaced, some carbonate filling, iron stained, and/or calcite filled.	Run 77 276.1 to 280.6	89 (58)
280 (229.4)			Run 78 280.6 to 285.8	96 (61)
		285.8-287.8 Fracture zone, joints very close to closely spaced, oriented at 20° to 60°, carbonate present. Hard and fresh. Core loss 0.1 ft.	Run 79 285.8-287.8	90 (0)
		288.2-289.3 Healed shear, 15°-30°, healed with dark green fine grained diorite.	Run 80 287.8 to 291.1	100 (88)
290 (237.6)		290.7-293.1 Joints very close to closely spaced, oriented at 15° to 70°. Iron staining and carbonate filling.	Run 81 291.1 to 296.1	96 (48)
			Run 82 296.1 to 301.1	100 (80)
300 (245.7)		300.9-301.2 Fracture zone, joints very closely spaced, oriented at 40° to 70°. Clay filling and chlorite coating. 301.1-306.1 Core loss 0.4 ft. 301.2-328.0 Joints close to moderately close spaced, oriented at 0° to 70° chlorite and carbonate filling. Hard and fresh.	Run 83 301.1 to 306.1	100 (62)
			Run 84 306.1-310.2	100 (90)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 11 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (253.9)	Diorite		Run 84	
			Run 85 310.2 to 315.4	92 (54)
			Run 86 315.4 to 320.4	100 (86)
320 (292.1)		321.2-321.4 Shear, breccia and gouge, clay with some carbonate filling, iron oxide staining.	Run 87 320.4 to 325.3	100 (52)
		325.1 Joint, 40°, slickensides.	Run 88 325.3-328.0	100 (63)
		328.0-335.9 Joints, close to very closely spaced generally oriented at 30° to 50°, carbonate filling.	Run 89 328.0 to 332.4	98 (43)
330 (270.3)			Run 90 332.4 to 337.5	100 (75)
		335.9-372.0 Joints close to moderately close spaced, carbonate and chlorite.	Run 91 337.5 to 341.0	97 (81)
340 (278.5)				

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Watana (North Bank) — SHEET NO. 12 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 92	63 (0)
		345.8-348.5 Alteration zone, slightly altered hydrothermally, joints have a thin clay coating/filling. Several healed fractures, moderately hard.	Run 93 341.4 to 346.6	100 (100)
350 (286.7)			Run 94 346.6 to 351.0	98 (77)
			Run 95 351.0 to 356.0	100 (88)
			Run 96 356.0 to 361.0	94 (95)
360 (294.9)		361.0-366.0 Core loss 0.8 ft. 362.0 Amount of mafics increase from 20-30% to 30-40%. 362.5-363.5 Felsic Dike, light gray, hard, unfractured, tight contact, oriented at 10°, 0.5 in. wide.	Run 97 361.0 to 366.0	90 (90)
			Run 98 366.0 to 370.6	100 (91)
370 (303.1)		370.3-381.0 Carbonate in joints.	Run 99	100 (87)

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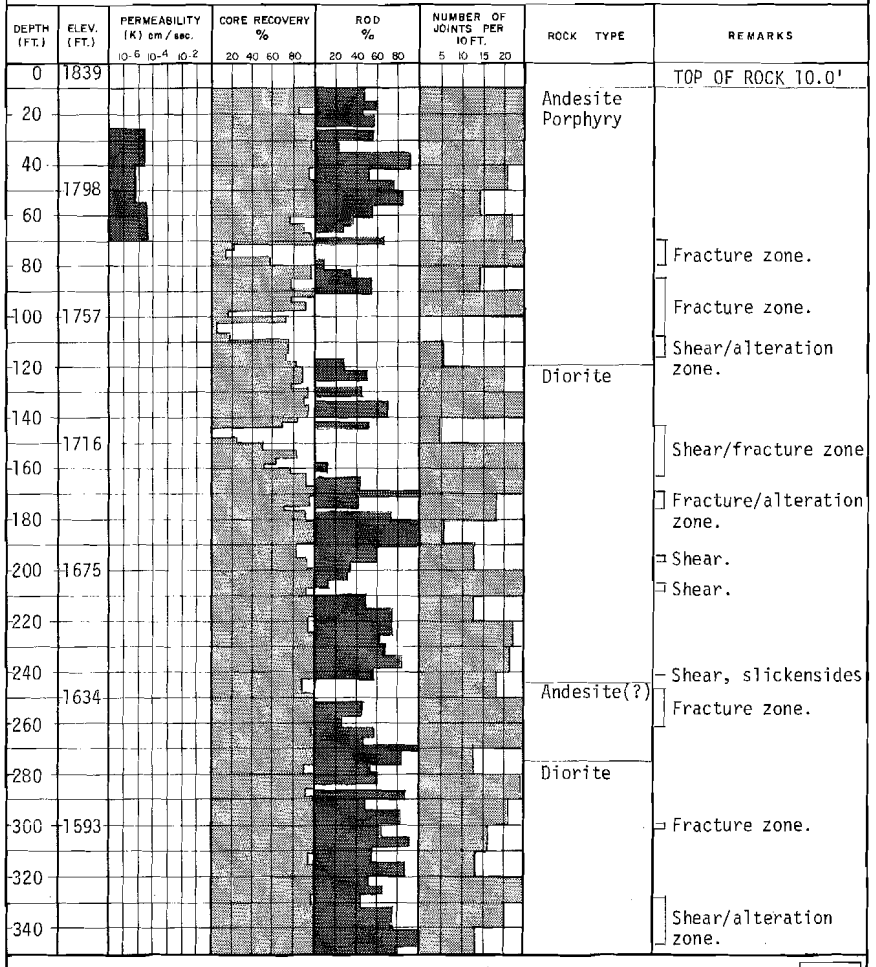
CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2
SITE Watana (North Bank) — SHEET NO. 13 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	374.1-375.0 Iron oxide staining.	Run 99 370.6 to 375.8	100 (87)
			Run 100 375.8 to 381.0	96 (67)
380 (311.3)		382.0-392.6 Shear/alteration zone, slightly to moderately altered. Joints are very close to close spaced, filled with carbonate and iron oxide staining, clay gouge, and sulfide mineralization. 382.0 Joint, oriented at 70°, 0.1 in. wide black clay layer in a carbonate vein 0.5 in. wide. 383.5 Shear, oriented at 40°, 0.5 in. wide, breccia, soft and friable. Carbonate filling with iron oxide staining. 386.2-386.8 Shear zone, chalky white clay gouge, iron oxide stained breccia. Soft, friable.	Run 101 381.0 to 386.2	96 (51)
390 (319.5)			Run 102 386.2 to 391.2	100 (87)
		392.6-401.0 Joints very close to close spaced, numerous healed joints throughout, hard.	Run 103 391.2 to 396.3	96 (59)
			Run 104 393.3- 398.8	96 (38)
400 (327.7)		END OF BORING	Run 105	100 (100)
401.0 (328.5)				

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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-2
Site Watana (North Bank) — **Sheet No.** 1 of 2

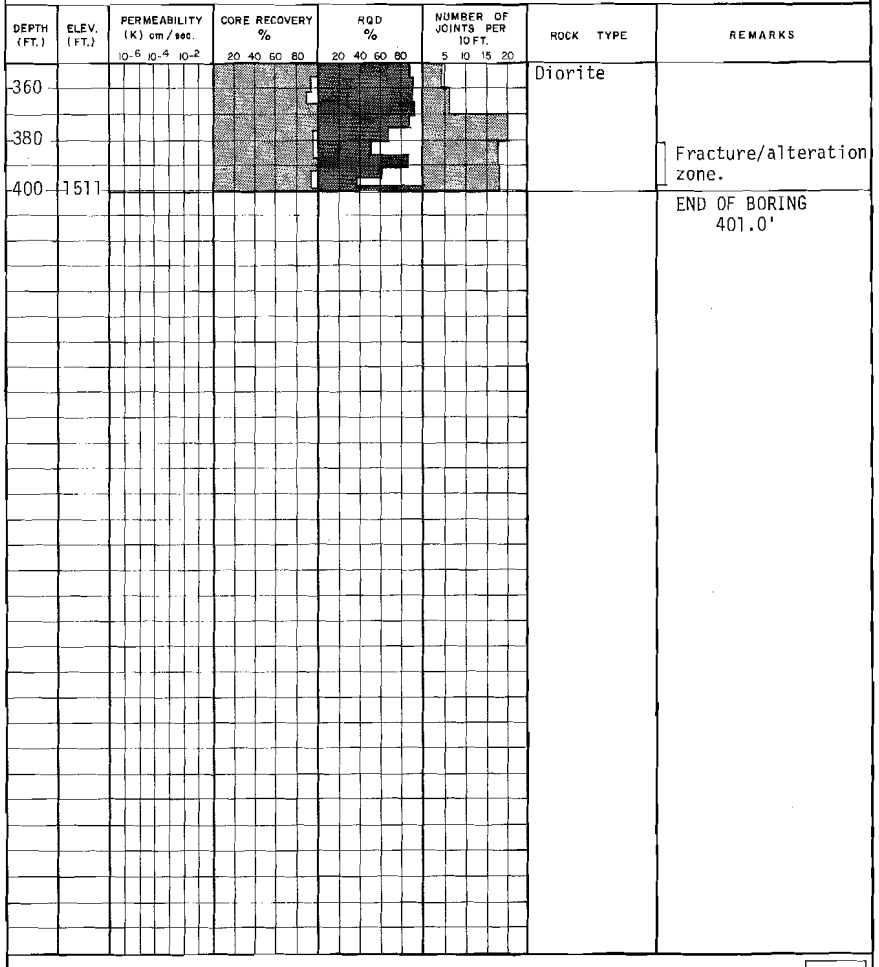


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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-2
Site Watana (North Bank) — **Sheet No.** 2 of 2



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CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-3

SITE: Watana (North Bank) — SHEET NO. 1 OF 31

CONTRACTOR: Interstate Exploration Inc. — DRILLING DATES: August 15 TO September 9, 1981
LOGGED BY: K.J. White, M.P. Bruen — DATE: September 1981

DRILLING METHOD: SOIL: Casing Advancer — CASING DIAMETER: NW (3.0") I.D.
ROCK: Diamond Core - Triple Tube — CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,228,197 — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E744,103 — GROUND SURFACE 2150.7
AZIMUTH 338° — ROCK SURFACE 2124.7
DIP 55° — BOTTOM OF HOLE 1367.8
WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0	Overburden	No samples taken.		
10 (8.2)				
20 (16.4)				

APPROVED: [signature] DATE: February 1, 1982

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 2 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
30 (24.6)	Overburden	TOP OF ROCK		
31.7 (26.0)	Diorite	Medium gray-green, medium grained, less than 5% quartz. Joints generally close to moderately closely spaced, iron oxide staining near surface, most joints carbonate coated. Fresh, very hard to hard. 31.8-46.4 Joints close to very closely spaced. Iron oxide staining on 30-40% of joints, trace to coating of carbonate. 36.7 Felsic dike, light gray, fine to medium grained, 10-20% quartz, less than 5% mafics, 0.5 in. to 1.5 in. wide. Tight contacts, hard, oriented at 90°.	Run 1 31.7 to 36.7	100 (44)
			Run 2 36.7 to 40.7	100 (40)
40 (32.8)		41.8-42.2 Core broken by drilling, pieces 0.5 in. to 2.0 in., iron oxide stained rock fragments. 43.4-43.7 Core broken by drilling, iron oxide staining on fragments. 44.5 Joint, 30°, 0.25 inch of carbonate filling.	Run 3 40.7 to 45.8	100 (37)
			Run 4	100 (36)
			Run 5 46.9 to 50.8	100 (97)
50 (41.0)			Run 6	100 (98)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 3 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	46.0-46.4 Shears, two along joints at 40°, approximately 0.1 foot and 0.05 feet wide, breccia and gouge.	Run 6 50.8 to 55.8	100 (98)
		46.4-111.2 Joints close to moderately closely spaced, trace to coating of carbonate and chlorite	Run 7 55.8 to 60.7	100 (92)
		46.8-48.4 Joints 20° to 30°, closely spaced, healed with carbonate.		
		49.4-50.2 Numerous irregular fractures healed with carbonate, very closely spaced.		
60 (49.1)		52.3 Felsic dike, 30°, unfractured, 0.25 inch wide, tight.	Run 8 60.7 to 65.7	100 (94)
		52.4-53.1 Fracture zone, irregular, discontinuous, healed with carbonate, very closely spaced joints.		
		53.3-58.0 Healed diorite breccia, subrounded fragments of diorite to 2 inch, healed with dark green diorite.		
		57.5-57.9 Fracture zone, fractures less than 0.1 inch wide, very closely spaced, irregular and discontinuous, healed with carbonate.	Run 9 65.7 to 70.7	100 (80)
		61.2, 64.3 Inclusion of dark green fine grained diorite, 1.0 inch and 2.0 inches respectively.		
70 (57.3)		65.9-69.9 Fractures, irregular and discontinuous, filled with carbonate, less than 0.1 inch to 0.25 inch wide, 10% of rock.	Run 10 70.7 to 75.9	98 (79)
		67.7-75.9 Healed breccia, contains fragments of diorite in the dark green, fine grained diorite. Fragments, 70-80% of rock.	Run 11 75.9 to 80.9	98 (68)
80 (65.5)			Run 12 80.9 to 85.9	98 (84)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 4 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	69.2 Inclusion of dark green, fine grained diorite.	Run 12	
		69.5-72.8 Occasional patches of red stain, irregular and discontinuous.	Run 13 85.9 to 90.8	100 (98)
		79.6-79.8 Core broken by drilling, pieces 1.0 inch to 2.0 inches.		
		80.8-80.9 Red staining on the core.		
90 (73.7)		81.3-82.3 Joints, 20°-30°, possibly open, iron oxide staining and carbonate coating.		
		81.3-87.0 Diorite breccia, healed, hard.	Run 14 90.8 to 95.8	100 (84)
		85.7-93.8 Joints/fractures, closely spaced, up to 2.0 inches wide, healed with carbonate.		
		94.1-95.1 Pods of felsic rock, light gray, fine to medium grained, some have quartz centers, up to 0.5 inches wide. Less than 5% of rock.	Run 15 95.8 to 100.8	100 (100)
100 (81.9)		96.6-98.5 Joints, very close to closely spaced, healed with carbonate.		
			Run 16 100.8 to 106.0	100 (100)
		106.4-106.7 Red stain in core, covering 70% of zone.		
			Run 17 106.0 to 110.7	100 (100)
110 (90.1)		111.2-190.7 Joints moderately closely spaced, with zones of closely, spaced joints.		
		111.6-132.0 Diorite breccia, rounded to subangular rock fragments to 1.0 inch, 60-70% of rock, in a dark green diorite matrix. Hard.	Run 18 110.7 to 115.9	100 (100)
			Run 19	

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 5 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	116.7-126.7 Joints, close to moderately closely spaced, healed with carbonate up to 0.25 inch wide, irregular and discontinuous.	Run 19 115.9 to 120.7	100 (100)
120 (98.3)			Run 20 120.7 to 125.7	100 (100)
		127.0-133.6 Shear/alteration zone, bleached to a light green, slightly altered hydrothermally, hard.	Run 21 125.7 to 130.7	100 (100)
		127.7 Shear, 15°, slickensides on carbonate, trace amounts of gouge.		
130 (106.5)		128.9-135.7 Fracture zone, healed with carbonate, closely spaced up to 0.5 inch but generally less than 0.1 inch.	Run 22 130.7 to 135.7	100 (100)
		135.7-138.3 Shear/alteration zone, slightly to moderately altered hydrothermally, oriented along healed shear to 10°. Feldspars breaking down to clay, approximately 1.0 inch wide. Moderately hard to soft. Core badly broken by drilling.	Run 23 135.7 to 140.7	98 (50)
140 (114.7)		137.9-138.3 Silty-sand coating, possible gouge.		
		140.2-143.4 Fracture zone, closely spaced, irregular, and discontinuous joints healed with carbonate filling less than 0.1 inch wide.	Run 24 140.7 to 145.8	100 (100)
		146.0-149.0 Joints healed with carbonate.		
		149.0-152.0 Alteration zone, slightly altered hydrothermally, feldspars altering to clay, hard.	Run 25 145.8 to 150.7	100 (100)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 6 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (122.9)	Diorite		Run 25	100 (100)
		153.0, 154.0 Felsic dikes, light gray and light red-gray, 10° and 15°, respectively, 0.5 inch wide. Second dike is offset 0.25 inch along a joint at 50°, healed with carbonate, hard.	Run 26 150.7 to 155.7	100 (100)
		153.9 Felsic dike, light red-gray, fine grained, at 10°. Truncated by shear at 30°, healed with dark green igneous material and carbonate, with offset greater than 2.0 inches.	Run 27 155.7 to 160.7	100 (100)
160 (131.1)		156.0 Carbonate vein, possibly a healed shear at 25°, 0.25 inch thick. Carbonate is stained red.		
		157.0 Alteration zone, moderately altered hydrothermally, approximately 1.0 inch wide at 25°.	Run 28 160.7 to 165.7	100 (100)
		157.3-174.6 Healed breccia, angular fine grained fragments to 0.25 inch in an igneous groundmass, hard. Majority of fragments in breccia are dark gray to green subangular, fine grained, igneous rock.		
		165.2 Alteration zone, hydrothermally altered, 0.5 inch wide, feldspars breaking down to clay. No definitive contacts.	Run 29 165.7 to 170.7	100 (98)
170 (139.3)		Note: Zones of alteration within the healed breccia up to 6.0 inch wide, generally less than 1.0 foot to 2.0 feet apart, moderately hard. Up to 25% of feldspars altering to clay.	Run 30 170.7 to 175.7	100 (94)
		177.0, 177.2 Shear, 20°, 0.25 inch wide, healed with green igneous rock and carbonate.	Run 31 175.7 to 180.7	100 (98)
180 (147.4)				

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 7 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	178.9 Joint, 20°, possible iron oxide staining. Alteration of feldspars on either side to 0.5 inches. 180.7-190.7 Joints closely spaced, approximately 50% are carbonate healed, with chlorite coating.	Run 32 180.7 to 185.4	100 (87)
		184.4-184.7 Core is badly broken, pieces less than 0.5 inches. Friable, possible fracture zone or shear zone. 184.8 Fracture, 0°, carbonate filled, offset approximately 0.5 inches. 186.3 Joints, two, 40° and 90°, with sandy-silt coating.	Run 33 185.4 to 190.7	98 (89)
190 (155.6)		188.0-190.3 Shear/fracture zone along joint at 0° to 10°, joints very closely spaced. Approximately 0.1 to 0.25 inches of gouge, no slickensides. Some are partially healed with carbonate and chlorite.	Run 34 190.7 to 195.6	100 (100)
		190.3-191.6 Healed breccia, 50-60% rock fragments within a dark green diorite matrix, hard. 190.7-228.6 Joints moderately close to widely spaced, averaging 2-3 feet, most healed with carbonate. 190.7-195.0 Irregular patches of red stain.	Run 35 195.6 to 200.7	100 (94)
200 (163.8)		203.0-203.5 Diorite breccia, healed with carbonate.	Run 36 200.7 to 205.7	100 (100)
		206.1-206.2 Healed breccia, 70°, hard.	Run 37 205.7 to 210.7	100 (100)
210 (172.0)			Run 38	100 (100)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 8 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	214.5-215.1 Numerous fractures, irregular and discontinuous, healed with carbonate up to 0.25 inches wide.	Run 38 210.7 to 215.7	100 (100)
		218.3-219.4 Healed breccia, approximately 50-60% rock fragments to 2 inches in a fine grained diorite matrix.	Run 39 215.7 to 220.7	100 (100)
220 (180.2)			Run 40 220.7 to 225.8	100 (100)
		224.1-225.5 Fracture zone, fractures/joints very closely spaced at 0° to 20° and 50° to 70°. Healed with carbonate, tight.		
		228.6-228.8 Core broken by drilling (?), angular pieces, 0.25 to 0.5 inches, carbonate coating. 228.6-315.7 Joints moderately closely spaced (average 1.0 to 2.0 feet). Approximately 50% healed with carbonate.	Run 41 225.8 to 230.8	100 (100)
230 (188.4)		230.5 Felsic dike, fractured but tight, at 20°, 0.5 inches wide.	Run 42 230.8 to 235.9	100 (100)
		233.3 Healed shear, 10°, 1.0 inch wide breccia zone, fragments of breccia are predominately carbonate, matrix is dark green igneous material. Re-shearing along this zone, silt and clay costing.		
		236.4 Healed shear, 20°, 0.25 inches wide, hard. 239.6 Joint, 20°, trace to 0.25 inches wide, tight.	Run 43 235.9 to 240.9	100 (96)
240 (196.6)		241.3 Shear, 10°, 0.5 inches wide, healed with carbonate, tight.	Run 44 240.9 to 245.9	100 (100)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 9 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	241.8-242.2 Discoloration of feldspars, yellow stain. 243.0-243.6 Carbonate vein, 0.3 inches wide, tight. 245.4-246.4 Numerous fractures, up to 0.25 inches, healed with carbonate. Joint, 10°, 0.5 inches of carbonate filling. 247.5-250.4 Joints closely spaced. 248.0-248.6 Fracture zone, joints very closely spaced, healed with carbonate, some broken by drilling. 248.8-248.9 Core broken by drilling, pieces 0.5 to 1.0 inches. 254.6-255.1 Fracture zone, very closely spaced, joints irregular, discontinuous, healed with carbonate.	Run 44	
			Run 45 245.9 to 250.9	100 (100)
250 (204.8)			Run 46 250.9 to 255.9	100 (100)
			Run 47 255.9 to 260.9	100 (100)
260 (213.0)			Run 48 260.9 to 265.6	98 (92)
			Run 49 265.6 to 270.7	100 (100)
270 (221.2)		272.1-272.3 Numerous fractures filled with carbonate, approximately 10-20% of rock is carbonate, some is stained red. 274.1 Shear, 20°, coating of clay gouge, slickensides. 275.2 Healed breccia, 30°, approximately 1-5 inches wide, healed with carbonate.	Run 50 270.7 to 275.7	100 (92)
			Run 51	100 (94)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 10 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 51 275.7 to 280.7	100 (94)
280 (229.4)		280.8-281.2 Inclusion of dark green, fine grained diorite.	Run 52 280.7 to 285.7	100 (100)
		284.7-302.8 Alternation zone, slightly altered hydrothermally. Within the alteration zone are healed breccia zones up to 2.0 inches wide, healed with dark green igneous rock and carbonate, moderately closely spaced. Feldspars stained yellow-green, moderately hard.	Run 53 285.7 to 290.7	100 (100)
290 (237.6)			Run 54 290.7 to 295.7	100 (100)
			Run 55 295.7 to 300.7	100 (100)
300 (245.7)			Run 56 300.7 to 305.7	100 (100)
		306.4-307.0 Healed diorite breccia, hard. 307.0-307.7 Numerous joints, 20°, healed by carbonate, very closely spaced, tight.	Run 57 305.7 to 310.7	100 (100)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 11 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (253.9)	Diorite	310.6-311.5 Numerous joints healed with carbonate, oriented at 40°, irregular, discontinuous fractures filled with carbonate, generally less than 0.25 inches.	Run 57	100 (100)
			Run 58 310.7 to 315.7	100 (100)
		315.7-348.5 Joints moderately close to widely spaced, many joints healed with carbonate, average width 2 to 3 feet.	Run 59 315.7 to 320.7	100 (100)
		319.9 Healed shear, oriented at 25°, 0.5 inches wide, hard.		
320 (262.1)			Run 60 320.7 to 325.7	100 (100)
		321.7-325.4 } Healed breccia, 70-80% diorite 329.1-329.7 } fragments, hard.		
			Run 61 325.7 to 330.7	100 (100)
330 (270.3)		331.4 Healed shear, 30°, 0.5 inches wide, healed with dark green igneous material, carbonate is along contacts.	Run 62 330.7 to 335.7	100 (100)
		336.5-340.7 Joints, 10°, closely spaced, slightly to moderately altered hydrothermally, 0.5 inches wide. Healed with carbonate, yellow-orange staining (iron oxide?), moderately hard. Alteration affects 20-30% of feldspars.		
			Run 63 335.7 to 340.7	100 (100)
340 (278.5)				

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 12 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	343.2 Carbonate vein, 30°, 0.5 to 1.0 inches wide, minor vugs.	Run 64 340.7 to 345.8	100 (100)
		346.8-348.2 Joints (3), 10°, closely spaced, slightly to moderately altered hydrothermally affecting 20-30% of feldspars. Healed with carbonate, rusty-orange stained, moderately hard.	Run 65 345.8 to 350.7	100 (92)
350 (286.7)		348.5-392.3 Joints moderately close to closely spaced, most healed by carbonate, chlorite coating, average 1 to 2 feet.		
		348.5-356.4 Core broken by drilling, pieces 3 to 6 inches. 349.4 Joint, 40° silt/clay coating. 350.1 Joint, 40°, trace of silt/clay coating 353.0 Joint, 30°, slickensides on chlorite, carbonate with trace of silt and clay. Healed but broken by drilling. 356.1 Joint, 40°, coated with carbonate and sandy-silt.	Run 66 350.7 to 355.7	100 (100)
		356.6-356.75 Healed breccia, 70-80% diorite fragments, in a dark green igneous matrix, hard.	Run 67 355.7 to 360.7	100 (100)
360 (294.9)		357.4-357.5 Pods of carbonate, up to 0.75 inches long, approximately 10% of rock. 358.2-363.5 Irregular patches of red staining in core, 60-70%. 359.7-360.8 Joint, 10°, carbonate healed, tight, slightly to moderately altered hydrothermally affecting 10-20% of feldspars within 1.0 inch. Carbonate is rusty-orange stained, possible clay coating on surface.	Run 68 360.7 to 365.7	100 (100)
			Run 69 365.7 to 370.7	100 (100)
370 (303.1)			Run 70 370.7 to 375.7	100 (72)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 13 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	365.8-366.6 Fracture zone, joints and fractures healed with carbonate very closely spaced, joints at 20°. Fractures are irregular and discontinuous, tight.	Run 70 370.7 to 375.7	100 (72)
		366.8-367.1 Healed breccia, 60-70% diorite fragments, in a dark green igneous matrix, hard.	Run 71 375.7 to 380.7	100 (80)
380 (311.3)		371.2-371.8 Red staining on core. 372.2 Joint, 10°, 0.1 inch coating of carbonate, chlorite, clay. 374.3-388.7 Joints close to moderately closely spaced, averaging 0.5 to 1.5 feet. 374.6 Joint, 0° to 10°, coated with carbonate chlorite, and silt/clay, approximately 0.1 inches wide. 379.4-388.2 Alteration zone, slightly altered hydrothermally, 30-40% of feldspars show staining and beginning to alter to clay. Close to very closely spaced joints, tight, healed with carbonate, moderately hard.	Run 72 380.7 to 385.9	100 (69)
		379.5 Joint, 60°, filling of silt/clay, approximately 0.25 inches thick. 379.9 Joint, 80°, coated with silt/clay. 384.5 Joint, 35°, with faint slickensides, chlorite staining.	Run 73 385.9 to 390.7	96 (54)
390 (319.5)		384.8-385.2 Shear, 70°, predominantly a breccia with layers of gouge to 0.5 inches. Breccia/gouge partially healed with carbonate, soft. 386.2-386.4 Core broken by drilling, average 1.0 inch, pieces coated with carbonate and chlorite. 386.4 Shear, 50° with 0.1 inch of breccia. 386.5-387.0 Shear, 0° to 10°, 0.1 inch of gouge. Slickensides on chlorite, slightly to moderately altered hydrothermally, friable.	Run 74 390.7 to 394.3	100 (58)
			Run 75 394.3 to 399.3	100 (46)
		392.3-416.7 Joints, very close to closely spaced, numerous zones of core broken by drilling, averaging 0.5 to 1.0 feet. 394.7-396.3 Joints, healed with carbonate, some broken by drilling.	Run 76 399.3-400.8	100 (0)
400 (327.7)			Run 77 400.8 to 405.8	100 (74)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 14 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 77	
			Run 78 405.8 to 410.8	100 (88)
410 (335.9)		406.3-408.7 Shear and fracture zone, joints very closely spaced. 406.3 Joint, 80°, slickensides on chlorite. 407.3-407.7 Core broken by drilling, pieces 0.5 to 1.0 inches, minor slickensides. 409.1-409.5 Alteration zone, core bleached to yellow-gray, slightly to moderately altered hdyrothermally. Feldspars are stained and altering to clay. Trend is parallel to healed shear at 40°, crosscuts this zone. 414.4-424.4 Shear/alteration zone, core is bleached to light yellow-green, slightly altered hydrothermally, feldspars, stained, hard to moderately hard. 415.0 Shear, 20°, slickensides on chlorite and carbonate filling. Crosscuts 1.0 inch wide zone of very closely spaced joints healed with carbonate. 416.6 Possible shear, 30°, healed by carbonate.	Run 79 410.8 to 415.8	100 (90)
			Run 80 415.8 to 420.9	100 (94)
420 (344.0)		416.7-450.5 Joints close to moderately closely spaced, average 1.0 to 2.0 feet. Chlorite coating of carbonate. 419.7 Healed shear, 20°, up to 0.25 inch thick, healed with dark green igneous material and carbonate. 424.2 Two joints very closely spaced, 20°, slickensides on chlorite and carbonate. Rusty-orange stain on carbonate.	Run 81 420.9 to 425.8	100
			Run 82 425.8 to 430.7	100 (100)
430 (352.2)		426.7 Joint, healed, 20°, rusty-orange, less than 0.1 inches of carbonate. Alteration of feldspars to 0.25 inches on either side. 428.2 Healed joint, 30°, rusty-orange stain, slickensides on carbonate and chlorite. 431.6 Healed joint, 30°, 0.5 inches of carbonate filling, slickensides, trace of clay.	Run 83 430.7-432.4	100 (100)
			Run 84	100 (88)
		437.5 Joint, 10°, trace of silty-sand, slightly altered to 0.5 inches on either side.	Run 85 432.8 to 438.0	100 (98)

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 15 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 85	
		439.9 Joint, 15°, healed with carbonate, trace of silty-sand, broken by drilling.	Run 86 438.0 to 440.7	100 (100)
440 (360.4)			Run 87 440.7 to 445.6	100 (100)
		443.2 Joint, 20°, slickensides on chlorite.		
		447.0-447.2 Shears (2), 20° and 40°, approximately 0.3 inches of chlorite breccia, slickensides.	Run 88 445.6 to 450.6	100 (100)
		449.0-454.5 Healed diorite breccia, 80 to 90% diorite fragments, in dark green, fine grained diorite, hard.		
450 (368.6)		450.5-458.3 Joints and fractures very closely spaced, tight, less than 50% healed by carbonate.	Run 89 450.6 to 455.6	100 (100)
		457.2 Joint, 20°, slickensides on carbonate and chlorite.		
		457.8 Joint, 0°, healed with carbonate, slickensides.		
		450.5-475.9 Joints, very close to closely spaced, average 0.5 to 1.0 feet.	Run 90 455.6 to 460.7	100 (78)
		459.7-460.7 Core broken by drilling, pieces 0.5 to 1.0 inch. Most surfaces have chlorite and carbonate stain, potential fracture zone.		
460 (376.8)				
		461.5 Joint, 0° to 10°, gray-green coating, similar to clay.	Run 91 460.7 to 463.7	100 (100)
		463.5-464.1 Fracture zone, joints and fractures very closely spaced, fragments have gray-green coating, broken by drilling.	Run 92 463.7 to 468.3	100 (76)
		467.4-475.9 Shear/fracture zone, joints very closely spaced. Approximately 25% of the core is badly broken by drilling.		
			Run 93	

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PROJECT Susitna Hydroelectric — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 16 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	469.5 Fragment with faint slickensides.	Run 93	100
470 (385.0)		470.3 Joint, 0°, faint slickensides. 471.0 Shear, 10°, approximately 0.5 inches of gouge and breccia. Core is badly broken.	468.3 to 473.7	(81)
			Run 94	96
		474.1-530.0 Shear/alteration zone, core is bleached to light yellow-green to light yellow-gray, moderate hydrothermal alteration. Approximately 50% of feldspars have altered to clay. Numerous carbonate healed joints, close to very closely spaced. Moderately hard to soft, locally friable.	473.7 to 478.7	(8)
			Run 95	100
480 (393.2)			478.7 to 483.7	(0)
		483.7-486.9 Shear zone, partially healed. Breccia healed with carbonate.	Run 96 483.7 to 488.7	100 (0)
			Run 97 488.7 to 491.5	100 (0)
490 (401.4)				
			Run 98 491.5 to 496.5	100 (0)
		494.6-503.5 Shear zone, partially healed, contact at 20°. Breccia and gouge healed with carbonate.		
			Run 99 496.5 to 500.7	86 (0)
500 (409.6)			Run 100	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 17 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 100 500.7 to 503.5	71 (0)
			Run 101 503.5 to 507.0	94 (0)
			Run 102 507.0 to 510.8	100 (0)
510 (417.8)		509.7-513.8 Shear zone, partially healed. Breccia and gouge healed with carbonate. Fragments of red-gray igneous material, possibly a dike.		
			Run 103 510.8 to 515.8	100 (0)
			Run 104 515.8 to 520.8	100 (0)
520 (426.0)				
			Run 105 520.8 to 525.9	100 (0)
			Run 106 525.9 to 530.7	100 (14)
530 (434.2)		530.0-550.7 Joints close to moderate closely spaced, chlorite coating, trace to coating of carbonate.		
			Run 107	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 18 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 107 530.7 to 535.7	100 (100)
		538.3 Joint, 30°, healed with carbonate, slight to moderate alteration to 1.5 inches on either side.	Run 108 535.7 to 540.7	100 (88)
540 (442.3)		545.0-551.0 Shear/alteration zone, core is bleached to a medium yellow-green, generally slightly altered hydrothermally. Feldspars are stained, less than 10% are altered to clay. Moderately hard, coincident with a healed breccia zone.	Run 109 540.7- 541.5	100 (100)
			Run 110 541.5 to 546.4	100 (100)
		550.7-554.5 Shear/fracture zone joints very closely spaced and badly broken by drilling. Chlorite/carbonate coating on joints, carbonate stained reddish-brown in places.	Run 111 546.4 to 550.7	100 (100)
550 (450.5)		551.0 Shear zone, 10°-20°, approximately 2.0 inches of breccia, gouge. 552.0 Shear, 10°, gouge/breccia coating, slickensides.	Run 112 550.7 to 555.7	96 (24)
		555.1-563.6 Joints are moderately closely spaced.		
			Run 113 555.7 to 560.7	100 (100)
560 (458.7)		559.9-622.4 Alteration zone, bleached to a light-medium yellow-green, slightly altered hydrothermally. Feldspars are stained, but generally have not altered to clay. Seems to be a mixture of diorite, an aphanitic/fine grained dark green igneous rock, and abundant carbonate fillings in approximately 10% of rock. Hard to moderately hard, carbonate stained red in places. 559.9-600.5 Healed shear zone, coincides with altered zone.	Run 114 560.7 to 565.7	100 (78)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3
SITE Watana (North Bank) — SHEET NO. 19 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	560.9-561.0 Two shears, very closely spaced, 30°. Upper shear, 0.5 inches wide breccia zone; lower shear, coating of carbonate. 563.6-565.7 Shear/fracture zone, joints very closely spaced, some joints have a silt/clay coating, gouge(?).	Run 114	
			Run 115 565.7 to 570.7	100 (100)
570 (466.9)		597.2-600.5 Felsic dike (?), light gray, fine to medium grained. Brittle, slightly altered hydrothermally, highly fractured, numerous drilling breaks. 565.7-600.5 Joints moderately close to wide, chlorite coating, with trace to coating of carbonate.	Run 116 570.7 to 575.1	100 (100)
			Run 117 575.1 to 580.1	100 (100)
580 (475.1)		600.4-605.3 Slightly to moderately altered hydrothermally, most joints are carbonate healed. Feldspars are discolored and and beginning to alter to clay, moderately hard.	Run 118 580.1 to 585.2	100 (100)
			Run 119 585.2 to 590.3	100 (100)
590 (483.3)			Run 120 590.3 to 595.4	100 (100)
			Run 121	100 (96)

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CLIENT Alaska Power Authority — JOB NO. P5701.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3
SITE Watana (North Bank) — SHEET NO. 20 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 121 595.4 to 600.5	100 (96)
600 (491.5)		600.5-622.4 Joints close to very closely spaced, numerous joints are healed with carbonate. Tight and competent, some broken during drilling, carbonate filling averages 0.1 to 0.25 inches. Moderately spaced healed shears, tight.	Run 122 600.5 to 605.7	100 (96)
			Run 123 605.7 to 610.8	100 (98)
610 (499.7)			Run 124 610.8 to 615.8	100 (100)
			Run 125 615.8 to 620.8	100 (100)
620 (507.9)		622.4-633.0 Alteration zones, closely spaced, approximately 0.5 feet wide. Feldspars stained, hard. 622.4-754.0 Joints close to moderately closely spaced, trace of carbonate, chlorite common. Average 0.5 to 1.5 feet.	Run 126 620.8 to 625.9	100 (100)
		626.8 Carbonate vein, offset by joints at 60°, offset approximately 0.25 inches.	Run 127 625.9 to 630.7	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 21 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
630 (516.1)	Diorite		Run 127	
			Run 128 630.7 to 635.7	100 (100)
			Run 129 635.7 to 640.7	100 (86)
640 (524.3)			Run 130 640.7 to 645.7	100 (100)
			Run 131 645.7 to 650.7	100 (100)
650 (532.4)			Run 132 650.7 to 655.6	100 (100)
		657.0 Shear, 20°, up to 0.25 inches wide, healed primarily with carbonate, but also some dark green diorite. 657.0-657.8 Joints, 10°-20°, very closely spaced, 20°. Healed with carbonate, tight.	Run 133 655.6 to 660.7	100 (100)
660 (540.6)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 22 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 134 660.7 to 665.7	100 (100)
			Run 135 665.7 to 670.7	100 (98)
670 (548.8)			Run 136 670.7 to 673.8	100 (97)
			Run 137 673.8 to 678.8	100 (92)
		677.0-681.1 Joints very close to closely spaced.		
			Run 138 678.8 to 680.8	100 (45)
680 (557.0)			Run 139 680.8 to 685.7	100 (80)
		683.1 Irregular shaped inclusion of felsic material.		
			Run 140 685.7 to 690.7	100 (80)
		688.8-689.4 Fracture zone, core broken by drilling, joints very closely spaced.		
690 (565.2)			Run 141	100 (88)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 23 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	695.4-696.1 Fracture zone, joints very closely spaced at 60°.	Run 141 690.7 to 695.7	100 (88)
		697.7-698.4 Fractures very closely spaced, discontinuous, healed with carbonate. 699.8 Felsic dike, medium gray, aphanitic, highly fractured but tight, 0.3 inches wide.	Run 142 695.7 to 700.7	100 (98)
700 (573.4)		702.0-707.7 Shear/alteration zone, bleached to a medium yellow-green, generally slightly altered hydrothermally. Hard to very hard. 702.7-703.5 Felsic dike, light green-gray, fine grained, fractured but tight. At 703.0 dike has been offset along a joint at 60°, approximately 1.0 inch. 704.2-705.7 Alteration is slight to moderate, with feldspars altering to clay. Rock is soft to moderately hard, friable along shear. Shear is at 705.0 and 705.5, approximately 0.25 inches of breccia and gouge. Minor sulfide mineralization. 704.5-705.7 Core loss 0.2 feet.	Run 143 700.7 to 705.7	100 (78)
			Run 144 705.7 to 710.7	100 (100)
710 (581.6)		710.3 Felsic dike, 50°, gray-green, fine grained, unfractured, chill margins. Approximately 1.5 inches wide. 711.0 Felsic dike, 40°, gray-green, fine grained to aphanitic, fractured, chill margins tight.	Run 145 710.7 to 715.6	100 (88)
		717.2 Felsic dike, 20°, gray green, fine grained to aphanitic, slightly fractured, chill margins, 2.0 inches wide. 718.3 Joint, 10°, trace of sandy-silt. 719.0 Joint, 10°, slickensides on chlorite, coating of carbonate and chlorite gouge.	Run 146 715.6 to 719.7	100 (100)
720 (589.8)			Run 147 719.7 to 724.8	100 (96)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 24 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 148 724.8 to 730.0	100 (100)
		729.2 Joint, 10°, trace of sandy-silt.		
730 (598.0)			Run 149 730.0 to 735.0	100 (100)
			Run 150 735.0 to 740.2	100 (100)
		737.6 Healed breccia, 70-80% diorite fragments in a dark green diorite matrix. Hard, numerous irregular, discontinuous fractures filled with carbonate, up to 0.3 inches, comprise 10% of rock.		
740 (606.2)			Run 151 740.2 to 745.2	100 (100)
			Run 152 745.2 to 750.3	100 (98)
		745.7 Joint, 45°, slickensides on chlorite. 749.5 Joint, 80°, slickensides on chlorite.		
750 (614.4)			Run 153 750.3 to 755.4	100 (100)
		753.6 Shear, 10°, healed. 754.0-773.9 Shear/fracture zone, joints very closely spaced, most are tight, some carbonate healed joints. Pieces of intact core approximately 1.0 foot long, brittle.	Run 154	100 (96)

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CLIENT Alaska Power Authority — JOB NO. P5701.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3
SITE Watana (North Bank) — SHEET NO. 25 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	757.0 Joint, 30°, slickensides on chlorite. 757.2 Joint, 60°, slickensides on chlorite. 757.7 Joint, 30°, slickensides on chlorite and carbonate. 758.6 Joint, 30°, slickensides on chlorite and carbonate. 759.3 Joint, 30°, slickensides, trace of gouge. 764.3-769.3 Most joints becoming healed with carbonate, less than 0.1 inch thick. 768.0 Shear, 30°, 1.0 inches of breccia, slickensides on chlorite, talc (?).	Run 154 755.4 to 760.5	100 (96)
760 (622.6)			Run 155 760.5 to 765.5	100 (98)
			Run 156 765.5 to 770.5	100 (96)
770 (630.7)		773.9 Joint, 35°, slickensides on chlorite. 773.9-801.1 Fracture zone, joints are close to very closely spaced, some healed with carbonate, tight, pieces average generally to 1.0 foot, but are brittle.	Run 157 770.5 to 775.5	98 (70)
			Run 158 775.5 to 780.6	100 (98)
780 (638.9)			Run 159 780.6 to 785.7	100 (100)
			Run 160 785.7 to 790.8	100 (100)

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CLIENT Alaska Power Authority — JOB NO. P5710.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3
SITE Watana (North Bank) — SHEET NO. 26 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
790 (647.1)	Diorite		Run 160	100 (100)
			Run 161 790.8 to 793.5	100 (100)
			Run 162 793.5 to 798.5	100 (76)
			Run 163 798.5- 800.7	100 (100)
800 (655.3)		800.5-800.7 Alteration zone, slightly altered hydrothermally, slightly bleached. Between a set of joints very closely spaced, at 20°, carbonate healed. Approximately 10% of feldspars are altered to clay. 801.1-840.8 Joints are closely spaced, average 0.5 to 1.0 feet. Chlorite filling, trace of carbonate. 801.3 Felsic dike, light gray, fine grained, 0.5 inches wide, offset by a healed shear. 805.7-807.0 Joints, very closely spaced, tight, healed with carbonate. 806.7 Joint, 20°, slickensides on chlorite.	Run 164 800.7 to 805.7	100 (100)
			Run 165 805.7 to 810.7	100 (100)
810 (663.5)		812.5 Felsic dike or healed breccia, light gray, fine grained to aphanitic ground mass with diorite fragments. Tight contacts, 0.5 inches wide, 10°, hard.	Run 166 810.7 to 815.7	100 (100)
		817.5 Felsic dike, 15°, light gray, fine grained to aphanitic, 1.0 inch wide, margins are fine grained quartz and feldspar, with 0.5 inch zone of quartz.	Run 167 815.7 to 820.7	100 (100)
820 (671.7)				

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CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 27 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	821.4 Joint, 50°, coating of sandy-silt/clay, gouge (?).	Run 168 820.7 to 825.5	98 (96)
			Run 169 825.5 to 830.5	100 (90)
830 (679.9)		828.9-844.8 Diorite becomes light to medium green, possibly due to changing composition of feldspars, may be an increase in quartz content.		
		831.3 Felsic dike, 90°, light gray, medium grained, 1.0 inch wide. 831.3-833.6 Gradational change in texture from medium grained to fine grained. Sharp contact with the underlying medium grained diorite, unfractured.	Run 170 830.5 to 835.2	100 (100)
			Run 171 835.2 to 840.2	100 (100)
840 (688.1)		840.8-882.3 Joints close to moderately closely spaced (average 1.0 feet), chlorite, trace to occasional filling of carbonate.	Run 172 840.2 to 845.2	100 (100)
			Run 173 845.2 to 850.2	100 (100)
		847.8, 848.0 Inclusions of dark green, fine grained diorite, 1.0 inch in diameter.		
850 (696.3)			Run 174 850.2-855.0	100 (100)

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BUFFALO, NEW YORK

DRILLING REPORT

CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 28 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 174	100 (100)
			Run 175 855.0 to 858.7	100 (100)
860 (704.5)			Run 176 858.7-860.7	100 (100)
		861.3-862.0 Several inclusions of dark green, fine grained diorite, up to 0.75 inches in diameter.	Run 177 860.7 to 865.7	100 (100)
			Run 178 865.7 to 870.8	100 (100)
870 (712.7)				
		871.7, 872.0 Inclusions of dark green, fine grained diorite, 1.0 and 2.0 inches, respectively. 873.1-955.7 Diorite changes to a light gray-green. Increase in quartz, possibly up to 10%.	Run 179 870.8 to 875.7	100 (98)
		878.6 Felsic dike (?), 60°, light gray, fine grained, 2.0 inches wide, irregular contacts, hard. 879.3-882.5 Healed breccia zone.	Run 180 875.7 to 880.7	100 (100)
880 (720.9)		880.3 Shear along joint, at 15°, approximately 0.1 inch of clay/silt, carbonate; gouge (?).		
		881.6 Shear along joint, at 20°, 0.5 inches wide breccia gouge zone. Partially healed with carbonate.	Run 181 880.7 to 885.8	100 (94)

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DRILLING REPORT

CLIENT Alaska Power Authority — JOB NO. P5701.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3
SITE Watana (North Bank) — SHEET NO. 29 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	882.3-888.1 Core broken by drilling, pieces generally less than 3.0 inches. Possible fracture zone (?).	Run 181	
			Run 182 885.8 to 890.7	100 (94)
		888.1-908.0 Joints closely spaced, with local zones of very closely spaced joints. Trace to occasional filling of carbonate.		
890 (729.0)			Run 183	100 (100)
		894.5-897.4 Shear/fracture zone (?), joints and fractures close to very closely spaced.	Run 184 892.0 to 896.6	100 (74)
		894.5-895.7 Core badly broken by drilling, pieces 1.0 to 2.0 inches. Two joints at 10° have slickensides, pieces are angular, fresh to slight chlorite staining.		
		898.8-899.1 Core broken by drilling, pieces are 1.0 to 2.0 inches, fresh, angular.	Run 185 896.6 to 900.7	100 (90)
900 (737.2)				
		903.0 Joint, 10°, healed, carbonate filling to 0.5 inches.	Run 186 900.7 to 905.7	100 (80)
		903.8-904.2 Core broken by drilling, pieces 0.5 to 1.0 inch.		
		905.1-906.0 Core broken by drilling or possible fracture zone. Pieces average 1.0 inch.	Run 187 905.7 to 910.7	100 (92)
		908.0-929.5 Joints are moderately close to close, averaging 1.0 to 1.5 feet.		
910 (745.4)				
		912.6-913.1 Fracture zone, joints very closely spaced at 10°.	Run 188 910.7 to 915.7	100 (100)
			Run 189	100 (98)

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CLIENT Alaska Power Authority — JOB NO. P5710.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3
SITE Watana (North Bank) — SHEET NO. 30 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 189 915.7 to 920.7	100 (98)
920 (753.6)			Run 190 920.7 to 925.8	100 (100)
		923.5-925.1 Fracture zone, joints very closely spaced. Most are tight but have been broken by drilling.		
		926.6-928.2 Shear/alteration zone, core bleached to light yellow-green, slightly altered hydrothermally, hard to moderately hard. Upper contact is gradational, lower is sharp along a 60° carbonate healed joint.	Run 191 925.8 to 930.8	100 (92)
930 (761.8)		927.2 Shear on joint at 35°, approximately 0.5 inches of breccia gouge, slickensides.		
		928.3-928.7 Irregular fractures healed with carbonate, up to 0.3 inches, less than 5% of rock.	Run 192 930.8 to 935.9	100 (100)
		929.5-955.7 Fracture zone, joints very closely spaced, most are tight, approximately 25% healed with carbonate. Minor sulfide mineralization, unbroken pieces range from 0.5 to 3.0 feet.		
		933.2-946.5 Shear/alteration zone, bleached to light yellow-green, slightly altered hydrothermally. Feldspars are stained, hard to moderately hard.	Run 193 935.9 to 940.7	100 (100)
940 (770.0)		934.9 Shear, 40°, coating of clay gouge, coincident with a healed shear.		
		943.6 Shear, 30°, up to 0.5 inches of breccia gouge.	Run 194 940.7 to 945.8	100 (100)
		946.1 Shear, 25°, up to 0.5 inches of breccia gouge.		
			Run 195 945.8 to 950.7	100 (100)

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DRILLING REPORT

CLIENT Alaska Power Authority — JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Watana (North Bank) — SHEET NO. 31 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
950 (778.2)	Diorite	948.0-948.9 Alteration zone, slightly altered hydrothermally, approximately 10-25% of feldspars are altering to clay. Hard to moderately hard.	Run 195	100 (100)
			Run 196 950.7 to 955.7	100 (100)
955.7 (782.9)		END OF BORING		

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana (North Bank)

Job No. P5700.05
Hole No. BH-3
Sheet No. 1 of 3

DEPTH (FT.)	ELEV. (FT.)	ROCK TYPE	REMARKS
0	2151	Overburden	
20			TOP OF ROCK 31.7'
40	2111	Diorite	Shear.
60			Fracture zone, healed. Fracture zone.
80			Breccia, healed.
100	2069		
120			Breccia, healed. Shear, alteration zone.
140	2028		Alteration zone.
160			Alteration zone.
180			Shear.
200	1987		
220			Shears, healed.
240	1987		
260			
280			Alteration zone.
300	1905		
320			
340			Alteration zone.

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana (North Bank)

Job No. P5700.05
Hole No. BH-3
Sheet No. 2 of 3

DEPTH (FT.)	ELEV. (FT.)	ROCK TYPE	REMARKS
360			Joint, slickensides.
380			Shear/alteration zone.
400	1823		
420			Shear/alteration zone.
440			
460	1784		Shear/fracture zone.
480			
500	1741		Shear/alteration zone.
520			
540			
560	1700		
580			Shear/alteration zone. Shear/fracture zone.
600	1659		
620			
640			
660	1619		
680			
700	1578		

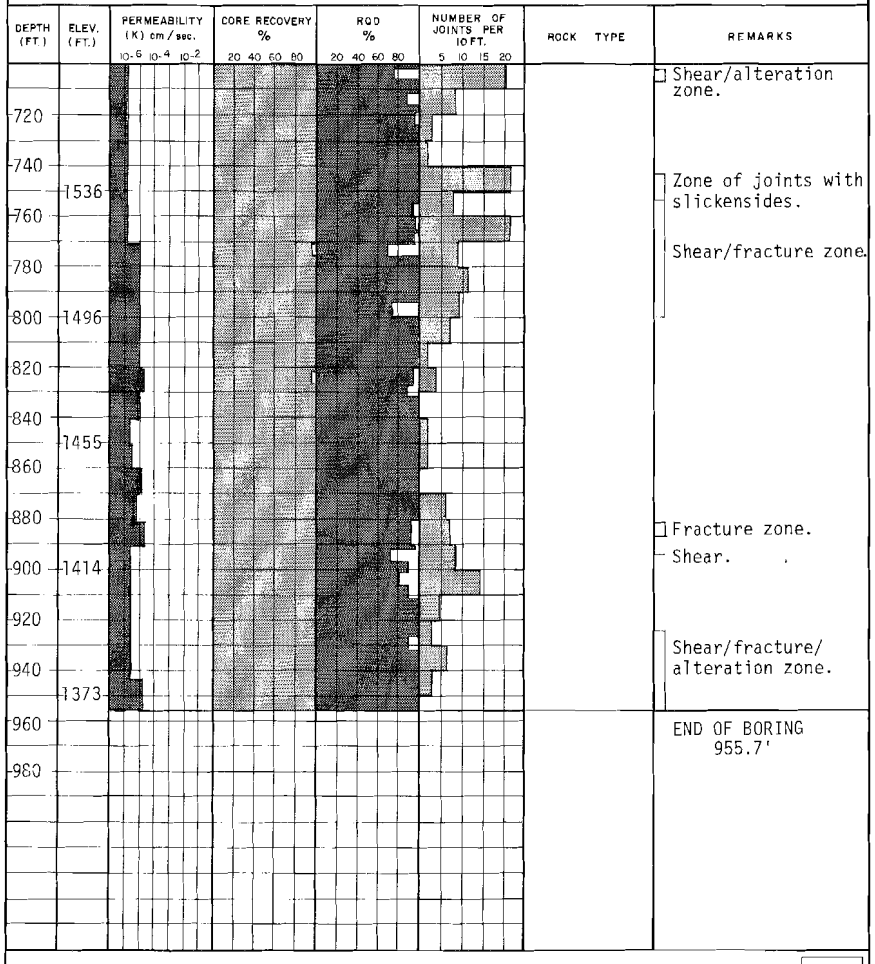
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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-3
Site Watana (North Bank) — **Sheet No.** 3 **of** 3



REMARKS

- Shear/alteration zone.
- Zone of joints with slickensides.
- Shear/fracture zone.
- Fracture zone.
- Shear.
- Shear/fracture/alteration zone.

END OF BORING
955.7'

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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-4

SITE: Watana (North Bank) — SHEET NO. 1 OF 31

CONTRACTOR: Interstate Exploration Inc. — DRILLING DATES: Sept. 11 TO Sept. 23, 1981
LOGGED BY: K.J. White, M.P. Bruen — DATE: September 1981

DRILLING METHOD: SOIL Casing Advancer — CASING DIAMETER: NW (3.0") I.D.
ROCK Diamond Core - Triple Tube — CORE DIAMETER: NW (1.75") O.D.

LOCATION: LATITUDE N3,228,421 — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E743,471 — GROUND SURFACE 2187.8
AZIMUTH 060° — ROCK SURFACE 2177.3
DIP 58° — BOTTOM OF HOLE 1382.5
WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	Overburden and cobbles.		
		6.5-12.4 - Very weathered fractured bedrock.		
10 (8.5)		TOP OF ROCK		
12.4 (10.5)	Andesite Porphyry	Medium gray to medium green-gray, aphanitic groundmass with white, fine to medium grained plagioclase phenocrysts (20-30%), up to 0.25 inches. Flow structures visible in some sections. Fresh to slightly weathered, hard to very hard. Occasional pods and stringers of carbonate, less than 0.5 inches, joints moderately closely spaced, generally iron stained and carbonate coated.	Run 1 12.4 to 16.1	100 (92)
			Run 2 16.1 to 21.0	100 (96)
20 (17.0)				

APPROVED: [signature] DATE: February 1, 1982

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 2 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Andesite Porphyry	12.4-21.0 - Joints closely to moderately closely spaced, trace of iron oxide staining, most joints have a trace of carbonate filling.	Run 3 21.0 to 25.2	100 (33)
		15.8 - Joint, 60°, 0.1 inches of silt/clay, possible shear.		
		21.0-70.6 - Joints closely to very closely spaced, iron oxide staining.	Run 4 25.2-27.1	100 (78)
		21.8-22.5 - Shear/fracture zone, joints very closely spaced, slightly weathered.	Run 5 27.1 to 30.8	100 (49)
		22.3 - Breccia/gouge, 0.25 inches thick on joint at 50°.		
30 (25.4)		24.1-24.3 - Fracture zone, broken core, yellow calcareous silt coating.		
		30.2-34.5 - Color changes to a light gray-green. Contains fragments of argillite to 0.5 inches, comprising approximately 5-10%.	Run 6 30.8 to 35.7	100 (35)
		32.5-41.0 - Fracture zone, joints very closely spaced, pieces are 1.0 to 2.0 inches.		
		34.0 - Joint, 80° with a silty-sand coating.	Run 7	100 (0)
		37.4 - Joint, 40° with a silty-clay coating.	Run 8 37.1 to 40.7	89 (0)
40 (33.9)		38.5-39.6 - "Granitic" rock, medium grained, 20-30% quartz, mafics less than 1.0%. Light yellow-gray rock, slightly to moderately altered/weathered, badly broken. Joint coated with calcareous clay. Contacts are fractured, not exposed.	Run 9 40.7 to 45.8	100 (33)
		39.6-41.0 - Slightly to moderately weathered.		
		43.4-44.6 - Fracture zone, very closely spaced joints, silty/sand coating.		
		48.9-49.6 - Probable fracture zone, pieces average 1.0 inch.	Run 10 45.8 to 50.8	100 (70)
50 (42.4)		50.1 - Joint, 40°, sulfide mineralization.		
			Run 11	

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-4

SITE Watana (North Bank) — **SHEET NO.** 3 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Andesite Porphyry	53.8-57.9 - Fracture zone, very closely spaced joints, heavy iron oxide staining, carbonate.	Run 11 50.8 to 55.6	98 (60)
			Run 12 55.6- 57.5	100 (0)
			Run 13 57.5- 59.2	100 (24)
60 (50.9)		62.5-70.6 - Fracture zone, very closely spaced joints, at 10° and 60°, heavy iron oxide staining, some carbonate coating.	Run 14 59.2 to 64.3	100 (40)
			Run 15 64.3 to 69.3	98 (8)
70 (59.4)		70.6-84.2 - Joints closely to moderately closely spaced, iron oxide staining, carbonate coating.	Run 16 69.3 to 74.3	100 (72)
			Run 17 74.3 to 79.5	100 (60)
		78.1-78.5 - Fracture zone, joints very closely spaced, at 30°. Slightly to moderately weathered, friable in places, silty/sand coating on most joint surfaces.		
80 (67.8)		80.5-81.3 - Fracture zone, very closely spaced joints, iron oxide staining, carbonate.	Run 18 79.5 to 84.5	100 (64)
		80.9 - Joint, 8°, possible slickensides.		
		84.2-112.0 - Joints closely spaced, iron oxide staining and carbonate coating.		
			Run 19	

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-4

SITE Watana (North Bank) — **SHEET NO.** 4 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Andesite Porphyry	84.5-112.0 - Rock changes to light green-gray with lithic fragments. Some flow structure at 70°, fragments of argillite, diorite, and andesite up to 1.0 inch but generally less than 0.5 inches.	Run 19 84.5 to 89.6	96 (53)
90 (76.3)		88.7-90.1 - Shear/fracture zone, joints very closely spaced, at 10° and 60°.		
		88.9-89.1 - Breccia/gouge fragments.	Run 20 89.6 to 94.7	100 (53)
		92.0-102.6 - Joints close to moderately closely spaced, open at 10° to 20°, irregular and rough. Heavy iron oxide staining and organics (?).		
			Run 21 94.7 to 99.6	100 (67)
100 (84.8)			Run 22 99.6 to 104.5	86 (41)
		102.9-105.2 - Fracture zone, joints very closely spaced, pieces 1.0 to 2.0 inches, iron oxide stained. Core loss 0.9 feet.		
			Run 23 104.5 to 109.5	100 (58)
		108.2-109.8 - Slightly to moderately weathered, joints very closely spaced.		
110 (93.3)		109.8-112.5 - Fracture zone, joints very closely spaced, silt and clay coating.	Run 24	92 (0)
112.0 (95.0)			Run 25 110.8 to 115.1	95 (23)
	Diorite	Medium gray-green, medium grained, 20-30% mafics, quartz less than 5%, trace of sulfides. Fresh, hard to very hard, joints closely to very closely spaced.		
			Run 26	85 (49)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4
SITE Watana (North Bank) — SHEET NO. 5 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	112.0 - Sharp contact with very thin stringers of andesite penetrating the diorite. Joint at contact, 70°, with a trace of silt coating. Penetrative iron staining for 0.5 feet, slightly weathered.	Run 26 115.1 to 119.8	85 (49)
120 (101.8)		112.0-126.1 - Joints close to very closely spaced, with iron oxide staining.	Run 27 119.8 to 124.8	84 (0)
		113.8-115.1 - Fracture zone, joints very closely spaced at 30° and 50°.		
		116.0 - Fracture, 10°, tight, healed with calcite, 0.25 inches wide, discontinuous, contains small fragments of diorite.	Run 28 124.8 to 130.1	96 (51)
		118.2-126.1 - Shear/fracture zone, joints very closely spaced, slightly to moderately weathered. Core loss 1.3 feet.		
		122.9-124.8 - Shear, gouge and breccia, friable.		
130 (110.2)		126.1-160.1 - Joints close to moderately closely spaced, generally 1.0 to 2.0 feet. Iron oxide staining, carbonate and chlorite present.	Run 29 130.1 to 135.3	100 (86)
		134.0 - Inclusion of dark green, fine grained diorite, 1.0 inch.		
		137.9 - Joint, 40°, carbonate/calcite.	Run 30 135.3 to 140.5	100 (89)
		139.0 - Joint, 10° with calcareous clay coating, some moderate hydrothermal alteration 1.0 inch on either side. Feldspars altering to clay.		
140 (118.7)			Run 31 140.5 to 145.5	100 (94)
		143.8 - Joint, 30°, moderately altered hydrothermally, 0.25 inches on either side of joint.		
			Run 32 145.5 to 150.6	100 (98)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Projecr — HOLE NO. BH-4
SITE Watana (North Bank) — SHEET NO. 6 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (127.2)	Diorite		Run 32	100 (98)
			Run 33 150.6 to 155.8	100 (79)
		153.2-153.6 - Healed shear, 20°, joints very closely spaced, healed with dark green fine grained diorite.		
		154.7-160.1 - Shear/fracture zone, joints very closely spaced at 20°-60°. Slightly altered hydrothermally, iron oxide staining and carbonate coating.	Run 34 155.8 to 160.1	77 (0)
		157.7 - Gouge, 0.1 inches wide.		
160 (135.7)		160.1-165.2 - No iron oxide staining.	Run 35 160.1 to 165.2	100 (92)
		163.3 - Joint, 30°, with clay coating.		
		165.2-205.8 - Joints close to very closely spaced, iron oxide staining, carbonate and chlorite coating.	Run 36 165.2 to 170.0	88 (21)
		165.2-175.4 - Fracture/alteration zone, slightly to moderately weathered/altered hydrothermally, joints very closely spaced. Hard to moderately hard, iron oxide staining below 171.5.		
170 (144.2)		165.2-165.7 - Clay on most joints.	Run 37 170.0 to 175.0	100 (36)
		169.0-169.5 - Shear/alteration zone, severely to completely altered hydrothermally, soft and friable.		
			Run 38 175.0 to 180.0	94 (32)
180 (152.6)			Run 39	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 7 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	181.8-184.2 - Fracture zone, joints are very closely spaced, at 10° and 40°-60°.	Run 39 180.0 to 185.0	100 (22)
		187.2 - Joint, 70°, with slickensides at 80°. 188.5 - Joint, 50°, with slickensides at 0°. 189.3 - End of iron oxide staining, trace amounts below this depth, carbonate coating on joints.	Run 40 185.0 to 190.1	100 (90)
190 (161.1)			Run 41 190.1 to 195.0	100 (88)
		195.5 - Joint, 15°, with clay filling 0.1 inches wide.	Run 42 195.0 to 200.0	100 (48)
200 (169.6)		199.7-200.1 - Core is broken, sandy clay coating.	Run 43 200.0 to 204.0	100 (65)
		204.4-205.4 - Shear along three joints, at 10°. Slickensides on chlorite and carbonate, 0.1 inches wide.	Run 44 204.0-205.8	88 (88)
		205.8-375.6 - Joints are moderately close to widely spaced, with a few zones of closely spaced. Trace of carbonate. 209.3-210.7 - Joints closely spaced. 229.8-231.8 - Joints closely spaced.	Run 45 205.8 to 210.7	100 (88)
210 (178.1)			Run 46	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 8 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 46 210.7 to 215.7	100 (100)
			Run 47 215.7 to 220.8	100 (100)
220 (186.6)			Run 48 220.8 to 225.8	100 (100)
			Run 49 225.8 to 230.8	100 (94)
230 (195.0)			Run 50 230.8 to 235.8	100 (100)
		234.8-236.4 - Shear/fracture zone, joints very closely spaced, at 20°. Chlorite and carbonate coating, less than 0.1 inches thick, slickensides.	Run 51 235.8 to 240.8	100 (90)
240 (203.5)			Run 52 240.8 to 245.8	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4
SITE Watana (North Bank) — SHEET NO. 9 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 52	
		247.1 - Felsic vein, 90°, light gray, less than 0.25 inches wide, tight, hard.	Run 53 245.8 to 251.0	100 (100)
250 (212.0)			Run 54 251.0 to 255.7	100 (100)
			Run 55 255.7 to 260.8	100 (100)
260 (220.5)			Run 56 260.8 to 265.8	100 (100)
			Run 57 265.8 to 270.8	100 (100)
270 (229.0)			Run 58 270.8 to 275.8	100 (100)
			Run 59	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4
SITE Watana (North Bank) — SHEET NO. 10 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 59 275.8 to 280.8	100 (100)
280 (237.4)		279.8 - Carbonate vein, 30°-40°, 0.1 inches wide.	Run 60 280.8 to 285.8	100 (100)
			Run 61 285.8 to 290.7	100 (100)
290 (245.9)		289.4 - Healed shear, 10°, 0.1 inches wide, healed with carbonate, tight, hard. 289.5 - Joint, 10° with slickensides on carbonate and chlorite coating. 291.0 - Healed shear, 10°, less than 0.1 inches thick, carbonate filled, tight, hard.	Run 62 290.7 to 295.8	100 (100)
			Run 63 295.8 to 298.9	100 (84)
300 (254.4)			Run 64 298.9-300.8	100 (95)
			Run 65 300.8 to 305.8	100 (100)
		306.0-307.9 ? 314.2-314.6 } Red intergranular stain on the diorite.	Run 66 305.8 to 310.8	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4
SITE Watana (North Bank) — SHEET NO. 11 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (262.9)	Diorite		Run 66	
			Run 67 310.8 to 315.8	100 (100)
		316.2 - Healed breccia, 20°, 0.1 feet wide, healed with dark green, fine grained igneous material, hard.	Run 68 315.8 to 320.8	100 (96)
320 (271.4)		320.3-320.6 - Core broken by drilling, fresh, angular pieces, 1.0 to 2.0 inches.		
		322.0-322.3 - Inclusion of fine grained, dark green diorite.	Run 69 320.8 to 325.8	100 (100)
		324.4-325.0 - Fractures healed with carbonate, irregular shape, discontinuous, up to 0.5 inches wide.		
		326.7-330.4 - Joint, 0°-10°, chlorite and carbonate coated, faint slickensides.	Run 70 325.8 to 330.8	100 (100)
330 (279.8)		331.2-332.2 - Fracture zone, joints very closely spaced at 0°-30°, some surfaces altered hydrothermally.	Run 71 330.8 to 335.8	100 (100)
			Run 72 335.8 to 340.8	100 (100)
340 (288.3)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4
SITE Watana (North Bank) — SHEET NO. 12 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	343.7-343.8 - Fracture zone, up to 0.1 inches wide, irregular, discontinuous, healed by calcite/carbonate, tight, hard.	Run 73 340.8 to 345.7	100 (100)
		344.0 - Healed shear, 30°, healed by dark green, fine grained igneous material, tight, hard.	Run 74 345.7 to 350.7	100 (100)
350 (296.8)				
			Run 75 350.7 to 355.6	100 (100)
		355.8 - Fracture, filled with carbonate, discontinuous, 0.25 inches wide.		
		356.5-357.7 - Fractures, 0°-10°, healed with carbonate less than 0.1 inches thick.	Run 76 355.6 to 360.2	100 (100)
360 (305.3)				
		361.0 ? 366.0 } Healed shears, 15°, less than or equal to 0.25 inches wide. Healed with dark green, fine grained diorite, hard.	Run 77 360.2 to 365.4	100 (100)
		367.7 - Healed fracture, 0.1 inches wide, regular, discontinuous, healed with carbonate.	Run 78 365.4 to 370.5	100 (100)
370 (313.8)		370.0-370.5 - Core broken by drilling.		
			Run 79 370.5-375.6	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 13 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	373.0-373.2 - Felsic dike, white-yellow to gray, 10-20% quartz, 1.0 to 2.0 inches wide. Contacts are hard, tight, and irregular.	Run 79 370.5 to 375.6	100 (100)
		375.6-423.9 - Joints are moderately closely spaced, average 2.0 feet, generally trace of carbonate and/or chlorite.	Run 80 375.6 to 380.6	100 (100)
380 (322.2)		378.5 - Joint, 20°, trace of silt/clay.	Run 81 380.6 to 385.6	100 (100)
			Run 82 385.6 to 390.7	100 (100)
390 (330.7)		392.4-393.2 - Healed breccia along several joints at 0° and 15°. Healed with dark green, fine grained diorite, tight, hard.	Run 83 390.7 to 395.5	100 (94)
		395.4-395.7 - Carbonate vein, 10°, up to 0.25 inches wide.	Run 84 395.5 to 400.6	100 (100)
400 (339.2)			Run 85 400.6 to 405.5	100 (98)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 14 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	405.2 - Healed breccia along a joint at 10°-20°, approximately 1.0 inches wide. Healed with dark green, fine grained diorite.	Run 86 405.5 to 410.4	100 (100)
410 (347.7)			Run 87 410.4 to 415.7	98 (98)
		416.5-416.8 - Healed breccia, 50°, diorite inclusions up to 2.0 inches in dark green, fine grained diorite.	Run 88 415.7 to 420.7	100 (100)
420 (356.2)		417.7-418.6 - Healed breccia, diorite fragments up to 2.0 inches and comprise 70-80% of the rock. Healed with a dark green, fine grained diorite, hard, tight.		
		419.3-419.8 - Fracture zone, joints very closely spaced at 60°, carbonate filling, tight healed joints.	Run 89 420.7 to 425.7	100 (100)
		420.8 - Felsic vein, 15°, less than 0.25 inches wide, tight.		
		423.9-510.4 - Joints close to moderately closely spaced, average 1.0 foot. Trace to coating of carbonate and chlorite.	Run 90 425.7 to 430.9	100 (100)
		426.0 - Joint, 10° with faint slickensides on chlorite. Felsic vein, 15°, light gray, fine grained, chilled contact, tight, hard.		
430 (364.6)		429.2 - Joint, 60° with faint slickensides.		
		429.5 - Joint, 10°, with slickensides on chlorite.	Run 91 430.9 to 435.8	100 (100)
		429.8 - Joint, 55°, with slickensides on chlorite at 40°.		
			Run 92	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 15 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
440 (373.1)	Diorite	430.7 - Joint, 10°, 0.25 inches thick, healed with carbonate, tight. Crosscutting joint, 10°, coated with talc/chlorite and carbonate, possible slickensides.	Run 92 435.8 to 440.8	100 (100)
		430.9-439.2 - Joints/fractures 0°-10° and 30°-50°, very closely spaced, irregular and discontinuous. Healed by carbonate and sulfides, generally moderately hard with some zones of friable rock, tight.	Run 93 440.8 to 445.8	100 (100)
		444.5 - Healed shear, 30°, 0.25 to 0.5 inches wide. Healed with dark green, fine grained diorite.		
450 (381.6)		445.0-448.0 - Andesite dike, 50°, medium gray-green, aphanitic rock with approximately 10% phenocrysts of carbonate up to 0.1 inches, parallel to flow structures. Fresh, hard, unfractured, contacts tight.	Run 94 445.8 to 450.8	100 (100)
		450.2-455.2 - Felsic dikes, four, 20°-30°, fine grained, composition is probably close to a granodiorite. Moderately closely spaced, 1.0 to 2.0 inches wide, hard, tight contacts.	Run 95 450.8 to 455.8	100 (100)
460 (390.1)		458.2-458.6 - Fracture zone, joints very closely spaced at 30°, healed with carbonate.	Run 96 455.8 to 460.8	100 (100)
		462.0-463.5 - Alteration zone, slightly altered hydrothermally, diorite bleached to light gray-green, hard.	Run 97 460.8 to 465.9	100 (100)
		464.0 - Joint, 20°, faint slickensides on chlorite. Crosscut joint at 30°, faint slickensides on chlorite.		
			Run 98 465.9 to 470.8	100 (98)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 16 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (398.6)	Diorite	465.4 - Shear along joint at 40°, slickensides, 0.1 inches thick gouge.	Run 98	100 (98)
		465.6 - Felsic dike, light gray, fine grained, possibly granodiorite, approximately 2.0 inches wide at 40°, tight contacts. Part of dike is crosscut by the above shear.	Run 99 470.8 to 475.8	100 (100)
			Run 100 475.8 to 480.8	100 (100)
480 (407.0)				
		483.3 - Joint, 10°, possible faint slickensides on chlorite.	Run 101 480.8 to 485.7	100 (94)
			Run 102 485.7 to 490.6	100 (100)
490 (415.5)		489.2 - Healed shear, 30°, 0.75 inches wide, healed with dark green, fine grained diorite.		
		490.1 - Healed shear as above, 40°, 1.0 inch wide.	Run 103 490.6 to 495.6	100 (100)
			Run 104 495.6 to 498.0	100 (100)
		497.3-499.0 - Inclusion or dike of fine grained, dark green diorite, sharp contacts at 40°, tight, hard.		
500 (424.0)			Run 105 498.0 to 500.8	93 (93)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 17 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	502.6-503.0 - Felsic dike, light gray, fine grained, probably granodiorite. Upper contact fractured, lower contact tight at 70°. Hard, unfractured.	Run 106 500.8 to 505.8	100 (100)
			Run 107 505.8 to 510.7	100 (100)
510 (432.5)		510.4-627.8 - Joints moderately close to widely spaced, trace of chlorite and carbonate coating.	Run 108 510.7 to 515.8	100 (100)
			Run 109 515.8 to 520.5	100 (100)
520 (441.0)			Run 110 520.5 to 525.6	100 (96)
		523.5-525.1 - Zones of joints very closely spaced, at 20°-30°, healed with carbonate.		
		524.3 - Healed shear, 30°, 1.0 inch wide, healed with dark green, fine grained diorite.		
		526.5-527.6 - Textural and mineralogical changes. Medium to fine grained, less than 15% mafics. Hard, sharp, tight contacts.	Run 111 525.6 to 530.7	100 (100)
530 (449.4)			Run 112 530.7- 535.8	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 18 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 112 530.7 to 535.8	100 (100)
		537.1 - Shear along joint, 20°, 0.5 inches of breccia and gouge, slickensides on chlorite.	Run 113 535.8 to 540.7	100 (100)
		537.7 - Joint, 30°, slickensides on chlorite.		
540 (457.4)		538.3-538.9 - Numerous healed fractures, irregular, discontinuous. Healed with calcite/carbonate, up to 0.25 inches wide.		
		539.1-541.2 - Felsic lenses and dikes, light gray, fine to medium grained. Felsic material comprises 50% of rock, tight contacts, hard.	Run 114 540.7 to 545.9	100 (65)
		543.7-548.9 - Alteration zone, bleached yellowish-white, hydrothermally altered. No mafics, feldspars altering to clay, moderately hard to soft. RQD = 0%.		
			Run 115 545.9 to 550.8	100 (43)
550 (466.4)				
			Run 116 550.8 to 555.8	100 (100)
		553.0-553.5 - Felsic dikes, three, 80°-90°, closely spaced, less than 0.5 inches, hard, tight.		
			Run 117 555.8 to 560.8	100 (100)
560 (474.9)		559.7 - Healed shear, 30°, 1.5 inches wide. Healed with dark green, fine grained diorite, hard.		
		560.5-561.2 - Red staining on core.	Run 118 560.8 to 565.8	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 19 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 118	
		567.7 - Felsic dike, 90°, light gray, medium to coarse grained, unfractured, 0.1 feet wide, tight contacts, hard.	Run 119 565.8 to 570.9	100 (100)
570 (483.4)		569.3 - Joint, 0°-20°, carbonate healed, slight hydrothermal alteration up to 1.0 inch.		
		571.7-574.9 - Alteration zone, bleached to yellow-white, moderately to severely altered hydrothermally. Feldspars altered to clay, no mafics, moderately hard to soft, locally friable. RQD = 0%.	Run 120 570.9 to 575.9	100 (50)
			Run 121 575.9 to 580.8	100 (100)
580 (491.8)		578.0-578.8 - Healed shears, closely spaced, healed by dark green, fine grained igneous material, hard.		
		578.5 - Possible offset of felsic dike, 1.0 inch wide. Offset up to 0.5 inches.	Run 122 580.8 to 585.8	100 (100)
			Run 123 585.8 to 590.8	100 (100)
590 (500.3)		588.5 - Healed shear, 30°, healed with carbonate less than 0.1 inches wide. Healed with dark green diorite, tight.		
		588.8-588.9 - Fracture zone, fractures very closely spaced, healed with carbonate, discontinuous, irregular, hard.	Run 124 590.8 to 595.8	100 (100)
		591.0 - Healed shear, 30°, 0.25 inches wide, healed with dark green diorite and carbonate, tight.		
			Run 125	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 20 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	597.0 - Felsic dike, 80°, light orange, 0.5 inches wide. Truncated by healed shear at 40°	Run 125 595.8 to 600.7	100 (100)
600 (508.8)		597.9 - Inclusion of dark green, fine grained diorite, diameter of 1.0 inch.		
			Run 126 600.7 to 605.7	100 (100)
			Run 127 605.7 to 610.7	100 (100)
610 (517.3)		610.9-618.3 - Shear/alteration zone, bleached to a light yellow-gray, slightly to moderately altered hydrothermally with zones of severe alteration. Feldspars altered to clay, moderately hard to soft, biotite crystals close to altered zone.		
		612.1-618.3 - Shear, 0°, 0.5 inches wide, partially healed with carbonate and chlorite. Alteration is more intense on one side than the other.	Run 128 610.7 to 615.7	100 (15)
			Run 129 615.7 to 620.8	100 (59)
620 (525.8)		620.1-622.2 - Shear, 10°, partially healed by carbonate, up to 0.5 inches wide.		
			Run 130 620.8 to 625.9	100 (80)
		627.8-710.2 - Joints close to moderately closely spaced, chlorite coated with trace to coating of carbonate.	Run 131 625.9 to 630.9	100 (88)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4
SITE Watana (North Bank) — SHEET NO. 21 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
630 (534.2)	Diorite	629.3 - Shear, 10°, 0.25 to 0.5 inches wide, partially healed by carbonate.	Run 131	100 (88)
		632.5 - Joint, 10°, partially healed by carbonate. Slickensides on chlorite.	Run 132 630.9 to 635.9	100 (30)
		635.9-637.5 - Fracture zone, joints and fractures very closely spaced, up to 0.1 inches wide. Healed with carbonate, discontinuous, irregular.	Run 133 635.9 to 640.8	100 (70)
640 (542.7)				
		642.4 - Joint, 10°, slickensides on chlorite.	Run 134 640.8 to 645.8	100 (45)
		644.1-644.8 - Fracture zone, joints very closely spaced, at 60°.		
		648.0-648.7 - Healed breccia, fragments of diorite comprise 70-80%, healed by dark green diorite. Hard, joint at 20° at upper contact, healed with carbonate, approximately 0.25 inches wide.	Run 135 645.8 to 650.8	100 (70)
650 (551.2)				
		649.4-649.8 - Joints, 50°-70°, very closely spaced, tight.	Run 136 650.8 to 655.8	100 (85)
			Run 137 655.8 to 660.7	100 (100)
660 (559.7)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4
SITE Watana (North Bank) — SHEET NO. 22 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 138 660.7 to 665.7	100 (66)
		666.8 - Diorite breccia, 0.5 inches wide, healed with carbonate, irregular, tight.	Run 139 665.7 to 670.7	100 (96)
670 (568.2)		669.7-670.7 - Joints, 10°, 0.5 inches wide, healed with carbonate. Irregular fractures, discontinuous, healed with carbonate.		
		671.4-672.3 - Red stain on core.	Run 140 670.7 to 675.7	100 (98)
		672.8 - Joint, 30°, 0.25 inches wide, healed with carbonate.		
		673.6-678.6 - Shear, 0°-10°, partially healed by carbonate and chlorite. Slickensides, thin coating of gouge less than 0.1 inches.	Run 141 675.7 to 680.8	100 (67)
680 (576.6)				
			Run 142 680.8 to 685.7	100 (100)
			Run 143 685.7 to 690.8	100 (100)
690 (585.1)		691.7-691.9 - Felsic dike, 30°, light green-gray, medium grained. Up to 10% quartz, 5-10% mafics. Tight, welded contacts, fractured and healed with carbonate, hard.	Run 144 690.8- 695.8	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 23 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	692.8-693.3 - Pods of felsic material similar to above dike. Irregular shapes up to 1.0 inch, hard.	Run 144 690.8 to 695.8	100 (100)
		693.9 - Inclusion of dark green, fine grained diorite, 2.0 inches long.		
		698.7-700.4 - Shear, 10°, partially healed with carbonate, chlorite. Faint slickensides.	Run 145 695.8 to 700.8	100 (100)
700 (593.6)		701.4-703.1 - Numerous healed fractures, closely to very closely spaced, up to 0.25 inches thick. Healed with carbonate, irregular, discontinuous.	Run 146 700.8 to 705.7	100 (100)
			Run 147 705.7 to 710.8	100 (90)
710 (602.1)		710.2-710.8 - Fracture zone, joints and fractures very closely spaced, angular pieces 0.5 to 1.0 inch, most surfaces stained.		
		710.2-755.9 - Joints closely spaced with zones of very closely spaced. Generally a coating of chlorite and a trace to coating of carbonate.	Run 148 710.8 to 715.8	100 (90)
		712.0-713.5 - Fracture zone, joints very closely spaced, at 20° and 60°. Joints at 20° are healed with carbonate.	Run 149 715.8 to 720.8	100 (36)
720 (610.6)		720.1-721.1 - Fracture zone, joints very closely spaced, at 40°-70°.		
		723.3 - Joint, 20°, trace of silty sand.	Run 150 720.8 to 725.8	98 (56)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 24 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	726.1-730.9 - Shear/fracture zone, joints very close to closely spaced, oriented at 30° and 10°. Numerous irregular fractures, some carbonate healed. Slickensides.	Run 150	98(56)
			Run 151 725.8 to 730.8	100 (15)
730 (619.0)		732.5 - Joint, 10°, with slickensides on chlorite.	Run 152 730.8 to 735.8	100 (30)
		734.6-738.0 - Shear/fracture zone, numerous joints very closely spaced, at 30°. Some healed with carbonate, up to 0.25 inches thick, tight.		
		736.4 - Joint, 20°, slickensides on chlorite.	Run 153 735.8 to 740.8	100 (30)
		738.3-739.5 - Joints, 70°, closely spaced.		
740 (627.5)		742.3-743.2 - Fracture zone, joints very closely spaced at 70°.	Run 154 740.8 to 745.8	100 (35)
			Run 155 745.8 to 750.8	100 (60)
750 (636.0)		749.4-755.0 - Fracture zone, joints and fractures very closely spaced, mostly tight, randomly oriented. Joints at 0°-10°, and 60°, less than half are healed with carbonate.		
		752.8-755.0 - Core broken along the 60° joint set.	Run 156 750.8 to 755.9	100 (16)
		755.9-768.8 - Joints are close to moderately closely spaced.	Run 157	

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-4

SITE Watana (North Bank) — **SHEET NO.** 25 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	758.5-759.8 - Healed shear, 10°, healed with dark green diorite and carbonate, tight.	Run 157 755.9 to 760.9	100 (94)
760 (644.5)			Run 158 760.9 to 765.8	100 (80)
		768.8-771.2 - Fracture zone, joints very closely spaced, at 0°-10°, some are healed by carbonate.	Run 159 765.8 to 770.9	100 (65)
770 (623.0)		768.8-786.2 - Joints close to very closely spaced.	Run 160 770.9 to 775.9	100 (16)
			Run 161 775.9 to 780.9	100 (58)
780 (661.4)		780.0 - Joint, 15°, slickensides on chlorite, trace of yellow sandy silt.	Run 162 780.9 to 785.9	100 (50)
		783.7 - Joint, 15°, trace of silt or clay.		
		786.2-850.5 - Joints close to moderately closely spaced, average 0.5 to 1.0 foot. Chlorite coating, trace to coating of carbonate.	Run 163 785.9 to 790.9	100 (90)

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-4

SITE Watana (North Bank) — **SHEET NO.** 26 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
790 (669.9)	Diorite		Run 163	100 (90)
			Run 164 790.9 to 795.8	100 (59)
		797.1 - Inclusion of fine grained diorite, diameter 1.0 inch.	Run 165 795.8 to 800.7	100 (75)
800 (679.1)		797.8-798.1 - Fracture zone, joints very closely spaced at 70°. Carbonate, chlorite coating, possibly some talc.		
		803.0 - Healed shear, 10°, healed with fine grained felsic material, tight. Offset of 0.5 inches along inclusion of fine grained diorite.	Run 166 800.7 to 805.6	100 (69)
		804.1-805.3 - Fracture zone, joints/fractures very closely spaced, at 0°-10°, and 40°, most healed with carbonate, broken by drilling.	Run 167 805.6 to 810.7	100 (88)
810 (686.9)		805.2-806.2 - Healed shear, 10°, 1.0 inch wide, fragments of diorite, healed by dark green diorite, tight, hard.		
		811.9-820.5 - Textural changes in diorite, light gray-green, medium to coarse grained, less than 10% mafics.	Run 168 810.7 to 815.8	100 (41)
		812.0-815.8 - Shear/fracture zone, joints very closely spaced at 10° and 60°. Broken by drilling, pieces 0.5 to 2.0 inches, coated with silt or clay. Most joints are tight, minor sulfide mineralization.		
		813.5 - Breccia, 1.0 inch wide, partially healed with carbonate.	Run 169 815.8 to 820.8	100 (32)
820 (695.4)				

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 27 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 170 820.8 to 825.8	100 (80)
		825.3-825.9 - Core is broken by drilling, minor sulfide mineralization on broken surfaces.		
			Run 171 825.8 to 830.8	100 (60)
		828.8 - Joint, 80°, faint slickensides on chlorite.		
830 (703.8)				
			Run 172 830.8 to 835.8	100 (40)
		834.5-835.8 - Fracture zone, joints/fractures very closely spaced, at 0°-10° and 40°-60°, irregular, healed to partially healed by carbonate. Joint/shear, 0°, offset 0.1 inches.		
		837.8 - Joint, 50°, possible slickensides.	Run 173 835.8 to 840.8	100 (94)
840 (712.3)				
			Run 174 840.8 to 845.7	100 (100)
			Run 175 845.7 to 850.5	100 (85)
850 (720.8)		850.5-896.0 - Joints moderately closely spaced, chlorite coating, trace to coating of carbonate.		
			Run 176 850.5 to 855.6	100 (100)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 28 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 176 850.5 to 855.6	100 (100)
			Run 177 855.6 to 860.5	100 (100)
		858.1-869.9 - Diorite changes to light green-gray, 10-20% mafics.		
860 (729.3)		859.6-866.6 - Fracture zone, joints and fractures very closely spaced, oriented at 30° and 70°. Mostly tight, less than 25% healed with carbonate.	Run 178 860.5 to 865.5	100 (100)
			Run 179 865.5 to 870.6	100 (100)
870 (737.8)		870.3-871.0 - Fracture zone, joints very closely spaced at 60°.		
			Run 180 870.6 to 875.6	100 (80)
		873.0-875.2 - Shear/alteration zone, core bleached to a light yellow-green, slightly to moderately altered hydrothermally. Hard to medium hard, joints/fractures very closely spaced, tight, generally healed with carbonate.		
		875.0 - Shear, 60°, healed with carbonate, breccia, 0.1 feet.	Run 181 875.6 to 880.6	100 (100)
		877.5 - Inclusion of dark green, fine grained diorite, 1.5 inches in diameter.		
880 (746.2)		878.8 - Joint, 30°, trace of clay.		
			Run 182 880.6 to 885.6	100 (92)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 29 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	883.5-884.5 - Numerous healed fractures/joints, healed with carbonate, 10% of rock. Joints, 20°-30°, fractures are irregular and discontinuous.	Run 182	
			Run 183 885.6 to 890.6	100 (100)
890 (754.7)		890.6-895.7 - Shear/alteration zone, core is bleached to a light yellow-green, generally slightly altered hydrothermally. Generally hard except for the following zones:	Run 184 890.6 to 895.6	100 (45)
		891.7 - Healed shear, 50°, crosscut by a joint with clay fillings less than 0.1 inches wide.		
		893.0-895.1 - Moderately altered hydrothermally, moderately hard to soft, locally friable.	Run 185 895.6 to 900.6	100 (100)
		893.1 - Shear, 15°, 1.0 to 2.0 inches of breccia, partially healed by carbonate.		
		893.3-893.4 - Broken fragments of breccia.		
900 (763.2)		893.8-894.1 - Fragments of altered diorite and breccia, pieces less than 1.0 inch.		
		895.1 - Shear, 30°, 1.0 inch wide, breccia and gouge healed with carbonate.	Run 186 900.6 to 905.6	100 (98)
		896.0-949.6 - Joints moderately close to wide, chlorite coating, trace to coating of carbonate.		
		898.9-899.8 - Joints, 30° and 70°, very closely spaced, healed with carbonate to 0.1 inches.	Run 187 905.6 to 910.6	100 (100)
		902.4 - Inclusion of dark green, fine grained diorite.		
910 (771.7)		903.0-903.2 - Inclusion or dike of dark green diorite, sharp contact at 45°.		
		904.5 - Joint, 80°, clay and carbonate coating.	Run 188 910.6 to 915.6	100 (100)
		909.1 - Felsic dike, 50°, light gray, medium grained, 0.5 inches wide, unfractured, tight contact.		
		909.5-910.5 - Healed shear, 0°-10°, healed with dark green, fine grained diorite.	Run 189	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Watana (North Bank) — SHEET NO. 30 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	913.5-939.0 - Healed shear zone, numerous shears very closely spaced, healed by dark green diorite, hard, competent. Felsic dikes within shear are light gray, fine grained, up to 1.0 inch wide, offset along healed shear planes up to 1.0 inch. Approximately 50-75% of zone is healed shears, approximately 5% of the shear zone is felsic dikes.	Run 189 915.6 to 920.6	100 (100)
920 (780.2)			Run 190 920.6 to 925.7	100 (100)
			Run 191 925.7 to 930.3	100 (100)
930 (788.6)			Run 192 930.3 to 935.4	100 (100)
			Run 193 935.4 to 939.3	100 (100)
		939.3-939.4 - Fragments, two, of andesite porphyry, probably fell in hole during bit change.		
940 (797.1)			Run 194 939.3 to 944.4	100 (98)
			Run 195 944.4 to 949.6	96 (96)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4

SITE Watana (North Bank) **SHEET NO.** 31 **OF** 31

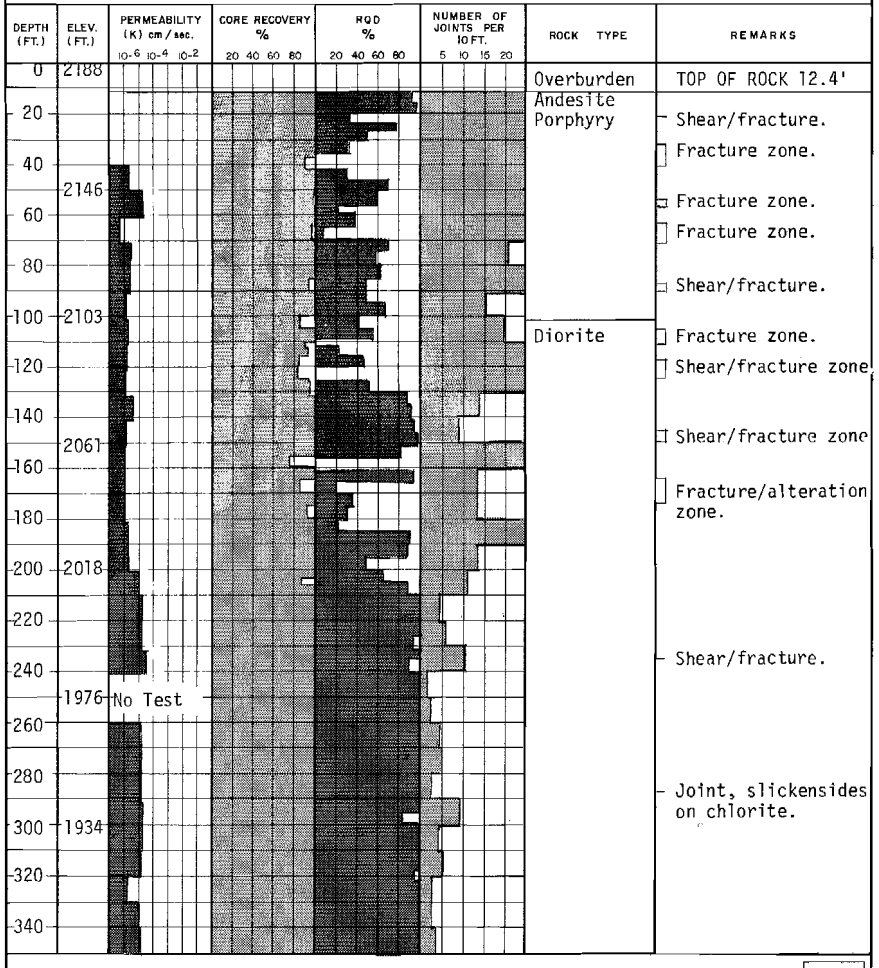
DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
949.6	Diorite	END OF BORING	Run 195	
(805.3)				

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana (North Bank)

Job No. P5700.05
Hole No. BH-4
Sheet No. 1 of 3



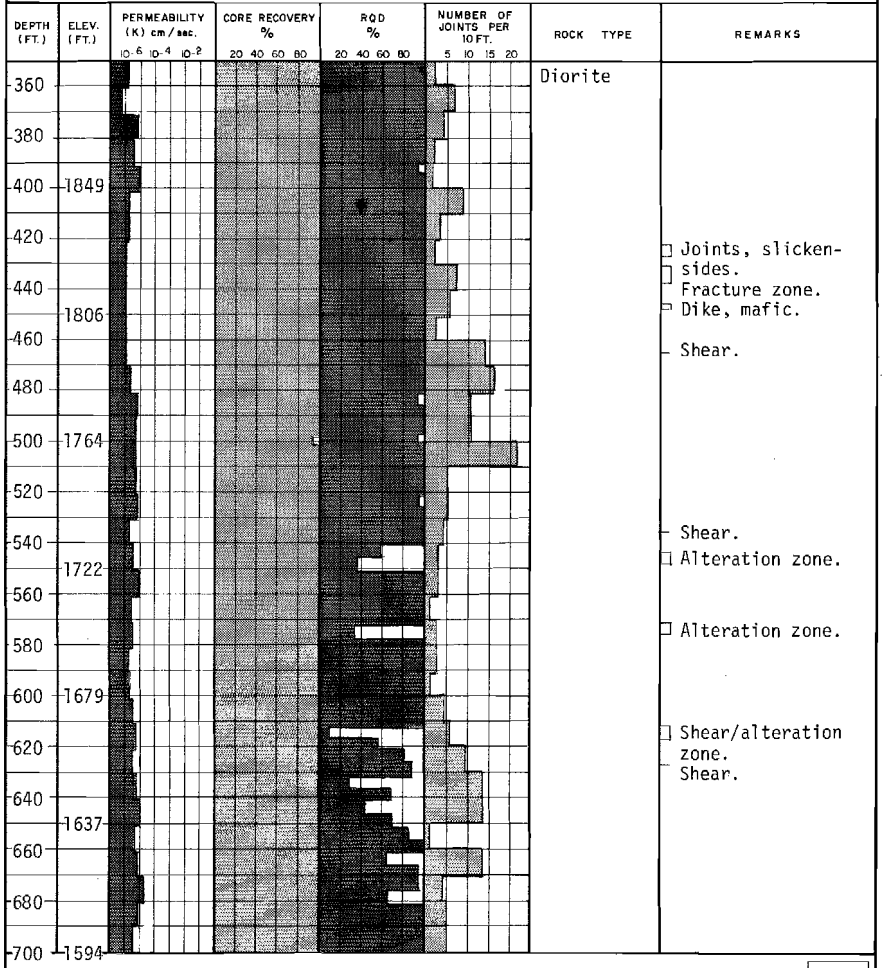
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana (North Bank)

Job No. P5700.05
Hole No. BH-4
Sheet No. 2 of 3

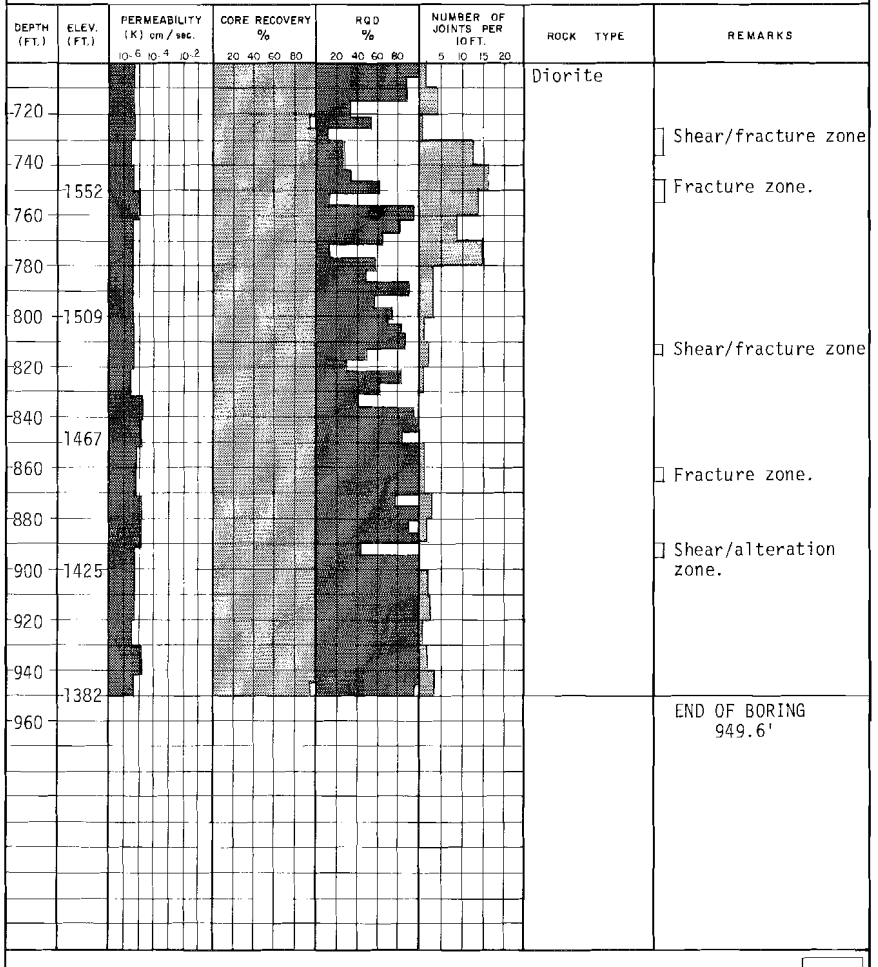


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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-4
Site Watana (North Bank) — **Sheet No.** 3 **of** 3



ROCK TYPE	REMARKS
Diorite	
	Shear/fracture zone
	Fracture zone.
	Shear/fracture zone
	Fracture zone.
	Shear/alteration zone.
	END OF BORING 949.6'

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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-6

SITE: Watana (North Bank) — SHEET NO. 1 OF 24

CONTRACTOR: The Drilling Company — DRILLING DATES: June 26 TO July 9, 1981
LOGGED BY: K.J. White, M.P. Bruen — DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer; ROCK Diamond Core - Triple Tube — CASING DIAMETER: NW (3.0") I.D.; CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,226,922; DEPARTURE E744,256; AZIMUTH 225°; DIP 60° — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4; GROUND SURFACE 1608.8; ROCK SURFACE 1601.9; BOTTOM OF HOLE 967.6; WATER TABLE 1461.8 (12-06-80)

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	Sandy gravel with cobbles and boulders.		
8.0 (6.9)		TOP OF ROCK		
	Diorite	Gray-green, fine to medium grained crystalline rock, 30-40% mafics (biotite and hornblende), up to 10% quartz. Slightly weathered, hard, fresh. Joints moderately closely spaced with iron oxide staining.	Run 1 8.0- to 10.7	74 (52)
10 (8.7)		8.0-10.7 - Core loss 0.7 feet. Red staining in core parallel to some joints, penetrative to 0.5 inches.	Run 2 10.7 to 15.0	88 (60)
			Run 3 15.0 to 19.6	100 (35)
17.5 (15.2)	Quartz Diorite	Green-gray to light gray, fine to medium grained rock. Mafics 20-30% (biotite and hornblende), 10-15% quartz, generally hard to very hard, fresh. Gradational contact.	Run 4	83 (0)
20 (17.3)				

APPROVED: [signature] DATE: February 1, 1982

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 2 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	Joints are very close to moderately close, with iron oxide staining.	Run 4 19.6 to 23.8	83 (0)
		17.1-26.8 - Fracture zone, joints and fractures very closely spaced, moderately to severely weathered with penetrative iron oxide staining. Core loss 0.7 feet.	Run 5 23.8 to 26.8	97 (0)
		26.0-64.3 - Fresh to slightly weathered, with more intense weathering on joints, iron oxide staining. Joints closely to moderately closely spaced.	Run 6 26.8 to 30.3	100 (63)
30 (26.0)		26.8-30.0 - Core loss 0.5 feet.		
		29.7-30.3 - Fracture zone, joints and fractures very closely spaced, joints at 0°-10° and 30°-40°, slightly weathered.	Run 7 30.3 to 32.8	100 (60)
			Run 8 32.8 to 36.8	100 (78)
			Run 9 36.8 to 40.5	100 (59)
40 (34.6)		40.5-45.0 - Core loss 0.2 feet.		
			Run 10 40.5 to 44.7	100 (90)
		45.6-46.5 - Core broken by drilling.		
			Run 11 44.7 to 49.1	91 (57)
		48.4-48.9 - Fracture zone, joints very closely spaced 0°-10°, 30°, and 50°-60°.		
50 (43.3)			Run 12	100 (0)
			Run 13	100 (0)
			Run 14	

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 3 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 14 51.4-55.5	100 (82)
			Run 15 55.5 to 59.3	100 (26)
60 (52.0)			Run 16 59.3 to 63.2	100 (77)
		64.3-105.8 - Joints are moderately close to closely spaced, at 10° to 60°, iron stained, some carbonate filled.	Run 17 63.2 to 66.5	97 (33)
		66.5-67.3 - Core loss 0.8 feet. Core broken by drilling.	Run 18	
			Run 19	
			Run 20 67.7 to 70.4	100 (59)
70 (60.6)		71.3-73.1 - Shear/fracture zone, joints very closely spaced, at 30°-60°. Slightly to moderately weathered, very thin clay gouge, iron oxide staining.	Run 21 70.4 to 75.3	96 (41)
			Run 22 75.3 to 80.3	100 (77)
80 (69.3)			Run 23 80.3 to 84.2	100 (77)
			Run 24	100(89)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 4 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 24 84.2 to 89.3	100 (89)
		89.3-94.6 - Core loss 0.3 feet.		
90 (77.9)			Run 25 89.3 to 94.6	94 (70)
			Run 26 94.6 to 98.5	97 (79)
		98.5-98.8 - Core loss 0.3 feet.		
			Run 27 98.5-100.3	83 (78)
100 (86.6)		101.9-102.3 - Core loss 0.4 feet.	Run 28	100(75)
		102.7-106.3 - Penetrative iron oxide staining on joints up to 0.5 inches.	Run 29	71(54)
			Run 30	100 (0)
		105.45 - Joint, 45°, clay coating 0.1 inch.	Run 31 103.1 to 108.2	94 (61)
		105.8-106.3 - Fracture zone, joints very closely spaced at 10° and 70°, iron oxide staining, clay coating on surfaces for 0.2 feet.		
		106.3-136.8 - Joints moderately closely spaced, generally fresh, minor iron oxide staining.	Run 32 108.2 to 111.7	100 (94)
110 (95.3)			Run 33	100(90)
		112.7-122.1 - Core loss 0.4 feet.	Run 34 112.2 to 116.2	100 (94)
			Run 35	100(84)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 5 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 35 116.2 to 121.1	100 (84)
120 (103.9)		122.5-123.6 - Penetrative iron oxide staining on joints to 0.5 inches.	Run 36 121.1 to 126.2	100 (82)
			Run 37	100 (89)
		129.6-130.6 - Felsic dike, light gray, fine grained quartz phenocrysts, less than 5% mafics. Fresh, unfractured, tight contacts, at 20°. Iron oxide stained joints, penetrative to 0.5 inches.	Run 38 127.6 to 131.1	100 (91)
130 (112.6)		131.0-131.1 - Felsic dike as above, 20°, unfractured, tight. 131.8-132.5 - Joints, 40°, with iron oxide staining.	Run 39 131.1 to 136.2	100 (83)
		136.8-155.1 - Alteration along joints penetrating slightly, average 0.06 inches up up to 0.1 feet. Joints are closely spaced, at 20° to 50°, with iron oxide staining and carbonate filling.	Run 40 136.2 to 140.6	100 (66)
140 (121.2)			Run 41 140.6 to 145.6	76 (100)
			Run 42 145.6 to 150.6	100 (82)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 6 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (129.9)	Quartz Diorite		Run 42	100 (82)
		154.2-155.1 - Fracture zone, joints very closely spaced, at 20° to 50°, iron and carbonate staining. 155.1-168.2 - Joints very closely to closely spaced, carbonate coated, iron oxide staining.	Run 43 150.6 to 155.6	100 (46)
			Run 44 155.6 to 160.6	100 (72)
160 (138.6)		162.4-163.3 - Fracture/alteration zone, altered hydrothermally, numerous healed fractures. Joints and fractures are very closely spaced, 10° to 60°, some iron oxide staining and carbonate filling. 165.6-175.2 - Core loss 0.3 feet.	Run 45 160.6 to 165.7	100 (71)
			Run 46 165.7 to 170.0	100 (47)
170 (147.2)		168.2-186.8 - Shear/alteration zone, core bleached to light gray, severely altered hydrothermally. Soft, friable with numerous rehealed fractures. Joints are close to moderately close. Contains chalky white diorite with feldspars breaking down into clay minerals, carbonate present. 176.3-177.2 - Shear zone, joints at 20°-60°, soft and friable. 178.2-179.8 - Shear zone, joints at 20°-60°, 0.4 feet of clay, soft and friable.	Run 47 170.0 to 175.2	94 (19)
			Run 48 175.2 to 179.8	91 (10)
180 (155.9)			Run 49	100(59)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 7 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 49 179.8 to 184.9	100 (59)
		186.8-221.1 - Joints closely spaced, most carbonate coated.	Run 50 184.9 to 190.0	100 (82)
190 (164.5)			Run 51 190.0 to 195.1	98 (86)
			Run 52 195.1 to 200.2	100 (82)
200 (173.2)			Run 53 200.2 to 205.1	100 (45)
		Below 208.0, texture fine to medium grained.	Run 54 205.1 to 210.0	98 (95)
210 (181.9)		210.0-215.0 - Core loss 0.3 feet. 210.0-245.0 - Inclusions of fine grained mafic rock, joints very close to widely spaced, up to 2.0 inches.	Run 55	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 8 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	215.4-215.7 - Highly fractured and moderately weathered.	Run 55 210.0-215.0	97 (86)
			Run 56 215.0 to 220.0	96 (72)
220 (190.5)		221.1 - Joints moderately close to widely spaced, most carbonate coated, occasional trace of iron oxide staining.	Run 57 220.0 to 225.2	100 (96)
			Run 58 225.2 to 230.4	100 (85)
230 (199.2)			Run 59 230.4 to 235.4	100 (84)
			Run 60 235.4 to 240.3	100 (100)
240 (207.8)			Run 61 240.3 to 245.5	96 (90)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 9 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 62 245.5 to 249.7	100 (93)
250 (216.5)			Run 63 249.7 to 255.0	100 (79)
		255.2-256.8 - Shear/alteration zone, slightly to moderately altered hydrothermally along joints, small light gray breccia and gouge zone. Numerous rehealed joints, chalky-white diorite, feldspars beginning to decompose.	Run 64 255.0 to 260.1	100 (86)
260 (225.2)		256.0-256.6 - Shear, 30°, joints very closely spaced, clay, carbonate, and breccia filling.	Run 65 260.1 to 265.1	100 (100)
		266.5-280.6 - Irregular discontinuous patches of red staining.	Run 66 265.1 to 270.2	100 (82)
270 (233.8)			Run 67 270.2 to 275.4	100 (56)
		272.6-273.8 - Shear/alteration zone, slightly altered hydrothermally, friable, with a breccia-gouge 0.1 feet thick, closely spaced joints.	Run 68	100 (92)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 10 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	273.4-273.5 - Breccia and clay gouge, 60°, soft and friable, carbonate filling.	Run 68 275.4 to 280.3	100 (92)
280 (242.5)		273.8-315.0 - Joints moderately closely spaced with minor carbonate coating.	Run 69	100 (100)
			Run 70 281.6 to 284.6	100 (100)
		284.6-290.6 - Core loss 0.2 feet.	Run 71 284.6-286.6	100 (100)
			Run 72 286.6 to 290.5	100 (100)
290 (251.1)			Run 73 290.5 to 295.7	100 (92)
			Run 74 295.7 to 300.7	100 (86)
300 (259.8)			Run 75 300.7 to 305.0	100 (100)
			Run 76 305.0 to 310.2	99 (98)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 11 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (268.5)	Quartz Diorite		Run 76	99 (98)
			Run 77 310.2 to 315.4	99 (83)
			Run 78 315.4 to 320.6	99 (88)
320 (277.1)		318.8-319.7 - Shear/alteration zone, bleached light gray, slightly to moderately altered hydrothermally. Friable, feldspars altering to clay, iron oxide staining on joints and fractures.		
		319.2 - Shear, 30°, 0.13 inch breccia and gouge, carbonate filling.	Run 79 320.6 to 325.6	100 (100)
		320.6-325.6 - Core loss 0.2 feet.		
		321.2-321.9 - Fracture zone, 0°-20°, joints very closely spaced, iron oxide staining and carbonate filling.		
		322.5-325.6 - Fracture/alteration zone, slightly to moderately altered hydrothermally, healed joints very close to closely spaced. Carbonate and clay filling in joints from altered feldspars, moderately hard.	Run 80 325.6 to 330.2	72 (48)
330 (285.8)		323.8 - Joint, 30°, slickensides, clay and carbonate filling, minor iron oxide staining.	Run 81 330.2 to 332.7	20 (0)
		324.4 - Carbonate vein, 40°, 0.5 inches wide, offset 0.5 inches along healed shear at 10°, tight.		
		328.2-332.7 - Fracture zone, joints very closely spaced, soft and friable. Core loss 3.3 feet.	Run 82 332.7 to 337.9	96 (65)
			Run 83 337.9 to 342.9	100 (100)
340 (294.4)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 12 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	339.0-345.0 - Alteration zone, bleached light gray, slightly altered hydrothermally, feldspars beginning to alter to clay. Joints very close to closely spaced at 30°, generally healed and tight with carbonate filling and iron oxide staining, hard to moderately hard.	Run 83	100 (100)
		343.0 - Core loss 0.2 feet.	Run 84 342.9 to 348.8	98 (92)
		345.0 - Joints close to moderately closely spaced.		
350 (303.1)			Run 85 348.8 to 353.8	100 (100)
			Run 86 353.8 to 358.9	100 (70)
		357.9-358.6 - Fracture zone, joints very closely spaced at 10°-20°, 30°, and 50°.		
360 (311.8)		360.1 - Joint, 50°, highly altered hydrothermally, carbonate filling.	Run 87 358.9 to 363.1	100 (40)
		360.1-361.4 - Fracture/alteration zone, slightly altered hydrothermally, joints very closely spaced (scalloped). Moderately hard to soft, friable.		
			Run 88 363.1 to 368.2	100 (75)
		368.2-373.2 - Core loss 0.2 feet.		
370 (320.4)			Run 89 368.2 to 373.2	100 (98)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 13 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	374.1-374.7 - Fracture zone, 20-30°, joints very closely spaced, carbonate filling and some iron oxide staining. 377.2 - Joint, 40°, surface severely altered hydrothermally to 0.13 inches.	Run 90 373.2 to 378.4	96 (77)
380 (329.1)		380.2-382.2 - Shear/alteration zone, slightly to moderately altered hydrothermally, joints close to very closely spaced. Numerous re-healed fractures, feldspars decomposing to clay, soft and friable. 381.5-382.2 - Shear zone, 40-50°, joints very closely spaced, clay gouge, breccia. 383.3-388.3 - Core loss 0.1 feet. 382.2-477.5 - Joints closely to moderately closely spaced.	Run 91 378.4 to 383.7	100 (72)
			Run 92 383.7 to 388.6	100 (98)
390 (337.7)			Run 93 388.6 to 393.3	100 (100)
			Run 94 393.3 to 398.3	100 (86)
		397.8-398.1 - Fracture zone, joints very closely spaced, at 60° to 80°, minor carbonate coating. 399.5-400.9 - Red staining, irregular and discontinuous.	Run 95 398.3-400.6	100 (76)
400 (346.4)		402.0 - Felsic dike, granodiorite composition, 0.1 feet thick.	Run 96 400.6 to 403.4	100 (95)
			Run 97	100 (98)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 14 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Quartz Diorite		Run 97	100 (98)
			Run 98 406.2 to 410.9	100 (98)
410 (355.1)		412.0 - Inclusions of fine grained diorite, 0.2 feet in diameter, sharp contacts, irregular shape.	Run 99 410.9 to 416.0	100 (100)
			Run 100 416.0 to 420.8	100 (100)
420 (363.7)		421.8 - Inclusion of fine grained diorite, 0.2 feet in diameter.	Run 101 420.8 to 426.0	99 (94)
			Run 102 426.0 to 430.5	100 (97)
430 (372.4)			Run 103 430.5 to 435.6	100 (100)
			Run 104	100 (98)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 15 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 104 435.6 to 440.4	100 (98)
440 (381.1)			Run 105 440.4 to 445.6	100 (94)
			Run 106 445.6 to 450.6	100 (90)
450 (389.7)			Run 107 450.6 to 455.8	96 (79)
		454.6-455.1 - Fracture zone, joints very closely spaced, at 20°-30° and 40°-70°, carbonate coating.	Run 108 455.8-458.2	88 (88)
460 (398.4)			Run 109 458.2 to 463.2	100 (78)
			Run 110	43(0)
			Run 111 463.9 to 468.4	100 (88)
			Run 112	95(83)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 16 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (407.0)	Quartz Diorite		Run 112 468.4 to 473.3	95 (83)
		472.7-473.3 - Core badly broken by drilling.	Run 113 473.3 to 477.8	100 (92)
		477.5-477.9 - Fracture zone, joints very closely spaced, at 60°-80°, chlorite coating.	Run 114 477.8 to 480.3	92 (72)
480 (415.7)			Run 115 480.3 to 485.3	94 (65)
		481.9-482.6 - Fracture zone, joints very closely spaced at 40°-60°.	Run 116 485.3 to 490.5	61 (0)
490 (424.4)		485.3-490.5 - Core barrel mislatched during drilling. Core loss 2.0 feet.	Run 117 490.5 to 495.5	99 (95)
			Run 118 495.5 to 500.5	98 (77)
500 (433.0)			Run 119	95(91)

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-6
SITE Watana (North Bank) — **SHEET NO.** 17 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 119 500.5 to 505.6	95 (91)
		505.7 - Healed shear, 40°, 0.5 inches wide, healed with dark green, fine grained diorite, tight, hard.	Run 120 505.6 to 510.6	100 (100)
510 (441.7)			Run 121 510.6 to 515.6	99 (92)
		516.2-516.8 - Core badly broken by drilling. 517.7 - Carbonate vein, 0.25 inches wide, irregular and discontinuous. 519.3 - Two joints very closely spaced, at 40°, healed with carbonate.	Run 122 515.6 to 520.7	98 (66)
520 (450.3)			Run 123 520.7 to 525.6	100 (67)
			Run 124 525.6 to 530.4	100 (74)
		529.5-529.9 - Fracture zone, joints very closely spaced at 40°, 0.5 inches spacing, carbonate filling and chlorite staining.		
530 (459.0)			Run 125	93 (0)
			Run 126	100 (0)
			Run 127	100 (52)

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-6
SITE Watana (North Bank) — **SHEET NO.** 18 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	530.5-533.0 - Shear/alteration zone, moderately to severely altered hydrothermally, moderately hard. Feldspars altered to clay.	532.0-534.5	100 (52)
		530.5-531.8 - Fracture, joints very closely spaced, carbonate filling. 531.8-532.8 - Approximately 1.0 foot of light gray clay gouge and breccia. 533.5-547.5 - Core loss 1.2 feet.	Run 128 534.5 to 539.5	100 (90)
540 (467.7)		541.3-541.7 - Fracture zones, joints very closely spaced, at 50° and 40°, carbonate filling and iron oxide staining.	Run 129 539.5 to 544.6	100 (73)
			Run 130 544.6 to 547.5	79 (55)
			Run 131 547.5 to 550.4	100 (76)
550 (476.3)			Run 132 550.4 to 555.4	94 (79)
			Run 133 555.4 to 560.7	100 (83)
		559.6-561.1 - Numerous healed joints, 60°, carbonate filled.		
560 (485.0)		560.8-561.5 - Shear, breccia healed with carbonate, chlorite, and quartz.	Run 134 560.7 to 565.7	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 19 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	564.6-576.7 - Shear/alteration zone, light gray, slightly to moderately altered hydrothermally. Joints close to very closely spaced, generally 20°-80°, numerous healed fractures. Feldspars decomposing to clay, carbonate filling and iron oxide staining. Soft, friable in places. Core loss 0.8 feet.	Run 134	100(100)
			Run 135 565.7 to 570.7	90 (7)
570 (493.6)		569.0 - Shear, 60°, very thin clay gouge.		
		571.9-572.7 - Breccia and clay gouge, white to light gray, 20° and 50°, soft, friable.	Run 136 570.7 to 575.9	94 (83)
			Run 137 575.9 to 580.7	98 (61)
580 (502.3)		579.5-580.7 - Fracture/alteration zone, slightly altered hydrothermally, joints very closely spaced, numerous healed fractures.		
		581.1-604.3 - Joints closely spaced, some carbonate filling and iron oxide staining.	Run 138 580.7 to 585.8	100 (64)
		583.4-583.7 - Core broken by drilling.		
			Run 139 585.8 to 590.8	100 (51)
590 (511.0)		590.8-592.8 - Core barrel mislatched during drilling. Core loss 0.6 feet.	Run 140 590.8-592.8	70 (0)
			Run 141 592.8 to 597.8	99 (82)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 20 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 141	99(82)
			Run 142 597.8 to 602.6	100 (42)
600 (519.6)		602.1-602.6 - Core broken by drilling.		
			Run 143 602.6 to 608.3	100 (61)
		607.7-607.9 - Core broken by drilling.		
			Run 144 608.3 to 611.8	100 (89)
610 (528.3)		611.3-612.4 - Felsic dike, light gray, fine grained, fresh, 6.0 inches thick. Lower and upper contacts at 10°, tight.	Run 145 611.8 to 615.4	78 (64)
			Run 146 615.4 to 620.3	100 (96)
620 (536.9)			Run 147 620.3 to 625.2	100 (94)
		626.1-627.2 - Felsic dike as above, light gray, fine grained, 20-30% quartz, 5-10% mafics, interfingering or containing clasts of the quartz diorite. Unfractured, contacts tight and melted, upper at 70°, lower at 40°.	Run 148 625.2 to 630.2	92 (79)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 21 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
630 (545.6)	Quartz Diorite	Core loss 0.4 feet.	Run 148	92 (79)
			Run 149	88 (72)
			Run 150 631.8 to 636.7	100 (80)
			Run 151 636.7 to 640.5	100 (100)
640 (554.3)			Run 152 640.5 to 645.6	98 (85)
			Run 153 645.6 to 650.5	99 (88)
649.7 (562.7)		648.7-649.7 - High concentration of biotite.		
650 (562.9)	Granodiorite	Light gray-white, generally fine to medium grained crystalline rock, 60-80% feldspars, 10-20% mafics (biotite), 10-20% quartz. Generally hard and fresh, some feldspars stained brown. Upper contact is gradational over 0.1 feet, feldspars slightly altered, tight.	Run 154 650.5 to 655.8	98 (88)
		656.0-670.0 - Numerous healed joints, calcite filling.	Run 155 655.8 to 660.6	96 (50)
660 (571.6)			Run 156	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6

SITE Watana (North Bank) — SHEET NO. 22 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Granodiorite		Run 156 660.6 to 665.7	100 (74)
			Run 157 665.7 to 670.8	97 (90)
670 (580.2)			Run 158 670.8 to 676.0	100 (58)
		674.4-674.7 - Core broken by drilling.	Run 159 676.0 to 680.6	97 (93)
680 (588.9)			Run 160 680.6 to 685.4	98 (90)
			Run 161 685.4-687.9	76 (72)
			Run 162 687.9 to 692.5	100 (91)
690 (597.6)			Run 163	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 23 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Granodiorite		Run 163 692.5 to 697.5	100 (80)
700 (606.2)			Run 164 697.5 to 702.7	100 (83)
		703.5-706.0 - Fracture/alteration zone, slightly altered hydrothermally, joints close to very closely spaced, at 40°-60°, feldspars altering to clay, carbonate filling present.	Run 165 702.7 to 707.2	100 (44)
710 (614.9)			Run 166 707.2 to 712.2	100 (78)
			Run 167 712.2 to 717.1	100 (88)
720 (623.5)			Run 168 717.1 to 722.2	100 (92)
		722.0-727.1 - Core loss 0.1 feet.	Run 169 722.2 to 727.3	99 (69)

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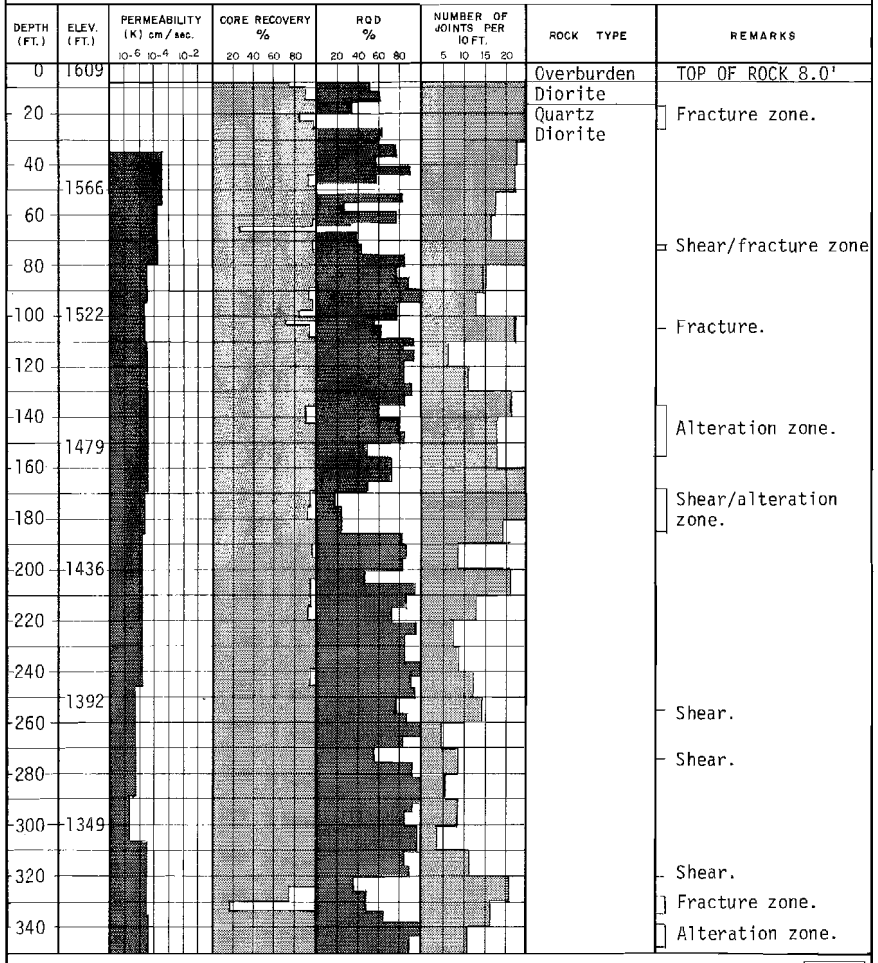
CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-6
SITE Watana (North Bank) — SHEET NO. 24 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Granodiorite	725.7-726.3 - Numerous healed joints very closely spaced, 20°-40°, faint slickensides, calcite filling.	Run 169	99 (69)
730 (632.2)			Run 170 727.3 to 730.5	100 (84)
			Run 171 730.5 to 735.3	100 (92)
(640.9) 740			Run 172 735.3 to 740.4	93 (73)
		END OF BORING		
740.4 (641.2)				
750 (649.5)				

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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-6
Site Watana (North Bank) — **Sheet No.** 1 of 3

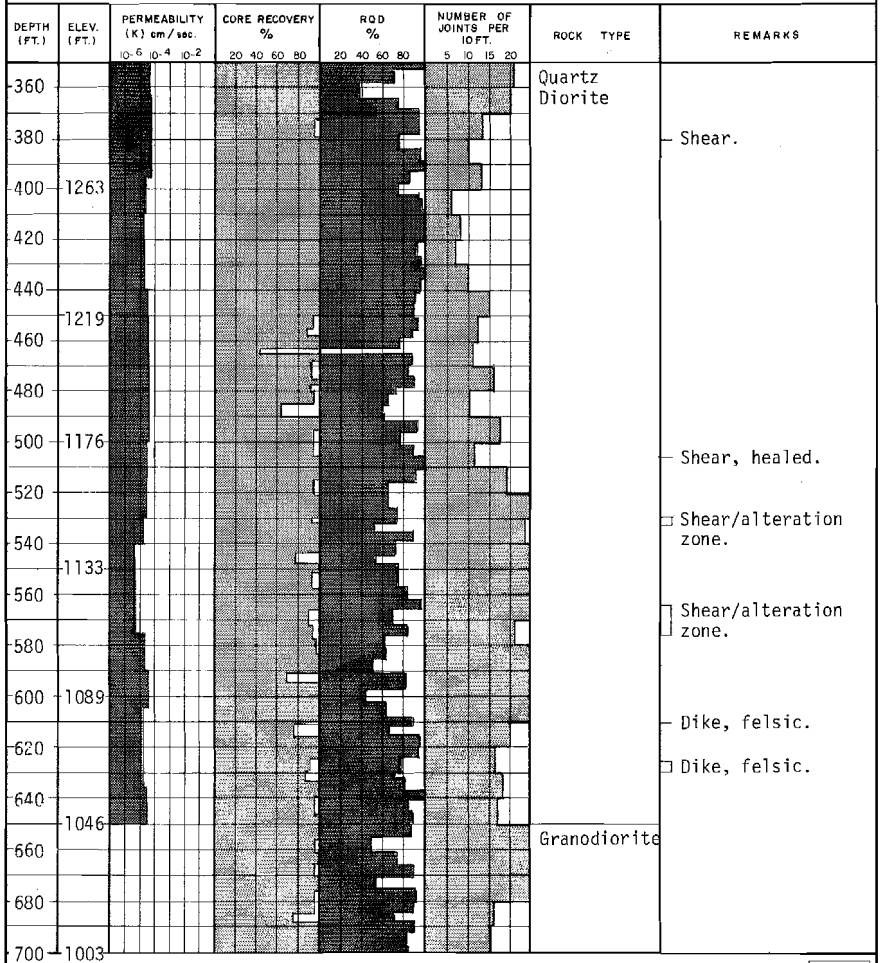


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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-6
Site Watana (North Bank) — **Sheet No.** 2 of 3



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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-6
Site Watana (North Bank) — **Sheet No.** 3 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10-6 10-4 10-2	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
720							
740	968						END OF BORING 740.4'

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CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-8

SITE: Watana (South Bank) — SHEET NO. 1 OF 24

CONTRACTOR: The Drilling Company — DRILLING DATES: July 29 TO August 9, 1980
LOGGED BY: K.J. White, M.P. Bruen — DATE: July 1980

DRILLING METHOD: SOIL: Casing Advancer — CASING DIAMETER: NW (3.0") I.D.
ROCK: Diamond Core - Triple Tube — CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,225,586 — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E744,482 — GROUND SURFACE 1979.7
AZIMUTH 060° — ROCK SURFACE 1972.8
DIP 60° — BOTTOM OF HOLE 1328.1
WATER TABLE 1963.7

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden			
8.0 (6.9)	Andesite Porphyry	Light gray to greenish gray, aphanitic groundmass with white, feldspar phenocrysts to 0.1 inch and 5-10% angular inclusions of argillite to 0.5 inch. Slightly weathered and hard. Flow structures visible.	No Core	
10 (8.7)		Joints very close to close spaced with planar to irregular, rough surfaces. Penetrative iron oxide staining up to 0.5 inch, minor carbonate filling.		
		8.0-13.8 - No core taken.	Run 1 13.8 to 18.0	64 (0)
		13.8-18.3 - Moderately weathered. Joints very close spaced with traces of sand and silt. Core loss 1.5 feet.		
20 (17.3)			Run 2 18.0 to 23.8	90 (20)

APPROVED: [signature] DATE: February 1, 1982

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 2 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Andesite Porphyry	18.3-34.1 - Slightly to moderately weathered. Joints very close to close spaced. Core loss 1.2 feet.	Run 2 18.0 to 23.8	90 (20)
			Run 3 23.8 to 28.8	92 (58)
30 (26.0)			Run 4 28.8 to 33.8	100 (35)
		33.8-38.8 - Core loss 1.1 feet.		
		34.1-49.6 Fresh to slightly weathered. Joints very close to close spaced with nonpenetrative iron oxide staining.	Run 5 33.8 to 38.8	79 (56)
40 (34.6)		44.3-49.6 - Fracture zone, joints very close spaced.	Run 6 38.8 to 43.9	98 (77)
		46.0-47.1 - Subrounded to subangular inclusions of argillite, quartz, diorite, and volcanics up to 2 inches, andesite matrix.		
		47.1-49.6 - Moderately to severely weathered. Silty to sandy clay with 20-30% subangular to subrounded, coarse sand. Core loss 1.1 feet. Drilling water return 50%.	Run 7 43.9-45.6	100 (0)
			Run 8 45.6 to 49.6	73 (26)
49.6 (43.0)				
50 (43.3)	Diorite to Quartz Diorite	Light gray to greenish gray, fine to medium grained, nonfoliated crystalline rock. 50-80% feldspar, 20-40% mafics (biotite and hornblende), 0-15% quartz and trace carbonate.	Run 9 49.6-52.5	72 (0)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-8

SITE Watana (South Bank) — **SHEET NO.** 3 **OF** 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite to Quartz Diorite	Fresh and very hard to hard. Joints close spaced, planar to rough. Carbonate coating on most surfaces.	Run 10 52.5 to 56.5	91 (11)
		49.6-53.4 - Fracture/alteration zone, hydrothermally altered, joints very closely spaced.	Run 11 56.5 to 59.5	100 (52)
60 (52.0)		50.1-52.9 - Two alteration zones, severely hydrothermally altered. 1 inch wide, 30°, soft and friable.	Run 12 59.5 to 63.6	85 (67)
		53.4-61.4 - Joints closely spaced, iron oxide stained.	Run 13 63.6 to 68.0	100 (69)
		60.3-61.4 - Healed shear, diorite breccia in dark gray, fine grained diorite matrix. Hard and tight. Carbonate stringers.	Run 14 68.0 to 73.0	100 (87)
70 (60.6)		61.4 - Contact resheared, 30°, 0.1 inch clay gouge.	Run 15 73.0 to 77.7	100 (48)
		61.4-64.5 - Alteration zone, moderately hydrothermally altered. Joints very close to close spaced.	Run 16 77.7 to 80.7	100 (25)
		62.2,62.9,64.4 - Severely hydrothermally altered zones, 1.0-2.0 inches wide, at 50-70°. soft and friable.	Run 17 80.7 to 84.0	97 (55)
		64.5-75.0 - Joints very close to close, surfaces fresh.	Run 18	
		65.0-66.0 - Three healed shears up to 1 inch wide, at 50°. Healed with dark green, fine grained diorite. Hard and tight.		
		75.0-78.8 - Fracture zone, joints very close to close spaced, open at 10-30°, 90°, and 0°. Some treated with carbonate, minor iron oxide staining and chlorite.		
		78.8-91.6 - Joints close spaced. Iron oxide staining, some carbonate filling. Slickensides on some surfaces.		
80 (69.3)		82.0-85.4 - Fracture zone, joints very close spaced at 80-90°, 50-60°, and 20-30°. Minor iron oxide staining, carbonate and chlorite.		
		83.5 - Slickensides on carbonate staining.		

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-8

SITE Watana (South Bank) — **SHEET NO.** 4 **OF** 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite to Quartz Diorite		Run 18 84.0 to 89.3	98 (63)
		88.4-91.6 - Fracture zone, joints very closely spaced at 0-30°. Iron oxide staining, some carbonate filling.		
90 (77.9)		91.6-96.6 - Core loss 0.6 feet.	Run 19 89.3-91.6	100 (0)
			Run 20 91.6 to 96.6	88 (57)
			Run 21 96.6 to 101.0	100 (91)
100 (86.6)		100.0-141.0 - Joints closely spaced, planar, rough. Iron oxide staining and carbonate coating.		
			Run 22 101.0 to 106.2	100 (83)
		105.2-111.4 - Healed shears, 1-2 feet spacing up to 0.1 feet wide. Healed with dark green, fine grained diorite. Tight, hard.	Run 23 106.2 to 111.0	100 (94)
110 (95.3)			Run 24 111.0 to 116.1	100 (92)
		116.1-121.1 - Core loss 0.3 feet.	Run 25	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 5 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite to Quartz Diorite		Run 25 116.1 to 121.1	95 (80)
120 (103.9)			Run 26 121.1 to 126.1	100 (76)
			Run 27 126.1 to 131.1	100 (98)
130 (112.6)			Run 28 131.1 to 135.6	100 (88)
			Run 29 135.6 to 140.8	100 (82)
140 (121.2)		140.8-142.9 - Core loss 0.5 feet. 141.0-190.0 - Joints closely spaced, planar, rough. Carbonate or chlorite filling.	Run 30 140.8-143.9	79 (26)
		145.0-147.1 - Shear/fracture zone, joints very close, 40-90°. Chlorite filling. 146.0-146.3 - Slickensides on chlorite surface. Joints tight. Fresh and hard.	Run 31 142.9 to 148.0	100 (70)
			Run 32	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 6 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (129.9)	Diorite to Quartz Diorite	148.9-149.3 - Diorite dike, dark green, fine grained. Tight irregular contacts at 30°, hard. 152.6-167.5 - Core loss 0.7 feet.	Run 32 148.0 to 152.6	100 (96)
			Run 33 152.6 to 157.7	100 (89)
160 (138.6)			Run 34 157.7 to 162.7	96 (85)
			Run 35 162.7 to 167.5	90 (79)
			Run 36 167.5 to 171.9	99 (86)
170 (147.2)		171.5-173.0 - Shear/alteration zone, hydrothermally altered, bleached white, medium hard to soft and friable, joints very close, some tight and healed with chlorite. Clay gouge less than 3 inches. Angular fragments 0.5-1.0 inches. Resheared healed shear, core loss 0.7 feet. 176.5-182.7 - Red staining intergranular. Irregular, discontinuous.	Run 37 171.9 to 176.5	85 (39)
			Run 38 176.5 to 181.0	90 (80)
180 (155.9)		180.7-181.0 - Possible fracture zone, core broken into fragments less than 1 inch, some fragments of healed breccia core loss 0.5 feet.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 7 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Diorite to Quartz Diorite		Run 39 181.0 to 185.9	100 (97)
			Run 40 185.9-189.2	88 (73)
190 (164.5)		189.2-189.4 - Possible fracture zone, slightly to moderately hydrothermally altered, fragments less than 1 inch, some healed breccia. Core loss 0.4 feet. 190.0-230.0 - Joints moderately close spaced, plane, rough, carbonate coated.	Run 41 189.2 to 194.2	100 (98)
			Run 42 194.2 to 199.2	100 (98)
		199.0-201.8 - Red staining, discontinuous.		
200 (173.2)		200.5 - Healed shear, 40°, 1 inch wide, healed with dark green diorite. Tight, hard, competent.	Run 43 199.2-201.0	100 (94)
			Run 44 201.0 to 206.4	100 (100)
		206.8-207.9 - Fracture/alteration zone, hydrothermally altered, joints very close at 30°, healed with carbonate, iron oxide staining, patches of rock bleached white, tight, hard.	Run 45 206.4 to 211.0	87 (76)
210 (181.9)		210.9 - Healed shear, 0.5 inch wide, carbonate filling at contact, tight, hard, healed with dark green diorite. 211.0-215.1 - Core loss 0.6 feet.	Run 46	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 8 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Diorite to Quartz Diorite		Run 46 211.0-215.1	100 (68)
			Run 47 215.1 to 219.3	100 (88)
220 (190.5)		221.2-222.2 - Fracture/alteration zone, hydrothermally altered, bleached white, joints very close at 30-40°. Iron oxide staining, slightly altered, hard. 224.1-228.1 - Red staining, irregular, discontinuous. 225.4-230.6 - Core loss 0.2 feet.	Run 48 219.3-221.2	100 (100)
			Run 49 221.2 to 225.4	100 (88)
			Run 50 225.4 to 230.6	96 (71)
230 (199.2)		230.0-290.0 - Joints moderately close, plane, rough, carbonate coated. 230.6-231.8 - Joint, tight, red staining penetrating 0.5 inches on each side.	Run 51 230.6 to 235.6	96 (94)
			Run 52 235.6 to 240.9	98 (89)
240 (207.8)		238.7, 239.2, 246.2 - Healed shears, 20-70°, less than 1 inch wide, healed with dark green, fine grained diorite, tight, hard.	Run 53 240.9 to 245.6	100 (91)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 9 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Diorite to Quartz Diorite	246.8-247.2 - Alteration zone, slightly to moderately altered hydrothermally, feldspars altering to clay, mafics completely altered, bleached white. Joints at 50° with iron oxide and carbonate, hard to moderately hard.	Run 54 245.6 to 251.0	98 (81)
250 (216.5)		250.0-251.8 - Possible shear/alteration zone, bleached light gray, slightly to moderately hydrothermally altered, hard to moderately hard. Joints very close at 50°, most tight but some opened by drilling, carbonate filling and iron oxide staining. Some clay on joints from altered feldspars.	Run 55 251.0 to 255.2	100 (57)
		251.8-324.5 - Joints close to moderately close except where noted.		
		254.8-258.8 - Red staining, irregular, discontinuous.	Run 56 255.2 to 260.1	100 (76)
260 (225.2)		261.6-262.2 - Healed shear, 10-20°, healed with dark green diorite, tight.	Run 57 260.1 to 265.1	98 (70)
			Run 58 265.1 to 270.1	100 (62)
270 (233.8)				
271.5 (235.1)	Quartz Diorite to Gradodiorite	Light gray, medium grained, non-foliated, crystalline with 15-30% mafics (biotite and hornblende), 10-15% quartz, up to 10% pink feldspar. Gradations to granodiorite. Contains inclusions of fine grained diorite, trace of pyrite and carbonate. Generally very hard to hard, fresh and competent.	Run 59 270.1 to 275.3	100 (77)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 10 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite to Granodiorite	Joints moderately close to close, planar, smooth to rough, mostly carbonate coated.	Run 60 275.3 to 280.3	100 (100)
280 (242.5)		280.7-281.0 - Dike/possible inclusion of granodiorite, fine grained groundmass of orthoclase feldspar and quartz, medium grained plagioclase feldspar phenocrysts, tight contacts, hard.	Run 61 280.3 to 284.4	98 (98)
		287.8-291.0 - Core barrel mislatch during drilling. Core loss 1.0 feet.	Run 62 284.4 to 287.8	94 (85)
290 (251.1)		290.0-330.0 - Joints moderately close, planar, rough, few with carbonate coating.	Run 63 287.8-291.0	70 (25)
		294.6-295.9 - Core badly broken during drilling.	Run 64 291.0 to 296.1	100 (75)
			Run 65 296.1 to 300.8	100 (89)
300 (259.8)		300.8-302.5 - Healed shear zone, 50-70°, very close shears healed with dark green quartz diorite, tight, hard, competent.	Run 66 300.8-303.7	97 (95)
		306.5-308.5 - Core broken during drilling, fresh angular pieces.	Run 67 303.7 to 308.8	100 (76)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 11 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (268.5)	Quartz Diorite to Granodiorite		Run 68 308.8 to 313.2	100 (93)
			Run 69 313.2 to 318.2	100 (98)
320 (277.1)			Run 70 318.3 to 321.5	94 (84)
		324.6-333.1 - Felsic, possible aplite dikes, light pinkish gray, 3 and 2 inches wide at 30° and 20°, respectively. Unfractured, hard.	Run 71 321.5 to 326.9	100 (94)
330 (285.8)		330.0-346.3 - Joints close to very close, planar, smooth to rough. Carbonate coated with zones of iron oxide staining.	Run 72 326.9 to 330.8	97 (97)
			Run 73 330.8 to 335.8	100 (96)
339.3 (293.8)			Run 74 335.8 to 340.1	100 (90)
340 (294.4)	Diorite/Diorite Porphyry	Dark greenish gray, fine grained crystalline rock with medium grained plagioclase		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 12 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite/ Diorite Porphyry	phenocrysts, fresh, hard. Joints coated with chlorite and carbonate.	Run 75 340.1- 343.2	97 (76)
347.2 (300.7)		346.3-351.9 - Joints close to moderately close, carbonate coating and filling.	Run 76 343.2 to 348.4	100 (100)
	Quartz Diorite	Rock description, as above.	Run 77 348.4 to 351.8	100 (68)
350 (303.1)		351.9-437.5 - Joints close to very close, planar, smooth to rough, carbonate coated, zones of iron oxide staining.	Run 78 351.8 to 356.8	100 (100)
			Run 79 356.8 to 360.9	100 (90)
360 (311.8)		360.9-361.1 - Diorite porphyry inclusion.	Run 80 360.9 to 364.2	100 (62)
			Run 81	85 (69)
366.3 (317.2)	Diorite Porphyry	Dark greenish gray, fine grained crystalline matrix with medium to coarse grained plagioclase phenocrysts, 40-50% mafics, fresh, hard.	Run 82 365.5 to 370.5	100 (82)
370 (320.4)		369.5 - Felsic dike, light gray, 1.5 inches wide, 30°, fractured along trend, tight contacts.	Run 83 370.5 to 375.8	100 (91)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-8
SITE Watana (South Bank) — **SHEET NO.** 13 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite Porphyry		Run 83 370.5 to 375.8	100 (91)
377.0 (326.5)	Quartz Diorite	Rock description, as above.	Run 84 375.8 to 380.7	100 (86)
		378.3 - Felsic dike, possibly aplite, light gray, unfractured, 0.5 inches wide, 40°, tight.		
380 (329.1)			Run 85 380.7 to 384.3	89 (56)
		385.1-387.0 - Shear/alteration zone slightly to moderately altered hydrothermally, soft and friable. Iron oxide staining and carbonate filling on joints. Silty sand gouge. Core loss 0.4 feet.	Run 86 384.3 to 389.3	98 (36)
		385.1-400.5 - Iron oxide staining on most joints.		
390 (337.7)			Run 87 389.3 to 393.7	98 (67)
			Run 88 393.7 to 398.0	100 (100)
400 (346.4)			Run 89 398.0 to 403.5	100 (93)
		403.5-413.1 - Core loss 0.8 feet.		
			Run 90	

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-8
SITE Watana (South Bank) — **SHEET NO.** 14 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JDINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	405.3-410.9 - Fracture/alteration zone, yellowish gray, slightly hydrothermally altered, generally moderately hard but occasionally soft. Carbonate and iron oxide staining.	Run 90 403.5 to 409.0	91 (26)
410 (355.1)		407.1 - Moderately to severely altered, possible shear, 2.0 inches wide. Broken rock fragments less than 0.5 inch.	Run 91 409.0 to 413.1	93 (49)
			Run 92 413.1 to 418.3	100 (73)
		418.3-418.5 - Healed shear, quartz diorite breccia in fine grained quartz diorite groundmass, tight.	Run 93 418.3 to 422.5	100 (79)
420 (363.7)		420.0-429.0 - Iron oxide staining on most joints.		
			Run 94 422.5 to 427.6	100 (100)
			Run 95 427.6 to 432.2	100 (57)
430 (372.4)		433.7-437.5 - Shear/fracture zone, joints very close, 20°-50°, some healed with carbonate.		
		433.7-434.8 436.1-437.5 } Soft and friable rock, slickensides, chlorite, clay gouge to 2.0 inches. Core loss 1.1 feet.	Run 96 432.2-434.8	69 (38)
			Run 97 434.8-437.5	89 (24)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 15 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	437.5-453.3 - Joints very close to close spaced, healed with carbonate, iron oxide stained.	Run 98 437.5 to 442.2	98 (66)
440 (381.1)		443.1-446.2 - Shear/alteration zone, rock bleached white, 40-90°, moderately weathered. Joints and fractures close, rough, planar. 0.8 feet clay gouge.	Run 99 442.2 to 447.2	94 (54)
		448.4-453.4 - Core loss 0.6 feet.	Run 100 447.2 to 452.2	88 (88)
450 (389.7)		453.3-610.0 - Joints moderately close to close, planar, smooth to rough, some carbonate coated.	Run 101 452.2 to 457.4	100 (100)
			Run 102 457.4 to 462.2	100 (100)
460 (398.4)			Run 103 462.2 to 466.6	100 (100)
			Run 104 466.6- 468.4	100 (89)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 16 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (407.0)	Quartz Diorite		Run 105 468.4 to 471.4	100 (100)
			Run 106 471.4 to 476.6	100 (100)
		477.8-478.0 - Alteration zone, rock bleached white, moderately hydrothermally altered, soft and friable along joints at 50°.	Run 107 476.6 to 481.8	100 (75)
480 (415.7)			Run 108 481.5- 483.0	100 (100)
			Run 109 483.0 to 486.8	92 (82)
			Run 110 486.8 to 491.6	100 (100)
490 (424.4)			Run 111 491.6 to 496.6	90 (48)
		494.2-496.8 - Alteration zone, rock bleached white, hydrothermally altered, soft and friable. Core loss 0.5 feet. Feldspars weathering to clay, slightly to moderately altered.	Run 112 496.6 to 501.7	100 (96)
500 (433.0)		499.4-502.7 - Felsic dike, light gray, fine to medium grained, less than 10% mafics, hard.		

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-8

SITE Watana (South Bank) — **SHEET NO.** 17 **OF** 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 113 501.7 to 507.0	96 (87)
510 (441.7)		508.4-520.7 - Alteration zone, bleached white-gray, slightly to moderately hydrothermally altered, numerous healed joints. Feldspars altering to clay, moderately hard but friable in places, joints close at 30-70°.	Run 114 507.0 to 512.0	88 (28)
			Run 115 512.0 to 517.4	94 (0)
520 (450.3)			Run 116 517.4 to 522.4	100 (34)
			Run 117 522.4 to 527.5	100 (98)
530 (459.0)			Run 118 527.5 to 532.6	96 (92)
		531.5-540.9 - Alteration zone, bleached white-gray, slightly to moderately hydrothermally altered, moderately hard to soft. Feldspars altering to clay.		

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-9

SITE Watana (South Bank) — **SHEET NO.** 18 **OF** 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 119 532.6 to 537.9	96 (64)
		535.0-536.3 - Occasional friable zones with clay up to 0.1 feet. Core loss 0.5 feet.		
540 (467.7)			Run 120 537.9 to 542.9	98 (86)
			Run 121 542.9 to 548.1	100 (100)
550 (476.3)			Run 122 548.1 to 552.8	100 (100)
		553.0-569.9 - Fractured/alteration zone, bleached white-gray, slightly to moderately hydrothermally altered, joints very close to close at 30-60°, healed with carbonate, iron oxide stained. Moderately hard to soft, friable in places. Feldspars altering to clay. Core loss 0.2 feet.	Run 123 552.8- 554.2	100 (0)
			Run 124 554.2 to 558.0	100 (0)
560 (485.0)			Run 125 558.0 to 562.8	98 (0)
			Run 126 562.8- 567.8	96 (0)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 19 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 126 562.8 to 567.8	96 (0)
570 (493.6)		569.0-578.8 - Healed shears, closely spaced, less than 0.1 feet wide, healed with dark green, aphanitic quartz diorite, tight. Core loss 0.6 feet.	Run 127 567.8 to 573.2	94 (39)
		573.0 - Texture of quartz diorite changes. Quartz and white feldspar are fine grained and intergrown, green feldspar (20-30%) is medium grained.	Run 128 573.2 to 577.0	92 (87)
		577.6-586.6 - Joints close to moderately close, carbonate coating and iron staining.	Run 129 577.0 to 582.1	100 (98)
580 (502.3)		581.6-582.5 - Alteration zone, bleached white, slightly altered hydrothermally, hard.		
			Run 130 582.1 to 587.2	100 (100)
		589.0-592.5 - Shear/alteration zone, bleached white-gray, slightly altered hydrothermally, healed and resheared. Numerous, very close shears healed with possible quartz/andesite, randomly oriented from 0-90°, hard.	Run 131 587.2 to 592.3	100 (71)
590 (511.0)		589.0-589.3 ? 592.1-592.5 } Zones of reshearing, breccia, and gouge, moderately soft and friable.	Run 132 592.3 to 597.6	98 (81)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 20 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	593.3 - Shear, 30°, 2 inches wide, breccia and gouge, moderately soft, sulphide mineralization and iron oxide staining.		
600 (519.6)			Run 133 597.6 to 602.6	100 (74)
			Run 134 602.6- 605.6	97 (77)
			Run 135 605.6 to 610.6	100 (92)
610 (528.3)		610.8-635.2 - Joints close to very close, many healed with carbonate.		
			Run 136 610.6- 614.0	100 (47)
			Run 137 614.0 to 619.2	96 (50)
620 (536.9)			Run 138 619.2 to 622.6	100 (56)
			Run 139 622.6 to 627.8	100 (54)
		626.2-627.7 - Core broken by drilling, rock fragments 1-2 inches, possible fracture zone.		
			Run 140	

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-8

SITE Watana (South Bank) **SHEET NO.** 21 **OF** 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
630 (545.6)	Quartz Diorite	628.2-629.8 - Core badly broken, rock fragments 1.0-2.0 inches.	Run 140 627.8-630.4	100 (27)
			Run 141 630.4 to 635.6	100 (69)
		635.2-700.0 - Joints moderately close, planar, smooth, most carbonate coated.		
			Run 142 635.6 to 640.9	91 (87)
640 (554.3)				
			Run 143 640.9 to 645.1	100 (95)
		646.7-650.1 - Shear/alteration zone, rock bleached white-gray, slightly hydrothermally altered, soft and friable. Breccia and clay zone 0.7 feet wide, joints close at 40-75°, carbonate coating.	Run 144 645.1 to 650.4	100 (94)
650 (562.9)				
			Run 145 650.4 to 655.4	100 (100)
			Run 146 655.4 to 660.7	98 (91)
660 (571.6)				

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-8

SITE Watana (South Bank) **SHEET NO.** 22 **OF** 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 147 660.7 to 665.8	100 (100)
			Run 148 665.8 to 671.1	100 (96)
670 (580.2)		671.1-676.4 - Core loss 0.3 feet.		
			Run 149 671.1 to 676.4	94 (85)
			Run 150 676.4 to 681.6	100 (100)
680 (588.9)		682.3-690.8 - Red staining, irregular and discontinuous, intergranular.		
			Run 151 681.6 to 686.9	100 (98)
			Run 152 686.9 to 692.2	100 (92)
690 (597.6)		692.2-695.0 - Core barrel mislatched during drilling. Core loss 0.2 feet.		
			Run 153	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

SITE Watana (South Bank) — SHEET NO. 23 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 153 692.2-695.0	86 (71)
			Run 154 695.0 to 700.0	100 (74)
700 (606.2)		700.0-752.4 - Joints closely spaced, planar, smooth to rough, carbonate coated.	Run 155 700.0 to 705.1	100 (86)
			Run 156 705.1 to 710.4	98 (83)
710 (614.9)			Run 157 710.4 to 715.0	100 (100)
		Run 158 redrilled.	Run 158 715.0 to 721.3	83 (60)
720 (623.5)		721.6-724.3 - Joints close, carbonate coating. Core loss 0.2 feet.		
			Run 159 721.3 to 726.6	96 (77)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-8

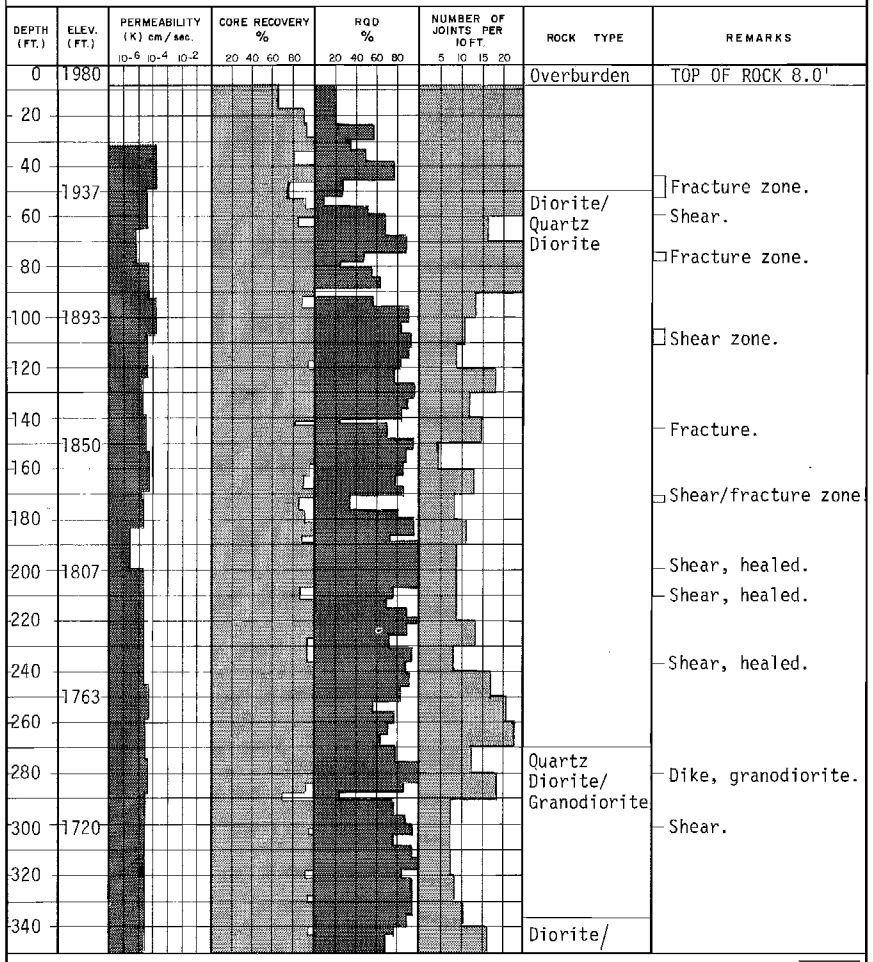
SITE Watana (South Bank) — SHEET NO. 24 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 159	96 (77)
			Run 160 726.6 to 731.2	100 (87)
730 (632.2)		731.9-747.1 - Numerous rehealed joints.	Run 161 731.2 to 736.2	100 (96)
			Run 162 736.2 to 741.2	100 (88)
740 (640.9)			Run 163 741.2 to 746.2	92 (92)
			Run 164 746.2 to 751.3	100 (73)
750 (649.5)			Run 165	100 (100)
752.4 (651.6)		END OF BORING		

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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-8
Site Watana (South Bank) — **Sheet No.** 1 of 3

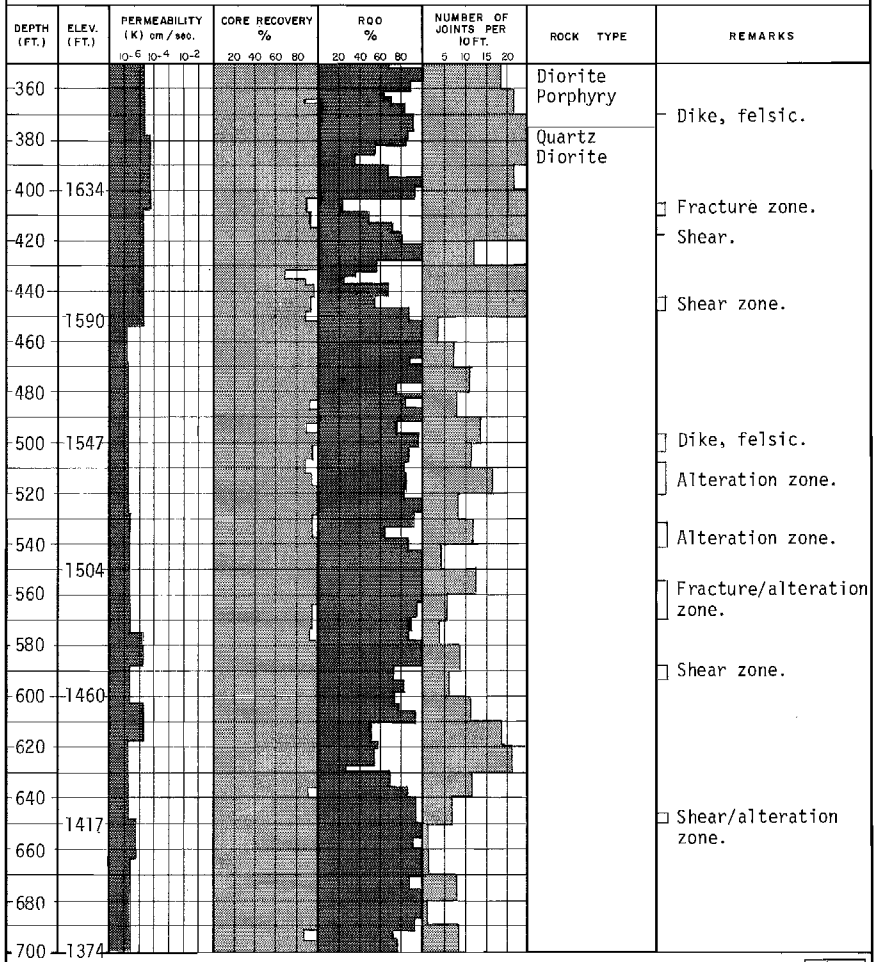


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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-8
Site Watana (South Bank) — **Sheet No.** 2 of 3

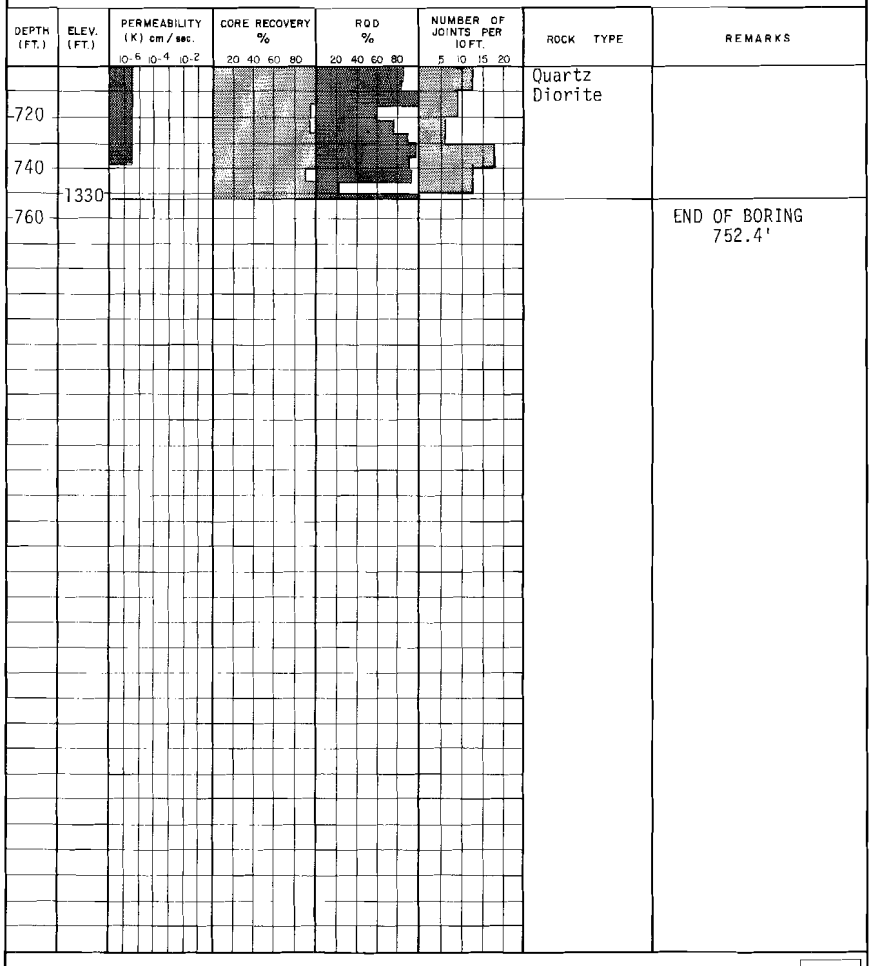


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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-8
Site Watana (South Bank) — **Sheet No.** 3 of 3



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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-12

SITE: Watana (South Bank) — SHEET NO. 1 OF 26

CONTRACTOR: Interstate Exploration Inc. — DRILLING DATES: July 18 TO August 5, 1981
LOGGED BY: K.J. White, R.R. Henschel — DATE: September 1981

DRILLING METHOD: SOIL Casing Advancer — CASING DIAMETER: NW (3.0") I.D.
ROCK Diamond Core - Triple Tube — CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,225,624 — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E744,515 — GROUND SURFACE 1975.7
AZIMUTH 220° — ROCK SURFACE 1959.8
DIP 36° — BOTTOM OF HOLE 1505.9
WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0	Overburden	Overburden of cobbles, boulders of granodiorite.	Run 1 0.0-2.0	0 (0)
10 (5.9)				
20 (11.8)				

APPROVED: [signature] DATE: February 1, 1982

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 2 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Overburden			
27.0 (15.9)	Andesite	Light bluish-gray to greenish-gray, generally aphanitic to fine grained, contains numerous angular fragments of argillite ranging from 0.13 to 1.0 inch (average 0.25 to 0.38 inches), 2-5% of rock. Generally hard.	Run 2 27.0 to 29.8	100 (55)
30 (17.6)		Joint spacing varies from very close to closely spaced in altered zones, to widely spaced in hard zones. Heavily stained with iron oxides, slightly to moderately weathered and open. Penetrative weathering up to 0.25 inches.	Run 3 29.8 to 34.7	100 (57)
		27.0-31.8 - Moderately weathered along joints, penetrative to 0.5 inches, slightly friable.	Run 4 34.7-36.6	100 (82)
		37.8 - Heavy iron oxide staining.	Run 5	0 (0)
			Run 6 37.4-39.8	88 (81)
40 (23.5)			Run 7 39.8 to 44.8	98 (93)
			Run 8 44.8 to 49.8	100 (94)
		49.8-51.7 - Fracture zone, very closely spaced fractures, intersecting joints at 50° and 0-20°. Slightly to moderately weathered with penetrative iron oxide staining to 0.75 inches.		
50 (29.4)		51.7-52.1 - Yellow-brown sandy/clay layer, 0.25 feet thick, small fragments of highly weathered andesite. Sharp contacts at 50°.	Run 9 49.8-51.9	100 (0)
			Run 10	97 (46)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 3 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Andesite	54.1-54.4 - Shear, 20°, 0.25 inches wide. Clay layer intruded by quartz, friable.	Run 10 51.9 to 57.3	97 (46)
		55.4 - Shear, 35°, 0.25 inches wide. Clay layer containing breccia, soft, friable.		
		56.1 - Shear, 20°, 0.25 inches of sandy clay breccia.	Run 11 57.3-59.4	100 (19)
60 (35.3)			Run 12 59.4 to 62.0	100 (42)
			Run 13 62.0 to 67.2	100 (46)
			Run 14 67.2-69.5	100
70 (41.2)		70.0-73.0 - Shear/fracture zone, joints very close to closely spaced at 40°-60°, open, moderately weathered. Friable locally, iron oxide stained, some sandy clay.	Run 15 69.5-71.4	84 (66)
			Run 16 71.4-73.1	100 (35)
			Run 17 73.1-75.1	100 (78)
		76.5-77.2 - Shear, 15°-20°, thin clayey breccia coating.	Run 18 75.1 to 79.6	97 (63)
80 (47.0)			Run 19 79.6 to 84.6	94 (34)
		83.6-93.3 - Shear/alteration zone, slightly bleached hydrothermally. Numerous fractures at 30°-40°. Heavy iron oxide staining, moderately hard to friable locally.		
		85.1-86.6 - Shears, sandy clay gouge to		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 4 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Andesite	0.25 inches.	Run 20 84.6 to 89.6	100 (9)
		86.6-87.6 - Open fractures, 0-10°, up to 0.5 inches wide, filled with highly weathered rock fragments, locally healed with calcite.		
90 (52.9)			Run 21 89.6 to 92.5	97 (59)
		93.3-108.5 - Joints generally close to moderately closely spaced, tight to partially open. Fresh to moderately weathered with moderate iron oxide staining. Minor clay coating.	Run 22	80 (0)
			Run 23 93.5 to 98.5	100 (82)
		97.2-98.1 - Fracture zone, very closely spaced joints, slightly weathered, iron oxide stained, open. Moderately hard.		
100 (58.8)		99.5-99.8 - Felsic dike, medium gray, very fine grained, very hard.	Run 24 98.5 to 103.5	100 (80)
			Run 25 103.5 to 108.5	100 (36)
108.7 (63.9)		108.5-108.7 - Gradational contact.		
110 (64.7)	Diorite	Light to medium gray, medium grained crystalline rock. Hard to very hard, fresh to slightly weathered along joints with minor iron oxide staining.	Run 26 108.5 to 114.0	96 (84)
			Run 27 114.0 to 119.0	100 (60)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 5 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	118.7-124.7 - Felsic dike, medium blue-gray, very fine grained. Porphyritic locally, phenocrysts to 0.13 inches diameter, hard.	Run 27	100 (60)
120 (70.6)			Run 28 119.0 to 124.0	100 (74)
		126.1 - Shear, 50°, silty clay gouge less than 1.0 inch. 127.0 - Shear, 15°, 0.1 inch gouge.	Run 29 124.0 to 129.1	100 (43)
130 (76.4)			Run 30 129.1 to 134.5	98 (42)
		133.8-134.5 - Fracture zone, fractures very closely spaced, 50°, with carbonate coating.	Run 31 134.5 to 139.5	100 (96)
140 (82.3)			Run 32 139.5 to 144.6	96 (88)
			Run 33 144.6 to 149.7	100 (83)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 6 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (88.2)	Diorite		Run 33	100(83)
		152.5 - Dike, 20°-30°, dark gray, very fine grained, 0.5 inches wide, hard.	Run 34 149.7 to 154.9	100 (66)
			Run 35 154.9 to 159.7	100 (67)
160 (94.1)		159.7-162.4 - Andesite dike, medium green-gray, very fine grained. Numerous very thin quartz stringers at 45°-60°. Very sharp contacts.	Run 36	100 (37)
		162.4 - Carbonate filling at contact, less than 0.06 inches thick, hard and brittle.	Run 37 161.2 to 166.0	94 (69)
			Run 38 166.0 to 169.9	97 (86)
170 (99.9)			Run 39 169.9 to 174.9	100 (100)
			Run 40 174.9 to 179.9	100 (100)
		179.2-179.3, 180.5-180.6 } Felsic dikes, light tan, very fine grained, hard.		
180 (105.8)			Run 41	100(78)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12
SITE Watana (South Bank) — SHEET NO. 7 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	180.6-183.6 - Alteration zone, bleached, slightly altered hydrothermally.	Run 41 179.9 to 185.0	100 (78)
			Run 42 185.0 to 189.9	100 (85)
190 (111.7)			Run 43 189.9 to 195.1	100 (71)
		193.5 - Joint, 30°, slickensides.		
		197.2-197.8 - Shear zone, 50°, slightly friable, clay/breccia layer, 0.38 inches wide, stiff, slightly plastic.	Run 44 195.1 to 199.9	100 (44)
200 (117.6)		197.7-197.8 - Brecciated zone, 0.25 inches wide, clay seam at 50°.	Run 45 199.9 to 204.9	100 (48)
		207.4-208.3 - Felsic dike, light gray, very fine grained.	Run 46 204.9 to 209.8	98 (90)
210 (123.5)			Run 47 209.8 to 214.9	100 (51)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12
SITE Watana (South Bank) — SHEET NO. 8 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	212.6-213.4 - Shear/alteration zone, moderately to completely altered hydrothermally, very closely fractured but still intact. Original structure and texture of diorite preserved.	Run 47	100 (51)
		214.3-214.4 - Two clay seams 40° and 70°, 0.13 inches wide.	Run 48 214.9 to 219.8	100 (73)
220 (129.4)			Run 49 219.8 to 224.9	100 (69)
			Run 50 224.9 to 229.8	98 (84)
230 (135.2)			Run 51 229.8 to 235.0	100 (69)
		232.9-234.2 - Shear/fracture zone, fractures very closely spaced. Clay/breccia layer, 0.25 inches wide, friable.		
		234.2-235.0 - Alteration zone, bleached white, altered hydrothermally, hard.	Run 52 235.0 to 240.1	100 (75)
240 (141.1)			Run 53 240.1 to 245.3	100 (61)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12
SITE Watana (South Bank) — SHEET NO. 9 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 54 245.3 to 250.2	100 (80)
250 (147.0)		251.8 - Joint, 60°, clay and rock fragments.	Run 55 250.2 to 255.5	98 (65)
			Run 56 255.5 to 260.2	100 (94)
260 (152.9)			Run 57 260.2 to 265.3	100 (66)
			Run 58 265.3 to 270.2	100 (73)
270 (158.8)			Run 59 270.2 to 275.3	100 (65)
		273.7-276.1 - Shear/alteration zone, slightly altered hydrothermally. Fractures very closely spaced, friable, carbonate coating.	Run 60	100 (0)
			Run 61	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12
SITE Watana (South Bank) — SHEET NO. 10 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING; LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	273.8 - Shear, 30°-35°, less than 0.13 inches. Soft, plastic, sandy clay.	Run 61 276.2 to 279.8	97 (25)
280 (164.6)		274.2-276.4 - Core badly broken by drilling, pieces slightly friable.	Run 62 279.8 to 284.5	100 (69)
		276.2-280.6 - Joints very close to closely spaced.	Run 63 284.5 to 289.7	100 (70)
290 (170.5)			Run 64 289.7 to 294.2	100 (98)
			Run 65 294.2- 296.5	100 (76)
			Run 66 296.5 to 299.8	82 (77)
300 (176.4)			Run 67 299.8 to 304.5	100 (79)
			Run 68 304.5 to 309.4	100 (80)
		308.6-309.4 - Fracture zone, joints very closely spaced at 20°, 50°, and 80°.		

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 11 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (182.3)	Diorite		Run 69 309.4 to 315.6	97 (73)
			Run 70 315.6 to 320.4	100 (83)
320 (188.2)			Run 71 320.4 to 325.0	100 (65)
		324.7-325.0 - Fracture zone, joints very closely spaced.	Run 72 325.0 to 330.0	100 (58)
330 (194.0)			Run 73 330.0 to 335.1	100 (45)
		332.7-332.9 - Fracture zone, joints very closely spaced.		
		335.6-336.8 - Core broken by drilling.	Run 74 335.1 to 340.0	100 (47)
340 (200.0)			Run 75	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 12 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	343.0-343.8 - Fracture zone, joints very closely spaced.	Run 75 340.0 to 343.6	94 (35)
			Run 76 343.6 to 348.3	100 (85)
350 (205.8)			Run 77 348.3 to 353.2	100 (69)
		355.8-362.6 - Alteration zone, bleached white, slightly to severely altered hydrothermally. Joints very close to closely spaced, moderately hard to very friable. Sharp contact at top, gradational at bottom.	Run 78 353.2 to 358.9	93 (39)
		355.9-356.9, 358.0-358.9 } Severely altered zones.		
360 (211.7)		362.1-362.6 - Several joints at 40° with minor clay and rock fragments, less than 0.06 inches thick.	Run 79 358.9 to 364.2	98 (47)
		366.9-367.6 - Fracture zone, joints very closely spaced.	Run 80 364.2 to 369.3	100 (65)
370 (217.6)			Run 81 369.3 to 374.6	100 (94)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 13 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 81	100 (94)
			Run 82 374.6 to 379.6	100 (100)
380 (223.4)			Run 83	100(88)
			Run 84 380.4 to 385.0	100 (87)
		383.1-383.4 - Fracture zone, fractures very closely spaced.		
			Run 85 385.0 to 389.8	100 (88)
		387.8-387.9 - Fracture zone, fractures very closely spaced.		
		389.3-389.8 - Fracture zone, fractures very closely spaced.		
390 (229.3)			Run 86 389.8 to 395.0	98 (96)
		396.1-404.2 - Fracture zone, fractures and joints very closely spaced, partly drilling induced.	Run 87 395.0 to 398.3	100 (42)
		397.0-397.3 - Quartz vein.		
400 (235.2)			Run 88 398.3 to 401.4	100 (0)
			Run 89 401.4 to 404.2	29 (0)
			Run 90	100(100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 14 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 90 404.2 to 409.1	100 (100)
410 (241.0)			Run 91 409.1 to 414.2	100 (100)
			Run 92 414.2 to 419.2	100 (92)
420 (247.0)			Run 93 419.2 to 424.4	100 (100)
			Run 94 424.4 to 429.4	100 (92)
430 (252.8)			Run 95 429.4 to 434.7	100 (58)
			Run 96 434.7 to 439.7	100 (86)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-12

SITE Watana (South Bank) **SHEET NO.** 15 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	439.3-439.7 - Fracture zone, joints very closely spaced at 40°.	Run 96 434.7 to 439.7	100 (86)
440 (258.7)			Run 97 439.7 to 444.8	100 (71)
		444.8-448.2 - Fracture zone, joints and fractures very closely spaced at 20°, 40°, and 50°, partly open to tight, coated with yellow-brown clayey material.	Run 98 444.8 to 449.5	100 (26)
450 (264.6)		449.8-454.8 - Shear/alteration zone, rock bleached, slightly to severely altered hydrothermally. 449.8-451.8 - Green-gray, granular texture, moderately hard. Possible shear planes present. 451.8-454.8 - Bleached zone, quartz rich, very few mafics, very hard.	Run 99 449.5 to 454.6	100 (43)
		457.7-463.2 - Shear/fracture zone, joints very closely spaced, carbonate filling, chlorite/talc coating, slickensides.	Run 100 454.6 to 459.5	96 (31)
460 (220.5)			Run 101 459.5 to 464.5	100 (24)
		463.2-465.2 - Alteration zone, bleached, slightly altered hydrothermally, hard. 464.5-465.2 - Shear zone, very thin shears at 60°-70°, calcareous clay filling, brecciated but intact.	Run 102 464.5 to 469.5	100 (62)

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PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-12

SITE Watana (South Bank) **SHEET NO.** 16 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (276.4)	Diorite	470.3 - Shear, 85°, 0.5 inches wide, sandy clay filling, chlorite coating, slickensides.	Run 103 469.5 to 474.6	100 (63)
		473.9-474.0 - Shear, 40°, less than 0.1 inches of breccia. Offset by 0.25 inches, healed. Moderately hard.		
		476.7 - Joints, 60°-65°, sandy clay filling, slight chlorite coating.	Run 104 474.6 to 478.8	100 (81)
480 (282.2)		477.9-482.0 - Shear/alteration zone, slightly to moderately altered hydrothermally. Breccia and gouge material. Soft to moderately hard, friable. 480.8-480.9 - Possible healed shear, 1.0 inch of dark gray, very fine grained material.	Run 105 478.8 to 484.1	96 (19)
		483.2-483.7 - Joint, 15°-20°, quartz/carbonate coating with slickensides.		
		483.5 - Joint, 60°, sandy clay filling, slickensides.	Run 106 484.1 to 489.2	100 (18)
		484.6 - Shear/alteration zone, slightly to moderately altered hydrothermally, soft to moderately hard. Shears, 60°-70°, clay/sand breccia.		
490 (288.1)		486.1-490.6 - Moderately hard, joints very close to closely spaced.	Run 107 489.2 to 494.3	100 (8)
		487.9-488.6 - Shear zone, 55°-70°, with approximately 0.5 inch spacing. Numerous very thin shears with clay gouge.		
		490.6-519.3 - Shear/alteration zone, slightly to moderately altered hydrothermally. Numerous very thin shear planes, brecciated but healed with calcareous sandy clay. Moderately hard to soft, friable. Joints moderately closely spaced, chlorite coating. 50% of joints healed with carbonate. Irregular patches of red staining.	Run 108 494.3 to 499.5	100 (52)
500 (294.0)			Run 109	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 17 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	498.6-499.1 - Fracture/alteration zone, yellow-green color, very closely spaced joints at 60° healed with carbonate. Feldspars stained but hard.	Run 109 499.5 to 503.7	100 (100)
		500.5 - Alteration zone, 2.0 inches wide, carbonate healed joint at 80°. Hard.	Run 110 503.7 to 509.0	100 (91)
		507.2-507.6 - Fracture zone, joints very closely spaced at 40°-70°, silt/clay coating.		
		509.1 - Joint, 30°, silt/clay coating.		
510 (299.9)		511.2-512.8 - Joints, healed with carbonate.	Run 111 509.0 to 514.1	100 (67)
		512.8-513.5 - Shear/fracture zone, very closely spaced joints. Shear, 60°-70°, 0.5 inches breccia, partially healed with carbonate.		
		511.2-571.6 - Joints, closely spaced with zones of very closely spaced, chlorite coating, carbonate healed, tight, up to 2 feet long.	Run 112 514.1 to 519.1	100 (100)
520 (305.8)		520.5-528.6 - Joints, 40°, closely spaced, healed with rusty orange carbonate. Slightly altered hydrothermally to 1.0 inch either side, 10-20% of feldspars altering to clay. Hard, tight.	Run 113 519.1 to 523.2	100 (100)
			Run 114 523.2 to 528.5	94 (72)
		530.9-538.8 - Fracture/shear zone, very closely spaced joints at 20° and 70°. Most joints healed and tight.	Run 115 528.5 to 533.4	100 (48)
530 (311.6)		531.1 - Shear, 20°, 0.1 inches breccia/ gouge.		
		531.6 - Shear, 10°, 0.5 inches breccia, faint slickensides.		

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 18 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite	532.8 - Alteration zone, slightly altered hydrothermally, 1.0 inch wide.	Run 115	
		533.8 - Shear, 60°, 0.5 inches of breccia/ gouge.	Run 116 533.4 to 538.4	100 (72)
		536.7 - Shear, 0°-10°, up to 0.3 inches breccia/gouge.		
		538.1 - Shear, 25°, less than 0.1 inch of gouge.	Run 117 538.4 to 543.4	100 (52)
540 (317.5)		542.3-545.9 - Felsic dike, light gray, fine grained, 10% mafics, 5-15% quartz, 5% green feldspar phenocrysts. Very closely spaced joints, tight. Upper contact 50°, fractured, sheared, slickensides. Lower contact 30°, probably sheared, trace clay/silt.	Run 118	91 (0)
		545.9-549.2 - Fracture zone, very closely spaced joints, tight.	Run 119 544.5 to 549.7	100 (62)
		548.4 - Joint, 60°, clay coating.		
		549.2 - Joint, 80°, clay coating.		
550 (323.4)			Run 120 549.7 to 554.7	98 (54)
		553.3 - Alteration zone, slightly altered hydrothermally, 10% of feldspars altering to clay, hard.		
		553.7-556.7 - Felsic dike (?), light gray, fine grained to aphanitic with fine to medium grained phenocrysts, 5-15% mafics, 5-15% feldspar. Tight joints very closely spaced. Upper contact, 40°, gradational 2.0 inches, tight. Lower, 50°, sheared with 0.5 inches of breccia partially healed with carbonate.	Run 121 554.7 to 559.7	100 (92)
560 (329.3)		557.0 - Joint, 30°, silt/clay coating, 0.25 inches of alteration, 10% of feldspars altering to clay.	Run 122 559.7 to 564.9	100 (62)
		565.7 - Joint, 60°, yellow orange carbonate/ silt coating.		

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 19 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Diorite	566.0-566.2 - Alteration zone, 10% feldspars altering to clay.	Run 123 564.9 to 570.0	100 (61)
		567.6 - Alteration zone, 1 inch thick, slight hydrothermal alteration, 10% feldspars altering to clay.		
570 (335.2)			Run 124	100(0)
		571.0-586.1 - Shear/fracture zone, joints very closely spaced, many carbonate healed.	Run 125 570.3 to 575.9	71 (45)
		571.4 - Zone of light gray-green, fine grained material 0.5 inches wide, sharp contacts at 70°. Offset by 0.2 inches wide carbonate filled shear at 40°. Either silty clay layer or altered felsic dike.		
575.9 (338.6)	Quartz Diorite	Light gray, fine to medium grained crystalline rock. Mafic content, variable averaging 20-30%, 10-15% quartz. Slightly altered overall.	Run 126 575.9-578.0	33 (0)
		578.0-579.8 - Core loss 0.8 feet.	Run 127 578.0-579.8	61 (22)
580 (341.0)		578.6 - Shear, 25°, 2.0 inches of breccia partially healed with carbonate and 0.1 inch of gouge.	Run 128 579.8 to 585.0	96 (44)
		582.0 - Shear, 50°, 1.0 inch breccia/gouge.		
		582.0-586.1 - Alteration zone, bleached to yellow-orange hydrothermally, hard to moderately hard. Joints, 10° and 70°-80° with clay coating.		
		586.1-605.9 - Joints, closely spaced, healed with carbonate, tight.	Run 129 585.0 to 589.8	100 (88)
		588.0-656.5 - Alteration zone, slightly to moderately altered. Feldspars bleached to yellow-gray. Very close to closely spaced joints. Minor sulphide mineralization. Hard.		
590 (346.9)		590.2 - Shear, 20°, clay/silt coating, faint slickensides.	Run 130 589.8 to 596.0	100 (75)
		595.8 - Shear, 20°, 0.1-0.3 inches of gouge.		
		596.0-596.7 ? 597.8-598.5 ? Alteration zones, moderately altered hydrothermally, 50% of feldspars altering to clay.		
			Run 131	100(92)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 20 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Quartz Diorite	596.0-596.7 - Breccia, healed.	Run 131 596.0 to 599.8	100 (92)
		598.2 - Joint, 80°, talc coating.		
600 (352.8)			Run 132 599.8 to 604.9	100 (100)
			Run 133 604.9 to 609.8	100 (98)
610 (358.7)		610.0-613.6 - Moderately altered, 20-30% of feldspars altered to clay.	Run 134 609.8 to 615.0	100 (38)
		613.2-613.5 - Shear, 80°, breccia/gouge.		
		614.3 - Shear, 30°, 0.5 inches breccia/gouge.		
		616.2 - Shear, 40-70°, 1.0-to 2.0 inches breccia/gouge.	Run 135 615.0 to 620.1	100 (54)
		619.0 - Shear, 25°, clay/gouge coating.		
620 (364.6)		621.4 - Shear, 60°, 0.1-1.0 inches gouge.	Run 136 620.1 to 625.0	100 (45)
		626.6 - Shear zone, 1.0 inch breccia/gouge.	Run 137 625.0 to 628.6	100 (87)
		626.8 - Shear, 40°, carbonate, gouge.		
			Run 138	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 21 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
630 (370.4)	Quartz Diorite		Run 138	100(73)
		631.3 - Shear, 45°, coating of clay gouge.	Run 139 629.7 to 634.7	100 (80)
		633.5 - Shear, 70°, 0.1 inches of gouge.		
		633.9-639.5 - Moderately altered, feldspars breaking down to clay.		
		634.0 - Shear, 60°, 2.0 inches breccia/gouge.	Run 140 634.7 to 639.8	100 (45)
		634.2 - Shear, 15°, clay coating.		
		635.2 - Shear, 60°, clay coating.		
		635.7 - Shear, 50°, 0.3 inches of gouge.		
640 (376.3)		637.4 - Shear, 40°, 0.5 to 1.0 inches wide, breccia and gouge.	Run 141 639.8 to 645.0	100 (65)
		638.1 - Shear, 50°, clay coating.		
		639.1 - Shear (?), 30°, clay coating.		
		643.2 - Shear (?), 60°, clay coating.		
		643.6 - Shear, 30°, 0.5 inches wide, 0.1 inches of gouge along a healed shear of dark gray igneous material and carbonate.	Run 142 645.0 to 649.8	100 (100)
		644.0 - Shear, 50°, clay coating, offsets a very thin vein of dark gray igneous material, 0.1 inches wide.		
650 (382.2)		651.6-656.5 - Moderately altered, feldspars altering to clay.	Run 143 649.8 to 655.0	100 (88)
		654.5-655.7 - Shear, 80°, breccia/gouge.		
656.8 (386.2)			Run 144 655.0 to 659.8	100 (92)
	Granodiorite	Light pink-gray, fine to medium grained crystalline rock. Mafics 20-30%, primarily hornblende/biotite, 5-15% quartz, and pink, green, and white feldspars. Hard, generally fresh to slightly hydrothermally altered. Alteration		
660 (388.1)			Run 145	100 (100)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 22 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Granodiorite	along healed joints.	Run 145 659.8 to 665.0	100 (100)
		656.8-681.4 - Joints, close to moderately closely spaced, most healed with carbonate.		
		660.3-662.0 } 662.9-663.5 } Alteration zones, 10-20% of feldspars altering to clay, moderately hard.	Run 146 665.0 to 669.8	100 (94)
670 (394.0)			Run 147 669.8 to 673.0	100 (100)
		674.0 - Joint, 35°, penetrative alteration of 0.5 inches.	Run 148 673.0 to 678.2	100 (88)
		674.1 - Within 1.0 inch zone, color has changed from pink (fresh rock) to light gray with less than 5% mafics and altered feldspars giving appearance of two rock types in texture and composition.		
680 (400.7)		677.4-678.5 } 681.2-681.4 } Alteration zone, moderate hydrothermal alteration of feldspars to clay.	Run 149 678.2 to 683.2	100 (92)
681.4 (400.7)	Quartz Diorite	Rock description as above.		
		681.4-695.6 - Joints, close to very closely spaced, many healed with carbonate.	Run 150 683.2 to 688.2	100 (69)
		683.4-688.3 - Alteration zone, altered hydrothermally with very thin to thin zones of bleached and altered rock with sulphide alteration.		
		684.2 - Joints, 20°, clay coated, possibly sheared.		
690 (405.7)		687.1-688.1 - Shears, 40-70°, very closely spaced, 0.5-1.0 inch breccia/gouge.	Run 151 688.2 to 693.4	100 (77)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12
SITE Watana (South Bank) — SHEET NO. 23 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite	687.1-689.0 - Alteration zone, moderate hydrothermal alteration of feldspars to clay. 692.1-692.3 - Shear, 60°, clay coating. 693.5-695.3 - Shear/alteration zone. Very closely spaced shears (3) at 60-90° with 0.5 inches of gouge.	Run 152 693.4 to 698.4	100 (48)
700 (411.6)		695.6-706.5 - Joints close to moderately closely spaced. 700.5 - Alteration zone, 1.0-2.0 inches penetrative alteration. 25% feldspars altered to rusty-orange clay. 703.4-704.8 - Alteration zone, moderately altered. 703.7 - Shear, 40°, 0.1 inches clay and talc (?). 704.1 - Vein, 70°, 0.5 inches wide, light gray, aphanitic, vuggy. 706.5-711.7 - Joints close to very closely spaced, healed, tight.	Run 153 698.4 to 703.6	96 (96)
			Run 154 703.6 to 708.8	100 (98)
710 (417.5)		711.7-738.3 - Joints close to moderately closely spaced, most are healed with carbonate, tight. 712.3-712.5 } Alteration zones, moderately 713.1-713.4 } altered hydrothermally. 714.3 - Shear, 25°, 0.1 inches of clay gouge.	Run 155 708.8 to 713.9	100 (97)
			Run 156 713.9 to 719.2	100 (100)
720 (423.4)			Run 157 719.2 to 724.4	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 24 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 158 724.4 to 729.6	100 (100)
730 (429.2)			Run 159 729.6 to 734.8	100 (100)
		735.1-751.5 - Alteration zone, moderately altered hydrothermally, numerous shears. 735.1 - Shear, 60°, 0.5 to 1.0 inch of breccia/gouge, slickensides. 736.3-736.6 - Shear, 25°, breccia with minor gouge.	Run 160 734.8 to 739.8	100 (100)
740 (435.1)		738.3-790.2 - Joints closely to very closely spaced, most joints are tight, carbonate healed, clay coating on many. 740.3 - Shear, 40°, clay coating. 742.6 - Shear, 80°, 1.0 inch of breccia/gouge. 743.9 - Shear, 30°-40°, 1.5 inches wide breccia/gouge.	Run 161 739.8 to 744.8	100 (64)
		744.5-744.8 - Core broken by drilling, pieces average 1.0 inch. Clay coating, possible shear. 746.8-747.0 - Shear, 60°, 0.3 inches of gouge, 2.0 inches of breccia, slickensides.	Run 162 744.8 to 749.8	100 (80)
750 (441.0)		749.3 - Shear, 35°, clay coated. 750.2 - Two shears, very closely spaced at 10°, breccia/gouge in a 1.0 inch wide zone, slickensides.	Run 163 749.8 to 754.9	100 (90)
			Run 164	100 (94)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 25 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Quartz Diorite		Run 164 754.9 to 759.9	100 (94)
760 (446.9)			Run 165 759.9 to 764.9	100 (100)
763.6 (449.0)	Felsic Dike	Light gray yellow, aphanitic to medium grained, 5-10% dark gray green phenocrysts, 5-10% rusty orange feldspar phenocrysts. Moderately hard. 763.6-764.1 - Healed shear, 30°, resheared with 0.3 inches of gouge. 768.0 - Shear, 30°, irregular, breccia/gouge.	Run 166 764.9 to 767.5	96 (96)
768.5 (451.9)	Quartz Diorite	Rock description as above. 768.5 - Shear, 80° along lower contact, 2.0 inches wide breccia and gouge.	Run 167 767.5 to 769.8	100 (91)
770 (452.8)		770.4 - Shear, 40°, clay coating with possible talc. 775.9 - Shear, 50°, 0.1 inches of gouge, slickensides.	Run 168 769.8 to 775.0	100 (100)
			Run 169 775.0 to 780.1	100 (75)
780 (458.6)		781.3-781.6 - Shear, 40°, shear planes very closely spaced, breccia, minor gouge, moderately altered hydrothermally. 786.9-787.5 - Alteration zone, moderately altered. 787.2 - Shear, 60°, 0.5 inches of breccia/gouge. 788.3-788.9 - Alteration zone, moderately altered hydrothermally. 788.3-788.4 - Two shears, very closely spaced at 70°, less than 0.1 inches gouge.	Run 170 780.1 to 785.1	100 (74)
			Run 171 785.1 to 790.1	98 (72)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-12

SITE Watana (South Bank) — SHEET NO. 26 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
790 (464.5)	Quartz Diorite	790.2-797.3 - Joints close to moderately closely spaced.	Run 171	98 (72)
			Run 172 790.1 to 795.1	98 (96)
		797.3-798.9 - Fracture zone, joints very closely spaced. Slight to moderate hydrothermal alteration.	Run 173 795.1 to 798.9	100 (82)
798.9 (469.8)		END OF BORING		
800 (470.4)				

APPENDIX C
DEVIL CANYON DIAMOND CORE DRILLING LOGS

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-1

SITE: Devil Canyon (North Bank) — SHEET NO. 1 OF 24

CONTRACTOR: The Drilling Company — DRILLING DATES: August 23 TO August 31, 1980
LOGGED BY: K.J. White, M.P. Bruen — DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer; ROCK Diamond Core - Triple Tube — CASING DIAMETER: NW (3.0") I.D.; CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,223,408; DEPARTURE E615,930; AZIMUTH 225°; DIP 67°

ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4; GROUND SURFACE 1413.7; ROCK SURFACE 1402.8; BOTTOM OF HOLE 723.1; WATER TABLE 1221.7 (11-21-80)

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	Sandy gravel with layer of silt and scattered cobbles. Not sampled.		
10 (12)				
11.8 (10.9)	Argillite	Medium to dark gray, fine grained, nonfoliated to weakly developed foliation parallel to bedding, 20°. Fresh to slightly weathered, hard, well indurated. Joints generally close spaced with iron oxide staining. Zones of quartz veins and stringers, minor sulfide mineralization.	Run 1 11.8 to 15.8	85 (23)
		11.8-30.8 - Numerous quartz veins and stringers, highly folded bedding. Quartz veins (12.7-13.7, 20.8-22.2, 27.1-27.5) are highly fractured but tight, vuggy, cross-cutting foliation, contacts are irregular and rough. Quartz stringers are parallel to	Run 2 15.8 to 20.8	100 (86)
20 (18.4)				

APPROVED: [signature] DATE: February 1, 1982

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 2 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	bedding/foliation at 0°-30°, less than 1 inch wide, folded, stretched, less fractured than veins, contacts generally tight.	Run 3 20.8 to 26.2	85 (78)
		11.8-80.1 Joint spacing generally close, generally planar and smooth, iron oxide stained, minor quartz and carbonate coating.		
		11.8-14.9 Core loss of 0.6 ft. Core broken by drilling, clay on some joints.		
		17.0-20.0 No drilling water return.		
		17.4-17.9 Core broken by drilling, clay on some joints.	Run 4 26.2 to 31.3	86 (80)
30 (27.6)		20.8-35.0 Core loss of 1.8 feet.		
		33.0-33.7 Core broken by drilling zone of quartz stringers 0.5 in. thick.	Run 5 31.3 to 35.0	92 (30)
		36.7 Bedding/foliation is at 20°. Rock does not tend to break along bedding/foliation.	Run 6 35.0 to 40.0	100 (80)
40 (36.8)			Run 7 40.0 to 45.0	100 (52)
42.5 (39.1)	Argillite/ Graywacke	Interbedded argillite and graywacke. Argillite as above, with very thin beds of graywacke, light to medium gray, 20 percent to 30 percent fine to medium sand in argillaceous matrix, grains elongate parallel to bedding/foliation generally at 20°, foliation is poorly developed. Fresh, hard and well indurated. Joint spacing is generally close, generally planar and rough, iron oxide stained, some carbonate and quartz filling.	Run 8 45.0 to 49.0	100 (90)
50 (46.0)			Run 9 49.0 to 53.2	100 (45)
		52.8-53.5 Clay on joint surface at 20°.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 3 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	54.3-61.2 Quartz stringers, spacing is very close to close, less than 0.1 in. wide, healed joints at 60° to 90° are quartz filled.	Run 10 53.2 to 58.3	98 (71)
60 (55.2)		62.2 Bedding/foliation is at 20°. 63.5-67.7 Fracture zone, joint and fracture spacing is very close at 15° to 30° and 50° to 70°, planar, smooth to rough. Quartz veins Bedding/foliaton is highly folded and stretched Core loss of 1.5 feet.	Run 11 58.3 to 63.5	100 (85)
			Run 12	30 (0)
		68.8-69.2 Quartz vein at 20° to 90°, highly fractured but tight, irregular, vuggy.	Run 13 64.5 to 68.9	82 (34)
70 (64.4)		70.7-72.0,72.3-72.6 Quartz veins, highly fractured but tight, vuggy, sulphide mineralization. 72.6-77.0 Quartz stringers, parallel to bedding/foliation at 0°, less than 0.5 in. wide Contacts are tight.	Run 14 68.9 to 72.3	100 (76)
			Run 15 72.3 to 77.2	98 (90)
		77.2-105.0 No drilling water return.	Run 16 77.2 to 80.7	94 (69)
80 (73.6)		80.1-108.5 Fracture zone, joint and "hairline" fracture spacing is very close, 0° to 20° and 60° to 90°, irregular and discontinuous, carbonate and iron oxide staining on most joints, silt on joints from 92.6 to 103.3, slickensides at 93.0 and 105.0 on joints at 0° to 15° and 80°.	Run 17 80.7 to 84.0	82 (48)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 4 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite/ Graywacke		Run 18 84.0 to 90.0	83 (57)
90 (82.8)		88.8-101.8 Quartz veins highly fractured but tight, discontinuous, vuggy. Contacts are irregular. Comprise 70 percent of rock.	Run 19 90.0 to 94.4	82 (39)
			Run 20 94.4 to 97.8	88 (53)
100 (92.1)			Run 21 97.8 to 101.5	54 (8)
		105.0 Bedding/foliation is at 10° to 20°. Argillite is "spotted" with a dark mineral less than 0.05 inch (possibly biotite). 105.7-106.7 Quartz vein, highly fractured, fractures at 40° and 70°, vuggy, sulphide mineralization. Contacts are irregular at 0° to 10°. 108.5-175.0 Joint spacing is close to moderately close, joints are generally planar, smooth to rough iron oxide stained, few with carbonate or quartz filling.	Run 22 101.5 to 105.0	57 (31)
			Run 23 105.0 to 109.1	98 (59)
110 (101.3)		110.3-113.9 Quartz stringers, close spacing, stretched, irregular, discontinuous, tight. 112.5-114.7 Core loss of 1.7 ft.	Run 24 109.1 to 112.5	100 (41)
		113.9-114.7 Quartz vein, highly fractured but tight, irregular, fractures at 30°, vuggy, minor iron oxide staining.	Run 25 112.5 to 117.6	86 (29)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 5 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	117.6-118.6 Quartz vein, highly fractured but tight, 1.5 inch wide. Contacts at 0° to 10°.	Run 26 117.6 to 120.9	100 (73)
120.9 (111.3)	Argillite	Medium to dark gray, very fine grained, bedding and poorly developed foliation are at 5° to 15°, very thinly laminated, sulphide mineralization. Fresh, hard, well indurated. Joint spacing is close to moderately close, joints are generally planar, smooth to rough, very few with carbonate or quartz filling.	Run 27 120.9 to 125.4	100 (53)
		120.9-124.5 Quartz stringers, spacing is very close to close, mostly at 50° to 90°, some at 0°, less than 0.1 in. wide.	Run 28 125.4 to 129.0	100 (22)
		120.9-129.0 Clay filling in joints.		
130 (119.7)		129.0-134.0 Healed fractures, quartz stringers irregular, discontinuous, tight, less than 0.1 in. wide.	Run 29 129.0 to 134.0	100 (78)
		133.2-134.0 Fracture zone, joint spacing very close, joints at 0° to 20°, iron oxide staining, trace clay and carbonate, slight weathering on joints. Core loss 0.4 feet.	Run 30 134.0 to 139.2	92 (93)
		139.5 Bedding/foliation, 20°.	Run 31 139.2 to 144.3	98 (92)
140 (128.9)		143.0 Sulphide minerals up to 0.5 inches becoming abundant. Progressive replacement with quartz.		
		144.3-148.0 Core loss 0.2 feet.	Run 32 144.3 to 148.0	95 (81)
		148.5 Bedding/foliation, 10°.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 6 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (138.1)	Argillite	149.0-157.9 Argillite interbedded with medium gray, fine grained graywacke, beds 2 inches to 2 feet wide, beds are highly folded, possible sheared along bedding planes, healed, tight, hard.	Run 33 148.0 to 153.2	100 (100)
			Run 34 153.2 to 156.2	100 (73)
		158.5-158.7 Quartz vein, discontinuous, irregular, tight, 0.5 inch wide.	Run 35 156.2 to 161.5	93 (81)
160 (147.3)			Run 36 161.5 to 166.5	100 (100)
			Run 37 166.5 to 171.5	96 (96)
170 (156.5)		175.0-276.1 Joint spacing is generally moderately close, joints are generally planar, rough to slick, very few with iron oxide staining or quartz filling.	Run 38 171.5 to 176.3	100 (92)
			Run 39 176.3 to 181.4	100 (100)
180 (165.7)				

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 7 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	182.2-184.0 Bedding/foliation highly folded, fractures are healed with quartz, tight, hard.	Run 40 181.4 to 186.3	100 (100)
			Run 41 186.3 to 191.5	100 (100)
190 (174.9)				
191.5 (176.3)	Argillite/ Graywacke	Interbedded argillite and graywacke, Argillite is dark gray, very fine grained, very thin to thinly bedded, Graywacke is reddish gray, fine to medium grained, Bedding and poorly developed foliation are at 0° to 30°. Generally fresh, hard, well indurated, Joint spacing is moderately close.	Run 42 191.5 to 196.4	100 (100)
		193.7-199.2 Quartz stringers and pods, closely spaced, folded, parallel to and crosscutting bedding/foliation, tight, less than 0.5 in. wide.	Run 43 196.5 to 201.5	100 (100)
200 (184.1)				
			Run 44 201.5 to 204.9	100 (94)
		207.3-207.4 Quartz vein, folded, tight.	Run 45 204.9 to 209.9	96 (72)
		209.0-209.9 Fracture zone, open, very close spacing, fractures parallel bedding/foliation at approximately 10°, slickensides, iron oxide staining, Core broken during drilling.		
210 (193.3)		209.9-215.8 Fracture, joint spacing is very close to close, average 2 inches at 0° and 70° to 90°, irregular, tight, healed with quartz.	Run 46 209.9-214.9	100 (84)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 8 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke			
		216.3-217.7 Lithic graywacke, subangular to subrounded argillite and graywacke fragments, up to 1 inch.	Run 47 214.9 to 220.0	88 (87)
220 (202.5)		220.0-221.5 Fracture zone, joint spacing very close, at 0°. Core broken into fragments less than 1 inch, surfaces smooth and coated/ filled with grayish green clay. Core loss of 0.6 feet.	Run 48 220.0 to 225.1	100 (65)
		222.5-223.1 Quartz pods, parallel to and crosscutting bedding, irregular, discontinuous.		
		227.0 Bedding/foliation is at 10°.	Run 49 225.1 to 230.0	100 (100)
230 (211.7)		230.2 Quartz vein at 50°, tight, 0.5 inch wide.	Run 50 230.0 to 235.0	100 (100)
		231.5-232.0 Quartz vein at 0°, 1 inch wide. 232.7-235.3 Healed shear/fracture zone, joint spacing is very close, beds offset, brecciated, healed with quartz, tight, hard, fractures irregular at approximately 70° to 90°.		
		235.0-240.1 Core loss of 0.9 feet.	Run 51 235.0 to 240.1	82 (82)
240 (220.9)			Run 52	100 (88)
		241.6-241.8 Fracture zone, joint spacing is very close, joints at 0° to 10°, clay coating. 241.8-249.0 Quartz stringers, spacing is very close to close, some offset along bedding/ foliation, healed, tight.	Run 53 241.8- 246.9	98 (98)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1
SITE Devil Canyon (North Bank) — SHEET NO. 9 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	246.0 Bedding/foliation is at 0° to 10°.		
			Run 54 246.9 to 251.5	98 (98)
250 (230.1)		251.0-252.0 Joints at 10° and 30°, slickensides.		
		253.5 Bedding /foliation is at 30° 254.1-277.3 Joint spacing is close, chlorite/ talc coating.	Run 55 251.5 to 255.9	100 (84)
256.0 (235.6)	Graywacke	Reddish gray, fine to medium grain sand in argillaceous matrix, bedding/developed foliation is at 0° to 10°. Generally fresh, hard, well indurated. 259.0-262.5 Bedding/foliation intensely folded, brecciated and healed with carbonate, tight, hard.	Run 56 255.9 to 260.5	100 (100)
260 (239.3)		261.5-262.5 Fracture zone, joint spacing very close, 0° to 40°, irregular to planar, discontinuous, talc coating.	Run 57 260.6-262.5	100 (50)
			Run 58 262.5 to 265.5	94 (70)
		265.0-276.1 Quartz stringers at 40° to 70°, less than 0.1 inch wide, closely spaced. 265.8 Bedding/foliation is at 0° to 10°.	Run 59 265.6 to 270.3	98 (94)
270 (248.5)				
271.8 (250.2)	Argillite	Dark gray, very fine grained, very thinly laminated, massive. Fresh, hard, well indurated.	Run 60 270.3 to 274.2	69 (54)
		274.2 Probable fracture zone, joint spacing very close, light green mineral coating. Core broken by drilling, core loss of 1.2 ft. 276.1-276.3 Contact zone, brecciated argillite.	Run 61	100 (26)
276.1 (254.2)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1
SITE Devil Canyon (North Bank) — SHEET NO. 10 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Mafic Dike (Diabase?)	Dark yellowish brown to dark green, fine grained feldspar laths, 5% white, radiating zeolites up to 0.2 in., flow structure at 30°. Joint spacing is close, slickensides on most joints. Slightly weathered, hard. 276.1-277.0 Chilled zone, very fine grained. 276.1-296.0 Drilling water return 50%.	Run 62 276.1 to 280.3	98 (43)
280 (257.7)				
		276.1-310.8 Joint spacing is close to very close, joints are generally planar, slick and open, iron oxide staining on most joints, talc coating on few.	Run 63 280.3 to 285.2	100 (67)
			Run 64	100 (57)
			Run 65 286.6 to 291.5	94 (71)
290 (266.9)				
		294.8-296.0 Chilled zone, very fine grained.	Run 66 291.5 to 296.0	100 (93)
296.0 (272.5)	Graywacke	Reddish gray, fine grained, massive. Generally fresh, hard. 296.0-300.4 Shear/fracture zone, joint spacing is very close, joints at 40° to 60° and 20°, slickensides on many surfaces, talc/ chlorite coating, random, irregular fractures. Core loss of 0.6 feet. 297.0-298.9 Core broken by drilling. 301.0 Bedding is at 50°. 303.7-304.3 Healed fracture zone, fracture spacing very close, quartz filling, tight, hard. 305.0-308.5 Numerous healed joints and fractures, joints at 0° and 30°, fractures at 65° to 90°, talc/chlorite coating on many surfaces. Core broken by drilling, core loss of 0.6 feet.	Run 67 296.0 to 298.9	79 (28)
300 (276.2)			Run 68 298.9 to 303.0	100 (100)
			Run 69 303.0-305.0	85 (85)
			Run 70	82 (0)
			Run 71 306.1-311.0	98 (69)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 11 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
310 (285.4)	Graywacke	310.8-598.2 Joint spacing generally close to moderately close, generally planar, smooth, carbonate, chlorite and talc coating.	Run 72 311.0 to 315.7	94 (94)
			Run 73 315.7 to 320.0	100 (95)
320 (294.6)			Run 74 320.0 to 325.0	100 (92)
		324.0-326.0 Healed breccia, fracture spacing is very close, quartz filling, tight, hard.	Run 75 325.0 to 329.7	100 (68)
		329.7-334.7 Core loss of 0.4 feet.		
330 (303.8)			Run 76 329.7 to 334.7	92 (92)
331.2 (304.9)		331.2 Sharp contact, tight.		
	Graywacke (Conglomerate)	Reddish, medium to dark gray, fine grained argillaceous matrix with 50 percent to 60 percent angular to subrounded rock fragments of sedimentary, volcanic and plutonic origin, fragments 0.01 ft. to 0.3 ft., no foliation, massive, very thin interbeds of argillite. Fresh, hard. Joint spacing moderately close, chlorite/talc and carbonate coating.	Run 77 334.7 to 339.3	98 (96)
340 (313.0)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 12 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)		Run 78 339.8 to 345.0	98 (92)
		345.0-381.5 Drilling water return less than 50 percent.	Run 79 345.0 to 349.7	100 (100)
350 (322.2)			Run 80 349.7 to 355.0	100 (89)
		356.1-360.7 Graywacke conglomerate intercalated with reddish gray, aphanitic igneous rock containing subrounded to subangular felsic fragment up to 0.5 inches, hard, contacts at 50°, tight.	Run 81 355.0 to 360.1	100 (100)
360.7 (332.0)	Felsic Dike (Rhyodacite)	Light to medium gray with reddish brown streaks, aphanitic, highly silicic, occasional plagioclase and quartz phenocrysts, inclusions of argillite and graywacke, flow structures at 50°. Fresh, very hard, tight contacts. Joint spacing close, are planar, smooth to rough.	Run 82	100 (100)
			Run 83 361.3-363.4	100 (100)
			Run 84	100 (100)
			Run 85 364.4 to 369.3	100 (100)
370.2 (340.8)	Graywacke (Conglomerate)	Rock description, as above.	Run 86 369.3 to 373.6	100 (77)

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SITE Devil Canyon (North Bank) — SHEET NO. 13 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)	373.4-373.5 Joint at 70° to 80°, clay filling and rock fragments.	Run 87 373.6 to 378.8	100 (100)
380 (349.8)		381.5-401.5 Core broken by drilling, joint spacing is moderately close, joints healed.	Run 88 378.8 to 381.5	96 (67)
			Run 89 381.5 to 386.5	100 (100)
		386.5-391.4 Core loss of 0.3 feet.	Run 90 386.5 to 391.4	94 (86)
390 (359.0)			Run 91 391.4 to 396.5	100 (94)
			Run 92 396.5 to 401.5	100 (66)
400 (368.2)		401.0-405.7 Healed fractures at 30°, spacing is very close to close, discontinuous, carbonate filling.	Run 93 401.5 to 406.6	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 14 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)			
		408.1-424.1 Core loss of 1.5 feet.	Run 94 406.6 to 411.5	88 (88)
410 (377.4)				
		413.4-413.8 Core badly broken, angular fragments up to 0.15 ft. Joint at 15°, slickensides, chlorite coating.	Run 95 411.5 to 415.3	97 (47)
			Run 96 415.3 to 420.3	96 (62)
420 (386.6)			Run 97 420.3 to 424.1	84 (76)
			Run 98 424.1 to 429.3	98 (98)
430 (395.8)			Run 99 429.3 to 434.3	100 (100)
			Run 100 434.3-439.4	98 (88)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 15 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)			
440 (405.0)			Run 101 439.4 to 444.4	100 (100)
			Run 102 444.4 to 449.5	100 (100)
450 (414.2)			Run 103 449.5 to 454.7	100 (96)
		454.7-514.8 Drilling water return 50%.	Run 104 454.7 to 459.8	100 (100)
460 (423.4)			Run 105 459.8 to 463.8	100 (95)
		468.6-497.0 Fracture and joint spacing is very close to close averaging 2 in., fractures and joints at 0° to 90° but mostly 30°, discontinuous, irregular, tight but some broken	Run 106 463.8 to 468.6	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 16 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (432.6)	Graywacke (Conglomerate)	by drilling. Talc/chlorite, quartz, carbonate and white mica coating. Core loss of 1.0 ft.	Run 107 468.6 to 473.1	100 (100)
			Run 108 473.1-475.3	87 (81)
			Run 109 475.3 to 480.4	100 (100)
480 (441.8)			Run 110 480.4 to 485.4	100 (100)
			Run 111 485.4 to 488.7	100 (94)
490 (451.0)			Run 112 488.7 to 491.5	96 (63)
			Run 113 491.5 to 496.7	92 (79)
		497.0-500.0 Fracture and joint spacing generally close with zones of very close, discontinuous, tight. Talc, carbonate and minor quartz and white mica filling.	Run 114 496.7 to 501.4	100 (96)
500 (460.3)				

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SITE Devil Canyon (North Bank) — SHEET NO. 17 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)		Run 115 501.4 to 506.5	100 (100)
			Run 116 506.5 to 511.5	100 (100)
510 (469.5)			Run 117 511.5 to 514.8	100 (94)
			Run 118 514.8 to 519.9	100 (100)
520 (478.7)			Run 119 519.9 to 525.1	98 (98)
			Run 120 525.1 to 530.4	100 (94)
530 (487.9)		530.4-539.0 Core loss of 0.5 feet.	Run 121 530.4 - 534.0	86 (87)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 18 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)		Run 122 534.0 to 539.0	100 (100)
540 (497.1)			Run 123 539.0 to 544.3	100 (100)
		543.5 Joint at 35°, planar, slickensides on talc.	Run 124 544.3 to 549.2	98 (96)
550 (506.3)			Run 125 549.2 to 554.5	100 (100)
			Run 126 554.5 to 559.7	98 (92)
560 (515.5)		563.4 Quartz vein 0.1 feet wide. 564.3 Joint at 55°, planar, slickensides on chlorite/talc.	Run 127 559.7 to 564.8	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 19 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)		Run 128 564.8 to 569.9	100 (96)
570 (524.7)			Run 129 569.9 to 575.1	100 (96)
		574.0-582.0 Lithic fragments increase to cobble size, up to 6 inches.		
		577.8-578.9 Joints at 40° to 50°, spacing is very close, joints healed, chlorite/talc coating, some slickensides. Core broken by drilling, angular pieces.	Run 130 575.1 to 579.9	100 (85)
580 (533.9)		579.9-645.2 Drilling water return less than 50%.	Run 131 579.9 to 584.9	100 (100)
			Run 132 584.9 to 590.1	100 (100)
590 (543.1)			Run 133 590.1 to 595.1	100 (96)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 20 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)	598.2-602.2 Healed fracture zone joint spacing very close, joints at 0° to 10° irregular, rough, carbonate healed, joints at 70° to 90° irregular, rough, carbonate healed, talc/chlorite filling. Most joints tight but some broken by drilling.	Run 134 595.1 to 599.5	98 (89)
600 (552.3)		598.2-637.7 Joint spacing is generally close, planar, smooth, tight, coated with talc/chlorite and carbonate.	Run 135 599.5 to 604.2	100 (79)
			Run 136 604.2 to 609.1	100 (100)
610 (561.5)			Run 137	93 (57)
		612.4-613.3 Quartz vein, highly fractured, tight, irregular, inclusions of argillite.	Run 138 610.5 to 614.8	100 (100)
		614.9-620.5 Fracture zone, joint spacing is very close, joints at 30°, healed with talc/chlorite, tight but some broken by drilling.	Run 139 614.8 to 619.8	100 (96)
620 (570.7)		615.0-630.0 Lithic fragments up to 0.7 feet.	Run 140 619.8-621.7	100 (84)
			Run 141 621.7 to 626.8	98 (98)
		623.8 Increasing amounts of very thin to thin beds of argillite.		

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 21 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
630 (579.9)	Graywacke (Conglomerate)	630.0 Joint at 20°, 0.04 inch of calcareous clay.	Run 142 626.8 to 631.7	100 (100)
		632.0-634.0 Joint spacing is very close, at 30°, discontinuous, tight.	Run 143 631.7 to 636.7	100 (100)
		637.7-721.3 Joint spacing is close to moderate close, joints generally planar, smooth, coated with carbonate, chlorite and talc.	Run 144 636.7 to 641.4	100 (100)
640 (589.1)			Run 145 641.4 to 645.1	100 (100)
			Run 146 645.1 to 650.0	100 (82)
		649.3-649.8 Core broken by drilling.		
650 (598.3)			Run 147 650.0 to 655.2	100 (100)
		655.2-660.9 No drilling water return.	Run 148 655.2 to 660.4	100 (87)
660 (607.5)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 22 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)		Run 149 660.4 to 665.6	90 (90)
			Run 150 665.6 to 670.8	96 (92)
670 (616.7)			Run 151 670.8 to 675.8	100 (100)
			Run 152 675.0 to 680.5	89 (62)
		678.9-683.8 Shear/fracture zone, fracture and joint spacing very close, joints at 70°, planar smooth, fractures irregular, rough. Carbonate and talc/chlorite coating on most surfaces, slickensides on some joints.		
680 (625.9)		678.9-690.0 Core loss of 0.2 feet.	Run 153 680.5 to 683.9	85 (24)
			Run 154 683.9 to 690.0	85 (60)
		689.8 Joint at 0°, planar, slickensides on chlorite.		
690 (635.1)		690.1-693.0 Fracture zone, joint spacing is very close, joints at 30° to 40°, planar, smooth, healed with carbonate and chlorite, some broken by drilling.	Run 155 690.0-695.2	100 (87)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-1

SITE Devil Canyon (North Bank) — SHEET NO. 23 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke (Conglomerate)			
			Run 156 695.2 to 700.5	98 (98)
700 (644.4)			Run 157 700.5 to 705.6	98 (98)
		707.0-708.3 Shear/fracture zone, joint spacing very close, joints at 30° to 50°, chlorite and sulphide mineralization, slickensides on one joint.	Run 158 705.6 to 710.6	100 (100)
710 (653.6)			Run 159 710.6 to 715.7	100 (100)
			Run 160 715.7 to 721.0	98 (98)
720 (662.8)		721.3-750.2 Joint spacing close to very close, joints generally planar, smooth, tight, coated with carbonate and talc.	Run 161 721.0 to 725.6	100 (91)

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SITE Devil Canyon (North Bank) — SHEET NO. 24 OF 24

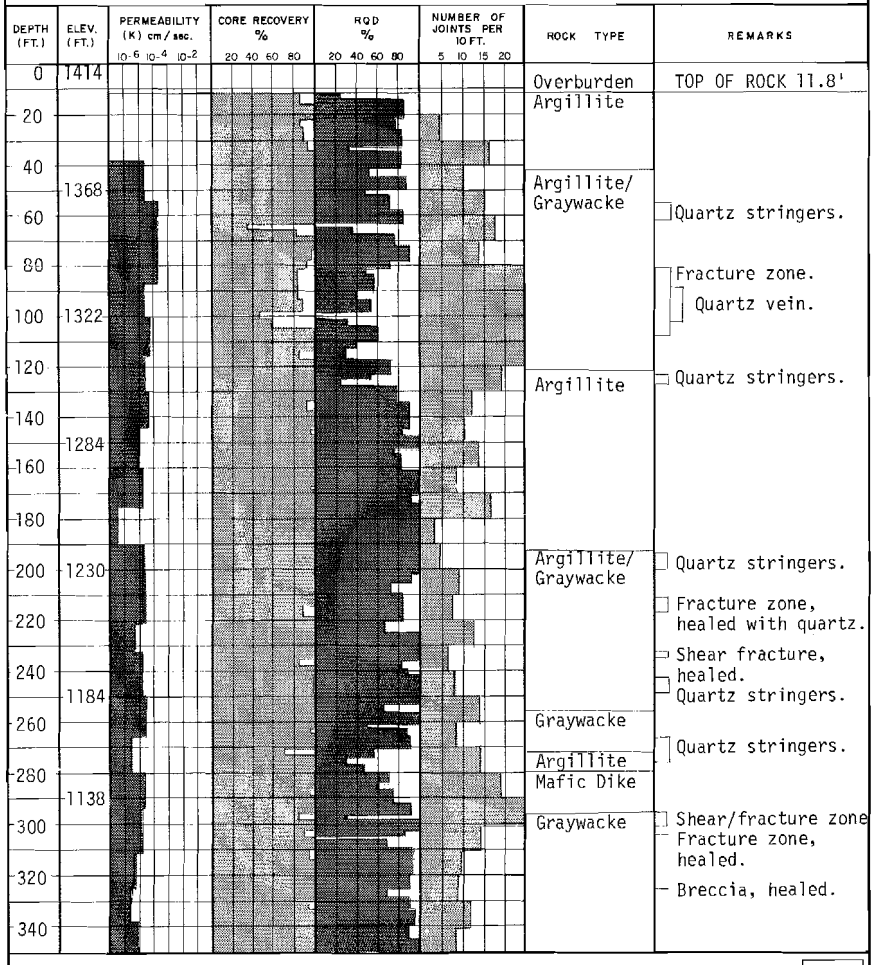
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	Graywacke (Conglomerate)		Run 162 725.6-727.4	100 (78)
		727.1 Joint 0.1 inch wide with clay filling and rock fragments.	Run 163 727.4 to 731.8	95 (77)
730 (672.0)		731.4-732.1 Fracture zone, joint spacing very close, joints coated with carbonate and talc. Core loss of 0.6 feet. 733.0 Joint with clay filling.	Run 164 731.8 to 737.1	94 (77)
		737.6 Joint at 60°, 0.1 inch wide, carbonate and clay filling.	Run 165 737.1 to 741.5	93 (80)
740 (681.2)			Run 166 741.5 to 745.7	100 (100)
		745.4-748.0 Fracture zone, joint spacing very close, joints at 50°, planar, smooth, healed with carbonate, tight, some opened by drilling. 745.7-750.2 Core loss of 0.3 feet.	Run 167 745.7 to 750.2	93 (73)
750.2 (690.6)		END OF BORING		

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. BH-1
Sheet No. 1 of 3

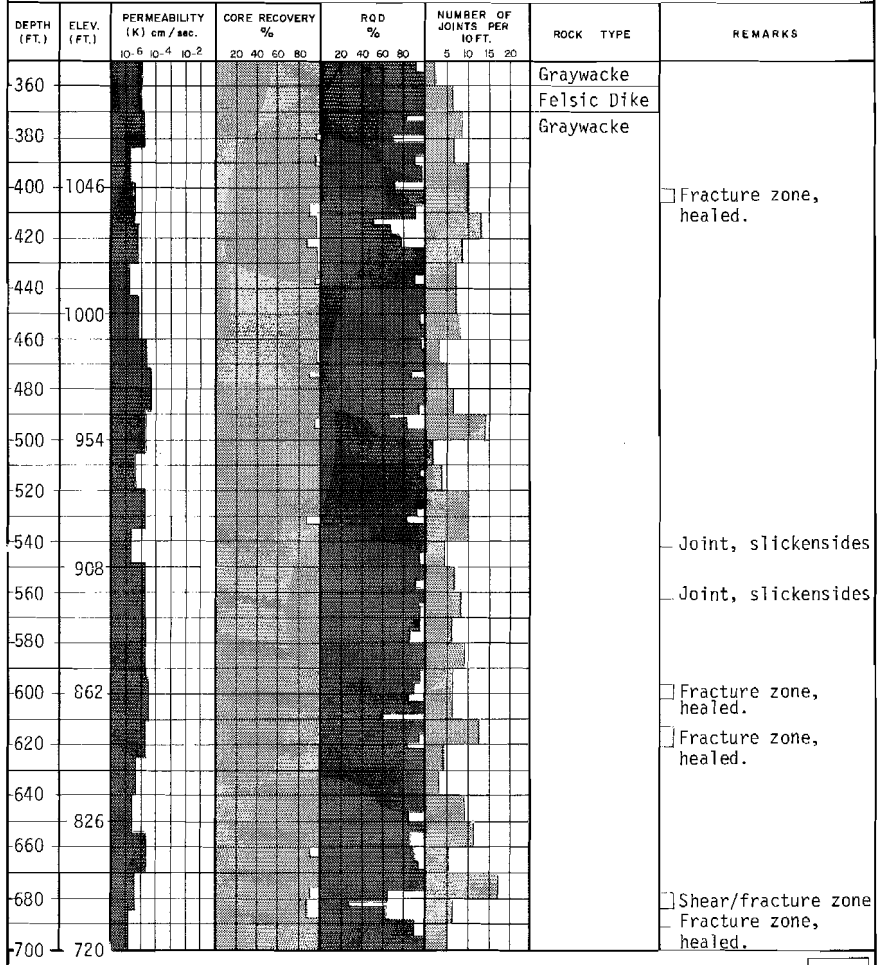


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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

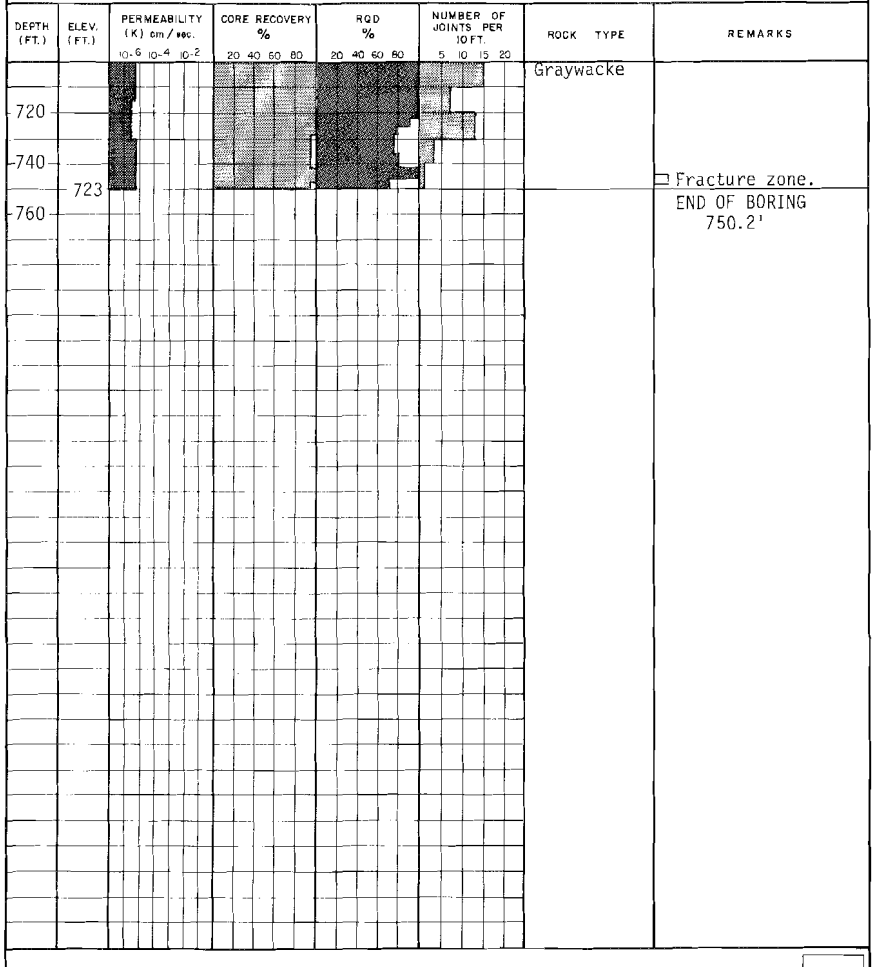
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SUMMARY LOG

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Project Susitna Hydroelectric Project **Hole No.** BH-1
Site Devil Canyon (North Bank) **Sheet No.** 3 **of** 3



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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-2

SITE: Devil Canyon (North Bank) — SHEET NO. 1 OF 21

CONTRACTOR: The Drilling Company — DRILLING DATES: Sept. 10 TO Sept. 15, 1980
LOGGED BY: K.J. White, M.P. Bruen — DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer — CASING DIAMETER: NW (3.0") I.D.
ROCK Diamond Core - Triple Tube — CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,223,137; DEPARTURE E616,101; AZIMUTH 0°; DIP 60°

ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4; GROUND SURFACE 1213.4; ROCK SURFACE 1211.7; BOTTOM OF HOLE 645.7; WATER TABLE 1208.4

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	Dark brown, organic silt with trace of light gray ash, some angular cobbles. No samples taken. TOP OF ROCK		
2.0 (1.7)	Graywacke	Reddish dark gray, fine grained metasedimentary rock. Bedding coincident with weakly developed foliation at 40°. Very thin to thin beds of dark gray argillite. Generally fresh to slightly weathered, hard, well indurated, sulphide mineralization (5% of rock). 2.0-30.4 - Joints closely spaced, planar, rough to smooth, iron oxide staining, few with quartz filling. 6.0-13.0 - Fracture zone, joints and fractures very closely spaced, irregular, discontinuous, healed with quartz, tight. Core loss of 4.4 feet.	Run 1 2.0 to 6.0	90 (75)
			Run 2	50 (0)
			Run 3	64 (0)
10 (8.7)			Run 4 8.1 to 10.5	63 (0)
11.2 (9.7)	Argillite	Dark gray, very fine grained metasedimentary rock. Very thin to thin bedding coincident with weakly developed foliation at 35° to 65°. Zones of phyllitic sheen, poor cleavage, very thin beds of fine grained graywacke. Generally fresh, hard, well indurated, sulphide mineralization.	Run 5 10.5 to 16.0	64 (48)
			Run 6 16.0 to 21.0	100 (89)
20 (17.3)		21.0 - Core loss of 0.1 feet.		

APPROVED: [signature] DATE: February 1, 1982

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 2 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 7 21.0 to 26.0	98 (82)
			Run 8 26.0-28.0	100 (57)
		28.4-32.2 Numerous healed fractures, very closely spaced, healed with quartz, irregular and discontinuous. Core loss of 0.3 feet.	Run 9 28.0 to 33.0	94 (82)
30 (26.0)		30.3, 30.9 Two healed shears, 30° and 50°, 1 in. wide, quartz healed breccia, tight. 30.4-90.9 Joints close to moderately closely spaced, planar, rough to smooth, iron oxide staining, some with quartz filling.	Run 10 33.0 to 38.0	100 (90)
		38.0-67.0 Drilling water return 50%.	Run 11 38.0 to 42.0	95 (88)
40 (34.6)			Run 12 42.0 to 46.9	100 (100)
46.0 (39.8)	Argillite/ Graywacke	Argillite, dark gray, very fine grained metasedimentary rock interbedded with thin to thick beds of graywacke, light to reddish gray, fine to medium grained metasedimentary rock with elongated sand grains in an argillaceous matrix. Bedding coincident with weakly developed foliation at 40°. Generally fresh, hard, well indurated.	Run 13 46.9 to 51.9	100 (96)
50 (43.3)				

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SITE Devil Canyon (North Bank) — SHEET NO. 3 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 14 51.9 to 56.9	100 (100)
		56.0 End of intense iron oxide staining on joint surfaces.		
		58.6-61.2 Fracture zone, 0°, very closely spaced fractures, healed with quartz, up to 1 inch wide.	Run 15 56.9 to 62.2	100 (94)
60 (52.0)				
		63.65 Core loss of 0.5 feet.	Run 16 62.2 to 67.0	90 (90)
		64.4 Quartz vein, less than 0.1 inch wide, stretched, parallel to bedding/foliation at 40°, crosscut by quartz vein at 90° which is offset along foliation planes.		
		64.4-67.4 Quartz stringers, less than 0.24 inch, closely spaced, parallel to and cross-cutting foliation.	Run 17 67.0 to 71.9	98 (98)
		68.95-69.05 Core loss of 0.1 foot.		
70 (60.6)				
			Run 18 71.9 to 76.8	100 (100)
		76.1-78.7 Felsic dike, light gray, aphanitic to fine grained groundmass, 50% quartz and plagioclase phenocrysts, medium grained, less than 5% mafics, granodiorite (?) composition. Contacts parallel to bedding/foliation at 60° tight. Chilled zone in dike up to 1 inch wide. Baked zone in surrounding argillite up to 6 inches wide.	Run 19 76.8 to 81.8	100 (84)
80 (69.3)				
		78.7 Argillite/graywacke, as above, but complexly folded and stretched, possibly brecciated, healed, tight.	Run 20 81.8 to 86.9	100 (91)

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SITE Devil Canyon (North Bank) — SHEET NO. 4 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 20	
		87.3-87.9 Core loss of 0.2 feet.	Run 21 86.9 to 91.6	96 (70)
90 (77.9)		89.4-90.9 Felsic dike, as above, subparallel to bedding/foliation, 40°-70°, somewhat irregular, tight.		
90.9 (78.7)	Graywacke	Reddish, dark gray, fine to medium grained metasedimentary rock with an argillaceous matrix. Bedding coincident with weakly developed foliation at 30° to 40°. Generally fresh, hard, well indurated.	Run 22 91.6 to 96.9	100 (91)
		90.9-138.6 Joints generally closely spaced, planar, smooth to rough, carbonate and quartz filling, very few with iron oxide staining.		
			Run 23 96.9 to 101.7	100 (100)
100 (86.6)				
			Run 24 101.7 to 105.0	97 (76)
		104.9 Core loss of 0.1 feet.		
		105.7-107.9 Core loss of 0.3 feet.	Run 25 105.0 to 107.9	90 (66)
			Run 26	100 (56)
110 (95.3)		109.5-112.0 Core loss of 1.5 feet due to core barrel mislatch during drilling. Core badly broken.	Run 27 109.5-112.0	40 (14)
			Run 28 112.0 to 114.6	100 (58)
		114.6-119.4 Core loss of 0.2 feet.	Run 29 114.6-119.4	96 (96)

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PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-2

SITE Devil Canyon (North Bank) — **SHEET NO.** 5 **OF** 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke		Run 29	
120 (103.9)		119.4-119.8 Quartz veins, folded, stretched, brecciated, healed, tight. 120.5 Bedding/foliation, 50° 121.7-123.2 Core badly broken, angular pieces less than 1 inch, some clay coating on joints at 0°.	Run 30 119.4 to 123.2	92 (53)
			Run 31 123.2 to 125.9	100 (59)
		125.9-132.0 Core loss of 2.5 ft. due to core barrel mislatch during drilling.	Run 32 125.9 to 132.0	59 (0)
130 (112.6)				
		135.0-135.5 Quartz stringers, up to 0.5 inch wide, irregular, discontinuous. Healed sheared contact between argillite and graywacke beds. 136.7-140.3 Core badly broken by drilling. Core loss of 0.5 feet. 137.8 Mafic dike, 30°, 0.5 inch wide, tight contacts. 138.6-141.8 Shear/fracture zone, joints very closely spaced, 10° to 20°. 138.6-139.0 Joints generally close to very closely spaced, planar, smooth to rough open to partially open, many with slickensides.	Run 33 132.0 to 135.0	100 (73)
			Run 34 135.0-137.0	95 (85)
			Run 35 137.0 to 140.3	88 (30)
139.5 (120.8)	Mafic Dike (Diabase)	Dark green, fine to medium grained, feldspar laths form a fibrous texture, 5-10% white, radiating zeolite crystals up to 0.02 inch, quartz replacement of crystals. Upper contact at approximately 50°, irregular, tight, argillite unaltered. Joints closely spaced, slickensides, chlorite on most. 139.5-147.0 Chilled zone in dike: 139.5-139.8 Aphanitic. 139.8-147.0 Very fine grained. 141.3-144.0 Joints at 10° to 20°, surfaces with chlorite and slickensides.	Run 36 140.3 to 143.4	100 (74)
			Run 37 143.4-145.4	100 (65)
			Run 38 145.4-147.5	100 (100)

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SITE Devil Canyon (North Bank) — **SHEET NO.** 6 **OF** 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (129.9)	Mafic Dike (Diabase)	147.5-155.0 Core loss of 0.7 feet.	Run 39 147.5 to 152.0	89 (89)
		152.2-155.0 Shear/fracture zone, joints very closely spaced at 10° and 90°, friable, breccia and clay gouge, slickensides. Core badly broken.	Run 40 152.0 to 155.0	93 (0)
		156.4-172.9 Slickensides on many joint surfaces, some on quartz and chlorite fillings.	Run 41 155.0 to 160.0	100 (82)
160 (138.6)		160.0-165.4 Core loss of 0.2 feet.	Run 42 160.0 to 165.4	96 (80)
			Run 43 165.4 to 170.5	100 (100)
170 (147.2)			Run 44 170.5 to 175.6	100 (96)
		174.6-183.1 Chilled zone: 174.6-178.5 Fine grained, less than 5% zeolites. 178.5-183.1 Very fine grained to aphanitic near contact. 179.0-183.8 Fracture zone, joints very closely spaced at 20°, 40° and 60°, chlorite, clay and slickensides on many surfaces. Core broken into angular pieces below 181.0.	Run 45 175.6 to 178.6	100 (87)
			Run 46 178.6-181.8	100 (47)
180 (155.9)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 7 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Mafic Dike (Diabase)			
183.1 (158.6)	Graywacke	Rock description, as above. 183.1 Contact at approximately 30°, irregular, tight, no shearing, no hornfels in graywacke.	Run 47 181.8 to 185.9	100 (73)
		186.3-192.2 Quartz stringers, very close to closely spaced at 20° to 70°, 0.04 to 0.2 inch wide, crosscutting bedding/foliation (50°), minor carbonate. 187.7-187.8 Shear, 50°, breccia and clay incompletely healed with carbonate and quartz, moderately soft and friable.	Run 48 185.9 to 190.8	100 (100)
190 (164.5)				
		192.2-193.5 Limy sandstone, light gray, fine grained. Fresh, hard, well indurated. Gradational contacts. 192.5 Bedding and poorly developed foliation at 40°.	Run 49 190.8 to 193.8	100 (100)
		193.0-251.1 Joints generally close to moderately closely spaced, planar smooth to rough, tight, quartz and carbonate filling, no staining.	Run 50 193.8 to 198.9	100 (100)
200 (173.2)			Run 51 198.9 to 203.2	100 (100)
			Run 52 203.2 to 208.4	100 (100)
		206.5-212.2 Fracture zone, fractures very closely spaced at 0° to 20°, irregular, healed with quartz and carbonate, tight, hard.		
210 (181.9)			Run 53 208.4 to 211.7	100 (100)

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SITE Devil Canyon (North Bank) — SHEET NO. 8 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke	213.4-213.7 Core broken along healed joints.	Run 54 211.7 to 216.9	100 (94)
		218.1-218.3 Fracture zone, healed, as above, but fractures at 90°.	Run 55 216.9 to 220.7	100 (95)
220 (190.5)			Run 56 220.7 to 226.0	100 (96)
			Run 57 226.0 to 231.2	100 (100)
230 (199.2)		230.0-231.0 Composition nearly quartzite, less than 20% fines in matrix. 231.2 Joint, 30°, slickensides.		
		233.0 Bedding/foliation at 40°.	Run 58 231.2 to 236.3	100 (100)
		235.0-238.3 Interbedded argillite, very thin to thin beds, dark gray.		
		236.0-236.6? / 237.8-238.3? Shears, 50°, healed quartz veins faulted and folded comprising 40% to 50% of rock, less than 0.5 in. wide, tight, hard, well indurated, tight contacts.	Run 59 236.3 to 241.0	100 (100)
240 (207.8)		241.0-242.0 Fracture zone, joints very close spaced at 50° and 0°, open and tight, slickensides, pyrite, chlorite. 241.0-244.0 Interbedded argillite, very thin to thin beds, dark gray.	Run 60 241.0 to 244.7	100 (89)

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SITE Devil Canyon (North Bank) — **SHEET NO.** 9 **OF** 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke	245.8-246.0 Two joints, 60° with slickensides.	Run 61 244.7 to 249.8	100 (90)
250 (216.5)			Run 62 249.8 to 255.0	100 (100)
			Run 63 255.0 to 260.0	98 (94)
258.5 (223.9)	Argillite/ Graywacke	Interbedded argillite and graywacke, metasedimentary rock. Very thin beds (less than 1 inch wide) coincident with foliation at 40° to 50°, zones highly folded and stretched. Tight, hard. Sharp contact.		
260 (225.2)			Run 64 260.0-262.5	100 (76)
		Joints closely to moderately closely spaced, planar to irregular, slick to rough, tight to open, carbonate, chlorite and clay filling.	Run 65 262.5 to 267.3	94 (83)
			Run 66 267.3-269.5	100 (82)
270 (233.8)			Run 67 269.5 to 274.7	100 (73)
273.9 (237.2)	Argillite	As above, bedding/foliation, 40° to 50°. 275.2-276.0 Fracture zone, joints very closely spaced at 0°, 50° and 70°, slickensides.	Run 68 274.7-277.5	96 (50)

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PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-2

SITE Devil Canyon (North Bank) — **SHEET NO.** 10 **OF** 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	277.4-279.8 Shear/fracture zone, joints very closely to closely spaced at 0°, 20° and 50°, carbonate, chlorite and talc on most surfaces, clay and slickensides on joints at 0° and 20°. 279.5-281.4 Bedding/foliation folded and stretched. Numerous quartz veins up to 2 in. wide, mostly along foliation and joints, tight, hard.	Run 69 277.5 to 281.5	100 (48)
280 (242.5)		279.5-287.0 Shear/fracture zone, joints very closely spaced at 0° and 10° to 20°, planar, smooth, tight, slickensides, talc coating, pyrite partially to completely replaced by quartz.	Run 70 281.5 to 287.0	100 (95)
287.0 (248.5)	Argillite/ Graywacke	Rock description, as above. Bedding/foliation at 30° to 40°, folded, stretched, offsets in bedding, argillite spotted with dark gray crystals 0.1 inches wide.	Run 71 287.0 to 292.0	100 (96)
290 (251.1)		291.1, 294.8 Two joints, 70° and 60° respectively, trace clay.		
		293.6-294.0 Fracture zone, fractures very closely spaced, irregular and discontinuous, quartz healed, generally crosscutting foliation, tight.	Run 72 292.0 to 297.0	100 (100)
		297.0-304.0 Pyrite cubes up to 0.5 inches, partially replaced by quartz. 297.9 Quartz vein at 50°, 0.5 inches wide, slightly folded, parallel to bedding/foliation. 299.7 Joint at 50°, clay filling and sand size argillite fragments.	Run 73 297.0 to 301.7	100 (87)
300 (259.8)		300.5-300.7? Shear, healed, folded and breciated 302.0-302.1) fragments in quartz matrix, tight hard.	Run 74 301.7 to 306.7	100 (100)
		305.5-307.7 Fractures very closely spaced, irregular, discontinuous, quartz filling, slickensides at 306.5.	Run 75 306.7-309.4	100 (70)
		310.4-311.5 Core broken into angular fragments		

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SITE Devil Canyon (North Bank) — SHEET NO. 11 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (268.5)	Argillite/ Graywacke	up to 1 inch wide. Joint at 30°, slickensides and talc; joint at 40° planar, slickensides, joint at 10°, planar, smooth, with 0.1 inches of silty fine to coarse grained sand.	Run 76 309.4- 311.5	67 (0)
311.5 (269.8)	Argillite	Rock description, as above, few interbeds of graywacke.	Run 77 311.5 to 316.7	100 (94)
		315.0-316.7 Fracture zone, irregular and discontinuous fractures, quartz filled, tight, hard.	Run 78 316.7 to 319.7	87 (37)
320 (277.1)		318.6-424.1 Joints generally closely to moderately closely spaced, occasional zones very closely spaced, generally planar, slick to smooth, tight, chlorite and talc filling quartz, carbonate and trace clay/silt.	Run 79 319.7 to 323.5	100 (74)
		322.3-323.0 Breccia, 0°, healed, tight, hard. 325.0-325.5 Bedding, 0°, crosscut by foliation at 50°.	Run 80 323.5 to 326.9	100 (100)
		325.5-326.6 Numerous quartz veins and stringers, parallel to bedding/foliation, very closely spaced, contorted, chlorite coating. 328.5 Joint, 45°, carbonate, less than 0.1 inches of silty sand.	Run 81 326.9 to 330.1	100 (91)
330 (285.8)		328.5 Argillite, reddish gray. 328.5-329.8 Quartz stringers, 60°, closely spaced, up to 0.25 inches wide, tight. 329.5-330.4 Quartz vein, 20°, 0.5 to 2.0 inches wide, irregular, fractured, tight.	Run 82 330.1- 332.6	92 (56)
		330.6-330.9 Quartz vein, 30°, 1.5 inches wide, fractured, tight, chlorite. 332.6-337.5 Core loss of 1.6 feet. 333.3-333.8 Shear/fracture zone, joints very closely spaced at 20°, slickensides and silty sand coating.	Run 83 332.6 to 337.5	67 (53)
334.8 (289.9)	Graywacke	334.6-334.8 Shear, quartz healed, tight, hard. As above, lower contact at 30°.		
		339.4-342.2 Numerous quartz stringers, contorted.	Run 84 337.5- 339.5	100 (70)
339.8 (294.3)	Argillite/ Graywacke	Argillite, reddish, medium to dark gray, very	Run 85	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 12 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	fine grained medasedimentary rock thinly interbedded with graywacke, reddish, medium to dark gray, fine to medium grained metasedimentary rock with elongated sand grains. Occasional phyllitic sheen in argillite. Generally fresh, hard, well indurated.	Run 85 339.5- 343.1	100 (83)
		340.5-340.6 Quartz vein, folded, tight, hard, inclusions of argillite. 341.5-342.0? Quartz stringers, 0.25 inches 342.8-343.3? wide, highly folded and contorted, some offset along foliation fracture cleavage at 40°, tight, hard.	Run 86 343.1 to 347.1	100 (100)
350 (303.1)		344.0 Graywacke beds becoming fine to coarse grained, some graded beds, beds generally less than 6 inches wide.	Run 87 347.1 to 352.2	100 (100)
			Run 88 352.2 to 357.1	100 (100)
			Run 89 357.1 to 361.9	98 (98)
360 (311.8)		359.5-362.0 Fracture zone, joints very closely spaced at 30°, tight. 361.4-364.7 Bedding/foliation at 50°.	Run 90 361.9 to 366.7	96 (96)
		364.6 Core loss of 0.2 feet.		
		366.5-366.9 Quartz vein, 40°, irregular, parallel to and crosscutting bedding.	Run 91 366.7 to 372.0	96 (96)
370 (320.4)				

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 13 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite Graywacke	374.0 Core loss of 0.2 feet. 375.3 Joint, 40°, silty sand filling.	Run 92 372.0 to 376.1	95 (73)
			Run 93 376.1 to 381.1	100 (100)
380 (329.1)			Run 94 381.1 to 386.2	100 (100)
		383.9-389.5 Bedding highly folded and contorted, foliation at 40° to 60° parallel to and crosscutting bedding, offsets along foliation.	Run 95 386.2 to 391.4	96 (96)
390 (337.7)		391.4-407.1 Core loss of 0.4 feet.	Run 96 391.4 to 396.6	98 (88)
392.5 (339.9)	Graywacke	Rock description, as above, few very thin to thin argillite beds. Joints closely to moderately closely spaced, generally planar, slick to smooth, tight, few chlorite and talc filled. 394.5 Quartz stringer, 70°, 0.1 inches wide, crosscutting foliation but slightly offset by fracture cleavage. 394.7 Quartz pod, 10°, 0.5 inches wide, 2 inches long, discontinuous. 400.7-406.0 Core loss of 0.1 feet.	Run 97 396.6 to 401.8	98 (98)
400 (346.4)		403.0 Bedding/foliation, 60°.	Run 98 401.8 to 407.1	92 (89)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 14 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Graywacke	406.2 Joint, 20°, clay filling.	Run 98	
			Run 99 407.1 to 411.6	100 (93)
410 (355.1)		410.7 Quartz pod with chlorite stringers, 1 inch wide.	Run 100 411.6 to 416.9	100 (100)
414.0 (358.5)	Argillite/ Graywacke	Rock description, as above. Joints generally moderately closely spaced, zones very closely spaced, generally planar to irregular, smooth to rough, tight to open, quartz and carbonate filling, some chlorite staining. 415.9-416.6 Felsic dike (aplite), light gray, highly irregular contacts, stringers penetrating graywacke up to 2 inches, tight, hard.	Run 101 416.9 to 421.9	100 (92)
420 (363.7)		420.8-421.2 Quartz stringers. 0.25 inches wide, folded, irregular and discontinuous, tight. 422.3-428.0 Quartz veins and stringers less than 1 inch wide, moderately closely to closely spaced, irregular, unfractured, tight, chlorite mineralization.	Run 102 421.9 to 427.2	100 (100)
430 (372.4)		424.1-562.8 Joints generally moderately closely spaced, planar to irregular, smooth to rough, tight to open, some carbonate filling, very few with quartz and clay filling, some chlorite staining. 424.4 Less talc and chlorite on joints below. 426.6-431.9 Core loss of 0.4 feet. 431.5 Quartz vein, 2 inches wide, as above.	Run 103 427.2 to 431.9	100 (100)
			Run 104 431.9 to 437.2	100 (94)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 15 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 105 437.2 to 442.2	96 (96)
440 (381.1)		439.7-453.6 Quartz veins, 20° to 50°, parallel to subparallel to bedding/foliation, 3 inches to 6 inches wide, closely spaced, very closely fractured, 10% to 20% chlorite mineralization, tight contacts.	Run 106 442.2 to 444.9	100 (100)
			Run 107 444.9 to 450.0	98 (98)
450 (389.7)			Run 108 450.0 to 455.3	98 (98)
			Run 109 455.3 to 460.1	100 (100)
460 (398.4)			Run 110 460.1 to 465.3	100 (100)
			Run 111 465.3 to 470.3	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 16 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (407.0)	Argillite/ Graywacke		Run 111	
		472.5-473.0 Core badly broken by drilling.	Run 112 470.3 to 475.0	100 (85)
		474.0 Quartz vein, 90°, 1 inch wide, fractured, open joint with chlorite. 474.5 Quartz vein, 40°, 1 inch wide, fractured, tight.	Run 113 475.0-477.3	100 (100)
480 (415.7)			Run 114 477.3 to 481.9	100 (100)
		484.4-485.4 Core badly broken by drilling.	Run 115 481.9 to 485.4	100 (69)
			Run 116 485.4 to 490.3	100 (96)
490 (424.4)		490.3-494.7 Shear/fracture zone, joints very closely to closely spaced at 30° to 60°, very thin breccia, clay gouge and carbonate on joint surfaces.	Run 117 490.3-492.5	100 (18)
			Run 118 492.5 to 495.4	100 (72)
			Run 119 495.4 to 499.4	100 (98)
		499.8 Joint, 50°, clay coating.		
500 (433.0)		500.5 Bedding/foliation, 50°.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2
SITE Devil Canyon (North Bank) — SHEET NO. 17 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	502.2-502.4 Quartz vein, approximately 90°, unfractured, tight, irregular contact. 503.0-503.1 Quartz vein, 60°, broken by drilling, tight contacts. 503.3-503.8 Quartz vein, approximately 0°, 0.5 inches to 1 inch wide, folded, unfractured, tight, irregular. 504.0-505.9 Quartz veins and stringers less than 1 inch wide, folded and offset along foliation, unfractured, tight, hard. 507.2 Quartz pods, 0.5 inches to 1 inch wide, as above.	Run 120 499.4 to 504.7	98 (91)
			Run 121 504.7 to 509.1	100 (100)
510 (441.7)		510.2 Quartz vein, 70°, 0.5 inches wide, fractured, tight.	Run 122 509.1 to 514.0	100 (84)
		514.3-514.5 Core broken by drilling.	Run 123 514.0 to 519.1	100 (96)
520 (450.3)		519.5 Bedding/foliation, 60°.	Run 124 519.1 to 524.3	100 (100)
			Run 125 524.3 to 529.5	100 (92)
530 (459.0)		529.5 Joint, 50°, planar, smooth, clay filling. 530.3-531.2 Fracture zone, joints at 0°, irregular, rough talc and carbonate coating. Core badly broken. 531.2 Quartz vein, 50°, 0.5 inches to 1.5 inches wide, unfractured, tight.	Run 126 529.5 to 534.7	100 (85)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2
SITE Devil Canyon (North Bank) — SHEET NO. 18 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	534.7 Core loss of 0.3 feet.	Run 126	
		535.6-543.5 Fractures closely spaced, irregular, tight, quartz healed.	Run 127 534.7 to 538.3	94 (94)
540 (467.7)			Run 128 538.3 to 542.0	81 (81)
			Run 129 542.0 to 547.2	100 (98)
		543.5-547.2 Shear/fracture zone, joint at 10°, irregular, sandy silt/clay breccia, joint at 70°, planar, smooth talc coating. Core badly broken.		
		548.7 Joint with clay filling.	Run 130 547.2 to 552.0	100 (100)
550 (476.3)			Run 131 552.0 to 557.1	94 (94)
		557.1-557.5 Core broken into angular fragments, generally less than 0.5 inches.	Run 132 557.1 to 562.0	100 (59)
560 (485.0)		562.8-621.0 Fractures and joints very closely to closely spaced, calcite and quartz healed, hard, tight.	Run 133 562.0 to 567.0	100 (88)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 19 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	562.9-592.0 Bedding highly folded, stretched and brecciated along foliation, tight, hard.	Run 133	
			Run 134 567.0 to 572.1	100 (94)
570 (493.6)				
			Run 135 572.1- 574.6	100 (92)
		574.4-598.0 Fracture zone, joints and fractures very closely spaced, most quartz healed, generally tight, chlorite coated, joints at 0° to 20° and 50° to 70°, fractures, irregular and discontinuous. Some core broken by drilling.	Run 136 574.6 to 579.9	100 (98)
580 (502.3)			Run 137 579.9 to 582.9	100 (90)
			Run 138	100 (20)
		584.9-589.6 Core loss of 0.2 feet.	Run 139 584.9 to 589.6	96 (55)
590 (511.0)			Run 140 589.6 to 594.6	100 (68)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-2

SITE Devil Canyon (North Bank) — SHEET NO. 20 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 141 594.6 to 599.6	100 (96)
600 (519.6)			Run 142 599.6- 601.8	100 (82)
		601.2-621.0 Fracture zone, joints and fractures very closely spaced, joints at 10° to 20°, planar smooth, some talc and carbonate coating, and at 40° to 70°, planar to irregular, trace talc and carbonate, fractures irregular and discontinuous, tight.	Run 143 601.8 604.0	100 (91)
			Run 144 604.0 to 609.2	100 (88)
610 (528.3)			Run 145 609.2 to 614.2	100 (76)
			Run 146 614.2 to 619.5	89 (81)
620 (536.9)			Run 147 619.5 to 624.8	100 (89)
		621.0-656.2 Joints generally widely to very widely spaced, planar, smooth to rough, tight to open, carbonate and quartz filling.	Run 148 624.8 to 630.1	94 (89)
		627.3 Shear, 60°, 1 inch wide, clay and breccia filling, friable. Core loss of 0.2 feet.		

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-2

SITE Devil Canyon (North Bank) — **SHEET NO.** 21 **OF** 21

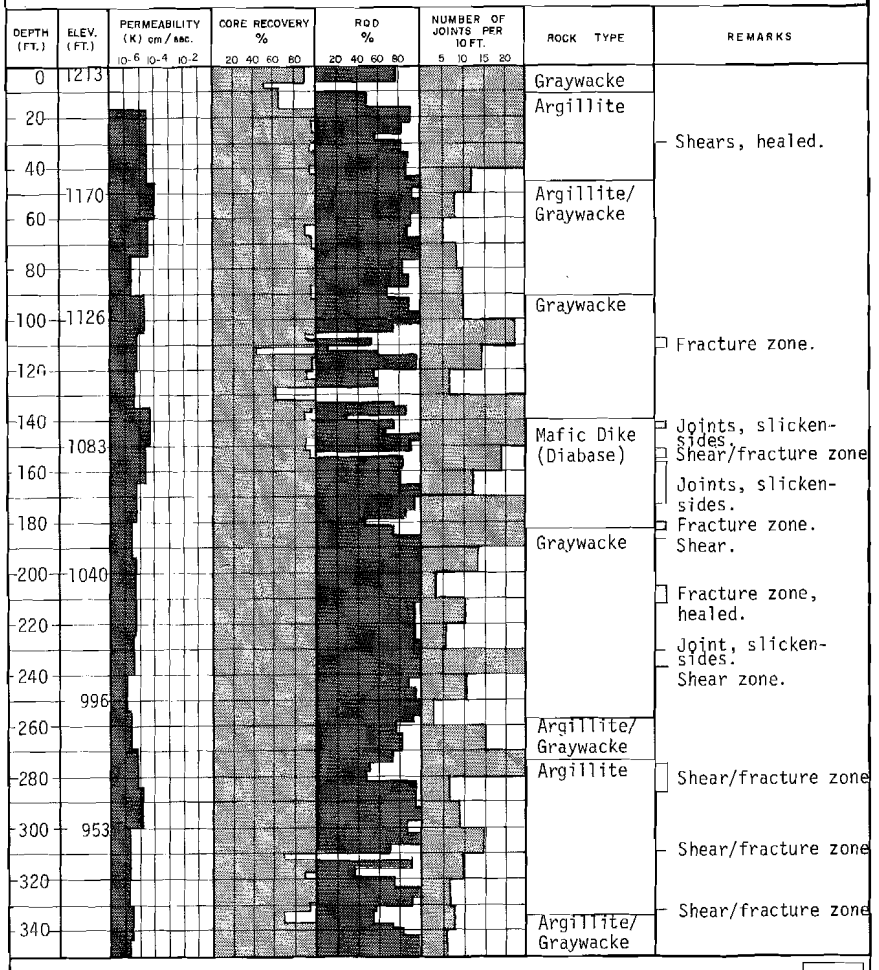
DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
630 (545.6)	Argillite/ Graywacke		Run 148	
			Run 149 630.1 to 635.3	100 (100)
632.6 (547.8)	Quartz Diorite/ Granodiorite Dike	Light gray, quartz rich rock, porphyritic texture with medium to coarse grained plagioclase and quartz crystals in a fine grained to aphanitic groundmass of plagioclase and mafics. Overall less than 10% mafics. Generally very hard, fresh, well indurated.	Run 150 635.3 to 640.5	100 (100)
640 (554.3)		Joints widely to very widely spaced at 30° and 60° to 70°, planar, smooth to rough, tight to open, quartz filling.	Run 151 640.5 to 645.8	98 (92)
		646.0-650.1 Quartz veins, closely spaced 1 inch to 6 inches wide, comprise 50% of rock, highly fractured, tight, minor chlorite, occasional vugs and recrystallization.	Run 152 645.8 to 650.8	100 (100)
650 (562.9)			Run 153 650.8 to 655.5	96 (96)
655.5 (567.7)		END OF BORING		

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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. BH-2
Sheet No. 1 of 2



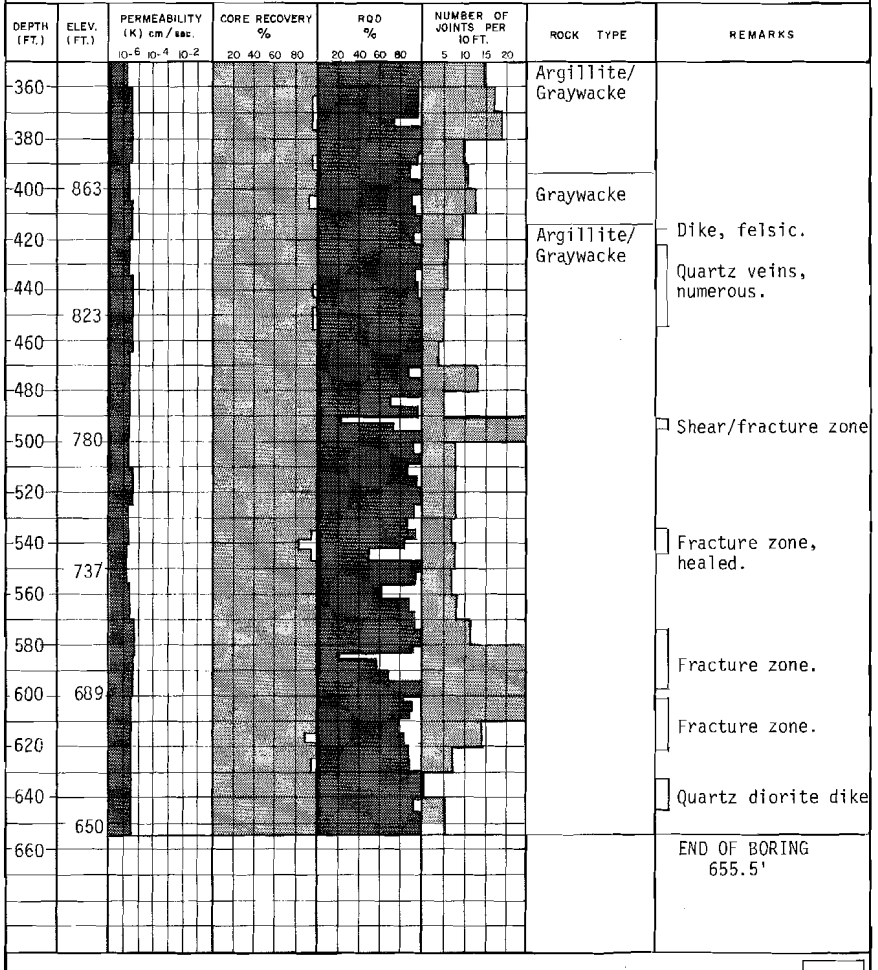
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. BH-2
Sheet No. 2 of 2



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ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-3

SITE: Devil Canyon (South Bank) — SHEET NO. 1 OF 13

CONTRACTOR: Interstate Exploration Inc. — DRILLING DATES: June 28 TO July 13, 1981

LOGGED BY: K.J. White, M.P. Bruen — DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer — CASING DIAMETER: NW (3.0") I.D.

ROCK Diamond Core - Triple Tube — CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,222,146 — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4

DEPARTURE E615,883 — GROUND SURFACE 1398.0

AZIMUTH 058° — ROCK SURFACE 1394.0

DIP 32° — BOTTOM OF HOLE 1190.7

WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	No samples taken.		
		TOP OF ROCK		
7.5 (4.0)	Argillite	Medium to dark gray, very fine to fine grained metasedimentary rock. Very thin beds coincident with weakly to moderately developed primary foliation. Zones of minor secondary foliation. Occasional very thin to medium beds of light gray, fine grained graywacke. Minor zones of quartz veining.	Run 1	100(100)
10 (5.3)			Run 2 8.0 to 10.9	93 (0)
			Run 3 10.9 to 14.7	100 (50)
		Joints close spaced, iron oxide stained.		
		7.5-11.4 - Joint spacing is close to very close, iron oxide staining. Bedding and primary foliation at 35° to 40° with weakly developed secondary foliation at 20°.	Run 4 14.7 to 17.8	100 (100)
		11.4-21.7 - Joints close to moderately close spaced, iron oxide staining.	Run 5 17.8 to 22.0	100 (67)
20 (10.6)				

APPROVED: [signature] DATE: February 1, 1982

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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 2 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	21.7-22.5 - Core broken by drilling, pieces 1 inch to 2 inches, iron oxide staining.	Run 5	
		22.5-27.8 - Joints close spaced, iron oxide staining is lessening.	Run 6 22.0-23.9	100 (53)
			Run 7 23.9 to 27.9	100 (38)
		27.8-28.1 - Core broken by drilling, pieces average 1 inch, clay/silt coating.		
		28.1-51.7 -Joints close to moderately closely spaced, averaging 1 foot, minor iron oxide staining.	Run 8 27.9 to 31.9	100 (56)
30 (15.9)				
			Run 9 31.9 to 37.0	100 (96)
			Run 10 37.0 to 42.0	100 (94)
40 (21.2)				
		43.8 - Joint at 50°, open, irregular, rough, iron oxide staining, clay/silt coating.	Run 11 42.0 to 47.0	100 (94)
		44.0 - Bedding/foliation, 60°, very faint secondary foliation at 10°.		
			Run 12 47.0 to 51.7	100 (83)
50 (26.5)		51.7-99.8 - Joints moderately close spaced, iron oxide staining, minor chlorite coating.		

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 3 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Argillite	55.7 - Joint, 10°, possible slickensides.	Run 13 51.7 to 56.5	100 (98)
			Run 14 56.5 to 61.6	100 (96)
60 (31.8)		63.3 - Joint, 90°, open, irregular, heavy iron oxide coating compared to surrounding joints.	Run 15 61.6 to 66.1	100 (96)
			Run 16 66.1 to 71.1	100 (100)
70 (37.1)		70.2 - Joint, 25°, possibly open, irregular, rough, heavy iron oxide staining.		
		72.6 - Joint, 20°, possibly open, irregular, rough, heavy iron oxide staining.	Run 17 71.1 to 76.3	100 (90)
			Run 18 76.3 to 81.4	100 (96)
80 (42.4)		80.4 - Joint, 30°, open, planar, smooth, iron oxide staining. Core broken.		
			Run 19 81.4 to 86.5	100 (94)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 4 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Argillite		Run 19	
			Run 20 86.5 to 91.6	100 (100)
90 (47.7)		90.0 - Bedding/foliation highly folded, 55°. Weakly developed secondary foliation at 20°.		
		91.0-91.2 - Quartz pods, up to 1 inch wide, stretched, unfractured.	Run 21 91.6 to 96.8	100 (92)
		93.1-98.3 - Quartz stringers, close spacing, crosscutting bedding/foliation, generally 0.1 inch wide.		
		94.3 - Joint, 60°, open, planar, smooth, iron oxide staining.		
			Run 22 96.8 to 101.8	100 (62)
100 (53.0)		99.8-101.8 - Quartz vein, highly fractured, broken by drilling along healed fractures, heavy iron oxide staining, possible open joints at 20°. Contains inclusions of argillite up to 0.1 foot wide. Fractured at contacts.		
		99.8-112.0 - Joints closely spaced.	Run 23 101.8 to 107.0	100 (71)
		104.5-105.5 - Quartz vein, highly fractured, no iron oxide staining. Fractures generally tight. Drilling breaks at both contacts.		
		109.3 - Shear, 25°, has approximately 0.5 inch breccia and gouge, slickensides.	Run 24 107.0 to 112.6	93 (84)
110 (58.3)		112.0-136.5 - Joints moderately close spaced.		
		113.0-128.7 - Sandy argillite and graywacke, bedding/foliation at 60°.	Run 25 112.6 to 117.4	100 (100)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 5 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 26 117.4 to 122.4	100 (96)
120 (63.6)		122.4-389.5 - Generally no drilling water return.		
		123.5-147.0 - Numerous quartz pods and stringers, up to 1 inch wide, folded and stretched, unfractured, spacing moderately close to very close.	Run 27 122.4 to 127.4	100 (100)
130 (68.9)		129.2 - Joint, 40°, open, irregular, rough, heavy iron oxide staining.	Run 28 127.4 to 132.4	100 (94)
		136.5-144.3 - Joint spacing is close to very closely spaced.	Run 29 132.4 to 137.4	100 (90)
			Run 30	100 (76)
140 (74.2)		141.3 - Quartz vein, 0.1 feet wide, fractured but tight.	Run 31 139.1 to 144.3	100 (52)
		142.7 - Quartz vein, 0.05 feet wide, fractured but tight at 15°, subparallel to bedding. Upper contact open, lower tight.		
		143.0 - Joint, 60°, possibly open, clay/silt coating.	Run 32 144.3 to 149.4	100 (90)
		143.6 - Quartz vein, 60°, subparallel to bedding/foliation, approximately 0.05 feet wide.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 6 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (79.5)	Argillite	143.9 - Quartz vein, 50°, approximately 0.05 feet wide, core loss. Argillite has a phyllitic appearance at the contact.	Run 33 149.4 to 152.6	98 (81)
		144.3-165.6 - Joints close to moderately close spaced.		
		147.0 - Quartz vein, 20°, approximately 0.05 feet wide. Open contacts with iron oxide staining.	Run 34 152.6 to 157.4	100 (94)
		148.0 - Bedding/foliation, 40°.		
		149.6-150.1 - Graywacke, fine grained at top to medium grained at bottom, graded bedding at 30° and possibly inverted.	Run 35 157.4 to 162.4	100 (96)
160 (84.8)		155.5 - Bedding/foliation, 40°, secondary foliation at 0° to 10°. Phyllitic sheen, poorly developed cleavage.		
			Run 36 162.4 to 167.4	90 (78)
		165.6-174.2 - Joints close to very close spaced, tight to partially open, approximately 25% iron oxide staining.		
			Run 37 167.4- 170.1	100 (59)
170 (90.1)			Run 38 170.1 to 174.3	95 (55)
		174.1 - Joint, 30°, clay/silt coating, possibly slickensides.		
		174.2-189.6 - Joints closely spaced, light to heavy iron oxide staining.	Run 39 174.3 to 178.7	100 (95)
		180.0-183.0 - Quartz stringers, close to very close spaced, generally parallel to bedding, less than 0.1 inch but up to 1 inch. Contacts tight except open at 182.0.		
180 (95.4)				

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 7 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 40 178.7-183.5	96 (67)
		184.1 - Bedding/foliation, 30°.	Run 41 183.5 to 187.4	90 (72)
190 (100.7)		189.6-257.0 - Joints close to moderately close spaced, light to heavy iron oxide staining, tight to partially open.	Run 42 187.4 to 192.6	100 (65)
		193.9-195.0 - Quartz stringers and pods, crosscutting bedding, 0.1 inch to 1 inch wide, unfractured. Approximately 10 percent of the zone.	Run 43 192.6 to 197.4	100 (71)
200 (106.0)			Run 44 197.4 to 202.6	100 (98)
		205.0 - Bedding/foliation, 30°. 206.2 - Joint, 30°, parallel to bedding, silt/clay coating.	Run 45 202.6 to 207.7	100 (84)
210 (111.3)			Run 46 207.7 to 212.6	100 (90)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 8 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 47 212.6 to 215.7	100 (61)
			Run 48	82 (76)
220 (116.6)			Run 49 217.4 to 222.5	100 (100)
			Run 50 222.5 to 227.4	100 (98)
		228.0 - Bedding/foliation, 30°.	Run 51 227.4 to 232.2	100 (75)
230 (121.9)			Run 52 232.2 to 237.4	100 (94)
		234.3-253.0 - Quartz stringers, close spaced, parallel to and crosscutting bedding, 0.1 inch wide, unfractured. Contacts tight.	Run 53 237.4 to 242.4	100 (94)
240 (127.2)			Run 54 242.4-247.4	96 (78)

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-3

SITE Devil Canyon (South Bank) — **SHEET NO.** 9 **OF** 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 54	
247.0 (130.9)	Graywacke	Light to medium gray, mostly fine to medium grained metasedimentary rock with an argillaceous matrix, occasional thin beds of dark gray argillite. Fresh, hard, and well indurated. Joints close to very close spaced, iron oxide staining.	Run 55 247.4 to 252.2	100 (92)
250 (132.5)				
		254.5 - Bedding/foliation, 25°.	Run 56 252.2 to 257.4	100 (60)
		257.0-257.4 - Core broken by drilling, pieces 1 inch to 2 inches.		
		257.0-275.2 - Joints close to very close spaced.	Run 57 257.4 to 261.8	91 (25)
260 (137.8)		258.8-259.2 - Fracture zone, joints very close spaced, 60°, iron oxide staining, light coating of silty clay.		
		260.3-260.6 - Core broken by drilling, pieces 1 inch to 2 inches.	Run 58 261.8 to 267.0	100 (38)
		263.3-264.7 - Fracture zone, joints very close spaced, 40° to 60°.		
		268.2-269.5 - Fracture zone, joints very close spaced at 50° to 70°.	Run 59 267.0 to 270.3	85 (11)
270 (143.1)			Run 60	100 (31)
		272.9-274.1 - Joint, 10°, open, heavy iron oxide staining.	Run 61 271.9 to 276.7	100 (44)
		274.4-286.7 - Joints close to moderately close spaced.		

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-3

SITE Devil Canyon (South Bank) — **SHEET NO.** 10 **OF** 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke		Run 62 276.7 to 281.7	100 (88)
280 (148.4)		282.9-283.5 - Fracture zone, joint spacing is very close, joints at 10° to 20°.	Run 63 281.7 to 286.7	82 (48)
286.7 (151.9)	Argillite	Rock description as above.	Run 64	0 (0)
		286.7-288.4 - Core loss of 1.4 feet. Core broken by drilling, pieces less than 0.2 feet.	Run 65	75 (0)
			Run 66	90 (0)
290 (153.7)		288.4-303.6 - Probable fracture zone, joint spacing is close to very close, trace iron oxide staining.	Run 68 289.7-291.8	90 (0)
		289.4-289.7 - Core badly broken, pieces 1/2 inch to 1 inch.	Run 69 291.8-293.8	80 (0)
		289.7-296.8 - Joints at 30°, 40°, and 60°, fractures at 0° to 10° and 40° to 50°.	Run 70 293.8 to 296.8	50 (0)
		294.6-296.6 - Core loss of 1.5 feet.		
		296.8-299.3 - Core loss of 1.4 feet.	Run 71 296.8-299.3	64 (36)
300 (159.0)			Run 72	100 (0)
		301.0-302.0 - Core badly broken by drilling, pieces 1 inch to 2 inches.	Run 73	100 (0)
		303.6-324.5 - Joints close spaced, trace iron oxide staining.	Run 74	100 (50)
			Run 75 303.6 to 306.9	100 (65)
		308.2 - Bedding/foliation, 20°.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 11 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC	LENGTH OF RUN (FT.)	REC (RQD)
310 (164.3)	Argillite	311.1 - Quartz vein, irregular contact at 30°, unfractured, 0.2 feet wide.	Run 76 306.9 to 312.2	98 (84)
		312.2-312.8 - Core badly broken by drilling, pieces less than or equal to 0.1 feet.	Run 77 312.2 to 316.8	61 (26)
			Run 78 316.8 to 321.7	45 (18)
320 (169.6)			Run 79	100(100)
		324.5-334.7 - Joints very close to close spaced, iron oxide staining.	Run 80 322.6 to 326.8	98 (43)
		237.9-328.7 - Core badly broken by drilling, pieces less than or equal to 0.1 feet.	Run 81 326.8 to 329.9	68 (11)
330 (174.9)		329.9-331.9 - Core loss of 0.7 feet. Core badly broken. Hole grouted and redrilled.		
		331.8-334.7 - Core badly broken, pieces average 1/2 inch to 1 inch.	Run 83	60 (0)
			R 84,85	N/A
			331.9 to 333.8	53 (0)
		334.7-352.8 - Joints close spaced, iron oxide staining.	Run 87 333.8 to 336.6	96 (0)
			Run 88 336.6 to 341.1	100 (84)
340 (180.2)				

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

SITE Devil Canyon (South Bank) — SHEET NO. 12 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC	LENGTH OF RUN (FT)	REC (ROD)
344.1	Argillite		Run 89 341.1 to 344.4	91 (12)
(182.3)	Mafic Dike	Dark green, fine grained igneous rock. Fresh and hard. Sheared contacts with breccia and gouge. Joints close spaced, silty sand coating.	Run 90 344.4 to 349.6	100 (58)
350.9		350.5-351.1 - Core loss of 0.3 feet. Core badly broken.	Run 91	100(100
(185.9)	Argillite	Rock description as above.	Run 92	42 (0)
		351.1-352.8 - Core loss of 0.7 feet. Core badly broken by drilling.	Run 93 351.1 to 354.7	50 (12)
		352.8-356.6 - Fracture zone, joints very close spaced at 30°, 50°, 60°, and 80°, fractures at 10° to 20°, iron oxide staining, minor carbonate coating.	Run 94 354.7 to 357.8	100 (19)
		357.8-362.2 - Joints closely spaced, iron oxide staining.	Run 95 357.8 to 363.0	100 (75)
360 (190.8)		361.8-366.6 - Quartz stringers and pods, very close spaced, parallel to bedding, stretched, folded, less than 0.5 inch wide, generally fractured but tight.		
		362.2-363.1 - Fracture zone, possibly sheared, heavy iron oxide staining, silty clay coating on joints, possibly gouge, pieces 0.25 to 1 inch.	Run 96 363.0 to 367.8	100 (57)
		363.1-389.9 - Joints closely to moderately close spaced, very close in some zones, less than 0.3 feet wide.	Run 97 367.8-370.5	100 (44)
370 (196.1)		370.0-370.3 - Fracture zone, joints very close spaced, fractures at 40° to 50°, silt/clay coating on joints, possible slickensides.	Run 98 370.3 to 374.4	100 (80)
		371.0 - Quartz vein at 30°, unfractured, 0.75 inch wide.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-3

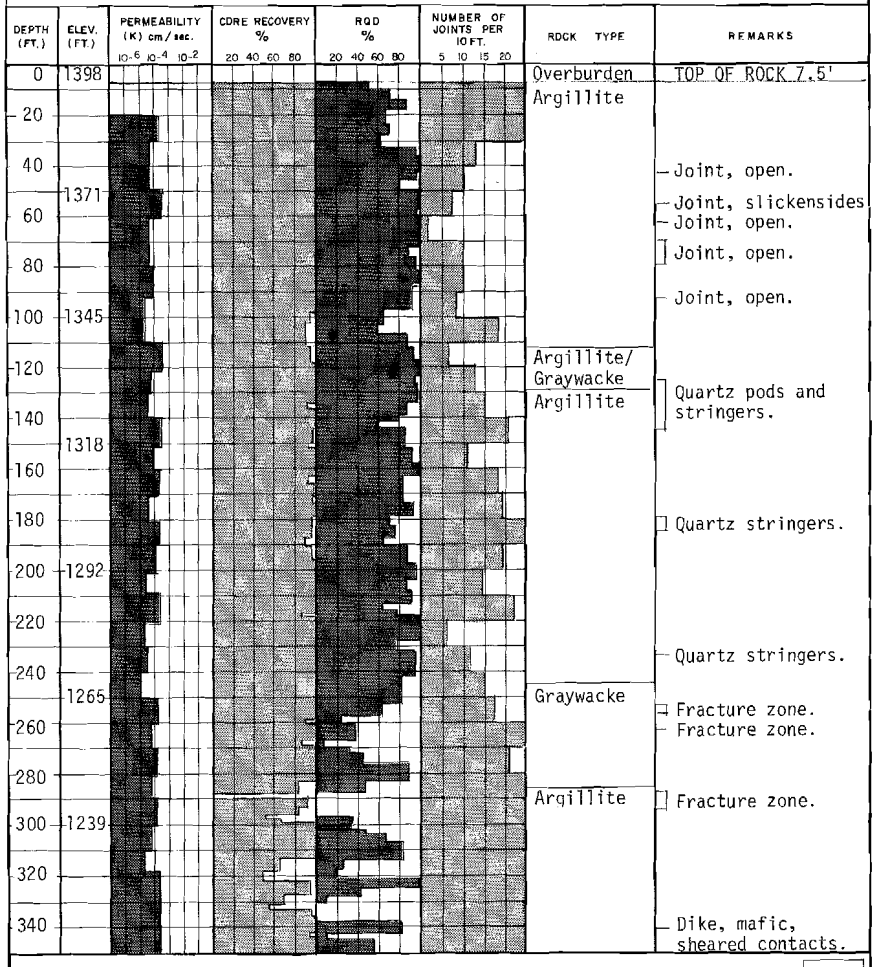
SITE Devil Canyon (South Bank) — SHEET NO. 13 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 98	
			Run 99 374.4 to 377.8	100 (88)
380 (201.4)			Run 100 372.8 to 382.8	100 (88)
			Run 101 382.8 to 387.8	100 (94)
			Run 102 387.8-389.9	100 (52)
390 (206.7)			Run 103	0 (0)
391.1 (207.3)		END OF BORING		

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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-3
Site Devil Canyon (North Bank) — **Sheet No.** 1 of 2

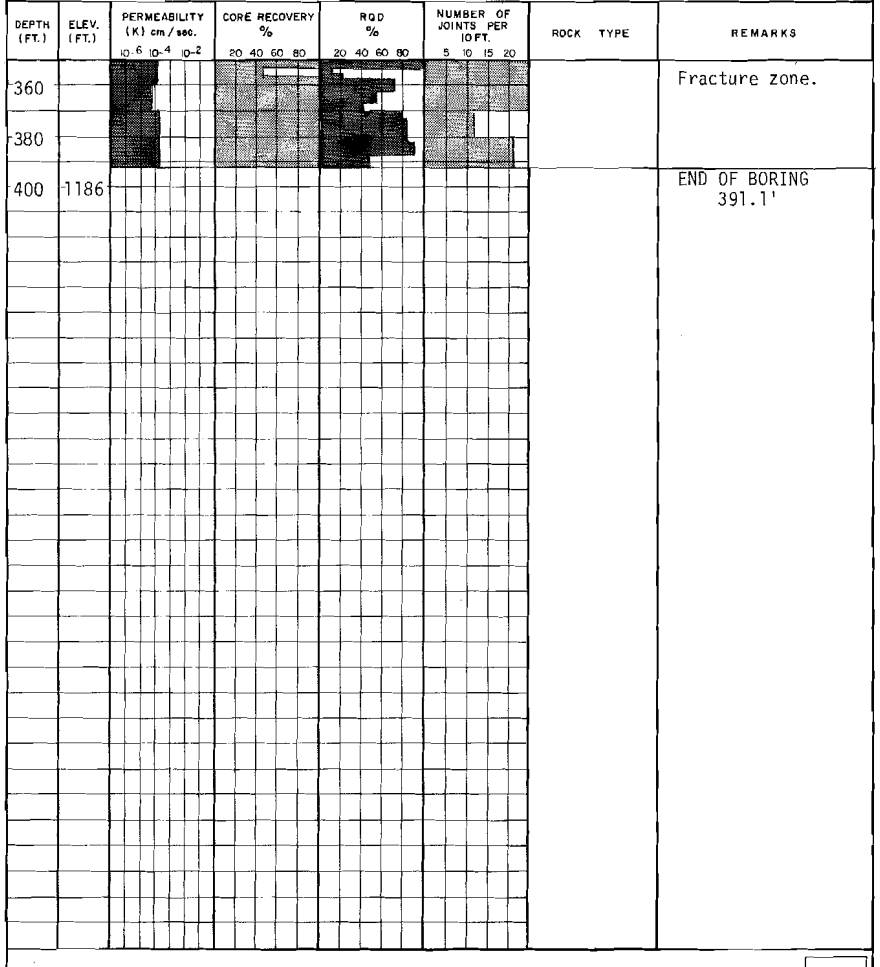


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SUMMARY LOG

Client ALASKA POWER AUTHORITY — Job No. P5700.05
Project Susitna Hydroelectric Project — Hole No. BH-3
Site Devil Canyon (North Bank) — Sheet No. 2 of 2



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ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-4

SITE: Devil Canyon (South Bank) — SHEET NO. 1 OF 16

CONTRACTOR: The Drilling Company — DRILLING DATES: August 14 TO August 19, 1980
LOGGED BY: K.J. White, M.P. Bruen — DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer — CASING DIAMETER: NW (3.0") I.D.
ROCK Diamond Core - Triple Tube — CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,222,004 — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E615,992 — GROUND SURFACE 1352.6
AZIMUTH 195° — ROCK SURFACE 1345.5
DIP 60° — BOTTOM OF HOLE 919.0
WATER TABLE 1321.6

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	No samples taken.		
		TOP OF ROCK		
7.0 (6.1)	Argillite/ Graywacke	Argillite, medium to dark gray, fine grained, interbedded with graywacke, medium to dark gray, fine to medium sand grains in an argillaceous matrix, elongate grains parallel to bedding/foliation. Very thin to thin bedding coincident with weakly developed foliation at 20°. Fresh, hard, well indurated.	No Core Taken	
10 (8.7)		Joints generally close to very close, planar, smooth to rough, tight to open, quartz and carbonate filling, iron oxide staining.	Run 1 12.0 to 15.2	75 (31)
		12.0-15.2 - Core loss of 0.6 feet.		
		12.0-35.1 - Joints generally close to very close, planar, smooth to rough, tight to open, quartz and carbonate filling, iron oxide staining.	Run 2 15.2 to 18.8	100 (67)
20 (17.3)		20.0, 23.4, 29.8 - Joints, 20-30° with slickensides and iron oxide staining, parallel bedding/foliation.	Run 3	100 (50)

APPROVED: [signature] DATE: February 1, 1982

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 2 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	20.8 - Quartz vein, 50°, crosscutting bedding/ foliation, 0.5 inches wide, stretched, tight.	Run 4 20.4 to 25.4	100 (92)
		23.0-29.0 - Quartz stringers, 0.1 inches wide, closely spaced, irregular, stretched, tight.	Run 5 25.4 to 30.5	100 (96)
30 (26.0)			Run 6 30.5 to 34.0	100 (49)
33.9 (29.4)	Graywacke	Medium to dark gray metasedimentary rock with medium to coarse grained sand in a fine grained argillaceous matrix, sand grains elongate parallel to bedding/foliation. Texture massive to weakly developed foliation coincident with bedding at 20-30°.	Run 7 34.0 to 39.0	100 (100)
40 (34.6)		35.1-103.1 - Joints generally closely spaced, planar, smooth to rough, tight, carbonate, quartz, chlorite and talc filling, occasional iron oxide staining.	Run 8 39.0 to 44.0	100 (100)
		44.0-47.0 - No drilling water return.		
		45.2-46.4 - Fracture zone, 2 inches wide, joints very closely spaced at 15-20°, open, sandy silt/clay coating, iron oxide staining.	Run 9 44.0 to 48.0	95 (88)
		47.0-58.1 - Drilling water return 50%.		
50 (43.3)		50.3 - No iron oxide staining below.	Run 10 48.0 to 53.1	98 (98)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 3 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke		Run 11 53.1 to 58.2	100 (100)
			Run 12 58.2 to 61.5	100 (88)
60 (52.0)			Run 13 61.5 to 65.7	100 (100)
			Run 14 65.7 to 70.2	100 (100)
70 (60.6)			Run 15 70.2 to 75.0	100 (98)
			Run 16 75.0 to 80.2	92 (92)
80 (69.3)			Run 17	100(86)
		83.2 - Quartz veins, 40°, 0.5 inches wide, tight, sulphide mineralization.	Run 18 80.9 to 84.4	100 (100)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 4 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke	86.5 - Quartz vein, 40°, 0.5 inches wide, tight. 88.4-90.3 - Rock fragments 0.5 to 1 inch long, stretched, parallel bedding/foliation at 30°.	Run 19 84.4 to 89.4	100 (100)
90 (77.9)			Run 20 89.4 to 93.8	100 (100)
			Run 21 93.8 to 98.2	100 (100)
100 (86.6)		102.3-103.1 - Numerous quartz veins and stringers, very closely spaced. 102.9 - Quartz vein, 50°, 0.75 inches wide, open contact, trace of sulphur-like mineral. 104.5 - Joint, 25°, planar, rough, slickensides, carbonate coating.	Run 22 98.2 to 103.4	100 (100)
			Run 23 103.4 to 108.1	100 (100)
108.4 (93.9)	Argillite/ Graywacke	Very thinly bedded graywacke, as above, interbedded with argillite, dark gray, very fine to fine grained, bedding coincident with weakly developed foliation at 5-10°, crosscut by microfolds, poor cleavage, phyllitic sheen in places.	Run 24 108.1 to 113.3	100 (100)
110 (95.3)		Joints moderately closely spaced at 20-30°, planar, rough to smooth, tight to open, some carbonate and trace silt filling.	Run 25 113.3 to 117.7	100 (100)
114.9 (99.5)	Argillite	Rock description as above. Joints generally moderately closely to widely		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 5 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	spaced with zones very closely spaced, planar, few irregular, rough to smooth, tight to open, few slickensides, carbonate, quartz, talc, and chlorite coating.	Run 26 117.7-120.0	100 (100)
120 (103.9)			Run 27 120.0 to 125.0	100 (100)
			Run 28 125.0 to 130.2	100 (100)
130 (112.6)			Run 29 130.2 to 135.5	100 (100)
		135.5-140.5 - Core loss of 0.3 feet.	Run 30 135.5 to 140.5	94 (88)
140 (121.2)		140.5-240.3 - Drill water return less than 50%.	Run 31 140.5 to 145.6	100 (100)
			Run 32 145.6 to 150.8	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 6 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (129.9)	Argillite		Run 32	
			Run 33 150.8 to 155.9	100 (100)
		157.0 - Joint, 20°, with slickensides.	Run 34 155.9 to 160.9	100 (100)
160 (138.6)		161.7 - Argillite becoming reddish, dark gray, massive to weakly developed foliation. Fresh, hard to very hard, well indurated.	Run 35 160.9 to 165.9	98 (98)
		169.5-170.4 - Quartz veins.	Run 36 165.9 to 170.9	98 (96)
170 (147.2)		171.3-172.3 - Quartz veins and stringers, slickensides, sulphide mineralization, poorly indurated. Core broken and ground by drilling.	Run 37 170.9 to 176.1	100 (90)
		178.5 - Joint, 35°, with slickensides. 178.5-181.6 - Joint surfaces talc coated. Core broken by drilling, fragments 0.05 to 0.1 feet.	Run 38 176.1 to 179.6	100 (77)
180 (155.9)				

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 7 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite		Run 39 179.6 to 184.0	100 (100)
		184.2-188.5 - Joints, 15° and 30°, with slickensides.	Run 40 184.0 to 189.1	100 (100)
190 (164.5)			Run 41 189.1 to 194.3	100 (94)
			Run 42 194.3 to 199.6	100 (100)
		199.8-201.6 - Quartz vein, 10°, 0.5 inches wide, fractured, possibly slickensides, talc coating, contact partially open.		
200 (173.2)			Run 43 199.6 to 204.6	100 (100)
		206.8-207.4 - Quartz vein at 0°, 0.5 inches wide, irregular, stretched, tight.	Run 44 204.6 to 209.6	100 (100)
		207.6-211.6 - Fractures very closely spaced, irregular, discontinuous, some quartz filled.		
210 (181.9)		211.5-213.2 - Quartz vein, 10°, crosscutting foliation, 0.5 inches wide, 40% chlorite in layers and pods, sulphide mineralization.	Run 45 209.6 to 214.9	94 (75)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 8 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite	213.5-213.7 - Quartz veins, 0.5 inches wide, irregular, folded, tight.	Run 45	
		214.2 - Quartz vein, 20°, parallel to bedding/foliation, 0.5 inches wide.	Run 46	
		214.9 - Core loss of 0.3 feet.	214.9 to 220.2	100 (100)
220 (190.5)		216.8-220.0 - Quartz veins, closely spaced, less than 0.5 inches wide, tight, crosscutting bedding/foliation at 0-10° but offset along cleavage planes.		
		221.0-252.0 - Shear/fracture zone, healed, 30-40% folded and nonfolded quartz veins. Folded veins contorted and stretched in matrix of argillite breccia. Nonfolded veins cross-cutting bedding/foliation, vuggy with chlorite and iron and lead sulphides. Generally tight.	Run 47 220.2 to 225.3	100 (96)
			Run 48 225.3 to 230.1	98 (98)
230 (199.2)		230.1-235.5 - Core loss of 0.2 feet.		
		233.8-328.3 - Joints generally closely spaced, planar, some curved and irregular, slick to rough, tight, some open, carbonate, quartz, chlorite, and talc coating.	Run 49 230.1 to 235.5	96 (85)
		236.2-240.9 - Fracture zone, very closely to closely spaced joints at 0° to 10°, slick, talc and carbonate coating, possible slickensides.	Run 50 235.5 to 240.3	100 (83)
240 (207.8)		240.3-240.9 - Core loss of 0.1 feet.		
		243.9, 245.8, 249.6 - Faint slickensides.	Run 51 240.3 to 245.6	98 (98)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 9 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	246.8-247.0 - Quartz vein, 0.6 feet wide, fractured, vuggy with iron and lead sulphides, carbonate and chlorite at contacts.	Run 52 245.6-247.8	100 (100)
		248.8-249.1 - Quartz vein, 30°, fractured but tight, open joints at contacts with talc, chlorite and possibly slickensides.	Run 53 247.8-250.3	96 (52)
250 (216.5)			Run 54 250.3 to 255.2	100 (100)
252.0 (218.2)	Argillite/ Graywacke	Interbedded argillite and graywacke, as above. Very thin to thin bedding. Joints generally closely spaced, planar, smooth, tight, quartz carbonate, chlorite and talc filling.		
		254.0-258.1 - Quartz veins, closely spaced, 0.5 to 1 inch wide, folded, tight.	Run 55 255.2 to 260.3	98 (94)
		257.3 - Core loss of 0.1 feet.		
		257.8 - Quartz vein, 20°, 1 inch wide, fractured but tight, vuggy with sulphide mineralization.		
260 (225.2)			Run 56 260.3-262.6	100 (100)
		262.3 - Quartz vein, 20°, 2 inches wide, vuggy with sulphide mineralization, tight.		
		263.8-264.4 - Quartz vein, fractured, tight to partially open, vuggy with sulphide mineralization, lower contact open.	Run 57 262.6 to 267.6	92 (72)
		264.7-308.5 - Argillite "spotted" with biotite (?), microfolds crosscutting foliation at 50°.		
267.0 (231.2)	Argillite	Rock description as above.	Run 58 267.6 to 272.3	100 (91)
		266.8-279.5 - Numerous quartz veins and stringers. Veins closely to moderately closely spaced at 30° to 40°, crosscutting bedding/ foliation, 0.5 inches to 8 inches wide, fractured but tight. Sulphide, chlorite and carbonate mineralization present. Between 270.6 to 272.4 broken by drilling. Stringers less than 0.5 inches wide, parallel to bedding/ foliation, folded, stretched, tight.		
270 (233.8)			Run 59 272.3 to 277.3	100 (98)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 10 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	278.1-280.8 - Joints, 70° and 0°, with slickensides.	Run 60 277.3 to 281.0	100 (92)
280 (242.5)				
		282.3-287.8 - Quartz vein, fractured but tight, chlorite and sulphide mineralization.	Run 61 281.0 to 286.0	100 (96)
		284.6-285.1 - Shear, 10°, 0.5 inches of breccia, chlorite, talc and carbonate coating.		
		286.0 - Core loss of 0.4 feet.	Run 62 286.0 to 290.5	91 (87)
290 (251.1)			Run 63 290.5 to 293.5	100 (33)
		292.9-295.6 - Shear zone, 10°, parallel to foliation, slick surfaces with talc coating, breccia and gouge on some surfaces, fragment of breccia/gouge 2 inches wide at 295.5. Breccia contains angular fragments in a clay matrix. Core loss of 0.7 feet at 293.5.	Run 64 293.5 to 297.9	84 (55)
			Run 65 297.9 to 301.9	90 (90)
300 (259.8)		301.9-307.0 - Core loss of 0.7 feet.		
			Run 66 301.9 to 307.0	94 (94)
		307.6-309.6, 309.6-311.2 - Bedding planes, 10°, with slickensides.		
		308.1-311.5 - Joints subparallel to core axis.	Run 67	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 11 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
310 (268.5)	Argillite	310.0-318.0 - Quartz veins and stringers, up to 1 inch wide, folded, parallel to bedding/ foliation and crosscutting veins with open fractures and sulphide and talc mineralization.	Run 67 307.0 to 312.2	96 (96)
		312.2 - Core loss of 0.2 feet.	Run 68 312.2 to 317.0	100 (88)
320 (277.1)			Run 69 317.0 to 322.0	100 (98)
			Run 70 322.0 to 327.2	98 (98)
330 (285.8)		328.3-385.6 - Joints generally closely to moderately closely spaced, planar to irregular, smooth to rough, tight to open, quartz and carbonate filling, chlorite coating. 330.4-331.1 - Joint, 20°, open.	Run 71 327.2 to 332.2	100 (100)
			Run 72 332.2 to 337.3	98 (98)
340 (294.4)		339.3 - Core loss of 0.2 feet.	Run 73 337.3 to 342.4	96 (96)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 12 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite	343.9-345.0 - Quartz vein.	Run 73	
			Run 74 342.4 to 347.0	96 (91)
		347.0 - Core loss of 0.2 feet.	Run 75 347.0 to 350.0	100 (97)
350 (303.1)		349.8 - Joint, 20°, with slickensides.	Run 76 350.0 to 353.5	100 (100)
351.2 (304.1)	Argillite/ Graywacke	Interbedded argillite and graywacke, as above. Joints generally closely spaced, mostly planar, smooth to rough, tight to partially open, quartz and carbonate filling, 2 joints with chlorite coating. 353.5 - Core loss of 0.4 feet.	Run 77 353.5 to 356.5	87 (77)
			Run 78 356.5 to 361.0	93 (93)
360 (311.8)				
362.5 (313.9)			Run 79 361.0 to 366.3	100 (94)
	Argillite	Rock description as above. Joints generally closely to moderately closely spaced, planar to irregular, smooth to rough, tight to open, quartz, carbonate and chlorite filling.		
		362.5-364.5 } 370.7-376.3 } Quartz vein, very closely spaced fractures, generally tight, some open, vuggy, chlorite, carbonate, and iron and lead sulphide mineralization, contacts at 10° to 20°, parallel to and crosscutting bedding/foliation at 10° and 20°, respectively.	Run 80 366.3 to 371.0	100 (100)
370 (320.4)		371.0-379.4 - Core loss of 2.0 feet.		

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 13 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	376.3-387.0 - Foliation better developed at 10°-20°, phyllitic sheen, poor cleavage.	Run 81 371.0 to 376.5	100 (84)
			Run 82 376.5 to 379.4	90 (79)
380 (329.1)		379.4-386.0 - Core barrel mislatched during drilling, core badly broken. Core loss of 0.2 feet.	Run 83 379.4 to 386.0	97 (97)
		385.6-437.8 - Joints generally closely to very closely spaced, planar, mostly smooth, tight, carbonate, quartz, chlorite and talc filling.		
387.1 (335.2)	Graywacke	Medium gray metasedimentary rock with fine to medium grained sand in an argillaceous matrix, with very thin argillite layers.	Run 84 386.0 to 390.8	92 (92)
390 (337.7)		Joints closely to moderately closely spaced, planar, slick to rough, tight, chlorite and talc filling.	Run 85 390.8 to 396.0	88 (88)
		390.8-396.0 - Core loss of 1.0 feet.		
		393.9 - Bedding/foliation, 20°.		
		396.3-396.8 - Quartz vein, 60°, very closely spaced fractures, generally tight, upper contact open, lower contact tight.	Run 86 396.0 to 401.1	100 (88)
398.6 (345.2)	Argillite	Rock description as above.		
400 (346.4)			Run 87 401.1 to 406.1	98 (98)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 14 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	406.5-410.4 - Graywacke interbedded with argillite, very thin to thin beds.	Run 87	
			Run 88 406.1 to 411.1	100 (96)
410 (355.1)			Run 89 411.1 to 416.2	100 (100)
			Run 90 416.2 to 420.0	100 (100)
420 (363.7)			Run 91 420.0 to 425.0	100 (100)
			Run 92 425.0 to 430.3	98 (98)
430 (372.4)			Run 93 430.3 to 435.1	100 (100)
		435.2-435.6 - Quartz stringers, generally at 0°, less than 0.5 inches wide, parallel to and crosscutting bedding/foliation.		

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

SITE Devil Canyon (South Bank) — SHEET NO. 15 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 94 435.1 to 440.1	100 (96)
440 (381.1)				
441.8 (382.6)			Run 95 440.1 to 445.1	100 (100)
	Argillite/ Graywacke	Interbedded argillite and graywacke. Rock description as above. Thin bedding coincident with foliation at 15°. Foliation better developed in argillite than in graywacke, phyllitic sheen, poor cleavage.		
		Joints generally closely to very closely spaced, at bedding contacts, joints very closely spaced in graywacke, without penetrating argillite. Joints generally planar, slick to smooth, tight, chlorite, talc and carbonate filling.	Run 96 445.1 to 450.2	100 (94)
450 (389.7)			Run 97 450.2 to 453.8	100 (100)
			Run 98	100 (44)
		455.0-457.8 - Core broken during drilling along very closely to closely spaced joints at 20° to 40°, most surfaces coated with talc, chlorite, and carbonate.	Run 99	100(63)
			Run 100 456.4 to 460.5	100 (80)
460 (398.4)				
			Run 101 460.5 to 465.7	100 (94)
465.8 (403.4)	Argillite	Rock description as above.	Run 102 465.7 to 471.5	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-4

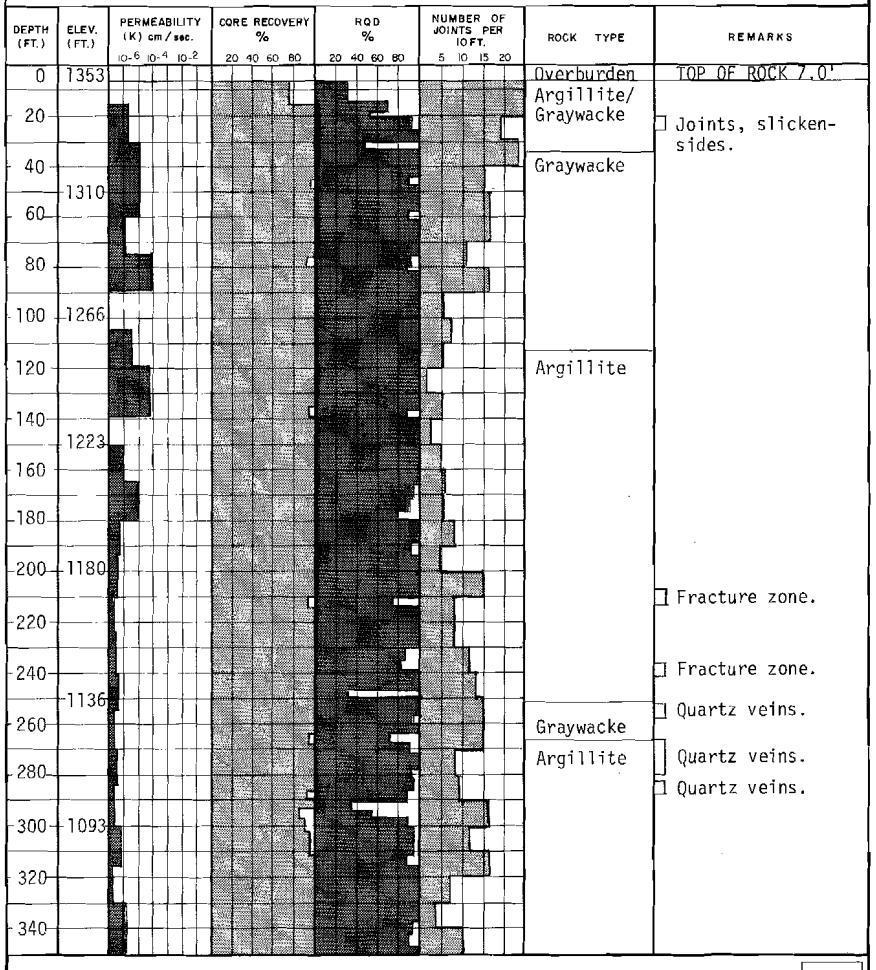
SITE Devil Canyon (South Bank) — SHEET NO. 16 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (407.0)	Argillite		Run 102	
		471.0 - Bedding/foliation, 15°.	Run 103 471.5 to 475.5	100 (100)
			Run 104 475.5 to 480.5	100 (94)
480 (415.7)			Run 105 480.5 to 485.5	98 (98)
		485.9 - Core loss of 0.2 feet.	Run 106 485.5 to 490.5	96 (96)
490 (424.4)			Run 107 490.5 to 495.7	100 (96)
			Run 108 495.7 to 500.7	100 (100)
500.7 (433.6)		END OF BORING		

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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-4
Site Devil Canyon (South Bank) — **Sheet No.** 1 of 2

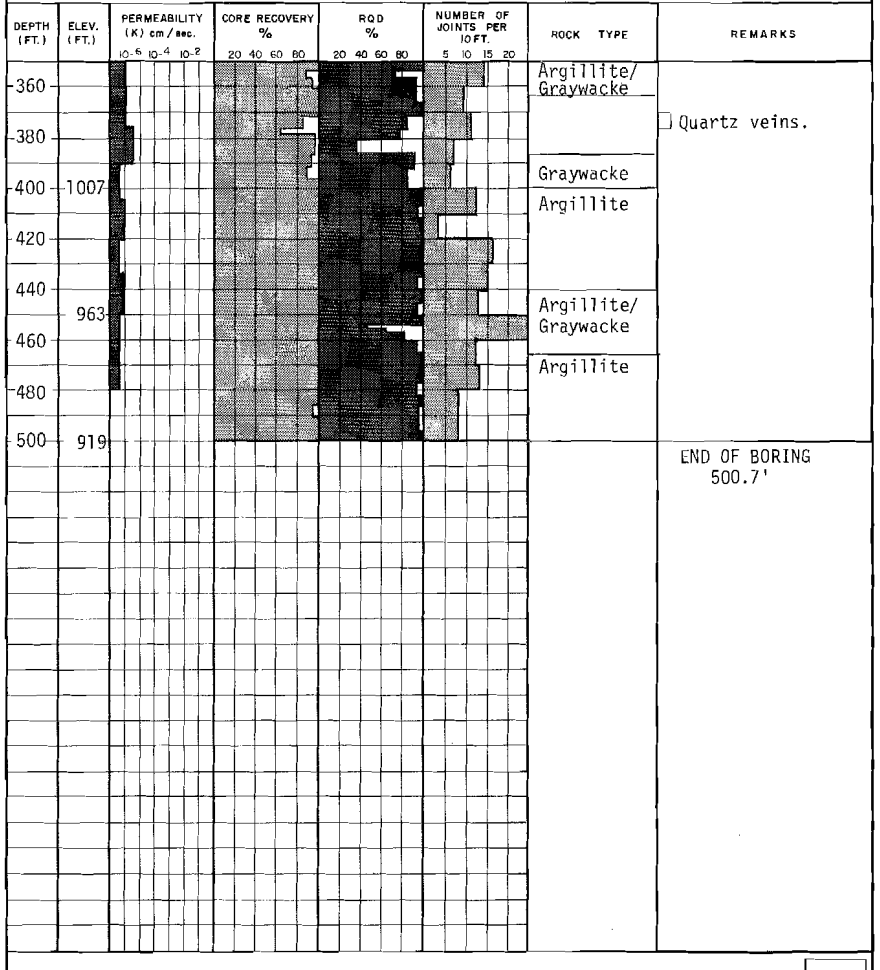


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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-4
Site Devil Canyon (South Bank) — **Sheet No.** 2 of 2



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ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-5a

SITE: Devil Canyon (North Bank) — SHEET NO. 1 OF 20

CONTRACTOR: Interstate Exploration Inc. — DRILLING DATES: June 4 TO June 15, 1981
LOGGED BY: R.R. Henschel — DATE: July 1981

DRILLING METHOD: SOIL — ; ROCK Diamond Core - Triple Tube — CASING DIAMETER: NW (3.0") I.D. — CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,222,961; DEPARTURE E616,646; AZIMUTH 189°; DIP 45°

ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4; GROUND SURFACE 974.5; ROCK SURFACE 974.5; BOTTOM OF HOLE 551.7; WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Argillite	Dark gray to black, very fine grained meta-sedimentary rock. Bedding generally coincident with weakly developed foliation at 20° to 25°. Occasional very thin beds of light to medium gray, fine grained graywacke. Occasional fresh sulphide mineralization. Slightly phyllitic locally. Generally fresh to slightly weathered, hard, brittle, well indurated.	Run 1 0.0-2.0	60 (25)
			Run 2	92 (0)
			Run 3 3.2-5.5	100 (91)
		Joints generally closely to moderately closely spaced, planar to irregular, rough to smooth, tight to partially open, iron oxide staining.	Run 4 5.5-8.0	100 (80)
		0.0-1.5 - Core broken by drilling. Core loss of 0.8 feet.	Run 5 8.0 to 11.5	94 (39)
10 (7.1)		0.0-42.6 - Joints and fractures very closely to closely spaced, joints at 20-25° and 40° crosscutting bedding/foliation and at 20-25° parallel to bedding/foliation, planar to irregular, smooth to rough, tight to partially open, heavy iron oxide staining and filling.	Run 6	100 (75)
			Run 7	91 (0)
		8.2-10.4 - Core broken by drilling. Core loss of 0.2 feet.	Run 8 14.2-16.6	79 (38)
		14.2-15.0 - Zone of very closely spaced joints at 10°, 30°, 60-70°.	Run 9	100 (100)
		16.0-16.6 - Core broken by drilling. Core loss of 0.2 feet.	Run 10 18.2 to 22.8	100 (94)
20 (14.1)				

APPROVED: [signature] DATE: February 1, 1982

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 2 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	22.8-30.3 - Fracture zone, joints very closely spaced, fragments hard and well indurated. Core broken by drilling. Some core loss.	Run 10	
			Run 11 22.8 to 28.5	35 (0)
30 (21.2)			Run 12 28.5-30.7	73 (18)
		31.2-31.7 - Core loss due to mechanical problems. Hole caving badly, 6.0 feet reamed to 31.7.	Run 13	50 (40)
			Run 14 31.7-33.7	75 (35)
		33.7-35.7 - Fractures very closely spaced, fragments hard and well indurated. Core broken by drilling.	Run 15	100 (30)
			Run 16 35.2 to 38.2	90 (64)
			Run 17	100(100)
			Run 18	100 (71)
40 (28.3)		40.8-42.6 - Fractures very closely spaced, fragments hard and well indurated. Core broken by drilling. Some core loss.	Run 19 40.0 to 42.6	50 (0)
		42.6-114.0 - Joints, close to moderately close spaced, iron stained, generally tight.	Run 20 42.6-44.6	100 (90)
			Run 21	100(39)
		46.0 - Bedding becomes less distinct with general trend 0-5°, syndepositional deformation.	Run 22 45.5-47.8	100 (100)
			Run 23 47.8-49.8	100 (70)
50 (35.4)			Run 24 49.8 to 53.0	100 (100)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 3 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 25 53.0 to 57.8	100 (96)
60 (42.4)			Run 26 57.8 to 62.7	92 (92)
			Run 27 62.7 to 67.7	100 (94)
		67.9-70.8 - Joints, average 30° and 50°, iron oxide and silt fillings.		
70 (49.5)			Run 28 67.7 to 72.5	98 (94)
		73.9-74.4 - Fracture zone, healed with carbonate, hard.	Run 29 72.5 to 75.7	88 (78)
		76.7-77.2 - Fracture zone, joints at 30° and 40°, closely to very closely spaced, iron oxide staining.	Run 30	100 (0)
			Run 31 76.3-78.3	95 (60)
80 (56.6)		80.4-95.0 - Quartz stringers, 20°, crosscut bedding, very thin.	Run 32 78.3-80.4	100 (90)
		82.0-85.3 - Bedding/foliation, 15°.	Run 33 80.4 to 83.8	100 (100)
			Run 34	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 4 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	86.1-87.0 - Joints, two, 15-20°, parallel bedding, slickensides, heavy iron oxide staining with calcareous clay.	83.8-86.7	100 (72)
			Run 35 86.7 to 90.5	100 (29)
90 (63.6)		87.3 - Joint, 20°, crosscutting bedding, rough, faint slickensides, iron oxide stained.		
		90.0 - Joint, 30°, faint slickensides, tight.		
		91.1-92.4 - Bedding/foliation, 20°. Joints parallel to and crosscutting bedding, planar, iron oxide and minor carbonate.	Run 36 90.5 to 95.0	93 (82)
			Run 37 95.0 to 98.0	97 (87)
		98.9-101.2 - Fracture zone, very closely spaced joints at 0-20° and 50-80°, rough, irregular, iron oxide staining. Core loss 1.1 feet.	Run 38 98.0 to 102.0	65 (35)
100 (70.7)			Run 39	92 (0)
			Run 40	92 (50)
			104.5-106.0	100 (0)
			Run 42	87 (53)
		107.5 - Joint, 25°, crosscutting bedding, iron oxide staining.	Run 43	100(50)
			108.0-109.6	100 (88)
110 (77.8)			Run 45 109.6 to 114.1	92 (60)
		113.5 - Joint, 20°, parallels bedding, slickensides, tight, thin iron oxide and clay coating.		
			Run 46	100 (87)
		116.0 - Bedding/foliation, 10-15°, poorly to well developed. Composition approaching graywacke.		

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 5 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
120 (84.9)	Argillite	116.0-121.0 - Joint spacing close to moderately close, partly open with iron oxide staining and carbonate.	Run 47 115.9 to 120.8	100 (71)
		120.6 - Joint, 15°, tight.		
		121.0-132.2 - Joints, 15° and 25-30°, closely to moderately closely spaced, smooth, planar.	Run 48 120.8-123.0	100 (59)
		122.2-122.5 - Quartz vein, 15-20°.	Run 49	100 (0)
		124.8 - Joint, 25°, parallels bedding, open, carbonate coating.	Run 50 123.7 to 128.0	100 (100)
		128.0-134.0 - Fracture zone, joints, closely spaced at 30-35° and 70°, healed.	Run 51	100(100)
130 (90.4)			Run 52 129.0 to 134.0	100 (100)
		132.0-167.9 - Joint spacing varies from close to wide, average moderately close.	Run 53	100 (47)
		134.0 - Composition becomes progressively more argillaceous, with thin interbeds of graywacke.	Run 54 135.9 to 140.9	100 (94)
140 (99.0)		134.4-136.0 - Zone of intense syndepositional deformation.	Run 55 140.9 to 145.8	100 (100)
		146.1-146.8 - Vein, 10-15°, sulphide mineralization.	Run 56 145.8 to 149.3	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 6 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (106.1)	Argillite	149.5 - Joint, 35°, well developed slickensides, tight, chloritized.	Run 57 149.3 to 154.2	100 (100)
		154.8-155.8 - Graywacke, fine grained, medium gray.	Run 58 154.2 to 158.0	97 (82)
		155.6-155.9 - Fracture zone, very closely spaced joints at 40-50°, open, carbonate/limonite staining.		
		156.5 } 156.7 } Joints, 50°, open, carbonate and minor limonite.	Run 59 158.0 to 163.0	100 (86)
160 (113.1)		159.4 - Joint, 25°, slickensides, carbonate and iron oxide.		
		166.1 - Joint, 20°, crosscuts bedding, well developed slickensides, zones of clay and breccia.	Run 60 163.0 to 168.0	100 (68)
		167.9-170.6 - Fractures, irregular, healed, very closely spaced.		
		168.9 - Joint, 25°, well developed slickensides, tight, carbonate.	Run 61 168.0 to 173.0	98 (86)
170 (120.2)	Meta-argillite	Rock description as above but with phyllitic sheen.		
		170.6-205.5 - Joints, closely spaced.	Run 62 173.0-175.4	100 (100)
		175.0 - Joint, 30°, slickensides, tight, chloritized.	Run 63 175.4 to 178.0	100 (100)
177.2 (125.5)	Argillite/ Graywacke	Rock description as above, interbedded with light to medium gray graywacke as stringers. Bedding/foliation generally 0-10°. Localized thin phyllitic bands.	Run 64 178.0 to 183.3	96 (89)
180 (127.3)				

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 7 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	183.3-188.0 - Core barrel mislatch. Core loss 1.3 feet.	Run 64	
			Run 65 183.3 to 188.0	66 (23)
		187.1-187.3 - Quartz vein, 20°.		
		188.0-191.9 - Fracture zone, well healed fractures.		
190 (134.4)		190.2, 190.4 Joints, 30-50°, irregular, partly open, slickensides.	Run 66 188.0 to 193.3	100 (77)
		193.9 - Fracture, 50°, irregular, slickensides.		
			Run 67 193.3 to 196.3	100 (100)
197 (139.3)	Argillite	Rock description as above, with thin interbeds of graywacke locally. Joints, tight.	Run 68	100 (100)
			Run 69 198.1 to 203.0	100 (88)
200 (141.4)				
		203.0-217.0 - Fractures, numerous, healed.		
		203.2 - Joint, 20°, crosscuts bedding, faint slickensides.	Run 70 203.0 to 206.0	100 (63)
		203.5-204.0 - Fracture and quartz stringers, 15°, tight, irregular, highly chloritized.		
		205.5-251.7 - Intermittant wavy bands and stringers of graywacke. Joints moderately close to widely spaced at 0-15°.	Run 71 206.0 to 211.3	96 (96)
210 (148.5)				
			Run 72	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 8 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 72 211.3- 215.3	100 (80)
		215.0 - Joint, 0-10°, possible shear, silt/ sandy coating.	Run 73 215.3 to 218.3	100 (93)
220 (155.6)			Run 74 218.3 to 222.8	100 (100)
		222.5-225.0 - Fractures, healed, very closely spaced and irregular, healed, small quartz vein.	Run 75 222.8 to 227.8	100 (100)
230 (162.6)			Run 76 227.8 to 232.6	100 (100)
			Run 77 232.6- 235.1	100 (100)
			Run 78 235.1 to 239.5	100 (100)
240 (169.7)		240.8 - Joint, 30°, tight, chlorite coating.	Run 79	100 (89)
			Run 80 241.3 to 244.4	100 (100)
		244.1-247.1 - Fracture zone, very thin joints, 30°, very closely spaced, healed.		

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-5a

SITE Devil Canyon (North Bank) — **SHEET NO.** 9 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite	247.1-252.1 - Core loss 0.4 feet.	Run 81 244.4 to 247.4	93 (73)
250 (176.7)		251.7-252.1 - Silty layer, 80°, with fresh angular rock fragments. Surrounding core fresh. Appears to be river silt. 251.7 - Fracture, 80-90°. 251.7-290.0 - Joints moderately closely spaced with zones of very close spacing.	Run 82 247.4 to 252.4	100 (94)
		252.1-252.4 - Joint, 30°, crosscuts apparent bedding/foliation. Filled by 1/8 inch clay/breccia. 252.4-253.9 - Fractures, irregular, 0-15°, clay/breccia filling.	Run 83 252.4 to 256.7	100 (65)
260 (183.8)			Run 84 256.7 to 261.8	100 (75)
		264.5-266.1 - Fracture zone of very closely spaced joints at 5°. Chloritization present. Core loss 0.3 feet.	Run 85 261.8 to 266.4	93 (80)
		265.4-267.4 - Fracture zone, very closely spaced joints at 20° and 30-40°. 266.5 - Joint, 25°, crosscuts bedding, well developed slickensides at 60°, tight.	Run 86 266.4 to 271.2	100 (85)
270 (190.9)			Run 87 271.2 to 276.4	92 (71)
		273.5 - Fracture, 25°, open. 274.8-276.0 - Fracture zone, very closely spaced joints at 0-10°, 40° and 60°. Core loss 0.2 feet.		

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CLIENT ALASKA POWER AUTHORITY — **JOB NO.** P5700.05

PROJECT Susitna Hydroelectric Project — **HOLE NO.** BH-5a

SITE Devil Canyon (North Bank) — **SHEET NO.** 10 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 88 276.4 to 281.6	96 (96)
280 (198.0)			Run 89 281.6 to 284.2	100 (88)
		285.6-288.0 - Quartz stringers, irregular.	Run 90 284.2 to 288.6	98 (93)
		288.0-289.7 - Fracture zone, closely spaced, open to healed joints at 30°, faint slickensides.	Run 91	72 (31)
290 (205.0)			Run 92 289.9-292.4	72 (48)
		291.0-297.6 - Shear/fracture zone, joint very closely spaced at 0° and 20-30°, slickensides well developed. 291.0-292.9 - Joint surfaces slick, highly chloritized. 296.3-297.9 - Shear, 40°. 296.2-297.6 - Fracture zone, jointed 20-40°, highly chloritized, slickensides.	Run 93 292.4 to 296.4	86 (10)
			Run 94	100 (0)
297.7 (210.5)	Graywacke	Light to medium gray, fine grained graywacke with thin interbeds of argillite. Bedding/foliation highly deformed by syndepositional processes, generally at 15°.	Run 95 297.9 to 302.9	100 (92)
300 (212.1)		297.7-367.4 - Joints moderately closely spaced with zones of very closely to closely spaced. Numerous weakly healed and rebroken. Generally at 20° and 40-50°. Faint slickensides.	Run 96 302.9 to 307.2	98 (86)
			Run 97 307.2 to 312.0	100 (90)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a
SITE Devil Canyon (North Bank) — SHEET NO. 11 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (219.2)	Graywacke		Run 97	
			Run 98 312.0 to 317.3	100 (85)
		317.0-317.7 - Fracture zone, very closely spaced joints parallel to bedding/foliation.	Run 99 317.3 to 320.3	93 (43)
320 (226.2)		320.5 - Joint, 20°, minor shear with 1/16 inch clay/breccia, highly chloritized.	Run 100 320.3 to 323.9	100 (78)
		322.0-323.6 - Fracture zone, healed with quartz, joints at 50-60°.	Run 101 323.9 to 328.3	100 (89)
		325.8-326.4 - Joint, 15°, minor shearing healed with carbonate, parallels bedding/foliation.		
330 (233.3)			Run 102 328.3 to 333.3	100 (92)
		333.2-333.4 - Joint, 25°, crosscuts bedding, healed with clay/breccia and carbonate.	Run 103	93 (29)
		333.3-333.8 - Shear/fracture zone, very closely spaced joints, slickensides, chloritized.	Run 104 334.7 to 338.3	100 (89)
		338.0 - Joint, 15°, slickensides, tight, highly chloritized.	Run 105 338.3- 343.3	98 (78)
340 (240.4)		340.6 - Joint, 20-30°, curved, minor shearing, highly chloritized.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a
SITE Devil Canyon (North Bank) — SHEET NO. 12 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke		Run 105	
		342.0-348.5 - Fracture/shear zone, very closely to closely spaced fractures, partially weakly healed. Joints at 20°, 25°, 30°, and 60°. Carbonate common. Possibly shearing.	Run 106 343.3 to 346.4	90 (48)
		342.0-343.5 - Highly fractured zone, numerous joints at 20-30°, weakly healed. Core loss 0.6 feet.	Run 107	100 (62)
			Run 108 347.7 to 350.5	100 (75)
350 (247.5)			Run 109 350.5 to 354.7	100 (79)
		354.3 - Fracture, 10-15°, irregular, faint slickensides, chloritized.	Run 110 354.7 to 358.1	94 (59)
360 (254.5)			Run 111 358.1 to 363.1	100 (96)
		361.2-361.5 - Joint, 20°, tight, faint slickensides, planar, chloritized.	Run 112 363.1 to 368.1	100 (98)
		367.4-392.4 - Joint spacing wide to very wide. Thickly bedded at approximately 0-10°.		
370 (261.6)			Run 113 368.1 to 373.1	100 (98)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 13 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING; FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke		Run 114 373.1 to 378.1	100 (106)
			Run 115 378.1-380.5	100 (91)
380 (268.7)			Run 116 380.5-382.5	100 (100)
			Run 117	70 (50)
			Run 118 383.5 to 388.2	100 (94)
		386.2-387.1 - Fractures, very tight, healed.		
			Run 119	100 (73)
390 (275.7)			Run 120	100 (67)
			Run 121 391.2-393.4	100 (82)
392.4 (277.4)	Argillite	Dark gray to black, very fine grained meta-sedimentary rock. Sulphide mineralization common. Joint spacing wide to very wide.	Run 122 393.4 to 396.5	100 (94)
		297.6-399.4 - Sandy argillite, very fine sand grains in fine grained argillaceous matrix.	Run 123 396.5 to 401.3	100 (100)
400 (282.8)				
			Run 124	100 (87)
	Graywacke	Rock description as above. Joint spacing wide to very wide. Healed fractures at 20° and 40°, faint slickensides on chloritized	Run 125 402.8-404.6	100 (89)
403.1 (280.2)				

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 14 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke	surfaces.	Run 126 404.6-407.4	100 (96)
410 (289.9)			Run 127 407.4 to 412.3	100 (92)
			Run 128 412.3 to 416.8	100 (89)
			Run 129 416.8 to 421.9	100 (94)
420 (296.9)			Run 130	94 (56)
			Run 131 423.7 to 428.4	98 (87)
425.7 (301.0)	Argillite	Rock description as above. 425.7-456.6 - Joints moderately close to widely spaced, average 30°. Low angle set, 15°, highly chloritized.	Run 132 428.4 to 433.6	100 (90)
430 (304.0)				
		437.8 - Shears, minor, joints at 40°, highly chloritized with very thin coating of clay/ breccia, tight.	Run 133 433.6 to 436.8	94 (88)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a
SITE Devil Canyon (North Bank) — SHEET NO. 15 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 134	100 (81)
440 (311.1)		440.4-442.5 - Zone of very closely spaced joints at 30-35°, tight, chloritized.	Run 135 438.4 to 442.9	97 (69)
		441.5-442.5 - Shears, 20-25°, very closely spaced, highly chloritized, slickensides, carbonate/gouge/breccia coating.		
		445.0 - Joint, 20°, healed, very tight, faint slickensides.	Run 136 442.9 to 446.9	100 (100)
450 (318.2)			Run 137 446.9 to 452.0	98 (90)
		451.6-456.6 - Core barrel mislatch.		
			Run 138 452.0 to 457.0	72 (0)
		456.6-527.4 - Joint spacing generally wide to very wide with zones of very close to closely spaced. Occasional irregular, healed fractures and quartz stringers.		
460 (325.2)			Run 139 457.0 to 461.9	100 (96)
			Run 140 461.9 to 466.9	100 (100)
			Run 141	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a
SITE Devil Canyon (North Bank) — SHEET NO. 16 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (322.3)	Argillite		Run 141 466.9 to 471.9	100 (100)
		475.5-475.9 - Quartz vein, 5-10°, 1/2 inch wide.	Run 142 471.9 to 476.9	100 (100)
		476.8 - Joint, 50°, open, planar.		
		478.6 - Joint, 60°, part open, rough.	Run 143 476.9 to 481.9	100 (94)
480 (333.6)				
			Run 144 481.9 to 486.9	100 (100)
			Run 145 486.9 to 491.9	100 (96)
490 (346.4)			Run 146 491.9 to 497.0	100 (82)
			Run 147 497.0 to 502.0	100 (96)
500 (353.5)				

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 17 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 147	
			Run 148	100 (93)
		505.2 - Joint, 20°, possible shear healed weakly with carbonate.	Run 149 503.4 to 508.4	100 (100)
510 (360.6)		510.4 - Fracture, 60°, open, rough, irregular.	Run 150 508.4 to 513.7	100 (100)
		513.0 - Shear, 40°, highly chloritized, 1/16 inch clayey breccia, slickensides.		
		515.5-516.8 - Fracture, 0-20°, very irregular, highly chloritized.	Run 151 513.7 to 518.4	96 (85)
			Run 152	71 (29)
520 (367.6)			Run 153 519.8 to 523.6	100 (84)
		522.7-527.4 - Shear/fracture zone, joints very closely spaced at 10° and 20°, generally irregular, slick, highly chloritized, well developed slickensides, carbonate. Core loss 2.4 feet.	Run 154 523.6 to 528.5	57 (12)
		527.4-538.1 - Fracture zone, closely to moderately closely spaced joints and fractures at 20-30° and 50°, highly chloritized with carbonate. Many are healed, rebroken by drilling.		
530 (374.7)			Run 155 528.5 to 533.5	100 (94)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 18 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite			
			Run 156 533.5 to 538.5	98 (90)
		538.1-540.9 - Shear/fracture zone, healed. Joints, 0-5°, very closely spaced, weakly healed with carbonate, tight, highly chloritized.	Run 157 538.5-540.7	100 (0)
540 (381.8)		540.9-597.7 - Joints, wide to very widely spaced, generally at 20°, healed with carbonate and rebroken by drilling, highly chloritized. Secondary set at 40-45°, moderately closely to widely spaced, tight.	Run 158 540.7 to 545.7	100 (46)
			Run 159 545.7 to 550.6	98 (86)
550 (388.9)			Run 160 550.6 to 555.7	100 (100)
			Run 161 555.7 to 560.9	100 (100)
560 (395.9)			Run 162 560.9 to 565.9	98 (88)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 19 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite			
			Run 163 565.9 to 570.4	100 (100)
570 (403.0)			Run 164 570.4 to 575.4	100 (92)
			Run 165 575.4 to 580.7	100 (94)
580 (410.1)			Run 166 580.7 to 583.7	100 (87)
			Run 167 583.7 to 588.5	100 (94)
590 (417.1)			Run 168 588.5 to 592.6	100 (100)
			Run 169 592.6 to 597.9	92 (92)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5a

SITE Devil Canyon (North Bank) — SHEET NO. 20 OF 20

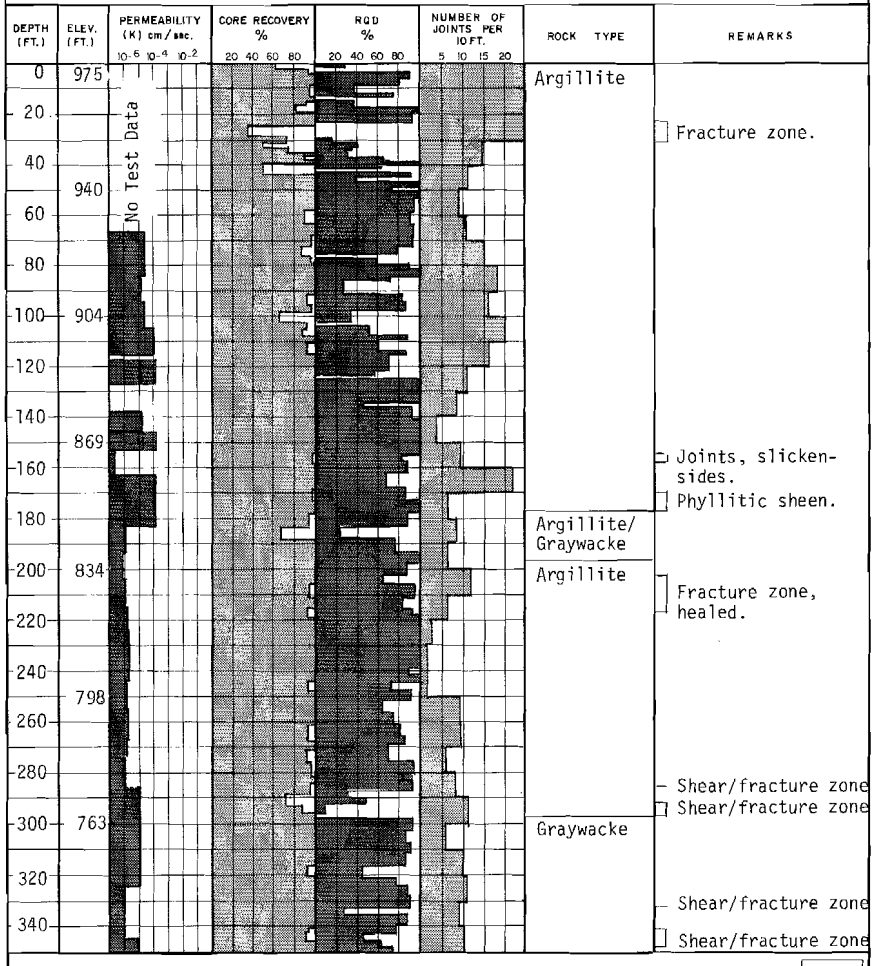
DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
597.9 (422.7)	Argillite	END OF BORING	Run 169	92(92)
600 (424.2)				

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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. BH-5a
Sheet No. 1 of 2

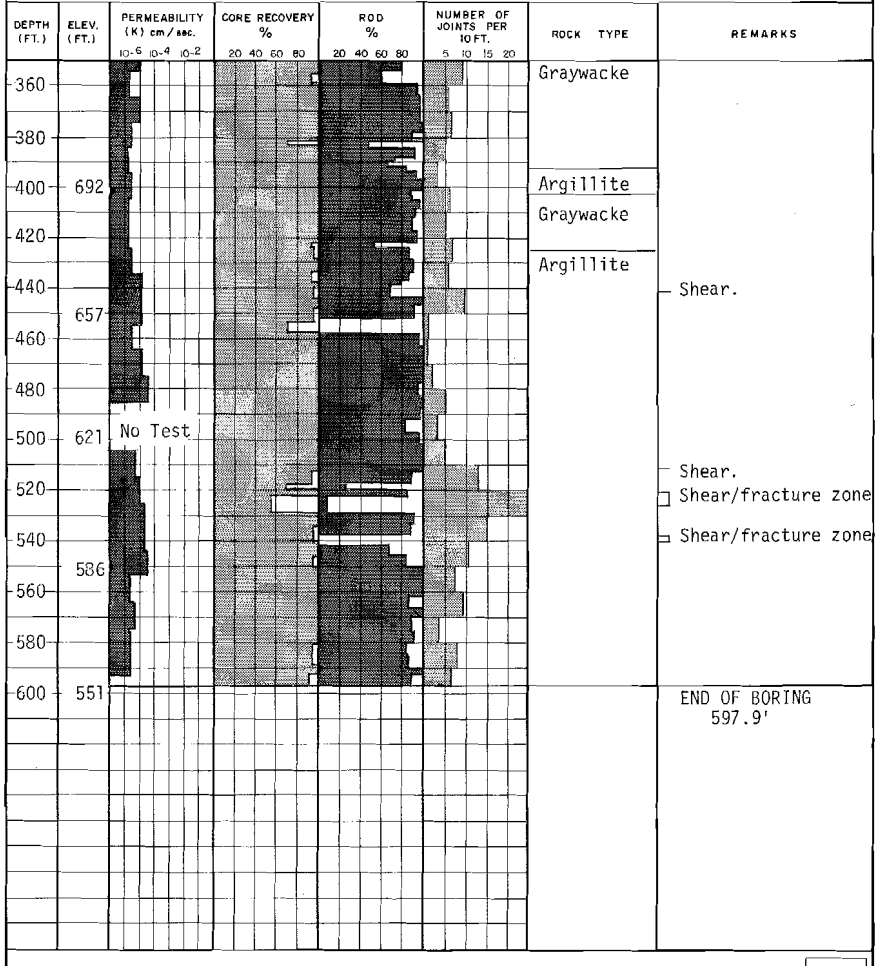


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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. BH-5a
Sheet No. 2 of 2



ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-5b

SITE: Devil Canyon (North Bank) — SHEET NO. 1 OF 7

CONTRACTOR: Interstate Exploration Inc. — DRILLING DATES: June 19 TO June 26, 1981
LOGGED BY: K.J. White, M.P. Bruen — DATE: July 1981

DRILLING METHOD: SOIL —; ROCK Diamond Core - Triple Tube — CASING DIAMETER: NW (3.0") I.D.; CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,222,964; DEPARTURE E616,638; AZIMUTH 277°; DIP 45° — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4; GROUND SURFACE 976.6; ROCK SURFACE 976.6; BOTTOM OF HOLE 835.0; WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Argillite	Medium to dark gray, fine grained meta-sedimentary rock. Very thin beds coincident with weak to moderately developed foliation. Occasional very thin to thin beds of light gray, fine grained graywacke. Fresh, hard, and well indurated. Minor quartz veins and stringers. Sulphide mineralization, predominantly pyrite, crystals up to 0.5 inch, some being replaced by quartz.	Run 1 0.0-2.5	92 (24)
			Run 2 2.5 to 6.3	87 (55)
		Joints close to moderately close spaced with iron oxide staining near surface, and chlorite and carbonate at depth.	Run 3	75 (41)
10 (7.1)		0.0-88.3 - Joints close spaced, iron oxide staining.	Run 4 7.9 to 12.9	84 (54)
		7.9-8.7 - Core broken by drilling, pieces less than or equal to 0.2 feet.		
		11.0 - Bedding foliation at 60°.		
		14.1-14.3 - Core broken by drilling.	Run 5	83 (33)
			Run 6 14.7 to 17.6	100 (57)
		19.5-20.6 - Some core loss. Core badly broken by drilling, pieces up to 2 inches.	Run 7 14.7-19.4	100 (28)
20 (14.1)			Run 8	83 (0)

APPROVED: [signature] DATE: February 1, 1982

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5b

SITE Devil Canyon (North Bank) — SHEET NO. 2 OF 7

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 9	(39)
			Run 10 21.5 to 26.3	100 (79)
			Run 11 26.3 to 29.2	93 (76)
30 (21.2)			Run 12 29.2 to 34.0	96 (85)
			Run 13 34.0-36.7	100 (15)
		37.1 - Joint, 40°, faint slickensides.		
		37.3-39.3 - Core loss of 1.6 feet. Core broken by drilling, pieces average 1 inch.	Run 14 36.7-39.3	54 (13)
40 (28.3)		40.3 - Bedding/foliation at 50°.	Run 15 39.3 to 44.2	94 (88)
		41.7-42.0 - Core broken by drilling, pieces 0.5 inch to 1 inch.		
		45.9 - Joint, 50°, talc/chlorite coating.	Run 16 44.2 to 48.1	100 (85)
		48.0-49.7 - Numerous quartz stringers, average 0.5 inch wide, folded and stretched, unfractured. Comprise 30 to 40% of rock.	Run 17	100 (100)
50 (35.4)		51.1-51.3 - Quartz stringers, 0.3 inch to 1 inch side, folded, unfractured.	Run 18 49.3 to 52.1	96 (68)
		52.5-52.8 - Joints very close spaced, heavy iron oxide staining, probably open.		

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5b

SITE Devil Canyon (North Bank) — SHEET NO. 3 OF 7

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite		Run 19 52.1 to 57.0	96 (61)
		57.2-57.7 - Core broken by drilling, pieces 1 inch to 2 inches.		
		58.2-58.7 - Quartz stringers, 0.5 inch to 1 inch, folded, fractured but tight.	Run 20 57.0-59.4	100 (54)
60 (42.4)		59.2-59.4 - Core broken by drilling, pieces 1 inch to 2 inches.	Run 21 59.4 to 62.9	91 (74)
			Run 22 62.9 to 66.6	97 (76)
		66.5 - Joint, 40°, silt coating.		
		68.0 - Joint, 50°, trace of silt.	Run 23 66.6 to 69.3	100 (89)
		69.6-69.8 - Joints very close spaced. Joint at 40° has slickensides.		
70 (49.5)		71.5-72.2 - Core broken by drilling, pieces 1 inch to 2 inches, minor iron oxide staining.	Run 24 69.3-71.8	100 (96)
			Run 25 71.8 to 76.2	98 (71)
			76.2-77.9	100 (68)
			Run 27	71 (71)
80 (56.6)		80.0 - Bedding/foliation at 10° to 20°.	Run 28 79.3 to 83.0	95 (76)
		82.5-83.8 - Core broken by drilling, pieces 0.5 inch to 2 inches. Joints at 20° to 60°, some have chlorite coating and slickensides.	Run 29 83.0-84.8	100 (50)
		83.0-83.3 - Core broken by drilling, pieces average 1 inch.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5b

SITE Devil Canyon (North Bank) — SHEET NO. 4 OF 7

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite	84.9-86.9 - Core loss of 0.8 feet. Core broken by drilling, pieces 0.5 inch to 2 inches.	Run 30 84.8-86.9	76 (0)
		88.3-90.7 - Shear/fracture zone, joints very close spaced, joints at 25° to 70°, chlorite and silt coating, some have slickensides.	Run 31 86.9-89.3	100 (67)
90 (63.6)		88.3-102.0 - Joints close to very close spaced, chlorite coating.	Run 32 89.3 to 92.3	100 (67)
			Run 33 92.3 to 96.1	100 (68)
			Run 34 96.1 to 99.1	100 (70)
100 (70.7)			Run 35 99.1-101.6	100 (56)
		102.0 - Bedding/foliation at 30° to 40°.	Run 36 101.6 to 105.1	97 (51)
		102.0-200.3 - Joints close to moderately close spaced, average 1 foot, trace of carbonate and chlorite coating.	Run 37	100(100)
			Run 38	100(100)
			Run 39	100 (83)
		109.7 - Shear, 30°, 0.1 inch of breccia, slickensides, chlorite coating.	Run 40 108.0 to 112.0	99 (99)
110 (77.8)			Run 41 112.0 to 116.0	95 (83)
		115.5 - Bedding/foliation at 50°.		
		116.0 - Joint, 50°, slickensides.		

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5b

SITE Devil Canyon (North Bank) — SHEET NO. 5 OF 7

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 42 116.0- 119.3	94 (88)
120 (84.9)			Run 43 119.3 to 124.2	100 (90)
		123.7-124.1 - Core broken by drilling, pieces 0.5 inch to 1 inch.		
		126.7-127.6 - Numerous quartz stringers, less than 0.5 inch wide, folded, unfractured. Comprise approximately 25% of rock.	Run 44 124.2 to 129.3	96 (90)
130 (91.9)		130.0 - Bedding/foliation at 40° to 50°.	Run 45 129.3 to 134.3	100 (88)
			Run 46 134.3 to 139.3	100 (96)
140 (99.0)			Run 47 139.3 to 143.7	100 (86)
			Run 48	90 (83)
			Run 49 145.2 to 149.3	95 (89)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5b

SITE Devil Canyon (North Bank) — SHEET NO. 6 OF 7

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (106.1)	Argillite		Run 50 149.3 to 154.5	99 (96)
		154.5 - Bedding/foliation at 50°.	Run 51 154.5 to 159.3	100 (90)
		158.0-159.3 - Shear/fracture zone, joints very close spaced. Shears at 30° and 50°, 0.1 inch of breccia, clay, and chlorite, fractures at 40°. Core badly broken, pieces average 1 inch, many have slickensides and clay coating. Core loss of 0.5 feet.		
160 (113.1)		159.3 - Quartz vein at 40°, 0.5 inch wide, unfractured, upper contact has slickensides, lower contact is tight.	Run 52 159.3 to 164.3	80 (77)
		162.9-163.9 - Core loss of 0.8 feet. Core broken by drilling, pieces average 1 inch.	Run 53	
		167.1-168.0 - Core loss of 0.6 feet. Core broken by drilling, pieces 0.5 inch to 1 inch.	164.3 to 169.3	94 (90)
170 (120.2)			Run 54 169.3 to 174.1	100 (86)
		174.0 - Bedding/foliation at 40°.	Run 55 174.1 to 179.3	100 (86)
		176.6-177.3 - Shear/fracture zone, joint spacing is very close. Joint at 40° has slickensides and chlorite coating. Other joints at 30° and 50°. Core loss of 0.3 feet.		
180 (127.3)		178.8 - Joint, 50°, silt/clay coating. No evidence of shearing. 180.1-181.5 - Core broken by drilling, pieces 0.1 feet to 0.2 feet.	Run 56	100 (80)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-5b

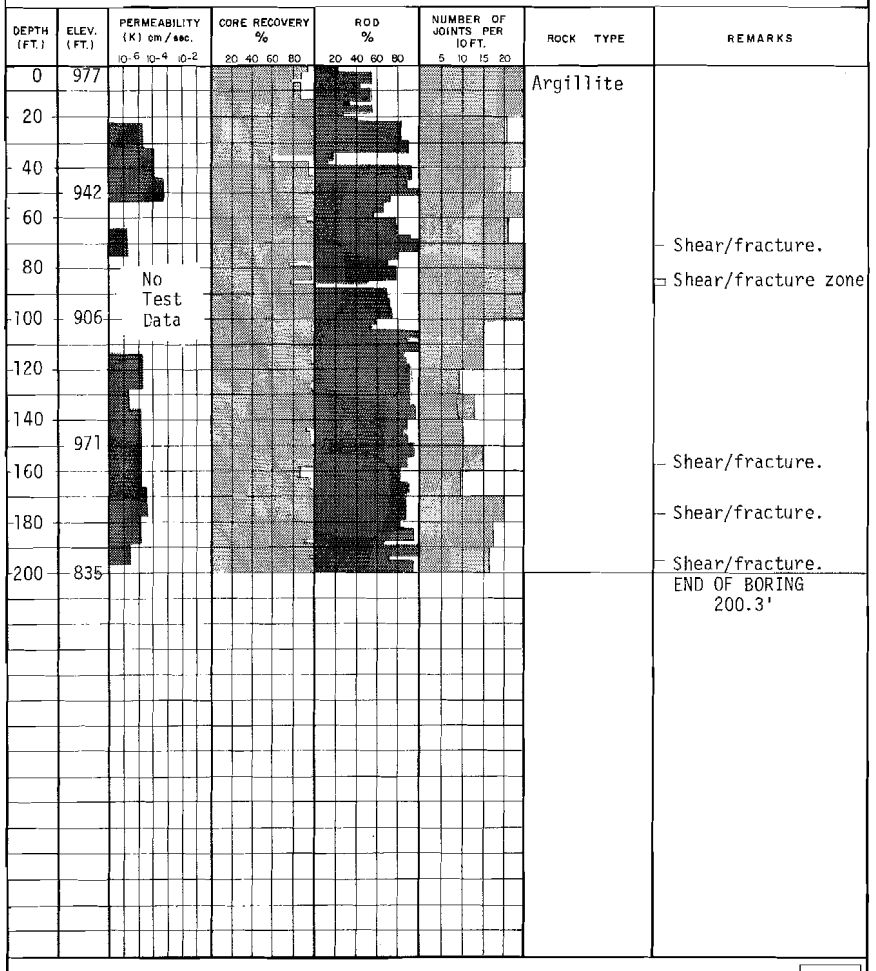
SITE Devil Canyon (North Bank) — SHEET NO. 7 OF 7

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite			
			Run 57 182.3 to 187.3	100 (94)
		187.0-188.7 - Shear/fracture zone, joints very close spaced. Joints at 20° and 50° have slickensides and chlorite coating.	Run 58 187.3- 189.3	85 (62)
		188.7 - Breccia is less than 0.1 inch wide.		
190 (134.4)			Run 59 189.3 to 192.7	100 (100)
		194.7-195.3 - Shear/fracture zone, joints very close spaced, joints at 20° have slickensides, most have a trace of silt coating. Core loss of 0.2 feet.	Run 60 192.7 to 195.3	92 (69)
			Run 61 195.3 to 200.3	100 (96)
		199.9 - Shear, 50°, slickensides, less than 0.1 inch of gouge.		
200.3 (141.6)		END OF BORING		

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** BH-5b
Site Devil Canyon (North Bank) — **Sheet No.** 1 of 1



ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY — JOB NO.: P5700.05

PROJECT: Susitna Hydroelectric Project — HOLE NO.: BH-7

SITE: Devil Canyon (South Bank) — SHEET NO. 1 OF 16

CONTRACTOR: Interstate Exploration Inc. — DRILLING DATES: May 18 TO May 31, 1981

LOGGED BY: R.R. Henschel — DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer; ROCK Diamond Core - Triple Tube — CASING DIAMETER: NW (3.0") I.D.; CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,221,701; DEPARTURE E616,133; AZIMUTH 009°; DIP 45° — ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4; GROUND SURFACE 1351.0; ROCK SURFACE 1343.2; BOTTOM OF HOLE 998.7; WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ( ).
2) All angles measured to the core axis.

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0	Overburden			
10 (7.1)		TOP OF ROCK		
11.0 (7.7)	Argillite/ Graywacke	Medium to dark gray, very fine grained argillite interbedded with light gray, fine grained graywacke in very thin beds. Foliation parallels argillite bedding at 70° with graywacke bedding/foliation planar to highly deformed. Well indurated, tending to break along bedding. Generally fresh to slightly weathered with iron oxide staining and carbonate coating on joint surfaces. Numerous irregular fractures healed with carbonate. Occasional quartz veinlets. Jointing very closely to moderately closely spaced at 0-15°, 55-65°, and 70-80°.	Run 1 11.0 to 14.8	81 (0)
			Run 2 14.8 to 19.2	80 (0)
20 (14.1)			Run 3	100 (17)

APPROVED: [signature] DATE: February 1, 1982

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 2 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke	11.0-12.7 - Rubble zone.	19.2-22.2	
		12.7-27.1 - Fracture zone, very closely spaced joints, 70-80°, paralleling bedding/foliation, and 0-15°. Iron oxide staining. Core loss 1.4 feet.	Run 4,5	62 (0)
			Run 6	91(70)
			23.8-25.4	94 (25)
			Run 8 25.4 to 29.3	100 (41)
30 (21.2)			Run 9 29.3 to 34.3	100 (83)
		37.5-38.1 - Fracture zone, very closely spaced joints at 0-10° and 70-80°.	Run 10 34.3 to 39.3	96 (76)
40 (28.3)			Run 11 39.3 to 44.9	96 (73)
			Run 12 44.9 to 49.3	95 (90)
50 (35.4)	Argillite	Rock description as above, with occasional thin beds of graywacke. Hard, fresh. Closely spaced joints. Numerous thin quartz veins.	Run 13 49.3 to 53.1	100 (95)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 3 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite		Run 14	60 (0)
			Run 15 54.1 to 59.0	100 (94)
59.0 (41.7)				
60 (42.4)	Quartz Diorite	Light gray, fine to medium grained dike material, very hard, sharp contacts. Joints moderately close to widely spaced at generally 10-20° and 70-80°.	Run 16 59.0 to 63.0	100 (70)
			Run 17 63.0 to 67.7	100 (97)
			Run 18	100(73)
			Run 19	100 (83)
70 (49.5)			Run 20 69.6 to 74.9	100 (80)
73.3 (51.8)	Argillite/ Graywacke	Rock description as above.		
			Run 21 74.9 to 78.9	100 (45)
80 (56.6)			Run 22 78.9 to 83.5	85 (61)
		83.5-86.4 - Core broken by drilling. Fragments 0.25 to 2 inches with chlorite coating, possible fracture zone.	Run 23	100(0)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 4 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 24 84.1 to 89.1	94 (0)
		87.0-104.8 - Shear/fracture zone at very closely to closely spaced joints, highly chloritized breccia and gouge, faint slickensides.		
90 (63.6)		87.0-91.0 - Core loss 1.3 feet.	Run 25 89.1 to 94.3	81 (42)
		94.4-104.8 - Joints, 70-80° paralleling bedding and 0-10°. Core loss 3.3 feet.		
			Run 26 94.3 to 99.3	64 (0)
100 (70.7)			Run 27 99.3 to 104.1	54 (0)
			Run 28 104.1 to 108.7	93 (9)
		108.3-122.4 - Shear/fracture zone, very closely spaced joints. Extensive chloritization on rock fragments and joints.	Run 29	77 (0)
110 (77.8)		109.0-110.0 - Breccia/gouge.		
		110.0-113.0 - Joint, 40° and 20°, very closely spaced.	Run 30 110.0 to 115.0	56 (0)
		112.0-115.0 - Breccia/gouge.		
			Run 31	24 (0)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 5 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 31 115.0 119.1	24 (0)
			Run 32	6 (0)
120 (84.8)			Run 33 120.2- 122.4	69 (0)
			Run 34 122.4 to 126.1	100 (27)
		125.9-130.7 - Shear/fracture zone, very closely to closely spaced joints at 0-10°, 50°, 80-90°, healed with carbonate, chloritized gouge.	Run 35 126.1- 128.2	86 (0)
		125.9-126.1 - Breccia/gouge on joints at 80-90°, possible slickensides.	Run 36	90 (0)
130 (91.9)		126.9-127.3 - Gouge on fracture at 30°, 1/4 inch thick. Core loss 0.6 feet.	Run 37 130.1 to 133.7	89 (58)
		130.1 - Foliation well developed, 30-35°. Phyllitic texture locally.	Run 38 133.7 to 138.6	100 (99)
		133.0-133.4 - Fracture zone, very closely spaced joints at 30-50° and 0-10°.		
		135.4 - Joint, 60-70°, slickensides.		
140 (99.0)			Run 39 138.6 to 142.1	100 (83)
			Run 40	100 (89)
			Run 41	75 (0)
			Run 42	100(100)
			Run 43	100 (47)
			Run 44 146.8- 149.6	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 6 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (106.1)	Graywacke	Light gray, fine grained metasedimentary rock, thickly bedded, disseminated sulphide minerals.	Run 45 149.6 to 154.5	100 (90)
157.2 (111.1)	Argillite/ Graywacke	Rock description as above. Foliation poorly to well developed, generally parallel to bedding. Fresh, hard.	Run 46 154.5 to 159.6	100 (95)
160 (113.0)		Joints closely to moderately closely spaced at 60-70°, 80°, and 0-10°. Carbonate filling common.	Run 47 159.6 to 164.4	100 (95)
			Run 48 164.4 to 169.4	100 (91)
170 (120.2)			Run 49 169.4 to 174.4	100 (100)
			Run 50 174.4 to 179.5	100 (100)
180 (127.3)			Run 51	

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 7 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 51 179.5 to 184.9	97 (93)
			Run 52 184.9 to 188.8	100 (89)
		188.2-188.9 - Broken zone, low angle healed fractures rebroken by drilling.		
190 (134.3)			Run 53 188.8 to 193.7	100 (86)
			Run 54 193.7 to 198.9	96 (96)
			Run 55	83 (67)
200 (141.4)			Run 56 200.1 to 203.7	100 (74)
			Run 57 203.7 to 208.7	100 (88)
		208.2 - Shear, 0-10°, less than 1 inch of breccia/gouge.		
210 (148.5)			Run 58 208.7 to 213.7	100 (93)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 8 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 59 213.7 to 218.9	100 (90)
220 (155.54)			Run 60 218.9 to 224.9	100 (90)
		226.6-227.2 - Quartz vein, 60-70°, part open contacts.	Run 61 224.9 to 229.5	98 (92)
230 (162.6)		231.0-231.5 - Quartz vein, 10-15°.	Run 62 229.5 to 234.6	100 (86)
		233.7-237.8, 245.0-248.0, 248.8-251.2 } Bedding/foliation highly distorted and irregular. Numerous quartz stringers. Hard, fresh.		
			Run 63 234.6 to 239.6	98 (98)
240 (169.7)			Run 64 239.6 to 244.5	100 (100)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7
SITE Devil Canyon (South Bank) — SHEET NO. 9 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 65 244.5 to 249.3	100 (92)
250 (176.8)			Run 66 249.3 to 254.3	98 (84)
		254.1-254.3 - Fracture zone, very closely spaced joints at 0-10°, 45-50°, and 80-90°. Numerous thin contorted quartz stringers and veinlets, hard, tight.	Run 67 254.3 to 259.2	98 (86)
260 (183.8)		260.0 - Foliation well developed, 40-50°, bedding 70-80°.	Run 68 259.2 to 264.1	100 (94)
			Run 69 264.1 to 267.9	95 (95)
			Run 70	100 (75)
270 (190.9)			Run 71 269.5 to 274.6	100 (82)
			Run 72	100 (84)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7
SITE Devil Canyon (South Bank) — SHEET NO. 10 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 72 274.6- 279.6	
280 (198.0)			Run 73 279.6 to 284.6	100 (98)
			Run 74 284.6 to 289.6	100 (96)
290 (205.0)			Run 75 289.6 to 294.6	100 (98)
		292.1-314.4 - Quartz stringers, closely to moderately closely spaced, up to 3/8 inches thick.	Run 76 294.6 to 299.6	100 (100)
		297.1 - Joint, 80°, chlorite, slickensides. 299.6 - Joint, 75°, faint slickensides.		
300 (212.1)		301.0-332.6 - Predominantly graywacke composition, thick beds, joints closely spaced generally at 70-80° and 5-15°.	Run 77 299.6 to 304.6	98 (62)
			Run 78 304.6 to 309.6	100 (89)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 11 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (219.2)	Argillite/ Graywacke			
			Run 79 309.6 to 314.6	100 (78)
			Run 80 314.6 to 319.6	100 (96)
320 (226.2)			Run 81 319.6 to 324.7	100 (92)
		326.7-326.9 - Fracture zone, very closely spaced joints at 0-10°, 50-60°, and 80-90°, chloritized.	Run 82 324.7 to 329.6	100 (80)
		327.5-327.8 - Shear zone, 70-80°, several chloritized planes.		
330 (233.3)		330.6-332.6 - Shear/fracture zone, very closely spaced joints at 0-10° and 70-80°, highly chloritized, quartz and carbonate coating. Core loss 0.4 feet.	Run 83 329.6 to 332.6	87 (20)
			Run 84 332.6 to 337.7	100 (84)
340 (240.4)			Run 85 337.7 to 342.1	100 (91)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 12 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Argillite/ Graywacke		Run 85	
		343.0-344.9 - Shear/fracture zone, 80°, very closely spaced fractures with some very thin breccia clay gouge coating, highly chloritized.	Run 86 342.1 to 347.8	91 (88)
350 (247.5)			Run 87 347.8 to 352.9	100 (100)
			Run 88	100 (100)
			Run 89 354.9 to 359.9	100 (83)
		358.4-363.0 - Joint, 0-5°, slick, planar, highly chloritized, tight, offset by 3/16 inches.		
360 (254.5)		358.2-372.8 - Predominantly graywacke, fine to medium grained.	Run 90 359.9 to 364.6	100 (59)
			Run 91 364.6 to 369.6	100 (86)
370 (261.6)			Run 92 369.6 to 374.6	100 (100)

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 13 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
374.6 (264.8)	Argillite/ Graywacke			
	Graywacke	Light to medium brownish gray metasedimentary rock with subrounded to elongate quartz grains. Bonded locally with dark gray argillaceous beds. Hard to very hard. Foliation poorly developed except in argillaceous layers, generally at 50°. Bedding, 70-85°, average 80°. Minor thin irregular quartz stringers. Joints moderately closely to widely spaced 0-10° and 70-80°.	Run 93 374.6 to 379.6	100 (98)
380 (268.7)			Run 94 379.6 to 384.6	100 (100)
			Run 95	100 (62)
			Run 96 385.9 to 390.5	100 (82)
390 (275.7)			Run 97 390.5 to 393.8	100 (76)
			Run 98 393.8 to 398.8	100 (94)
400 (282.8)			Run 99 398.8 to 403.8	94 (86)
		404.0-407.7 - Foliation weakly developed at 50-60°.	Run 100	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 14 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke		Run 100 403.8 to 409.2	98 (98)
410 (289.9)			Run 101 409.2 to 414.5	98 (91)
		414.0-414.5 - Fracture zone, very closely spaced joints and fractures at 10° and 20°.	Run 102 414.5 to 419.6	100 (92)
420 (296.9)		418.2-420.8 - Argillaceous zone with weakly developed foliation at 50°.	Run 103 419.6 to 424.7	100 (88)
		427.0 - Shear, 1.8 inch wide, tight, chloritized, sulphides.	Run 104 424.7 to 429.6	100 (76)
		427.5-427.6, 428.6-428.8 } Quartz veins.		
430 (304.0)		429.6-432.8 - Argillaceous zone with bedding at 60-65°, phyllitic locally, closely spaced joints.	Run 105 429.6 to 434.6	100 (98)
		433.4-446.6 - Quartz intrusions 70% of core. Highly irregular contorted quartz stringers, pods and veinlets destroying original structure of rock. Zones range from 1 inch to 8 inches thick.	Run 106 434.6- 437.7	100 (57)

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CLIENT ALASKA POWER AUTHORITY — JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 15 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke			
440 (311.1)			Run 107 437.7 to 444.7	100 (88)
			Run 108 444.7 to 449.7	100 (90)
450 (318.2)		450.6-456.7 - Argillaceous zone, hard, brittle, weakly developed foliation at 40-45°. Joints generally 50° and 70-80°.	Run 109 449.7 to 454.8	100 (98)
		457.9-460.7 - Quartz vein, massive, hard, sulphide mineralization.	Run 110 454.8 to 459.7	100 (73)
460 (325.2)		461.7-462.7 - Core loss 0.4 feet.	Run 111 459.7-461.7	80 (45)
			Run 112	60 (0)
		463.0 - Shear zone, 65°, 1/4 inch wide breccia/gouge, healed with carbonate, chloritized, intact but friable, slickensides.	Run 113 462.7 to 467.6	100 (98)
			Run 114	

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PROJECT Susitna Hydroelectric Project — HOLE NO. BH-7

SITE Devil Canyon (South Bank) — SHEET NO. 16 OF 16

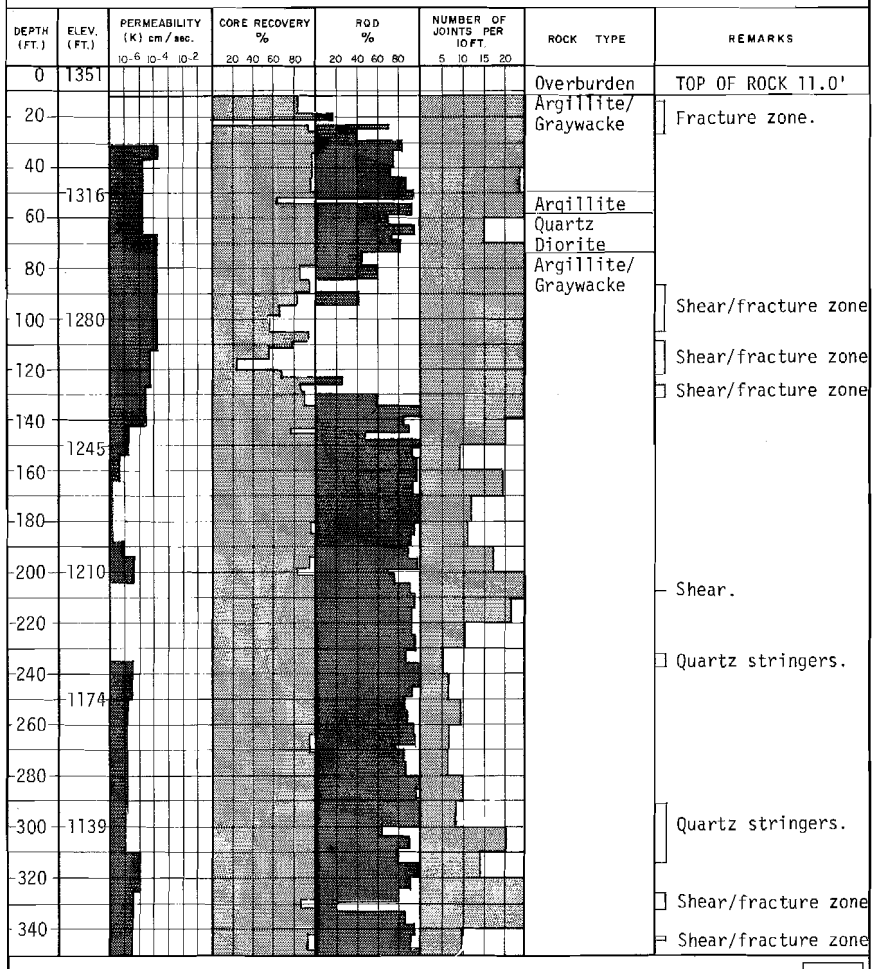
DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
470 (332.3)	Graywacke		Run 114 467.6 to 472.6	100 (84)
			Run 115 472.6 to 477.8	100 (100)
		479.5-480.9 - Shear/fracture zone, 15-20°, very closely spaced joints and fractures, some breccia/gouge, chloritized, some carbonate.	Run 116 477.8 to 480.3	100 (64)
480 (339.4)			Run 117 480.3 to 485.6	100 (90)
		488.7-490.5 - Foliation highly contorted and folded quartz stringers.	Run 118 485.6 to 489.7	100 (71)
490 (346.4)			Run 119 489.7 to 494.7	100 (96)
			Run 120 494.7 to 498.3	100 (100)
498.3 (352.3)		END OF BORING		
500 (353.5)				

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. BH-7
Sheet No. 1 of 2

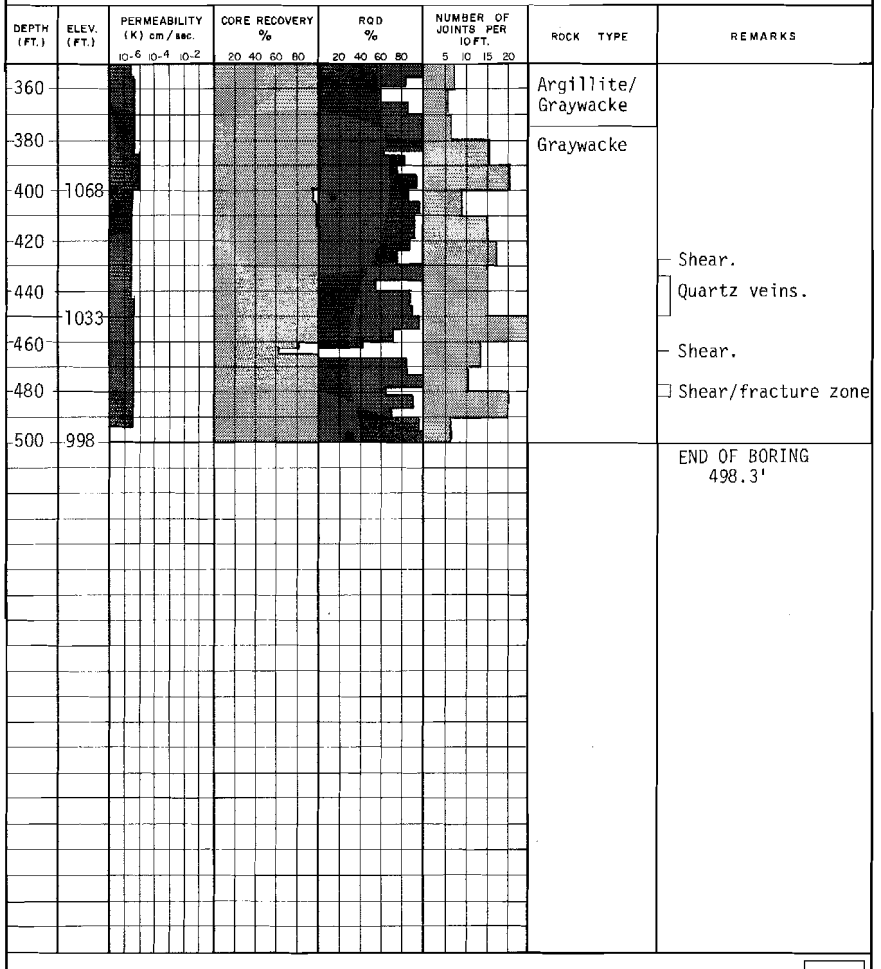


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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. BH-7
Sheet No. 2 of 2

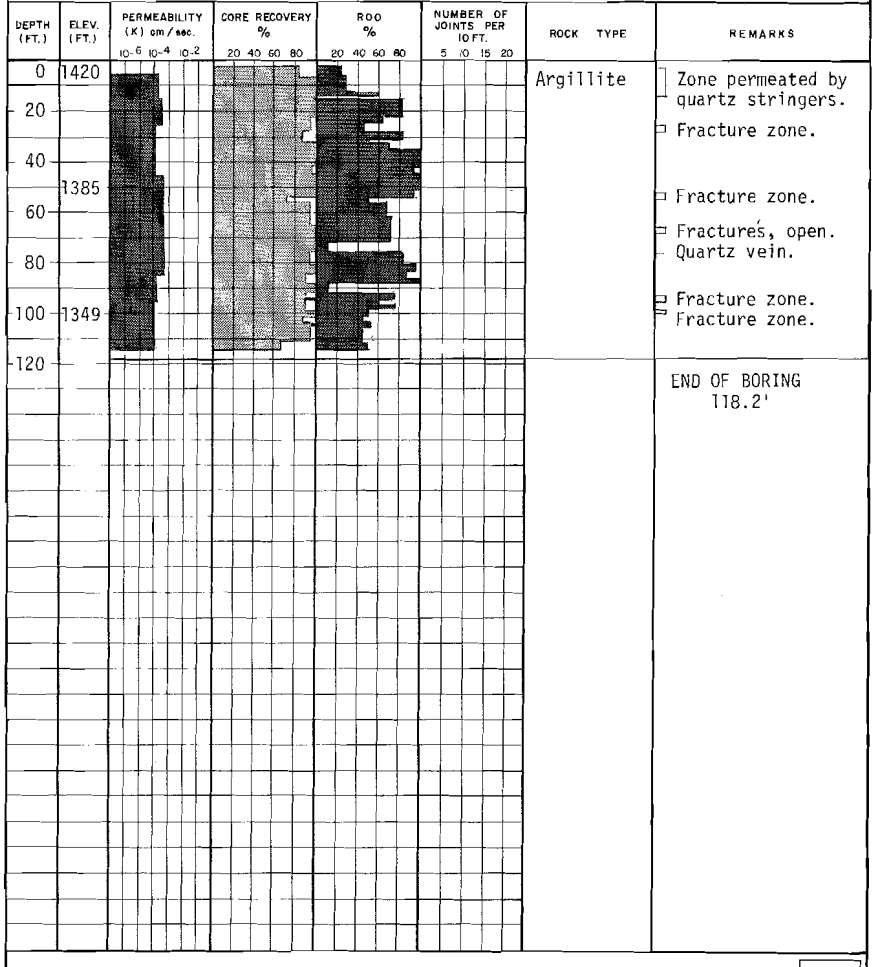


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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. USBR DH-1
Sheet No. 1 of 1

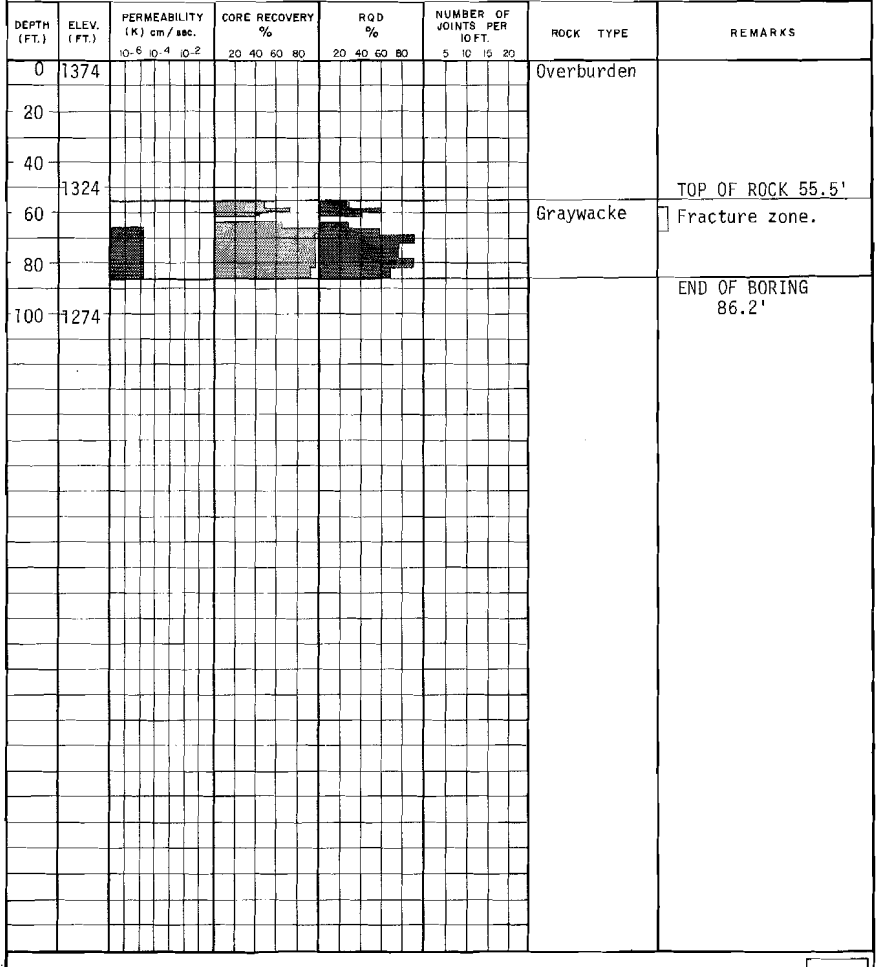


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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. USBR DH-5
Sheet No. 1 of 1



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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** USBR DH-6
Site Devil Canyon (South Bank) — **Sheet No.** 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1370					Overburden	
20							
40	1320						
60							
80							TOP OF ROCK 87.5'
100	1270	No Test Data				Graywacke	Faint slickensides.
120	1250						END OF BORING 107.3'

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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** USBR DH-7
Site Devil Canyon — **Sheet No.** 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1376					Overburden	
20							TOP OF ROCK 33.9'
40	1326		Missing Core			Argillite	
60							END OF BORING 59.5'

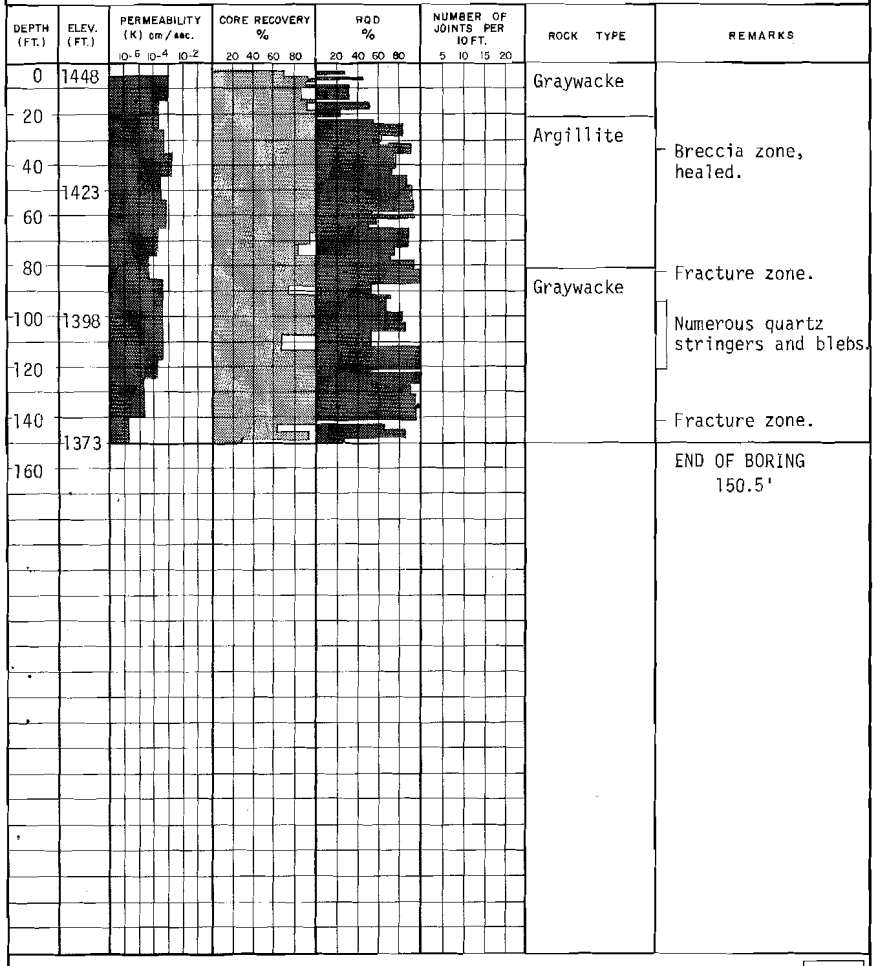
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. USBR DH-8
Sheet No. 1 of 1



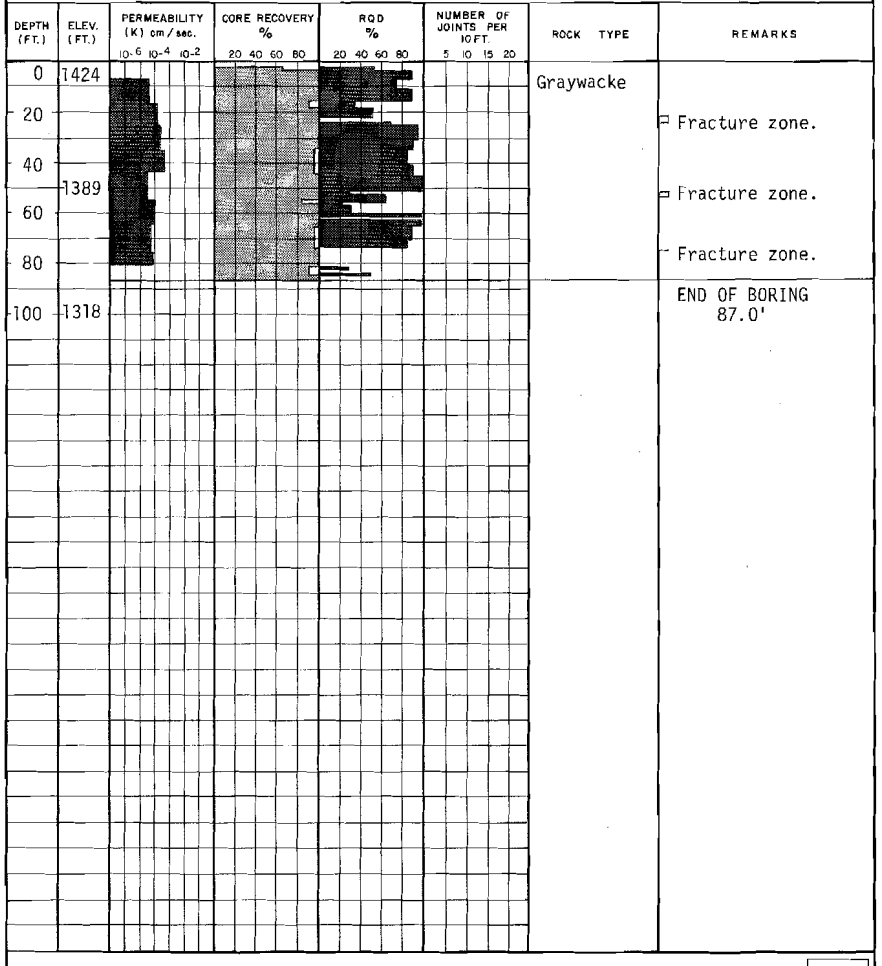
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. USBR DH-9
Sheet No. 1 of 1



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SUMMARY LOG

Client ALASKA POWER AUTHORITY **Job No.** P5700.05
Project Susitna Hydroelectric Project **Hole No.** USBR DH-10
Site Devil Canyon (South Bank) **Sheet No.** 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1425	No Test Data				Graywacke	
20							
40							
	1386						
60							
80							
100	1346						Fracture zone.
120	1315						END OF BORING 122.7'
140							

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SUMMARY LOG

Client ALASKA POWER AUTHORITY **Job No.** P5700.05
Project Susitna Hydroelectric Project **Hole No.** USBR DH-11
Site Devil Canyon (South Bank) **Sheet No.** 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	894					Argillite	
20							
40	867						END OF BORING 31.2'

Note: Borehole daylighted.

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. USBR DH-11A
Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	894					Argillite	
20							
40	866						END OF BORING 29.8'

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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. USBR DH-11B
Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	894					Argillite	Fracture zone.
20							
40	863						END OF BORING 33.9'

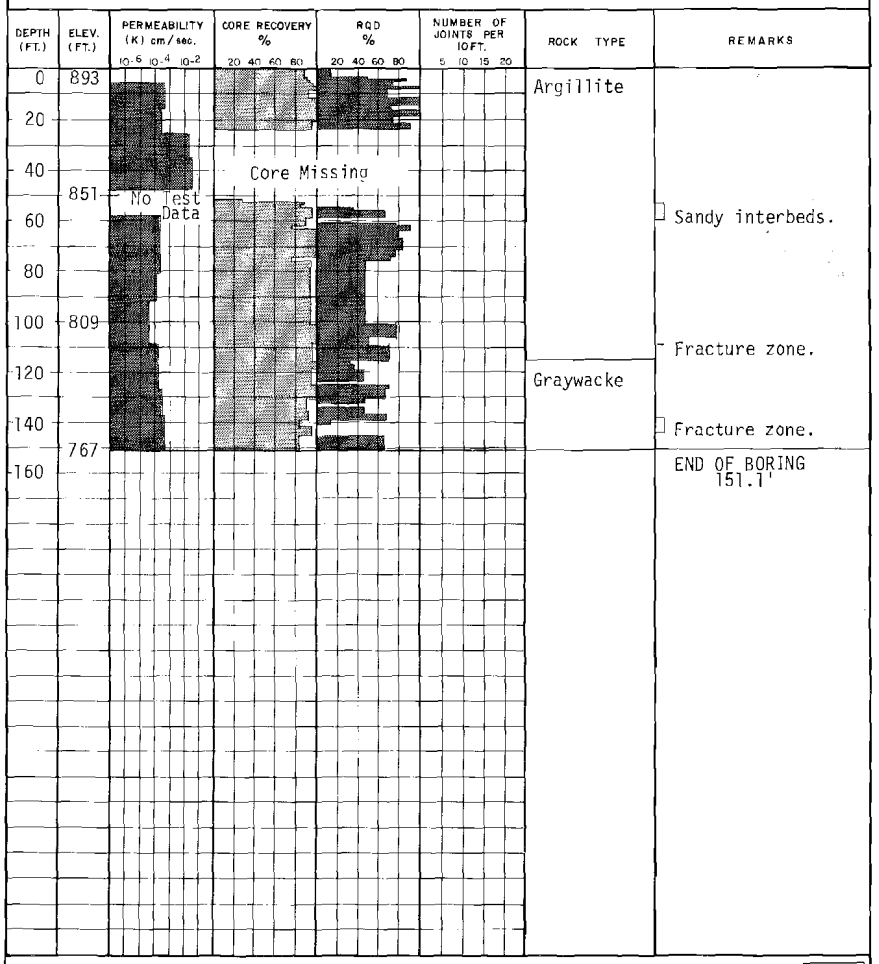
Note: Borehole daylighted in the river.

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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** USBR DH-11C
Site Devil Canyon (South Bank) — **Sheet No.** 1 of 1

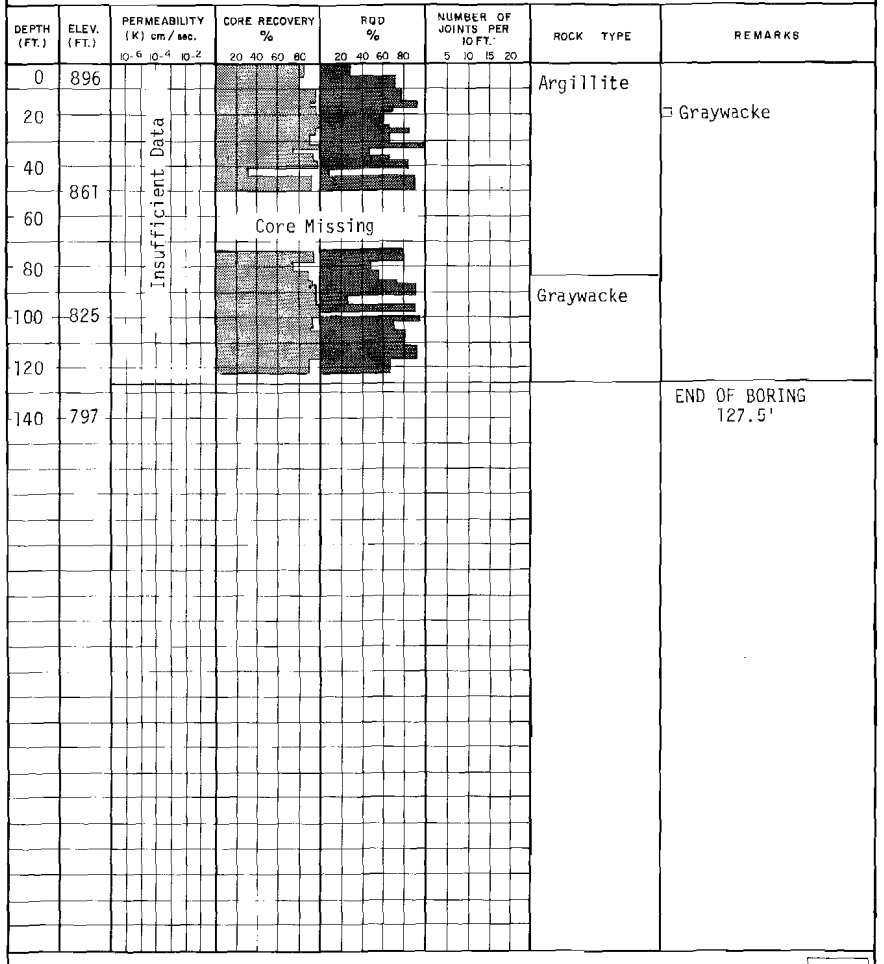


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Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** USBR DH-12
Site Devil Canyon (South Bank) — **Sheet No.** 1 of 1



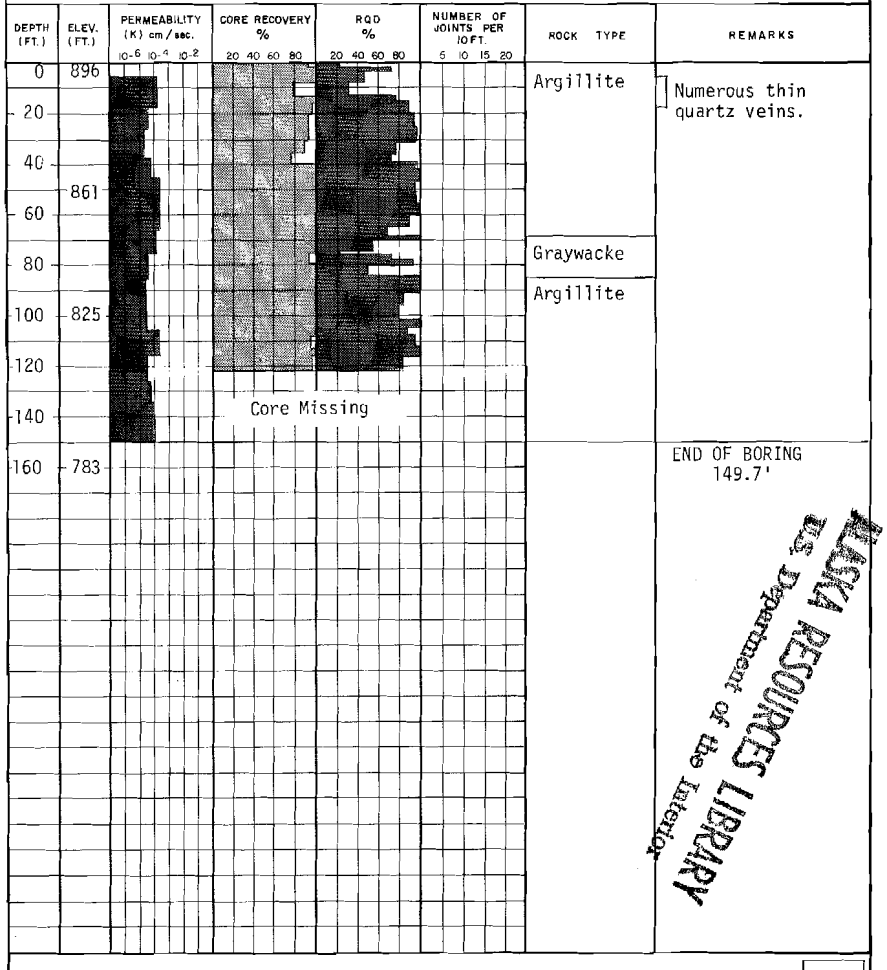
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Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (South Bank)

Job No. P5700.05
Hole No. USBR DH-12A
Sheet No. 1 of 1



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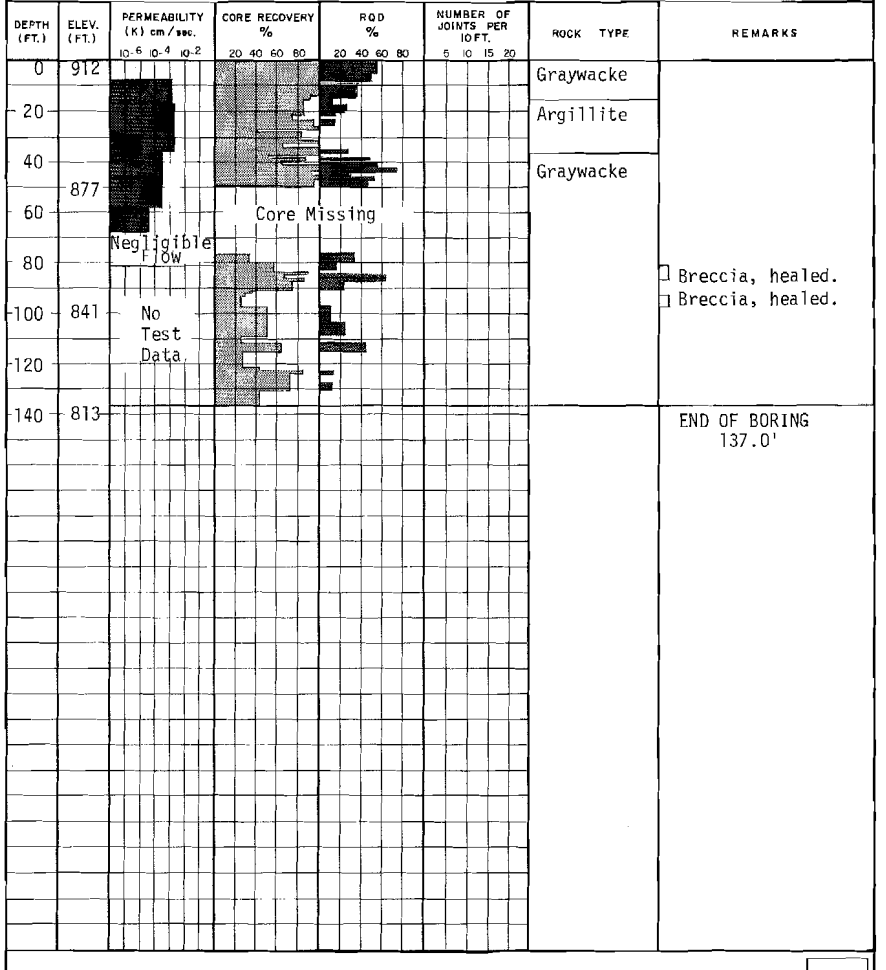
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. USBR DH-13
Sheet No. 1 of 1



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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** USBR DH-13A
Site Devil Canyon (North Bank) — **Sheet No.** 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT 5 10 15 20	ROCK TYPE	REMARKS
0	912	No Test Data				Graywacke	
20						Argillite	
40						Graywacke	
60	882						Dike, felsic, minor shearing at contact.
80	864						END OF BORING 80.7'

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SUMMARY LOG

Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** USBR DH-14
Site Devil Canyon (North Bank) — **Sheet No.** 1 of 1

DEPTH (FT.)	E..EV. (FT.)	PERMEABILITY (K) cm/sec. 10^{-6} 10^{-4} 10^{-2}	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	903					Argillite	Fracture zone.
20		No Flow					
40							
60	868						END OF BORING 50.0'

Note: Borehole daylighted in the river.

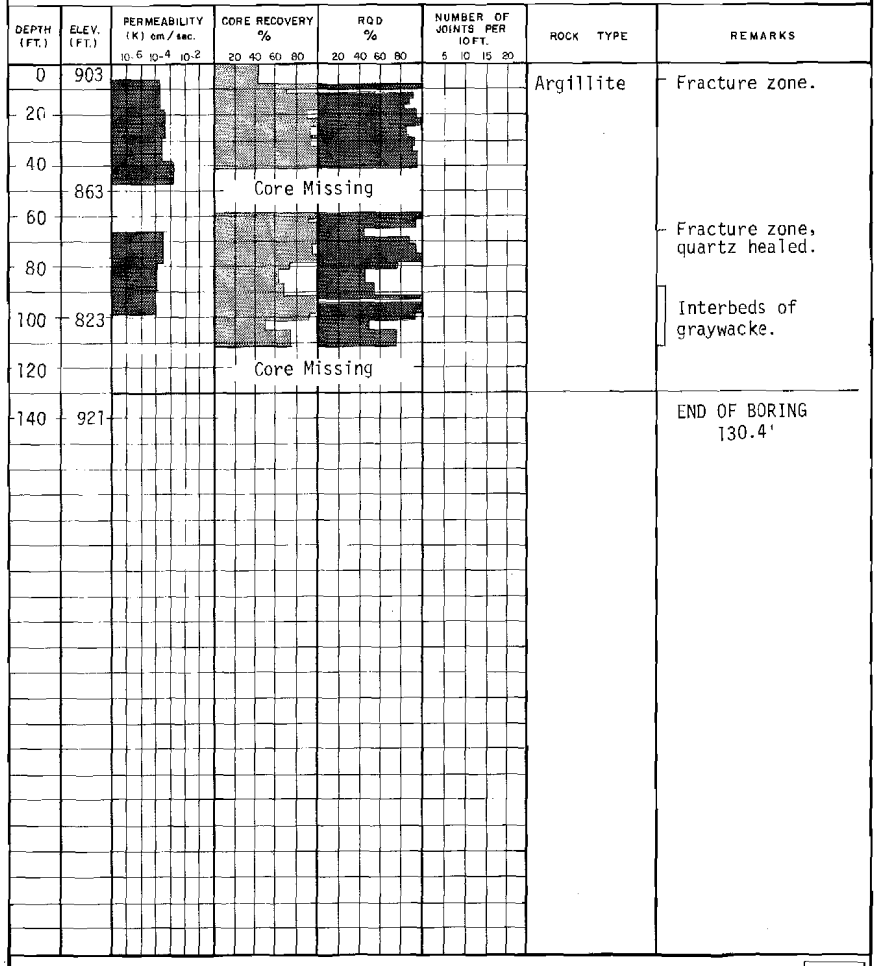
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. USBR DH-14A
Sheet No. 1 of 1



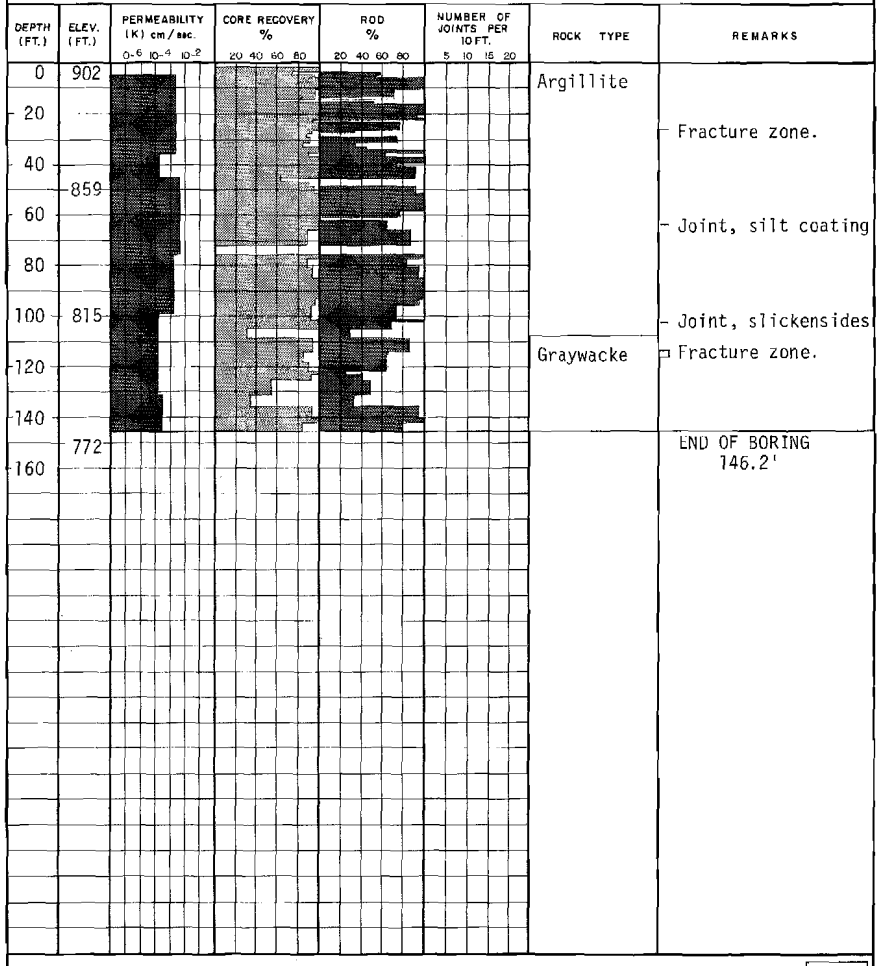
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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. USBR DH-14B
Sheet No. 1 of 1

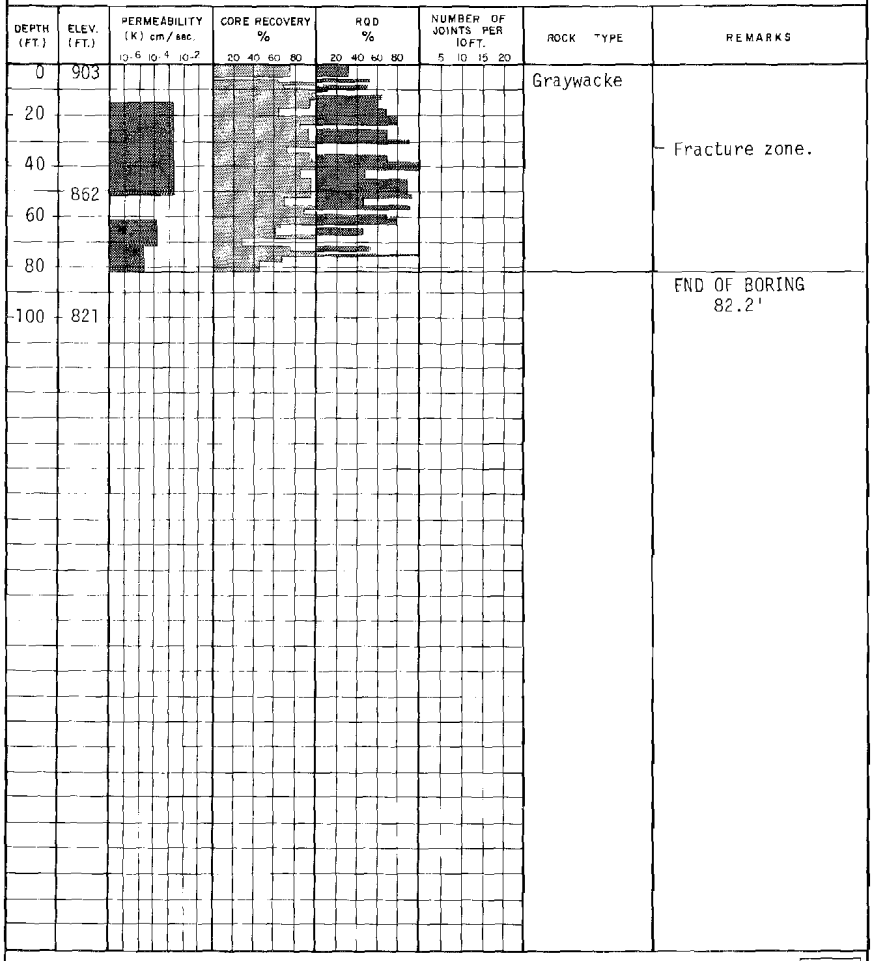


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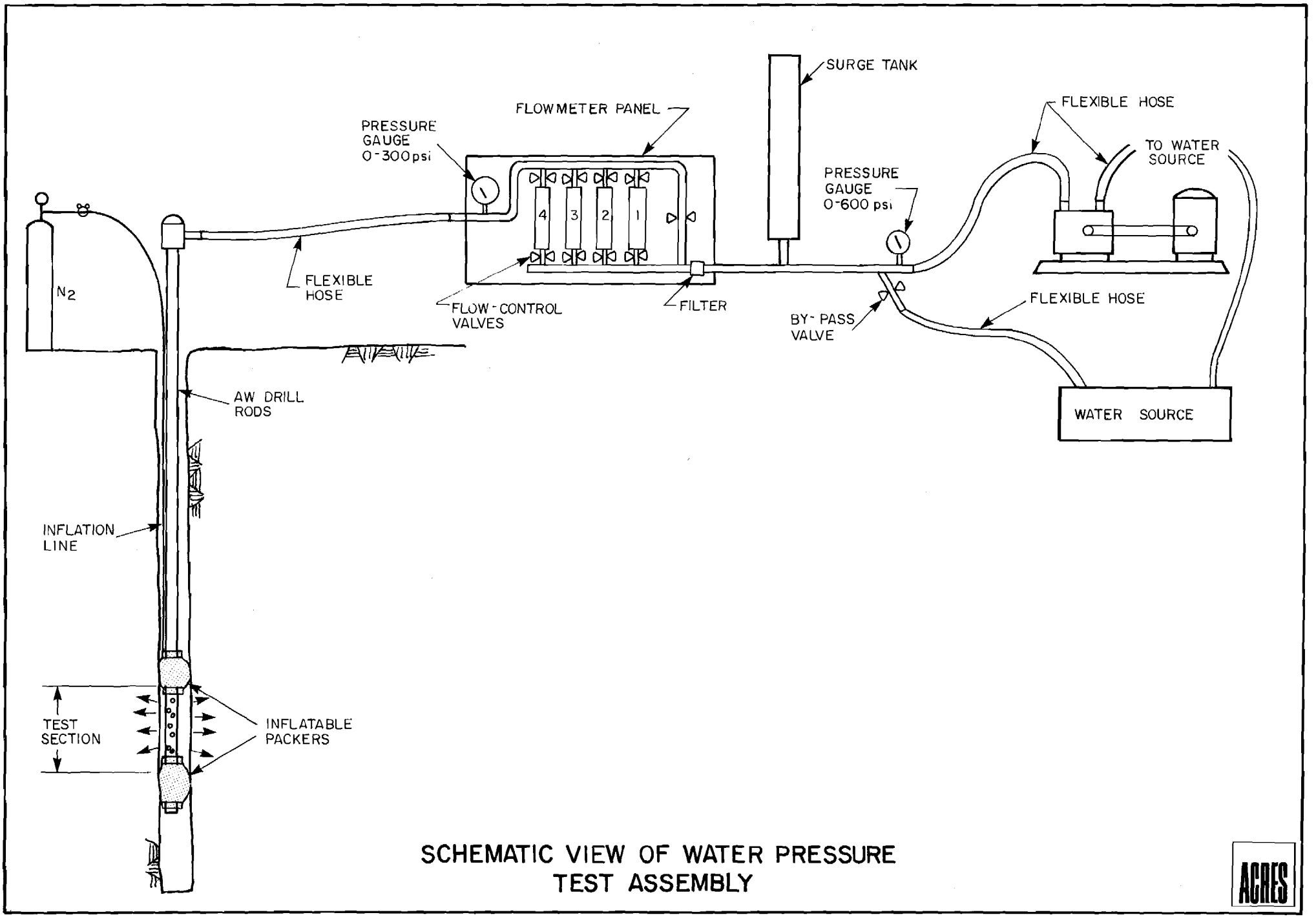
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Client ALASKA POWER AUTHORITY — **Job No.** P5700.05
Project Susitna Hydroelectric Project — **Hole No.** USBR DH-14C
Site Devil Canyon (North Bank) — **Sheet No.** 1 of 1



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APPENDIX D
WATANA WATER PRESSURE TESTING DETAILS



SCHEMATIC VIEW OF WATER PRESSURE TEST ASSEMBLY

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SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-1
Location Watana
Ground Surface Elevation 2049.7 ft.
Static Water Level 1993.3 ft
Dip of Hole 70°
Stickup 7.1 ft.

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
22.6	32.6	13	5	0.22	1.65×10^{-5}
30.0	40.0	18-20	6	0.10	5.65×10^{-6}
40.0	50.0	30-31	8	0.12	4.75×10^{-6}
50.0	60.0	28	3	0.0	0.0
60.0	70.0	35-36	9	0.45	1.36×10^{-5}
70.0	80.0	39	2	1.05	3.01×10^{-5}
80.0	91.1	45-46	8	5.4	1.41×10^{-4}
90.0	101.1	48-50	6	9.03	2.25×10^{-4}
100.0	111.1	53	6	>10	$>2.36 \times 10^{-4}$
110.0	121.1	60-63	8	0.48	1.02×10^{-5}
120.0	131.1	62-64	6	0.43	9.06×10^{-6}
130.0	141.1	69-73	8	0.90	1.74×10^{-5}
140.0	151.1	72	8	1.5	2.87×10^{-5}
150.0	161.1	76	6	>10	$>1.84 \times 10^{-4}$
160.0	171.1	81	6	>10	$>1.75 \times 10^{-4}$
171.1	200.0	No Test			
* 200.0	211.0	98-99	4	6.0	9.08×10^{-5}
210.0	221.0	105	10	7.1	1.02×10^{-4}
220.0	231.0	109-114	5	3.80	5.21×10^{-5}
230.0	241.0	112-115	6	1.41	1.90×10^{-5}
235.0	246.0	118-119	6	1.30	1.69×10^{-5}
250.0	261.0	120-122	6	1.35	1.73×10^{-5}
260.0	271.0	No Test			
270.0	281.0	133-138	10	2.0	2.34×10^{-5}

* Packers did not completely seal.

BH-1 (continued)

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
279.0	290.0	140-142	6	1.25	1.42×10^{-5}
180.0	300.0	90	8	3.0	6.84×10^{-6}
200.0	300.0	100	8	2.3	5.64×10^{-6}
220.0	300.0	110	8	2.15	5.91×10^{-6}
240.0	300.0	120	8	2.3	7.63×10^{-6}
260.0	300.0	130	8	2.2	9.43×10^{-6}
280.0	300.0	138	8	2.3	1.65×10^{-5}

NOTE: Section 180 ft to 300 ft depth, tests performed using single packer only.

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-2
Location Watana
Ground Surface Elevation 1838.8 feet
Static Water Level 1768.8 feet
Dip of Hole 55^{o}
Stickup 0 feet

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (minutes)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
23.9	40	20	20	.32	1.44×10^{-5}
38.9	55	26	10	.18	5.96×10^{-6}
53.9	70	30	20	.42 to 2.5	1.14×10^{-5} to 6.8×10^{-5}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-3
Location Watana
Ground Surface Elevation 2150.7 ft.
Static Water Level 2150.7 ft.
Dip of Hole 55°
Stickup 4.6 ft.

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
34	45	19-20	8	0.07	6.21×10^{-6}
40	51	23	5	0.17	1.30×10^{-5}
50	61	27	4	0.20	1.32×10^{-5}
60	71	31	4	0.02	1.16×10^{-6}
70	81	35	5	3.10	1.60×10^{-4}
* 80	91	39	2	2.90	1.35×10^{-4}
90	101	43	5	0.06	2.54×10^{-6}
100	111	47-49	5	0.08	3.05×10^{-6}
*110	121	No Test			
120	131	54	10	0.32	1.09×10^{-5}
130	141	58	9	0.29	9.23×10^{-6}
140	151	64	9	0.03	9.53×10^{-7}
150	161	67	11	0.05	1.38×10^{-6}
160	171	72	11	0.03	8.00×10^{-7}
170	181	76	10	0.08	1.92×10^{-6}
180	191	80	16	0.07	1.63×10^{-6}
190	201	84	12	0.04	8.87×10^{-7}
200	211	88	12	0.04	8.65×10^{-7}
210	221	92	10	0.06	1.21×10^{-6}
220	231	96	8	0.06	1.16×10^{-6}
230	241	100	8	0.20	3.74×10^{-6}
240	251	104	10	0.48	$8.63 \quad 10^{-6}$
250	261	108	10	0.17	2.95×10^{-6}

*Packers did not completely seal.

BH-3 (continued)

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
260	271	112	8	0.16	2.66×10^{-6}
270	281	117	12	0.25	4.01×10^{-6}
280	291	121	8	0.15	2.33×10^{-6}
290	301	125	8	0.17	2.54×10^{-6}
300	311	129	8	0.12	1.75×10^{-6}
310	321	133	6	0.16	2.26×10^{-6}
320	331	137	6	0.22	3.02×10^{-6}
330	341	141	6	0.22	2.93×10^{-6}
340	351	145	6	0.36	4.67×10^{-6}
350	361	149	6	0.46	5.81×10^{-6}
360	371	153	6	0.70	8.61×10^{-6}
370	381	158	8	0.82	9.78×10^{-6}
380	391	162	5	0.40	4.65×10^{-6}
390	401	166	5	0.47	5.34×10^{-6}
400	411	170	5	0.98	1.09×10^{-5}
410	421	150	4	1.02	1.28×10^{-5}
420	431	178	5	2.8	2.97×10^{-5}
430	441	162	5	1.0	1.16×10^{-5}
440	451	187	12	2.2	2.22×10^{-5}
450	461	193	12	1.8	1.76×10^{-5}
460	471	195	6	2.2	2.13×10^{-5}
471	520	No Test			
520	531	215	8	0.59	5.19×10^{-6}
*530	541	190-200	6	3.22	3.12×10^{-5}
*540	551	100	8	0.95	1.78×10^{-5}
*550	561	180	10	0.59	6.18×10^{-6}
560	571	235	8	0.41	3.29×10^{-6}
570	581	240	8	0.22	1.73×10^{-6}
580	591	200-210	10	6.07	5.59×10^{-5}
*590	601	200	10	6.87	6.49×10^{-5}
600	611	224	10	0.09	7.60×10^{-5}
610	620	200	10	0.41	3.87×10^{-6}

*Packers did not completely seal.

BH-3 (continued)

Depth Tested From (feet)	To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
620	631	220	10	0.15	1.29×10^{-6}
*630	641	210	6	1.53	1.38×10^{-5}
640	651	240-250	8	5.05	3.90×10^{-5}
*650	661	220-235	8	3.63	3.02×10^{-5}
660	671	200-245	10	0.47	3.90×10^{-6}
670	681	200	10	0.61	5.76×10^{-6}
680	691	200	12	0.94	8.88×10^{-6}
690	701	220	10	0.23	1.98×10^{-6}
700	711	225	8	0.24	2.02×10^{-6}
710	721	225	8	0.24	2.02×10^{-6}
720	731	230	8	0.23	1.89×10^{-6}
730	741	235	8	0.24	1.93×10^{-6}
740	751	240	6	0.25	1.97×10^{-6}
750	761	240	8	0.25	1.97×10^{-6}
760	771	245	6	0.24	1.85×10^{-6}
770	781	250	8	2.35	1.78×10^{-5}
780	781	250	6	2.50	1.89×10^{-5}
790	801	250	8	2.23	1.69×10^{-5}
800	811	250	6	1.42	1.07×10^{-5}
810	821	250	8	1.60	1.21×10^{-5}
820	831	240	6	4.17	3.29×10^{-5}
830	841	245	8	1.29	9.96×10^{-6}
840	851	250	8	0.61	4.62×10^{-6}
850	861	160-165	8	0.57	6.63×10^{-6}
860	871	160	8	0.89	1.05×10^{-5}
870	881	210	10	0.98	8.82×10^{-6}
880	891	235-245	8	2.80	2.21×10^{-5}
890	955	235-240	8	2.45	4.61×10^{-6}
900	955	240-245	8	2.45	5.31×10^{-6}
911	955	240-250	8	2.00	5.05×10^{-6}
922	955	240-250	8	2.03	6.51×10^{-6}
933	955	240-250	10	2.11	9.41×10^{-6}
944	955	235-250	8	2.30	1.85×10^{-5}

*Packers did not completely seal

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-4

Location Watana

Ground Surface Elevation 2187.8 ft.

Static Water Level 1687.8'

Dip of Hole 58°

Stick-up 0.0 ft.

Depth Tested From (feet)	To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
40	51	22	8	0.06	2.96×10^{-6}
50	61	26	6	0.9	3.60×10^{-5}
60	71	30-40	10	0.02	6.73×10^{-7}
70	81	35	6	0.09	3.03×10^{-6}
80	91	40	6	0.11	3.40×10^{-6}
90	101	43	5	0.06	1.77×10^{-6}
100	111	47	5	0.10	2.78×10^{-6}
110	121	52	6	0.10	2.59×10^{-6}
120	131	56	6	0.05	1.23×10^{-6}
130	141	60	5	0.23	5.37×10^{-6}
140	151	64	5	0.10	2.23×10^{-6}
150	161	69	5	0.05	1.05×10^{-6}
160	171	73	5	0.05	1.01×10^{-6}
170	181	77	5	0.06	1.16×10^{-6}
180	191	81	5	0.15	2.79×10^{-6}
190	201	86	5	0.16	2.83×10^{-6}
200	211	90	5	0.55	9.40×10^{-6}
210	221	94	5	0.65	1.07×10^{-5}
220	231	98	7	0.86	1.37×10^{-5}
230	241	102	5	4.5	6.94×10^{-5}
*240 to	260	No Test			
260	271	115	7	1.3	1.81×10^{-5}
270	281	119	5	1.7	2.31×10^{-5}
280	291	124	8	0.97	1.27×10^{-5}

*Packers did not completely seal

BH-4 (continued)

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
290	301	128	6	1.6	2.04×10^{-5}
300	311	132	6	1.8	2.23×10^{-5}
310	321	136	6	1.2	1.45×10^{-5}
320	331	140	8	0.21	2.48×10^{-6}
330	341	145	6	0.80	9.16×10^{-6}
340	351	150	6	0.92	1.02×10^{-5}
350	361	153	6	0.14	1.53×10^{-6}
360	371	158	6	0.08	8.49×10^{-7}
370	381	162	6	0.83	8.62×10^{-6}
380	391	165	6	0.68	6.95×10^{-6}
390	401	170	6	0.77	7.66×10^{-6}
400	411	175	6	0.32	3.10×10^{-6}
410	421	179	6	0.24	2.28×10^{-6}
420	431	183	7	0.18	1.68×10^{-6}
430	441	188	9	0.19	1.73×10^{-6}
440	451	192	6	0.18	1.61×10^{-6}
450	461	196	6	0.17	1.49×10^{-6}
460	471	200	6	0.21	1.81×10^{-6}
470	481	204	6	0.48	4.06×10^{-6}
480	491	209	6	1.1	9.10×10^{-6}
490	501	213	6	0.81	6.58×10^{-6}
500	511	217	4	0.70	5.59×10^{-6}
510	521	220	7	0.90	7.10×10^{-6}
520	531	225	6	1.0	7.73×10^{-6}
530	541	230	6	0.52	3.94×10^{-6}
540	551	234	6	0.83	6.19×10^{-6}
550	561	240	6	2.1	1.53×10^{-5}
560	571	245	6	0.80	5.72×10^{-6}
570	581	250	6	0.92	6.47×10^{-6}
580	591	250	6	0.55	3.87×10^{-6}
590	601	250	6	0.70	4.92×10^{-6}
600	611	250	6	0.75	5.27×10^{-6}

BH-4 (continued)

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
610	621	250	6	0.90	6.32×10^{-6}
620	631	250	6	0.73	5.13×10^{-6}
630	641	250	6	0.97	6.82×10^{-6}
640	651	250	6	1.1	7.73×10^{-6}
650	661	250	5	0.84	5.90×10^{-6}
660	671	250	5	1.4	9.86×10^{-6}
670	681	250	6	2.9	2.04×10^{-5}
680	691	250	6	1.4	9.84×10^{-6}
690	701	250	6	0.97	6.82×10^{-6}
700	711	250	6	0.83	5.83×10^{-6}
710	720	250	6	1.0	7.03×10^{-6}
720	731	250	6	0.95	6.68×10^{-6}
730	741	250	6	0.73	5.13×10^{-6}
740	751	250	5	0.80	6.62×10^{-6}
750	761	250	5	1.5	1.05×10^{-5}
760	771	250	5	0.90	6.32×10^{-6}
770	781	250	5	0.92	6.47×10^{-6}
780	791	250	5	0.92	6.47×10^{-6}
790	801	250	5	1.1	7.73×10^{-6}
800	811	250	5	0.82	5.76×10^{-6}
810	821	250	5	0.84	5.90×10^{-6}
820	831	250	5	0.70	4.92×10^{-6}
*830	841	250	5	3.8	2.67×10^{-5}
*840	851	250	5	2.6	1.83×10^{-5}
850	861	250	6	1.1	7.73×10^{-6}
860	871	250	5	1.1	7.73×10^{-6}
870	881	250	5	1.5	1.05×10^{-5}
880	891	250	5	1.5	1.05×10^{-5}
890	901	250	5	1.0	7.03×10^{-6}
900	911	250	5	1.0	7.03×10^{-6}
910	921	250	5	1.0	7.03×10^{-6}
920	931	250	5	0.92	6.47×10^{-6}
*930	941	250	5	2.4	1.69×10^{-5}
940	951	250	6	1.0	7.03×10^{-6}

*Packers did not completely seal

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-6
Location Watana
Ground Surface Elevation 1608.8 ft
Static Water Level 1461.8 ft.
Dip of Hole 60°
Stickup 2.5 - 5.5 ft.

Depth Tested From (feet)	Depth Tested To (feet)	Stick-up (feet)	Gauge Pressure (psi)	Duration of Test (min)	Average Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
33.9	50	2.5	16 to 18	10	11	4.59×10^{-4}
48.9	65	5.5	22 to 24	10	10.8	3.27×10^{-4}
63.9	80	2.5	28 to 30	10	6.4 to 8.0	1.5×10^{-4} to 1.98×10^{-4}
78.9	95	5.5	35 to 36	10	2.4	4.81×10^{-5}
43.9	110	2.5	41 to 44	10	2.2	3.80×10^{-5}
108.9	125	5.5	48 to 50	10	2.9	4.30×10^{-5}
123.9	140	2.5	54 to 58	10	4.4	5.84×10^{-5}
138.9	155	5.5	61 to 62	10	3.7	4.40×10^{-5}
153.9	170	2.5	66 to 68	10	4.3	4.72×10^{-5}
168.9	185	5.5	76 to 78	10	4.0	3.95×10^{-5}
183.9	200	2.5	82 to 88	10	1.3	1.23×10^{-5}
198.9	215	5.5	92 to 98	15	1.7	1.49×10^{-5}
213.9	230	2.5	98 to 104	10	1.4	1.19×10^{-5}
228.9	245	5.5	108	15	1.75	1.42×10^{-5}
243.9	260	2.5	114	25	1.0	7.91×10^{-6}
258.9	275	5.5	125	25	1.2	8.88×10^{-6}
273.9	290	2.5	125	45	1.2	8.94×10^{-6}
288.9	305	5.5	130	145	.51	3.90×10^{-6}
303.9	320	2.5	140	25	4.9	3.38×10^{-5}
318.9	335	5.5	140	10	6.2	4.25×10^{-5}

BH - 6 (continued)

Depth Tested From (feet)	Depth Tested To (feet)	Stick-up (feet)	Gauge Pressure (psi)	Duration of Test (min)	Average Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
333.9	350	2.5	200	10	10 to 30	5.34×10^{-5} to $1.60 \times 10^{-}$
348.9	365	5.5	200	50	.31 to 14.7	1.65×10^{-6} to 7.81×10^{-5}
363.9	380	2.5	204	10	15 to 30	7.89×10^{-5} to $1.58 \times 10^{-}$
378.9	395	5.5	202	10	15 to 30	7.91×10^{-5} to 1.58×10^{-4}
393.9	410	2.5	204	10	6.6	3.47×10^{-5}
408.9	425	5.5	202	10	3.75	1.98×10^{-5}
423.9	440	2.5	202	10	5.7	3.02×10^{-5}
438.9	455	5.5	200	15	11 to 30	5.85×10^{-5} to $1.59 \times 10^{-}$
453.9	470	2.5	200	10	11 to 30	5.88×10^{-5} to 1.60×10^{-4}
468.9	485	5.5	202	15	11 to 30	5.80×10^{-5} to $1.58 \times 10^{-}$
483.9	500	2.5	200	10	11 to 30	5.88×10^{-5} to 1.60×10^{-4}
498.9	515	5.5	202	15	7.8	4.12×10^{-5}
513.9	530	2.5	204	15	7.5	3.95×10^{-5}
528.9	545	5.5	195	15	5.2	2.82×10^{-5}
243.9	560	2.5	205	10	3.8	1.99×10^{-5}
558.9	575	5.5	200	15	1.45	7.71×10^{-6}
573.9	590	2.5	195	10	5.2	2.83×10^{-5}
588.9	605	5.5	200	15	8.6	4.57×10^{-5}
603.9	520	2.5	205	10	2.95	1.55×10^{-5}
618.9	635	5.5	203	10	3.35	1.76×10^{-5}
633.9	650	2.5	198	20	.55	2.96×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-8

Location Watana

Ground Surface Elevation 1979.7 ft.

Static Water Level 1804.7

Dip of Hole 60°

Stickup 1.2 to 6.2 ft.

Depth Tested From (feet)	To (feet)	Stick-up (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
31.9	48	1.2	20	13	4.55	1.81×10^{-4}
46.9	63	6.2	25	20	2.1	6.15×10^{-5}
61.9	78	1.2	31	5	.34	8.33×10^{-6}
76.9	93	6.2	38	10	4.0	7.80×10^{-5}
91.9	108	1.2	45	15	6.2	1.06×10^{-4}
106.9	123	6.2	51	20	3.2	4.67×10^{-5}
121.9	138	1.2	57	10	0.8	1.06×10^{-5}
136.9	153	6.2	64	5	3.2	3.74×10^{-5}
151.9	168	1.2	70	9	6.6	7.15×10^{-5}
166.9	183	6.2	77	10	3.0	2.92×10^{-5}
181.9	198	1.2	84	10	0.38	3.45×10^{-6}
196.9	213	6.2	90	10	1.2	1.01×10^{-5}
211.9	228	1.2	97	8	2.15	1.75×10^{-5}
226.9	243	6.2	104	8	3.7	2.87×10^{-5}
241.9	258	1.2	110	6	10.3	7.82×10^{-5}
256.9	273	6.2	116	5	7.5	5.45×10^{-5}
271.9	288	1.2	50	6	7.0	7.84×10^{-5}
286.9	305	6.2	50	7	3.85	4.24×10^{-5}
301.9	318	1.2	50	6	2.95	3.30×10^{-5}
316.9	333	6.2	142	5	7.8	5.00×10^{-5}
331.9	348	1.2	149	5	7.3	4.58×10^{-5}

BH-8 (Continued)

Depth Tested From (feet)	Depth Tested To (feet)	Stick-up (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
346.1	363	6.2	155	6	2.45	1.48×10^{-5}
361.9	378	1.2	162	5	2.75	1.63×10^{-5}
376.9	393	6.2	150	35	12.7	7.86×10^{-5}
391.9	428	1.2	110	40	10.9	8.27×10^{-5}
406.9	423	6.2	50	5	1.7	1.87×10^{-5}
421.9	438	1.2	188	6	.4	2.14×10^{-6}
436.9	453	6.2	195	5	2.4	1.24×10^{-6}
451.9	468	1.2	200	8	.36	1.84×10^{-6}
466.9	483	6.2	200	6	.54	2.74×10^{-6}
481.9	498	1.2	200	7	.54	2.76×10^{-6}
496.9	513	6.2	200	7	.60	3.05×10^{-6}
511.9	528	1.2	200	5	.55	2.81×10^{-6}
526.9	543	6.2	200	5	.96	4.87×10^{-6}
541.9	558	1.2	200	6	.85	4.35×10^{-6}
556.9	573	6.2	200	6	2.76	3.86×10^{-6}
571.9	588	1.2	200	7	2.05	1.05×10^{-5}
586.9	603	6.2	200	6	.85	4.32×10^{-6}
601.9	618	1.2	200	7	2.8	1.43×10^{-5}
616.9	633	6.2	200	6	.75	3.81×10^{-6}
631.9	648	1.2	200	6	.82	4.20×10^{-6}
646.9	663	6.2	225	8	1.60	7.46×10^{-6}
661.9	708	1.2	200	6	.80	4.09×10^{-6}
676.9	723	6.2	200	7	1.1	5.59×10^{-6}
691.9	738	1.2	200	6	1.08	5.53×10^{-6}
706.9		6.2	200	6	1.2	6.09×10^{-6}
721.9		1.2	200	12	1.0	5.12×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-12
Location Watana
Ground Surface Elevation 1975.7 ft.
Static Water Level 1975.7 ft.
Dip of Hole 36^{o}
Stickup 7.1 ft.

Depth Tested From (feet)	To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
30.0	41.0	10	10	3.10	4.52×10^{-4}
30.0	41.0	8-10	10	3.00	4.73×10^{-4}
40.0	51.0	14	10	6.35	7.08×10^{-4}
50.0	61.0	15	6	2.91	3.07×10^{-4}
60.0	71.0	20	8	0.07	5.78×10^{-6}
70.0	81.0	22	10	0.036	2.73×10^{-6}
80.0	91.0	27	10	0.18	1.14×10^{-5}
90.0	101.0	30	8	0.45	2.59×10^{-5}
* 100.0	111.0	30	3	0.82	4.72×10^{-5}
* 105.0	116.0	30	4	0.99	5.70×10^{-5}
110.0	121.0	35	10	0.30	1.50×10^{-5}
120.0	131.0	38-40	10	0.32	1.42×10^{-5}
130.0	141.0	42	10	0.53	2.24×10^{-5}
140.0	151.0	44	12	0.19	7.70×10^{-6}
150.0	161.0	48-49	12	0.60	2.22×10^{-5}
160.0	171.0	51	6	0.17	6.00×10^{-6}
170.0	181.0	54	6	0.05	1.67×10^{-6}
180.0	191.0	58	6	0.02	6.29×10^{-7}
190.0	201.0	60	6	0.10	3.02×10^{-6}
200.0	211.0	65-66	6	0.39	1.08×10^{-5}
210.0	221.0	70-71	10	1.67	4.30×10^{-5}
220.0	231.0	71	6	0.30	7.72×10^{-6}
* 230.0	241.0	No Test			

* Packers did not completely seal

BH - 12 (continued)

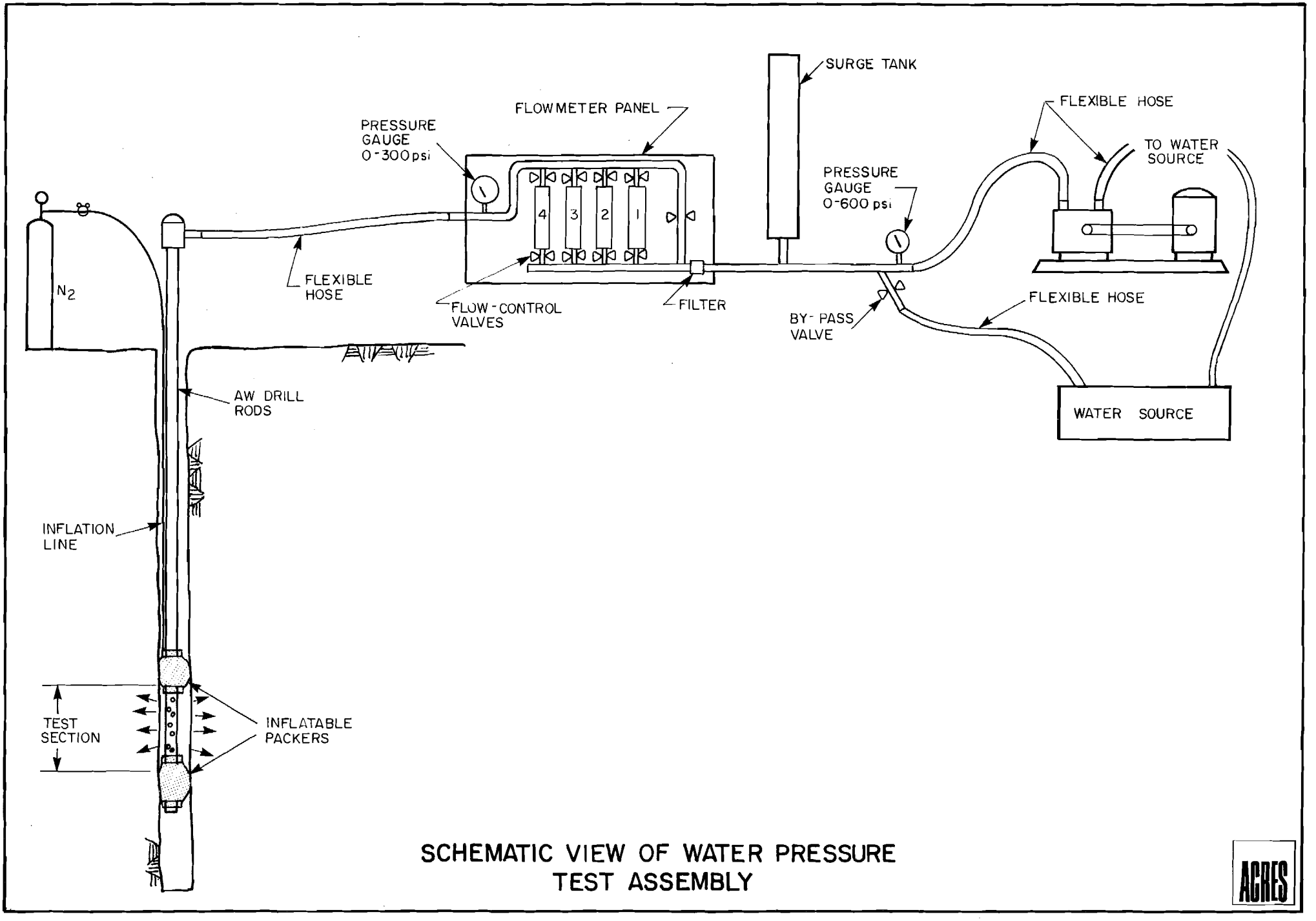
Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
235.0	246.0	73-74	6	0.21	5.27×10^{-6}
240.0	251.0	77	6	0.18	4.29×10^{-6}
250.0	261.0	80-82	6	2.54	5.76×10^{-5}
* 260.0	271.0	84-85	11	0.70	1.52×10^{-5}
270.0	281.0	88-92	8	2.45	5.02×10^{-5}
275.0	286.0	86-90	11	2.12	4.40×10^{-5}
* 286.0	289.0	No Test			
289.0	300.0	91-92	11	2.02	4.07×10^{-5}
299.0	310.0	92-98	10	1.00	1.94×10^{-5}
309.0	320.0	98-103	12	0.90	1.64×10^{-5}
* 310.0	321.0	98-99			
310.0	321.0	98-99	10	0.89	1.67×10^{-5}
* 321.0	324.0	No Test			
324.0	335.0	104-108	10	4.75	8.62×10^{-5}
329.0	350.0	No Test			
349.0	360.0	110	6	0.56	9.45×10^{-6}
359.0	370.0	114-116	8	1.05	1.70×10^{-5}
369.0	380.0	117-119	10	0.76	1.20×10^{-5}
380.0	391.0	120-122	10	0.79	1.21×10^{-5}
390.0	401.0	126-128	8	1.48	2.17×10^{-5}
400.0	411.0	128-132	10	1.77	2.54×10^{-5}
410.0	421.0	132-134	10	0.66	9.25×10^{-6}
420.0	431.0	134-136	8	0.84	1.16×10^{-5}
430.0	441.0	136-140	10	0.74	1.00×10^{-5}
440.0	451.0	140	10	0.89	1.19×10^{-5}
450.0	461.0	144	8	0.91	1.18×10^{-5}
460.0	700.0	Hole Caving, Redrilled and Tested From Bottom Up			
700.0	711.0	222-226	10	0.75	6.30×10^{-6}
710.0	721.0	226-228	6	0.75	6.22×10^{-6}
720.0	731.0	232-236	8	0.81	6.52×10^{-6}
730.0	741.0	230-234	6	0.80	6.49×10^{-6}
740.0	751.0	234	8	0.77	6.20×10^{-6}
750.0	761.0	238-244	8	1.59	1.24×10^{-5}

*Packers did not completely seal.

BH - 12 (continued)

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
760.0	771.0	240-246	10	1.27	9.84×10^{-6}
770.0	781.0	242-250	14	2.25	1.72×10^{-5}
780.0	791.0	250-256	10	2.10	1.56×10^{-5}

APPENDIX E
DEVIL CANYON WATER PRESSURE TESTING DETAILS



SCHEMATIC VIEW OF WATER PRESSURE TEST ASSEMBLY

ACRES

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-1

Location Devil Canyon

Ground Surface Elevation 1413.7 ft.

Static Water Level 1221.7 ft.

Dip of Hole 67°

Stickup 3 to 8 ft.

Depth Tested From (feet)	Depth Tested To (feet)	Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
38.9	55	8	20	11	.72	2.34×10^{-5}
53.9	70	3	30	10	4.06	1.03×10^{-4}
68.9	85	8	40	10	6.18	1.18×10^{-4}
83.9	100	3	45	10	.78	1.33×10^{-5}
98.9	115	8	55	10	5.17	7.23×10^{-5}
113.9	130	3	60	46	.90 to 5.40	1.16×10^{-5} to 6.95×10^{-5}
128.9	145	8	70	21	.77	8.50×10^{-6}
143.9	160	3	75	14	.83	8.57×10^{-6}
158.9	175	8	85	11	1.05	9.58×10^{-6}
173.9	190	3	90	10	.06	5.18×10^{-7}
188.9	205	8	100	10	2.16	1.68×10^{-5}
203.9	220	3	105	10	2.19	1.63×10^{-5}
218.9	285	8	115	10	0.84	5.89×10^{-6}
233.9	250	3	120	10	2.70	1.87×10^{-5}
248.9	265	8	130	10	5.37	3.50×10^{-5}
263.9	280	3	135	10	.25	1.61×10^{-6}
278.9	295	8	145	10	3.63	2.22×10^{-5}
292.9	310	3	150	10	2.05	1.24×10^{-5}
308.9	325	8	160	10	1.24	7.11×10^{-6}
323.9	390	3	165	10	.42	2.38×10^{-6}
338.9	355	8	170	10	1.48	8.15×10^{-6}
252.9	370	3	180	10	1.61	8.61×10^{-6}
368.9	385	8	190	10	2.15	1.10×10^{-5}
383.9	400	3	195	10	.26	1.32×10^{-6}

BH-1 (Continued)

Depth Tested From (feet)	Depth Tested To (feet)	Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
398.9	415	8	200	10	.40	1.97×10^{-6}
413.9	430	3	200	10	1.98	9.84×10^{-6}
428.9	445	8	200	10	.29	1.43×10^{-6}
443.9	460	3	200	10	1.15	5.72×10^{-6}
458.9	475	8	200	10	5.08	2.50×10^{-5}
473.9	490	3	200	10	7.21	3.58×10^{-5}
488.9	505	8	200	10	2.34	1.15×10^{-5}
503.9	420	3	200	10	1.48	7.35×10^{-6}
518.9	535	8	200	10	4.2	2.07×10^{-5}
533.9	550	3	200	10	.39	1.94×10^{-6}
548.9	565	8	200	10	4.51	2.22×10^{-5}
563.9	580	3	200	10	3.72	1.85×10^{-5}
578.9	595	8	200	10	3.9	1.92×10^{-5}
593.9	610	3	200	10	9.7	4.82×10^{-5}
608.9	625	8	150	13	2.58	1.54×10^{-5}
622.9	639	3	130	18	1.20	7.91×10^{-6}
638.9	655	8	130	11	1.63	4.11×10^{-6}
653.9	670	3	200	10	7.4	3.68×10^{-5}
668.9	685	8	130	11	1.03	6.72×10^{-6}
683.9	700	3	150	25	.45	2.71×10^{-6}
698.9	715	8	150	19	.69	4.12×10^{-6}
713.9	730	3	150	13	.23	1.39×10^{-6}
728.9	745	8	150	14	.78	4.66×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-2

Location Devil Canyon

Ground Surface Elevation 1213.4 ft.

Static Water Level 1208.4 ft.

Dip of Hole 60°

Stickup 2 to 7 ft.

Depth Tested From (feet)	Depth Tested To (feet)	Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
13.9	30	7	12	10	.72	5.92×10^{-5}
28.9	45	2	18	10	1.1	7.39×10^{-5}
43.9	60	7	22	10	4.0	2.08×10^{-4}
58.9	75	2	25	10	1.16	5.85×10^{-5}
73.9	90	7	35	10	.15	5.27×10^{-6}
88.9	105	2	42	12	.67	2.10×10^{-5}
103.9	120	7	50	10	.31	7.94×10^{-6}
118.9	135	2	65	10	.25	6.09×10^{-6}
133.9	150	7	70	10	2.92	5.88×10^{-5}
148.9	165	2	82	10	1.27	2.46×10^{-5}
163.9	180	7	85	10	.35	5.67×10^{-6}
178.9	195	2	100	10	.15	2.41×10^{-6}
193.9	210	7	105	10	.49	6.58×10^{-6}
208.9	225	2	110	10	.46	6.02×10^{-6}
223.9	240	7	115	10	.37	4.54×10^{-6}
238.9	255	2	125	10	.08	9.58×10^{-7}
253.9	270	7	130	10	.21	2.28×10^{-6}
268.9	285	2	100	32	.68 to 3.1	7.22×10^{-6} to 3.29×10^{-5}
283.9	300	7	145	10	.99	1.33×10^{-5}
298.9	315	2	155	10	.21	2.01×10^{-6}
313.9	330	7	160	10	.25	2.21×10^{-6}
328.9	345	2	170	10	.36	3.12×10^{-6}
343.9	360	7	175	10	.26	2.10×10^{-6}
358.9	375	2	185	10	.71	5.64×10^{-6}
373.9	390	7	190	10	.60	4.46×10^{-6}

BH-2 (Continued)

Depth Tested						
From (feet)	To (feet)	Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
388.9	405	2	190	10	.38	2.78×10^{-6}
403.9	420	7	200	10	.62	4.27×10^{-6}
418.9	435	2	200	10	.36	2.51×10^{-6}
433.9	450	7	200	10	.61	4.20×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-3
Location Devil Canyon
Ground Surface Elevation 1398.0 ft.
Static Water Level dry hole
Dip of Hole 32°
Stickup 7.1 ft.

Depth Tested From (Feet)	Depth Tested To (Feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
20.0	31.0	18	10	1.35	9.5×10^{-5}
30.0	41.0	22	8	0.71	4.1×10^{-5}
40.0	51.0	12	8	0.36	2.7×10^{-5}
50.0	61.0	16-22	8	4.4	2.6×10^{-4}
60.0	71.0	22	8	0.72	3.4×10^{-5}
70.0	81.0	20-22	12	0.71	3.3×10^{-5}
80.0	91.0	25	10	0.98	3.9×10^{-5}
90.0	101.0	28-29	8	0.32	1.1×10^{-5}
100.0	111.0	30	12	0.28	9.3×10^{-6}
110.0	121.0	30	2	11.0	3.5×10^{-4}
120.0	131.0	35	8	2.4	6.8×10^{-5}
130.0	141.0	38	8	1.1	2.9×10^{-5}
140.0	151.0	41-46	6	11.0	2.6×10^{-4}
150.0	161.0	45-46	6	3.4	7.7×10^{-5}
160.0	171.0	46	2	11.0	2.4×10^{-4}
170.0	181.0	48	6	2.45	5.1×10^{-5}
180.0	191.0	52	10	5.6	1.1×10^{-4}
190.0	201.0	54	12	4.6	8.6×10^{-5}
200.0	211.0	60	20	2.2	3.8×10^{-5}
210.0	221.0	60	4	11.0	1.9×10^{-4}
220.0	231.0	64	10	0.80	1.3×10^{-5}
230.0	241.0	65	20	2.3	3.6×10^{-5}
240.0	251.0	68-77	14	0.58	8.4×10^{-6}
250.0	261.1	72-74	4	11.0	1.6×10^{-4}

BH-3 (Continued)

Depth Tested From (Feet)	Depth Tested To (Feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
260.0	271.0	72-75	8	5.6	7.8×10^{-5}
270.0	281.1	77	6	11.0	1.5×10^{-4}
280.0	291.1	79-80	6	5.3	6.8×10^{-5}
290.0	301.1	83	8	8.9	1.1×10^{-4}
300.0	311.1	86	8	5.7	6.8×10^{-5}
310.0	321.1	88-90	7	1.1	1.3×10^{-5}
320.0	331.1	80-91	8	8.7	1.0×10^{-4}
330.0*	341.1	92-94	7	11.0	1.2×10^{-4}
340.0*	351.1	96-97	6	11.0	1.2×10^{-4}
350.0*	361.1	100	6	11.0	1.1×10^{-4}
360.0	371.1	100-102	8	8.2	8.3×10^{-5}
370.0*	381.1	105	8	11.0	1.1×10^{-4}
380.0*	390.7	108	9	11.0	1.1×10^{-4}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-4

Location Devil Canyon

Ground Surface Elevation 1352.6 ft

Static Water Level 1321.6 ft

Dip of Hole 60^{o}

Stickup 1 to 6 ft

Depth Tested From (feet)	Depth Tested To (feet)	Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
13.9	30	1	10	10	.046	3.48×10^{-6}
28.9	45	6	15	10	.252	1.15×10^{-6}
43.9	60	1	20	10	.247	1.03×10^{-5}
58.9	75	6	24	10	.039	1.38×10^{-6}
78.9	90	1	34	12	3.21	9.48×10^{-5}
88.9	105		UNABLE TO SEAT PACKERS			
108.9	125	14	50	10	.26	5.29×10^{-6}
118.9	135	6	55	10	3.75	7.46×10^{-5}
123.9	140	1	56	10	4.24	8.58×10^{-5}
138.9	155		UNABLE TO SEAT PACKERS			
148.9	165	6	70	10	.052	8.54×10^{-7}
153.9	170	1	50	10	1.042	2.31×10^{-5}
163.9	180	1	80	10	.622	9.37×10^{-6}
178.9	195	6	85	10	.041	5.74×10^{-7}
193.9	210	1	95	10	.034	4.41×10^{-7}
208.9	225	6	100	10	.02	2.44×10^{-7}
223.9	240	1	105	10	.029	3.45×10^{-7}
238.9	255	6	115	10	.048	5.18×10^{-7}
253.9	270	1	125	10	.034	3.46×10^{-7}
208.9	205	6	130	10	.036	3.48×10^{-7}
283.9	300	1	140	10	.028	2.57×10^{-7}
298.9	315	6	145	10	.105	9.22×10^{-7}
313.9	330	1	150	10	.033	2.85×10^{-7}
328.9	345	6	160	12	.423	3.40×10^{-6}

BH-4 (Continued)

Depth Tested From (feet)	Depth Tested To (feet)	Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
343.9	360	1	170	10	.208	1.60×10^{-6}
358.9	375	6	175	10	.113	8.36×10^{-7}
373.9	390	1	185	10	.92	6.54×10^{-6}
388.9	405	6	190	9	.09	6.17×10^{-7}
403.9	420	1	200	10	.151	9.98×10^{-7}
418.9	435	6	200	10	.121	7.92×10^{-7}
433.9	450	1	200	10	.119	7.87×10^{-7}
448.9	465	6	200	10	.099	6.48×10^{-7}
458.9	475	1	200	10	.103	6.81×10^{-7}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-5a
Location Devil Canyon
Ground Surface Elevation 974.5 feet
Static Water Level 935.6 feet
Dip of Hole 45^{o}
Stickup 4.0 feet

Depth Tested From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (minutes)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
63.0	74.0	30	6	0.89	3.5×10^{-5}
73.0	84.0	30	6	0.93	3.6×10^{-5}
83.0	94.0	33	6	0.71	2.6×10^{-5}
93.0	104.0	36	6	1.0	3.5×10^{-5}
103.0	114	40	8	2.5	8.2×10^{-5}
114.0	115.9	No Test			
115.9	126.9	40	16	3.4	1.1×10^{-4}
126.9	135.6	No Test			
135.6	146.6	55	8	0.76	2.0×10^{-5}
143.0*	154.0	55	4	9.4	2.4×10^{-4}
153.0	164.0	60	2	0.01	2.4×10^{-7}
163.0*	174.0	60	6	9.2	2.2×10^{-4}
173.0	184.0	65	10	5.1	1.2×10^{-4}
183.0	194.0	70	4	0.06	1.3×10^{-6}
193.0	204.0	70	4	0.09	1.9×10^{-6}
203.0	214.0	75	6	0.04	8.2×10^{-7}
213.0	224.0	80	4	0.10	1.9×10^{-6}
223.0	234.0	85	8	0.14	2.6×10^{-6}
233.0	244.0	85	8	0.16	2.9×10^{-6}
243.0	254.0	90	6	0.10	1.8×10^{-6}

*Packers did not completely seal

BH-5a (Continued)

Depth Tested From (feet)	To (feet)	Gauge Pressure (psi)	Duration of Test (minutes)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
253.0	264.0	95	6	0.14	2.4×10^{-6}
263.0	274.0	95	6	0.13	2.2×10^{-6}
273.0	284.0	100	6	0.58	9.3×10^{-6}
283.0	294.0	105	12	1.0	1.5×10^{-5}
293.0	304.0	110	12	1.1	1.6×10^{-5}
303.0	314.0	110	18	1.7	2.5×10^{-5}
313.0	324.0	115	8	1.4	2.0×10^{-5}
323.0	334.0	118-120	8	0.13	1.8×10^{-6}
333.0	344.0	124	8	0.07	9.4×10^{-7}
343.0	354.0	124	8	0.58	7.8×10^{-6}
353.0	364.0	132	8	0.21	2.7×10^{-6}
363.0	374.0	132	8	0.87	1.1×10^{-5}
373.0	384.0	134	8	0.40	5.0×10^{-6}
383.0	394.0	139	8	0.22	2.7×10^{-6}
393.0	404.0	144	8	0.45	5.3×10^{-6}
403.0	414.0	145	8	0.33	3.8×10^{-6}
413.0	424.0	148	8	0.30	3.4×10^{-6}
423.0	434.0	150	8	0.35	4.0×10^{-6}
433.0	444.0	155	8	1.7	1.9×10^{-5}
443.0	454.0	162	8	2.1	2.2×10^{-5}
453.0	464.0	164	7	0.29	3.0×10^{-6}
463.0	474.0	171	8	2.6	2.6×10^{-5}
473.0	484.0	170	6	5.9	6.0×10^{-5}
484.0	503.0	No Test			
503.0	514.0	180	10	0.82	7.9×10^{-6}
513.0	524.0	185	6	0.93	8.7×10^{-6}
523.0	534.0	190	8	3.7	3.4×10^{-5}
533.0	544.0	190	6	3.3	3.0×10^{-5}
543.0	554.0	195	6	5.4	4.8×10^{-5}
553.0	564.0	200	4	0.38	3.3×10^{-6}
563.0	574.0	200	6	0.66	5.8×10^{-6}
573.0	584.0	205	8	0.47	4.0×10^{-6}
581.7	592.7	210	6	0.43	3.6×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-5b
Location Devil Canyon
Ground Surface Elevation 976.6 ft
Static Water Level 946.2 ft
Dip of Hole 45°
Stickup 2.2 - 4.0 feet

Depth Tested From (feet)	Depth Tested To (feet)	Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
23.0	34.0	4.4	21	7	0.51	3.1×10^{-5}
33.0	44.0	4.0	25	6	1.4	6.9×10^{-5}
43.0	54.0	4.0	28	6	11.0	4.9×10^{-4}
54.0	63.0		No Test			
63.0	74.0	4.0	32	6	0.06	2.4×10^{-6}
68.3	79.3	2.2	30	8	0.33	1.4×10^{-5}
79.3	116.0		No Test			
116.0	127.0	2.2	46	6	0.68	2.2×10^{-5}
126.0	137.0	2.2	52	6	0.10	2.9×10^{-5}
136.0	147.0	2.2	55	8	0.47	1.3×10^{-5}
146.0	157.0	2.2	58	6	0.71	1.9×10^{-5}
156.0	167.0	2.2	60	6	0.67	1.7×10^{-5}
166.0	177.0	2.2	65	8	1.7	4.1×10^{-5}
176.0	187.0	2.2	70	6	0.64	1.5×10^{-5}
186.0	197.0	2.2	70-72	8	0.18	4.0×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-7
Location Devil Canyon
Ground Surface Elevation 1351.0 ft
Static Water Level 1338.3 ft.
Dip of Hole 45°
Stickup As Noted

Depth Tested From (Feet)	Depth Tested To (Feet)	Stickup (Feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
30.0	47.0	6.1	20	8	5.2	2.6×10^{-4}
35.9	52.0	1.1	20	6	0.19	1.0×10^{-5}
50.9	67.0	6.1	20	6	0.38	1.9×10^{-5}
65.9	82.0	1.1	25	6	3.2	1.4×10^{-4}
80.9	97.0	6.1	30	14	3.6	1.3×10^{-4}
95.9	112.0	1.1	35	11	3.0	1.0×10^{-4}
110.9	127.0	61.	40	8	1.9	5.6×10^{-5}
125.9	142.0	1.1	45	22	0.89	2.5×10^{-5}
138.9	155.0	7.0	48	20	0.04	1.1×10^{-6}
148.9	165.0	3.1	50	10	0.02	5.0×10^{-7}
163.9	180.0	3.1	55	10	0.03	6.9×10^{-7}
178.9	195.0	8.1	60	10	0.03	6.1×10^{-7}
188.9	205.0	8.1	60	12	0.22	4.5×10^{-6}
205.0	233.0		No Test			
233.9	253.1	3.1	80	9	0.38	6.2×10^{-6}
248.1	265.0	8.1	80	10	0.26	4.1×10^{-6}
263.9	280.0	3.1	85	6	0.22	3.4×10^{-6}
278.9	295.0	8.1	90	7	0.11	1.6×10^{-6}
293.9	310.0	3.1	95	10	0.07	9.7×10^{-6}
308.9	325.0	8.1	102	10	1.1	1.4×10^{-6}
323.9	340.0	3.1	105	10	0.43	5.4×10^{-6}
338.9	355.0	8.1	110	8	0.44	5.2×10^{-6}
353.9	370.0	3.1	115	10	0.61	7.1×10^{-6}

BH-7 (Continued)

Depth Tested From (feet)	Depth Tested To (feet)	Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
368.9	385.0	8.1	120	10	0.78	8.5×10^{-6}
383.9	400.0	3.1	124	9	0.90	9.7×10^{-6}
398.9	415.0	8.1	128	10	0.58	6.0×10^{-6}
413.9	430.0	3.1	135	10	0.65	6.5×10^{-6}
428.9	445.0	8.1	140	10	0.56	5.3×10^{-6}
443.9	460.0	3.1	145	10	0.67	6.2×10^{-6}
458.9	475.0	8.1	150	10	0.63	5.6×10^{-6}
473.9	490.0	3.1	155	10	0.62	5.4×10^{-6}
478.2	494.3	8.1	158	12	0.70	5.9×10^{-6}

APPENDIX F
WATANA BORROW AREA INVESTIGATION

EXPLANATION OF SELECTED SYMBOLS

STANDARD SYMBOLS

ORGANIC MATERIAL	COBBLES & BOULDERS	IGNEOUS ROCK	SANDY SILT
CLAY	CONGLOMERATE	METAMORPHIC ROCK	SILT GRADING TO SANDY SILT
SILT	SANDSTONE	ICE, MASSIVE	SANDY GRAVEL, SCATTERED COBBLES (ROCK FRAGMENTS)
SAND	MUDSTONE	ICE - SILT	INTERLAYERED SAND & SANDY GRAVEL
GRAVEL	LIMESTONE	ORGANIC SILT	SILTY CLAY w/TR. SAND

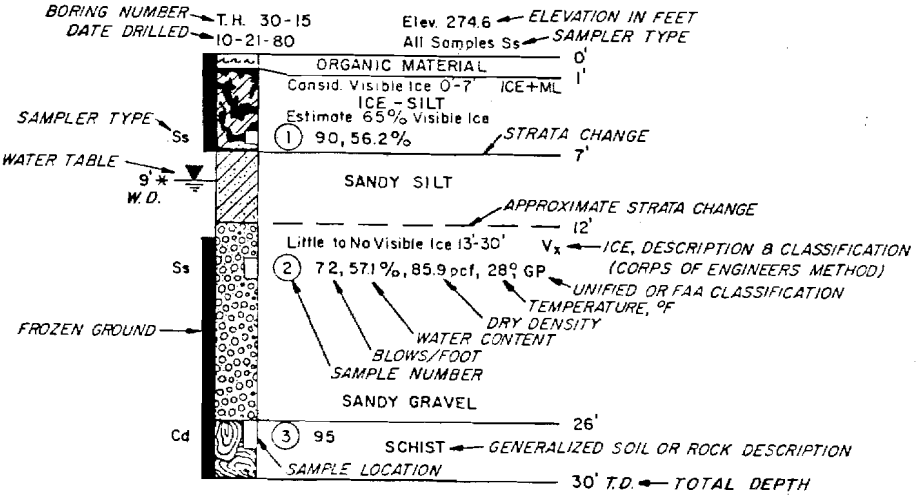
SAMPLER TYPE SYMBOLS

St . . . . . 1.4" SPLIT SPOON WITH 47 # HAMMER
Ss . . . . . 1.4" SPLIT SPOON WITH 140 # HAMMER
Sl . . . . . 2.5" SPLIT SPOON WITH 140 # HAMMER
Sh . . . . . 2.5" SPLIT SPOON WITH 340# HAMMER
Sx . . . . . 2.0" SPLIT SPOON WITH 140 # HAMMER
Sz . . . . . 1.4" SPLIT SPOON WITH 340# HAMMER
Sp . . . . . 2.5" SPLIT SPOON, PUSHED
Hs . . . . . 1.4" SPLIT SPOON DRIVEN WITH AIR HAMMER
Hl . . . . . 2.5" SPLIT SPOON DRIVEN WITH AIR HAMMER

Ts . . . . SHELBY TUBE
Tm . . . . MODIFIED SHELBY TUBE
Pb . . . . PITCHER BARREL
Cs . . . . CORE BARREL WITH SINGLE TUBE
Cd . . . . CORE BARREL WITH DOUBLE TUBE
Bs . . . . BULK SAMPLE
A. . . . . AUGER SAMPLE
G. . . . . GRAB SAMPLE

NOTE: SAMPLER TYPES ARE EITHER NOTED ABOVE THE BORING LOG OR ADJACENT TO IT AT THE RESPECTIVE SAMPLE DEPTH.

TYPICAL BORING LOG



DRILLING SYMBOLS

WD:	While Drilling	AB:	After Boring
WL:	Water Level	TD:	Total Depth
WS:	While Sampling		

Note: Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious unfrozen soils, the indicated elevations are considered to represent actual ground water conditions. In impervious and frozen soils, accurate determinations of ground water elevations cannot be obtained within a limited period of observation and other evidence on ground water elevations and conditions are required.

PREPARED BY: R&M CONSULTANTS, INC.

EXPLANATION OF SELECTED SYMBOLS

PREPARED FOR: ACRES

SOILS
CLASSIFICATION AND CONSISTENCY

CLASSIFICATION: Identification and classification of the soil is accomplished in accordance with the Unified Soil Classification System. Normally, the grain size distirbution determines classification of the soil. The soil is defined according to major and minor constituents with the minor elements serving as modifiers of the major elements. Minor soil constitutents may be added to the classification breakdown in accordance with the particle size proportions listed below; (i.e., sandy silt with some gravel, trace clay).

no call - 0-3% trace - 3-12% some - 13-30% sandy, silty, gravelly - >30%

Identification and classification of soil strata which have a significant cobble and boulder content is based on the unified classification of the minus 3 inch fraction augmented by a description (i.e., cobbles and boulders) of the plus 3 inch fraction. Where a gradation curve, which includes the plus 3 inch fraction, exists (samples from test trenches and pits) a modifier is used to describe independently the percentage of each of the two plus 3 inch components. If there is no gradation curve incorporating the plus 3-inch fraction (as in auger holes), the plus 3-inch material is described as a single component (i.e., cobbles and boulders), and a modifier is used to indicate the relative percentage of the plus 3-inch fraction based on the field logs. The modifiers in each case are used as follows:

Scattered - 0-40% Numerous - >40%

SOIL CONSISTENCY - CRITERIA: Soil consistency as defined below and determined by normal field and laboratory methods applies only to non-frozen material. For these materials, the influence of such factors as soil structure, i.e. fissure systems, shrinkage cracks, slickensides, etc., must be taken into consideration in making any correlation with the consistency values listed below. In permafrost zones, the consistency and strength of frozen soils may vary significantly and unexplainably with ice content, thermal regime and soil type.

Cohesionless Soils			Cohesive Soils		
	N* (blows/ft)	Relative Density		N* (blows/ft)	qu - (tsf)
Very Loose	0 - 4	20%	Very Soft	0 - 2	0 - 0.25
Loose	4 - 10	20 to 40%	Soft	2 - 4	0.25 - 0.5
Medium Dense	10 - 30	40 to 60%	Medium	4 - 8	0.5 - 1.0
Dense	30 - 50	60 to 80%	Stiff	8 - 15	1.0 - 2.0
Very Dense	>50	>80%	Very Stiff	15 - 30	2.0 - 4.0
			Hard	>30	>4.0

* Standard Penetration "N": Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch OD split-spoon except where noted.

Often the split-spoon samplers do not reach the total intended sample depth. Where this occurs the graphic log notes a refusal (Ref.) and give an indication of the cause of the refusal. Tight soils are indicated by a blow count value followed by a penetration length in inches. The presense of large rock fragments is indicated by a cobble and boulder callout following the refusal callout. In certain instances a blow count of 100+ may be listed to indicate tight soils where total sampler penetration is possible with more than 100 blows per foot.

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PREPARED FOR: ACRES

EXPLANATION OF ICE SYMBOLS

Percentage of visible ice has been grouped for the purpose of designating the amount of soil ice content. These groups have arbitrarily been set out as follows:

0%	No Visible Ice
1% - 10%	Little Visible Ice
11% - 20%	Occasional Visible Ice
21% - 35%	Some Visible Ice
>35%	Considerable Visible Ice

The ice description system is based on that presented by K. A. Linell, and C. W. Kaplar (1966). In this system, which is an extension of the Unified Soil Classification System, the amount and physical characteristics of the soil ice are accounted for. The following table is a brief summary of the salient points of their classification system as modified to meet the needs of this study.

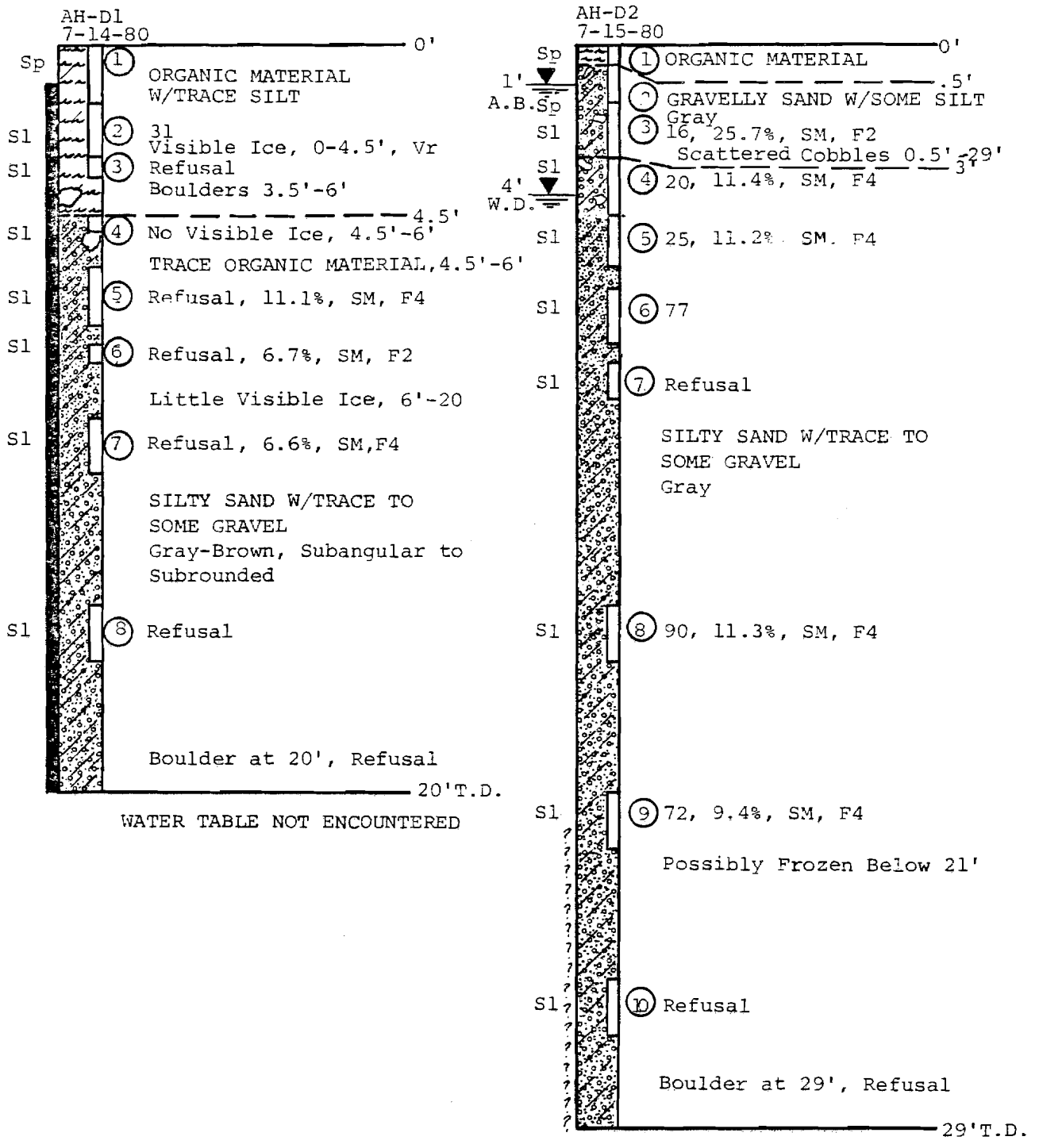
ICE DESCRIPTIONS

GROUP SYMBOL	ICE VISIBILITY & CONTENT	SUBGROUP	
		DESCRIPTION	SYMBOL
N	Ice not visible	Poorly bonded or friable	N_f
		Well bonded — No excess ice	N_b — N_{bn}
		Well bonded — Excess ice	N_b — N_{be}
V	Ice visible, <50%	Individual ice crystals or inclusions	V_x
		Ice coatings on particles	V_c
		Random or irregularly oriented ice formations	V_r
		Stratified or distinctly oriented ice formations	V_s
ICE	Ice visible, >50%	Ice with soil inclusions	ICE + soil type
	Individual layer >6" thick *	Ice without soil inclusions	ICE

* In some cases where the soil is ice poor a thin ice layer may be called out by special notation on the log, i.e. 2" ice lens at 7'

F.1 BORROW SITE D

AUGER HOLE LOGS



PREPARED BY:

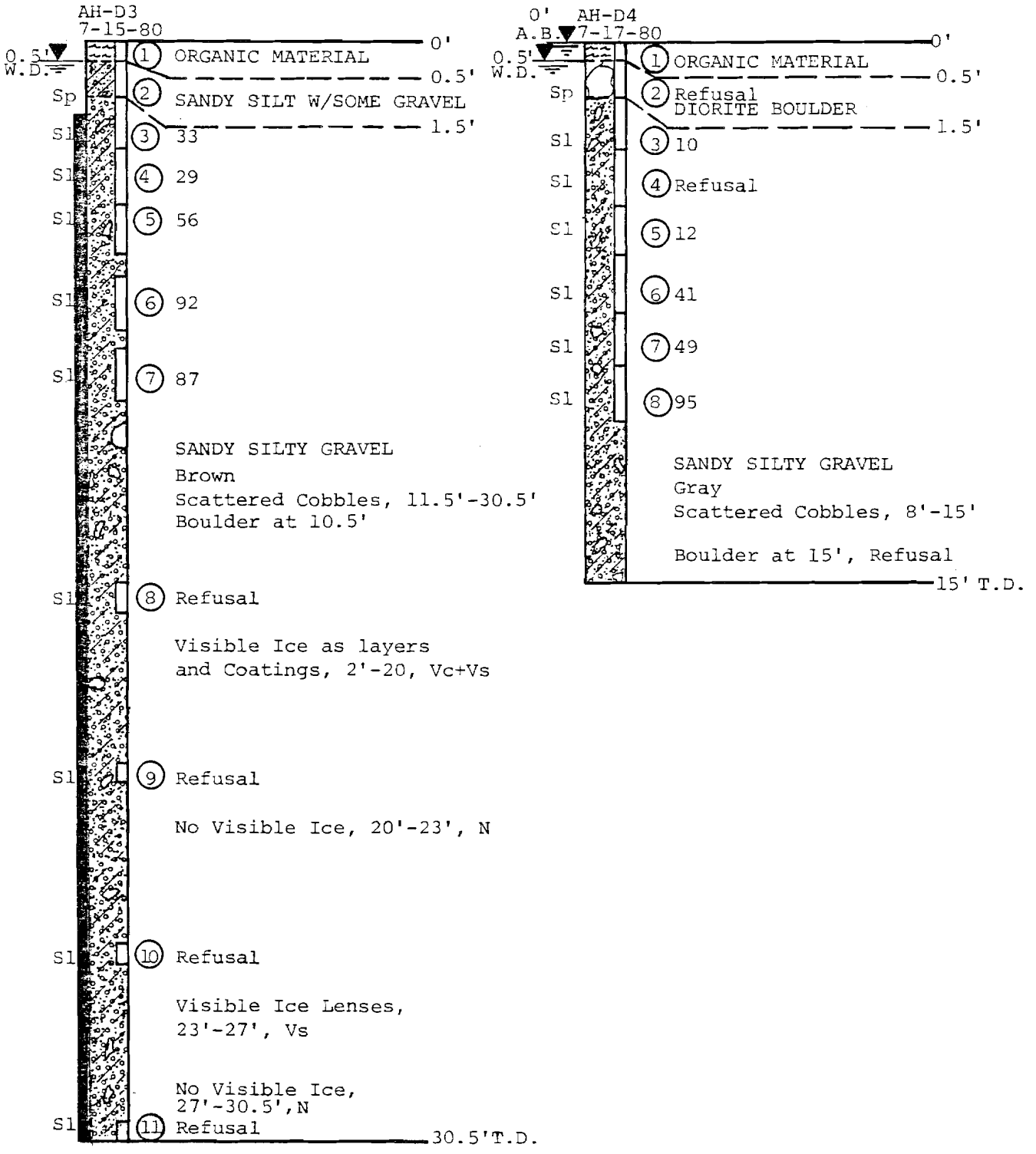
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BORROW AREA D
AUGER HOLES AH-D1 AND AH-D2

Scale 1"=4'

PREPARED FOR:

ACRES



PREPARED BY:

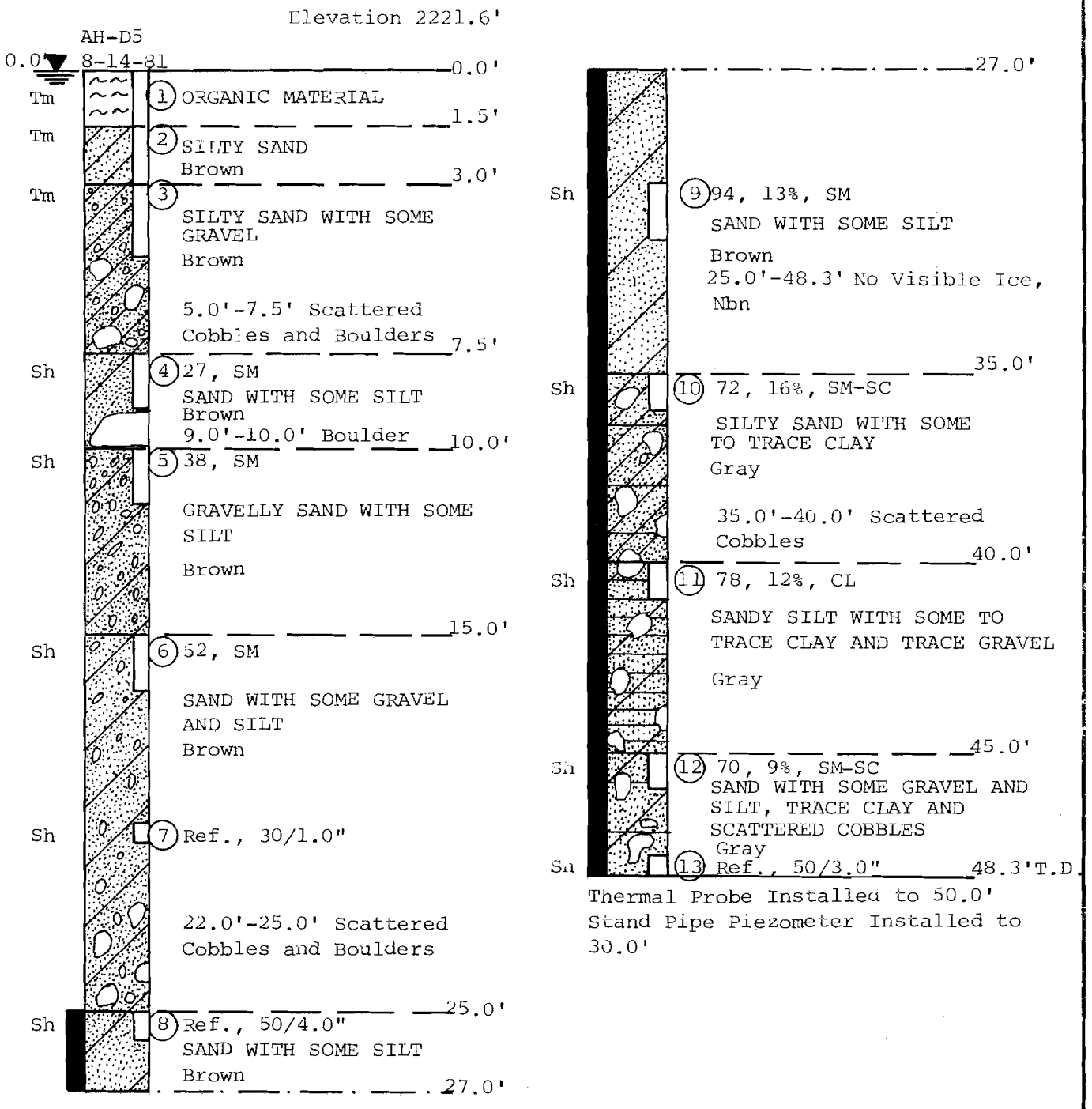
R&M CONSULTANTS, INC.

BORROW AREA D
AUGER HOLES AH-D3 AND AH-D4

Scale 1"=4'

PREPARED FOR:

ACRES



PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA D
AUGER HOLE AH-D5

Scale: 1"=4'

PREPARED FOR:

ACRES

Elevation 2262.9'

AH-D6

0.0' 8-22-81 — 0.0'

Tm (1) ORGANIC MATERIAL

Tm — 2.0'

(2) Ref.
NUMEROUS COBBLES AND BOULDERS

— 5.0'

Sh (3) 17, 10%, SM
SILTY SAND WITH TRACE GRAVEL
Gray

Sh (4) 20, 8%, SM — 7.5'

Sh (5) 24
ORGANIC MATERIAL — 8.0'

Sh (6) 19, 12%, SM

Sh (7) 21, 11%, SM

SAND WITH SOME TO TRACE SILT
Gray

Sh (8) 21

5.0'-50.0' No Visible Ice, Nbn

Sh (9) 49, 12%, SM

— 22.0'

SILTY SAND WITH SOME TO TRACE GRAVEL AND SCATTERED COBBLES

Sh (10) 74, 9%, SM

— 27.0'

Sh (11) 90, 8%

Sz (12) 89, 9%, SM

SILTY SAND WITH SOME TO TRACE GRAVEL AND SCATTERED COBBLES
Gray

Sh (13) Ref., 50/3"

Sh (14) Ref., 51/5.0"

Sz (15) Ref., Cobble — 50.0'
T.D.

Thermal Probe Installed to 50.0'
Stand Pipe Piezometer Installed to 50.0'

PREPARED BY:

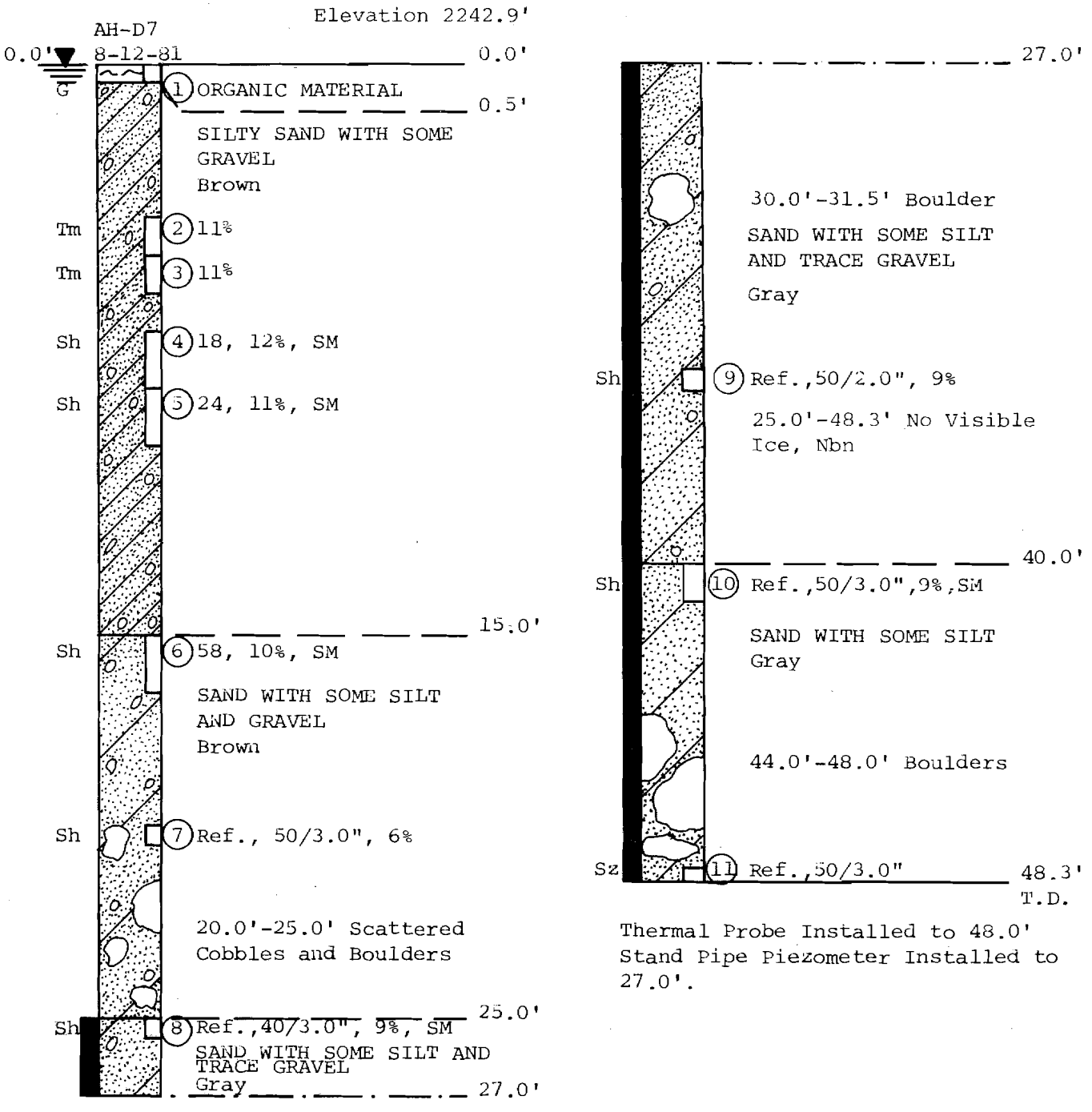
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BORROW AREA D
AUGER HOLE AH-D6

Scale: 1"=4'

PREPARED FOR:

ACRES



Thermal Probe Installed to 48.0'
Stand Pipe Piezometer Installed to 27.0'.

PREPARED BY:

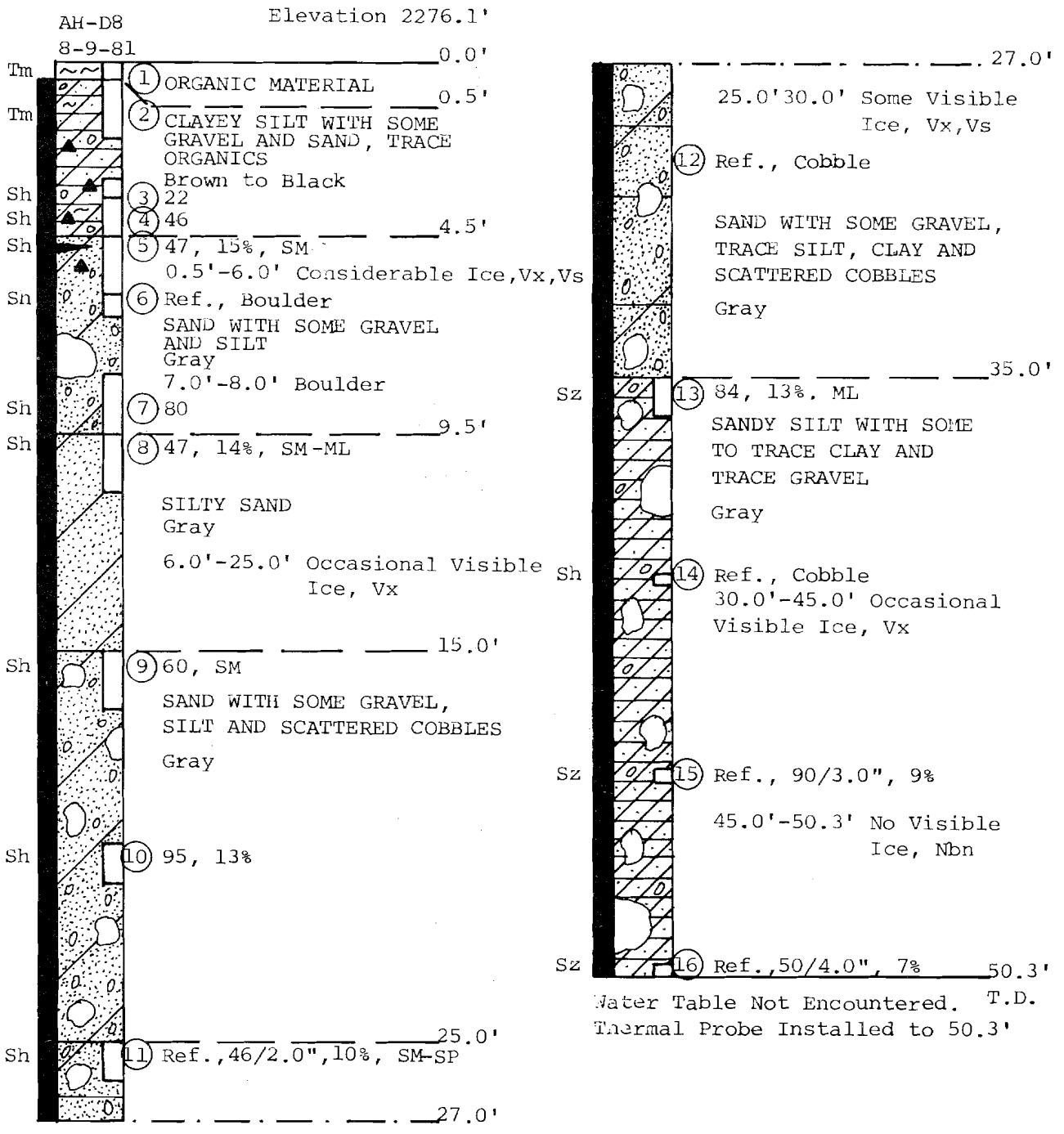
R&M CONSULTANTS, INC.

BORROW AREA D
AUGER HOLE AH-D7

PREPARED FOR:

ACRES

Scale: 1"=4'



PREPARED BY:

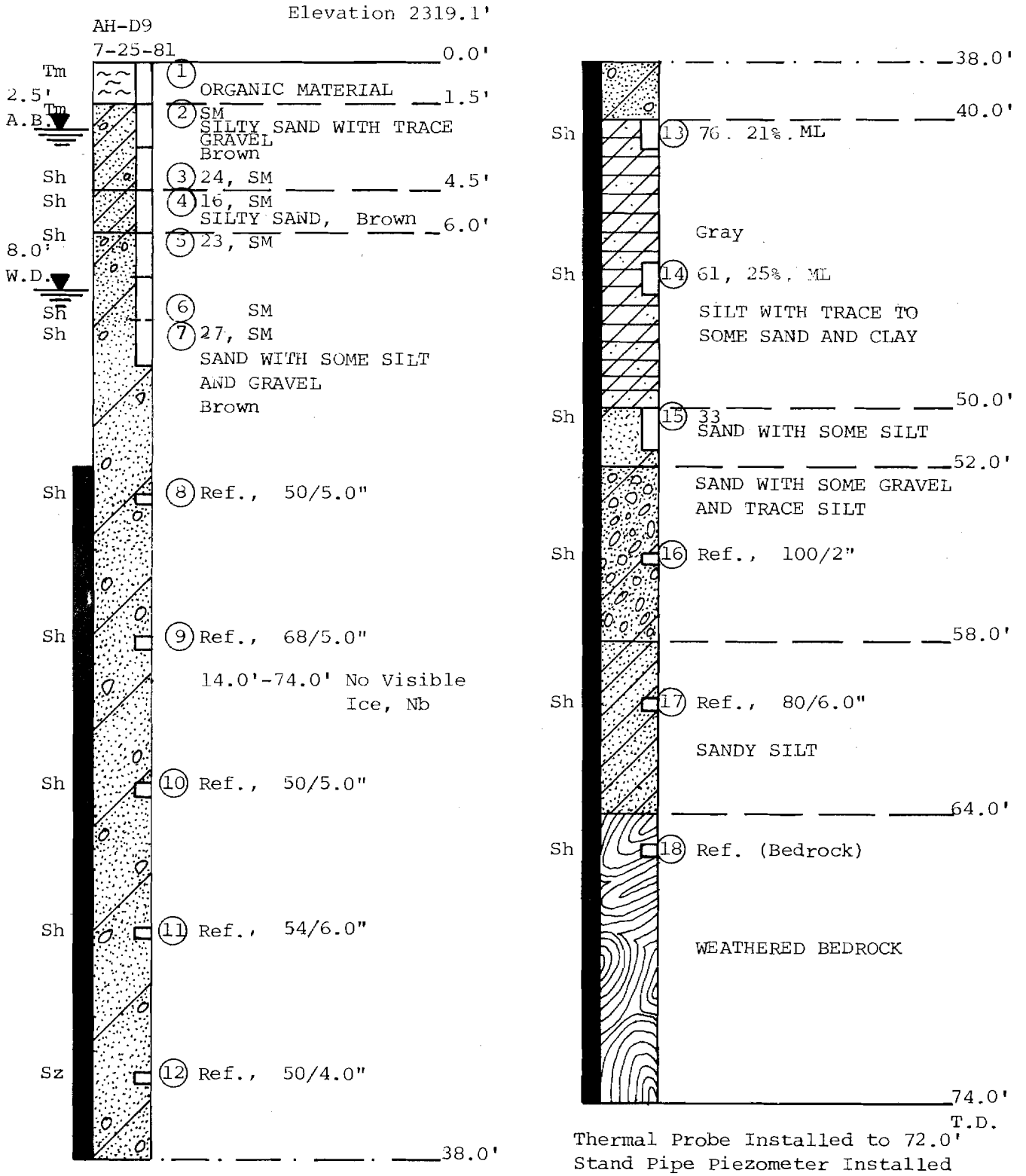
R&M CONSULTANTS, INC.

PREPARED FOR:

ACRES

BORROW AREA D
AUGER HOLE AH-D8

Scale: 1"=4



Prepared by:

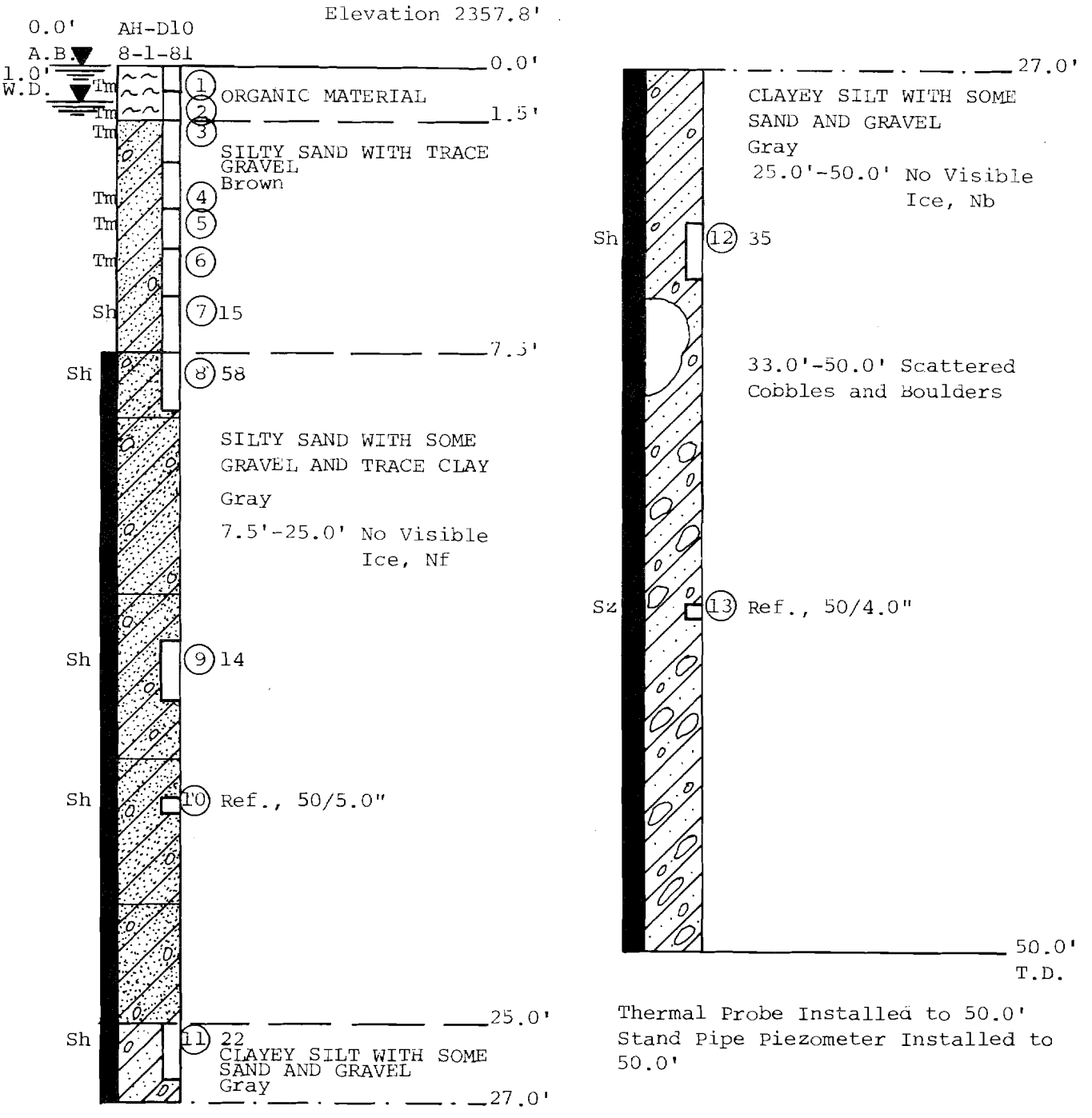
R&M CONSULTANTS, INC.

BORROW AREA D
AUGER HOLE AH-D9

Scale: 1"-5

Prepared for:

ACRES



Thermal Probe Installed to 50.0'
Stand Pipe Piezometer Installed to 50.0'

PREPARED BY:

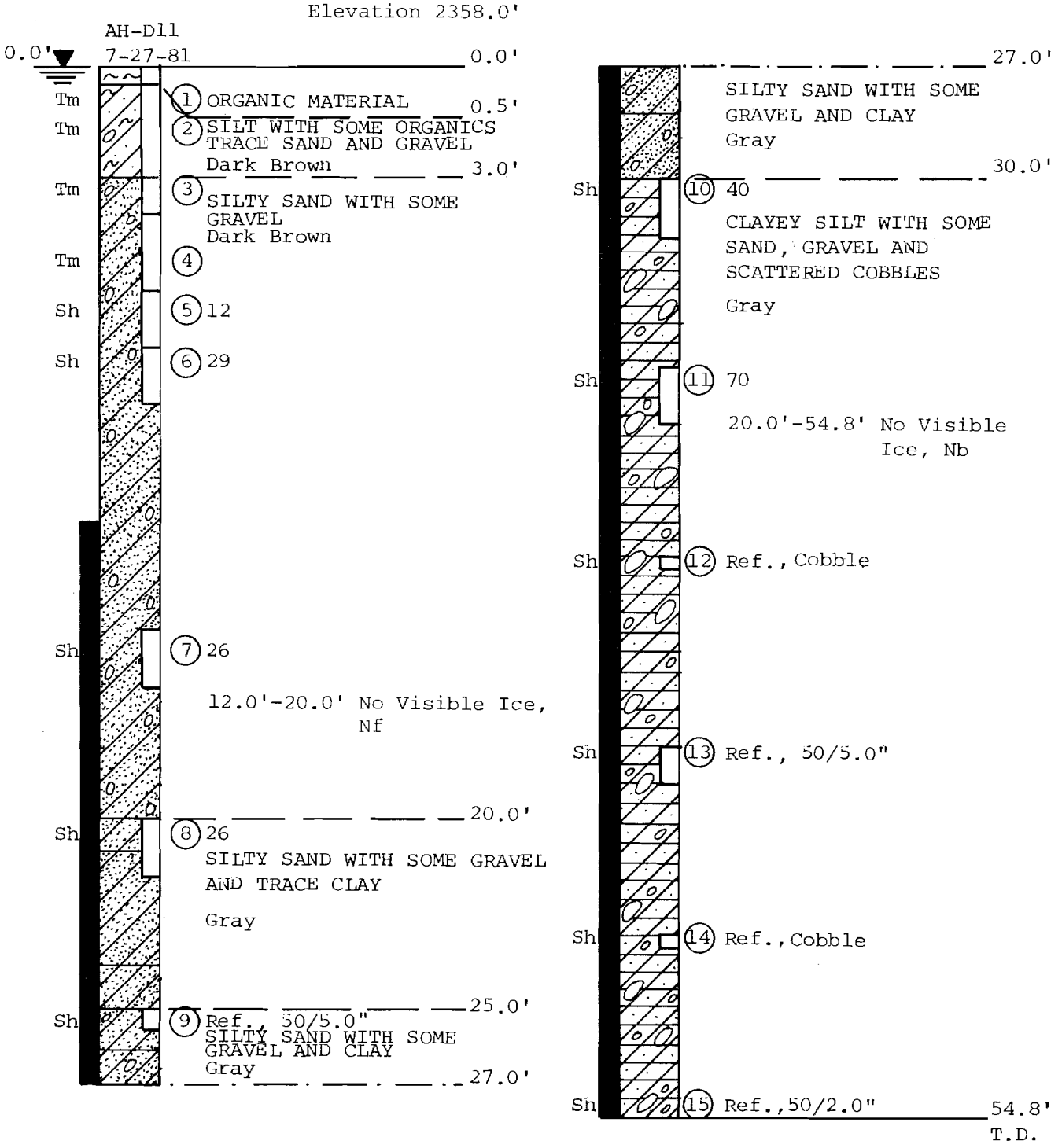
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BORROW AREA D
AUGER HOLE AH-D10

PREPARED FOR:

ACRES

Scale: 1"=4'



Thermal Probe Installed to 54.8'
Stand Pipe Piezometer Installed to 54.8'

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA D
AUGER HOLE AH-D11

PREPARED FOR:

ACRES

Scale: 1"=4'

Elevation 2337.9'

AH-D12

0.0' 7-30-81 — 0.0'

Tm ① ORGANIC MATERIAL

Tm ② — 1.5'

Tm ③ SILTY SAND WITH SOME ORGANICS
Dark Brown

Tm ④ — 4.0'

Sh ⑤ 64
0.5'-4.5' Some Visible Ice, Vx,Vs

Sh ⑥ 100

Sh ⑦ 100

Sh ⑧ Ref., 34/4.0"
SILTY SAND WITH SOME GRAVEL AND TRACE CLAY
Gray
4.5'-25.0' No Visible Ice, Nbn

— 15.0'

Sh ⑨ Ref., Cobble

Sh ⑩ Ref., 30/2.0"
SILTY SAND WITH SOME GRAVEL, SCATTERED COBBLES AND BOULDERS
Gray

— 25.0'

Sh ⑪ 100
GRAVELLY SAND WITH SOME SILT, SCATTERED TO NUMEROUS COBBLES AND BOULDERS
Gray

Sz ⑫ *
25.0'-30.0' Some Visible Ice, Vx

Sz ⑬ *

. — . — . — . — 38.0'

. — . — . — . — 38.0'

GRAVELLY SAND WITH SOME SILT, SCATTERED TO NUMEROUS COBBLES AND BOULDERS

Sz ⑭ *

60.0' T.D.

Thermal Probe Installed to 28.0'

* Tricone Cuttings Filling Hole, Unable to Sample Undisturbed Material

Prepared by:

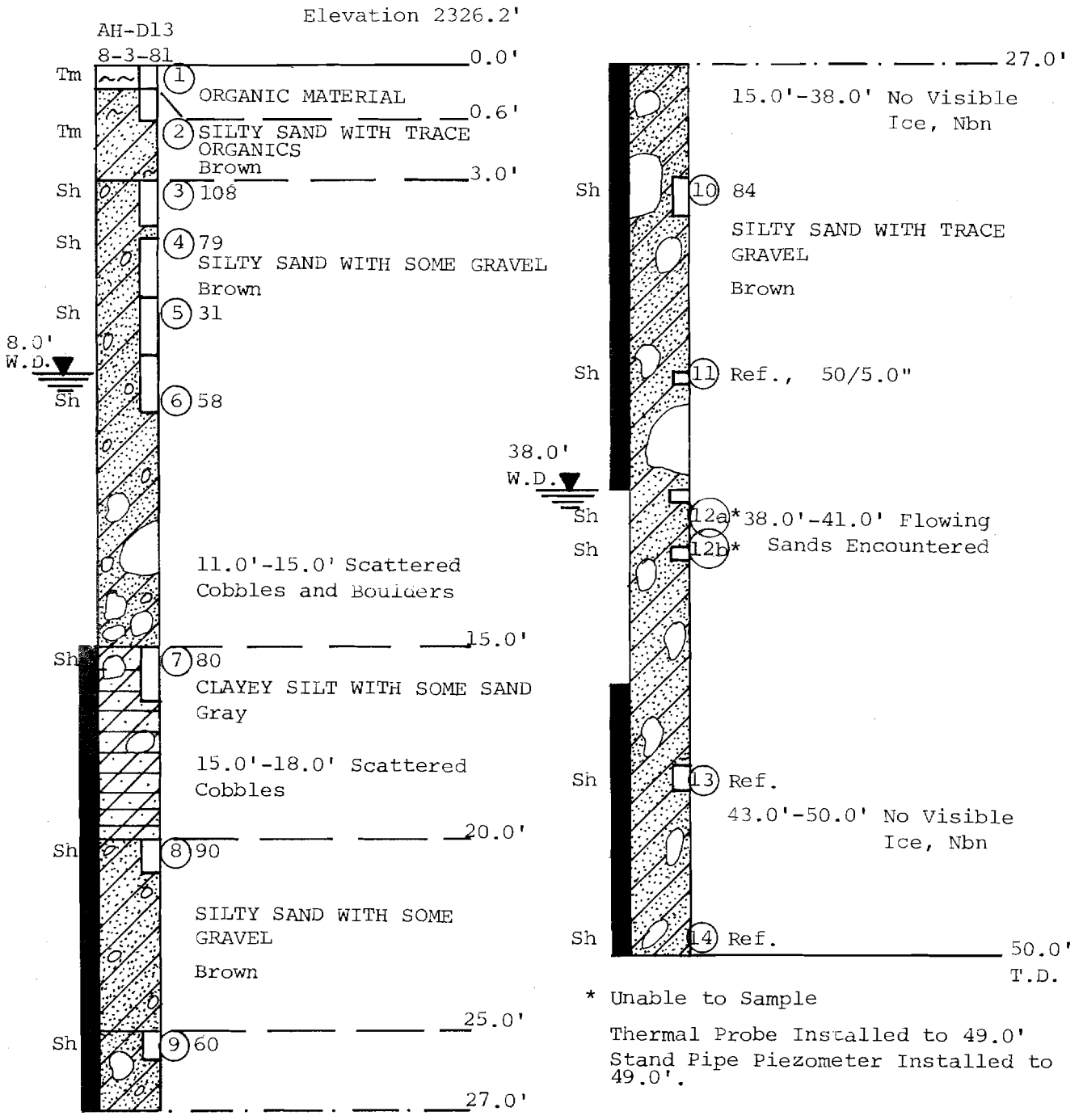
R&M CONSULTANTS, INC.

BORROW AREA D
AUGER HOLE AH-D12

Prepared for:

ACRES

Scale: 1"=5'



* Unable to Sample

Thermal Probe Installed to 49.0'
Stand Pipe Piezometer Installed to 49.0'.

PREPARED BY:

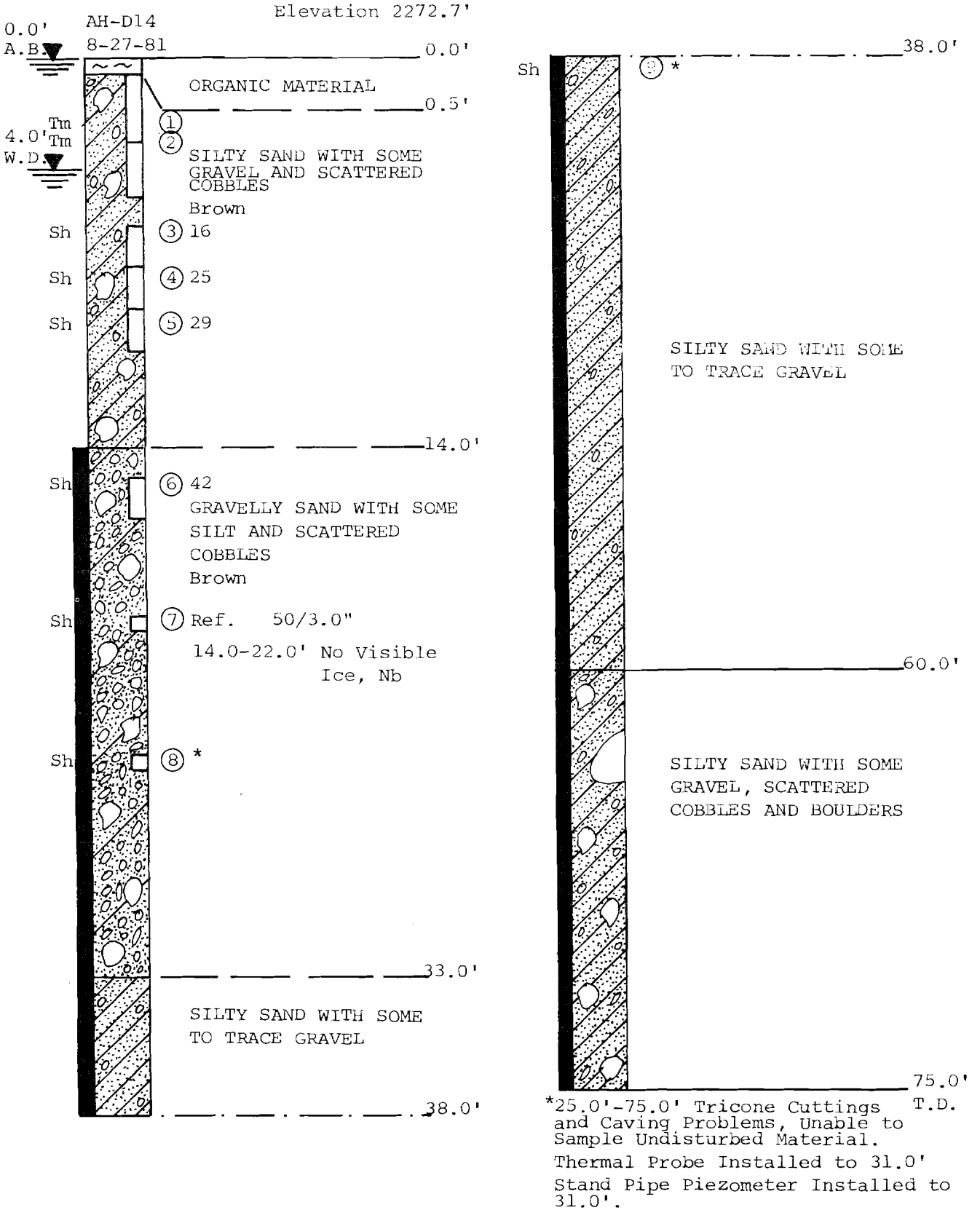
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BORROW AREA D
AUGER HOLE AH-D13

PREPARED FOR:

ACRES

Scale: 1"=4'



*25.0'-75.0' Tricone Cuttings and Caving Problems, Unable to Sample Undisturbed Material.

Thermal Probe Installed to 31.0'

Stand Pipe Piezometer Installed to 31.0'.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA D

AUGER HOLE AH-D14

PREPARED FOR:

ACRES

Scale: 1"=5'

LABORATORY TEST DATA

PROJECT NO. 052504
CLIENT: Acres American, Inc.
PROJECT NAME Susitna Hydroelectric (Watana Dam Site)

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE October 17, 1980
PARTY NO. _____ PAGE NO. _____

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	4"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.
AH-D1		5	6.0'- 7.5'					100	99	95	94	90	84	69	42.3	19.0	6.1	2.6	11.1	NV	NP	SM
AH-D1		6	8.0'- 8.5'				100	87	87	83	80	76	69	54	28.3	14.4	6.1	3.3	6.7			SM*
AH-D1		7	10.0'-10.3'						100	91	91	87	76	62	35.7	18.2	8.2	4.9	6.6			SM*
AH-D2		3	1.5'- 3.0'		100	80	80	80	77	73	72	67	61	47	28.5	12.0	3.2	2.9	25.7	NV	NP	SM
AH-D2		4	3.0'- 4.5'				100	94	92	90	89	86	79	62	35.0	21.2	4.1	2.4	11.4	13.9	NP	SM
AH-D2		5	4.5'- 6.0'					100	98	96	92	87	80	59	30.7	13.8	3.9	1.6	11.2	NV	NP	SM
AH-D2		8	15.0'-16.5'						100	99	97	93	87	70	44.0	22.5	8.9	4.0	11.3	15.5	2.2	SM
AH-D2		9	20.0'-21.5'				100	96	94	93	91	85	78	61	38.6	21.3	10.3	4.2	9.4	17.5	4.2	SM

REMARKS: * Estimated Value

** NV=Non Viscous NP=Non Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

APPROVED

PROJECT NO. 052504

CLIENT: Acres American, Inc.

PROJECT NAME Susitna Hydroelectric (Watana Dam Site)

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE October 17, 1980

PARTY NO. _____ PAGE NO. _____

DESCRIPTION	4"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.
DEADMAN W-80-282 (Grab Sample)											100	99.5	81.3	69.6	50.8	42.1	55.9	33.2	CL-CH
DEADMAN W-80-300 (Grab Sample)			100	95	93	89	87	86	80	76	58	26.9	9.2	3.0	1.3	6.6	NV**	NP**	SM

REMARKS: * Estimated Value

** NV=Non Viscous, NP=Non Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
Client: Acres American
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE September 1981

PARTY NO. _____ PAGE NO. 1

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	1 1/2"	1"	3/4"	1/2"	3/8"	4	10	40	200	.02	.005	.002	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	D5	4	7.5'- 9.0'						100	87	53	22.8										SM
	D5	5	10.0'-11.5'	100	70	69	67	67	67	52	35	15.9										SM
	D5	6	15.0'-16.5'			100	76	76	76	69	51	23.2										SM
	D5	9	30.0'-31.5'						100	84	60	26.4					14	NP			13	SM
	D5	10	35.0'-36.0'						100	85	63	44.6					17	6			16	SM-SC
	D5	11	40.0'-41.5'			100	98	96	92	87	73	55.2					23	14			12	CL
	D5	12	45.0'-46.0'		100	88	88	88	88	74	48	25.3					39	14			9	SM-SC
	D6	3,4	5.0'- 7.5' *					100	91	84	67	40.5					15	NP			10, 8	SM
	D6	6,7	8.0'-11.0' *						100	80	55	23.2					13	NP			12,11	SM
	D6	9	20.0'-21.5'						100	80	40	11.7					17	2			12	SW-SM
	D6	10	25.0'-26.5'	** 83	83	80	77	75	71	67	51	32.5					15	NP			9	SM
	D6	11	30.0'-31.0'																		8	
	D6	12	35.0'-36.0'			100	98	94	89	83	65	40.5					17	NP			9	SM
	D6	13	40.0'-40.5'																		12	

REMARKS: * Sample Combined for Sieve Analysis and Atterberg Limits
** 100% Passing 2"
NP= Non-Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
Client: Acres American
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE September 1981

PARTY NO. _____ PAGE NO. 2

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	1 1/2"	1"	3/4"	1/2"	3/8"	4	10	40	200	.02	.005	.002	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	D7	2	4.0'- 5.0'																		11	
	D7	3	5.0'- 6.0'																		11	
	D7	4,5	7.0'-10.0' *	100	97	91	88	85	79	71	51	31.2									12,11	SM
	D7	6	15.0'-16.5'	100	90	88	86	84	80	72	52	26.6									10	SM
	D7	7	20.0'-20.2'																		6	
	D7	8	25.0'-25.7'		100	94	94	94	94	77	51	23.3				2.62					9	SM
	D7	9	35.0'-35.2'																		9	
	D7	10	40.0'-40.7'						100	79	50	19.8				2.73					9	SM
	D8	5	4.5'- 6.0'				100	82	82	57	39	17.5					14	NP			15	SM
	D8	8	9.5'-11.0'						100	84	67	41.8					14	NP			14	SM-ML
	D8	9	15.0'-16.5'					100	88	73	47	17.7										SM
	D8	10	20.0'-21.0'																		13	
	D8	11	25.0'-25.7'	100	77	77	72	72	72	55	33	11.2					18	5			10	SM-SP
	D8	13	35.0'-36.0'			100	97	95	91	86	72	52.6									13	ML
	D8	15	45.0'-45.2'																		9	
	D8	16	50.0'-50.2'																		7	

NOTE: SIEVE ANALYSIS = PERCENT PASSING

REMARKS: * Sample Combined for Sieve Analysis
NP= Non-Plastic

PROJECT NO. 052506
Client: Acres American
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

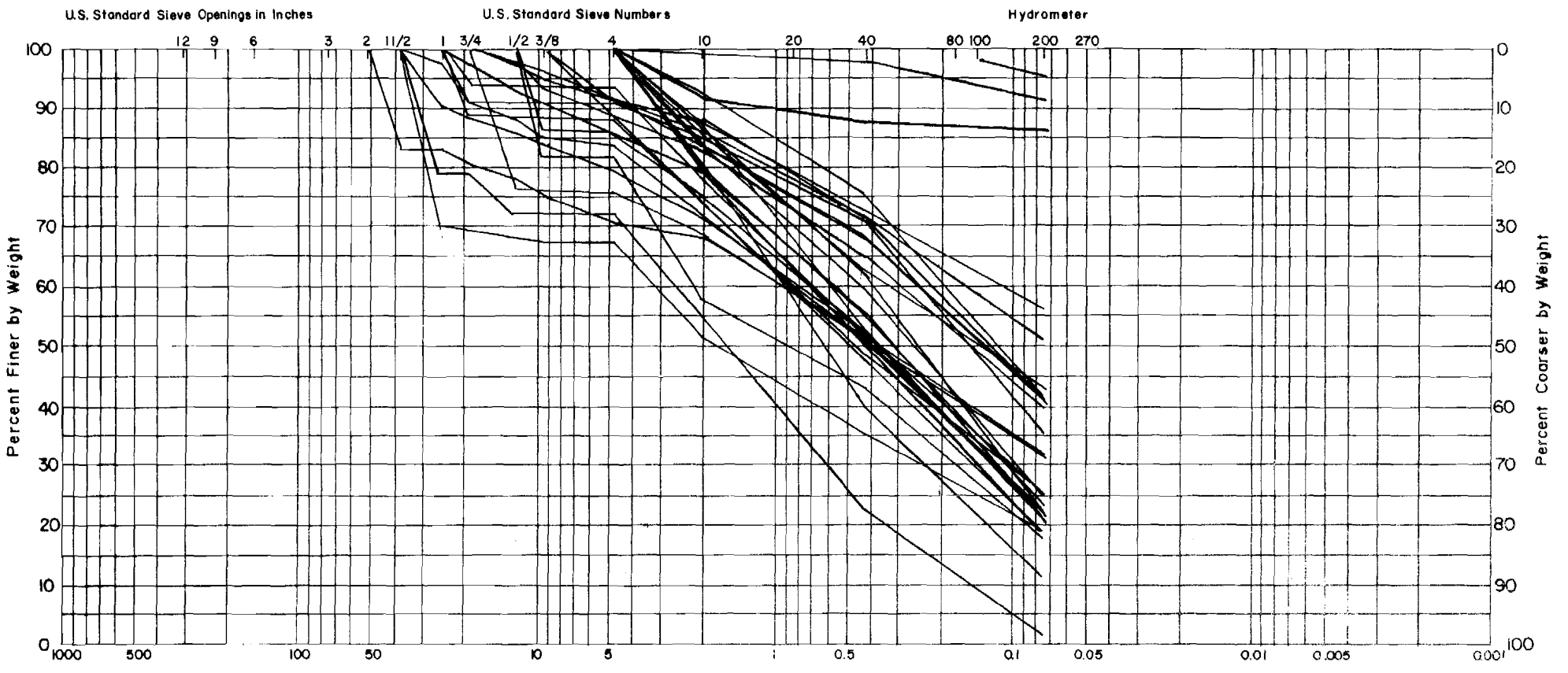
DATE September 1981

PARTY NO. _____ PAGE NO. 3

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	1 1/2"	1"	3/4"	1/2"	3/8"	4	10	40	200	.02	.005	.002	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	D9	2	1.5'- 3.0'		100	91	91	91	91	85	71	35.4										SM
	D9	3	3.0'- 4.5'					100	91	87	71	41.4										SM
	D9	4	4.5'- 6.0'						100	93	75	41.6										SM
	D9	5	6.0'- 7.5'		100	97	93	91	86	79	55	20.9										SM
	D9	6	7.5'- 9.0'						100	86	61	23.0										SM
	D9	7	9.0'-10.5'				100	86	86	75	53	21.7										SM
	D9	13	40.0'-41.0'						100	99	98	91.7					21	NP			21	ML
	D9	14	45.0'-46.5'						100	92	87	82.7					35	7			25	ML
	BORROW D									* 80	* 100	* 200										
	BULK SAMPLE									100	98	95.1					59	23				MH

REMARKS: NP= Non-Plastic
*Sieve Size

NOTE: SIEVE ANALYSIS = PERCENT PASSING



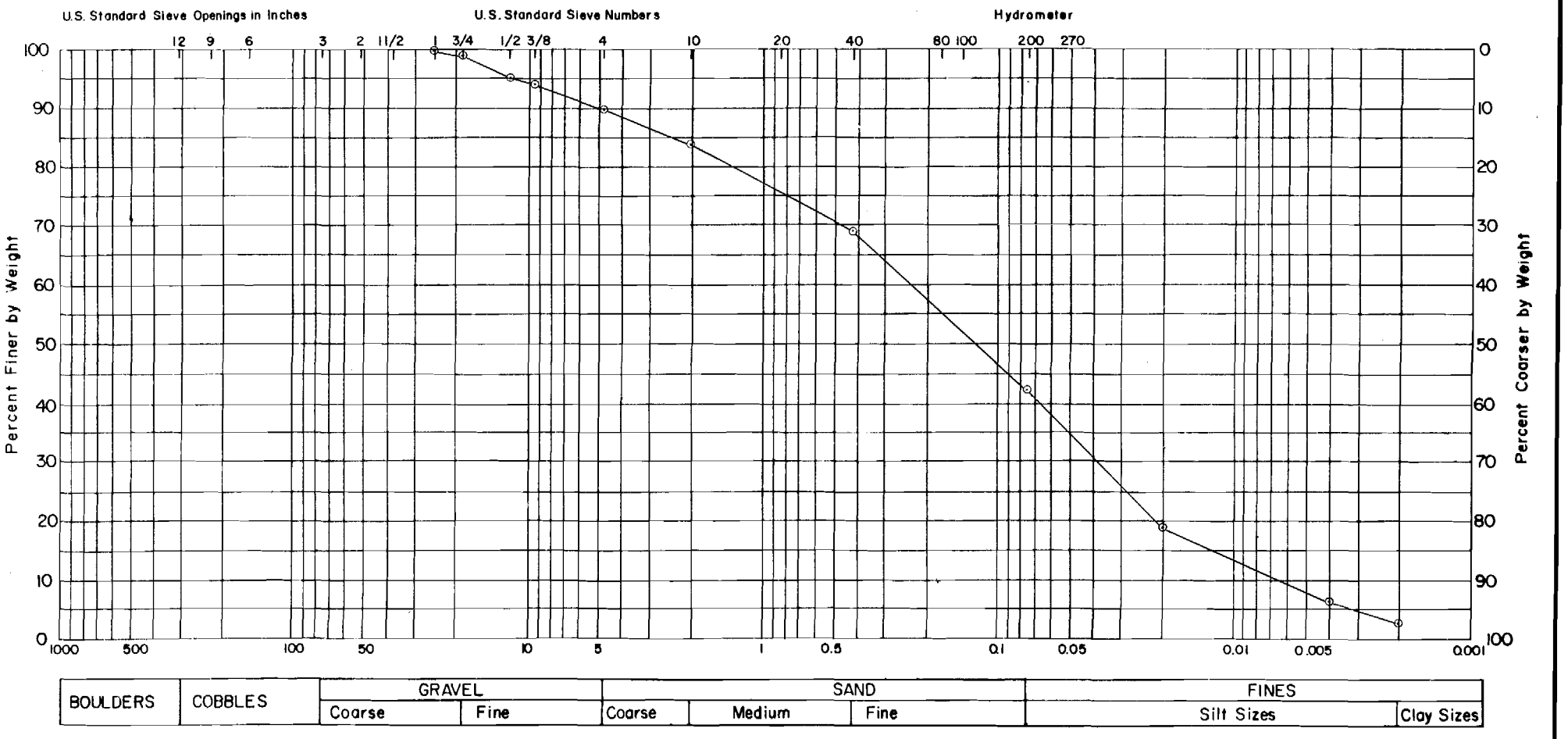
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION

R&M CONSULTANTS INC.

BORROW AREA D
COMPOSITE GRADATION CURVE

DRAWN BY:
APPROVED BY:
DATE:
PROJECT NO.



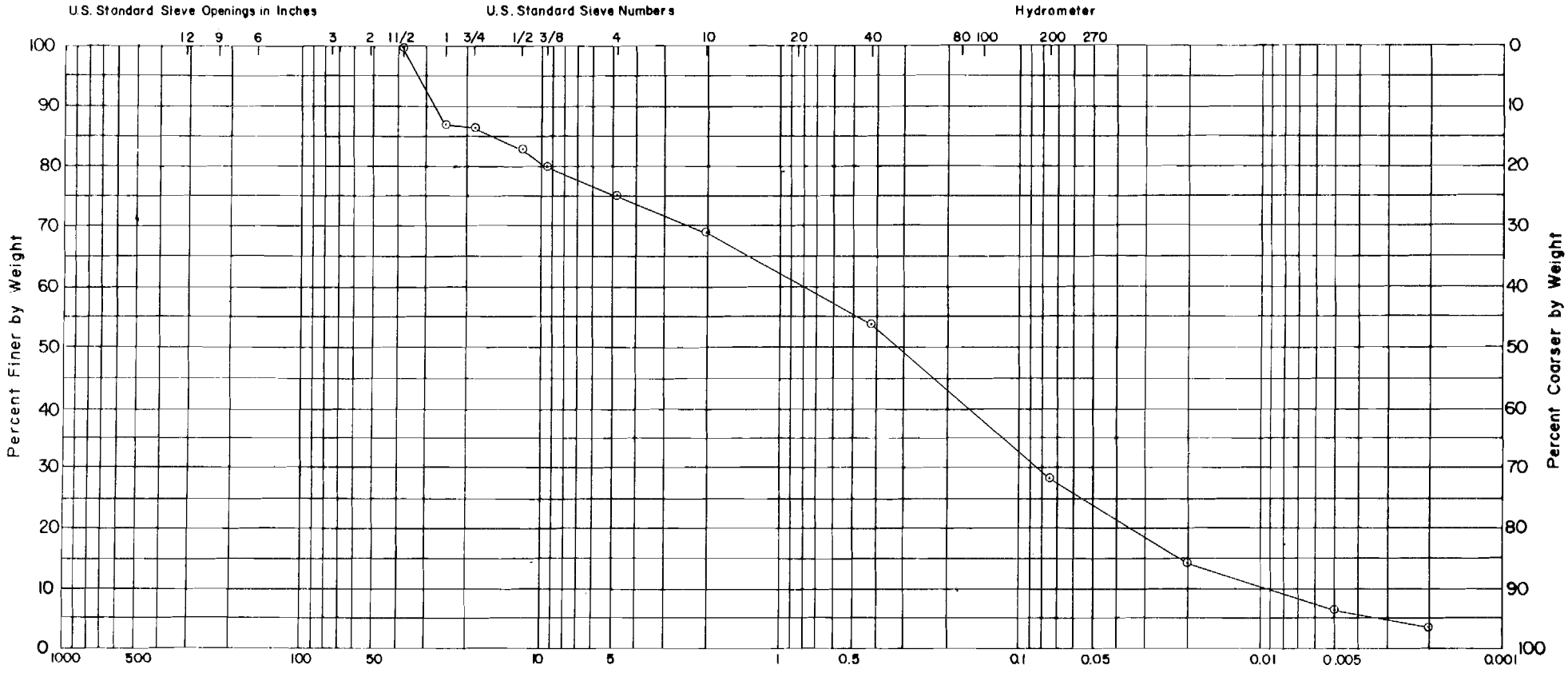
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-D1-5	11.1%		NV	NP	SM	SILT AND SAND WITH TRACE GRAVEL AND TRACE CLAY
(6.0-7.5')						Non Viscous, Non Plastic

R&M CONSULTANTS INC.

BORROW AREA D

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



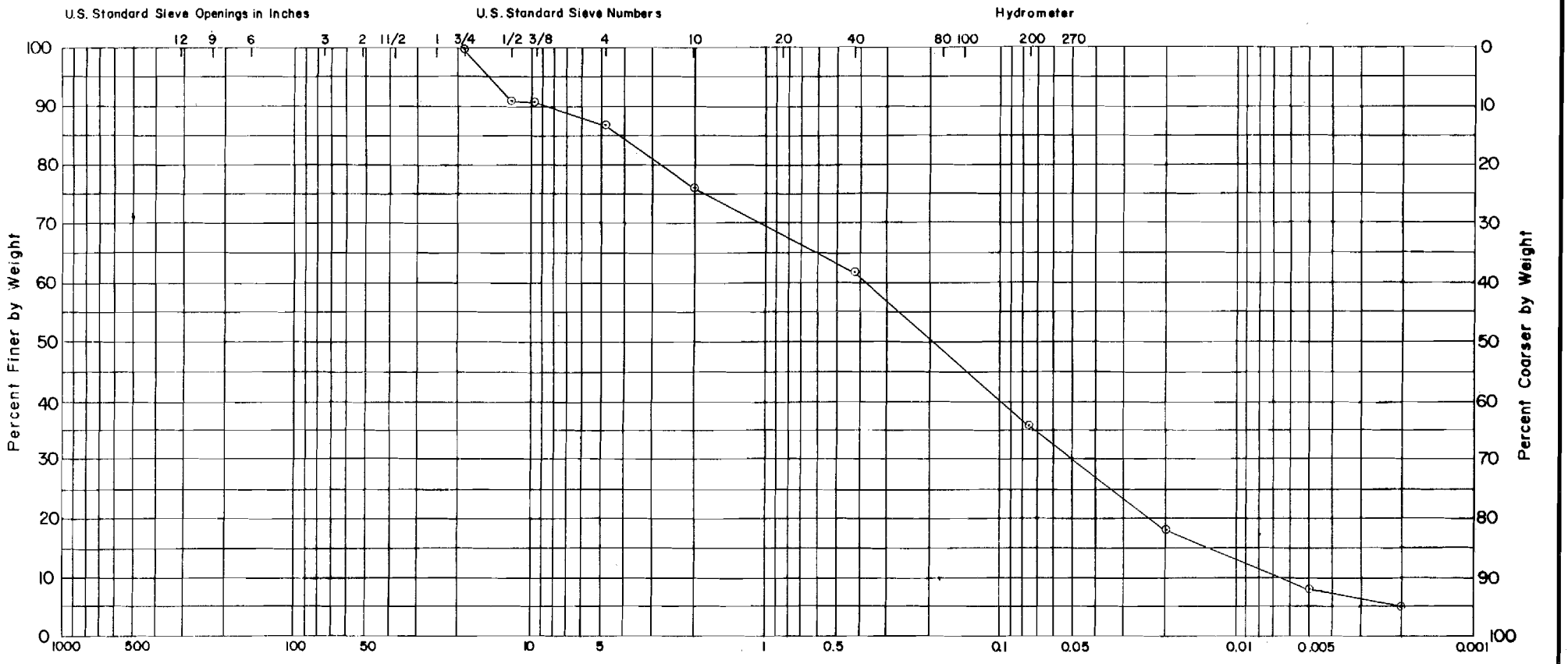
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D1-6 (8.0-8.5')	6.7%				SM	GRAVELLY SILTY SAND WITH TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA D

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



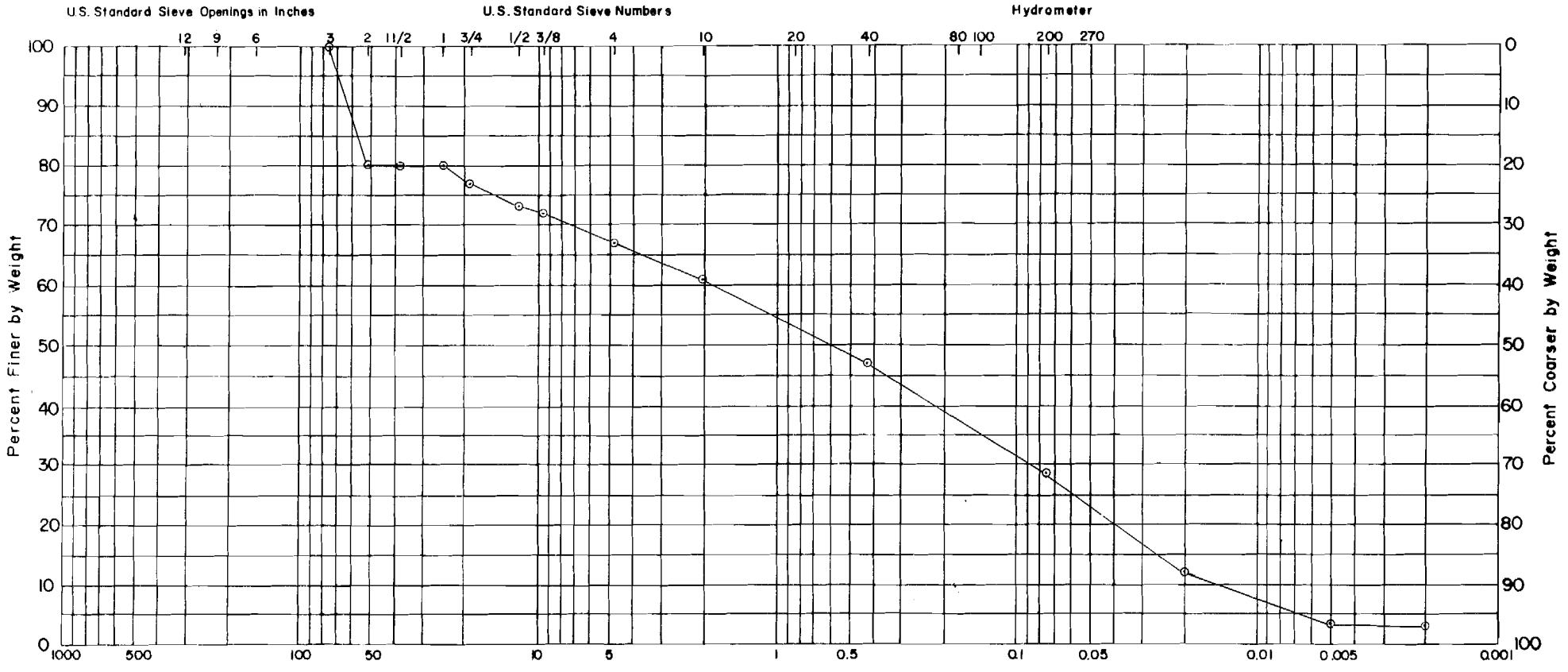
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D1-7	6.6%				SM	SILTY SAND WITH SOME GRAVEL, TRACE CLAY
(10.0-10.3')						

R&M CONSULTANTS INC.

BORROW AREA D

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



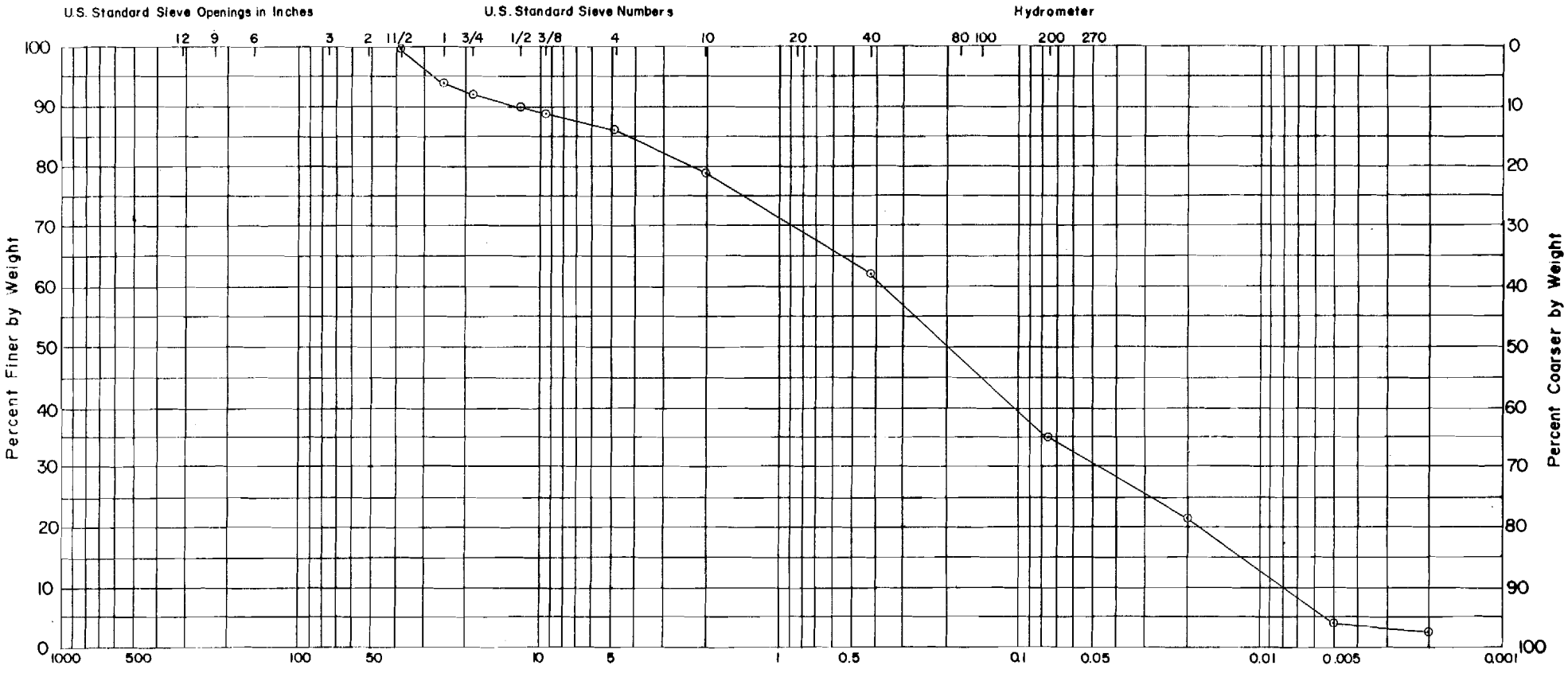
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D2-3	25.7%		NV	NP	SM	SILTY GRAVELLY SAND W/TRACE CLAY
(1.5-3.0')						

R&M CONSULTANTS INC.

BORROW AREA D

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APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



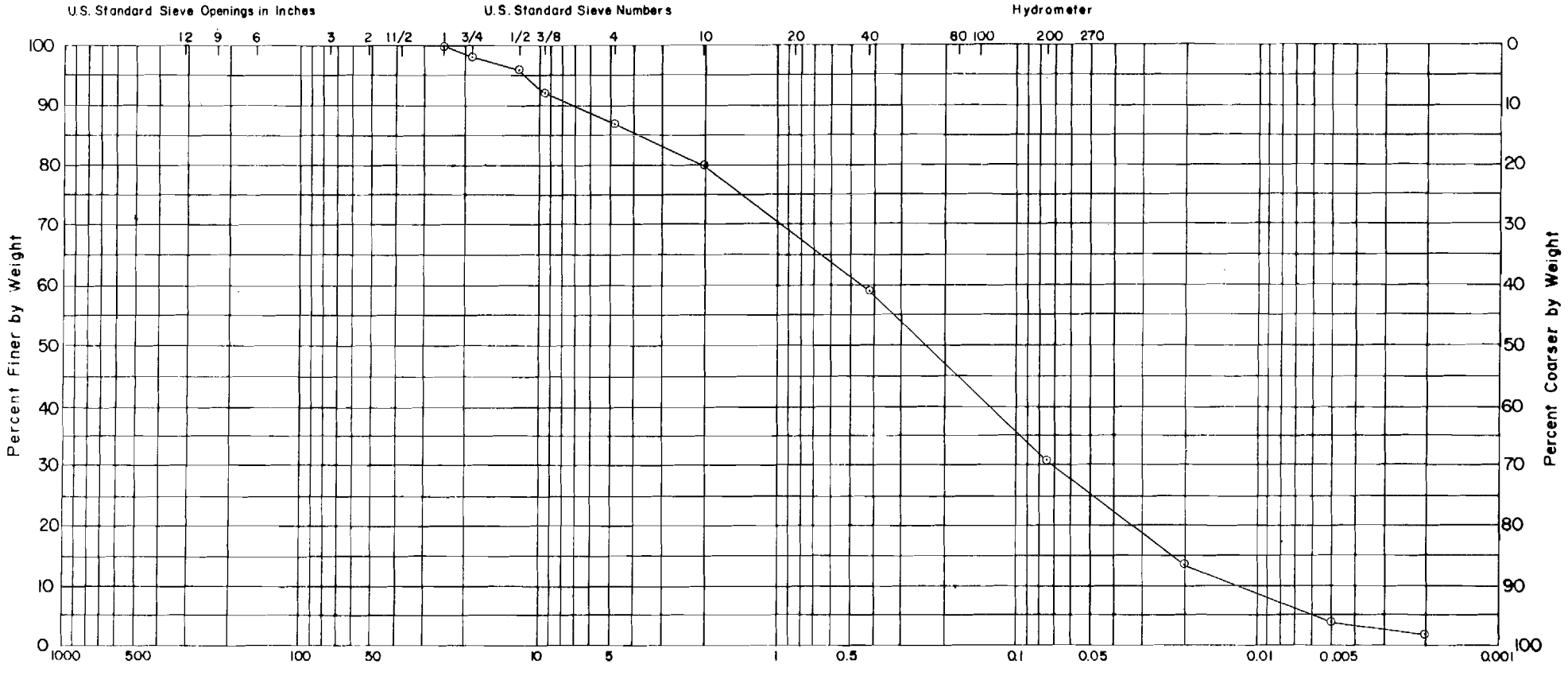
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D2-4	11.4%		13.9	NP	SM	SILTY SAND WITH SOME GRAVEL, TRACE CLAY
(3.0-4.5')						Non Plastic

R&M CONSULTANTS INC.

BORROW AREA D

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



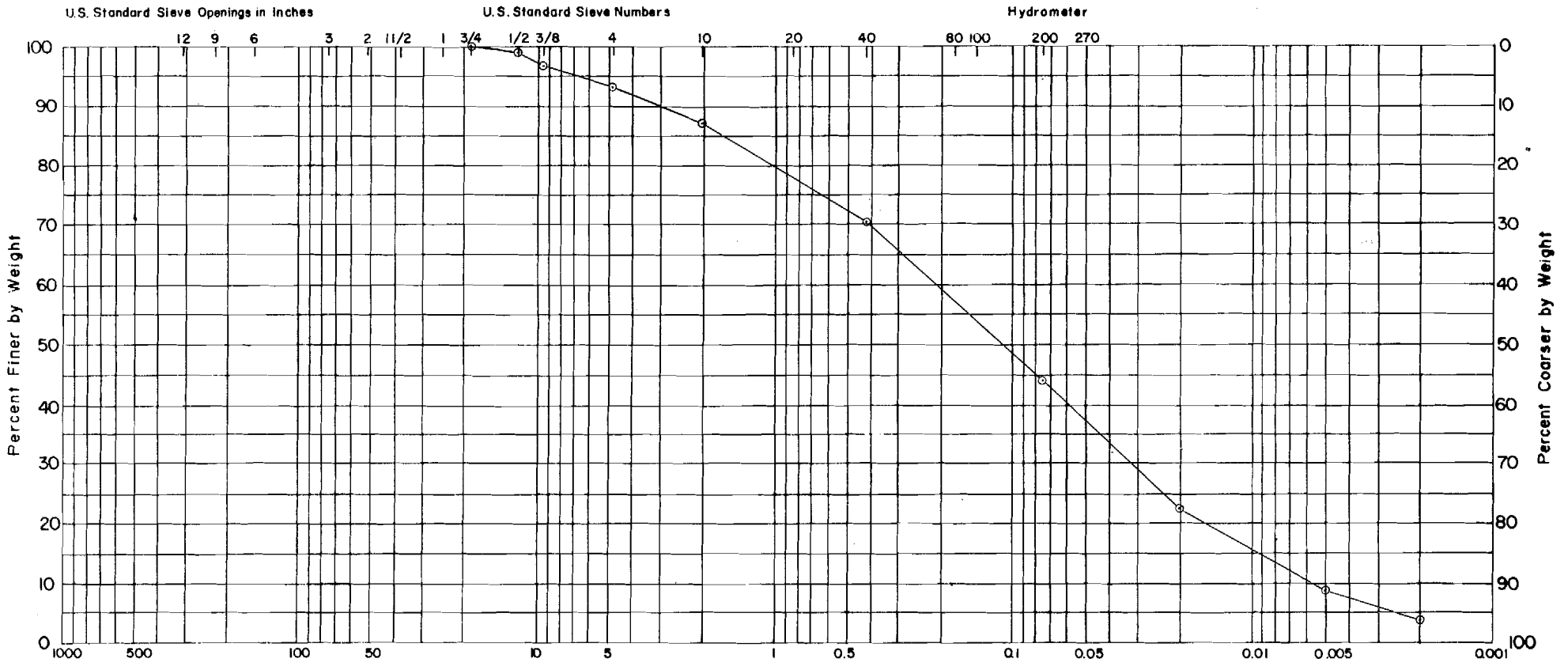
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D2-5	11.2%		NV	NP	SM	SILTY SAND WITH SOME GRAVEL, TRACE CLAY
(4.5-6.0')						Non Viscous, Non Plastic

R&M CONSULTANTS INC.

BORROW AREA D

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



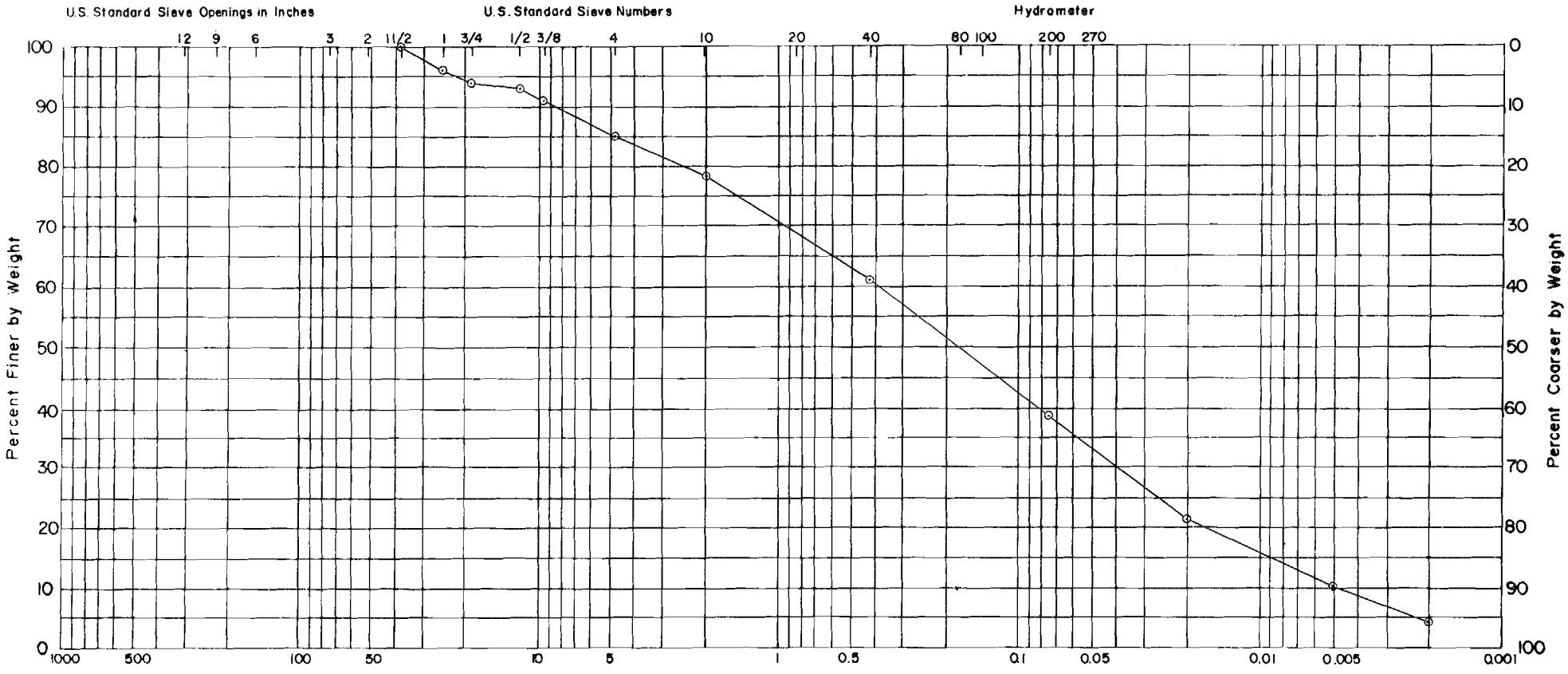
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D2-8	11.3%		15.5	2.2	SM	SILTY SAND WITH TRACE GRAVEL, TRACE CLAY
(15.0-16.5')						

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BORROW AREA D

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APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



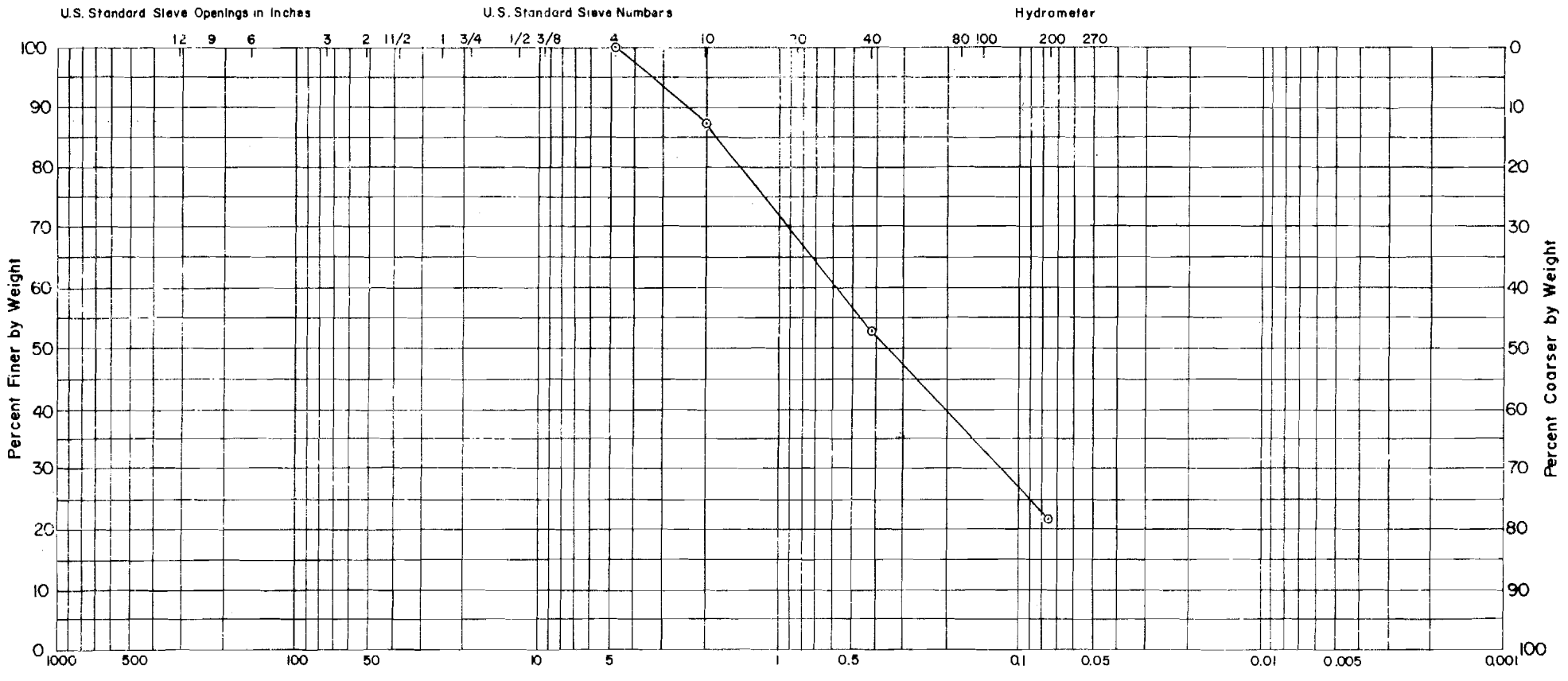
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D2-9 (20.0-21.5')	9.4%		17.5	4.2	SM	SILTY SAND WITH SOME GRAVEL, CLAY

R&M CONSULTANTS INC.

BORROW AREA D

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



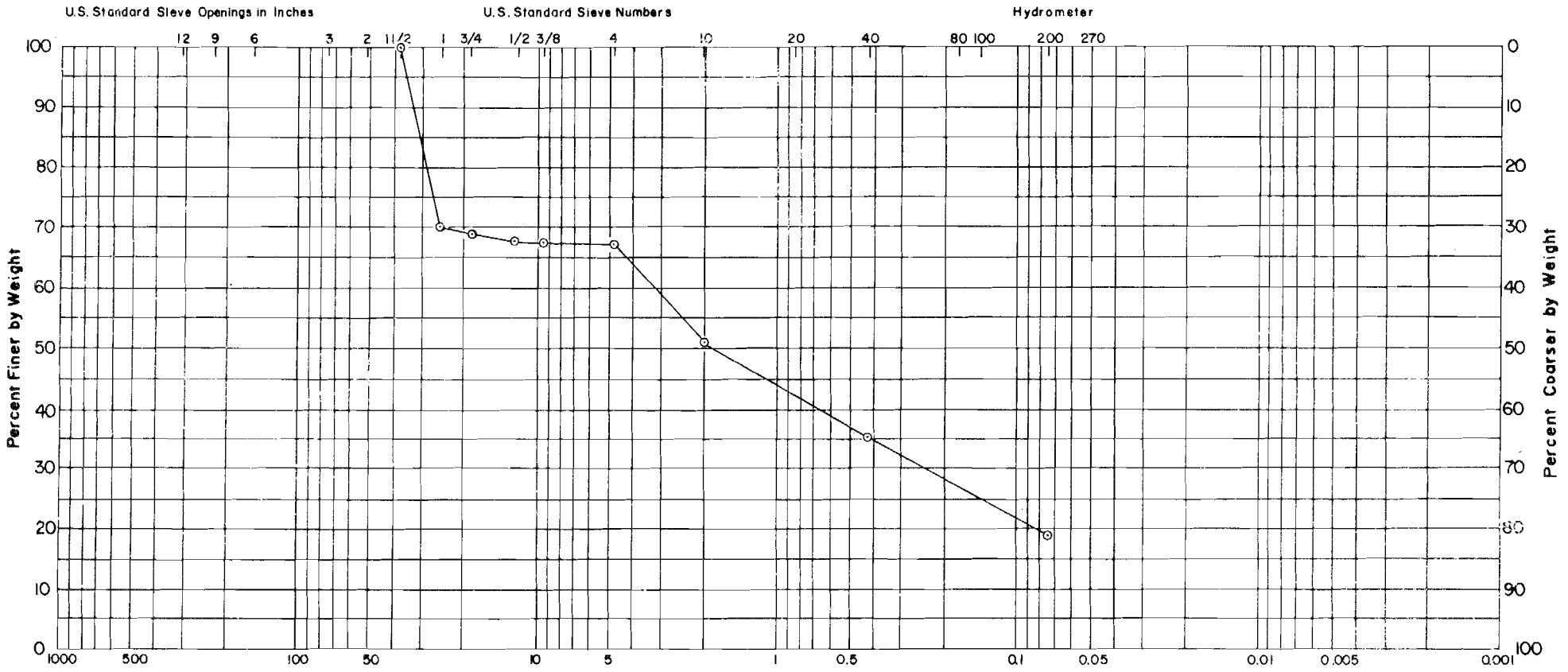
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 4					SM	SAND WITH SOME SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



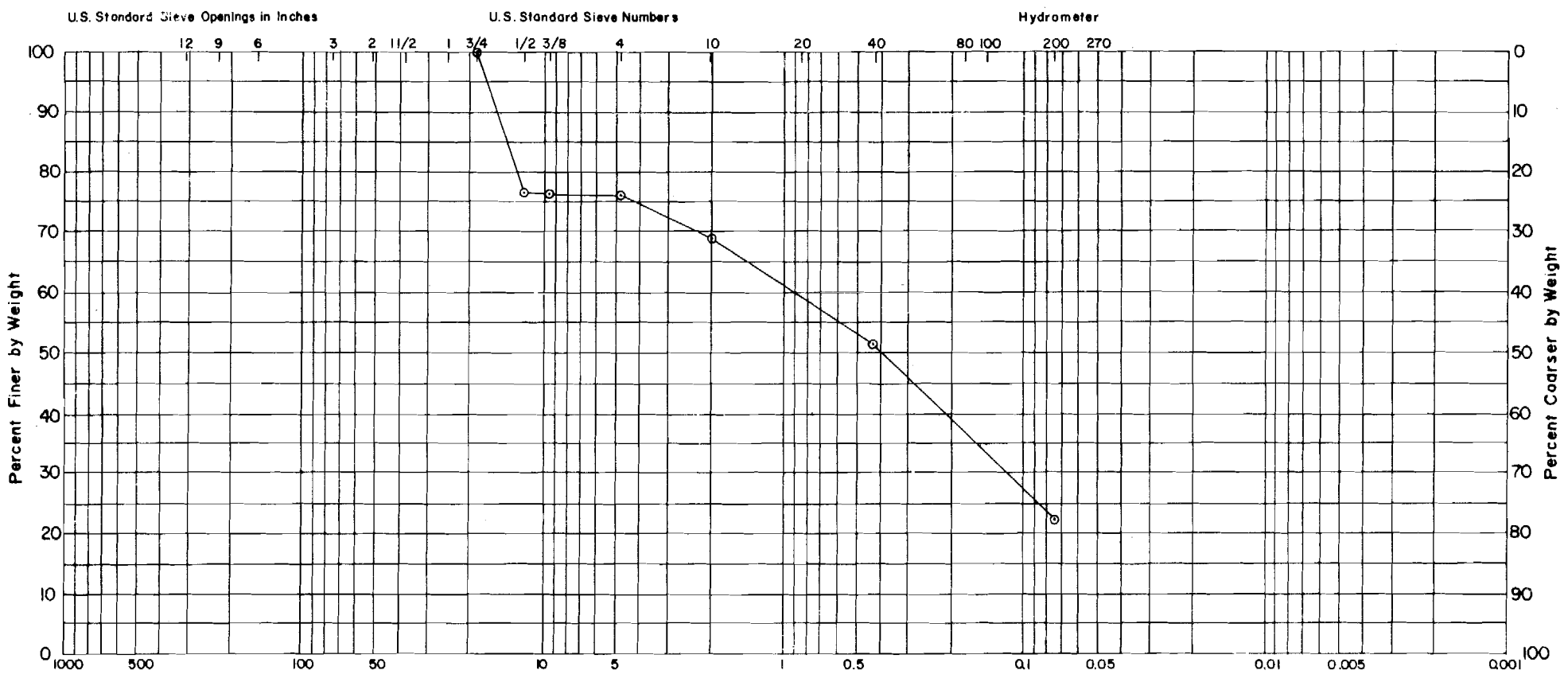
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 5					SM	GRAVELLY SAND WITH SOME SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



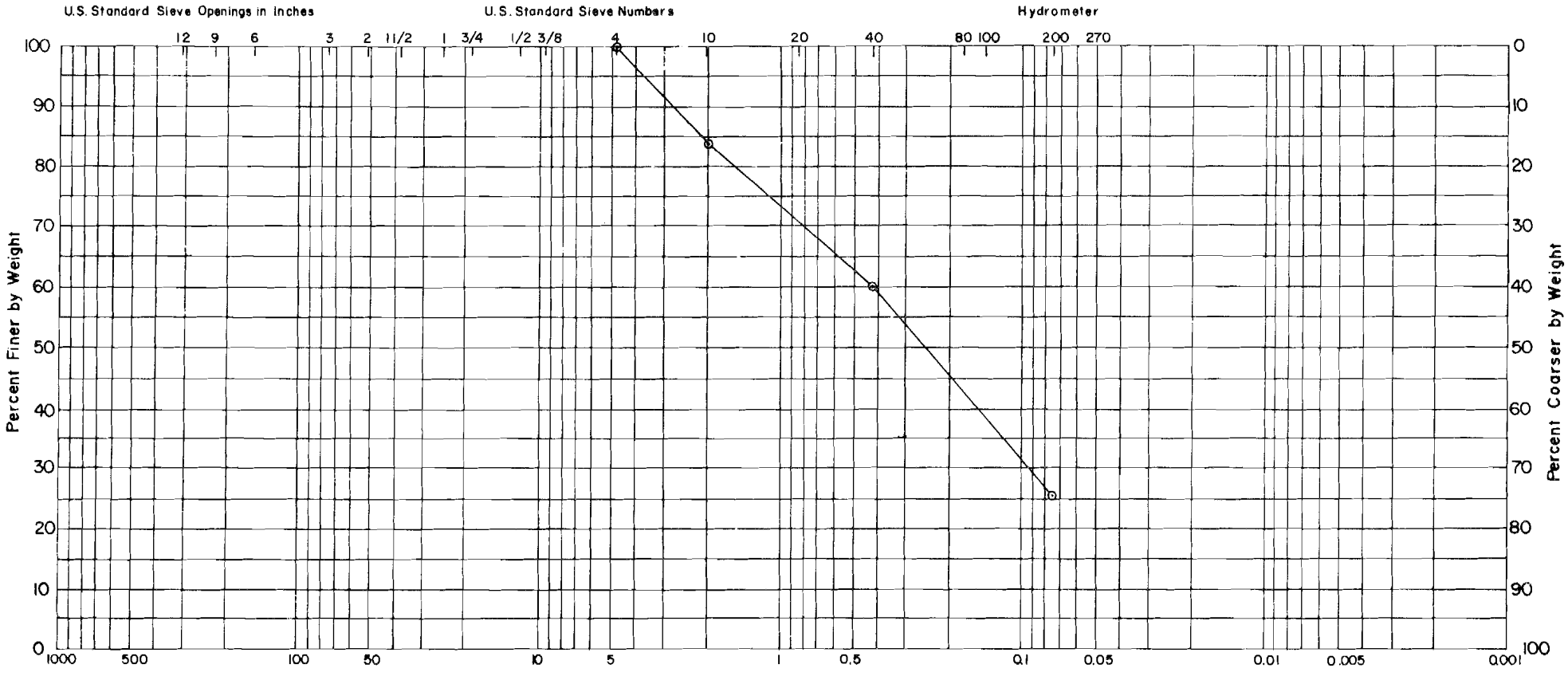
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 6					SM	SAND WITH SOME GRAVEL AND SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



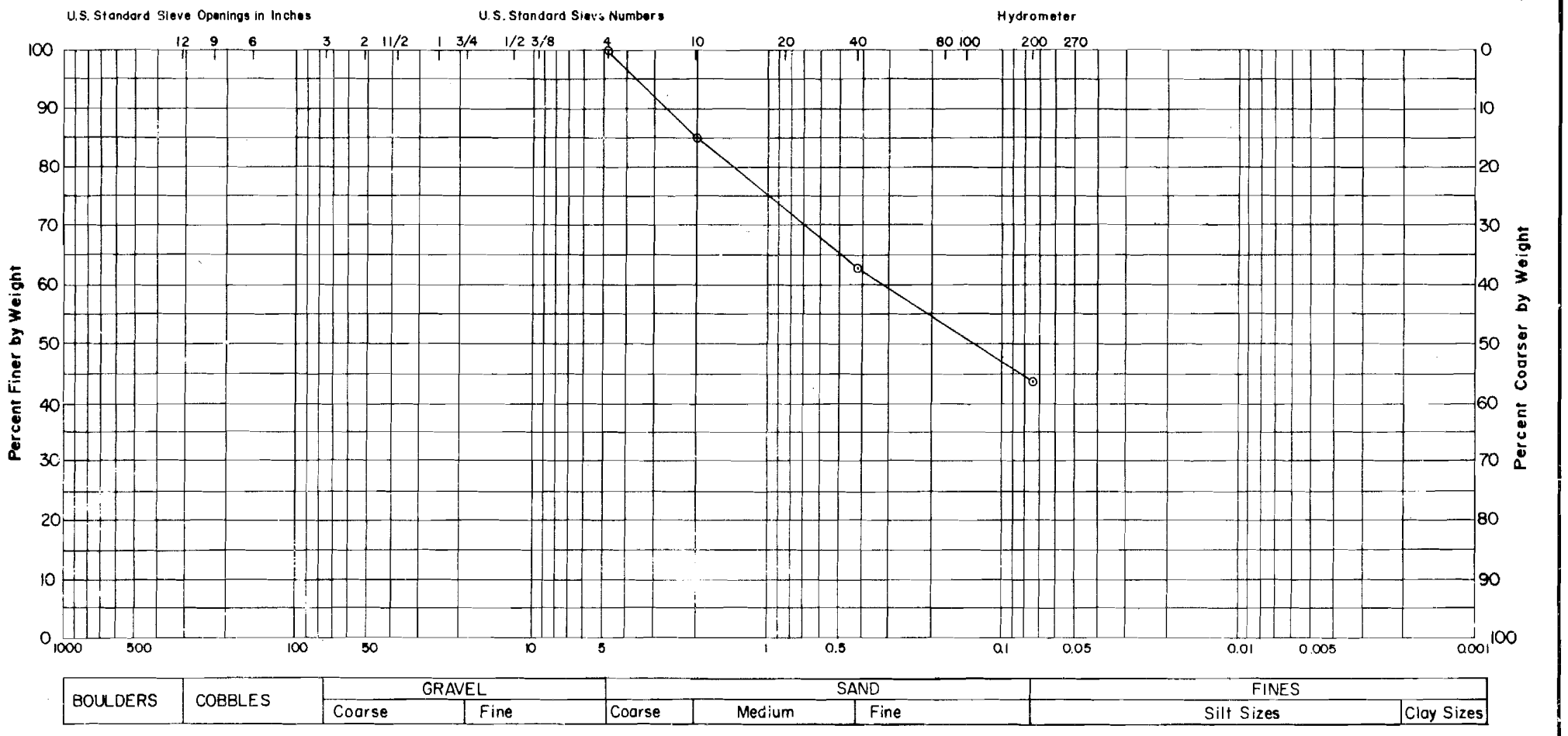
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 9	13		14	NP	SM	SAND WITH SOME SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



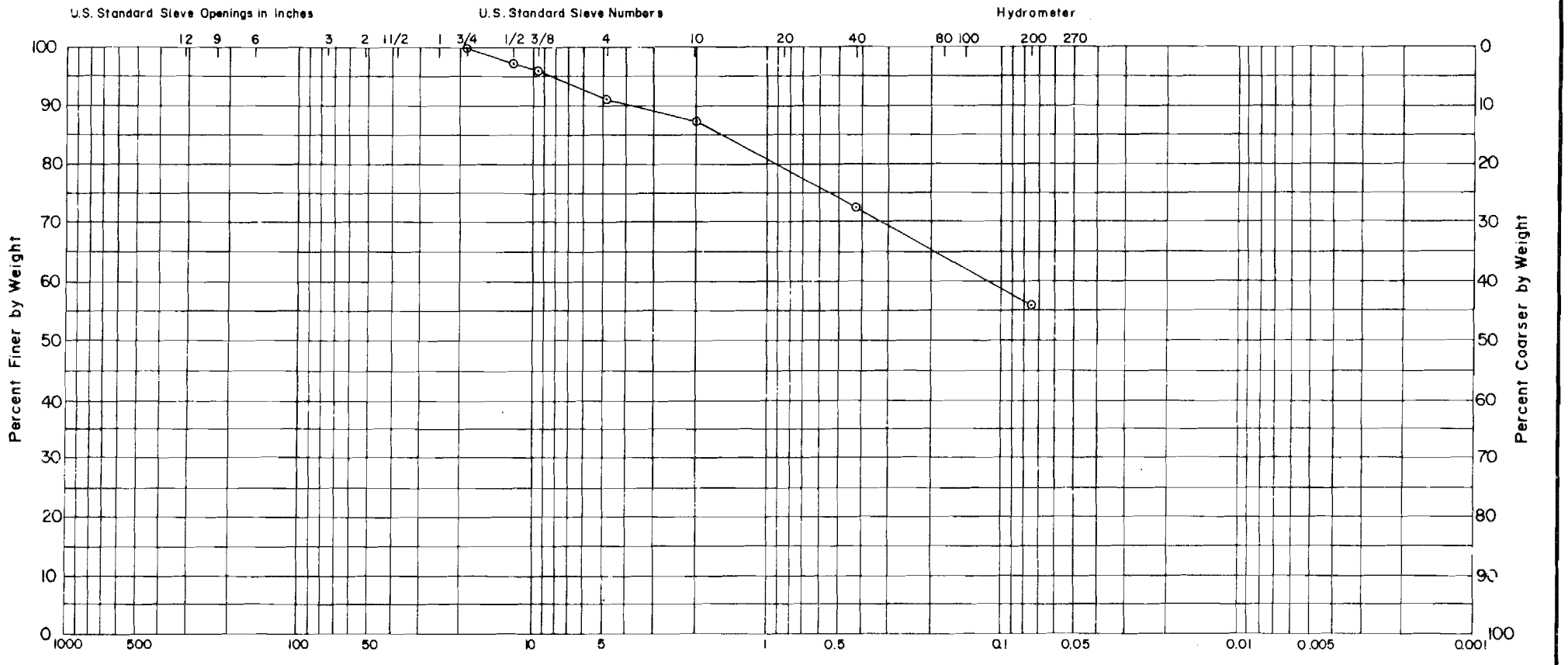
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 10	12		17	6	SM-SC	SILTY SAND WITH SOME TO TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



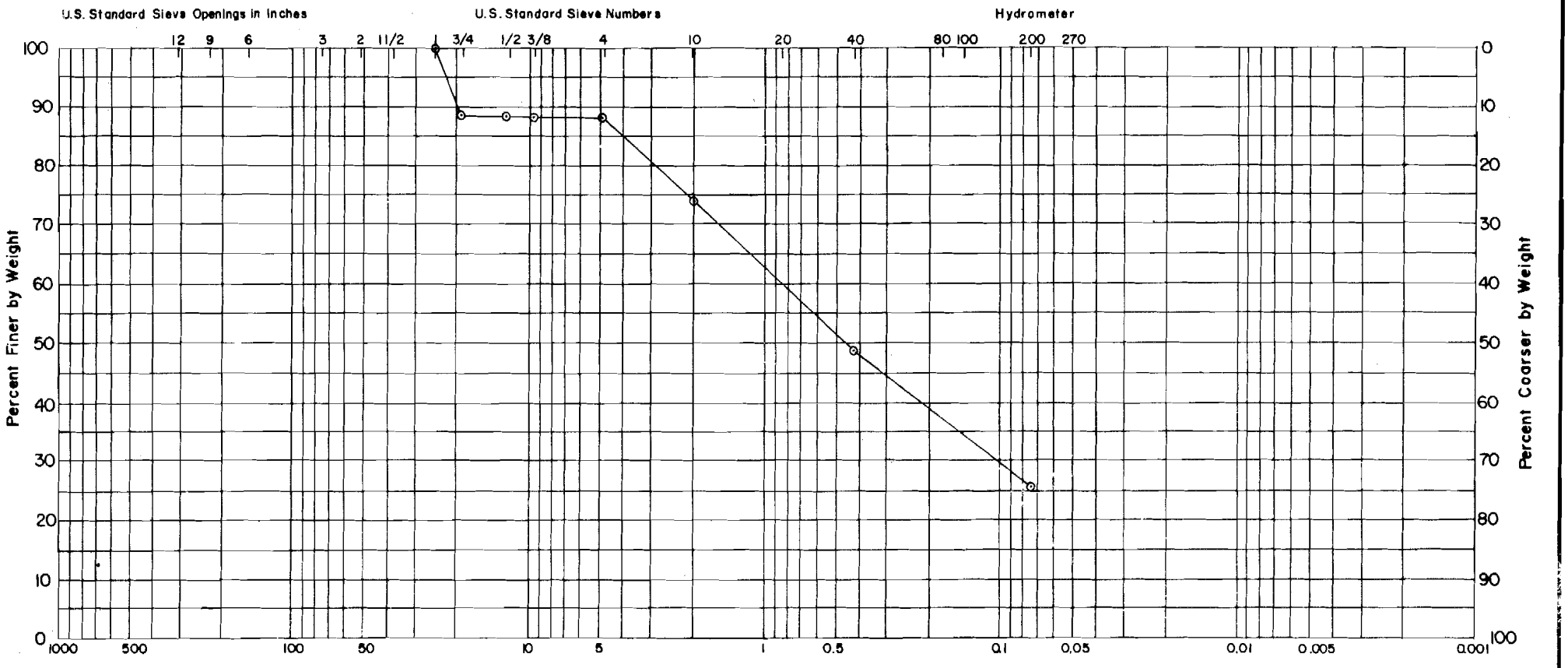
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5-11	12		23	14	CL	SANDY SILT WITH SOME TO TRACE CLAY AND TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



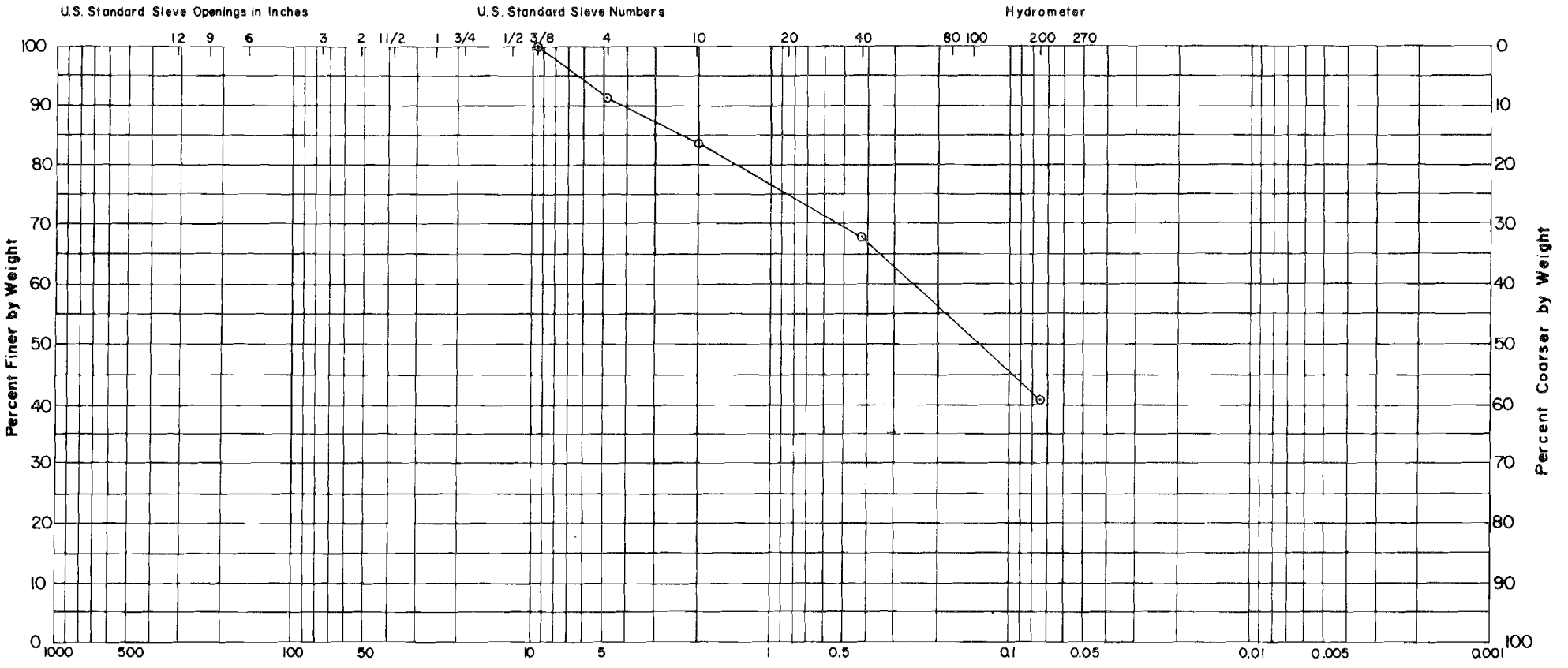
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 12	9		39	14	SM-SC	SAND WITH SOME GRAVEL AND SILT AND TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



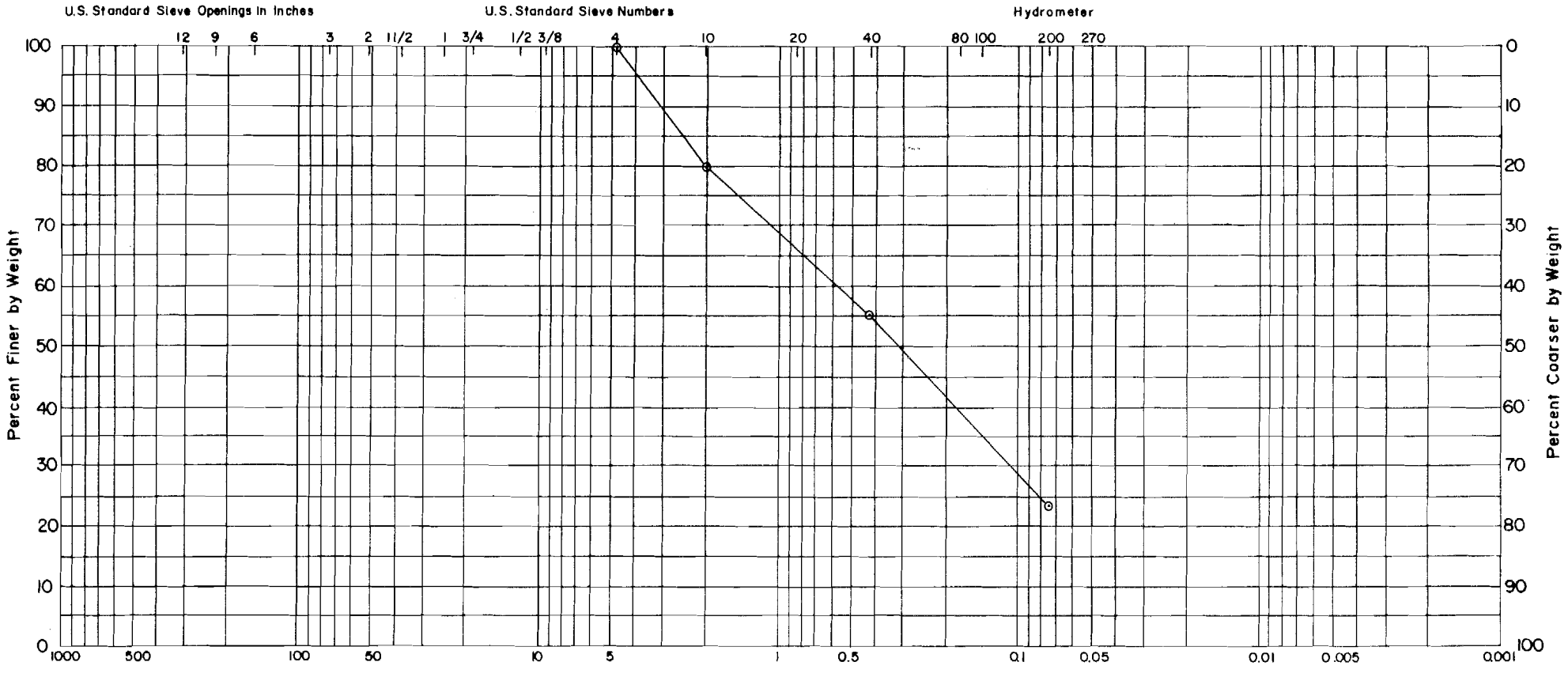
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 3,4,	10,8		15	NP	SM	SILTY SAND WITH TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



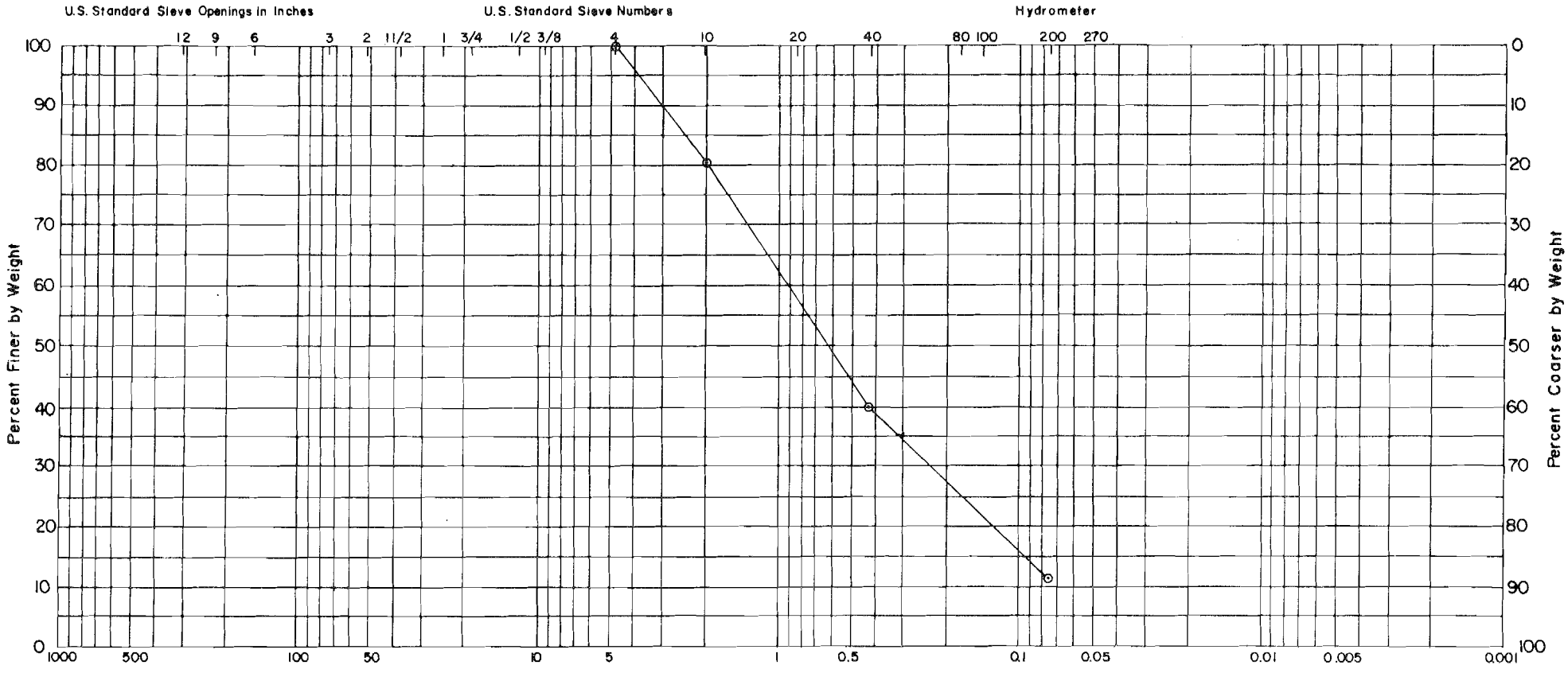
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 6,7	12,11		13	NP	SM	SAND WITH SOME SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



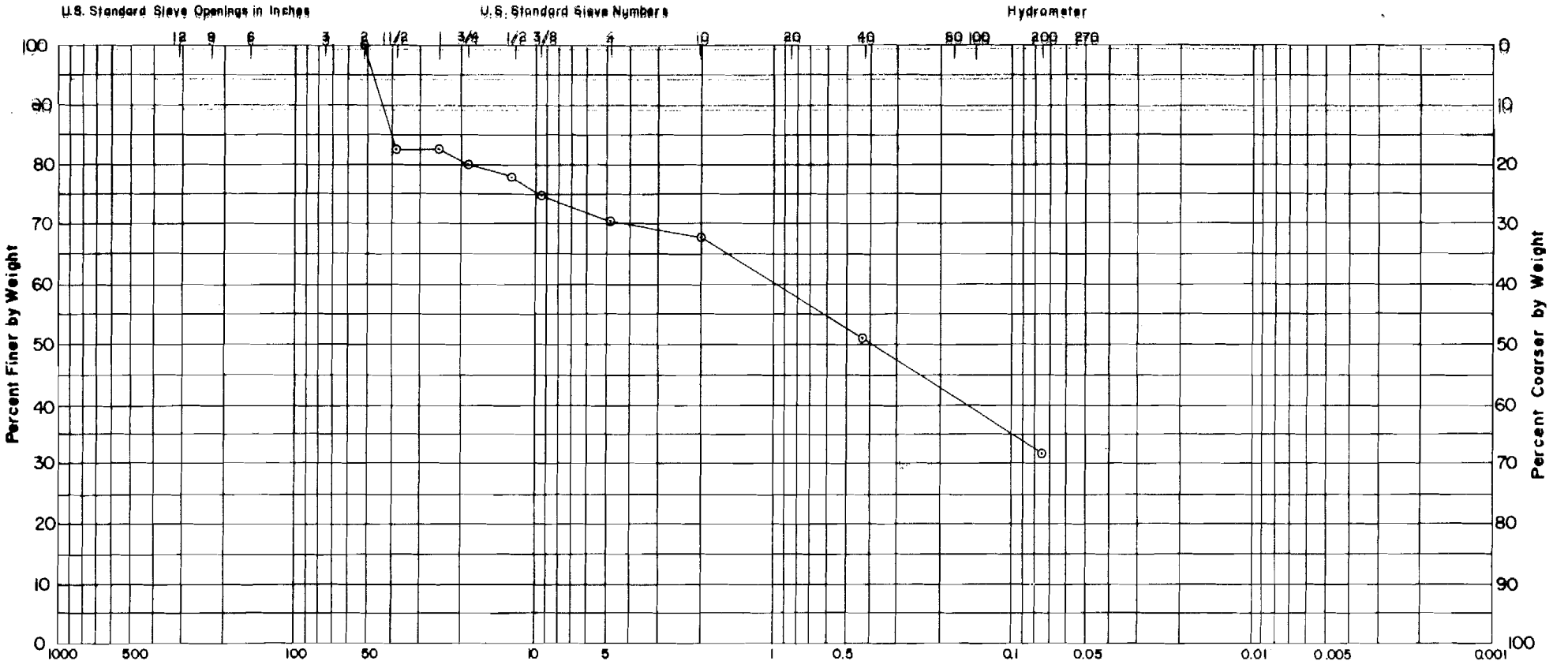
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 9	12		17	2	SW-SM	SAND WITH TRACE SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



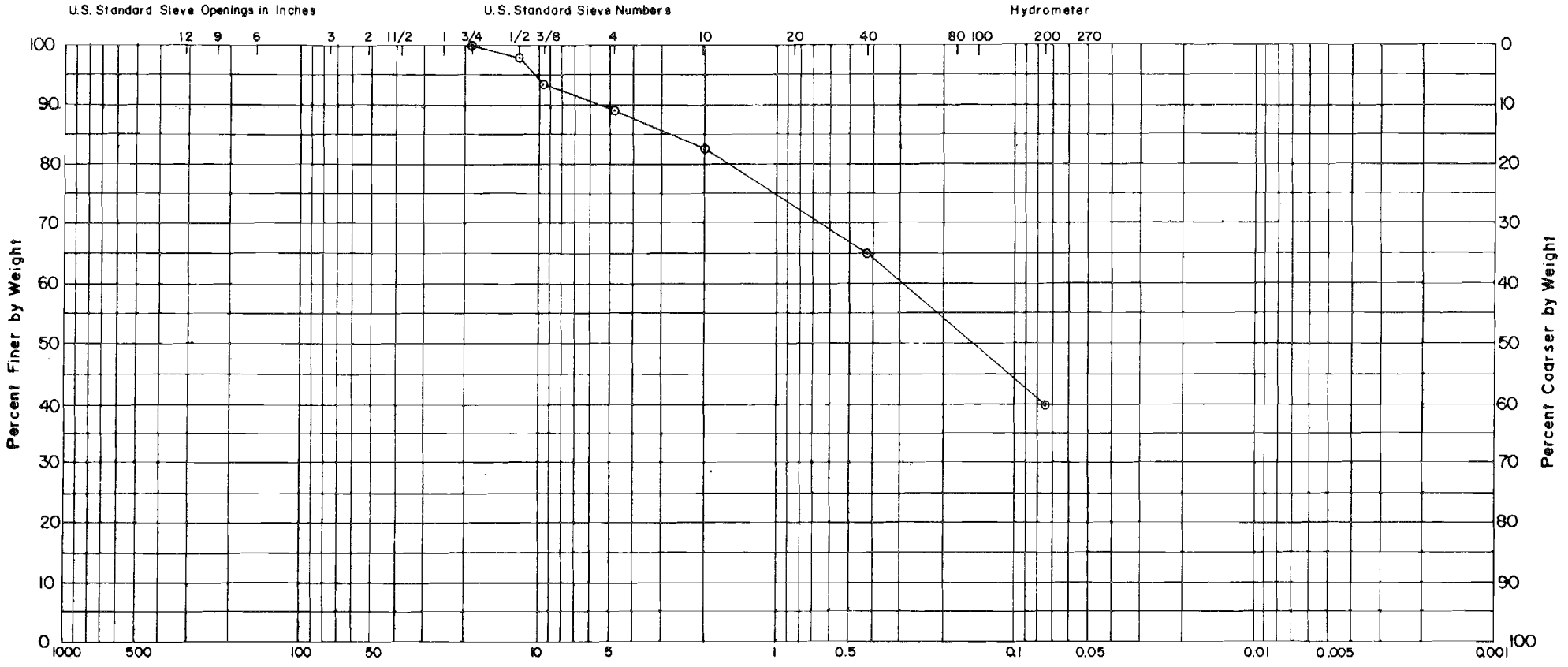
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 10	9		15	NP	SM	SILTY SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



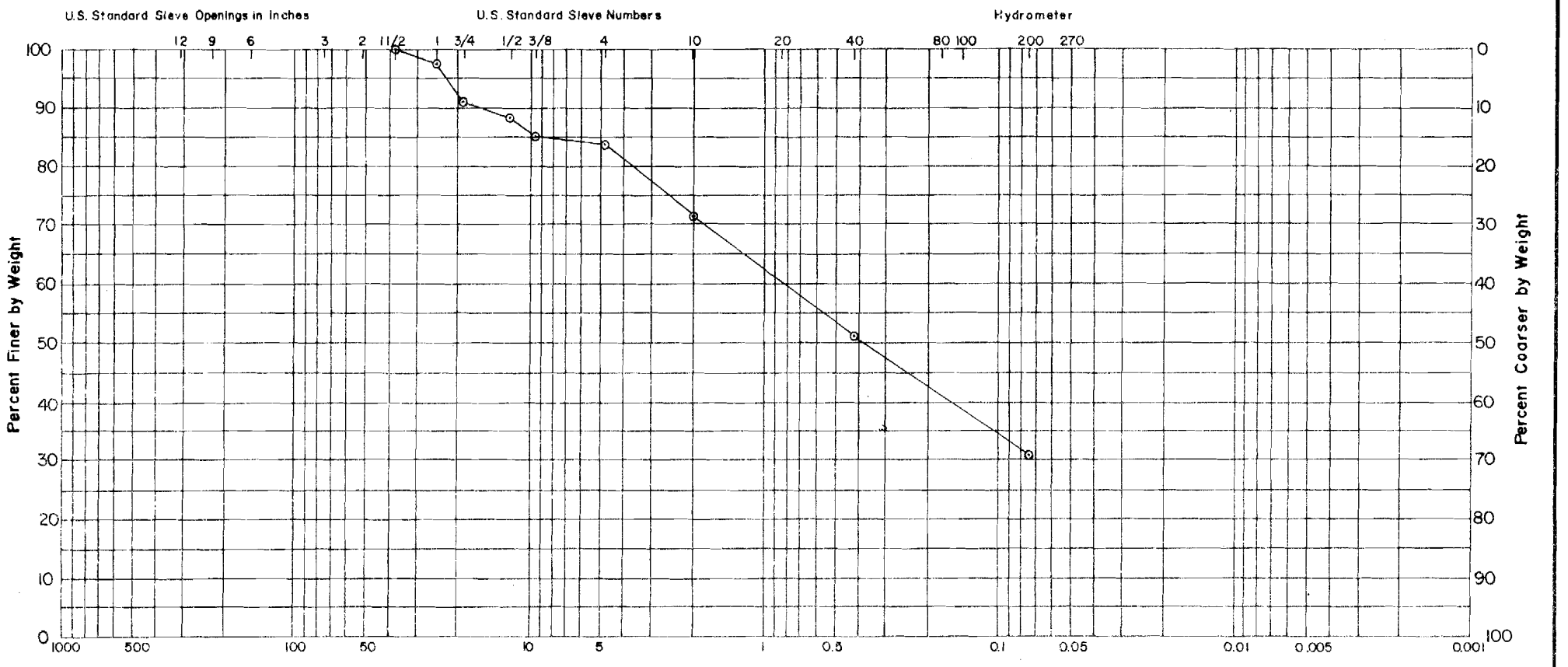
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 12	9		17	NP	SM	SILTY SAND WITH TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



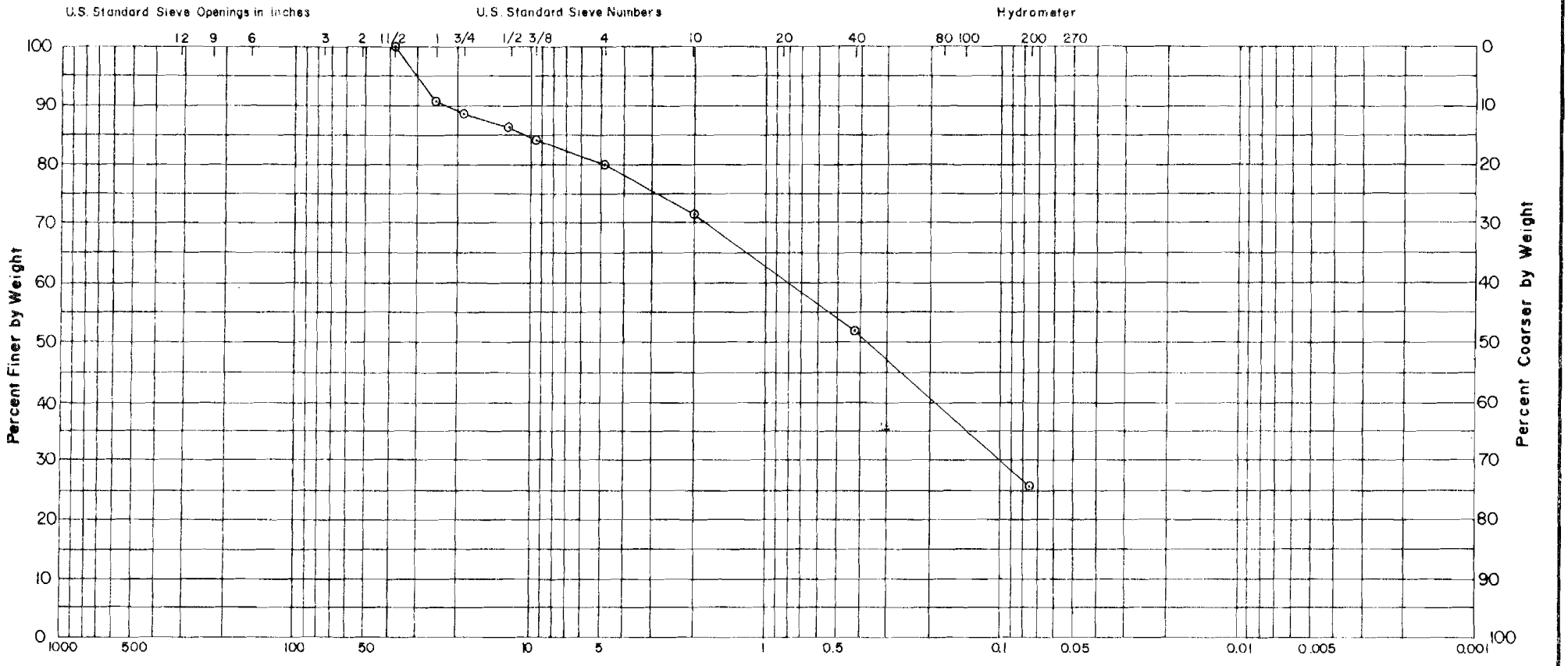
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D7 - 4,5	12,11				SM	SILTY SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D7

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



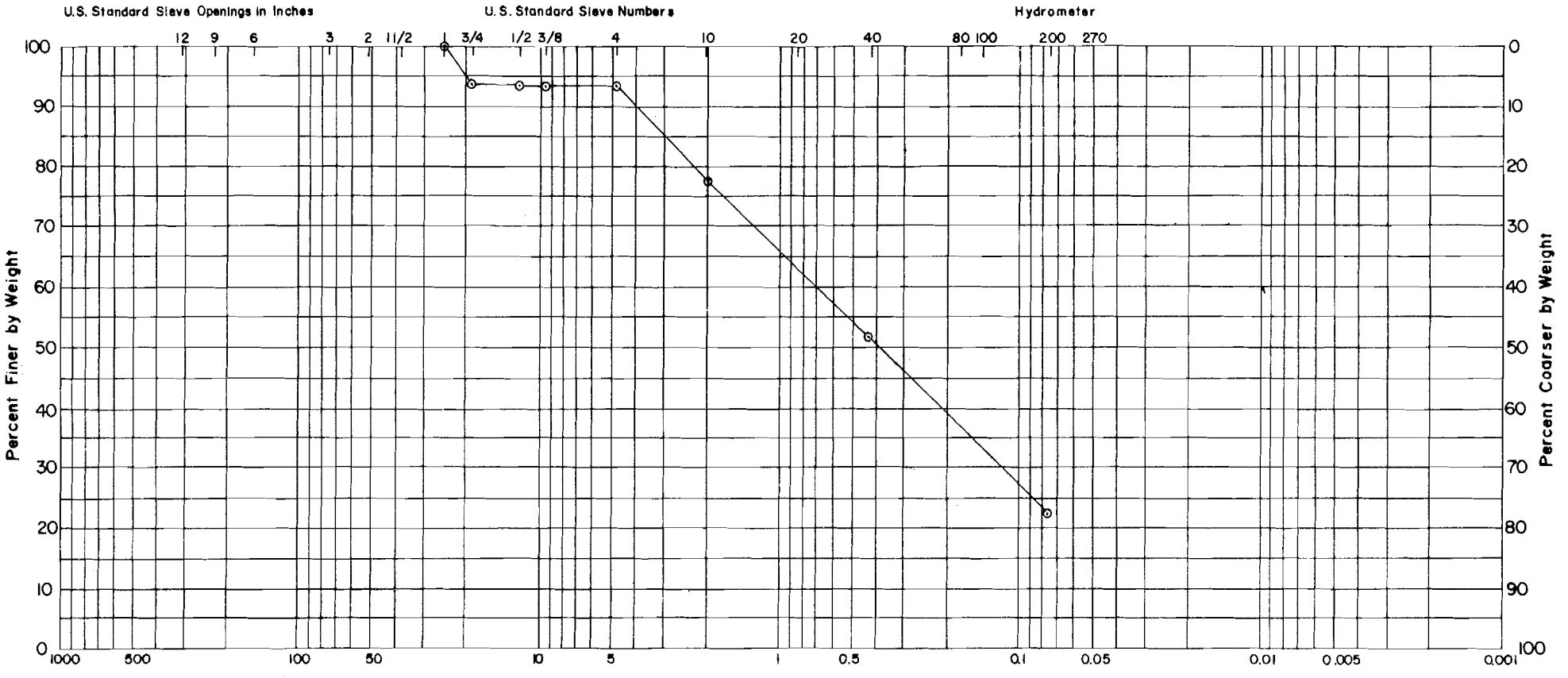
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D7 - 6	10				SM	SAND WITH SOME SILT AND GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D7

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



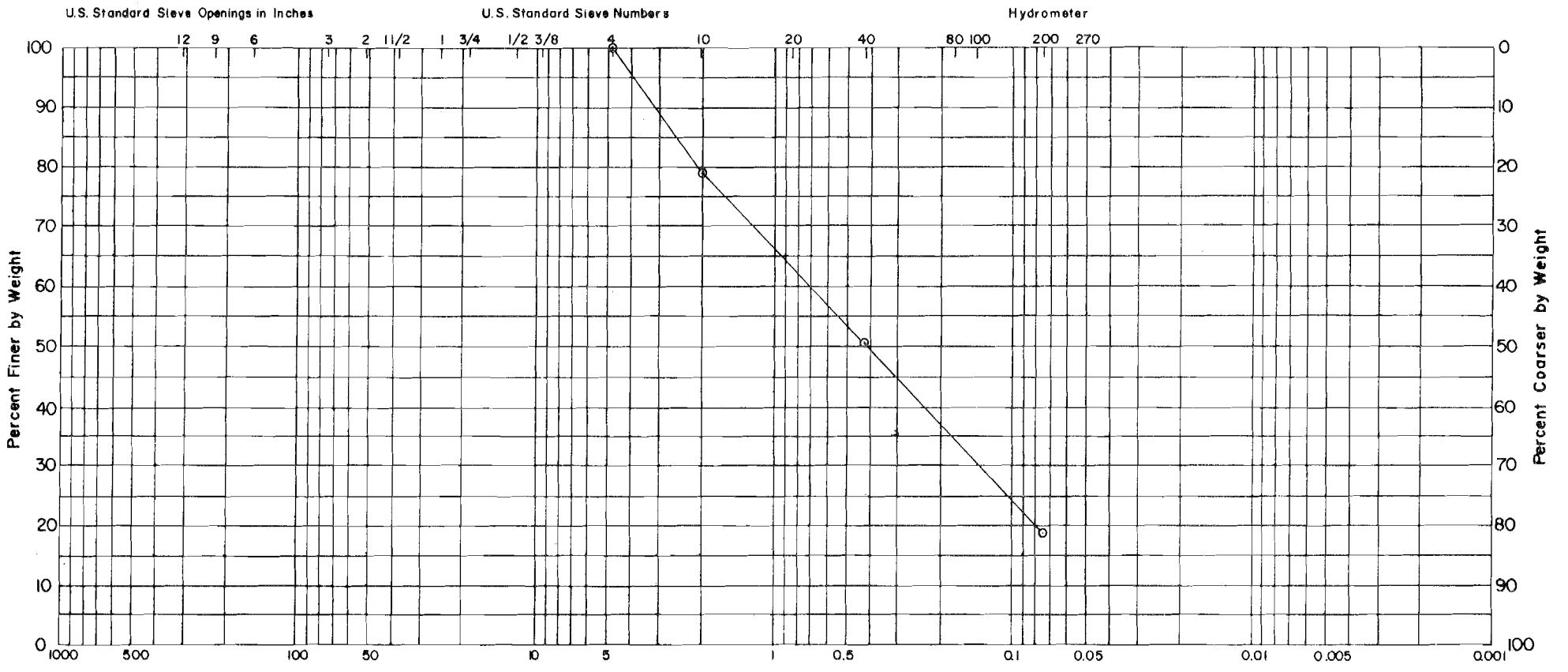
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D7 - 8	9				SM	SAND WITH SOME SILT, TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D7

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



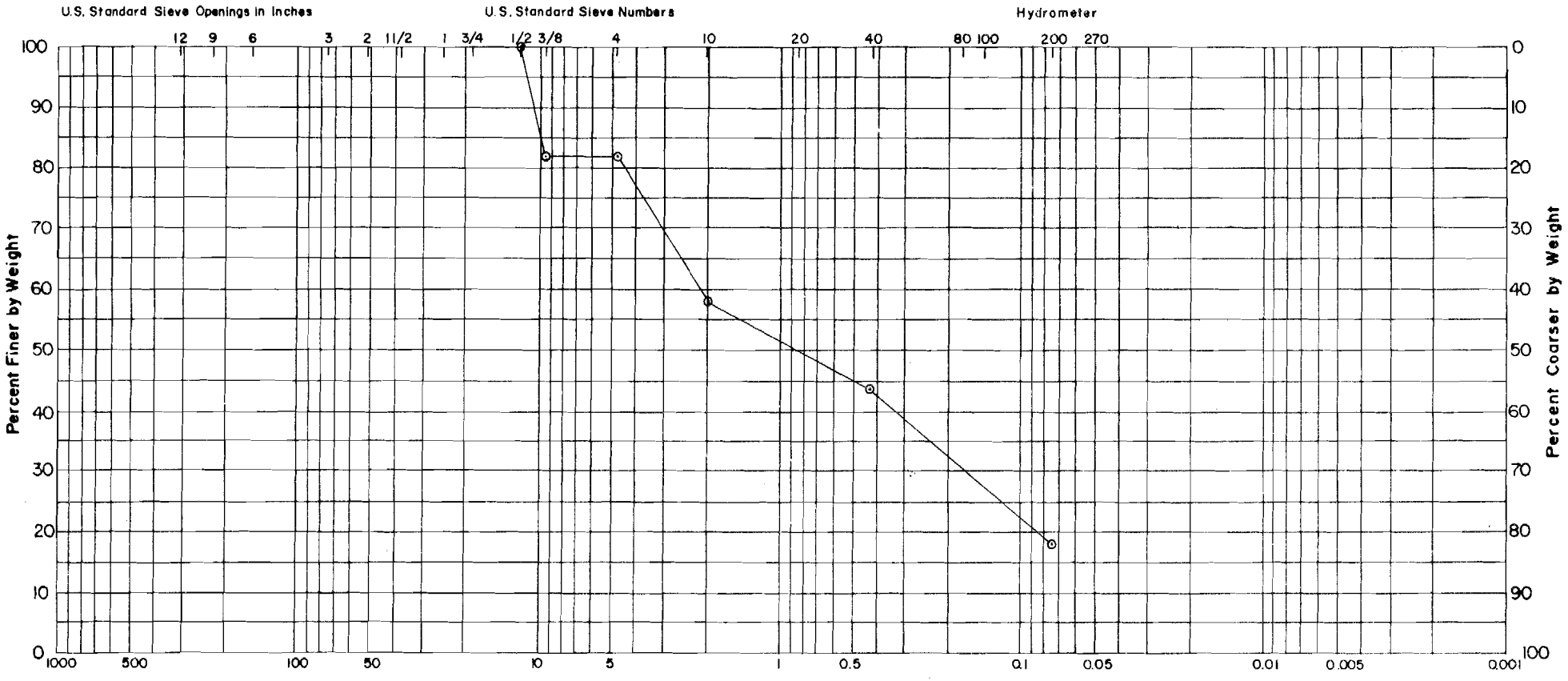
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D7 - 10	9				SM	SAND WITH SOME SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D7

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



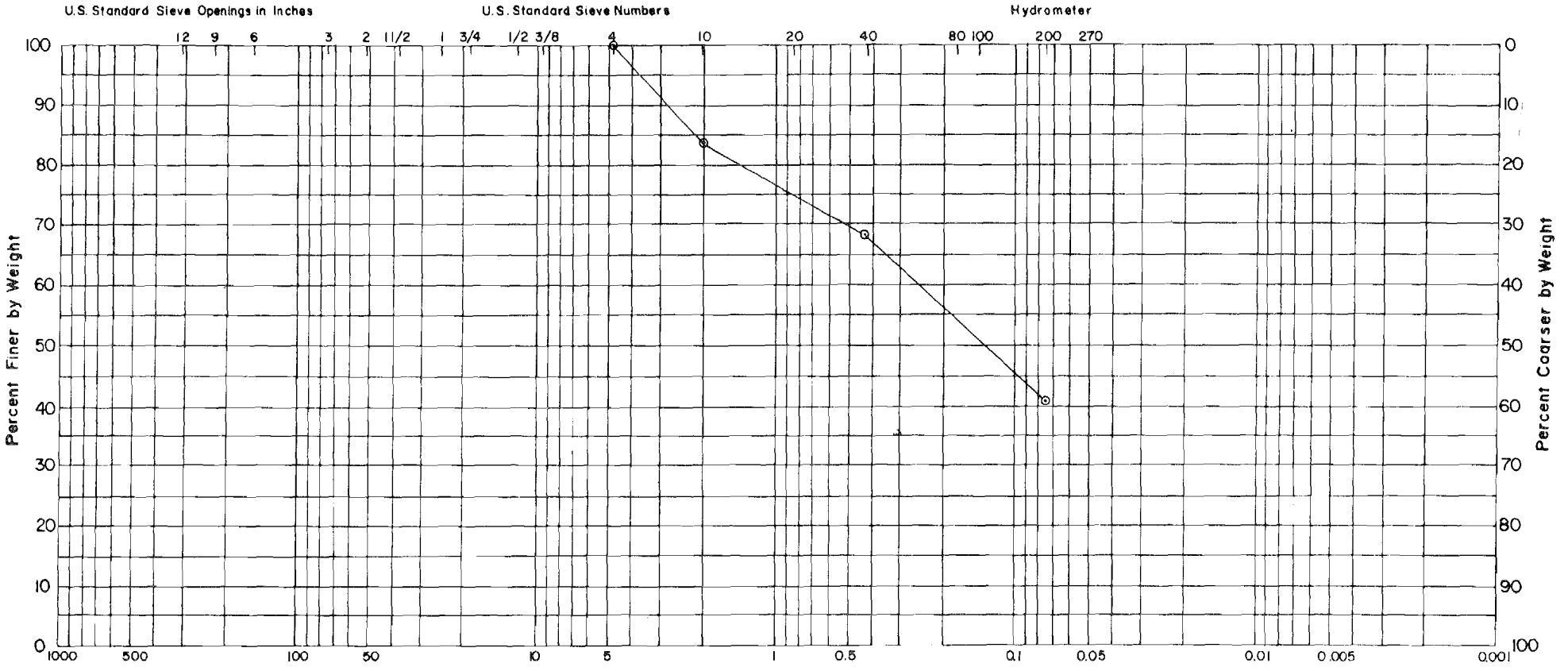
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 5	15		14	NP	SM	SAND WITH SOME GRAVEL AND SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D8

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 8	14		14	NP	SM-ML	SILTY SAND

R&M CONSULTANTS INC.

BORROW AREA D

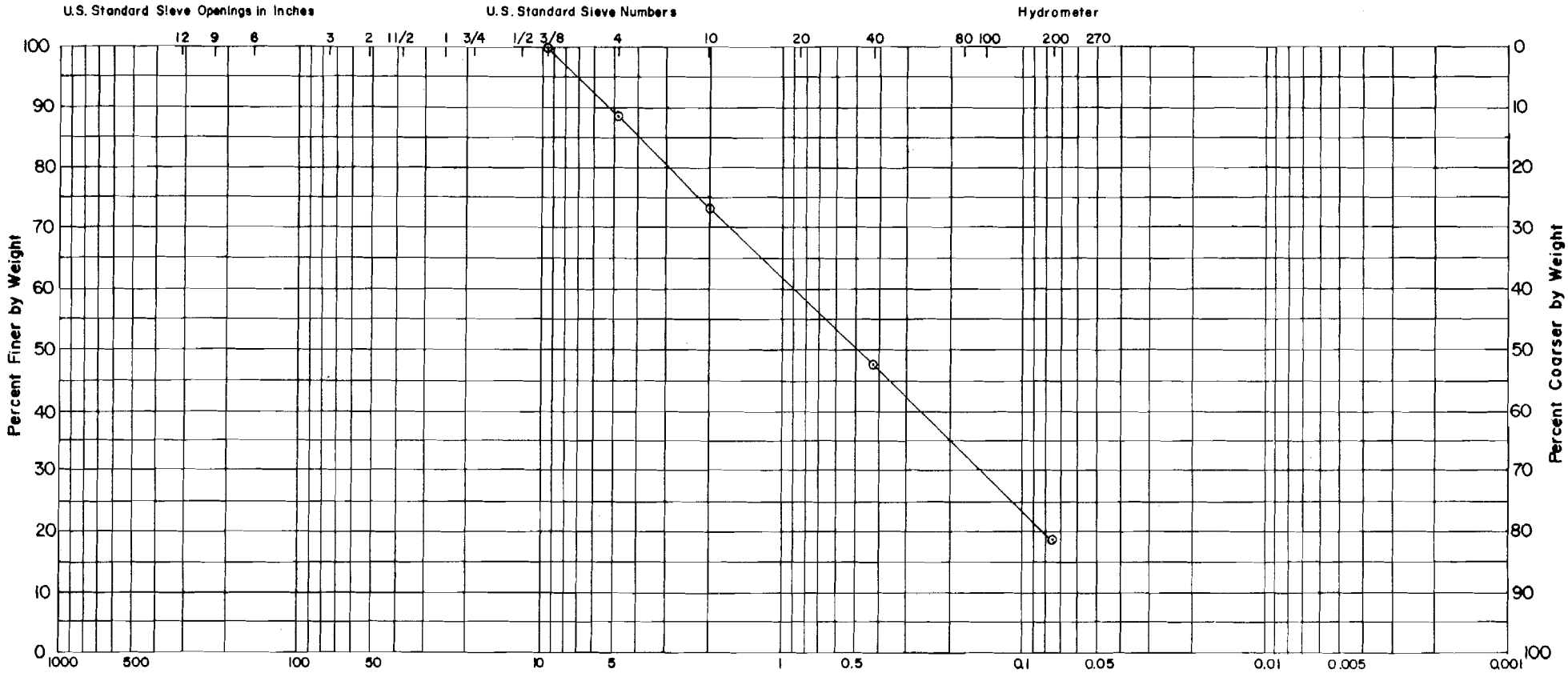
AUGER HOLE AH-D8

DRAWN BY: P.T.

APPROVED BY: W.O.S.E.

DATE: 12/81

PROJECT NO. 052506



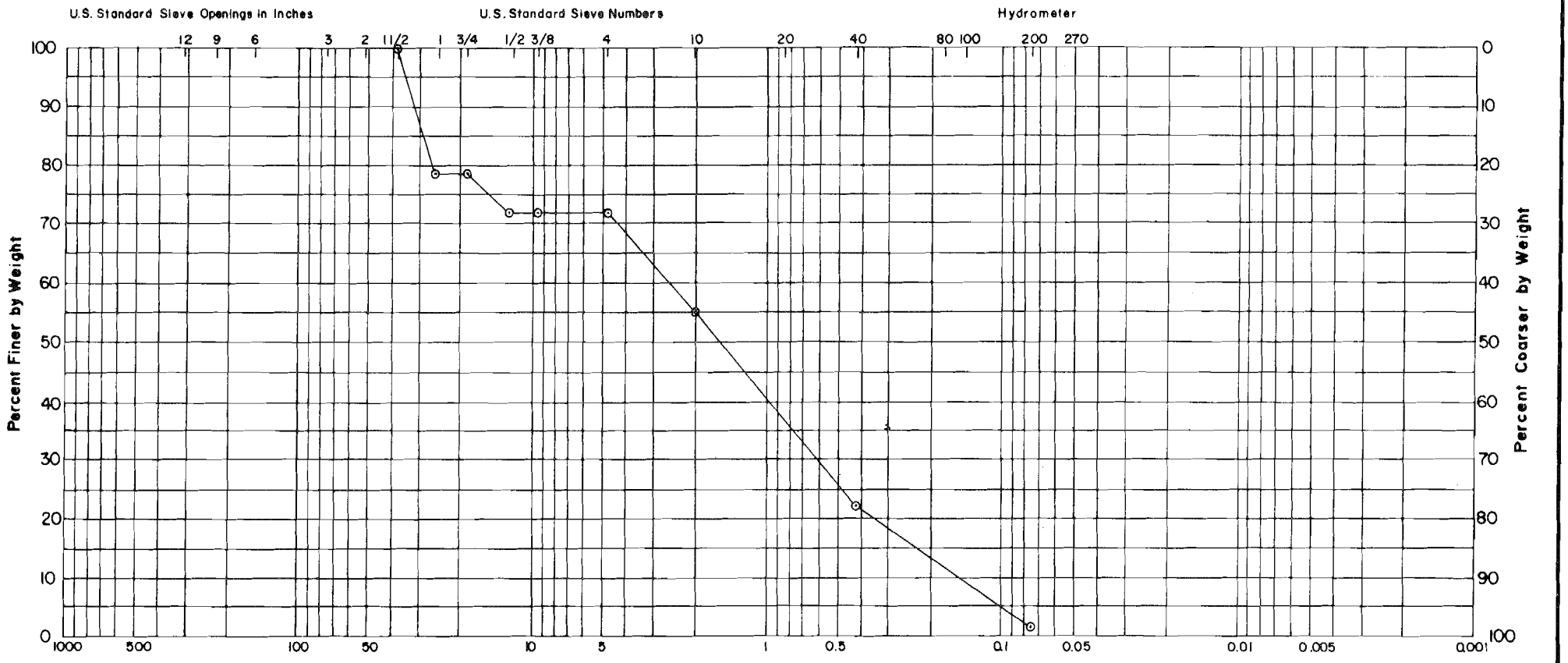
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 9					SM	SAND WITH SOME GRAVEL AND SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D8

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



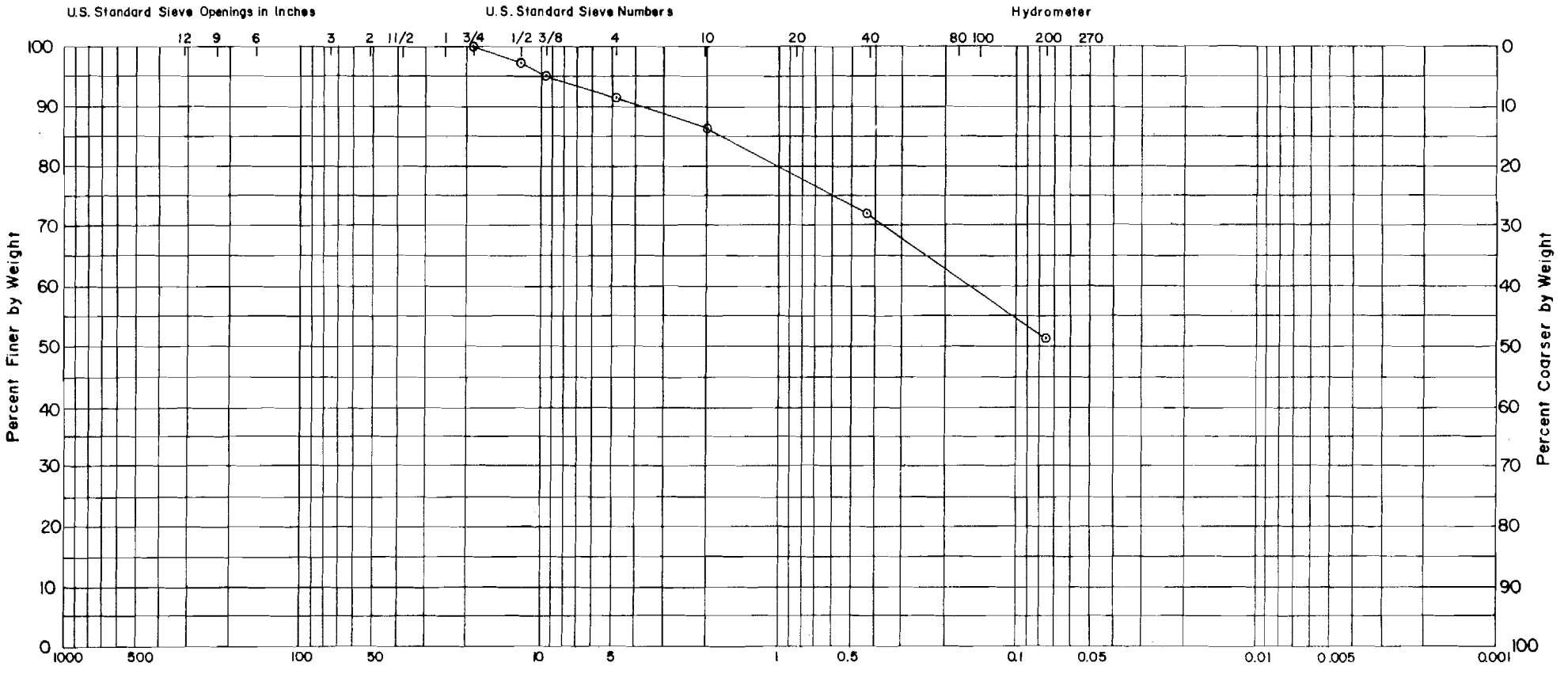
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 11	10		18	5	SP	SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D8

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



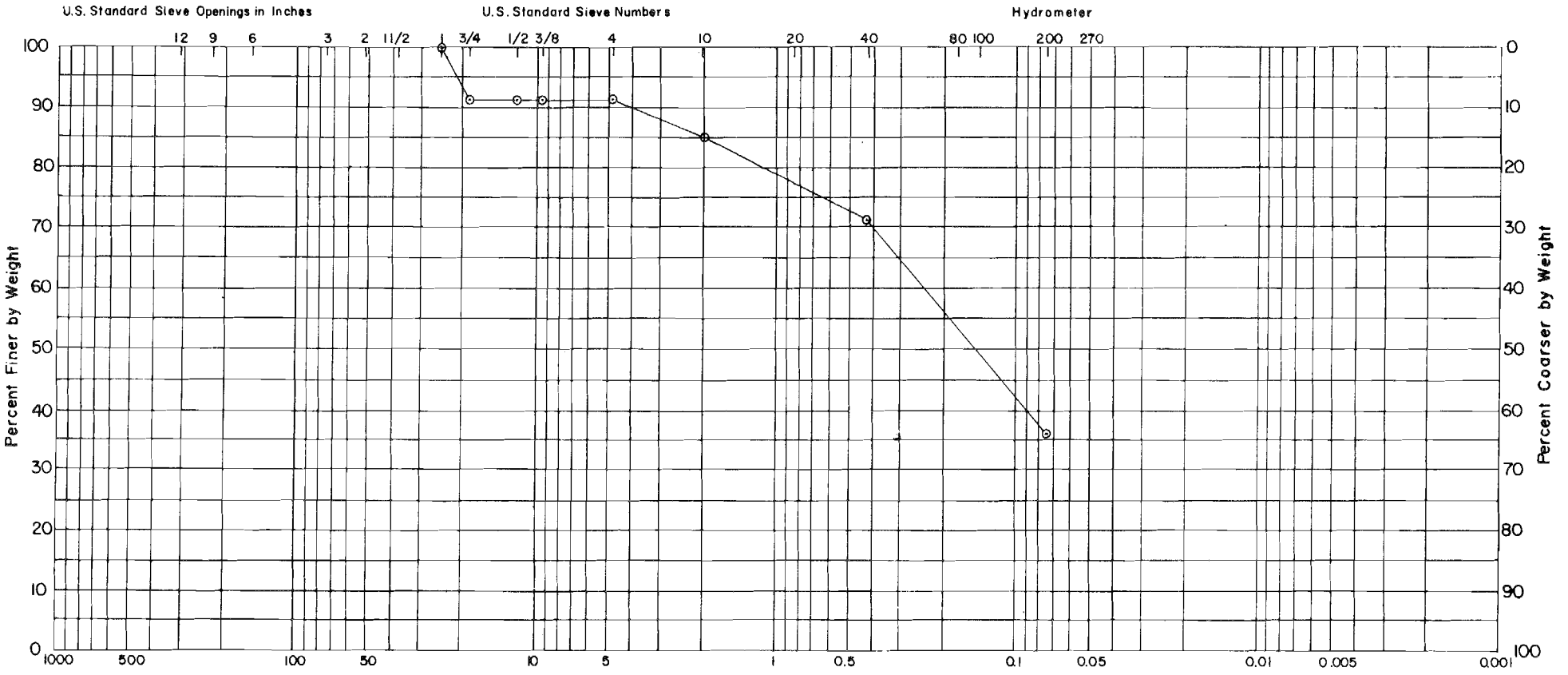
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 13	13				ML	SANDY SILT WITH SOME TO TRACE CLAY AND TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D8

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



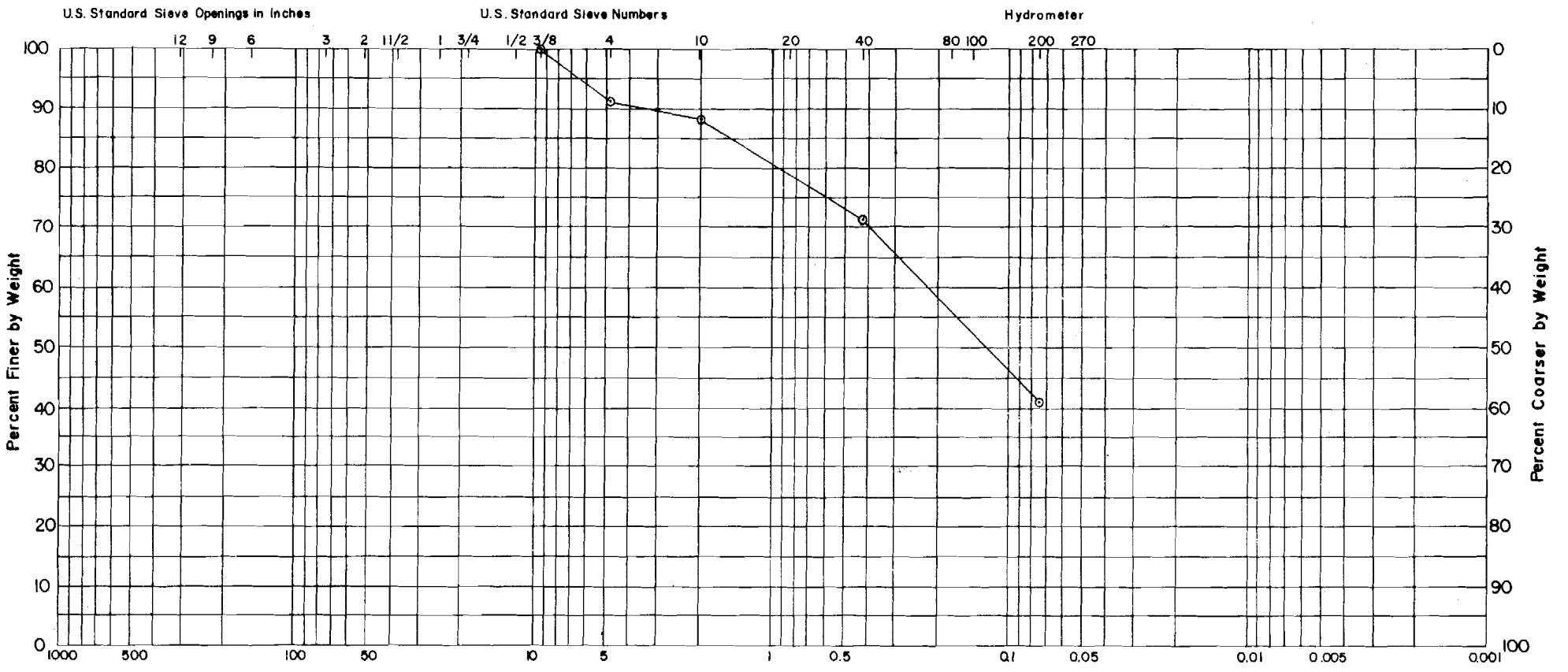
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 2					SM	SILTY SAND WITH TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



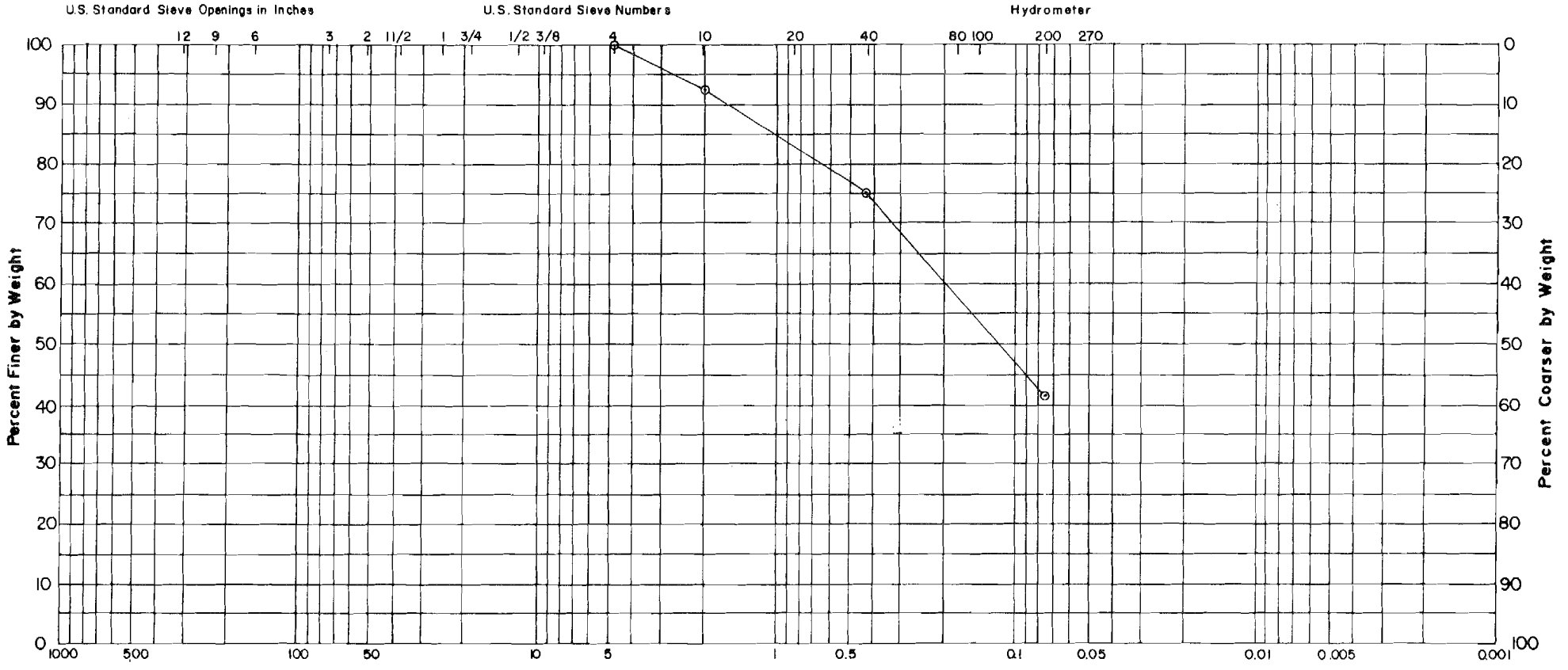
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 3					SM	SILTY SAND WITH TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



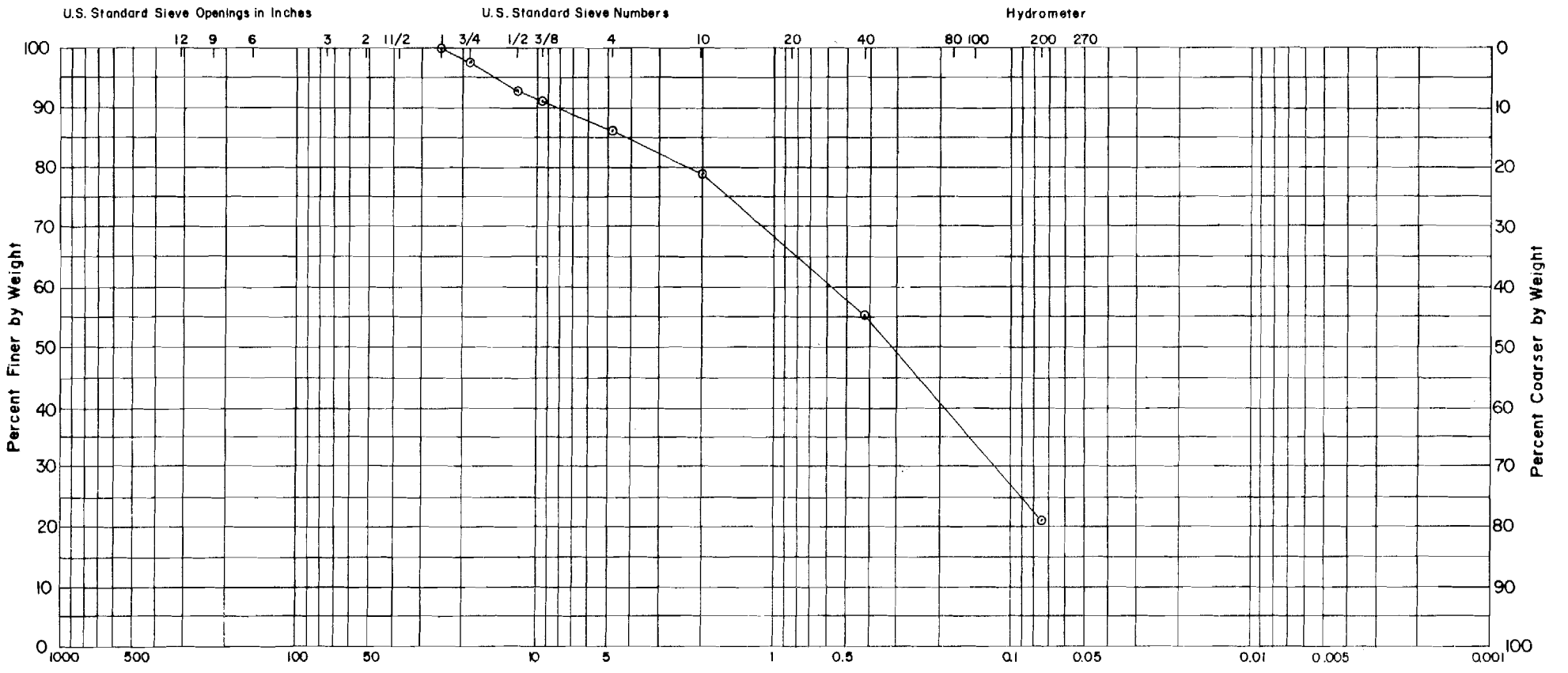
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 4					SM	SILTY SAND

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 5					SM	SAND WITH SOME SILT AND GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D

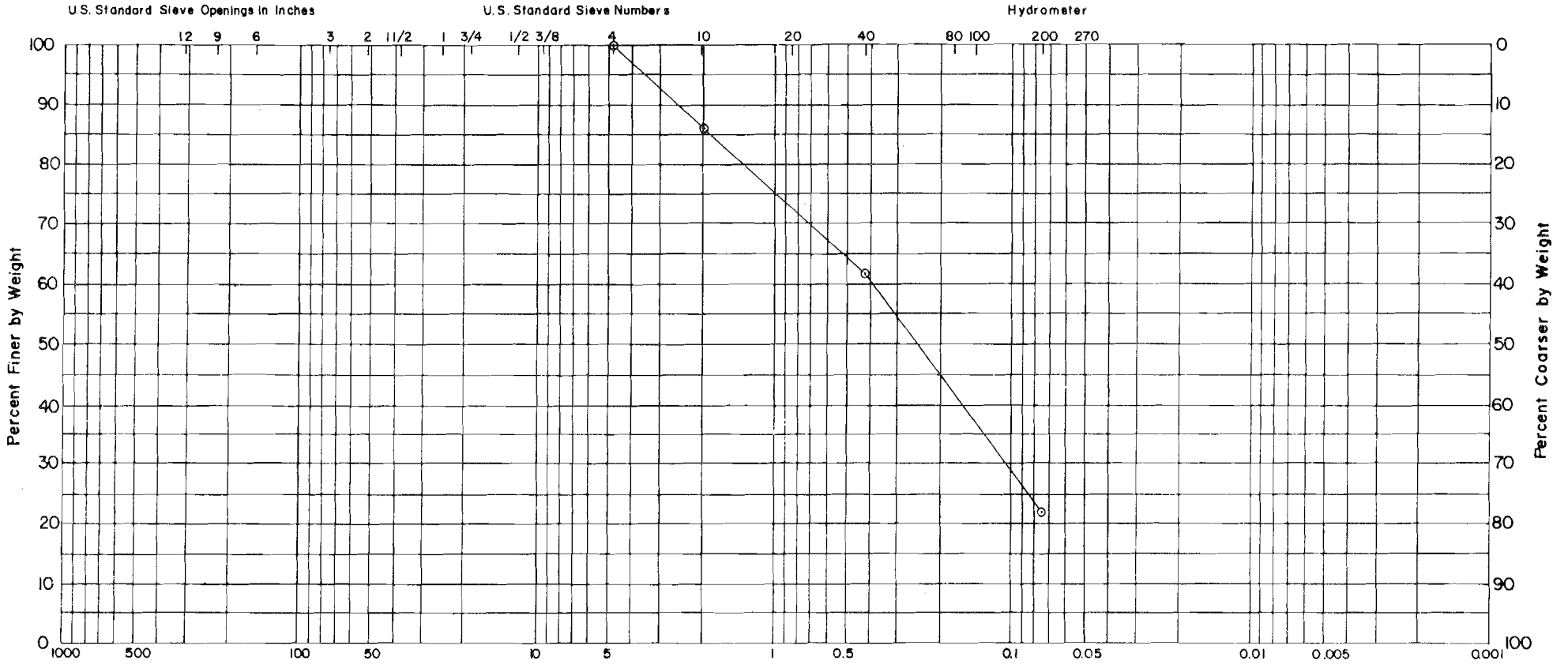
AUGER HOLE AH-D9

DRAWN BY: P.T.

APPROVED BY: W.O.S.E.

DATE: 12/81

PROJECT NO. 052506



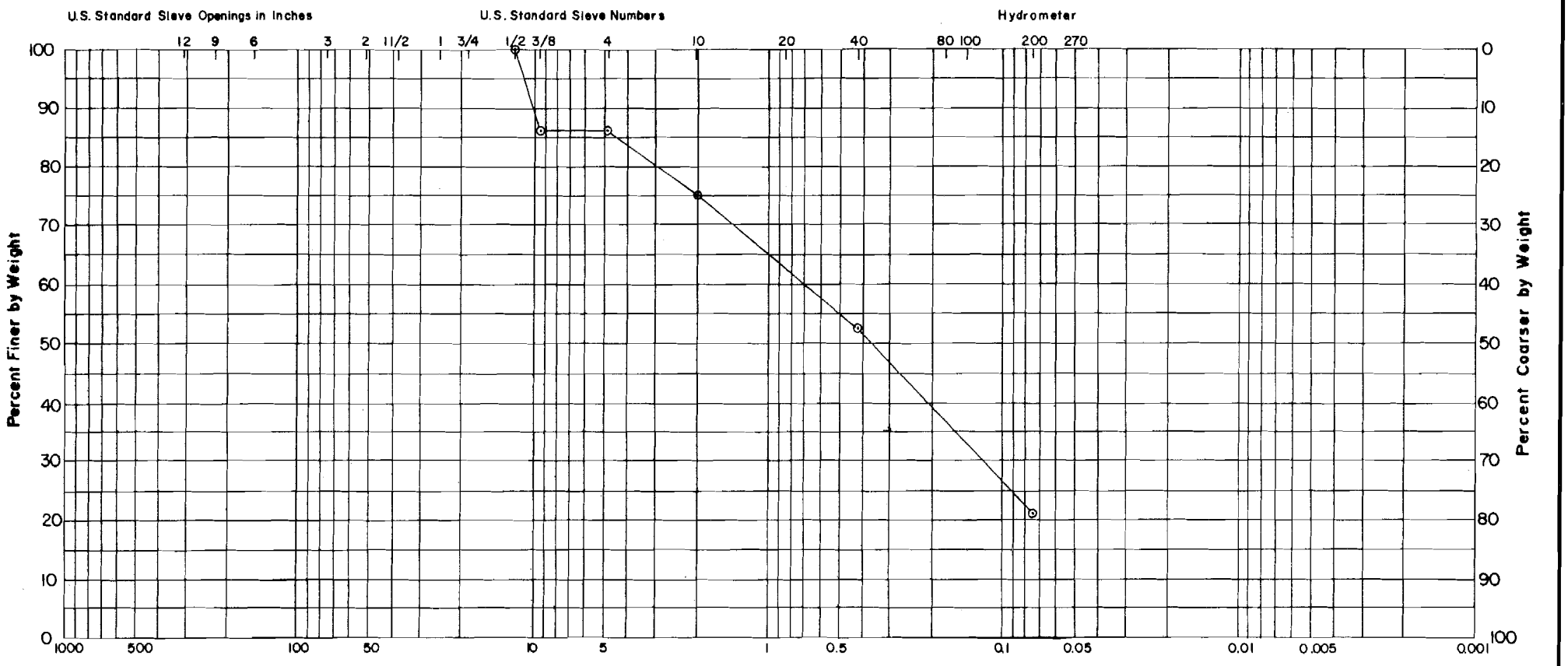
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 6					SM	SAND WITH SOME SILT

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



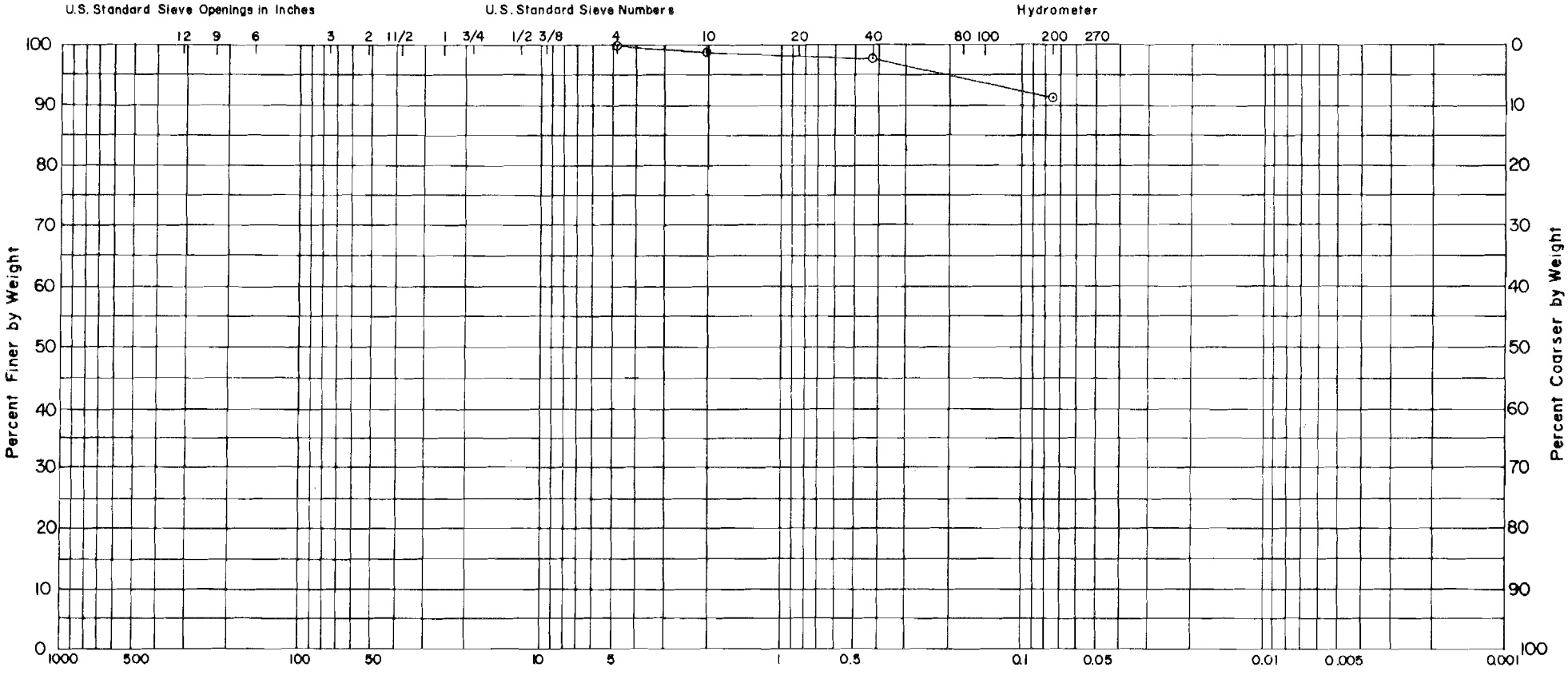
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 7					SM	SAND WITH SOME SILT AND GRAVEL

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



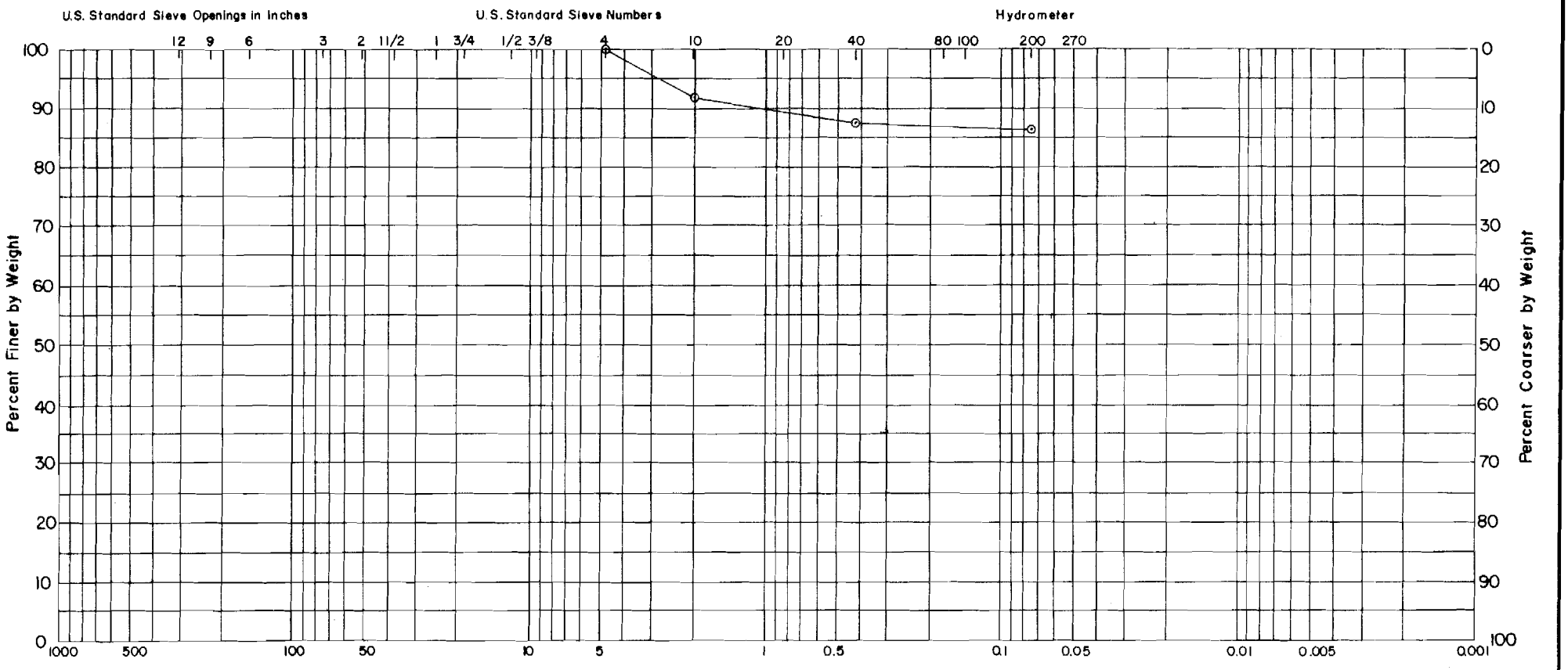
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 13	21		21	NP	ML	SILT WITH TRACE SAND AND TRACE TO SOME CLAY

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



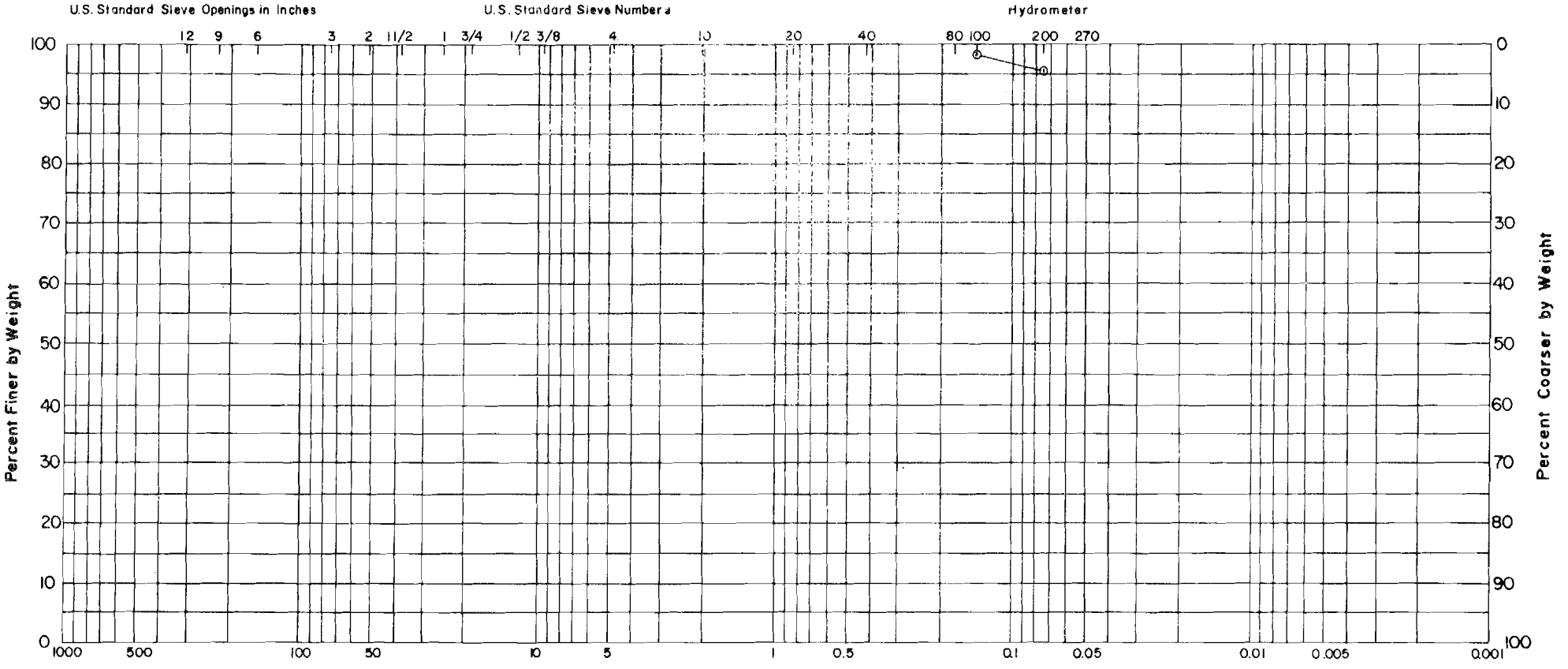
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 14	25		35	7	ML	SILT WITH SOME SAND AND TRACE TO SOME CLAY

R&M CONSULTANTS INC.

BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



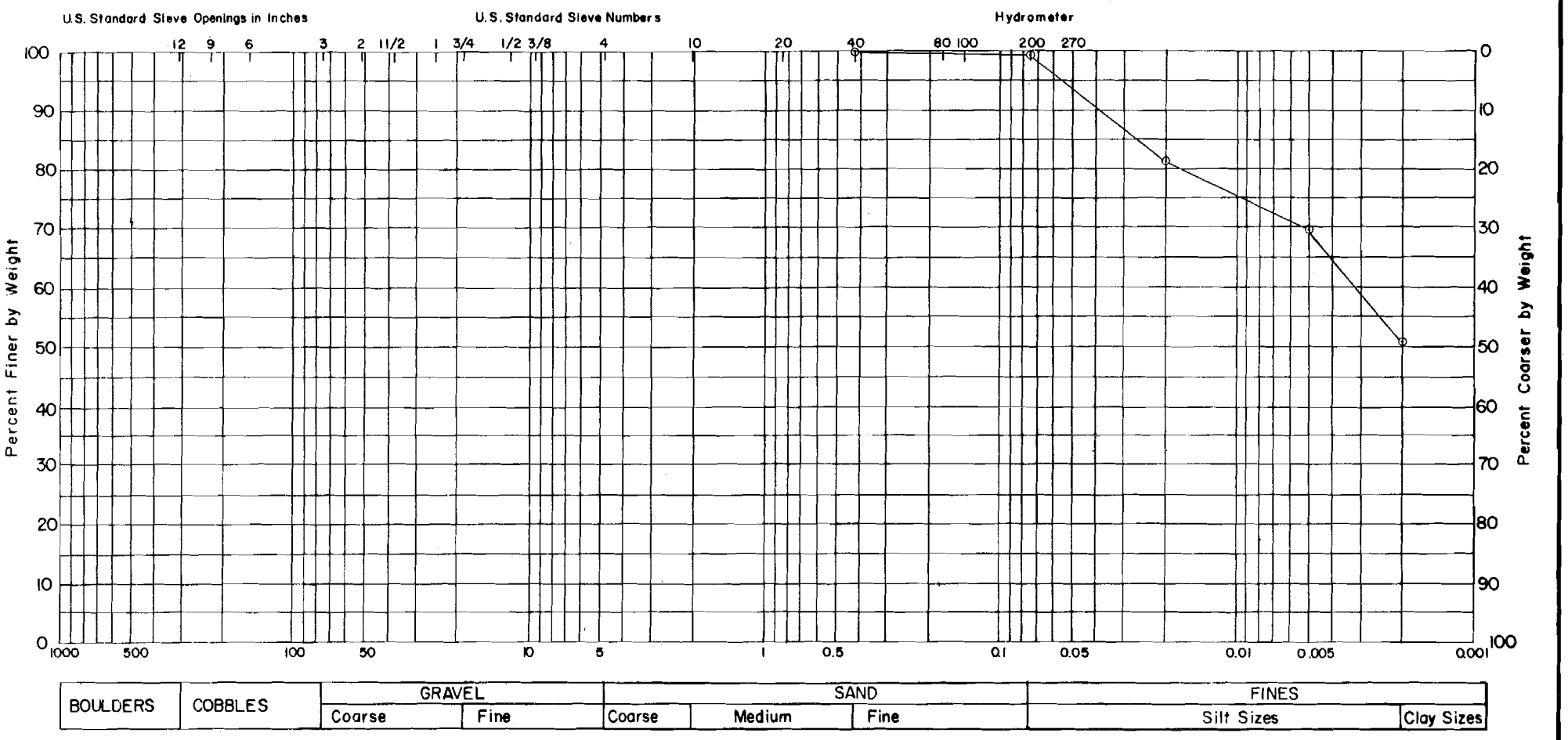
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
BORROW D BULK			59	23	MH	SILT WITH SOME TO TRACE CLAY AND TRACE SAND OR CLAYEY SILT WITH TRACE SAND

R&M CONSULTANTS INC.

BORROW AREA D
BULK SAMPLE

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506

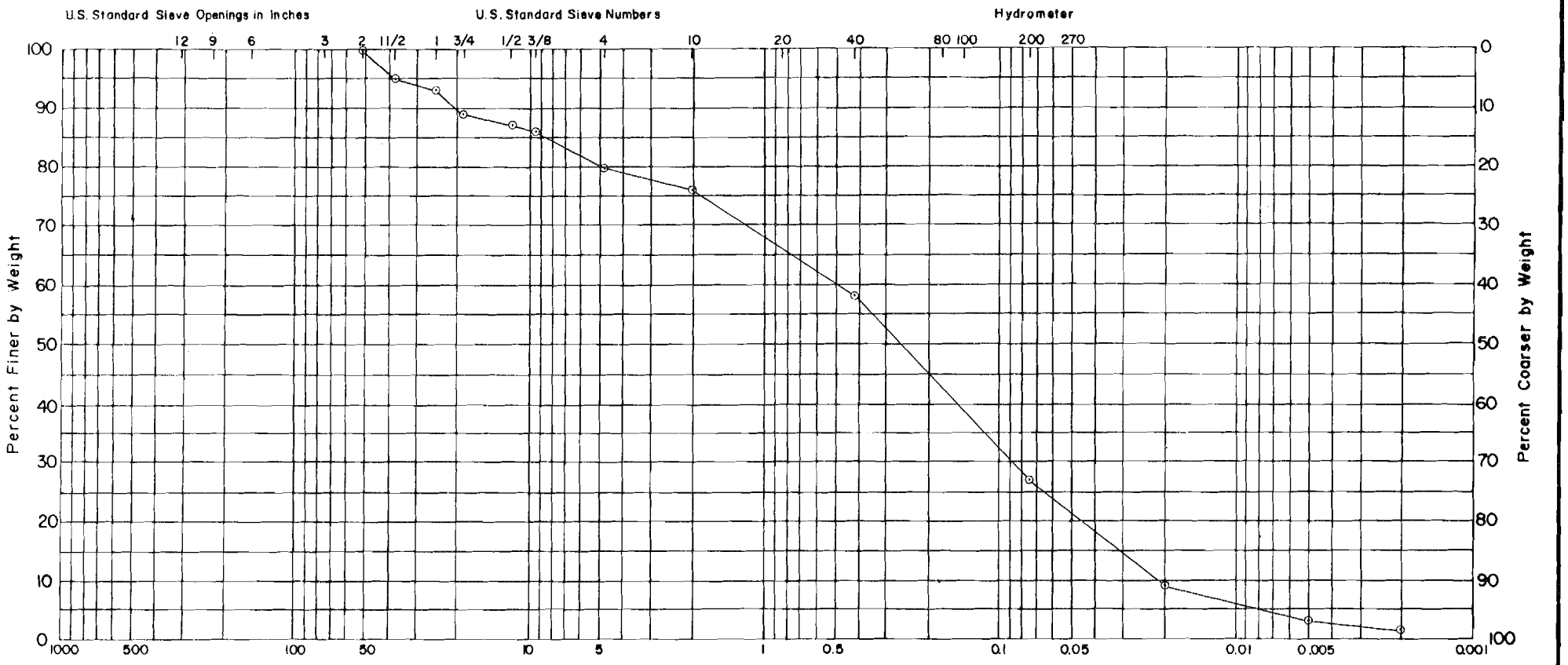


SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
W-80-282	42.1%		55.9	33.2	CL-CH	SILT AND CLAY Medium to High Plasticity
(Grab Sample)						

R&M CONSULTANTS INC.

DEADMAN BORROW AREA

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
W-80-300	6.6%		NV	NP	SM	Sandy 'Till' with non plastic fines
(Grab Sample)						GRAVELLY SILTY SAND WITH TRACE CLAY
						Well graded

R&M CONSULTANTS INC.

DEADMAN BORROW AREA

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504

Project No. 052504
Date 11-20-80

R&M Consultant Inc.

LABORATORY COMPACTION CONTROL REPORT

Job Name and Location: Susitna (Watana Dam Site)

Architect or Engineer: Acres American Inc.

Contractor:

A. Description of Soil: Well Graded 'Till'- GRAVELLY, SILTY SAND W/TRACE CLAY

Material Mark: B Unified Classification: SM AASHO Classification:

Source of Material: Deadman Creek Sample No. W-80-300

Natural Water Content: 6.6% % Natural Dry Density: PCF Specific Gravity:

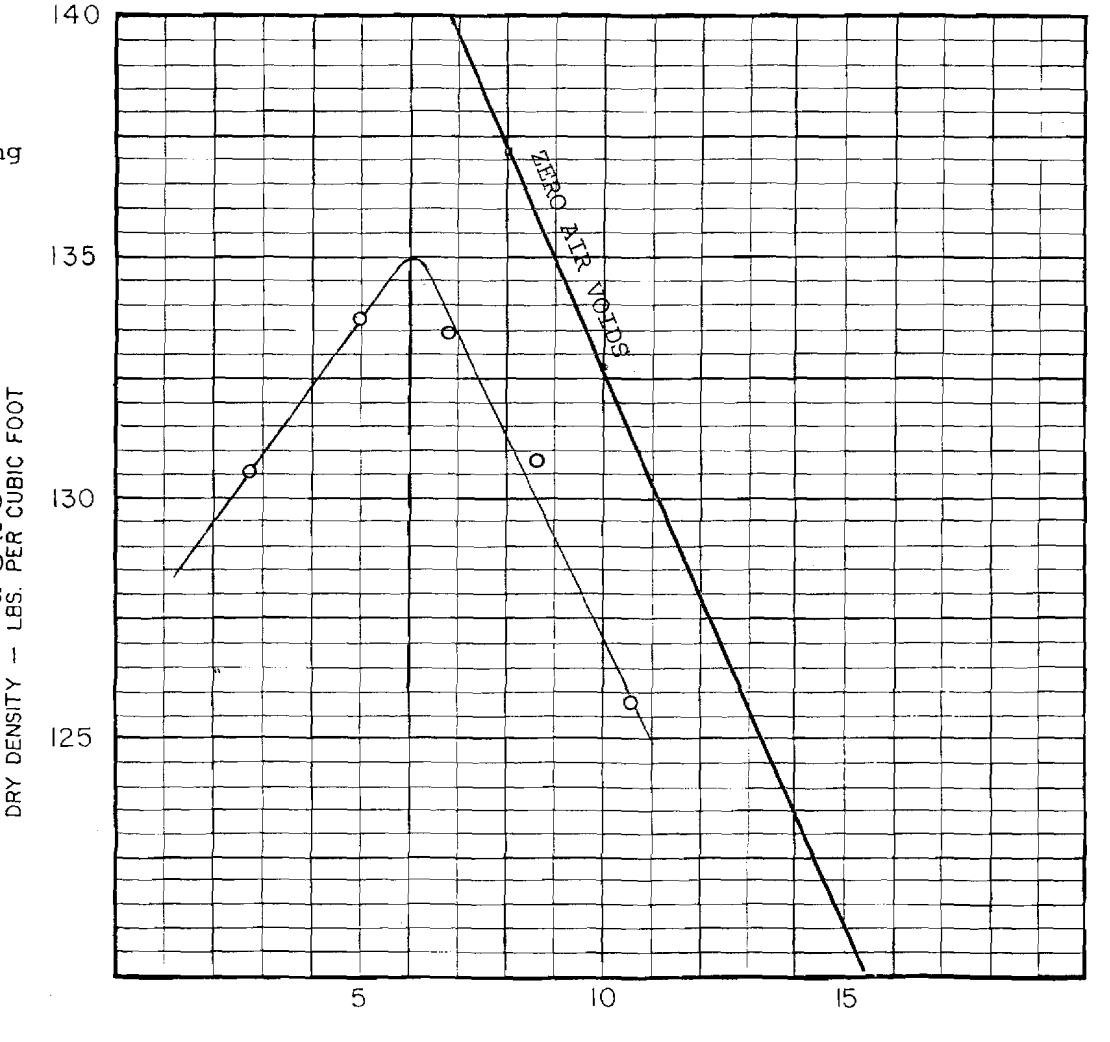
Liquid Limit: Non Viscous % Plastic Limit: % Plasticity Index: Non Plastic

B. Test Procedure Used: T-180 "D" - AASHTO

C. Test Results: Maximum Dry Density: 135.0 PCF Optimum Water Content: 6.0 %

Sieve Analysis

Size	% Passing
2 "	100
1½ "	95
1 "	93
3/4"	89
1/2"	87
3/8"	86
# 4	80
# 10	76
# 40	58
#200	26.9
.02mm	9.2
.005	3.0
.002	1.3



Project No. 052504
Date 11-20-80

R&M Consultant Inc.

LABORATORY COMPACTION CONTROL REPORT

Job Name and Location: Susitna (Watana Dam Site)

Architect or Engineer: Acres American Inc.

Contractor:

A. Description of Soil: SILT AND CLAY

Material Mark: A Unified Classification: CL-CH AASHO Classification:

Source of Material: Deadman Creek Sample No. W-80-282

Natural Water Content: 42.1% % Natural Dry Density: PCF Specific Gravity:

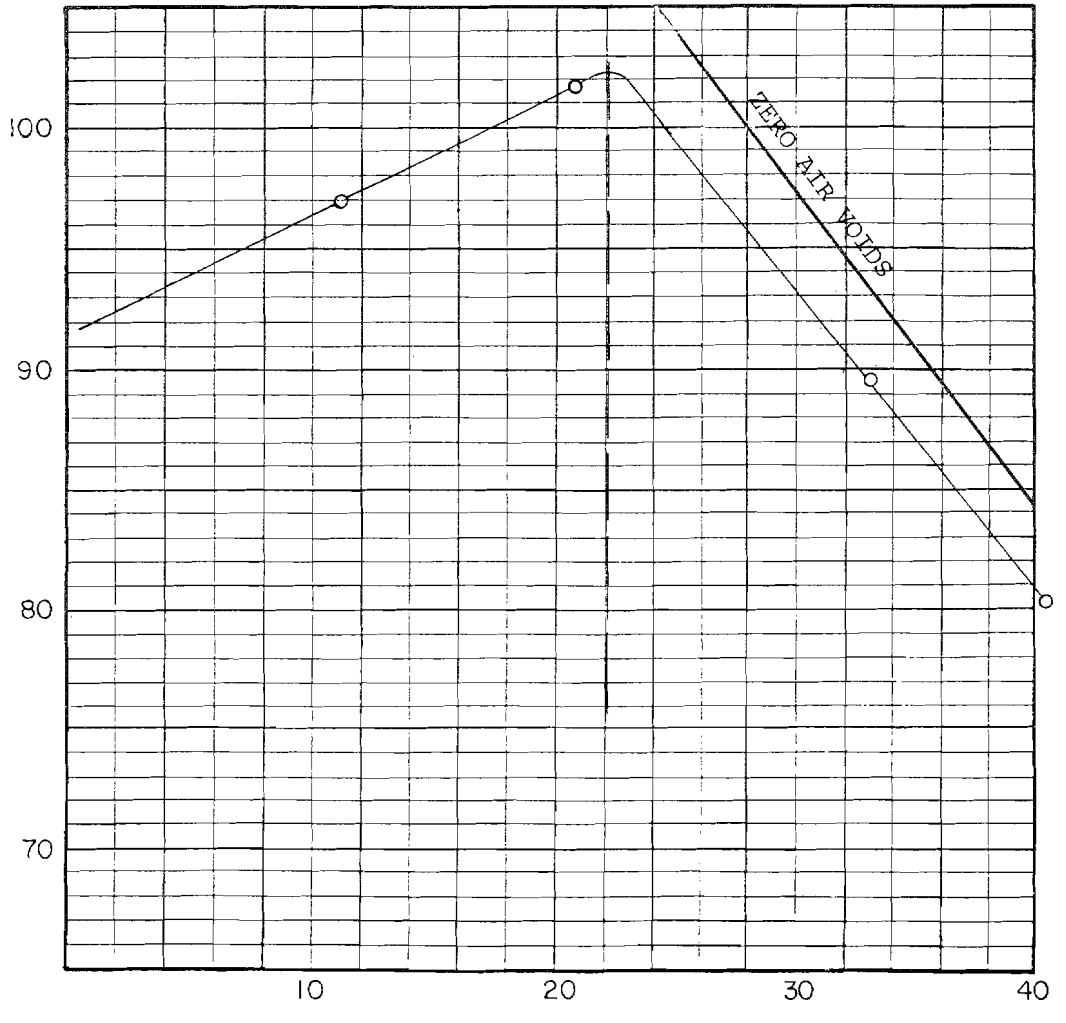
Liquid Limit: 55.9 % Plastic Limit: % Plasticity Index: 33.2

B. Test Procedure Used: T-180 Method "A" - AASHTO

C. Test Results: Maximum Dry Density: 102.5 PCF Optimum Water Content: 22.0%

Sieve Analysis

Size	% Passing
# 40	100
#200	99.5
.02mm	81.3
.005	69.6
.002	50.8



F.2 BORROW SITE E

PROJECT NO. 052506

PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE 6-15-81

PARTY NO. _____ PAGE NO. _____

BORING NO.	SAMPLE NO.	DEPTH	+12"	7"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	CLASS
E17	1	0.5'- 1.0'										100	98	94	89	79	76	67.7	SM-MH
E17	2	3.5'- 4.0'												100	98	82	73	41.4	SM
E17	3	10.0'-10.5'		76	75	70	64	56	51	46	42	35	27	19	13	7	6	4.5	GP-GM
E18	1	0.25'-0.75'			100	92	89	76	69	61	55	45	34	20	12	5	4	2.0	GP
E18	2	2.5'		100	90	88	88	84	84	83	82	80	79	78	73	50	45	28.1	SM
E18	3	5.0'- 5.5'			100	98	93	81	69	57	50	37	29	19	9	3	2	1.1	GP
E18	4	10.0'-10.5'		80	65	60	56	48	43	39	36	29	22	15	9	4	4	2.4	GP
E19	1	1.0'- 1.5'												100	98	76	65	33.6	SM
E19	2	2.5'- 3.0'											100	99	95	53	44	21.2	SM
E20	1	1.5'- 2.0'										100	99	99	97	81	76	53.4	SM-ML
E20	2	3.0'- 3.5'	74	62	39	36	33	30	28	26	24	21	18	13	8	3	3	1.5	SP
E20	3	7.5'- 8.5'		100	91	85	84	84	83	82	82	81	79	72	65	49	45	31.4	SM
E20	4	11.0'-11.5'		72	58	56	50	46	43	39	38	34	29	23	18	11	10	6.4	SP-SM
E21	1	2.0'- 2.5'											100	97	92	84	82	70.3	SP-SC
E21	2	6.5'- 7.0'		48	31	30	27	24	22	20	18	15	13	11	9	6	6	4.3	GP-GM

NOTE: SIEVE ANALYSIS = PERCENT PASSIN

REMARKS: _____

PROJECT NO. 052506

PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE 6-15-81

PARTY NO. _____ PAGE NO. _____

SUMMARY OF LABORATORY TEST DATA

BORING NO.	SAMPLE NO.	DEPTH	+12"	7"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	CLASS
E9	3	2.5'			95	81	77	71	67	63	60	55	50	45	41	28	25	16.6	GM
E10A	1	3.5'- 4.0'			82	78	71	63	58	51	46	37	31	28	21	8	6	2.5	GP
E10A	2	6.5'- 7.5'											100	99	89	43	35	16.5	SM
E10B	1	2.0'- 2.5'			100	91	86	77	66	54	48	36	28	18	11	4	3	2.1	GP
E11	1	1.5'											100	99	94	65	58	37.7	SM
E11	2	5.0'		83	73	70	66	60	56	51	47	39	33	38	22	13	11	7.8	GP-GM
E12	1	2.0'- 2.5'		79	77	74	69	62	56	50	46	37	29	21	14.2	9	8	5.9	GP-GM
E12	2	2.5'- 3.5'							100	94	91	90	88	86	80	59	53	38.4	SM
E12	3	3.5'- 4.5'				79	79	75	74	73	72	71	70	66	58	40	35	23.8	SM
E14	1	1.0'- 2.0'										100	97	85	61	20	14	5.3	SP-SM
E14	2	6.0'- 7.0'		73	58	56	52	48	45	41	38	31	25	18	11	5	4	2.5	SP
E15	1	3.0'- 3.5'	79	77	65	50	45	37	32	26	23	17	13	9	5	2	2	.9	GW
E16	1	3.0'- 3.5'	74	72	61	61	59	53	50	45	41	34	24	13	7	3	2	1.5	SP

NOTE: SIEVE ANALYSIS = PERCENT PASSIN

REMARKS: _____

PROJECT NO. 052506

PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE 6-15-81

PARTY NO. _____ PAGE NO. ____

BORING NO.	SAMPLE NO.	DEPTH	+12"	7"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	CLASS
E1	1	2.5'- 3.0'				96	92	82	72	61	56	47	38	33	27	18	15	8	GP-GM
E1	2	7.0'- 7.5'		77	53	51	48	43	39	34	32	26	21	17	10	4	3	1.5	GP
E2	1	2.5'- 3.0'		84	79	79	77	73	68	62	58	51	46	38	22	5	4	2.4	SP
E2	2	5.5'- 6.0'		64	55	54	52	45	40	35	31	23	17	12	7	2	1	.8	GW
E3	1	2.5'- 3.0'		78	54	54	49	41	37	32	28	22	16	11	7	3	2	1.3	GW
E3	2	10.5'-11.0'		75	57	56	55	49	43	37	33	26	19	11	6	3	2	1.6	GP-GW
E4	1	3.0'-3.5'		58	39	38	35	30	27	24	22	18	15	10	5	2	2	1.0	GP
E4	2	10.5'-11.0'		61	42	40	39	32	29	25	22	18	14	9	5	2	2	1.2	GP
E5	1	1.0'- 2.0'		79	45	42	39	34	30	25	22	17	13	9	5	2	2	1.0	GW-GP
E6	1	7.5'- 8.0'				100	99	90	87	83	81	75	69	59	46	25	22	13.3	SM
E8	1	2.5'- 3.0'		74	73	72	69	59	51	41	35	24	16	10	6	2	2	1.0	GW
E8	2	6.5'- 7.0'				100	99	95	89	83	77	64	46	24	10	2	2	.9	SP
E9	1	2.5'												100	99	96	95	90.5	ML
E9	2	4.5'			91	89	87	86	85	83	81	78	76	74	70	45	38	19.9	SM

NOTE: SIEVE ANALYSIS = PERCENT PASSIN

REMARKS: _____

PROJECT NO. 052504
CLIENT: Acres American, Inc.
PROJECT NAME Susitna Hydroelectric (Watana Dam Site)

R & M CONSULTANTS, INC.

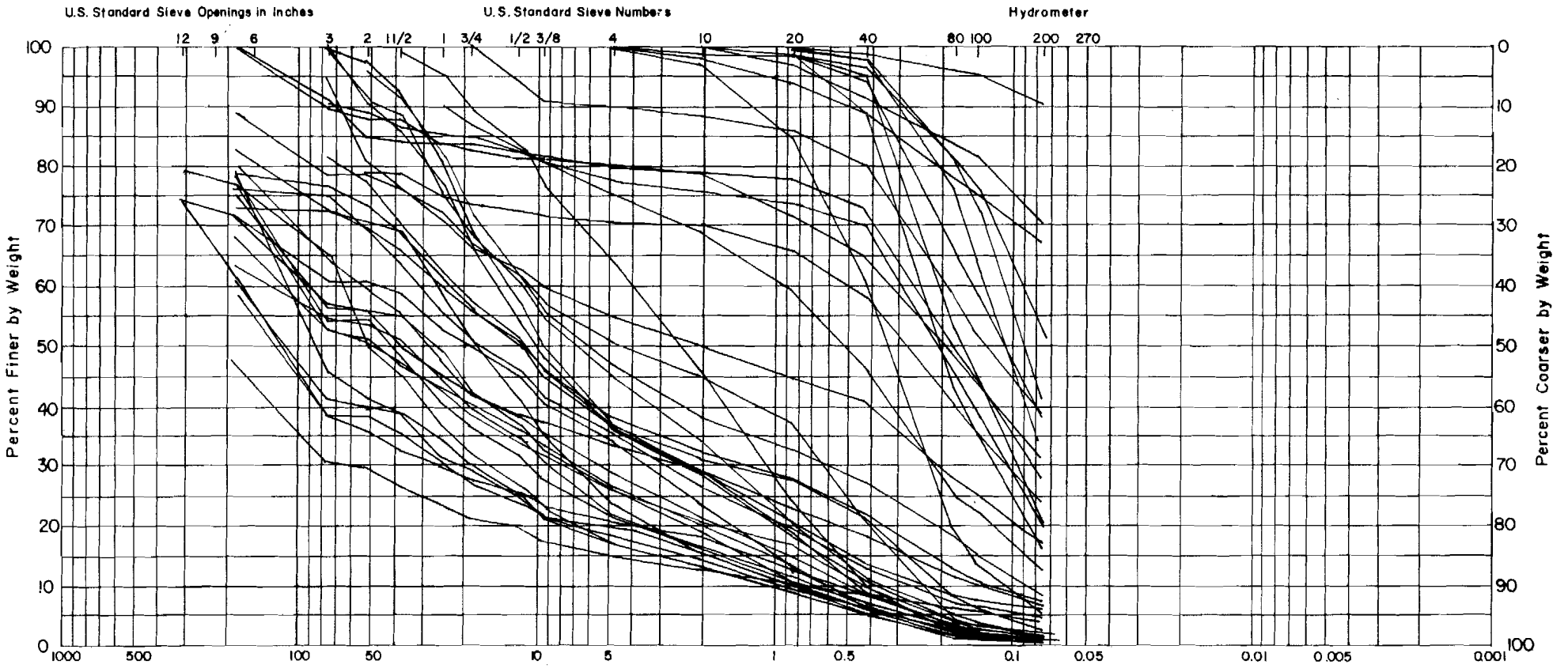
SUMMARY OF LABORATORY TEST DATA

DATE October 17, 1980
PARTY NO. _____ PAGE NO. _____

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	4"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.
AH-E1		3	1.0'- 1.5'										100	99	48.0				19.6			SM
AH-E1		4	2.0'- 3.5'										100	98	59.5				27.3			ML*
AH-E3		6	4.5'- 6.0'		100	89	89	83	80	76	72	62	52	28	6.2				4.4			SP-SM
AH-E3		7	6.5'- 8.0'			**	100	90	76	62	57	40	31	16	3.7				0.7			GW
AH-E4		6	5.0'- 6.5'							100	99	98	92	66	22.2				17.6			SM
AH-E7		3	2.0'- 3.0'				100	85	73	56	49	39	31	12	2.1				2.3			GP
AH-E9		2	1.5'- 3.0'										100	99	28.6				15.7			SM
AH-E9		6	6.5'- 8.0'					100	95	87	79	57	44	33	17.0				4.4			GM

REMARKS: ** 1-2" Rock Present in Sample
* Estimated Value

NOTE: SIEVE ANALYSIS = PERCENT PASSING



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

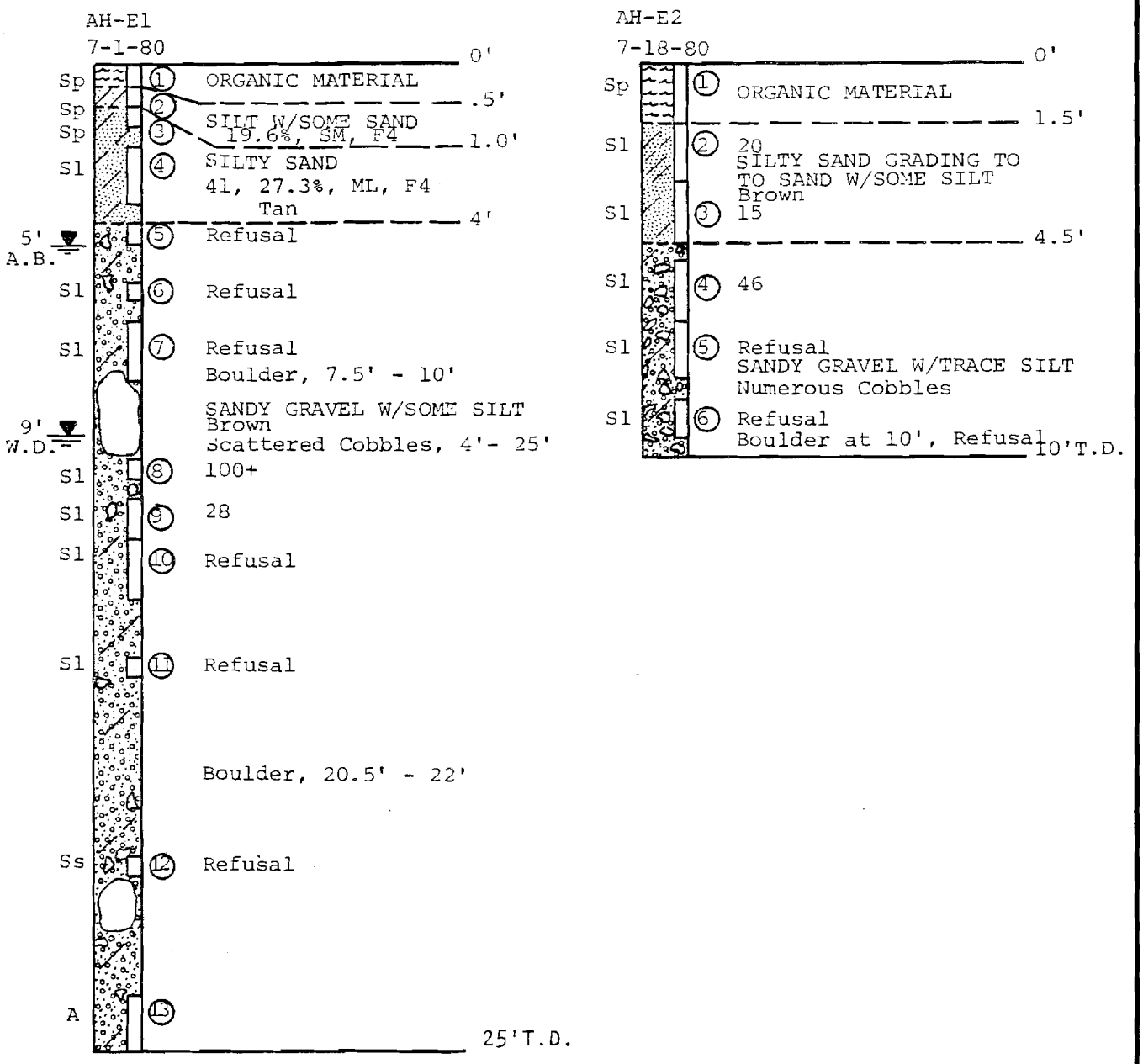
SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION

R&M CONSULTANTS INC.

BORROW AREA E
COMPOSITE GRADATION CURVE

DRAWN BY:	
APPROVED BY:	
DATE:	
PROJECT NO.	

AUGER HOLE LOGS



PREPARED BY:

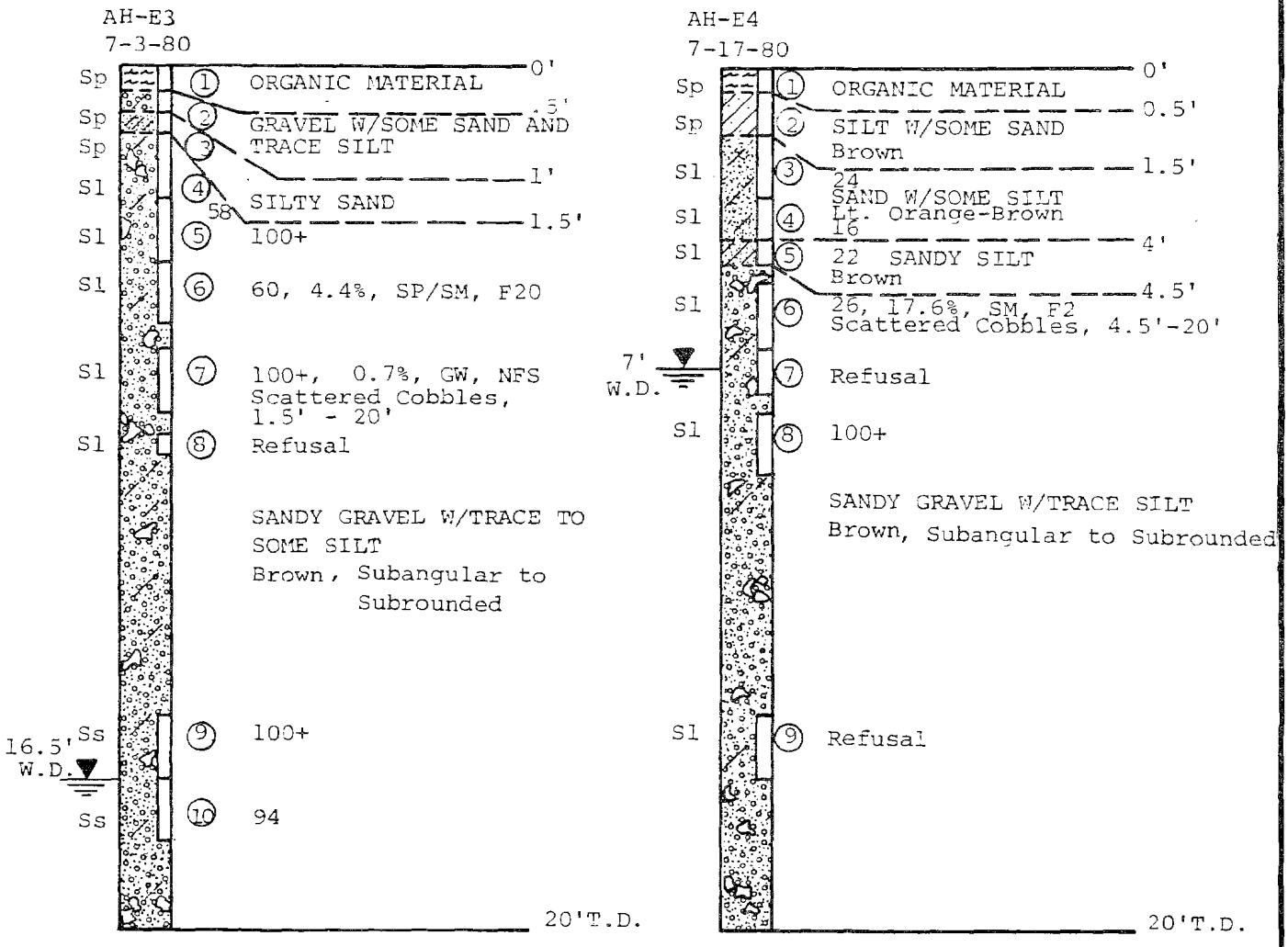
R&M CONSULTANTS, INC.

BORROW AREA E
AUGER HOLES AH-E1 AND AH-E2

Scale 1"=4

PREPARED FOR:

ACRES



PREPARED BY:

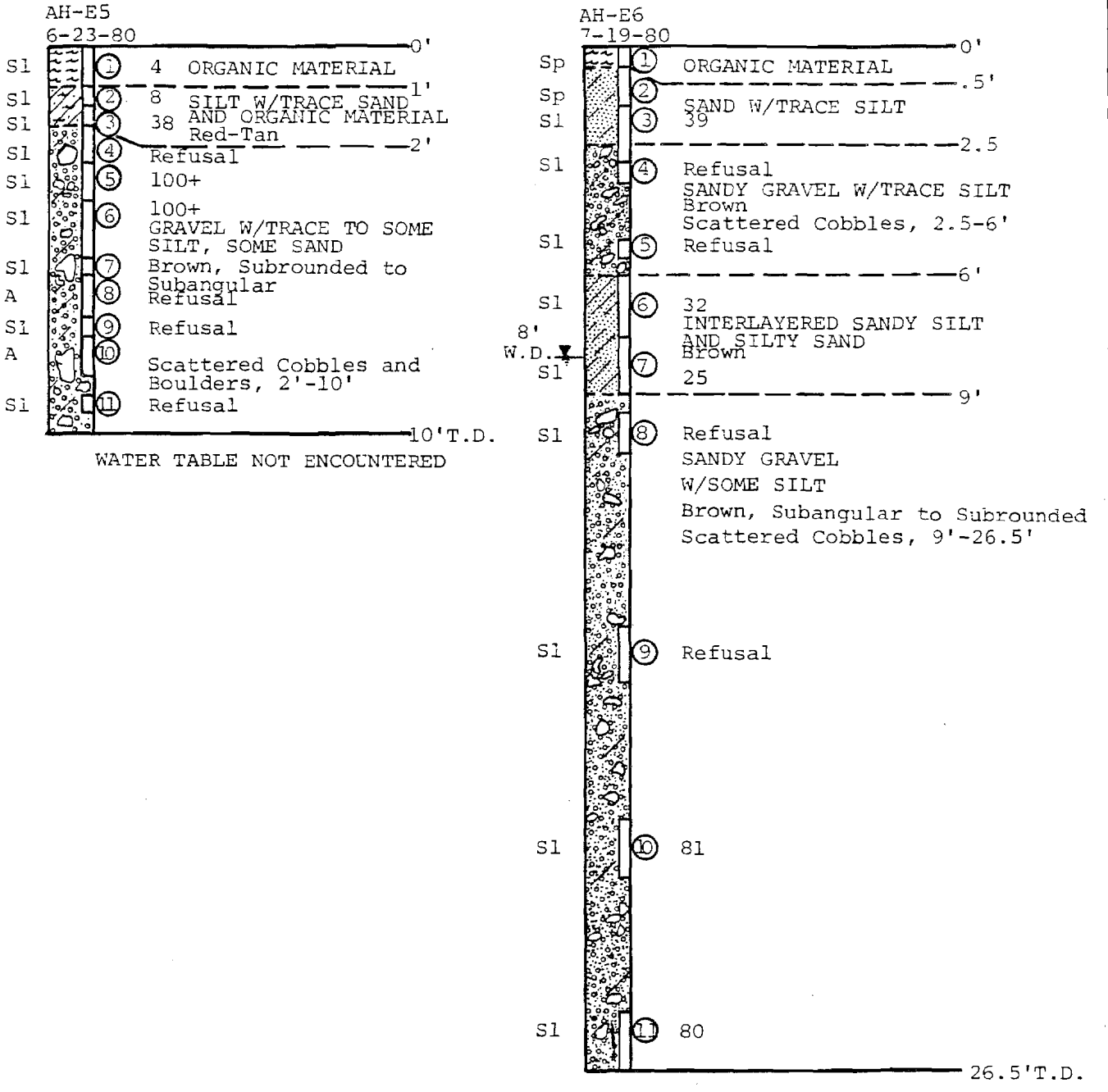
R&M CONSULTANTS, INC.

BORROW AREA E
AUGER HOLES AH-E3 AND AH-E4

Scale 1"=4'

PREPARED FOR:

ACRES



PREPARED BY:

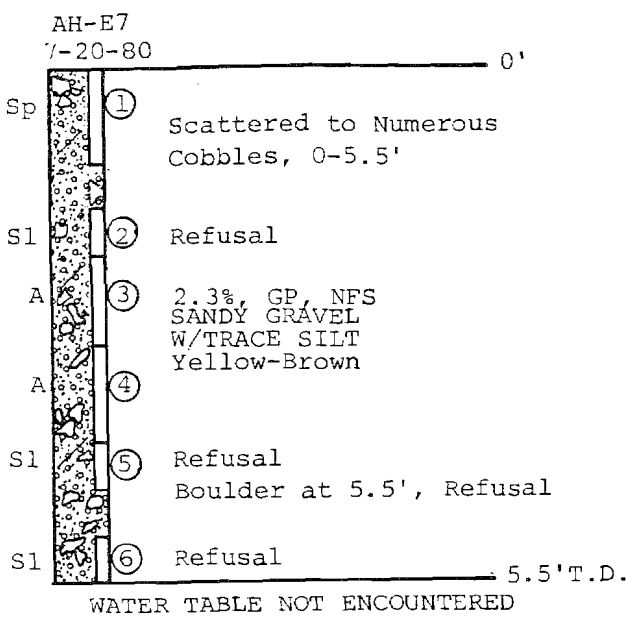
R&M CONSULTANTS, INC.

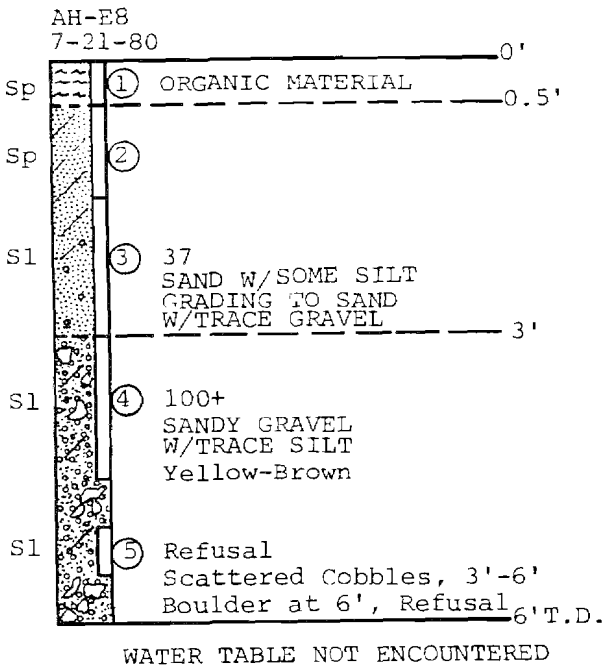
BORROW AREA E
AUGER HOLES AH-E5 AND AH-E6

Scale 1"=4'

PREPARED FOR:

ACRES





PREPARED BY:

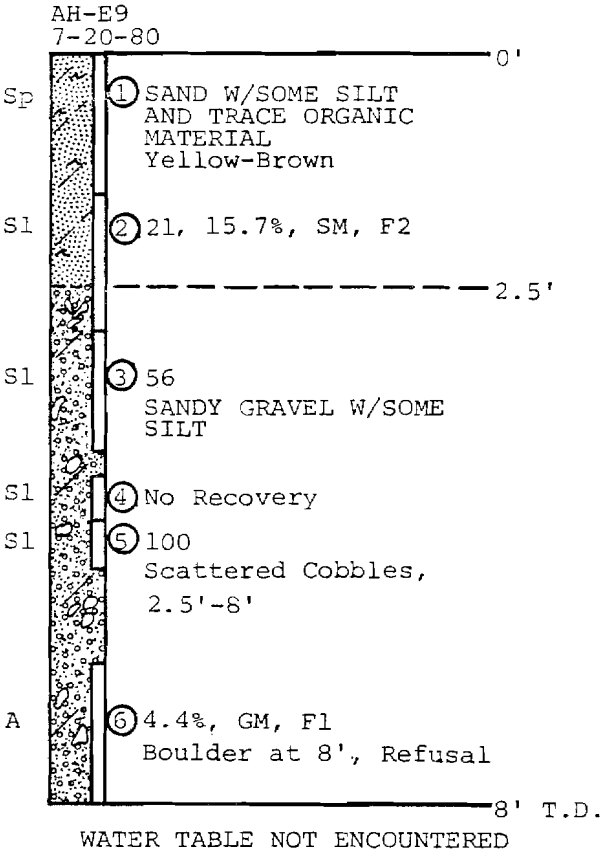
R&M CONSULTANTS, INC.

BORROW AREA E
AUGER HOLES AH-E7 AND AH-E8

Scale 1"=4

PREPARED FOR:

ACRES



WATER TABLE NOT ENCOUNTERED

PREPARED BY:

R&M CONSULTANTS, INC.

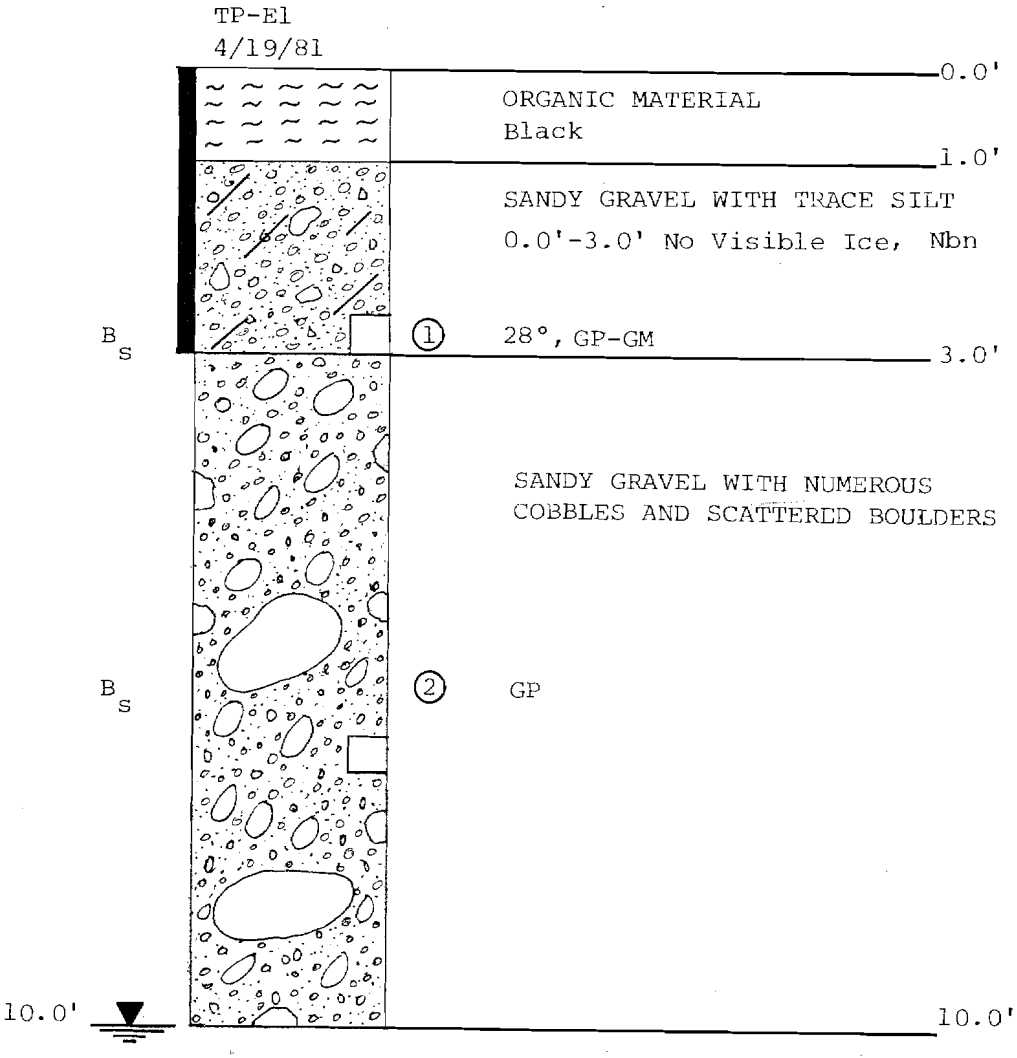
BORROW AREA E
AUGER HOLE AH-E9

Scale 1"=2'

PREPARED FOR:

ACRES

TEST PIT/TEST TRENCH LOGS



PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E1

Scale: 1"=2'

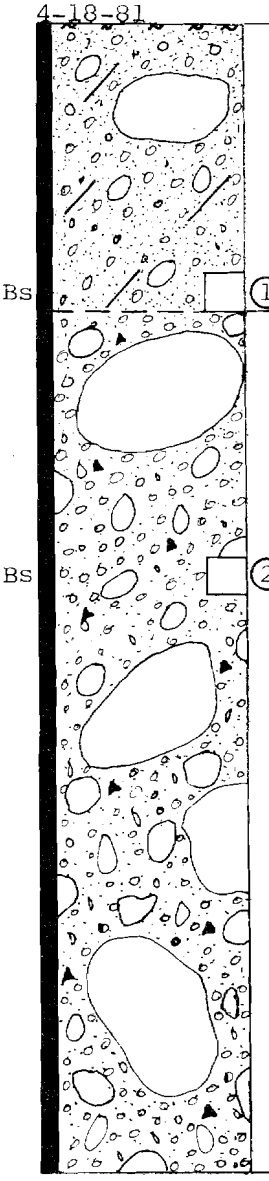
PREPARED FOR:

ACRES

TP-E2

4-18-81

Elevation 1436.6'



0.0'

Thin Organic Layer at Surface

0.0'-3.0' No Visible Ice, Nbn

GRAVELLY SAND WITH SCATTERED COBBLES

Grayish Brown

Bs ① 27°, SP

3.0'

3.0'-12.0' Little Visible Ice, Vx

Bs ② 27°, GW

SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS

Grayish Brown

12.0'T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E2

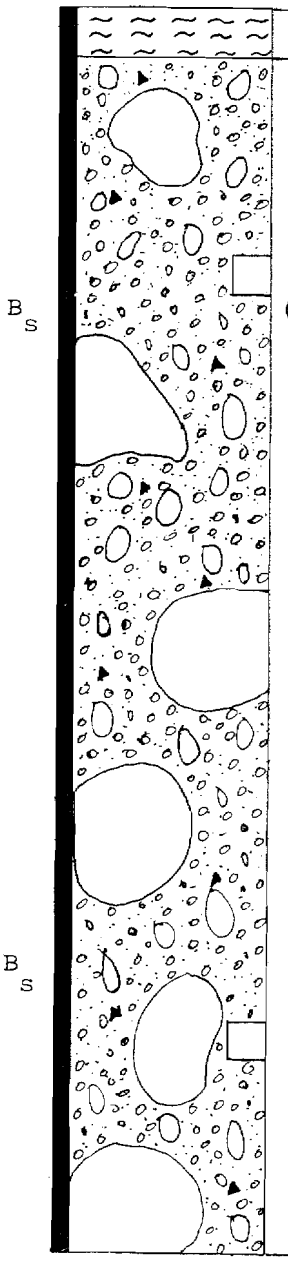
PREPARED FOR:

ACRES

Scale: 1"=

TP-E3
4/17/81

Elevation: 1464.2'



0.0'

ORGANIC MATERIAL

0.5'

0.0'-13.0' Little Visible Ice, Vx

B_S ① GW

SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS

Grayish Brown

B_S ② GW-GP

13.0' T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E3

Scale: 1"=2'

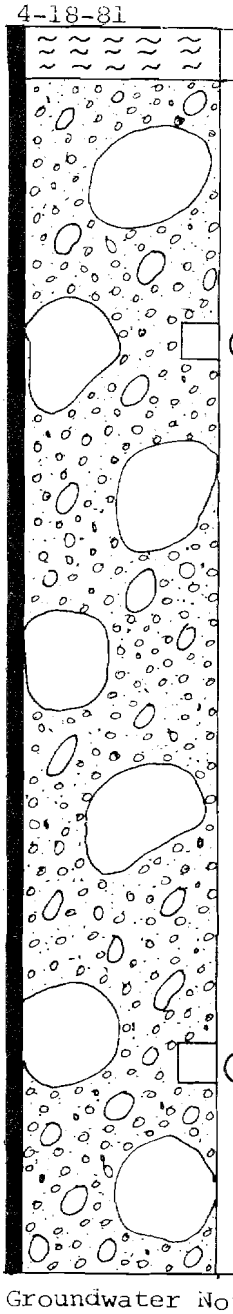
PREPARED FOR:

ACRES

TP-E4

4-18-81

Elevation: 1454.9'



0.0'

ORGANIC MATERIAL

0.5'

0.5'-13.0' No Visible Ice, Nbn

Bs ① GP

SANDY GRAVEL WITH NUMEROUS
COBBLES AND SCATTERED BOULDERS

Brownish Gray

Bs ② 27°, GP

13.0' T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E

TEST PIT TP-E4

Scale: 1"=

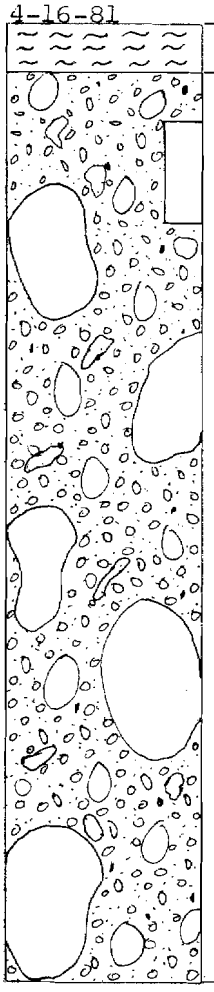
PREPARED FOR:

ACRES

TP-E5

4-16-81

Elevation: 1470.1'



0.0'

ORGANIC MATERIAL

0.5'

Bs

① GW-GP

SANDY GRAVEL WITH NUMEROUS
COBBLES AND SCATTERED
BOULDERS
Brownish Gray

10.0'T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E5

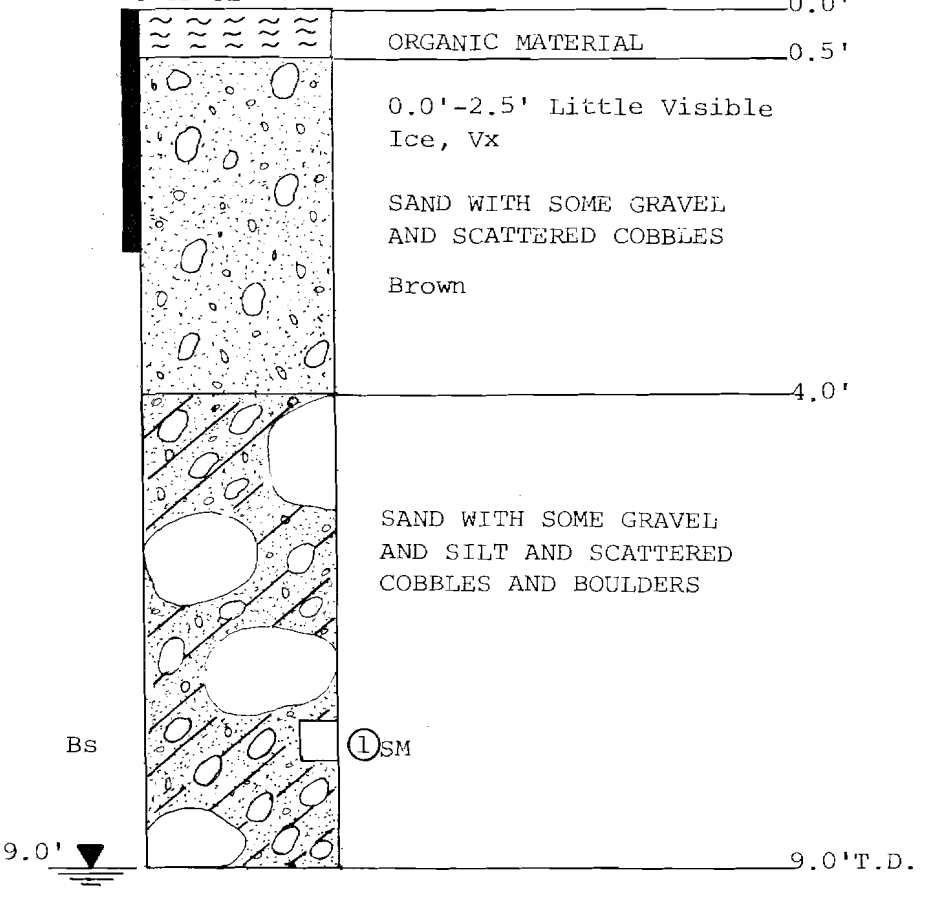
Scale:1"=2'

PREPARED FOR:

ACRES

TP-E6
4-15-81

Elevation: 1443.4'



PREPARED BY:

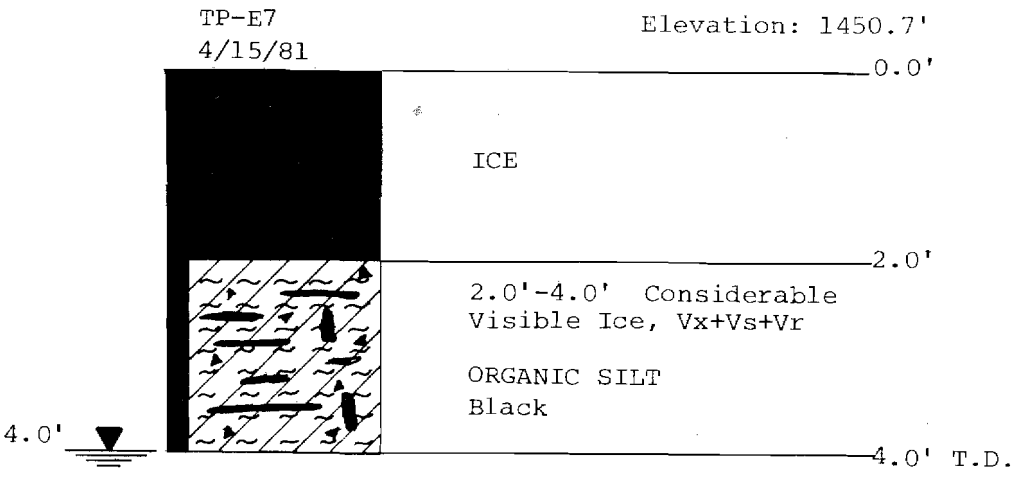
R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E6

Scale: 1"=

PREPARED FOR:

ACRES



PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E7

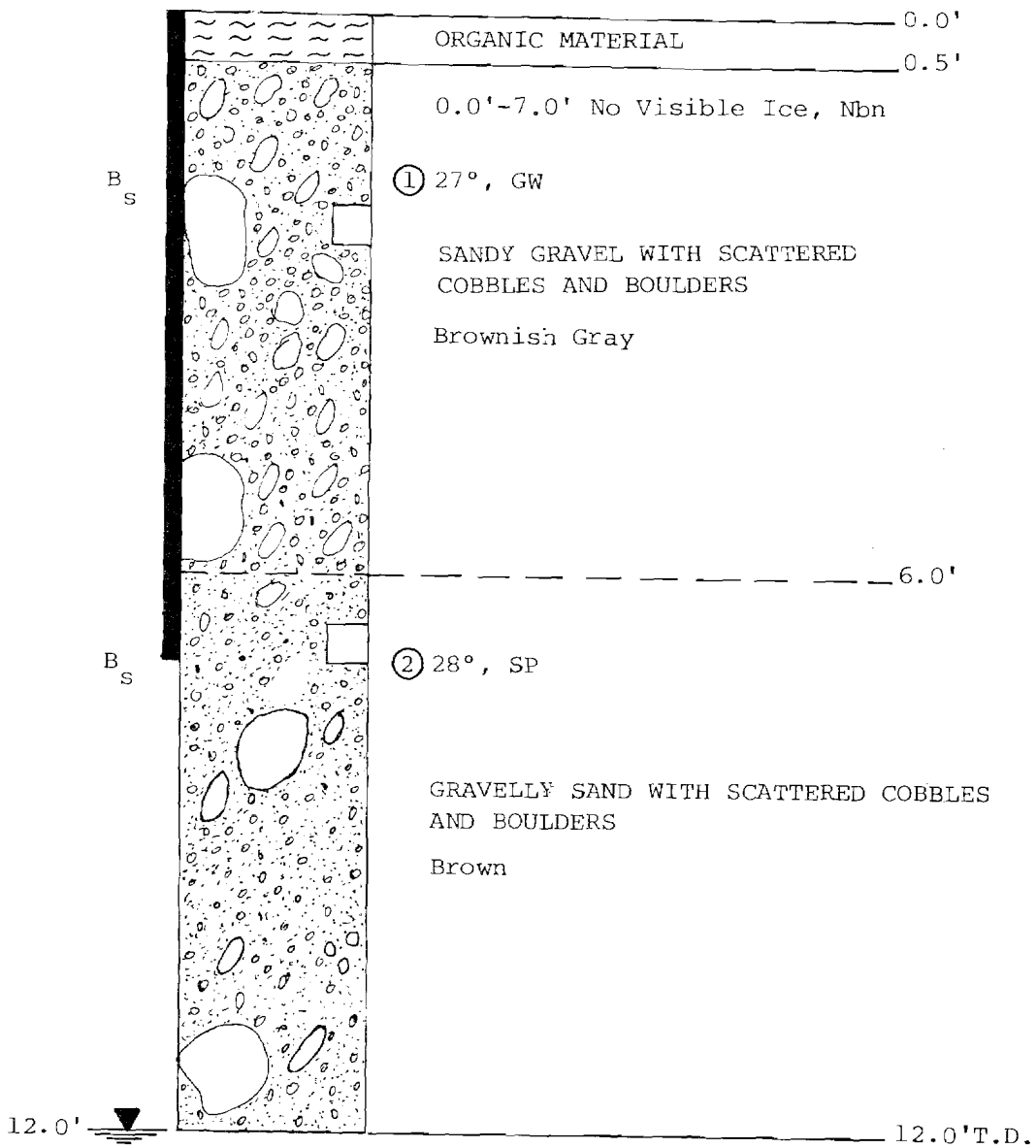
Scale: 1"=2'

PREPARED FOR:

ACRES

TP-E8
4/20/81

Elevation: 1450.2'



PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E8

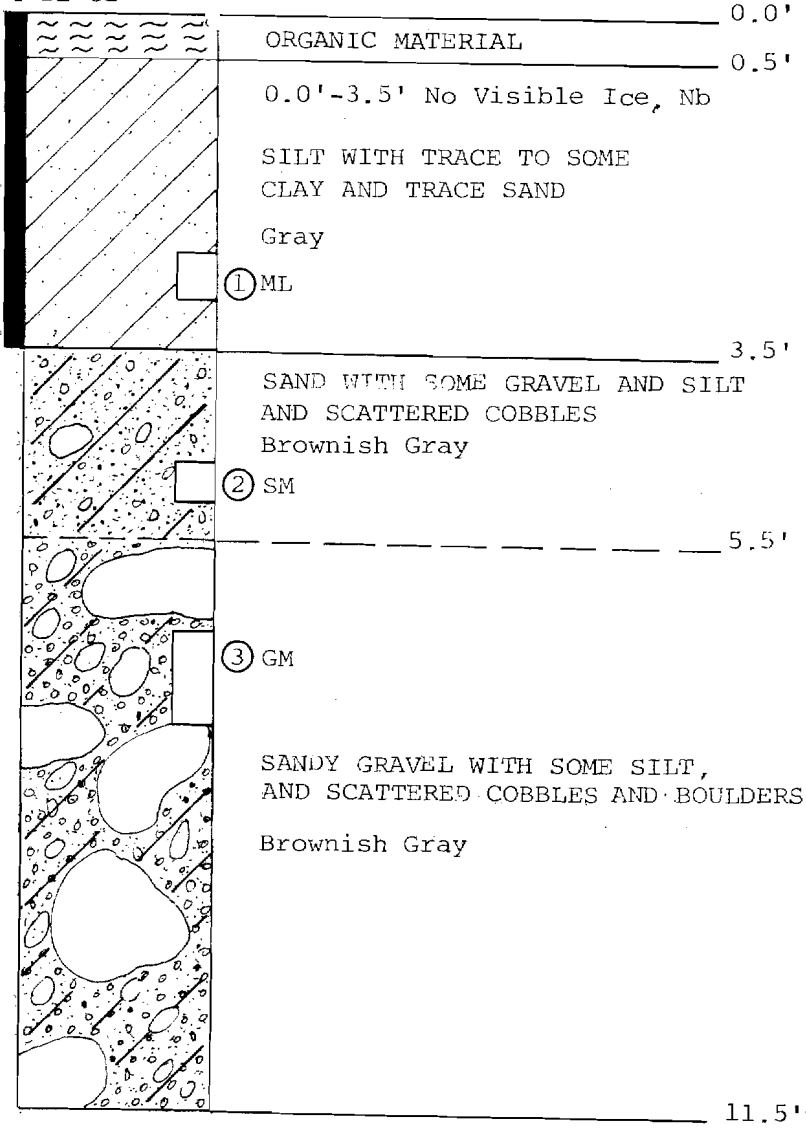
Scale:1"=2'

PREPARED FOR:

ACRES

TP-E9
4-21-81

Elevation: 1476.7'



Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E9

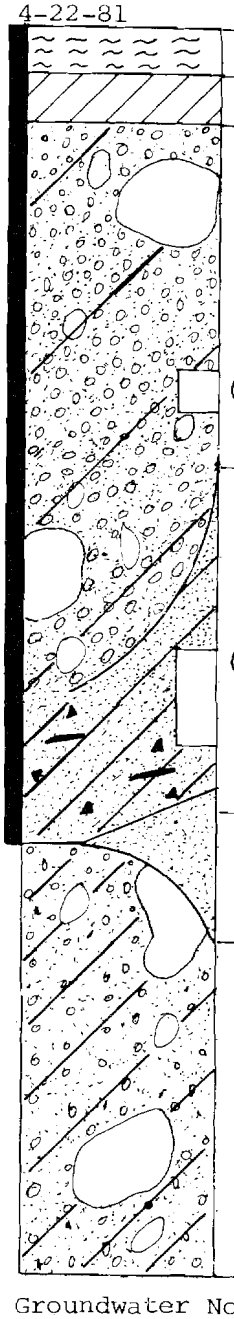
PREPARED FOR:

ACRES

Scale: 1"=2'

TP-E10A
4-22-81

Elevation: 1500.7'



0.0'

ORGANIC MATERIAL

0.5'

VOLCANIC ASH

1.0'

0.0'-7.0' No Visible Ice, Nbn

SANDY GRAVEL WITH SCATTERED COBBLES

Brown

Bs ① 27°, GP

4.5'

SAND WITH SOME SILT
Brown

Bs ② SM

7.0'-8.5' Occasional Visible Ice, Vx+Vs

8.0'

SAND
Brown

9.5'

8.5'-13.5' No Visible Ice

SAND AND GRAVEL WITH TRACE TO SOME SILT, SCATTERED COBBLES AND BOULDERS

Brown

13.0'T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E10A

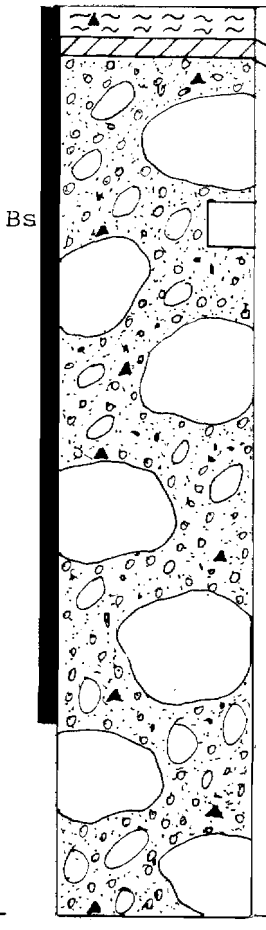
Scale: 1"=2'

PREPARED FOR:

ACRES

TP-E10B
4-22-81

Elevation: 1493.7'



0.0'

ORGANIC MATERIAL

0.3'

VOLCANIC ASH Lt. Gray

0.5'

0.0'-9.5' Little Visible Ice, Vx

1 27°, GP

SANDY GRAVEL WITH SCATTERED COBBLES AND BOULDERS

Med. to Dark Brown

9.5'

9.5'T.D.

PREPARED BY:

R&M CONSULTANTS, INC.

PREPARED FOR:

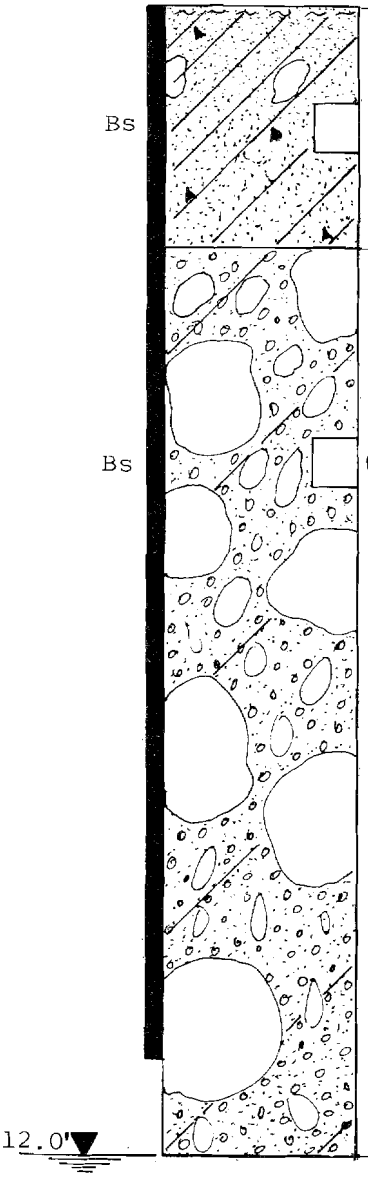
BORROW AREA E
TEST PIT TP-E10B

Scale: 1"=2

ACRES

TP-E11
4-24-81

Elevation: 1512.7'



0.0'

2.0" Organic Mat at Surface
0.0'-2.5' Little Visible Ice, Vx

Bs ① SM

SILTY SAND
Brown

2.5'

2.5'-12.0' No Visible Ice

Bs ② GP-GM

SANDY GRAVEL WITH TRACE SILT,
SCATTERED COBBLES AND BOULDERS

Brown

12.0' ▼

12.0'T.D.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E11

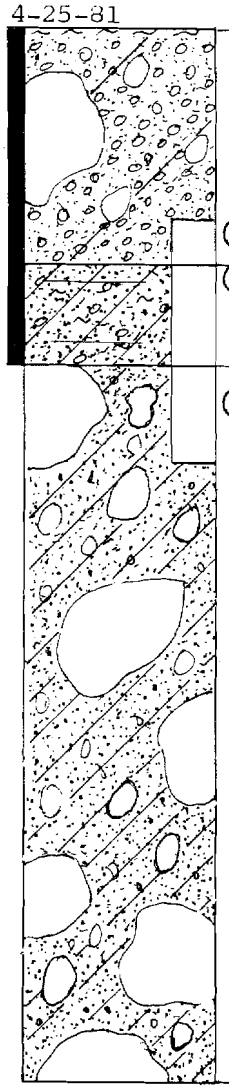
Scale: 1"=2'

PREPARED FOR:

ACRES

TP-E12
4-25-81

Elevation: 1534.9'



0.0'

2.0" Organic Mat at Surface

SANDY GRAVEL WITH TRACE SILT, SCATTERED COBBLES AND BOULDERS

Dark Brown

0.0'-3.5' No Visible Ice, Nbn

Bs ① GP-GM

2.5'

Bs ② SM
SILTY SAND WITH TRACE GRAVEL, ORGANICS AND CLAY
Dark Brown

3.5'

Bs ③ SM

SAND WITH SOME SILT, TRACE GRAVEL AND SCATTERED COBBLES AND BOULDERS

Brown

11.0'T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E12

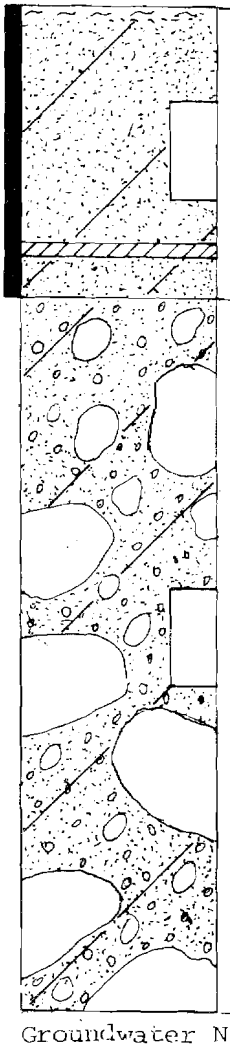
Scale: 1"=2'

PREPARED FOR:

ACRES

TP-E14
4-26-81

Elevation: 1503.0'



0.0'

2.0" Organic Mat at Surface

0.0'-3.0' No Visible Ice, Nb

Bs ① SP-SM
SAND WITH TRACE SILT
Brown

2.5' 1" Ash Layer

3.0'

GRAVELLY SAND WITH TRACE SILT, AND SCATTERED COBBLES AND BOULDERS

Brown

Bs ② SP

10.5'T.D.

Groundwater Not Encountered

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E14

PREPARED FOR:

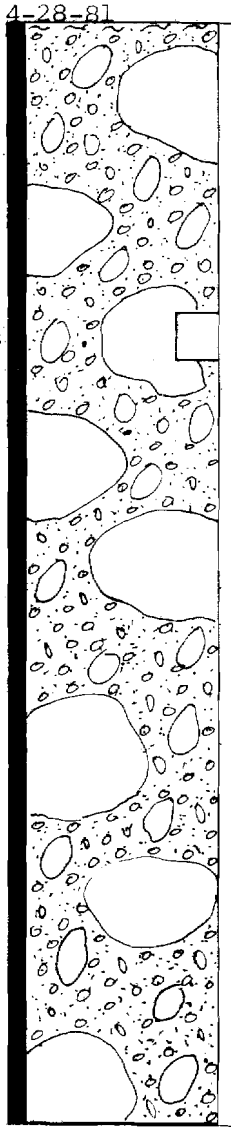
ACRES

Scale: 1"=2'

TP-E15

Elevation: 1468.3'

4-28-81



0.0'

2.0" Organic Mat at Surface

0.0'-11.5' No Visible Ice, Nf

Bs

① 28°, GW

GRAVEL WITH SOME SAND, SCATTERED COBBLES AND BOULDERS

Brown

11.5'T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E

TEST PIT TP-E15

PREPARED FOR:

ACRES

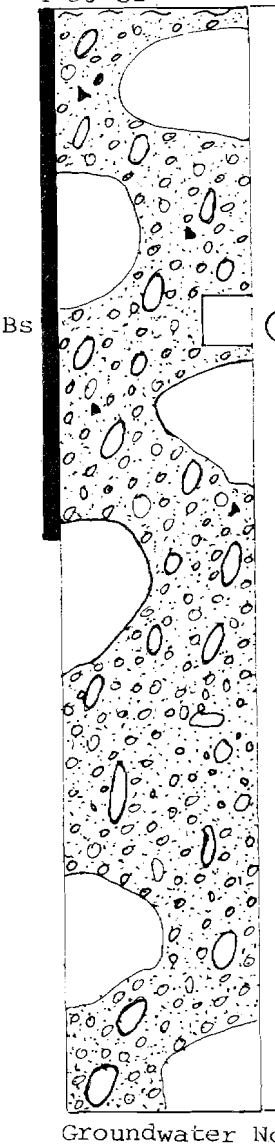
Scale: 1"=2

TP-E16

4-30-81

Elevation: 1463.8'

0.0'



1.0" Organic Mat at Surface

1.0" Clayey Silt Beneath Organic Mat

0.0'-5.5' Little to No Visible Ice, Vx and Nbn

Bs

(1) SP

GRAVELLY SAND WITH SCATTERED COBBLES AND BOULDERS

Brown

11.5'T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E

TEST PIT TP-E16

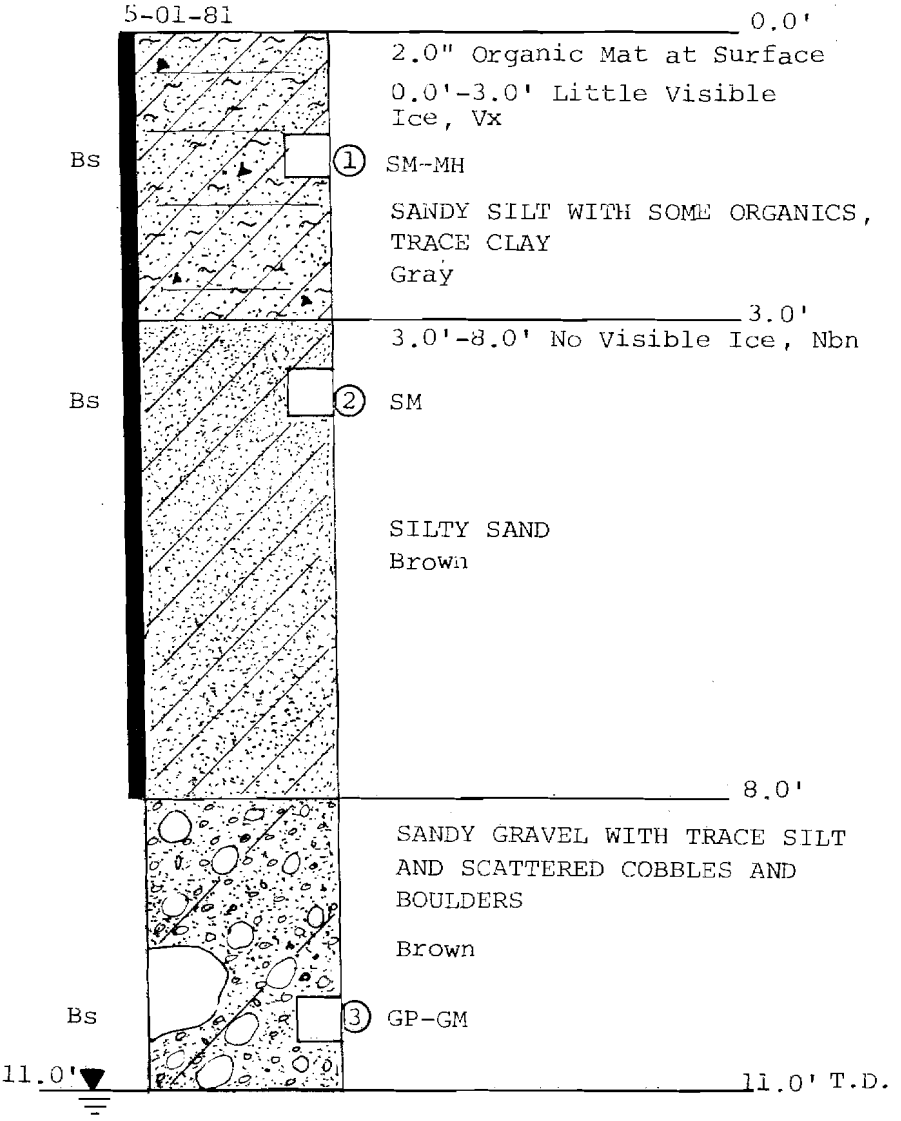
Scale: 1"-2'

PREPARED FOR:

ACRES

TP-E17
5-01-81

Elevation: 1441.7'



PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E

TEST PIT TP-E17

Scale: 1"-2'

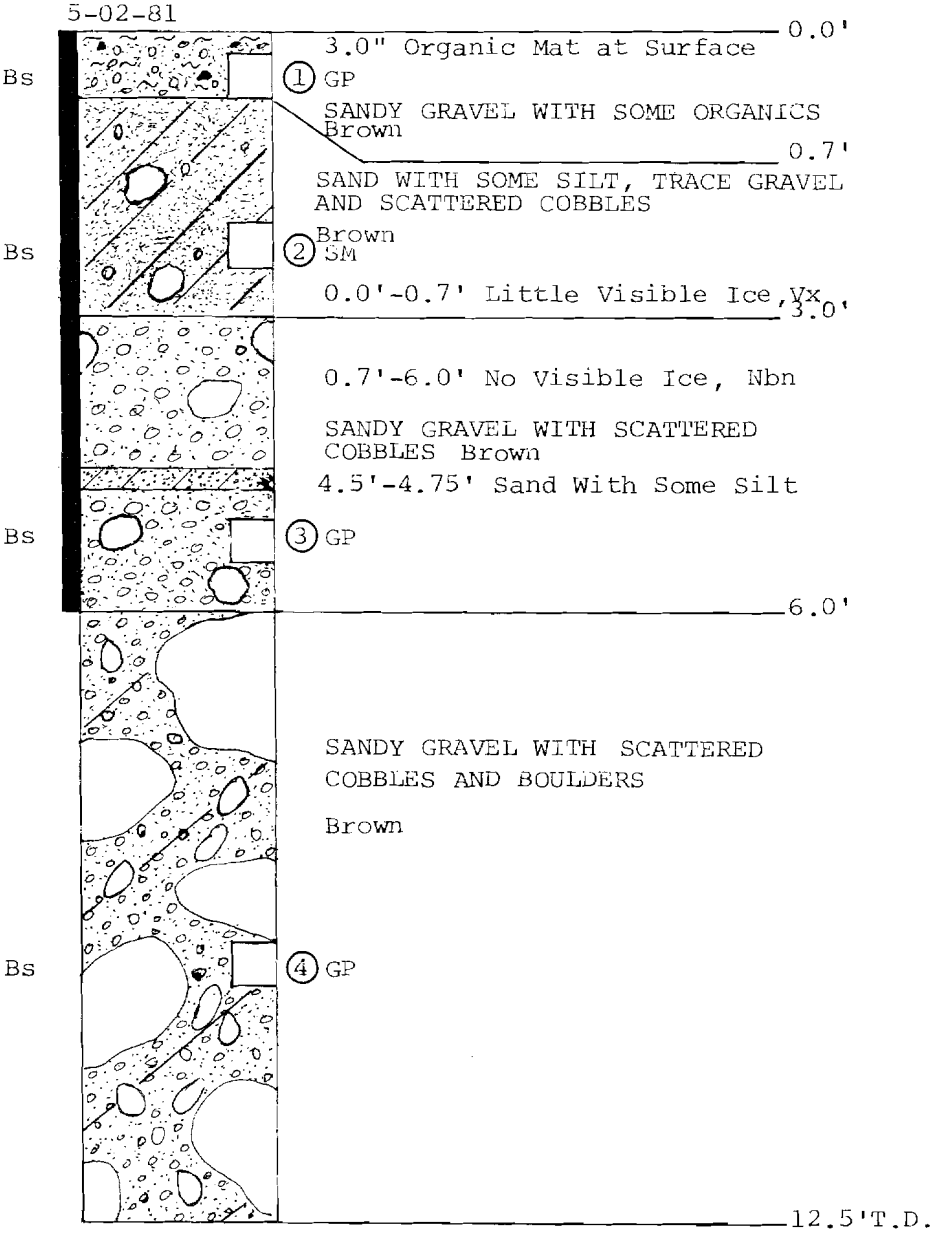
PREPARED FOR:

ACRES

TP-E18

5-02-81

Elevation: 1455.1'



Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E

TEST PIT TP-E18

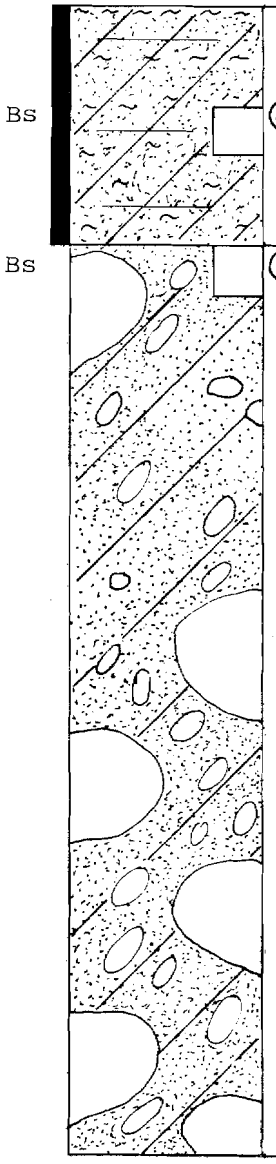
PREPARED FOR:

ACRES

Scale: 1"=2'

TP-E19
5-02-81

Elevation: 1464.7'



0.0'

2.0" Organic Mat at Surface

0.0'-2.5' No Visible Ice, Nbn

Bs ① SM

SILTY SAND WITH SOME ORGANICS, TRACE CLAY

Brown

2.5'

Bs ② SM

SAND WITH SOME SILT, SCATTERED COBBLES AND BOULDERS

Brown

12.0'T.D.

Groundwater Not Encountered.

PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA E
TEST PIT TP-E19

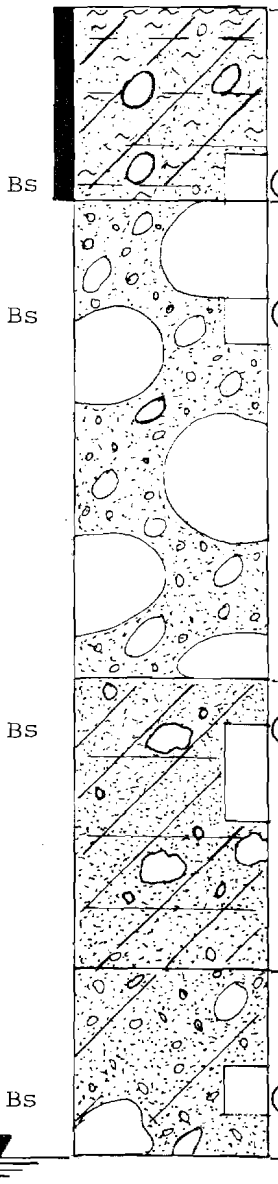
PREPARED FOR:

ACRES

Scale: 1"=2

TP-E20 Elevation: 1435.0'

5-03-81



0.0'

1.5" Organic Mat at Surface

SANDY SILT WITH SOME ORGANICS, TRACE CLAY

Brown

0.0'-2.0' No Visible Ice, Nbn

Bs (1) SM-ML

2.0'

Bs (2) SP

GRAVELLY SAND WITH TRACE CLAY AND SCATTERED COBBLES AND BOULDERS

Brown

7.0'

Bs (3) SM

SILTY SAND WITH TRACE CLAY AND GRAVEL AND SCATTERED COBBLES

Brown

10.0'

GRAVELLY SAND WITH TRACE SILT, SCATTERED COBBLES AND BOULDERS

Brown

Bs (4) SP-SM

12.0' ▼

12.0' T.D.

PREPARED BY:

R&M CONSULTANTS, INC.

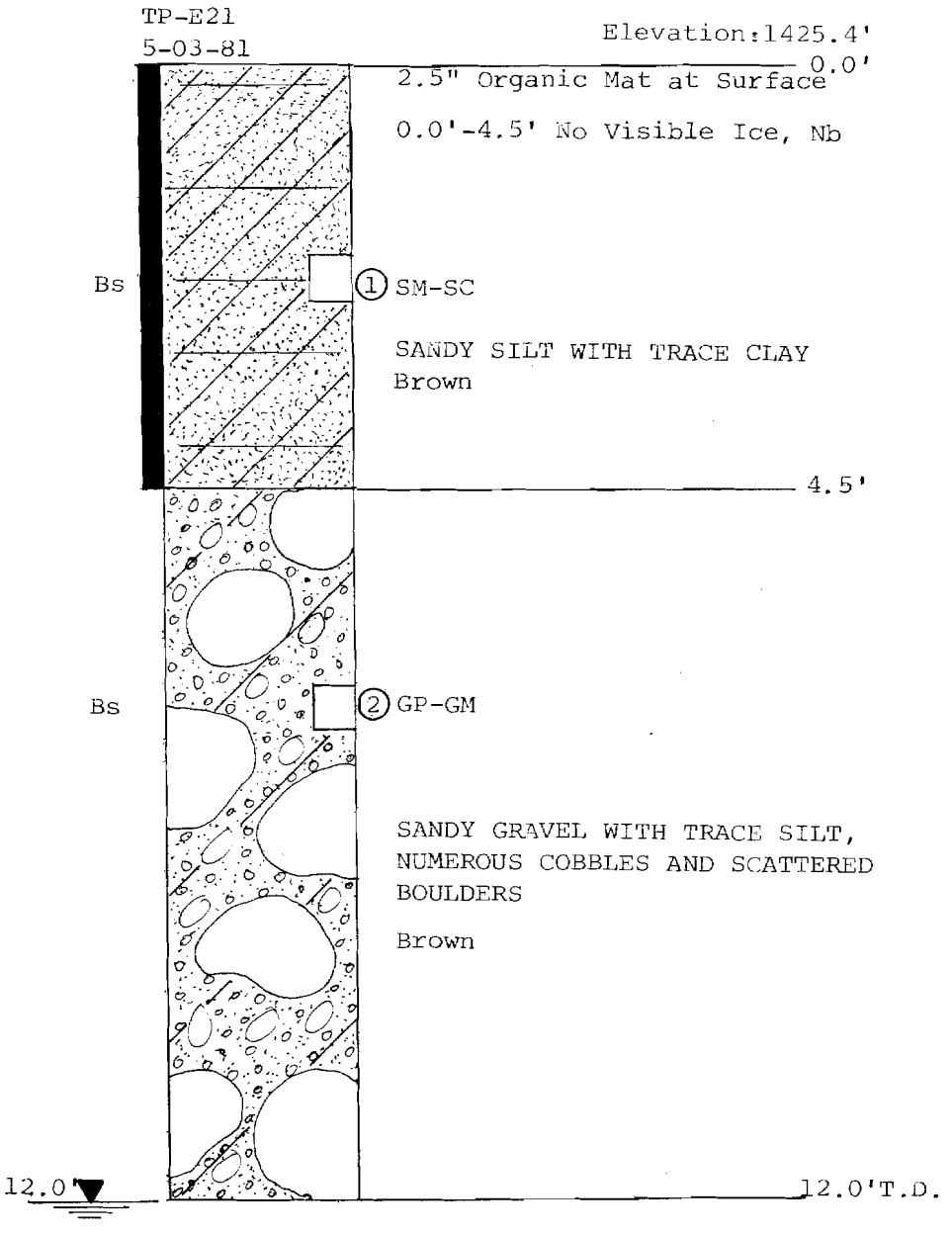
BORROW AREA E

TEST PIT TP-E20

Scale: 1"=2

PREPARED FOR:

ACRES



PREPARED BY:

R&M CONSULTANTS, INC.

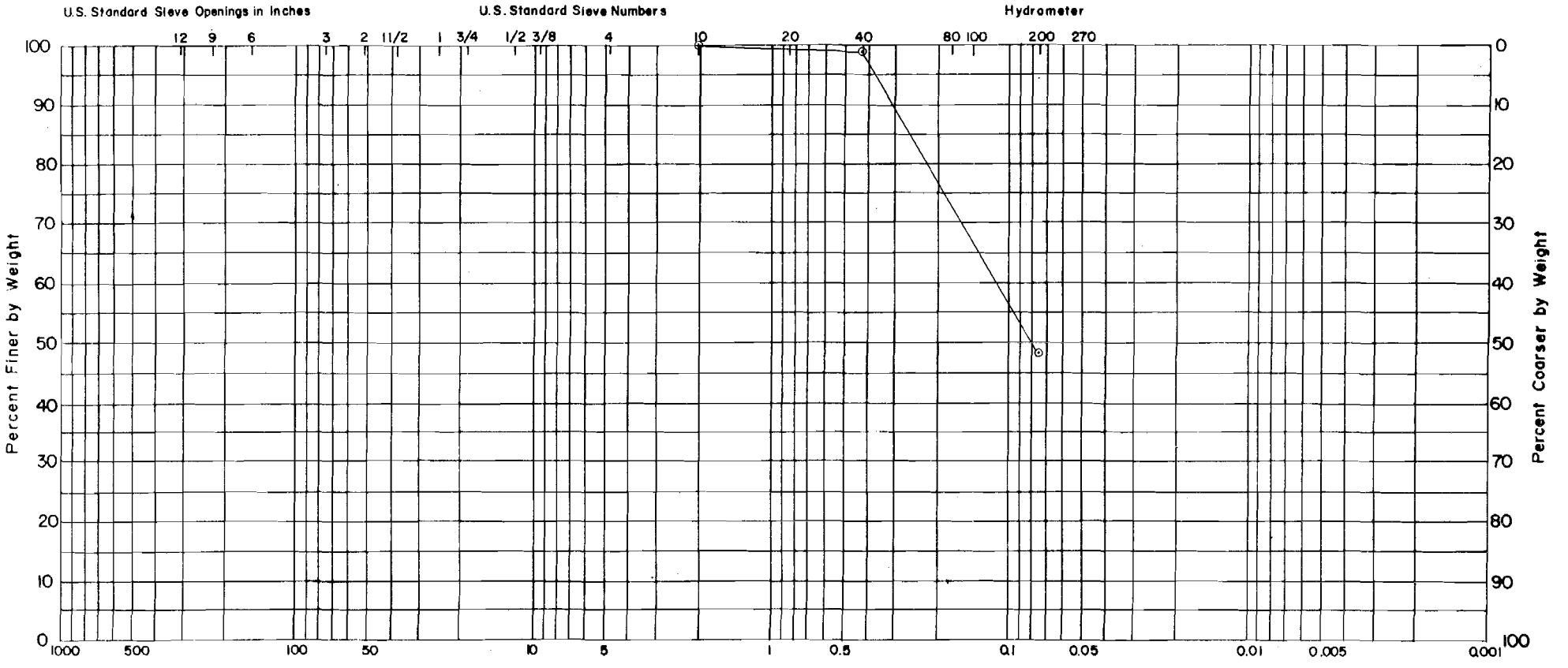
BORROW AREA E
TEST PIT TP-E21

Scale: 1"=2'

PREPARED FOR:

ACRES

LABORATORY TEST DATA



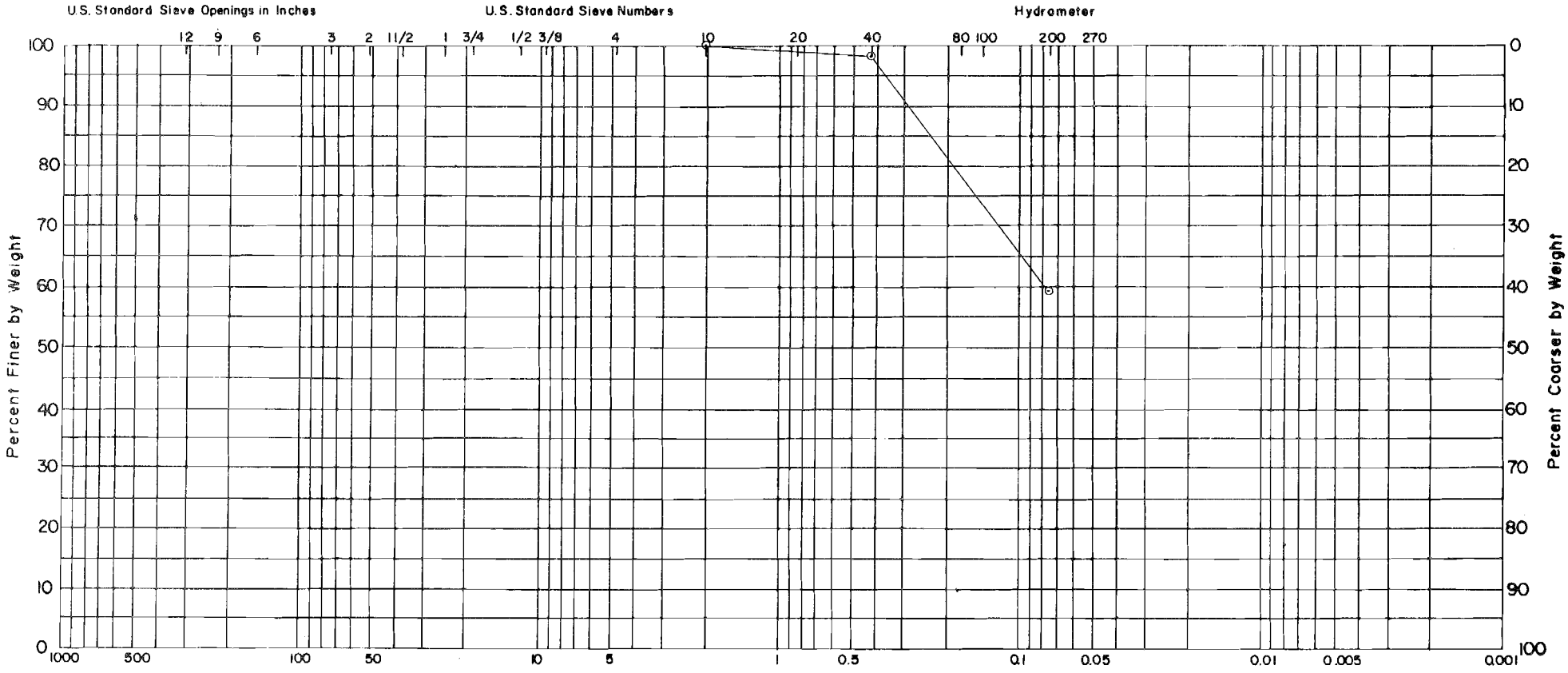
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E1-3 (1.0-1.5')	19.6%				SM	SILTY SAND

R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



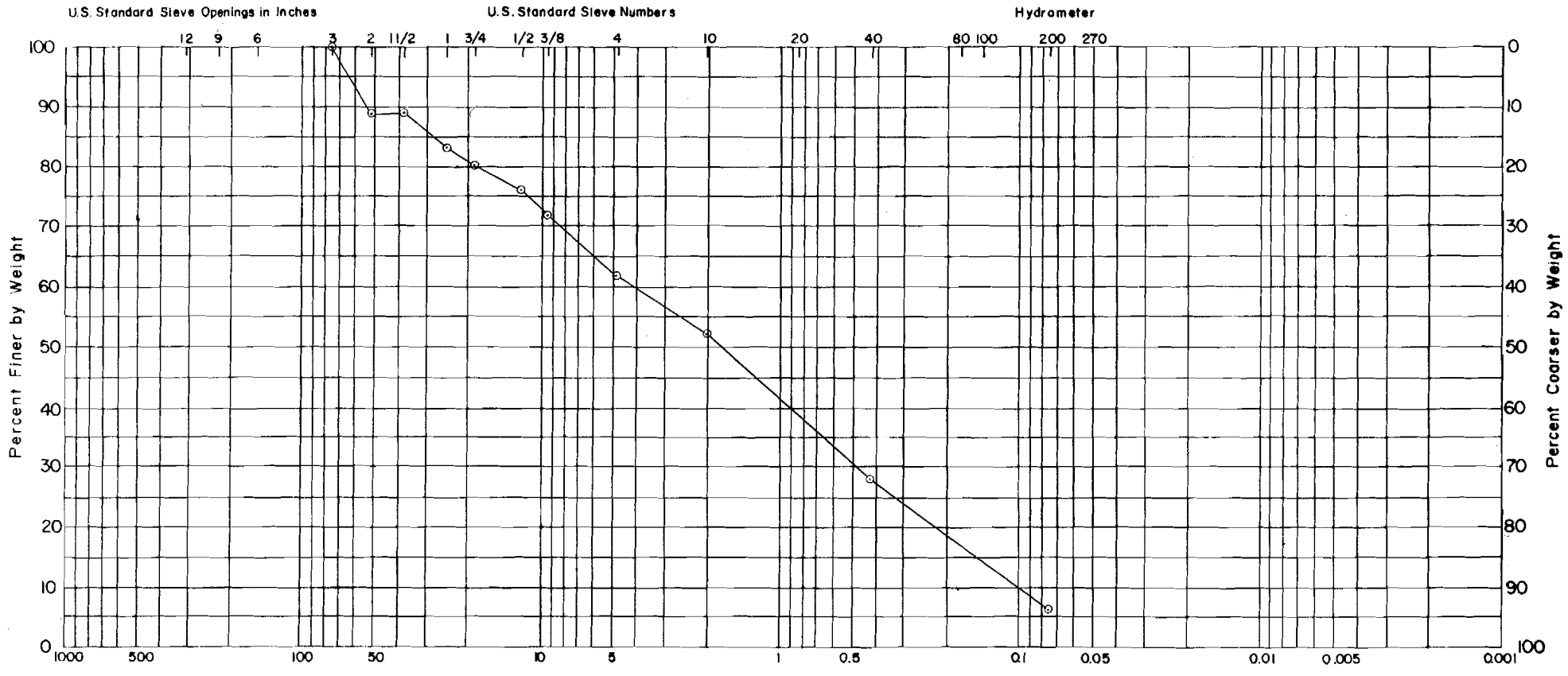
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E1-4 (2.0-3.5')	27.3%				ML	SANDY SILT

R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



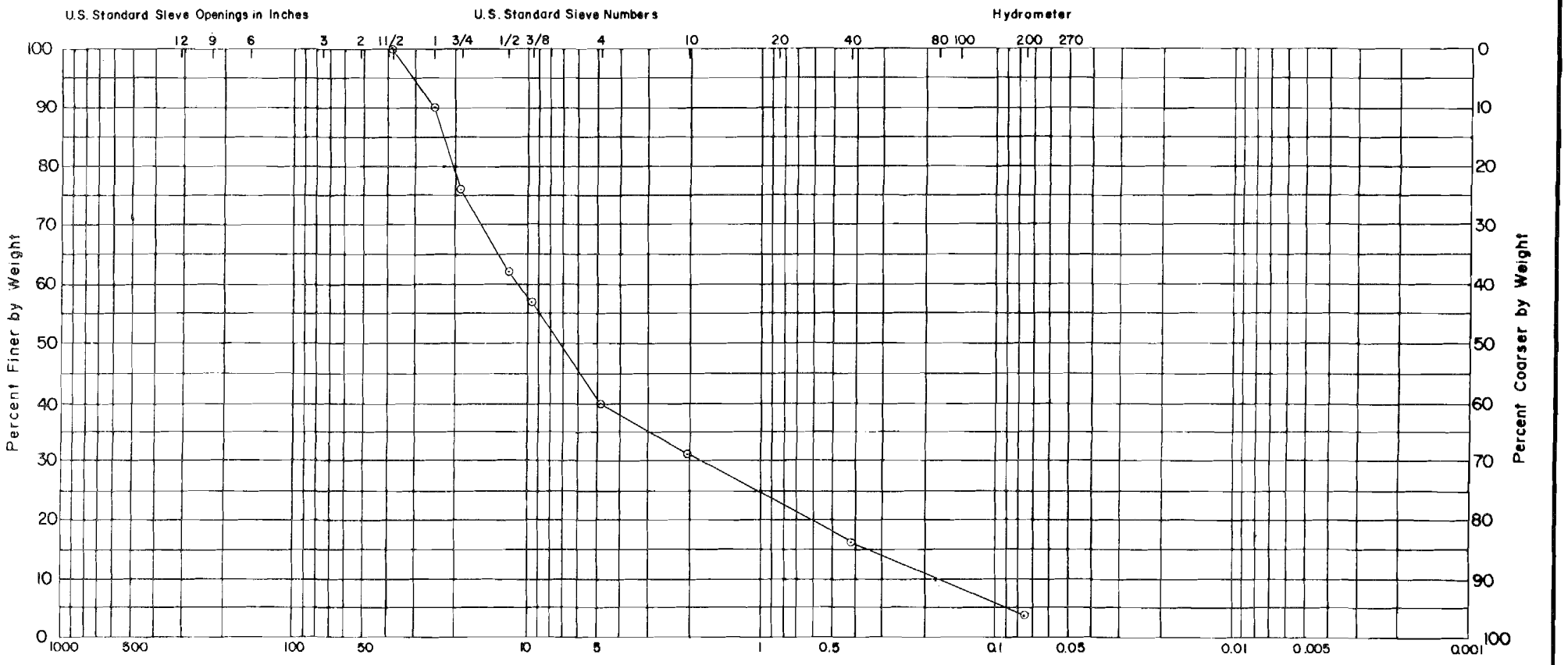
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E3-6	4.4%				SP-SM	GRAVELLY SAND
(4.5-6.0')						Poorly Graded

R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



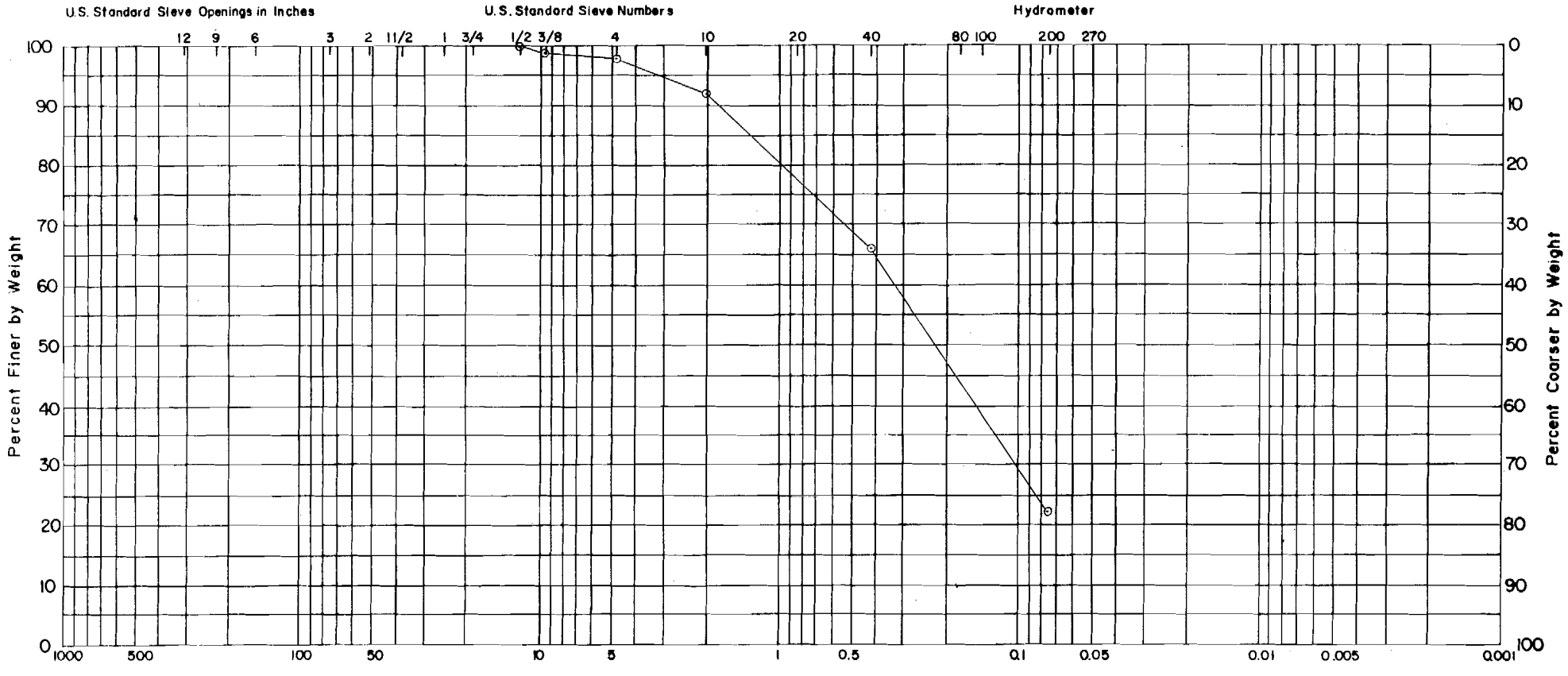
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E3-7	0.7%				GW	SANDY GRAVEL
(6.5-8.0')						Well Graded

R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



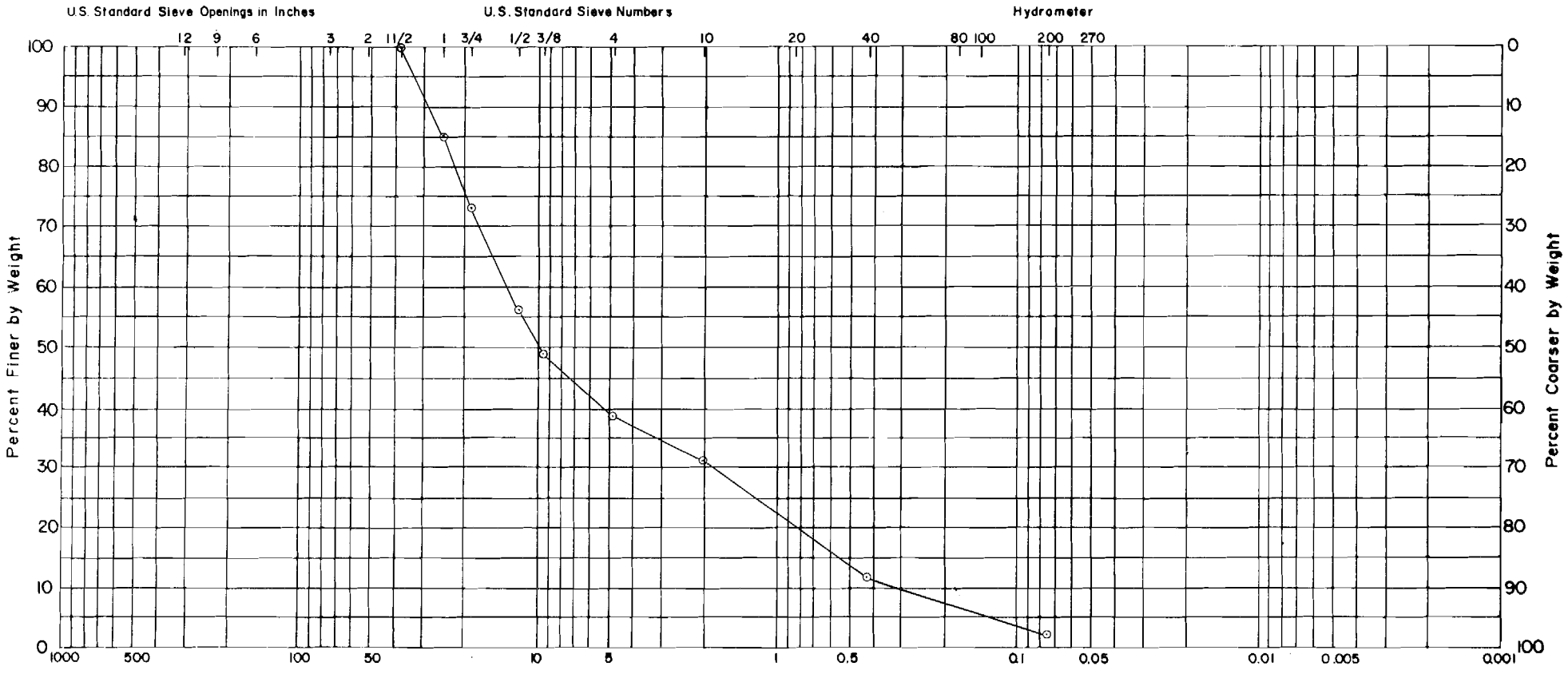
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E4-6 (5.0-6.5')	17.6%				SM	SILTY SAND WITH TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



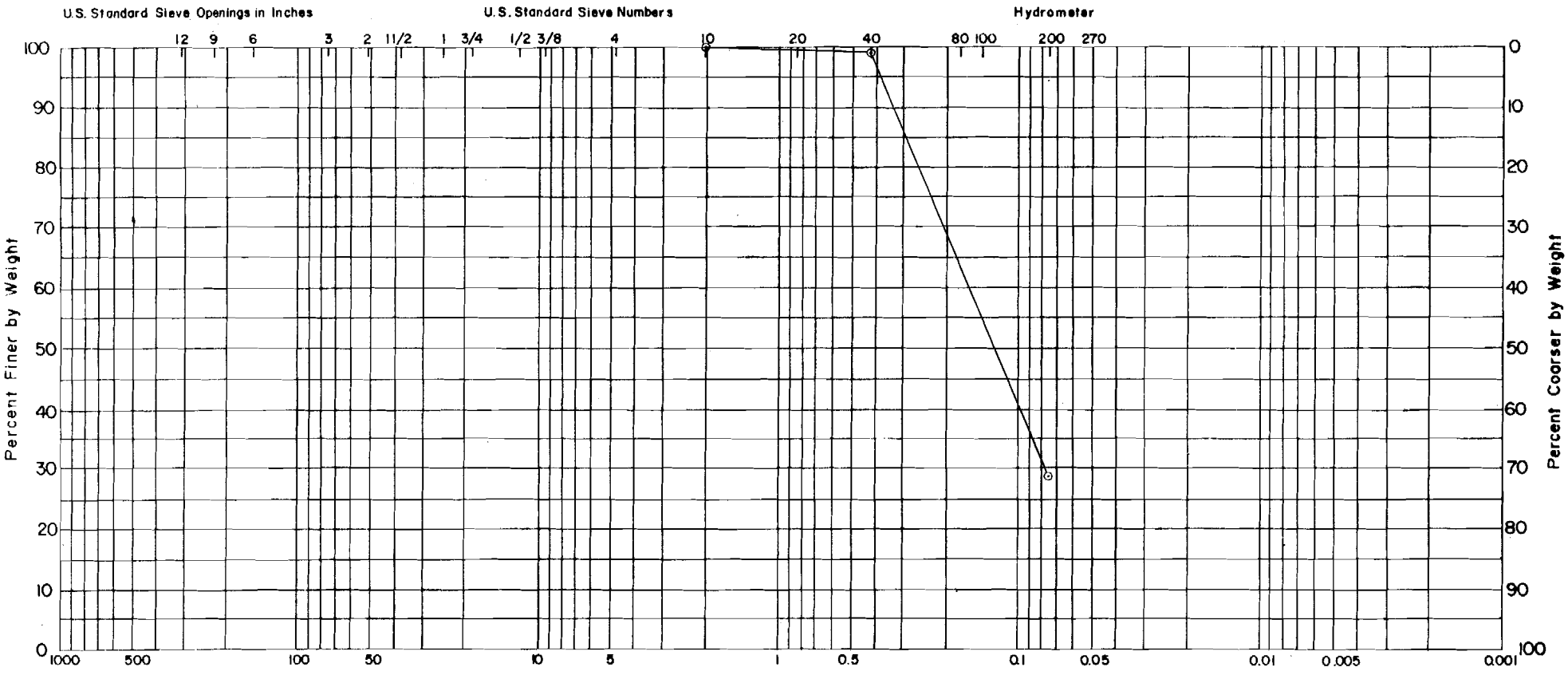
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E7-3	2.3%				GP	SANDY GRAVEL WITH TRACE SILT
(2.0-3.0')						

R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



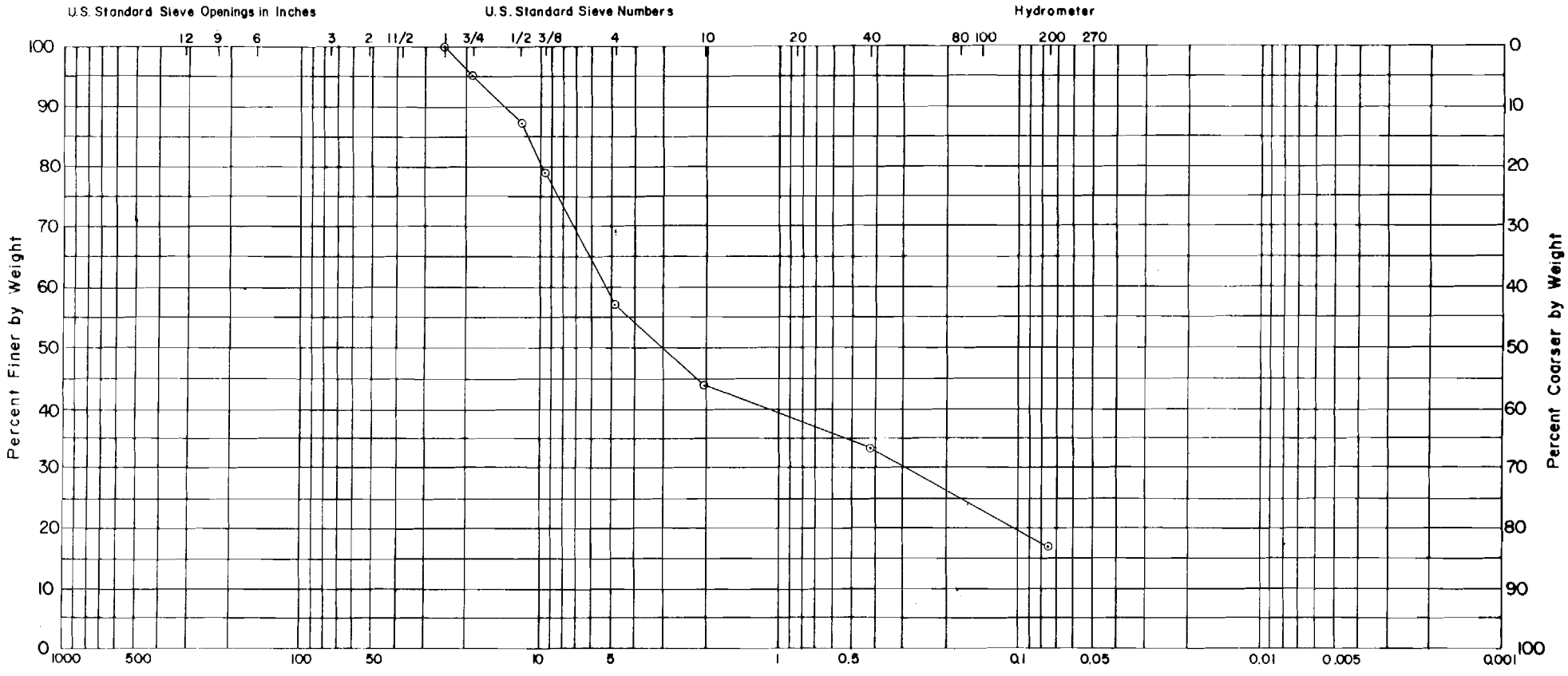
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-E9-2	15.7%				SM	SILTY SAND
(1.5-3.0')						Poorly Graded

R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



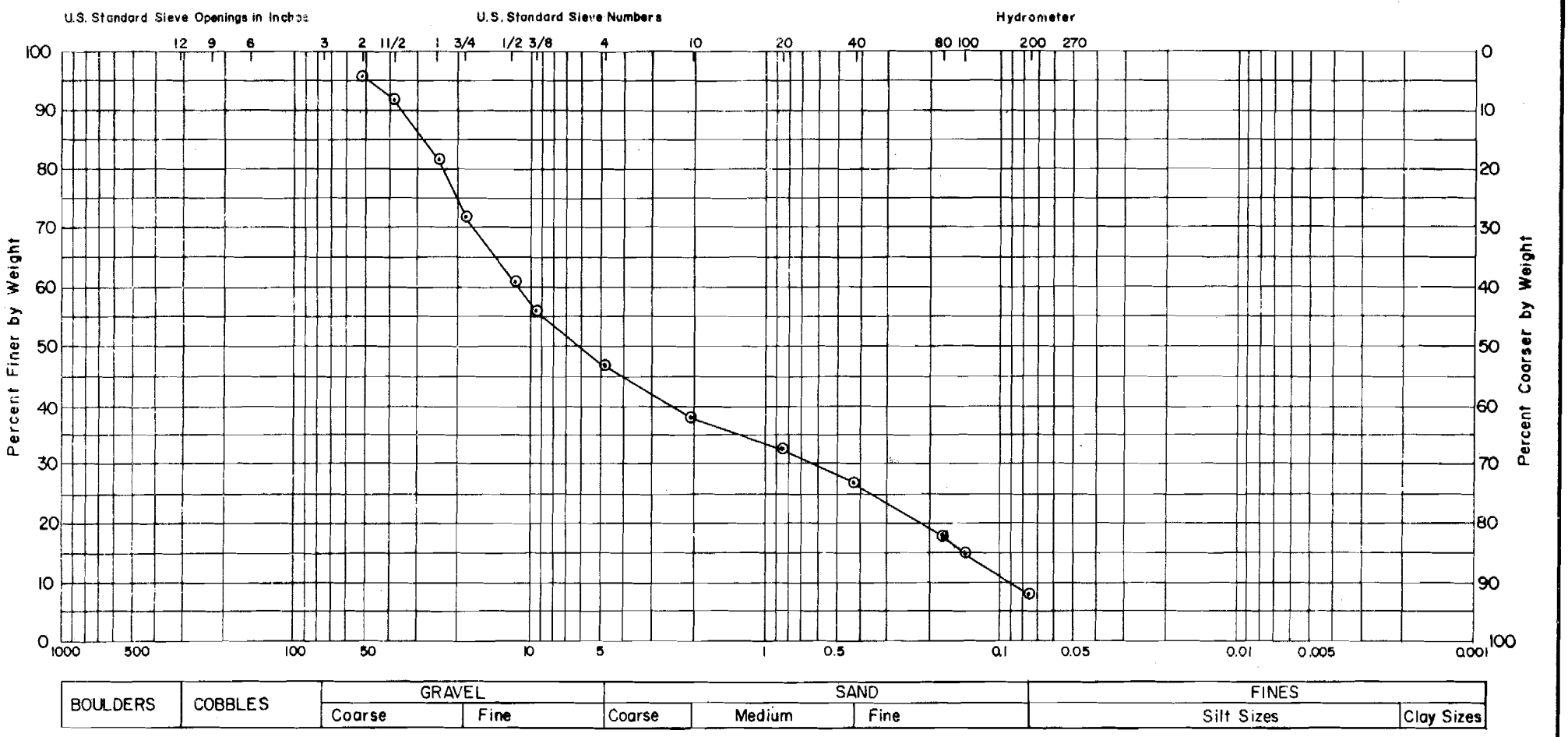
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E9-6	4.4%				GM	SANDY GRAVEL WITH SOME SILT
(6.5-8.0')						

R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



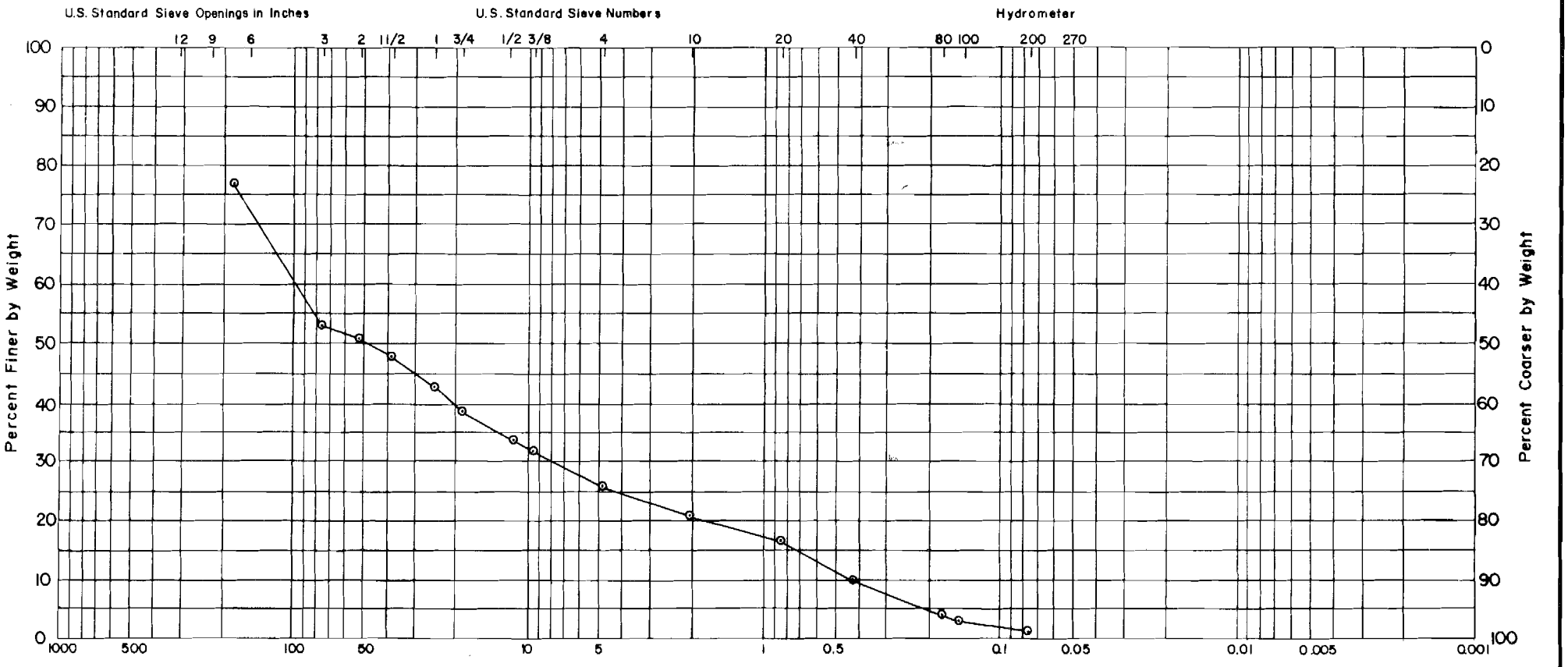
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E1 #1					GP-GM	SANDY GRAVEL WITH TRACE SILT

R&M CONSULTANTS INC.

Borrow Area E
Test Pit TP-E1

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



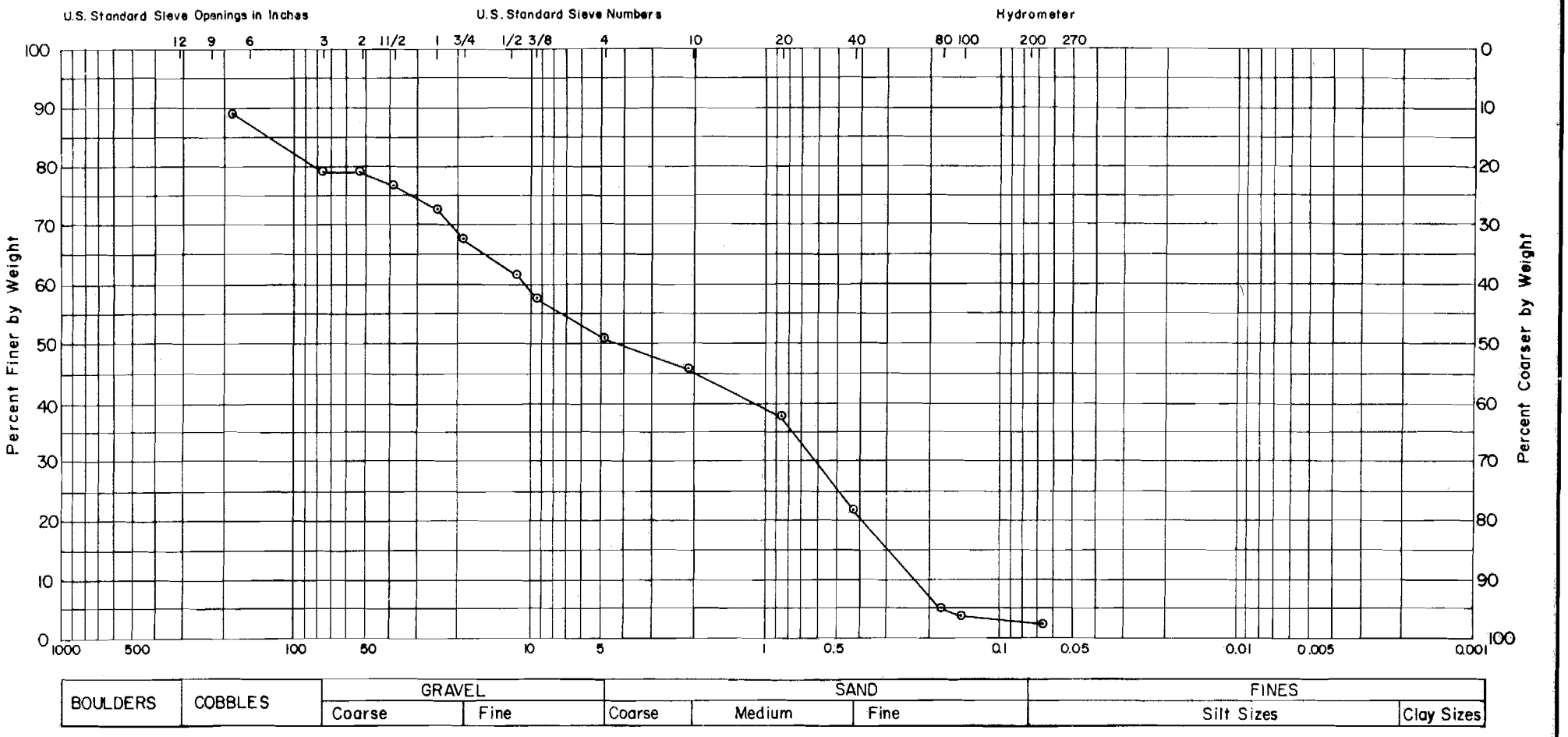
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E1 #2					GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E1

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



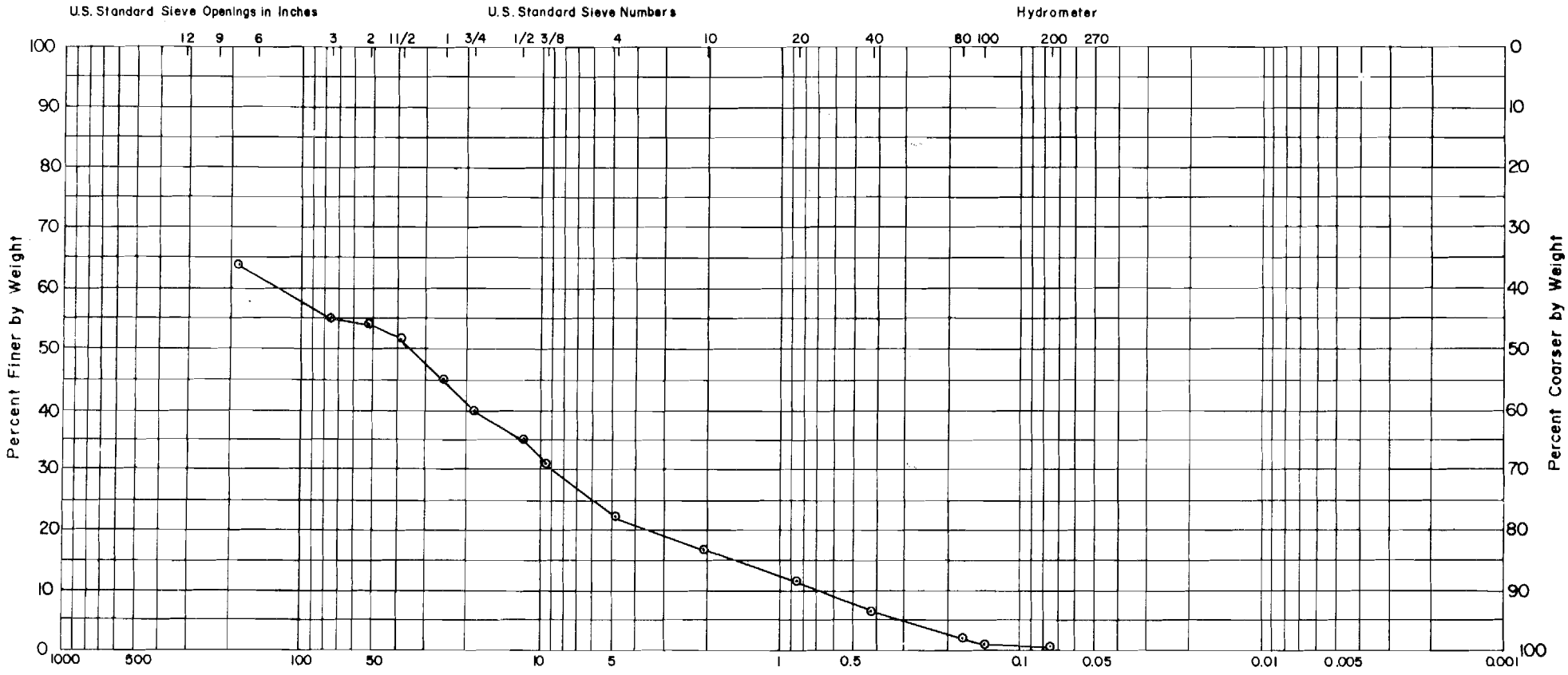
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E2 #1					SP	GRAVELLY SAND WITH SCATTERED COBBLES

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E2

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



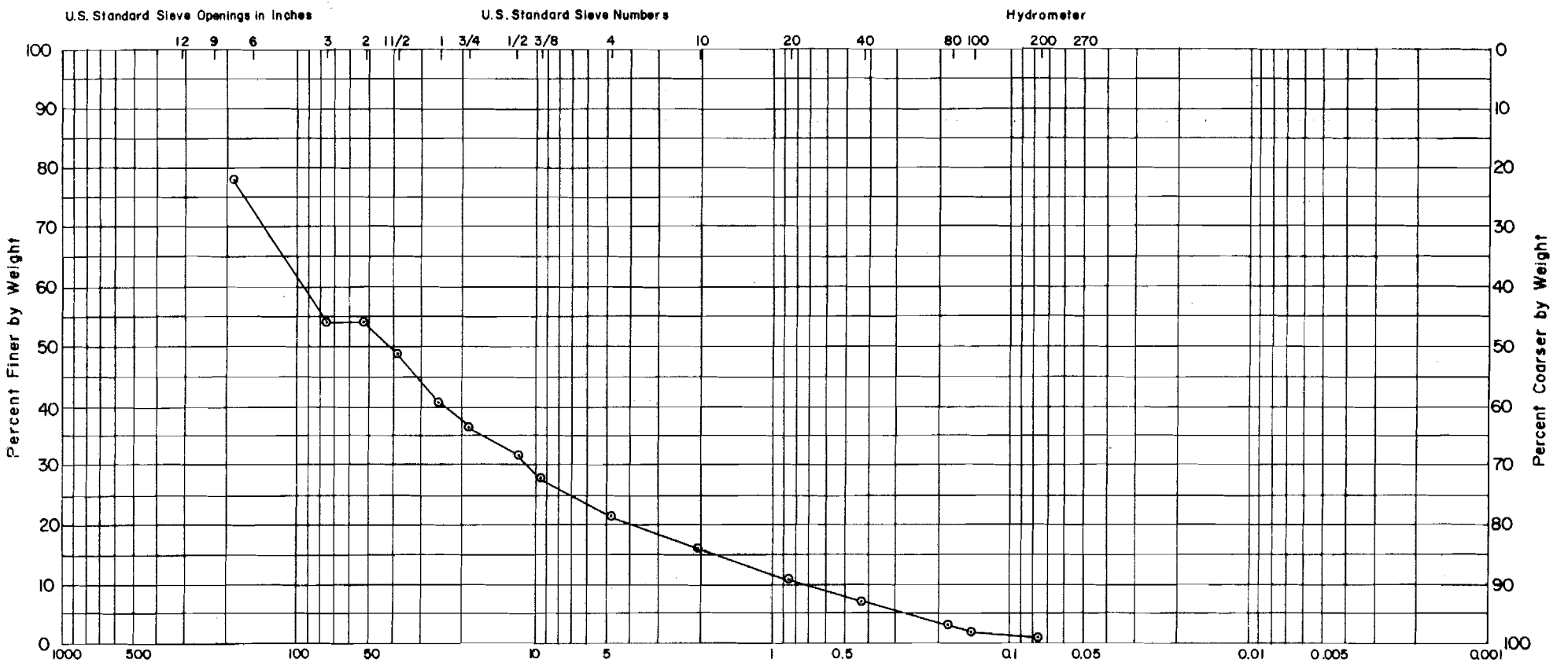
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E2 #2					GW	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E2

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



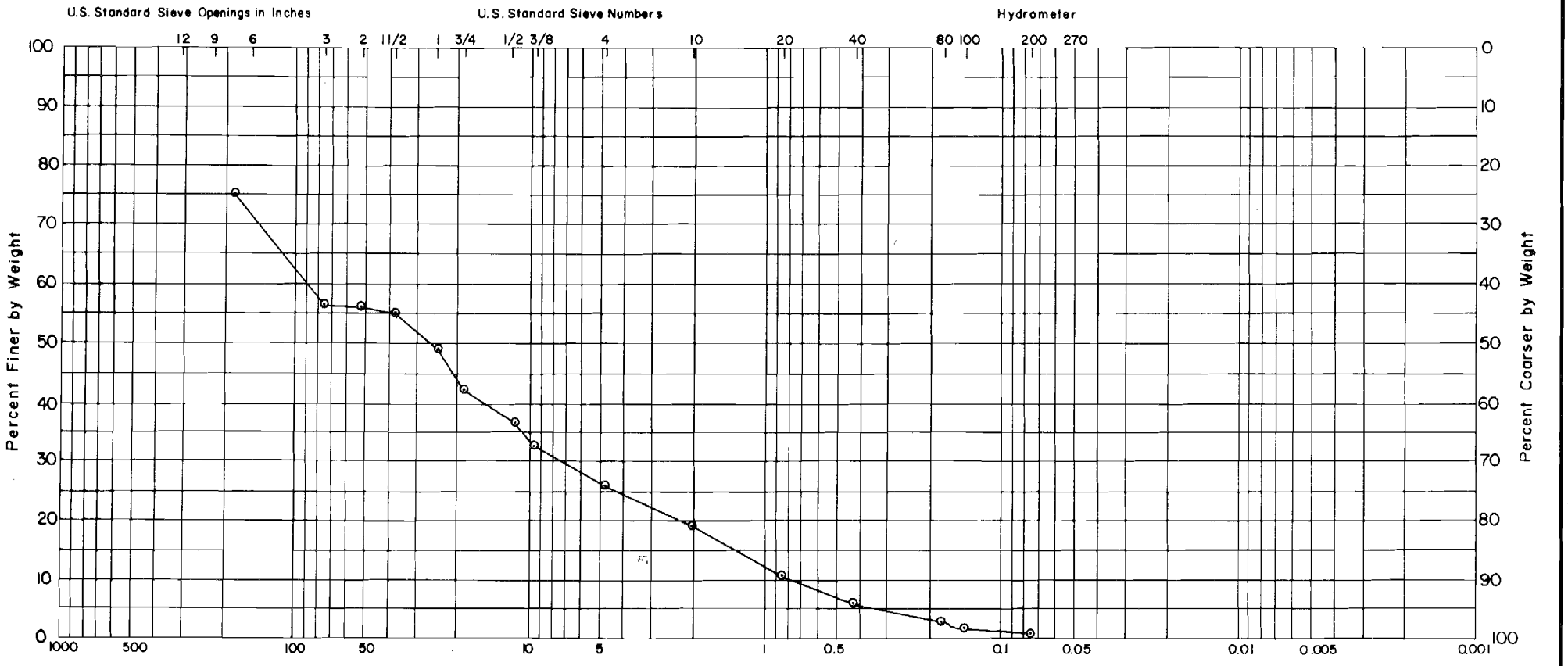
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E3 #1					GW	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E3

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



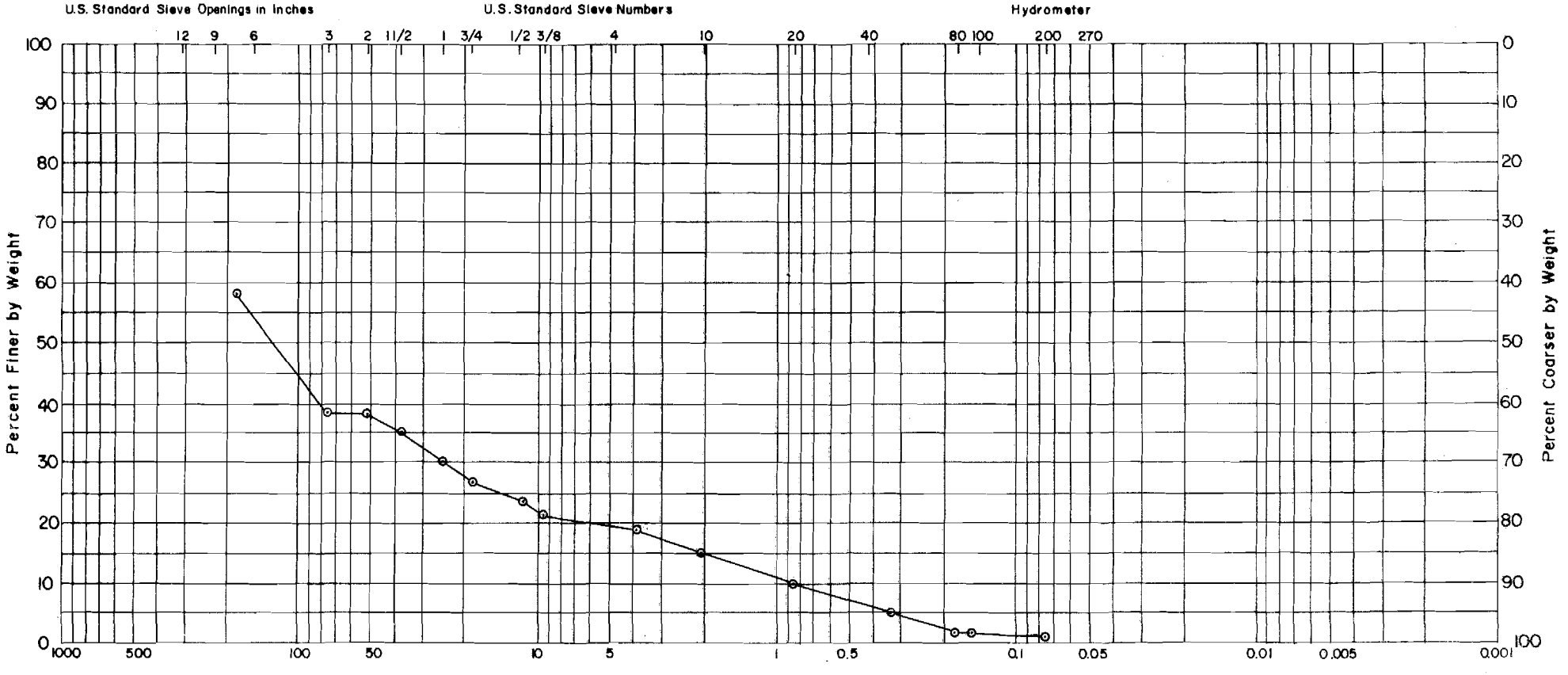
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E3 #2					GW-GP	SANDY GRAVEL WITH NUMBEROUS COBBLES AND SCATTERED BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E3

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



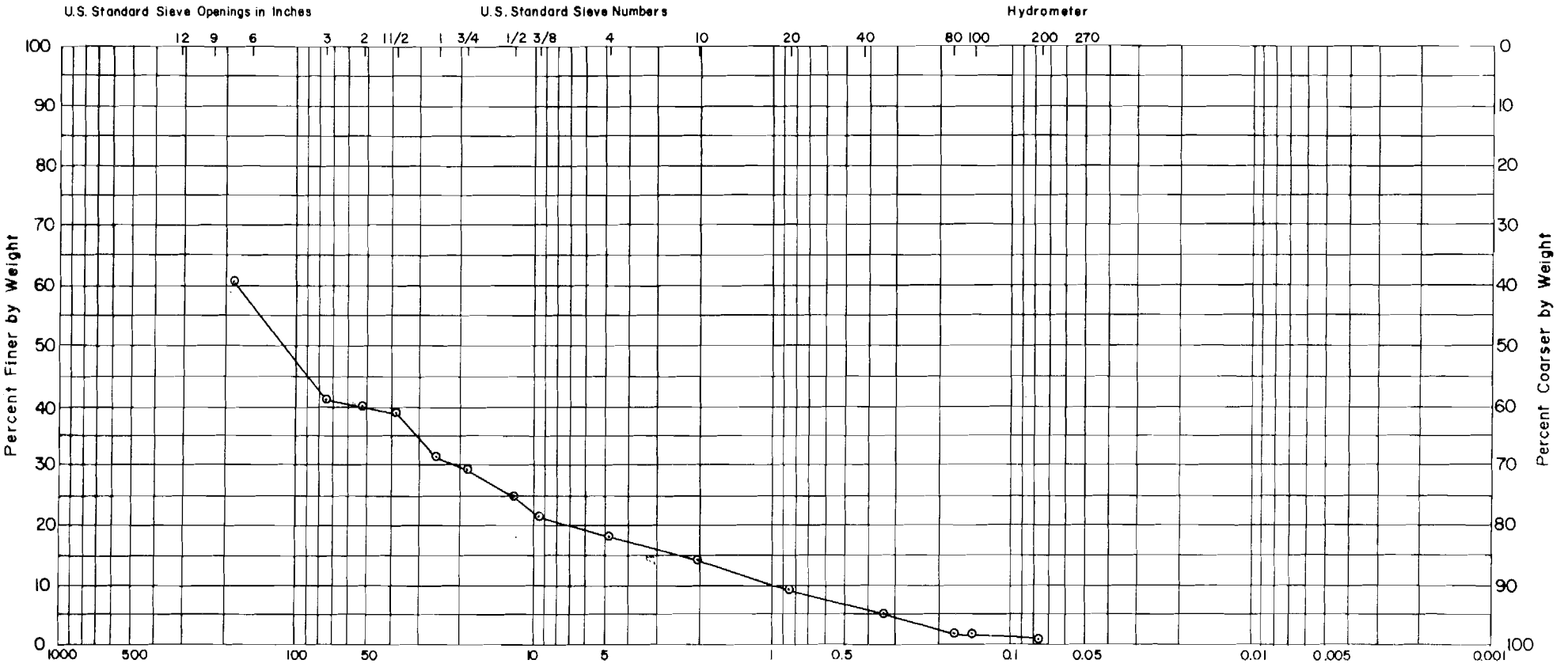
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E4 #1					GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TR-E4

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



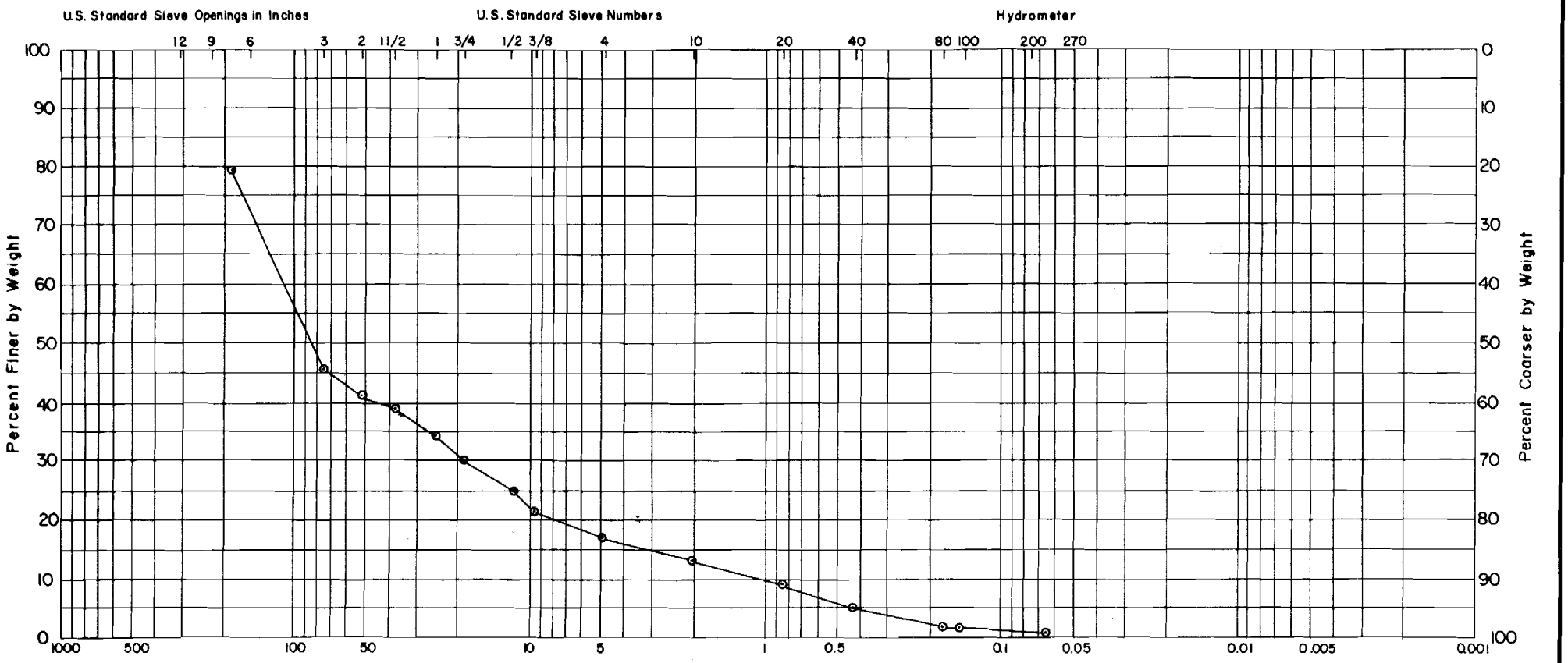
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E4 #2					GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E4

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



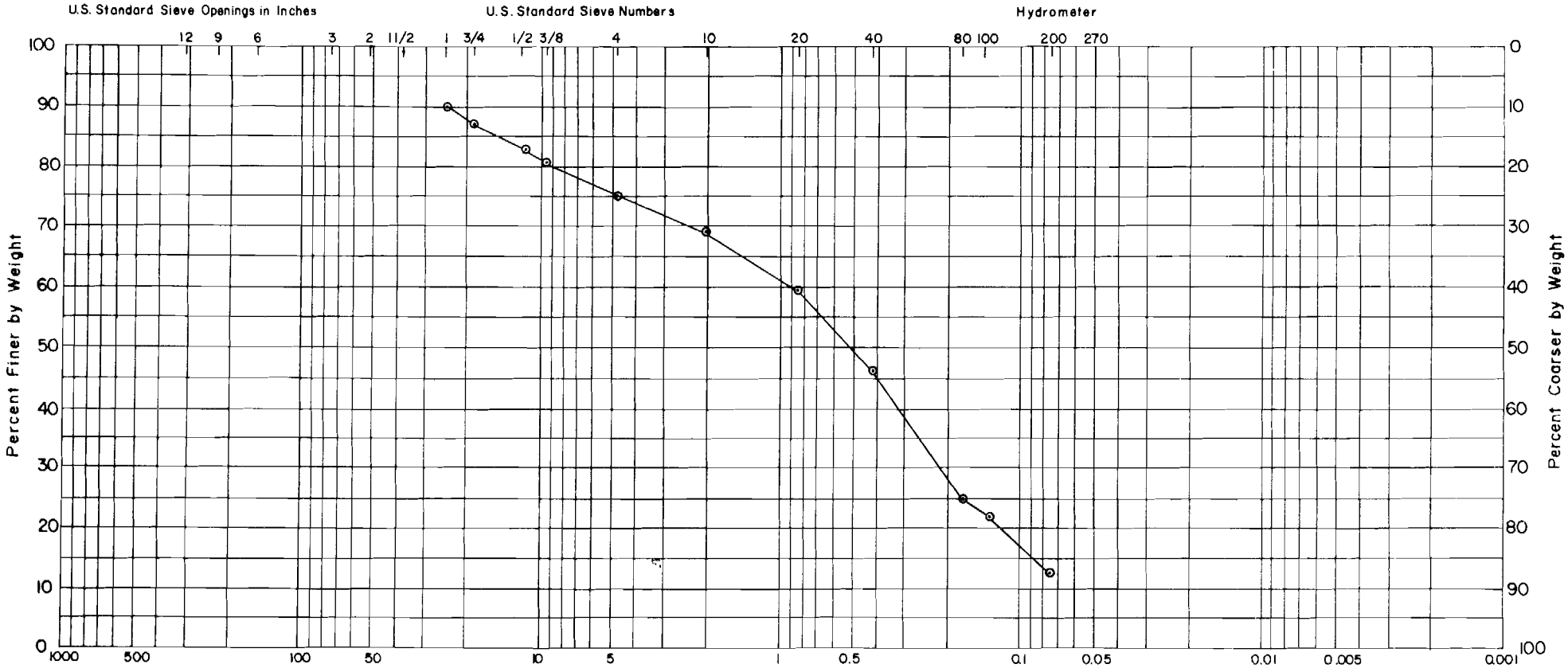
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E5 #1					GW-GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E5

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



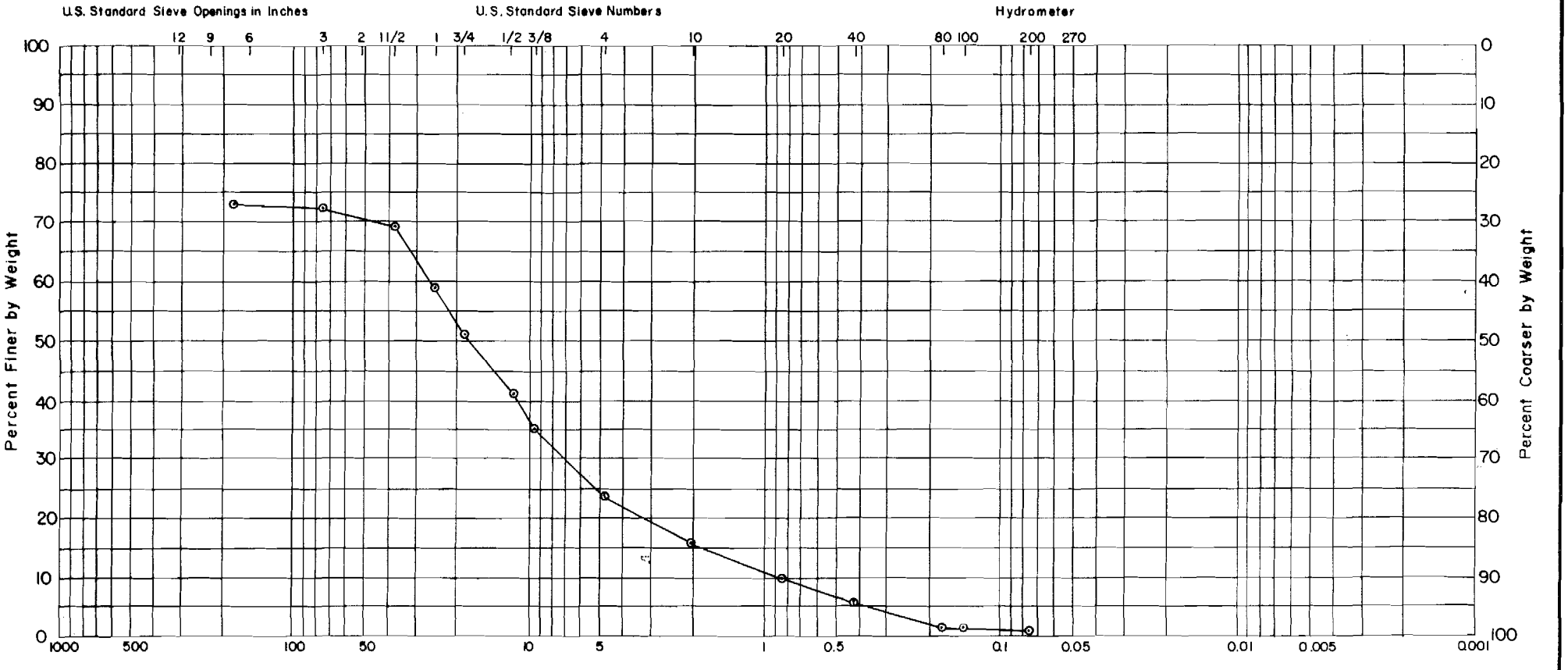
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E6 #1					SM	SAND WITH SOME GRAVEL AND SILT

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E6

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



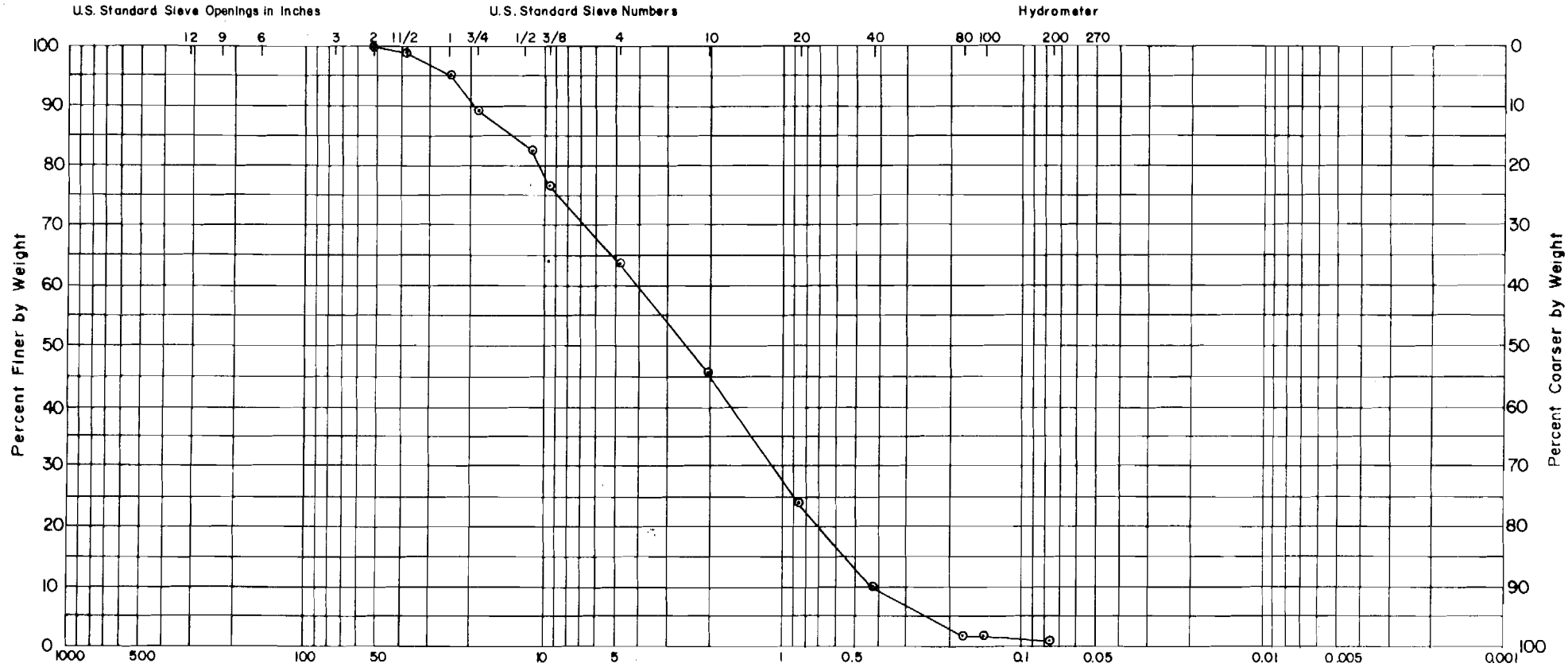
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E8 #1					GW	SANDY GRAVEL WITH SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E8

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



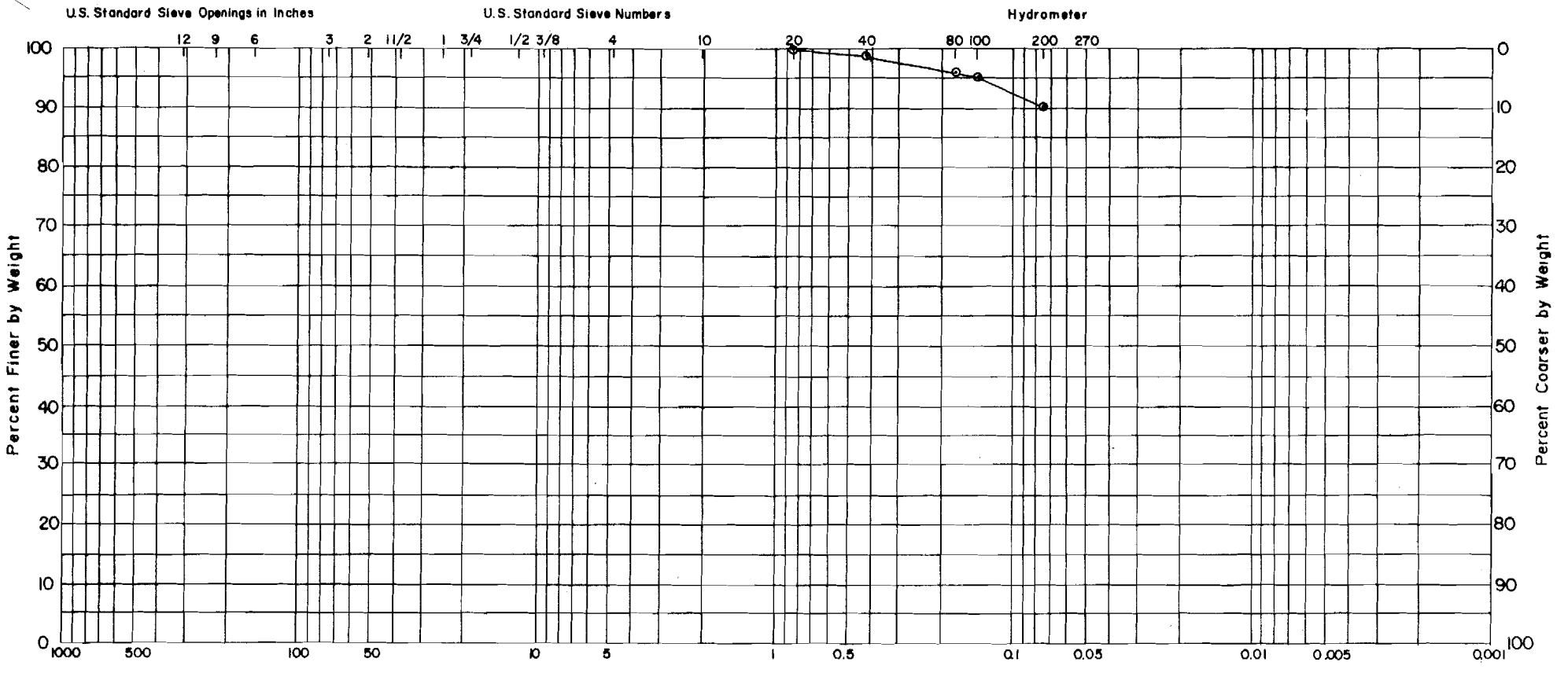
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E8 #2					SP	GRAVELLY SAND

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E8

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



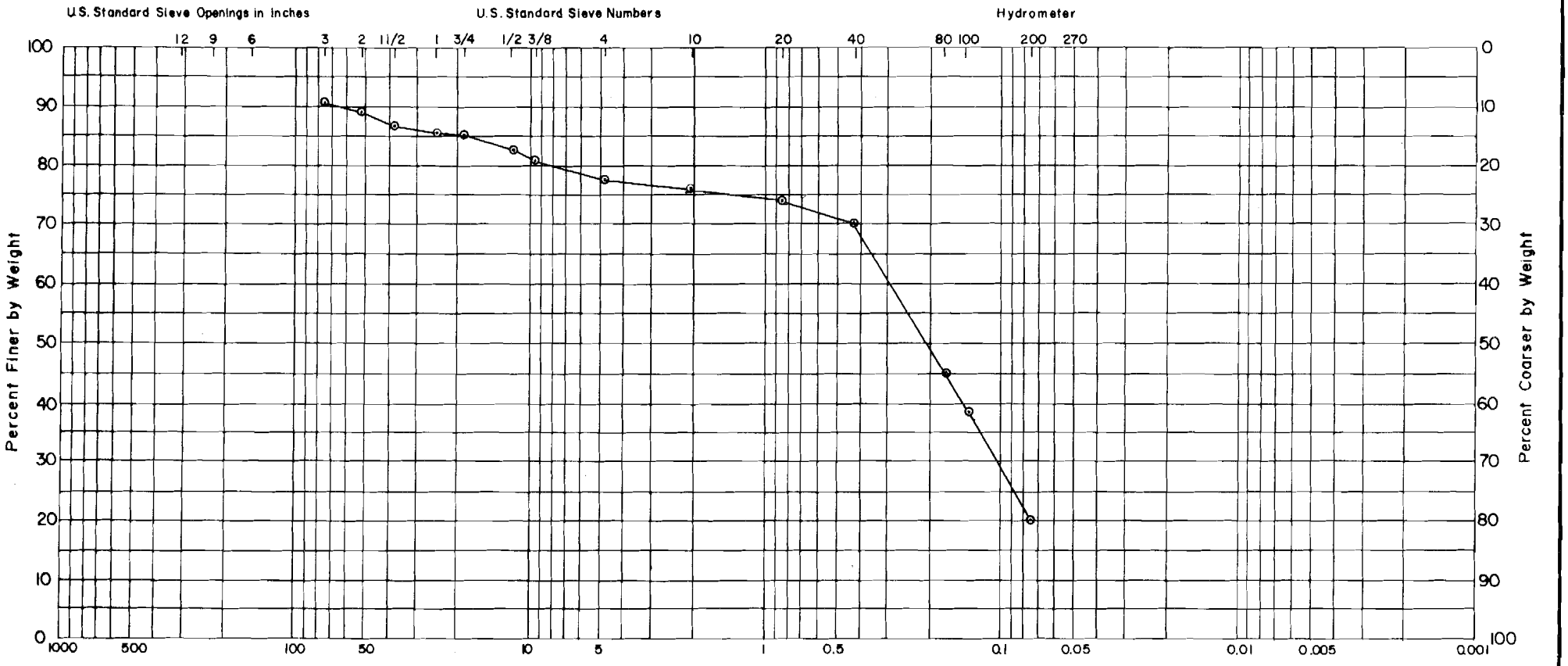
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E9 #1					ML	SILT WITH SOME TO TRACE CLAY AND TRACE SAND

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E9

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



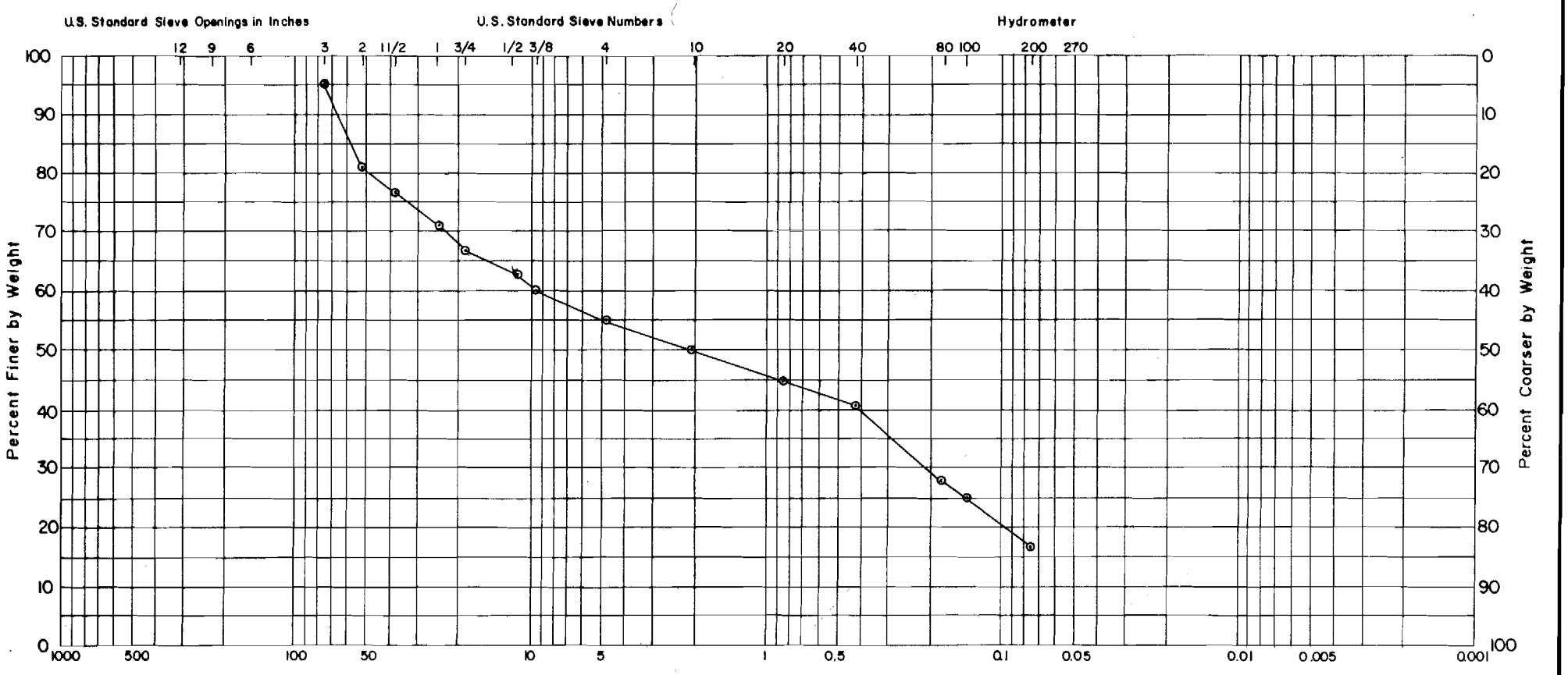
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E9 #2					SM	SAND WITH SOME GRAVEL AND SILT AND SCATTERED COBBLES

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E9

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



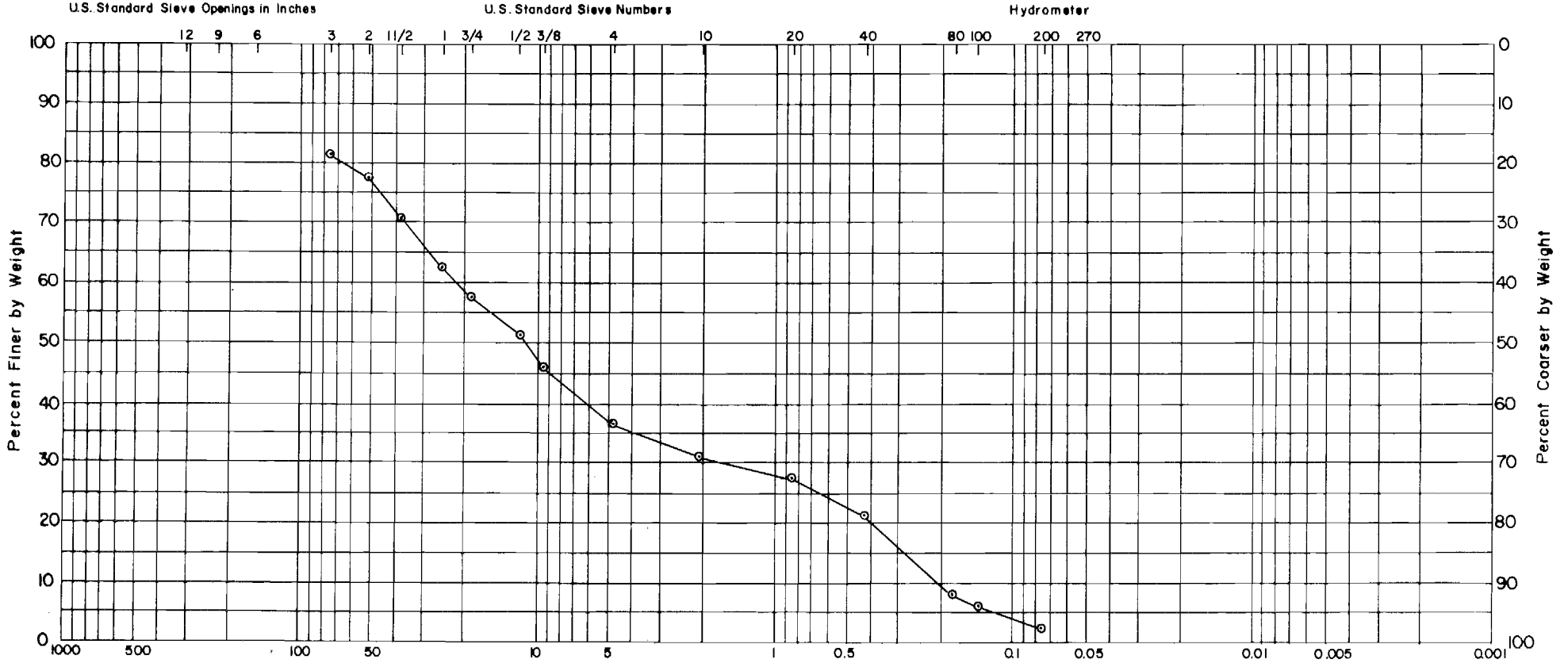
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E9 #3					GM	SANDY GRAVEL WITH SOME SILT AND SCATTERED COBBLES.

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E9

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



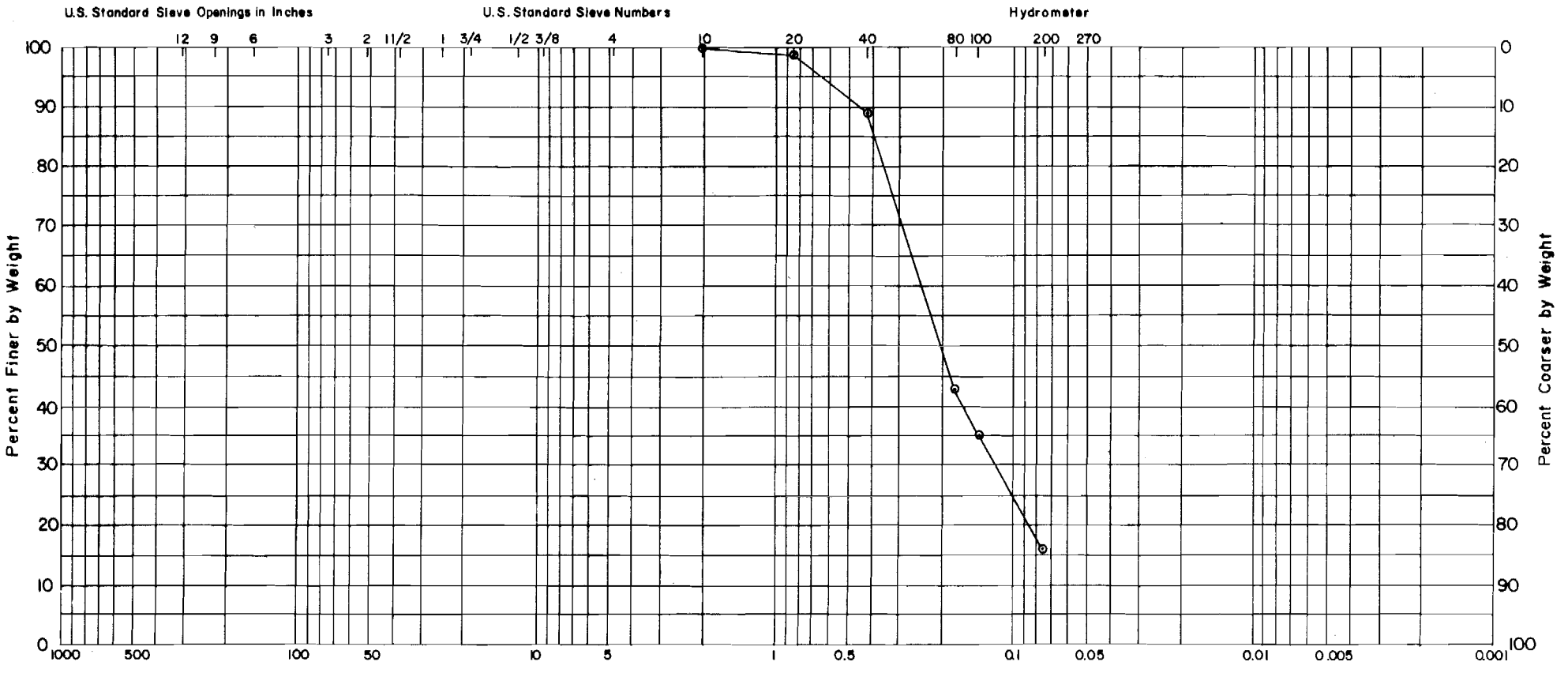
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E10A #1					GP	SANDY GRAVEL WITH SCATTERED COBBLES

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E10A

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



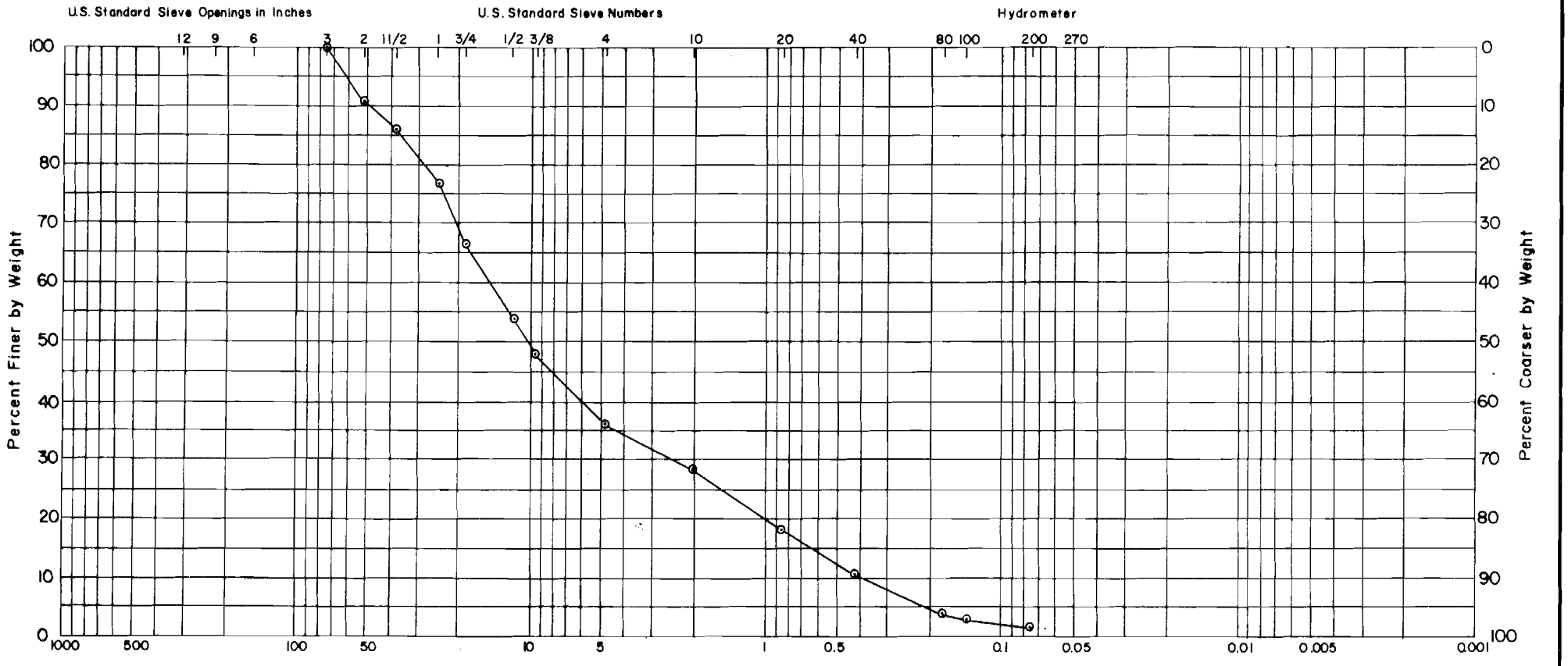
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E10A #2					SM	SAND WITH SOME SILT

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E10A

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



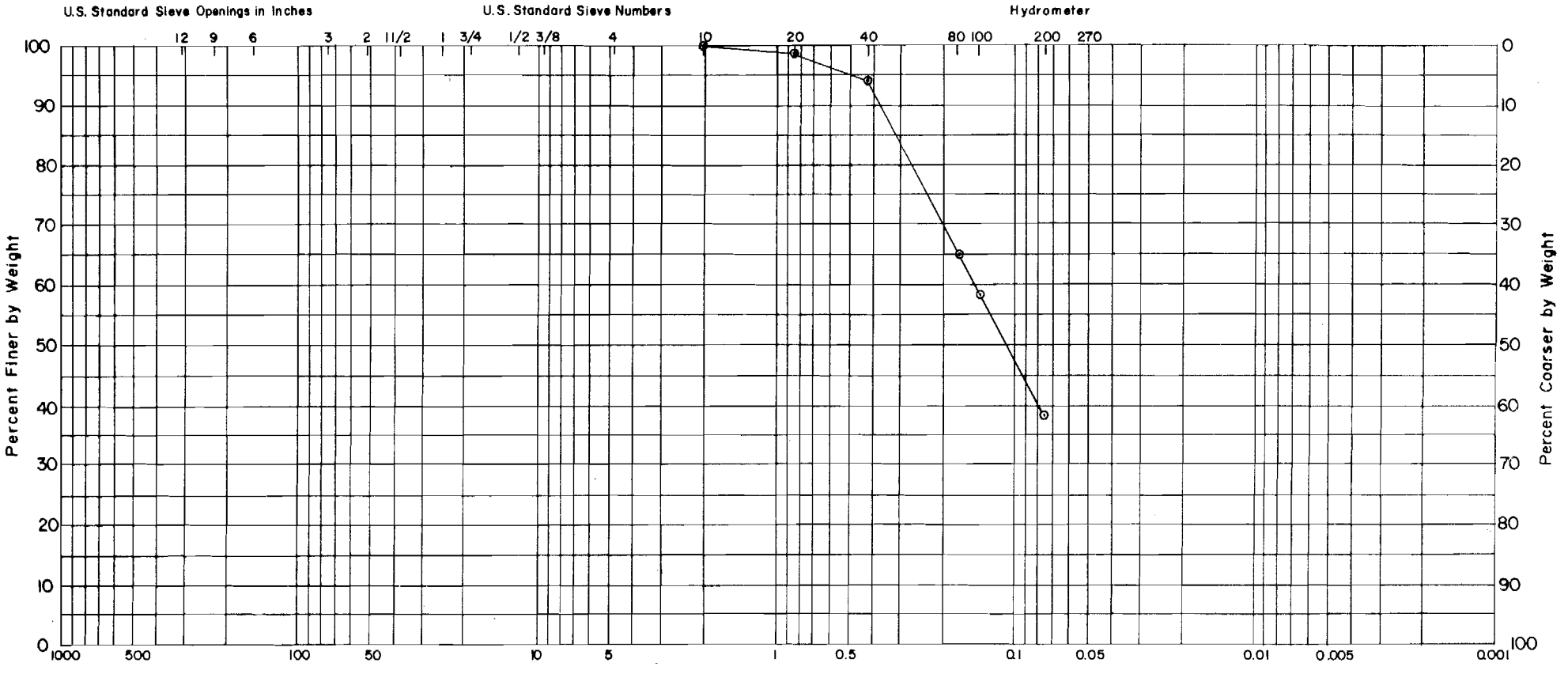
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E10B #1					GP	SANDY GRAVEL

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-#10B

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



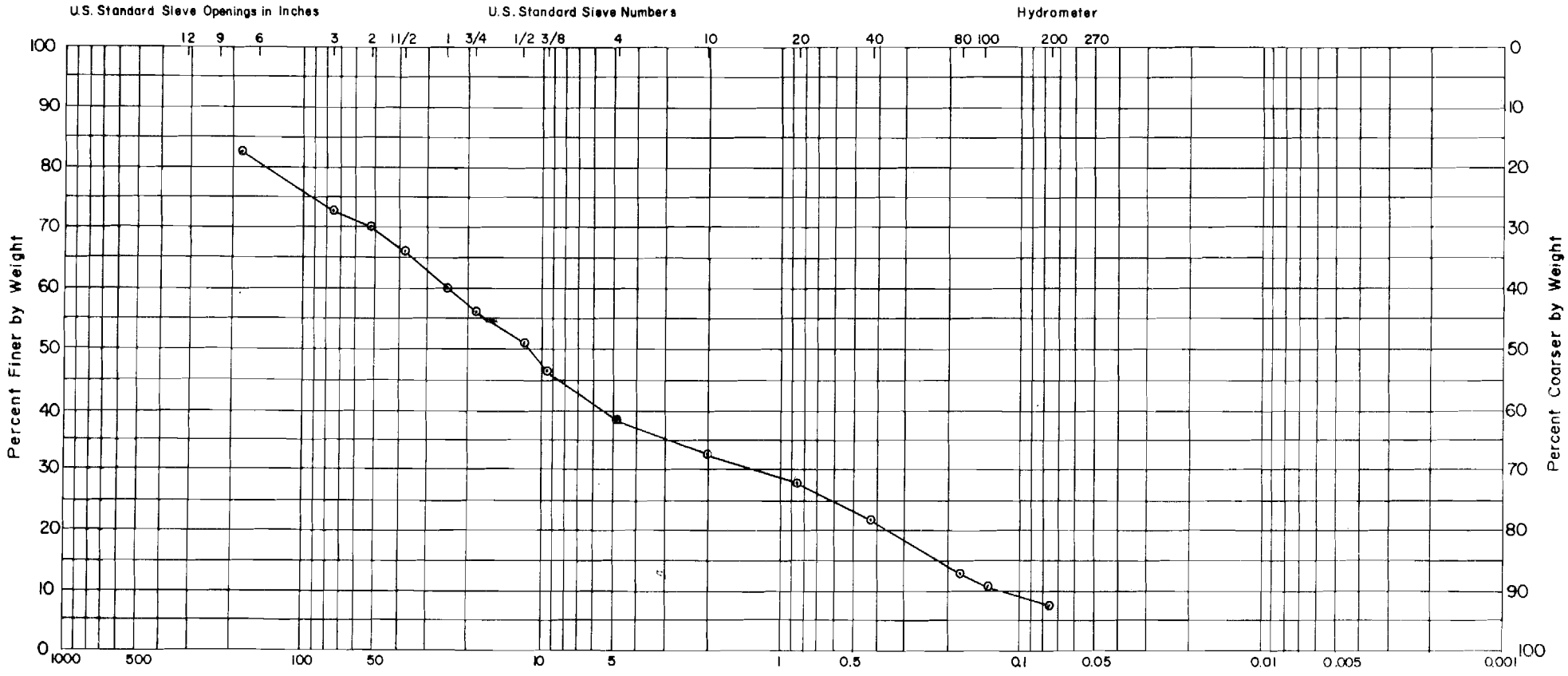
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E11 #1					SM	SILTY SAND

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E11

DRAWN BY: J.M.
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DATE: Dec. 1981
PROJECT NO. 052506



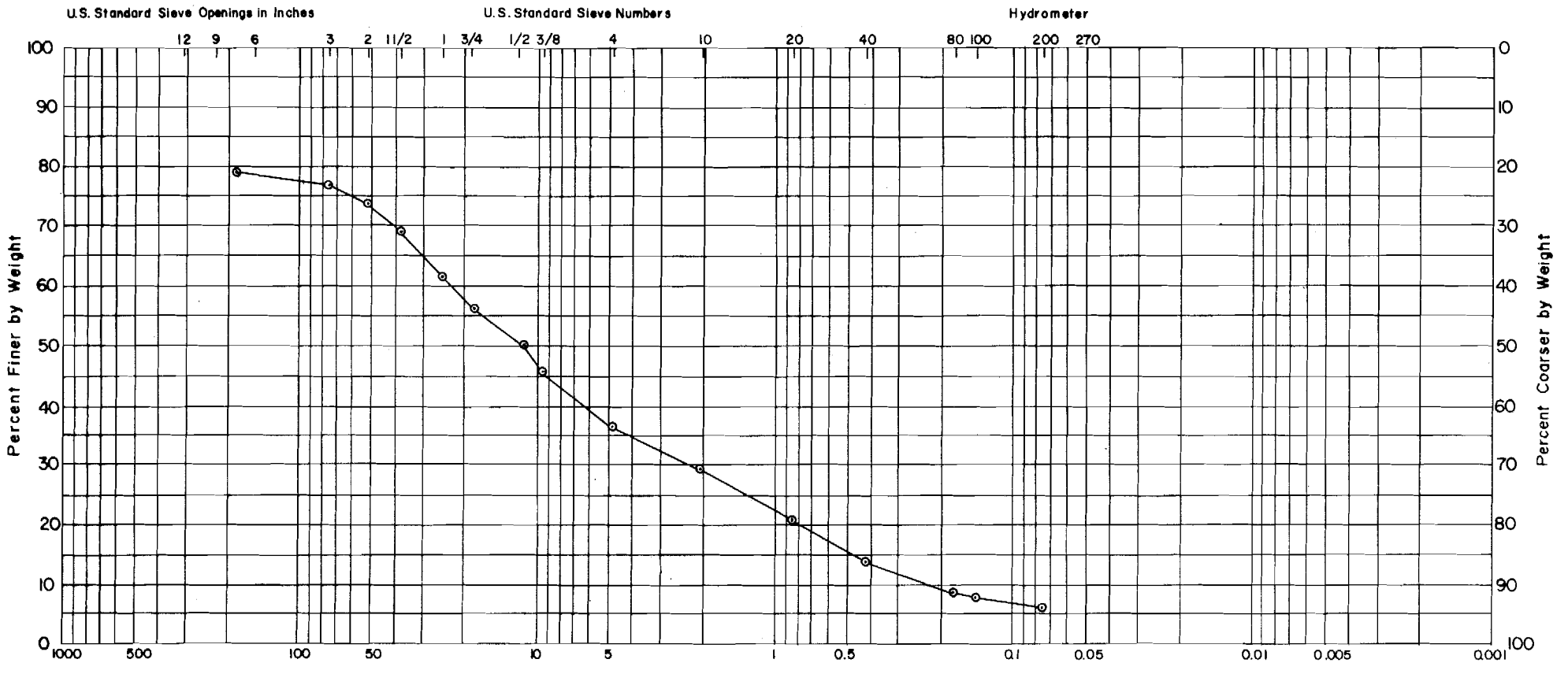
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E11 #2					GP-GM	SANDY GRAVEL WITH TRACE SILT AND SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E11

DRAWN BY:	J.M.
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DATE:	Dec. 1981
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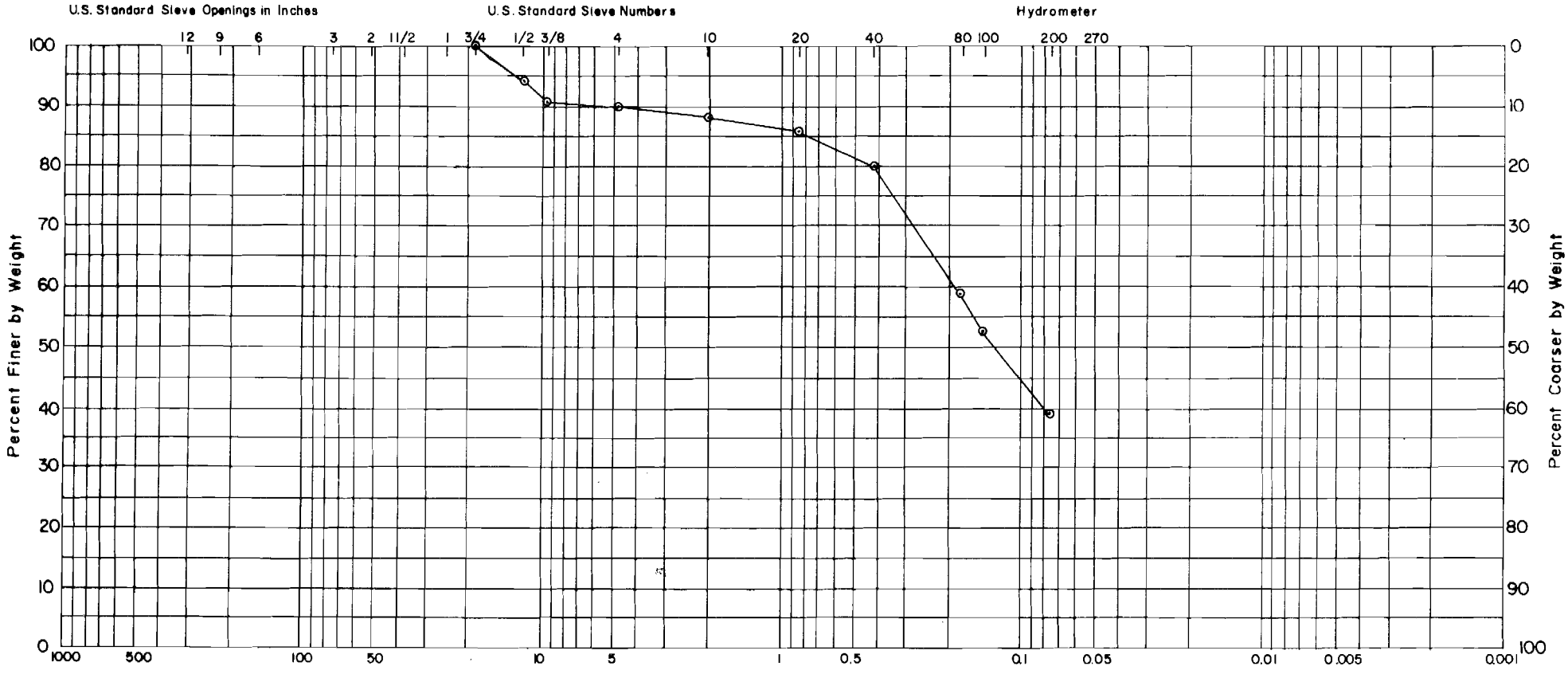
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E12 #1					GP-GM	SANDY GRAVEL WITH TRACE SILT AND SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E12

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APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



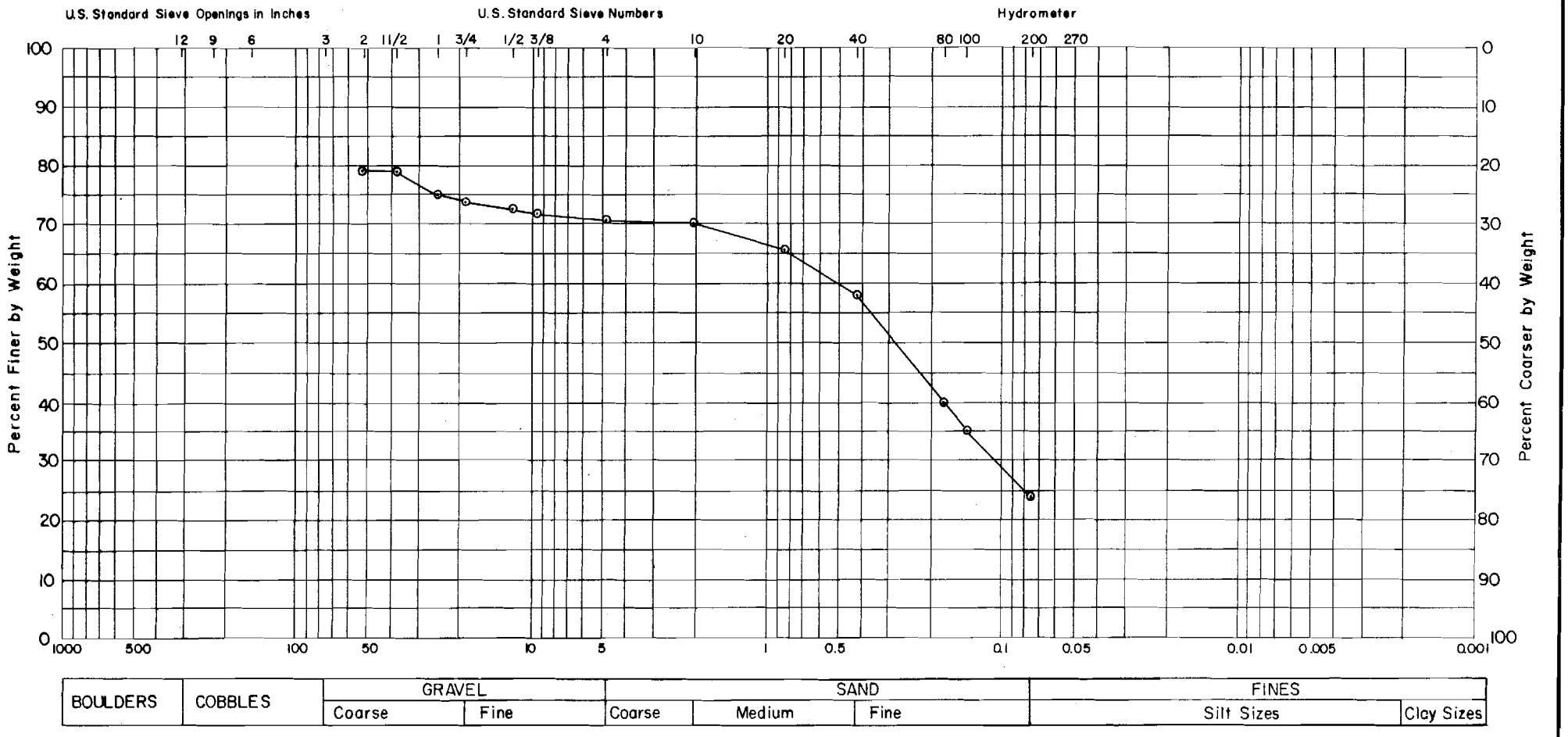
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E12 #2					SM	SILTY SAND WITH TRACE GRAVEL AND CLAY
						(FIELD GEOLOGIST NOTES TRACE ORGANICS)

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E12

DRAWN BY: J. M.
APPROVED BY: T. I.
DATE: Dec. 1981
PROJECT NO. 052506



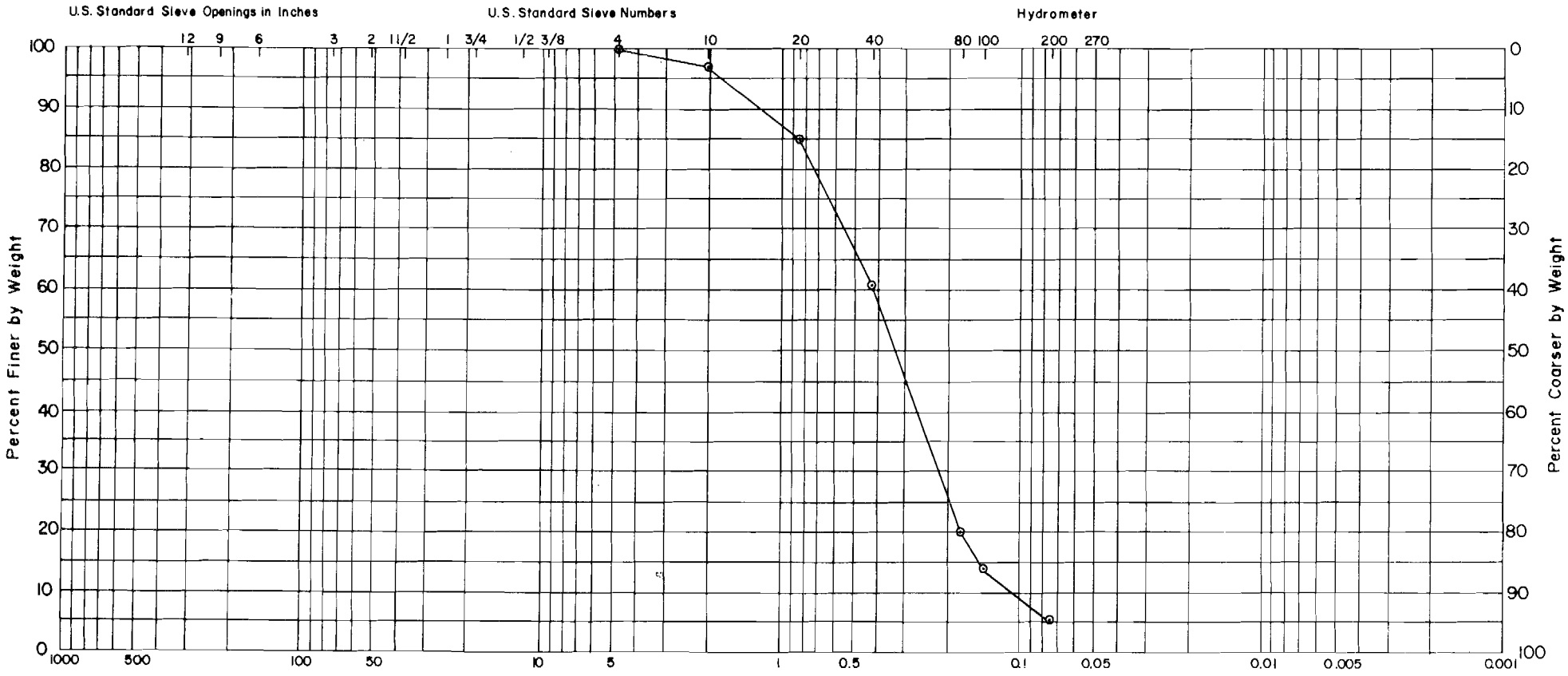
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E12 #3					SM	SAND WITH SOME SILT, TRACE GRAVEL AND SCATTERED COBBLES

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E12

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DATE:	Dec. 1981
PROJECT NO.	052506



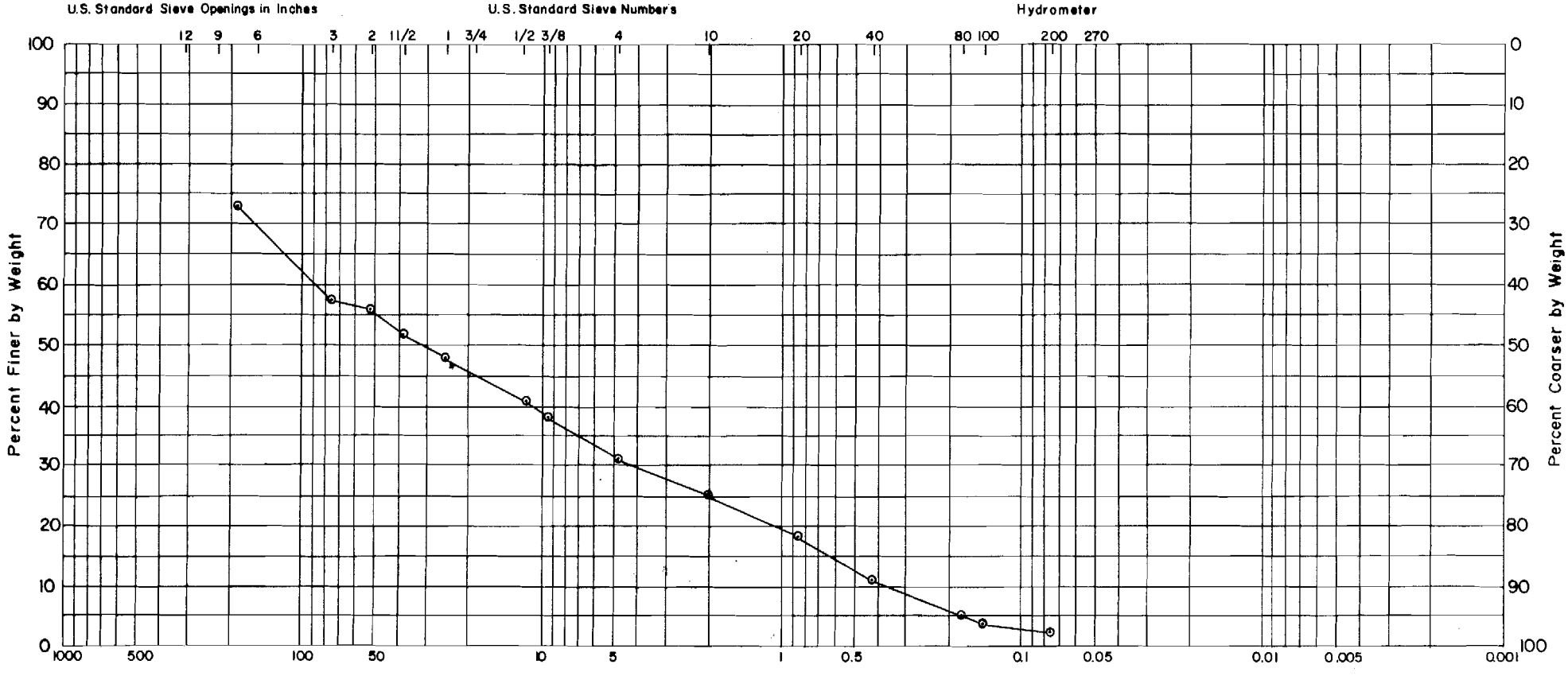
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E14 #1					SP-SM	SAND WITH TRACE SILT

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BORROW AREA E
TEST PIT TP-E14

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APPROVED BY:	T.I.
DATE:	Dec. 1981
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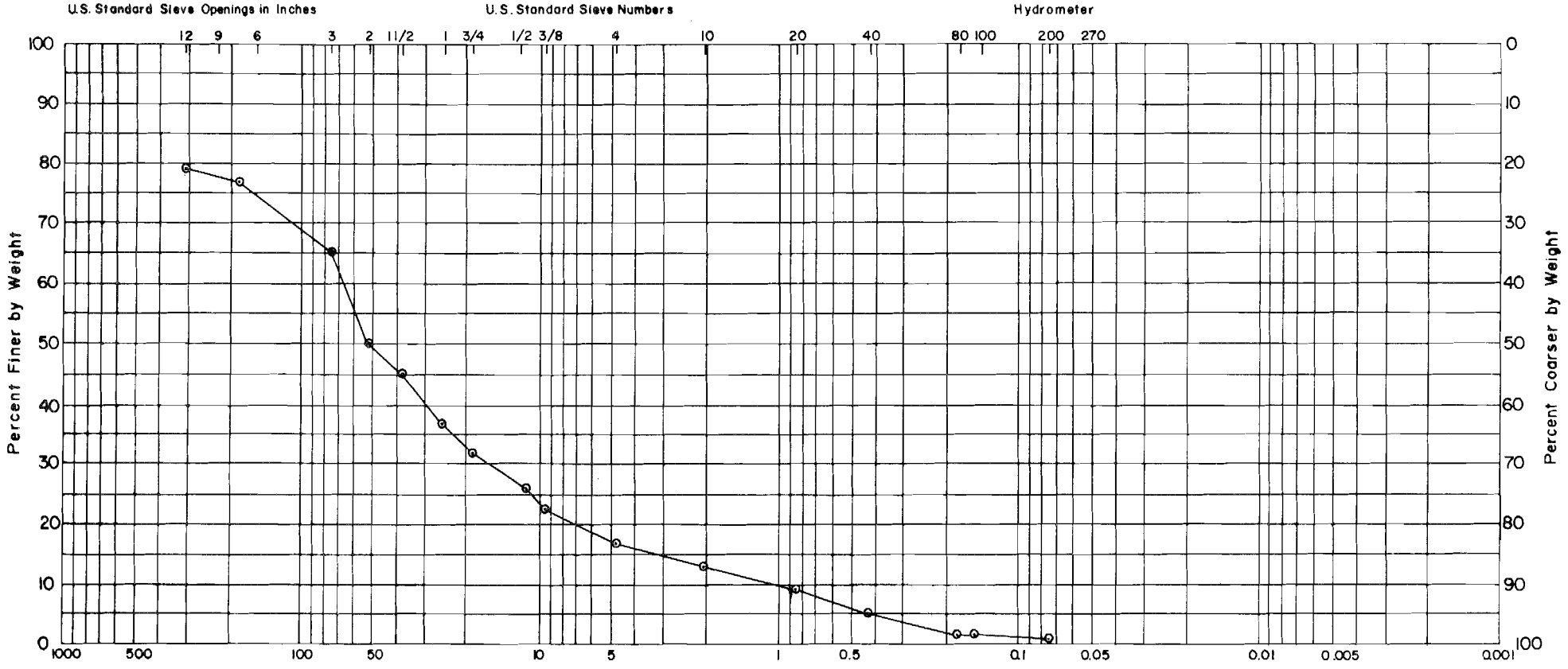
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E14 #2					SP	GRAVELLY SAND W/TRACE SILT, AND SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E14

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



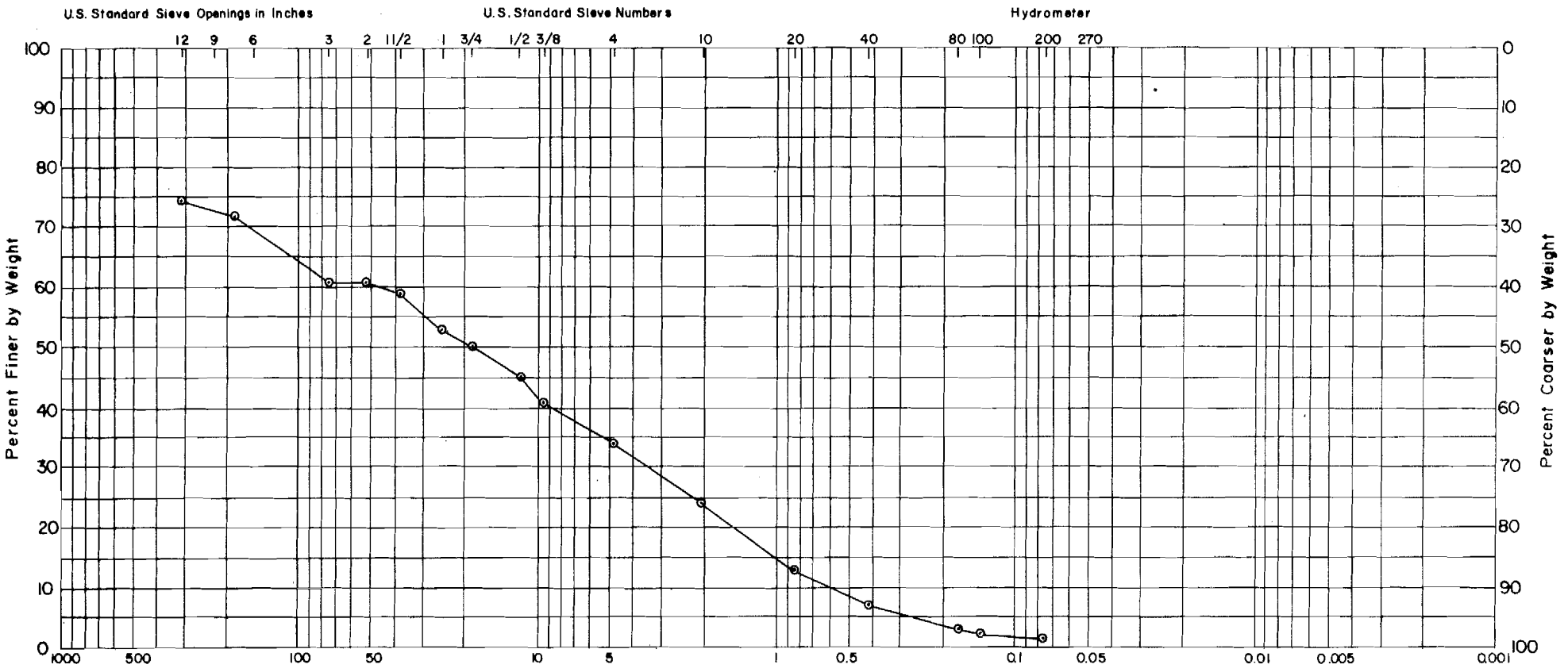
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E15 #1					GW	GRAVEL WITH SOME SAND AND SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E15

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APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



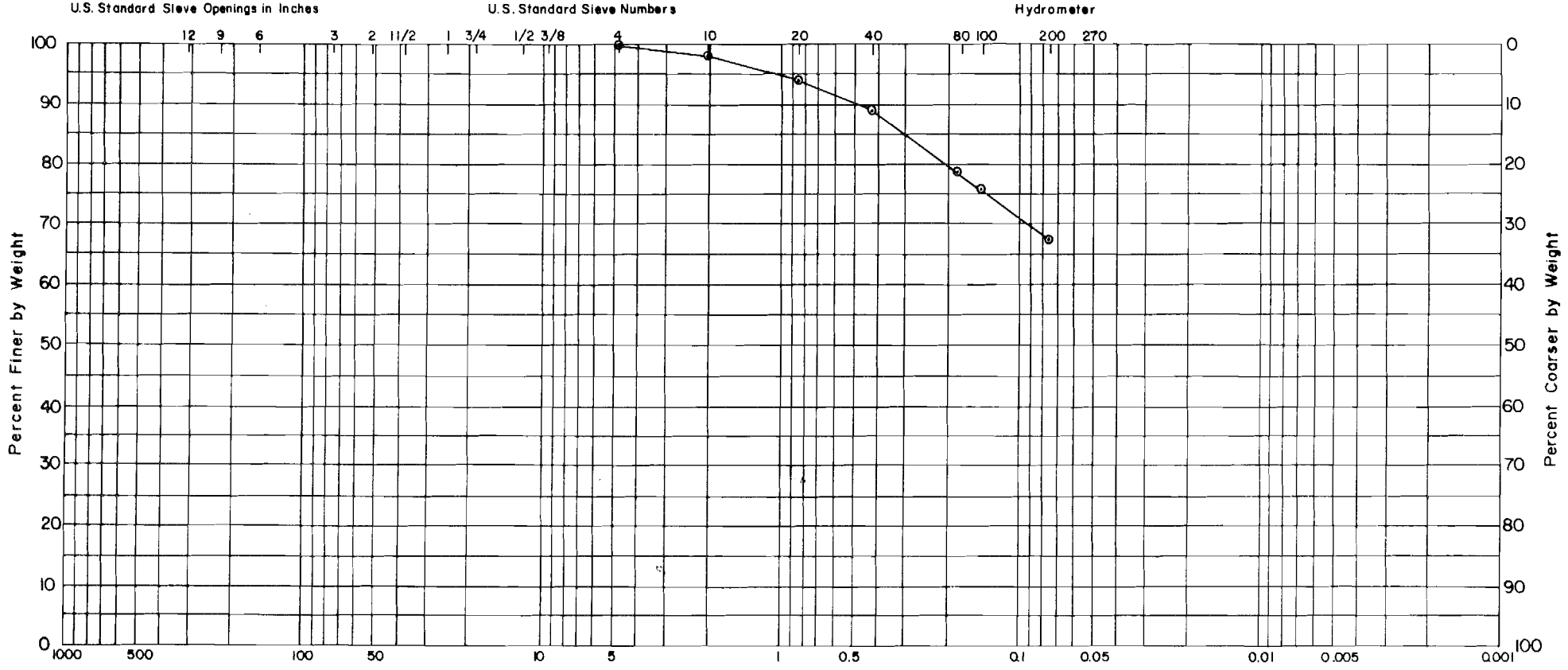
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E16 #1					SP	GRAVELLY SAND WITH SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E16

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



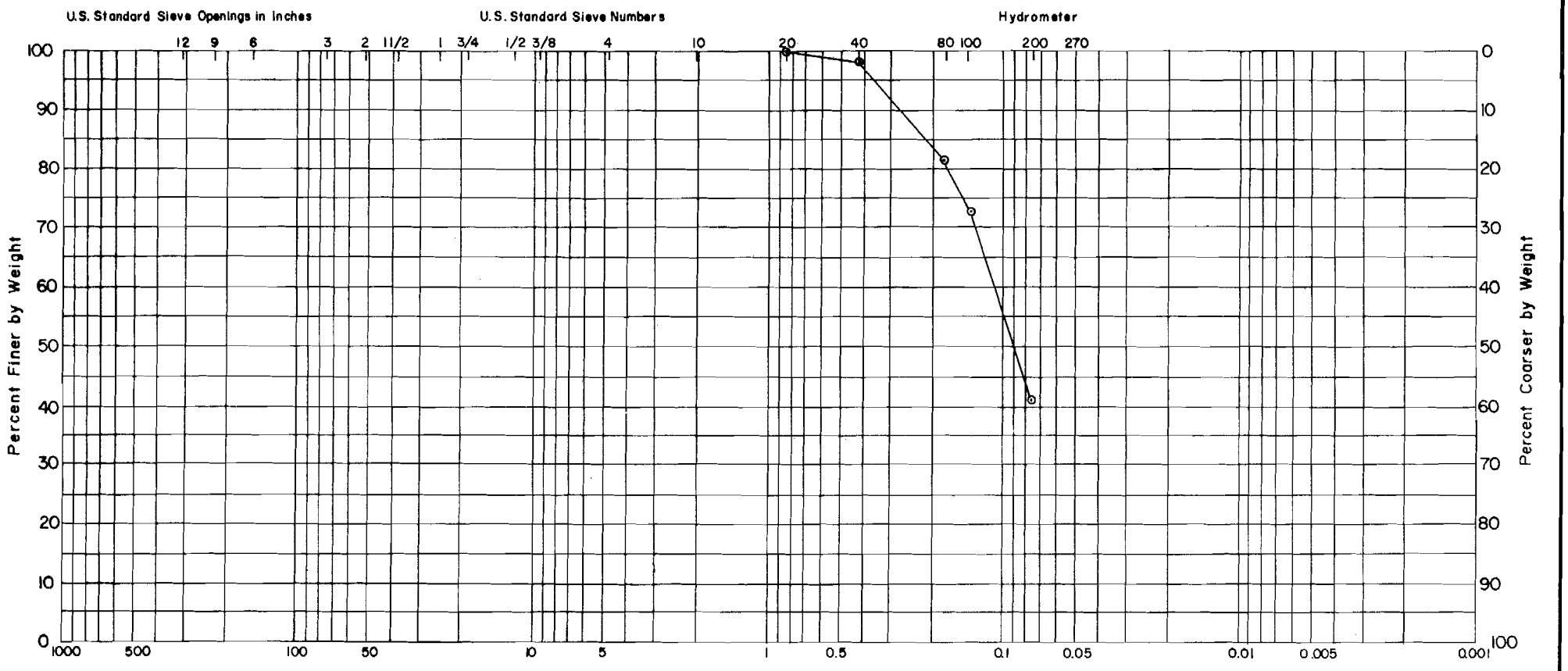
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E17 #1					SM-MH	SANDY SILT WITH SOME TO TRACE CLAY
						(FIELD GEOLOGIST NOTES SOME TO TRACE ORGANICS)

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BORROW AREA E
TEST PIT TP-E17

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APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



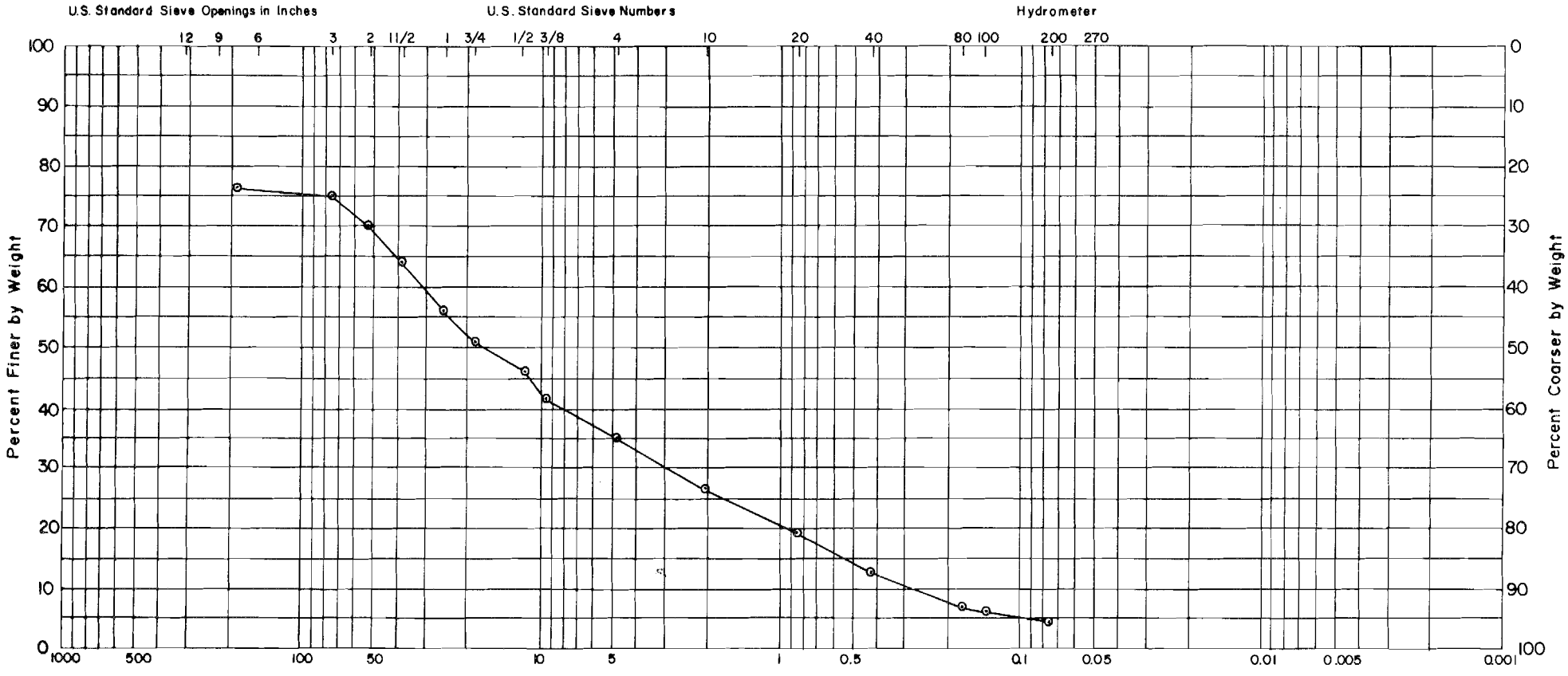
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E17 #2					SM	SILTY SAND

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BORROW AREA E
TEST PIT TP-E17

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DATE: Dec. 1981
PROJECT NO. 052506



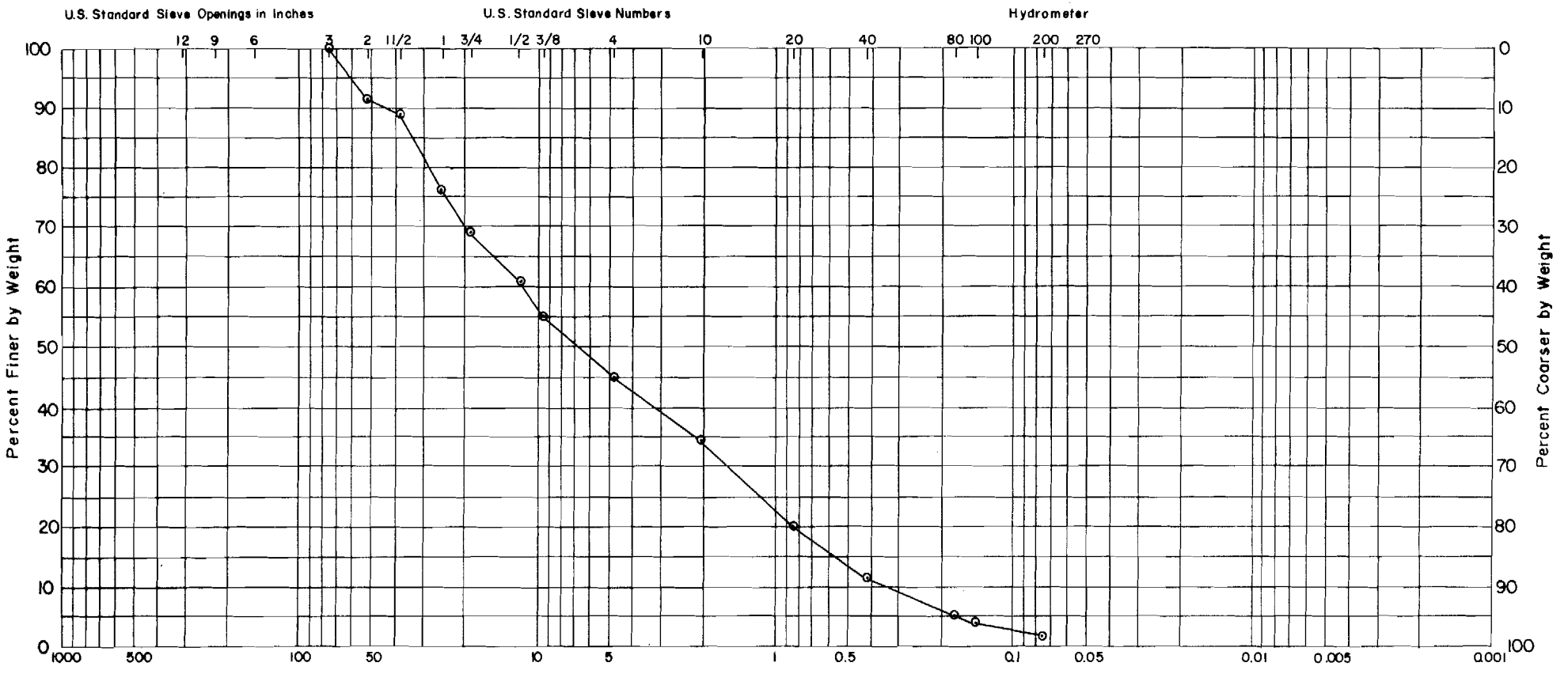
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E17 #3					GP-GM	SANDY GRAVEL WITH TRACE SILT, SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E17

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APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



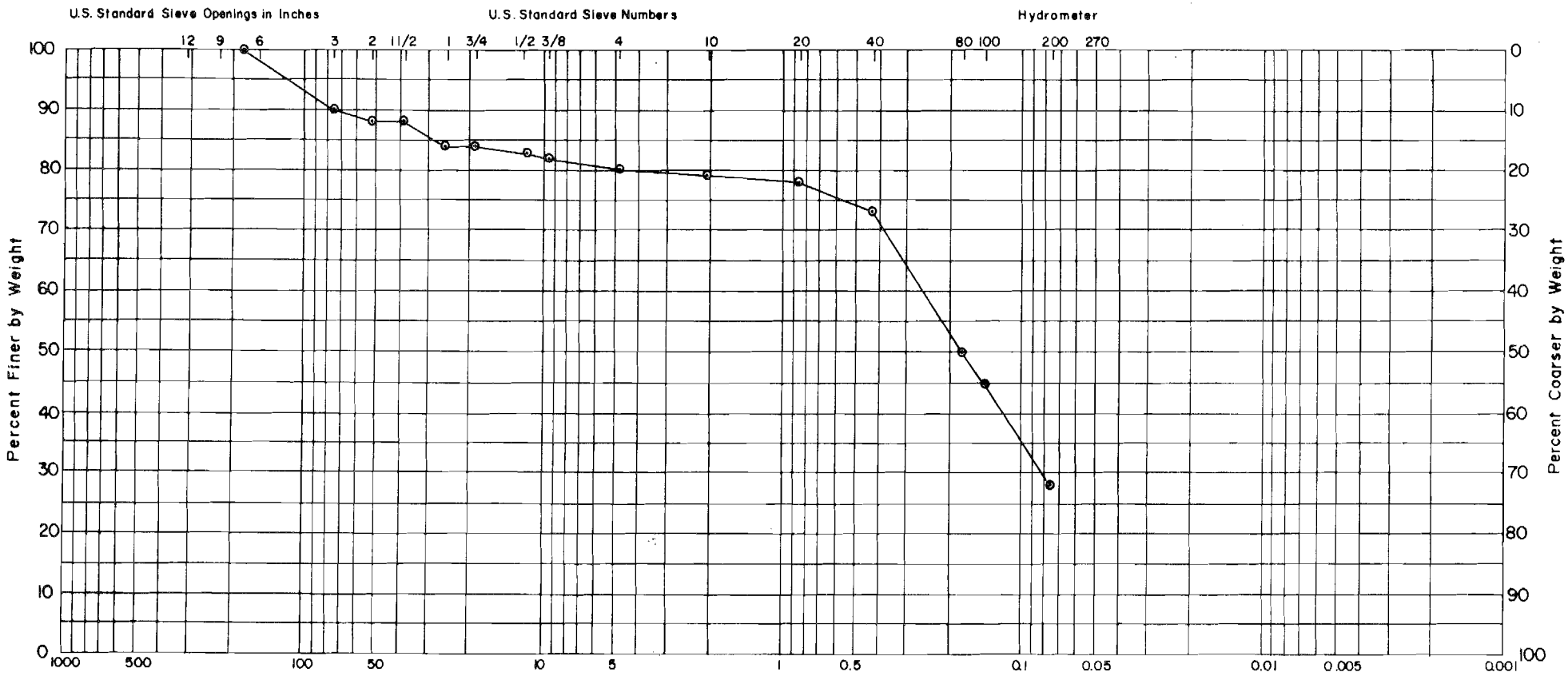
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E18 #1					GP	SANDY GRAVEL
						(FIELD GEOLOGIST NOTES SOME ORGANICS)

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E18

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



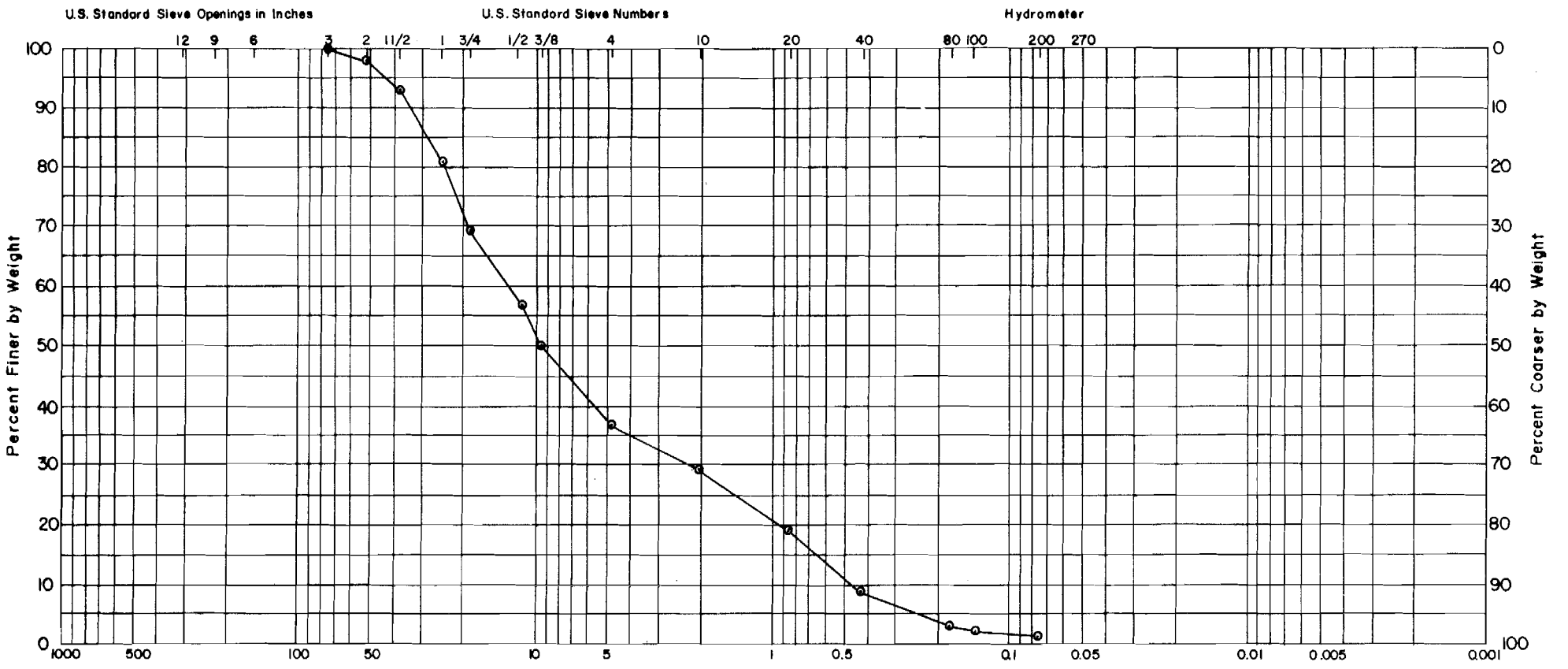
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E18 #2					SM	SAND WITH SOME SILT, TRACE GRAVEL AND SCATTERED COBBLES

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E18

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



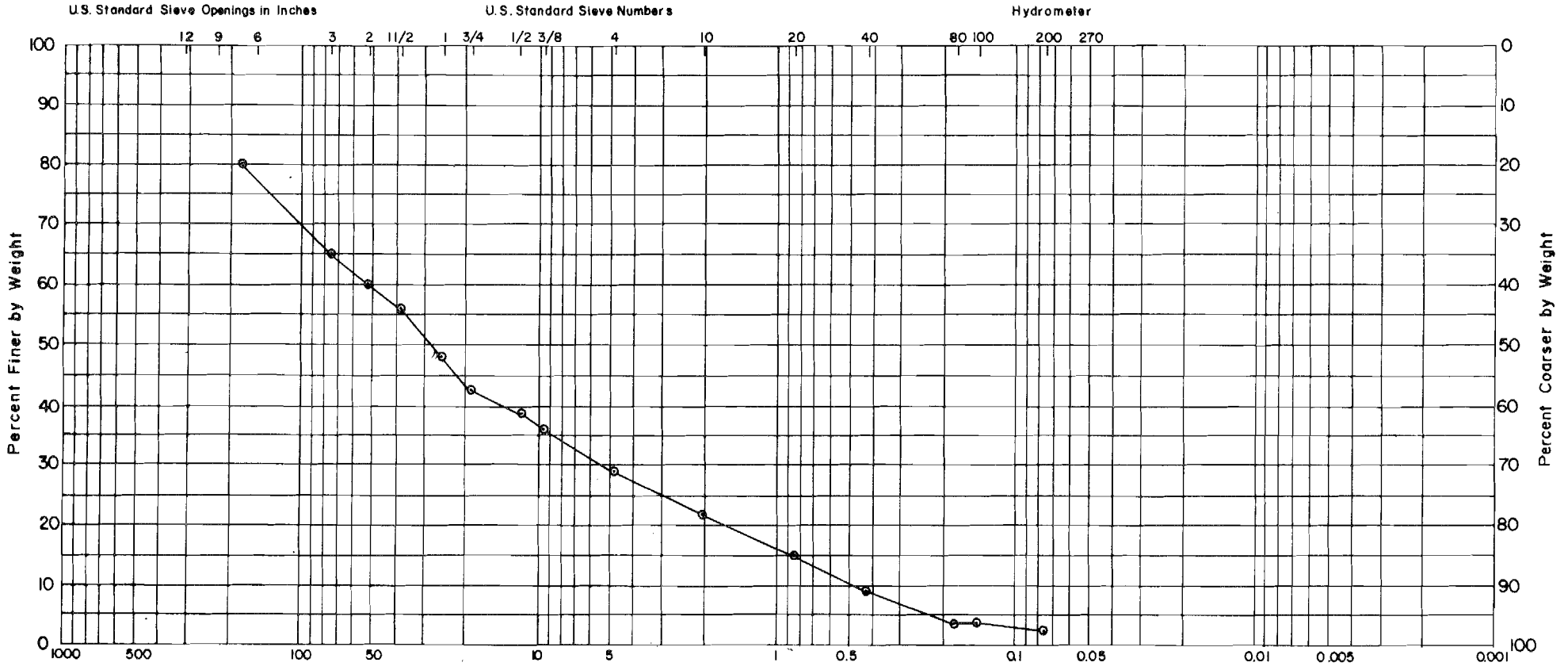
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E18 #3					GP	SANDY GRAVEL

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BORROW AREA E
TEST PIT TP-E18

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APPROVED BY:	T.I.
DATE:	Dec. 1981
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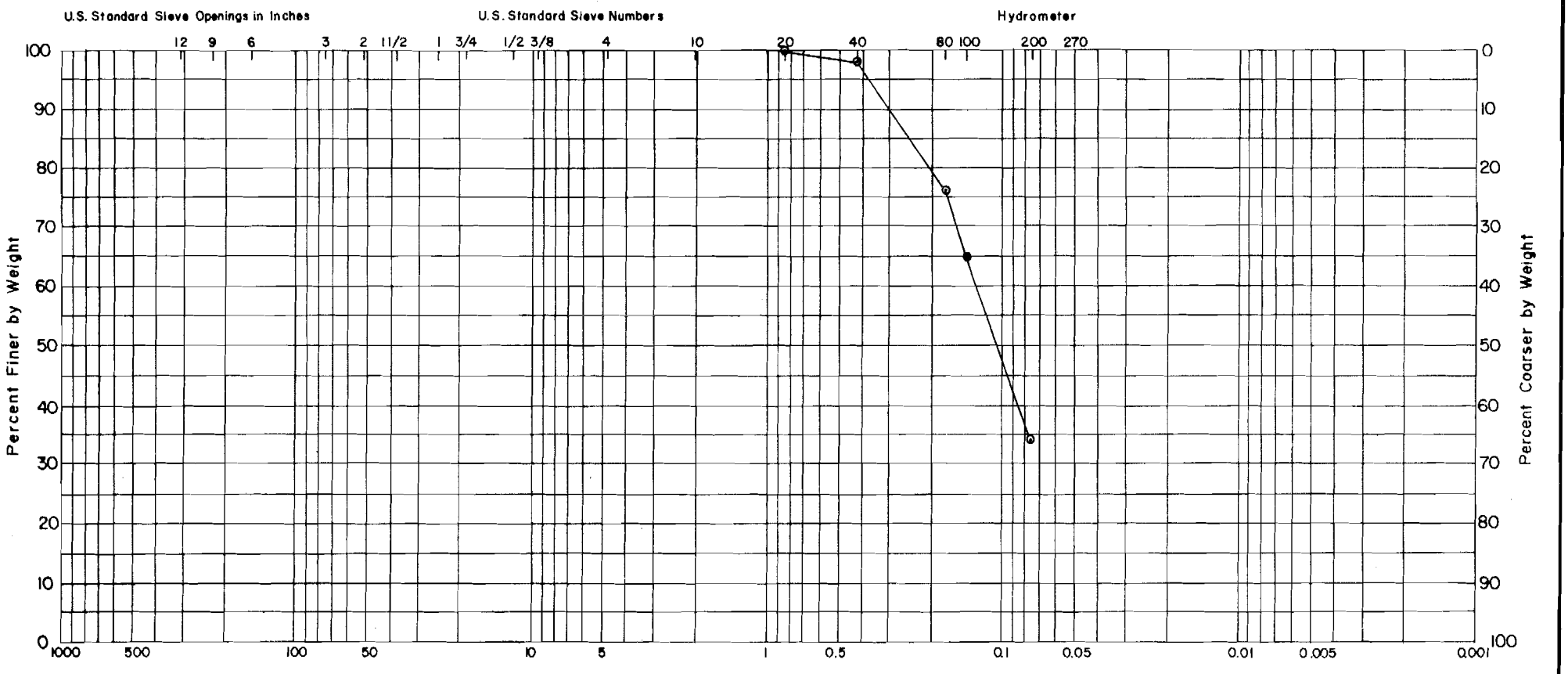
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E18 #4					GP	SANDY GRAVEL WITH SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E18

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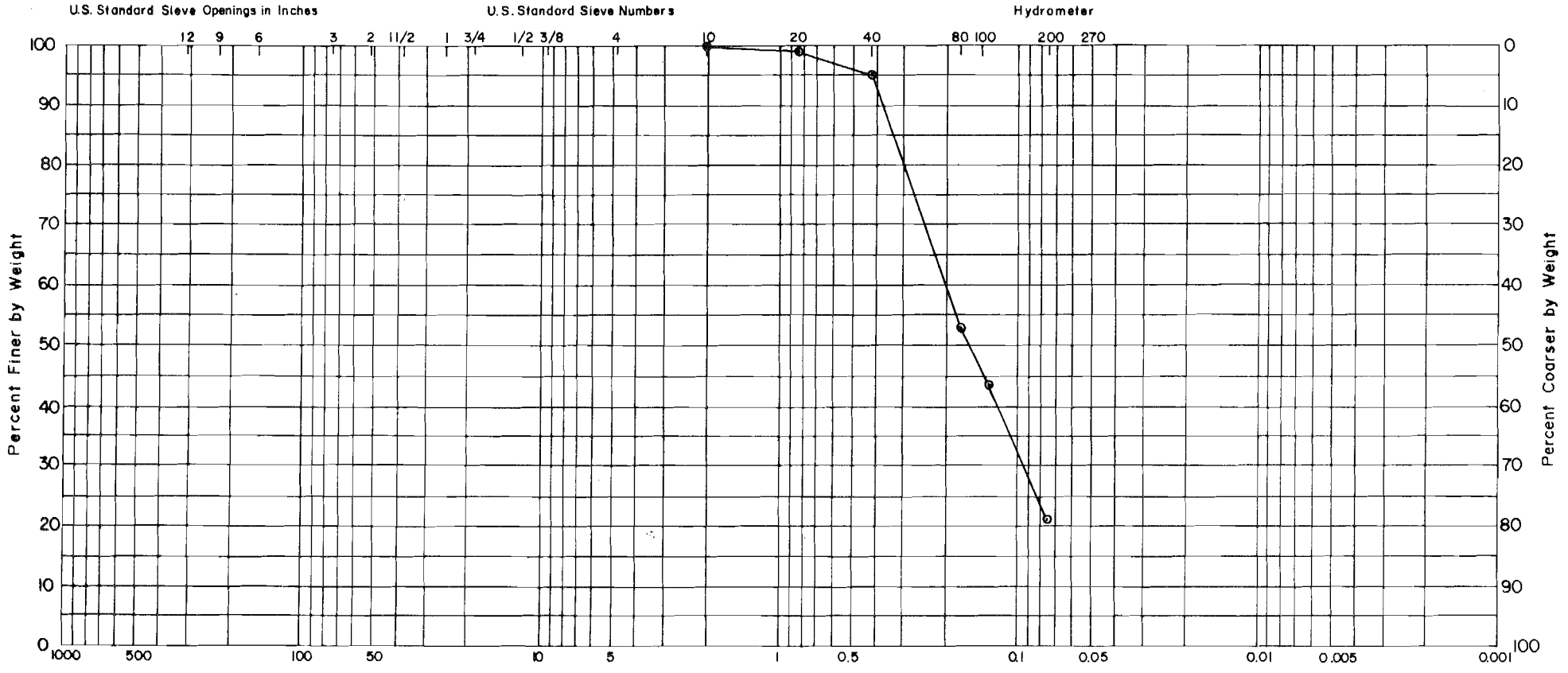
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E19 #1					SM	SILTY SAND WITH TRACE CLAY.
						(FIELD GEOLOGIST NOTES TRACE ORGANICS)

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E19

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



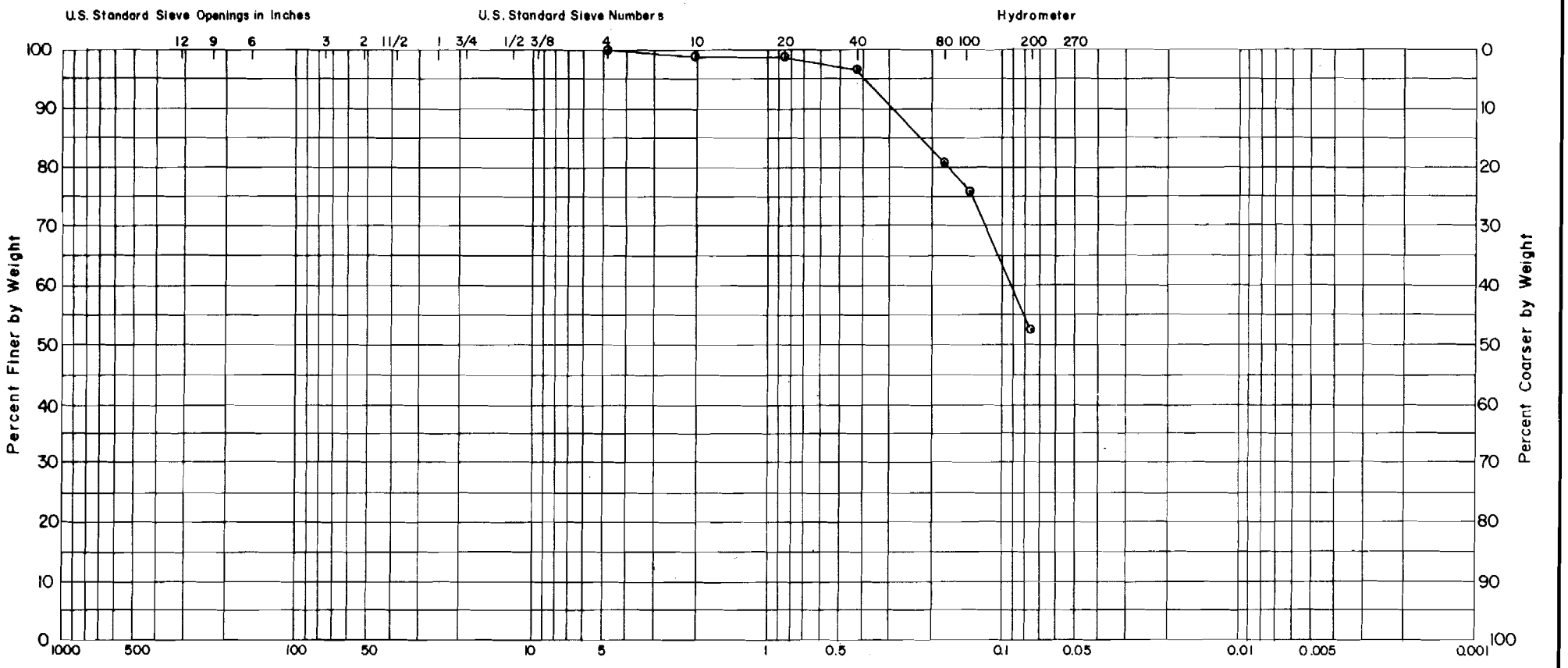
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E19 #2					SM	SAND WITH SOME SILT,

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BORROW AREA E
TEST PIT TP-19

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DATE:	Dec. 1981
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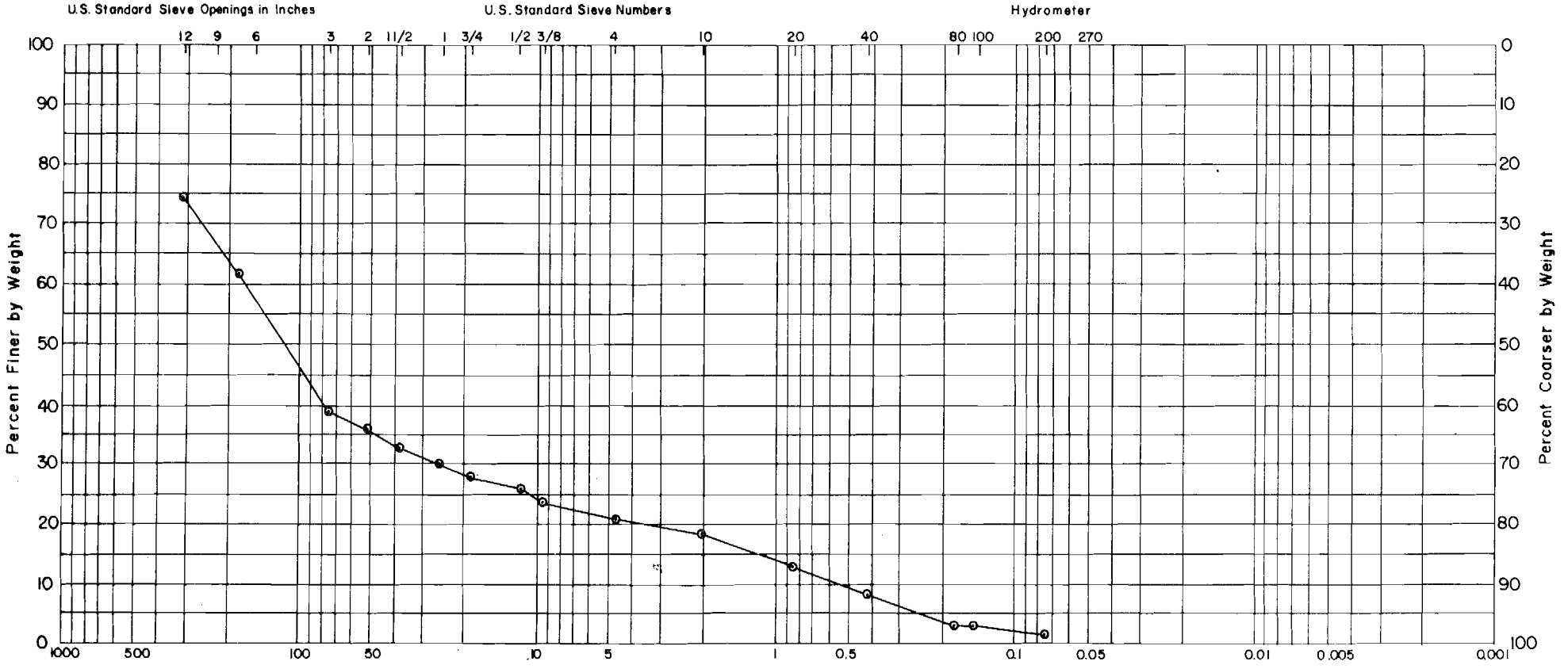
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E20 #1					SM-ML	SANDY SILT WITH TRACE CLAY
						(FIELD GEOLOGIST NOTES TRACE ORGANICS)

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BORROW AREA E
TEST PIT TP-E20

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DATE:	Dec. 1981
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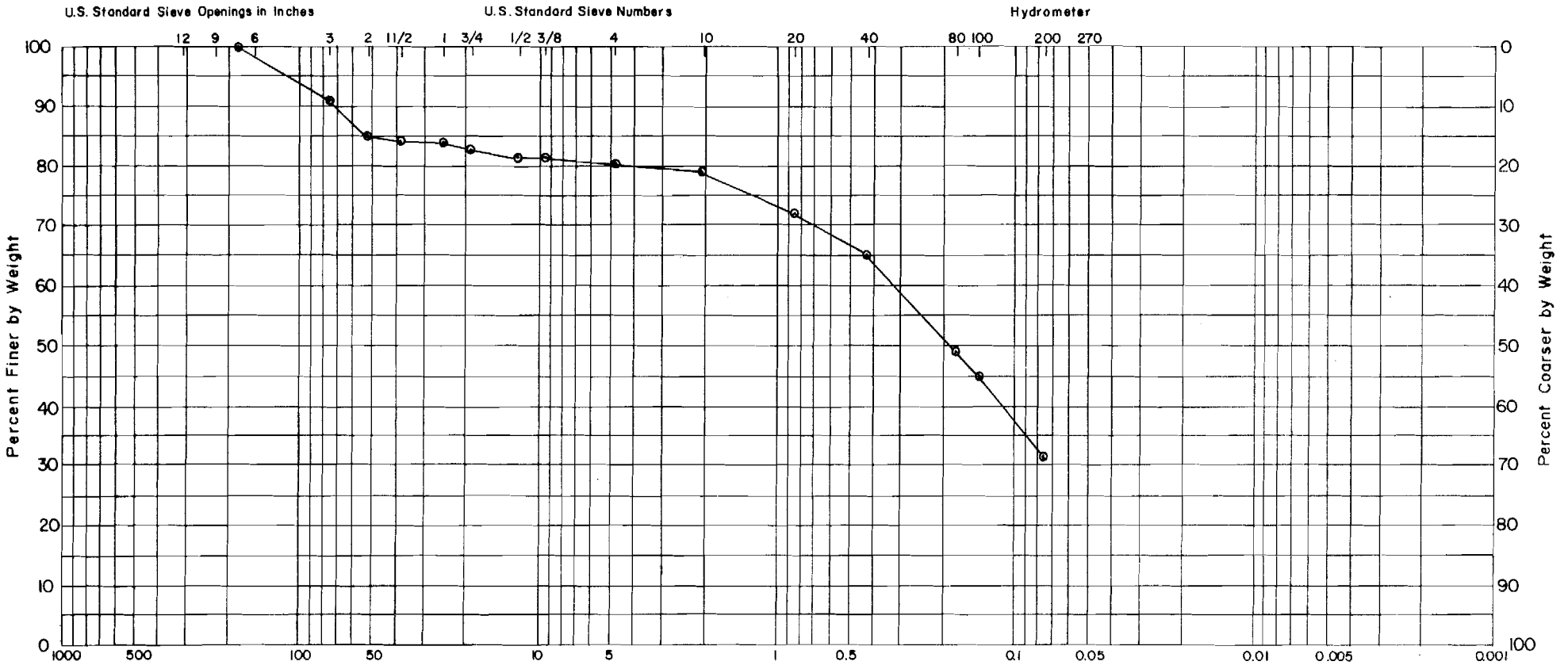
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E20 #2					SP	GRAVELLY SAND WITH TRACE CLAY AND SCATTERED COBBLES AND BOULDERS

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BORROW AREA E
TEST PIT TP-E20

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DATE: Dec. 1981
PROJECT NO. 052506



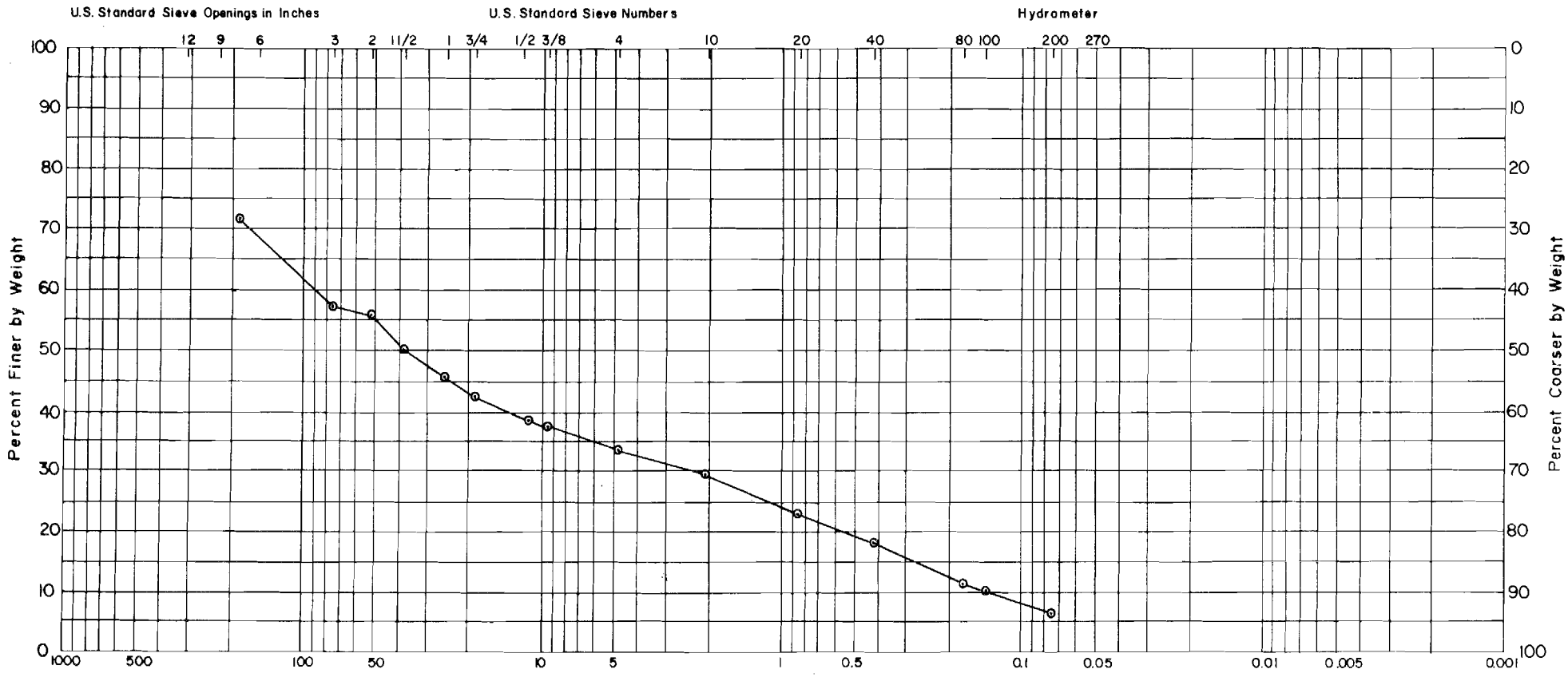
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E20 #3					SM	SILTY SAND WITH TRACE CLAY AND GRAVEL AND SCATTERED COBBLES

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BORROW AREA E
TEST PIT TP-E20

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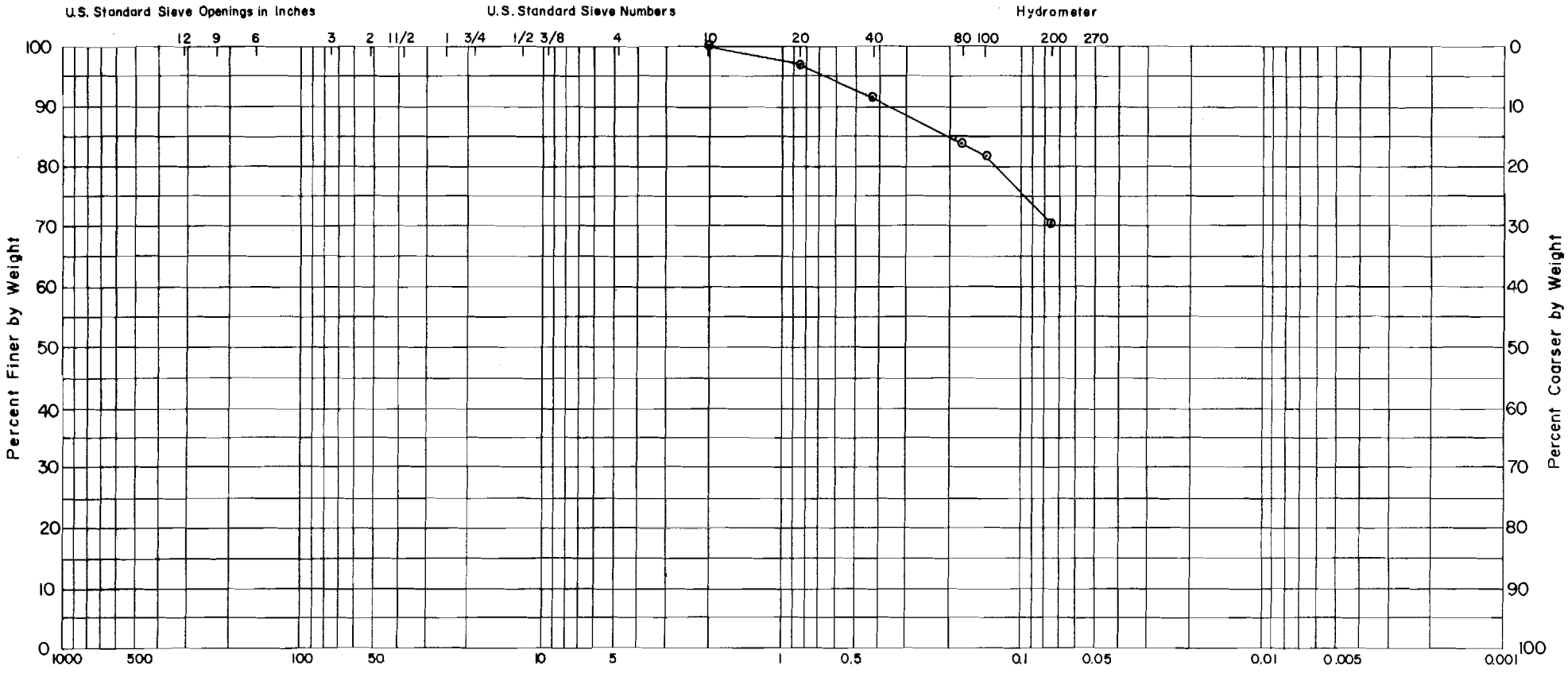
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E20 #4					SP-SM	GRAVELLY SAND WITH TRACE SILT SCATTERED COBBLES AND BOULDERS

R&M CONSULTANTS INC.

BORROW AREA E
TEST PIT TP-E20

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



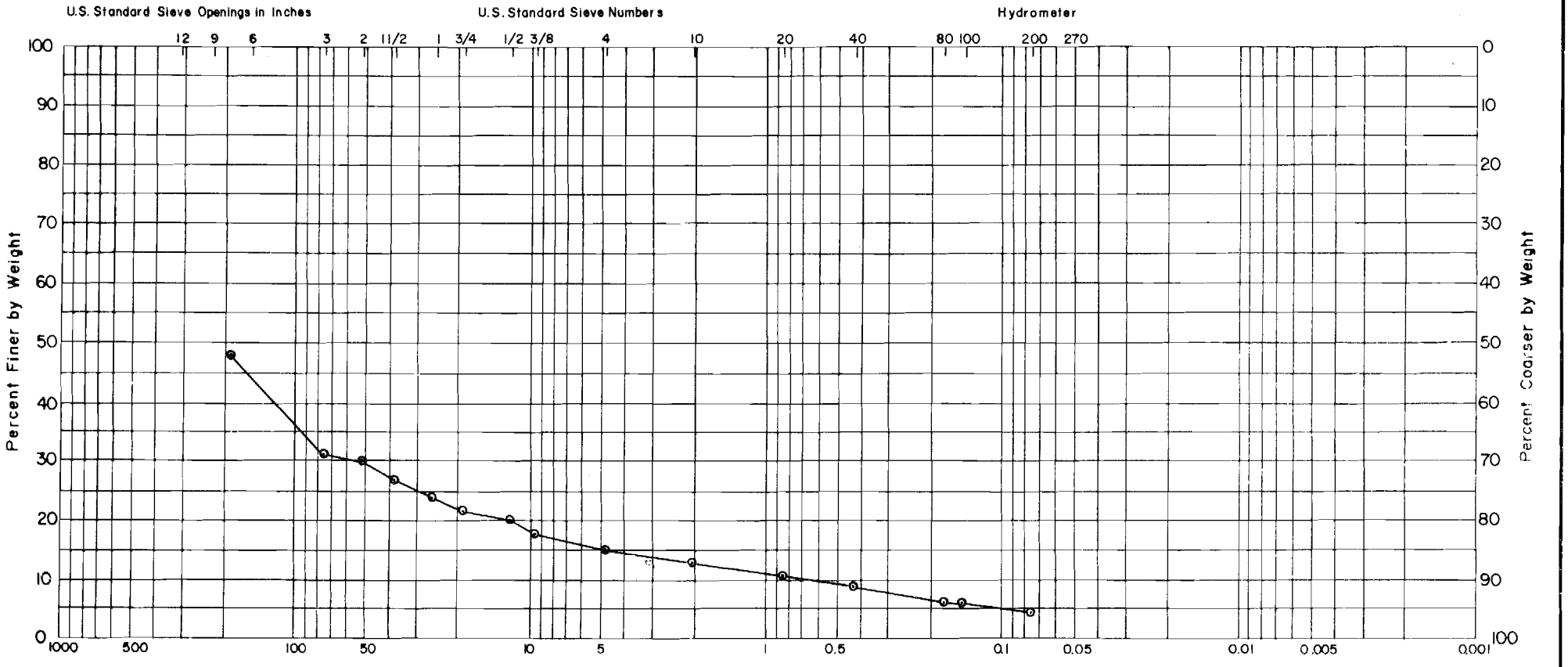
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E21 #1					SM-SC	SANDY SILT WITH TRACE CLAY

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BORROW AREA E
TEST PIT TP-E21

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	Dec. 1981
PROJECT NO.	052506



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E21 #2					GP-GM	SANDY GRAVEL WITH TRACE SILT, NUMEROUS COBBLES AND SCATTERED BOULDERS

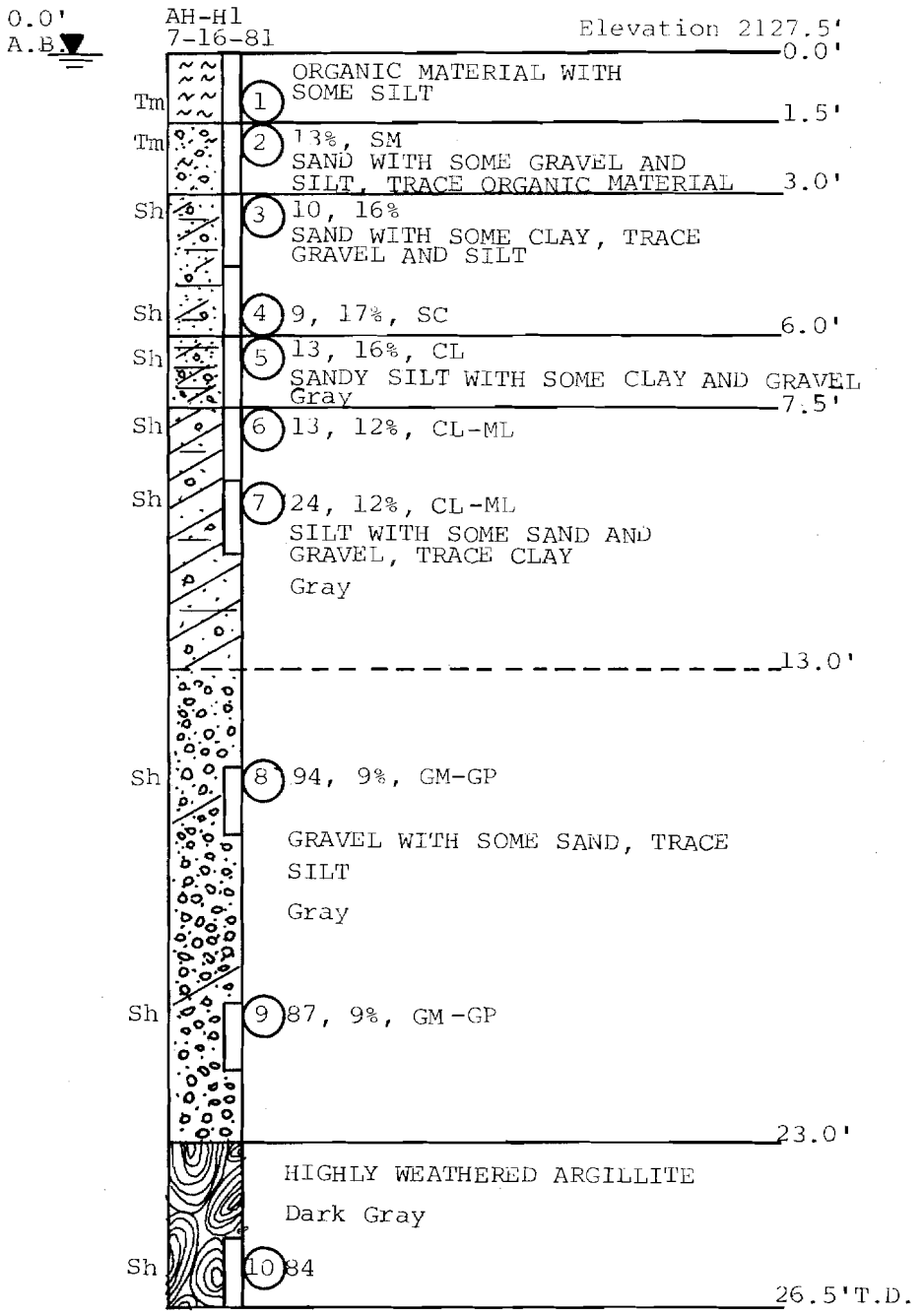
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BORROW AREA E
TEST PIT TP-E21

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506

F.3 BORROW SITE H

AUGER HOLE LOGS



PREPARED BY:

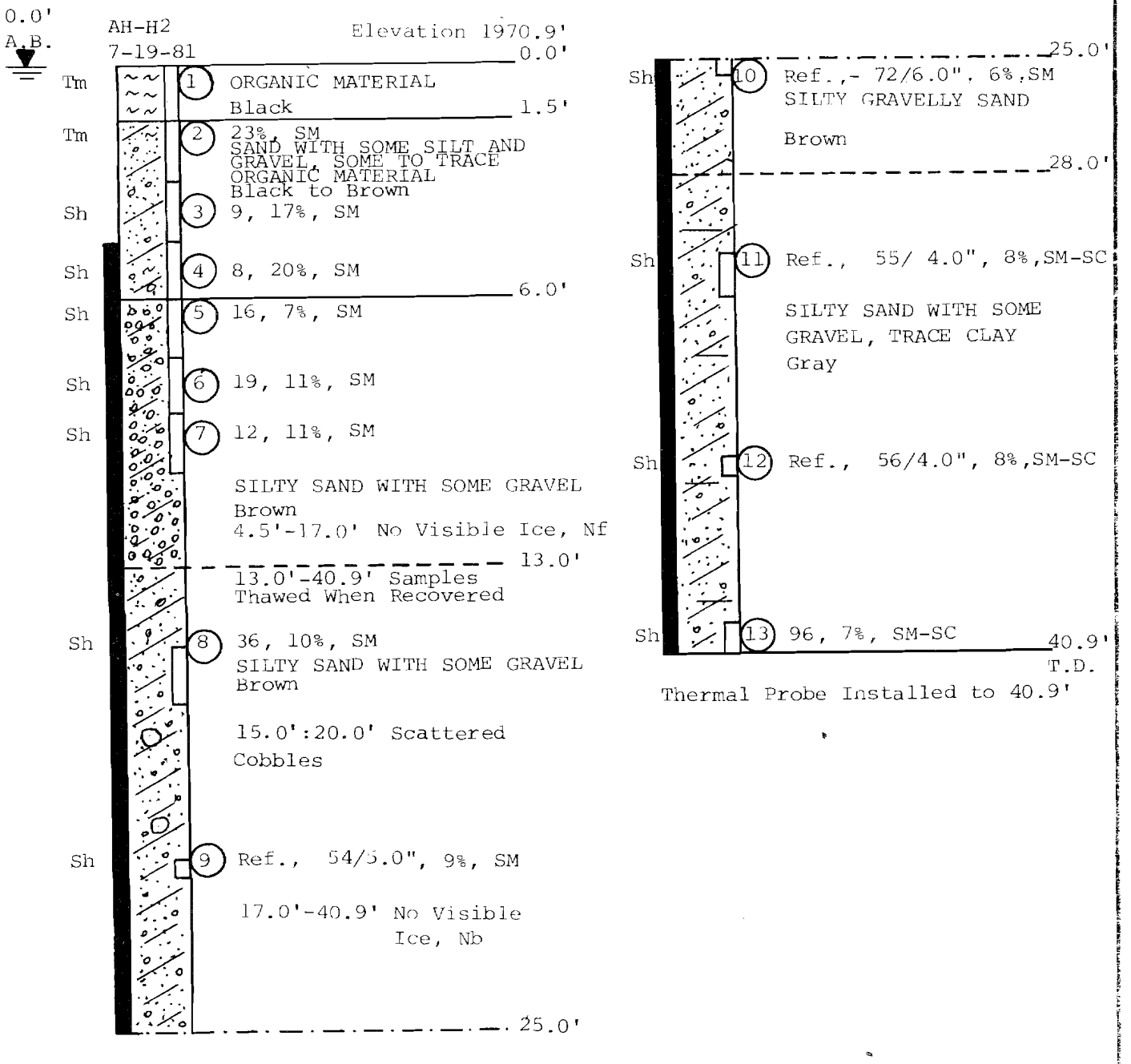
R&M CONSULTANTS, INC.

BORROW AREA H
AUGER HOLE AH-H1

Scale: 1"=4'

PREPARED FOR:

ACRES



PREPARED BY:

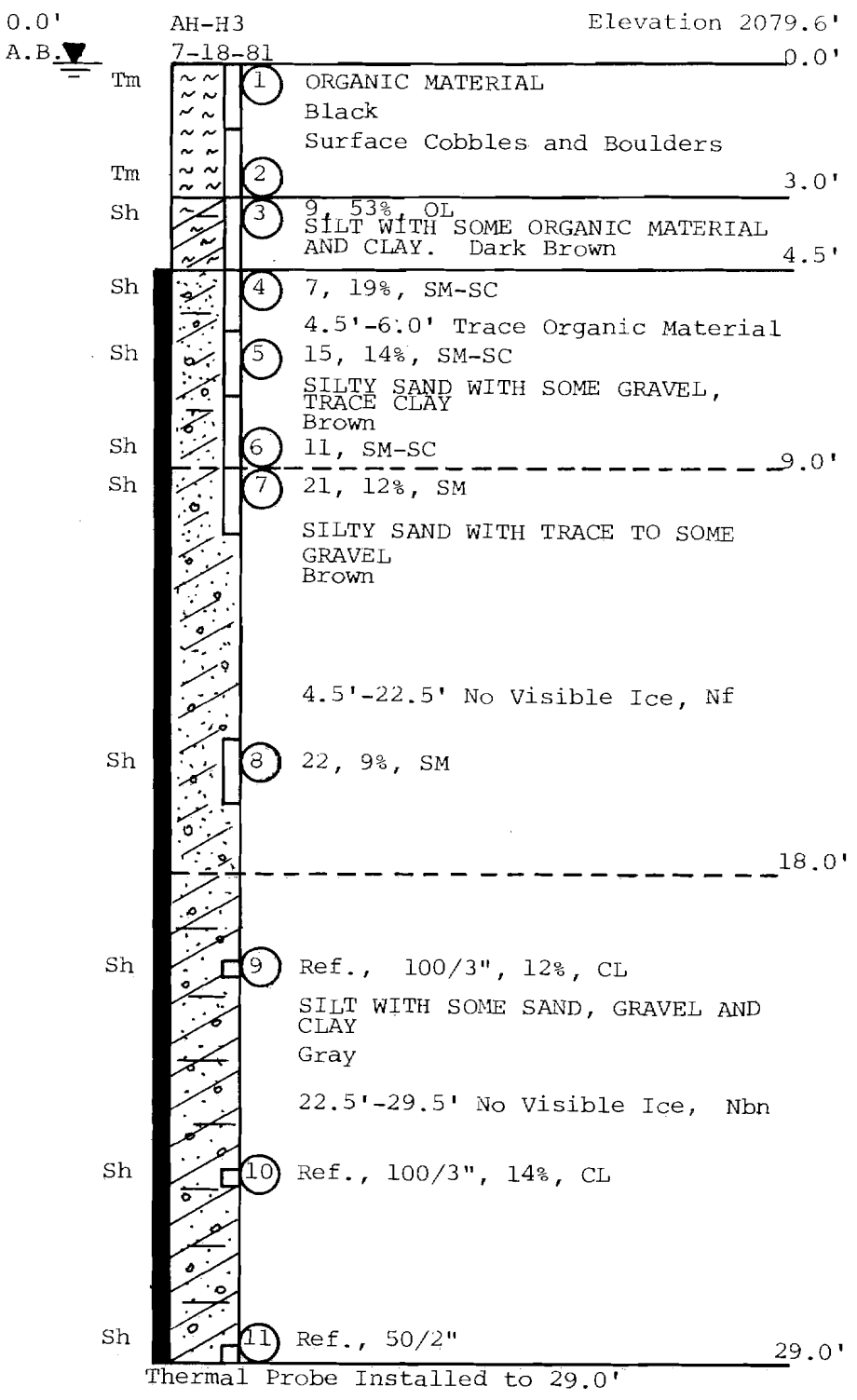
R&M CONSULTANTS, INC.

BORROW AREA H
AUGER HOLE AH-H2

Scale: 1"=4'

PREPARED FOR:

ACRES



PREPARED BY:

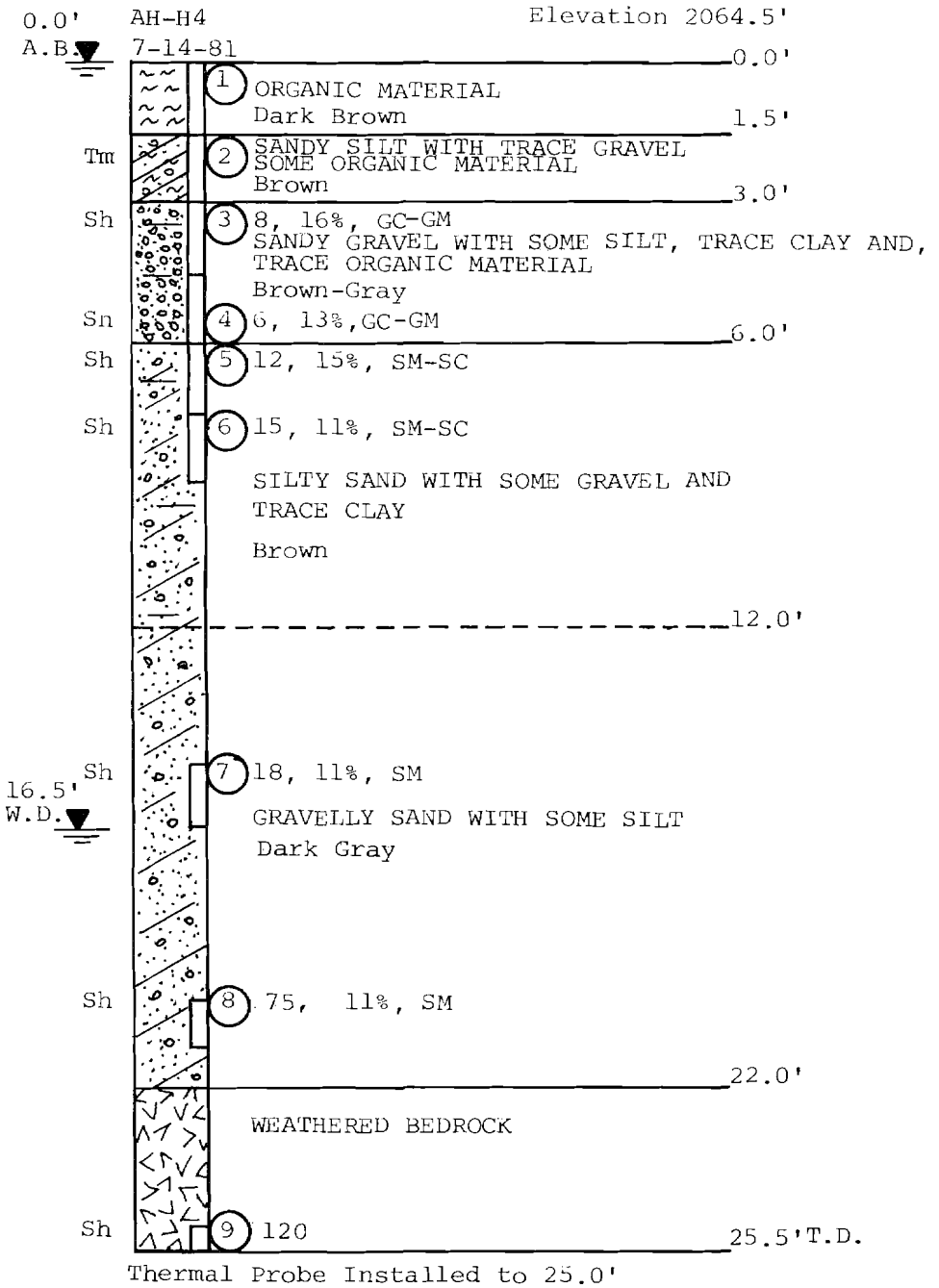
R&M CONSULTANTS, INC.

BORROW AREA H
AUGER HOLE AH-H3

PREPARED FOR:

ACRES

Scale: 1"=4'



Thermal Probe Installed to 25.0'

PREPARED BY:

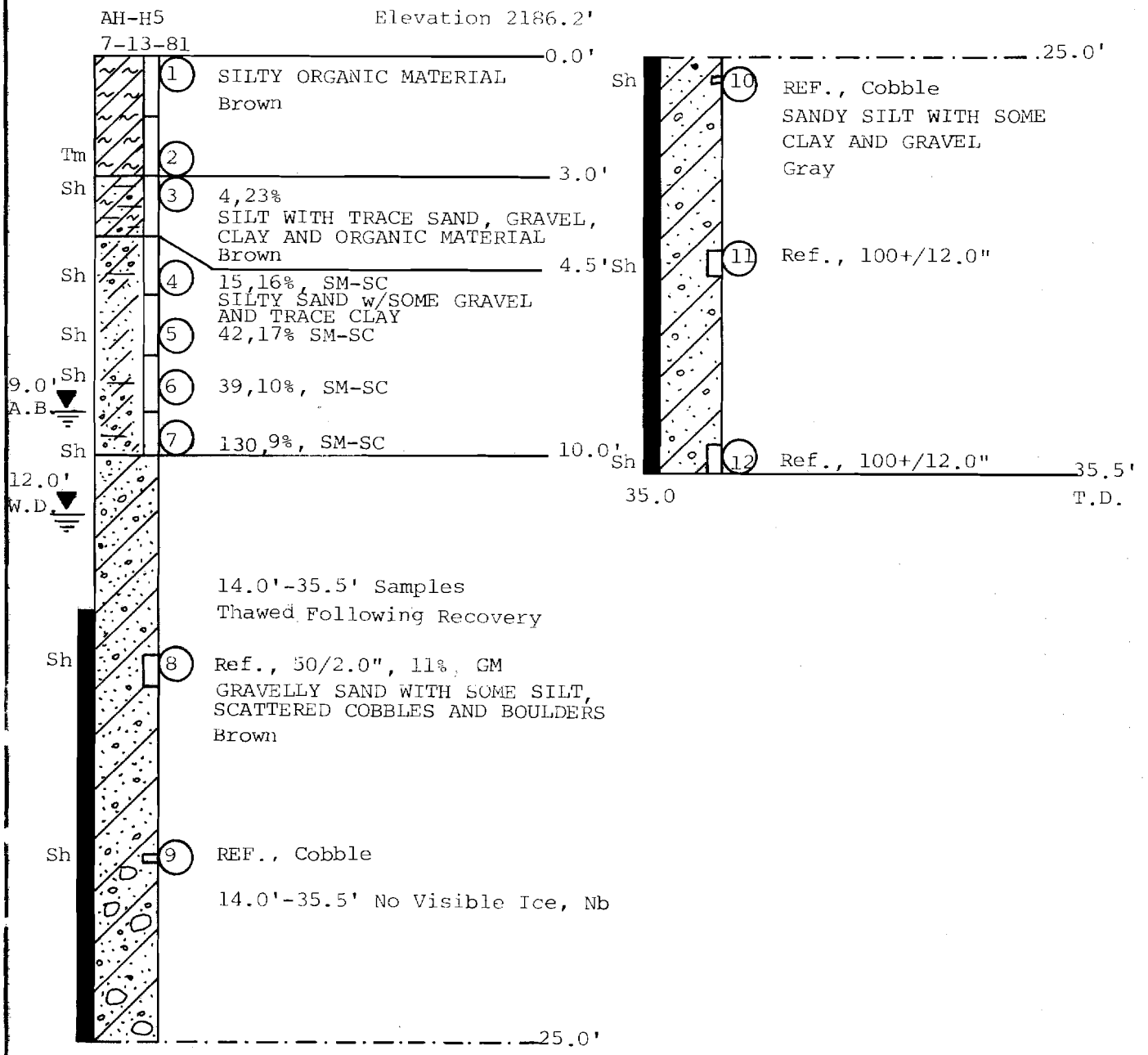
R&M CONSULTANTS, INC.

BORROW AREA H
AUGER HOLE AH-H4

Scale: 1"-4'

PREPARED FOR:

ACRES



PREPARED BY:

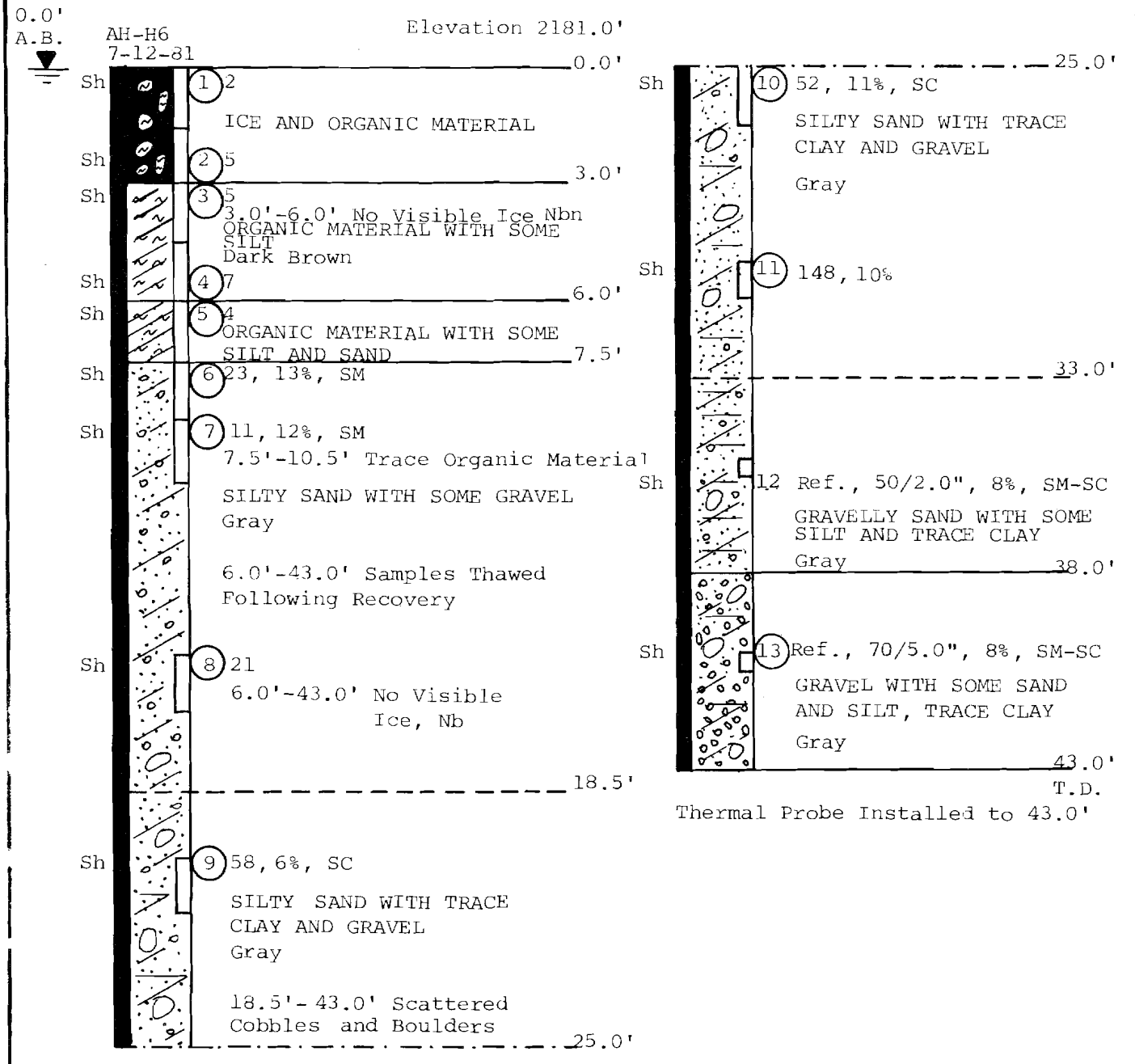
R&M CONSULTANTS, INC.

BORROW AREA H
AUGER HOLE AH-H5

Scale: 1"=4'

PREPARED FOR:

ACRES



PREPARED BY:

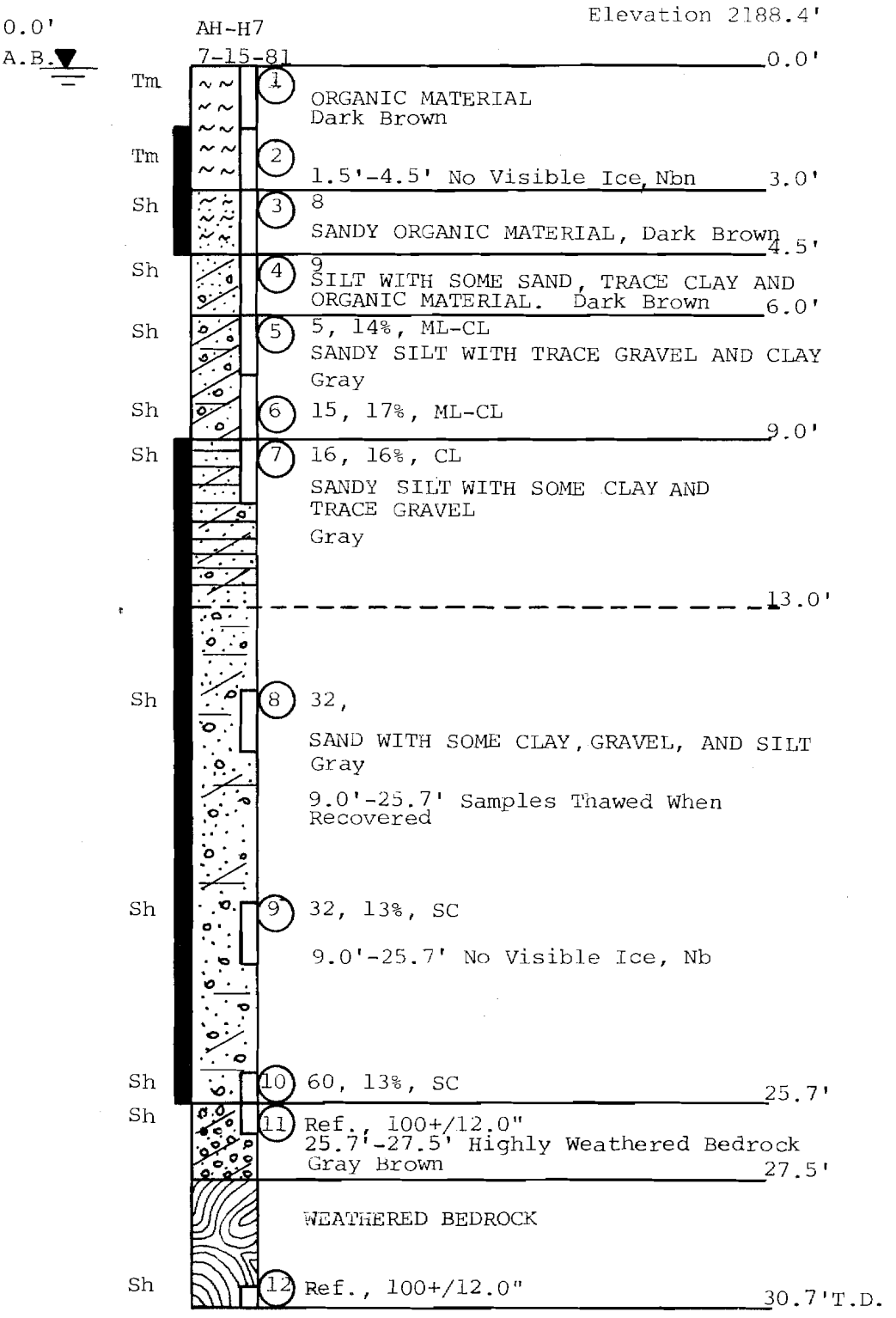
R&M CONSULTANTS, INC.

BORROW AREA H
AUGER HOLE AH-H6

Scale: 1"=4'

PREPARED FOR:

ACRES



Thermal Probe Installed to 30.7'

PREPARED BY:

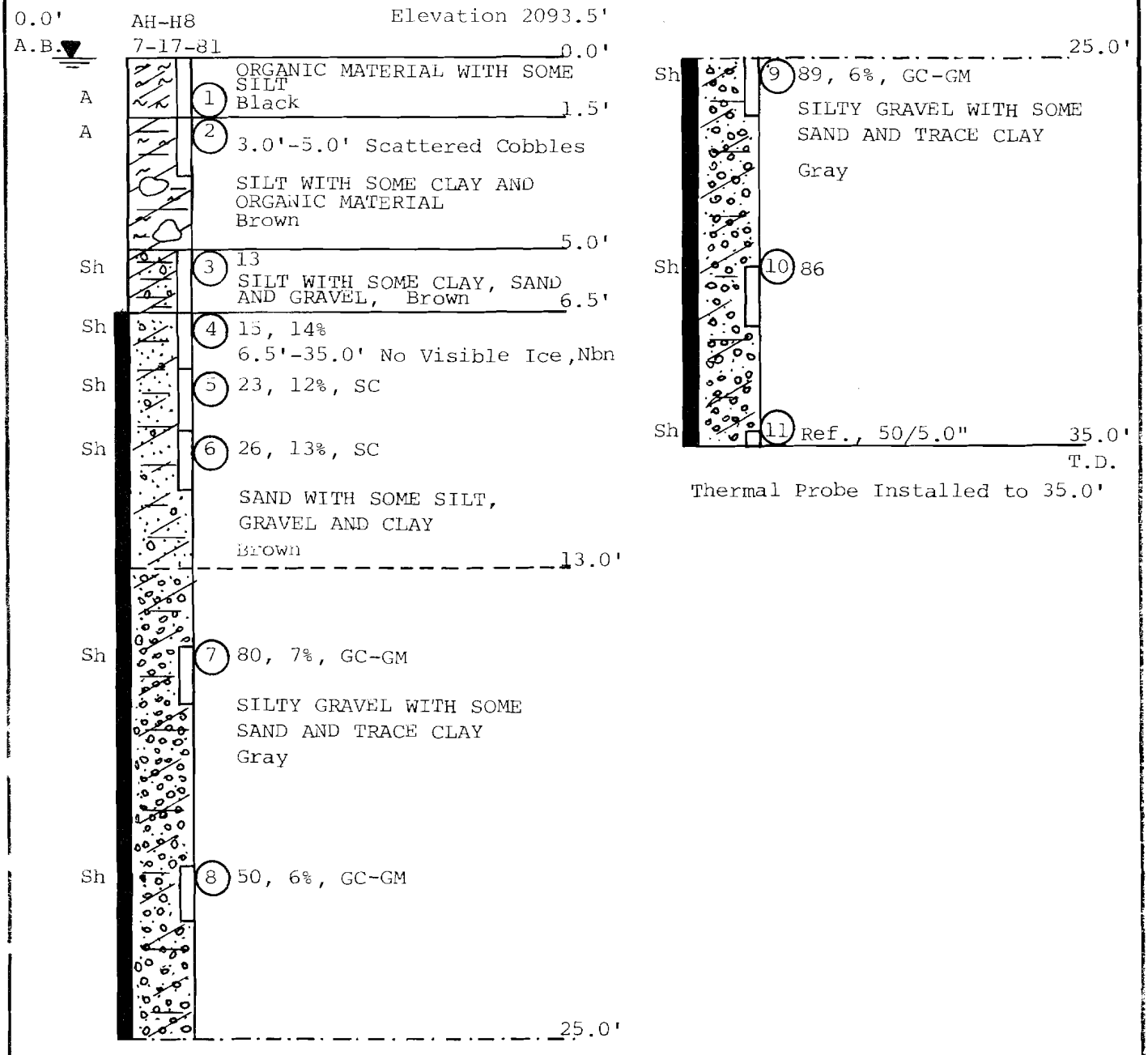
R&M CONSULTANTS, INC.

BORROW AREA H
AUGER HOLE AH-H7

Scale: 1"=4'

PREPARED FOR:

ACRES



PREPARED BY:

R&M CONSULTANTS, INC.

BORROW AREA H
AUGER HOLE AH-H8

Scale: 1"-4'

PREPARED FOR:

ACRES

LABORATORY TEST DATA

PROJECT NO. 052504

CLIENT: Acres American, Inc.

PROJECT NAME Susitna Hydroelectric (Watana Dam Site)

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE October 17, 1980

PARTY NO. _____ PAGE NO. C-01

DESCRIPTION				4"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.
BORROW		H	W-80-256			100	95	88	84	81	78	71	64	53	38.2	24.3	13.6	8.6	10.9	21.7	9.2	GC-SC
			(Grab Sample)																			GM-SM
BORROW		H	W-80-257			100	97	92	89	84	81	73	66	54	36.0	19.6	8.9	5.2	12.3	17.1	2.5	GM-SM
			(Grab Sample)																			

REMARKS: _____

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
CLIENT: Acres American
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE October 5, 1981
PARTY NO. _____ PAGE NO. 1

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	3"	2"	1½"	1"	3/4"	½"	3/8"	4	10	40	200		FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	H1	2	1.5'- 3.0'			100	92	89	85	82	74	59	46	24.8							13	SM
	H1	3	3.0'- 4.0'																		16	
	H1	4	4.5'- 6.0'			100	96	96	94	92	88	79	60	21.4			32	17			17	SC
	H1	5	6.0'- 7.5'					100	93	90	86	77	66	51.7			34	21			16	CL
	H1	6,7	7.5'-10.5'*			100	98	94	88	85	82	74	64	55.1			25	7			12,12	CL-ML
	H1	8,9	15.0'-21.5'*		100	69	57	50	45	41	34	28	20	12.1			21	NP			9	GM-GP
	H2	2-4	1.5'- 6.0'*					100	95	91	85	69	48	22.9			NV	NP			23,17,20	SM
	H2	5-7	6.0'-10.5'*		100	88	83	82	78	74	67	61	50	35.0			18	NP			7,11,11	SM
	H2	8	15.0'-16.5'				100	90	85	80	76	65	51	32.7							10	SM
	H2	9,10	20.0'-25.5'*				100	93	84	78	73	62	48	31.5			17	NP			9,6	SM
	H2	11-13	30.0'-40.8'*				100	95	89	87	82	71	61	39.7			18	5			8,8,7	SM-SC
	H3	3	3.0'- 4.5'																		53	
	H3	4,5	4.5'- 7.5'*					100	94	91	86	74	59	42.0			18	5			19,14	SM-SC
	H3	7	9.0'-10.5'					100	99	97	93	82	63	40.6			NV	NP			12	SM
	H3	8	15.0'-16.5'					100	93	88	83	67	51	29.9			14	NP			9	SM
	H3	9	20.0'-20.3'																		12	
	H3	10	25.0'-25.2'																		14	

NOTE: SIEVE ANALYSIS = PERCENT PASSING

REMARKS: * Samples Combined for Gradation and Atterberg Limits
NV = Non-Viscous, NP = Non-Plastic

PROJECT NO. 052506
CLIENT: Acres American
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE October 1981
PARTY NO. _____ PAGE NO. 2

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	3"	2"	1½"	1"	3/4"	½"	3/8"	4	10	40	200		FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	H4	3,4	3.0'- 6.0'*		100	82	82	73	66	61	55	49	37	20.4			23	7			16,13	GM-GC
	H4	5,6	6.0'- 9.0'*		100	89	87	86	85	81	74	67	55	39.5			20	4			15,11	SM-SC
	H4	7,8	15.0'-21.5'*		100	92	90	83	78	74	64	55	41	27.2			22	NP			11	SM
	H5	3	3.0'- 4.5'																		23	
	H5	4	4.5'- 6.0'			100	95	93	89	86	78	72	62	41.0			23	6			16	SM-SC
	H5	5	6.0'- 7.5'								100	89	73	45.2			22	6			17	SM-SC
	H5	6,7	7.5'-10.0'*		100	81	76	76	76	76	76	61	49	33.3			21	4			10,9	SM-SC
	H5	8	15.0'-15.7'																		11	
	H6	6,7	7.5'-10.5'*			100	97	93	91	88	78	69	53	32.5			NV	NP			13,12	SM
	H6	9	20.0'-21.5'																		6	
	H6	10	25.0'-26.5'					100	95	93	90	79	63	45.5			23	9			11	SC
	H6	11	30.0'-31.0'																		10	
	H6	12	35.0'-35.6'			100	82	82	73	71	66	47	34	19.2			21	6			8	SM-SC
	H6	13	40.0'-40.4'																		8	

REMARKS: * Samples Combined for Gradation and Atterberg Limits
NV = Non-Viscous, NP = Non-Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
CLIENT: Acres American
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

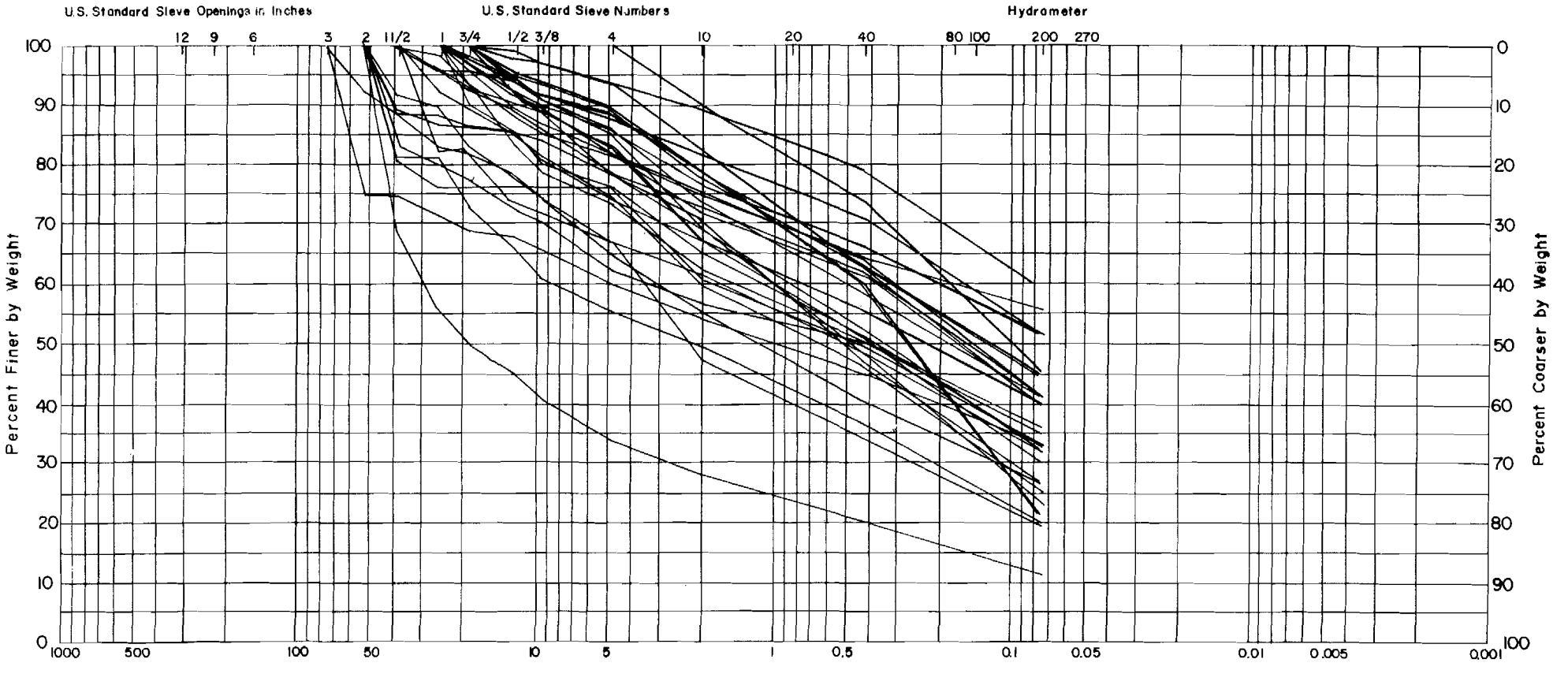
SUMMARY OF LABORATORY TEST DATA

DATE October 1981
PARTY NO. _____ PAGE NO. 3

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	3"	2"	1½"	1"	3/4"	½"	3/8"	4	10	40	200		FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	H7	5,6	6.0'- 9.0'*				100	98	94	92	88	82	71	51.5			17	4			14,17	ML-CL
	H7	7	9.0'-10.5'					100	98	97	93	89	79	58.7			29	14			16	CL
	H7	9,10	20.0'-25.7'*	100	92	88	88	87	86	84	78	71	48	27.4			33	19			13,13	SC
	H8	4	6.5'- 8.0'														NV	NP			14	
	H8	5,6	8.0'-11.0'*				100	97	92	89	82	75	64	42.4			25	11			12,13	SC
	H8	7	15.0'-16.5'		100	83	79	77	72	70	62	56	50	36.3			21	7			7	GC-GM
	H8	8,9	20.0'-26.5'*	100	75	75	72	69	68	66	60	54	45	32.9			21	7			6,6	GC-GM
	BORROW H					100	95	92	87	79	57	51	44	30.5			23	6				
	Bulk Sample																					

NOTE: SIEVE ANALYSIS = PERCENT PASSING

REMARKS: * Samples Combined for Gradation and Atterberg Limits
NV = Non-Viscous, NP = Non-Plastic



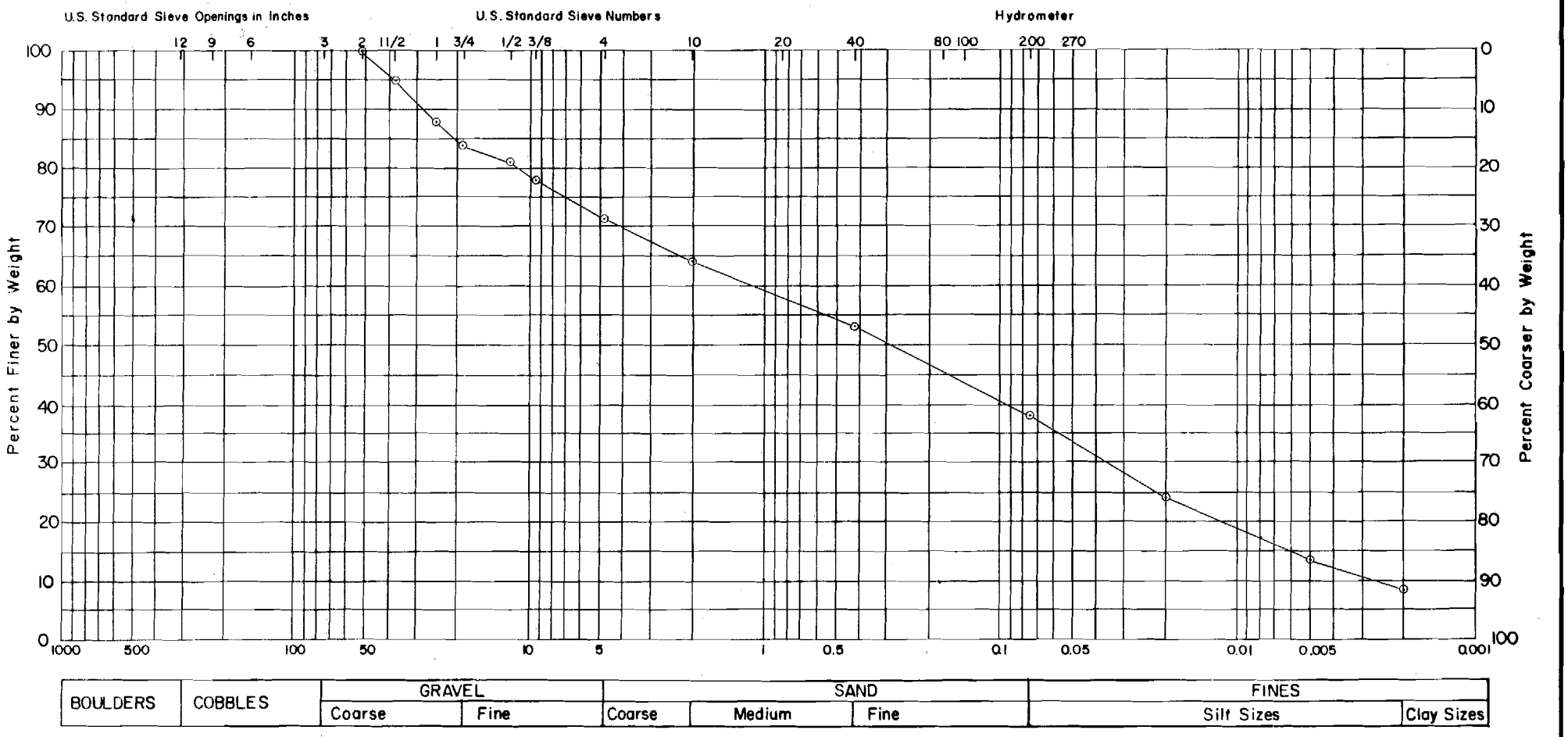
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION

R&M CONSULTANTS INC.

BORROW AREA H
COMPOSITE GRADATION CURVE

DRAWN BY:	
APPROVED BY:	
DATE:	
PROJECT NO.	



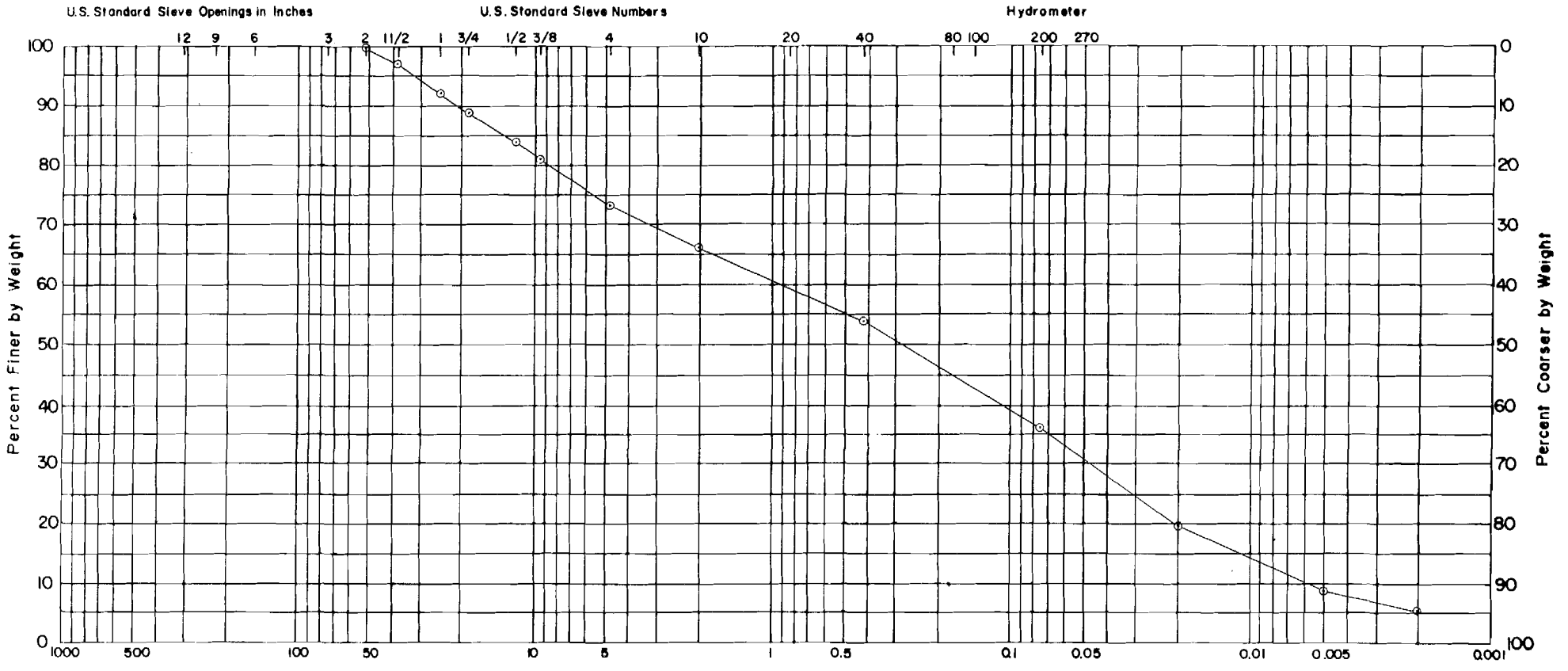
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
W-80-256	10.9%		21.7	9.2	GC-SC	Poorly graded 'Till' with low Plasticity
(Grab Sample)						SILTY GRAVEL AND SAND WITH TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



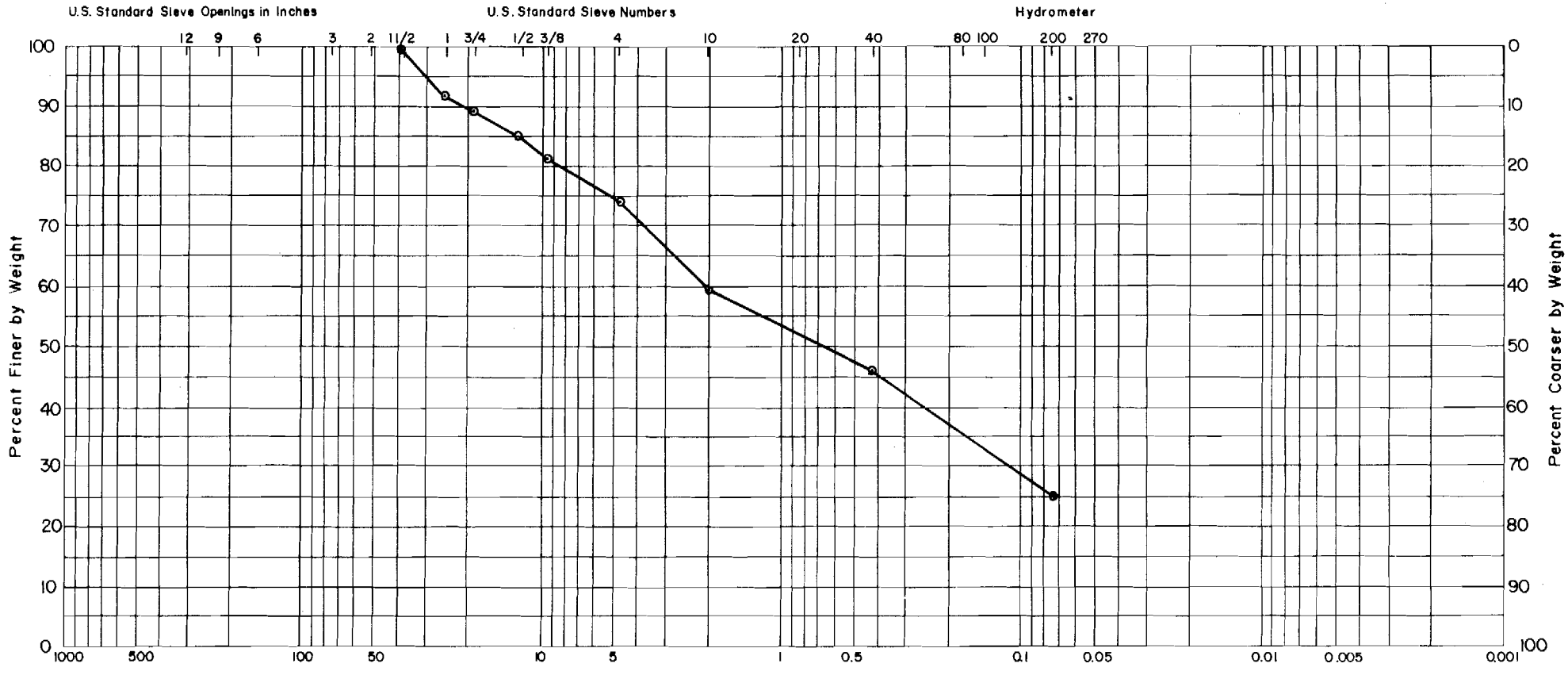
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
W-80-257	12.3%		17.1	2.5	GM-SM	Poorly graded 'Till' with Non-Plastic Fines
(Grab Sample)						SILTY GRAVEL AND SAND WITH TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



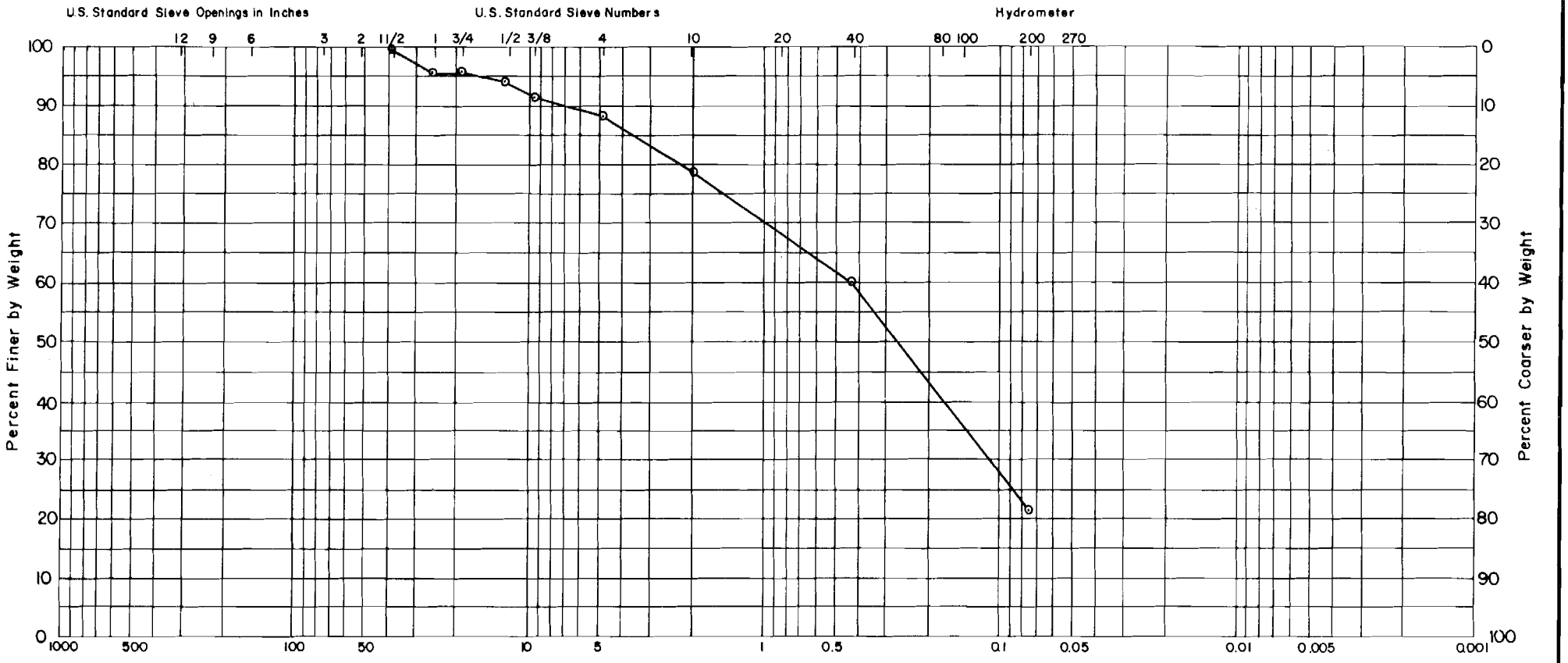
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H1 #2	13				SM	SAND WITH SOME GRAVEL AND SILT, TRACE ORGANIC MATERIAL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:
APPROVED BY: MCH
DATE: Oct, 1981
PROJECT NO. 052506



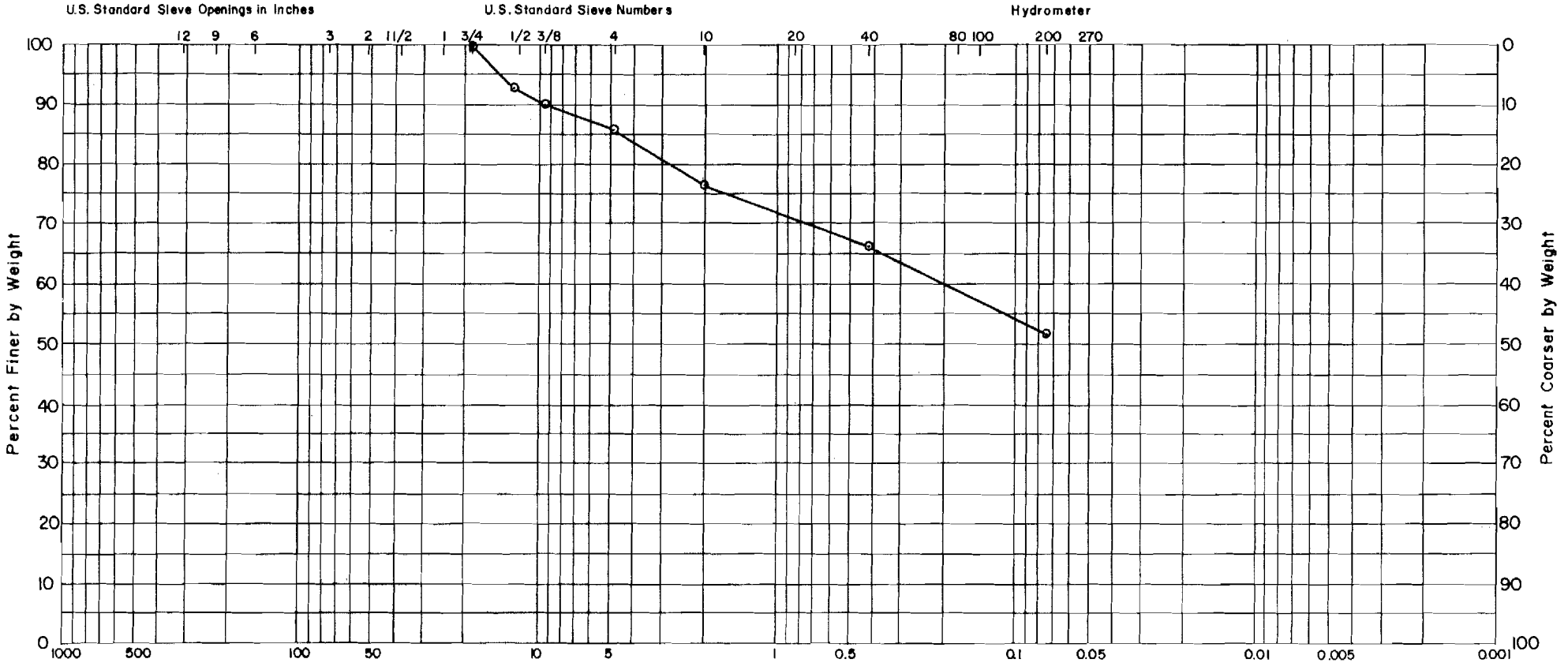
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H1 #4	17		32	17	SC	SAND WITH SOME CLAY, TRACE GRAVEL AND SILT

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:	
APPROVED BY:	MCH
DATE:	Oct. 1981
PROJECT NO.	052506



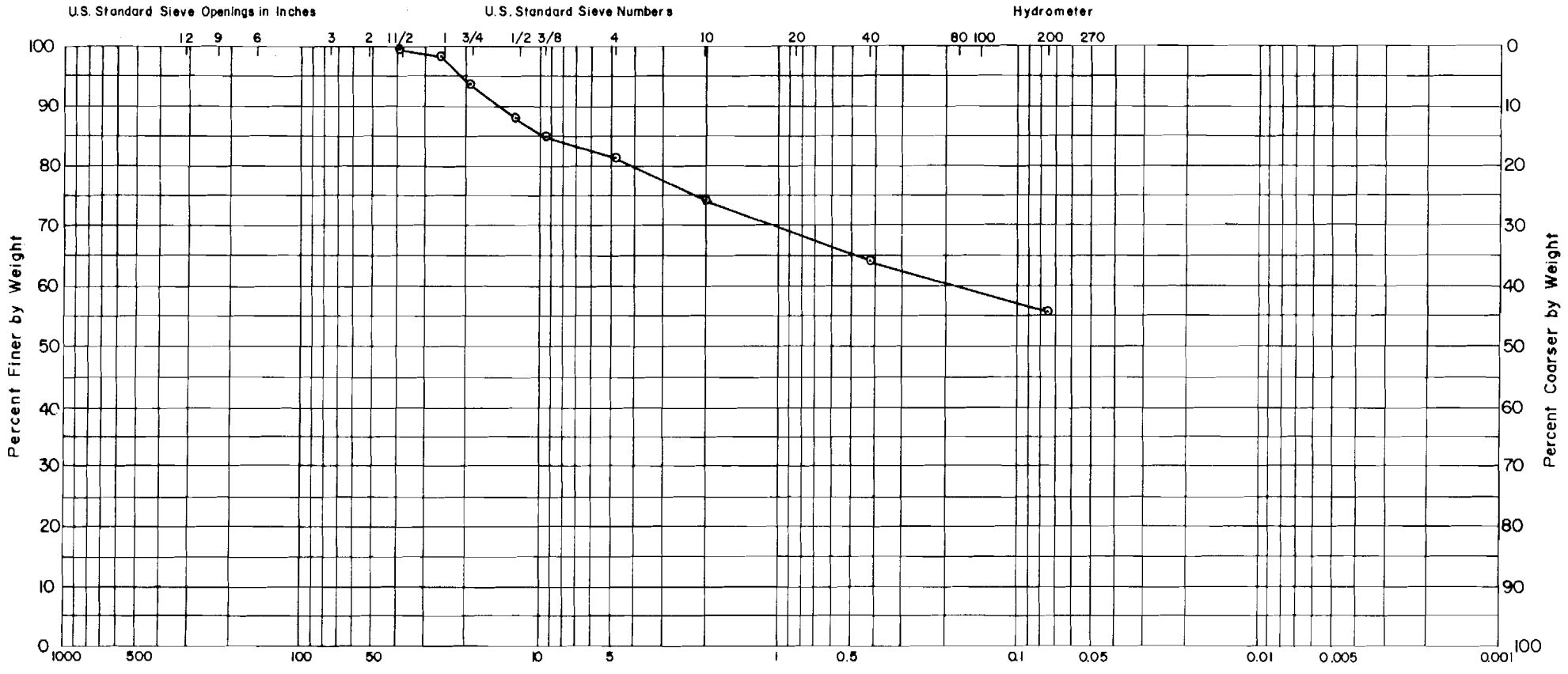
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY,	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H1 #5	16		34	21	CL	SANDY SILT WITH SOME CLAY AND GRAVEL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



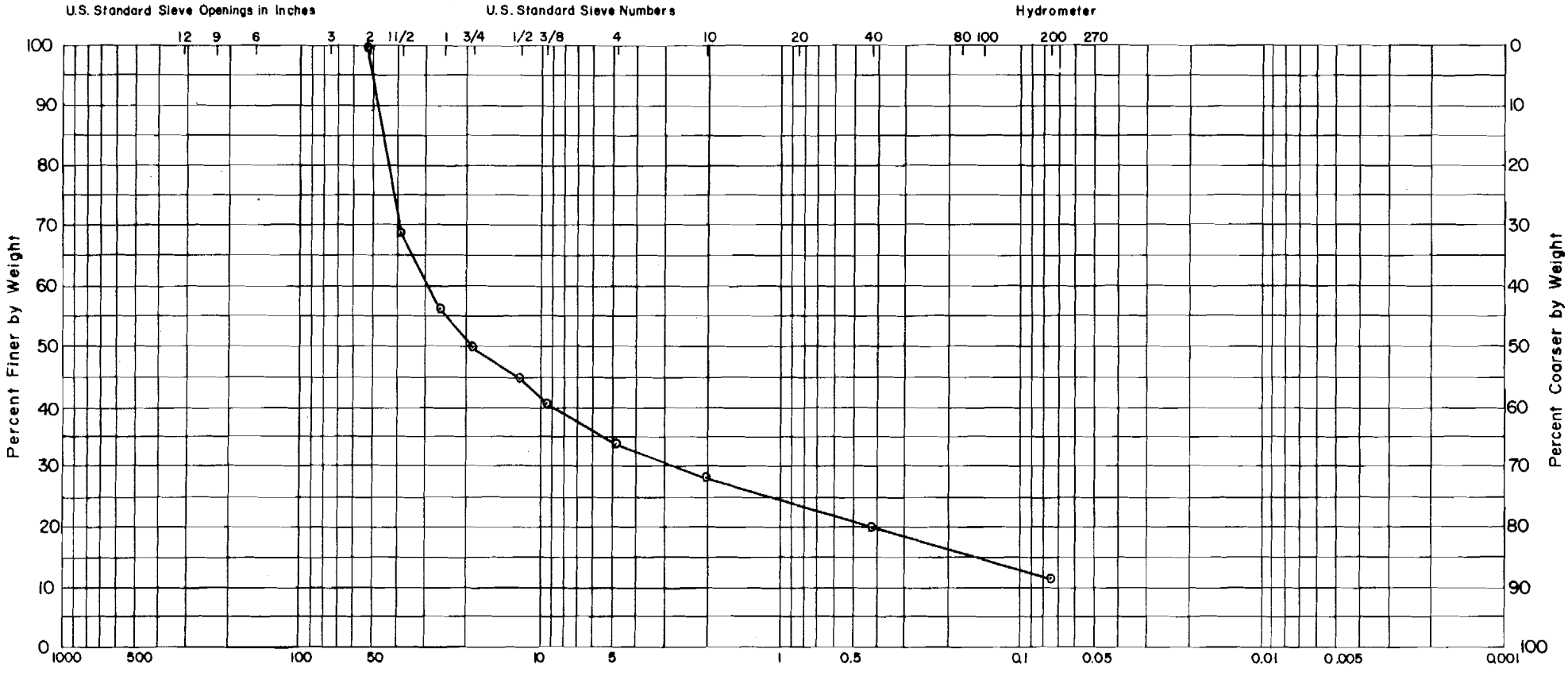
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H1 #6,7	12,12		25	7	CL-ML	SILT WITH SOME SAND AND GRAVEL, TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



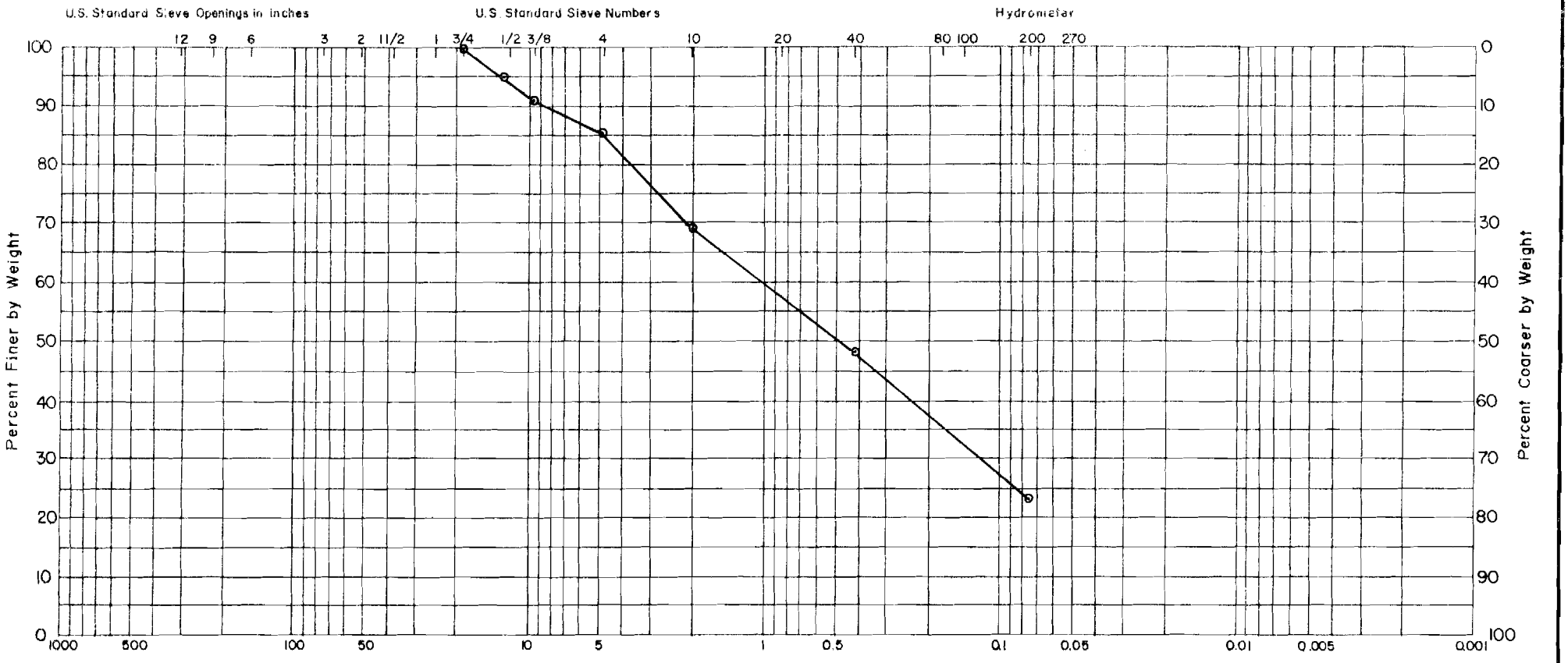
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-H1 #8,9	9		21	NP	GP-GM	GRAVEL WITH SOME SAND, TRACE SILT

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



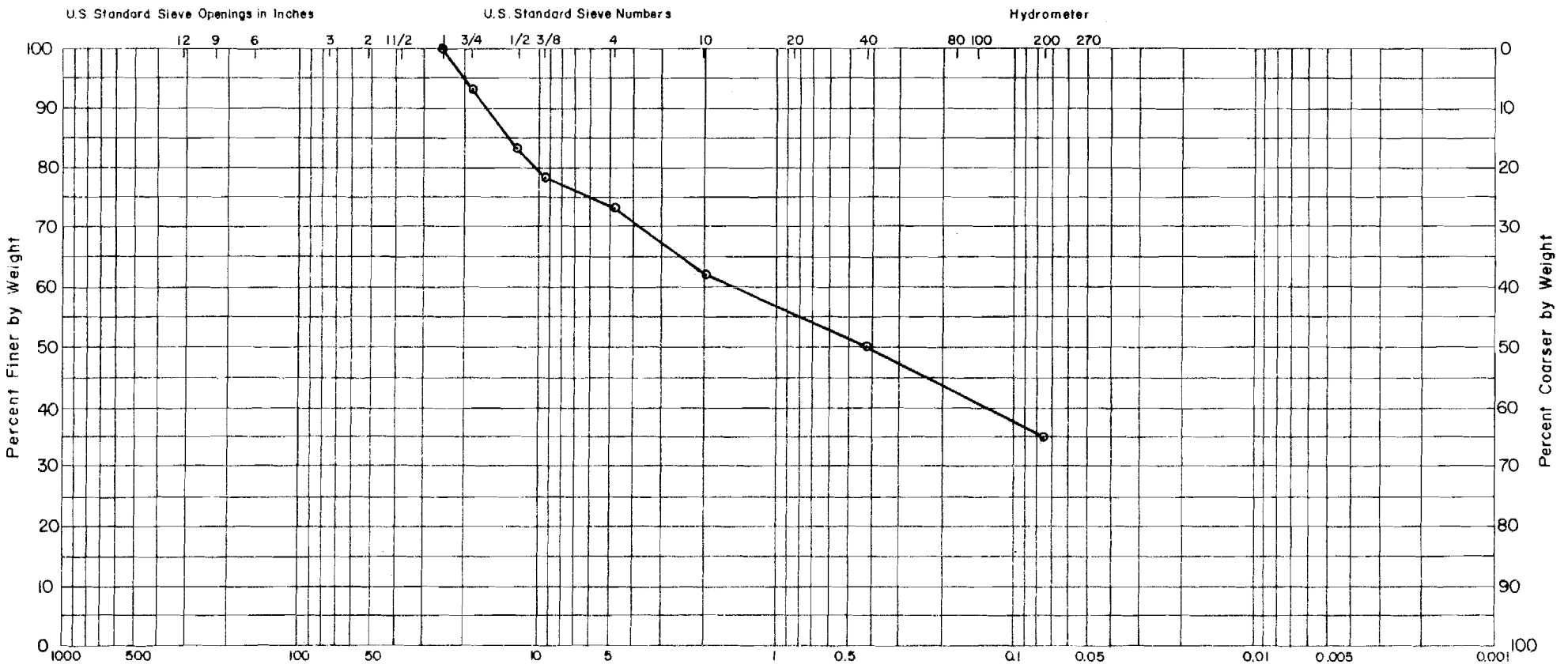
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H2 #2,3,4	23,17,20		NV	NP	SM	SAND WITH SOME SILT AND GRAVEL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



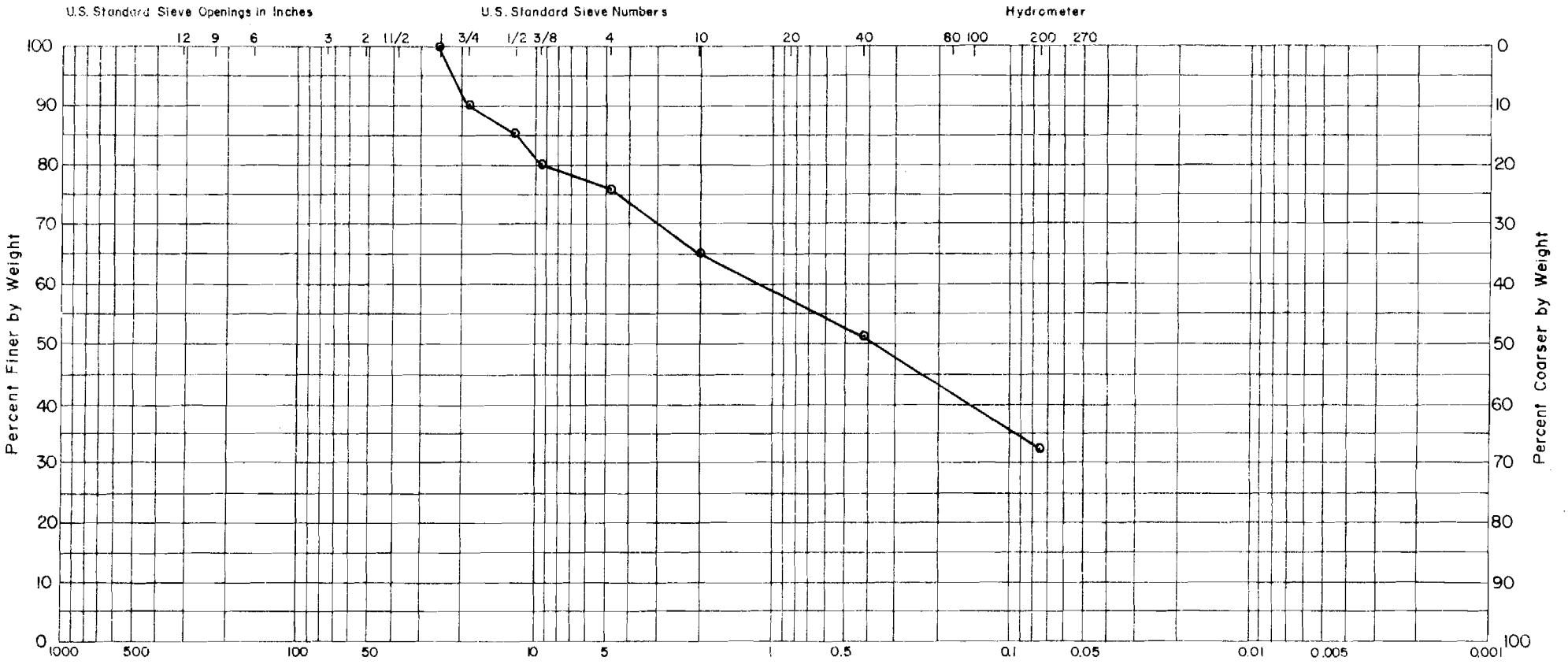
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H2 #5,6,7	7,11,11		18	NP	SM	SILTY SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:	
APPROVED BY:	MCH
DATE:	Oct. 1981
PROJECT NO	052506



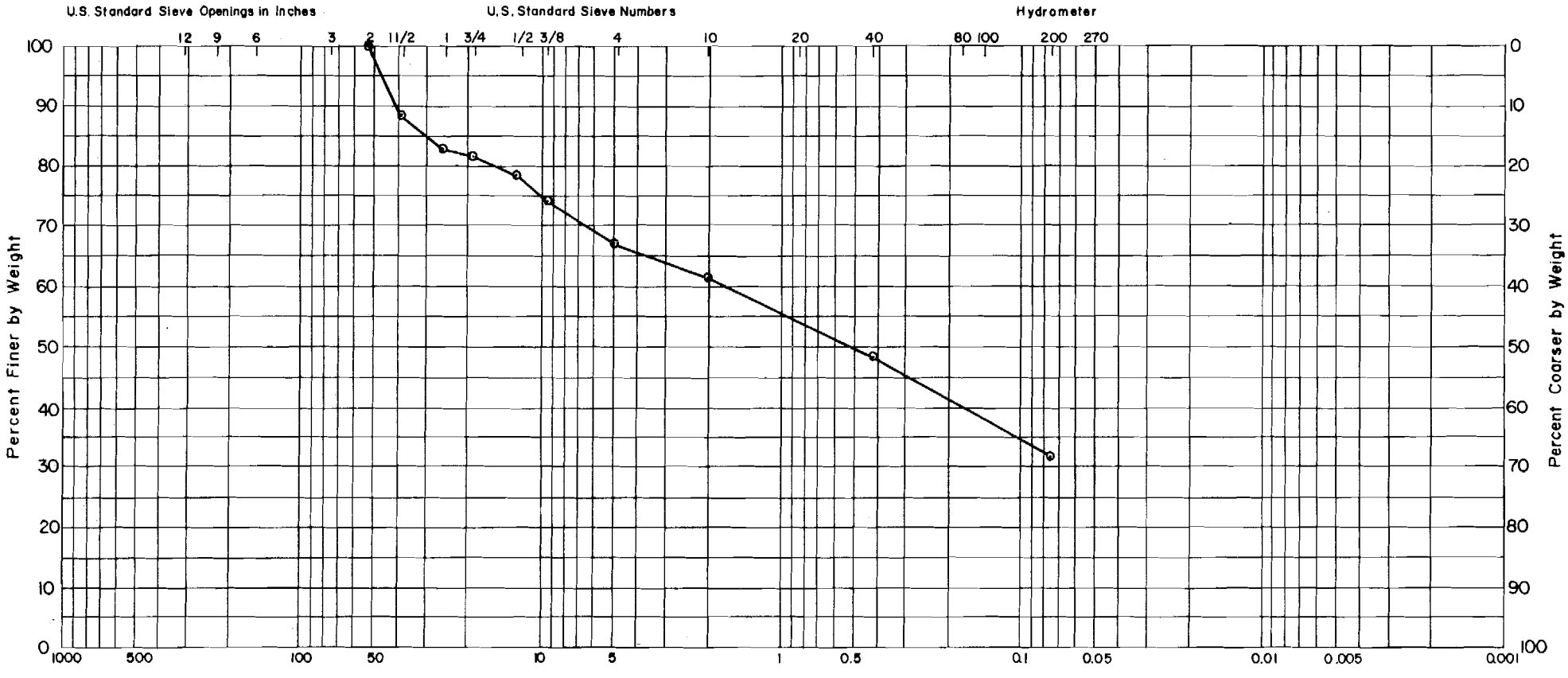
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H2 #8	10				SM	SILTY SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



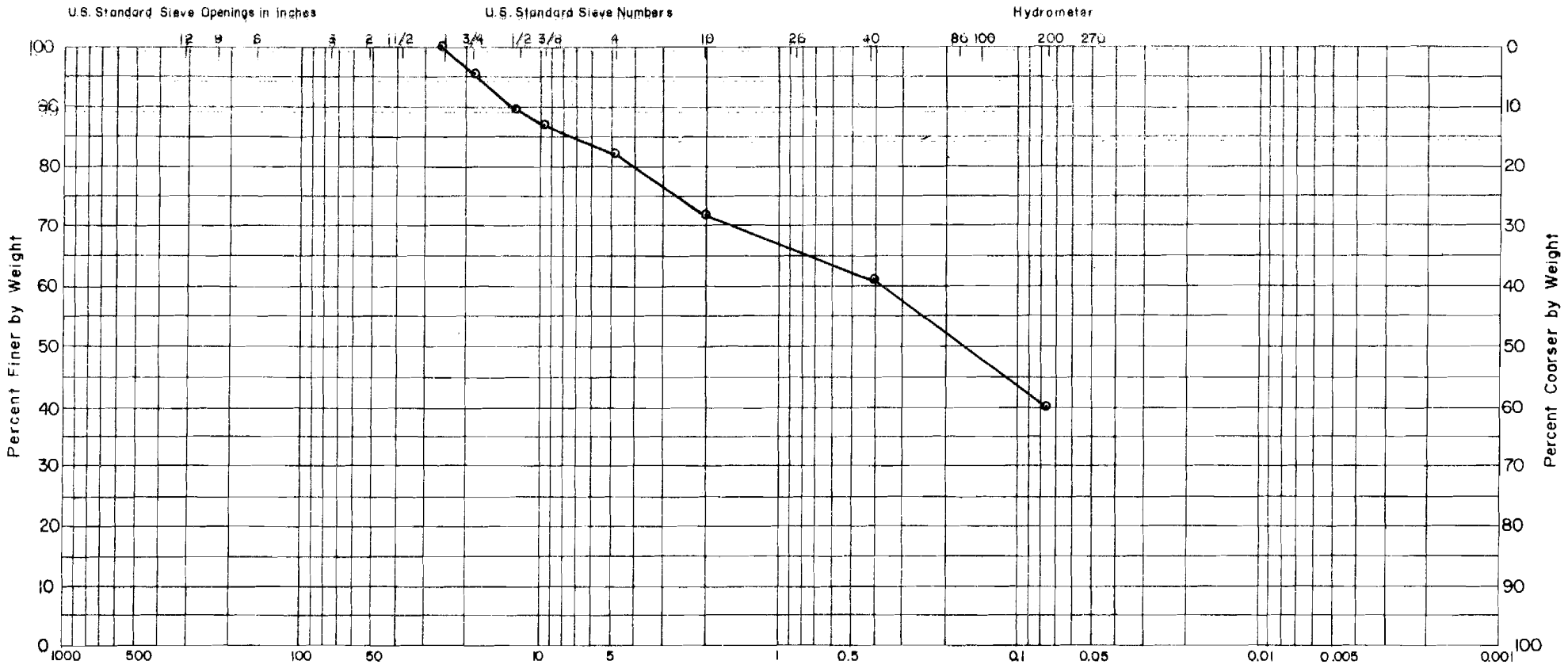
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H2 #9,10	9,6		17	NP	SM	SILTY, GRAVELLY SAND

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



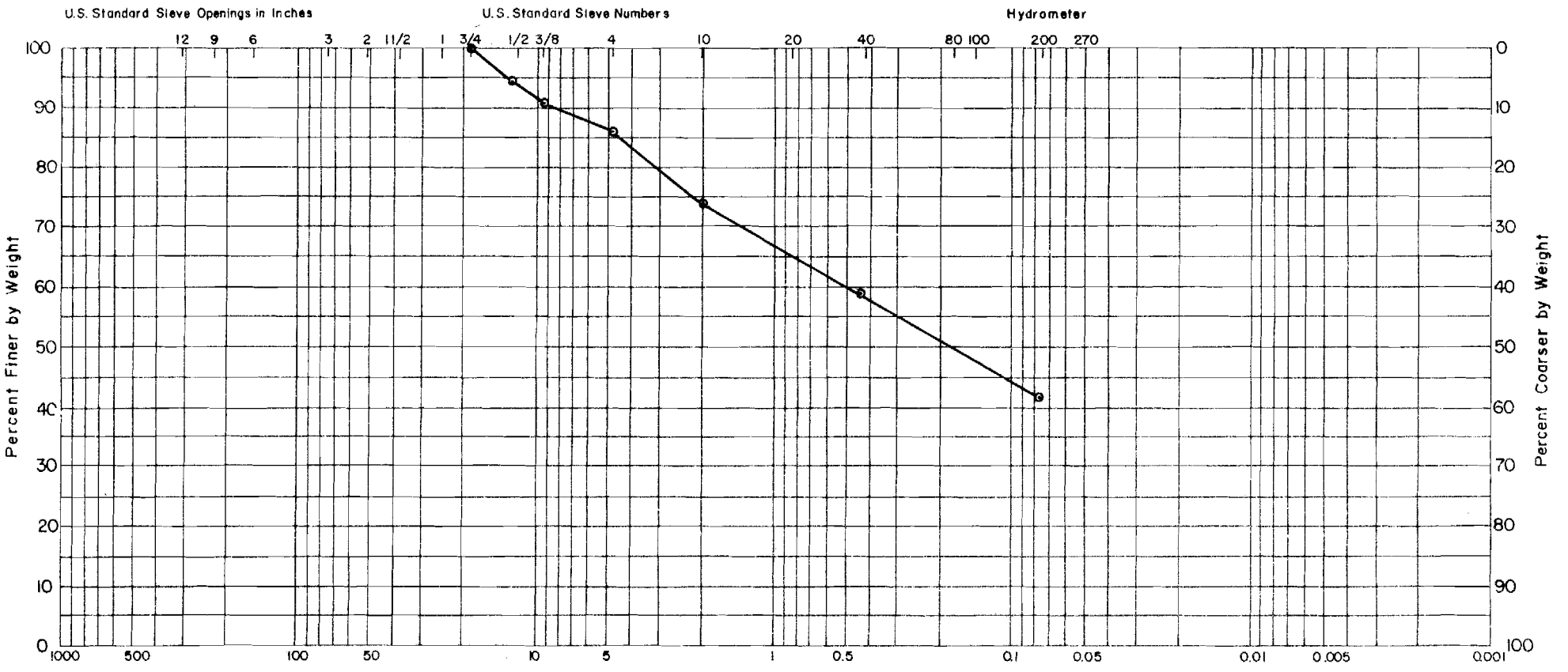
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H2 #11,12,13	8,8,7		18	5	SM-SC	SILTY SAND WITH SOME GRAVEL, TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



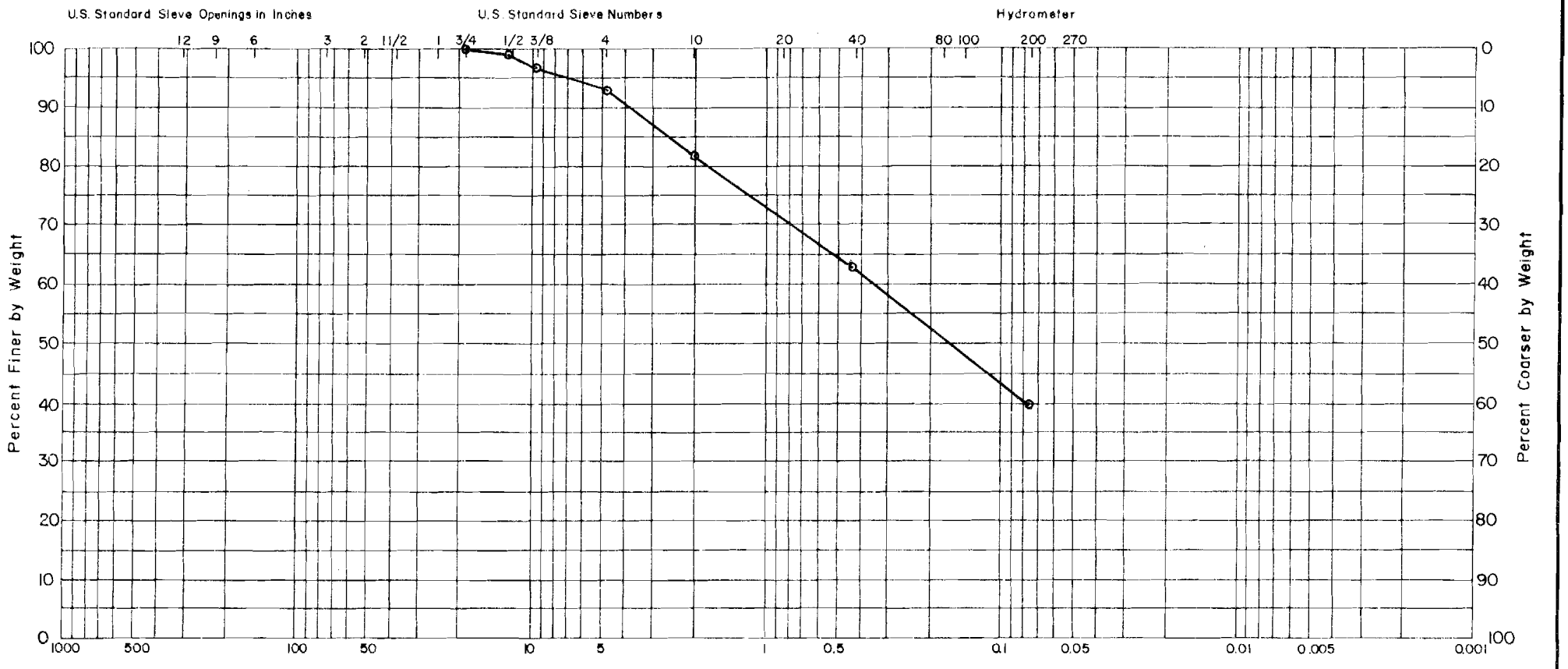
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H3 #4,5	19,14		18	5	SM-SC	SILTY SAND WITH SOME GRAVEL, TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H3

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



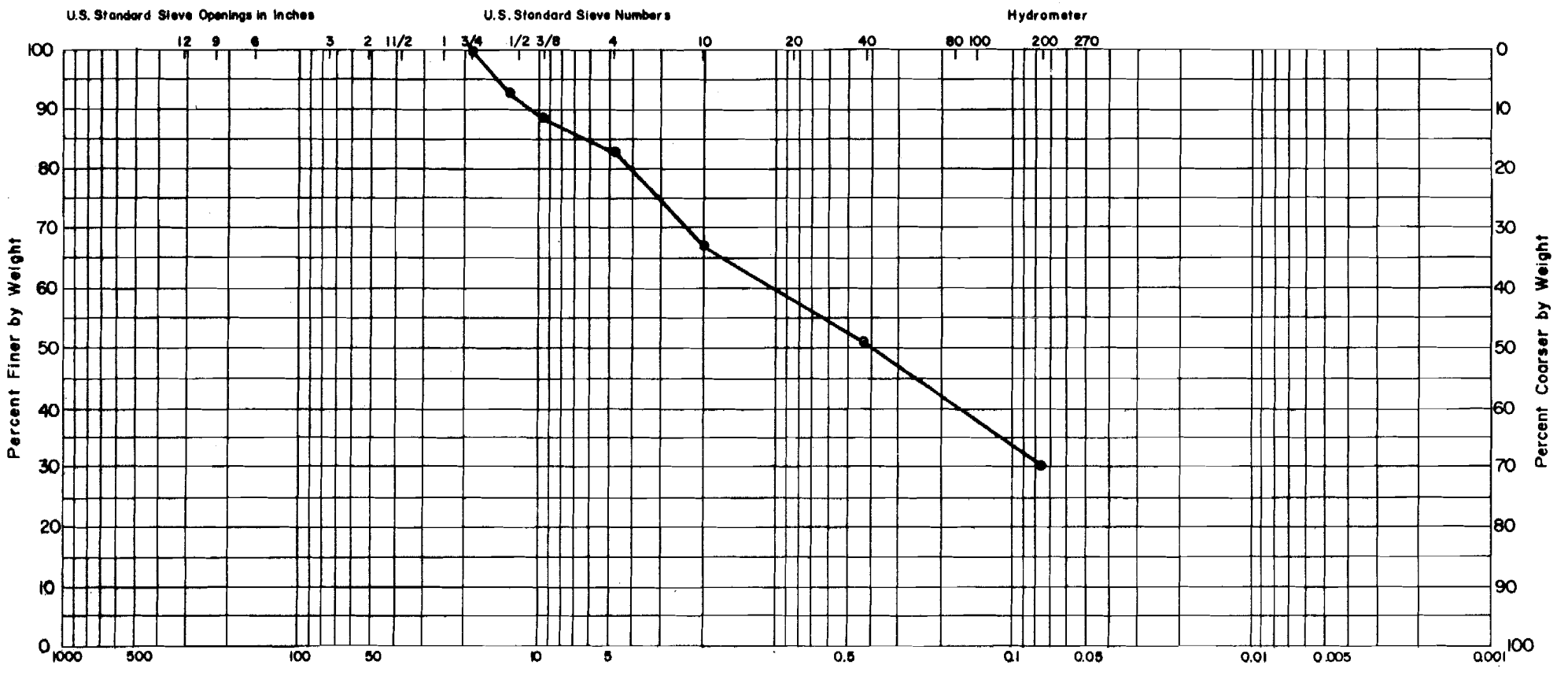
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H3 #7	12		NV	NP	SM	SILTY SAND WITH TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H3

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



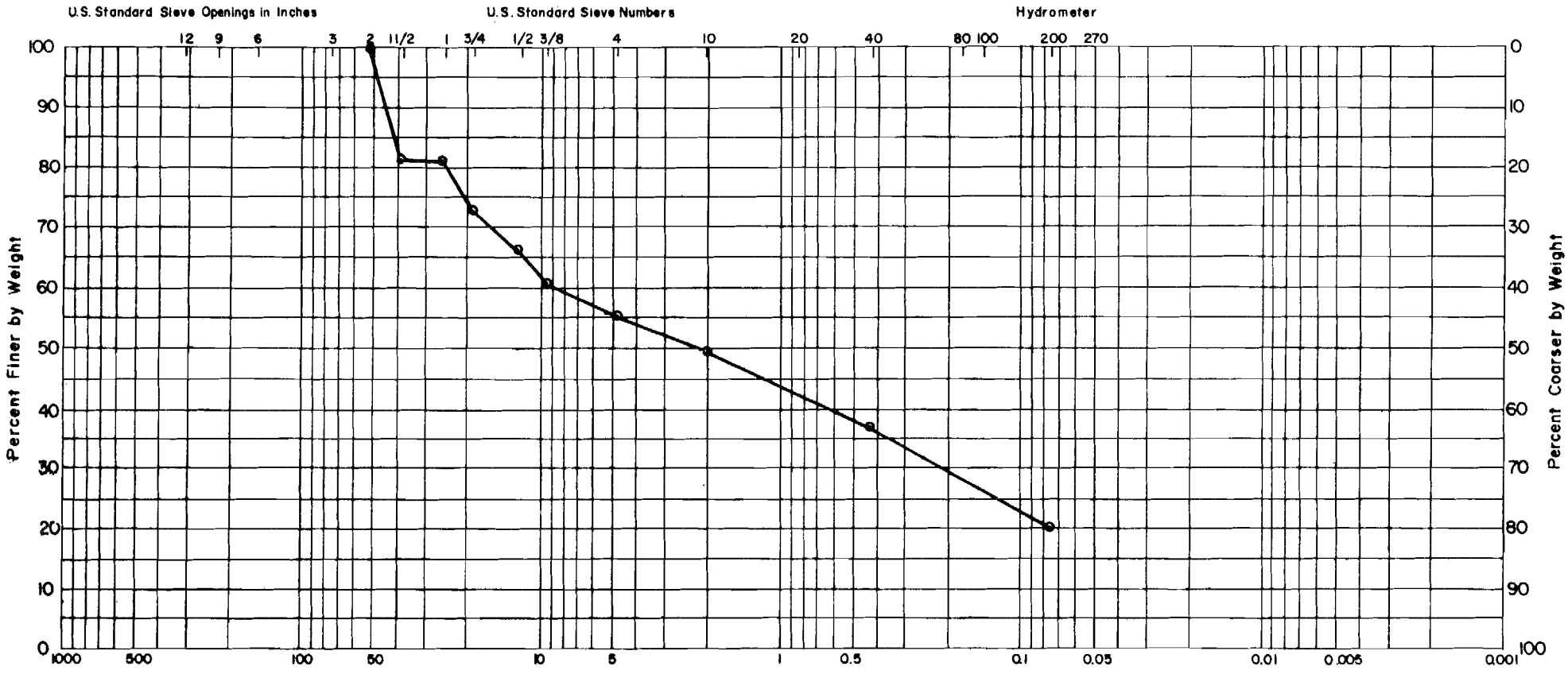
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H3 #8	9		14	NP	SM	SILTY SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H3

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



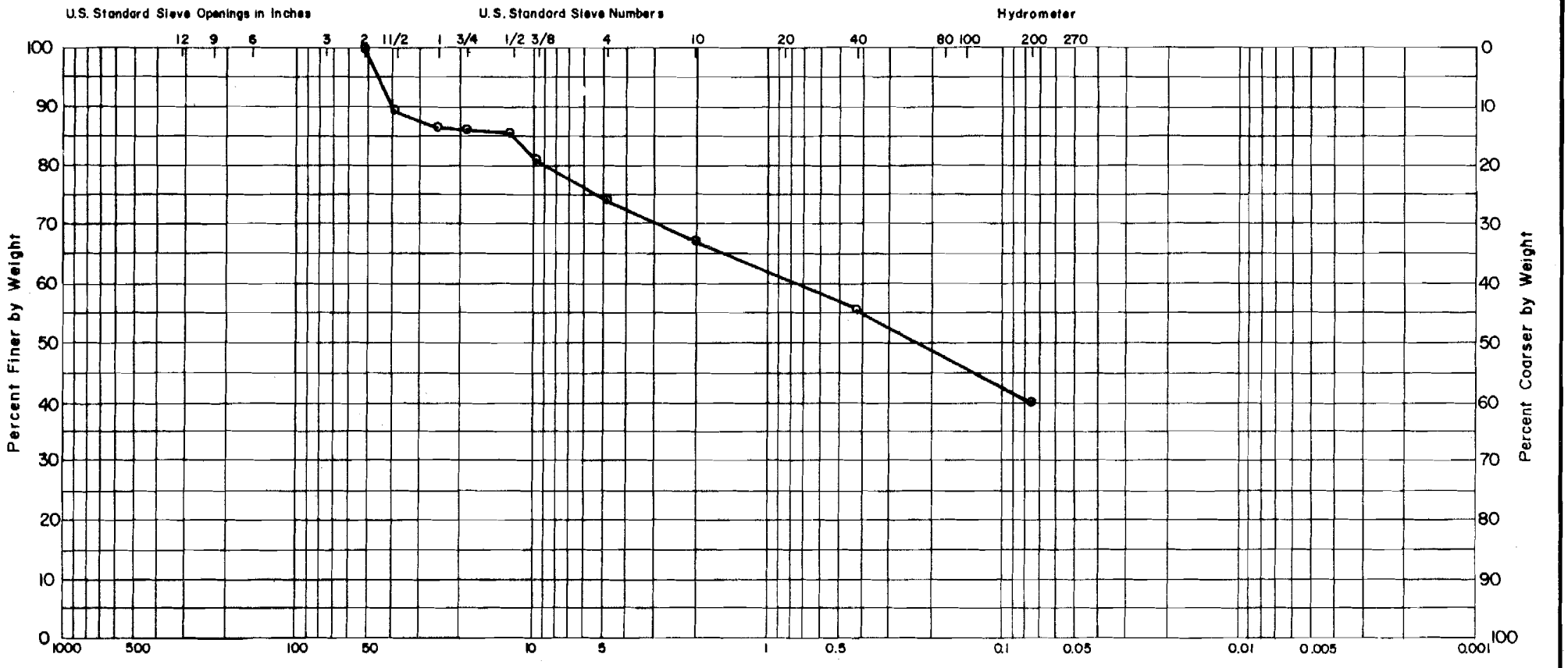
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-H4 #3,4	16,13		23	7	GC-GM	SANDY GRAVEL WITH SOME SILT AND TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H4

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



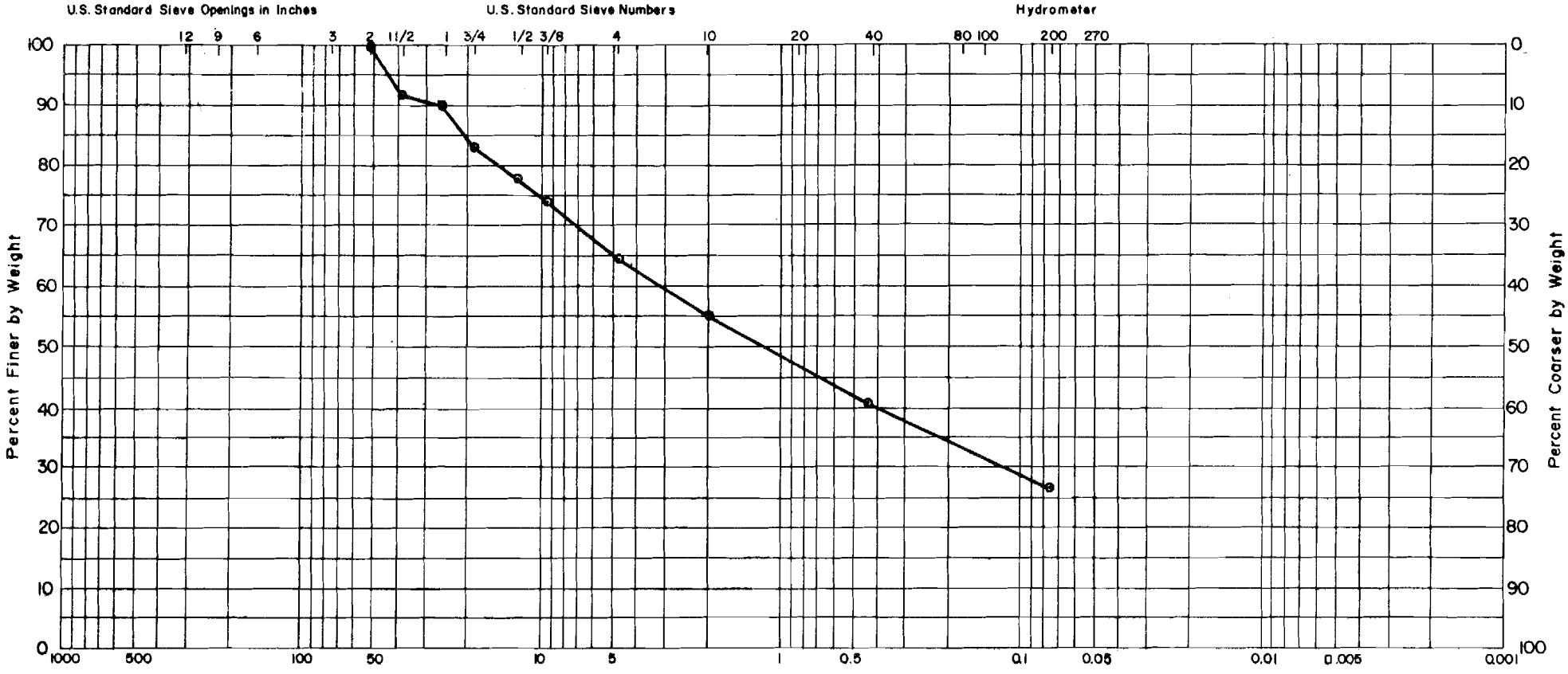
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H4 #5,6	15,11		20	4	SM-SC	SILTY SAND WITH SOME GRAVEL AND TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H4

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



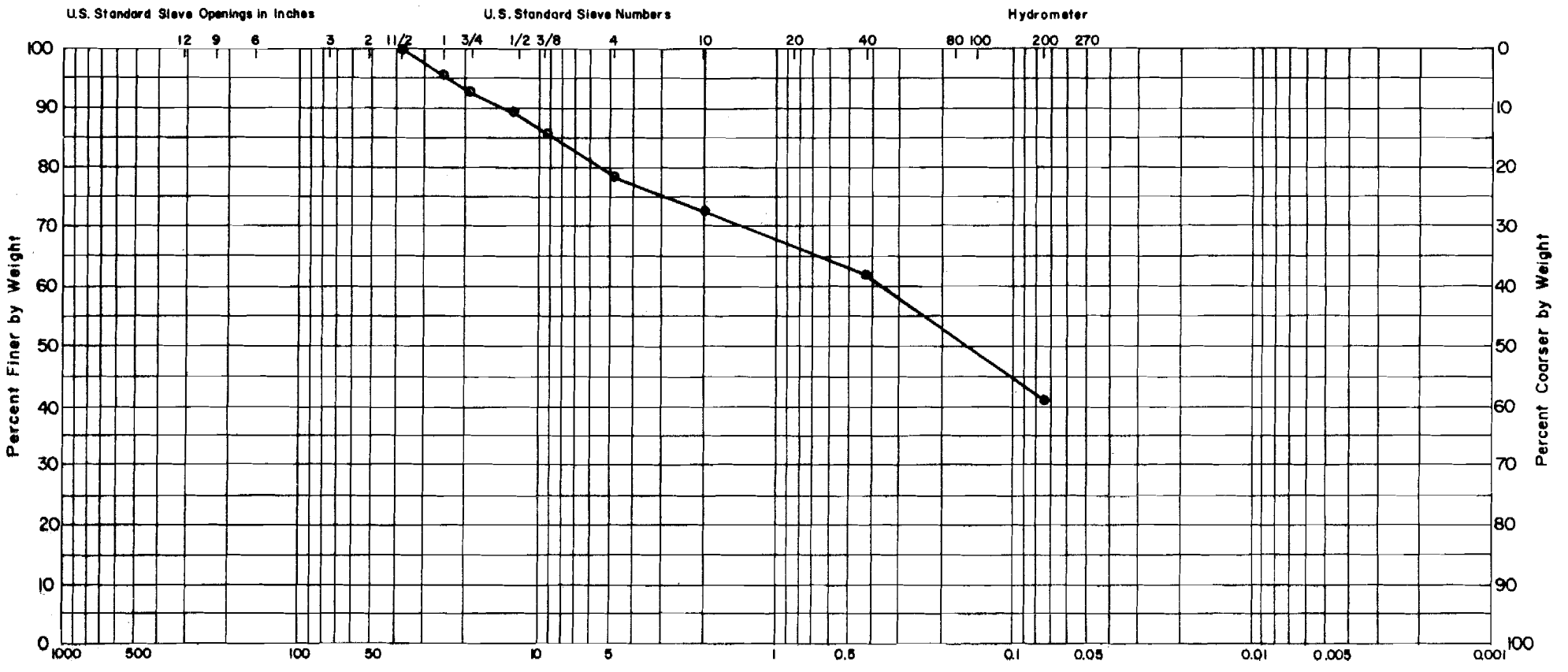
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H4 #7,8	11		22	NP	SM	GRAVELLY SAND WITH SOME SILT

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H4

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



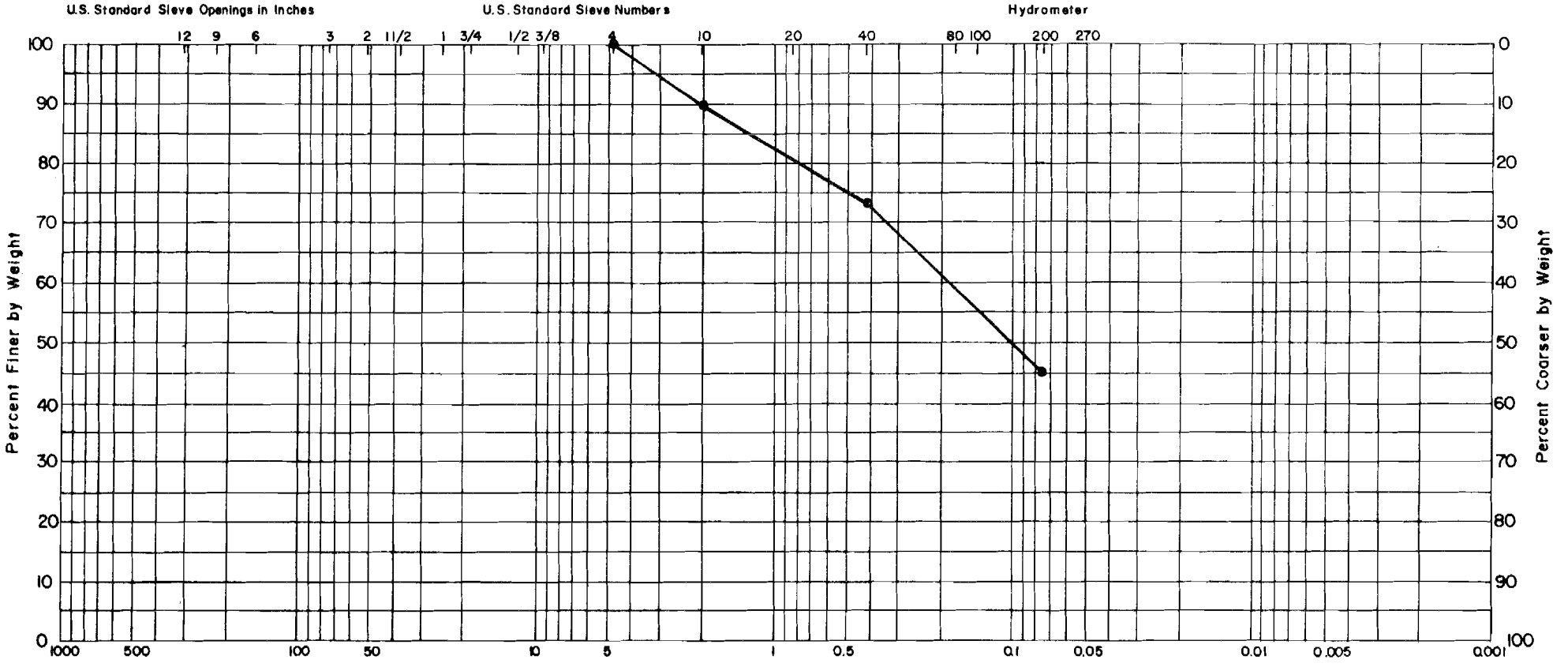
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H5 #4	16		23	6	SM-SC	SILTY SAND WITH SOME GRAVEL AND TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H.
AUGER HOLE AH-H5

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



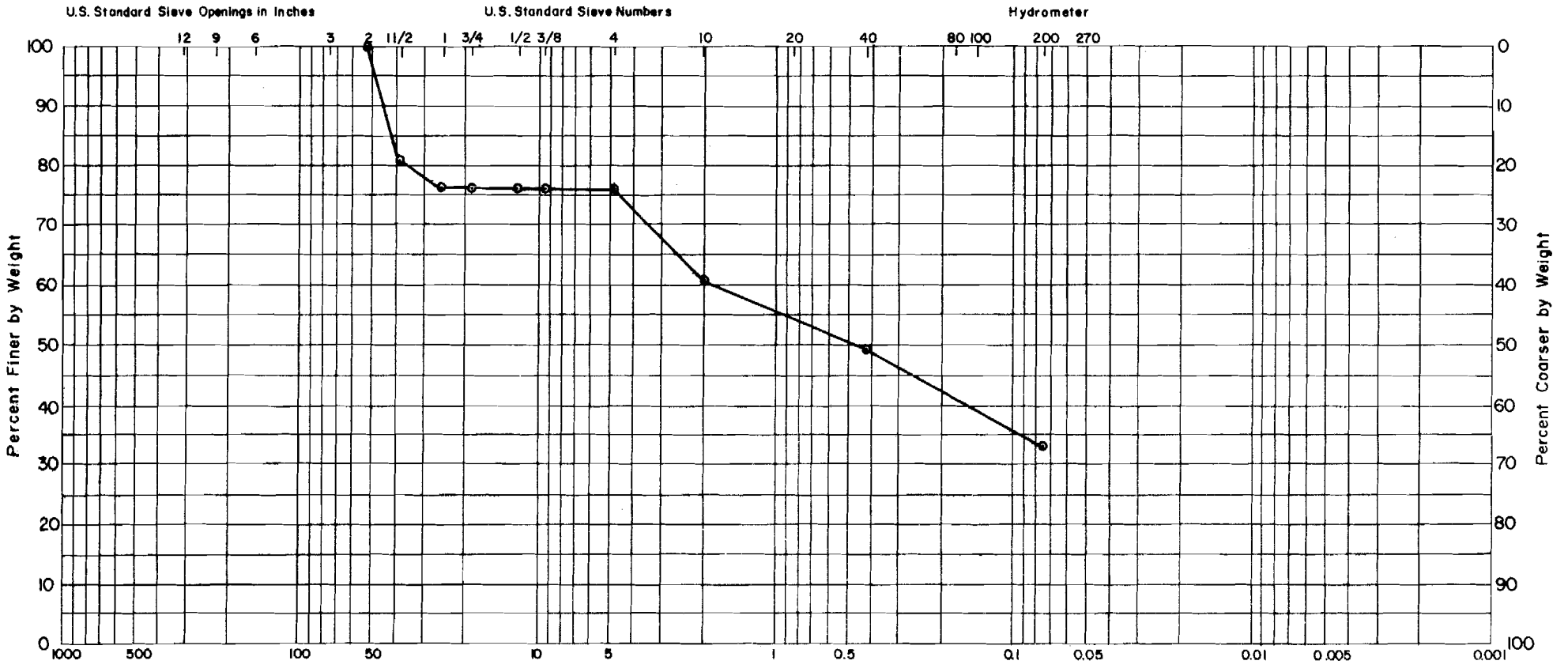
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H5 #5	17		22	6	SM-SC	SILTY SAND WITH TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H5

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



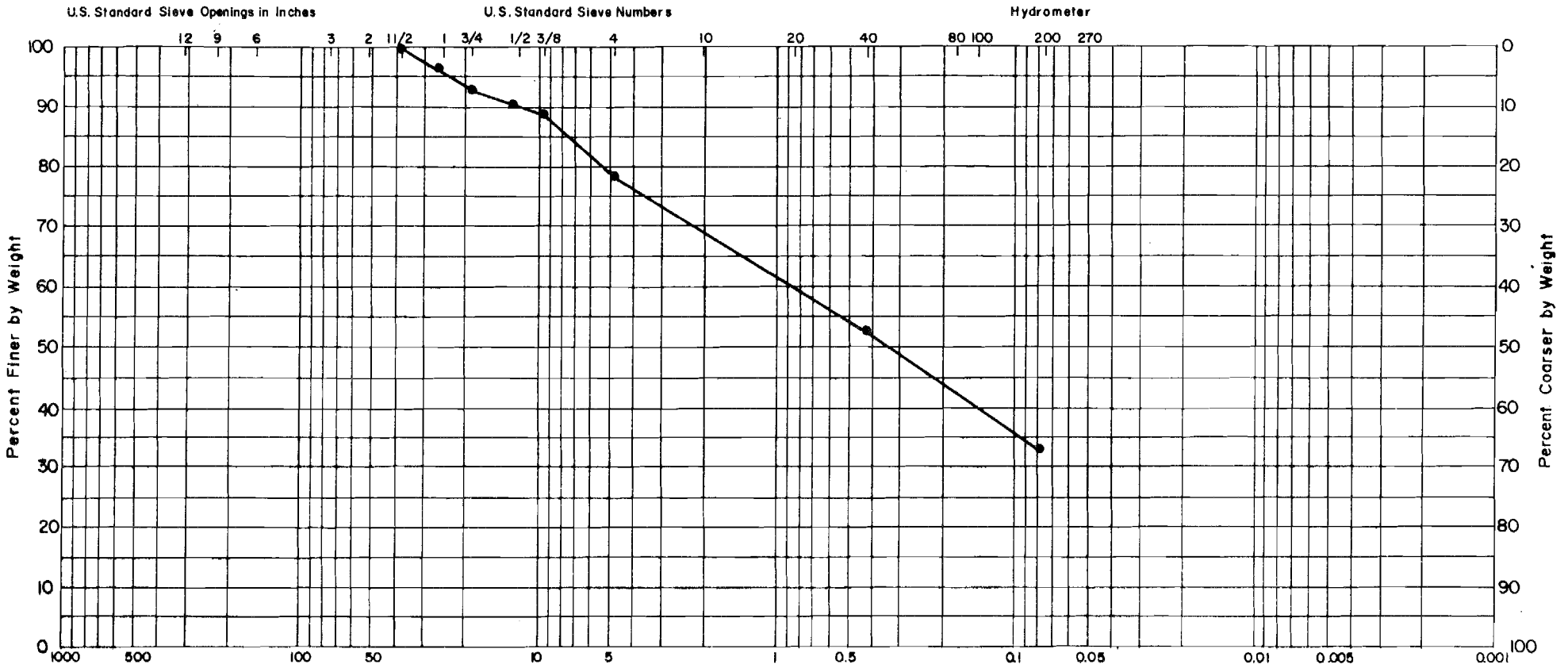
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H5 #6,7	10,9		21	4	SM-SC	SILTY SAND WITH SOME GRAVEL AND TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H5

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



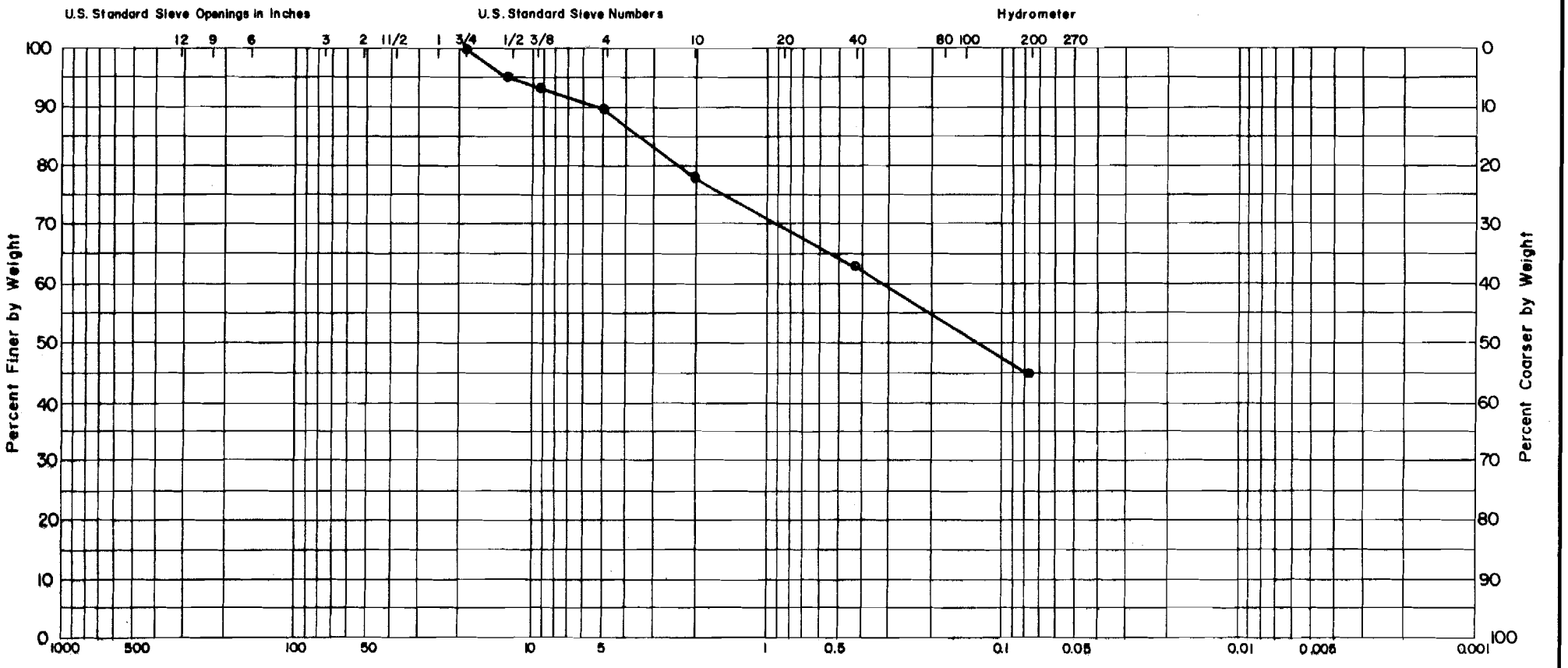
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H6 #6,7	13,12		NV	NP	SM	SILTY SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H6

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



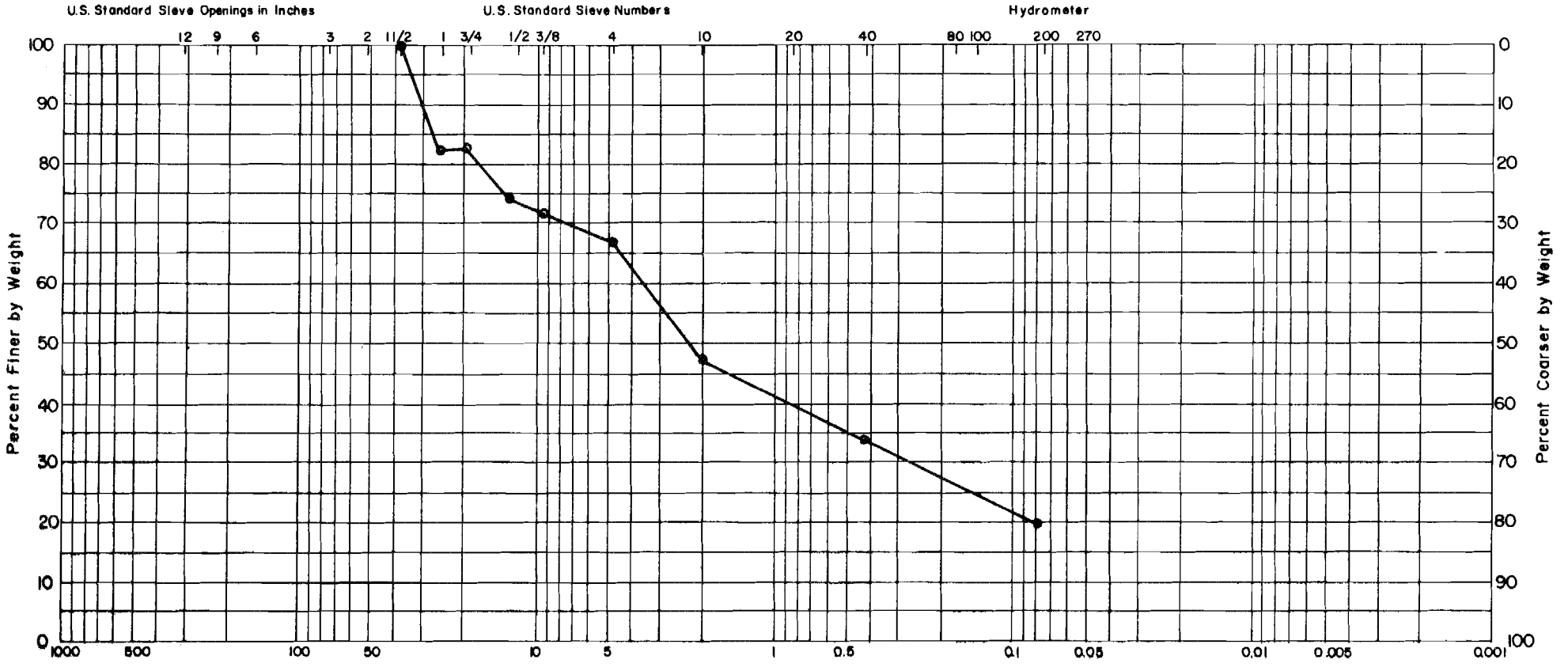
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H6 #10	11		23	9	SC	SILTY SAND WITH TRACE GRAVEL AND CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H6

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



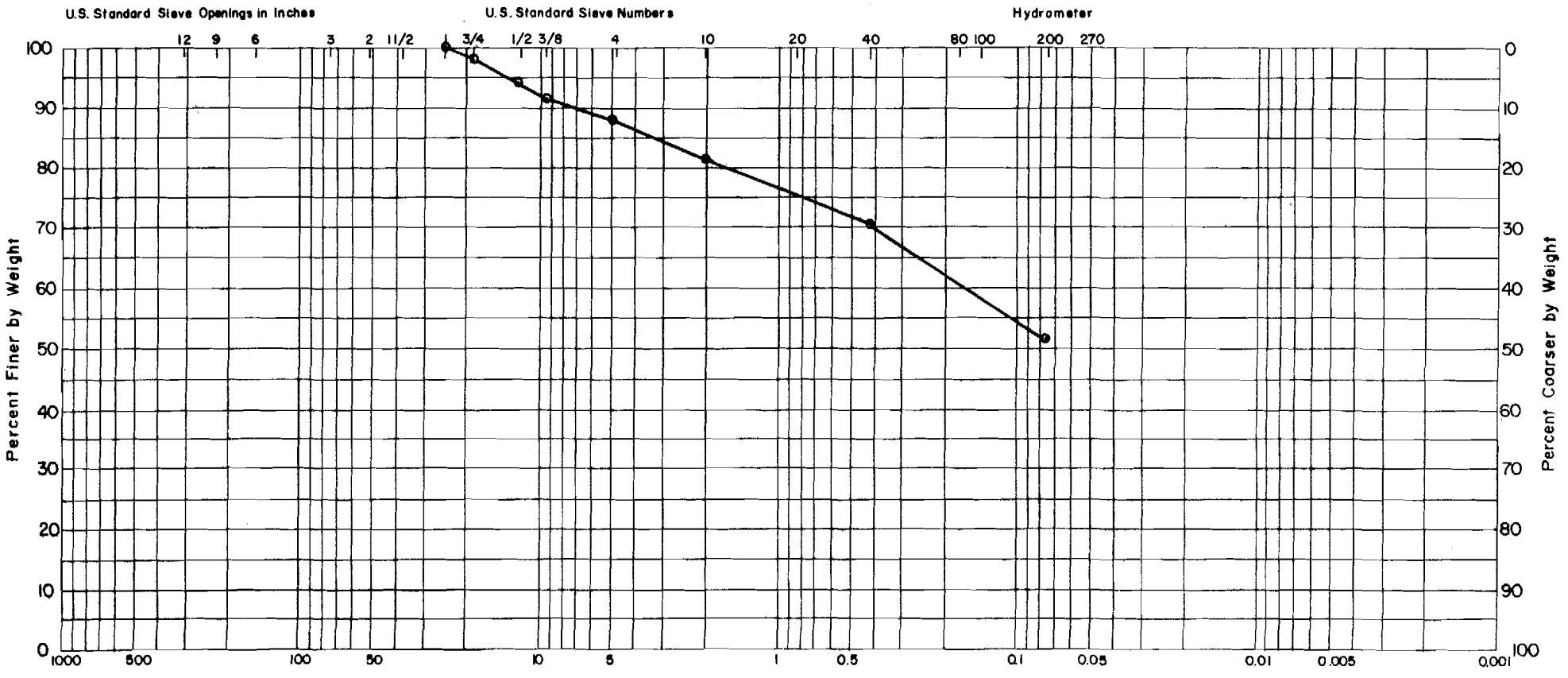
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H6 #12	8		21	6	SM-SC	GRAVELLY SAND WITH SOME SILT, TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H6

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



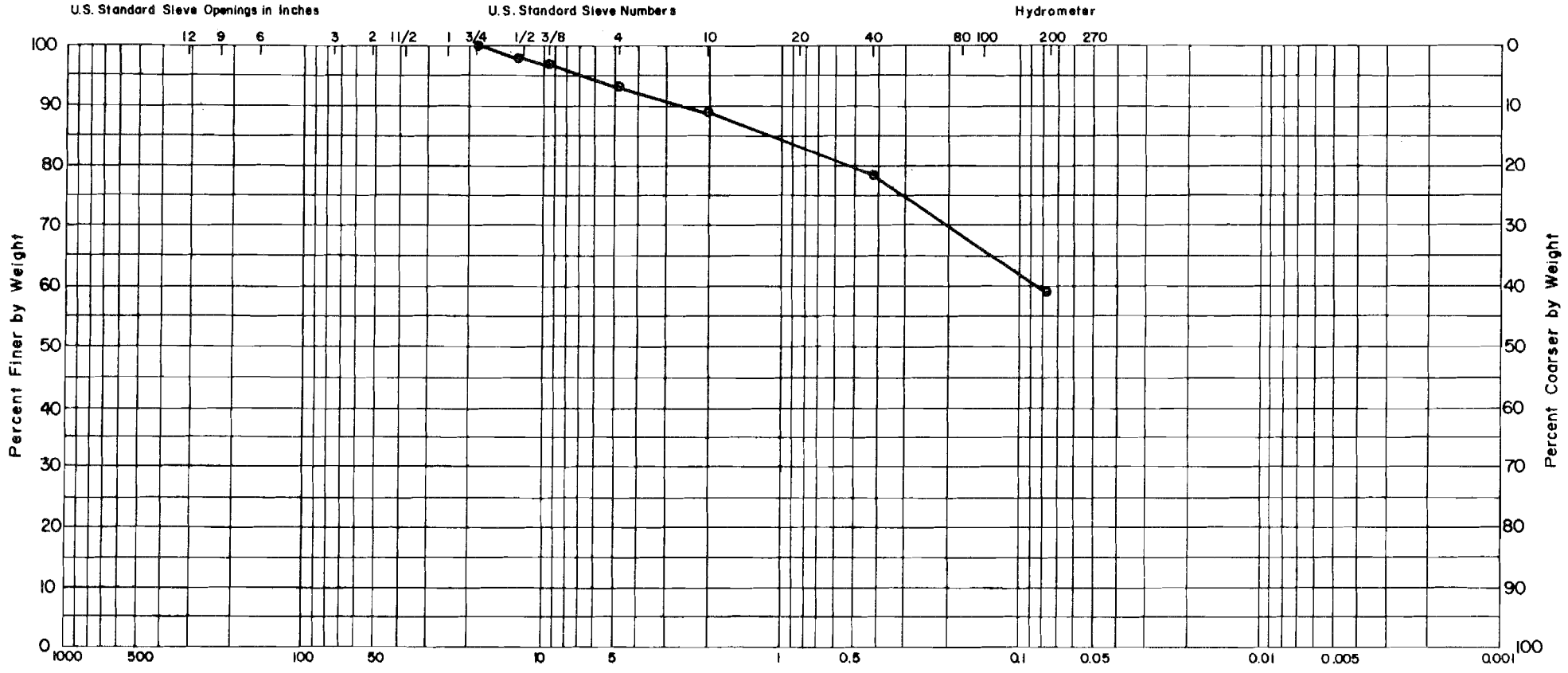
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-H7 #5,6	14,17		17	4	ML-CL	SANDY SILT WITH TRACE GRAVEL AND CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H7

DRAWN BY:	
APPROVED BY:	MCII
DATE:	Oct. 1981
PROJECT NO.	052506



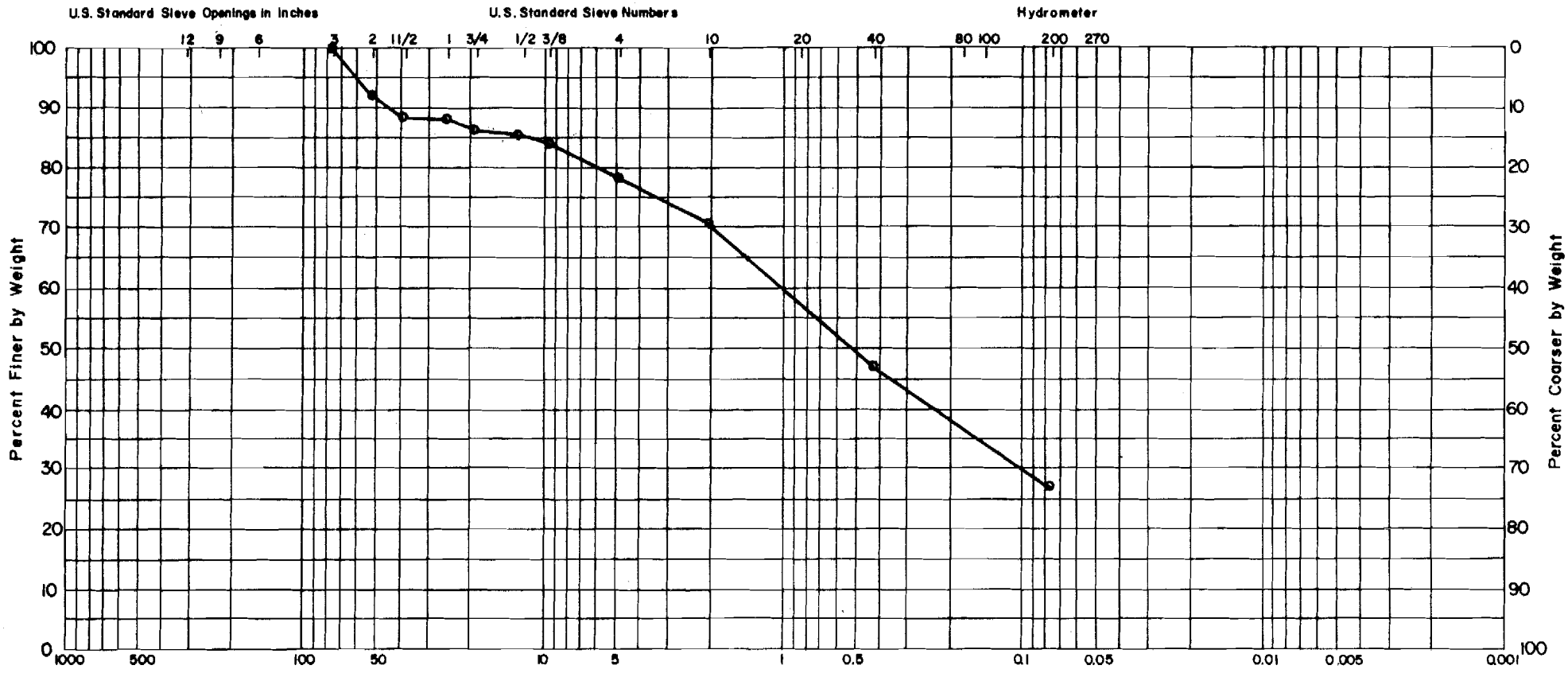
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-H7 #7	16		29	14	CL	SANDY SILT WITH SOME CLAY AND TRACE GRAVEL

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H7

DRAWN BY:	
APPROVED BY:	MCH
DATE:	Oct. 1981
PROJECT NO.	052506



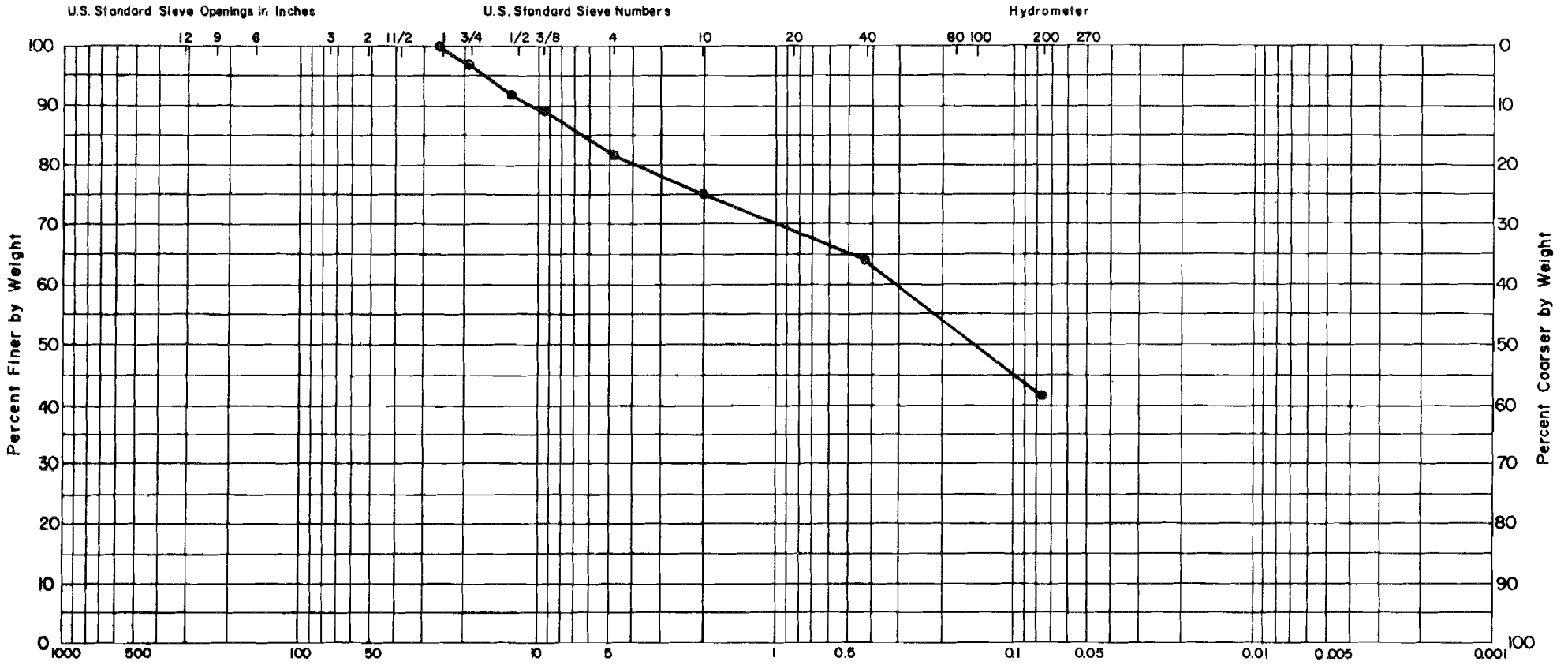
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-H7 #9,10	13,13		33	19	SC	SAND WITH SOME CLAY, GRAVEL, AND SILT

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H7

DRAWN BY:
APPROVED BY: MCh
DATE: Oct. 1981
PROJECT NO. 052506



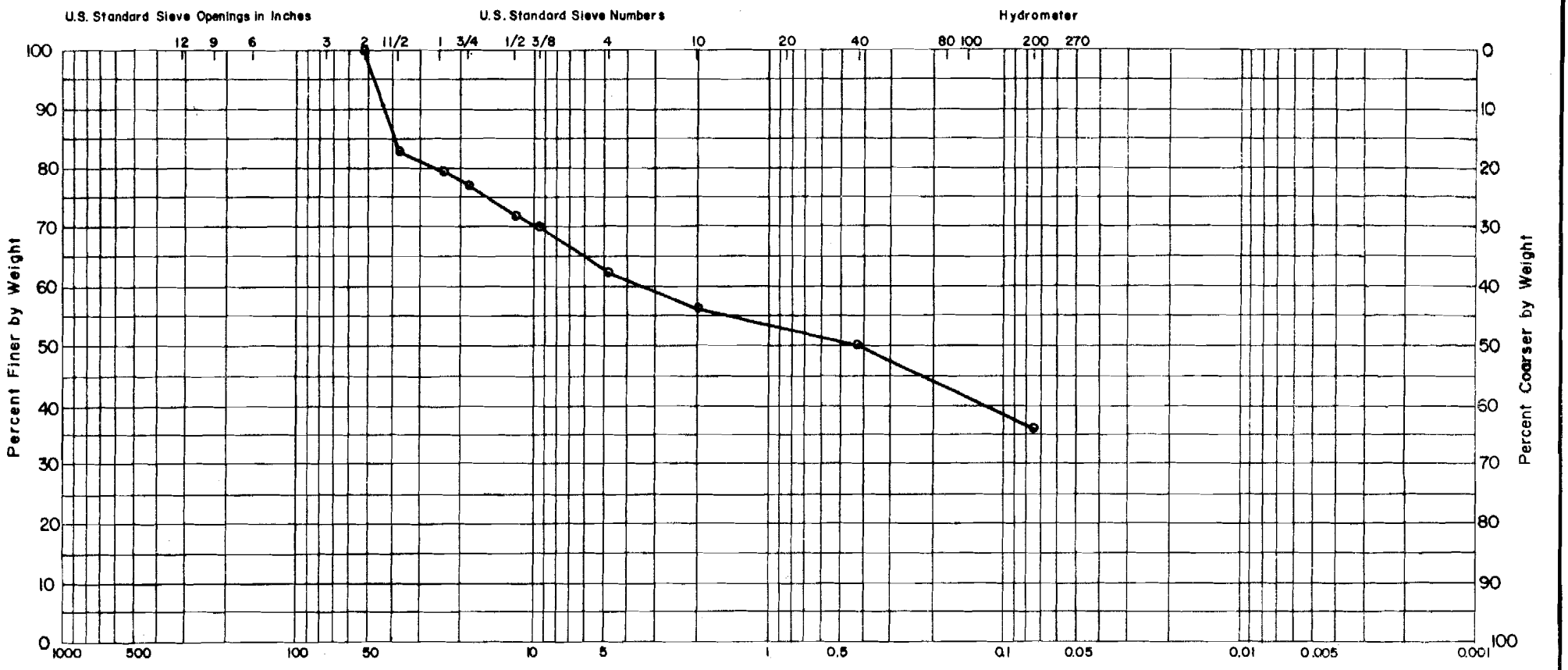
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H8 #5,6	12,13		25	11	SC	SAND WITH SOME SILT, GRAVEL, AND CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H8

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



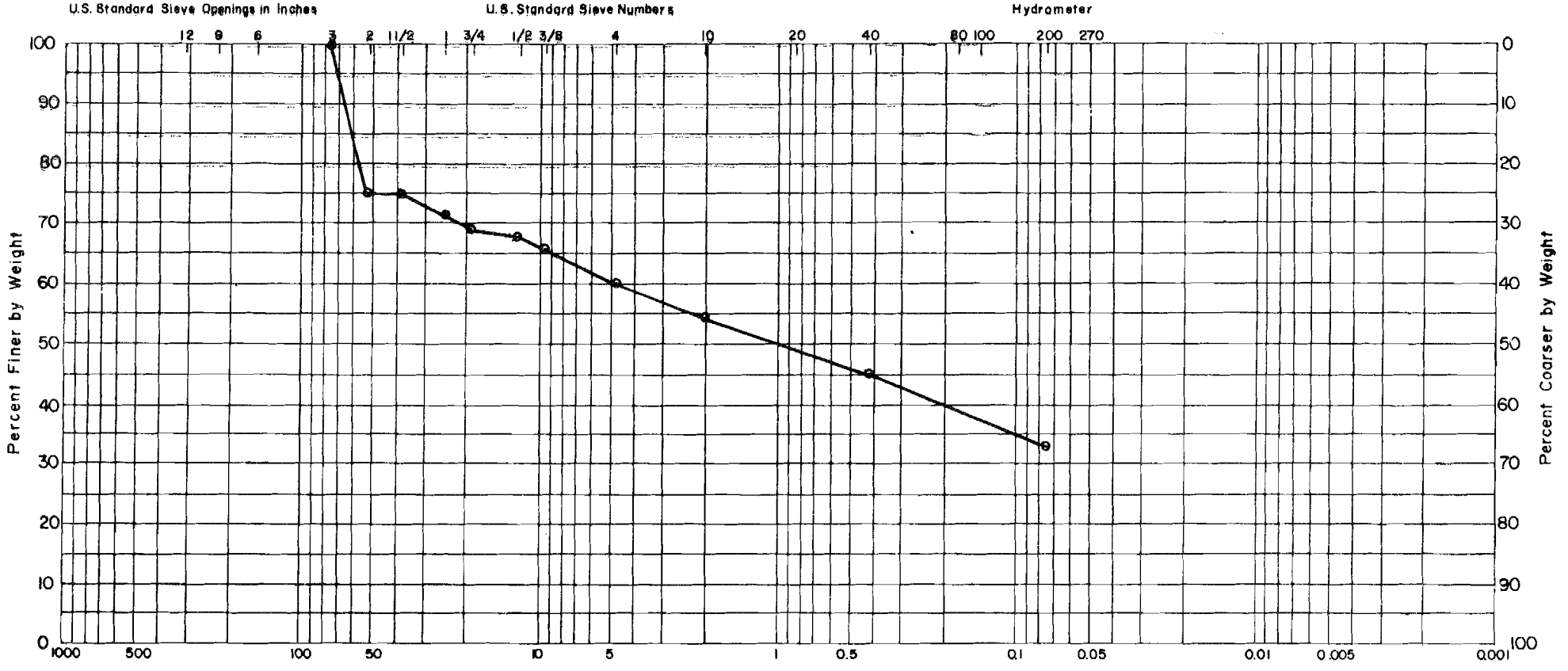
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
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SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-H8 #7	7		21	7	GC-GM	SILTY GRAVEL WITH SOME SAND, TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H8

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H8 #8,9	6,6		21	7	GC-GM	GRAVEL WITH SOME SAND, SILT, AND TRACE CLAY

R&M CONSULTANTS INC.

BORROW AREA H
AUGER HOLE AH-H8

DRAWN BY:	
APPROVED BY:	MCH
DATE:	Oct. 1981
PROJECT NO.	052506

Project No. 052504
Date 11-20-80

R&M Consultant Inc.

LABORATORY COMPACTION CONTROL REPORT

Job Name and Location: Susitna (Watana Dam Site)

Architect or Engineer: Acres American Inc.

Contractor:

A. Description of Soil: Poorly Graded 'Till', SILTY GRAVEL AND SAND W/TRACE CLAY

Material Mark: C Unified Classification: GC-SC AASHO Classification:

Source of Material: Borrow Area H Sample No. W-80-256

Natural Water Content: 10.9 % Natural Dry Density: ____ PCF Specific Gravity: ____

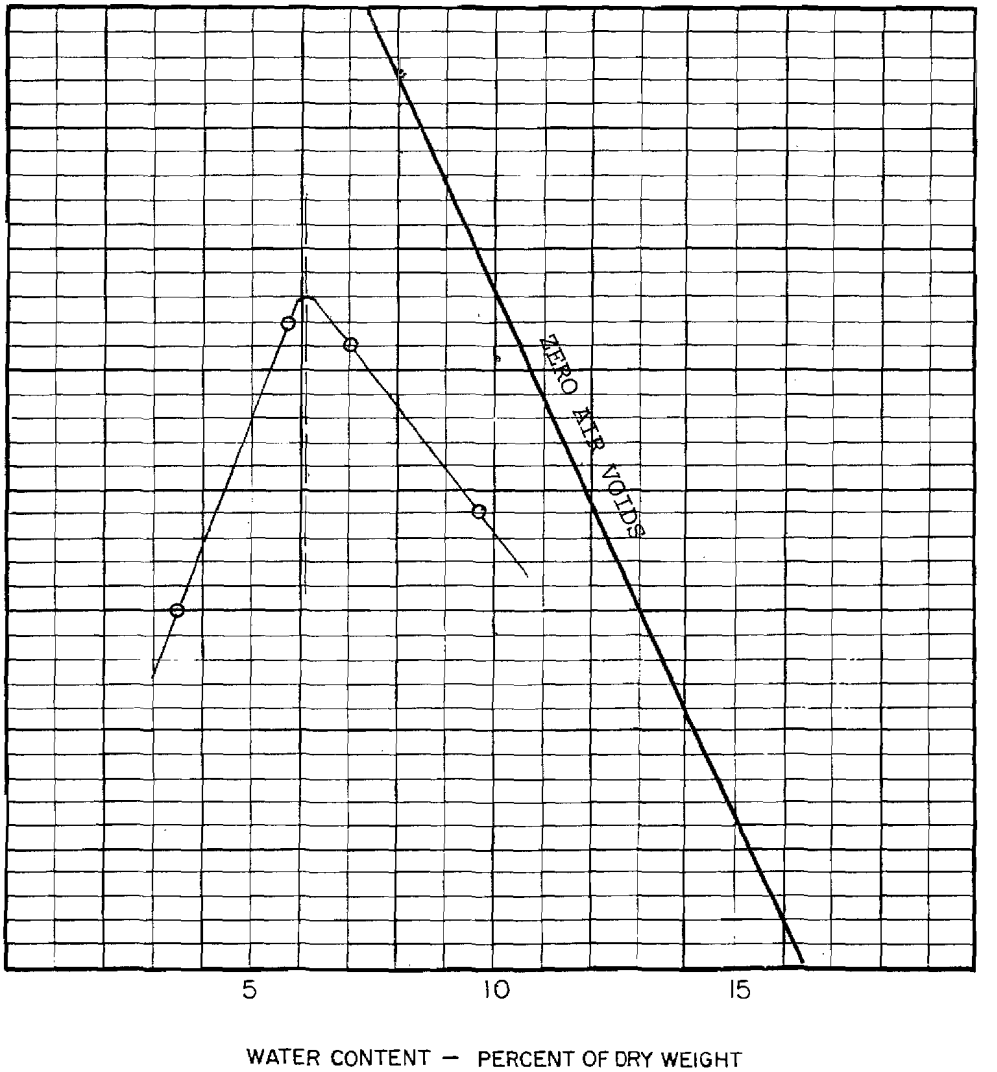
Liquid Limit: 21.7 % Plastic Limit: ____ % Plasticity Index: 9.2

B. Test Procedure Used: T-180 Method "D" - AASHTO

C. Test Results: Maximum Dry Density: 139.0 PCF Optimum Water Content: 6.2 %

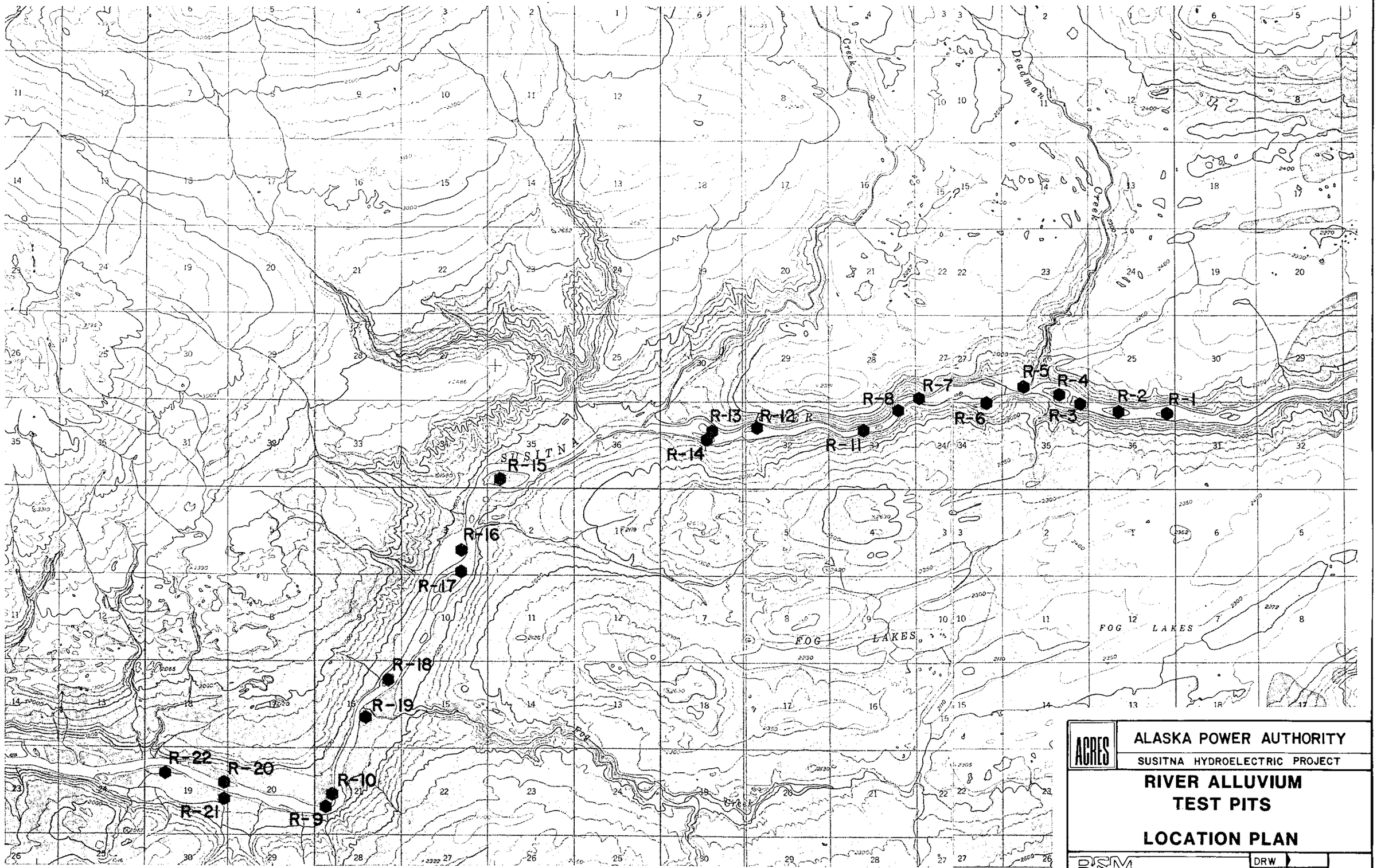
Sieve Analysis

Size	% Passing
2 "	100
1 ½"	95
1 "	88
3/4"	84
1/2"	81
3/8"	78
# 4	71
# 10	64
# 40	53
#200	38.2
.02mm	24.3
.005	13.6
.002	8.6



F.4 BORROW SITES I AND J

TEST PIT/TEST TRENCH LOGS



ACRES

ALASKA POWER AUTHORITY

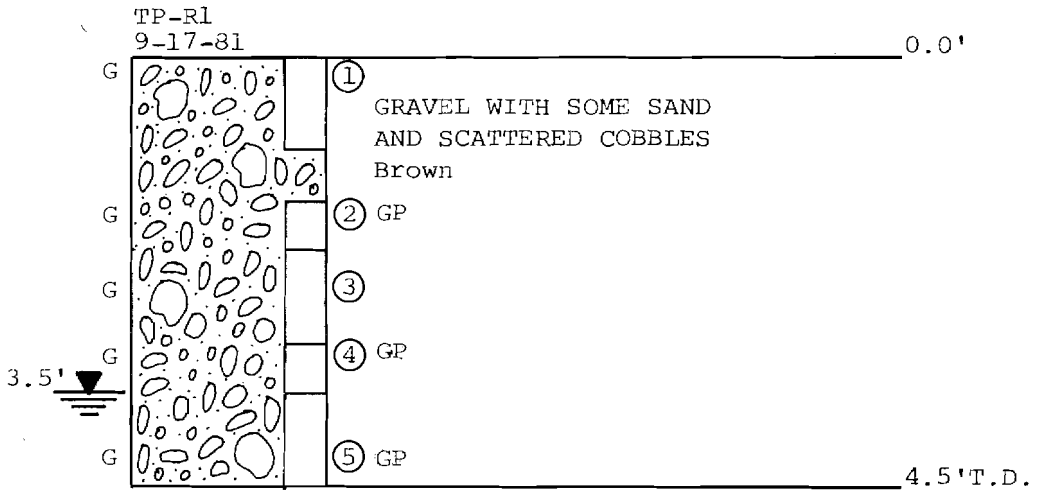
SUSITNA HYDROELECTRIC PROJECT

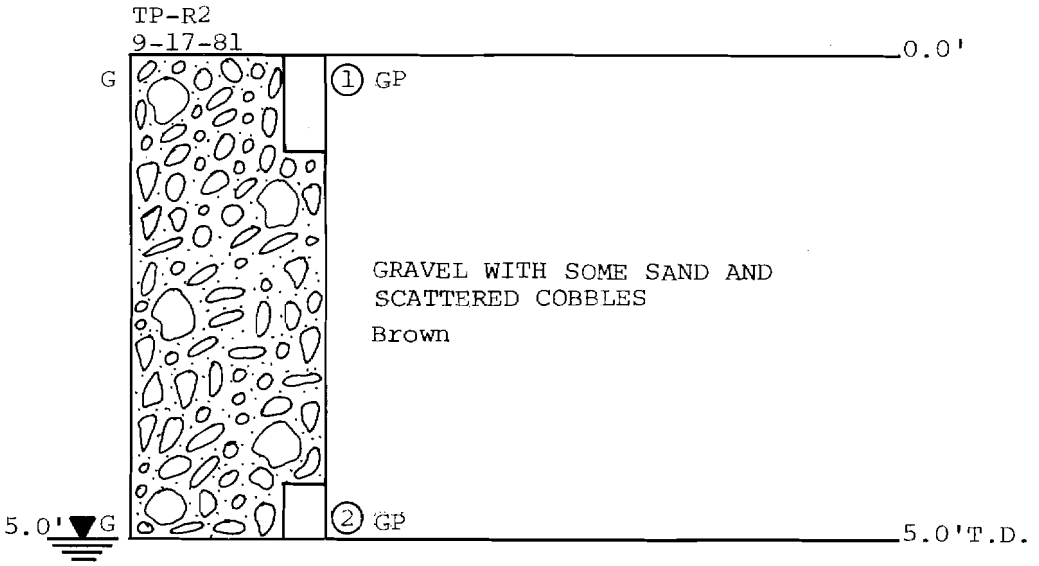
RIVER ALLUVIUM TEST PITS

LOCATION PLAN

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

DRW	
CHK	
APP'D	





ALASKA RESOURCES LIBRARY
U.S. Department of the Interior

Prepared by:

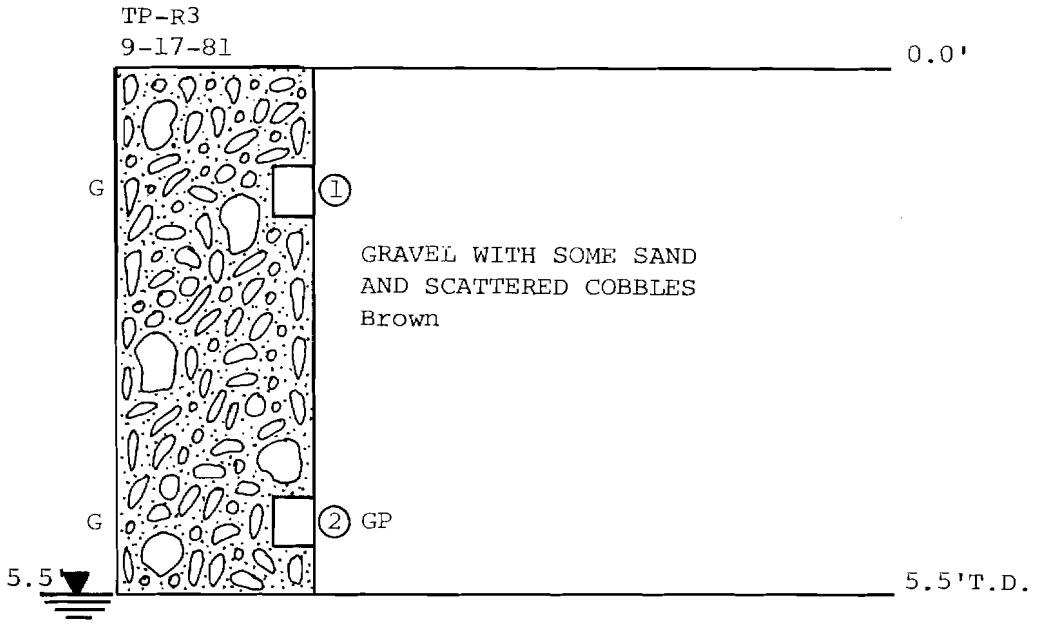
R&M CONSULTANTS, INC.

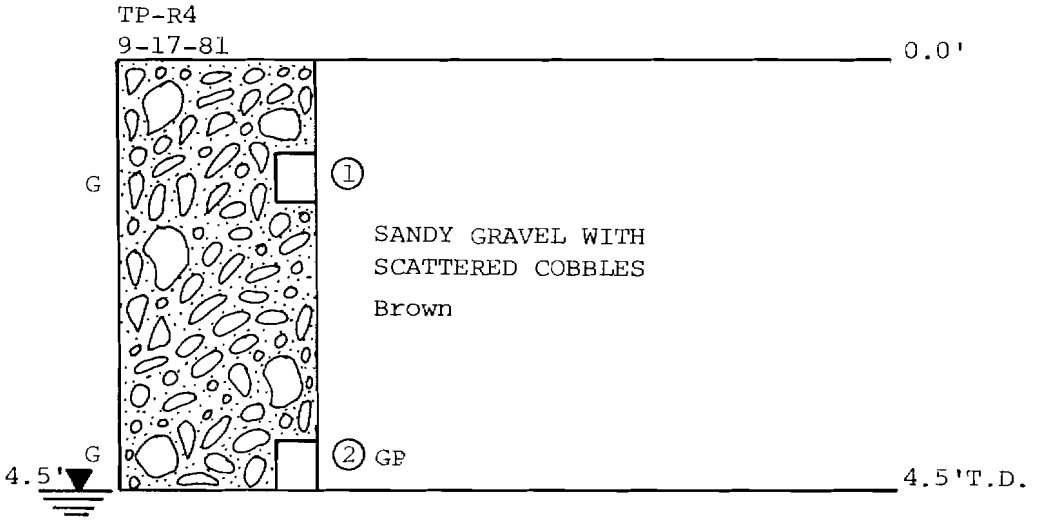
RIVER ALLUVIUM
TEST PITS
TP-R1, R2

Prepared for:

ACRES

Scale: 1"=2'





Prepared by:

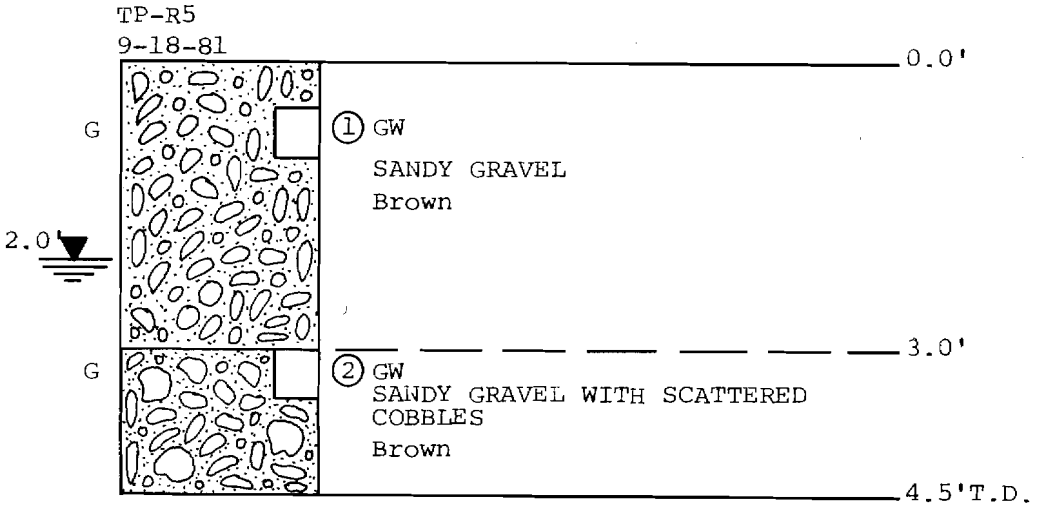
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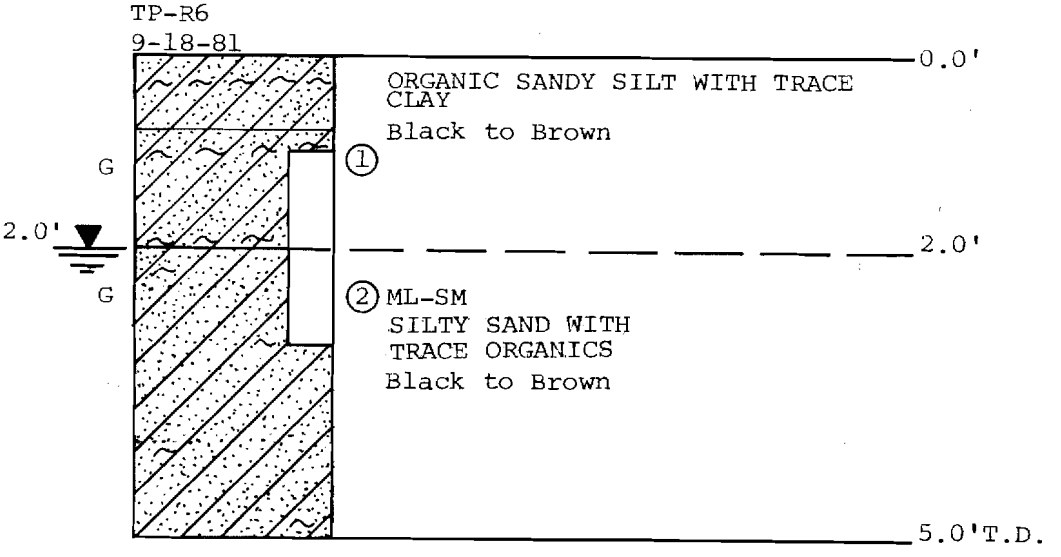
RIVER ALLUVIUM
TEST PITS
TP-R3, R4

Prepared for:

ACRES

Scale: 1"=2'





Prepared by:

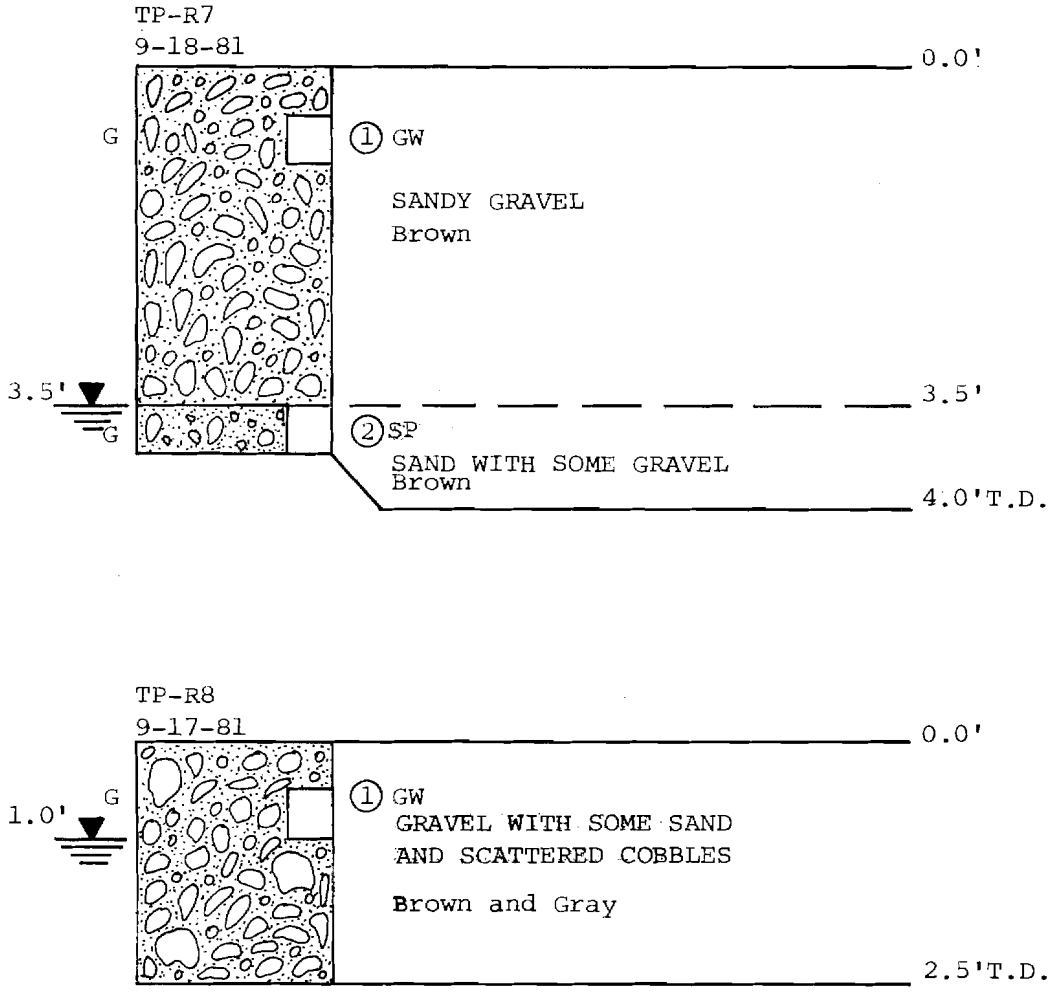
R&M CONSULTANTS, INC.

RIVER ALLUVIUM
TEST PITS
TP-R5, R6

Prepared for:

ACRES

Scale: 1"=2'



Prepared by:

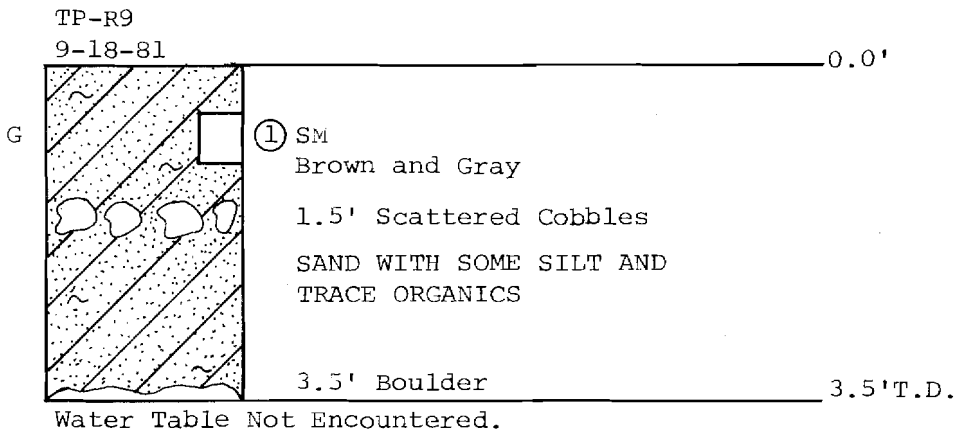
R&M CONSULTANTS, INC.

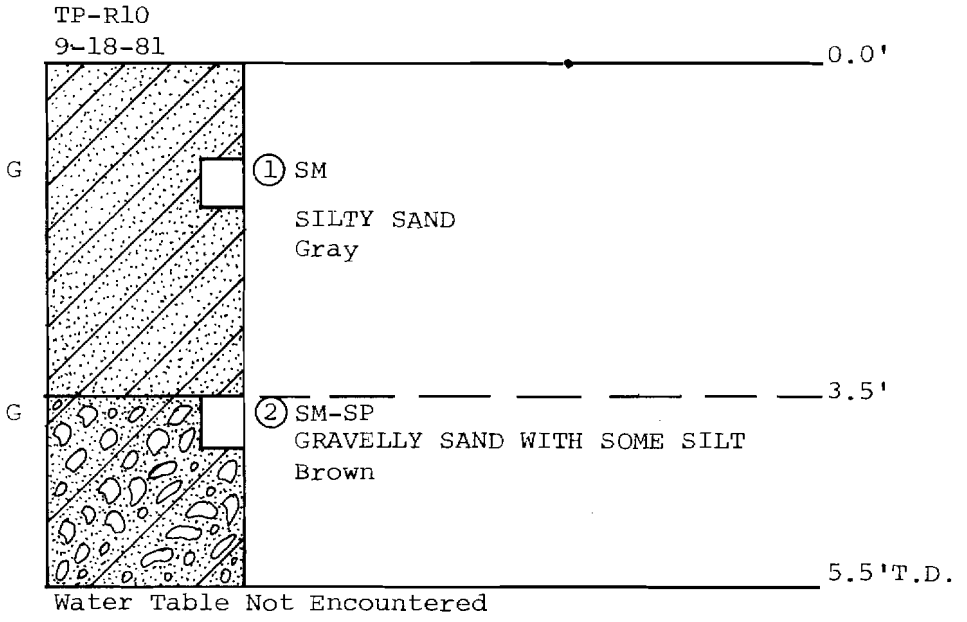
RIVER ALLUVIUM
TEST PITS
TP-R7, R8

Prepared for:

ACRES

Scale: 1"=2





Prepared by:

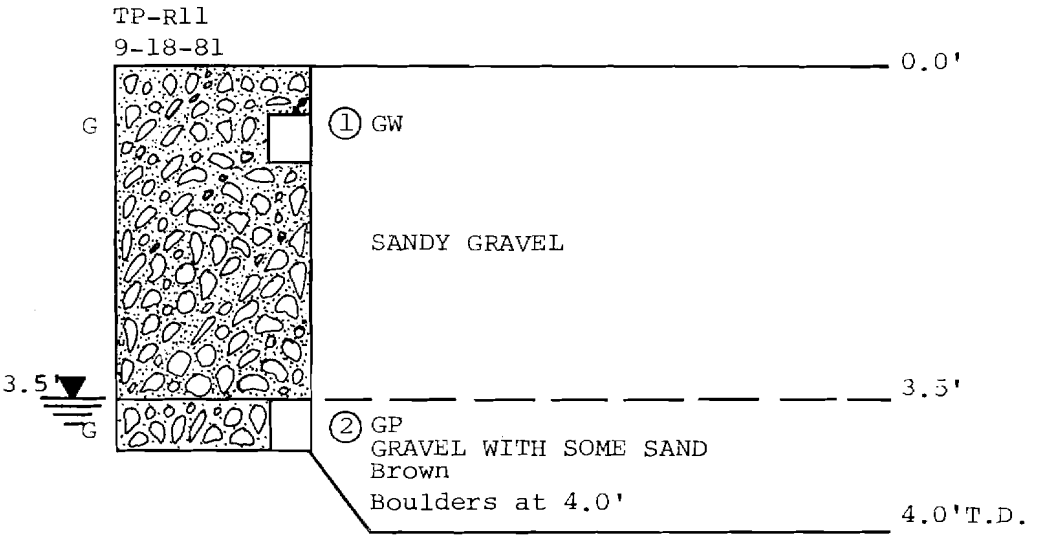
R&M CONSULTANTS, INC.

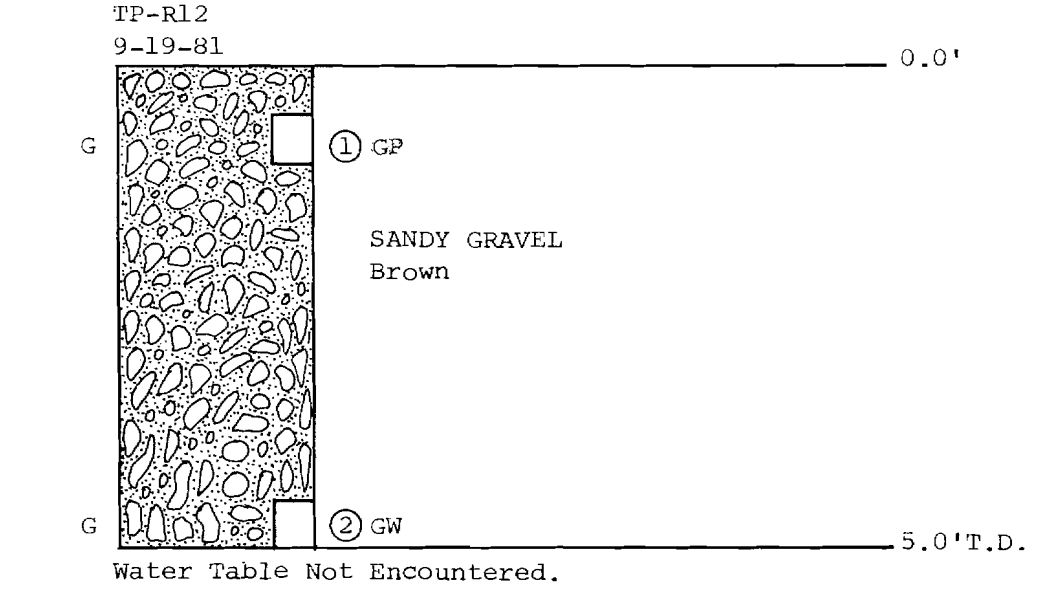
RIVER ALLUVIUM
TEST PITS
TP-R9, R10

Prepared for:

ACRES

Scale: 1"=2'





Water Table Not Encountered.

Prepared by:

R&M CONSULTANTS, INC.

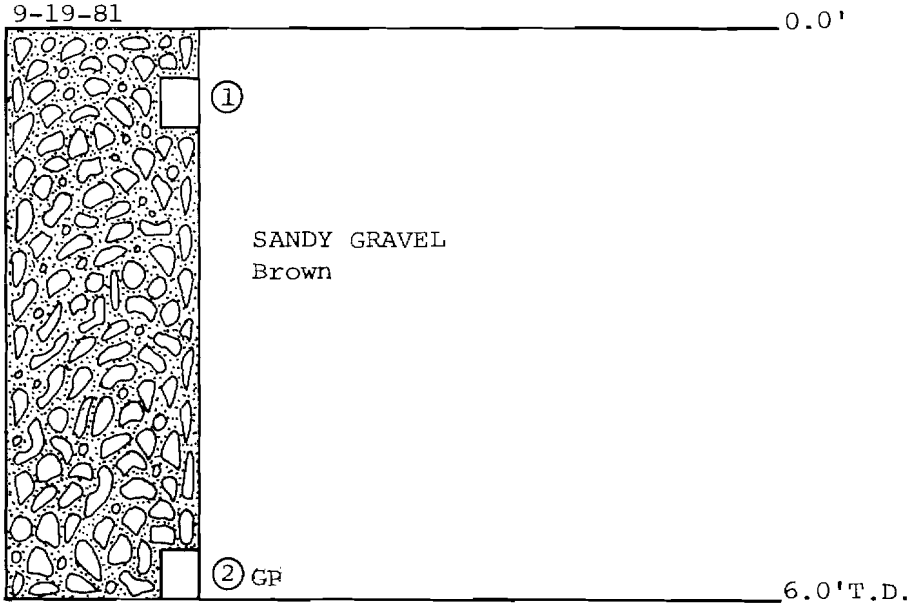
RIVER ALLUVIUM
TEST PITS
TP-R11, R12

Prepared for:

ACRES

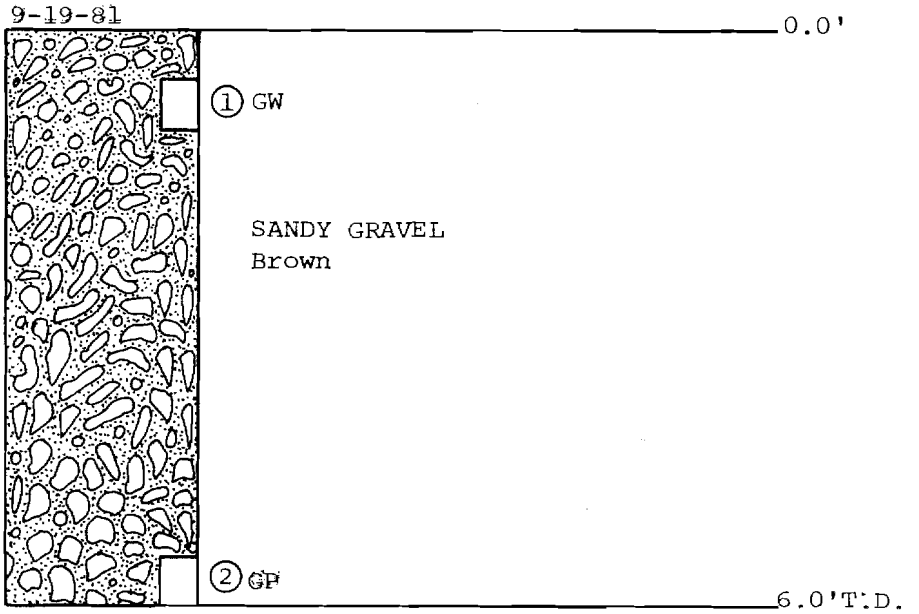
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TP-R13
9-19-81



Water Table Not Encountered.

TP-R14
9-19-81



Water Table Not Encountered

Prepared by:

R&M CONSULTANTS, INC.

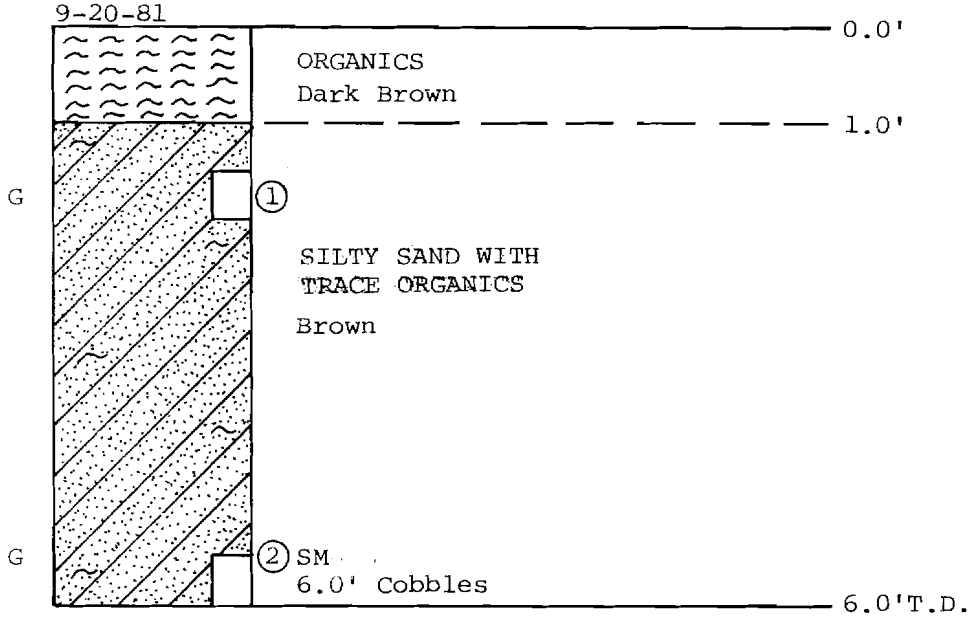
RIVER ALLUVIUM
TEST PITS
TP-R13, R14

Prepared for:

ACRES

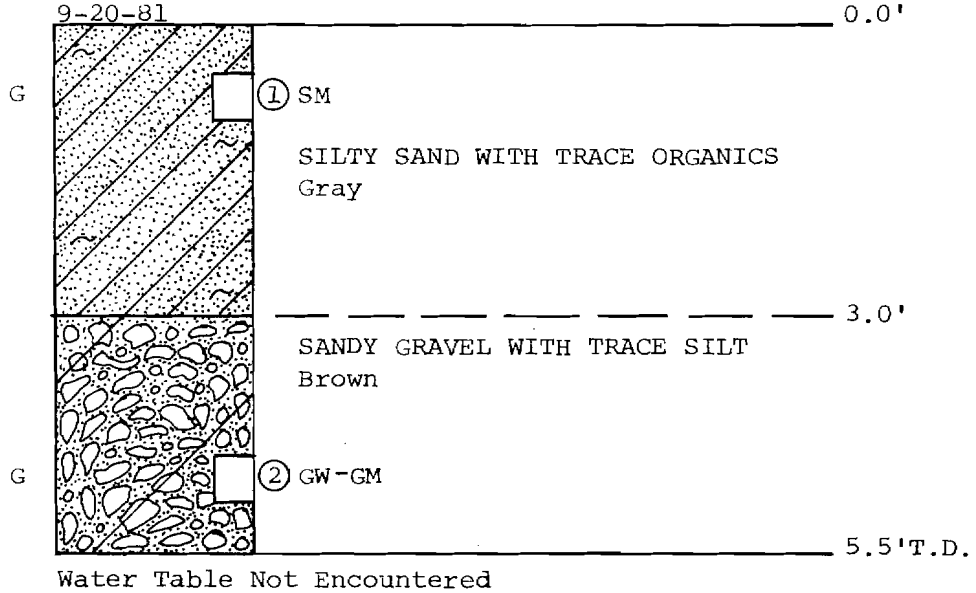
Sacle: 1"=2'

TP-R15
9-20-81



Water Table Not Encountered

TP-R16
9-20-81



Water Table Not Encountered

Prepared by:

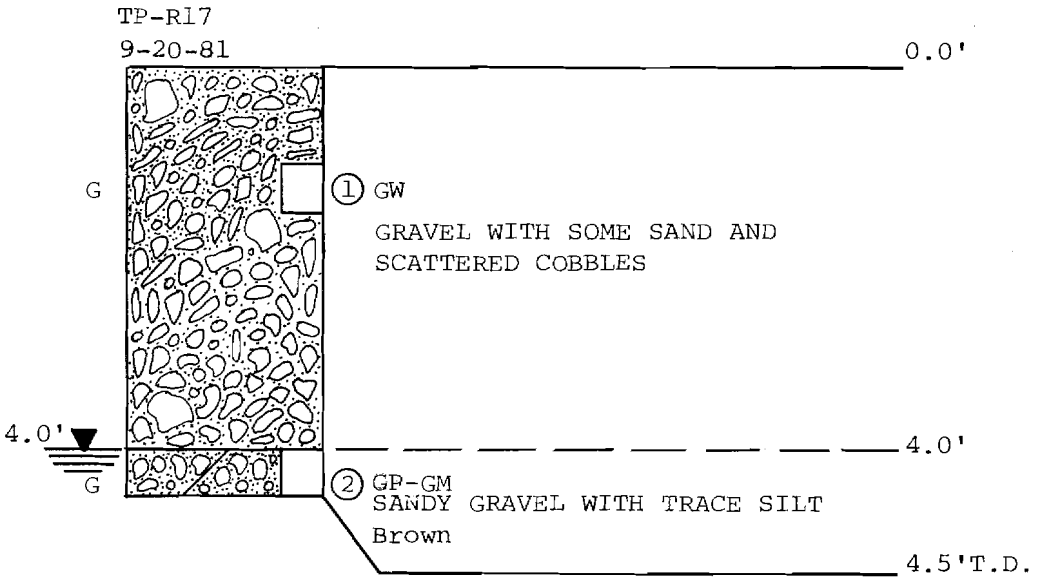
R&M CONSULTANTS, INC.

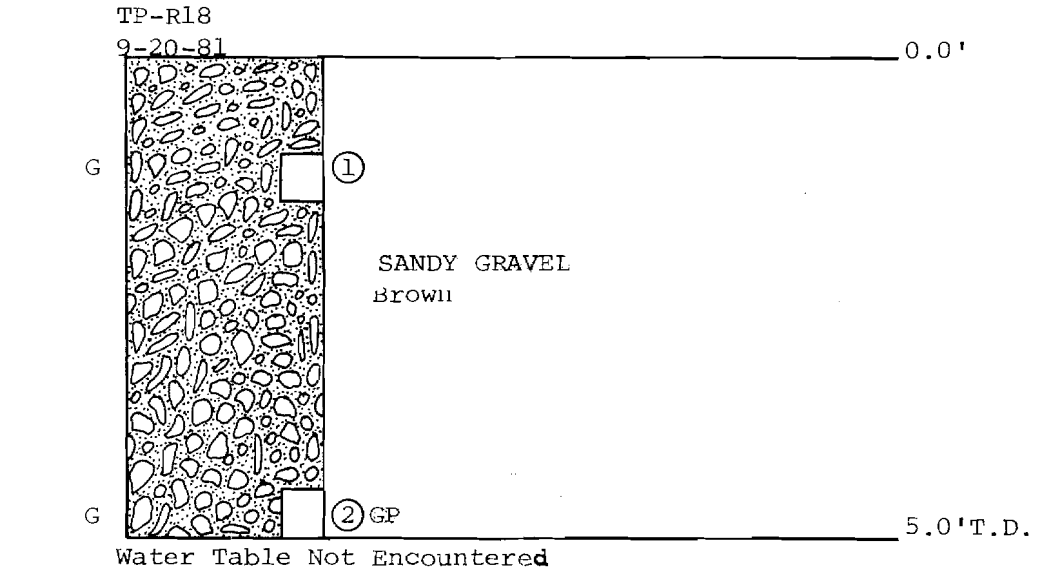
RIVER ALLUVIUM
TEST PITS
TP-R15, R16

Prepared for:

ACRES

Scale: 1"=2'





Prepared by:

R&M CONSULTANTS, INC.

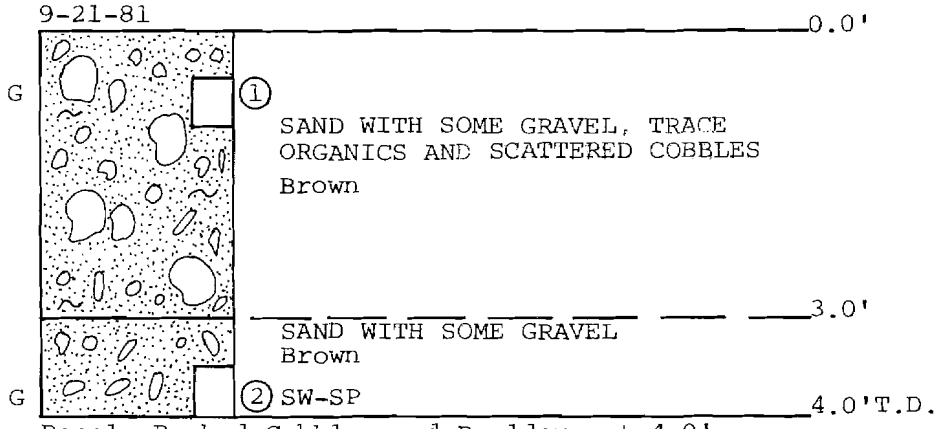
RIVER ALLUVIUM
TEST PITS
TP-R17, R18

Scale: 1"=2'

Prepared for:

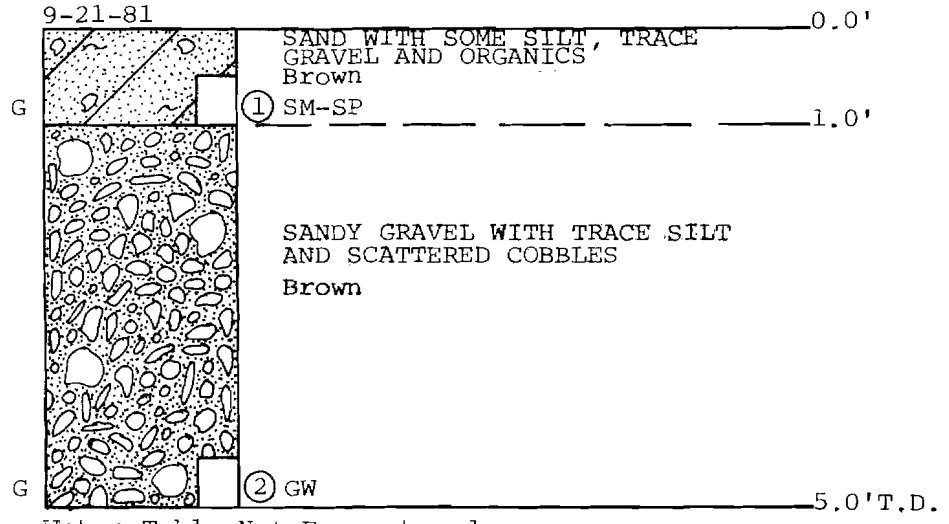
ACRES

TP-R19
9-21-81



Densly Packed Cobbles and Boulders at 4.0'
Water Table Not Encountered

TP-R20
9-21-81



Water Table Not Encountered.

Prepared by:

R&M CONSULTANTS, INC.

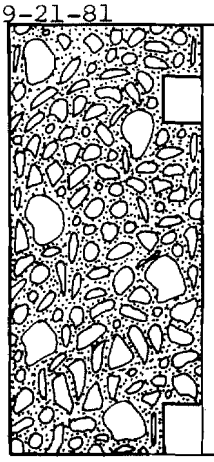
RIVER ALLUVIUM
TEST PITS
TP-R19, R20

Prepared for:

ACRES

Scale: 1"=2'

TP-R21
9-21-81



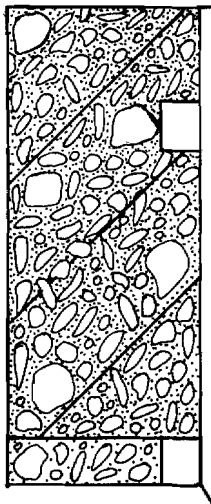
0.0'

G ① SAND AND GRAVEL WITH
NUMEROUS COBBLES
Brown

G ② 4.5'T.D.

Water Table Not Encountered.

TP-R22
9-21-81



0.0'

G ① GP-GM
SANDY GRAVEL WITH SOME
SILT AND SCATTERED COBBLES

Brown

4.5'

② GW
GRAVEL WITH SOME SAND AND
SCATTERED COBBLES
Brown 5.0'T.D.

Water Table Not Encountered.

Prepared by: R&M CONSULTANTS, INC.

RIVER ALLUVIUM
TEST PITS
TP-R21, R22

Prepared for: ACRES

Scale: 1"=2'

LABORATORY TEST DATA

PROJECT NO. 052504
CLIENT: Acres American, Inc.
PROJECT NAME Susitna Hydroelectric (Watana Dam Site)

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

DATE October 17, 1980

PARTY NO. _____ PAGE NO. _____

DESCRIPTION		4"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.
STREAM ALLUVIUM	W-80-302 (Crab Sample)	100	92	90	82	69	58	45	38	27	23	14	2.6							GP

REMARKS: _____

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
CLIENT: Acres American, Inc.
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE October 29, 1981

PARTY NO. _____ PAGE NO. 1 of 3

SUMMARY OF LABORATORY TEST DATA

BORING NO.	SAMPLE NO.	DEPTH	4½"	4"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	.02	.005	.002	CLASS
TP-R1	2	1.5'-2.0'		100	95	89	78	67	59	49	43	31	22	16	13	6	4	2.2				GP
TP-R1	4	3.0'-3.5'		100	99	87	79	65	56	45	39	28	20	14	13	5	4	1.5				GP
TP-R1	5	3.5'-4.5'		100	98	94	79	67	57	46	39	29	21	17	13		4	1.5				GP
TP-R2	1	0.0'-1.0'		100	77	64	54	44	39	33	29	23	18	16	15	7	5	2.0				GP
TP-R2	2	4.5'-5.0'	100	94	89	74	63	50	42	34	30	21	14	11	11	6	5	2.0				GP
TP-R3	2	4.5'-5.0'			100	96	89	72	60	47	40	29	22	17	14	5	3	1.2				GP
TP-R4	2	4.0'-4.5'		100	97	86	77	65	58	49	43	31	25	17	11		2	0.7				GP
TP-R5	1	0.5'-1.0'			100	90	79	69	61	53	47	36	23	12	8	5	4	2.2				GW
TP-R5	2	3.0'-3.5'	100	95	90	80	75	66	60	51	44	32	21	10	8		2	1.1				GW
TP-R6	2	2.0'-3.0'									100	99	95	92	89	72	65	47.2	15.6	3.8	2.4	ML-SM
TP-R7	1	0.5'-1.0'			100	95	86	71	62	52	45	32	24	18	11	7	1	0.5				GW
TP-R7	2	3.5'-4.0'				100	91	91	87	86	84	77	75	72	47		3	1.0				SP
TP-R8	1	0.5'-1.0'		100	92	73	67	57	51	44	39	28	19	15	11	5	4	1.7				GW

REMARKS: River Alluvium Test Pits, Watana Area

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
CLIENT: ACRES AMERICAN, INC.
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE October 29, 1981

SUMMARY OF LABORATORY TEST DATA

PARTY NO. _____ PAGE NO. 2 of 3

BORING NO.	SAMPLE NO.	DEPTH	4½"	4"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	.02	.005	.002	CLASS
TP-R9	1	0.5'-1.0'												100	99	62	50	24.6	4.0	1.5	1.3	SM
TP-R10	1	1.0'-1.5'												100	99	82	68	30.0				SM
TP-R10	2	3.5'-4.0'			100	92	88	81	76	71	68	64	61	59	55	38	31	14.0	2.0	.67	.63	SM-SP
TP-R11	1	0.5'-1.0'			100	90	80	66	58	48	42	33	27	24	19	7	6	2.4				GW
TP-R11	2	3.5'-4.0'			100	92	81	68	60	49	42	30	22	19	14	5	4	2.0				GP
TP-R12	1	0.5'-1.0'			100	92	77	65	58	49	43	33	26	23	21		7	3.3				GP
TP-R12	2	4.5'-5.0'			100	89	79	67	59	49	43	32	25	20	14	5	3	1.5				GW
TP-R13	2	5.5'-6.0'			100	93	85	74	65	54	49	38	31	22	12	4	3	1.7				GP
TP-R14	1	0.5'-1.0'			100	95	88	75	66	55	48	36	28	22	20	7	5	1.7				GW
TP-R14	2	5.5'-6.0'			100	93	84	69	61	52	47	36	27	19	13	5	4	1.4				GP
TP-R15	2	5.5'-6.0'													100	91	82	44.7	4.8	1.1	0.7	SM
TP-R16	1	0.5'-1.0'													100	89	78	36.8				SM
TP-R16	2	4.5'-5.0'			100	93	85	72	64	56	51	41	31	24	20	13	11	6.0	1.2	0.59	0.44	GW-GM

REMARKS: River Alluvium Test Pits, Watana Area

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
CLIENT: Acres American, Inc.
PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

SUMMARY OF LABORATORY TEST DATA

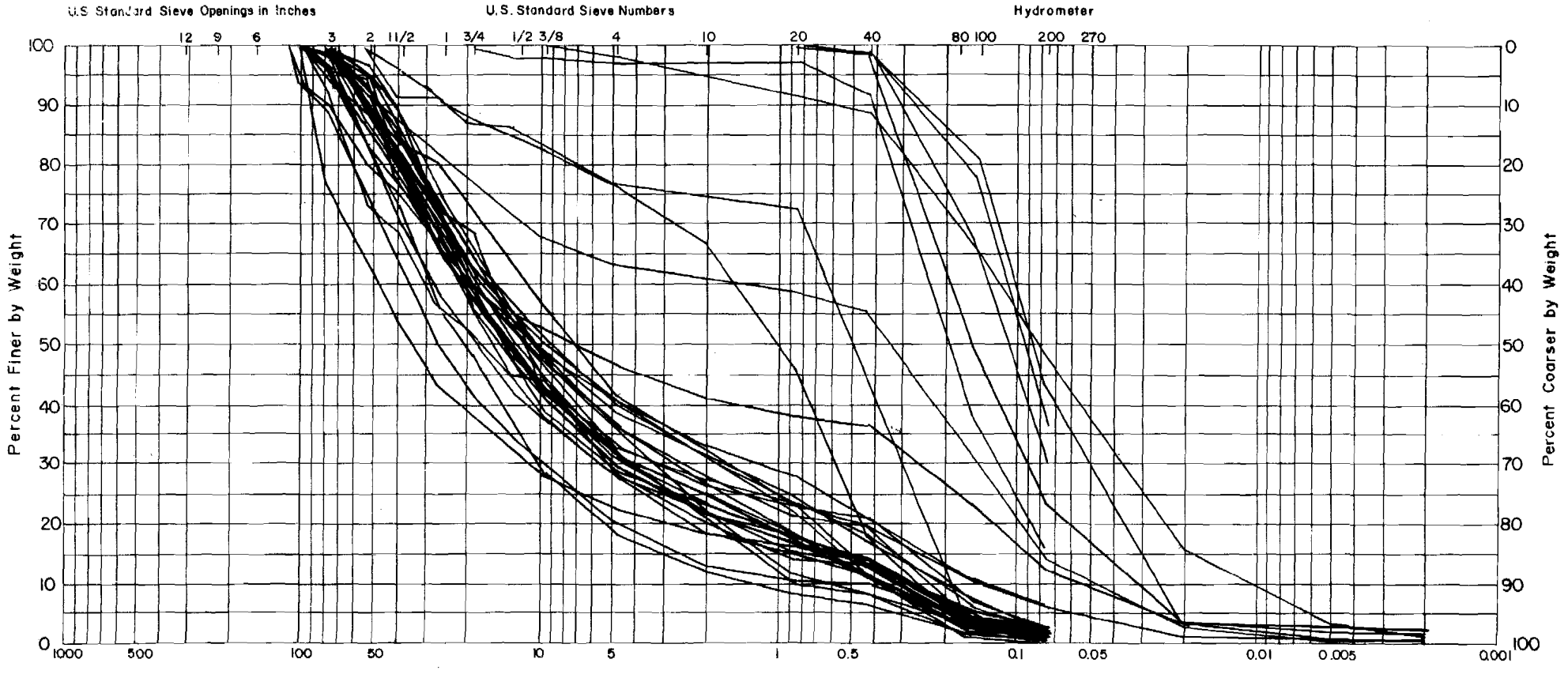
DATE October 29, 1981

PARTY NO. _____ PAGE NO. 3 of 3

BORING NO.	SAMPLE NO.	DEPTH	4½"	4"	3"	2"	1½"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	.02	.005	.002	CLASS
TP-R17	1	1.0'-1-5'		100	98	84	70	58	50	41	36	27	21	16	11	4	3	1.6				GW
TP-R17	2	4.0'-4.5'			100	91	82	70	63	55	50	41	34	28	21	13	11	7.0				GP-GM
TP-R18	2	4.5'-5.0'			100	91	84	81	73	63	56	42	33	24	14	5	4	2.8				GP
TP-R19	2	3.5'-4.0'				100	96	92	88	85	82	76	67	46	19	5	3	2.5				SW-SP
TP-R20	1	0.5'-1.0'							100	98	98	97	97	97	91	48	39	15.2				SM-SP
TP-R20	2	4.5'-5.0'		100	93	89	81	72	63	53	48	38	32	25	17	9	7	3.6				GW
TP-R22	1	1.0'-1.5'		100	96	84	76	67	61	55	52	46	41	38	36	26	23	12.7	2.4	1.0	0.6	GP-GM
TP-R22	2	4.5'-5.0'		100	96	83	72	56	47	36	29	18	12	9	7	3	2	1.2				GW

REMARKS: River Alluvium Test Pits, Watana Area

NOTE: SIEVE ANALYSIS = PERCENT PASSIN



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION

R&M CONSULTANTS INC.

RIVER ALLUVIUM

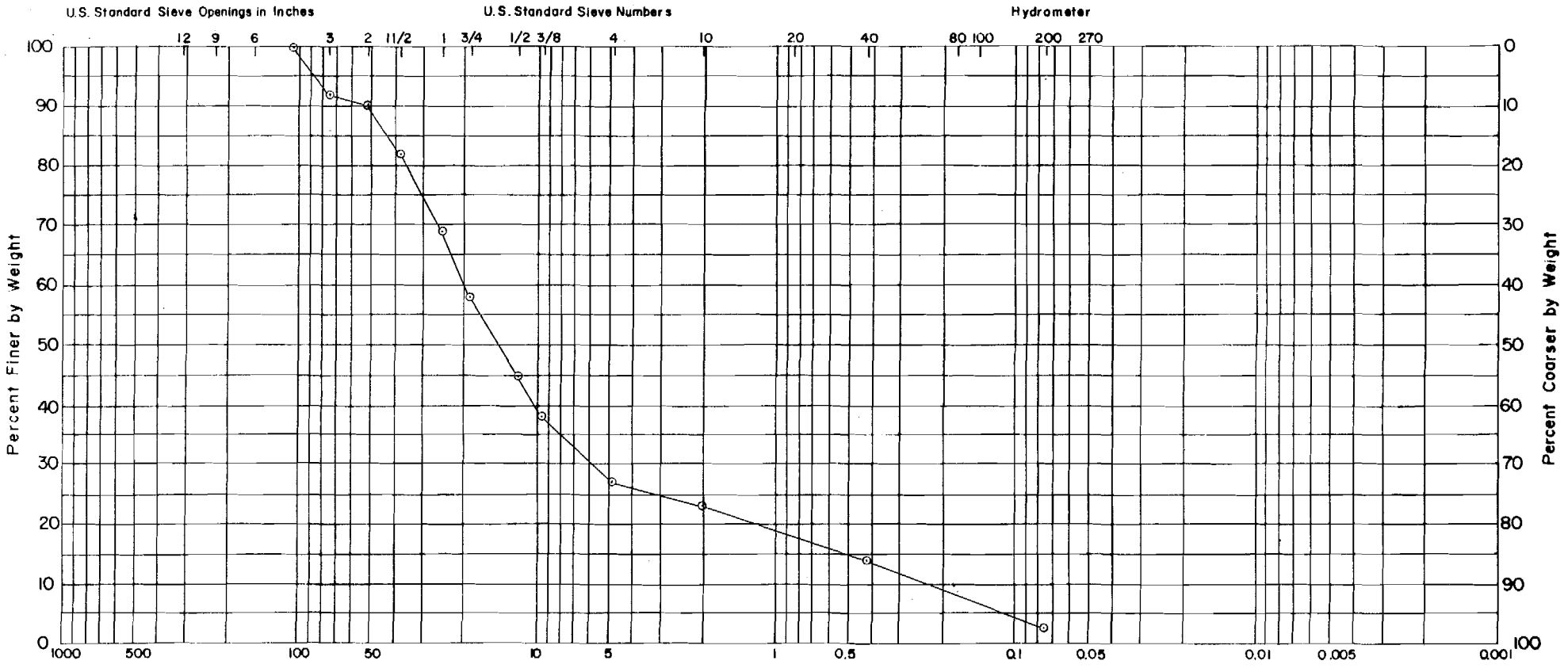
COMPOSITE GRADATION CURVE

DRAWN BY: J.M

APPROVED BY: L.J.A.

DATE: 1-82

PROJECT NO. 052506



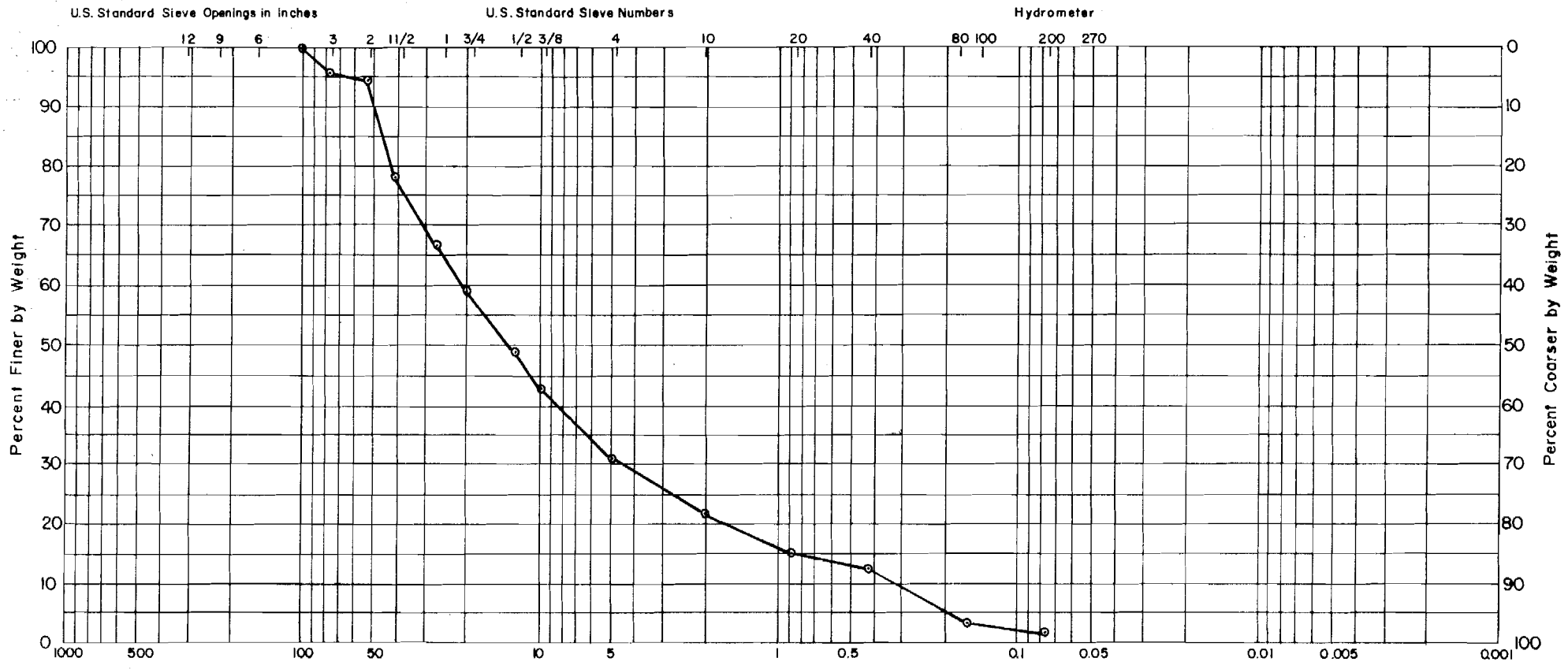
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
W-80-302					GP	SANDY GRAVEL W/TRACE SILT
(Grab Sample)						Poorly Graded

R&M CONSULTANTS INC.

STREAM ALUVIUM

DRAWN BY: DL
APPROVED BY:
DATE: December 1980
PROJECT NO. 052504



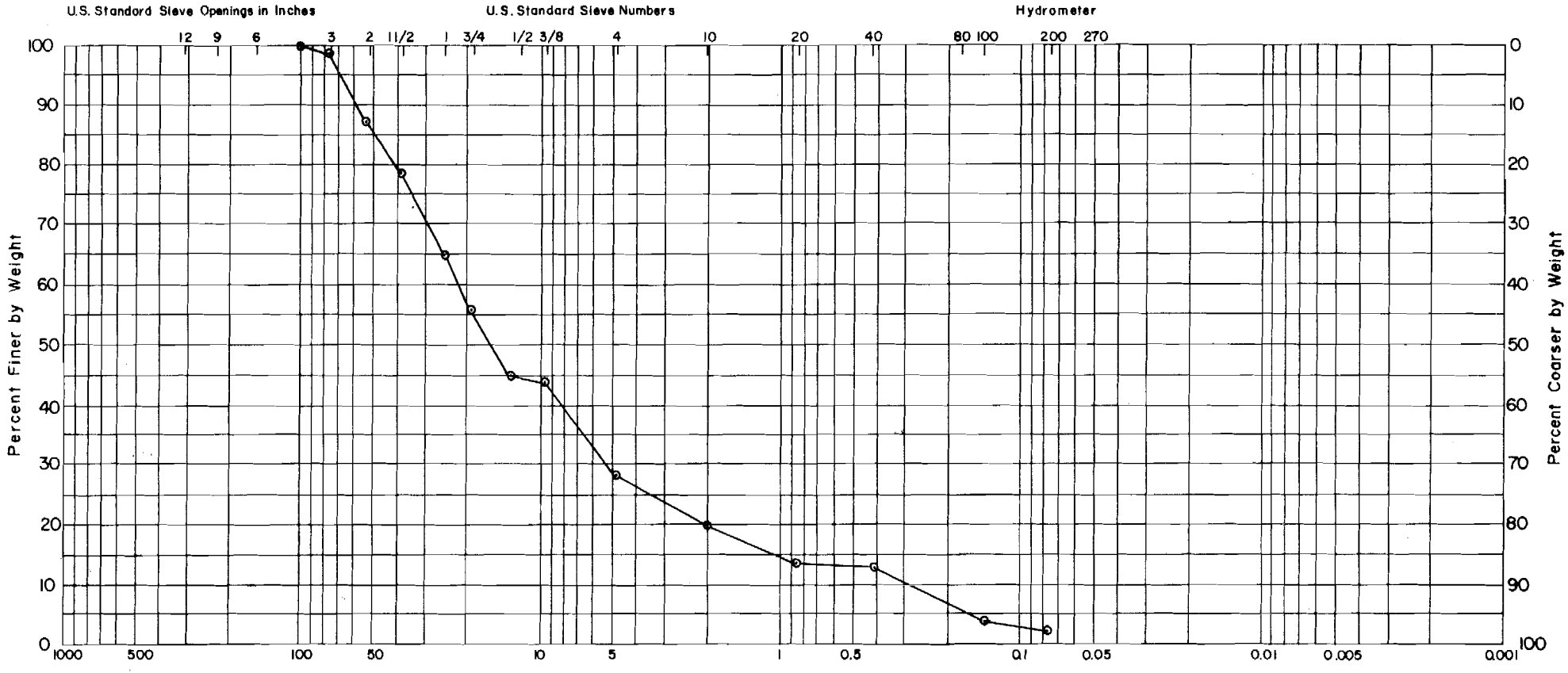
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R1 #2					GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R1

DRAWN BY:	P.T.
APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



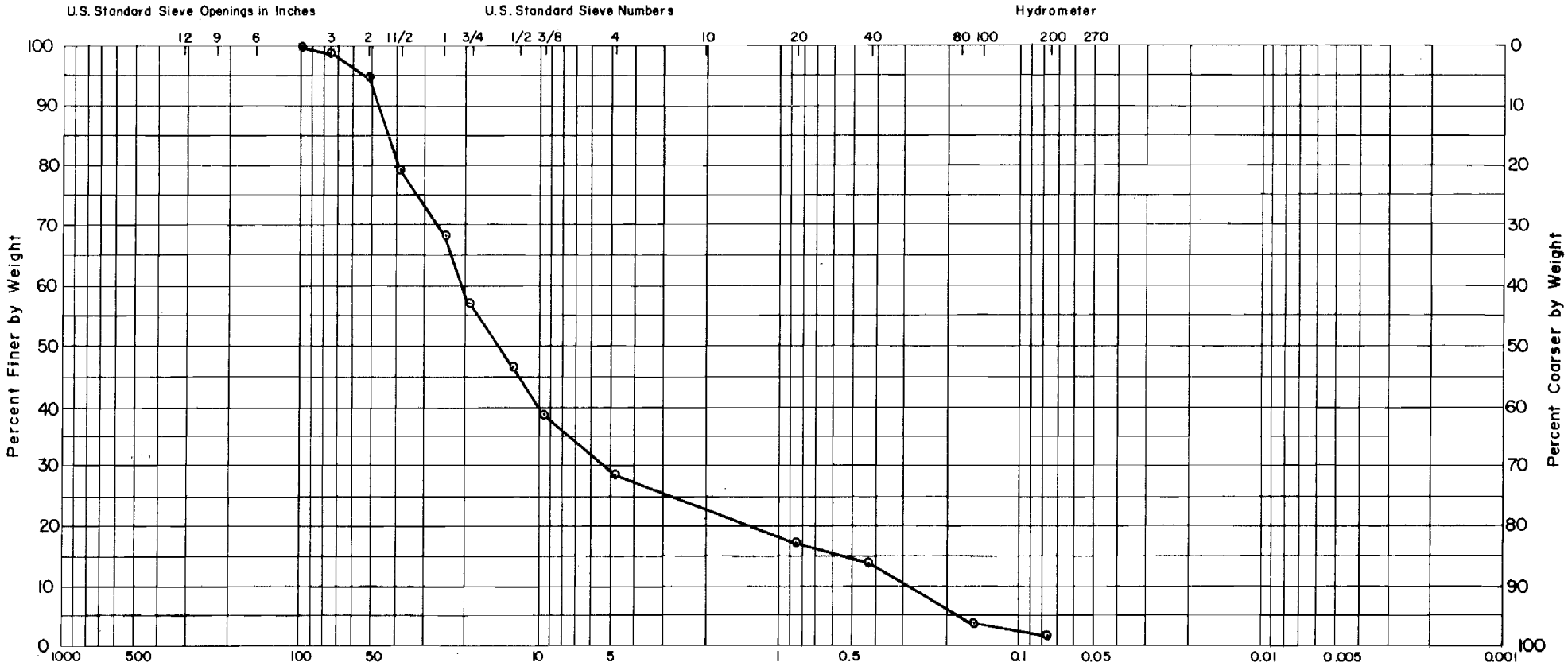
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R1 #4					GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R1

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



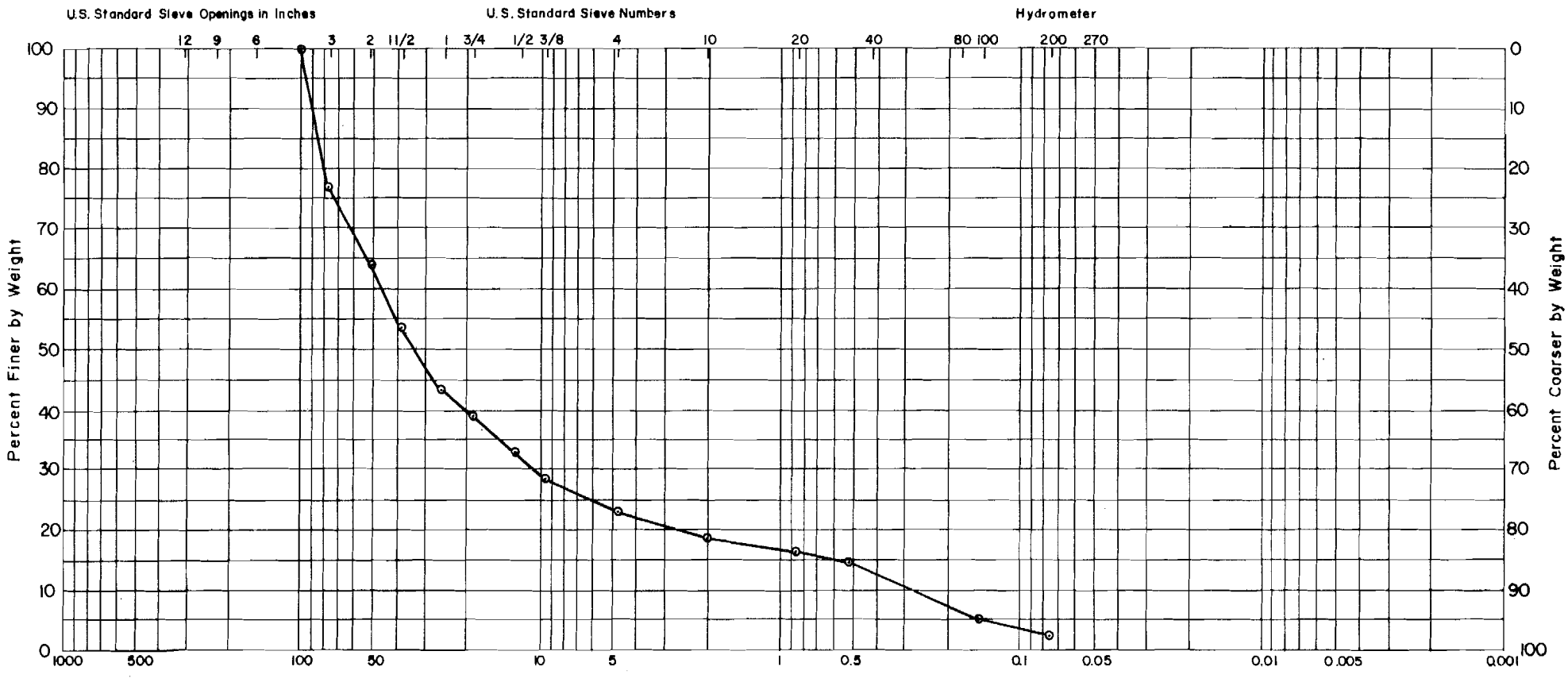
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R1 #5					GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R1

DRAWN BY:	P.T.
APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



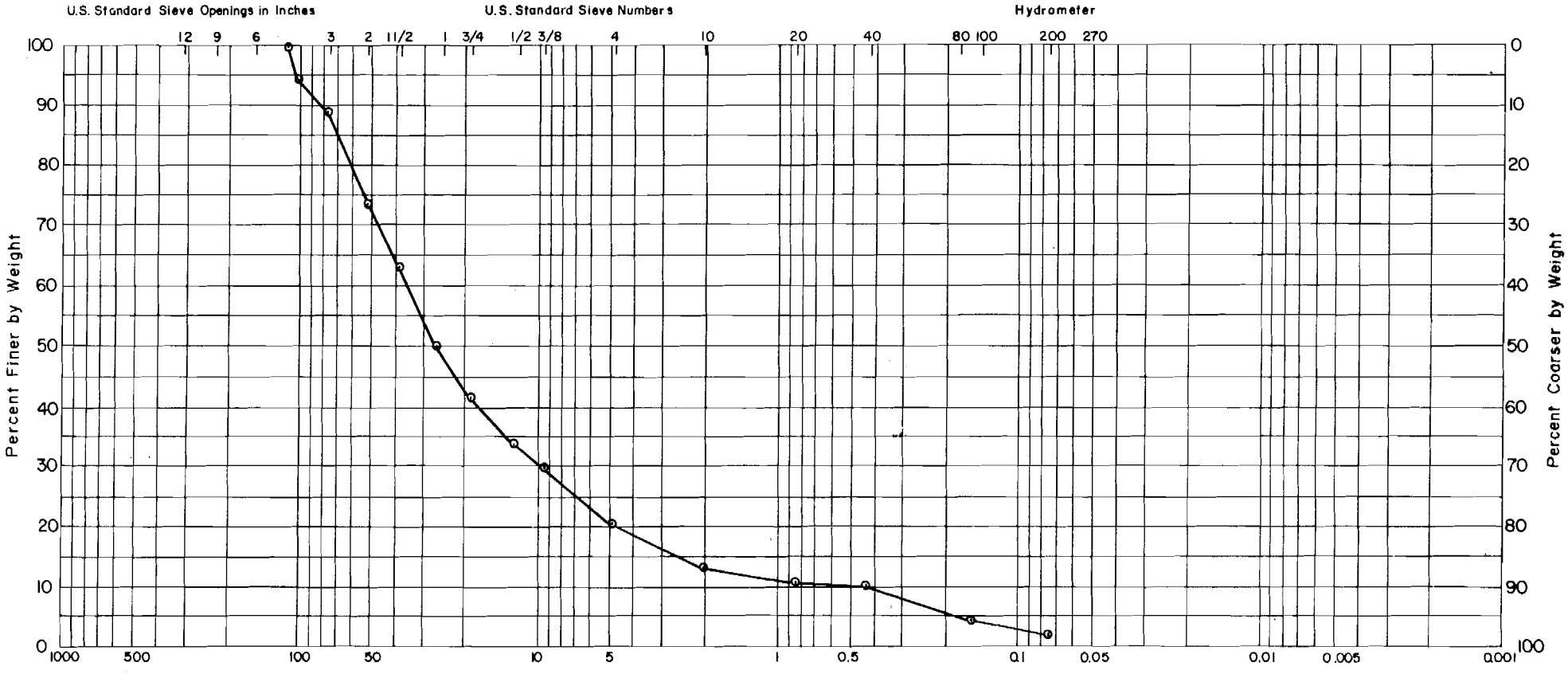
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R2 #1					GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R2

DRAWN BY:	P.T.
APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



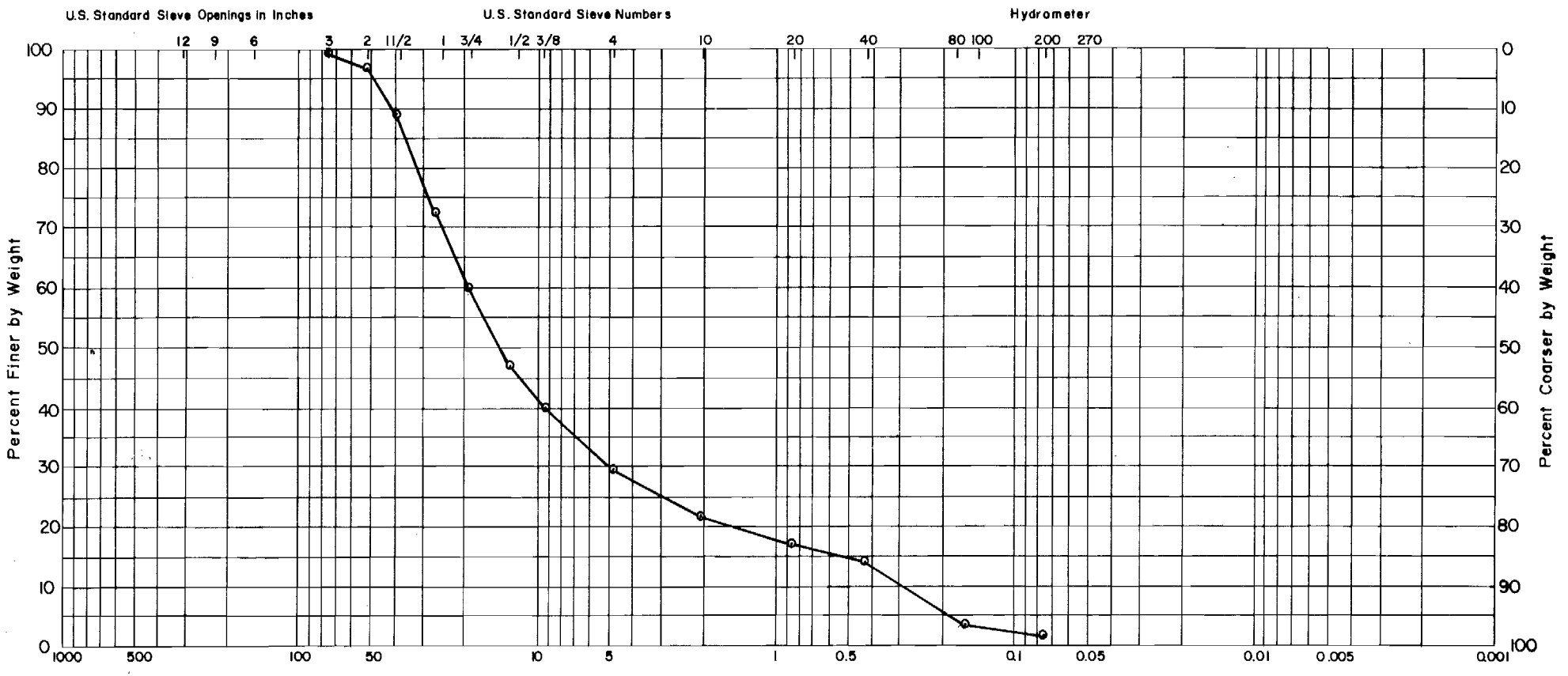
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R2. #2					GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R2

DRAWN BY:	P.T.
APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



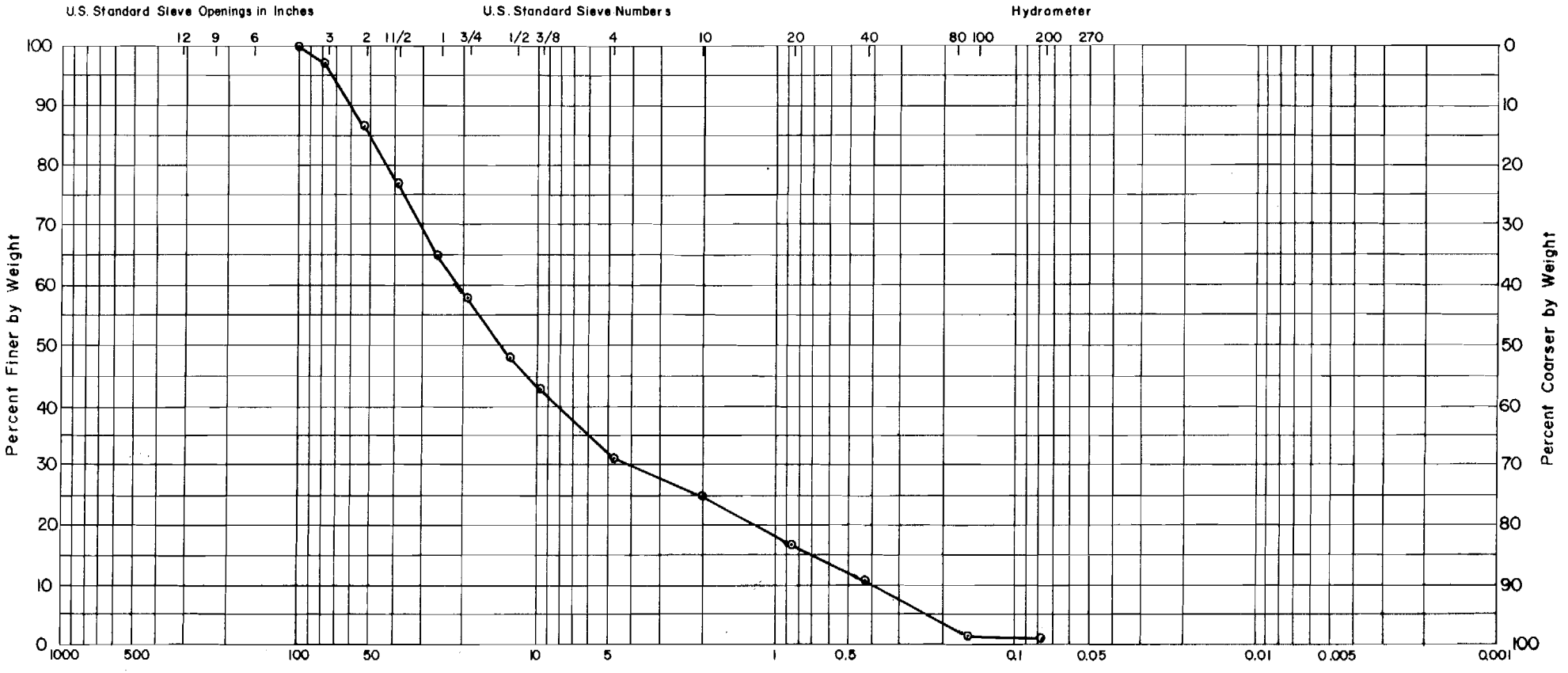
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R3 #2					GP	GRAVEL WITH SOME SAND

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R3

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



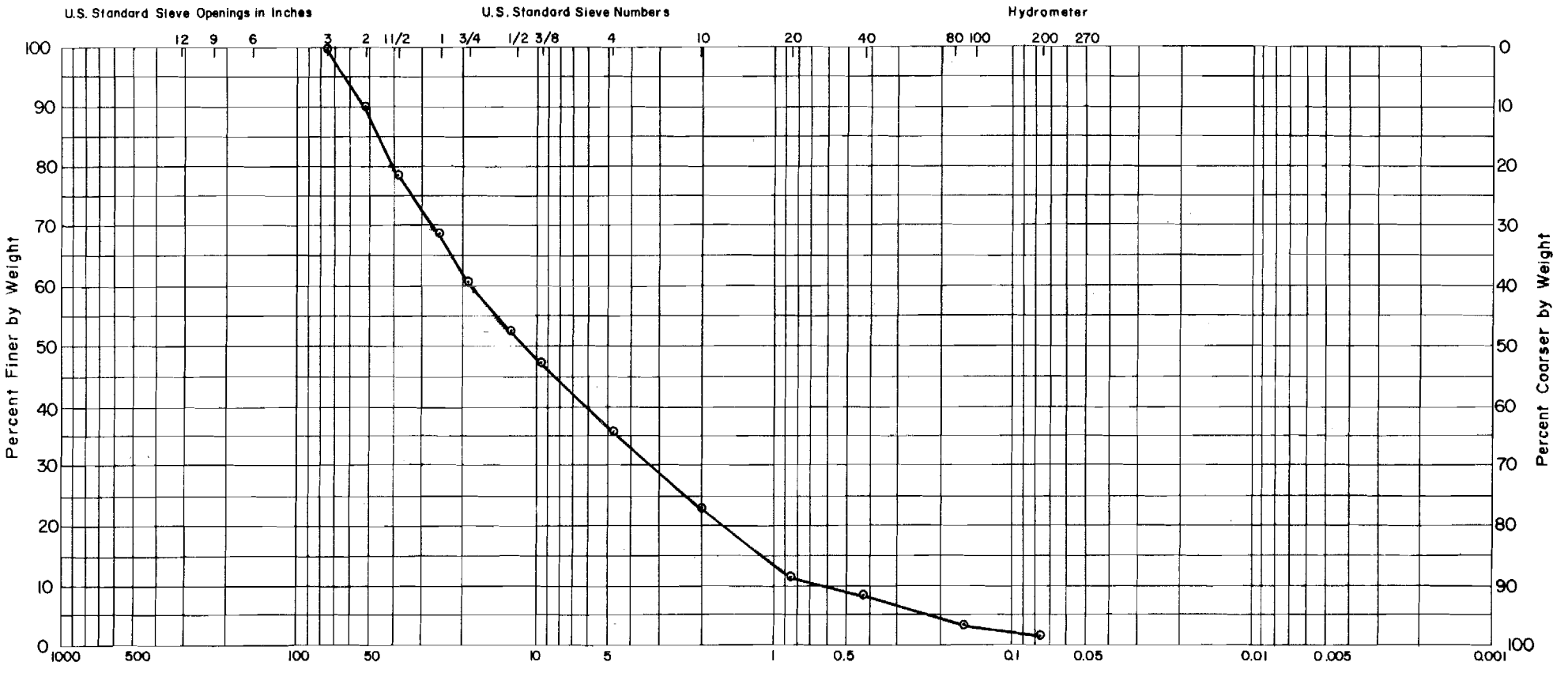
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R4 #2					GP	SANDY GRAVEL WITH SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R4

DRAWN BY:	P.T.
APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



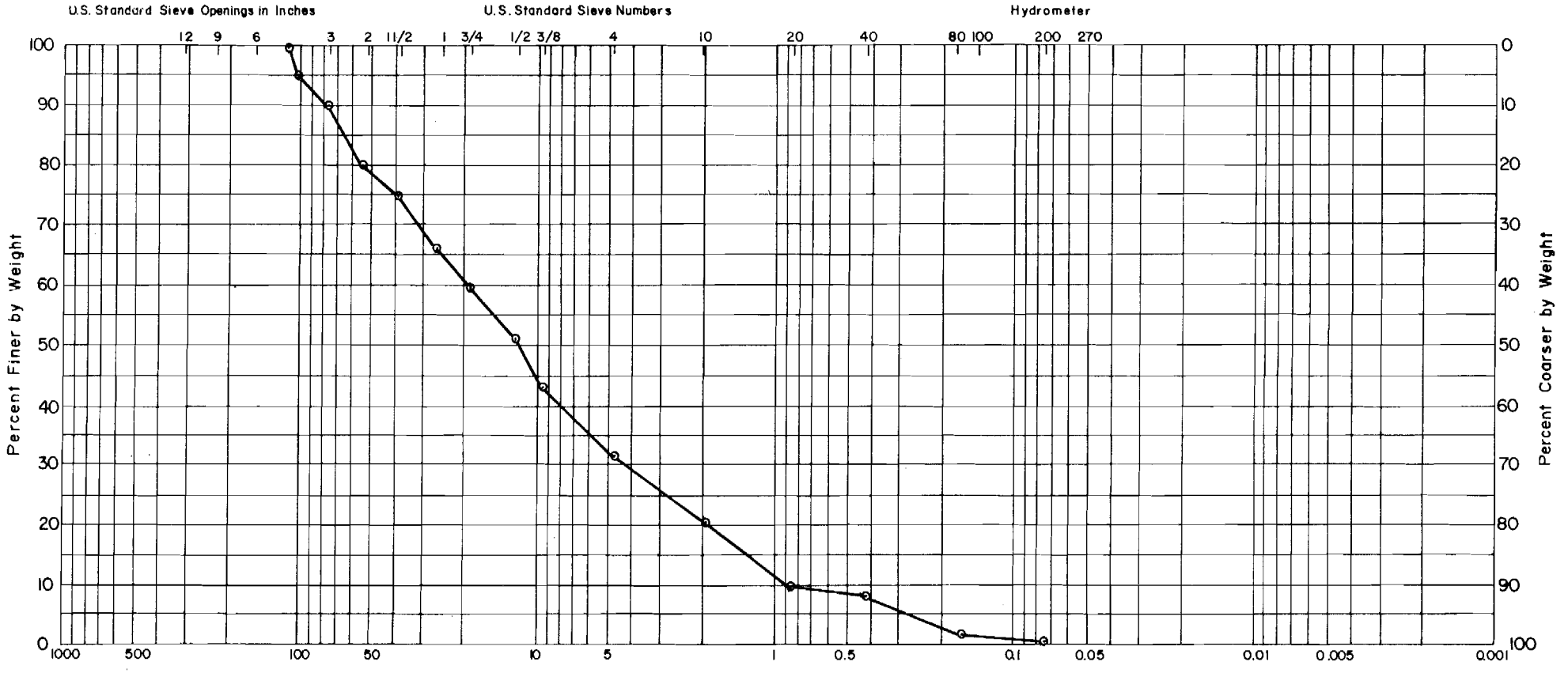
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R5 #1					GW	SANDY GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R5

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



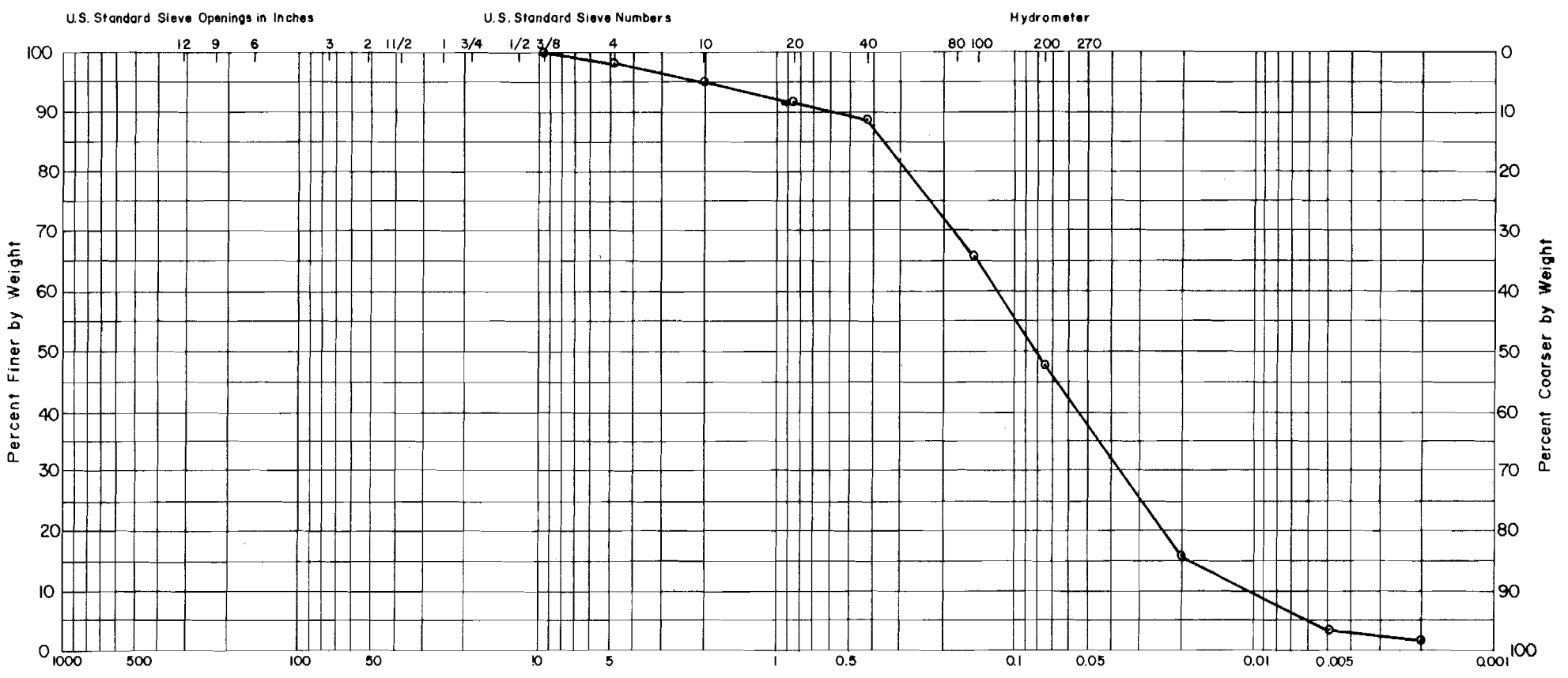
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R5 #2					GW	SANDY GRAVEL WITH SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R5

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



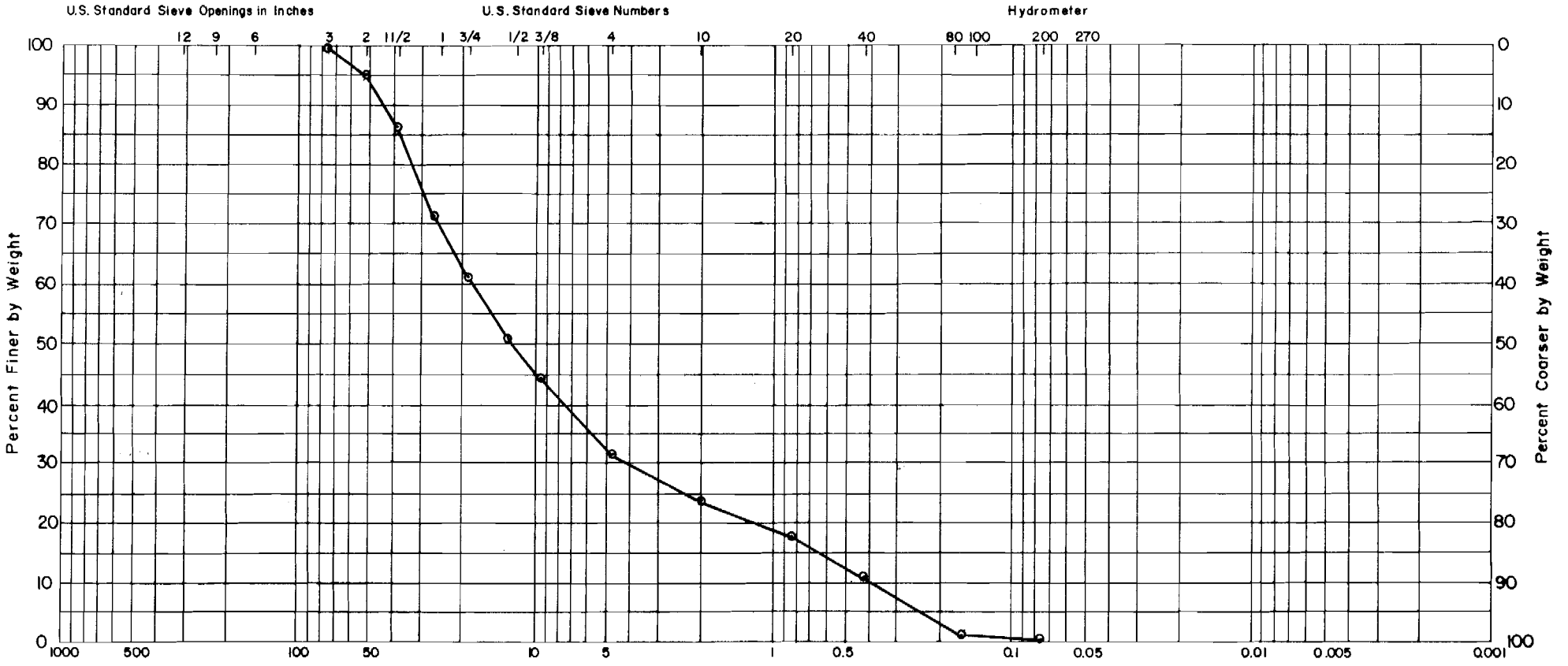
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R6 #2					ML-SM	SILTY SAND
						(FIELD GEOLOGIST NOTES TRACE ORGANICS)

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R6

DRAWN BY:	P.T.
APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



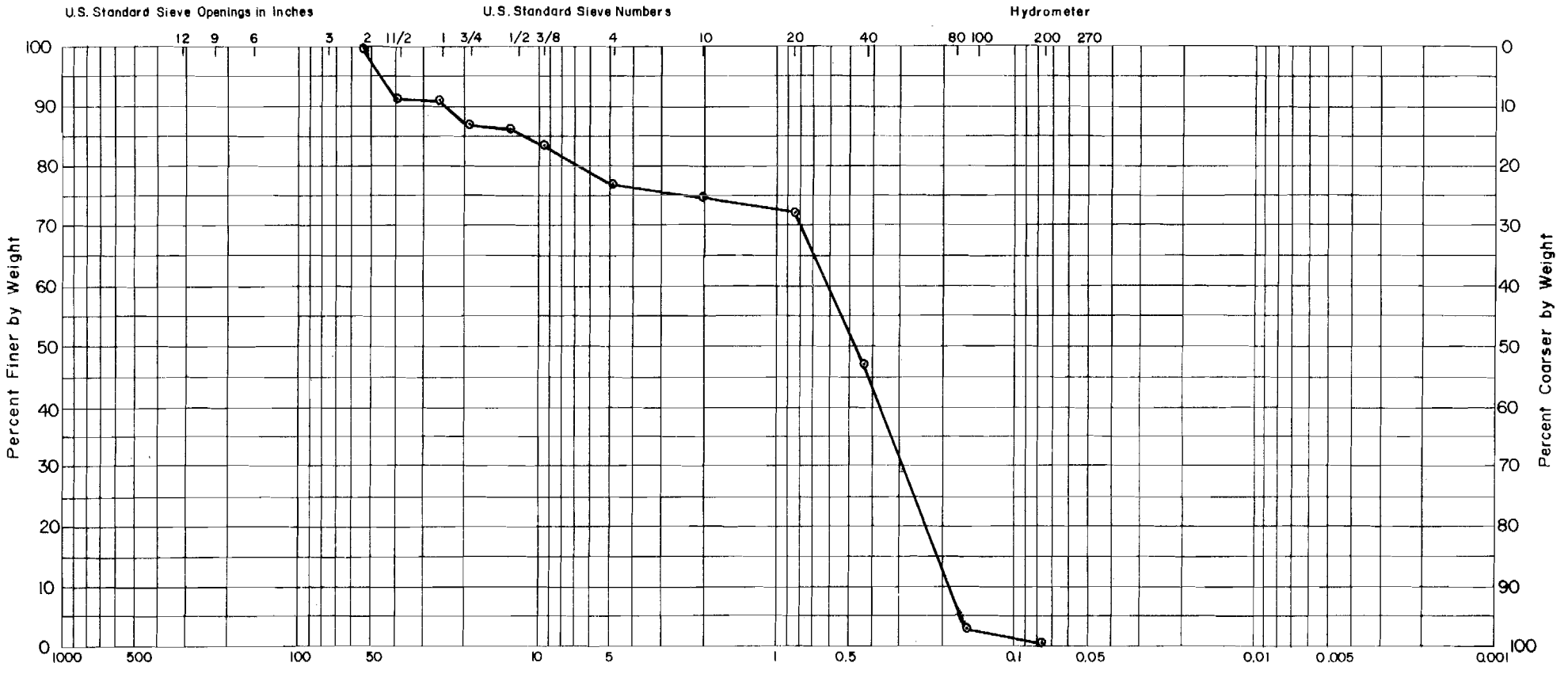
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R7 #1					GW	SANDY GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R7

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



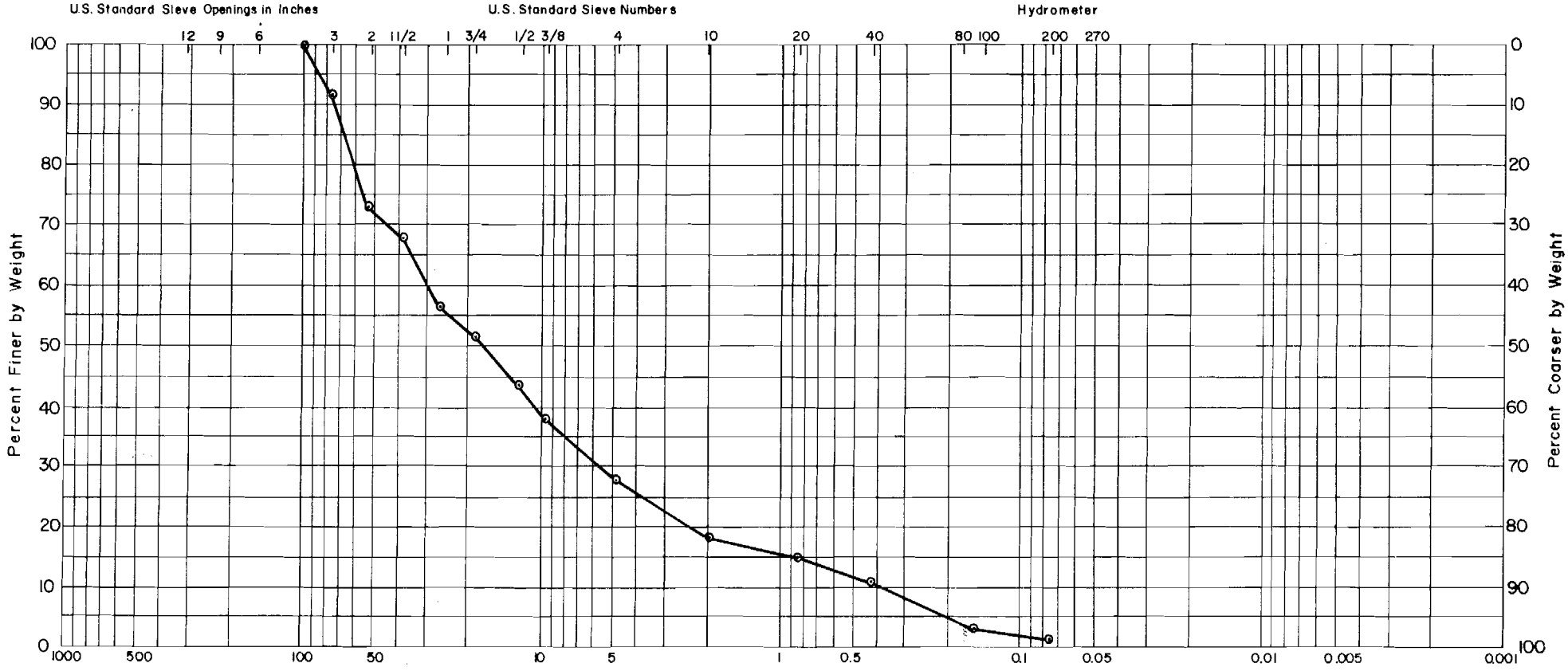
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R7 #2					SP	SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R7

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



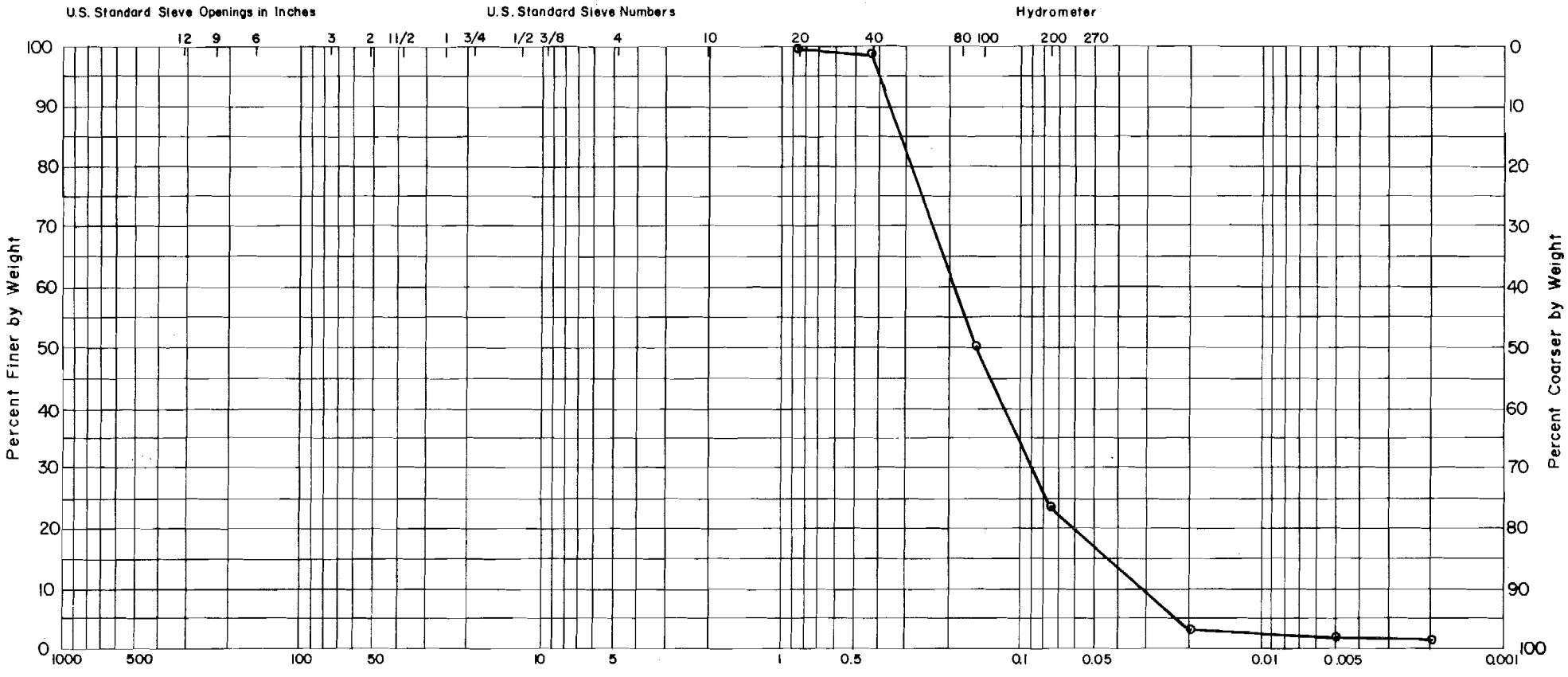
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R8 #1					GW	GRAVEL WITH SOME SAND AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R8

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



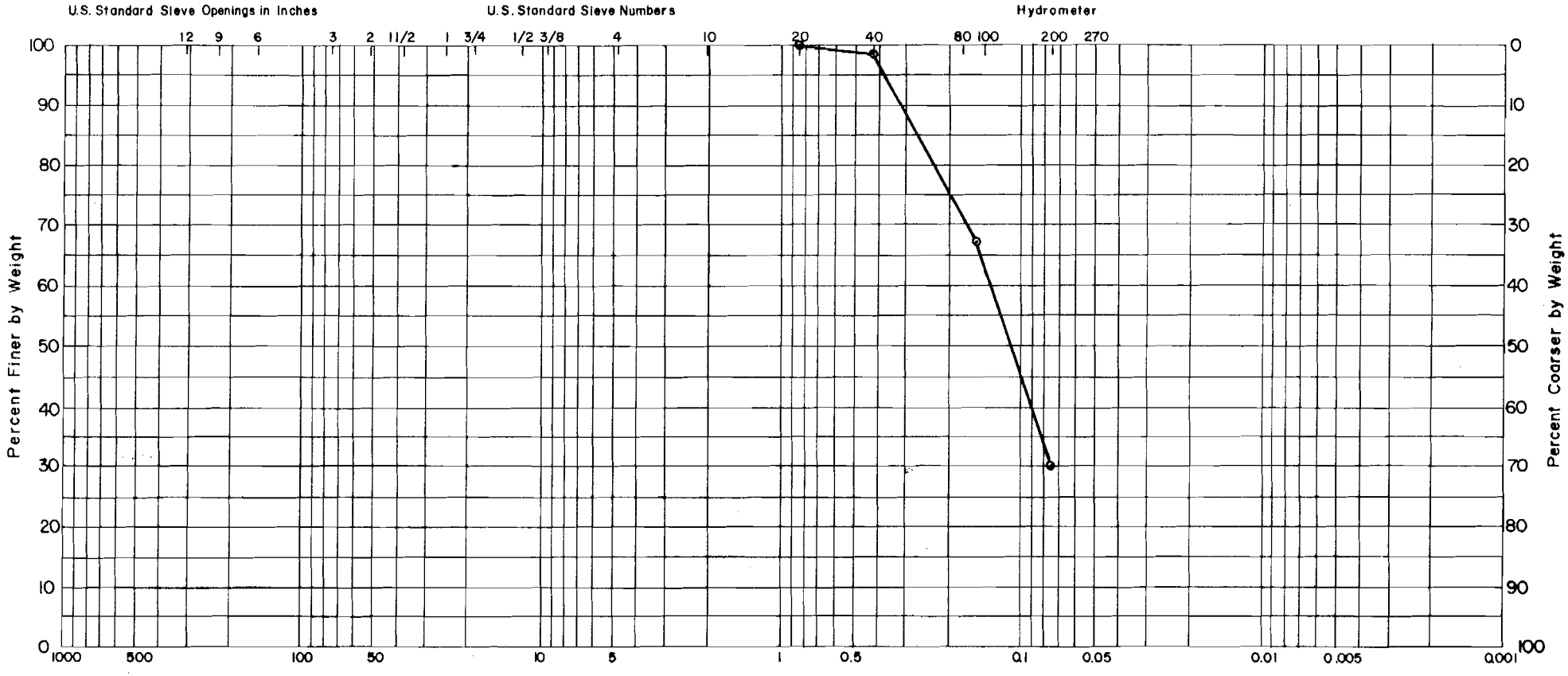
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R9 #1					SM	SAND WITH SOME SILT
						(FIELD GEOLOGIST NOTES TRACE ORGANICS)

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R9

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



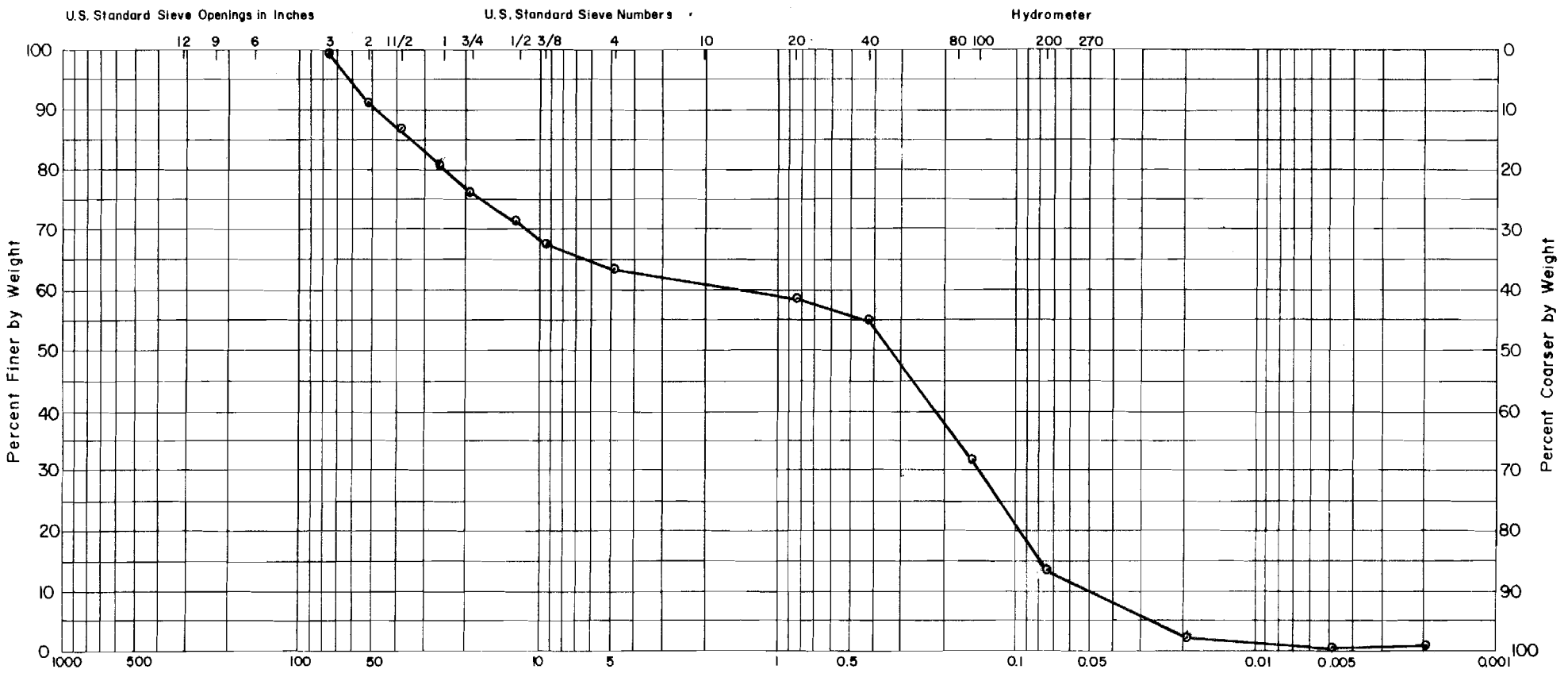
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R10 #1					SM	SILTY SAND

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R10

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PROJECT NO. 052506



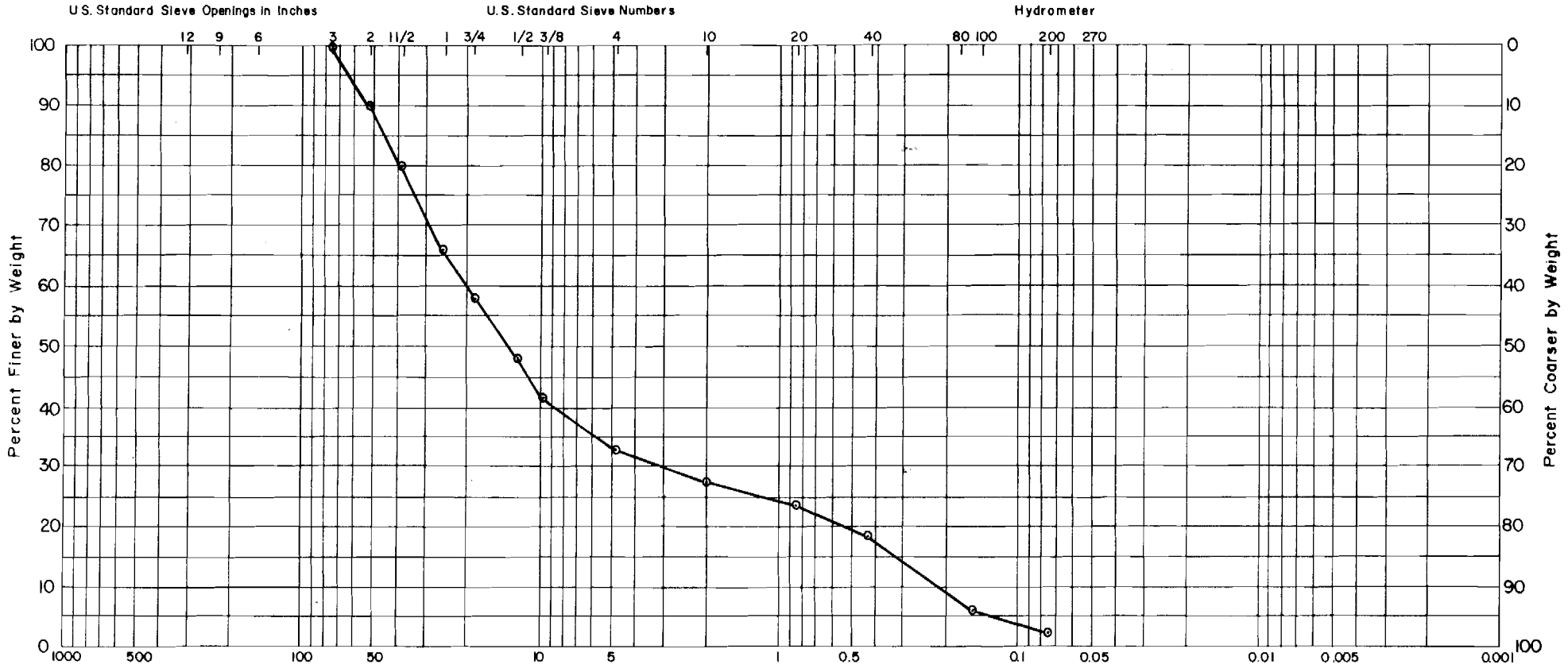
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R10 #2					SM-SP	GRAVELLY SAND WITH SOME SILT

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R10

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



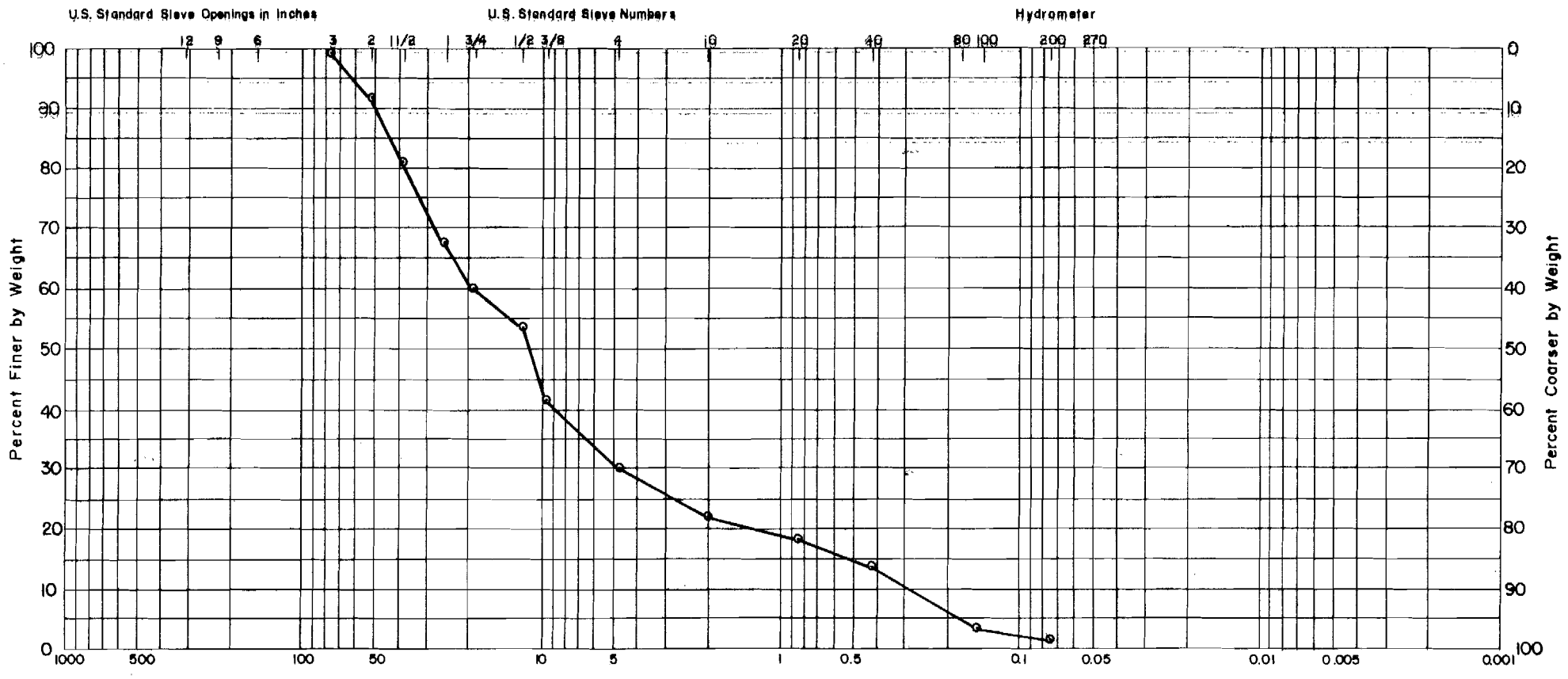
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R11 #1					GP	SANDY GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R11

DRAWN BY:	P.T.
APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



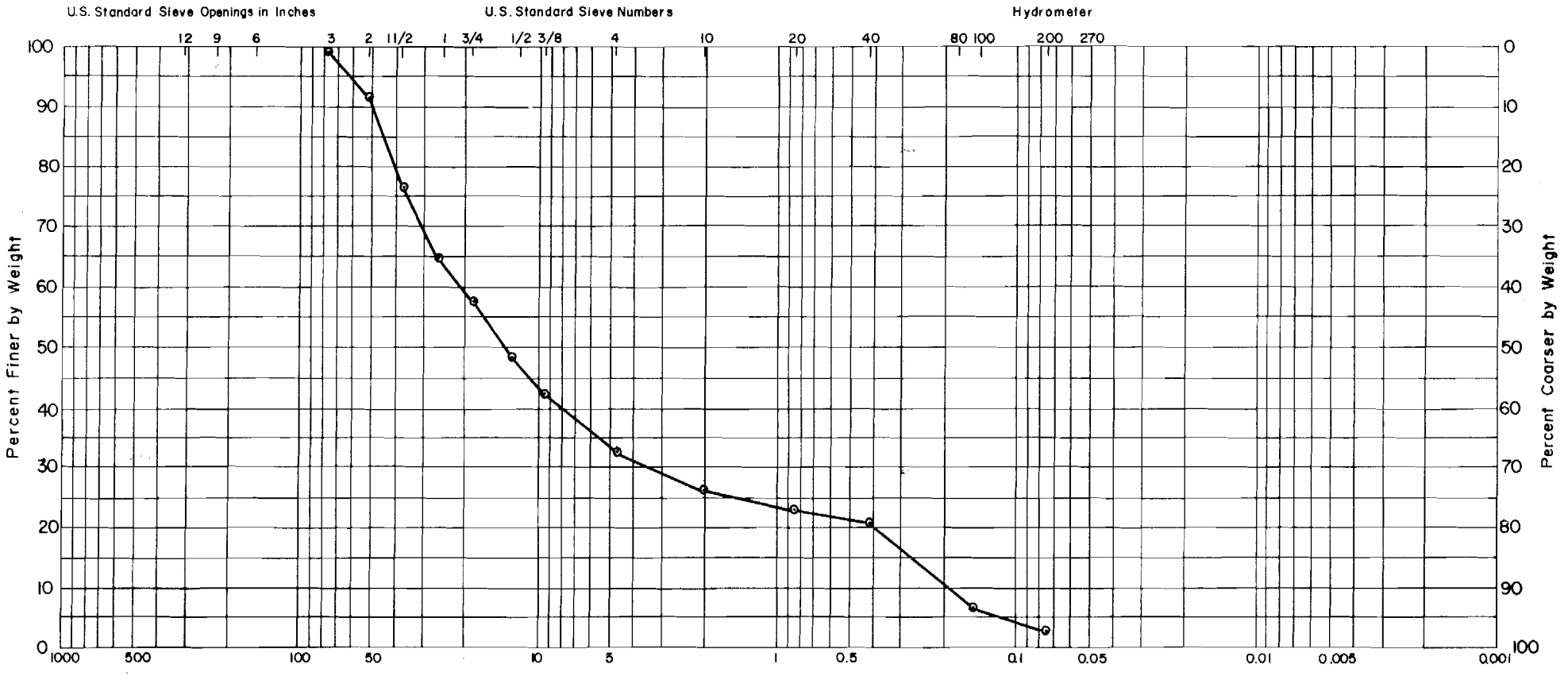
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R11 #2					GRAVEL WITH SOME SAND

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R11

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



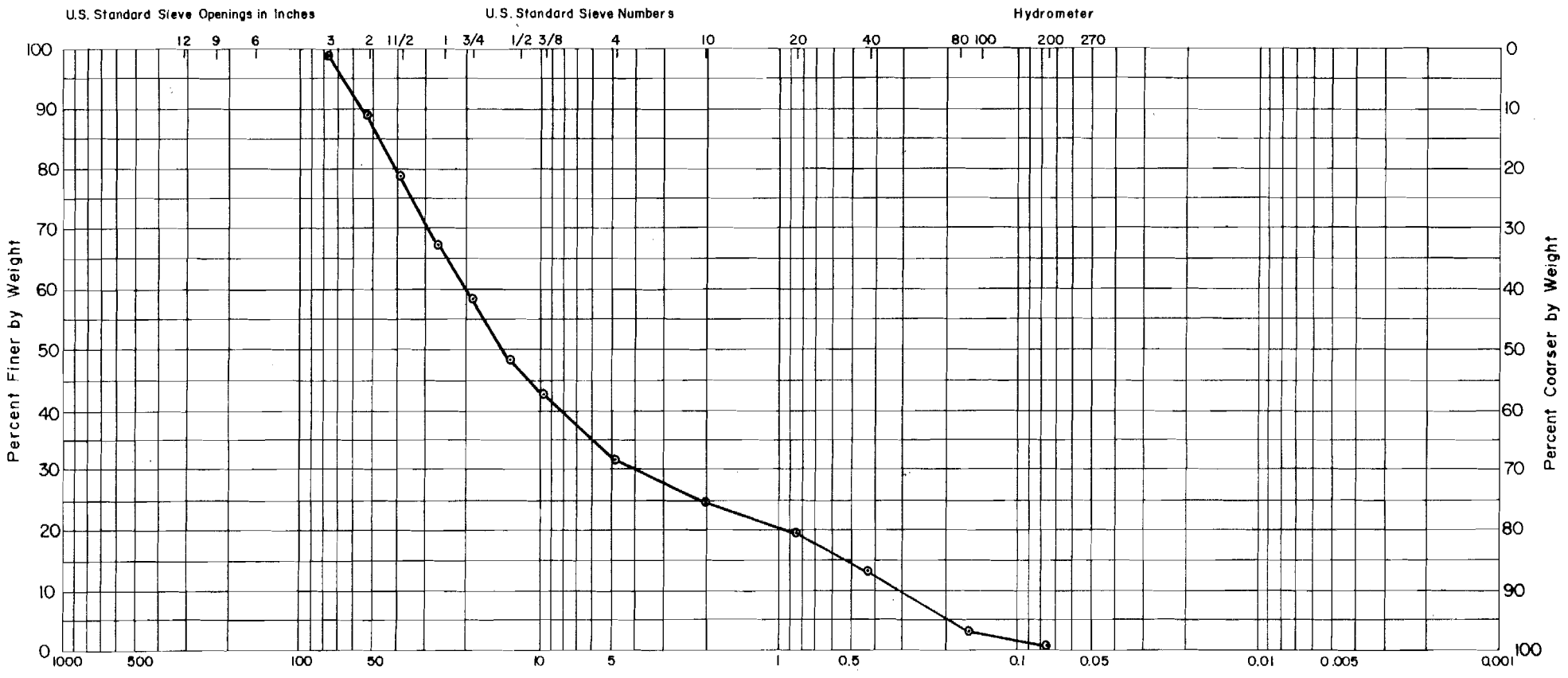
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R12 #1					GP	SANDY GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R12

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APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



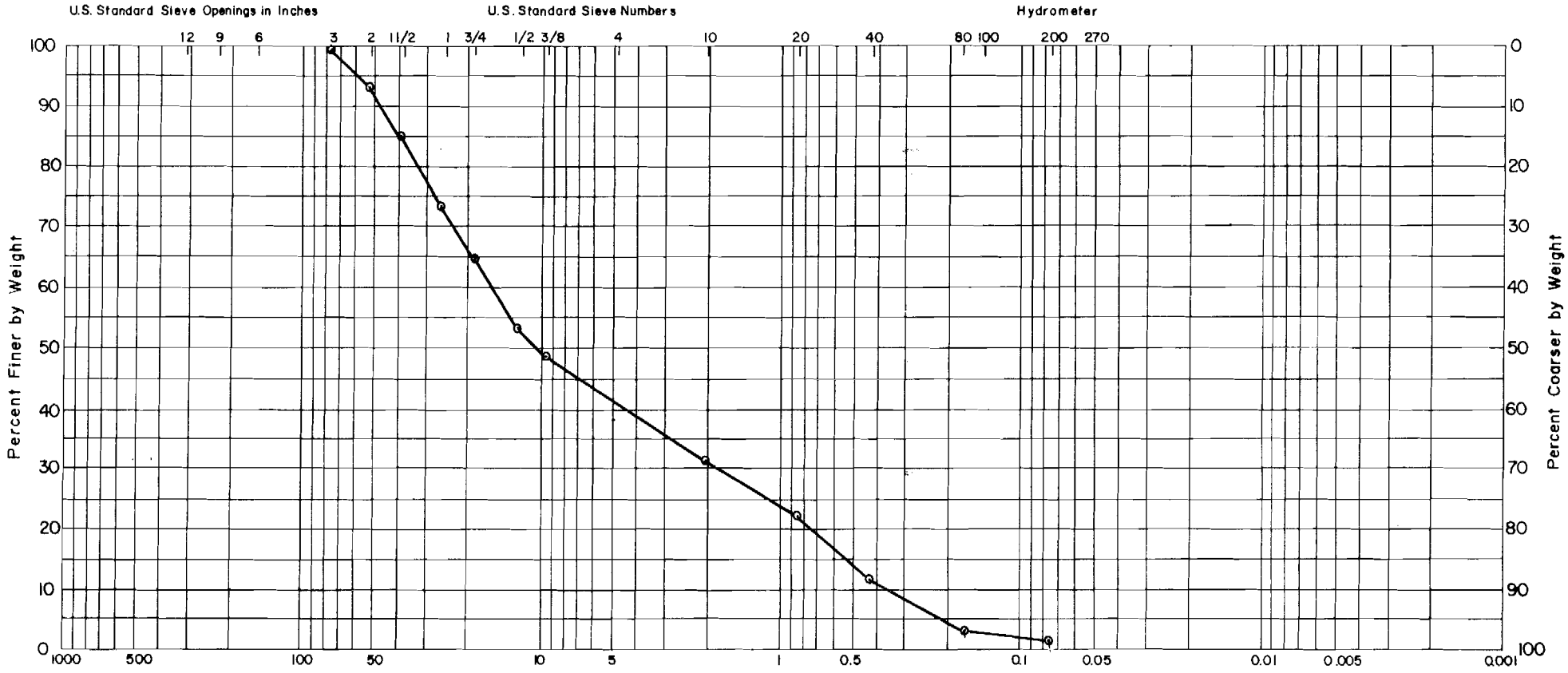
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R12 #2					GW	SANDY GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R12

DRAWN BY: R.T.
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DATE: 11-6-81
PROJECT NO. 052506



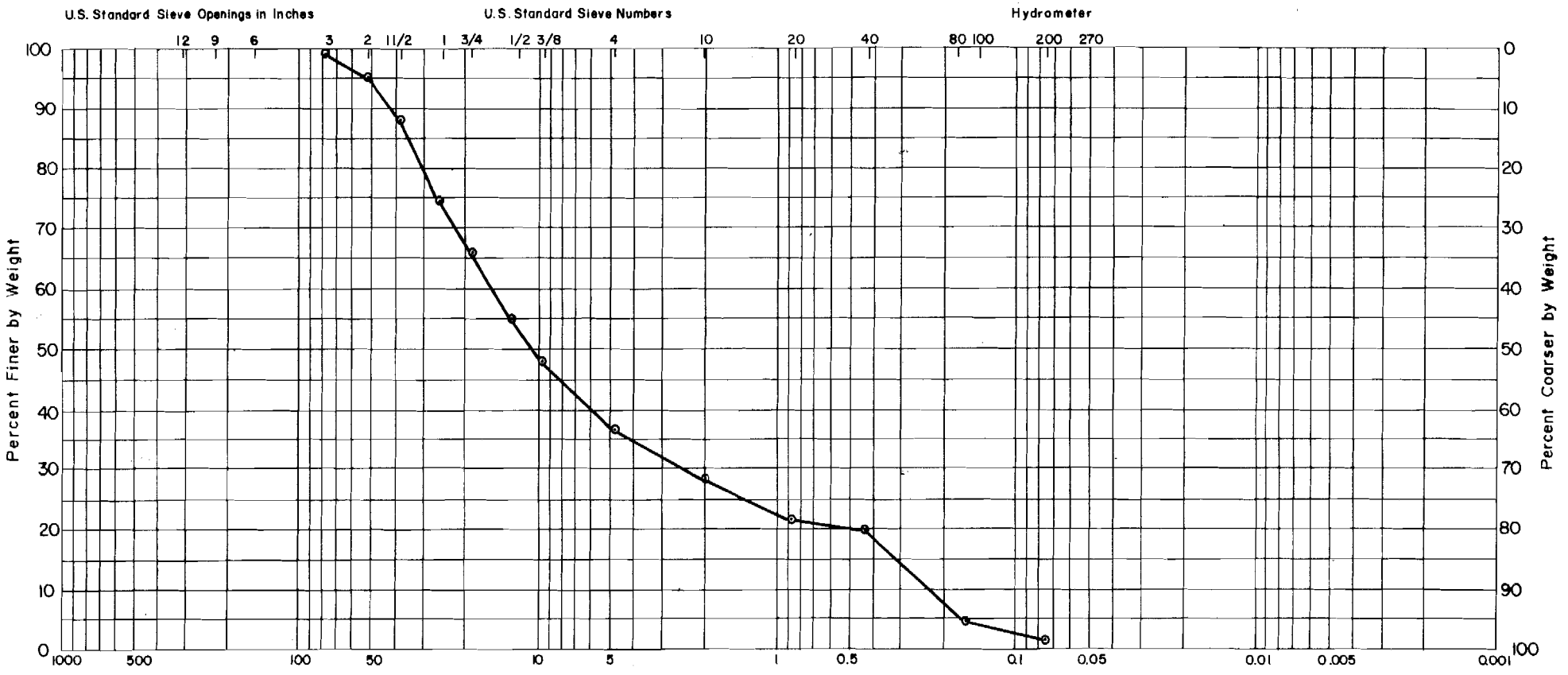
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R13 #2					GP	SANDY GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R13

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APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



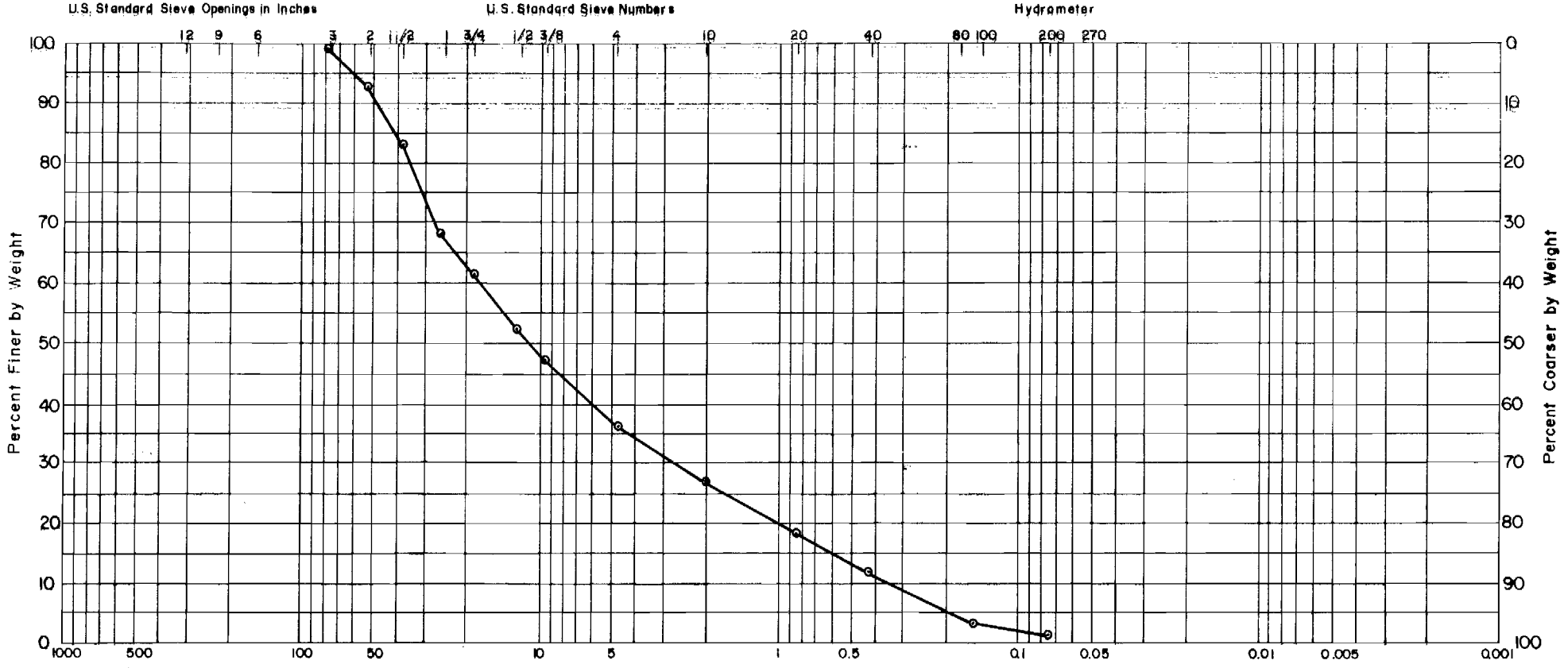
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R14 #1					GW	SANDY GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R14

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APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



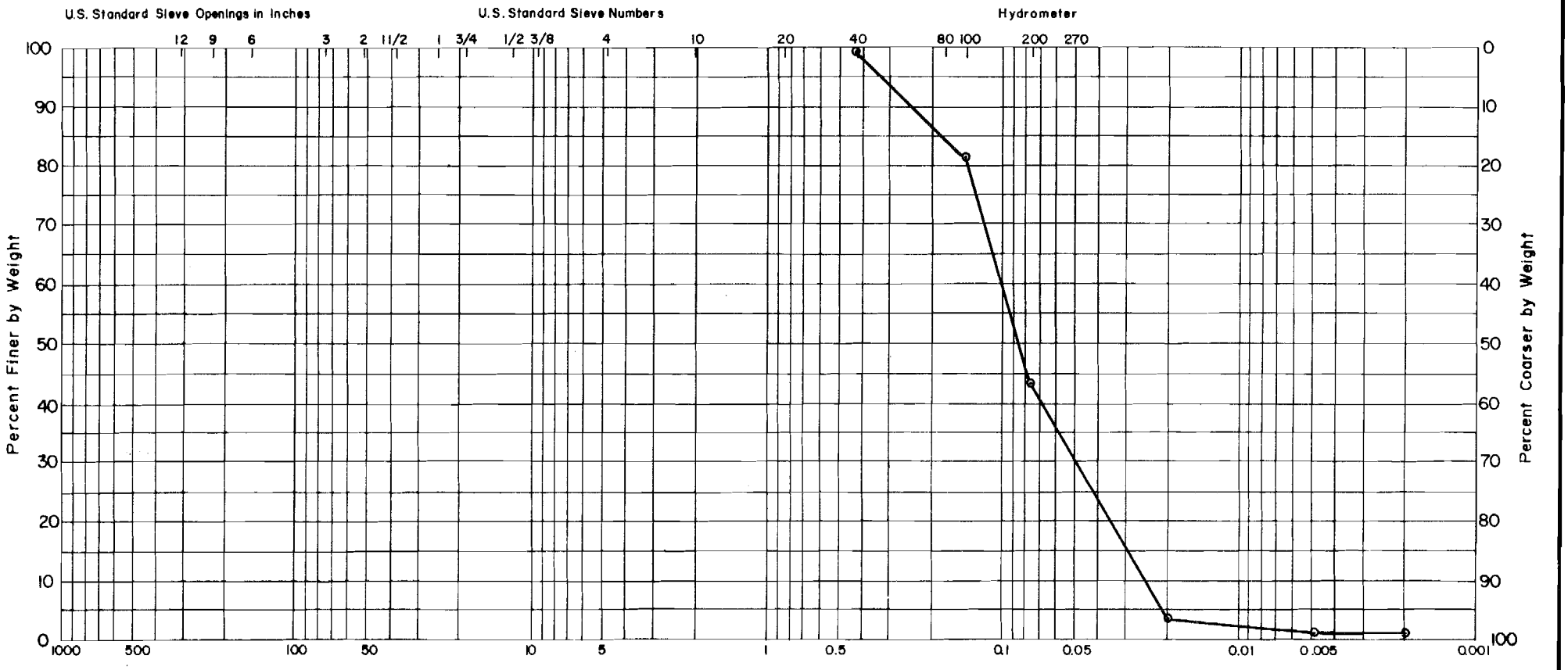
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R14 #2					GP	SANDY GRAVEL

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RIVER ALLUVIUM
TEST PIT TP-R14

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DATE:	11-6-81
PROJECT NO.	052506



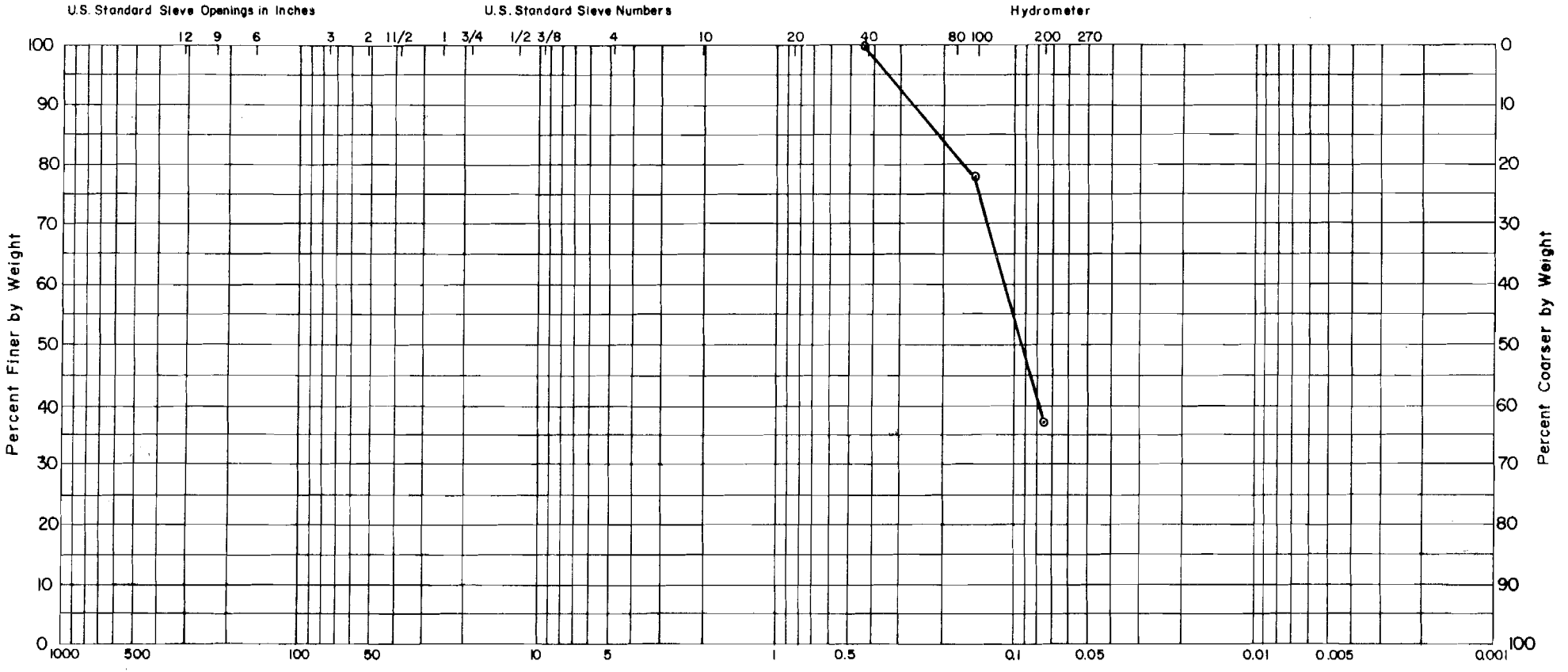
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R15 #2					SM	SILTY SAND
						(FIELD GEOLOGIST NOTES TRACE ORGANICS)

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R15

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APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



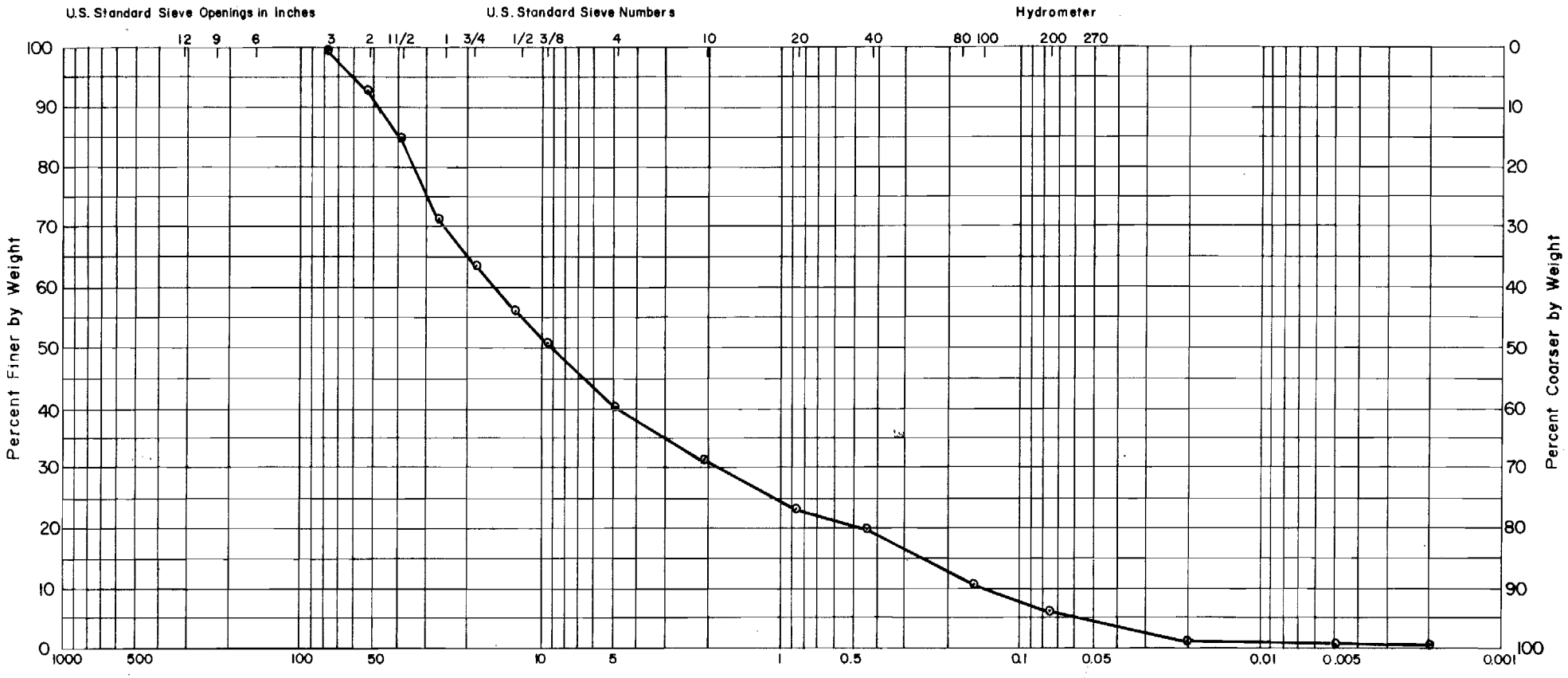
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
TP-R16 #1					SM	SILTY SAND
						(FIELD GEOLOGIST NOTES TRACE ORGANICS)

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R16

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APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



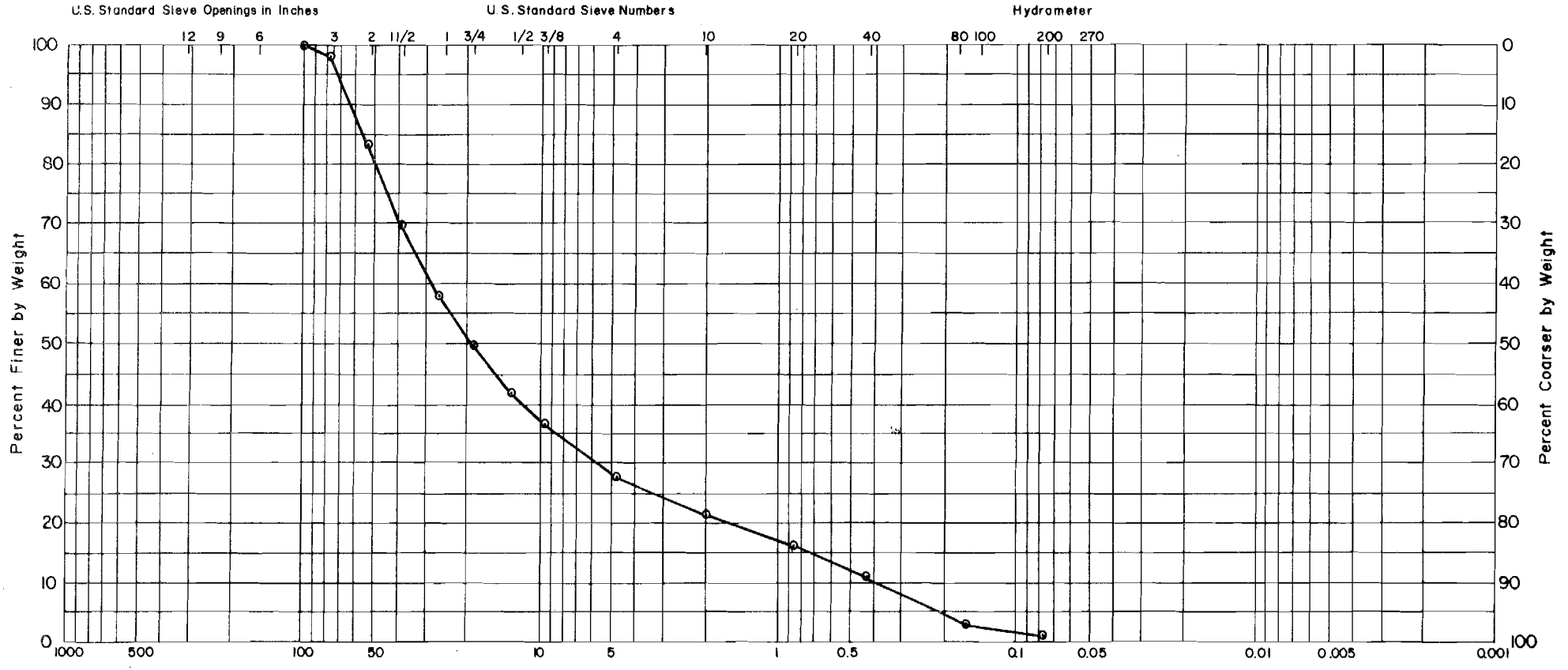
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R16 #2					GW-GM	SANDY GRAVEL WITH TRACE SILT

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R16

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DATE:	11-6-81
PROJECT NO.	052506



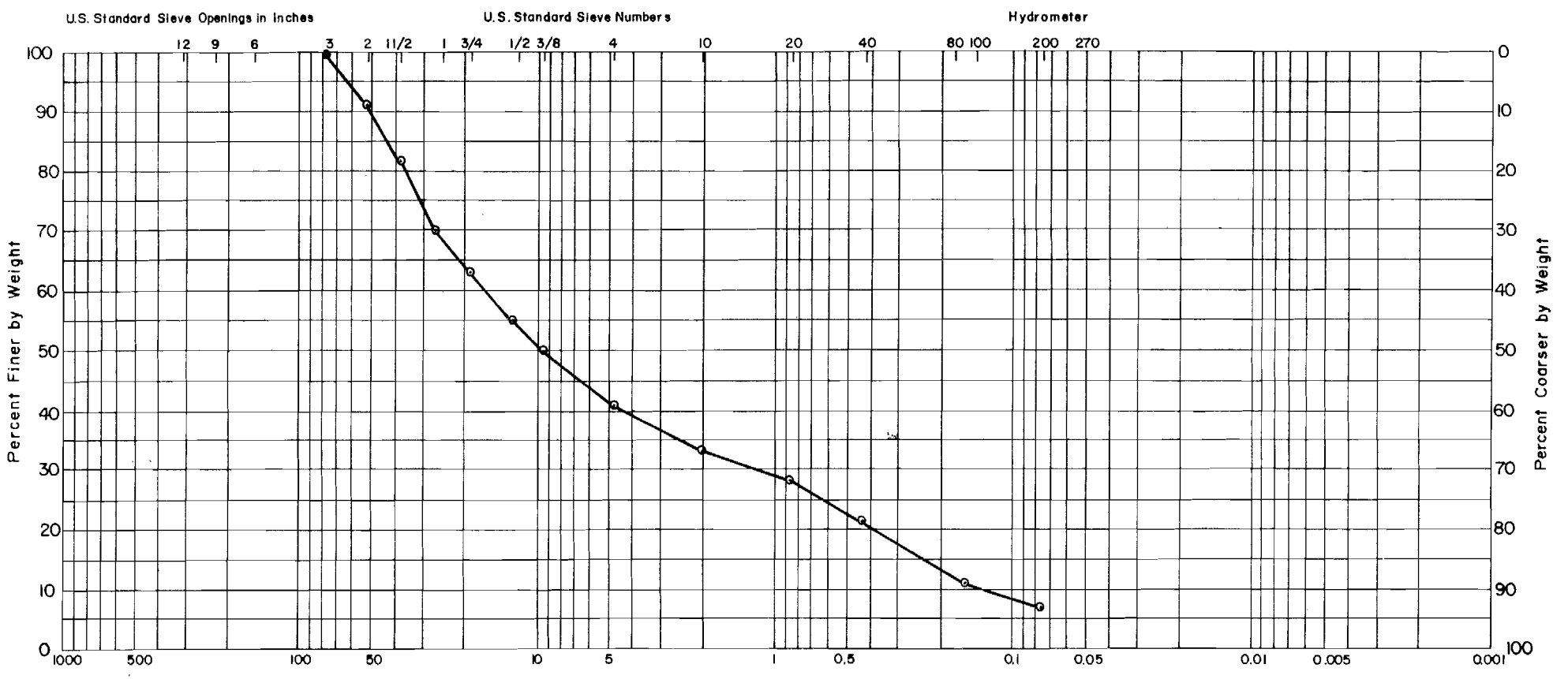
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R17 #1					GW	GRAVEL WITH SOME SAND AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R17

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



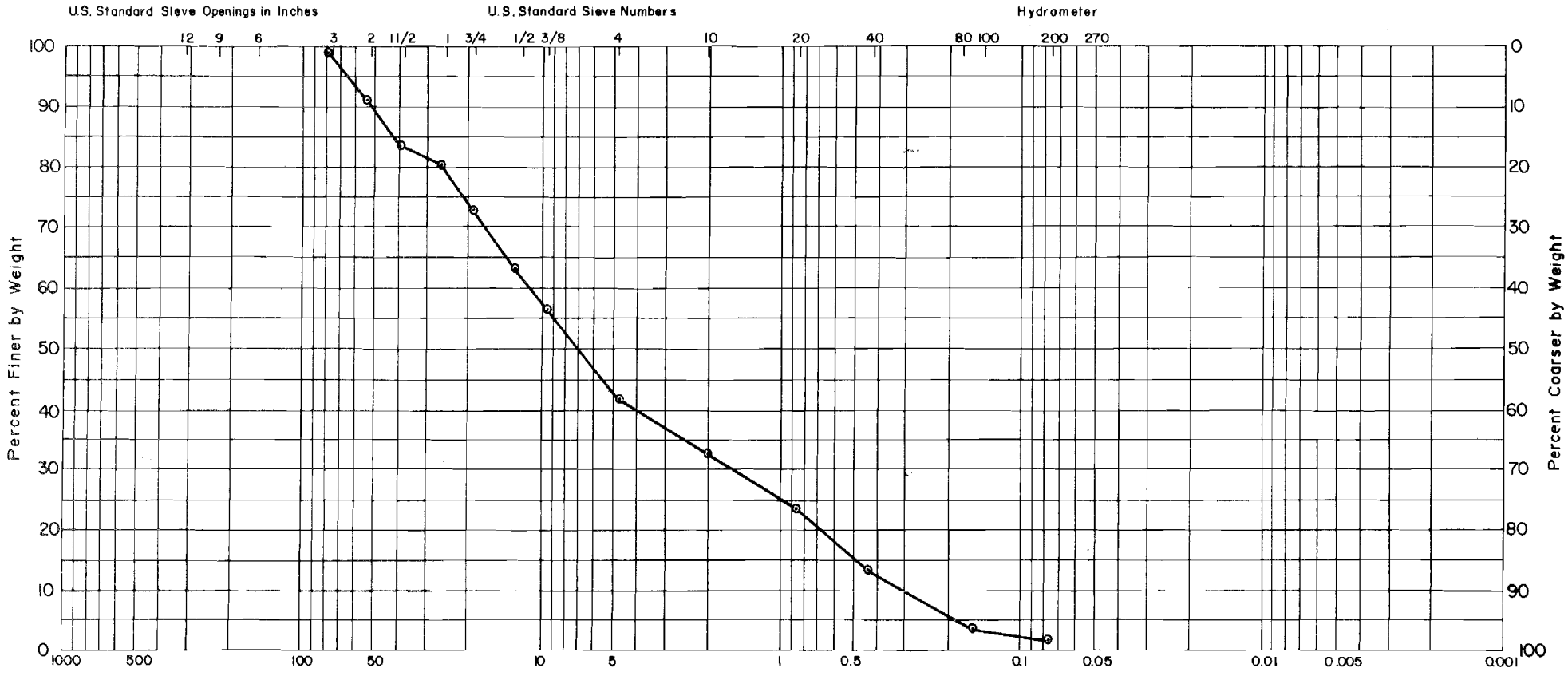
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R17 #2					GP-GM	SANDY GRAVEL WITH TRACE SILT

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R17

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APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



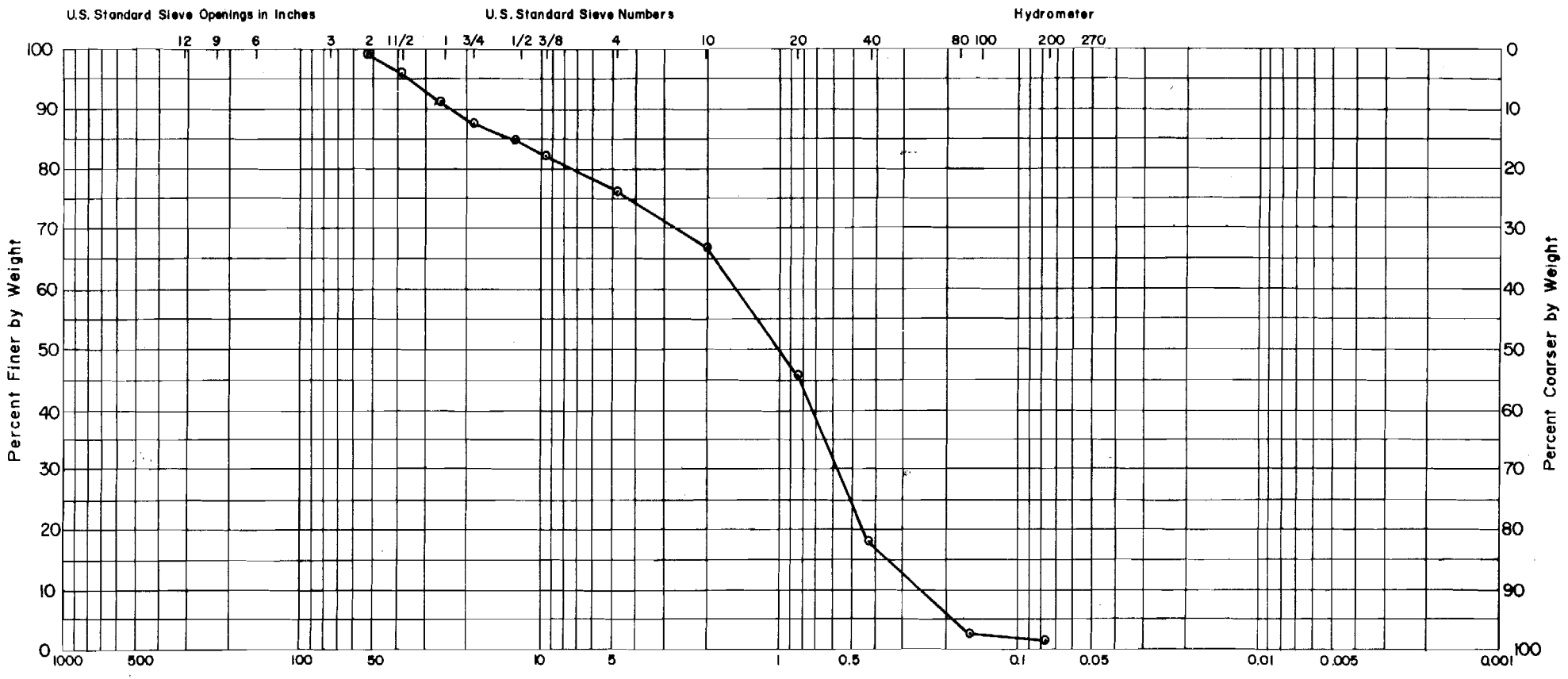
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R18 #2					GP	SANDY GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R18

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APPROVED BY:	T.I.
DATE:	11-6-81
PROJECT NO.	052506



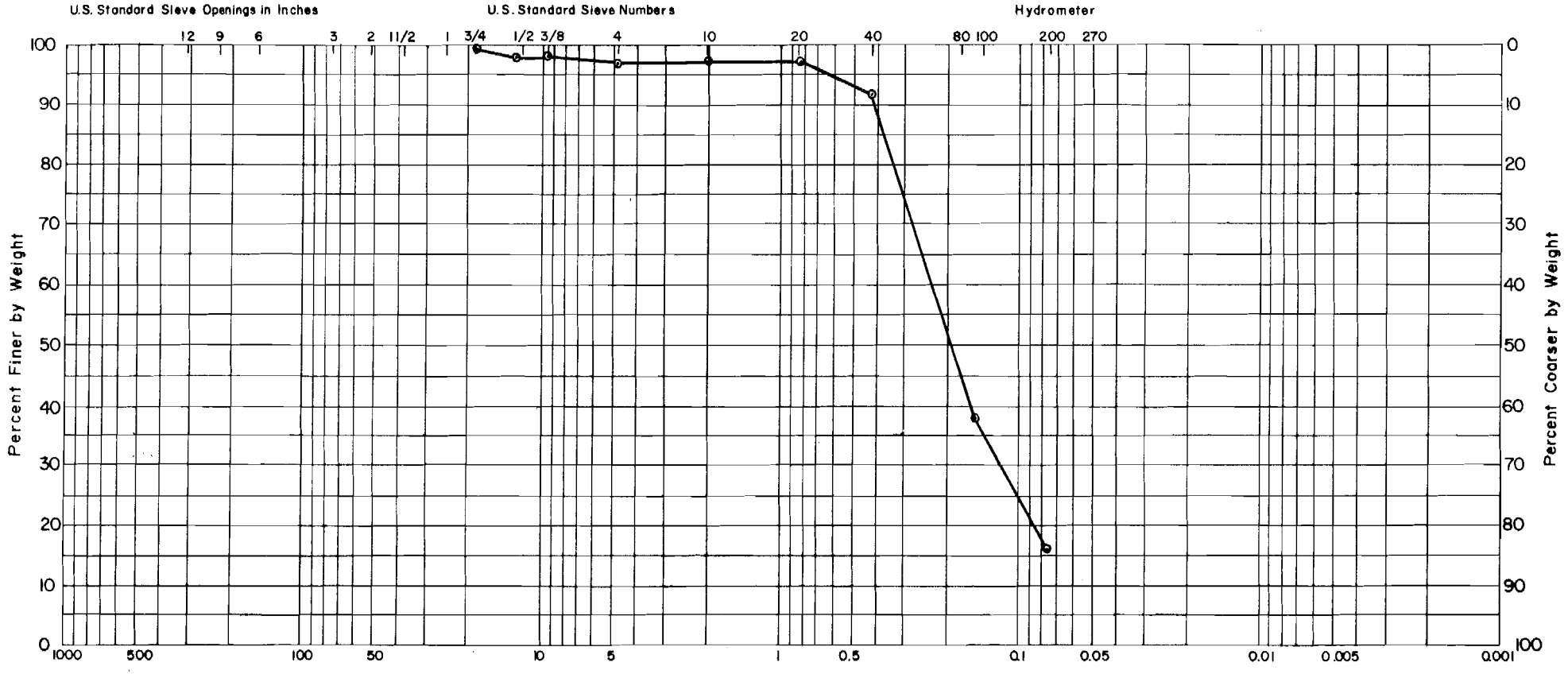
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R19 #2					SW-SP	SAND WITH SOME GRAVEL

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R19

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



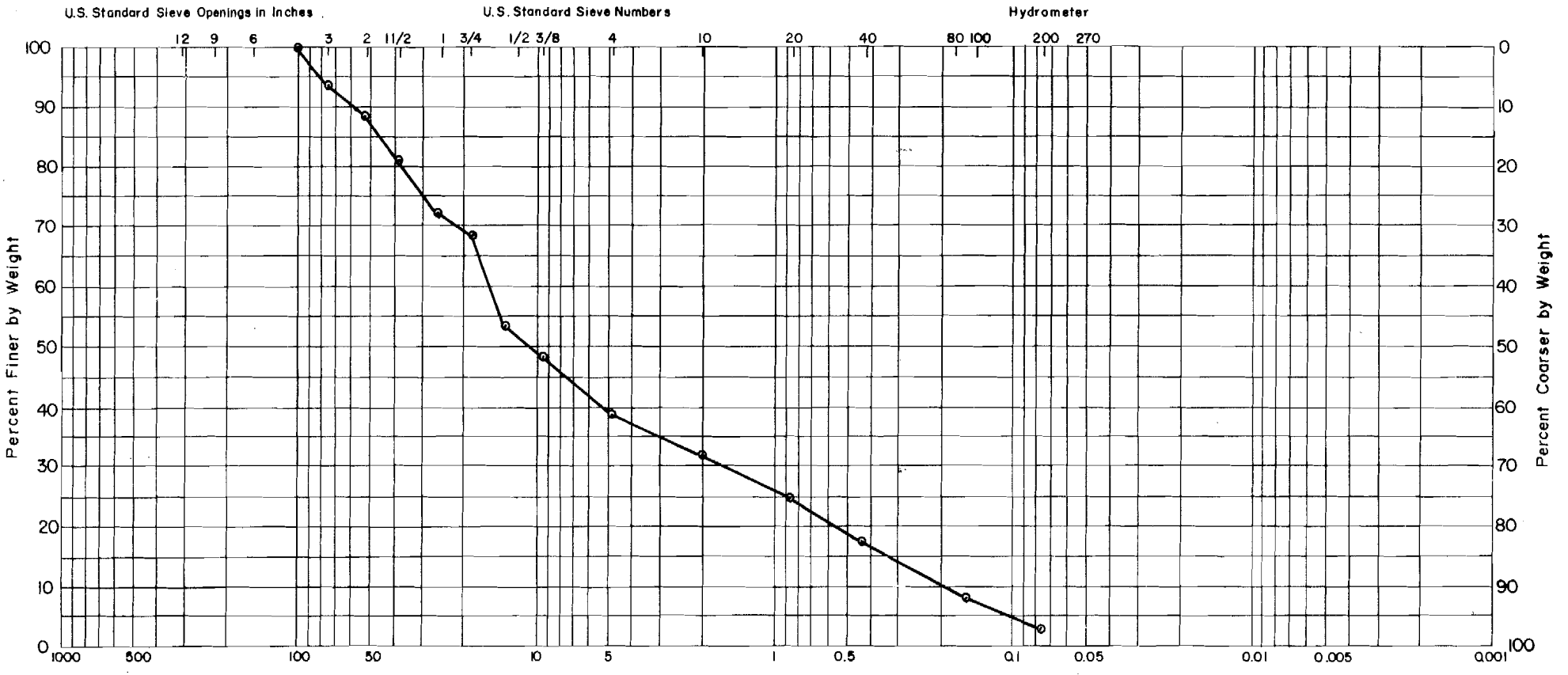
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R20 #1					SM-SP	SAND WITH SOME SILT AND TRACE GRAVEL.
						(FIELD GEOLOGIST NOTES TRACE ORGANICS)

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R20

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



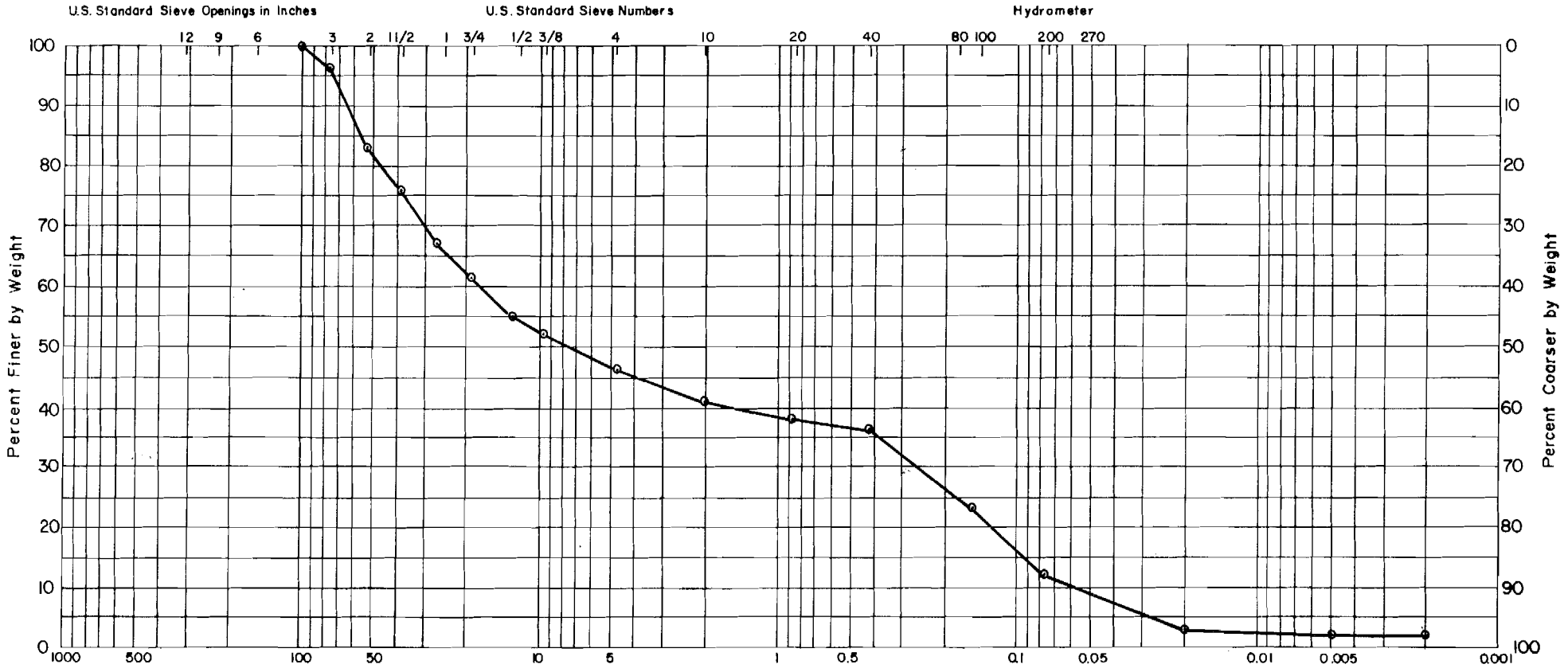
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R20 #2					GW	SANDY GRAVEL WITH TRACE SILT AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R20

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



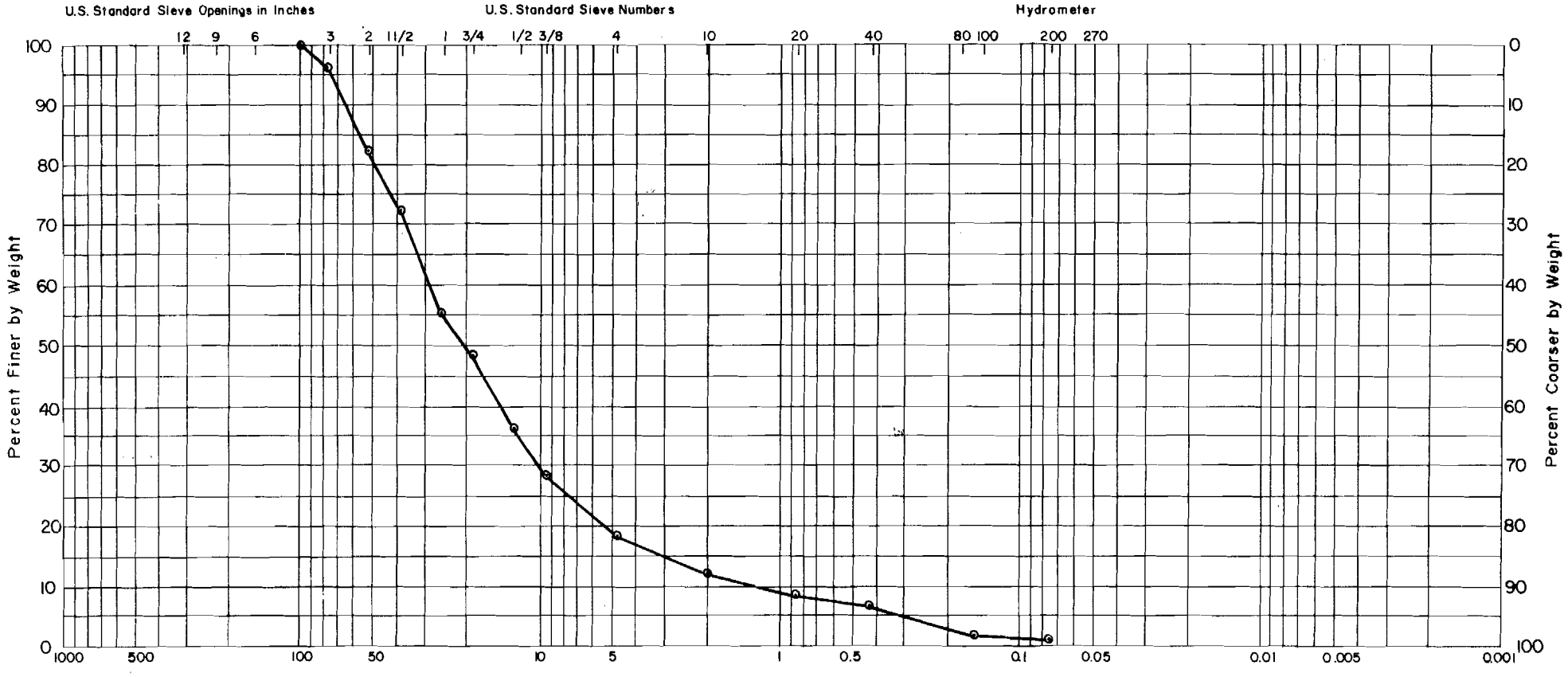
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R22 #1					GP-GM	SANDY GRAVEL WITH SOME SILT AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R22

DRAWN BY:	J.M.
APPROVED BY:	T.I.
DATE:	12-81
PROJECT NO.	052506



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R22 #2					GW	GRAVEL WITH SOME SAND AND SCATTERED COBBLES

R&M CONSULTANTS INC.

RIVER ALLUVIUM
TEST PIT TP-R22

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506