CONTINENTAL GOLD CORP.

MT. MILLIGAN PROJECT

TAILINGS AREA C
GEOTECHNICAL REFERENCE DATA
VOLUME II

APRIL, 1991

REPORT NO. 1675/1

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"THIS REPORT HAS BEEN PREPARED EXCLUSIVELY FOR CONTINENTAL GOLD CORP. NO THIRD PARTY SHALL BE ENTITLED TO RELY ON ANY OF THE INFORMATION, CONCLUSIONS, OPINIONS OR ANY OTHER MATTER CONTAINED IN THIS REPORT".

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CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

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GEOTECHNICAL REFERENCE DATA

VOLUME II - CONTENTS

APPENDIX V

PERMEABILITY DATA

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

SUMMARY OF BOREHOLE PERMEABILITY TESTS

Test Hole No.	Completion Zone Depth (ft)	Completion Zone Depth (m)	Type of Test	Material	Measured Permeability (cm/s)
Main Embankment					
C1-P1	38.7 - 64.8	11.8 - 19.8	Rising Head	Bedrock	7×10^{-7}
C1-P2	17.3 - 27.6	5.3 - 8.4	Rising Head	Sandy Till	9×10^{-6}
C2-P1	176.7 - 196.5	53.9 - 59.9	Not Tested	Sandy Till	
C2-P2	69.1 - 87.6	21.1 - 26.7	Rising Head	Lacustrine Sand, Silt, Clay	10^{-4}
C3-P1	67.3 - 90.0	20.5 - 27.4	Artesian	Sand and Gravel	10^{-3}
C4-P1	174.4 - 189.0	53.2 - 57.6	Not Tested	Dense Sand and Gravel	
C4-P2	33.1 - 48.4	10.1 - 14.8	Not Tested	Dense Sand and Gravel	
C5-P1	70.4 - 83.3	21.5 - 25.4	Not Tested	Bedrock	
C5-P2	42.3 - 55.4	12.9 - 16.9	Not Tested	Sandy Till	
C6-P1	18.4 - 84.6	5.6 - 25.8	Not Tested	Sand and Silt	
Saddle Dam					
C7-P1	23.9 - 38.3	7.3 - 11.7	Not Tested	Sandy Till	
C7-P2	49.5 - 63.0	15.1 - 19.2	Not Tested	Bedrock	
C7	53.0 - 63.0	16.2 - 19.2	Packer	Bedrock	3×10^{-6}
C8-P1	32.2 - 53.8	9.8 - 16.4	Not Tested	Alluvial Sand and Silt	
C8	69.5 - 80.5	21.2 - 24.5	Packer	Bedrock	10^{-7}

Test Hole No.	Completion Zone Depth (ft)	Completion Zone Depth (m)	Type of Test	Material	Measured Permeability (cm/s)
South Embankment					
C9-P1	38.5 - 70.5	11.7 - 21.5	Not Tested	Bedrock	
C9	50.0 - 60.0	15.2 - 18.3	Packer	Bedrock	9×10^{-8}
C9	60.0 - 71.0	18.3 - 21.6	Packer	Bedrock	3×10^{-7}
C10-P1	27.6 - 47.7	8.4 - 14.5	Not Tested	Alluvium	
C11-P1	18.0 - 31.2	5.5 - 9.5	Not Tested	Silty Sandy Till	
C12-P1	15.4 - 91.2	4.7 - 27.8	Not Tested	Sandy Till/Alluvium	
C13-P1	20.7 - 57.4	6.3 - 17.5	Not Tested	Alluvium	
C14-P1	10.0 - 48.6	3.0 - 14.8	Not Tested	Alluvium	
Water Storage Dam					
WSD1-P1	125.0 - 159.0	38.1 - 48.5	Not Tested	Alluvial Sand	
WSD2-P1	28.9 - 39.7	8.8 - 12.1	Not Tested	Sand and Gravel	
WSD2-P2	7.9 - 18.0	2.4 - 5.5	Not Tested	Alluvial Sand	
WSD2	47.0 - 60.0	14.3 - 18.3	Packer	Bedrock	
WSD3-P1	35.8 - 45.8	10.9 - 13.9	Not Tested	Weathered Bedrock	3×10^{-5}

PACKER TESTING CALCULATION SHEET

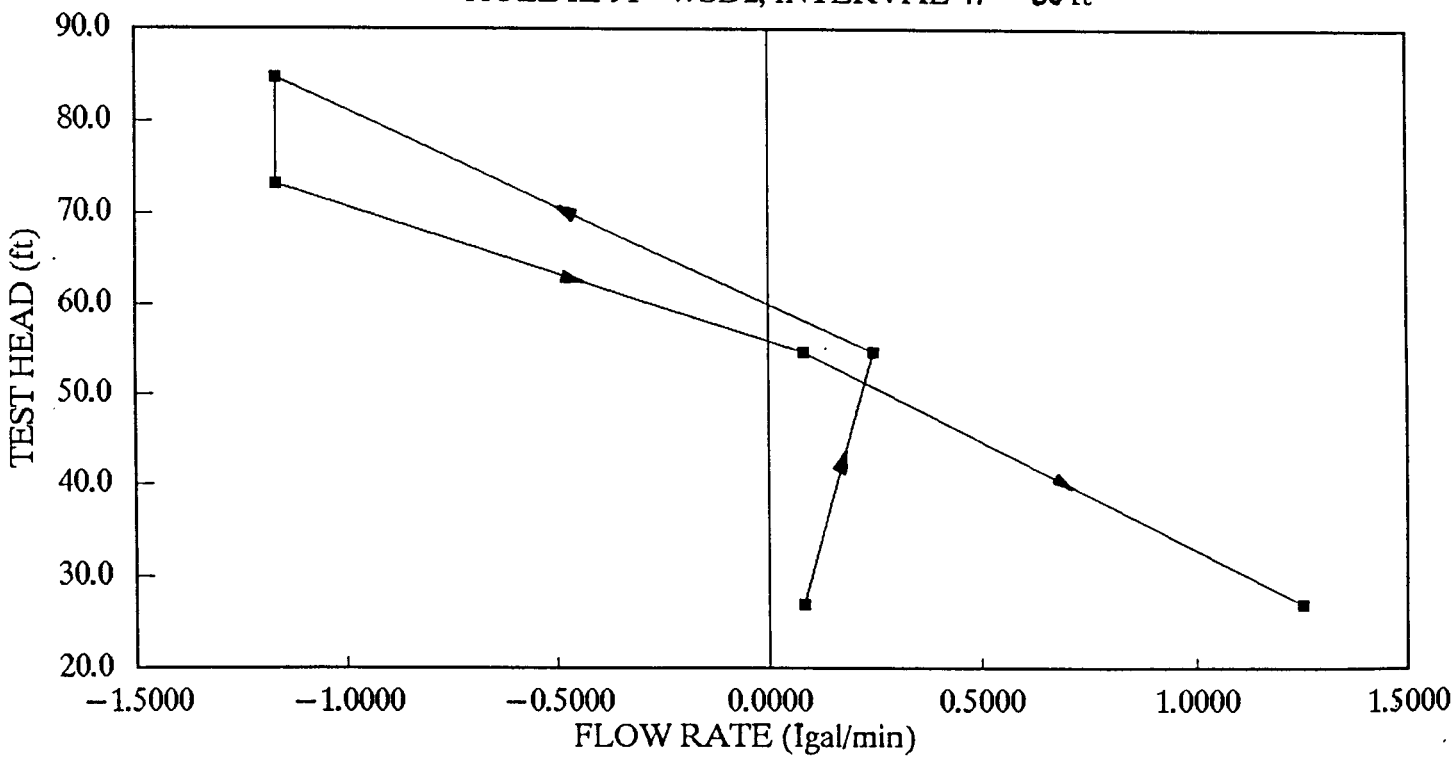
PROJECT: MOUNT MILLIGAN
LOCATION: WATER STORAGE DAM
HOLE No: KP91-WSD2
TEST DATE: MARCH 6, 1991
COORDINATES(m) N: 12564.0 E: 25089.8
REF. ELEV.(m) 1007.20

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW PRESSURE GAUGE (ft): 4
BEDROCK DEPTH(ft): 41.5
TESTED BY: RNK
ANGLE FROM VERTICAL (deg): 0
HEIGHT OF PRESSURE GAUGE ABOVE GROUND(ft): 4

TEST No.	INTERVAL below grd(ft) from	to	METER RDG (US gallons) initial	final	ELAPSED TIME (min)	FLOW RATE (lgpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	47	60	88.2	88.3	5	0.083	10.0	0.0	27.1	1.4E-05	Bedrock
	47	60	88.3	88.6	5	0.250	22.0	0.0	54.8	2.1E-05	Qtz-Biotite Schist
	47	60	88.2	86.8	3	-1.166	35.0	0.0	84.8	-6.4E-05	(Iron stained)
	47	60	87.2	87.3	5	-1.166	30.0	0.0	73.3	-7.4E-05	
	47	60	87.3	88.8	5	0.083	22.0	0.0	54.8	7.1E-06	Moderate RQD
	47	60	88.9	87.5	5	1.249	10.0	0.0	27.1	2.1E-04	

MT. MILLIGAN PACKER TEST RESULTS

HOLE KP91–WSD2, INTERVAL 47 – 60 ft



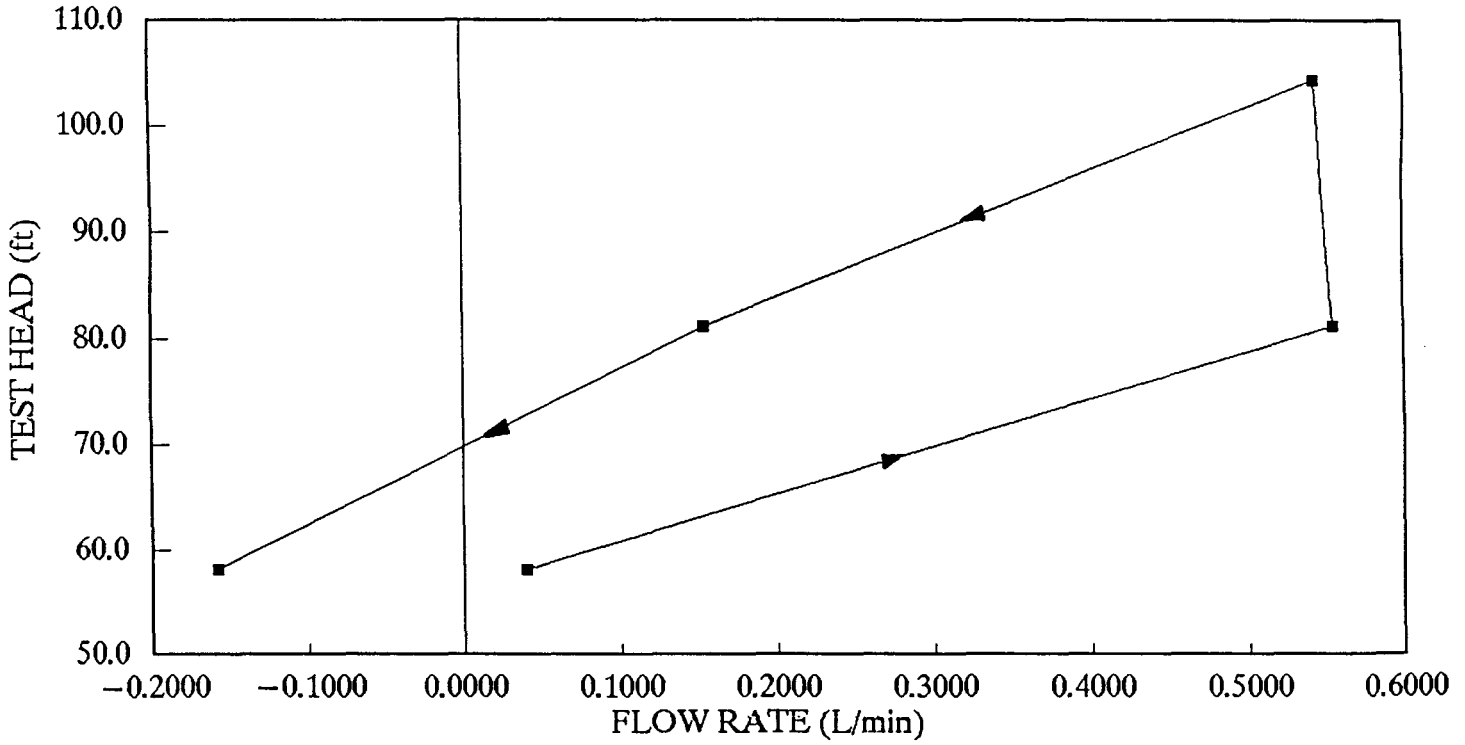
PACKER TESTING CALCULATION SHEET

PROJECT:	MT. MILLIGAN	HOLE DIAMETER (inches):	3.782
LOCATION:	TAILINGS AREA C	DEPTH TO GDW TABLE BELOW PRESSURE GAUGE(ft):	35
HOLE No:	KP91-C7	BEDROCK DEPTH(ft):	35
TEST DATE:	MARCH 7, 1991	TESTED BY:	MDG
COORDINATES(m) N:	12706.5 E: 21018.9	ANGLE FROM VERTICAL (deg):	0
REF. ELEV.(m)	1075.9	HEIGHT OF PRESSURE GAUGE ABOVE GROUND(ft):	3

TEST No.	INTERVAL below grd(ft) from	to	METER RDG (litres) initial	final	ELAPSED TIME (min)	FLOW RATE (L/min)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	53.0	63.0	69.55	69.75	5	0.040	10.0	0.0	58.1	8.2E-07	Bedrock
	53.0	63.0	61.00	63.77	5	0.554	20.0	0.0	81.2	8.1E-06	Qtz-Biotite Schist
	53.0	63.0	64.21	66.92	5	0.542	30.0	0.0	104.3	6.2E-06	
	53.0	63.0	66.90	67.67	5	0.154	20.0	0.0	81.2	2.2E-06	Poor RQD
	53.0	63.0	66.89	66.10	5	-0.158	10.0	0.0	58.1	-3.2E-06	

MT. MILLIGAN PACKER TEST RESULTS

HOLE KP91-C7, TEST INTERVAL 53 – 63 ft



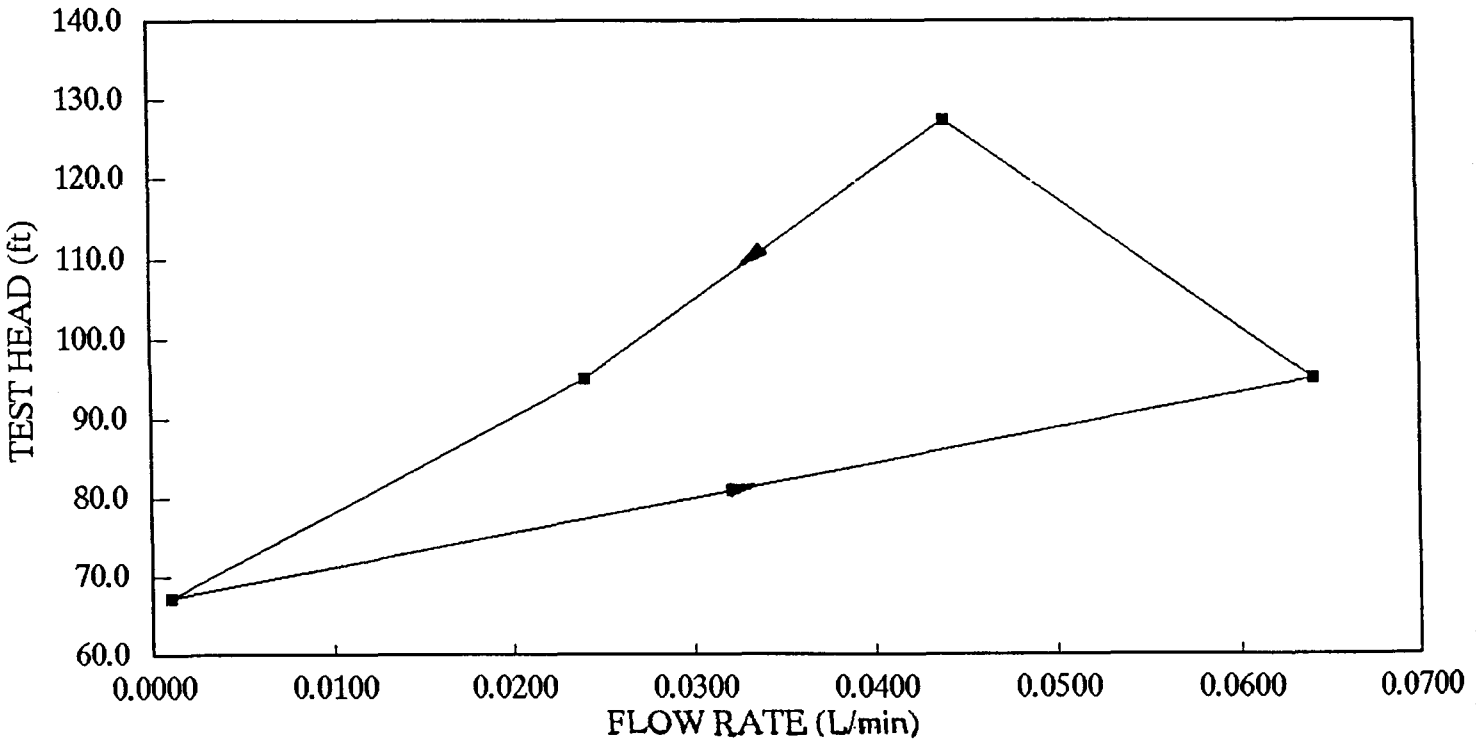
PACKER TESTING CALCULATION SHEET

PROJECT:	MT. MILLIGAN	HOLE DIAMETER (inches):	3.782
LOCATION:	HEATHER LAKE, TAILINGS AREA C	DEPTH TO GDW TABLE BELOW PRESSURE GAUGE(ft):	6.67
HOLE No:	KP91-C8	BEDROCK DEPTH(ft):	62.5
TEST DATE:	MARCH 6, 1991	TESTED BY:	MDG
COORDINATES(m) N:	11585.1 E: 21448.3	ANGLE FROM VERTICAL (deg):	0
REF. ELEV.(m)	1037.4	HEIGHT OF PRESSURE GAUGE ABOVE GROUND(ft):	3.3

TEST No.	INTERVAL below grd(ft) from	to	METER RDG (litres) initial	final	ELAPSED TIME (min)	FLOW RATE (L/min)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	69.5	80.5	44.66	44.66	5	< 0.001	14.0	0.0	67.3	< 1.6E-08	Bedrock
	69.5	80.5	44.73	45.30	5	0.064	26.0	0.0	95.0	7.4E-07	Gabbro
	69.5	80.5	45.46	45.93	5	0.044	40.0	0.0	127.4	3.8E-07	
	69.5	80.5	45.93	46.05	5	0.024	26.0	0.0	95.0	2.8E-07	Corrected for Minor
	69.5	80.5	46.04	46.04	5	< 0.001	14.0	0.0	67.3	< 1.6E-08	Leakage 0.05L/min

MT. MILLIGAN PACKER TEST RESULTS

HOLE KP91-C8, TEST INTERVAL 69½-80½ ft



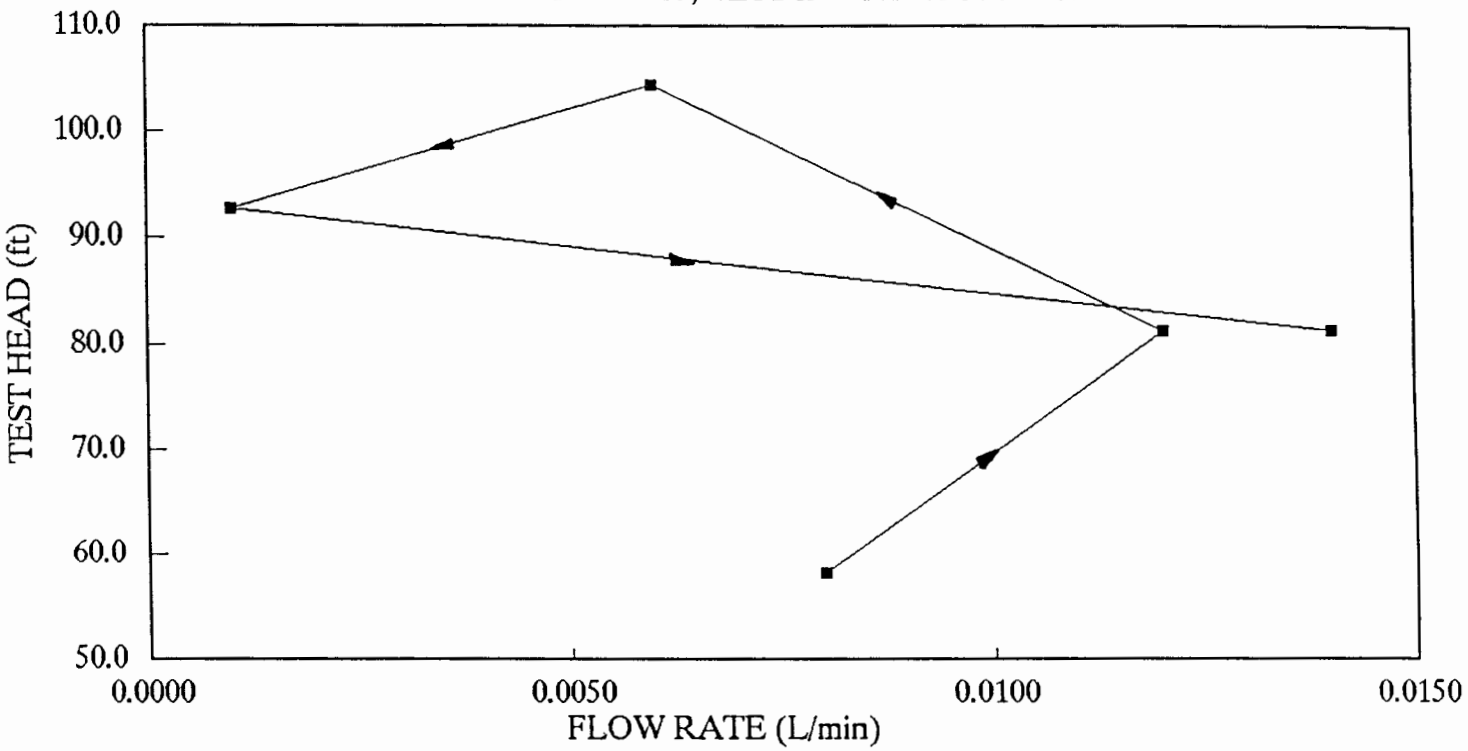
PACKER TESTING CALCULATION SHEET

PROJECT:	MT. MILLIGAN			HOLE DIAMETER (inches):	3.782
LOCATION:	SOUTH DAM ABUTMENT			DEPTH TO GDW TABLE BELOW PRESSURE GAUGE(ft):	31.5
HOLE No:	KP91-C9			BEDROCK DEPTH(ft):	43
TEST DATE:	MARCH 5, 1991			TESTED BY:	KGB
COORDINATES(m)	N: 11426.8	E:	22593.1	ANGLE FROM VERTICAL (deg):	0
REF. ELEV.(m)	1064.4			HEIGHT OF PRESSURE GAUGE ABOVE GROUND(ft):	2.3

TEST No.	INTERVAL below grd(ft) from	to	METER RDG (litres) initial	final	ELAPSED TIME (min)	FLOW RATE (L/min)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	50.0	60.0	8.99	9.03	5	0.008	10.0	0.0	58.1	1.6E-07	Bedrock - Gabbro
	50.0	60.0	9.15	9.21	5	0.012	20.0	0.0	81.2	1.8E-07	
	50.0	60.0	9.29	9.32	5	0.006	30.0	0.0	104.3	6.8E-08	Moderate RQD
	50.0	60.0	9.32	9.32	5	< 0.001	25.0	0.0	92.7	< 1.3E-08	No Leakage Detected
	50.0	60.0	9.32	9.39	5	0.014	20.0	0.0	81.2	2.0E-07	
2	60.0	71.0	75.05	75.20	5	0.030	12.0	0.0	62.7	5.3E-07	Bedrock - Gabbro
	60.0	71.0	75.26	75.42	5	0.032	22.0	0.0	85.8	4.1E-07	
	60.0	71.0	75.50	76.68	5	0.136	35.0	0.0	115.8	1.3E-06	Corrected for Minor
	60.0	71.0	76.75	76.88	5	0.026	22.0	0.0	85.8	3.3E-07	Leakage 0.1L/min
	60.0	71.0	76.88	76.88	5	< 0.001	12.0	0.0	62.7	< 1.8E-08	at gauge pres =35psi

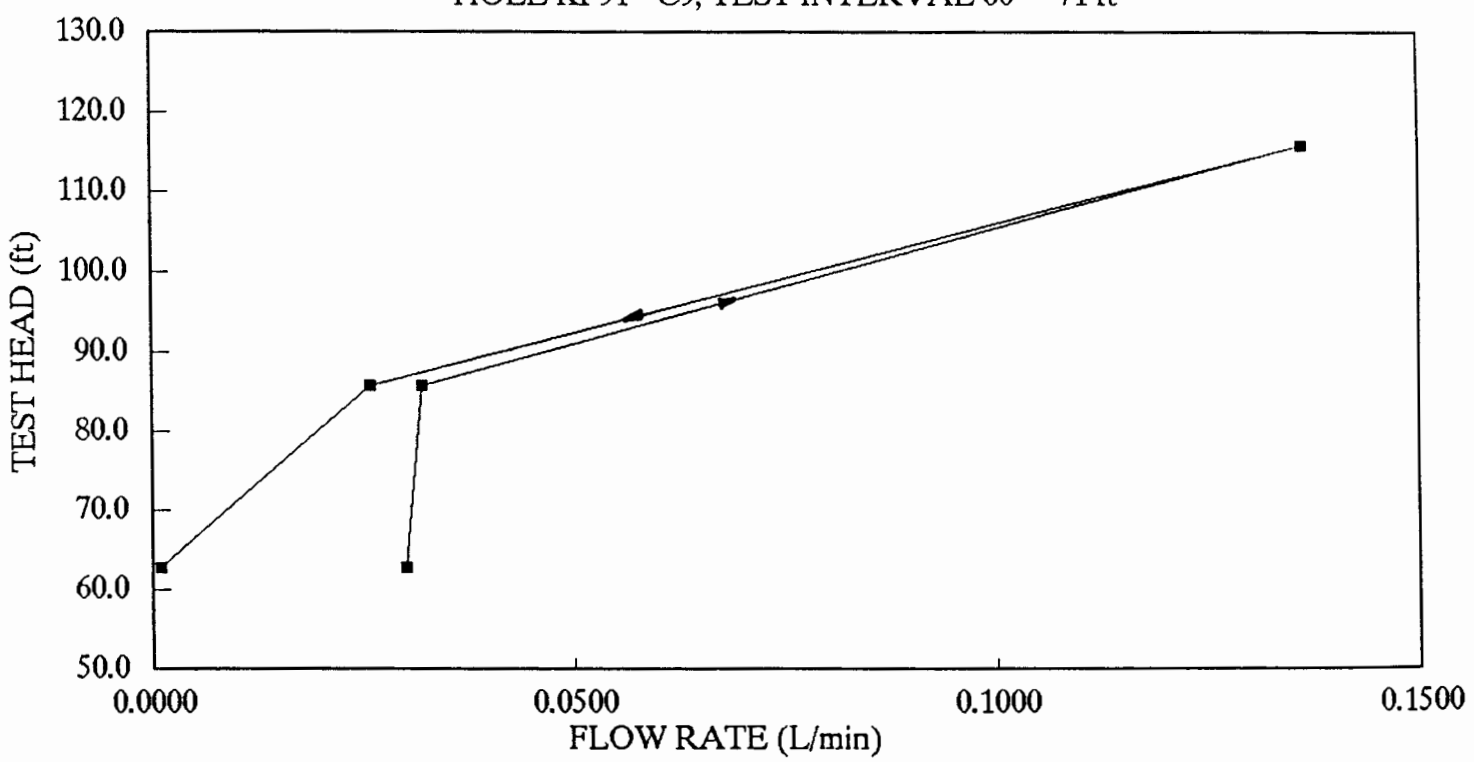
MT. MILLIGAN PACKER TEST RESULTS

HOLE KP91–C9, TEST INTERVAL 50 – 60 ft



MT. MILLIGAN PACKER TEST RESULTS

HOLE KP91–C9, TEST INTERVAL 60 – 71 ft

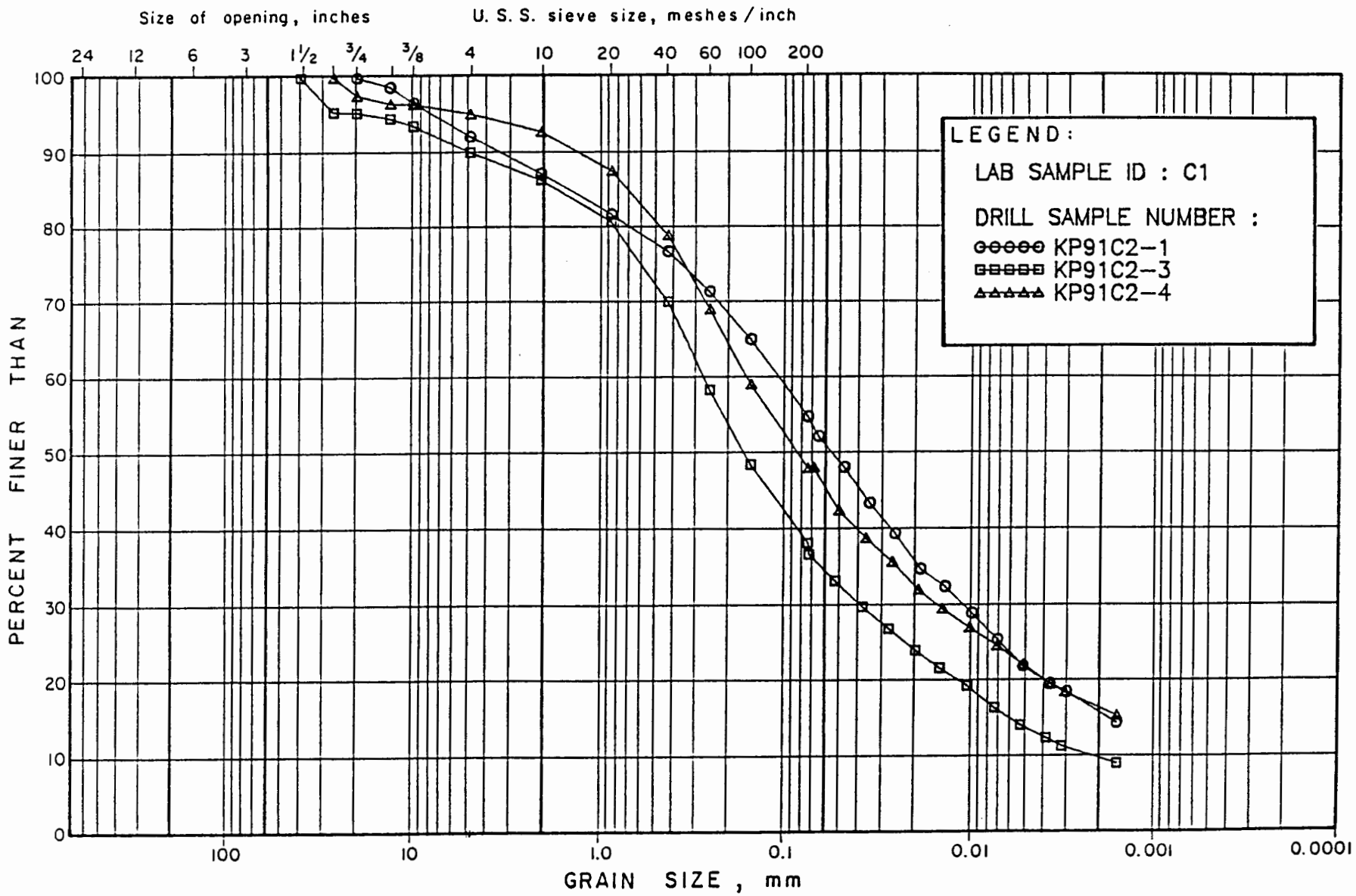


APPENDIX VI

LABORATORY TEST RESULTS

PROJECT 9121001D DRAWN REVIEWED DATE MAR-13-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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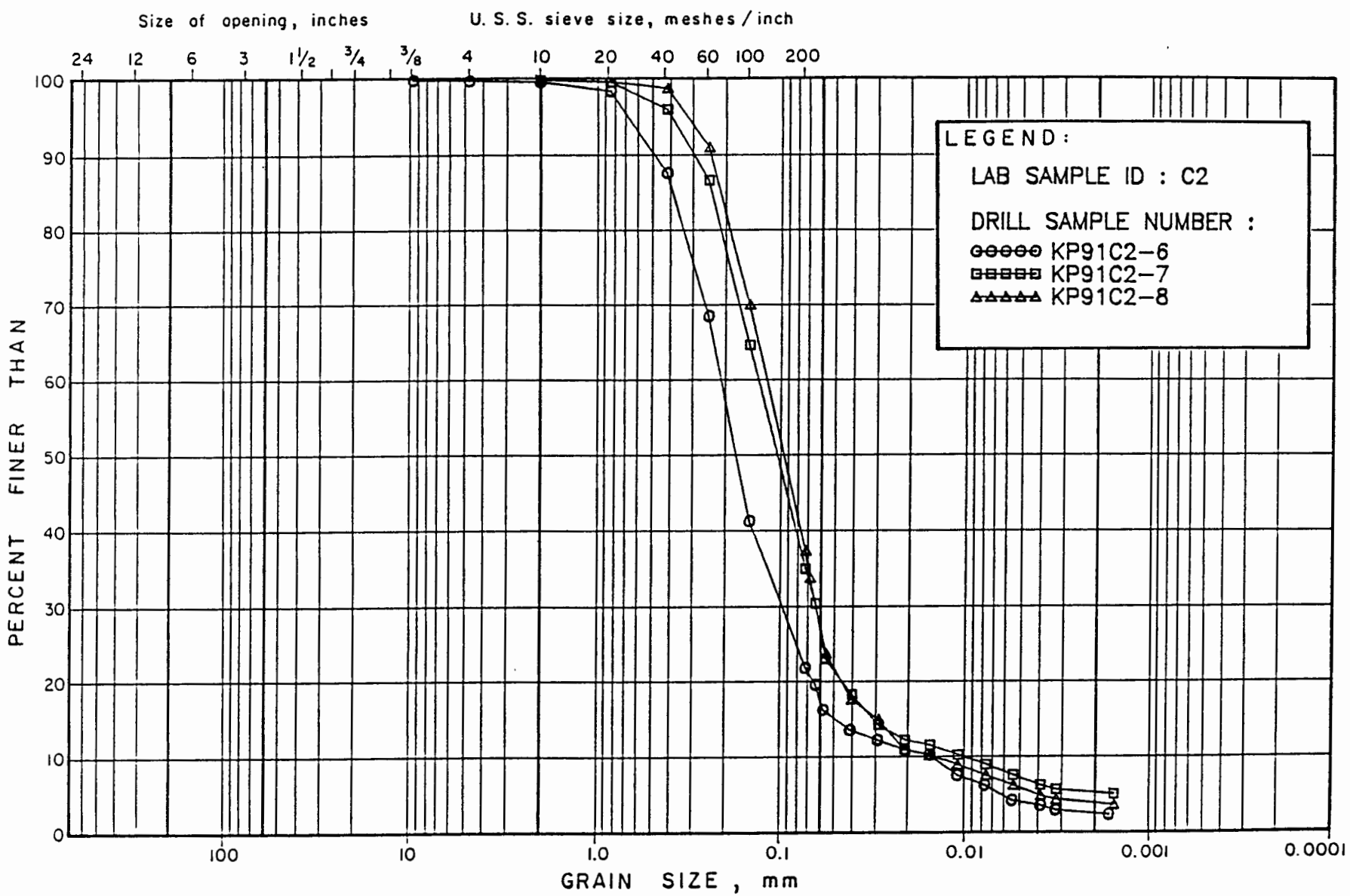
PROJEC 9121001D DRAWN REVIEWED DATE MAR-13-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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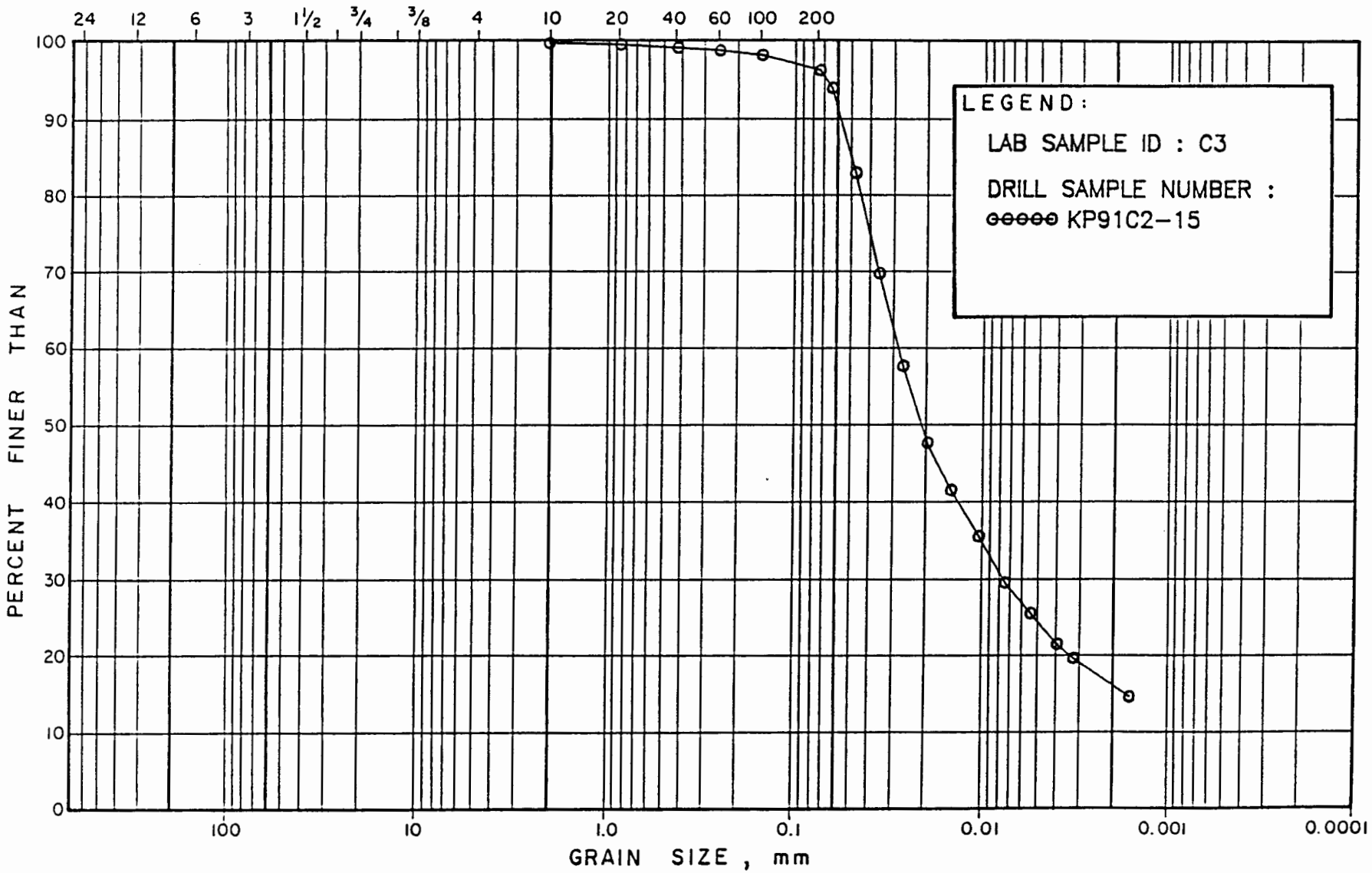
PROJECT 91210010 DRAWN REVIEWED DATE MAR-13-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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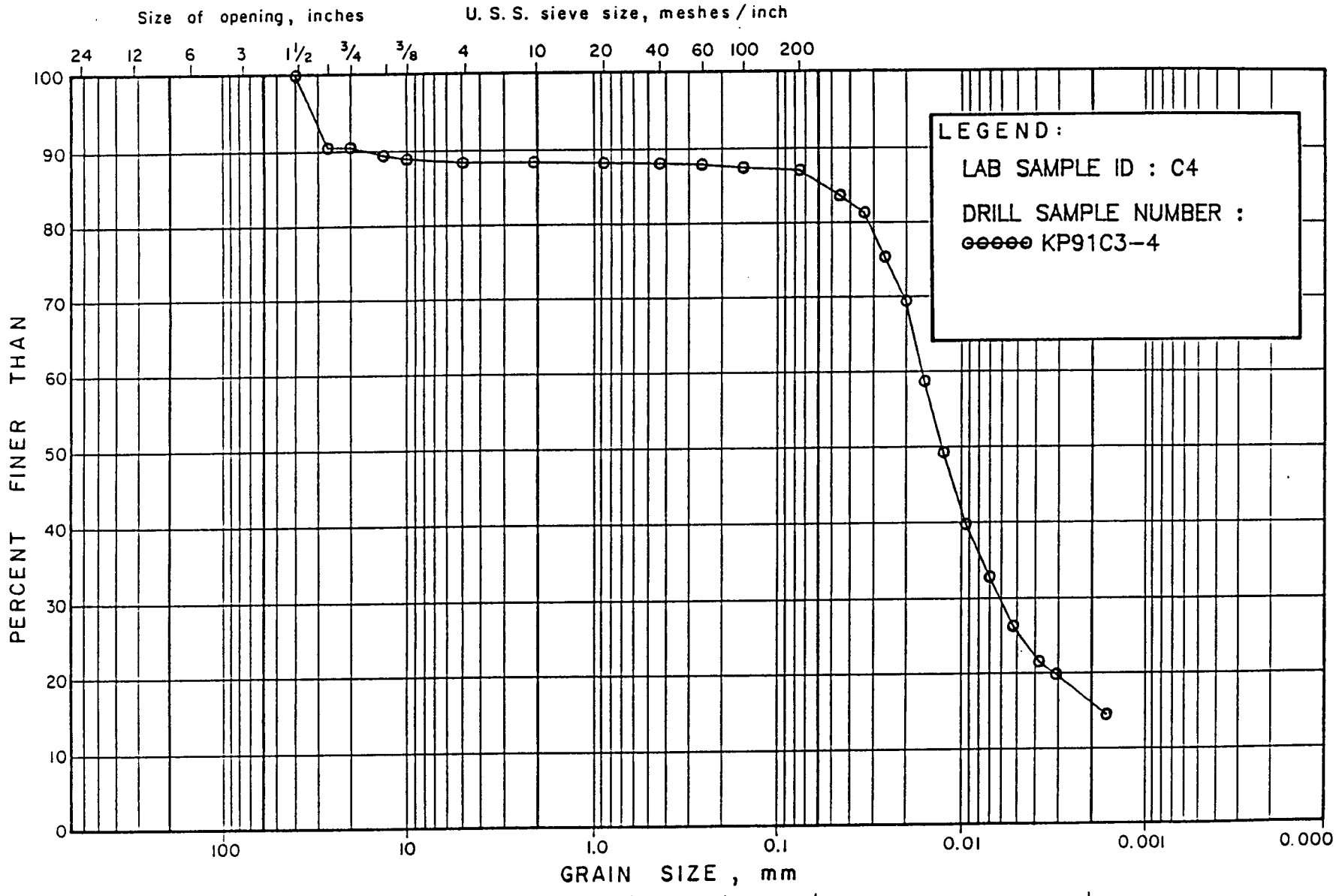
PROJECT 3121001D DRAWN REVIEWED DATE MAR-13-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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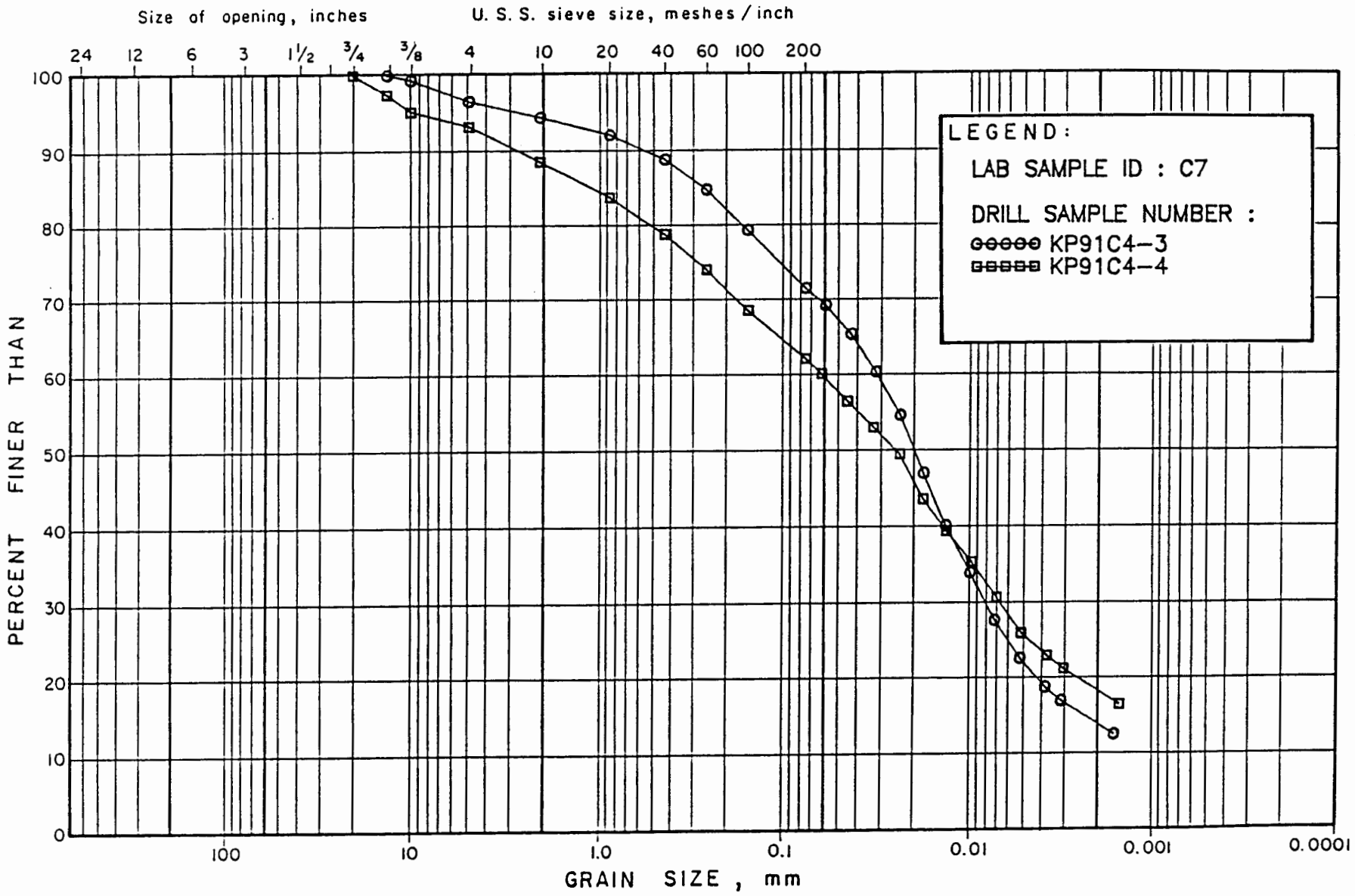
PROJECT 9121001D DRAWN REVIEWED DATE MAR-13-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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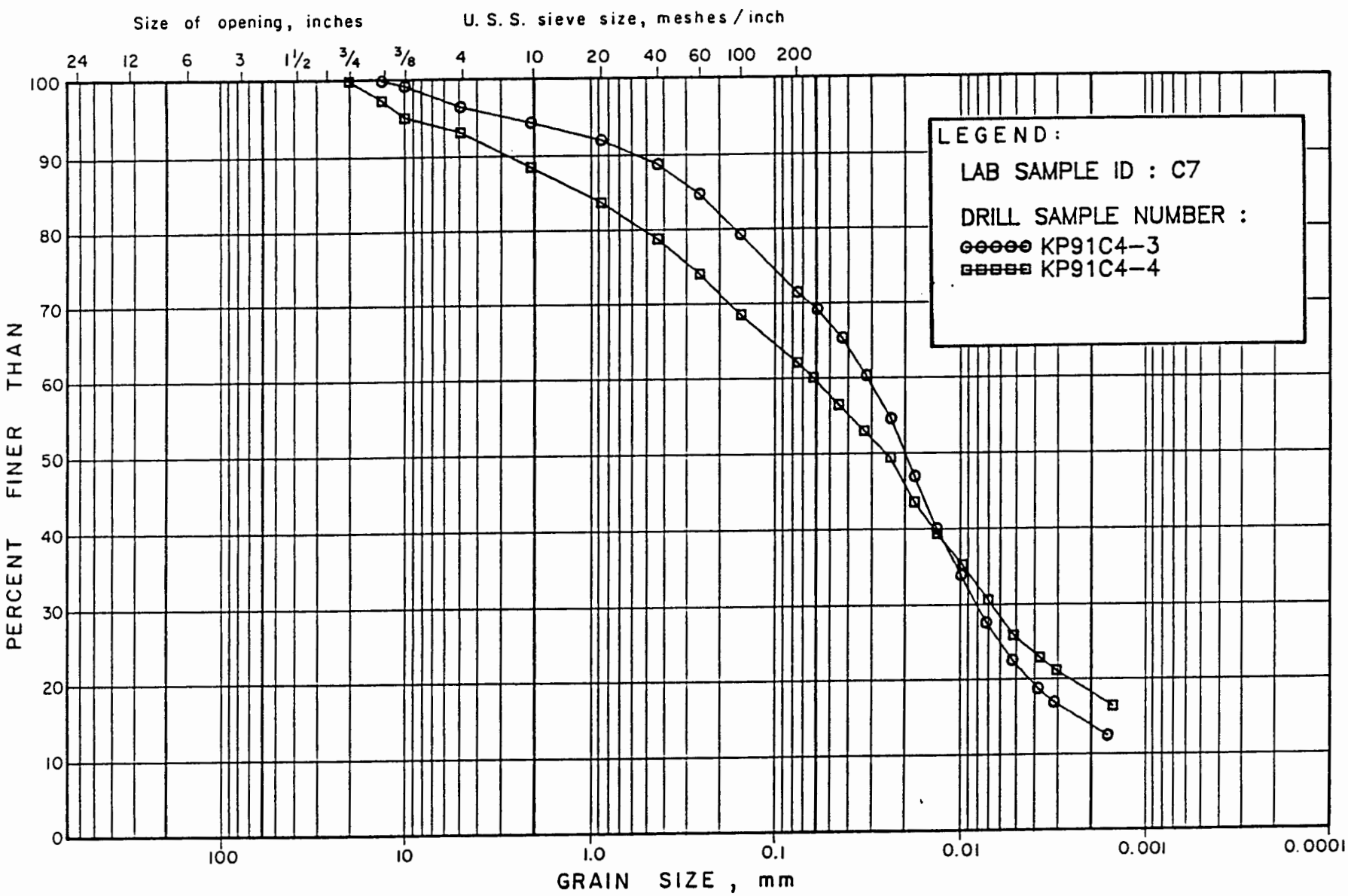
PROJECT 9121001D DRAWN REVIEWED DATE MAR-13-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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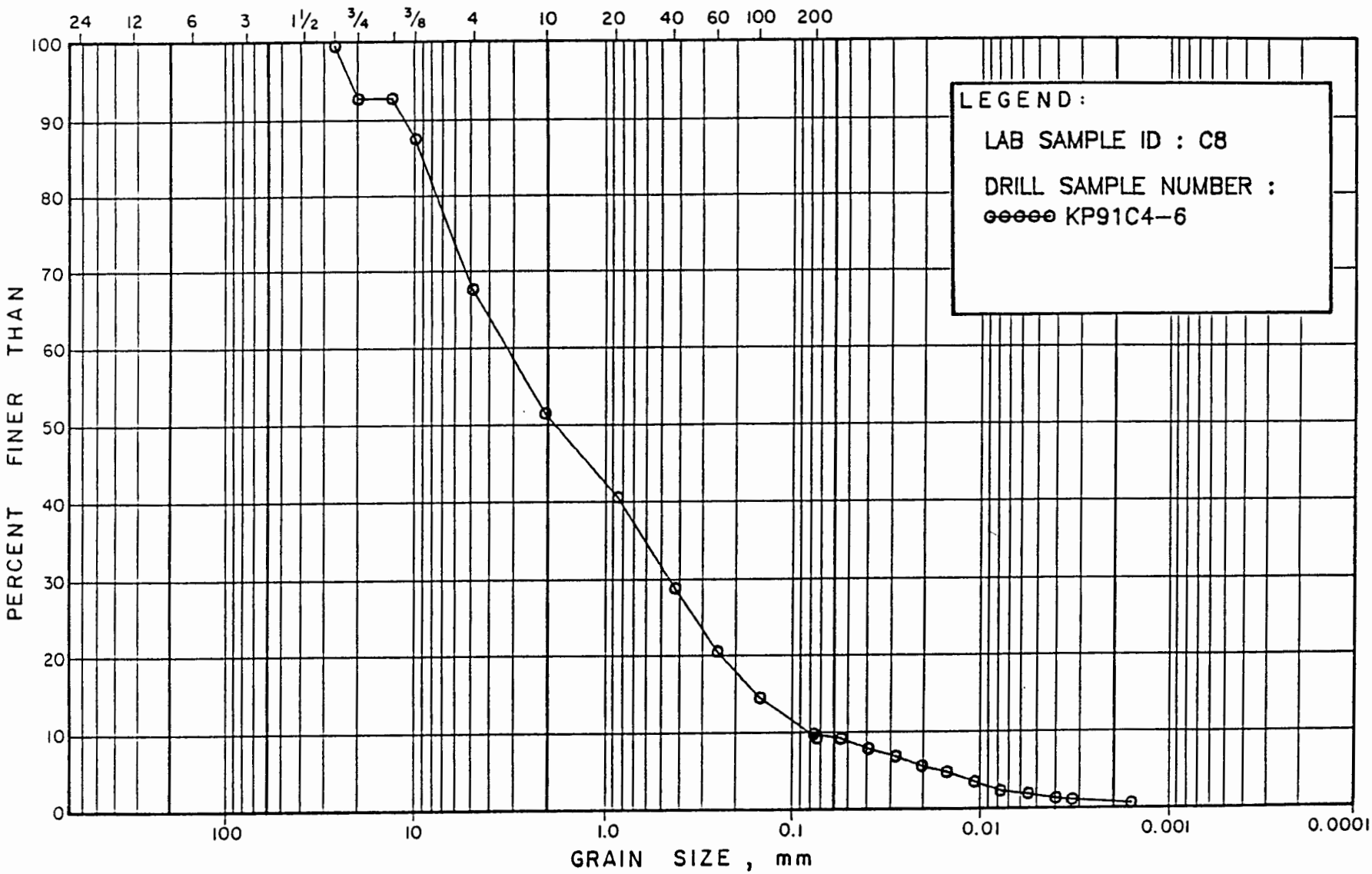
PROJECT NO. 9121001D DRAWN REVIEWED DATE MAR-13-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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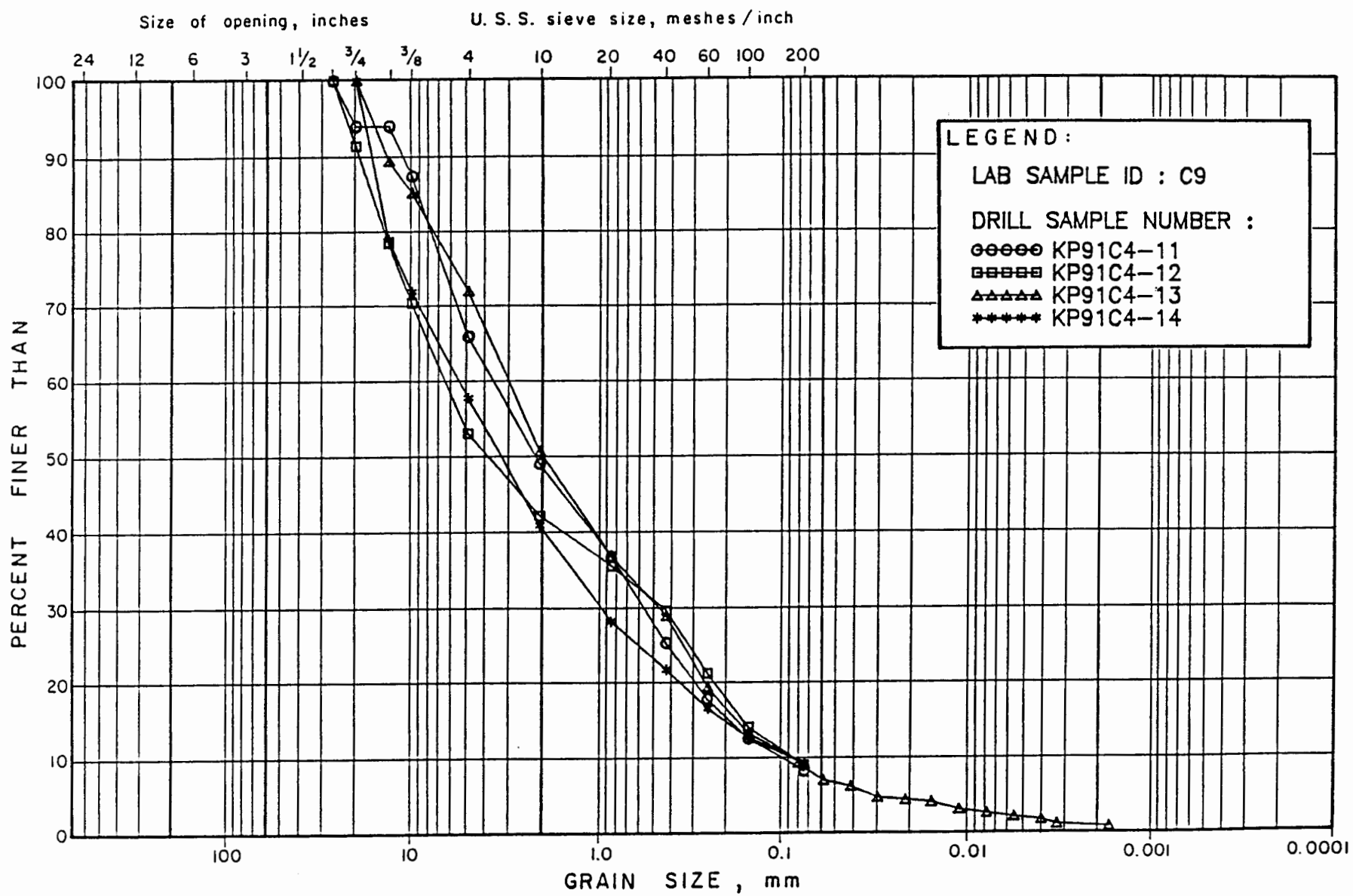
PROJECT 9121001D DRAWN REVIEWED DATE MAR-13-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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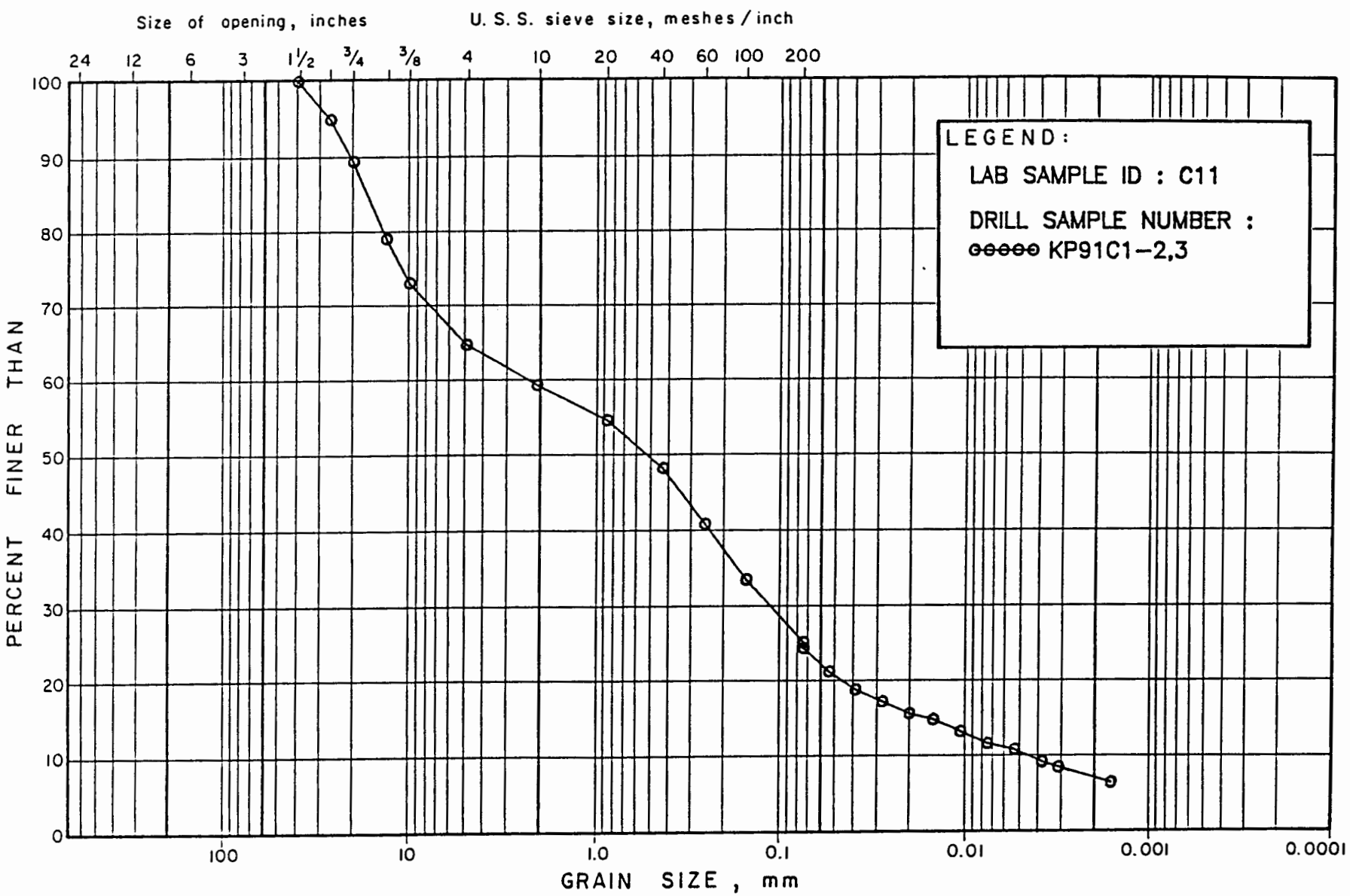
PROJECT 121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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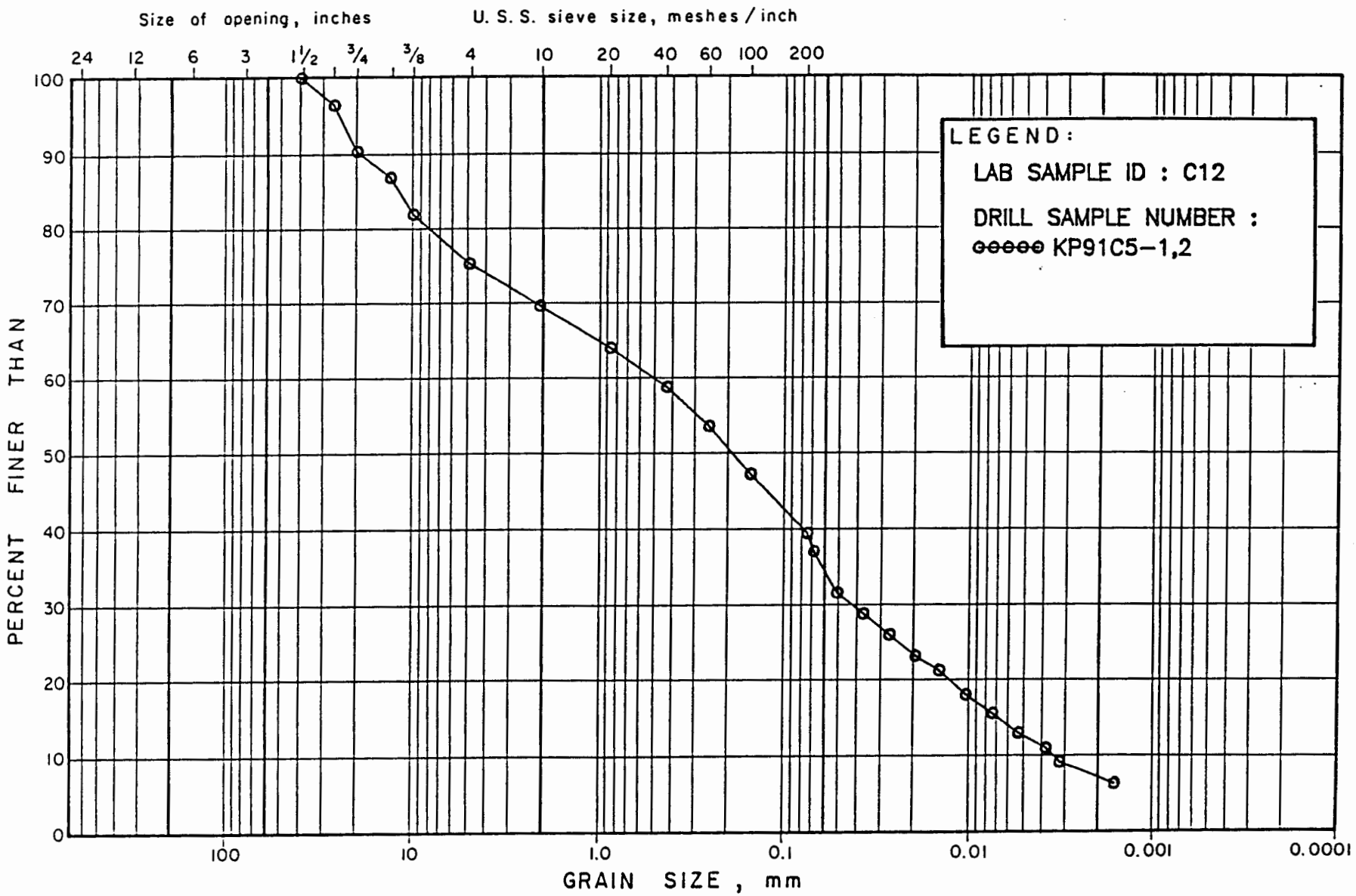
PROJECT 9121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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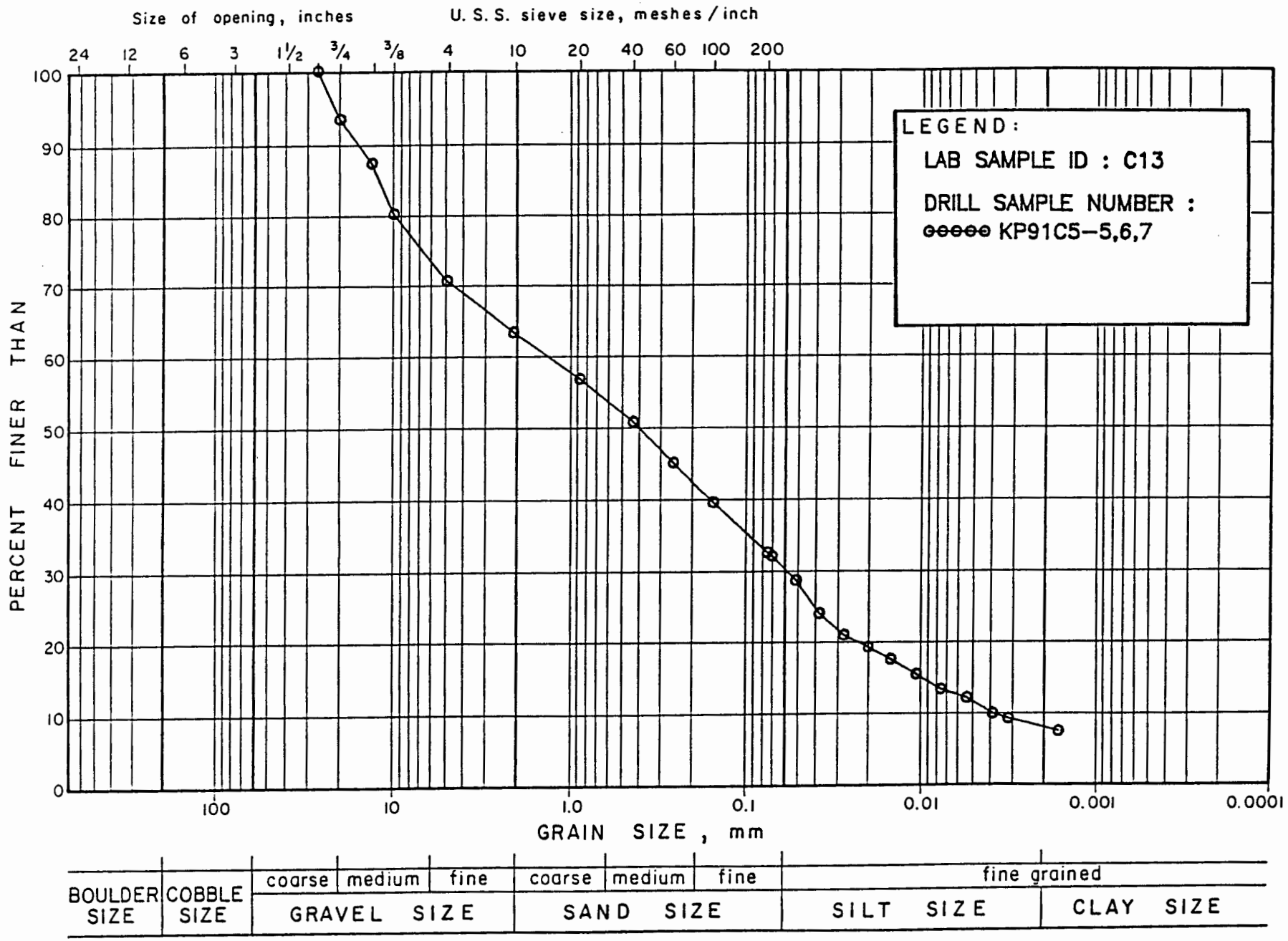
M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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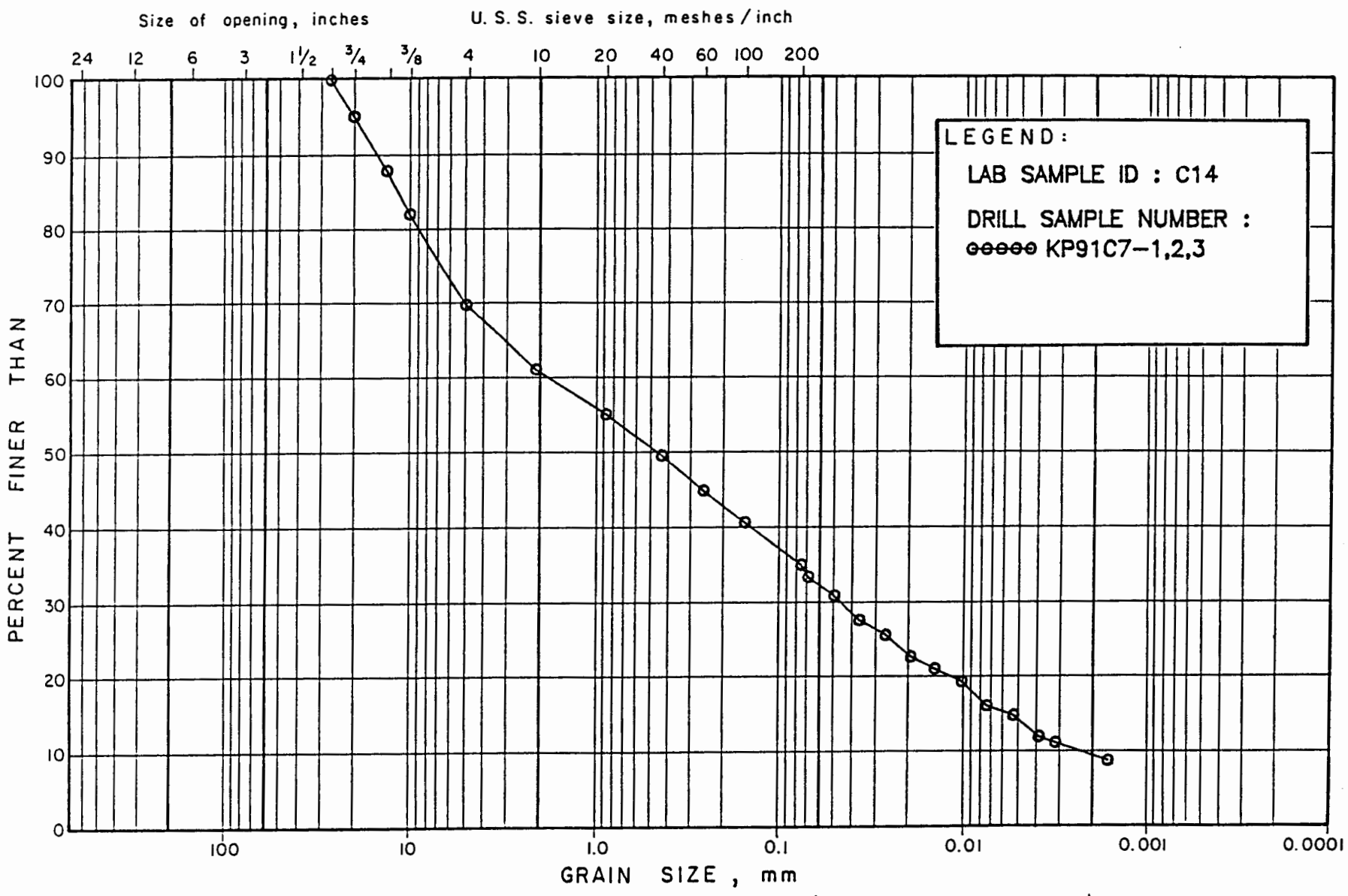
M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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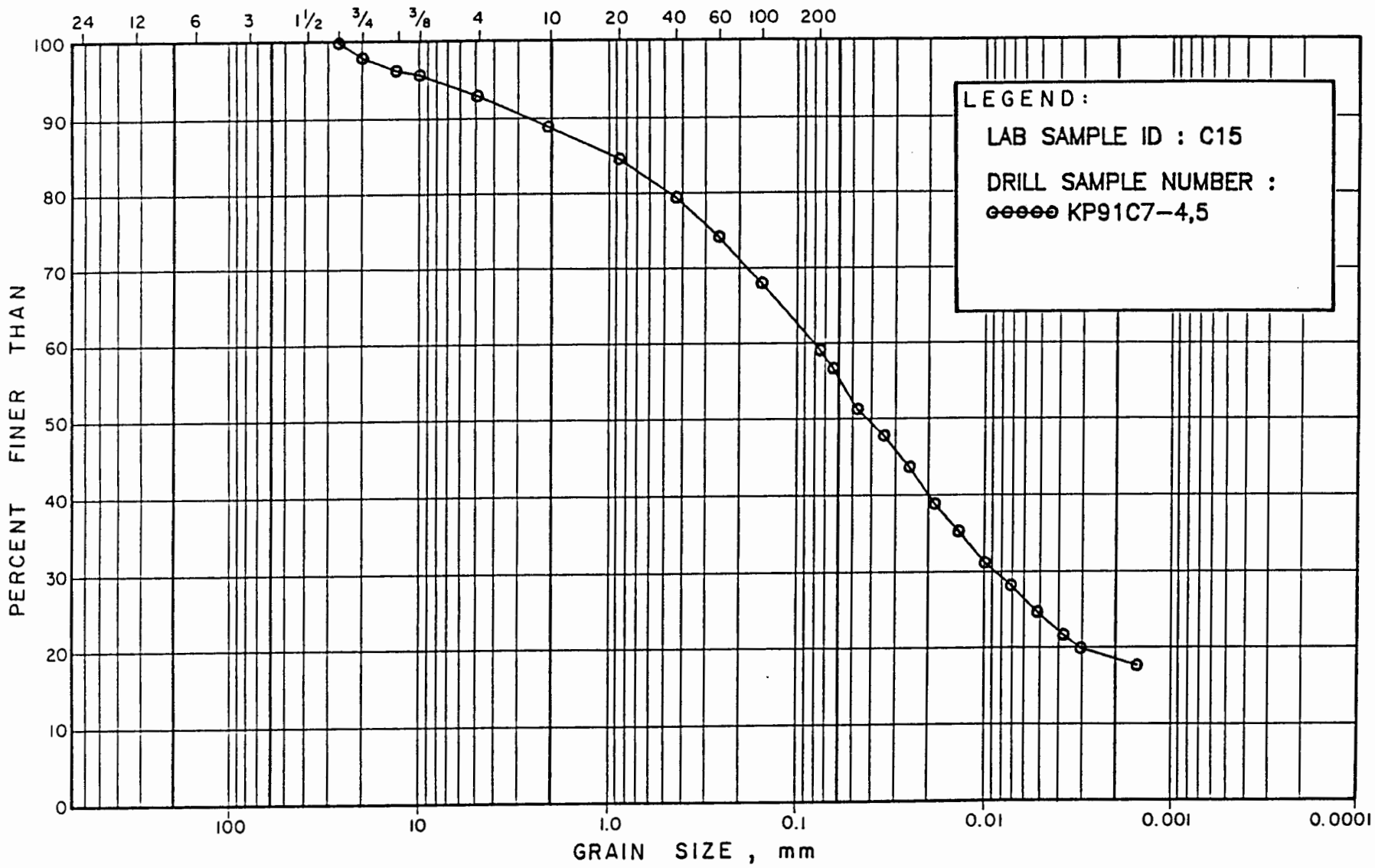
PROJECT 9121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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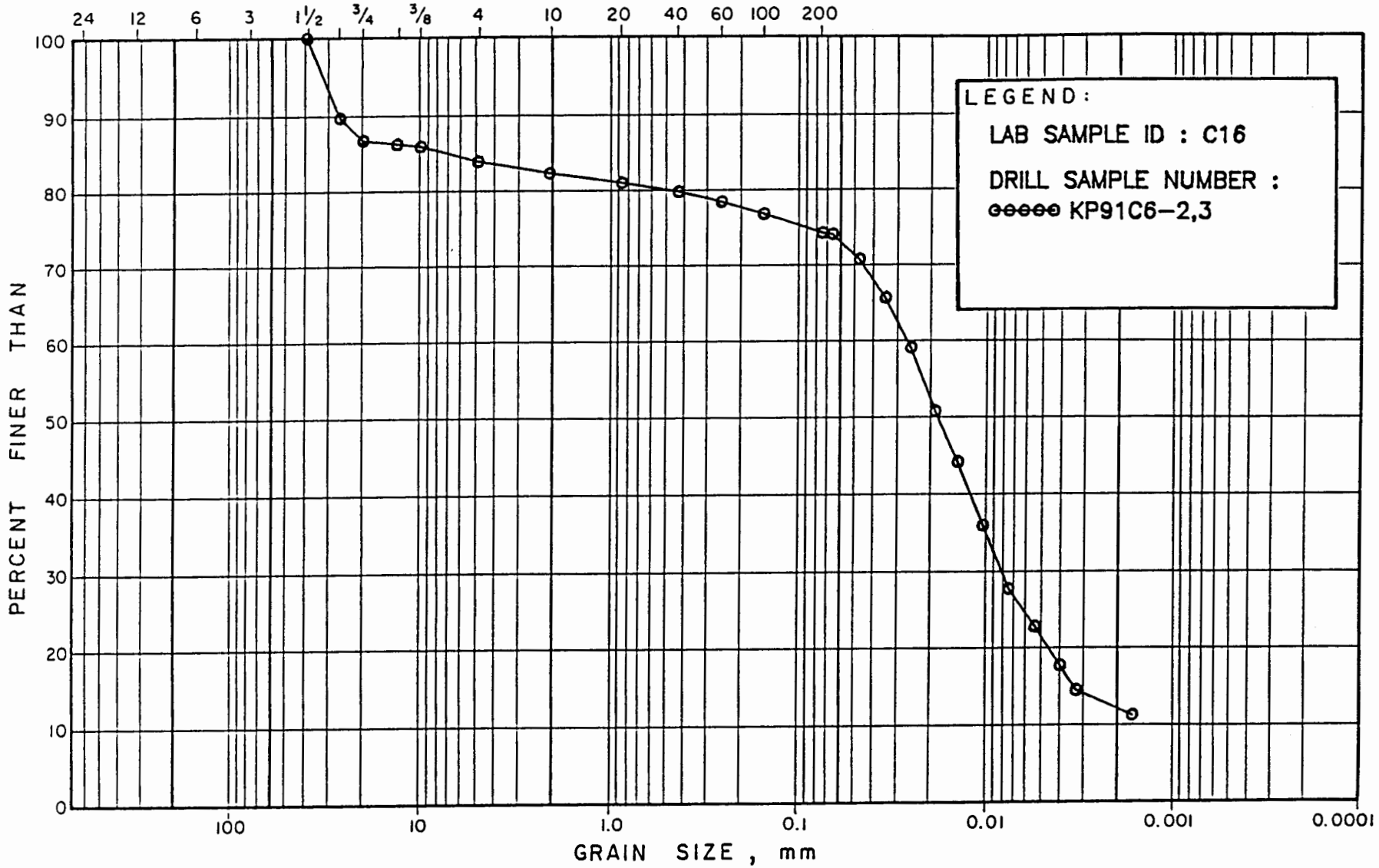
PROJECT NO. 9121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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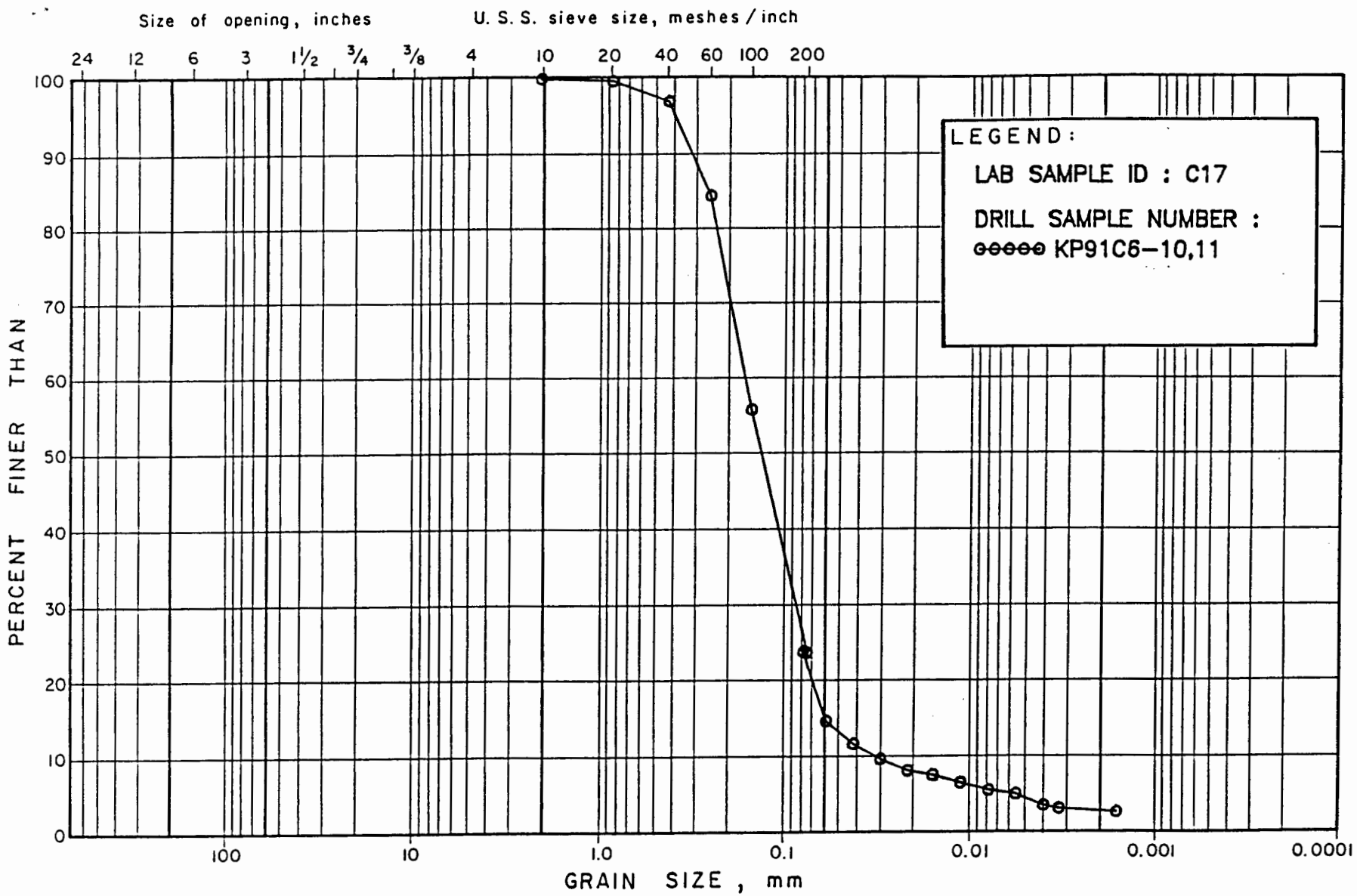
PROJECT 9121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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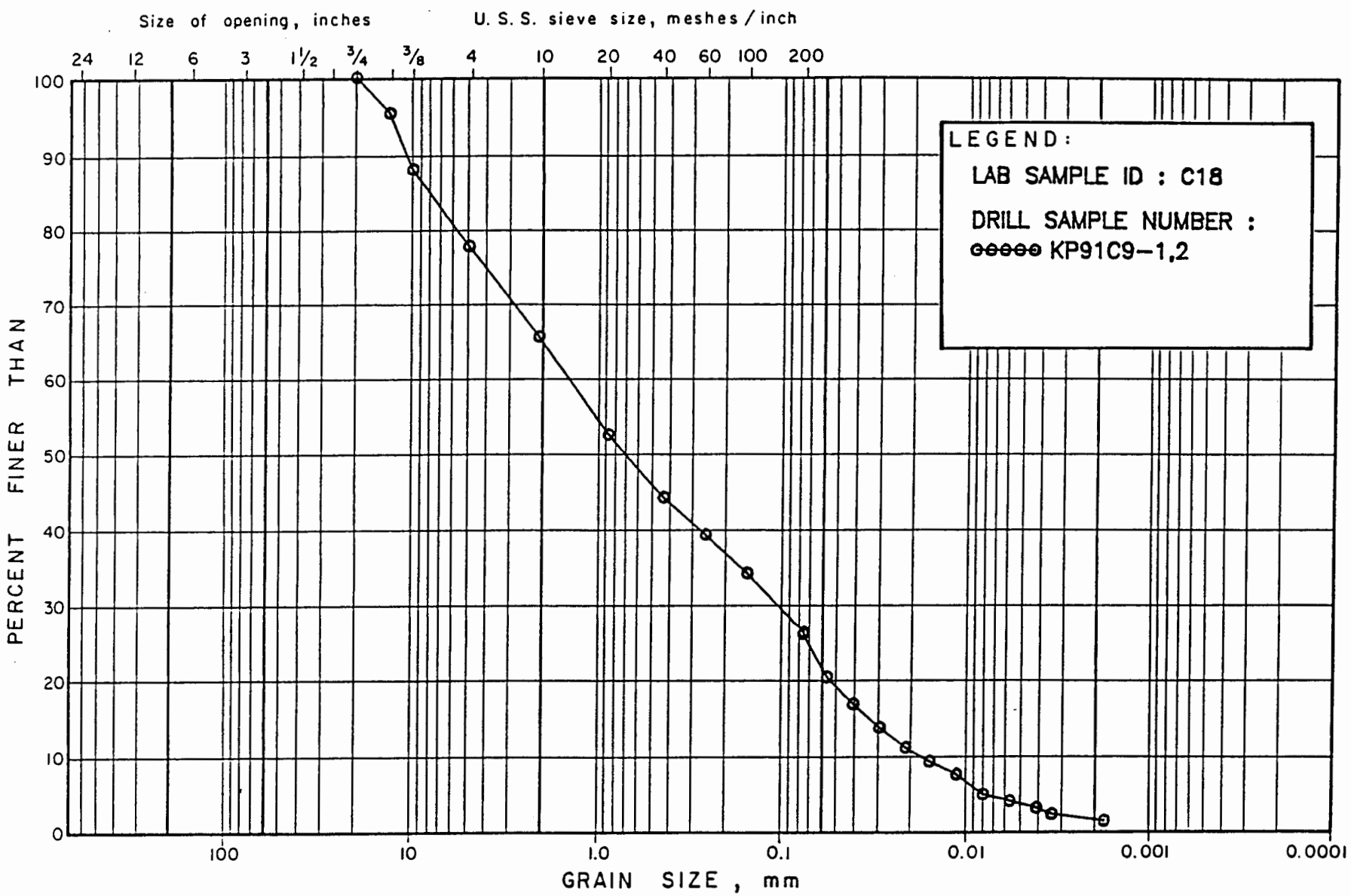
PROJECT 91210010 DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE
		coarse	medium	fine	coarse	medium	fine	fine grained	

GRAIN SIZE DISTRIBUTION

Figure

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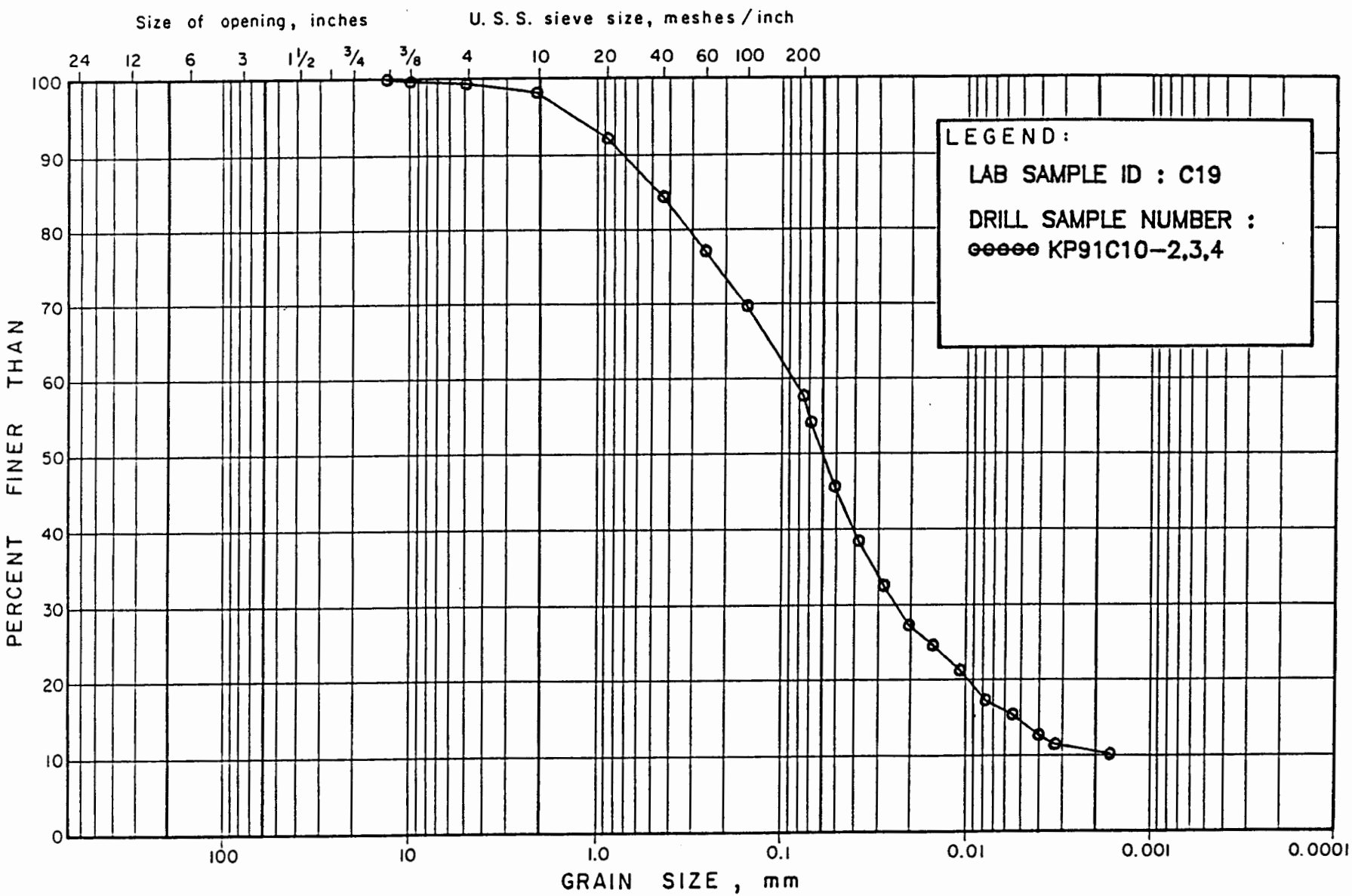
PROJECT 91210010 DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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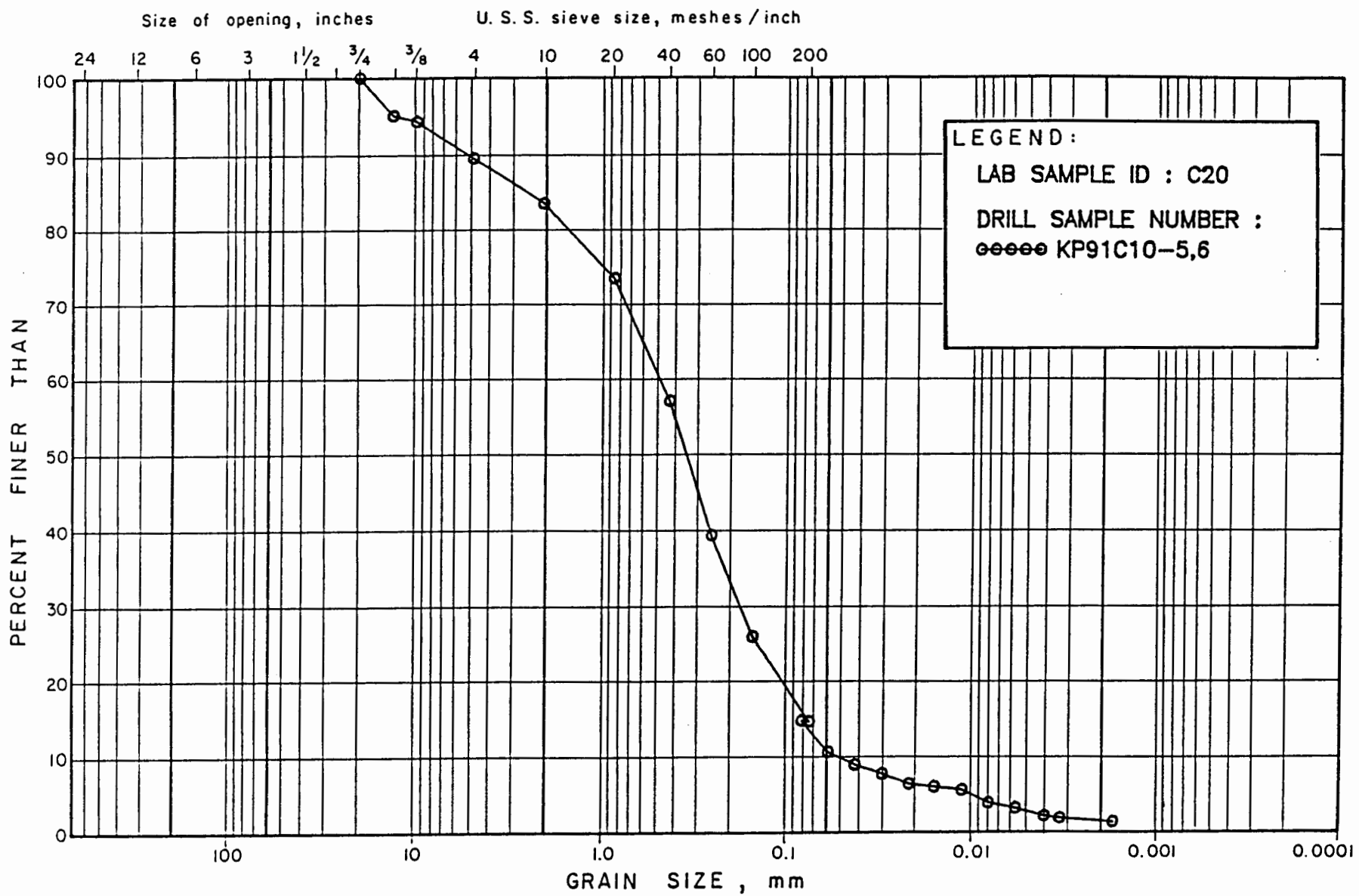
PROJECT 9121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



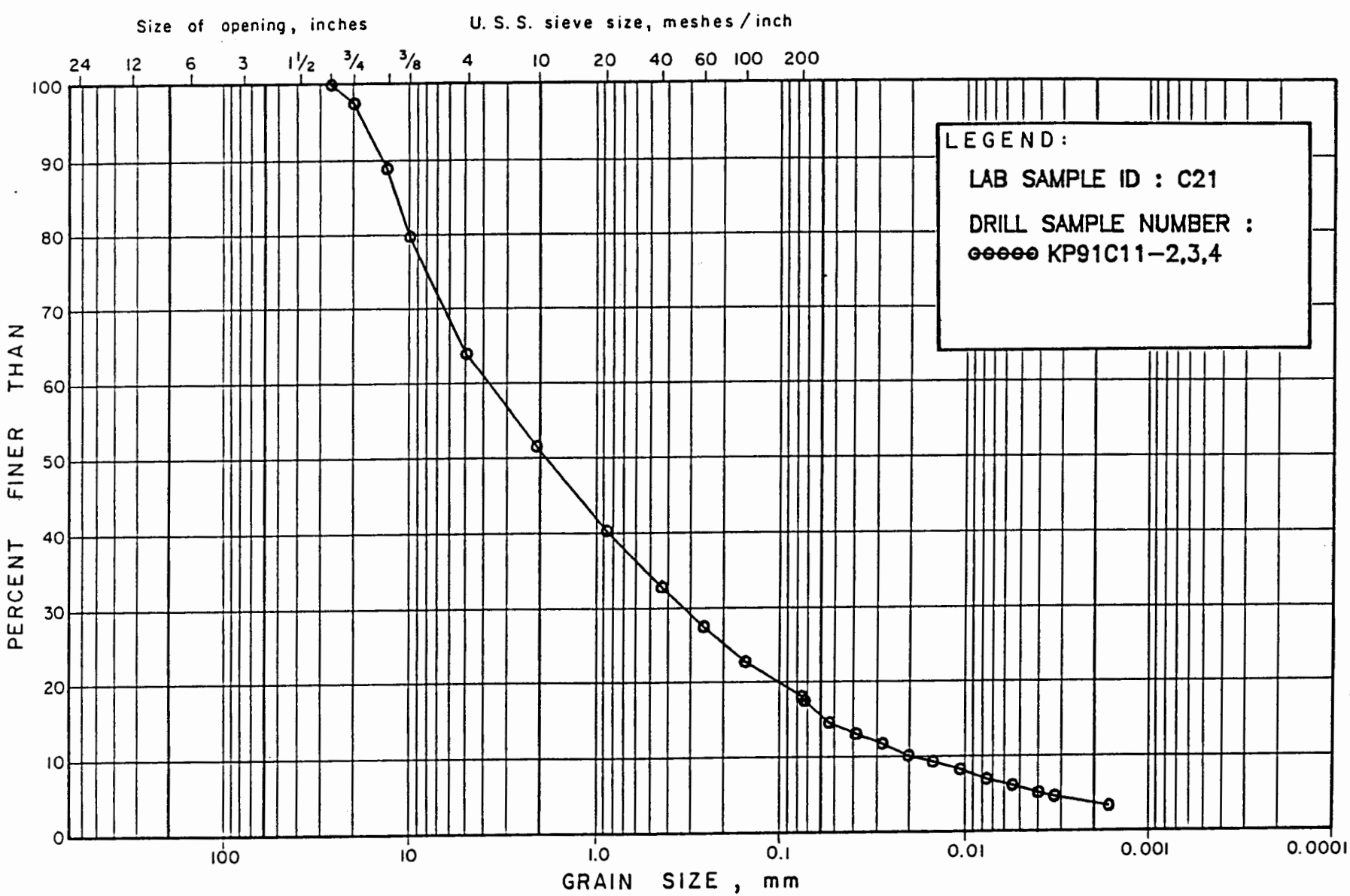
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT 9121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	coarse	medium	fine	coarse	medium	fine	fine grained	
		GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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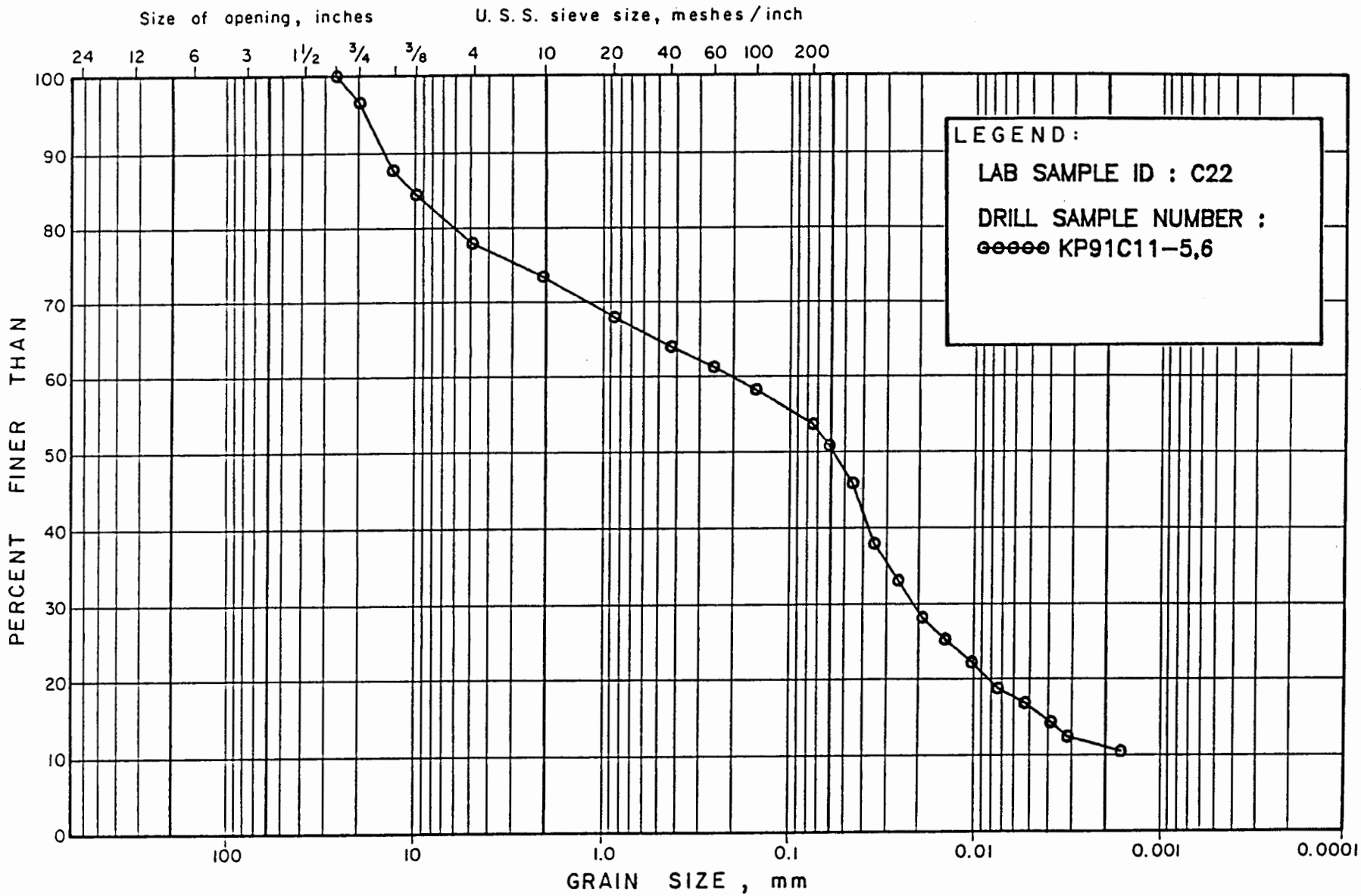
PROJECT 9121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	coarse	medium	fine	coarse	medium	fine	fine grained	
		GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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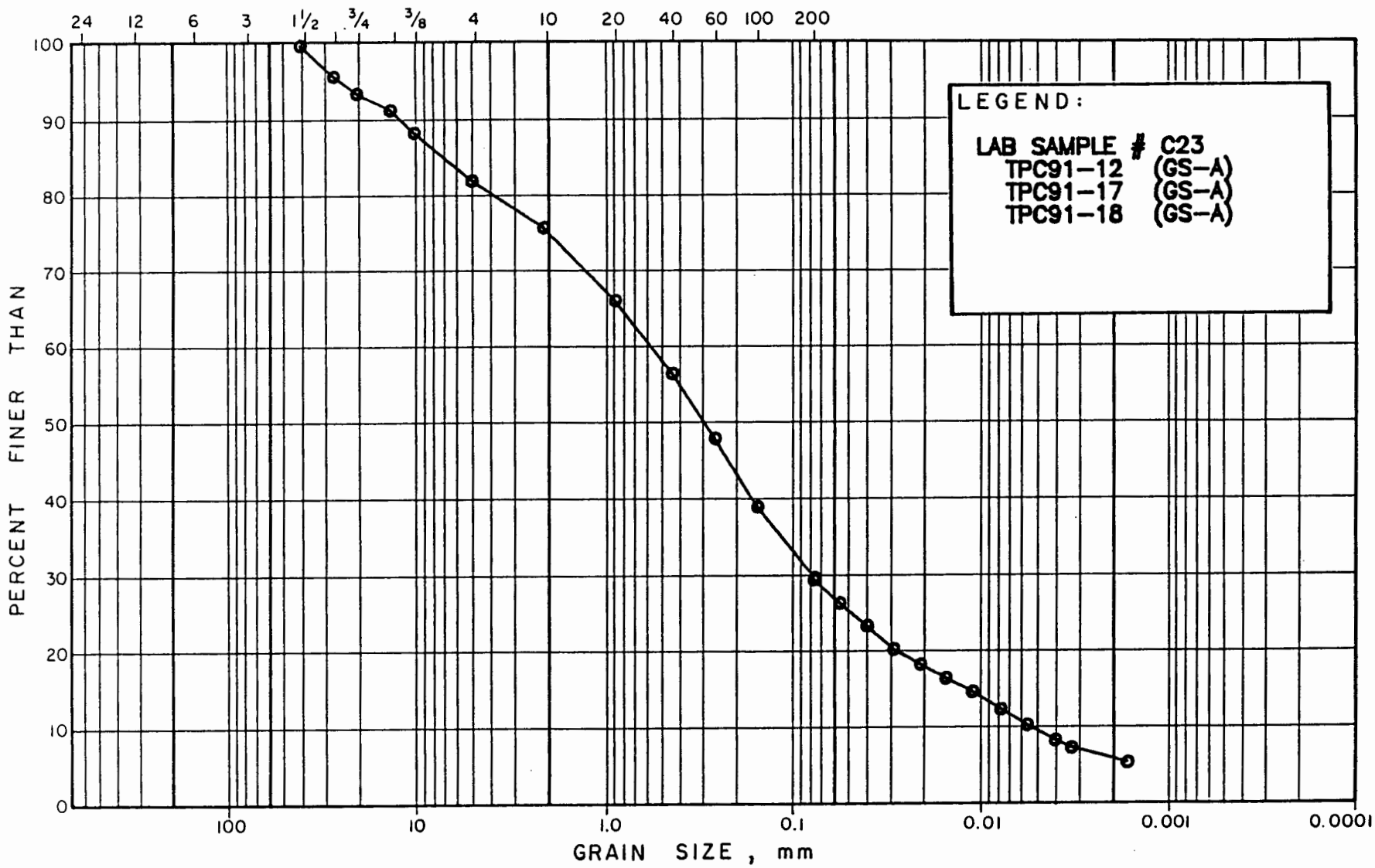
PROJECT NO 9121001D DRAWN REVIEWED DATE APR-03-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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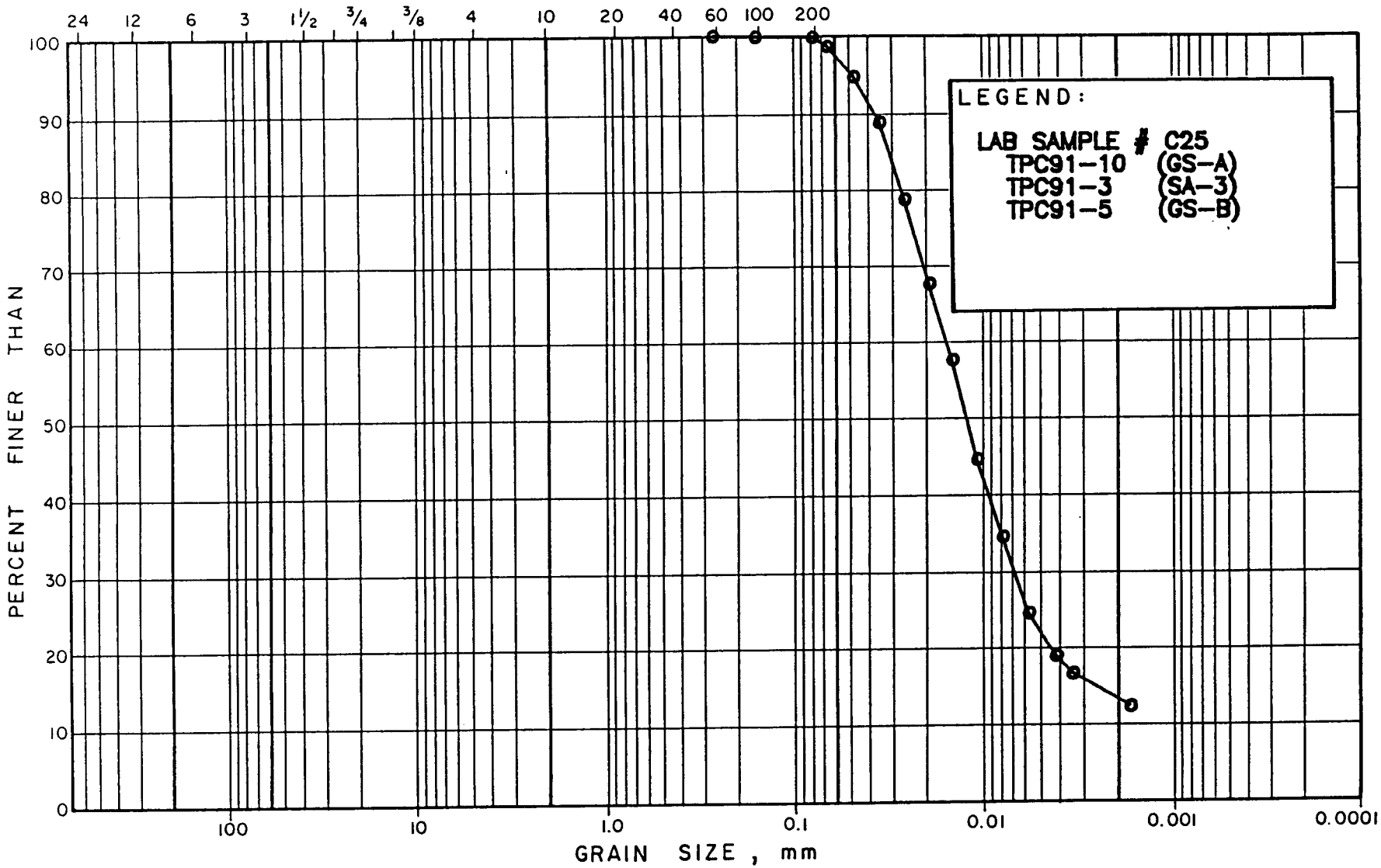
PROJECT NO 9121001D DRAWN REVIEWED DATE APR-03-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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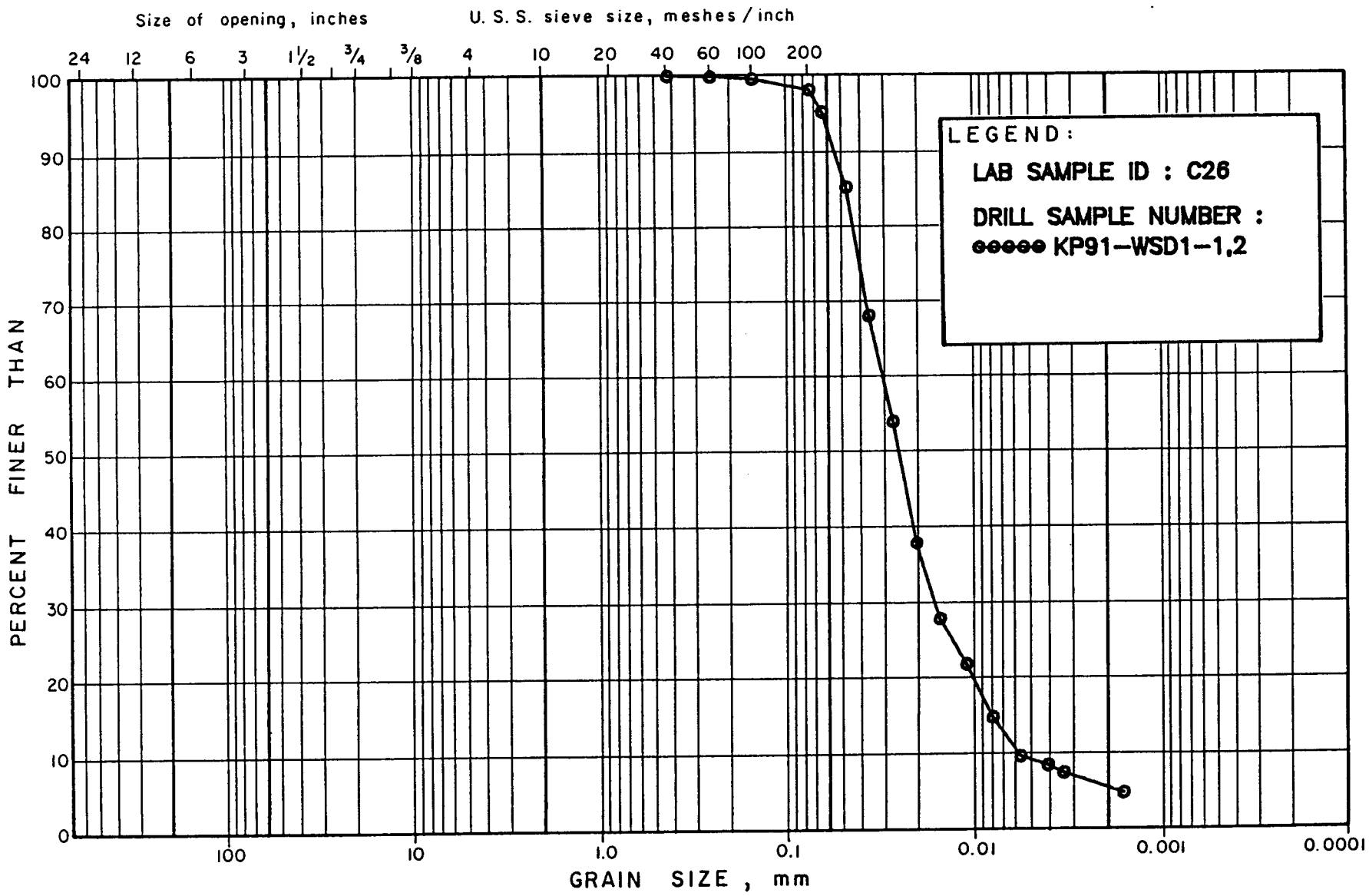
PROJECT 9121001D DRAWN REVIEWED DATE APR-08-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

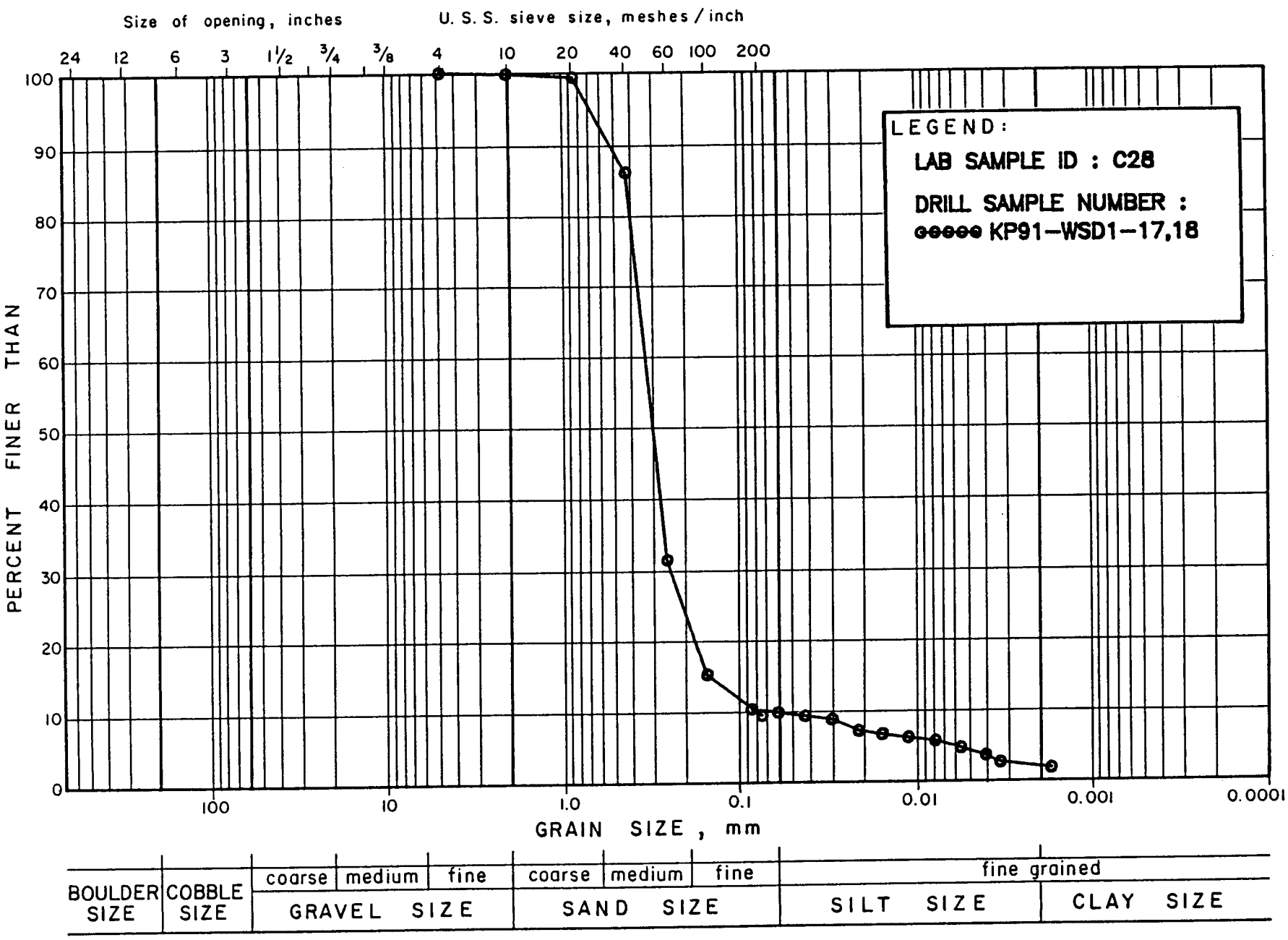
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT 9121001D DRAWN REVIEWED DATE APR-08-91

M.I.T. GRAIN SIZE SCALE



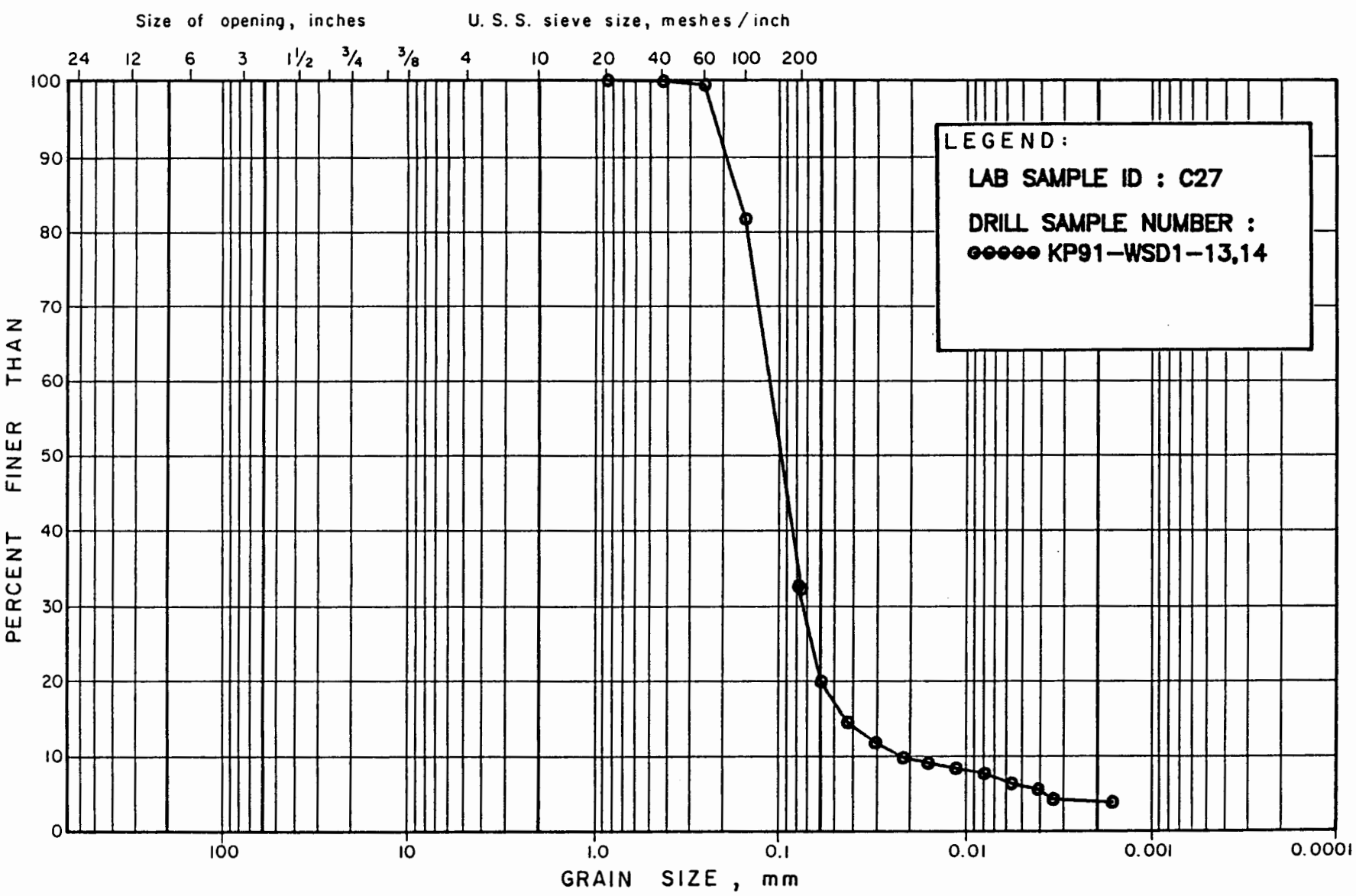
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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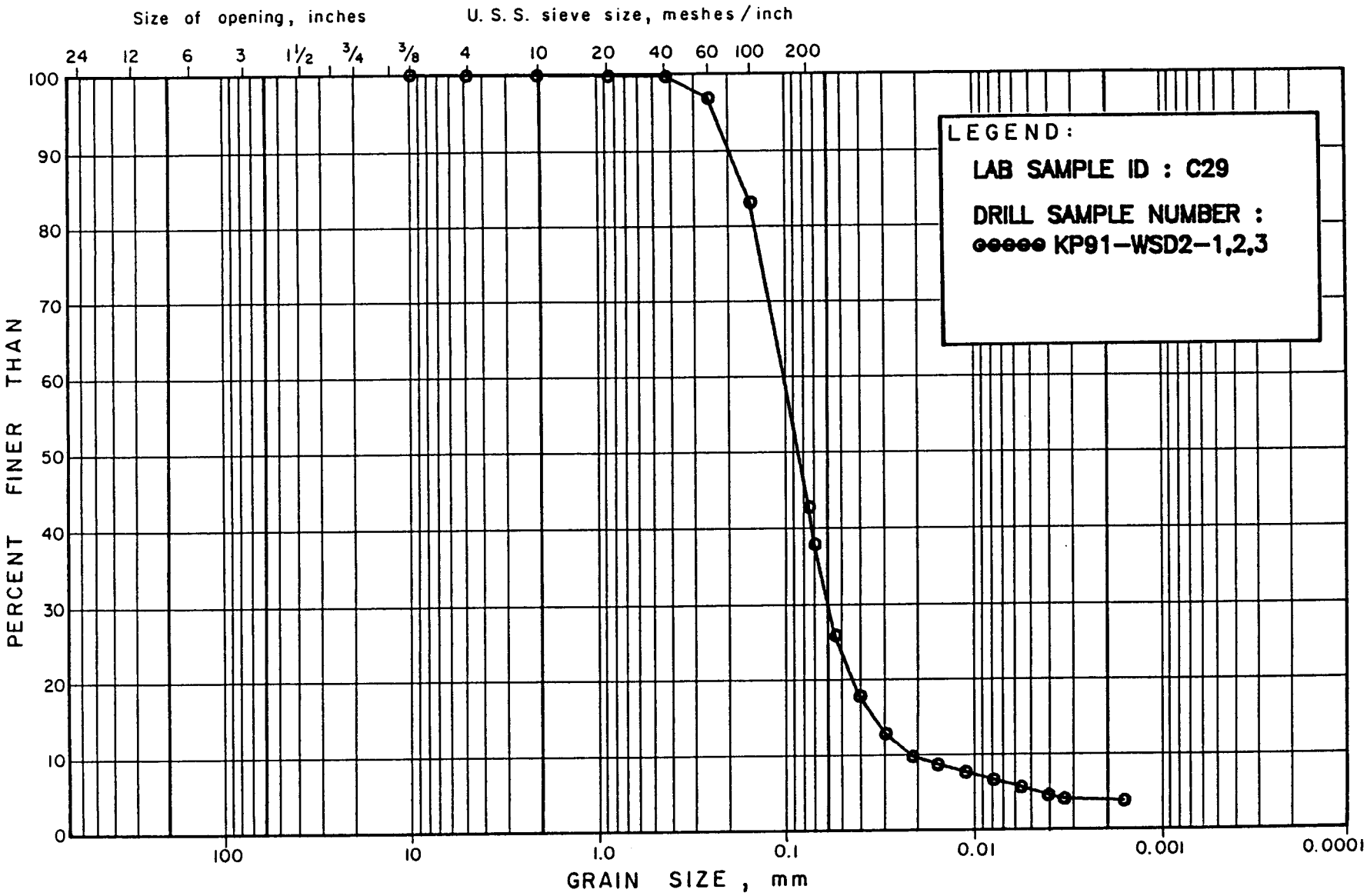
PROJEC 0.9121001D DRAWN REVIEWED DATE APR-06-01

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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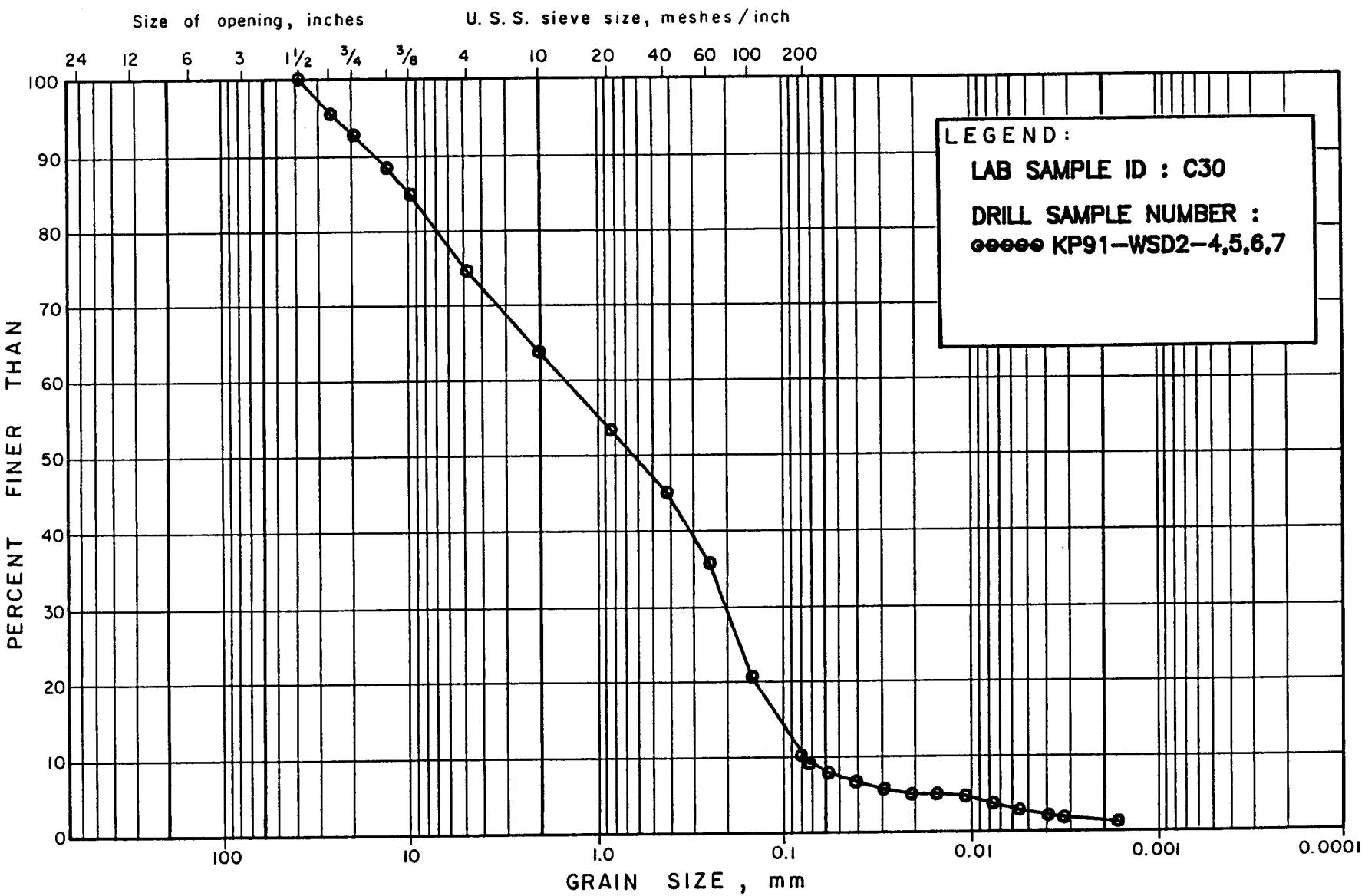
PROJEC 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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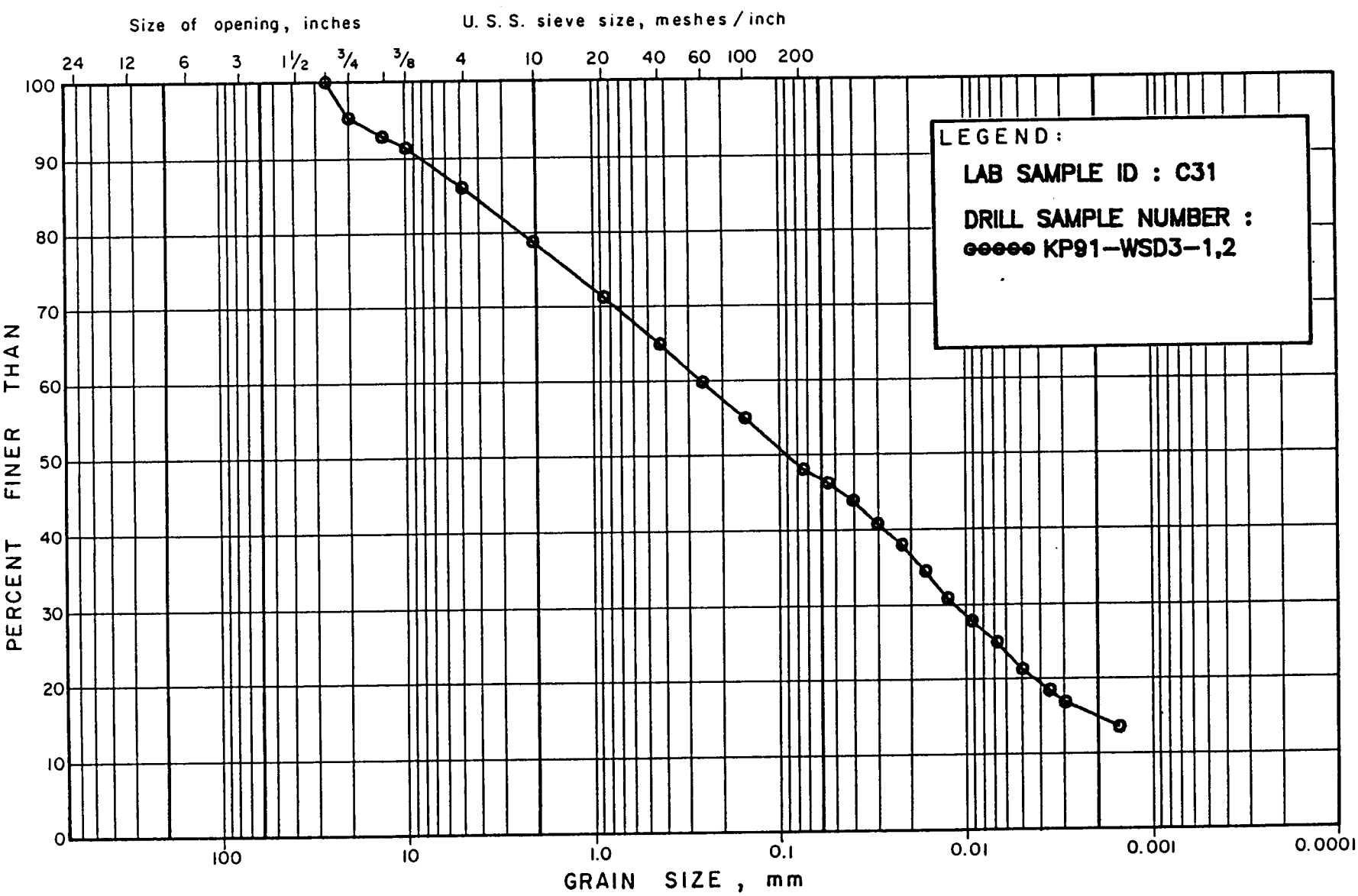
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

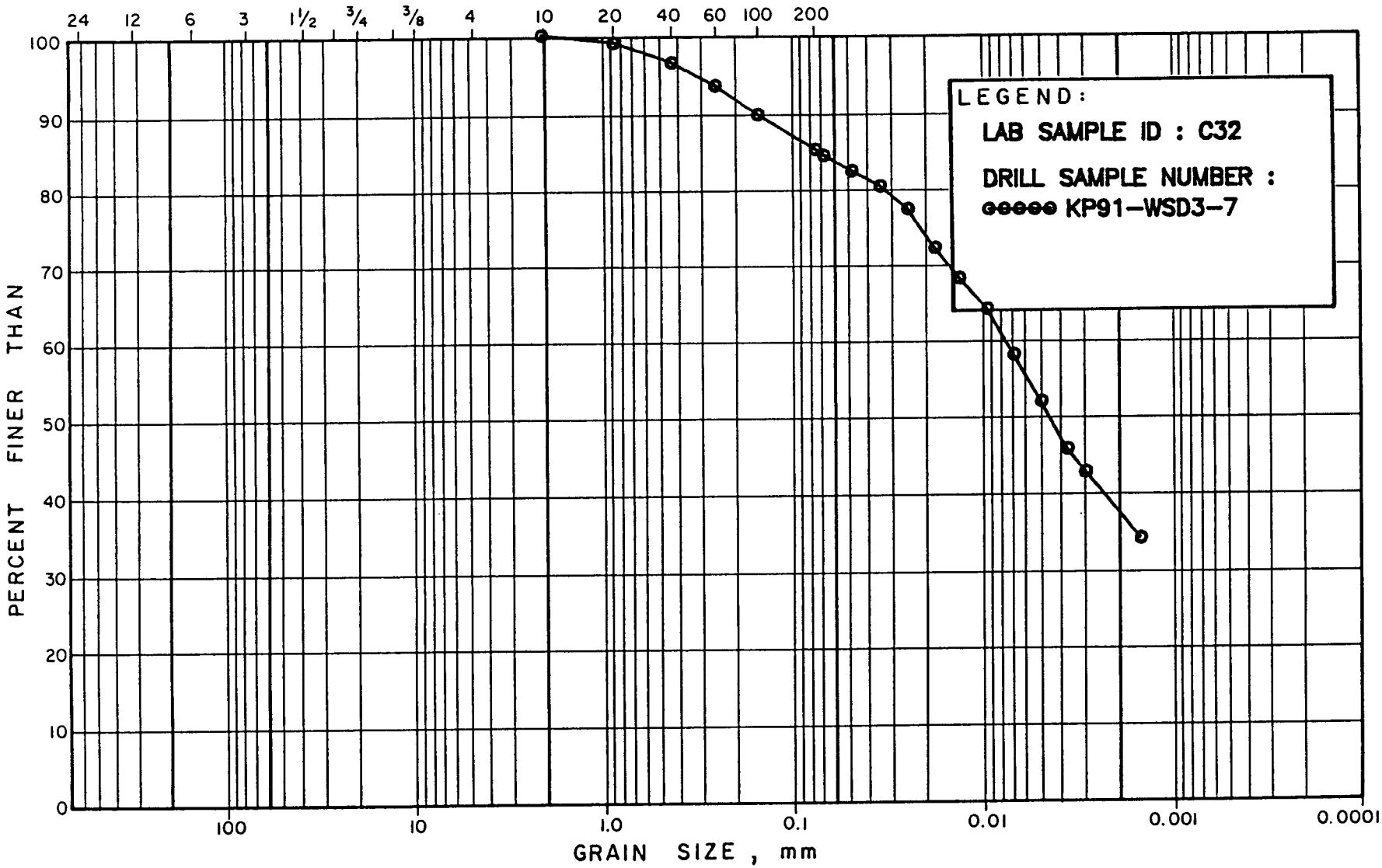
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN ..... REVIEWED ..... DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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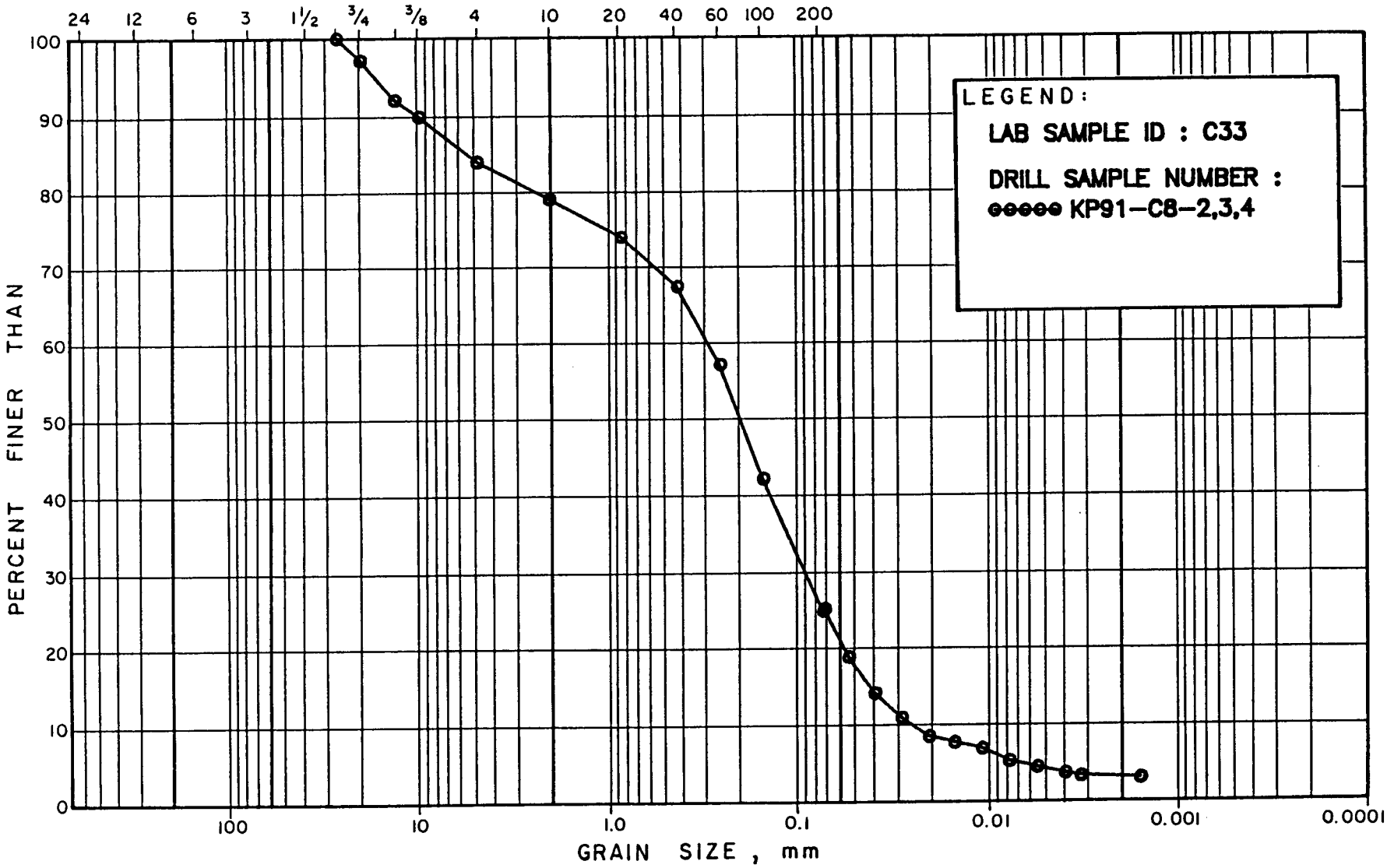
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-08-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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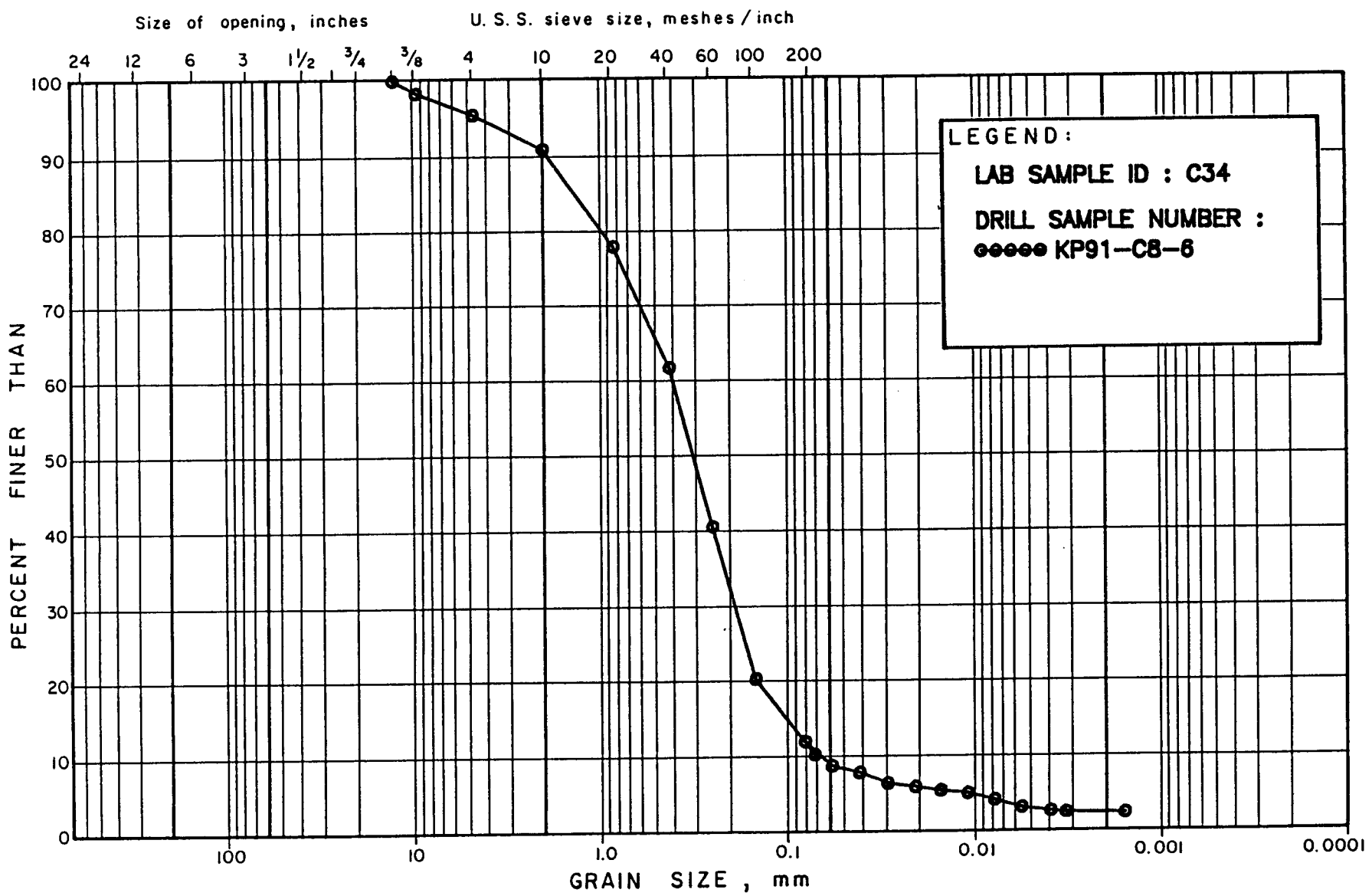
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	coarse	medium	fine	coarse	medium	fine	fine grained	
		GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE

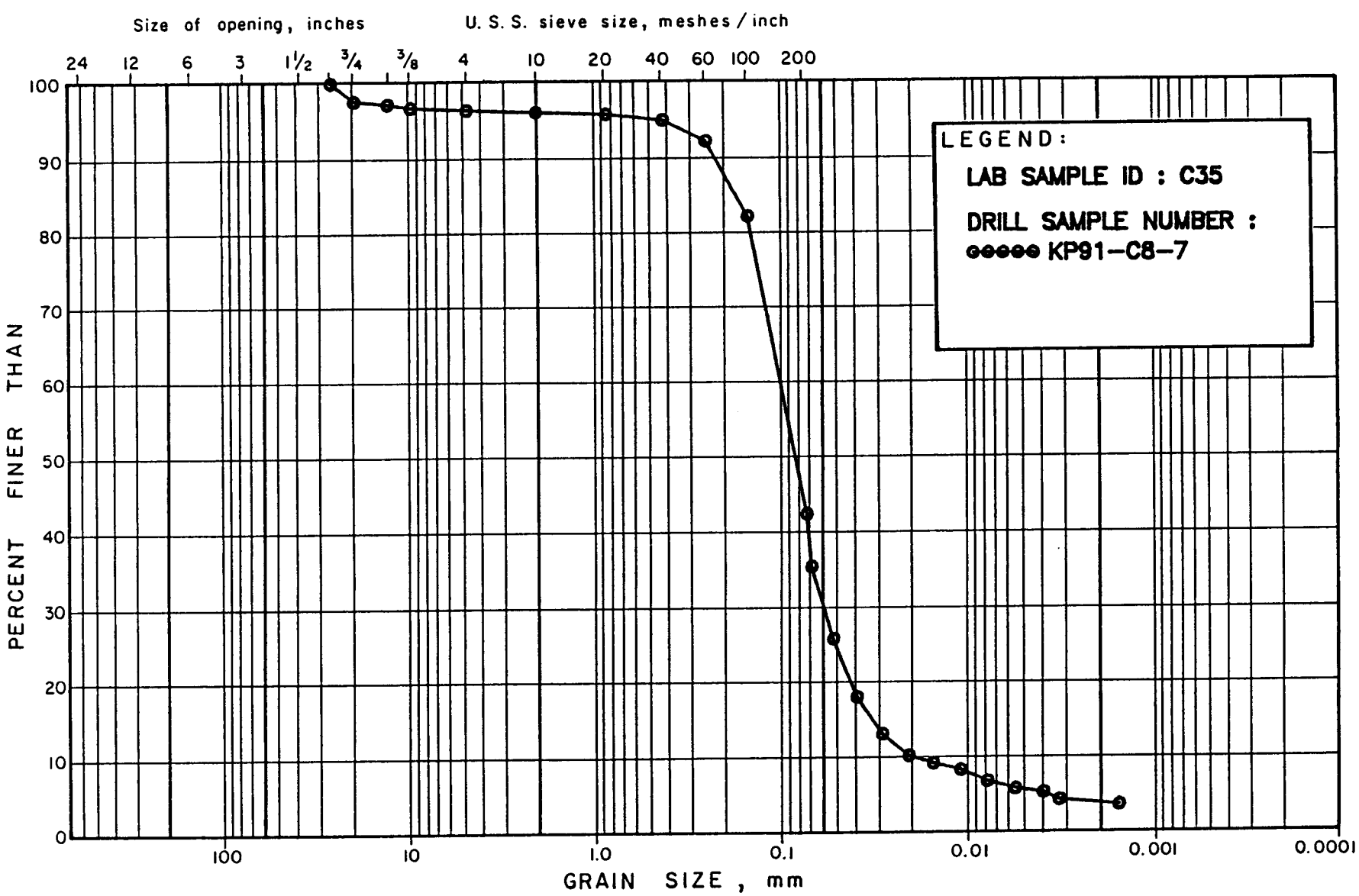
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-01

M.I.T. GRAIN SIZE SCALE



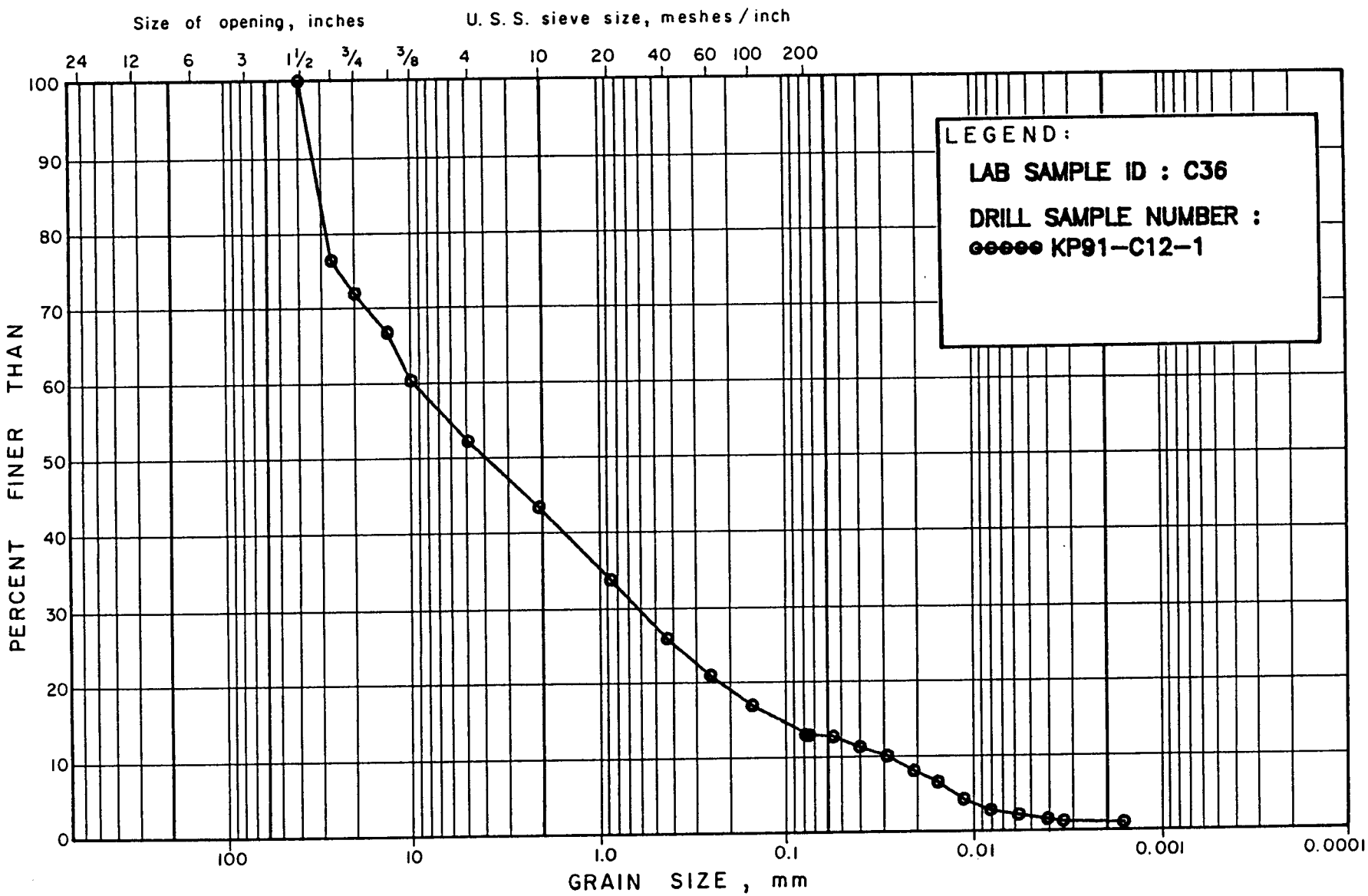
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	SILT SIZE (fine grained)	CLAY SIZE (fine grained)

GRAIN SIZE DISTRIBUTION

Figure

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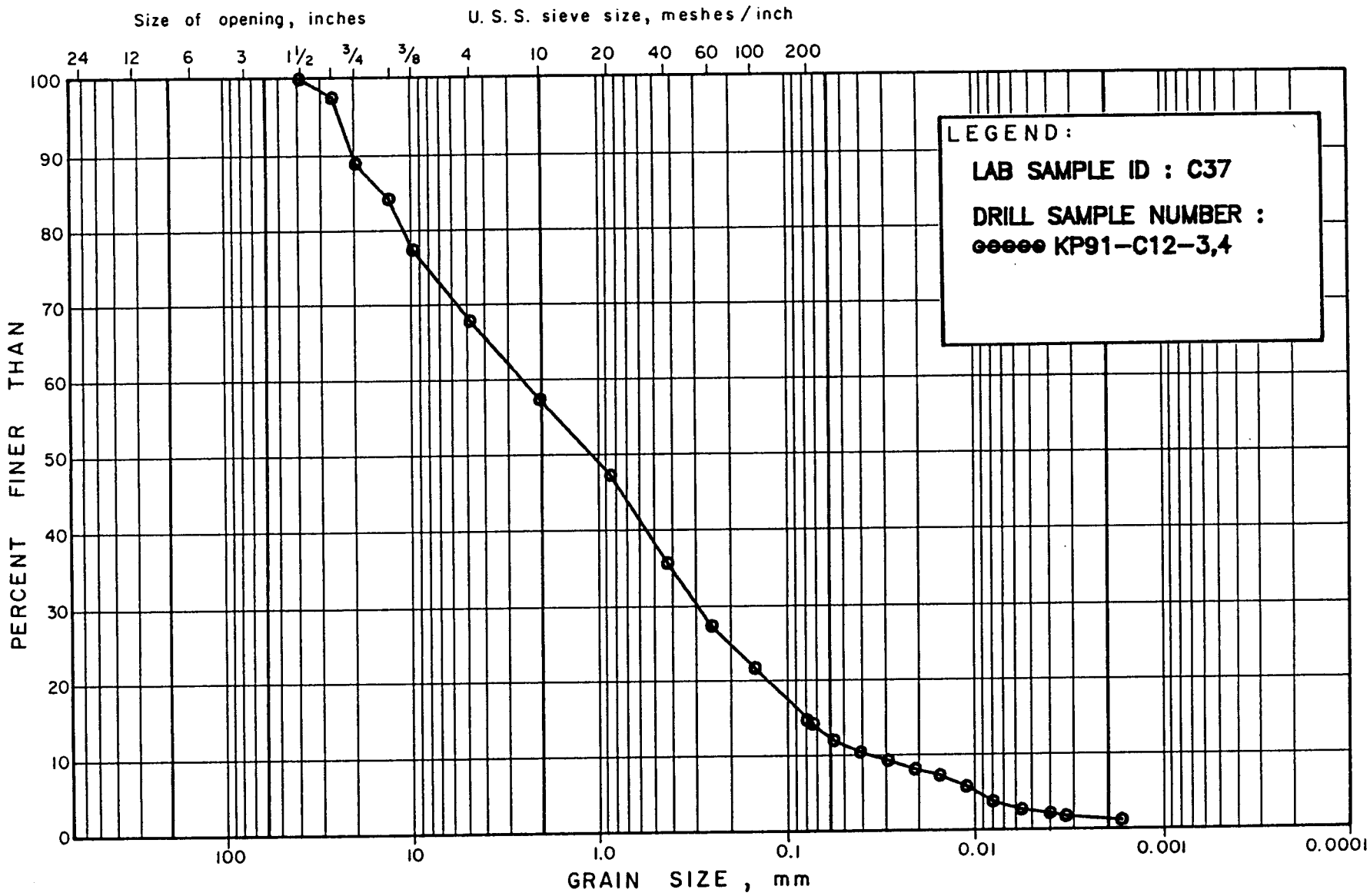
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	coarse	medium	fine	coarse	medium	fine	fine grained	
		GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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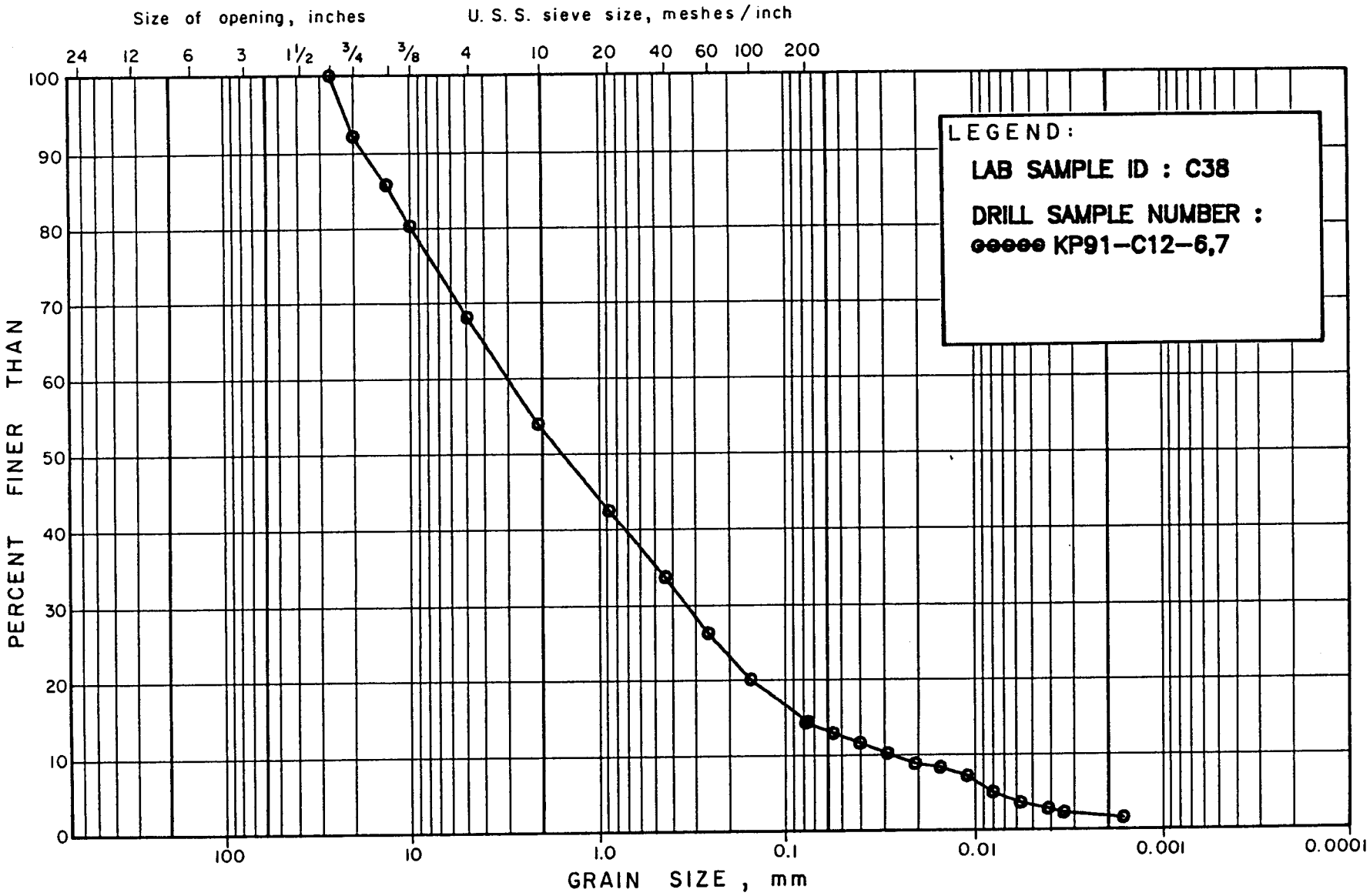
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-08-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	coarse	medium	fine	coarse	medium	fine	fine grained	
		GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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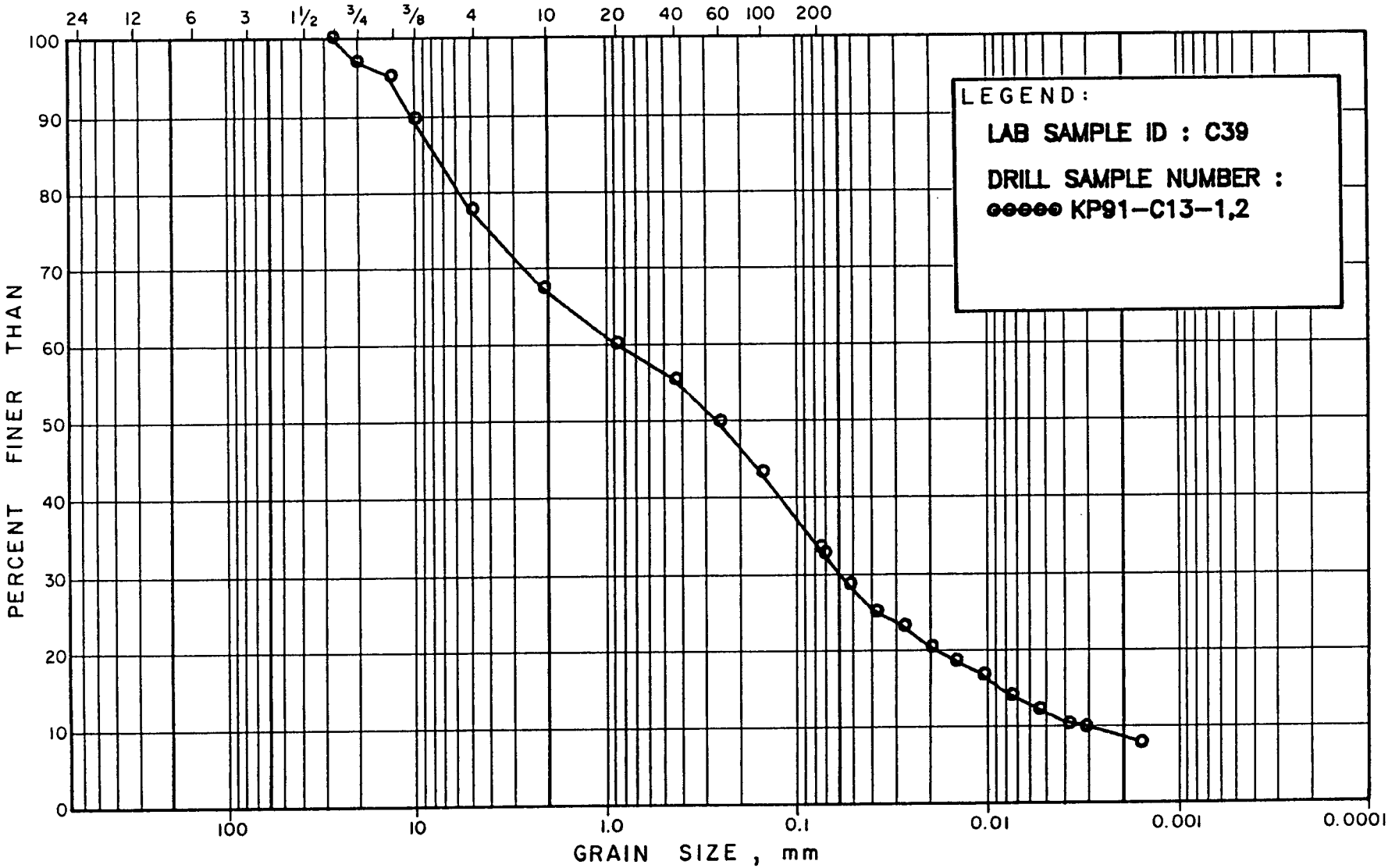
PROJEC. NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	SILT SIZE: fine grained	CLAY SIZE

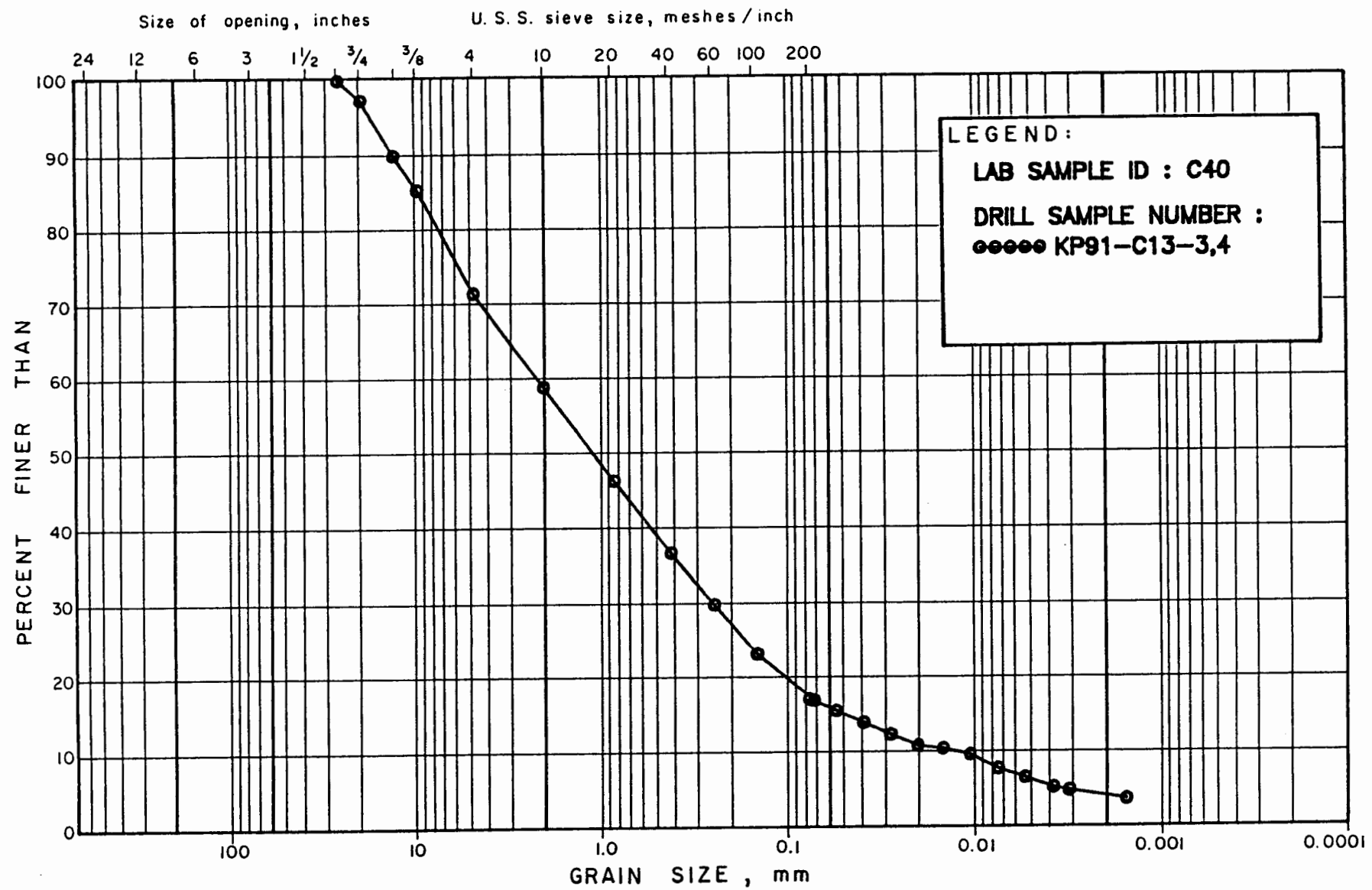
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



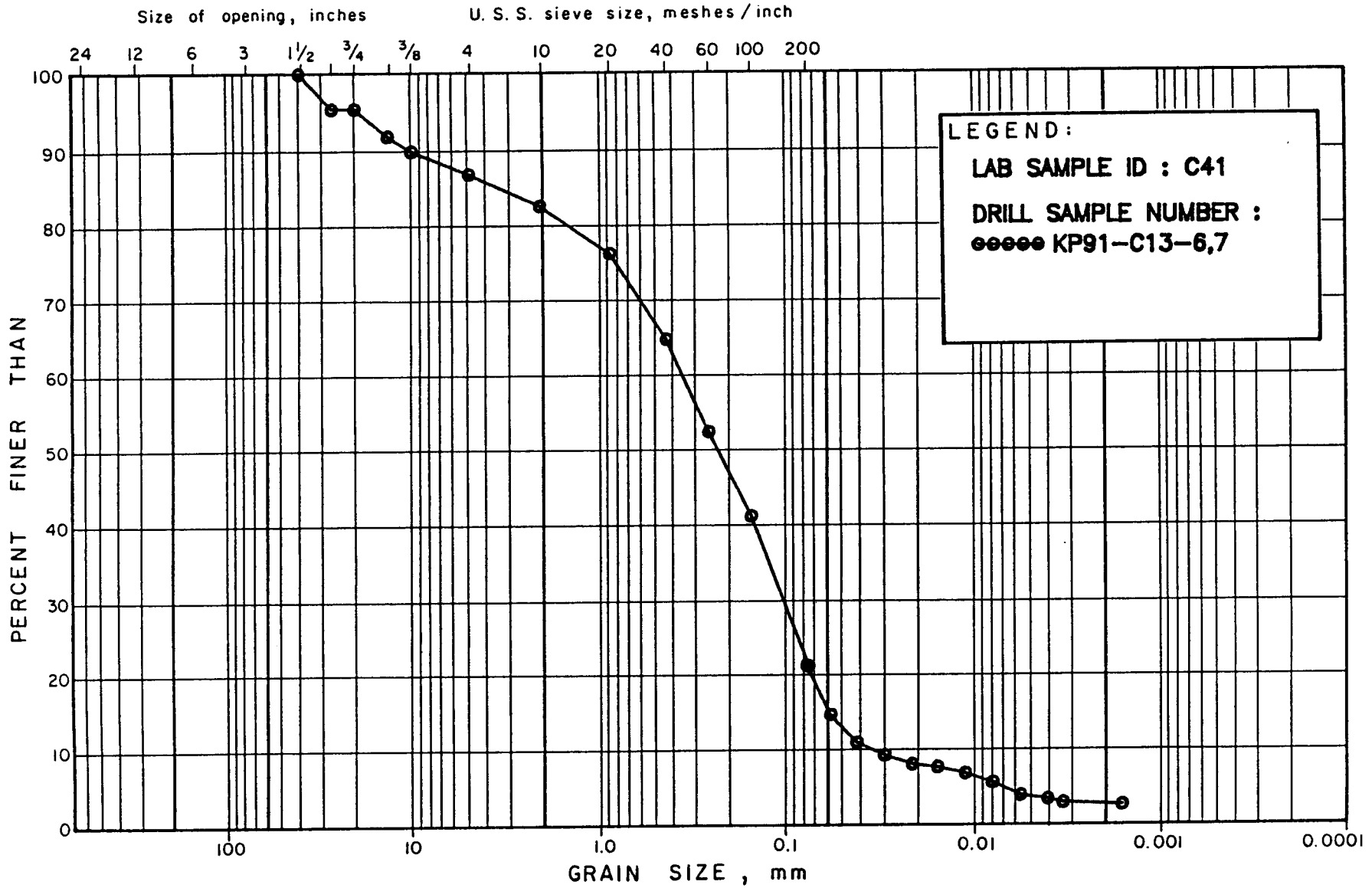
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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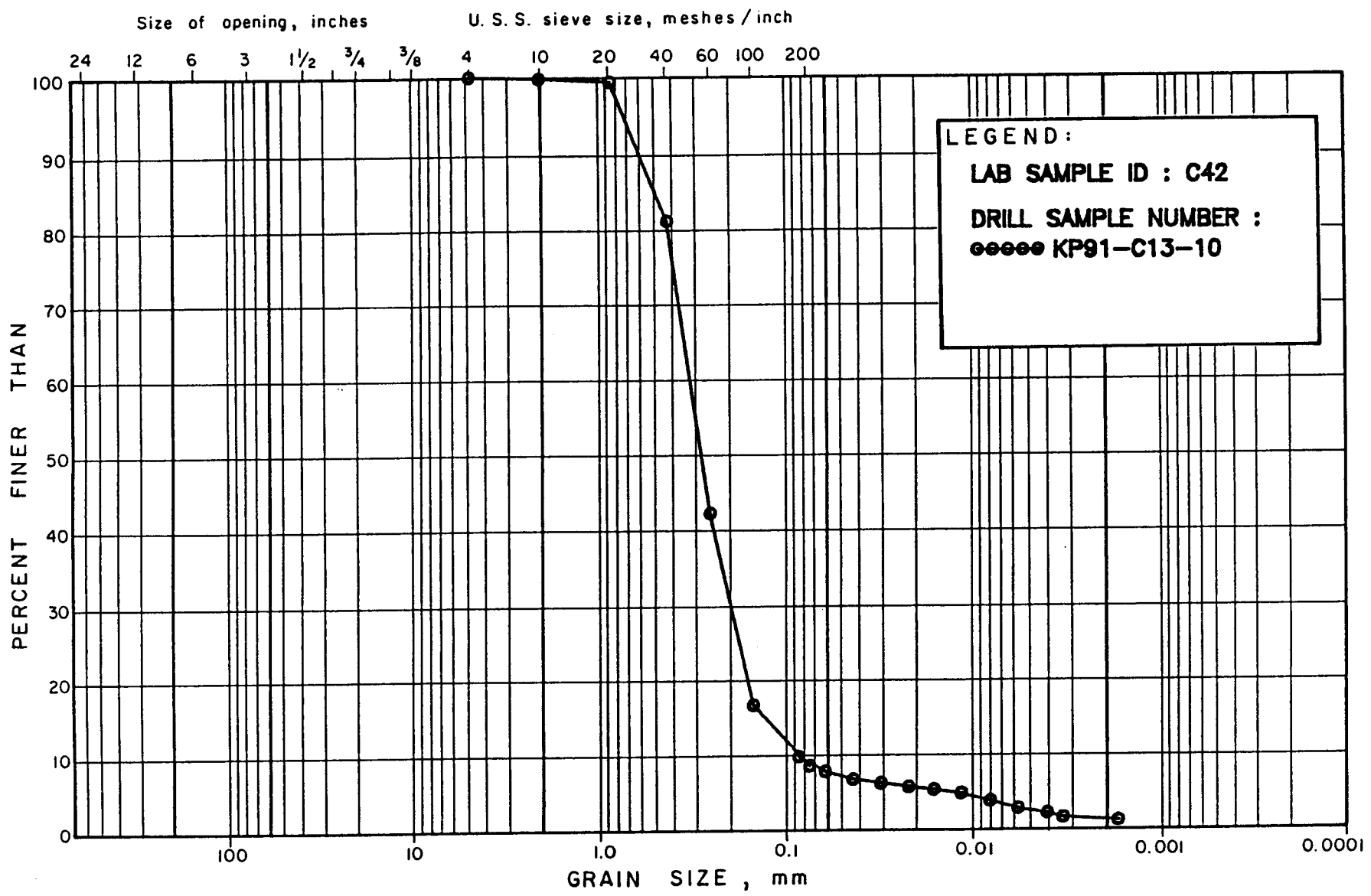
PROJEC. NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



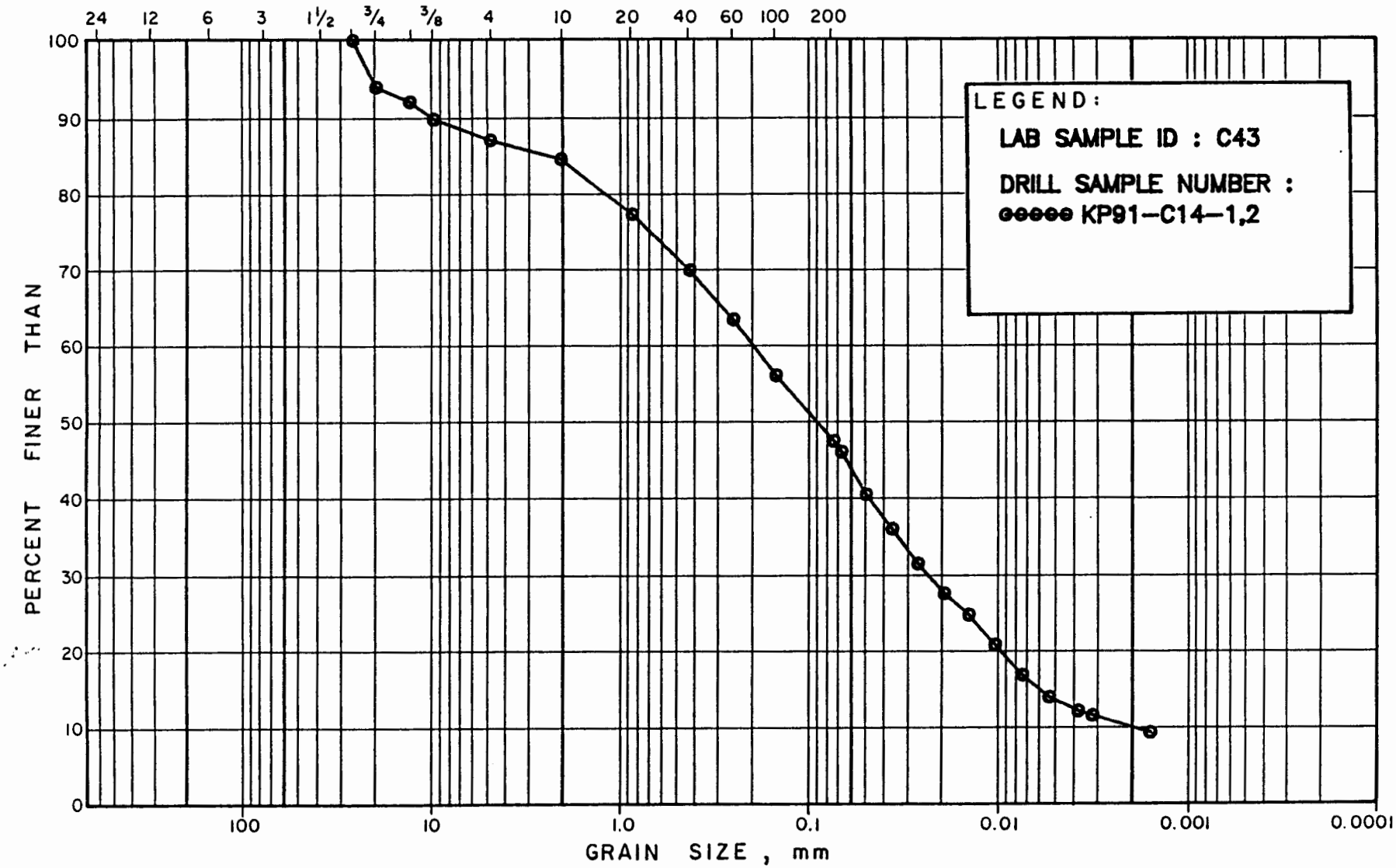
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	SILT SIZE: fine grained	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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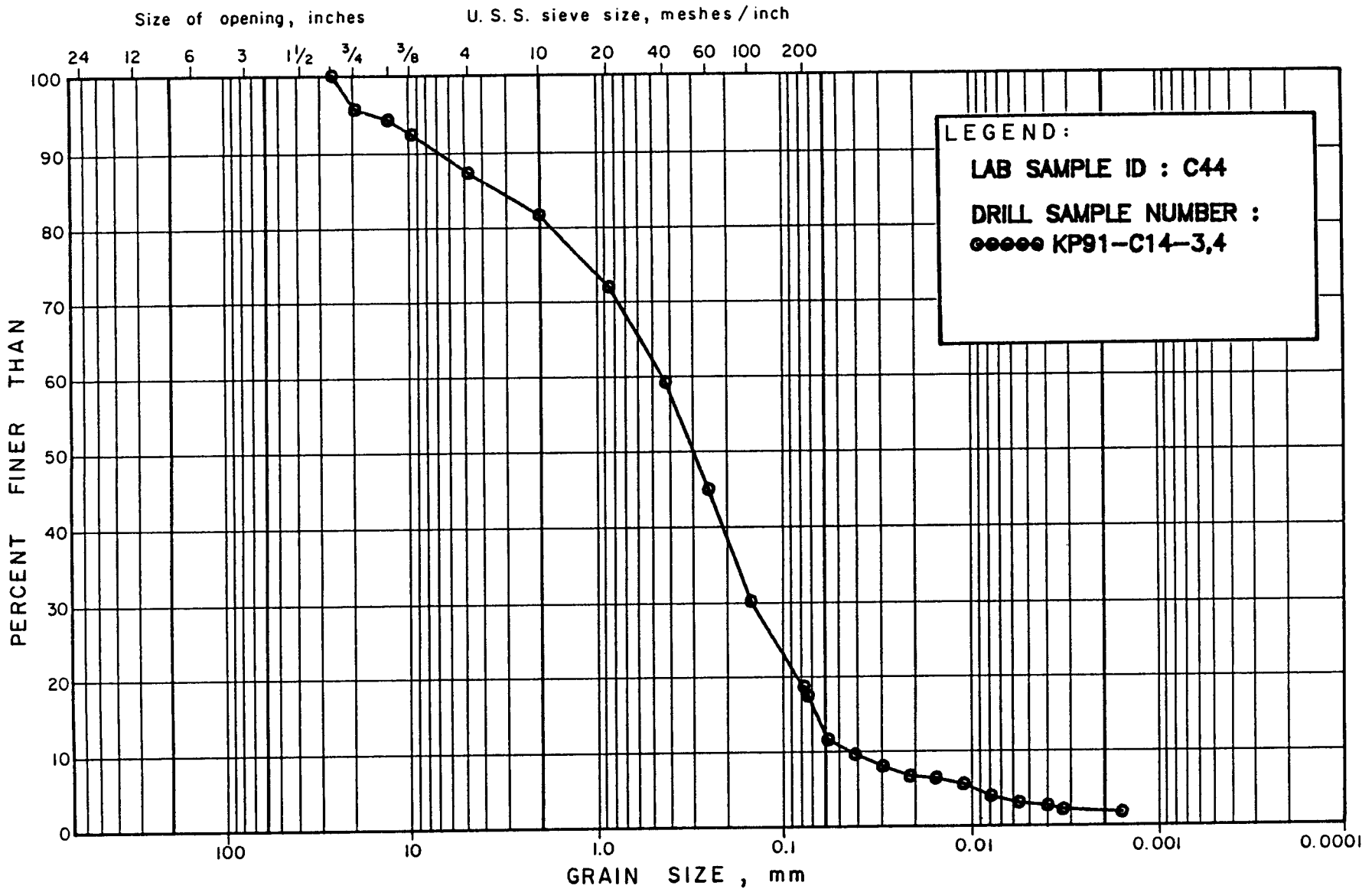
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-08-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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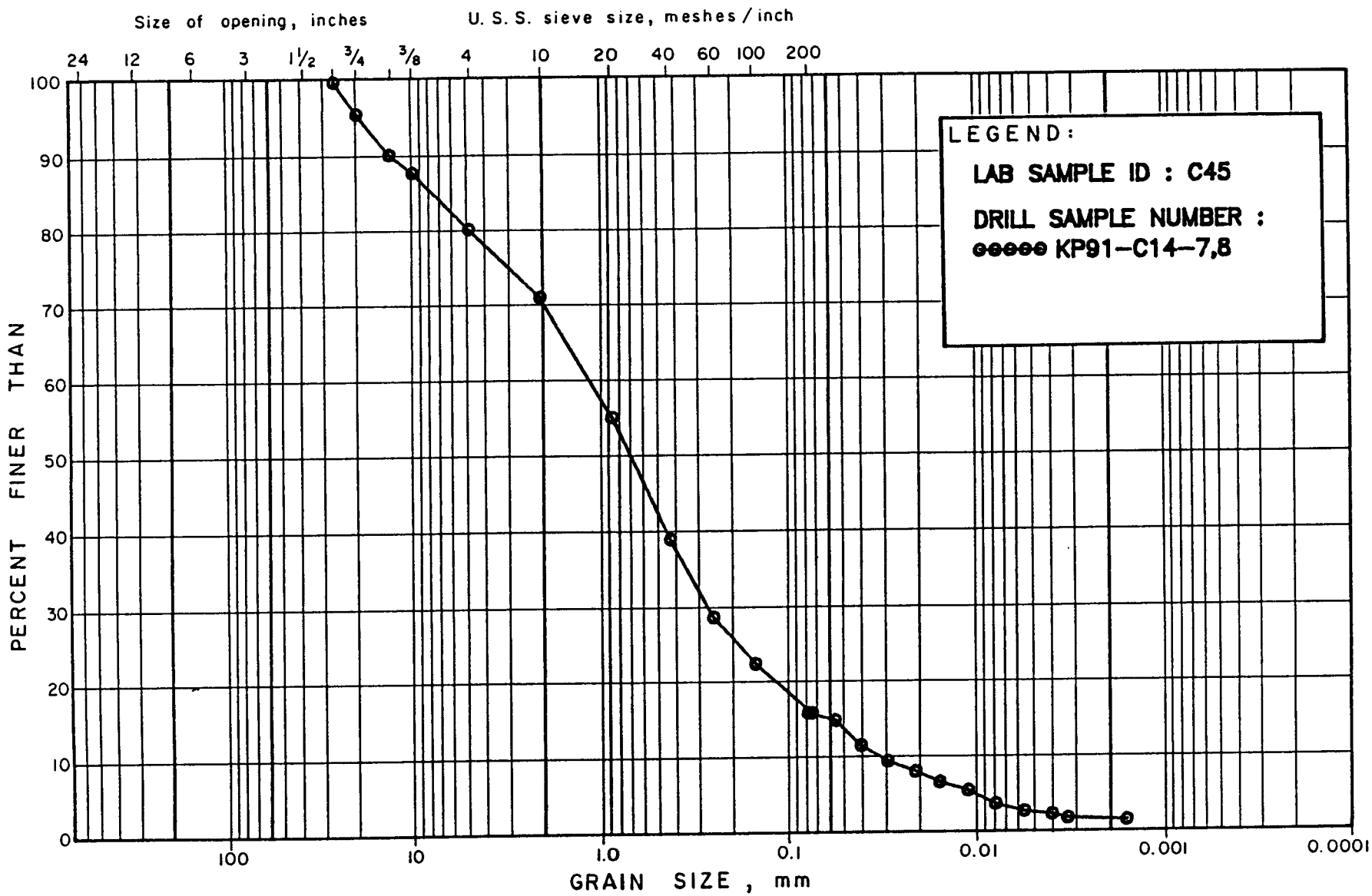
PROJECT NO 9121001D DRAWN REVIEWED DATE APR-08-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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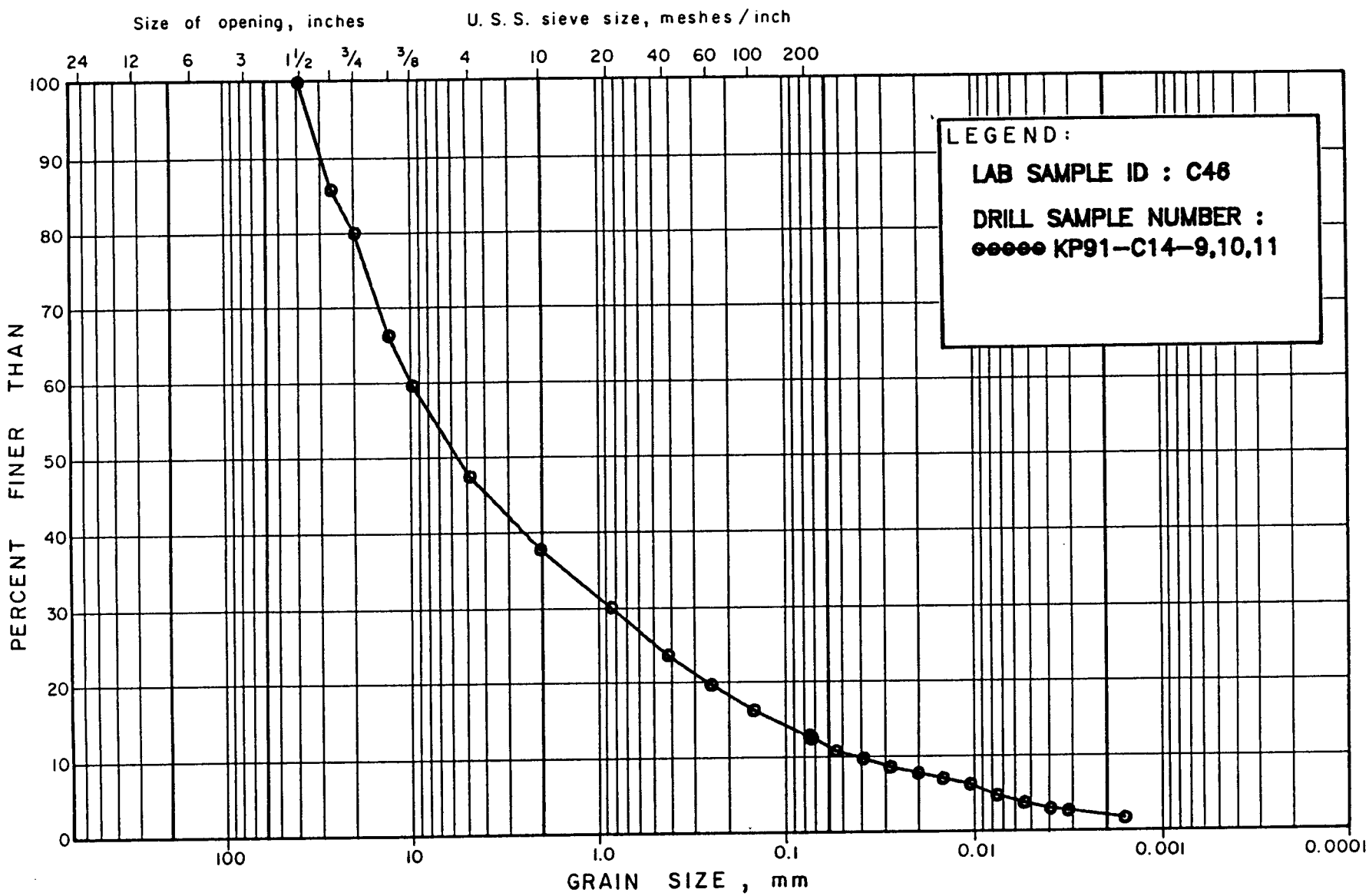
PROJECT NO. 91210010 DRAWN ..... REVIEWED ..... DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	coarse	medium	fine	coarse	medium	fine	fine grained	
		GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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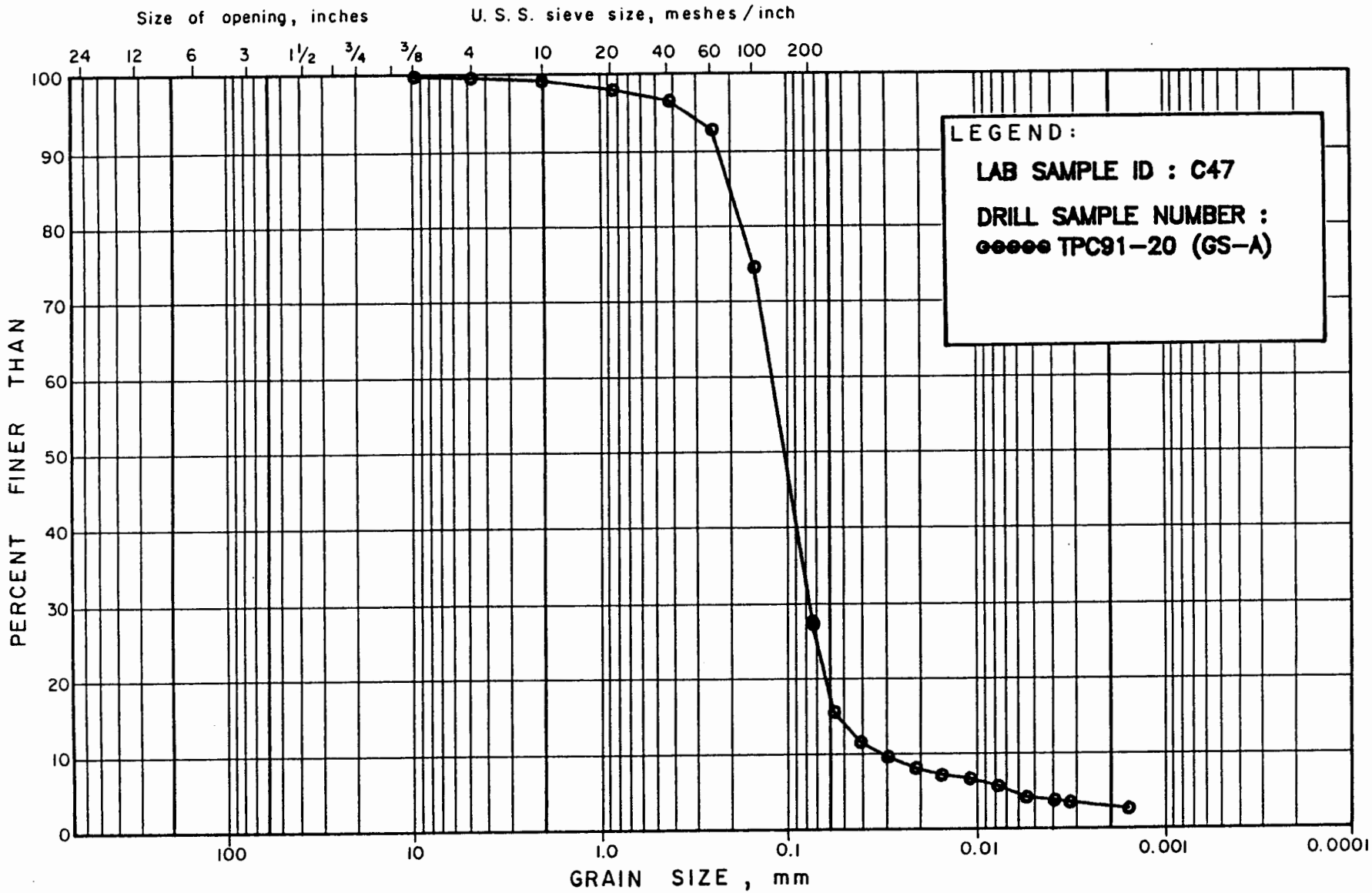
PROJECT NO. 91210010 DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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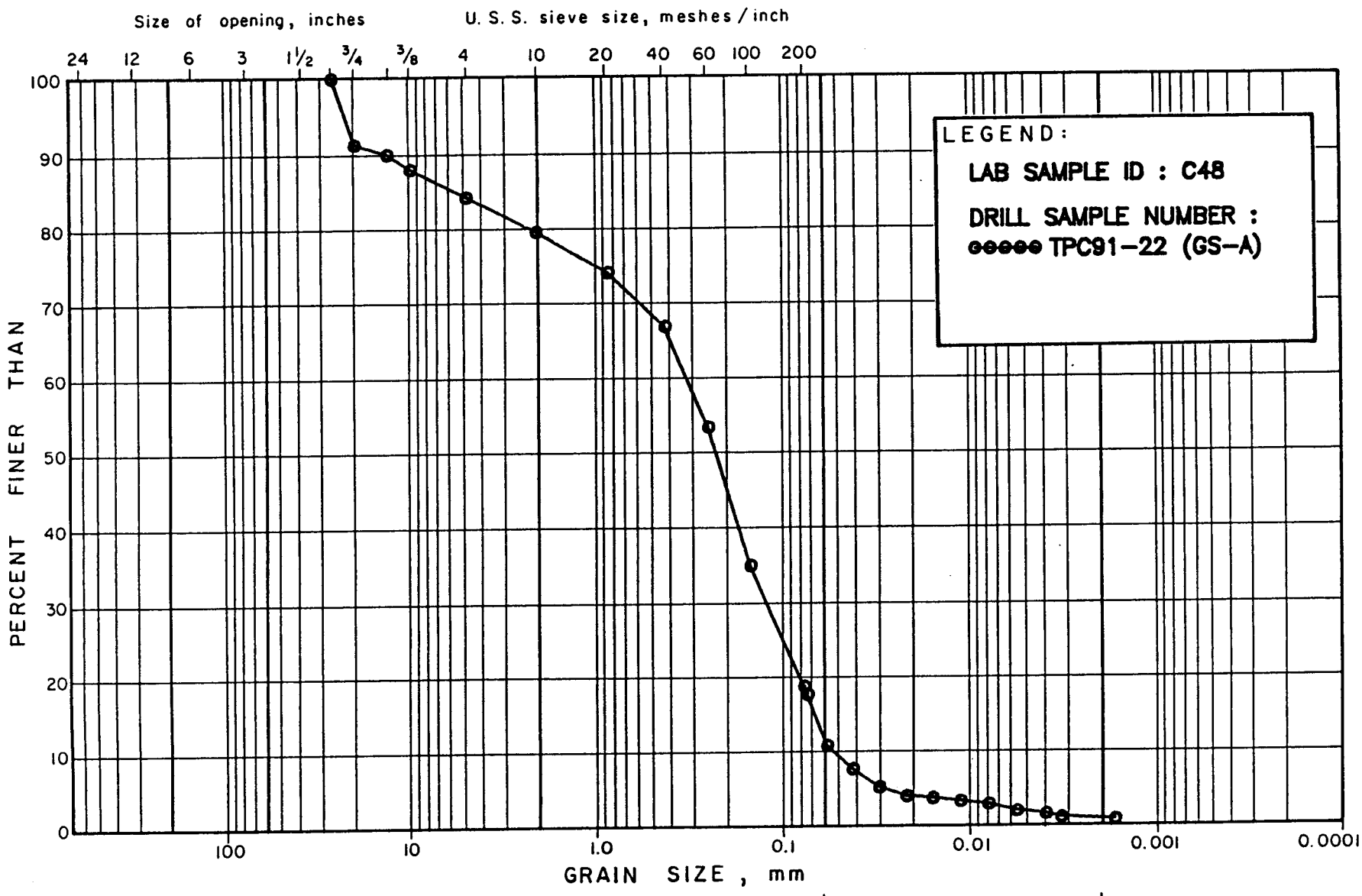
PROJEC. NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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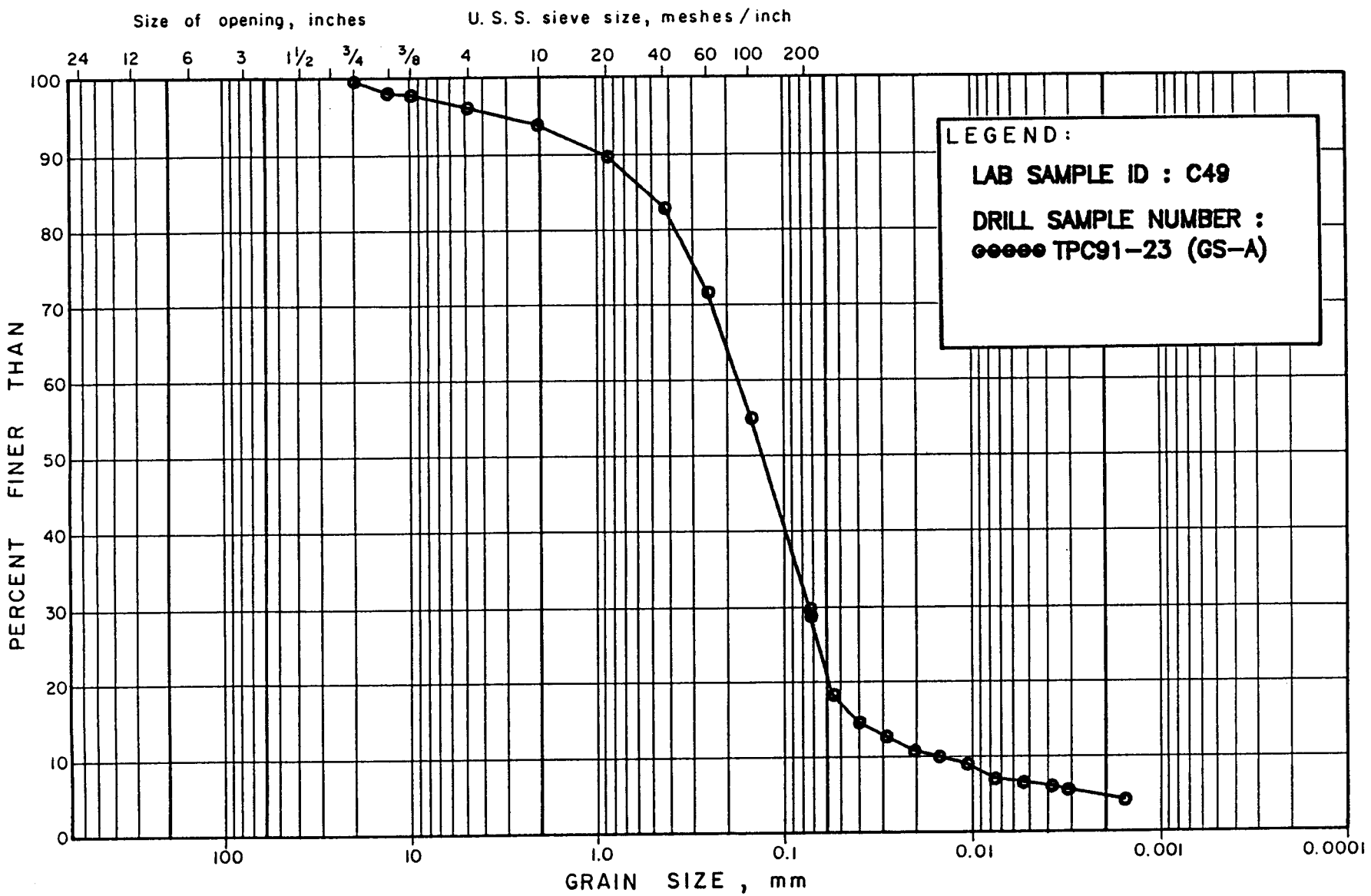
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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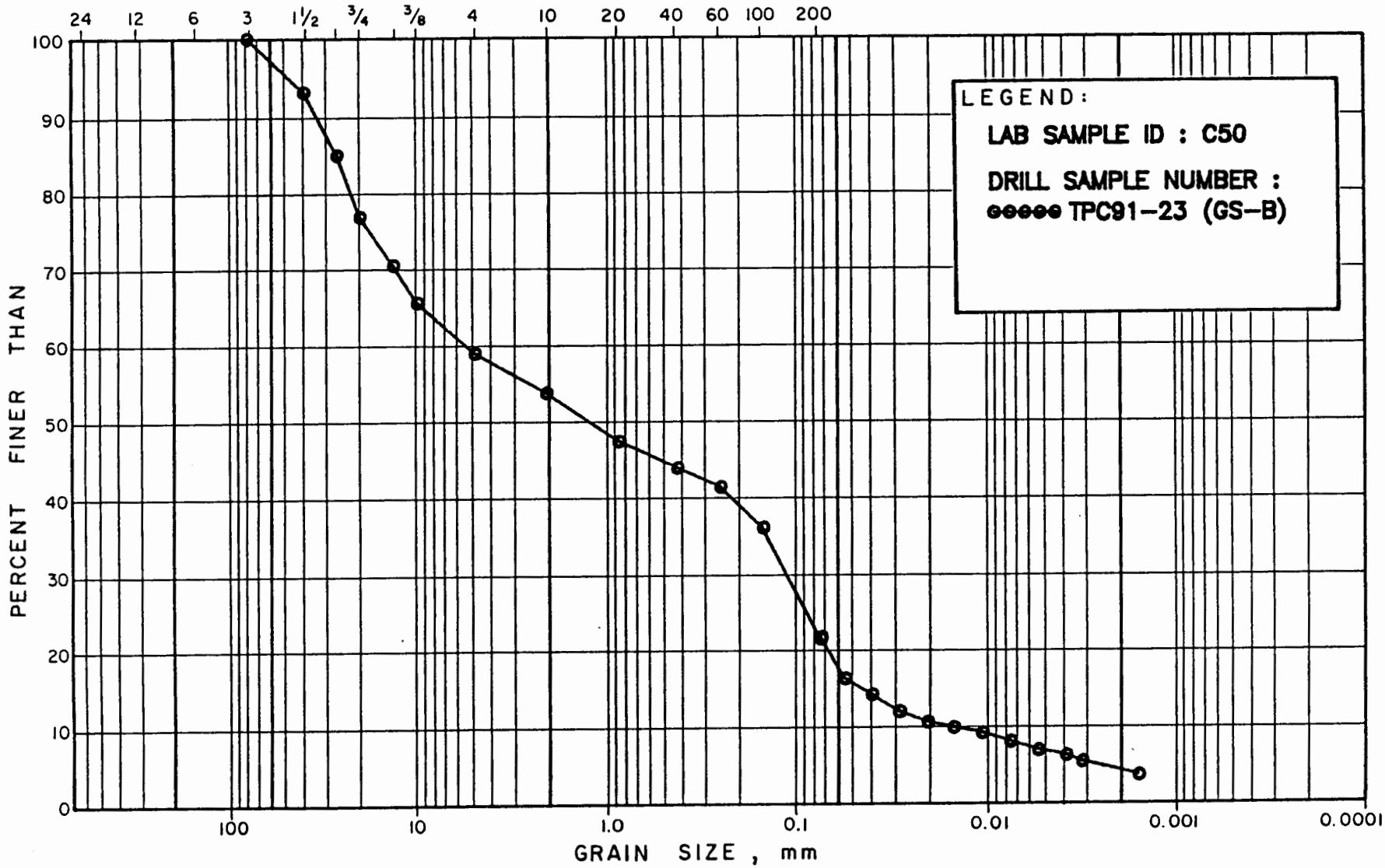
PROJECT NO. 9121001D DRAWN ..... REVIEWED ..... DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



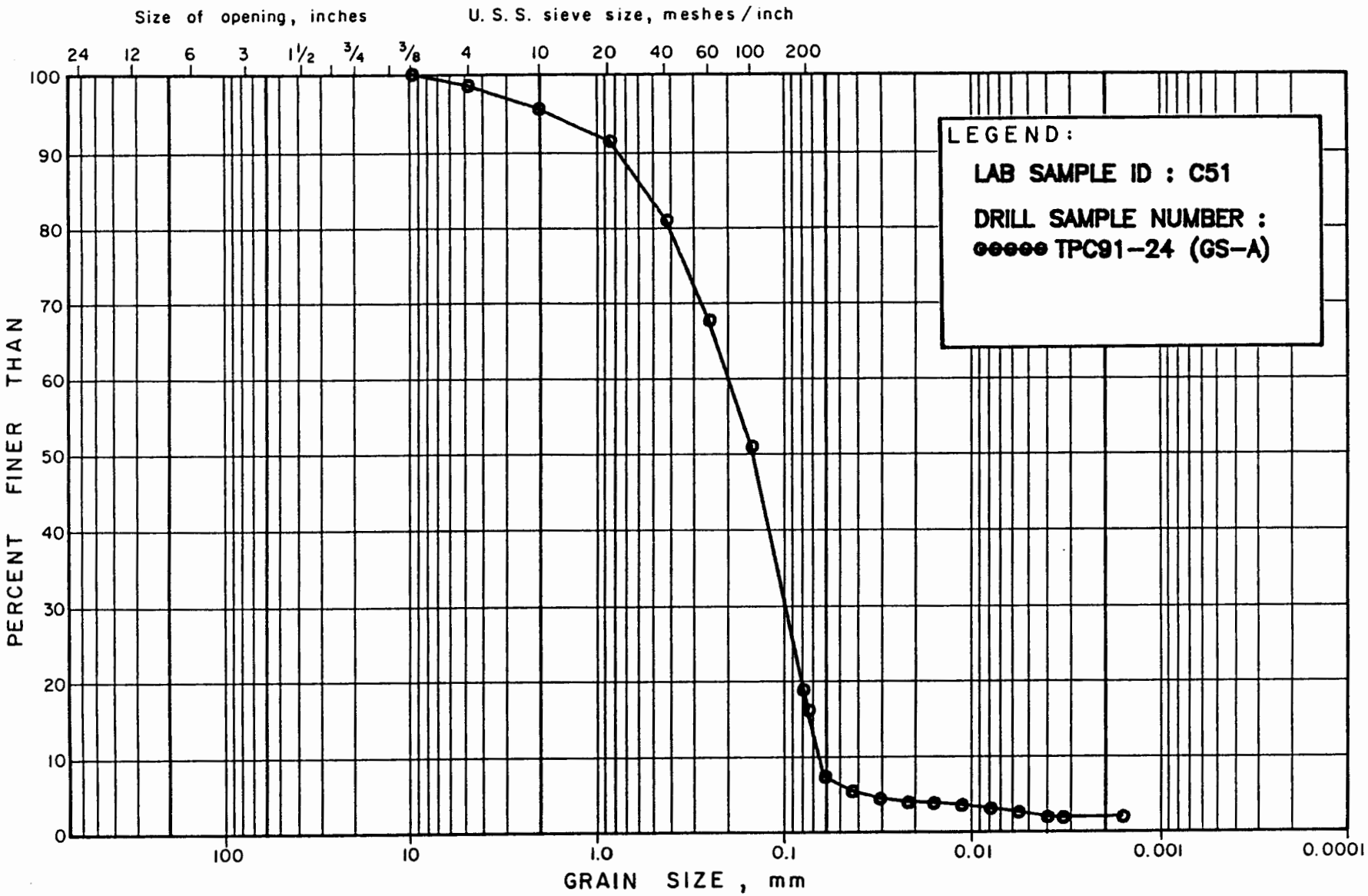
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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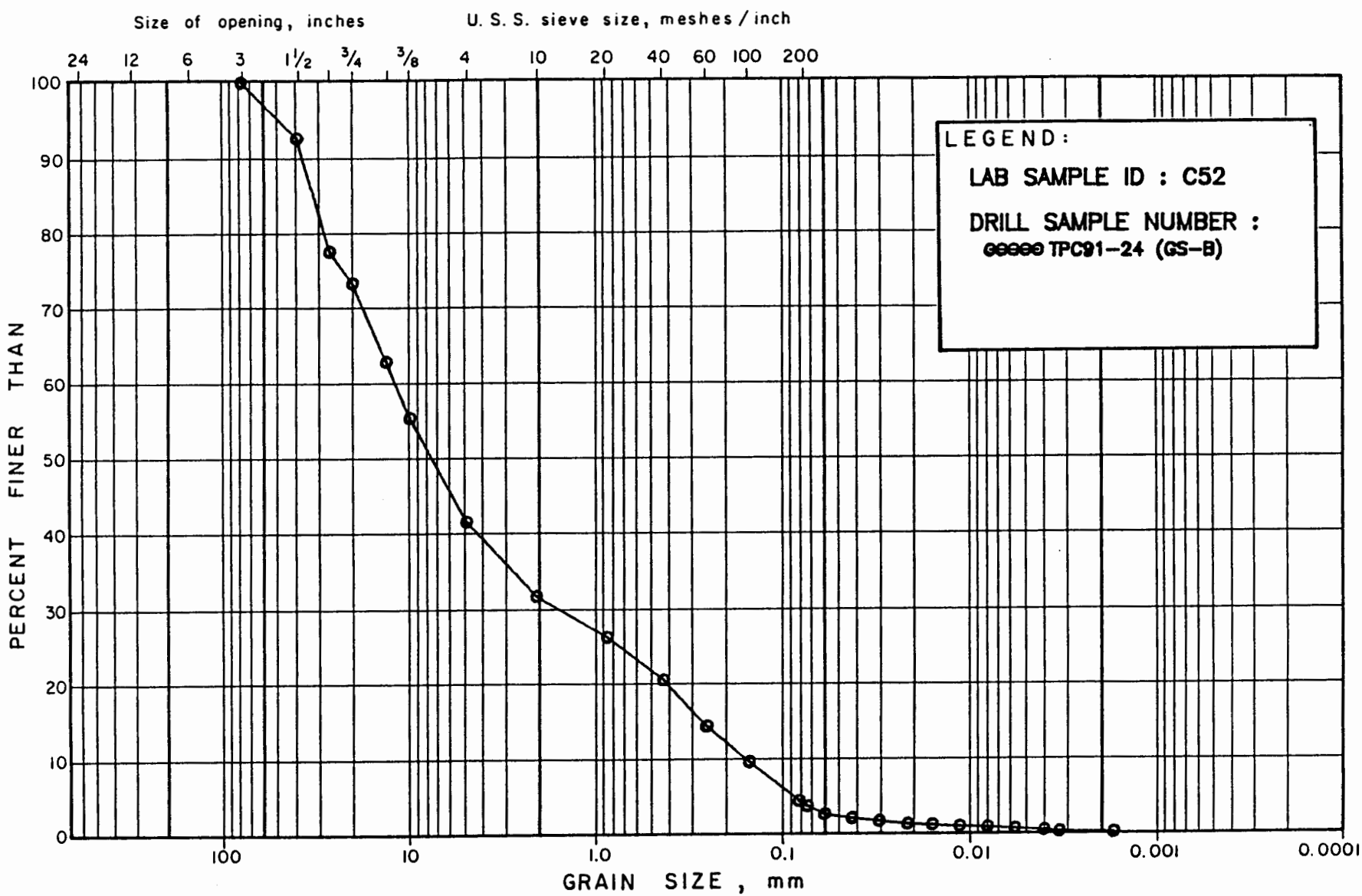
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-12-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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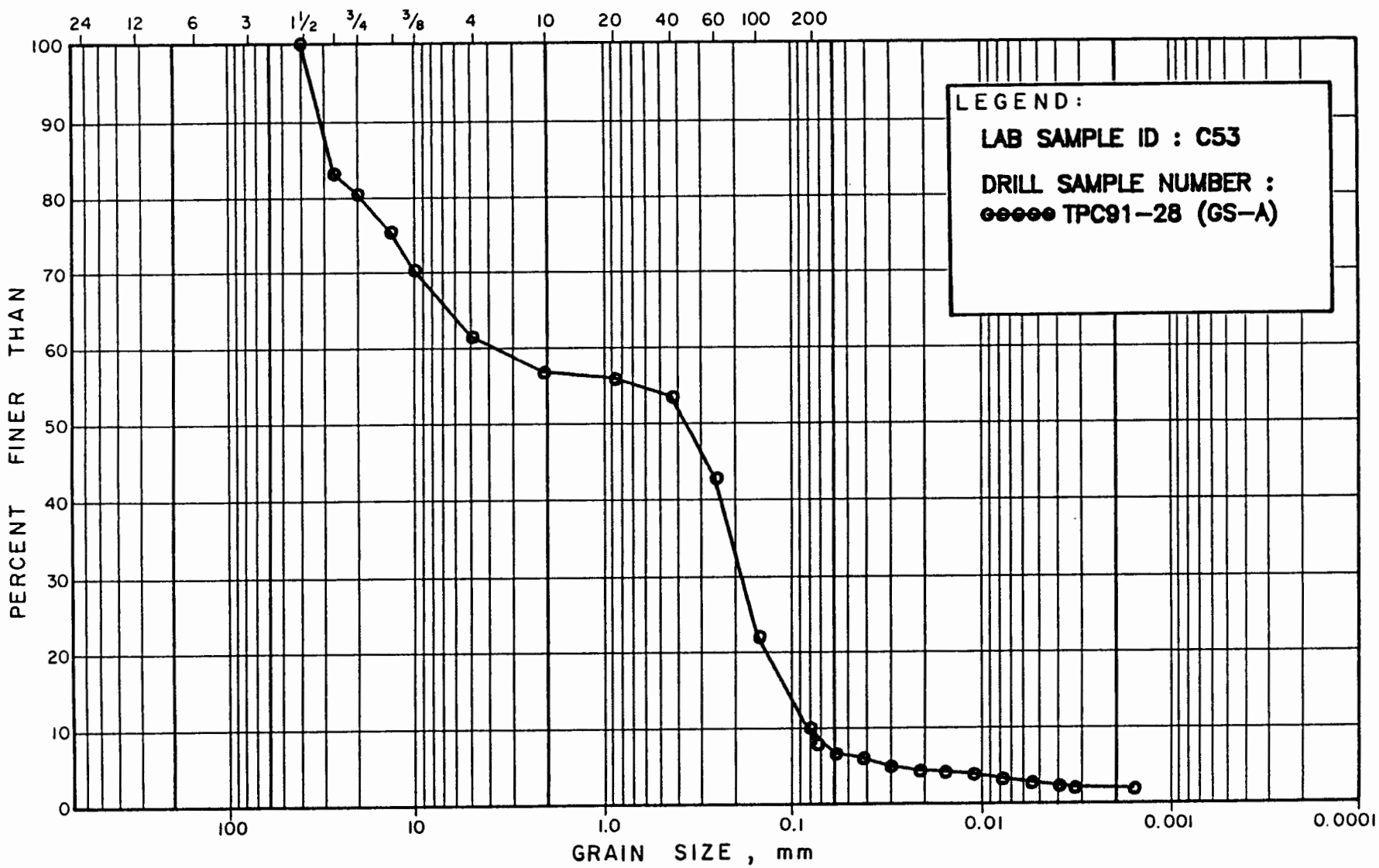
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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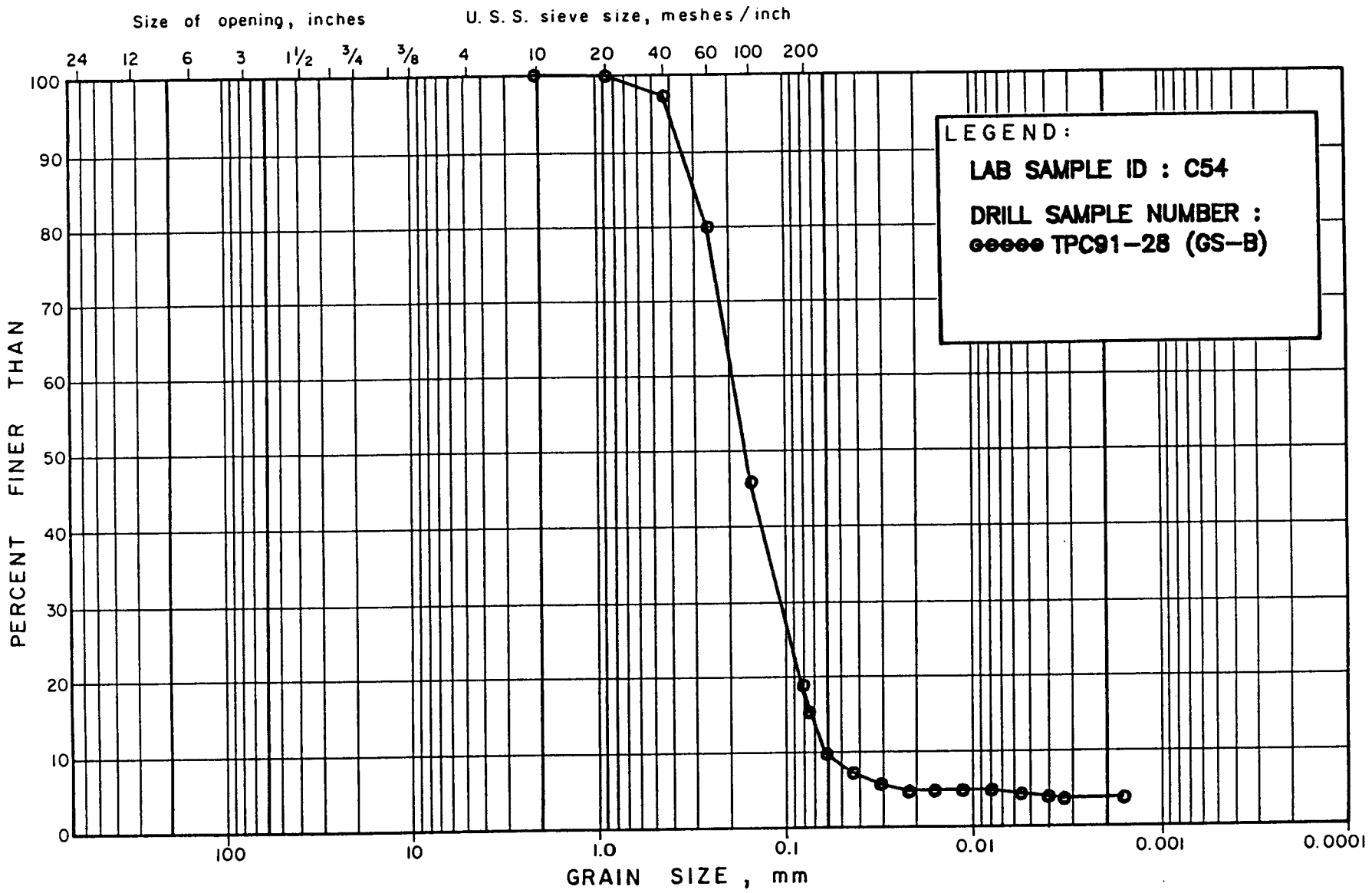
PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

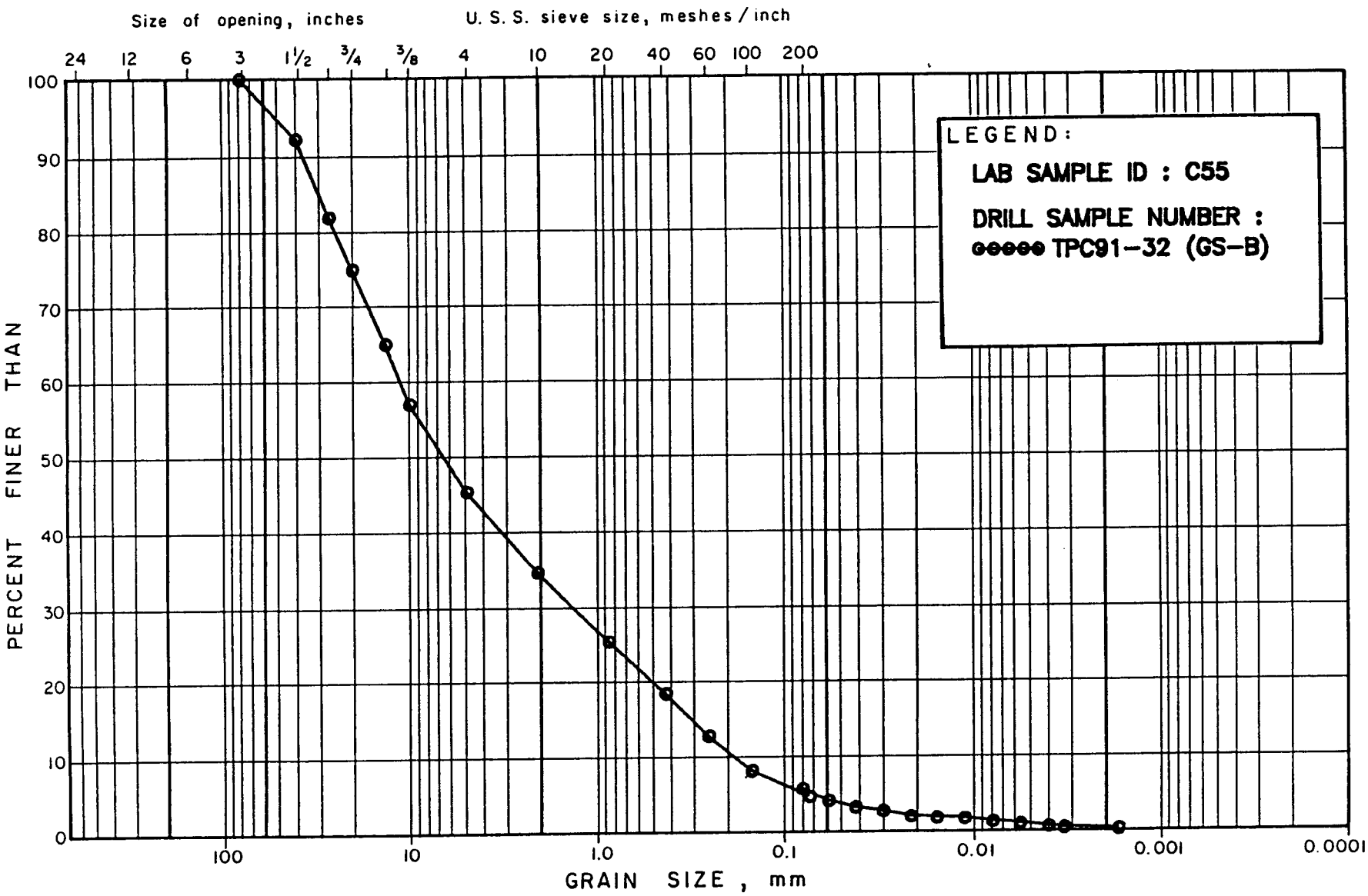
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-06-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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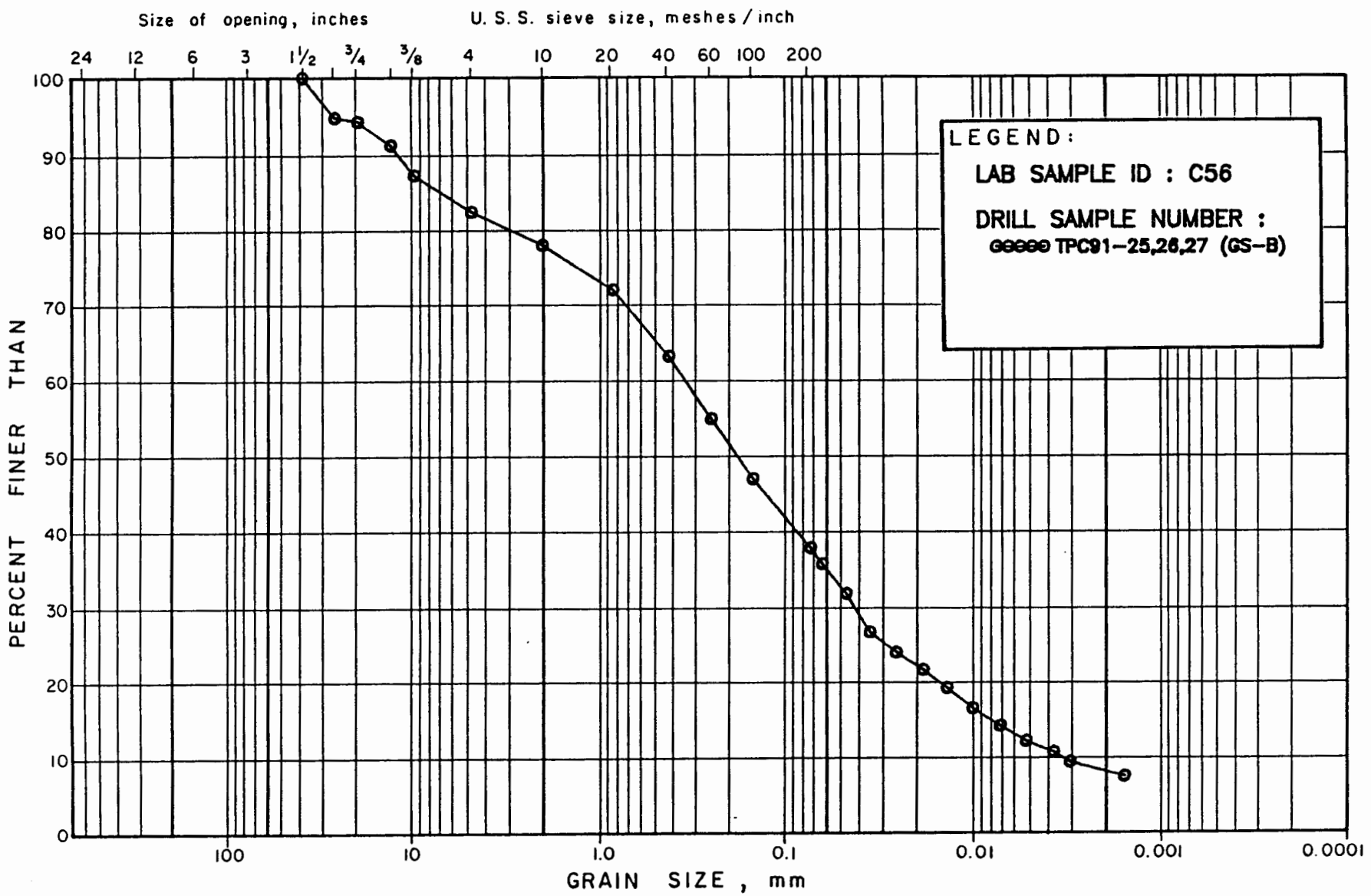
PROJEC. NO. 9121001D DRAWN REVIEWED DATE APR-12-91

M.I.T. GRAIN SIZE SCALE



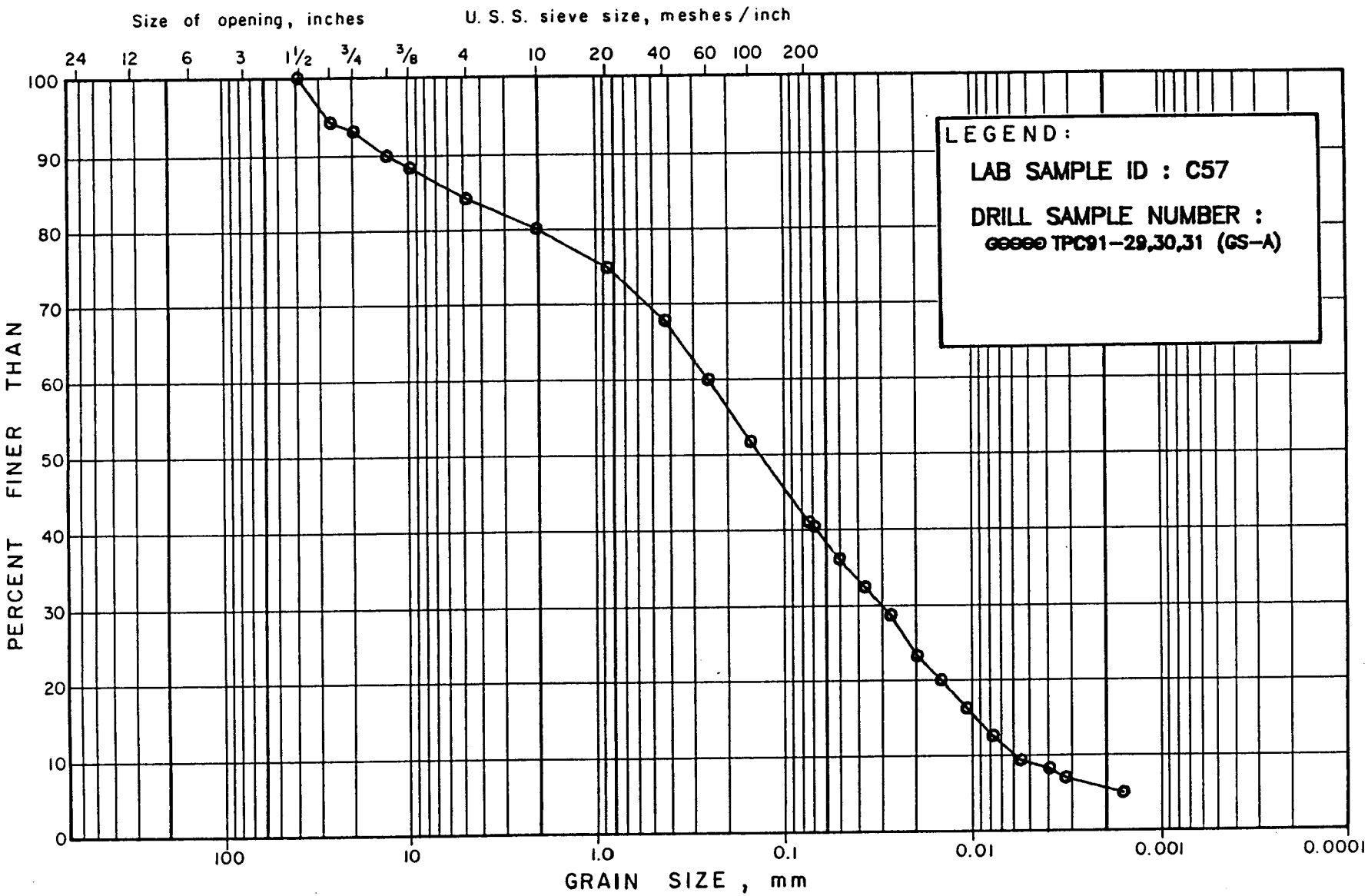
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-12-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

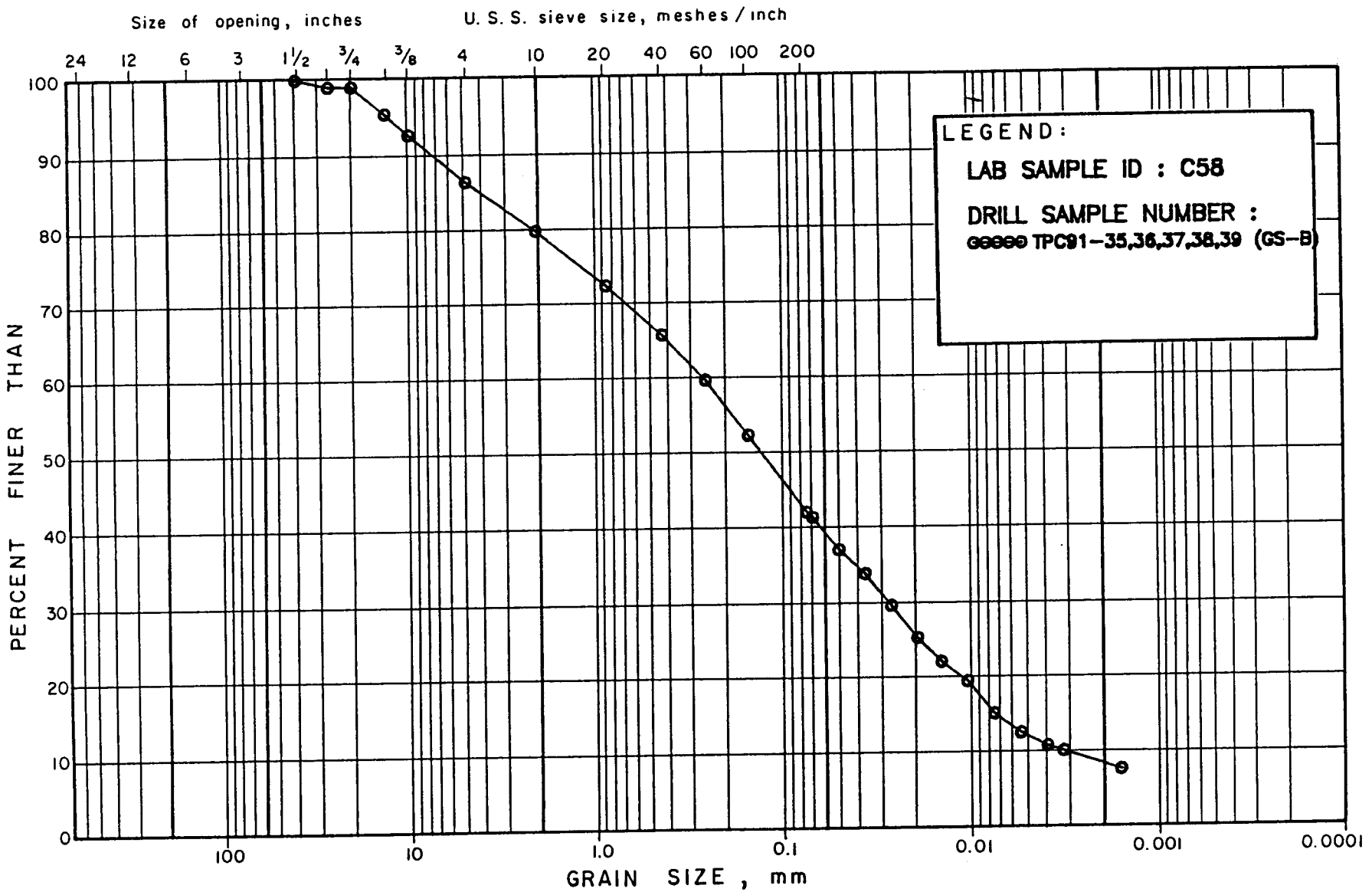
GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-12-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	coarse	medium	fine	coarse	medium	fine	fine grained	
		GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE

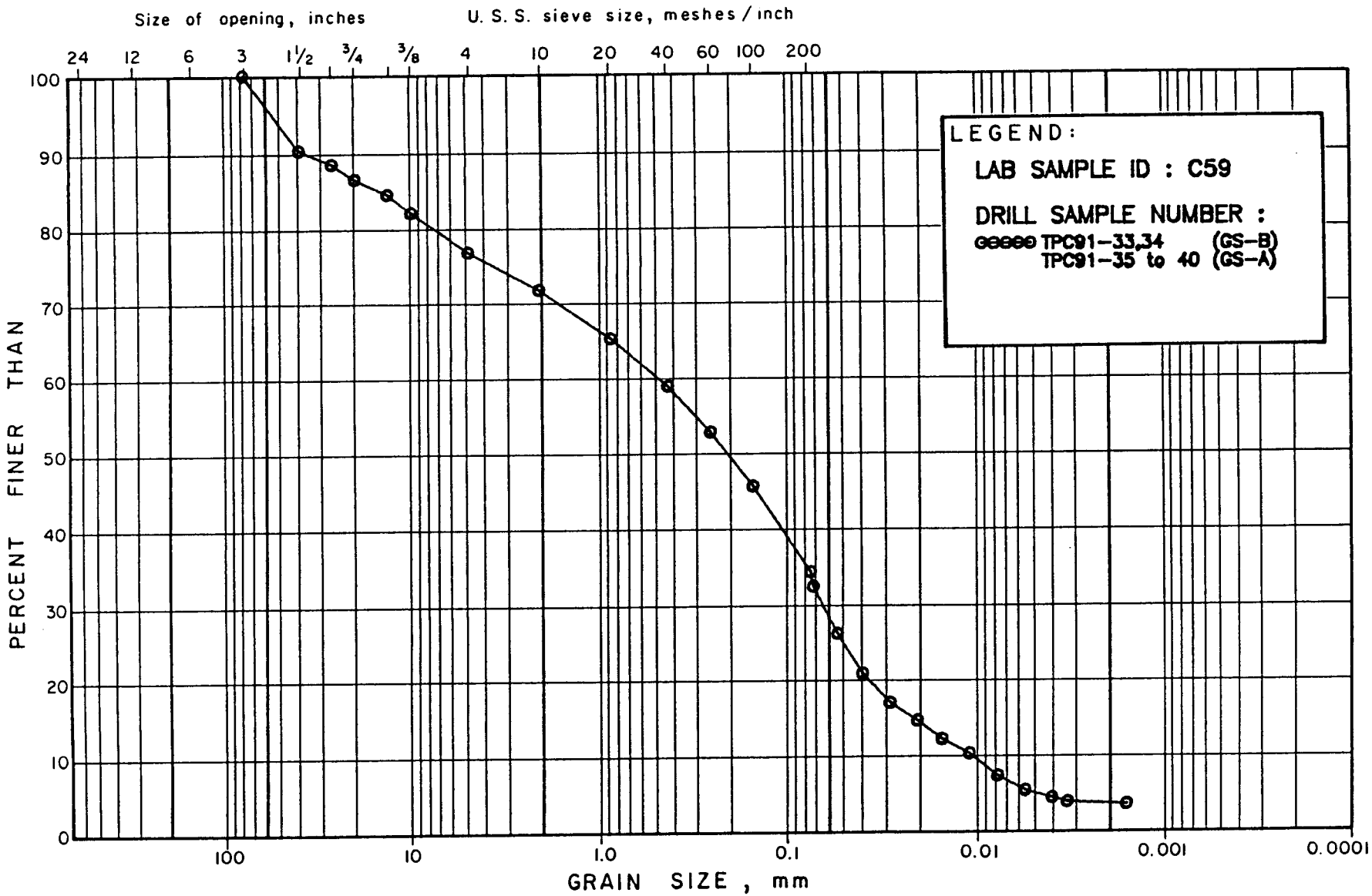
Golder Associates

GRAIN SIZE DISTRIBUTION

Figure

PROJECT NO. 9121001D DRAWN REVIEWED DATE APR-12-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

Golder Associates

Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

PROJECT No. 9121001D LAB No. B53

SITE LOCATION: C23

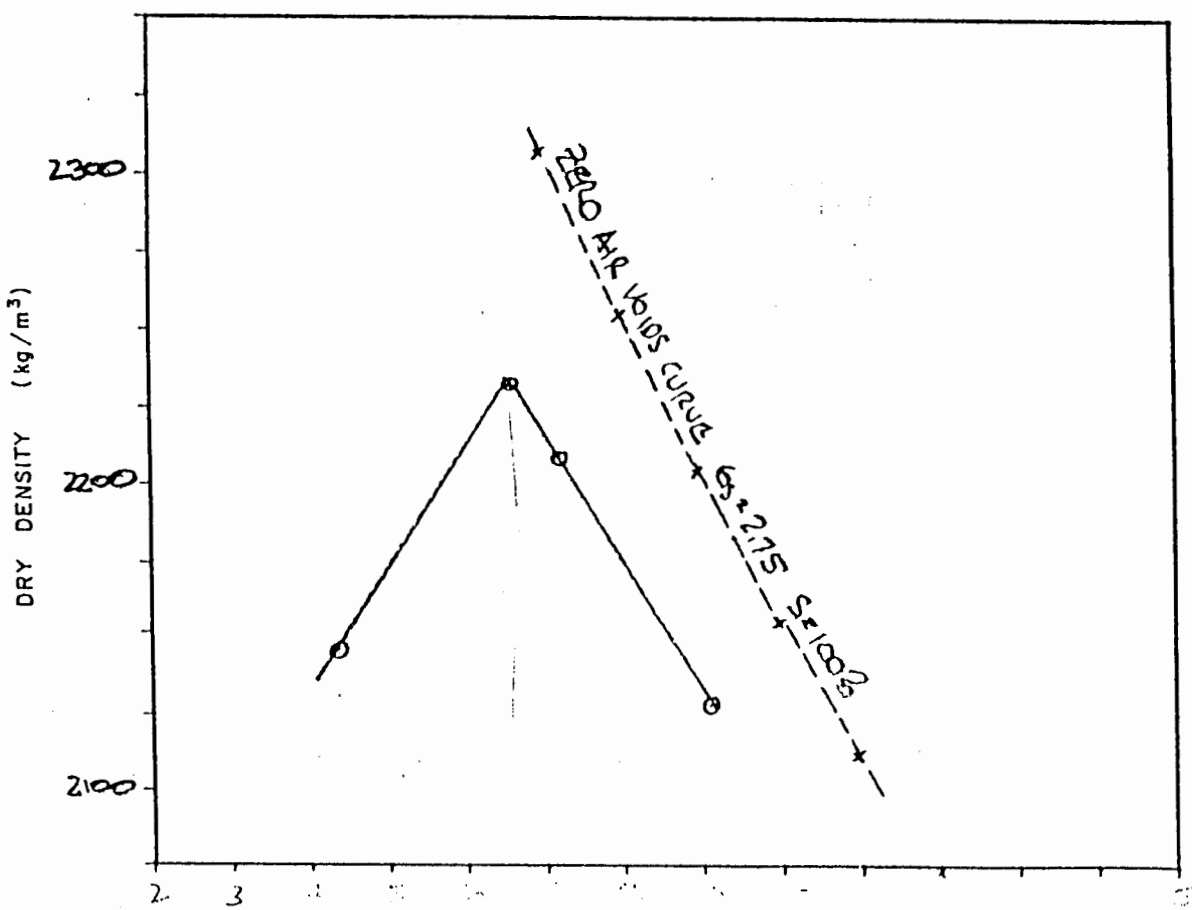
SOURCE: TPC91-12,17,18 (6S-A)

DATE TESTED: 4/1/91 BY: LL

MOISTURE DENSITY RELATIONSHIP (MODIFIED)

	TRIAL NO.	1	2	3	4			
DENSITY	WT. OF SAMPLE WET + MOLD	10,468.8	10,739.6	10,765.6	10,632.3			
	WEIGHT OF MOLD	5709	5709	5709	5709			
	WT. OF SAMPLE WET	4759.8	5030.6	5056.6	4928.3			
	WET DENSITY (kg/m³)	2241.0	2368.5	2380.7	2320.3			
	DRY DENSITY (kg/m³)	2146.6	2209.4	2233.3	2176.8			

MOISTURE CONTENT	MOISTURE ADDED	4.0	7.0	5.5	8.5			
	CONTAINER No.	22	9	33	45			
	WT. OF WET SOIL + TARE	1320.0	1377.1	1270.0	1667.5			
	WT. OF DRY SOIL + TARE	1279.3	1309.3	1213.1	1557.4			
	WEIGHT OF WATER	40.7	67.8	56.9	110.1			
	TARE WEIGHT	360.9	371.9	354.8	352.6			
	WEIGHT OF DRY SOIL	918.4	937.4	858.3	1204.8			
	MOISTURE CONTENT (%)	4.4 ✓	7.2 ✓	6.6 ✓	9.1 ✓			



MAX. DRY DENSITY 2233.3 kg/m³

OPTIMUM MOISTURE 6.6 %

MOLD DIA. 15.24 cm

MOLD VOL. .002124 m³

ASTM D 698 ☐

ASTM D1557 ☑

METHOD C

SAMPLE DESCRIPTION:

Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

PROJECT No. 9121001D LAB No. B53

SITE LOCATION: C24

TPC91-13, 14, 16 (65-B)

SOURCE:

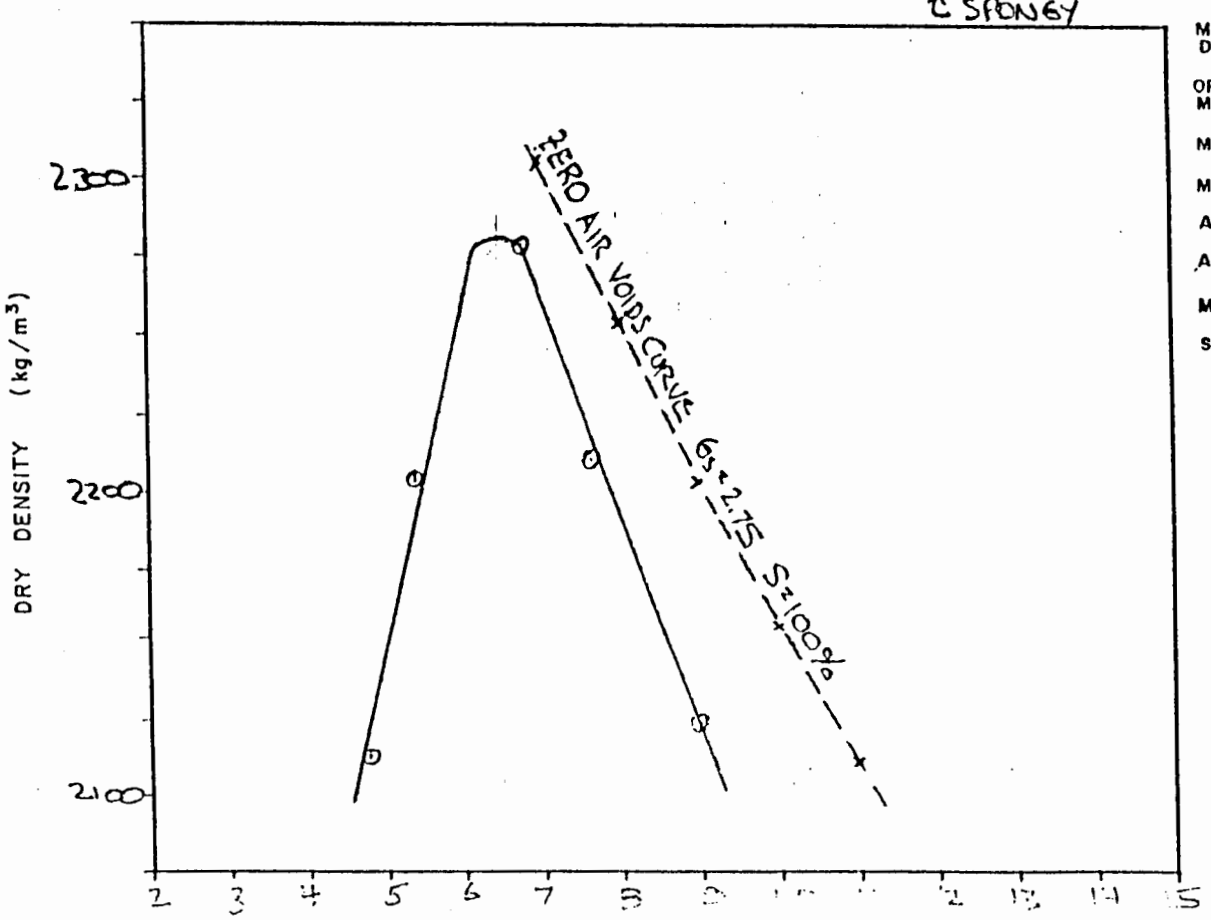
DATE TESTED: 4/1/91 BY: LC

MOISTURE DENSITY RELATIONSHIP (MODIFIED)

	TRIAL NO.	1	2	3	4	5		
DENSITY	WT. OF SAMPLE WET + MOLD	10,411.4	10,683.4	10,767.4	10,626.4	10,815.5		
	WEIGHT OF MOLD	5709	5709	5709	5709	5709		
	WT. OF SAMPLE WET	4702.4	4974	5058.4	4917.4	5166.5		
	WET DENSITY (kg/m³)	2213.9	2324.0	2381.5	2315.2	2432.4		
	DRY DENSITY (kg/m³)	2112.5	2204.9	2211.2	2124.0	2277.5		

	MOISTURE ADDED	4	5.5	7.0	8.5	6.6		
MOISTURE CONTENT	CONTAINER No.	0	75	B4	303	45		
	WT. OF WET SOIL + TARE	832.0	916.2	939.5	1141.8	1738.4		
	WT. OF DRY SOIL + TARE	802.1	874.7	880.1	1056.7	1650.4		
	WEIGHT OF WATER	29.9	41.5	59.4	85.1	88.0		
	TARE WEIGHT	177.5	107.7	110.3	111.9	352.7		
	WEIGHT OF DRY SOIL	624.6	767.0	769.8	944.8	1297.7		
	MOISTURE CONTENT (%)	4.8 ✓	5.4 ✓	7.7 ✓	9.0 ✓	6.8 ✓		

↑ SPONGY



MAX. DRY DENSITY 2280 kg/m³

OPTIMUM MOISTURE 6.5 %

MOLD DIA. 15.24 cm

MOLD VOL. .002124 m³

ASTM D 698 ☐

ASTM D1557 ☑

METHOD C

SAMPLE DESCRIPTION:

Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

PROJECT No. 9121001D LAB No. 853

SITE LOCATION: C25

TPC91-10, 3, 5 (GS-A, SA-3, GS-B

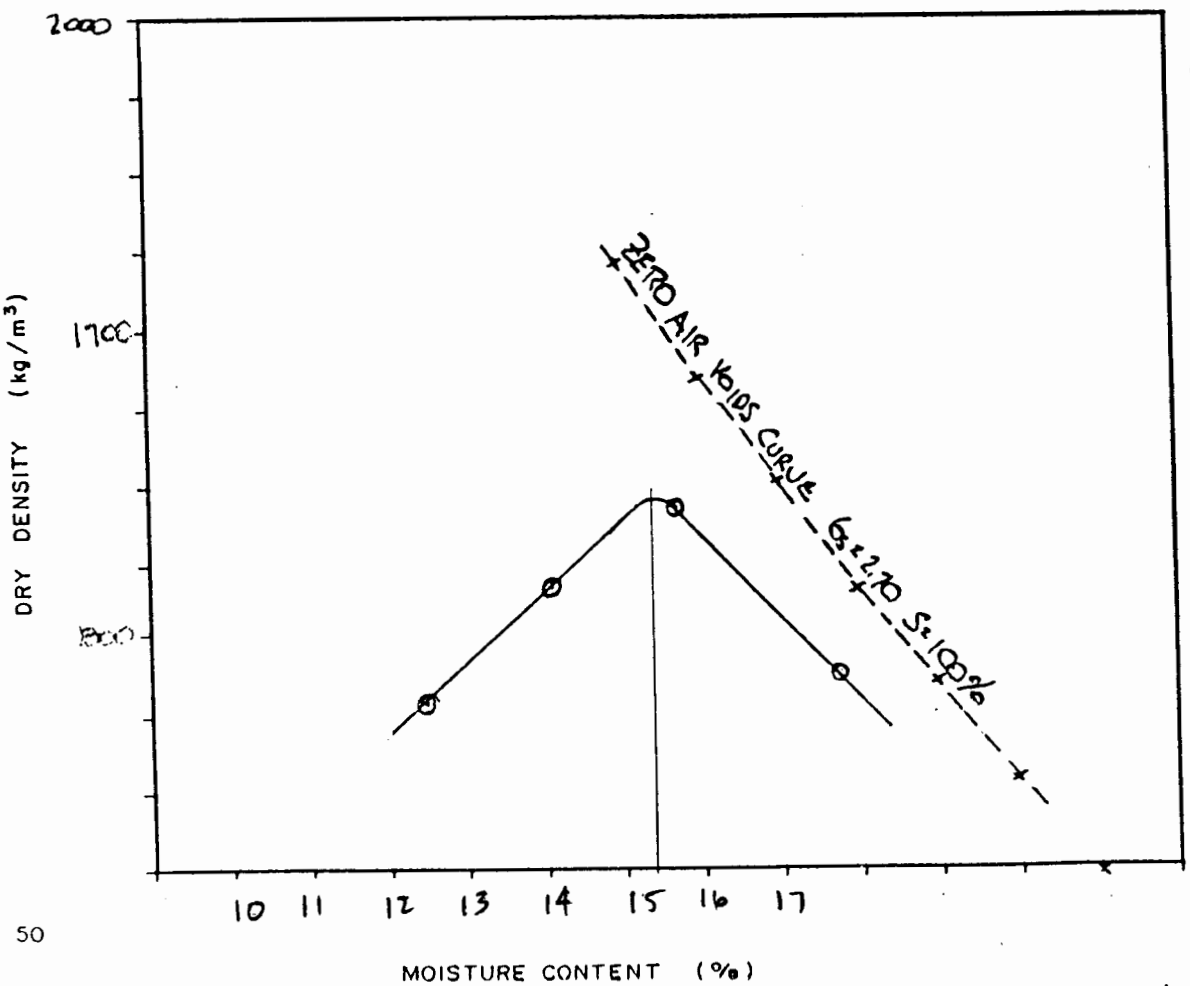
SOURCE:

DATE TESTED: 4/1/91 BY: LL

MOISTURE DENSITY RELATIONSHIP (MODIFIED)

	TRIAL NO.	1	2	3	4	5		
DENSITY	WT. OF SAMPLE WET + MOLD	6150.6	6219.1	6274.7	6250.1			
	WEIGHT OF MOLD	4262	4262	4262	4262	4262		
	WT. OF SAMPLE WET	1888.6	1957.1	2012.7	1988.1			
	WET DENSITY (kg/m³)	2000.6	2073.2	2132.1	2106.0			
	DRY DENSITY (kg/m³)	1778.3	1817.0	1842.8	1781.8			

	MOISTURE ADDED	10	+	++	+++			
MOISTURE CONTENT	CONTAINER No.	220	329	136	3			
	WT. OF WET SOIL + TARE	279.2	388.2	563.6	452.6			
	WT. OF DRY SOIL + TARE	250.3	342.3	489.4	386.9			
	WEIGHT OF WATER	28.9	45.9	74.2	65.7			
	TARE WEIGHT	18.1	17.5	17.7	17.7			
	WEIGHT OF DRY SOIL	232.2	324.8	471.7	369.2			
	MOISTURE CONTENT (%)	12.5 ✓	14.1 ✓	15.7 ✓	17.8 ✓			



MAX. DRY DENSITY 1845 kg/m³

OPTIMUM MOISTURE 15.4 %

MOLD DIA. 10.16 cm

MOLD VOL. .000944 m³

ASTM D 698 ☐

ASTM D1557 ☑

METHOD A

SAMPLE DESCRIPTION:

Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

PROJECT No. 912 1001D LAB No. 859

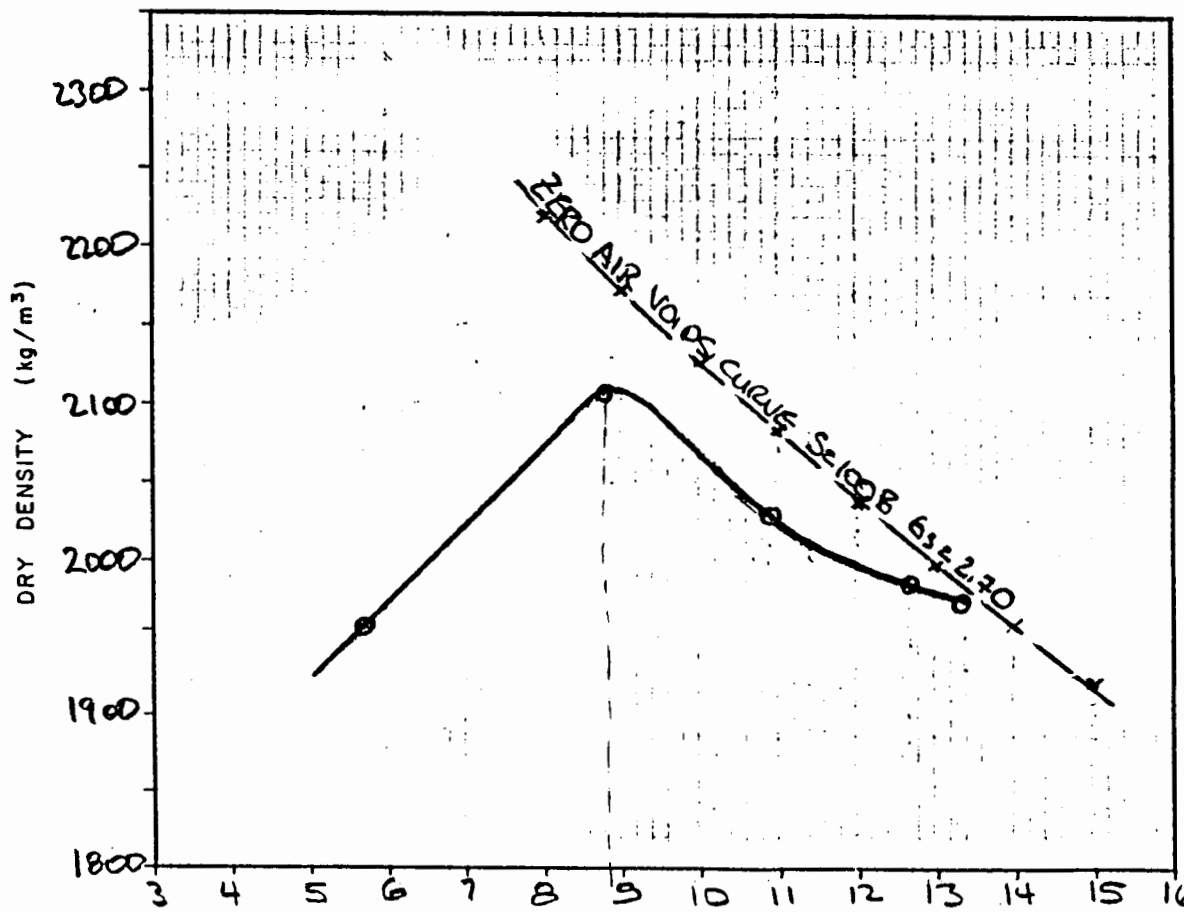
SITE LOCATION: KPCM - 1, 2, 3, 4, 5 (PAD)

MOISTURE DENSITY RELATIONSHIP

*ESTIMATED SOURCE: LAB ID # C10

DATE TESTED: MAR 4/91 BY: IT M.

	TRIAL NO.	1 "NAT"	2 ORY	3 +5%	4 +10%			
DENSITY	WT. OF SAMPLE WET + MOLD	10491.	10101.	10459.	10464.	10582.		
	WEIGHT OF MOLD	5709	→	→	→	→		
	WT. OF SAMPLE WET	4782	4392	4750	4755	4873		
	WET DENSITY (kg/m³)	2251.	2068.	2236	2239	2294		
	DRY DENSITY (kg/m³)	2030	1956	1984 ?	1974	2108		
MOISTURE CONTENT	MOISTURE ADDED	NONE	-5%	125ml	150ml			
	CONTAINER No.	#161	#194	#384	#5	#D		
	WT. OF WET SOIL + TARE	479.3	602.6	646.9	771.0	1139.4		
	WT. OF DRY SOIL + TARE	434.0	571.1	576.1	682.0	1064.6		
	WEIGHT OF WATER	45.3	31.5	70.8	89.0	74.8		
	TARE WEIGHT	18.4	17.5	18.0	17.9	214.6		
	WEIGHT OF DRY SOIL	415.6	553.6	558.1	664.1	850.0		
	MOISTURE CONTENT (%)	10.9	5.7	12.7	13.4	8.8		



MAX. DRY DENSITY 2108 kg/m³

OPTIMUM MOISTURE 9.0 %

MOLD DIA. _____ cm

MOLD VOL. 2124 cm³

ASTM D 698 ☐

ASTM D1557 ☑

METHOD MOD

SAMPLE DESCRIPTION:

TAN COLOURED SANDY SILTY GRAVEL.

Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

PROJECT No. 9121001D LAB No. _____

SITE LOCATION: LAB ID # CS6

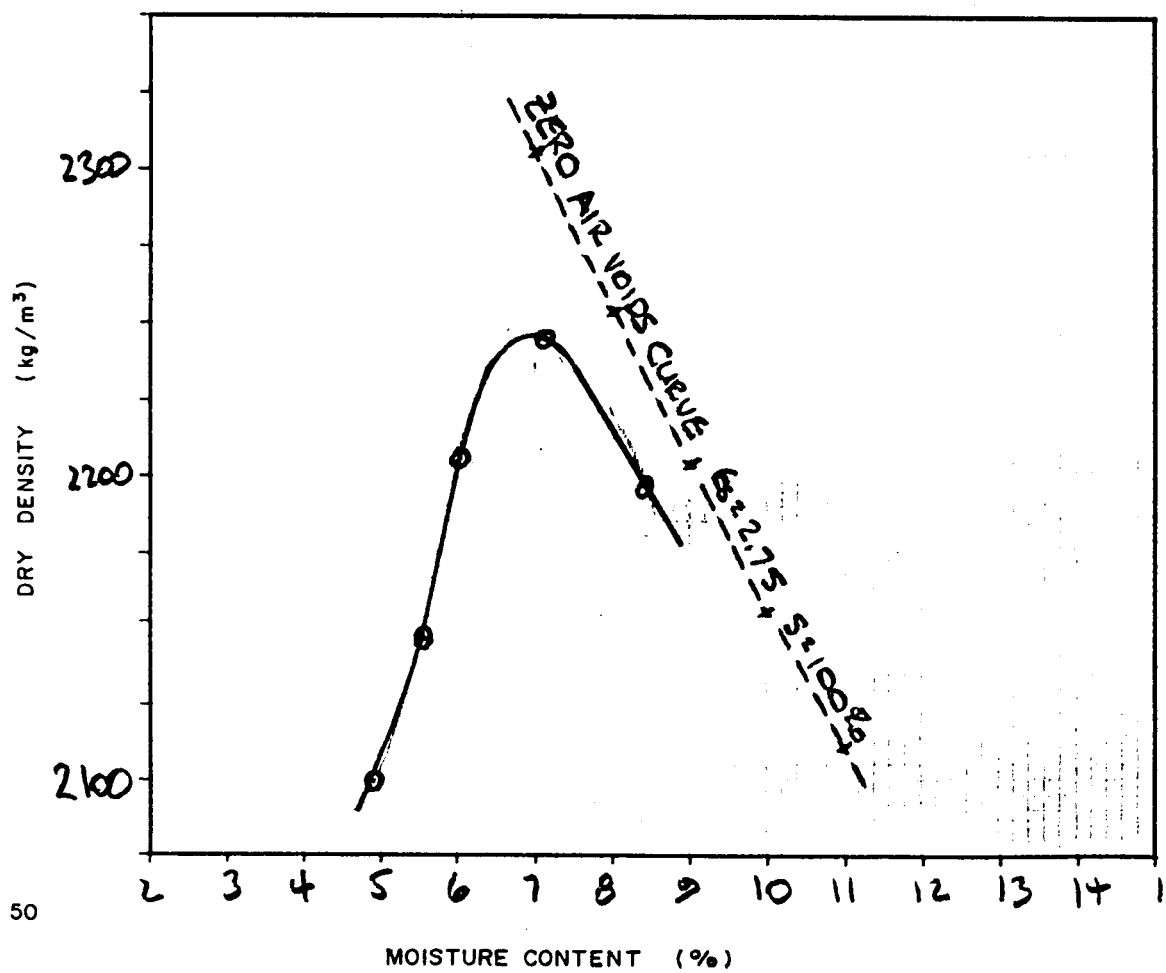
SOURCE: _____

DATE TESTED: 4/9/91 BY: LL

MOISTURE DENSITY RELATIONSHIP (MoD)

	TRIAL NO.	1	2	3	4	5		
DENSITY	WT. OF SAMPLE WET + MOLD	10,385 H	10,522.8	10,672.4	10,817.2	10,764.9		
	WEIGHT OF MOLD	5709	5709	5709	5709	5709		
	WT. OF SAMPLE WET	4676.4	4813.8	4963.4	5108.2	5055.9		
	WET DENSITY (kg/m^3)	2201.7	2266.4	2336.8	2405.0	2380.4		
	DRY DENSITY (kg/m^3)	2098.9	2146.2	2204.5	2245.6	2195.9		

	MOISTURE ADDED	4.5	5.5	6.5	7.5	9.0		
MOISTURE CONTENT	CONTAINER No.	44	5	37	41	35		
	WT. OF WET SOIL + TARE	1583.4	1432.8	1460.7	1829.2	1626.7		
	WT. OF DRY SOIL + TARE	1526.3	1376.2	1398.6	1730.5	1527.8		
	WEIGHT OF WATER	57.1	56.6	62.1	98.7	98.9		
	TARE WEIGHT	351.6	365.9	360.2	353.7	351.1		
	WEIGHT OF DRY SOIL	1174.7	1010.3	1038.4	1376.8	1176.7		
	MOISTURE CONTENT (%)	4.9	5.6	6.0	7.1	8.4		



MAX. DRY DENSITY 2246 kg/m^3

OPTIMUM MOISTURE 7.0 %

MOLD DIA. 1524 cm

MOLD VOL. .002124 m^3

ASTM D 698 ☐

ASTM D1557 ☑

METHOD C

SAMPLE DESCRIPTION:

Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

PROJECT No. 912/001D LAB No. _____

SITE LOCATION: LAB ID # CS7

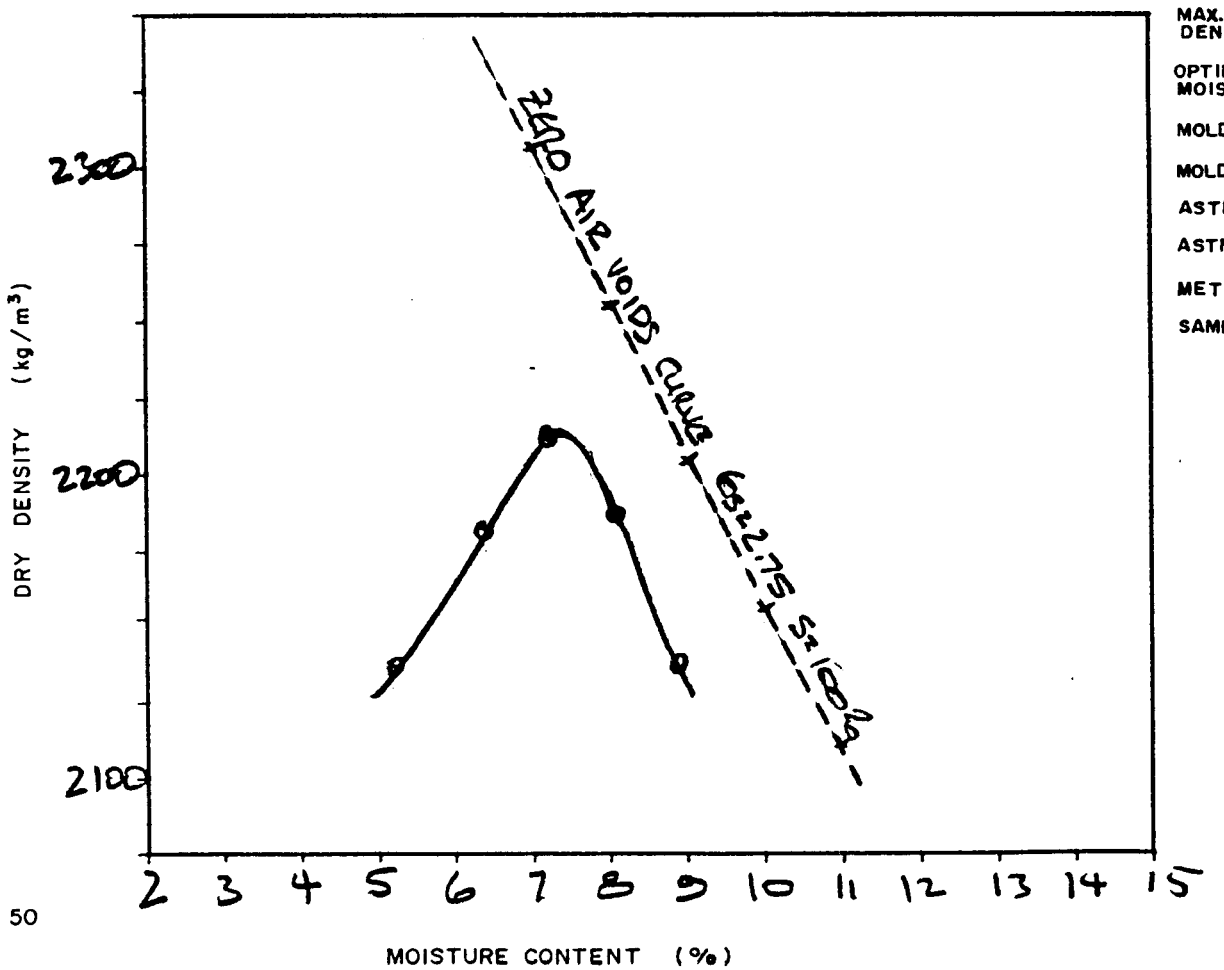
MOISTURE DENSITY RELATIONSHIP (Modified)

SOURCE: _____

DATE TESTED: 4/10/91 BY: LL

	TRIAL NO.	1	2	3	4	5		
DENSITY	WT. OF SAMPLE WET + MOLD	10,482.5	10,657.0	10,751.9	10,732.1	10,648.2		
	WEIGHT OF MOLD	5709	5709	5709	5709	5709		
	WT. OF SAMPLE WET	4773.5	4948.0	5042.9	5023.1	4939.3		
	WET DENSITY (kg/m^3)	2247.4	2329.9	2374.3	2364.9	2325.4		
	DRY DENSITY (kg/m^3)	2136.1	2189.9	2214.8	2187.7	2135.4		

	MOISTURE ADDED	4.5	6.0	7.0	8.0	9.0		
MOISTURE CONTENT	CONTAINER No.	37	5	41	44	7		
	WT. OF WET SOIL + TARE	1320.5	1461.6	1533.2	1677.3	1938.1		
	WT. OF DRY SOIL + TARE	1272.8	1395.3	1453.8	1577.5	1810.5		
	WEIGHT OF WATER	47.7	66.3	79.4	99.8	127.6		
	TARE WEIGHT	360.2	365.9	353.7	351.4	370.4		
	WEIGHT OF DRY SOIL	912.6	1029.4	1100.1	1226.1	1440.1		
	MOISTURE CONTENT (%)	5.2	6.4	7.2	8.1	8.3		



MAX. DRY DENSITY 2214 kg/m^3

OPTIMUM MOISTURE 7.4 %

MOLD DIA. 15.24 cm

MOLD VOL. .002127 m^3

ASTM D 698 ☐

ASTM D1557 ☑

METHOD C

SAMPLE DESCRIPTION:

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

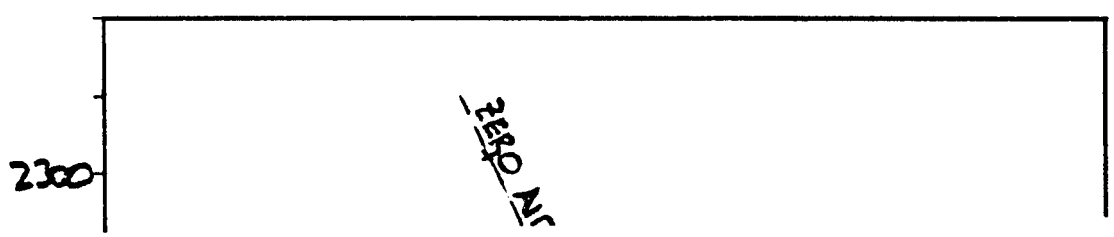
PROJECT No. 9121001D LAB No. _____
SITE LOCATION: LAB ID # C58

MOISTURE DENSITY RELATIONSHIP (MODIFIED)

SOURCE: _____
DATE TESTED: 4/10/91 BY: LL

	TRIAL NO.	1	2	3	4	5		
DENSITY	WT. OF SAMPLE WET + MOLD	10,436.8	10,141.8	10,836.1	10,758.4			
	WEIGHT OF MOLD	5709	5709	5709	5709	5709		
	WT. OF SAMPLE WET	4727.8	5032.8	5127.1	5049.4			
	WET DENSITY (kg/m³)	2225.9	2369.5	2413.9	2377.3			
	DRY DENSITY (kg/m³)	2121.9	2235.4	2258.1	2187.0			

	MOISTURE ADDED	4.5	6.0	7.5	9.0			
MOISTURE CONTENT	CONTAINER No.	24	308	B-3	103.4			
	WT. OF WET SOIL + TARE	859.6	1147.9	906.6	1618.0			
	WT. OF DRY SOIL + TARE	828.6	1089.1	855.0	1496.7			
	WEIGHT OF WATER	31.0	58.8	51.6	121.3			
	TARE WEIGHT	194.8	110.5	112.0	103.6			
	WEIGHT OF DRY SOIL	633.8	978.6	743.0	1393.1			
	MOISTURE CONTENT (%)	4.9	6.0	6.9	8.7			



MAX. DRY DENSITY 7.1 kg/m³
OPTIMUM MOISTURE 2270 %
MOLD DIA. 15.24 cm
MOLD VOL. 1002124 m³
ASTM D 698 ☐

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

PROJECT No. 9121001D LAB No. _____
SITE LOCATION: LAB ID # C56

MOISTURE DENSITY RELATIONSHIP (MOD)

SOURCE: _____
DATE TESTED: 4/9/91 BY: LL

	TRIAL NO.	1	2	3	4	5		
DENSITY	WT. OF SAMPLE WET + MOLD	10,385.4	10,522.8	10,672.4	10,817.2	10,764.9		
	WEIGHT OF MOLD	5709	5709	5709	5709	5709		

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

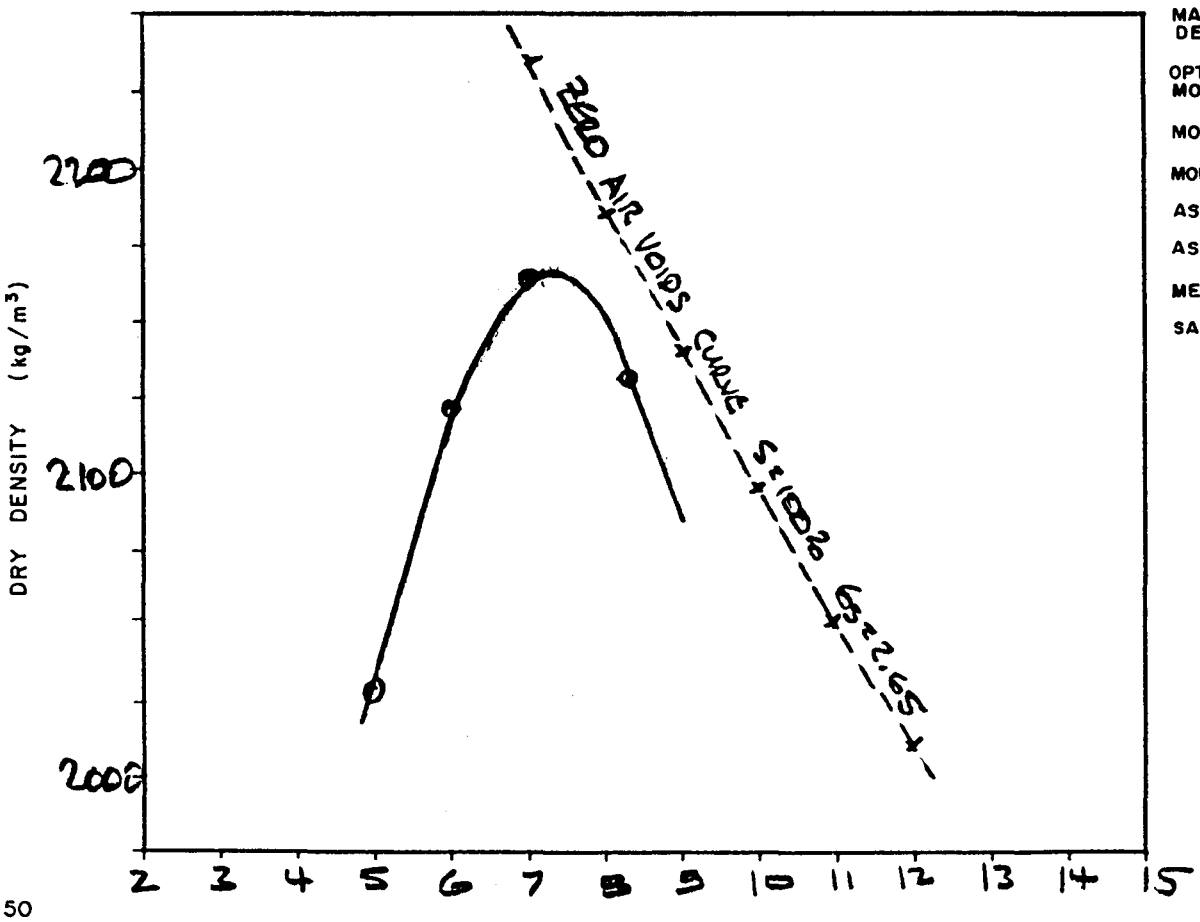
PROJECT No. 91210010 LAB No. _____
SITE LOCATION: LAB ID #C59

MOISTURE DENSITY RELATIONSHIP (MODIFIED)

SOURCE: _____
DATE TESTED: 4/10/91 BY: LL

	TRIAL NO.	1	2	3	4	5		
DENSITY	WT. OF SAMPLE WET + MOLD	10231.5	10,487.1	10,637.5	10,609.3			
	WEIGHT OF MOLD	5709	5709	5709	5709	5709		
	WT. OF SAMPLE WET	4522.5	4778.1	4928.5	4900.3			
	WET DENSITY (kg/m³)	2129.2	2249.6	2320.4	2307.1			
	DRY DENSITY (kg/m³)	2027.9	2122.2	2164.5	2130.3			

	MOISTURE ADDED	4.5	6.0	7.5	9.0			
MOISTURE CONTENT	CONTAINER No.	31	K	250	18			
	WT. OF WET SOIL + TARE	1182.8	1226.9	1347.6	1208.7			
	WT. OF DRY SOIL + TARE	1132.2	1067.6	1263.8	1032.1			
	WEIGHT OF WATER	50.6	59.3	83.8	76.6			
	TARE WEIGHT	111.1	89.6	104.2	108.4			
	WEIGHT OF DRY SOIL	1021.1	978.0	1159.6	923.7			
	MOISTURE CONTENT (%)	5.0	6.0	7.2	8.3			



MAX. DRY DENSITY 2165 kg/m³
OPTIMUM MOISTURE 7.4 %
MOLD DIA. 15.24 cm
MOLD VOL. .002124 m³
ASTM D 698 ☐
ASTM D1557 ☑
METHOD C
SAMPLE DESCRIPTION:

Golder Associates Ltd.
CONSULTING ENGINEERS

WATER CONTENT DETERMINATION

PROJECT No. 9121001D

DATE: 3/13/91

LAB NUMBER	← BLOCK SAMPLE →					
BOREHOLE NUMBER	TPC 91-1					
SAMPLE NUMBER	←	#2	→			
DEPTH OF SAMPLE (m)	←	2.5m	→			
CONTAINER NUMBER	A	134	150			
MASS WET SOIL + TARE	414.65	538.24	343.84			
MASS DRY SOIL + TARE	314.48	412.64	265.23			
MASS OF WATER	100.17	125.76	78.61			
TARE MASS	13.01	17.30	17.77			
MASS OF DRY SOIL	301.47	395.34	247.46			
WATER CONTENT W (%)	33.2	31.8	31.8	}	W% AVG =	32.3%

LAB NUMBER						
BOREHOLE NUMBER						
SAMPLE NUMBER						
DEPTH OF SAMPLE (m)						
CONTAINER NUMBER						
MASS WET SOIL + TARE						
MASS DRY SOIL + TARE						
MASS OF WATER						
TARE MASS						
MASS OF DRY SOIL						
WATER CONTENT W (%)						

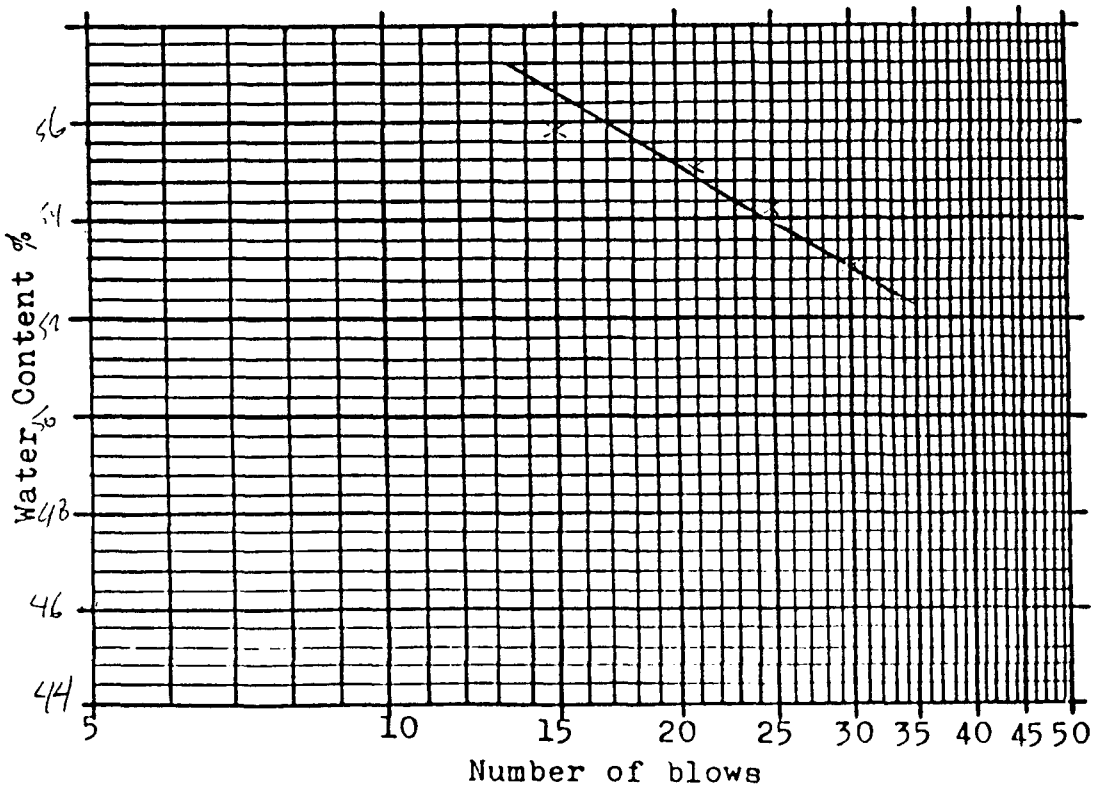
LAB NUMBER						
BOREHOLE NUMBER						
SAMPLE NUMBER						
DEPTH OF SAMPLE (m)						
CONTAINER NUMBER						
MASS WET SOIL + TARE						
MASS DRY SOIL + TARE						
MASS OF WATER						
TARE MASS						
MASS OF DRY SOIL						
WATER CONTENT W (%)						

LABORATORY TEST SHEET – ATTERBERG LIMITS

Lab Work #853 Project # 912-1001D Date MARCH 14/91

Type of Test	LL	LL	LL	LL		Nat MC
Container #	#3	B7	A10	E		
Number of blows	30	25	21	14		
Wt.sample wet + tar	14.24	17.46	14.40	18.18		
Wt.sample dry + tar	10.61	12.81	10.58	12.92		
Weight of water	3.63	4.65	3.82	5.26		
Tare	3.49	4.30	3.63	3.51		
Wt. of dry soil	7.12	8.51	6.95	9.41		
Water content %	50.9	54.6	54.9	55.9		

Type of Test	PL	PL	Borehole #	TPC 91-1
Container #	B3	B16	Sample #	#2
Wt.sample wet + tar	10.59	11.55	Depth	1.5m
Wt.sample dry + tar	9.38	10.12	Liquid Limit	53.8
Wt. of water	1.21	1.43	Plastic Limit	21.0
Tare	3.52	3.46	Plasticity index	32.8
Weight of dry soil	5.86	6.66	Moisture content	
Water content	20.6	21.4	Liquidity Index	



SAMPLE DESCRIPTION

CH

NATURAL DENSITY TEST - SUBMERGED WAX METHOD

FIGURE

Project No. ----------

JOB N° 91210010 TITLE K+P/(1673/4)/Mt. Milligan Date 3/13/91

Bore Hole TPC91-1 Sample #2 Depth 2.5 m by LL

Volume of Wax

Wt. soil + wax ② = 2048.5 gr

Wt. soil ① = 1897.8 gr

Wt. wax = 150.7 gr

Vol. wax $\left(\frac{\text{Wt. wax}}{0.849}\right)$ = 177.5 cc

Volume of Soil + Wax

Wt. soil + wax ② = 2048.5 gr

Wt. submerged ③ = 876.5 gr

Vol. soil + wax = 1172.0 cc

W.C. Determination	
DISH N°	B3
Wt. wet soil + tare	1980.7
Wt. dry soil + tare	1558.1
Wt. tare	112.2
Wt. water	422.6
Wt. dry soil	1445.9
Water Content %	29.2%

Volume of Soil

Vol. soil + wax = 1172.0 cc

Vol. wax = 177.5 cc

Vol. soil = 994.5 cc

Natural Density $\gamma_{nat.} = \frac{1897.8}{994.5} =$ 1.9083 g/cm³

Dry Density $\gamma_d = \frac{\gamma_{wet}}{1 + W.C.} =$ 1.4770 g/cm³

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DETERMINATION NUMBER		1	2	3	4
BOTTLE NUMBER		1	3		
AIR REMOVAL METHOD		VACUUM	VACUUM		
WEIGHT OF BOTTLE, gm.		179.56	174.01		
INITIAL WEIGHT OF BOTTLE + SOIL, gm.		—	—		
INITIAL WEIGHT OF SOIL, gm.		75.00	75.00		
WEIGHT BOTTLE + SOIL + WATER, gm.	W_1	725.85	720.28		
TEMPERATURE, °C	T	20.8	20.9		
WEIGHT BOTTLE + WATER, gm.	W_2	677.96	672.30		

EVAPORATING DISH NUMBER		35	2		
WEIGHT DISH + DRY SOIL, gm.		425.91	449.27		
WEIGHT OF DISH, gm.		351.17	374.47		
WEIGHT OF SOIL, gm.	W_s	74.74	74.80		
SPECIFIC GRAVITY OF WATER	G_T	0.99806	0.99804		
$G_T W_S$		74.60	74.65		
$W_1 - W_2$		47.89	47.98		
$W_S - (W_1 - W_2)$		26.85	26.82		
SPECIFIC GRAVITY OF SOIL	G_s	2.78	2.78		

$$G_s = \frac{G_T W_S}{W_S - (W_1 - W_2)} = 2.78$$

BOTTLE CALIBRATION

BOTTLE NUMBER _____

DETERMINATION NUMBER		1	2	3	4
WEIGHT BOTTLE + WATER, gm.	W_2				
TEMPERATURE, °C	T				

REMARKS

SPECIFIC GRAVITY OF SOIL (PYCNOMETER METHOD)

TESTED BY LL

CALCULATED BY _____

CHECKED BY _____

DATE OF TESTING 3/14/91

PROJECT NUMBER 9121001

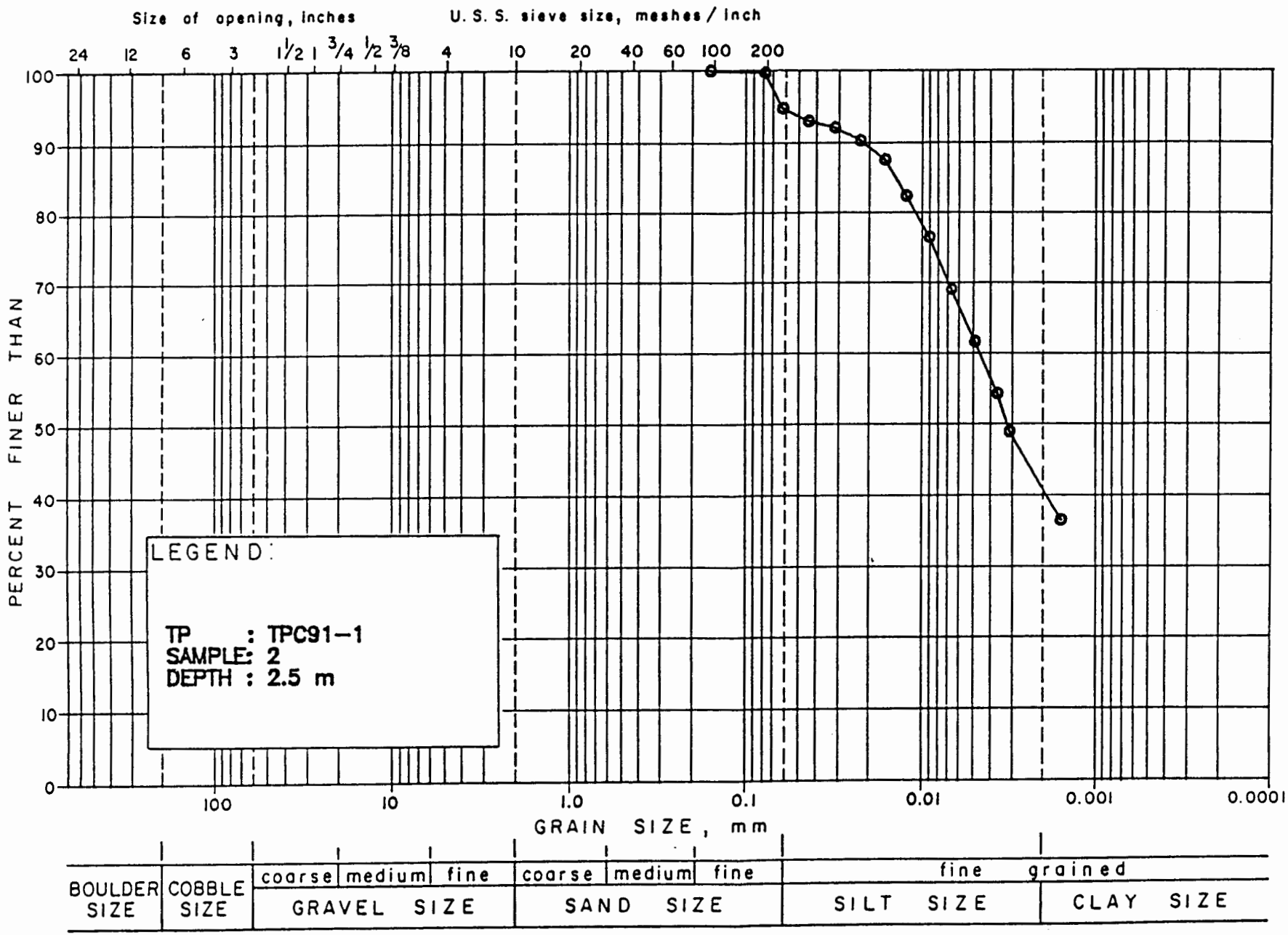
BOREHOLE NUMBER TPC91-1

SAMPLE NUMBER 2

DEPTH OF SAMPLE 2.5 M

PROJECT NO. 9121001D ..... DRAWN ..... REVIEWED ..... DATE ... MAR-25-91 .....

M.I.T. GRAIN SIZE SCALE



GRAIN SIZE DISTRIBUTION

Figure

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GRAINSIZE ANALYSIS

Project#: 91210010 TP: TPC91-1
Client : KNIGHT & PIESOLD SA: 2
Project : (1673/4) DEPTH: 2.5 m
Location: MT. MILLIGAN

1st SIEVE : (Entire Sample) HYDROMETER: (Minus #10)
Wt before sieve = 299.3 gms Wt = 55.0 gms

2nd SIEVE : (Minus #10) Gs = 2.78
Wt before sieve = 55.0 gms

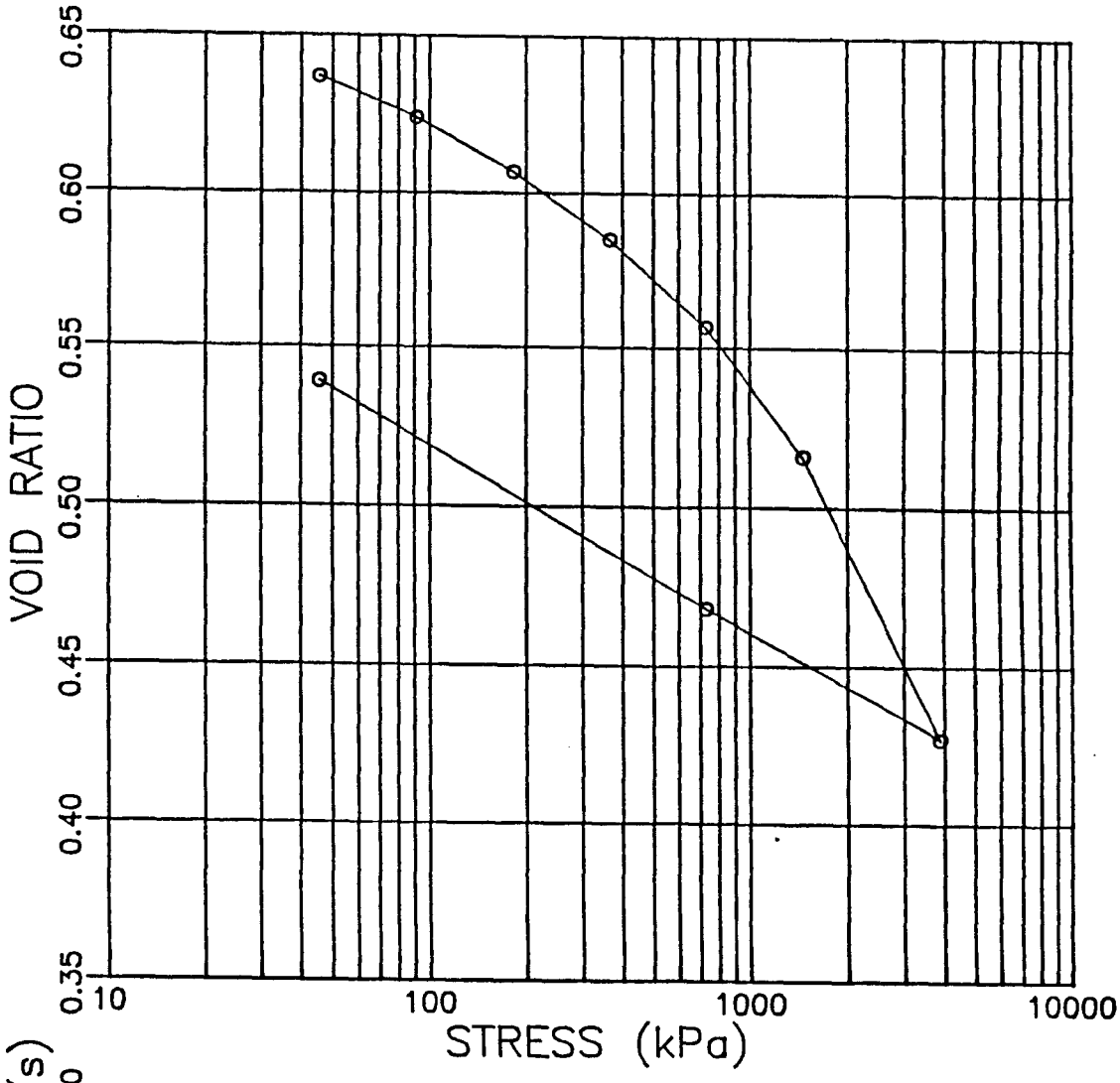
Size (USS)	Wt Ret (gms)	% Ret	% Ret Total	Diameter (mm)	% Pass
6"	0.0	0.0	0.0	152.40	100.0
3"	0.0	0.0	0.0	76.20	100.0
1 1/2"	0.0	0.0	0.0	38.10	100.0
1"	0.0	0.0	0.0	25.40	100.0
3/4"	0.0	0.0	0.0	19.10	100.0
1/2"	0.0	0.0	0.0	12.70	100.0
3/8"	0.0	0.0	0.0	9.52	100.0
#4	0.0	0.0	0.0	4.76	100.0
#10	0.0	0.0	0.0	2.00	100.0
#20	0.0	0.0	0.0	0.840	100.0
#40	0.0	0.0	0.0	0.420	100.0
#60	0.0	0.0	0.0	0.250	100.0
#100	0.0	0.0	0.0	0.149	100.0
#200	0.1	0.2	0.2	0.074	99.8
Pan	49.4	89.8	89.8		

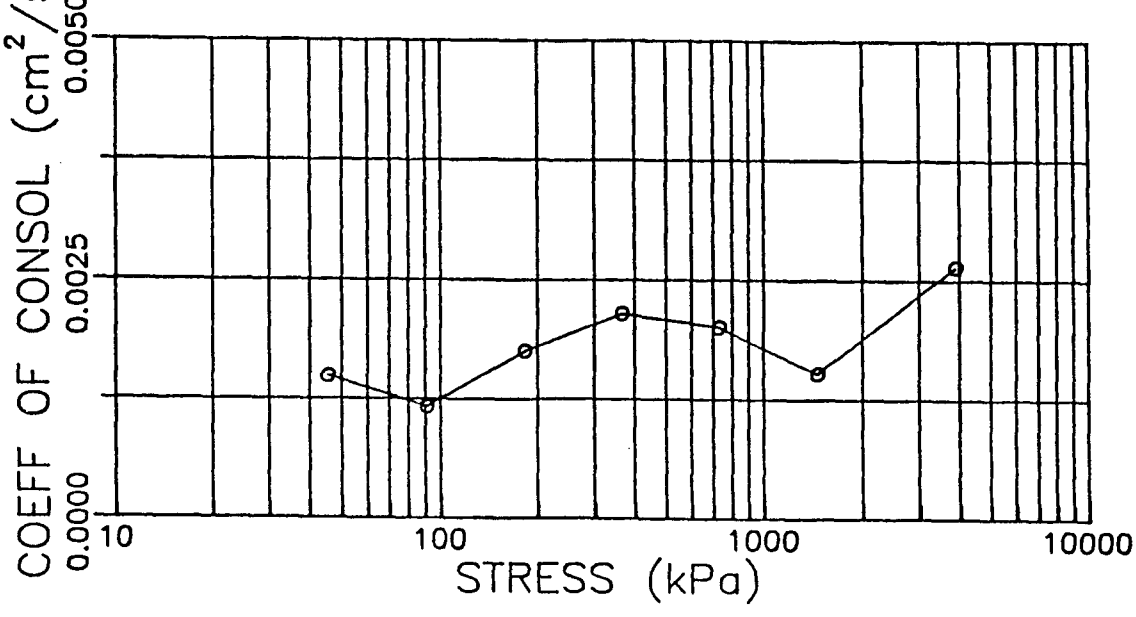
HYDROMETER ANALYSIS

Elapsed Time	Hydro Read	Temp (C)	Corr	Hydro Corr	Diam (mm)	% Pass
0.5	56.0	19.5	-3.8	52.2	0.0587	94.8
1	55.0	19.5	-3.8	51.2	0.0420	93.0
2	54.5	19.5	-3.8	50.7	0.0299	92.1
4	53.5	19.5	-3.8	49.7	0.0213	90.3
8	52.0	19.5	-3.8	48.2	0.0153	87.6
15	49.2	19.5	-3.8	45.4	0.0115	82.5
30	46.0	19.5	-3.8	42.2	0.0084	76.7
60	42.0	19.5	-3.8	38.2	0.0062	69.4
120	38.0	19.4	-3.9	34.1	0.0045	62.1
240	34.0	19.5	-3.8	30.2	0.0033	54.8
360	31.0	20.0	-3.8	27.2	0.0028	49.5
1440	24.5	17.5	-4.1	20.4	0.0014	37.1

CONSOLIDATION TEST
TPC91-1 SAMPLE:2 DEPTH:2.5 m

Figure





PROJECT NO. ....91210010.... DRAWN ..LL.... REVIEWED ..... DATE ...MAR-25-91..

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ONE DIMENSIONAL CONSOLIDATION TEST

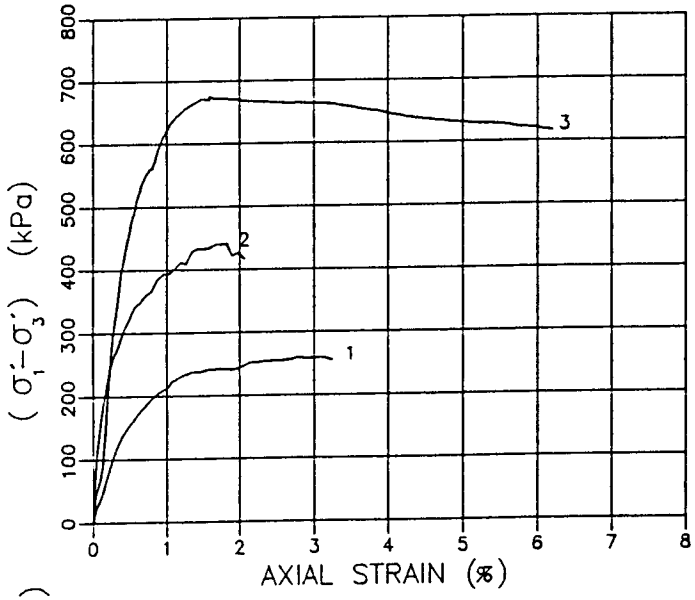
PROJ# : 91210010	MACH # =	5	WET WT =	48.26 gms
TP : TPC91-1	RING # =	5	DRY WT =	39.28 gms
SA : 2	HT (mm) =	12.15	WET DENSITY =	2057 Kg/M^3
DEPTH : 2.5 m	DIA (mm) =	49.58	DRY DENSITY =	1675 Kg/M^3
DATE : MAR-24-91	AREA(cm^2)=	19.31	INIT WC =	22.90
	VOL (cm^3)=	23.46	Gs =	2.78
			2Ho =	7.32 mm
			SAT =	96.3 %

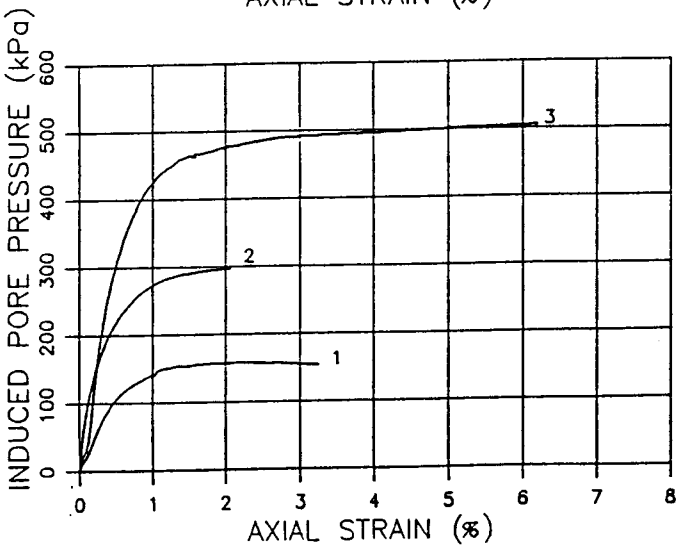
REMARKS : - T50 determined by Casagrande Method
- test run at natural moisture content

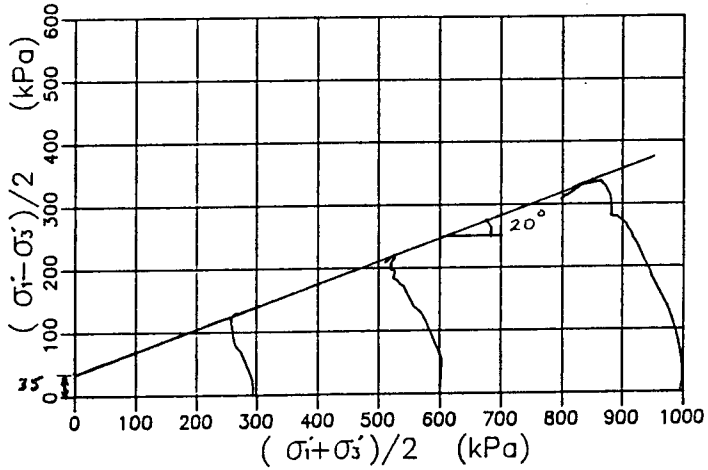
LOAD NO.	STRESS (TSF)	STRESS (kPa)	DIAL (mm)	2H (mm)	2H-2Ho (mm)	VOID RATIO	T50 (min)	Cv (cm^2/s)	Av (1/kPa)	Mv (1/kPa)	K (cm/sec)
0		0.0	0.00	12.15	4.83	0.660					
1		45.6	0.17	11.98	4.66	0.637	0.80	1.49E-03	5.09E-04	3.11E-04	4.6E-08
2		91.2	0.26	11.89	4.57	0.624	1.00	1.17E-03	2.82E-04	1.73E-04	2.0E-08
3		182.9	0.39	11.76	4.44	0.607	0.65	1.76E-03	1.91E-04	1.19E-04	2.1E-08
4		364.8	0.55	11.60	4.28	0.585	0.52	2.15E-03	1.16E-04	7.34E-05	1.6E-08
5		729.6	0.76	11.39	4.08	0.557	0.54	2.01E-03	7.83E-05	5.03E-05	9.9E-09
6		1459.2	1.05	11.10	3.78	0.516	0.68	1.53E-03	5.54E-05	3.66E-05	5.5E-09
7		3891.3	1.71	10.44	3.12	0.427	0.36	2.64E-03	3.70E-05	2.59E-05	6.7E-09
8		729.6	1.41	10.74	3.42	0.468					
9		45.6	0.89	11.26	3.95	0.539					

CONSOLIDATED UNDRAINED TRIAXIAL TEST
K&P/(1673/4)/MT.MILLIGAN
TPC91-1 SA-2 DEPTH 2.5 m

Figure







NOTE :
Shear plane development was visiable on top portion of triaxial specimen during the end of Stage-1 and became more progressive during Stage-2 and Stage-3.

$$\phi' = \sin^{-1}(\tan 20^\circ) = 21^\circ$$

$$c' = \frac{35}{\cos 21^\circ} = 37 \text{ kPa}$$

Golder Associates

PROJECT NO. ....9121001D.... DRAWN ..LL.... REVIEWED ..... DATE ..MAR-24-91..

CIU TRIAXIAL TEST SUMMARY

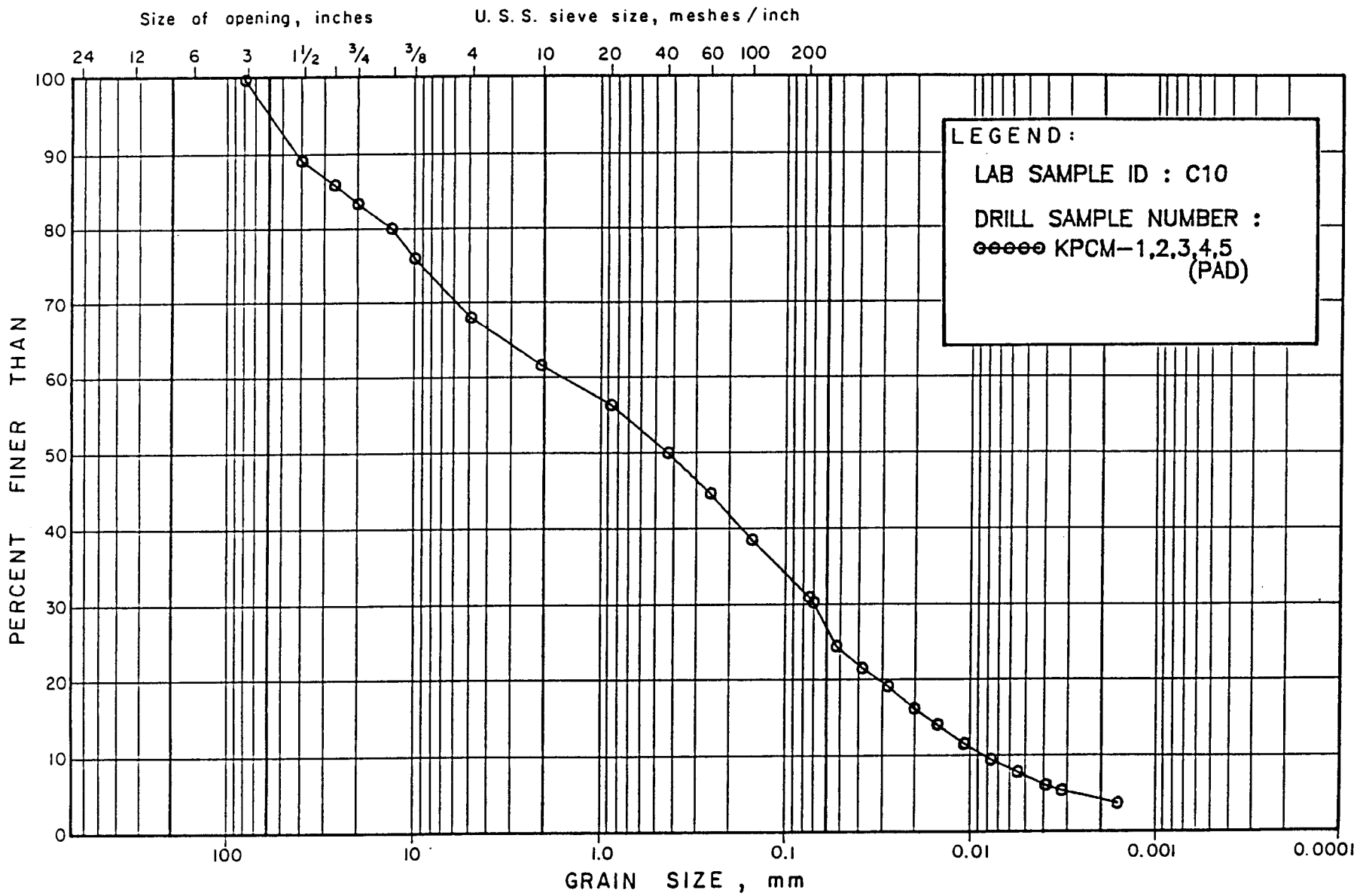
PROJECT# 91210010 K&P/(1473/4)/MT. MILLIGAN

REMARKS:
One triaxial specimens was trimmed from
undisturbed block sample for Multi-stage Testing

	STAGE-1	STAGE-2	STAGE-3
TESTPIT	TPC91-1	TPC91-1	TPC91-1
SAMPLE	2	2	2
DEPTH (m)	2.5 m	2.5 m	2.5 m
BEFORE CONSOLIDATION			
Ho (mm)	116.4	114.4	110.7
Dia (mm)	50.04	49.26	49.53
Ao (cm2)	19.67	19.06	19.27
Vo (cm3)	229.0	218.0	213.3
W (%)	26.3	23.2	21.9
Wwet (kg/M3)	1975	2024	2049
Wdry (kg/M3)	1564	1643	1681
AFTER CONSOLIDATION			
Ho (mm)	114.4	110.7	109.1
Dia (mm)	49.26	49.53	49.42
Ao (cm2)	19.06	19.27	19.18
Vo (cm3)	218.0	213.3	209.3
W (%)	23.2	21.9	20.7
Wwet (kg/M3)	2024	2049	2065
Wdry (kg/M3)	1643	1681	1711
B-VALUE	0.99	0.99	0.99
CP (kPa)	570	874	1270
BP (kPa)	277	275	276
SIG-3C' (kPa)	293	599	994
Vc (cm3)	10.8	4.8	4.0
T100 (min)	202	233	239
Cv (cm2/s)	2.2E-03	1.8E-03	1.7E-03
k (cm/s)	2.8E-08	-----	-----
STRAIN RATE			
(mm/min)	0.012	0.0073	0.0073
(%/HR)	0.63	0.40	0.40
MAXIMUM VALUES			
SIG-D' (kPa)	260	440	672
@ E%	2.76	1.74	1.50
PSR	2.90	2.44	2.27
@ E%	2.76	1.74	1.50
w% FINAL	23.2	21.9	20.7

PROJECT 9121001D DRAWN REVIEWED DATE MAR-15-91

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

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CONSULTING GEOTECHNICAL AND MINING ENGINEERS

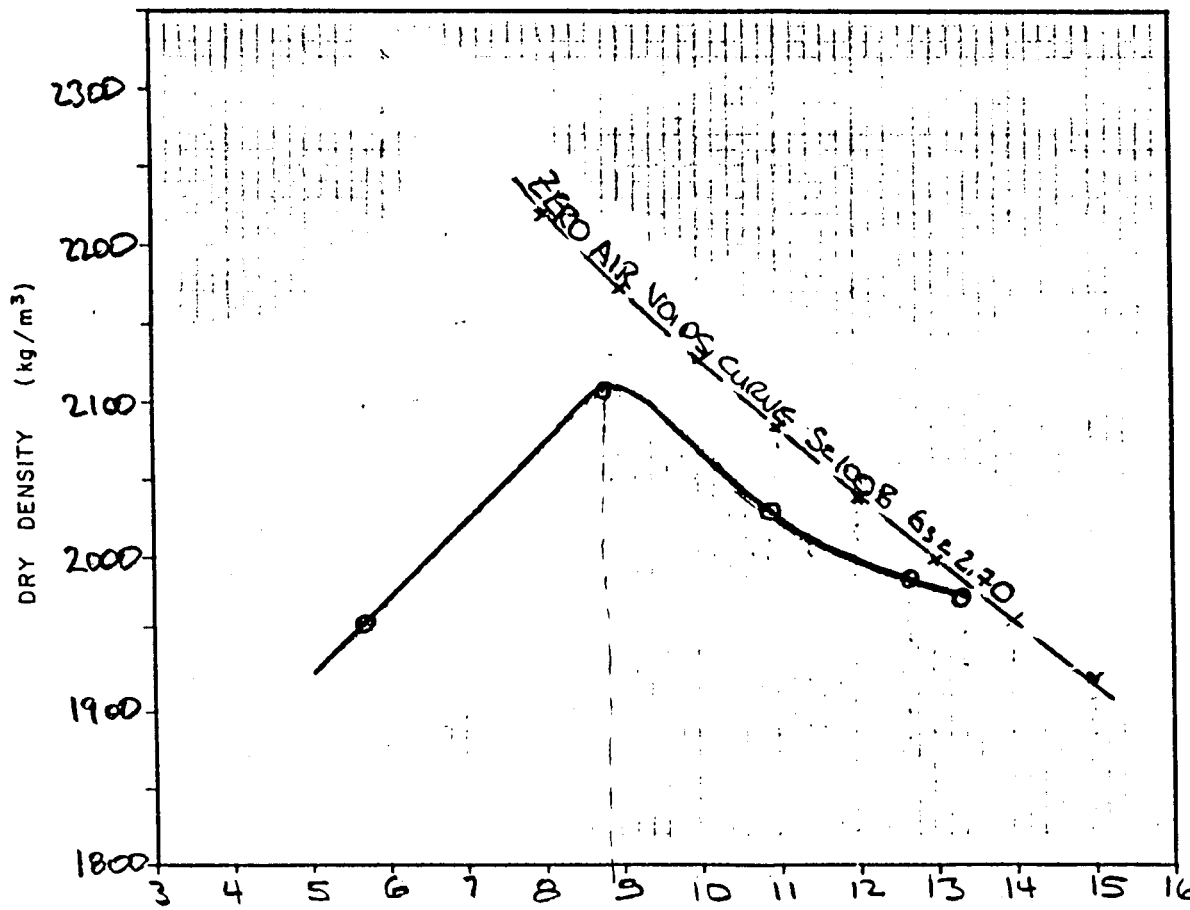
PROJECT No. 912 1001D LAB No. 859
SITE LOCATION: KPCM - 1, 2, 3, 4, 5 (PAD)

MOISTURE DENSITY RELATIONSHIP

*ESTIMATED SOURCE: LAB ID # C10
DATE TESTED: MAR 04/91 BY: IT M.O

		"NAT"	DRY	+ 5%	+ 10%			
DENSITY	TRIAL NO.	1	2	3	4			
	WT. OF SAMPLE WET + MOLD	10491.	10101.	10459.	10464.	10582.		
	WEIGHT OF MOLD	5709	—	—	→	→		
	WT. OF SAMPLE WET	4782	4392	4750	4755	4873		
	WET DENSITY (kg/m³)	2251	2068	2236	2239	2294		
	DRY DENSITY (kg/m³)	2030	1956	1984	1974	2108		

MOISTURE CONTENT	MOISTURE ADDED	NONE	-5%	125 ml	250 ml			
	CONTAINER No.	#161	#194	#384	#5	#A		
	WT. OF WET SOIL + TARE	479.3	602.6	646.9	771.0	1139.4		
	WT. OF DRY SOIL + TARE	434.0	571.1	576.1	682.0	1064.6		
	WEIGHT OF WATER	45.3	31.5	70.8	89.0	74.8		
	TARE WEIGHT	18.4	17.5	18.0	17.9	214.6		
	WEIGHT OF DRY SOIL	415.6	553.6	558.1	664.1	850.0		
	MOISTURE CONTENT (%)	10.9	5.7	12.7	13.4	8.8		



MAX. DRY DENSITY 2108 kg/m³
OPTIMUM MOISTURE 9.0 %
MOLD DIA. ____ cm
MOLD VOL. 2124 cm³
ASTM D 698 ☐
ASTM D1557 ☑
METHOD MOD
SAMPLE DESCRIPTION:
TAN COLOURED SANDY SILTY GRAVEL

Knight and Piésold Ltd.
CONSULTING ENGINEERS

APPENDIX VII

REPORT ON

PHASE II GEOTECHNICAL INVESTIGATIONS FOR TAILINGS AREA C

CONTINENTAL GOLD CORP.

MT. MILLIGAN PROJECT

REPORT ON
PHASE II GEOTECHNICAL INVESTIGATIONS
FOR TAILINGS AREA C

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1672.021	Geotechnical Sections - Tailings Area C

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Appendix B	Geotechnical Borehole Logs
Appendix C	Field Permeability Test Results for Main Embankment Site
Appendix D	Field Permeability Test Results for South Embankment Site
Appendix E	Overburden Gradations

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

REPORT ON
PHASE II GEOTECHNICAL INVESTIGATIONS
FOR TAILINGS AREA C

SECTION 1.0 - INTRODUCTION

1.1 PREVIOUS FIELD WORK

A preliminary geotechnical evaluation of the Mt. Milligan site was conducted during November and December, 1989. Field work included general surface reconnaissance, test pit excavation at potential waste dumps, millsite and tailings storage areas, preliminary evaluation of overburden and groundwater at the proposed open pit, and permeability testing of exploration drill holes located in the proposed open pit. Results are presented in the report:

- Preliminary Geotechnical Site Evaluation, Knight and Piesold Ltd., January, 1990.

Phase I of the two stage site investigation program was conducted during January and February, 1990. The phase I investigation program targeted the Heidi Lake valley and King Richard Creek, south-east of the proposed open pit. Field work included overburden and bedrock drilling, wireline packer permeability testing and piezometer installations. Results of the Phase I investigation program are presented in the document:

- Report on Phase I Geotechnical Investigations, Knight and Piesold Ltd., March, 1990.

A test pit program was completed by Continental Gold Corp. in April, 1990. The test pit program was conducted at the proposed open pit to investigate overburden types, compositions, physical properties and neutralization capabilities. Results of the site investigation program are presented in the report:

- Mt. Milligan Test Pit Program, Continental Gold Corp., April, 1990.

1.2 SCOPE OF WORK

Phase II of the geotechnical investigation program for tailings area C (See claims) was conducted during June and July, 1990. The investigation program consisted of geotechnical drilling and test pit excavation. The scope of work included:

- Coring of competent overburden and bedrock.
- Wireline packer in-situ permeability testing.
- Standard penetration testing of overburden.
- Installation of 38 mm (1.5 inch) diameter PVC piezometers.
- Test pit excavation and sample collection.
- Laboratory index testwork on soil samples recovered from the drilling and test pit programs.
- Laboratory permeability testing on surficial soil samples.

The drilling program was conducted to assess the surficial geology and geotechnical parameters of the materials near the proposed embankment sites in tailings area C. The test pit program was carried out to assess the surficial material types and conditions, and to confirm near surface drilling interpretations.

This report summarizes the information obtained in the Phase II investigation program and provides an evaluation of the surficial and overburden geology within

tailings area C. Additional geotechnical information for the millsite foundations and for the millsite storage pond site were also collected in the Phase II program. The results of the millsite investigations are included in the Knight and Piesold Ltd. document:

- Report on Phase II Geotechnical Investigations for Millsite Area, dated October, 1990.

SECTION 2.0 - SURFICIAL GEOLOGY

2.1 GENERAL

Tailings Area C is located in the upper 10 km stretch of Limestone Creek and is characterized by gently rolling topography. The valley is broad with moderately steep sloping walls at the Main and South embankment sites, and is narrow with steep sloping walls at the Water Storage dam and East Dam sites. Surficial deposits consist of glacial till and outwash sands and gravels.

Vegetation cover in Tailings Area C typically includes pine trees, poplar trees, willows, swamp grasses and assorted shrubs. In well drained sandy deposits, pine trees are prominent. Alternatively, poor draining till-like deposits support shrubs and scrub foliage.

Recent stream deposits of sand, silt and occasional sand and boulder zones are present at the surface in Limestone Creek. Swamps, ponds and beaver dams are characteristic features along the valley. Foliage in the valley generally consists of swamp grasses and shrubs. Organic-rich silt and clay deposits typically flank stream valleys at lower elevations.

A test pit program was conducted by Knight and Piesold Ltd. and Continental Gold Corp. to investigate surficial deposits at Tailings Area C. Additional information was also obtained from air photos and from road cuts within the project area.

A total of 20 test pits were excavated with a CAT EL200B excavator from July 9 to 12, 1990 as shown on Drawing No. 1672.020. The test pit program was conducted to investigate the type and distribution of surficial materials and the near surface foundation conditions at the Main and South embankment sites. Test pits

were excavated by hand at the Water Storage dam site as no road access was available. Detailed test pit logs are included in Appendix A.

2.2 MAIN EMBANKMENT SITE

A total of 17 test pits were excavated at the Main embankment site to investigate the distribution and extent of surficial materials, foundation conditions and potential borrow materials for the proposed embankment.

Surficial deposits include a medium dense sandy till varying in thickness from 1 to 5 m on both valley slopes. Extensive thick alluvial sand and gravel deposits were also encountered on the valley walls at the embankment site. On the south-west slope, road cuts and test pits (TPC90-13, 14 and 15) expose a thick section of glacial meltwater outwash sands and gravels. The deposit is approximately 5 m thick and is moderately dense.

Downstream of the proposed embankment axis, along the south-west valley slope, road cuts expose a thick deposit of uniform, moderately dense fine sand (approximately 75 m west of drill hole 90-695). The deposit extends parallel to the valley and is approximately 5 to 15 m thick.

A moderately dense sandy till overlies alluvial sands and gravels on the north-east (right) abutment of the proposed embankment. The till is approximately 2 to 5 m thick and extends along the upper plateau regions away from the valley slopes. Test pits (TPC90-1, 2, 3 and 4) at higher elevations and exposures along the valley slopes reveal alluvial sands and gravels under the surficial till.

Recent alluvium consisting primarily of loose sands and soft silts and clays exists at surface along the valley bottom. Some cobbles and boulders are also present.

Limestone Creek is presently a low energy meandering stream which deposits fine sands and silts.

Swamp grass and shrubs cover the valley bottom where the creek has meandered in the past and where extensive beaver dams have modified the stream flows. The grass and shrub growth overlies a thin cover of soft and wet clays, silts and organics as exposed at drill sites 90-705 and 90-707. These deposits are approximately 1 to 2 m thick in the valley bottom and up to 4 to 5 m thick along the base of the valley slopes. The groundwater table is at the ground surface along the valley bottom.

2.3 SOUTH EMBANKMENT SITE

A total of 3 test pits were excavated at the South embankment site. Surficial materials consist of a thin cap of sandy glacial till which extends from the valley bottom to the left (south-east) abutment slope. The till pinches out towards the north-west where alluvial silt and sand deposits are exposed.

South-east of the embankment, at higher elevations, road cuts expose alluvial sands and gravels and sandy till. The sandy till is medium dense, contains little clay or silt, and varies in thickness from approximately 4 m in the valley to 6 m on the south-east slope (TPC 90-19, 20).

A test pit, TPC 90-18 and road cuts (drill site 90-682 access) on the right (north-west) abutment slope expose bedrock at a depth of approximately 3m. A thin cover of very uniform, medium dense alluvial silty sands overlie bedrock. The silty sand is exposed at drill site 90-682 and extends to the south-west along the access road (Drawing No. 1672.020).

2.4 WATER STORAGE DAM SITE

Five, 1 m deep test pits were excavated by hand at the Water Storage dam site. Test pit logs are included in Appendix A. The surficial geology of the site is characterized by terrace or esker-like deposits of silt and sand. The left (south) abutment consists of very uniform soft grey silts (WSD-5). Surficial deposits on the right (north) abutment slope consist of poorly graded moderately dense silts, sands and some pebbles and cobbles at depth. Test pits WSD-2, 3 and 4 revealed weak stratification or layering with an overall fining up sequence from small, well rounded pebbles at the base to medium grained sand, fine sand and uniform silt at the surface. Test pits on the north slope reveal layering with uniform medium dense silts overlying dense sand and pebbles. The stratification, or layering, suggests that the materials were deposited in a fluvial environment, such as an esker or glacial meltwater stream.

Recent channel fill deposits of silt and sand lie in the creek bottom. As shown on Drawing No. 1672.021 these deposits are inferred to be a few metres thick based on extrapolation from test pits at the Main and South embankment sites a few kilometres downstream.

2.5 EAST DAM SITE

The East dam site is situated on the drainage divide at the top of Limestone Creek as shown on Drawing No. 1672.100 in the Draft Pre-feasibility Study completed by Wright Engineers Ltd. and Continental Gold Corp in August, 1990.

Bedrock exposures of sedimentary units were identified on the stream banks of the proposed East dam site during a surface reconnaissance program. Limestone is exposed on the topographic knob immediately to the south and metamorphosed

sandstones and siltstones outcrop near stream level on the north side of the valley. Swampy organic deposits infill the narrow topographic depression at the site and the bedrock slopes are mantled by variable thicknesses of colluvium.

SECTION 3.0 - GEOTECHNICAL DRILLING

3.1 GENERAL

The geotechnical drilling program consisted of eleven holes drilled near the proposed Main and South embankment sites in Tailings Area C. The drilling program commenced June 27, 1990, and was completed July 18, 1990. Both tricone and diamond drilling methods were utilized to drill vertical boreholes to investigate the engineering properties, lithologies and permeabilities of the overburden and bedrock.

Geotechnical drilling at the Main embankment site consisted of 7 boreholes; 6 located along the proposed embankment alignment and 1 located approximately 850 m downstream along Limestone Creek. Geotechnical drilling at the South embankment site consisted of 4 boreholes; 3 adjacent to the proposed embankment alignment and 1 groundwater monitoring well located approximately 300 m to the south-west. The locations of all geotechnical boreholes are shown on Drawing No. 1672.020. Detailed geotechnical borehole logs are included in Appendix B.

In-situ wireline packer permeability tests and Standard Penetration Tests (SPT) were performed progressively down each borehole. An NQ wireline double packer testing system provided in-situ permeability measurement of discrete intervals in competent overburden and bedrock. SPT tests were performed down each borehole to investigate in-situ densities and to provide samples of overburden materials. The SPT procedures were conducted in accordance with ASTM D1586 and included a donut hammer lifted with 1½ wraps of rope around a cathead.

Groundwater levels were measured in open boreholes. Three standpipe piezometers, installed in selected boreholes at the Main and South embankment

sites, will be used to measure groundwater levels and for groundwater quality analyses. The locations of the piezometers are shown on Drawing No. 1672.020.

The results of the geotechnical drilling program for the Main and South embankment sites, and test pit sampling at the Water Storage dam site are discussed in the following sections. The overburden geology was interpreted from the drilling program and is summarized for each site on Drawing No. 1672.021.

3.2 MAIN EMBANKMENT SITE

3.2.1 Lithology

NQ core recovered in overburden was limited to hard clay, dense glacial till and competent bedrock, whereas soft and loose silts and sands generally washed away with the drilling fluid. The lithological interpretation of the overburden materials is therefore largely based on SPT sampling, drilling conditions and drill cuttings sampled from the drill mud.

The overburden geology at the Main embankment site generally consists of a dense sandy glacial till which overlies dense alluvial sands and gravels. The sands and gravels in turn overlie glacial lacustrine sediments to the east (drill holes 90-698, 90-700 and 90-707) and dense boulder clay till to the west (drill hole 90-690). The underlying bedrock profile generally reflects the surface topography. A geologic cross section along the Main embankment is shown on Drawing No. 1672.021.

Bedrock at the Main embankment site consists primarily of a soft, weathered micaceous schist (DH 90-698 and 90-705). Gneiss zones consisting of alternating felsic (white) and mafic (dark green) bands were

also encountered (DH 90-705). Bedrock was generally soft and weak but intact. RQD was generally very high and core recovery was generally 100%.

Approximately 6 m of silty till overlies alluvial sands and gravels on the upper left (south-west) abutment (drill hole 90-685). The sands and gravels overlie a thick section of dense boulder clay till (drill holes 90-685 and 90-690). The till decreases in thickness to the north-east where it intersects a sequence of dense lacustrine silts and clays. The till is approximately 10 m thick in drill holes 90-705, 90-695 and 90-698.

A thick deposit of very dense, impermeable glacial lake sediments occurs at the centre of the valley. The lacustrine deposits are approximately 65 m thick in the valley, as measured in drill hole 90-707, and decrease in thickness to the east and west. The lacustrine sequence consists of varves of thin layers of silt and fine sand interbedded with hard blue-grey clay layers. Varved lacustrine sediments are generally deposited in cold, fresh water environments, typical of glacial lakes. The dense nature of the clay suggests that the lacustrine sediments were compacted and consolidated probably by subsequent glacial loading.

Alluvial sand and gravel deposits overlie the lacustrine sediments on both sides of the valley. Sands and gravels on the west side of the valley are interlayered and cross bedding is apparent in the extensive sand deposits, while the gravels exist as thin layers. The thickness of the sand and gravel deposit varies from 7 m near drill hole 90-690 to 12 m towards the valley at drill hole 90-685.

Surficial deposits of soft silts, sands and clays lie along the valley bottom. The surficial sediments are approximately 3 to 5 m thick as indicated by drill holes 90-705, 90-707 and 90-695. The sand and gravel deposits do not exhibit noticeable layering or bedding on the east bank and are more coarse grained than the alluvial sands and gravels on the west side of the valley.

The overburden geology at the Main embankment site is complex. The interpretation is based on information collected from 7 geotechnical boreholes and 17 test pits. A preliminary summary of the geologic history at the Main embankment site as shown on Drawing No. 1672.021 is as follows:

- Glaciation and deposition of boulder clay till over bedrock.

- Formation of a glacial lake and deposition of varved glacial lacustrine silt and clay sediments.

- Deposition of outwash sands and gravels by glacial meltwater during glacial retreat.

- Deposition of surficial till over sands and gravels and localized scour of sediments during a temporary glacial advance.

- Glacial retreat, down-cutting and erosion of glacial outwash sands and gravels to form Limestone Creek valley.

- Recent deposition of sands, silts and clays by the stream which meanders along the valley bottom.

The alluvial sands and gravels were likely deposited by glacial meltwater as the glacier retreated. The presence of cross bedding and gravel lenses to the west suggest that these deposits possibly originated from an ice margin delta which extended into the glacial lake.

The dense surficial till at higher elevations to the east may have resulted from a later ice advance which also induced ice loading compaction and consolidation of the lower alluvial and lacustrine sediments.

3.2.2 Permeability Testing

In-situ permeability testing was performed in the geotechnical boreholes, using a Longyear NQ wireline double packer testing system. Permeability test data was obtained for discrete intervals in overburden and bedrock.

Permeability testing was coordinated and conducted by Knight and Piesold Ltd. The general testing procedure was as follows:

- Tricone and case overburden to a competent formation.

- Core with NQ drill system approximately 3 m (10 feet) to define the test interval.

- Flush the hole with clean water to remove drill mud and pull back drill string to expose a test interval below the bit.

- Install NQ wireline double packer system down the drill string.

- Inflate packers and pump clean water down the drill string to displace air from the system and check for leaks.

- Conduct a permeability test in the open hole below the packers by increasing the water pressure in three stages and measuring the flow into the formation for each pressure. The water pressure was then decreased for two additional tests to enable verification of test conditions.

A total of 6 holes were tested at the Main embankment site. The locations of all packer test intervals are shown on Drawing No. 1672.021. Detailed results of the permeability tests are included in Appendix C and are summarized on Table 3.1.

Drill hole 90-705 could not be tested because artesian water pressures were encountered at depth. Artesian conditions result when an inclined permeable zone is confined by a low permeability formation. The permeable zone intersected in drill hole 90-705, has a hydraulic connection to groundwater at a higher elevation and is confined by a thick layer of low permeability lacustrine sediments.

Packer tests were usually performed in lacustrine silts, glacial till and bedrock. Tests were unsuccessful in loose, coarse grained overburden materials, as it was often not possible to get a proper packer seal at the top of the test interval.

In-situ packer testing indicates that the bedrock is relatively impermeable with permeabilities ranging from 1×10^{-7} cm/s in fractured zones, (drill hole 90-698) to 3×10^{-8} cm/s in competent zones (drill hole 90-690). The dense

boulder clay till overlying bedrock was also relatively impermeable as measured in drill hole 90-690 where a permeability of 4 x 10^{-7} cm/s was measured. Apparent sand and boulder zones in the till resulted in locally higher permeability values of $< 1 \times 10^{-4}$ cm/s and 2 x 10^{-6} cm/s as measured in drill hole 90-685.

Permeability testing was attempted in the alluvial sands and gravels but often the materials were too soft and loose to enable a good packer seal. However, the dense silty sands and gravels on the south-west side of the valley were successfully tested. The permeabilities of these dense sands and gravels ranged from 5 x 10^{-4} cm/s to 6 x 10^{-4} cm/s in drill hole 90-685. These values are considered to be representative of the alluvial deposits in the area. However, because the surficial sands and gravels north-east of the valley are somewhat less dense than those to the south-west, the permeability of the alluvium to the north-east may be slightly greater than measured in drill hole 90-685.

3.2.3 SPT Results

Standard penetration tests were performed progressively down boreholes 90-685, 90-698, 90-700 and 90-705 at the Main embankment site. The surficial till, alluvial sands and gravels, and lacustrine silts and clays were tested. The results presented in Table 3.2 include corrections for overburden pressure and energy calibration.

A dense clay till was encountered near the surface at the left (south-west) abutment (DH 90-685). Dense alluvial sands underlying the surficial till produced normalized blow counts, $(N_1)_{60}$, which increased with depth from 26 blows/ft at 10.1 m to 89 at 14.6 m (DH 90-685). The lacustrine silts

and clays encountered in the centre of the valley were also dense with $(N_1)_{60}$ blow counts ranging from 24 blows/ft (DH 90-695 and 90-705) to 38 blows/ft (DH 90-700). Alluvial sands on the right (north-east) abutment were very dense with $(N_1)_{60}$ blow counts ranging from 27 to 58 blows/ft in DH 90-698 and 47 to 93 blows/ft in DH 90-700. No SPT tests were attempted in the basal till.

3.2.4 Piezometer Completions

A standpipe piezometer was installed in drill hole 90-695 next to Limestone Creek approximately 850 m downstream of the Main embankment site, as shown on Drawing No. 1672.020. This piezometer will be used for routine measurement of groundwater levels and for periodic sampling for groundwater quality analyses. The piezometer is a perforated 38 mm (1.5 inch) diameter PVC pipe, and was completed to a depth of 72 m (237 feet). A bentonite seal was installed at the surface to prevent surface water from entering the piezometer. In addition, the upper 4 m (13 feet) of the piezometer was not perforated to prevent surface water in the swamp from entering the piezometer. Completion details are included in Figure 1.

3.3 SOUTH EMBANKMENT SITE

3.3.1 Lithology

Lithologic interpretation of the overburden materials at the South embankment site is based on 4 geotechnical boreholes, 3 test pits and extensive road cuts. Core recovery from the drill holes was limited to competent glacial till and bedrock. The geologic interpretation of granular

materials is based largely on drilling conditions and drill cuttings sampled from the drill mud.

Since all drill holes intersected bedrock, the total overburden thickness was delineated across the valley. The total overburden thickness varies from 3 m at drill hole 90-682 to approximately 33 m at drill hole 90-676 and 15 m at drill hole 90-681. The overburden geology at the South embankment site generally consists of three units; basal till, glaciofluvial sands and gravels, and surficial till as shown on Drawing No. 1672.021.

Bedrock at the South embankment site is a competent dark green gabbro. In general RQD values were high and core recovery was excellent (DH 90-676). Bedrock was weathered and badly broken near the contact in drill holes 90-681 and 90-682. Bedrock quality generally increased with depth.

Drilling conditions and drill mud sampling revealed a dense basal sand and gravel till with occasional boulder zones above the bedrock contact. The basal till varies in thickness from 9 m at drill hole 90-681 to 7 m at drill hole 90-676.

Glaciofluvial sands and gravels overlie the basal till. These glacial outwash deposits are approximately 20 to 25 m thick in the valley and thin laterally to approximately 3 m at drill holes 90-682 and 90-681.

A thin cover of glacial till overlies the sands and gravels to the south-east. The surficial till generally consists of coarse grained medium dense to dense sands and gravels with some silt and a trace of clay. The unit is approximately 6 m thick at drill hole 90-681 and pinches out laterally to fluvial sands and gravels and bedrock to the north-west.

The geologic section for the South embankment is shown on Drawing No. 1672.021. A preliminary summary of the geologic history at the South embankment site is as follows:

- Glaciation and deposition of basal till over bedrock.

- Glacial melting and deposition of glaciofluvial sand and gravel outwash deposits in the valley channel.

- Deposition of ablation till over fluvial sands and gravels.

The thickness and coarse grained nature of the surficial till suggest that it was deposited as an ablation-type till as the ice melted and the glacier retreated.

3.3.2 Permeability Testing

Wireline packer permeability testing was performed in all 4 boreholes at the South embankment site. Detailed results of the permeability tests are included in Appendix D and are summarized on Table 3.3 and Drawing No. 1672.021.

Groundwater flow at the South embankment site is controlled by the more permeable materials. In-situ test results indicate that the bedrock and basal till units are essentially impermeable, apart from occasional boulder zones in the till and slightly fractured zones in the bedrock. Therefore, groundwater flow is largely controlled by the extensive and thick glaciofluvial sand and gravel deposits in the valley.

Permeabilities in bedrock range from 3 x 10^{-5} cm/s in fractured bedrock (drill hole 90-682) to $<2 \times 10^{-8}$ cm/s in competent bedrock (drill holes 90-676 and 90-711). Bedrock permeability is strongly controlled by fractures and shear zones which act as conduits for groundwater flow. The bedrock is typically weathered and fractured near contacts with glacial till, resulting in higher permeabilities. In general, the bedrock became more competent with depth and has corresponding lower permeabilities.

The sandy basal till is very dense and impermeable. A packer test in drill hole 90-681 resulted in a permeability value of $< 6 \times 10^{-8}$ cm/s. Similar drilling conditions in drill hole 90-676 suggest that a permeability value of 10^{-8} cm/s is representative of the basal till.

Permeabilities measured in the glaciofluvial sands and gravels were highly variable, ranging from 5 x 10^{-3} cm/s to 3 x 10^{-8} cm/s in drill hole 90-676. The variability likely results from layering or stratification found in the fluvial sand and gravel deposits.

3.3.3 SPT Results

Standard penetration tests were performed progressively down boreholes 90-676, 90-681 and 90-711 at the South embankment site. The surficial till and the underlying alluvial sands and gravels were tested. The results are included in Table 3.4.

The surficial till was very dense with normalized blow counts, $(N_1)_{60}$, ranging from 44 to 76 blows/ft in drill holes 90-676 and 90-681. The alluvial sands were moderately dense with $(N_1)_{60}$ blow counts of 26 blows/ft in drill holes 90-681 and 90-711. Silts and sands encountered in the upper

34 ft in drill hole 90-711 were loose with $(N_1)_{60}$ blow counts ranging from 3 to 11 blows/ft.

3.3.4 Piezometer Completions

Two standpipe piezometers were installed at the South embankment site, as shown on Drawing No. 1672.020. The piezometers consist of perforated PVC pipe completed to depths of 28 m (93 feet) and 43 m (141 feet) in drill holes 90-676 and 90-711 respectively. Bentonite seals were installed at the surface to prevent the entry of surface water into the piezometers. Completion details are included in Figure 1.

Approximately one week following installation, the water level in drill hole 90-711 was 5.2 m (17 feet). The water level in piezometer 90-676 three weeks following installation measured 7 m (23 feet). After accounting for differences in piezometer collar elevation, the water levels measured in both piezometers suggest that the groundwater table is approximately level in the area. The piezometers will be used to measure water levels, and for groundwater sampling and water quality analyses.

SECTION 4.0 - LABORATORY TESTWORK

4.1 GENERAL

Representative soil samples of the three main overburden materials encountered during the field program were selected for laboratory testwork. Eleven samples of glacial till, alluvial sands and gravels, and lacustrine silts and clays were obtained from drill holes, test pits and road cuts at the Main and South embankment sites in Tailings Area C. Each sample was analyzed in the laboratory to determine basic index properties. Results are summarized in Sections 4.2 and 4.3.

4.2 INDEX TESTWORK

Laboratory index testwork included natural water content, Atterberg limits, specific gravity and grain size distributions for eleven samples as summarized in Table 4.1. Grain size distributions are included in Appendix E.

Selected samples from drill holes, test pits and road cuts at the Main embankment site include basal till (drill hole 90-705), lacustrine silts and clays (drill holes 90-695 and 90-707), alluvial silts, sands and gravels (TPC 90-2, RC-9 and drill hole 90-685), and silty surficial till (TPC 90-15).

The glacial till samples at depth are generally very well graded. The surficial till is moderately graded and typically contains a higher sand fraction.

The lacustrine silts and clays are well sorted and poorly graded. Atterberg limits indicate that the silts and clays have low to medium plasticity. Pocket penetrometer and Torvane shear tests were performed on three samples (90-695(2) and 90-707) as summarized in Table 4.2. Pocket penetrometer measurements vary from 2.75

TSF (263 kPa) to 4.2 TSF (402 kPa), while Torvane measurements vary from 0.45 TSF (43 kPa) to 2.30 TSF (220 kPa). These values indicate that the lacustrine silts and clays can be classified as firm to hard.

In general, the alluvial sands and gravels are moderately graded and moderately sorted. Samples RC-9, drill hole 90-685 and TPC 90-18 are comprised of very uniform sands and silts.

4.3 PERMEABILITY TESTWORK

Laboratory permeability testing was performed on selected overburden samples from road cuts and test pits at the Main and South embankment sites and from shallow test pits excavated at the Water Storage dam site.

Permeabilities were obtained from laboratory Air Entry Permeameter (AEP) tests on field samples compacted at the natural moisture content to approximately 95 percent of the Modified Proctor density. The laboratory permeability test results are summarized in Table 4.3.

In general, the permeabilities of the alluvial silts and sands are low, ranging from 2×10^{-8} cm/s for the silts at the Water Storage dam site (WSD-1), to 4×10^{-5} cm/s for the silty sands at the Main embankment site (RC-9 at drill site 90-695)

Permeabilities of the surficial till are also low, ranging from 9×10^{-10} cm/s for the silty clay till at the South embankment site (RC-5 at drill site 90-681) to 4×10^{-8} cm/s for the sandy till at the Main embankment site (RC-8 at drill site 90-690).

Test results indicate that the alluvial silts and sands at the Water Storage dam site have very low permeabilities, ranging from 6×10^{-7} cm/s in the moderately dense

silty sands (WSD-2) to 2 x 10^{-8} cm/s in the silts (WSD-1). Sample WSD-1 was tested at different densities to best determine the relationship between density and permeability. Permeabilities ranged from 2 x 10^{-8} cm/s for 100 percent compaction to 8 x 10^{-8} cm/s for hand compaction. Since the density of the samples compacted by hand approximates the observed in-situ density of the silt, a permeability value of 8 x 10^{-8} cm/s is considered representative of the silts at the Water Storage dam site.

TABLE 3.1

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

SUMMARY OF WIRELINE PACKER PERMEABILITY TEST RESULTS FOR MAIN EMBANKMENT SITE

Hole No.	Depth Interval (m)	Depth Interval (ft)	Comments	Measured Permeability (cm/s)
90-685	5.8-8.2	(19-27)	Pebbles, Clay and Silt	5×10^{-4}
	13.4-15.9	(44-52)	Coarse Sand and Silt	6×10^{-4}
	19.5-22.0	(64-72)	Clay, Silt and Sand	6×10^{-8}
	22.6-25.0	(74-82)	Clay, Silt and Sand	$< 9 \times 10^{-4}$
	36.3-38.7	(119-127)	Pebbles, Clay and Sand Till	$< 1 \times 10^{-4}$
	51.5-54.0	(169-177)	Clay, Pebbles and Sand Till	2×10^{-6}
	60.4-62.8	(198-206)	Clay, Pebbles and Silt Till	$< 1 \times 10^{-4}$
90-690	12.8-17.4	(42-57)	Clay Pebble Till	$< 4 \times 10^{-5}$
	40.9-43.3	(134-142)	Sandy Clay Till	4×10^{-7}
	56.1-58.3	(184-191)	Slightly fractured Bedrock	9×10^{-7}
	65.3-67.7	(214-222)	Competent Bedrock	3×10^{-8}
90-695	13.4-15.9	(44-52)	Blue-grey Clay	$< 2 \times 10^{-8}$
90-698	43.9-46.4	(144-152)	Competent Bedrock	2×10^{-8}
	50.0-52.5	(164-172)	Fractured Bedrock	1×10^{-7}
90-700	22.6-25.0	(74-82)	Blue-grey Clay	8×10^{-7}
90-707	22.6-25.0	(74-82)	Blue-grey Clay	$< 5 \times 10^{-8}$

TABLE 3.2

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

SUMMARY OF STANDARD PENETRATION TEST RESULTS FOR MAIN EMBANKMENT

Hole No.	Depth Interval (m)	(ft)	N (blows/ft)	N_1 (blows/ft)	$(N_1)_{60}$ (blows/ft)	Comments
90-685	1.5-2.1	(5-7)	101	152	114	Very dense clay till
	3.1-3.7	(10-12)	104	114	86	Very dense clay till
	9.8-10.4	(32-34)	40	30	26	Medium dense sand
	11.3-11.9	(37-39)	76	53	40	Dense sand
	14.3-14.9	(47-49)	199	119	89	Very dense sand
	22.0-22.4	(72-73.5)	92	37	28	Hard clay-refusal
90-695	15.9-16.5	(52-54)	34	24	18	Very stiff clay
	28.7-29.3	(94-96)	52	31	23	Dense sand and silt
	31.7-32.3	(104-206)	80	44	33	Dense sand and silt
	43.6-44.2	(143-145)	72	32	24	Hard and dense clay and silt
90-698	1.5-2.1	(5-7)	24	36	27	Medium dense to dense sand
	3.7-4.3	(12-14)	64	77	58	Very dense sand
	6.7-7.3	(22-24)	70	63	47	Very dense sand and silt
	13.4-14.0	(44-46)	66	43	32	Dense silt and clay

TABLE 3.2 (Cont'd)

Hole No.	Depth Interval (m)	Depth Interval (ft)	N (blows/ft)	N_1 (blows/ft)	$(N_1)_{60}$ (blows/ft)	Comments
90-700	1.5-2.1	(5-7)	62	99	74	Very dense silty sand
	3.7-4.3	(12-14)	113	124	93	Very dense silty sand
	5.8-6.3	(19-20.5)	124	105	79	Very dense silty sand
	11.0-11.6	(36-38)	96	62	47	Very dense sandy silt
	17.1-17.7	(56-58)	85	51	38	Hard grey clay and silt
90-705	4.9-5.5	(16-18)	17	20	15	Very stiff clayey silt
	8.5-9.2	(28-30)	34	32	24	Hard grey clay
	14.0-14.6	(46-48)	84	63	47	Very dense, nothing recovered

Notes:

1. N value is field measurement with standard equipment and donut hammer with rope and cathead.
2. N_1 value includes correction for effective overburden pressure.
3. $(N_1)_{60}$ value includes energy correction for donut hammer.
4. For description of energy corrections see Seed, H.B., Tokimatsu, K., Harder, L.F., Chung, R.N., "The Influence of SPT Procedures in Soil Liquefaction Resistance Evaluations", 1984, Report No. UCB/EERC-84/15.

TABLE 3.3

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

SUMMARY OF WIRELINE PACKER PERMEABILITY TEST RESULTS FOR SOUTH EMBANKMENT SITE

Hole No.	Depth Interval (m)	Depth Interval (ft)	Comments	Measured Permeability (cm/s)
90-676	11.9-12.8	(39-42)	Competent Till	$<7 \times 10^{-8}$
	14.9-15.9	(49-52)	Sand and Gravel	5×10^{-6}
	21.0-22.0	(69-72)	Gravel and Sand	4×10^{-3}
	41.2-43.3	(135-142)	Competent Bedrock	3×10^{-7}
	50.3-52.5	(165-172)	Competent Bedrock	$<2 \times 10^{-8}$
90-681	10.4-12.8	(34-42)	Sand and Silt, trace Clay	$<6 \times 10^{-8}$
	19.5-22.0	(64-72)	Competent Bedrock	$<6 \times 10^{-8}$
	38.1-40.3	(125-132)	Slightly fractured Bedrock	1×10^{-6}
90-682	4.3-6.7	(14-22)	Competent Bedrock	$<9 \times 10^{-8}$
	10.4-12.8	(34-42)	Fractured Bedrock	2×10^{-5}
	15.9-18.3	(52-60)	Fractured Bedrock	3×10^{-5}
	22.3-24.7	(73-81)	Slightly fractured Bedrock	1×10^{-6}
	28.1-30.5	(92-100)	Slightly fractured Bedrock	6×10^{-6}
90-711	40.6-43.0	(133-141)	Competent Bedrock	$<2 \times 10^{-8}$

TABLE 3.4

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

SUMMARY OF STANDARD PENETRATION TEST RESULTS FOR SOUTH EMBANKMENT SITE

Hole No.	Depth Interval (m)	(ft)	N (blows/ft)	N_1 (blows/ft)	$(N_1)_{60}$ (blows/ft)	Comments
90-676	1.8-2.4	(6-8)	50	75	56	Dense sand and gravel
	4.3-4.9	(14-16)	54	59	44	Dense sandy till
90-681	0.0-0.6	(0-2)	17	27	20	Medium dense pebbles and sand
	1.4-2.0	(4.5-6.5)	64	102	76	Dense sandy till
	4.0-4.6	(13-15)	66	86	65	Very dense sandy till
	6.1-6.7	(20-22)	31	34	26	Medium dense silty sand
90-711	2.1-2.7	(7-9)	10	14	11	Stiff clay and some silt
	4.3-4.9	(14-16)	4	4	3	Firm clay and loose sand
	6.7-7.3	(22-24)	12	11	8	Medium dense sand, some silt
	9.8-10.4	(32-34)	7	6	5	Firm clay, loose silt and sand
	14.6-15.3	(48-50)	48	34	26	Dense sand, some gravel

Note: 1. N value is field measurement with standard equipment and donut hammer with rope and cathead.
2. N_1 value is the field value (N) corrected for effective overburden pressure.
3. $(N_1)_{60}$ value includes energy correction for donut hammer.
4. For description of energy corrections see Seed, H.B., Tokimatsu, K., Harder, L.F., Chung, R.N., "The Influence of SPT Procedures in Soil Liquefaction Resistance Evaluations", 1984, Report No. UCB/EERC-84/15.

TABLE 4.1

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

SUMMARY OF LABORATORY TEST RESULTS

Drillhole/ Test Pit No.	Sample No.	Depth (m)	Depth (ft)	Natural Moisture Content (%)	Atterberg Limits L.L. (%)	Atterberg Limits P.L. (%)	Atterberg Limits P.I. (%)	Specific Gravity	Grain Size Distribution % Finer 4.76 mm	Grain Size Distribution % Finer 0.074 mm (4 sieve)	Description (200 sieve)
Main Embankment Site											
TPC 90-2	GS-B	2.7-3.0	(9-10)	9.4	19.9	11.5	8.4	2.72	77	29	Sandy till
TPC 90-15	GS-A	4.6-4.9	(15-16)	6.5	16.2	11.8	4.4	2.71	70	37	Silty sand till
RC-9	at DH 90-695	1.0	(3)	10.9	non plastic			2.73	100	6	Sand, uniform
DH 90-685	8	14.3-14.9	(47-49)	18.1	16.7	16.4	0.3	-	100	64	Silty sand till
DH 90-695	2	11.3-11.9	(37-39)	21.2	32.4	18.9	13.5	2.74	100	100	Clayey silt
DH 90-695	3	15.9-16.5	(52-54)	30.5	49.8	20.7	29.1	-	100	99	Clayey silt
DH 90-705	3	44.5	(146)	9.4	23.0	13.2	9.8	2.74	59	29	Clay till
DH 90-707	5	12.8-13.4	(42-44)	17.1	16.6	14.9	1.7	-	100	86	Clayey silt
DH 90-707	CS	22.6-22.9	(74-75)	28.9	34.9	21.4	13.5	-	100	99	Clayey silt
South Embankment Site											
TPC 90-18	GS-B	2.1-2.4	(7-8)	14.5	non plastic			-	94	32	Sand, some silt
TPC 90-20	GS-A	1.8-2.1	(6-7)	8.6	15.8	13.0	2.8	2.73	41	14	Silty sand till

TABLE 4.2

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

SUMMARY OF POCKET PENETROMETER AND TORVANE TEST RESULTS

Drillhole No.	Sample No.	Depth (m)	Depth (ft)	Pocket Penetrometer (TSF)	Pocket Penetrometer (kPa)	Torvane (TSF)	Torvane (kPa)	Consistency
DH 90-695	2	11.3-11.9	(37-39)			1.75	168	Very stiff
						2.13	204	Very stiff
						2.30	220	Very stiff
						2.0	192	Very stiff
DH 90-695	3	15.9-16.5	(52-54)	3.5	335	0.93	89	Firm to stiff
				3.7	354	1.0	96	Stiff
				3.5	335	0.80	77	Firm to stiff
				4.2	402	0.88	84	Firm to stiff
DH 90-707	5	12.8-13.4	(42-44)	2.75	263	0.45	43	Soft to firm
				3.3	316	0.50	48	Soft to firm

Note:

1. All samples consist of lacustrine silts and clays.
2. Vane shear tests were also attempted on sample DH 90-695, but unable to insert shear vane into sample.

TABLE 4.3

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT

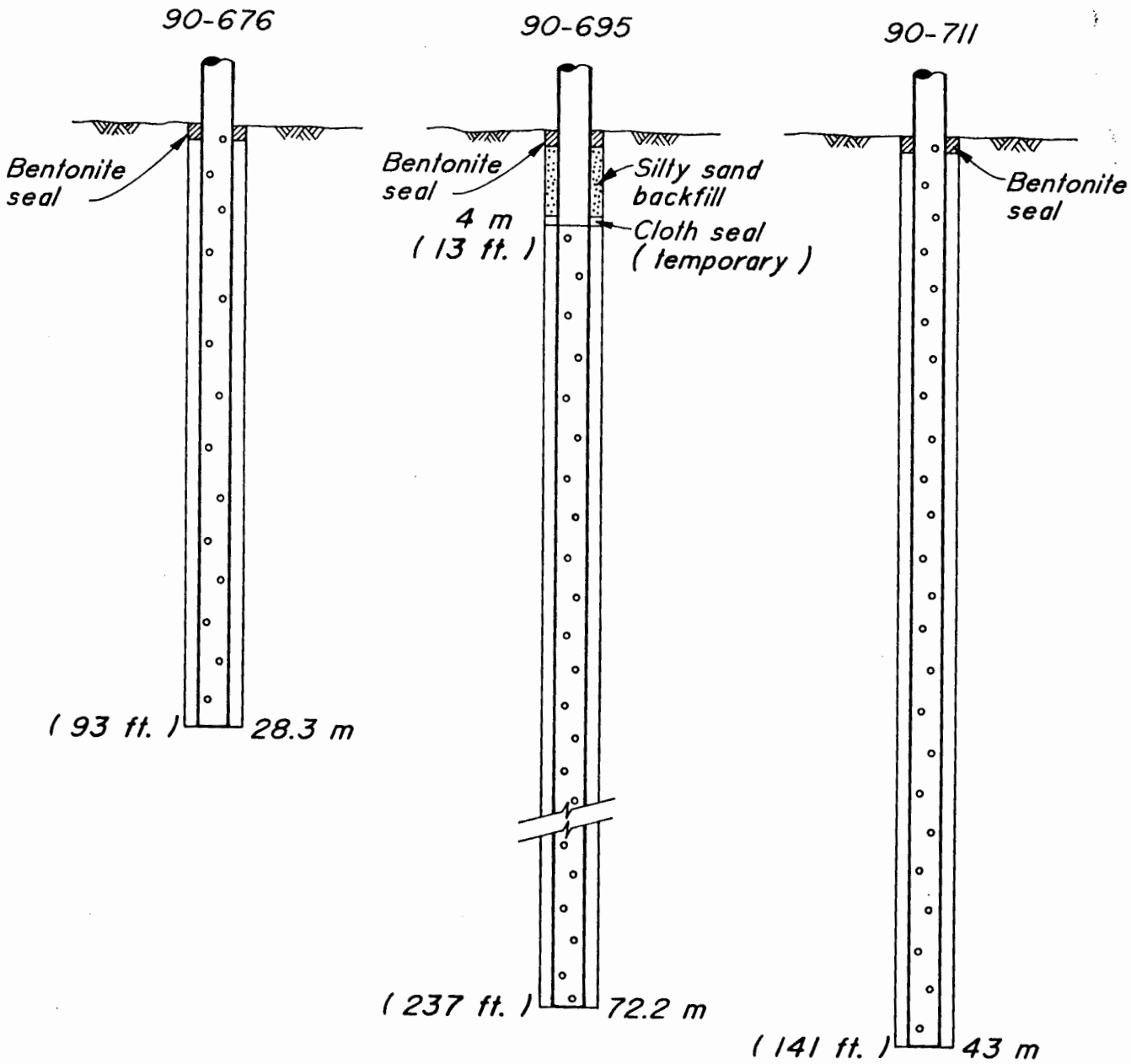
SUMMARY OF LABORATORY PERMEABILITY TEST RESULTS

Test Pit No.	Sample No.	Sample Location	Permeability (cm/s)	Soil Type
Main Embankment Site				
RC	8	Drill site 90-690	4×10^{-8}	Sandy till
TPC 90-15	GS-A	Drill site 90-690	3×10^{-8}	Silty sand till
RC	9	Drill site 90-695	4×10^{-5}	Sand, uniform
TPC 90-2	GA-B	200 m S of 90-698	2×10^{-8}	Sandy till
South Embankment Site				
RC	5	Drill site 90-681	9×10^{-10}	Silty clay till
TPC 90-20	GS-A	10 m E of 90-681	9×10^{-9}	Silty sand till
RC	7	Drill site 90-682	6×10^{-5}	Sandy silt
TPC 90-18	GS-B	10 m S of 90-682	6×10^{-7}	Sand, some silt
Water Storage Dam Site				
WSD	1	Water Storage Dam	2×10^{-8}	Silt, trace clay
WSD	2	Water Storage Dam	6×10^{-7}	Sand and gravel, trace silt

Note:

1. Permeabilities are from laboratory Air Entry Permeameter tests on samples compacted to 95 percent of Modified Proctor density.
2. All samples were collected at or near ground surface.

CONTINENTAL GOLD CORP.
MT. MILLIGAN PROJECT
TAILINGS STORAGE FACILITY
TAILINGS AREA C - PIEZOMETERS



NOTES

1. Piezometers are 3.81 cm (1½") diameter PVC pipe perforated with 0.64 cm (¼") diameter holes every 30 cm over entire length, except where otherwise noted.
2. NQ drill holes are typically 10.8 cm (4¼") diameter near the surface.
3. Bentonite seals at the surface prevent infiltration of surface water.

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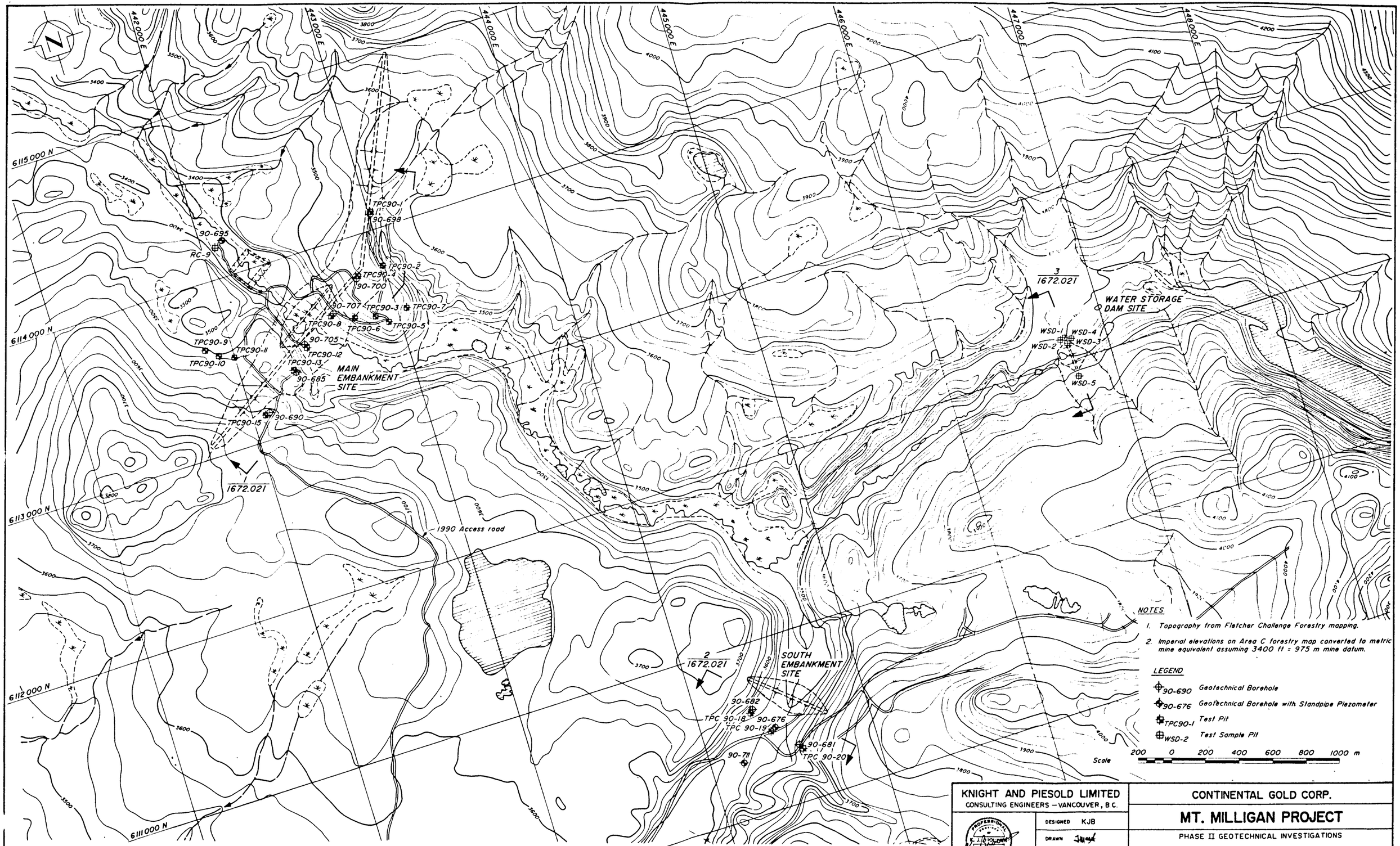
FIGURE 1



1672.021	GEOTECHNICAL SECTIONS - TAILINGS AREA C
DRG NO	DESCRIPTION

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	APPROVED

REVISIONS

KNIGHT AND PIESOLD LIMITED
CONSULTING ENGINEERS – VANCOUVER, B.C.

PROFESSIONAL ENGINEER

DESIGNED KJB
DRAWN
CHECKED KJB
APPROVED

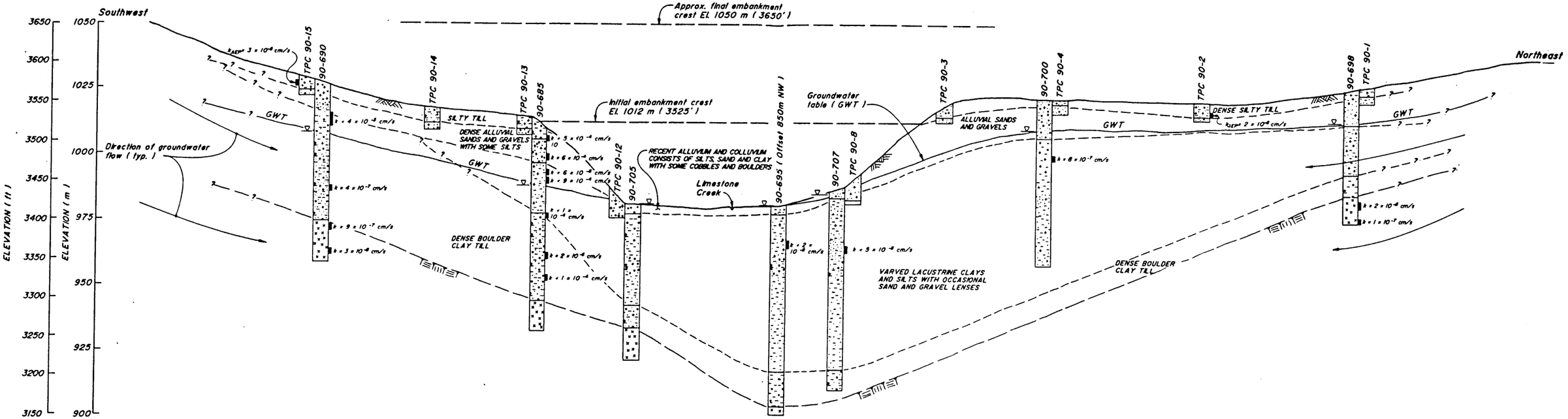
CONTINENTAL GOLD CORP.

MT. MILLIGAN PROJECT

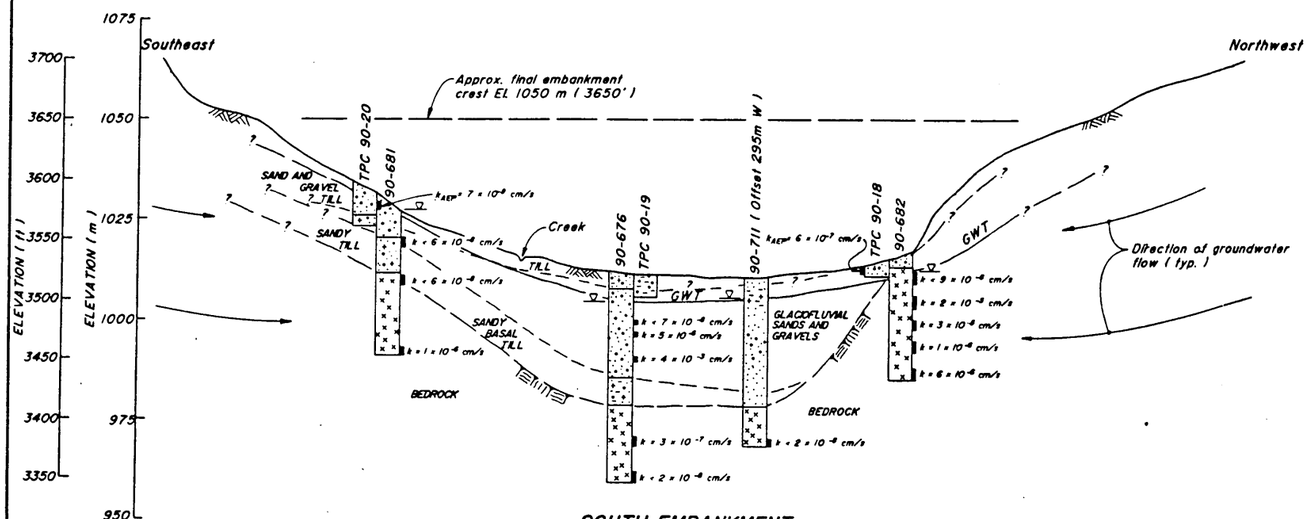
PHASE II GEOTECHNICAL INVESTIGATIONS

GEOTECHNICAL LOCATION PLAN
TAILINGS AREA C

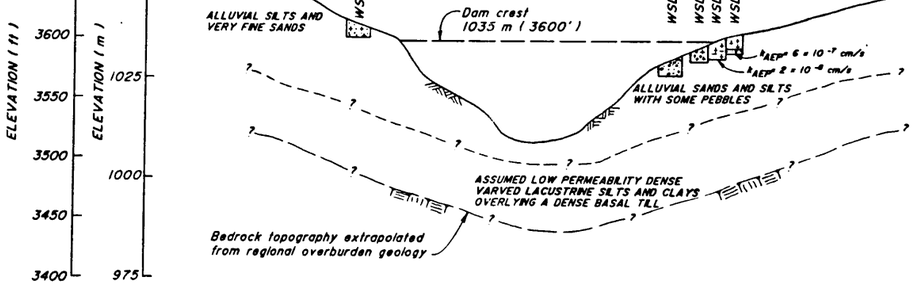
DATE OCT. 15, 1990 | SCALE AS SHOWN | DRG. NO. 1672.020 | REV



MAIN EMBANKMENT
SECTION 1672.020
Scale A



SOUTH EMBANKMENT
SECTION 2 1672.020
Scale B



WATER STORAGE DAM
SECTION 3 1672.020
Scale B

NOTES:

1. k = Permeability from wireline packer test.
2. k_{AEP} = Permeability from Lab Air Entry Permeameter test.
3. Imperial elevations on Area C forestry map converted to metric mine equivalent assuming 3400 ft = 975 m mine datum.

VERTICAL SCALE: 10 5 0 20 40 60 80 100 m

HORIZONTAL SCALES:
B 100 50 0 100 m
A 100 50 0 100 200 m

1672.020	GEOTECHNICAL LOCATION PLAN - TAILINGS AREA C
DRG NO	DESCRIPTION

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS

KNIGHT AND PIESOLD LIMITED
CONSULTING ENGINEERS – VANCOUVER, B.C.

DESIGNED MDG/KGB
DRAWN JMcK
CHECKED KJB
APPROVED HMann

CONTINENTAL GOLD CORP.

MT. MILLIGAN PROJECT

PHASE II GEOTECHNICAL INVESTIGATIONS

GEOTECHNICAL SECTIONS
TAILINGS AREA C

DATE OCT. 15, 1990 | SCALE AS SHOWN | DRG. NO. 1672.021 | REV.

APPENDIX A

TEST PIT LOGS

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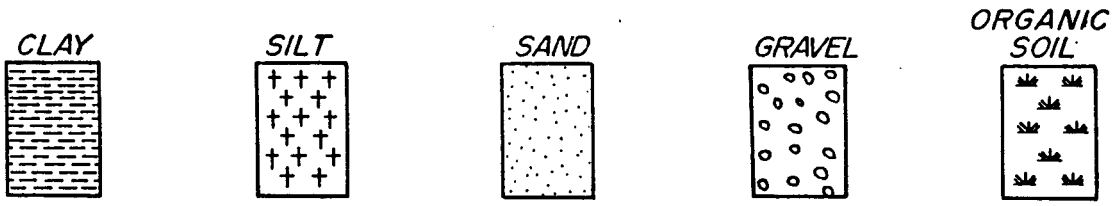
SYMBOLS AND TERMS USED IN THE REPORTS



The symbols may be combined to denote various soil combinations, the predominant soil being heavier.

RELATIVE PROPORTIONS

TERM	RANGE
Trace	0 - 10%
Some	10 - 20%
"y" or "ey"	20 - 35%
and	35 - 50%

ie. CLAY - silty, trace sand

means : Clay soil with 20% to 35% silt and 0% to 10% sand

CLASSIFICATION BY PARTICLE SIZE

Boulder		Over 8"
Cobble		3" - 8"
Gravel	-	
	Coarse	3/4" - 3"
	Fine	#4 - 3/4"
Sand	-	
	Coarse	#4 - #10
	Medium	#10 - #40
	Fine	#40 - #200
Silt		#200 - #0.002 mm
Clay		Finer than 0.002 mm

NOTE

Sieve sizes shown are U.S. standard

DENSITY OF SANDS AND GRAVELS

DESCRIPTIVE TERM	RELATIVE DENSITY	STANDARD PENETRATION TEST
Very loose	0 - 15%	0 - 4 Blows per foot
Loose	15 - 35%	4 - 10 Blows per foot
Medium dense	35 - 65%	10 - 30 Blows per foot
Dense	65 - 85%	30 - 50 Blows per foot
Very dense	85 - 100%	Over 50 Blows per foot

CONSISTENCY OF CLAYS AND SILTS

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH - TONS/SQ.FT.	N VALUE STANDARD PENETRATION TEST	REMARKS
Very soft	Less than 0.25	Less than 2	Can penetrate with fist
Soft	0.25 - 0.50	2 - 4	Can indent with fist
Firm	0.50 - 1.0	4 - 8	Can penetrate with thumb
Stiff	1.0 - 2.0	8 - 15	Can indent with thumb
Very stiff	2.0 - 4.0	15 - 30	Can indent with thumb - nail
Hard	4.0 and greater	Greater than 30	Cannot indent with thumb - nail

NOTES

1. Relative density determined by standard laboratory tests
2. N Value - blows/ft. of a 140 lb. hammer falling 30 in. on a 2 in. O.D. split spoon

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TEST PIT LOG

TEST PIT No. TPC 90-1
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT N of Hole #6
GROUND ELEVATION
DATE July 9/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Topsoil and forest litter - brown organic material
	1–9		Silt with trace clay and some sand. Also contains gravel and cobbles, with occasional boulder to 10" or 12". Dense and moist, medium brown. Moderately graded, poorly sorted (TILL?)
GS B			
	9–10		Sand with gravel and cobbles. Moderately well graded and poorly sorted, loose to medium dense.
	10–19		Sand, fine to medium. Poorly graded, moderately well sorted with occasional alternating layers of coarse / fine material. Medium dense and clean, little to no silt, brown
GS A			

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TEST PIT LOG

TEST PIT No. TPC 90-2
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Old pad #6
GROUND ELEVATION
DATE July 9/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL 200B Excavator	0		Topsoil and forest litter - brown organic material
	1–17		Silt and sand with trace clay. Also contains some gravel and cobbles, occasional boulder to 10". Dense and moist, moderately well graded and poorly sorted, brown. (Till ?) Top 2' is same composition, but is less dense (medium dense)
GS B	10		
	18–19		Sand and gravel with some cobbles, trace silt. Poorly sorted, moderately well graded. Medium dense, slightly moist, brown.
GS A			

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TEST PIT LOG

TEST PIT No. TPC 90-3
SHEET of

PROJECT Mt. Milligan - Area C Tailings
LOCATION OF TEST PIT Old pad #5
DATE July 9/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Topsoil and forest litter - brown organic material
	1–13		Silt and sand with trace clay. Also contains some gravel and cobbles. Medium dense to dense, moderately well graded and poorly sorted, brown (Sandy till?)
GSA	7		
	14–15		Sand and gravel with cobbles. Moderately graded, poorly sorted. Quite loose.
	16–19		Sand, with trace gravel. Poorly graded. Loose, brown, fine - medium grained. Little to no silt. Trace cobbles.
GSB	18		

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TEST PIT LOG

TEST PIT No. TPC 90-4
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT behind Hole #5
GROUND ELEVATION
DATE July 9/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
			Topsoil and forest litter - dark brown organic material
Cat EL 200B Excavator	1		Silt and sand with some gravel and cobbles. Moderately well graded, poorly sorted. Medium dense to dense. (Sandy till?) Trace clay.
	2		
GS D	3		
	4		
	5		
	6		
GS C	7		Sand, with some gravel, fine to medium grained. Poorly graded, moderately well sorted. Medium to dense to loose, brown.
	8		
	9		
	10		Sand and gravel with some cobbles. Sand is medium to coarse. Moderately graded, poorly sorted, medium dense, brown.
	11		
GS B	12		
	13		
	14		
	15		
	16		
	17		Sand with some gravel. Moderate to poorly graded medium loose to loose. Brown, no silt. Sand is medium grained.
	18		
	19		
GS A			Sand - fine grained, poorly sorted, loose, brown.

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TEST PIT LOG

TEST PIT No. TPC 90-5
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Bend in road
GROUND ELEVATION
DATE July 9/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Topsoil and forest litter - brown organic material
	1		Silty sand with some gravel. Poorly graded, poorly sorted loose, brown, slightly oxidized
	2		
	3		Sand and gravel. Poorly graded, poorly sorted. Medium dense to loose, moist brown.
GS A	4		
* Note: Moisture seeping along contact	5		
	6		Silt and sand with trace clay. Also contains some gravel and cobbles, occasional boulder to 15". Very dense, moderately graded and poorly sorted. Medium - dark grey - brown (till?)
GS B	7		
* Note: Excavator had difficulty ripping this material	8		Till is extremely dense and hard, cemented
	9		
	10		
	11		
	12		
	13		
	14		
	15		
	16		
	17		
	18		
	19		

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TEST PIT LOG

TEST PIT No. TPC 90-6
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Y in road
GROUND ELEVATION
DATE July 9/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - dark brown organic material
	1–9		Silt, with some clay. Firm, light brown. Moist
GSA			
	9–19		Clay and silt. Sections are very stiff and layered. Some sections are firm to stiff and are very moist. Color is blue grey.
GSB			
* Note: Clay layer appears to follow slope of valley			

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TEST PIT LOG

TEST PIT No. TPC 90-7
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Borrow pit E of curve
GROUND ELEVATION
DATE July 10/90
LOGGED BY

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Topsoil and forest litter - brown organic material
	1–6		Silty sand with trace clay, some gravel and cobbles. Moderately well graded, poorly sorted. Brown, medium dense (Till)
	7–13		Silty sand with trace clay, some gravel and cobbles. Moderately well graded, poorly sorted. Brown, dense to medium dense (Till)
GS B			
GS A	14		Sand and gravel with some cobbles. Poorly sorted, moderate to poorly graded. Medium dense to loose
	15–16		silty sand with trace clay. Poorly graded, moderately well sorted. Medium dense
* Note: Water flowing in at contact. Sands started to cave in due to high water flow. Trench filled up in cavern created at bottom	17–19		Silty sand with trace clay, some gravel and cobbles moderately well graded, poorly sorted, brown, dense (Till)
* Note: Picture 19			

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TEST PIT LOG

TEST PIT No. TPC 90-8
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Pad #4
GROUND ELEVATION
DATE July 10/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - dark brown organic material
	1–15		Sandy silt with trace clay. Sand is fine grained. Medium brown, firm and moist.
	16–19		Silty sand with trace clay, some gravel and cobbles, occasional boulder to 10". Brown, very moist, well graded and poorly sorted, medium dense (Till)

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TEST PIT LOG

TEST PIT No. TPC 90-9
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT 250 m W
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Topsoil and forest litter - brown organic material
	1–7		Sandy silt with some gravel and cobbles, occasional boulder to 14". Moderately well graded, poorly sorted, medium dense to dense, brown Till. Trace clay.
Water seeping in at contact	7–13		Sandy silt with some gravel and cobbles, occasional boulder to 10". Moderately well graded, poorly sorted, dense to very dense, brown Till. Trace clay.
GS B			
GS A	14–16		Sandy silt with some gravel and cobbles, occasional boulder to 10". Moderately well graded, poorly sorted, very dense grey - brown Till. Trace clay.
	17–19		

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TEST PIT LOG

TEST PIT No. TPC 90-10
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT 170 m W
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - brown organic material
	1–10		Silt with some clay, trace sand, gravel and cobbles. Moderate to moderately poorly graded, poorly sorted, dense medium brown (Till)
GS A	7		
	10–19		Sandy silt with trace clay, some gravel and cobbles, occasional boulder to 12". Moderately graded, poorly sorted. Very dense brown to grey brown. Till Note: Sections appear to have small and irregular sand lenses.
GS B	13		

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TEST PIT LOG

TEST PIT No. TPC 90-11
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT 70 m W
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc'.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - dark brown organic material
GS A	1–9		Silt with some sand, trace clay. Also contains some gravel and cobbles. Moderately graded, poorly sorted, dense, medium brown Till
GS B	10–18		Silt with some sand, trace clay. Some gravel and cobbles, occasional boulder to 10". Moderately graded, poorly sorted, dense to very dense, brown - grey Till
	19		

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TEST PIT LOG

TEST PIT No. TPC 90-12
SHEET 1 of 2

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Pad #3
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - dark brown organic material
	1		Silt with clay and some sand. Also contains some gravel. Moderate to poorly graded, poorly sorted. Bluish brown color, medium dense, very moist. (Reworked Till ?). Occasional cobble
GS B	16		Silt and sand with some clay, some gravel and cobbles. Medium brown color, medium dense, moist. Moderately well graded, poorly sorted (Till)

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TEST PIT LOG

TEST PIT No. TPC 90-12
SHEET 2 of 2

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Pad #3
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
GS A	21 22 23 24 25 26 27		

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TEST PIT LOG

TEST PIT No. TPC 90-13
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT N of 685
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator			Forest litter and topsoil - dark brown organic material
	1		Silty sand with some gravel and cobbles, trace clay. Moderately well graded, poorly sorted, medium dense to loose, brown Till
	2		
GS D	3		Sand with some silt, some gravel and cobbles. Moderately graded, poorly sorted, medium to loose Till
	4		
	5		Silty sand with some gravel and cobbles, occasional boulder to 10", trace clay. Moderately well graded, poorly sorted dense brown Till
	6		
	7		
GS C	8		
	9		
	10		
	11		
	12		
	13		
	14		Sandy silt with trace gravel, trace clay. Poorly graded, moderately sorted, firm to stiff. Sand is fine. Medium to light brown.
GS B	15		
	16		
	17		Sand, with trace silt & clay and trace gravel. Poorly graded and sorted. Medium brown, medium dense to loose
GS A	18		
	19		

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TEST PIT LOG

TEST PIT No. TPC 90-14
SHEET 1 of 2

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT SE of Junction
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - brown organic material
	1–18		Silty sand with gravel, cobbles and boulders to 10". Well graded, poorly sorted, loose.
GS			
	18–19		Alternating layers of sand with some gravel and sand with gravel, cobbles and boulders to 10". Loose, poorly sorted and graded.

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TEST PIT LOG

TEST PIT No. TPC 90-14
SHEET 2 of 2

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT SE of Junction
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
	21 22 23 24 25		Alternating layers of sand / sand & gravel & cobbles

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TEST PIT LOG

TEST PIT No. TPC 90-15
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT SE of 90-940
GROUND ELEVATION
DATE July 11/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - brown organic material
	1–14		Silt, with some sand and gravel. Has occasional clay layer. Poorly graded, moderately well sorted, firm to stiff, brown
GS B			
GS A	14–19		Silt, with some gravel and cobbles, trace sand and clay. Moderately graded, poorly sorted, very dense blue-grey-brown till

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TEST PIT LOG

TEST PIT No. TPC 90-16
SHEET 1 of 2

PROJECT Mt. Milligan - Area C Tailings
LOCATION OF TEST PIT SW of 90-485 (100 m)
DATE July 12/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Topsoil and forest litter - dark brown original material
	1		Silt with some gravel, moderately graded, poorly sorted. Rusty brown, loose. Trace clay. (Weathered)
	2		
	3		Sand and gravel, with trace silt and trace cobbles. Moderately graded and sorted, brown medium dense to loose.
	4		
	5		
GS A	6		
	7		
	8		
	9		
	10		Silt with fine sand, trace clay and trace gravel. Poorly graded, moderately sorted, medium dense and brown.
	11		
	12		Silt with some sand and gravel, trace cobbles. Moderately well graded, poorly sorted, dense to very dense brown Till. Trace clay
	13		
GS B	14		
	15		
	16		
	17		
	18		Sand and gravel with cobbles and boulders to 12". Moderately graded, poorly sorted. Medium dense, brown
GS C	19		

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TEST PIT LOG

TEST PIT No. TPC 90-16
SHEET 2 of 2

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT SW of 90-485 (100 m)
GROUND ELEVATION
DATE July 12/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
	21 22 23 24		Sand, gravel, cobbles and boulders

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TEST PIT LOG

TEST PIT No. TPC 90-17
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT SW of 90-685 (50m N @ 160°)
GROUND ELEVATION
DATE July 12/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - brown organic material
	1–2		Silt, with trace clay and sand, some gravel. Moderate to poorly graded, poorly sorted. Loose to medium dense, brown (top 1' is oxidized, rusty brown)
	2–13		Silt with trace clay and sand, some gravel and cobbles. Moderately graded, poorly sorted. Brown, dense Till. Occasional boulders to 14".
GS A	8		
	13–14		Last 1' is sandier. Silt with some sand, trace clay, some gravel and cobbles.
GS B	14–16		Sand (quite coarse) with gravel. Poorly sorted, poorly to moderately graded. Medium dense.
	16–19		

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TEST PIT LOG

TEST PIT No. TPC 90-18
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT SE of 90-682 (SE embankment)
GROUND ELEVATION
DATE July 12/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - brown organic material
GS A	1–3		Sandy silt with trace clay. Poorly graded, moderately sorted, medium dense light brown.
	3–11		Sand, with trace silt. Medium grained with occasional coarse layer. Moderate to poorly graded, moderate to well sorted, weakly stratified
GS B	11–16		Sand, with trace silt (as above). Also contains trace gravel and cobbles, occasional angular to sub-angular bedrock fragments.
	16		Bedrock - gabbro

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TEST PIT LOG

TEST PIT No. TPC90-19
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT S of 90-676 on pad (SE embankment)
GROUND ELEVATION
DATE July 12/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Topsoil and forest litter - dark brown organic material
GS A	1–2		Silt and clay. Brown, firm. Trace sand. Poorly graded, moderately sorted, moist
	3–4		Clay, silt and sand with some gravel and cobbles. Well graded, moderately sorted (appears to have weak stratification), Medium dense, very moist, brown. Units are interbedded.
GS B	5–7		
	8–17		
	18–19		

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TEST PIT LOG

TEST PIT No. TPC 90-20
SHEET 1 of 2

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT E of 90-681 on pad (SE embankment)
GROUND ELEVATION
DATE July 12/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Cat EL200B Excavator	0		Forest litter and topsoil - dark brown organic material
	1–16		Silty sand with some clay, some gravel and cobbles and occasional boulder to 12". Very moist, poorly sorted, well graded medium dense, brown. Composition is similar to till, but it seems too coarse grained.
GS A			
	16–19		Sand, fine to medium grained with some silt and some gravel. Moist poor to moderately graded, moderately sorted, medium dense, brown to light brown.
GS B			

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TEST PIT LOG

TEST PIT No. TPC 90-20
SHEET 2 of 2

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT E of 90-681 on pad (SE embankment)
GROUND ELEVATION
DATE July 12/90
LOGGED BY KE

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft.	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
* Note: Water seeping in at 22'	21 22 23 24		

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TEST PIT LOG

TEST PIT No. WSD - 1
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Water Storage Dam (North slope)
GROUND ELEVATION
DATE July 19/90
LOGGED BY MDG/KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Excavated by hand with shovel	0		Topsoil and forest litter - brown organic material
WSD-1	1		Silt with trace brown clay. Loose to medium dense. Very uniform; poorly graded; very well sorted. Slight cohesion. Low water content. Light brown colour.
	2		
	3		
	4		

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TEST PIT LOG

TEST PIT No. WSD - 2
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Water Storage Dam (North slope)
GROUND ELEVATION
DATE July 19/90
LOGGED BY MDG/KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Excavated by hand with shovel			Topsoil and forest litter - organic material
Difficult digging with shovel	1		Brown silt with trace brown clay - same as test hole WSD-1 silt.
WSD-2	2		Sand with some gravel and trace silt. Moderately sorted, moderately graded, medium to coarse sand; brown colour; moderately dense to dense. Few cobbles to 5 cm diameter.
	3		
	4		

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TEST PIT LOG

TEST PIT No. WSD-3
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Water Storage Dam (North slope)
GROUND ELEVATION
DATE July 19/90
LOGGED BY MDG/KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Excavated by hand with shovel			Topsoil and forest litter - organic material
Easy digging with shovel	1		Fine sand with some silt. Loose, no cohesion, very uniform, poorly graded and well sorted.
WSD-3	2		Medium grained sand with some rounded pebbles (1 to 3 cm diameter). Pebbles comprise approx. 20 % by volume. Moderately dense. No silt content.
	3		
	4		

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TEST PIT LOG

TEST PIT No. WSD - 4
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Water Storage Dam (North slope)
GROUND ELEVATION
DATE July 19/90
LOGGED BY MDG/KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Excavated by hand with shovel			Topsoil and forest litter - organic material
	1		Silt with trace clay and occasional pebble. Medium brown colour. Very uniform and somewhat cohesive. (Very similar to WSD-1)
WSD-4	2		
	3		Silt and cobbles/pebbles encountered at 3'.
	4		

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TEST PIT LOG

TEST PIT No. WSD-5
SHEET of

PROJECT Mt. Milligan - Area C Tailings
PROJECT No. 1672
LOCATION OF TEST PIT Water Storage Dam (South slope)
GROUND ELEVATION
DATE July 19/90
LOGGED BY MDG/KGB

NOTES Groundwater level, difficulty in digging, equipment used, etc.	DEPTH ft	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Excavated by hand with shovel			Topsoil and forest litter - organic material
WSD-5	1		Grey silt with trace grey clay. Very uniform, very well sorted and very poorly graded. Soft and loose to moderately dense. Some cohesion.
	2		
	3		
	4		

APPENDIX B

GEOTECHNICAL BOREHOLE LOGS

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TEST HOLE LOG

TEST HOLE No. 90-676
SHEET 1 of 3

PROJECT Mt. Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE S. Embankment
GROUND ELEVATION
DATE BEGUN June 27/90 DATE FINISHED June 30/90
LOGGED BY KGB/RNK

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
• NQ Hole • Bw rods • SPT hammer operated with wire line. • Triconing from 0'–16'					0		At surface: - Sand and gravel with some silt and clay (Sandy Till) - visible from drill pad clearing.
	25	35/6" 35/12" 15/19" 5/24" } 50		#1	6		- Sand and gravel with some silt and clay - angular fragments - grey colour
					8		
					10		
- SPT at 14'–16'		0 6" 30 12"			14		- Gravel with some sand and silt (⇒ Sandy Gravel Till)
	63	24 18" 62 24" } 54		#2			- angular fragments. - trace rust staining on fragments.
- Coring overburden at 16'					16		- possible weathered bedrock
- Pump pressure increase, along with some sand in cuttings during brief L.O.C.	30						- Coarse gravel and fine cobbles only recovered, with exception of a clump of clayey sand and gravel (Gravelly Till)
	2				20		Very few stones recovered; rare finer clumps
	15				25		Only stones recovered
	30				30		Only stones recovered
	0				36		Only stones recovered (½" ⇒ 1½" dia)
		$K = 7 \times 10^{-8}$ cm/s			40		No core recovery, but drilling conditions and extremely low K, indicated by packer test, suggests glacial till.
	5				42		Some gravel and fine cobbles recovered. Mud washing out of top of casing contains sand and small pebbles.
	0				45		Drilling conditions indicate that soil is consistently gravelly.
	0				48		
					50		

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TEST HOLE LOG

TEST HOLE No. 90-676
SHEET 2 of 3

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE S Embankment
GROUND ELEVATION
DATE BEGUN June 27/90 DATE FINISHED June 30/90
LOGGED BY KGB/RNK

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
	0	K = 5 x 10^{-6} cm/s			50		Packer test indicates a more permiable soil medium, but seal washed out at highest pressure, so leakage is probable around the packer during the entire test.
	5				52		several large stones recovered Drilling conditions unchanged from before.
	5				58.5		sloughing of the hole may indicate a sandier till.
Casing put down to 60' to prevent further sloughing.					60		
					62		
Temporary L.O.C. at 63' for 2 min, and intermittent L.O.C. down to 72'.	50						Circulation problems may indicate gravel and sand.
serious L.O.C. at 70'-72'	5		high K		66		
- Casing put down to 72' prior to SPT to prevent any sloughing		k = 4 x 10^{-3} cm/s			70		Packer test attempted, but unable to fill interval while pumping at 50 Litres/minute. May indicate gravel and sand with only trace silt and/or clay (if any at all).
- Get some returns while lowering casing.	0	50+6"			72		Large rock hit during SPT
- Nearly full circ. returned when switching back to mud.	0				72.5		
- SPT attempted at 72' but no recovery					73		Lots of rock chips coming out of top of casing. Much coarser material being flushed out in drilling mud than previously.
- Tricone down 2' to 74' to get past rock.	20	72/6" 102/12" 114/8" 71/24" } 216		#3	74		Sand and gravel with some cobbles (1½" dia). Angular particles. (Gravelly Till) Grey colour.
- Tricone to 85' - SPT at 74'-76'					76		Drilling conditions very rough Probably still sand and gravel.
					81		

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TEST HOLE LOG

TEST HOLE No. 90-676
SHEET 3 of 3

PROJECT Mt Milligan
LOCATION OF TEST HOLE S Embankment
DATE BEGUN June 27/90 DATE FINISHED June 30/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY KGB / RNK

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
· Complete L.O.C. between 81'-84'. Hole sloughing. · Full return at 84'	0				81 84		Drilling conditions indicate boulders. Hole sloughing again.
SPT at 85'-85½'	0				85		Sand and gravel with some clay and silt (Sandy Till)
Coring from 85.5' to 96'	90	236/6"			85.5		2½" long sample is cohesive Angular frags Grey-brown colour
Piezometer slotted every foot. Open hole around piezo. 1' thick bentonite cap installed at surface to prevent surface runoff into piezo.	38				40		Drilling conditions indicate coarse material (gravel) Same conditions as before. Large gravel / fine cobbles (~½"-2" dia) recovered.
Piezometer installed to 93' Tricone from 96' to bedrock.	27				93		Cored through 3" thick boulder. Stones recovered.
					96		Driller's log indicates coarse sand and gravel
					100		
Coring starts at 112'							
Interval / RQD							
112-117 77%	88						Bedrock → Gabbro Dark green colour, coarse-grained, white phenocrysts, oriented bands Very competent (few fractures)
117-122 70%	93				120		
122-127 70%	100						
127-132 63%	100						
132-137 55%	100		mod K 135				
137-142 65%	95	$k = 3 \times 10^{-7}$ cm/s			140		
142-147 47%	95		142				
147-152 55%	90						
152-157 73%	100						
157-162 55%	93		low K		160		
162-167 88%	98		165				
167-172 80%	97	$k < 2 \times 10^{-8}$ cm/s					
E.O.H = 172'			172		172		

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TEST HOLE LOG

TEST HOLE No. 90-681
SHEET 1 of 3

PROJECT CONTINENTAL GOLD CORP. – MT. MILLIGAN
PROJECT No. 1672
LOCATION OF TEST HOLE S.E. of S. EMBANKMENT
GROUND ELEVATION
DATE BEGUN JUNE 30, 1990 DATE FINISHED JULY 1, 1990
LOGGED BY MDG / KGB

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
SPT 0'-2' Tricone 4¼"	63	6/6" 8/6" 9/6" 24/6"		#1	0 2		Clay till – Some pebbles and some sand Dark brown and wet Sandy till – with coarse sand and pebbles at base Sample #1 – 14" over 0'-2' interval SPT: Hit rock at 18" ∴ final blow count may be too high
SPT test: single pulley cathead w 1" rope SPT 4.5'-6.5'	38	19/6" 47/6" 17/6" 31/6"		#2	4.5 6.5		Sand and Gravel with some silt & trace clay ⇒ Sandy Gravel Till SPT: hit rock at 12"
SPT 13'-15'	29	26/6" 31/6" 35/6" 27/6"		#3	13 15		Sandy Gravel Till – as above for 4.5'-6.5' interval SPT: consistent blow counts ∴ uniform over 13'-15' interval
					19		Start of silt at 19' – easy tricone drilling
	50	12/6" 15/6" 16/6" 50/6"		#4	20 22		Silty sand – very uniform & well sorted. Medium brown colour sand medium grain size SPT: hit rock at 24".
Coring from 22' casing at 22'	33				23.5		Boulders encountered 1" to 3" core samples Sands and gravel with some silt & trace clay.
Coring smoothly & easily	17				30		Sand and Gravel with some silt & trace clay – many rock core samples (boulders) ave. dia. ≈ 3" – grey/brown colour ⇒ Sand & Gravel Till
	80				32		Sand and silt with some gravel and trace clay – few boulders present (unlike above) – finer particle size than above
	60		K<6×10⁻⁸ cm/s v. low K	#5	37 40		As above (32'-37') Sample #5: 1' core sample – representative of the impervious material. Packer test No. 1 34'-42': K very low (permeability)
			34 42		42		As above

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TEST HOLE LOG

TEST HOLE No. 90-681
SHEET 2 of 3

PROJECT CONTINENTAL GOLD CORP. - MT. MILLIGAN
LOCATION OF TEST HOLE S.E. of S. EMBANKMENT
DATE BEGUN JUNE 30, 1990 DATE FINISHED JULY 1, 1990

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY KGB / MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
SPT test attempt at 42'. Hit rock. Sample taken but blow count too high.	100	75+/6"		#6	42		Sand and silt with some gravel, trace clay
							Increasing amount of boulders.
Tricone down to 45'					45		
SPT at 45' Hit boulder again		56+/6"					Hole is staying open — implies competent material e.g. till in the hole - more rocks (gravel) encountered as SPT is attempted repeatedly. - Driller says material feels same as till in upper intervals.
Tricone 45'-55'							
					55		Rock and boulders encountered ⇒ High blow counts
SPT at 55'-56'	25	130/6" 100+/6"		#7	56		Sand and gravel with some silt and trace clay - More gravel than in sample #6 - angular fragments. - sample has same colour as above samples] Sample #7
Coring from 56'							White rock core recovered — Quartzite - probably large boulder. Quartzite broken but very hard RQD = 0 in quartzite
RQD					60		
0%					62		Bedrock - altered to clay-like consistency but has bedrock appearance Gabbro: crumbly, broken - can break with fingers poor quality rock
28		$k < 6 \times 10^{-8}$ cm/s	64 Packer		70		
25			72		72		Dark green gabbro. Easily broken with rock hammer - broken in part
31					75		Metamorphosed intrusive. Schistose texture in part - mafic inclusions surrounded by felsic stringers - broken to 1 cm pieces in part. Planar frac.
28					80		
67					82		As above (75-82). Planar frac. at high angle to core axis
57			94 Failed Packer Test		87		Bedrock: Dark green gabbro. Crumbly in part ~7 frac./m but weak rock - can break with fingers. Soft rock - easily indented w rock hammer
42					92		As above (87'-92') - easily indented w rock hammer. Crumbly. Although rock quality low, primary perm. probably low. Perm. is likely controlled by frac. in rock.
62			102		97		As above (92-97) Packer Test: 94'-102' Could not get seal in rock.
					102		As above
					108		

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TEST HOLE LOG

TEST HOLE No. 90-681
SHEET 3 of 3

PROJECT CONTINENTAL GOLD CORP. - MT. MILLIGAN
PROJECT No. 1672
LOCATION OF TEST HOLE S.E. of S. EMBANKMENT
GROUND ELEVATION
DATE BEGUN JUNE 30, 1990 DATE FINISHED JULY 1, 1990
LOGGED BY MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Coring Continues In bedrock	RQD 46				108		Dark green Gabbro (as above)
	73				112		Clay at 112' ~ 1cm thick. Probably fault gouge.
	55				117		Bedrock. High RQD values. Good quality rock.
	67		124		122		Packer test at 124'-132' indicates very low permeability bedrock.
		$k \approx 1 \times 10^{-6}$ cm/s	132		127		
					132		END OF HOLE

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TEST HOLE LOG

TEST HOLE No. 90-682
SHEET 1 of 2

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE S Embankment
GROUND ELEVATION
DATE BEGUN July 1/90 DATE FINISHED July 2/90
LOGGED BY KGB / MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft.)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone down to 5'					0		Sandy silt with trace gravel and clay, some organics.
					1		Sand and gravel lens; visible from road cut.
							Drilling conditions indicate less gravel but more boulders. (drilling into finer sandy silt material again)
SPT at 5'-5½' Hit two rocks during test.	100	66/6"		#2	5		Sandy silt with trace gravel and clay. ⇒ Silty Till Brown colour. Boulders encountered. Rock chips in sample due to triconing through boulders (in first 2" of the sample).
Tricone to 11' (thru 4' of bedrock)					7		
Casing at 11'							BEDROCK (Gabbro)
Coring NQ at 11'					10		Weakly metamorphosed, green rock with oriented bands and white phenocrysts.
					11		
11'-14' RQD = 0%	89				14		Soft, clay-like consistency rock in several spots. Clay-like along fracture surfaces.
14'-18' RQD = 0%	77		14'				Can indent rock with thumb nail
18'-22' RQD = 19%	71		$k = 9 \times 10^{-8}$ cm/s	low K	18		Bedrock has several intervals of extremely fractured bedrock (1"-2" intervals); clay along fracture surfaces.
			22'		20		Bedrock is rigid and not soft and crumbly and clay-like as in the beginning (7' ~ 18')
22'-26' RQD = 20%	92						Two fracture planes contain lots of clay (@ 25' ⇒ 25.5')
26'-30.5' RQD = 31%	70				30		
30.5'-35.5' RQD = 52%	96		34'				No apparent clay along fracture surfaces.
35.5'-40' RQD = 0%	28		$k = 2 \times 10^{-5}$ cm/s	high K			- Loss of core recovery; grinding core - Very fractured.
40'-42' RQD = 0%	79		42'		40		
42'-47' RQD = 15%	67						
47'-52' RQD = 0%	72						Very fractured bedrock; frags ~ 1" wide.
52'-58' RQD = 35%	75		52'		50		
58'-58.5' RQD = 0%	42		$k = 3 \times 10^{-5}$ cm/s	high K			
58.5'-60' RQD = 10%	57		60'		60		Badly broken bedrock at 60' Pieces ~ 1/4" to 3"
60'-67' RQD = 11%	60						
67'-70' RQD = 34%	45				70		

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TEST HOLE LOG

TEST HOLE No. 90-682
SHEET 2 of 2

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE S Embankment
GROUND ELEVATION
DATE BEGUN July 1/90 DATE FINISHED July 2/90
LOGGED BY KGB/MOG

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
					70		At 70'4" Black in drilling Broken core but good recovery Broken zone at 71' — pieces ave 1" (4" zone)
70'-75' RQD=55%	77		73'				
		$K=1\times10^{-6}$ cm/s					Drilling conditions indicate clay zone at 78'
75'-81' RQD=25%	69				80		2 clay gouge zones from 80'-81' — 5" and 4" zones. Clay matrix in rock frag. (1mm → 10mm)
			81'				
81'-86' RQD=30%	85						Dark clayey shale; possibly gouge (6" zone) Crumbly and badly broken.
86'-90' RQD=44%	88						
					90		Badly broken at 89'-90' Grand bedrock core.
90'-95' RQD=52%	92		92'				Hard bedrock; excellent recovery Competent rock; planar fractures; ~7 fracts/meter. Occasional quartz bands (1cm thick).
95'-98' RQD=42%	100	$k=6\times10^{-6}$ cm/s					
			100'		100		E.O.H. at 100'

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TEST HOLE LOG

TEST HOLE No. 90-685
SHEET 1 of 4

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 3/90 DATE FINISHED July 5/90
LOGGED BY MDG / KGB

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4¼" with mud.							
SPT at 5'-7'	100	3"/6" 59/6" 42/6" 53/6"		#1	5 7		Very dense clay with some silt and trace pebbles, sand, and rock frags. (to 1 cm). Light brown clay ⇒ silty clay with trace pebbles ⇒ Clayey till.
SPT at 10'-12'. Very dense. Decide to core.	88	33/6" 46/6" 58/6" 85/6"		#2	10		Difficult hammering ⇒ very dense. Very dense clayey till with some silt and trace small pebbles and sand.
Coring at 12'. NQ rods.	17				12		Hit rock at 11'6" 55 blows/4" for last blow count ∴ 85/6" may be high. Pebbles and clay with rock frags (to 3cm). Clay matrix holding pebbles. Low recovery. ⇒ Boulder Clay Till.
17'-22': Coring with water.	27		19	#3	17		Clay and pebbles (to 1cm) with some silt. Imm rock frags in cuttings. Medium dense clay and some sand.
	29	K=2x10⁻⁴ cm/s		#4	22		Clay with some silt and sand. Uniform, well sorted, poorly graded.
	50				24		Silty clay with some subangular pebbles (to 2cm)
	0		27		25		Silty clay is homogeneous and uniform. Easily indented with finger.
					27		No recovery. Probably loose silt unit which washed during coring.
SPT at 32'-34'	100	14/6" 18/6" 22/6" 29/6"		#5	32 34		Coarse sand (1-3 mm). Very well sorted, poorly graded. Occasional pebble to 1cm. Clean sand, trace silt.
SPT at 37-39'. Tricone (2 15/16") from 37'.	65	19/6" 38/6" 38/6" 43/6"		#6 #7	37 39		Coarse grained sand (6" sample), very clean and uniform. Contact well defined. Sandy silt with trace clay (9.5" sample). Brown colour, well sorted, uniform. Easily indented with finger-nail.
Packer at 42'-44' took long to deflate. Possible sloughing at hole wall.			44'				Return from top of casing is dark brown with abras sand particles. (from hand sieve). Smooth drilling conditions. Probably interbedded sequence of coarse sand / sandy silt.
SPT at 47'-49'. Dense material with high blow counts.	50	K=6x10⁻⁴ cm/s 44/6" 83/6" 146/6" 83/6"		#8	47 49		Coarse grained sand (as above). 2" sample. well defined contact. Sandy Silt (as above). 10" sample.
Switched to coring at 52'.			52'				
	20				55		Hole stays open very well when rods repeatedly withdrawn. A competent, cohesive unit.
	100			#9	57		Brown-grey Clay with trace silt. Very homogeneous and uniform. Very stiff (barely indent with finger) and competent. Upper 2" of sample is clay / coarse sand mixture.
	75				59		Clay, as above, except blue-grey in colour.
Packer test at 64-72'. Clay smeared on bottom packer, indicating a good seal.	100	K=6x10⁻⁸ cm/s	64'		62 67		Clay, as above.

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CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-685
SHEET 2 of 4

PROJECT Mt. Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment.
GROUND ELEVATION
DATE BEGUN July 3/90 DATE FINISHED July 5/90
LOGGED BY MDG/KGB.

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
67'-72'. Packer test hydrofractured (?) clay. High Q rate.	75			#10	67		Clay, as above.
SPT 72'-73½'	100	38/6" 51/6" 41/4.5"	72	#11	72		On 3rd 6" interval, clay became v. dense and hammer wouldn't punch through.
	15		74		73.5		Core recovery is low. Clay clumps continue from top of casing in return.
	75	$k=9\times10^{-4}$ cm/s			77		
	68		82		79		Clay, as above.
	45				82		Trace pebbles found in clay core. Some silt. ⇒ Silty Clay.
Switched to triconing at 87' with 4¼" tricone (to keep hole open). Casing to 87'					87		Clay, as above; easy drilling conditions.
Coring at 102', with mud	0				102		Trace of clay recovery on core tube wall, probably soft clay with some silt.
	17				107		Silty clay with trace fine sand. Cohesive and somewhat stiff. Light brown colour. Different from blue-grey clay above in colour and higher silt content. Probably glaciolacustrine sed. Silt washed outside casing.
	15			#12	112		Clayey silt, as above.
Sand and clay washing up outside casing	23		119		117		Blue clay with some silt. Similar appearance to clay found in 60'-87' interval. Stiff clay.
	38	$K=1\times10^{-4}$ cm/s			122		Clay and pebbles with some sand. Cored through boulder. Dense. Boulder Clay Till.
	19		127		124		Pebbles and clay with some cobbles (to 4cm), silt and sand. Very well graded, poorly sorted. Typical Glacial Till.
Rock chips and brown clay washing out of casing.	10				127		Clay and pebbles with some sand, as above. Some pebbles rounded. Most angular. Cored through 2" boulder.
	13				132		As above. Core return has some lengths of clay and pebbles.
	28				137		As above. Turning more brown in colour. Intersected zone of angular rock chips, with clay and coarse sand. Very iron stained. Rock chips ~ 2cm wide.
					142		

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TEST HOLE LOG

TEST HOLE No. 90-685
SHEET 3 of 4

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 3/90
DATE FINISHED July 5/90
LOGGED BY MDG / KGB

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
					142		
	17						Recovered pebbles and small clump of clay and sand. Most recovery was pebbles with the clay matrix washed out. Pebbles show iron staining and mottled appearance. Boulder Clay Till.
					147		
	7						As above. Small clay clump recovered, but mostly pebbles. Drilling conditions unchanged over last 25'.
					152		
	3						Drilling conditions unchanged.
Changed bit at 157'. Pulled out rods and Pot Hole down again. Continued coring.					157		
	0						More sand recovered in seive samples. Drilling conditions are smoother as drill moves down on its own weight. Dark brown colour from return (as before). Silt appears with sand. ⇒ Sandy Clay Till.
					162		
	5						Cored through boulder. Has sandy clay adhearing to its ends. Looks like the same clay till recovered previously. Several pebbles recovered with same staining pattern.
					167		
	0		149				No changes in drilling conditions.
	10		$k = 2 \times 10^{-6}$ cm/s		172		Only pebbles recovered. Have the same iron stained / mottled pattern as those in the boulder clay till recovered before. Packer test has low K, indicating a fine-grained material.
			177		177		
	5						Only pebbles recovered. Some are fractured into smaller pieces. Have the same appearance as before.
					182		
	0						Drilling conditions unchanged.
					187		
	7						A few pebbles recovered. Trace of clay and silt stuck to pebbles.
	75			#13	192		
					193.5		Clay and pebbles with some silt and sand. Very dense. Brown colour. Pebbles partially cemented in silty clay matrix. Till, as above, with higher clay content. ⇒ Boulder Clay.
	50						
Difficult drilling conditions. High pressure drilling. Good mud return.			198		197		
	30		$k = 1 \times 10^{-4}$ cm/s				As above, with more silt and sand. Cored through large boulder (8" long).
					202		
	25						As above.
Tricone from 206' to bedrock with $2\frac{15}{16}$" bit inside casing with mud.			206		206		
							As above, from drilling conditions.
					220		← Hardpan, hard clay from drilling conditions and brown mud return. (Hard but smooth drilling suggests dense clay with few boulders).

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TEST HOLE LOG

TEST HOLE No. 90-685
SHEET 4 of 4

PROJECT Mt. Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 3/90 DATE FINISHED July 5/90
LOGGED BY MDG / KGB.

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Good mud return suggests good ground conditions. ie: Competent and low K till.					220		Dense clay; hardpan (from driller). Unchanged drilling conditions.
Continued to tricone through bedrock.					232		Bedrock slab (?), 16' thick. Gray mud return and smooth, hard drilling conditions suggests bedrock.
					248		Clay again from drilling conditions. Increase in pressure. Reddish brown mud returns with small clumps of red clay in cuttings.
							Sticky grey clay. Tough mucking for tricone bit.
Triconing with 2 7/8" continues to 269'.							Boulders at 259' from drilling conditions.
					260		Boulder material. Shakey drilling, low water pressure.
							Triconing through boulders and clay.
					269'		E.O.H.

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TEST HOLE LOG

TEST HOLE No. 90-690
SHEET 1 of 3

PROJECT MOUNT MILLIGAN — PROJECT No. 1672
LOCATION OF TEST HOLE MAIN EMBANKMENT — GROUND ELEVATION
DATE BEGUN JULY 6, 1990 — DATE FINISHED JULY 8, 1990 — LOGGED BY KGB / MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone from 0' with mud, no casing SPT not performed at 5' and 10' due to the amount of boulders encountered during triconing. SPT at 15' aborted due to boulders. Tried to withdraw tricone at 20', but hole caving. Till not very consolidated or dense.				Unable to Sample	0 5 10 20		Rough drilling conditions. Triconing through boulders. Surface road cuts reveal silt with some sand, gravel, boulders and trace clay ⇒ Silt Boulder Till Continuous rough triconing through rocks. Unable to get a sample from SPT. Triconing conditions much harder than in previous holes. Drilling conditions improve slightly. Fewer boulders encountered than before. Returns from top of hole is coarse-grained sand and rock chips. Still in the Silt Boulder Till. Hole staying open fairly well. As above
27' Triconing ≈ 4¼" 29' bit continues, open hole. No SPT test because drilling conditions suggest boulder rich till.	70	105/6"		90-690 #1	30		Boulders at 27' ∴ Aborted SPT test. Rock cuttings from tricone very dense sand & gravel till with some silt & clay. 6" sample Sand and silt - Smooth drilling conditions Boulders and sand with some clay (from drill cuttings)
Install casing at 46'. Coring begins at 46' - reamed casing shoe 4" into bouldery gravel. Hole caved in after pulling up from 62' to 52' for packer test ∴ must pull casing & tricone past caved zone with 4¼" bit with mud then case past cobble zone.	29 100 33 10	k64+	42 5 to 10 cm 57 Packer Attempted 62	90-690 #2	40 46 48 52 57 62 70 80	Dense Till	Shaky drilling & low press. suggests boulder rich, dense till. Sharp drill cuttings have trace of clay ∴ call it boulder clay till. Boulders & gravel. Pebbles & grey clay with trace of silt. Very dense clay matrix supporting pebbles & cobbles to 4cm. very coarse sand & pebbles in grey stiff clay matrix Clay ~ 80%, Clasts ~ 20% (est. very low permeability). As above (48'-52') but with higher coarse sand fraction. Recovered pebbles only from core tube. Pebbles 1 to 4 cm with trace of clay coating on some pebbles. Poor recovery. (est. very high K zone). Driller's log: Drilling conditions same as above. Lots of pebbles and some boulders encountered. Hole staying open. Driller says that the material in this interval is same as for 48'-52' interval.

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TEST HOLE LOG

TEST HOLE No. 90-690
SHEET 2 of 3

PROJECT MOUNT MILLIGAN
PROJECT No. 1672
LOCATION OF TEST HOLE MAIN EMBANKMENT
GROUND ELEVATION
DATE BEGUN JULY 6, 1990 DATE FINISHED JULY 8, 1990
LOGGED BY KGB / MDG

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
					80		
							Driller's Log: Drilling conditions indicate lots of boulders. 1' thick on average. Bouldery clay till (?) Same drilling as 0-20' interval.
					90		
					100		
							Driller's log: Drilling conditions as in 52'-80' interval. Pebbles encountered, relatively smooth drilling. Driller says that this is the same type of conditions as in 48'-52' ⇒ Pebble Clay till
					110		← More sand
							Drilling conditions same as above, but more sand encountered in seive samples (cuttings) from top of hole. Chocolate brown coloured mud from returns. Mud return is much more brown than in 100-110'. Could be higher silt content. Sand content decreases at 116' ⇒ Sandy Clay Till.
					120		
Casing at 122' Coring from 122'-132'					122		
Packer test at 124'-132' but did not seal.	40						Clay w coarse sand & gravel, trace silt. Very cohesive. Cannot indent w finger, can scratch w fingernail. Medium brown colour. Rock chips ~ 1". Well graded, poorly sorted. Same material as hole 90-685 ⇒ Sandy Clay Till.
Realized that casing disappeared down hole, so packer probably hit it.	13				127		As above
Casing slid down to 126'. Coring to 142' for packer test.	10	K = 4x10⁻⁵ cm/s	134'	low k	132		Small clumps of clay & coarse sand & gravel as above. Chunks very stiff & hard. Mostly a "soupy mess". ⇒ Sandy Clay Till
					139		Packer test indicates an impermeable medium (as above)
Triconing 2 15/16" bit from 142'	0		142'		142		
					149		Mud return turn colour to a brownish-grey. Driller says something is pulling on the rods (adhearing could mean clay). Sand particles from top of hole and from casing when seived. Probably higher clay content / lower sand content till. Drilling conditions smooth. No pebbles or boulders.
					149		Drilling conditions changed. No more pulling on rods. Return still brown-grey, but more pebbles encountered. Tricone gets continually plugged up, indicating a dense clay. ⇒ Sandy Clay Till.
					155		Mud return becomes chocolate brown again at 152' (same as 110'-144'). Brown return suggests possible brown clay till

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TEST HOLE LOG

TEST HOLE No. 90-690
SHEET 3 of 3

PROJECT Mount Milligan — PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment — GROUND ELEVATION
DATE BEGUN July 6, 1990 — DATE FINISHED July 8, 1990 — LOGGED BY KGB / MDG

NOTES
Water loss, type and size of hole, drilling method, groundwater level, etc.

Tricone to 165' with 2 15/16" bit. Coring starts at 164'
- bottom 22' of hole sloughed (caved) after pulling tricone - rods binding at 167'.

Casing at 176' to prevent hole from squeezing & binding drill rods. Coring at 176'

Interval	RQD(%)
176-182	25
182-191	0
191-195	10
195-198	0
198-202	38
202-207	33
207-212	68
212-217	37
217-222	7

Mislatch at end of hole, caused poor core recovery.

DEPTH (ft)	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
160						Brown mud return suggests brown clay till. Driller says "sticky" drilling. Drill bit pressure down suggesting dense clay till as above. (Smooth but hard & sticky drilling ⇒ clay till.
	20					→ Angular rock frag. Black, pieces ~1→2 cm recovered from core tube.
						Cuttings consist of mafic rock frags. & occasional red clay clumps.
170						As above
						← Driller says boulders at 176'.
	64					Dark grey-brown mud return. Pieces of mafic rock chips collected from sieve. Same rock frags. as 164-170 interval. Very coarse, sand-like Texture. Good core recovery.
180						Rock: mafic, silicified, fractures into blocky fragments (planar edges), iron stained on frac. surfaces, qtz/calcite infilling on frac. surfaces. Very hard. Some parts very fractured & broken. ⇒ Andesite (?) Bedrock at ~178'
	9	K = 9 x 10⁻⁷ cm/s	184	low K		Mafic rock as above. Poor recovery
190			191			
	100					Frac. very frequent. Several large zones of very fractured rock (5"-12")
195	67					Rock mostly fractured.
198	92					Single fractures only. Mostly competent rock.
202	100					As above
207	100					Good competent core. Fractures mostly all single, planar.
212	100		214			Locally fractured zones 1"-2" wide; mostly single fractures throughout.
217	80	K = 3 x 10⁻⁸ cm/s		low K		Locally very fractured zones 3" wide. Rock has more of a clay-gouge appearance than earlier intervals. Still very hard.
222	3		222			Ground core due to mislatch.
232						E.O.H. at 232'

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TEST HOLE LOG

TEST HOLE No. 90-695
SHEET 1 of 4

PROJECT Mt. Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 8/90 DATE FINISHED July 10/90
LOGGED BY MDG/KGB

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4¾" bit. Open hole.					0		Abundant angular rock frags in drill cuttings. Drilling smoothly. Afew clumps of grey clay in returns (clay could be from surface). Rock chips could be boulders.
Casing and coring at 6'.	23				6		Boulders and rock core (probably from broken pieces of large boulders). 2" long piece of rock — volcanic — green aphanitic groundmass and white phenocrysts — Andesite. 5" long piece of metamorphosed breccia. Rounded and uneven fractured ∴ probably boulders.
	46			#1	11		Pebbles and rock frags overlying very dense grey clay.
	6				13		Rock frag (pebble) recovered. Everything else washed out.
Drill bit plugged at 17'. No recovery.	0				17		No cuttings in mud return. Return consists of blue-grey coloured mud. Very smooth drilling conditions.
SPT attempted but hole sloughed in. Continued triconing with 4¾".					22		
							As above. Blue-grey clay in mud return. Some mafic cuttings in mud.
Tricone to 36'. Reamed hole out and put down casing to 36'.							
Shelby Tube at 37'-39'				SHELBY.	37		
Coring at 39' with triple tube core barrel.	100			#2	39		Dense blue grey clay. Very uniform. Very dense.
	100						
	57	$K < 2 \times 10^{-8}$ cm/s	44		45		Homogeneous blue-grey clay. Few fractures. Very dense (cannot indent with finger; can barely indent with thumb nail.)
SPT at 52'-54'. Easily punched through clay.	83	11/6"	52		50		
	100	15/6" 18/6" 23/6"		#3	52		
	100				54		
	50				57		
					62		At 62', a pebble was found in the end of the core. Contact between clay and pebble clay.
	37						Only pebbles and rock core (boulders) recovered. Pebbles range in size from 1-3cm. Rock (boulder) is 3cm long. Trace clay on end of rock core. Mud return is the same dark grey colour as before. Pebbles are more angular than rounded.
71'-72' Hole sloughed in when rods withdrawn. Switched to triconing at 72'.	0				67		No recovery. Drilling conditions indicate more pebbles. Save sample from return shows sand.
Failed packer test at 72'.					72		Drilling conditions indicate more pebbles, not boulders. Save sample has lots of fine to coarse grained sand in it. Some particles are rounded (like beach sand). Different types of sand particles.
					80		Lots of sand in salve. Clay jamming up tricone. No more pebbles.

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CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-695
SHEET 2 of 4

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 8/90 DATE FINISHED July 10/90
LOGGED BY KGB / MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
					80		Drilling very easy. Tricone moves through material quickly. Mud return is same gray colour as before, and lots of sand in solve. Hole staying open well.
					90		
SPT at 94'-96'. First blow count too low (though material at bottom of hole).	100	7/6" 22/6" 20/6" 33/6"		#4	94		Very fine to fine sand with trace of silt. Poorly graded and well sorted. Uniform, grey colour. Medium dense. Somewhat cohesive.
	8				96		Pebbles only recovered. Fine sand in mud return washed away. Easy drilling conditions indicate low density sand and pebbles. Sand and rock frags recovered from screen sampling drill cuttings.
					101		As above, but grey clay clumps recovered in drill cuttings.
SPT at 104'-106'	50	23/6" 38/6" 42/6" 47/6"		#5	104		Same sample as in 94'-96'.
					106		
					110		Grey mud return. Few cuttings. Smooth drilling conditions. Probably grey clay with some sand.
					120		Grey clay and sand with some pebbles. Angular cuttings, sand, and clay clumps in return.
					130		
					140		Fine sand with trace to some clay. Sand is fine-grained and is very poorly graded and uniform.
SPT at 143'-145'. Bottom 10' of hole caved in after test. Continued to tricone.	100	25/6" 33/6" 39/6" 58/6"		#6	143		Silt and clay with some very fine sand. Can easily indent with finger. Bluish-grey colour. Poorly graded and uniform. SPT test hit rock in last 3".
					145		
					150		Sand and clumps of sticky blue-grey clay in cuttings. Same as above.
					160		Fine sand particles and grey clay particles in mud return. Same as above. Mud return is grey.

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CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-695
SHEET 3 of 4

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 8/90 DATE FINISHED July 10/90
LOGGED BY MD6/K6B.

NOTES	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Water loss, type and size of hole, drilling method, groundwater level, etc.							
176' at shift change. Hole sloughed in 6' before the next shift came on.					160 170 180		Grey clay and fine sand, as above.
					190 200		
Piezometer installed to 237'. Top 37' not slotted. Plug seated at 13'. Backfilled with slurry silt to surface.					210		Gravel encountered with clay.
220'-256' Hole sloughed in when rods withdrawn. Unable to ream down through. Hole also squeezing in.					220 223 230 237 240		More dense clay encountered. Trying to plug up the tricone. Deep grey mud return, as above. Sieve sample shows grey clay clumps and some angular rock frags.

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TEST HOLE LOG

TEST HOLE No. 90-695
SHEET 4 of 4

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 8/90 DATE FINISHED July 10/90
LOGGED BY KGB/MDG

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
					240		
					250		Grey clay, as above.
					256		
					260		Bedrock. Many black mafic rock chips in return. Extremely hard drilling.
Hole abandoned at 266' due to squeezing ground conditions.					266		E.O.H.

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TEST HOLE LOG

TEST HOLE No. 90-698
SHEET 1 of 3

PROJECT Mt. Milligan
LOCATION OF TEST HOLE Main Embankment
DATE BEGUN JULY 10/90 DATE FINISHED JULY 11/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY MDG/KGB

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4 1/4" bit with mud, open hole.					0		
	75	13/6" 14/6" 10/6" 14/6"		#1	5		Medium sand with trace silt. Very uniform, well sorted and poorly graded.
					7		
					10		
	75	19/6" 27/6" 37/6" 57/6"		#2	12		Medium grained sand with trace silt (as above). Very homogeneous & uniform clean sand.
					14		Medium sand in drill cuttings (as above)
					20		
	75	16/6" 30/6" 40/6" 63/6"		#3	22		very fine sand & silt. Very uniform, poorly graded. Brown colour. Soft, low water content.
					24		Loose fine to medium sand with some silt recovered from returns (as above). Drilling conditions unchanged Mud return is medium brown colour (as above).
					30		
					40		
SPT Test - 1st blow count good but bit rocks on second 6" blow count.	100	33/6" 64/6"		#4	44		Silt and clay with some fine to medium sand. (more clay than above)
					46		
					50		
					60		silt with some clay and some fine sand (as above) Drilling conditions unchanged.
					70		
					75		← Grey mud return at 75'. Grey clay and fine sand in returns.
					78		
					80		Pebbles and sand

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TEST HOLE LOG

TEST HOLE No. 90 - 698
SHEET 2 of 3

PROJECT Mt. Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN JULY 10/90 DATE FINISHED JULY 11/90
LOGGED BY MDG / KGB

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tri-coning 4 1/4" bit open hole with mud					80		Coarse sand & pebbles from screen sample of returns. Also some brown clay present. Shaky drilling conditions suggest pebbles. Brown colour mud return. Easy drilling ∴ probably not till.
loose sand & gravel ∴ cannot perform SPT test, core, or perform packer test ∴ keep tri-coning					90		Medium grained sand and pebble fragments recovered from screen sample. Drilling conditions smoother ∴ probably more sand than pebbles. Boulders at 90'
No packer test performed since material is too loose & would wash away, preventing packer from sealing.					100		Medium sand and some gravel from cuttings (as above)
					110		Medium sand with occassional gravel Gravel-rich layer. Heavily shaky drilling conditions for ~2 feet.
					111		← Drilling conditions changed – smooth but hard drilling. Cuttings consist of dark green fragments ∴ could be bedrock or dense till.
					116		← Casing at 116'
Stopped tri-coning at 116'. Set casing at 116' and start coring with mud inside casing at 116'.	75			#5	117 120		Very dense till. Well graded, very poorly sorted. Pebbles and cobbles to 3cm in matrix of very dense blue-grey clay and coarse sand. Sub-angular clasts comprise ~30 to 40% and average 1cm. (estimate very low permeability).
	13				122		Only rock fragments and pebbles recovered. Also one clump of dense coarse sand recovered.
	20				127 130		Pebbles only recovered. Sub-rounded to rounded pebbles from 1cm to 5cm → ave. 2cm. No evidence of clay.
	27				132		Small pebbles in matrix of grey clayey silt. Breaks apart in fingers – not very well consolidated. Small pebbles comprise ~20%.
RQD 28	100				137		Bedrock at 137'. 137'-139' weathered and broken rock. Altered pelitic metamorphic rock → Micaceous schist. Sub-schistose fabric parallel to planar, rough frac. planes. Healed, iron stained vein-like frac. throughout. Pinkish light brown colour.
8	50		144		140 142		Bedrock (as above). Badly broken and crumbly in part to coarse sand texture. Micaceous throughout. Highly weathered, poor quality rock in general.
58	100	K=2x10	-8 cm/s	very low K	147 150		Bedrock (as above). Good quality. Few planar fractures.
30	100		152		152		As above. Clay alteration along fractures.
					157 160		

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-698
SHEET 3 of 3

PROJECT Mt. Milligan
LOCATION OF TEST HOLE Main Embankment
DATE BEGUN July 10/90 DATE FINISHED July 11/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY MDG/KGB

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
RQD					157		
0	20						Crushed up bedrock, ave. particle size ~1cm. Poor recovery zone.
			164		162		
32	100						Excellent rock quality, very solid and few fractures.
		$k = 1 \times 10^{-7}$ cm/s			167		
13	50						Much more weathered than earlier intervals; gouge-like texture, very soft in some places. Rock quality deteriorates towards the end of the hole.
			172		172		E.O.H.

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-700
SHEET 1 of 3

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 11/90 DATE FINISHED July 13/90
LOGGED BY KGB / MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4¼".					0		Smooth drilling conditions, often pebbles encountered.
SPT at 5'-7'. Hit boulder at 12"-18" of test interval.	33	22/6" 31/6" 44/6" 26/6"		#1	5		Silty sand with some gravel, medium to coarse grained sand. Brown colour, quite cohesive. Fine grained gravel. SPT hit rock during test.
					7		Smooth drilling conditions indicate sand and occasional pebbles.
SPT at 12'-14'.	75	40/6" 53/6" 60/6" 80/6"		#2	12		Silty sand with some fine grained gravel, medium grained sand. well sorted, poorly graded. Similar to 5'-7'.
					14		Drilling conditions indicate sand and pebbles. Hit boulder at 18'.
SPT at 19'-20½'. Hit rock on last 2" but slowly moved down through it.	67	39/6" 62/6" 72/6"		#3	19		Silty sand with trace gravel. Similar to samples #1 and #2. Boulders encountered at and at SPT mid just before the test.
					20.5		Many boulders encountered from drilling. Overall drilling conditions smooth. Some rock frags, but mostly coarse grained sand in mud return.
					30		
SPT at 36'-38'.	71	28/6" 40/6" 58/6" 69/6"		#4	36		Sandy silt. Very fine grained sand, no visible gravel. Very uniform, well sorted, poorly-graded. Medium brown colour.
					38		
					40		As above, Sandy silt. Sand from mud return is fine to medium grained. Mud return is medium brown in colour. Occasional boulder encountered.
					50		
SPT at 56'-58'. Casing to 56'. Reamed shoe 4". Tricone 2 15/16" inside casing.	33	19/6" 34/6" 51/6" 68/6"		#5	53		Blue-grey clay with some silt. Drilling conditions very smooth and mud return is grey colour.
					56		Grey clay with some silt. Also wood pieces 3cm long in clay. Med. stiff (can easily indent with finger).
					58		
					60		Grey coloured mud return with flecks of silt in return. Silty grey clay, as above. Smooth and easy drilling conditions.
					70		
Packer test at 74'-82'		K=8x10⁻⁷ cm/s	74		77		Homogeneous and uniform grey clay and silt. Clay somewhat sensitive and stiff. Can indent with finger.
	83			#6	80		

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-700
SHEET 2 of 3

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 11/90 DATE FINISHED July 13/90
LOGGED BY KGB / MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone plugging up in grey clay.	83		82	#6	80 82		As above, blue-grey clay. Clay is well indurated and hard in parts. (has consistency of weak shale in parts).
					90		
					100		Smooth, easy drilling conditions. Grey mud, no cuttings in return. ∴ Grey clay, as above.
					110		
					120		
					126		Fine sand, uniform, dark-green and black sand grains from sieve samples. Similar to the sand recovered above hard till from the previous hole (90-698).
					130		
					134		Grey clay again at 134'. Interbedded fine sand and clay.
					140		
					150		Grey clay with fine sand.
					160		Drilling conditions at 156' indicate a "harder" unit (at 156'). No cuttings in mud return. Probably a more dense clay.

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-700
SHEET 3 of 3

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 11/90 DATE FINISHED July 13/90
LOGGED BY KGB/MDG

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
High mud pressure at tricone bit suggests bit is clogged with clay.					160		Few flecks of sand but otherwise grey clay in mud return. As above.
					170		
					180		
					190		
					200		Grey clay clumps, with a trace of very fine sand grains in mud return. Drilling conditions unchanged. Grey clay with some silt and trace fine sand, as above. Grey silty clay.
At shift change, sand and clay clogged the drill rods so they were unable to turn or be raised. Flushing hole didn't work. Reamed casing down to 170' to pull rods out. Hole abandoned.					210		
					214		E.O.H.

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90 - 705
SHEET 1 of 3

PROJECT Mt. Milligan
LOCATION OF TEST HOLE Main Embankment
DATE BEGUN JULY 13/90 DATE FINISHED JULY 14/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY KGB / MDG

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4 1/4" through top 17' open hole, with mud (top 10' is fill from drill pad)					0	FILL	At surface: Clayey silt with trace sand, gravel & cobbles. Dark brown-grey colour. Very homogeneous, well sorted, poorly graded. Very cohesive. High water content. Moderately stiff (difficult to indent with finger) Banded black organic layers (2cm ave width) in top 2'-3' Sand is fine grained.
					10		Ground surface at 10'.
							Clayey silt with trace sand, gravel, cobbles; As above.
SPT at 16'-18'	79	8/6" 8/6" 9/6" 12/6"		#1	16		Clayey silt with some sand. Well sorted, poorly graded. Sand is fine grained with occasional coarse grains; very homogeneous & uniform. Cohesive, brown-grey colour.
					18		
					20		Boulders encountered more frequently
SPT at 28'-30'	25	26/6" 22/6" 12/6" 19/6"		#2			Dense grey clay with some small pebbles and trace coarse sand.
					30		Drilling conditions suggest pebbles & boulders with some sand
							Coarse sand & pebbles with some grey clay from cuttings.
					40		Coarse sand, pebble fragments & grey clay in cuttings (as above) - mud return medium grey colour.
SPT at 46'-48' nothing recovered	0	20/6" 39/6" 46/6" 58/6"		none	46		Silt & clay remnants like inner walls of split spoon tube. Coarser sand was not recovered.
					48		
					50		Grey clay & medium grained sand. Very smooth drilling conditions. Grey mud return, as above.
							Medium to coarse sand and clay, in equal proportions, found in returns (as above).
							Fine sand & grey clay.
					60		Medium sand & grey clay in returns
							Medium sand & grey clay. Wood pieces present from 46'.
					70		Drilling conditions changed. Hard drilling. Could be hardpan till or boulder. Grey mud colour return.
							Boulders from 74'-76'. Vibrating drilling conditions.
							Rock fragments with trace clay in cuttings. Hard drilling.
					80		

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CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-705
SHEET 2 of 3

PROJECT Mt. Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN JULY 13/90 DATE FINISHED JULY 14/90
LOGGED BY KGB/MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4 1/4" open hole with mud.					80		Boulders at 80'.
							Rock fragments & trace clay (as above). Drilling conditions unchanged
							← Drill mud turns light grey colour. Could be bedrock
Casing at 86'. Coring at 86'.					86		
	7						Poor recovery in boulders & clay. Pebbles & cobbles in grey clay matrix. Clasts ~80%.
					91		Very poor ground conditions. Boulders with trace clay.
Losing casing down hole at 94': must pull drill rods & casing. Tricone until reach firm stratum.							
					100		
					110		Fine to medium grained sand and clay. As before boulder zone which started at 72'.
					120		
					130		
							← Hard & shaky drilling conditions at 136'.
Casing down to 140'					140		Fine to medium sand and clay in cuttings as above. Very shaky & vibrating drilling conditions suggest the presence of hard, basal till.
Coring at 144'.					144		(Sample #3 10" long)
	90			#3			Grey clay w some gravel & boulders, coarse sand & silt. Clay matrix contains angular rock fragments. Extremely cohesive. Rock frags. range from 1 cm → 15 cm. Rock frags primarily matic (black), fine grained rock w Qtz/calcite stringers (Andesite)
					149		Moderately dense (indent w thumbnail). Poorly sorted, well graded. ⇒ Clay - Boulder Till
Problems with circulation at 152'-155'. Drilling slowly & using thick mud to keep hole from squeezing and caving in. Rods pulled up to 149'. Water continuously came out at casing.	67						as above
	22		153	V. high K	152		
	67				153.5		Only pebbles & rock core recovered. Both are same rock type as found above. Pebbles ave. 1.5cm. Up to 5cm for rock core.
					165		Rock core with remanent clay
					137		Pebbles & rock core with remanent clay
					169		As above. Rock core has clay-gouge-like appearance on frac. Could be start of bedrock (?)
⇒ Artesian conditions.			161		161		

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TEST HOLE LOG

TEST HOLE No. 90-705
SHEET 3 of 3

PROJECT Mt. Milligan
LOCATION OF TEST HOLE Main Embankment
DATE BEGUN JULY 13/90 DATE FINISHED JULY 14/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY KGB / MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Coring at 161'.	RQD						
	0 — 77				162		Rock fragments & pebbles.
							Pebbles from 162'-163'.
							Rock core & shear zone 163'-164.5'
					165		Bedrock. Soft, weathered bedrock mottled texture. Purple & white colour. Felsic micaceous schist Crumbles easily to coarse grains
Driller says rock is plugging up the bit ∴ soft & broken rock.	87 — 100						
					170		Bedrock, as above. Lower RQD than above. Rock is slightly more broken & weaker than above. Broken in part. Badly broken to coarse grains in 6" zone. Rock easily broken out of core tube. Rock is highly weathered. Crumbles in fingers.
	33 — 100						
					175		
	53 — 100						Bedrock, as above. Rock quality slightly improved. Estimate low permeability.
					180		
	60 — 100						Bedrock. Broken, soft & weathered as above. Core broke coming out of core tube ∴ RQD is higher than indicated.
Packer Test: 184'-192' was aborted due to high water press. down hole at depth (artesian conditions).			184		183.5		
	55 — 100						Bedrock. Slightly harder than above - can easily indent w rock hammer. Approx. 3-4 planar frac. per foot. Frac. planes contain clay infilling ≈ 2mm thick. Rock slightly less weathered than above.
					189		
	80 — 100						189'-191' Bedrock as above (felsic)
			192				191'-192' Mafic gneiss - dark green colour.
	67 — 100				192		Bedrock: Alternating felsic (white) & mafic (dark green) metamorphic bedrock. Contorted bands. Crumbly & very soft in parts. Can indent & easily break w fingers.
					197		
	73 — 100						Bedrock, as above (192'-197') from 197'-199'. Very crumbly and badly broken in part. Soft & weak, highly weathered bedrock, as above. 199'-202' mafic schist. Clay-like coating on core. Very soft & pulverized in part.
					202		
	82 — 100						Bedrock (202'-205') - Soft, very crumbly & weathered.
							Bedrock (205'-207') - Good quality rock. Few frac. Banded gneiss or schist. Purple & white colour bands.
					207		E.O.H. at 207'.

Rocks: metamorphic intrusive. Thin bands of alternating felsic & mafic (gneiss). Abundant silicified veins Crumbly shear zone last 6" of core run (white-grey colour) core run blocked in shear zone

Although RQD is high, rock is soft and weak.

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TEST HOLE LOG

TEST HOLE No. 90-707
SHEET 1 of 4

PROJECT Mt. Milligan
LOCATION OF TEST HOLE Main Embankment
DATE BEGUN JULY 15/90 DATE FINISHED JULY 16/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY KGB / MDG

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4 1/4" open hole with mud.					0		At surface: Clay with some silt & organics, see below. Same material as at surface at hole 90-705.
SPT at 5'-7'. Ground so soft that one hit drove spoon 6".	100	5/24"		#1	5		Clay & some silt and organics. Very high water content. Very soft - easily indented with finger. Grey-brown colour. Some small wood fibres included. Well sorted, poorly graded & swamp.
					7		Smooth drilling conditions - Assume clay.
SPT at 12'-14'. Rock lodged in end of split spoon.	58	5/6" 9/6" 17/6" 13/6"		#2	12		1st 6" is clay with some silt, sand & gravel. Dark brown colour, as above. 8" is sand & some silt & gravel, trace clay. Med. grained sand. Brown colour. Gravel is fine to coarse grained. Rounded fragments. Mod. sorted, well graded. Low density, cohesionless.
					14		
SPT at 20'-22'	67	4/6" 4/6" 5/6" 11/6"		#3	20		Clay with some silt and trace sand & gravel. Very cohesive. Local 1cm interval coarse sand / fine gravel. Well sorted, mod. graded. Grey-brown colour.
					22		Drilling conditions indicate a hard clay. Alternating high mud return with "clogging" conditions ∴ likely clay.
SPT at 32'-34'	100	4/6" 4/6" 6/6" 9/6"		#4	32		Blue-grey clay with trace silt. Very uniform, well sorted and poorly graded. Easily indented with finger. Very cohesive and "sticky".
					34		Smooth drilling; Clay clumps in mud return; grey mud return. ⇒ Blue-grey clay.
Casing to 42'					42		Blue-grey clay with some silt and sand. Cohesive. Difficult to indent with finger. High water content. Well sorted, poorly graded. Same as above but higher silt content.
SPT at 42'-44'. Coring at 44' for packer test.	92	16/6" 15/6" 34/6" 33/6"		#5	44		
	75				47		As above
	58				52		As above
Lost core from 52'-57' as core tube was not put down rods.	Lost				57		Drilling conditions unchanged from above ∴ Blue-grey clay, as above.
	70				62		As above
	92				67		Uniform, very dense blue grey clay form very hard discs throughout core. Hard discs separated by thinner soft discs. Soft zones represent clay with some silt & fine sand. Hard zones represent 100% dense clay which consolidates to higher density than clay which contains silt and sand.
	72			74-75 ft C.S. core sample	72		
	95		74	U.tube #5	77		
Coring ends at 82' in clay.	60		$k < 5 \times 10^{-8}$ cm/s	#6	82		

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CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-707
SHEET 2 of 4

PROJECT Mt. Milligan
LOCATION OF TEST HOLE Main Embankment
DATE BEGUN JULY 15/90 DATE FINISHED JULY 16/90

PROJECT No. 1672
GROUND ELEVATION
LOGGED BY KGB / MDG

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4 1/4" open hole with mud from 82'.					82		very dense grey clay, as above.
							Grey clay, as above. Drilling conditions unchanged. Grey colour mud return, as above.
					94		Boulders encountered at 94'. Probably boulders in clay. Light grey mud. (lighter than above). Rock fragments & coarse sand in cuttings. No clay found. Shaky drilling conditions Driller thinks it may be hardpan (?)
					100		Return of dark grey mud return. Rock frag. & coarse sand with trace grey clay.
							Abundant boulder & pebble fragments & coarse sand in cuttings. Heavily vibrating drilling conditions. Dark grey colour mud return. Hard drilling conditions. Little clay present.
					110		Abundant coarse boulder fragments with some very coarse sand in cuttings.
					120		Grey clay returns at approx. 120'.
							Grey clay, as before boulder zone above. Quiet & smooth drilling conditions.
					130		very easy & smooth drilling conditions suggest loose sand - likely contains some clay as well. at 130'.
					134		Grey clay at 134'.
					140		Grey clay, as above.
					150		
					160		

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CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-707
SHEET 3 of 4

PROJECT Mt. Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN JULY 15/90 DATE FINISHED JULY 16/90
LOGGED BY KGB / MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4 1/4" open hole with mud. Hole staying open in clay.					160		Grey clay, as above.
					168		Easy, smooth drilling suggests loose sand with some clay. Tricone bit not plugging up ∴ probably sand & clay.
Losing circulation down hole at 176'					180		Drilling conditions suggest sand & clay to 206'. - easy, smooth drilling.
					190		
					200		
Circulation over shift change to prevent clay from squeezing rods.					206		As above.
					220		Drilling conditions indicate hard and soft material. Tricone plugging. Probably a few rocks in with clay & sand.
							Drilling becomes smooth again. Clay clumps and sand in mud return.
					230		← Hit boulders at 230'. Black rock chips and clay clumps in mud return.
							Possible Till. No clay clumps recovered in mud return.
					238		Bedrock at 238'(?)
					240		

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-707
SHEET 4 of 4

PROJECT Mt. Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE Main Embankment
GROUND ELEVATION
DATE BEGUN July 15/90 DATE FINISHED July 16/90
LOGGED BY KGB / MDG

NOTES Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
					240		
							Smooth tricone drilling. Abundant matic rock chips in cuttings. Rock chips all of the same size and shape — angular ave. 4mm. dia. Seem to be same type. Dence clay till (?)
Casing to 252'. Coring NQ at 252' Tricone bit clogged with grey clay.	29				252		Brown coloured mud return. Recovered only rock frag. (ave. size 4cm width). Several different rock types. No clay present on any of rocks. Rock: green-black, fine-grained w white & black phenocrysts -other rock types recovered, as well. (~ 1-3mm wide)
	0				254		No core return. Screen samples indicate rock frags., sand. No clay chunks found. Mud return grey brown colour. Rough drilling conditions.
	0				256		Very rough drilling conditions. Hitting several boulders. Metallic fibres in mud return indicate core bit is wearing. Rocks must be very hard. Sand & rock chips in return.
Increasing amount of steel chips in mud return. Core bit worn out. Ground condition extremely hard. Drill vibrates when drilling probably because of worn bit, not boulders.	0				257		As above.
					258		E.O.H. at 258'.

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TEST HOLE LOG

TEST HOLE No. 90-711
SHEET 1 of 2

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE S Embankment Monitoring Hole
GROUND ELEVATION
DATE BEGUN July 17/90 DATE FINISHED
LOGGED BY KGB/MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
Tricone 4¾"					0		At Surface: Clay with some silt and sand. Interbedded with sand with some clay and silt. Smooth Drilling Conditions.
SPT at 7'-9'.	92	5/6" 5/6" 6/6" 4/6"		#1	7		Clay with some silt, trace sand and fine-grained gravel. Interbedded with sand with some coarse grained gravel and clay and silt. Sand is fine to med. grained. Both well sorted, moderately graded. Brown colour, cohesive. Sand portion is approx 6" long.
					9		Easy drilling conditions.
SPT at 14'-16'. Last blow count may be high as split spoon was packed so full that the shell was being forced apart.	100	4/6" 2/6" 2/6" 4/6"		#2	14		Interbedded clay and sand layers, as above. Some sections are sandy clay and others are sand, both with some silt and clay and trace gravel. Similar properties as above.
					16		Smooth drilling conditions.
SPT at 22' to 24'	71	6/6" 6/6" 6/6" 8/6"		#3	22		Fine grained sand with some silt and trace clay. Very uniform. Well sorted, med. graded. Dark brown colour, as above. Cohesive, high water content (liquifies when tapped repeatably).
					24		Smooth drilling conditions.
SPT at 32'-34'.	88	2/6" 3/6" 4/6" 5/6"		#4	32		Interbedded clay with some silt / sand with some silt and trace clay. Same properties as above.
					34		
					40		Occasional boulder encountered, otherwise smooth drilling. Mostly sand recovered in mud return, but some clay clumps retrieved. Still in interbedded sand and clay layers.
					44		← Hit boulders at 44'. Rough drilling conditions. Lots of sand (only) in mud return. ⇒ Sand and gravel.
SPT at 48'-50'.	50	12/6" 23/6" 28/6" 27/6"		#5	48		Clean sand with some gravel and trace silt. Sand med. grain size. Gravel is coarse grained (up to 3cm wide). Some cohesion due to silt content. Overall colour is brown. Med. dense, well sorted, poorly graded, uniform.
					50		
					60		Drilling conditions rough. Several boulders encountered. Lots of sand and rock chips in mud return. ⇒ Sand and gravel.
					70		
					80		

KNIGHT AND PIESOLD LTD.
CONSULTING ENGINEERS

TEST HOLE LOG

TEST HOLE No. 90-711
SHEET 2 of 2

PROJECT Mt Milligan
PROJECT No. 1672
LOCATION OF TEST HOLE S Embankment Monitoring Hole
GROUND ELEVATION
DATE BEGUN July 17/90 DATE FINISHED July 18/90
LOGGED BY KGB/MDG

NOTES: Water loss, type and size of hole, drilling method, groundwater level, etc.	CORE RECOVERY %	BLOWS / FOOT	MOISTURE CONTENT %	SAMPLES FOR TESTING	DEPTH (ft)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION OF MATERIAL
					80		Hit hard stratum at 80'. Hard and smooth drilling conditions. Light green mud return. White and green frags in cuttings. Uniform, poorly graded and well sorted, med. grained sand. Ave. size 1mm.
Tricone to 90'. Set casing to 90'. Coring at 90'.					90		
	2				92		Med. to coarse grained sand. Hard and smooth drilling conditions, therefore sand is quite dense. Recovered only a hand full of sand in core tube.
					100		As above. Drilling conditions hard and smooth as before.
RQD = 28%	83				107		
RQD = 17%	83				110		
RQD = 0%	47				112		
RQD = 30%	53				117		
RQD = 45%	95				122		Bedrock: Dark green gabbro with felsic (plag) phenocrysts. Good, hard, quality rock. Broken to 5cm pieces in upper zone, increases in rock quality with depth.
RQD = 43%	85				127		
RQD = 38%	58		133		132		
RQD = 69%	100		$k < 2 \times 10^{-8}$ cm/s		137		
			141		141		E.O.H.
Piezometer installed to 141'. Slotted all along its length. Bentonite seal at surface.							

APPENDIX C

FIELD PERMEABILITY TEST RESULTS FOR MAIN EMBANKMENT SITE

PACKER TESTING CALCULATION SHEET

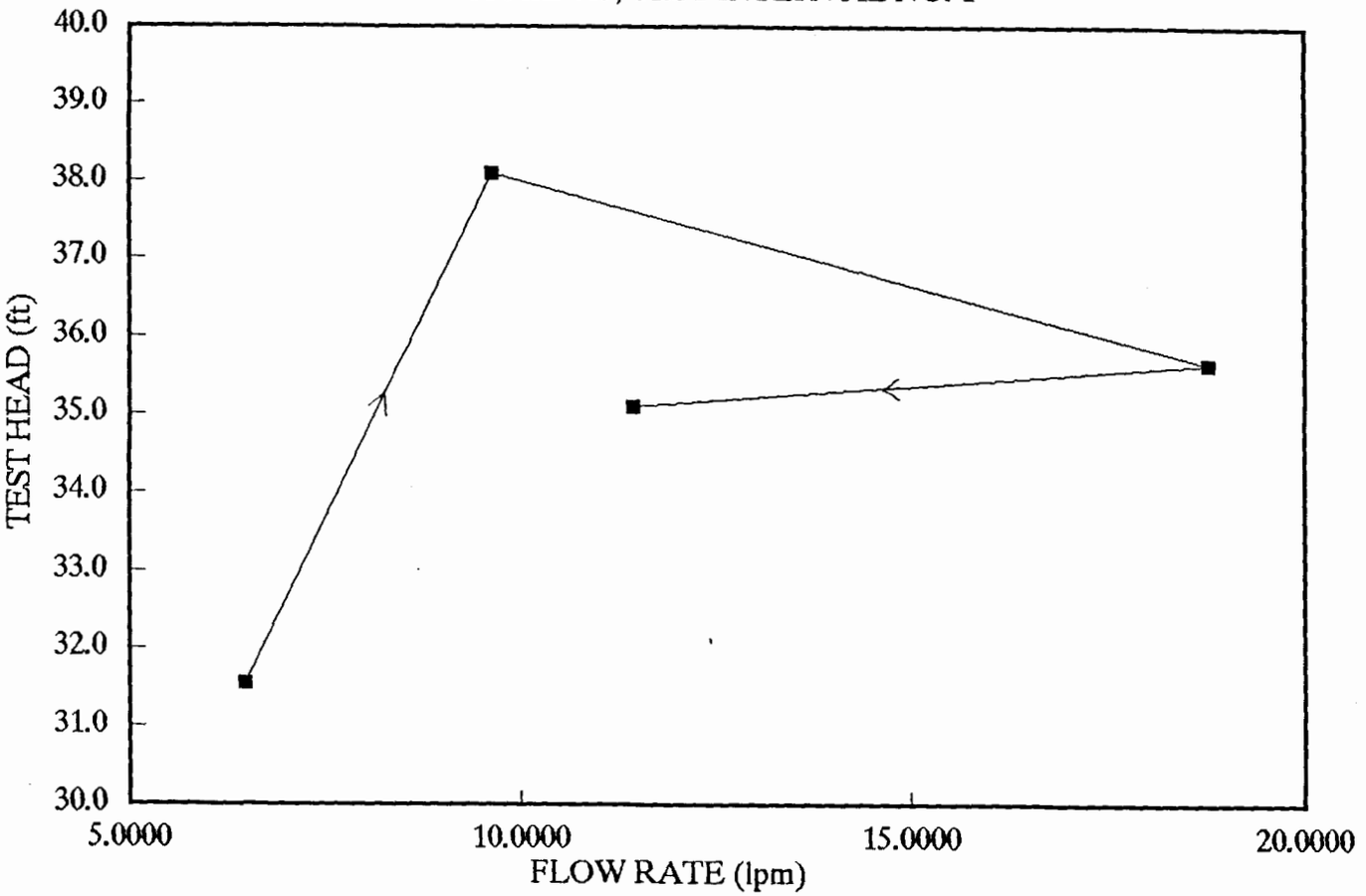
PROJECT: MOUNT MILLIGAN
LOCATION: MAIN EMBANKMENT TAILINGS AREA
HOLE No: 90-685
TEST DATE: JULY 3 to JULY 5, 1990
COORDINATES(m) N: 6 113 340 E: 442 330
REF. ELEV.(m) 1019.58

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW PRESSURE GAUGE (ft): 68
BEDROCK DEPTH(ft): NONE
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0
HEIGHT OF PRESSURE GAUGE ABOVE GROUND(ft): 7

TEST No.	INTERVAL below grd(ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	19	27	6.80	39.17	5	6.474	5.0	10.0	31.5	3.1E-04	Pebbles, clay and silt
1	19	27	6.20	54.35	5	9.630	10.0	15.0	38.1	3.8E-04	
1	19	27	567.50	623.80	3	18.767	15.0	29.0	35.6	7.8E-04	
1	19	27	633.80	691.00	5	11.440	10.0	18.0	35.1	4.8E-04	
2	44	52	790.00	900.00	5	22.000	9.0	32.0	43.8	7.5E-04	Coarse sand and silt
3	64	72	4.49	4.51	5	0.004	12.0	0.0	95.7	6.2E-08	[illegible]
3	64	72	900.00	975.75	5	15.150	21.0	23.0	93.5	2.4E-04	Extremely Permeable
3	64	72	30.50	212.00	5	36.300	36.0	59.0	92.1	5.9E-04	(possible loss of
3	64	72	224.00	332.20	5	21.640	22.0	32.0	86.8	3.7E-04	packer seal)
3	64	72	339.00	364.30	5	5.060	12.0	7.5	88.2	8.5E-05	
4	74	82	521.00	644.3	5	24.660	12.0	37.0	58.7	6.2E-04	Clay and silt
4	74	82	5871.80	6076.20	5	40.880	27.0	70.0	60.4	1.0E-03	Extremely Permeable
4	74	82	103.50	357.00	5	50.700	40.0	94.0	66.4	1.1E-03	
4	74	82	386.00	595.80	5	41.960	27.0	71.0	59.4	1.1E-03	
4	74	82	620.00	758.50	5	27.700	12.0	42.0	53.7	7.7E-04	
5	119	127	781.50	816.10	5	6.920	21.0	12.0	104.5	9.8E-05	Pebbles and clay
5	119	127	820.50	913.80	5	18.660	43.0	29.0	138.3	2.0E-04	with some sand
5	119	127	6923.50	7062.40	5	27.780	64.0	42.0	173.8	2.4E-04	(TILL)
5	119	127	72.00	186.00	5	22.800	43.0	34.0	133.3	2.5E-04	
5	119	127	194.00	266.23	5	14.446	21.0	23.0	93.5	2.3E-04	
6	169	177	5.52	5.52	5	0.000	31.0	0.0	139.6	0.0E+00	Pebbles and clay
6	169	177	8.85	11.81	5	0.592	60.0	0.0	206.6	4.3E-06	with some sand
6	169	177	4.50	22.45	5	3.590	88.0	0.0	271.2	2.0E-05	(TILL)
6	169	177	23.00	25.44	5	0.488	58.0	0.0	201.9	3.6E-06	
6	169	177	25.40	26.28	5	0.176	31.0	0.0	139.6	1.9E-06	
7	198	206	319.20	352.00	5	6.560	35.0	10.0	138.8	7.0E-05	Clay and pebbles
7	198	206	363.50	425.60	5	12.420	68.0	19.0	206.0	9.0E-05	with some silt
7	198	206	437.00	541.80	5	20.960	104.0	30.0	278.2	1.1E-04	(TILL)
7	198	206	558.70	651.20	5	18.500	70.0	29.0	200.7	1.4E-04	
7	198	206	659.00	718.70	5	11.940	35.0	19.0	129.8	1.4E-04	

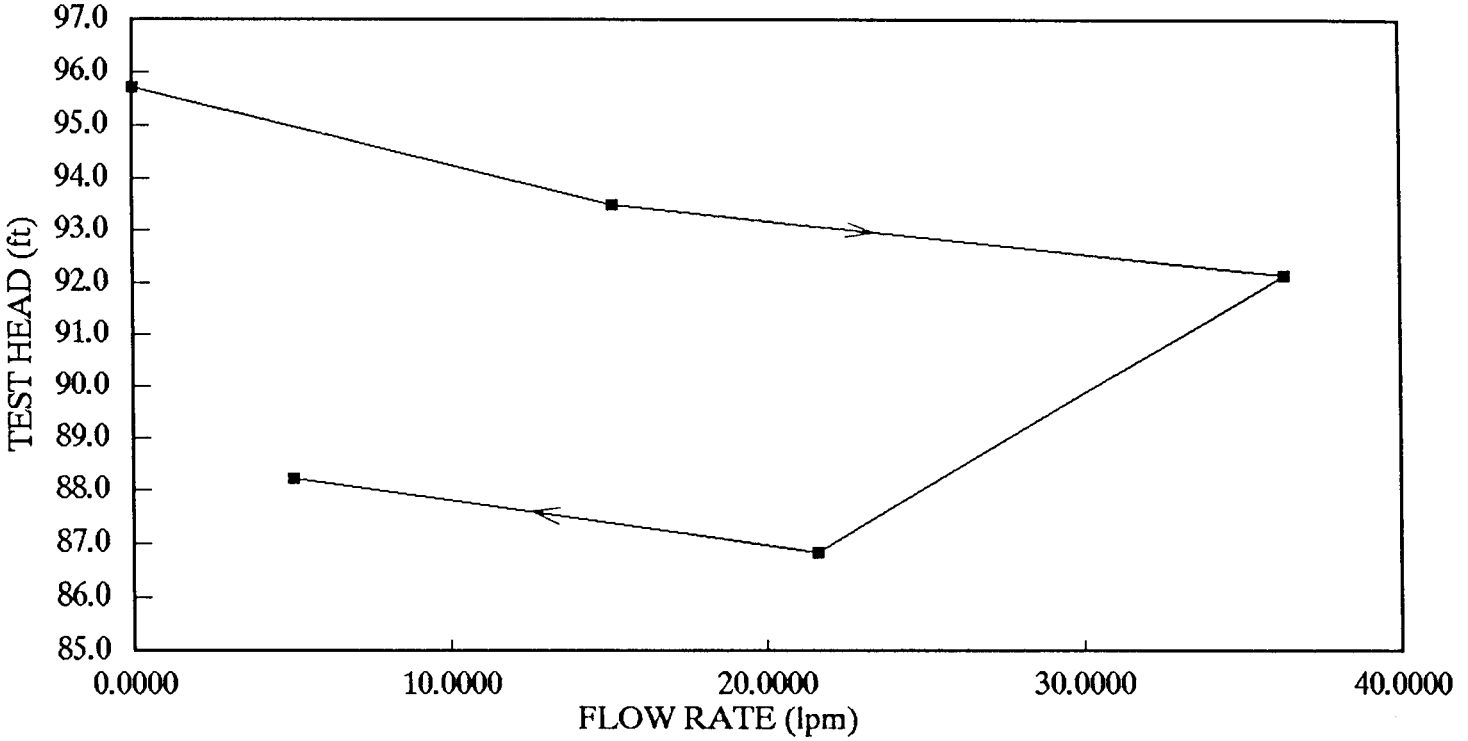
MT MILLIGAN PACKER TEST RESULTS

HOLE 685, TEST INTERVAL NO. 1



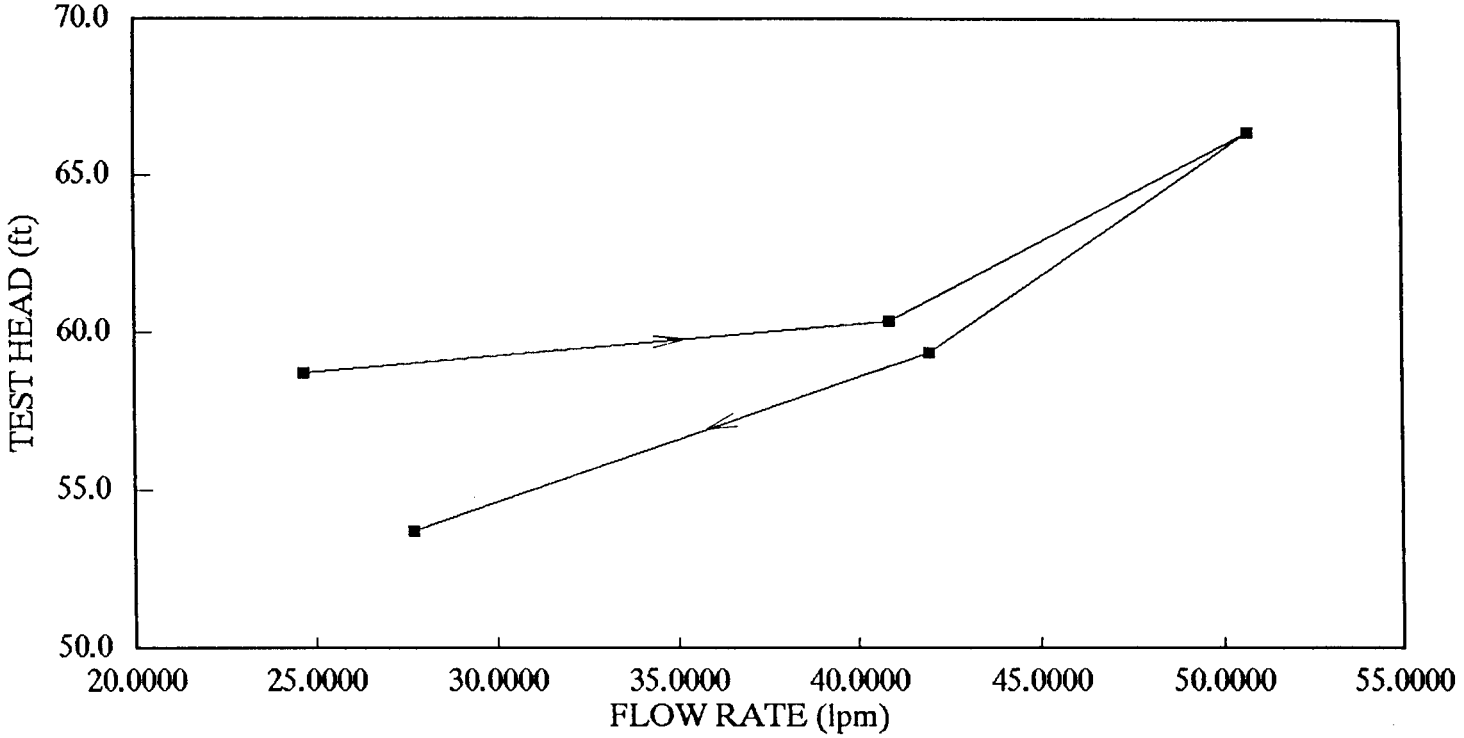
MT MILLIGAN PACKER TEST RESULTS

HOLE 685, TEST INTERVAL NO. 3



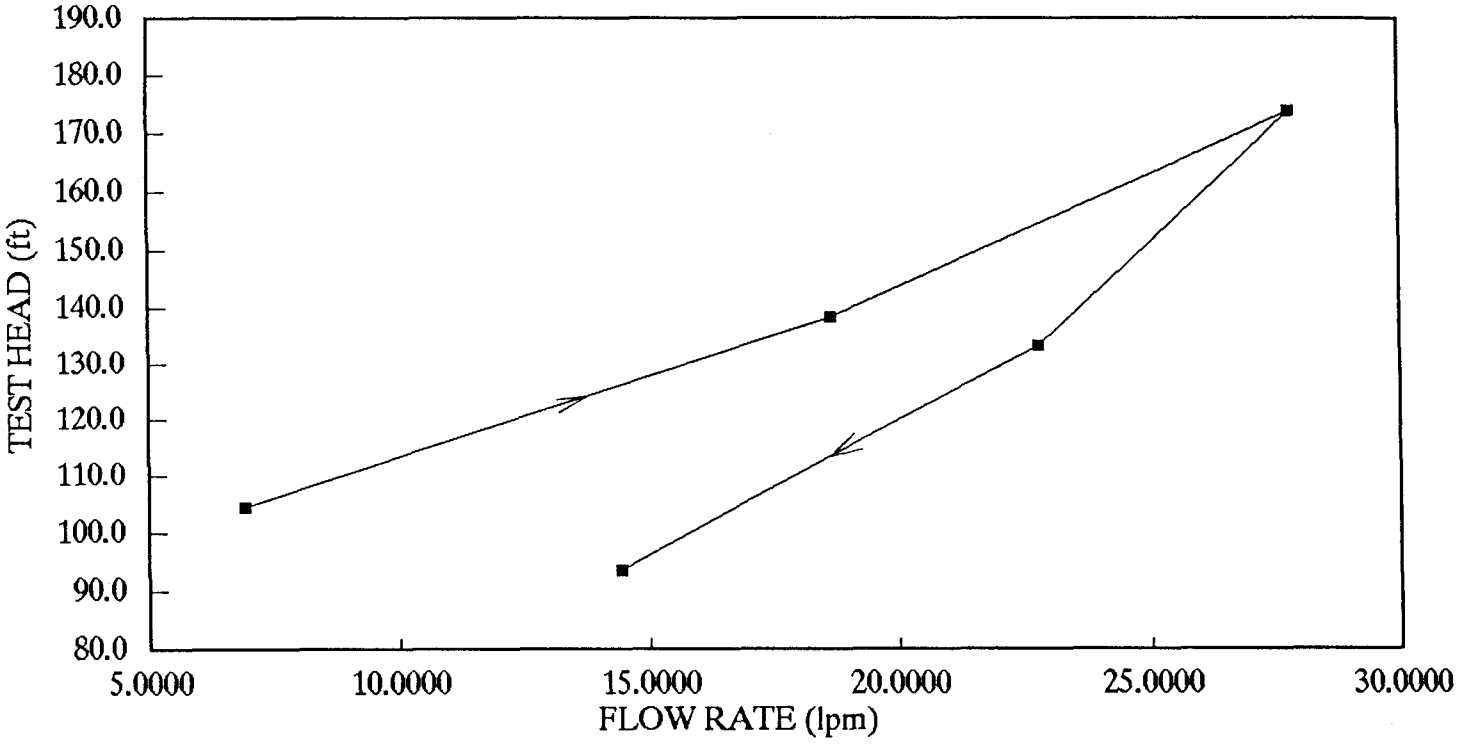
MT MILLIGAN PACKER TEST RESULTS

HOLE 685, TEST INTERVAL NO. 4



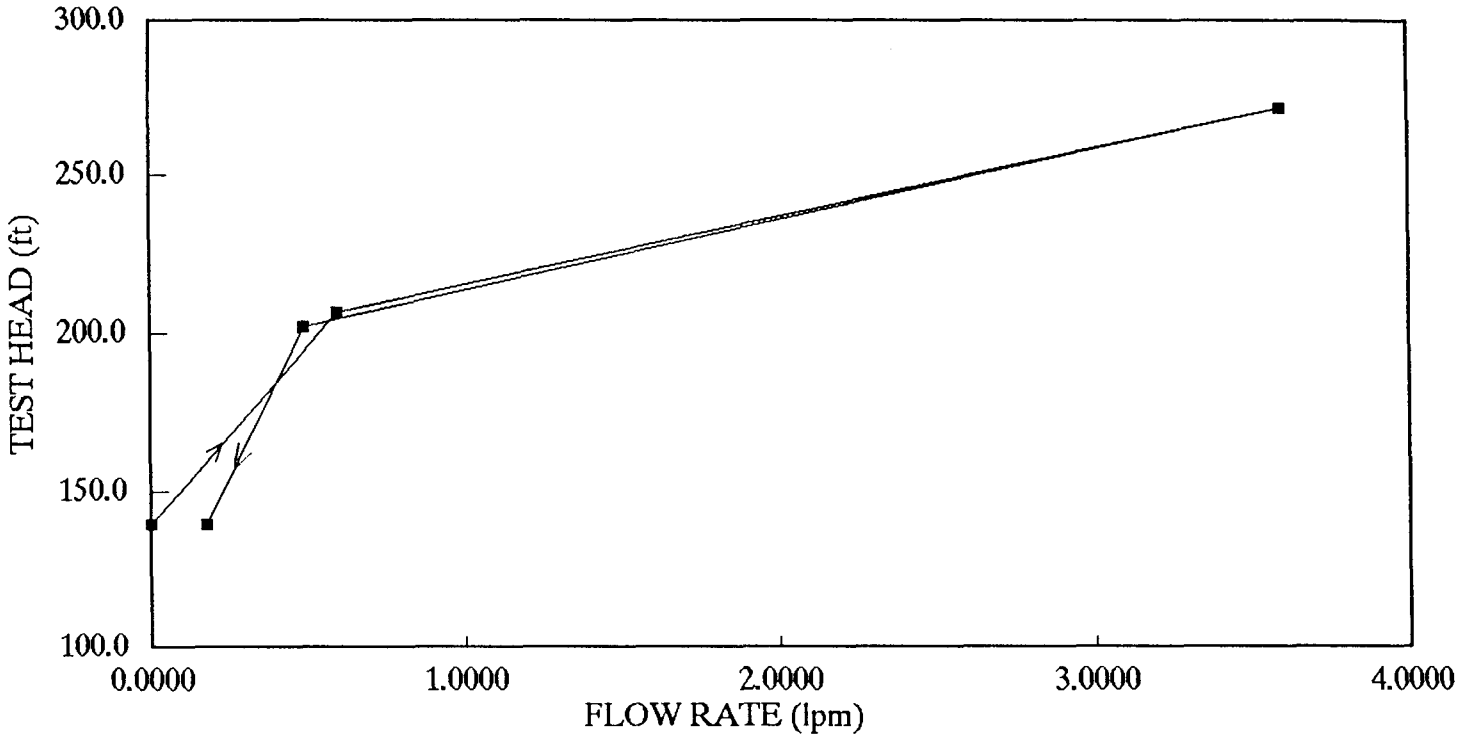
MT MILLIGAN PACKER TEST RESULTS

HOLE 685, TEST INTERVAL NO. 5



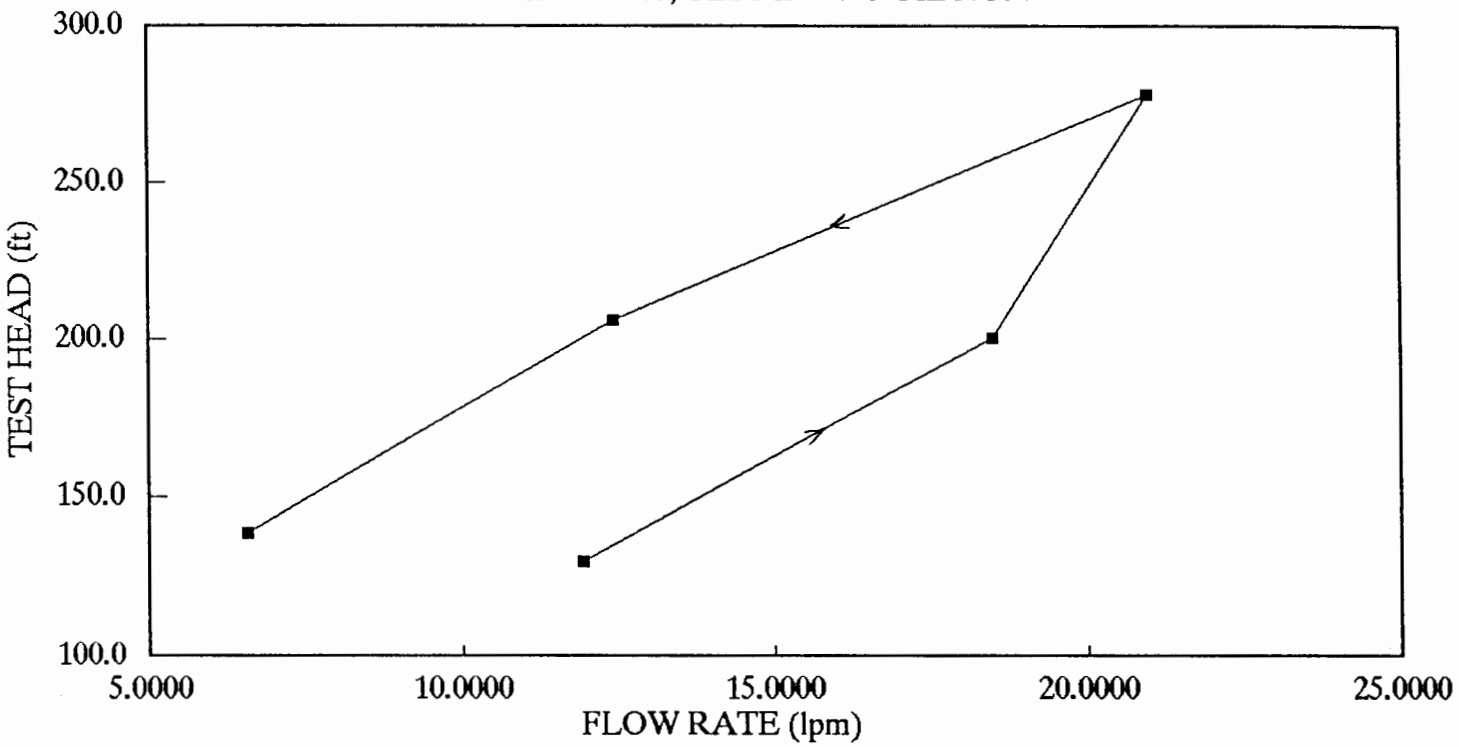
MT MILLIGAN PACKER TEST RESULTS

HOLE 685, TEST INTERVAL NO. 6



MT MILLIGAN PACKER TEST RESULTS

HOLE 685, TEST INTERVAL NO. 7



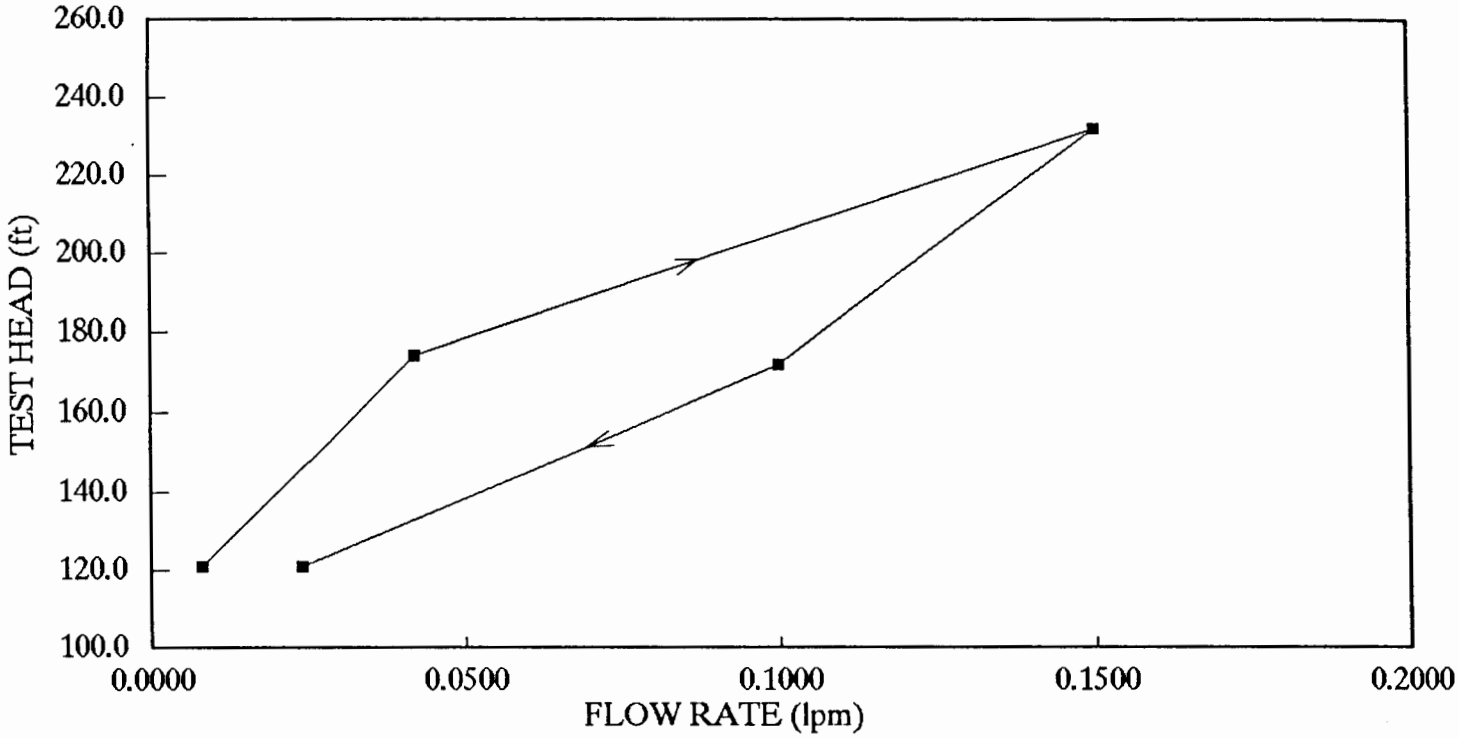
PACKER TESTING CALCULATION SHEET

PROJECT:	MOUNT MILLIGAN	HOLE DIAMETER (inches):	2.98
LOCATION:	MAIN EMBANKMENT TAILINGS AREA	DEPTH TO GDW TABLE BELOW PRESSURE GAUGE (ft)	68
HOLE No:	90-690	BEDROCK DEPTH(ft):	178
TEST DATE:	JULY 6 to JULY 8, 1990	TESTED BY:	KGB/MDG
COORDINATES(m) N:	6 113 160 E: 442 105	ANGLE FROM VERTICAL (deg):	0
REF. ELEV.(m)	1036.44	HEIGHT OF PRESSURE GAUGE ABOVE GROUND(ft):	7

TEST No.	INTERVAL below grd(ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	42	57	32.00	49.70	5	3.540	10.0	0.0	79.6	4.1E-05	Clay Pebble Till
1					5	0.000		0.0			
1					5	0.000		0.0			
1					5	0.000		0.0			
1					5	0.000		0.0			
2	134	142	2.80	2.84	5	0.008	23.0	0.0	121.1	9.8E-08	Sandy Clay Till
2	134	142	3.03	3.24	5	0.042	46.0	0.0	174.2	3.6E-07	
2	134	142	3.38	4.13	5	0.150	71.0	0.0	232.0	9.6E-07	
2	134	142	4.12	4.62	5	0.100	45.0	0.0	171.9	8.6E-07	
2	134	142	4.57	4.69	5	0.024	23.0	0.0	121.1	2.9E-07	
3	184	191	2.00	2.31	5	0.062	32.0	0.0	141.9	7.2E-07	Top of Bedrock
3	184	191	2.43	3.34	5	0.182	64.0	0.0	215.8	1.4E-06	
3	184	191	3.50	4.85	5	0.270	96.0	0.0	289.7	1.5E-06	
3	184	191	4.90	5.72	5	0.164	63.0	0.0	213.5	1.3E-06	
3	184	191	5.73	5.73	5	0.000	33.0	0.0	144.2	0.0E+00	
4	214	222	8.22	8.22	5	0.000	37.0	0.0	153.5	0.0E+00	Fractured Bedrock
4	214	222	8.46	8.49	5	0.006	72.0	0.0	234.3	3.8E-08	
4	214	222	8.77	9.00	5	0.046	105.0	0.0	310.5	2.2E-07	
4	214	222	9.00	9.00	5	0.000	73.0	0.0	236.6	0.0E+00	
4	214	222	8.99	8.99	5	0.000	37.0	0.0	153.5	0.0E+00	

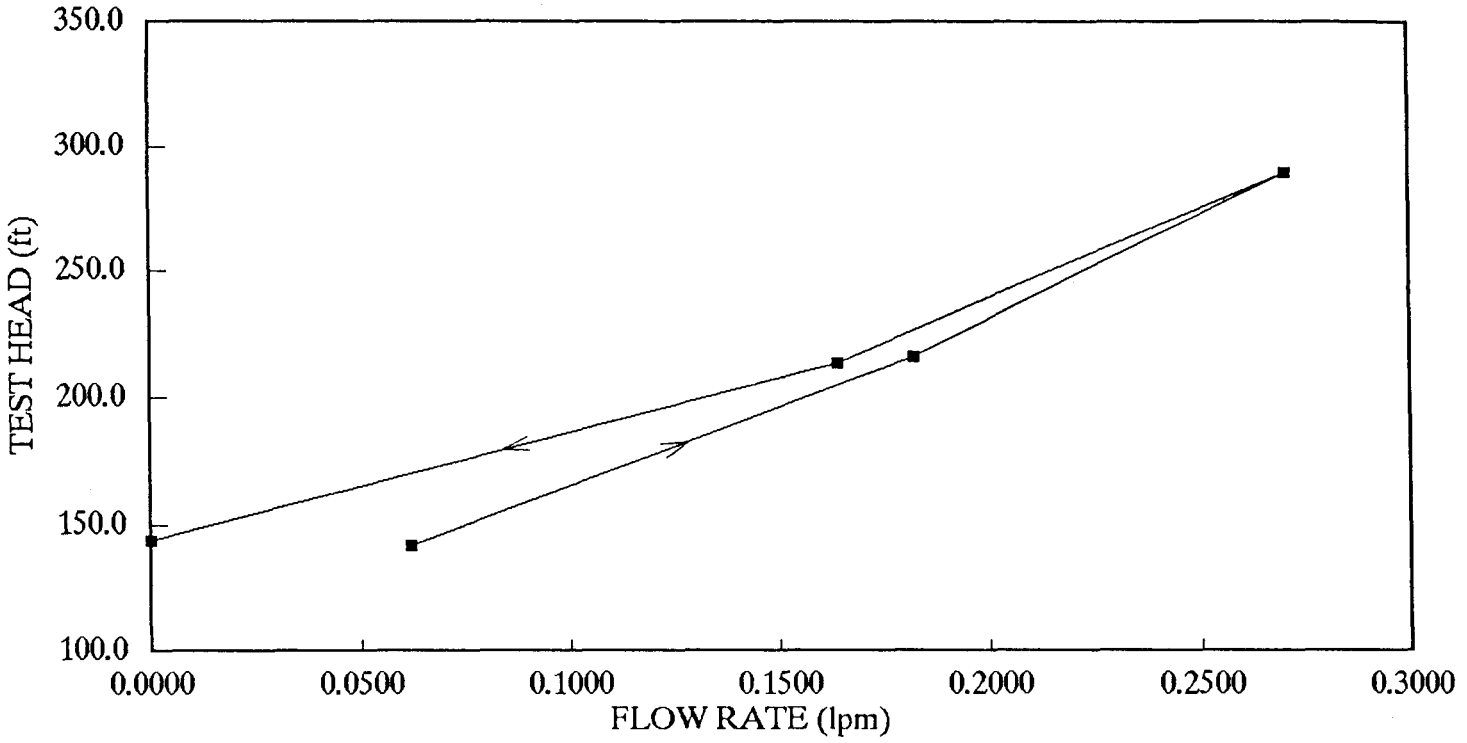
MT MILLIGAN PACKER TEST RESULTS

HOLE 690, TEST INTERVAL NO. 2



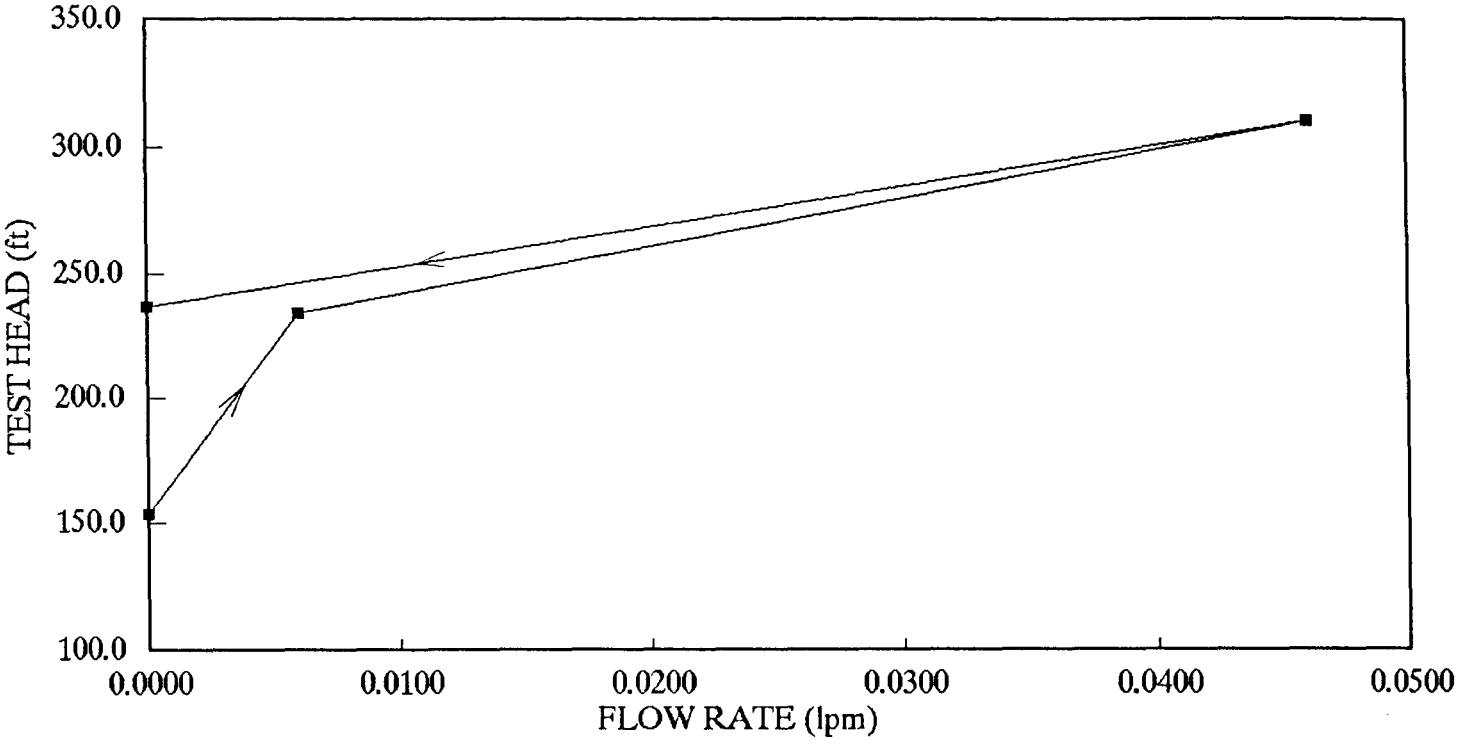
MT MILLIGAN PACKER TEST RESULTS

HOLE 690, TEST INTERVAL NO. 3



MT MILLIGAN PACKER TEST RESULTS

HOLE 690, TEST INTERVAL NO. 4



PACKER TESTING CALCULATION SHEET

PROJECT: MOUNT MILLIGAN
LOCATION: MAIN EMBANKMENT TAILINGS AREA
HOLE No: 90-695
TEST DATE: JULY 8 to JULY 10, 1990
COORDINATES(m) N: 6 114 212 E: 442 113
REF. ELEV.(m) 976.04

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 11
BEDROCK DEPTH(ft): 256
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	44	52	8.71	8.71	5	0.000	10.0	0.0	34.1	0.0E+00	Blue-grey Clay
1	44	52	8.85	8.85	5	0.000	19.0	0.0	54.9	0.0E+00	(impermeable)
1	44	52	8.93	8.93	5	0.000	26.0	0.0	71.0	0.0E+00	
1	44	52	8.85	8.85	5	0.000	18.0	0.0	52.6	0.0E+00	
1	44	52	8.73	8.73	5	0.000	10.0	0.0	34.1	0.0E+00	

PACKER TESTING CALCULATION SHEET

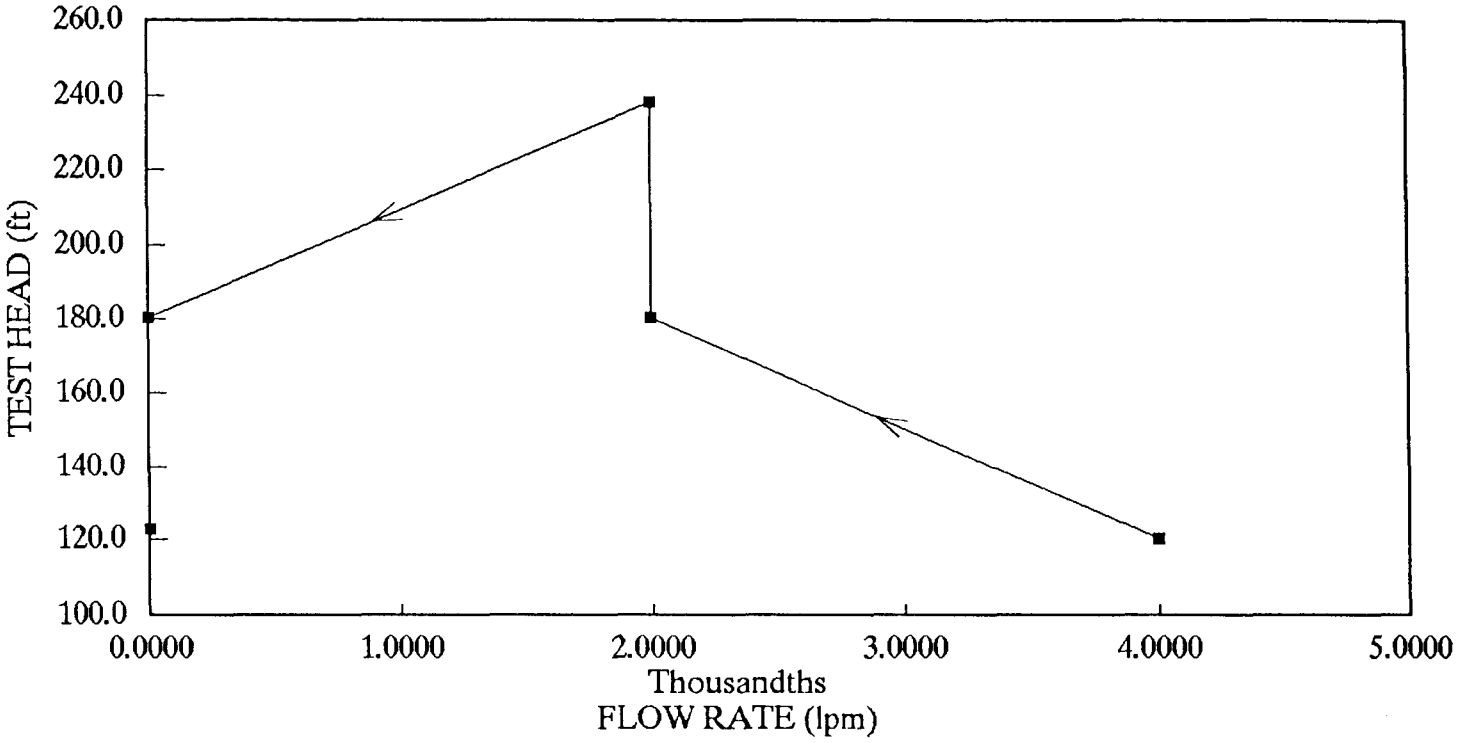
PROJECT: MOUNT MILLIGAN
LOCATION: MAIN EMBANKMENT TAILINGS AREA
HOLE No: 90-698
TEST DATE: JULY 10 to JULY 11, 1990
COORDINATES(m) N: 6 114 090 E: 443 010
REF. ELEV.(m) 1029.86

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 65
BEDROCK DEPTH(ft): 137
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	144	152	2.25	2.27	5	0.004	24.0	0.0	120.4	4.9E-08	Bedrock
1	144	152	2.29	2.30	5	0.002	50.0	0.0	180.5	1.6E-08	
1	144	152	2.35	2.36	5	0.002	75.0	0.0	238.2	1.2E-08	
1	144	152	2.32	2.32	5	0.000	50.0	0.0	180.5	0.0E+00	
1	144	152	2.28	2.28	5	0.000	25.0	0.0	122.7	0.0E+00	
2	164	172	2.90	2.90	5	0.000	29.0	0.0	132.0	0.0E+00	Bedrock
2	164	172	3.13	5.58	5	0.490	57.0	0.0	196.6	3.7E-06	(Poor Quality)
2	164	172	8.00	11.55	5	0.710	86.0	0.0	263.6	4.0E-06	
2	164	172	11.55	11.55	5	0.000	58.0	0.0	198.9	0.0E+00	
2	164	172	11.55	11.55	5	0.000	29.0	0.0	132.0	0.0E+00	

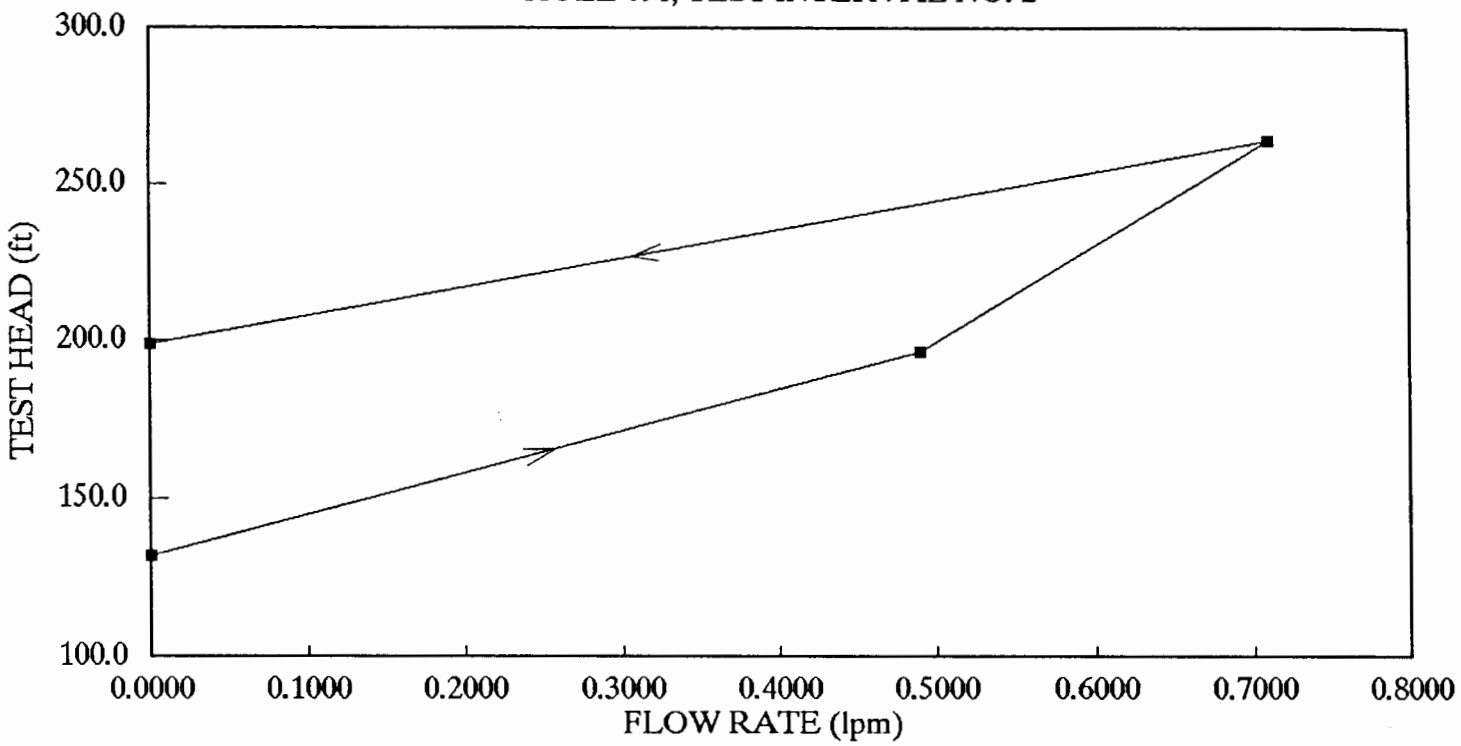
MT MILLIGAN PACKER TEST RESULTS

HOLE 698, TEST INTERVAL NO. 1



MT MILLIGAN PACKER TEST RESULTS

HOLE 698, TEST INTERVAL NO. 2



PACKER TESTING CALCULATION SHEET

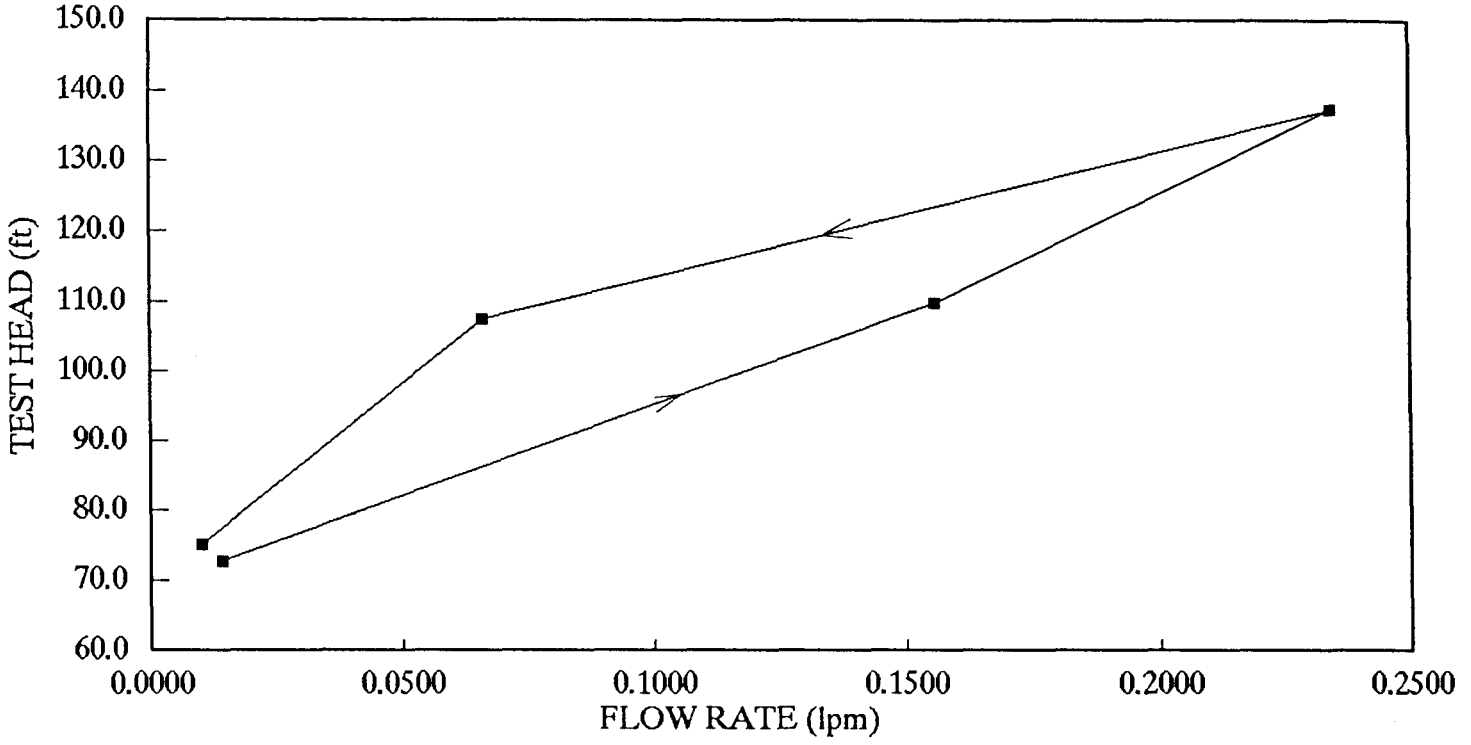
PROJECT: MOUNT MILLIGAN
LOCATION: MAIN EMBANKMENT TAILINGS AREA
HOLE No: 90-700
TEST DATE: JULY 11 to JULY 12, 1990
COORDINATES(m) N: 6 113 750 E: 442 820
REF. ELEV.(m) 1025.82

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 45
BEDROCK DEPTH(ft): None
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	74	82	1.28	1.35	5	0.014	12.0	0.0	72.7	2.9E-07	Blue-grey Clay
1	74	82	1.48	2.26	5	0.156	28.0	0.0	109.7	2.1E-06	
1	74	82	2.45	3.62	5	0.234	40.0	0.0	137.4	2.5E-06	
1	74	82	3.73	4.06	5	0.066	27.0	0.0	107.4	9.1E-07	
1	74	82	4.05	4.10	5	0.010	13.0	0.0	75.0	2.0E-07	

MT MILLIGAN PACKER TEST RESULTS

HOLE 700, TEST INTERVAL NO. 1



PACKER TESTING CALCULATION SHEET

PROJECT: MOUNT MILLIGAN
LOCATION: MAIN EMBANKMENT TAILINGS AREA
HOLE No: 90-705
TEST DATE: JULY 13 to JULY 14, 1990
COORDINATES(m) N: 6 113 475 E: 442 420
REF. ELEV.(m) 983.12

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 5
BEDROCK DEPTH(ft): 165
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	153	161	220.00	340.00	5	24.000	20.0	0.0	51.2	7.0E-04	Clay Till
1	153	161			5	0.000		0.0	5.0	0.0E+00	(Test in error)
1	153	161			5	0.000		0.0	5.0	0.0E+00	
1	153	161			5	0.000		0.0	5.0	0.0E+00	
1	153	161			5	0.000		0.0	5.0	0.0E+00	

PACKER TESTING CALCULATION SHEET

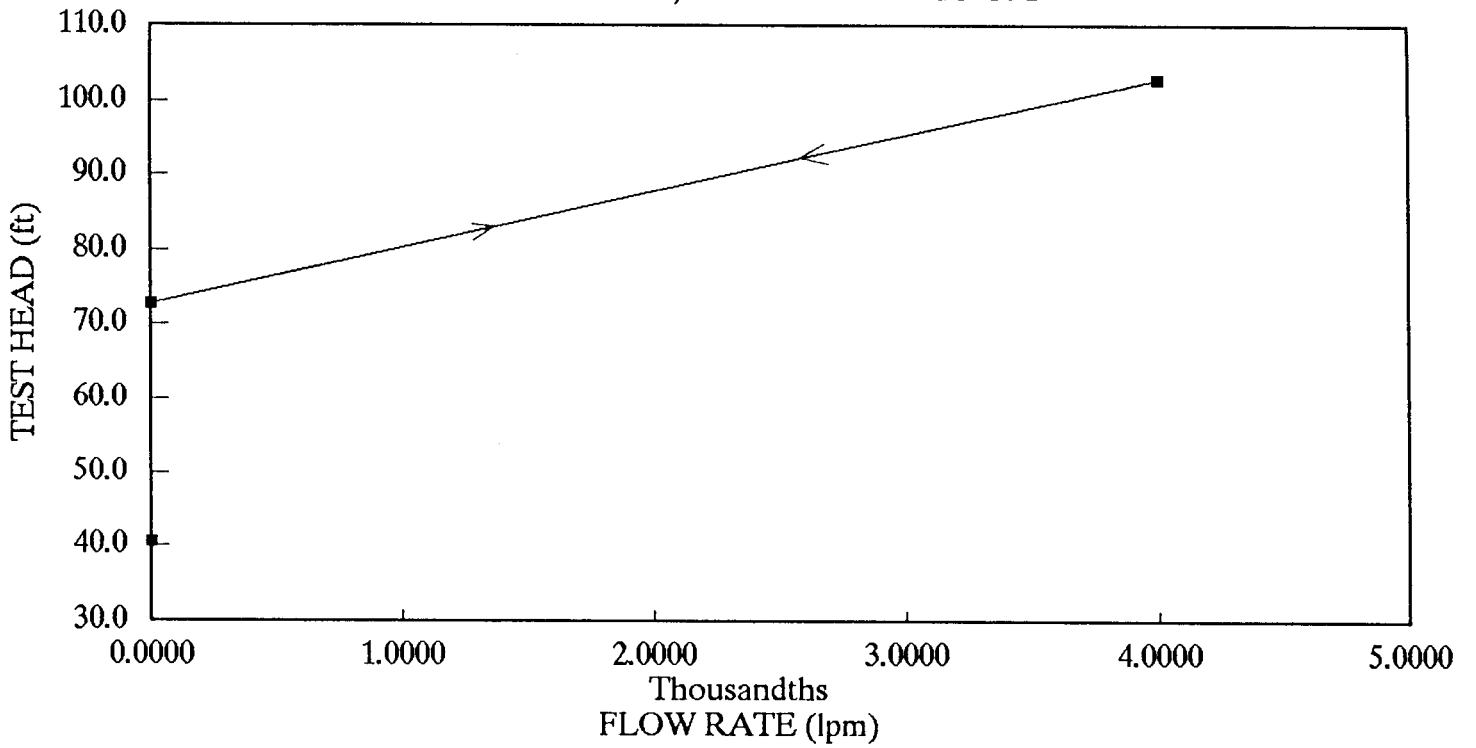
PROJECT: MOUNT MILLIGAN
LOCATION: MAIN EMBANKMENT TAILINGS AREA
HOLE No: 90-707
TEST DATE: JULY 15 to JULY 16, 1990
COORDINATES(m) N: 6 113 600 E: 442 630
REF. ELEV.(m) 989.55

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 10.5
BEDROCK DEPTH(ft): None
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	74	82	0.03	0.03	5	0.000	13.0	0.0	40.5	0.0E+00	Blue-grey Clay
1	74	82	0.08	0.08	5	0.000	27.0	0.0	72.9	0.0E+00	
1	74	82	0.11	0.13	5	0.004	40.0	0.0	102.9	5.8E-08	
1	74	82	0.12	0.12	5	0.000	27.0	0.0	72.9	0.0E+00	
1	74	82	0.12	0.12	5	0.000	13.0	0.0	40.5	0.0E+00	

MT MILLIGAN PACKER TEST RESULTS

HOLE 707, TEST INTERVAL NO. 1



APPENDIX D

FIELD PERMEABILITY TEST RESULTS FOR SOUTH EMBANKMENT SITE

PACKER TESTING CALCULATION SHEET

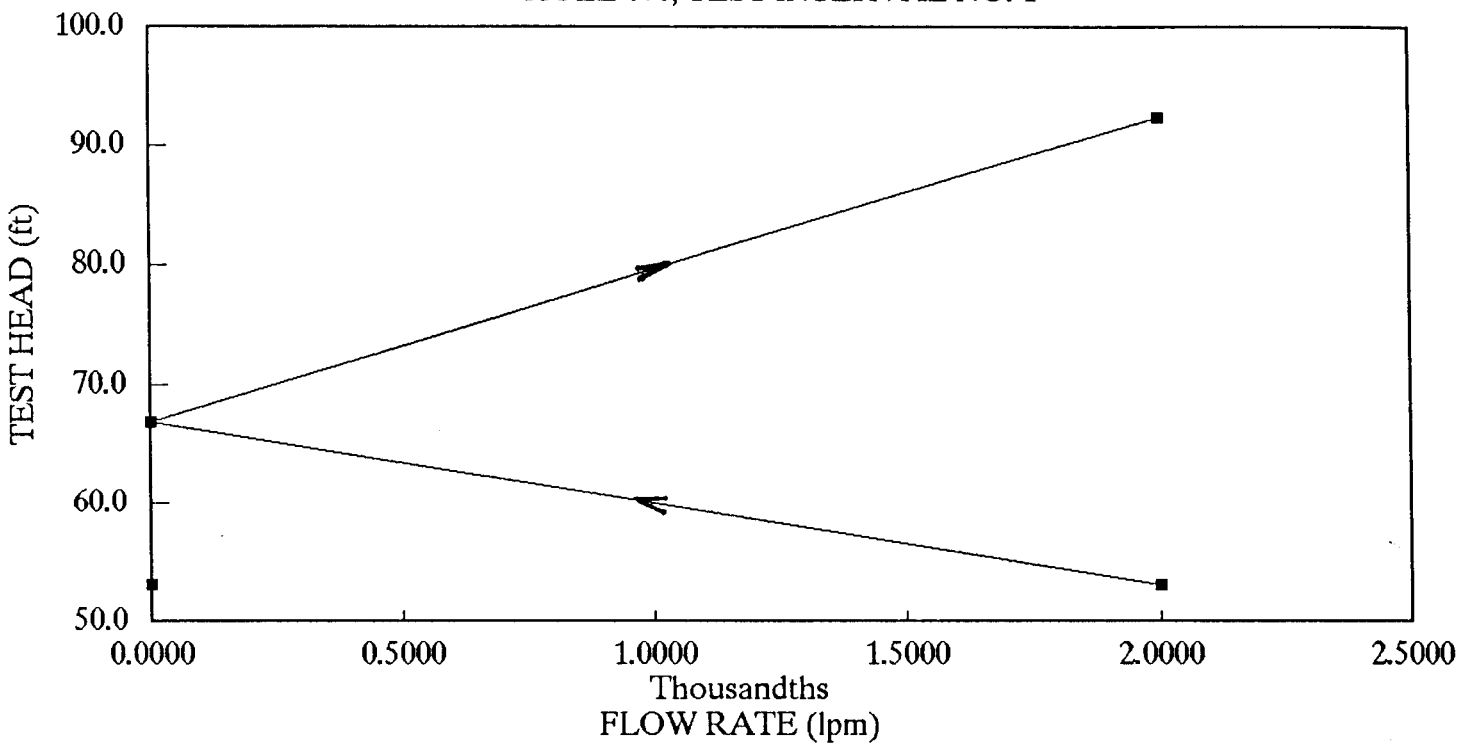
PROJECT: MOUNT MILLIGAN
LOCATION: SOUTH EMBANKMENT TAILINGS AREA
HOLE No: 90-676
TEST DATE: JUNE 27 to JUNE 30, 1990
COORDINATES(m) N: 6 110 475 E: 444 430
REF. ELEV.(m) 1007.33

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 30
BEDROCK DEPTH(ft): 108
TESTED BY: KGB/RNK
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	39	42	1.09	1.10	5	0.002	10.0	0.0	53.1	1.1E-07	Sand and Gravel
1	39	42	1.10	1.10	5	0.000	16.0	0.0	67.0	0.0E+00	
1	39	42	1.12	1.13	5	0.002	27.0	0.0	92.4	6.6E-08	
1	39	42	1.13	1.13	5	0.000	16.0	0.0	67.0	0.0E+00	
1	39	42	1.13	1.13	5	0.000	10.0	0.0	53.1	0.0E+00	
2	49	52	1.38	1.48	5	0.020	10.0	0.0	53.1	1.1E-06	Sand and Gravel
2	49	52	2.45	4.85	5	0.480	20.5	0.0	77.3	1.9E-05	
2	49	52				0.000			30.0	0.0E+00	
2	49	52				0.000			30.0	0.0E+00	
2	49	52				0.000			30.0	0.0E+00	
3	69	72	0.00	250.00	5	50.000	10.0	9.8	43.3	3.5E-03	Gravel and Sand
3	69	72			5	0.000		0.0	30.0	0.0E+00	Very Permeable
3	69	72			5	0.000		0.0	30.0	0.0E+00	(Over 50L/min)
3	69	72			5	0.000		0.0	30.0	0.0E+00	
3	69	72			5	0.000		0.0	30.0	0.0E+00	
4	135	142	2.49	2.52	5	0.006	25.0	0.0	87.7	1.1E-07	Bedrock
4	135	142	2.92	3.03	5	0.022	44.0	0.0	131.6	2.7E-07	(Moderate RQD)
4	135	142	3.21	3.48	5	0.054	66.0	0.0	182.4	4.9E-07	
4	135	142	3.47	3.47	5	0.000	44.0	0.0	131.6	0.0E+00	
4	135	142	3.47	3.47	5	0.000	25.0	0.0	87.7	0.0E+00	
5	165	172	4.90	4.90	5	0.000	29.0	0.0	97.0	0.0E+00	Bedrock
5	165	172	4.94	4.94	5	0.000	58.0	0.0	163.9	0.0E+00	(High RQD)
5	165	172	5.02	5.02	5	0.000	86.0	0.0	228.6	0.0E+00	
5	165	172	5.05	5.05	5	0.000	62.0	0.0	173.2	0.0E+00	
5	165	172	5.02	5.02	5	0.000	31.0	0.0	101.6	0.0E+00	

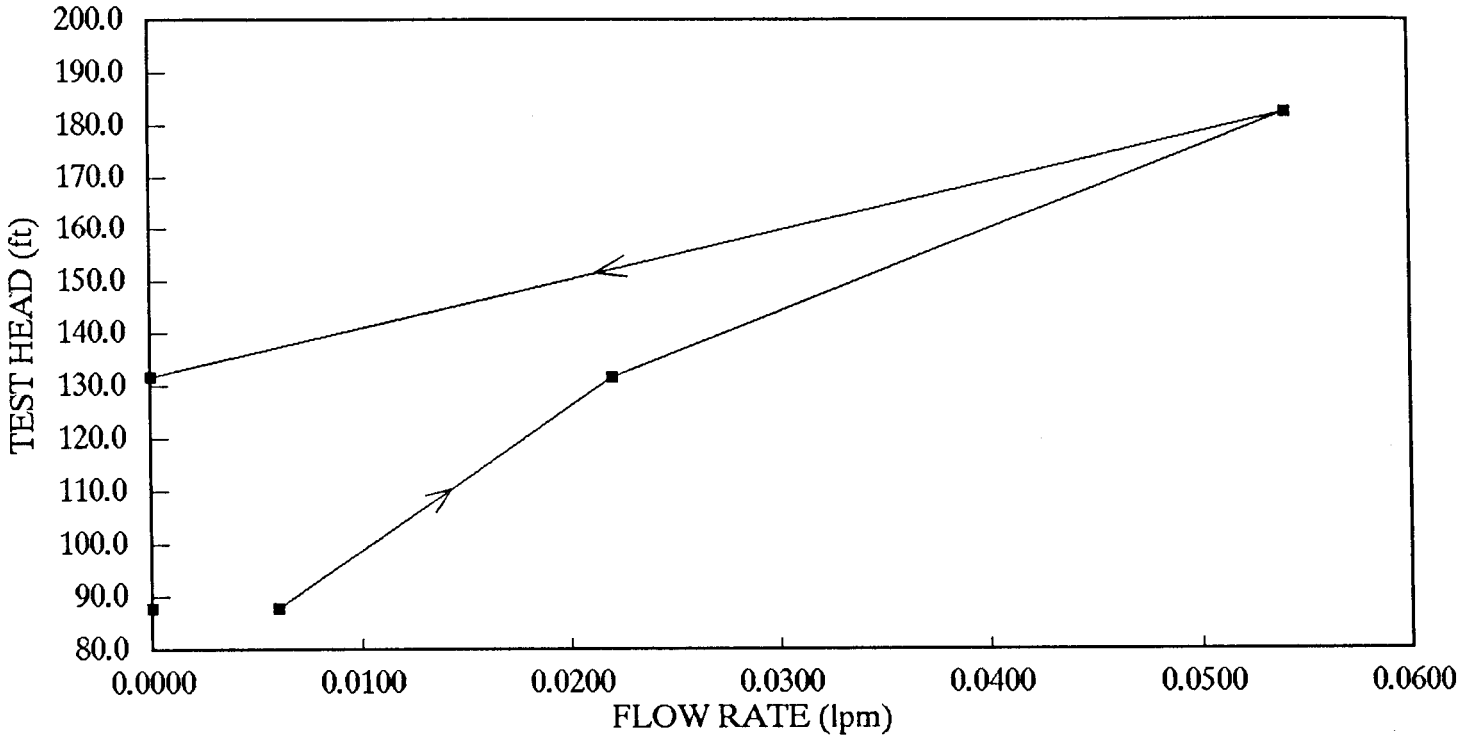
MT MILLIGAN PACKER TEST RESULTS

HOLE 676, TEST INTERVAL NO. 1



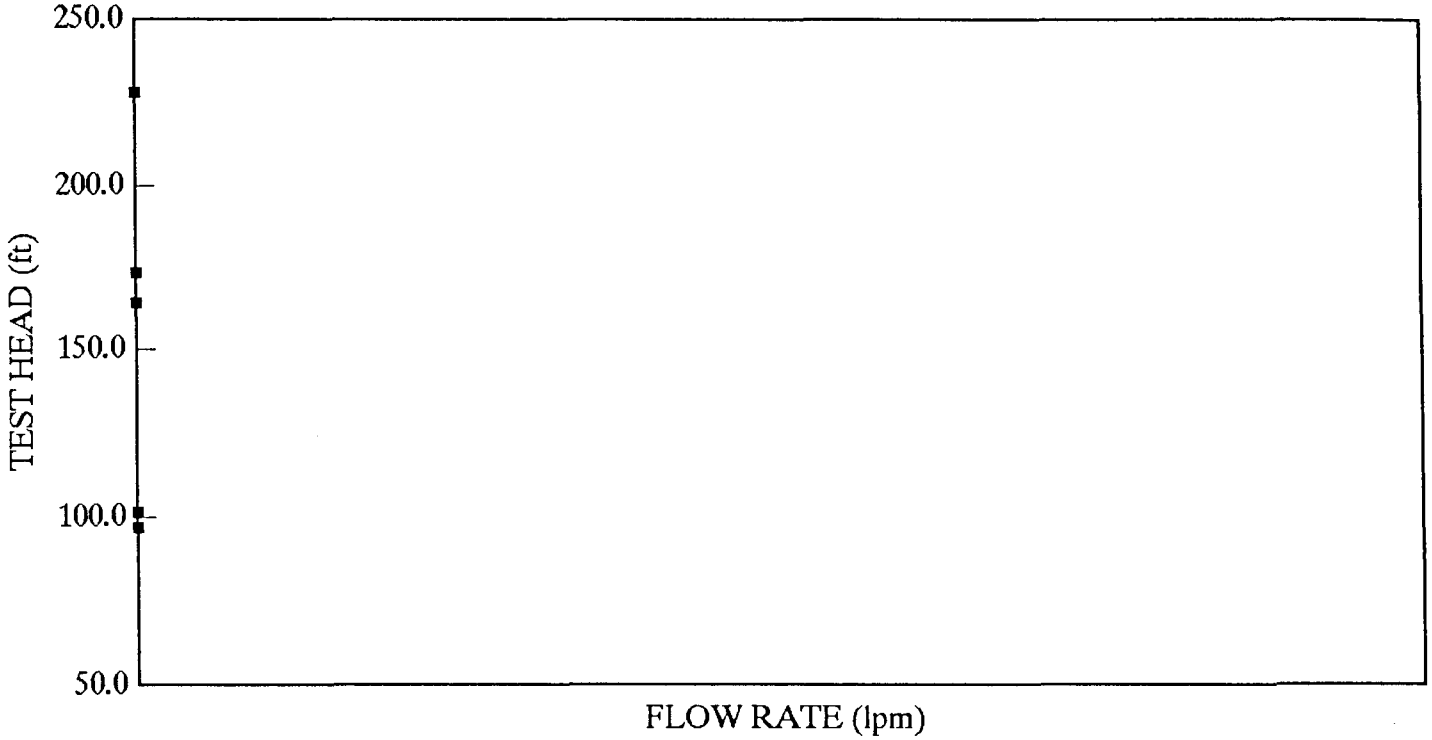
MT MILLIGAN PACKER TEST RESULTS

HOLE 676, TEST INTERVAL NO. 4



MT MILLIGAN PACKER TEST RESULTS

HOLE 676, TEST INTERVAL NO. 5



PACKER TESTING CALCULATION SHEET

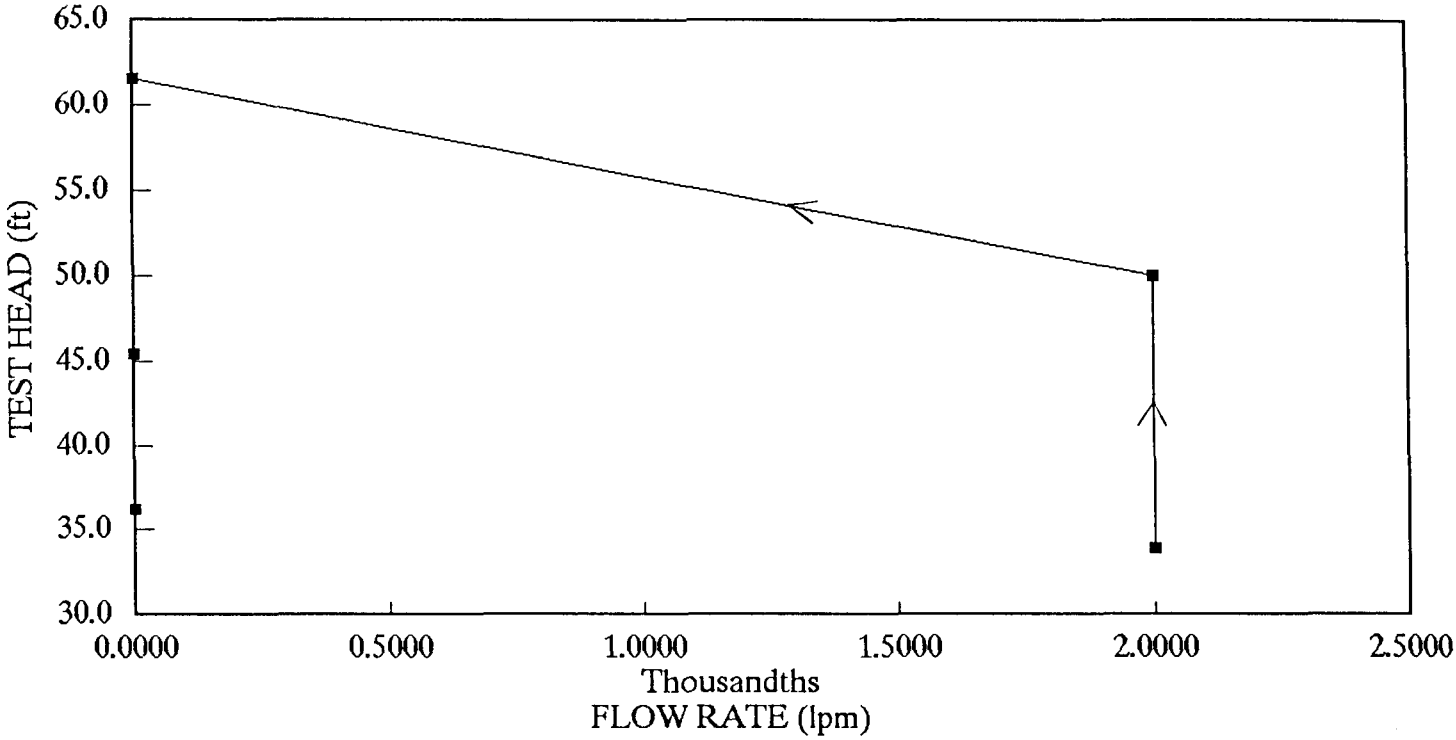
PROJECT: MOUNT MILLIGAN
LOCATION: SOUTH EMBANKMENT TAILINGS AREA
HOLE No: 90-681
TEST DATE: JUNE 30 to JULY 1, 1990
COORDINATES(m) N: 6 110 335 E: 444 540
REF. ELEV.(m) 1017.91

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 20
BEDROCK DEPTH(ft): 82
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	34	42	5.33	5.34	5	0.002	6.0	0.0	33.9	8.8E-08	Sand and silt
1	34	42	5.39	5.40	5	0.002	13.0	0.0	50.0	5.9E-08	with some gravel
1	34	42	5.43	5.43	5	0.000	18.0	0.0	61.6	0.0E+00	and trace clay
1	34	42	5.43	5.43	5	0.000	11.0	0.0	45.4	0.0E+00	(impervious)
1	34	42	5.43	5.43	5	0.000	7.0	0.0	36.2	0.0E+00	
2	64	72	7.30	7.31	5	0.002	12.0	0.0	47.7	6.2E-08	Bedrock
2	64	72	7.35	7.37	5	0.004	23.0	0.0	73.1	8.1E-08	(moderate RQD)
2	64	72	7.41	7.43	5	0.004	33.0	0.0	96.2	6.2E-08	
2	64	72	7.57	7.57	5	0.000	24.0	0.0	75.4	0.0E+00	
2	64	72	7.57	7.57	5	0.000	12.0	0.0	47.7	0.0E+00	
3	125	132	1.23	1.26	5	0.006	22.0	0.0	70.8	1.4E-07	Bedrock
3	125	132	1.33	2.28	5	0.190	45.0	0.0	123.9	2.5E-06	(moderate RQD)
3	125	132	2.56	3.77	5	0.242	66.0	0.0	172.4	2.3E-06	
3	125	132	3.87	4.63	5	0.152	44.0	0.0	121.6	2.1E-06	
3	125	132	4.67	4.87	5	0.040	22.0	0.0	70.8	9.3E-07	

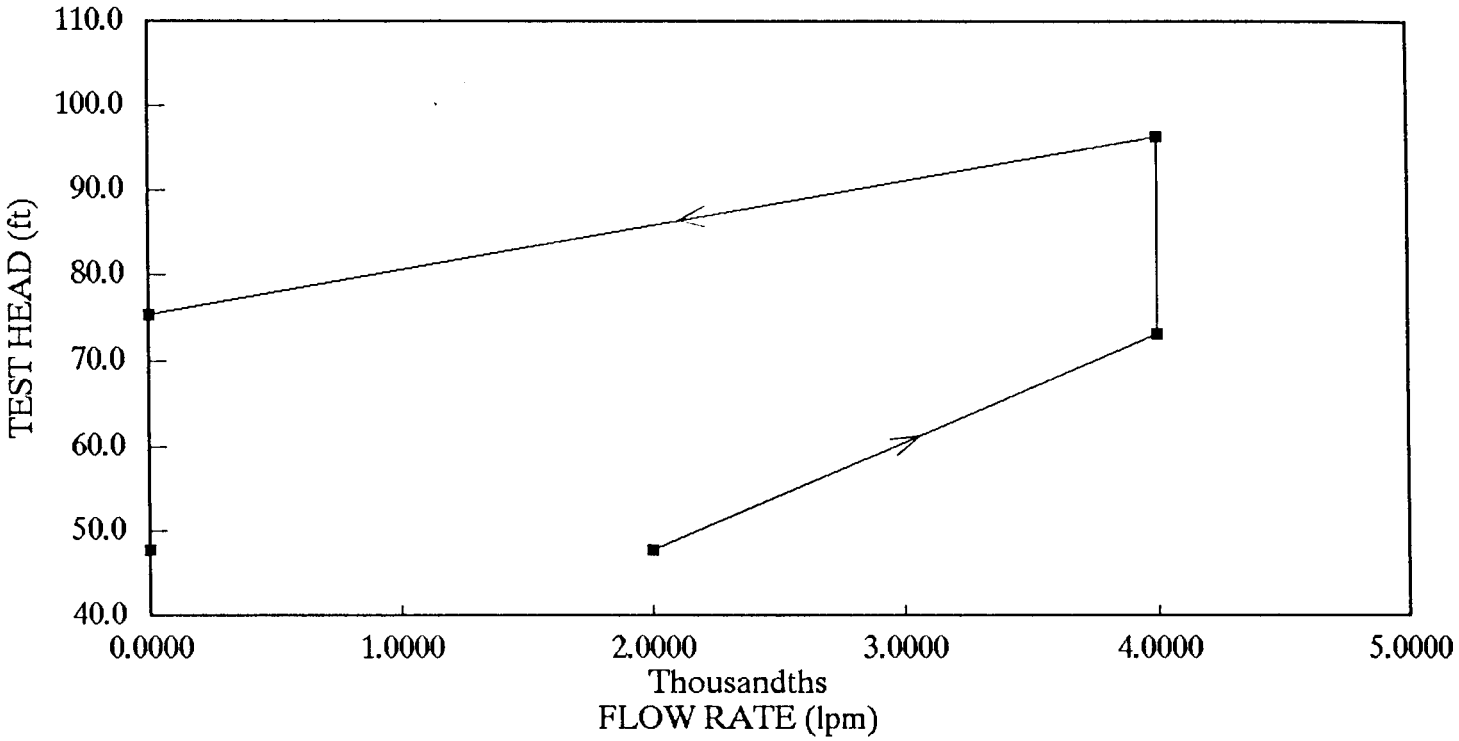
MT MILLIGAN PACKER TEST RESULTS

HOLE 681, TEST INTERVAL NO. 1



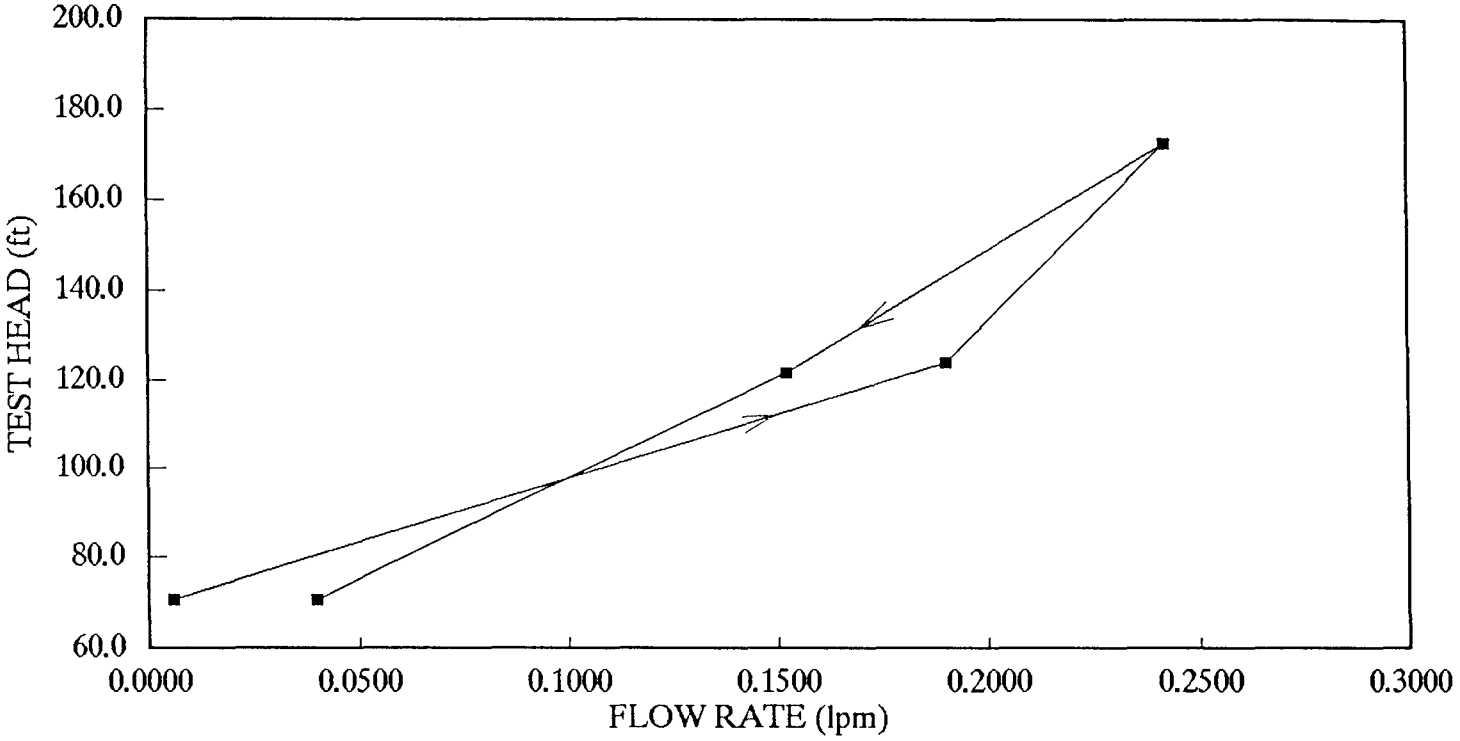
MT MILLIGAN PACKER TEST RESULTS

HOLE 681, TEST INTERVAL NO. 2



MT MILLIGAN PACKER TEST RESULTS

HOLE 681, TEST INTERVAL NO. 3



PACKER TESTING CALCULATION SHEET

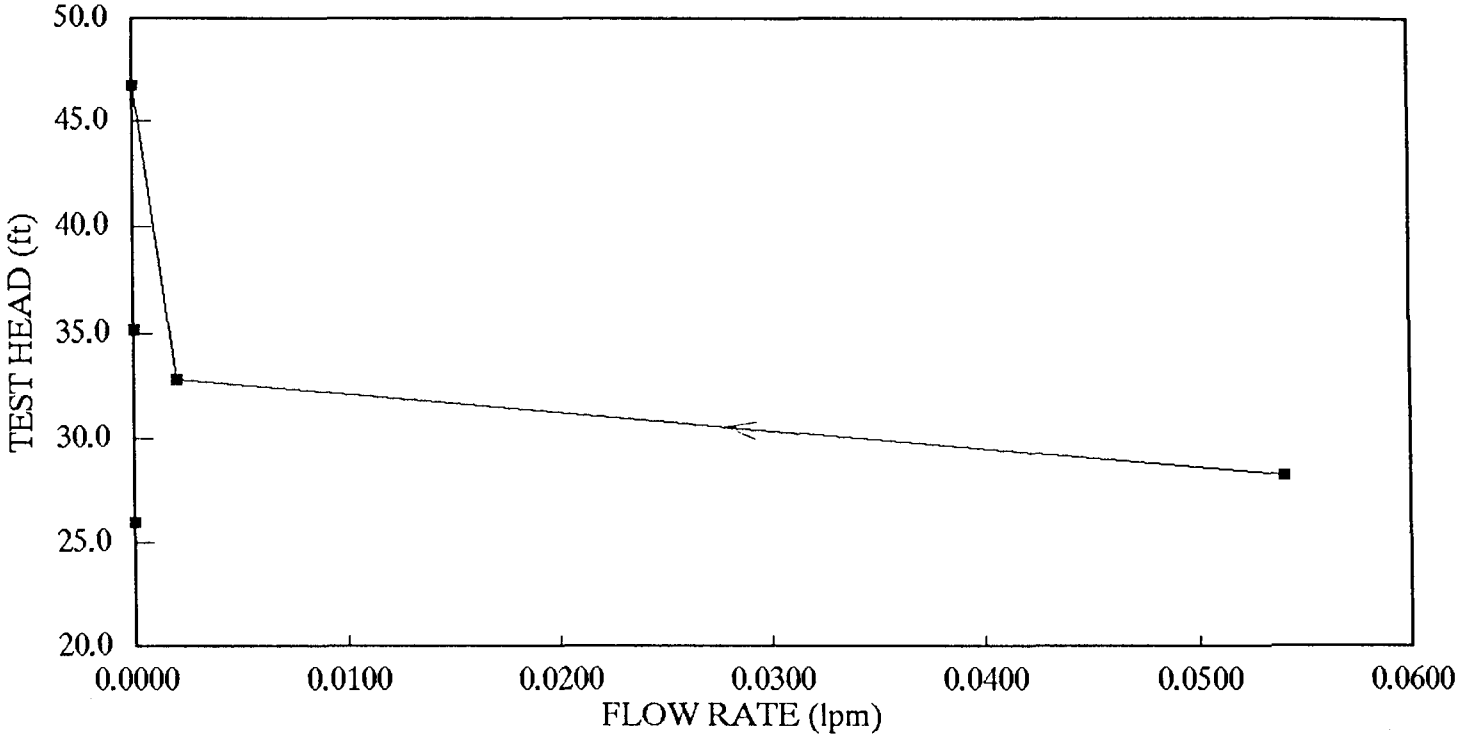
PROJECT: MOUNT MILLIGAN
LOCATION: SOUTH EMBANKMENT TAILINGS AREA
HOLE No: 90-682
TEST DATE: JULY 1 to JULY 2, 1990
COORDINATES(m) N: 6 110 620 E: 444 335
REF. ELEV.(m) 1011.42

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 19
BEDROCK DEPTH(ft): 7
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	14	22	2.91	3.18	5	0.054	4.0	0.0	28.2	2.8E-06	Fractured Bedrock
1	14	22	3.18	3.19	5	0.002	6.0	0.0	32.9	9.0E-08	(low RQD)
1	14	22	3.19	3.19	5	0.000	12.0	0.0	46.7	0.0E+00	
1	14	22	3.19	3.19	5	0.000	7.0	0.0	35.2	0.0E+00	
1	14	22	3.19	3.19	5	0.000	3.0	0.0	25.9	0.0E+00	
2	34	42	3.75	6.10	5	0.470	7.0	0.0	35.2	2.0E-05	Fractured Bedrock
2	34	42	6.27	8.69	5	0.484	14.0	0.0	51.3	1.4E-05	(low RQD)
2	34	42	8.94	12.45	5	0.702	21.0	0.0	67.5	1.5E-05	
2	34	42	2.63	4.52	5	0.378	13.0	0.0	49.0	1.1E-05	
2	34	42	4.63	5.43	5	0.160	8.0	0.0	37.5	6.3E-06	
3	52	60	3.00	4.63	5	0.326	10.0	0.0	42.1	1.2E-05	Fractured Bedrock
3	52	60	5.25	10.75	5	1.100	20.0	0.0	65.2	2.5E-05	(moderate RQD)
3	52	60	1.70	14.27	5	2.514	30.0	0.0	88.3	4.2E-05	
3	52	60	5.30	14.64	5	1.868	20.0	0.0	65.2	4.3E-05	
3	52	60	6.55	12.93	5	1.276	10.0	0.0	42.1	4.5E-05	
4	73	81	7.21	7.24	5	0.006	13.0	0.0	49.0	1.8E-07	Bedrock
4	73	81	7.29	7.92	5	0.126	28.0	0.0	83.7	2.2E-06	(moderate RQD)
4	73	81	8.11	8.80	5	0.138	41.0	0.0	113.7	1.8E-06	
4	73	81	8.87	9.47	5	0.120	29.0	0.0	86.0	2.1E-06	
4	73	81	9.58	9.84	5	0.052	13.0	0.0	49.0	1.6E-06	
5	92	100	3.79	5.06	5	0.254	17.0	0.0	58.3	6.5E-06	Bedrock
5	92	100	5.32	7.01	5	0.338	33.0	0.0	95.2	5.3E-06	(moderate RQD)
5	92	100	7.23	9.76	5	0.506	50.0	0.0	134.5	5.6E-06	
5	92	100	10.00	11.70	5	0.340	32.0	0.0	92.9	5.4E-06	
5	92	100	11.83	13.11	5	0.256	17.0	0.0	58.3	6.5E-06	

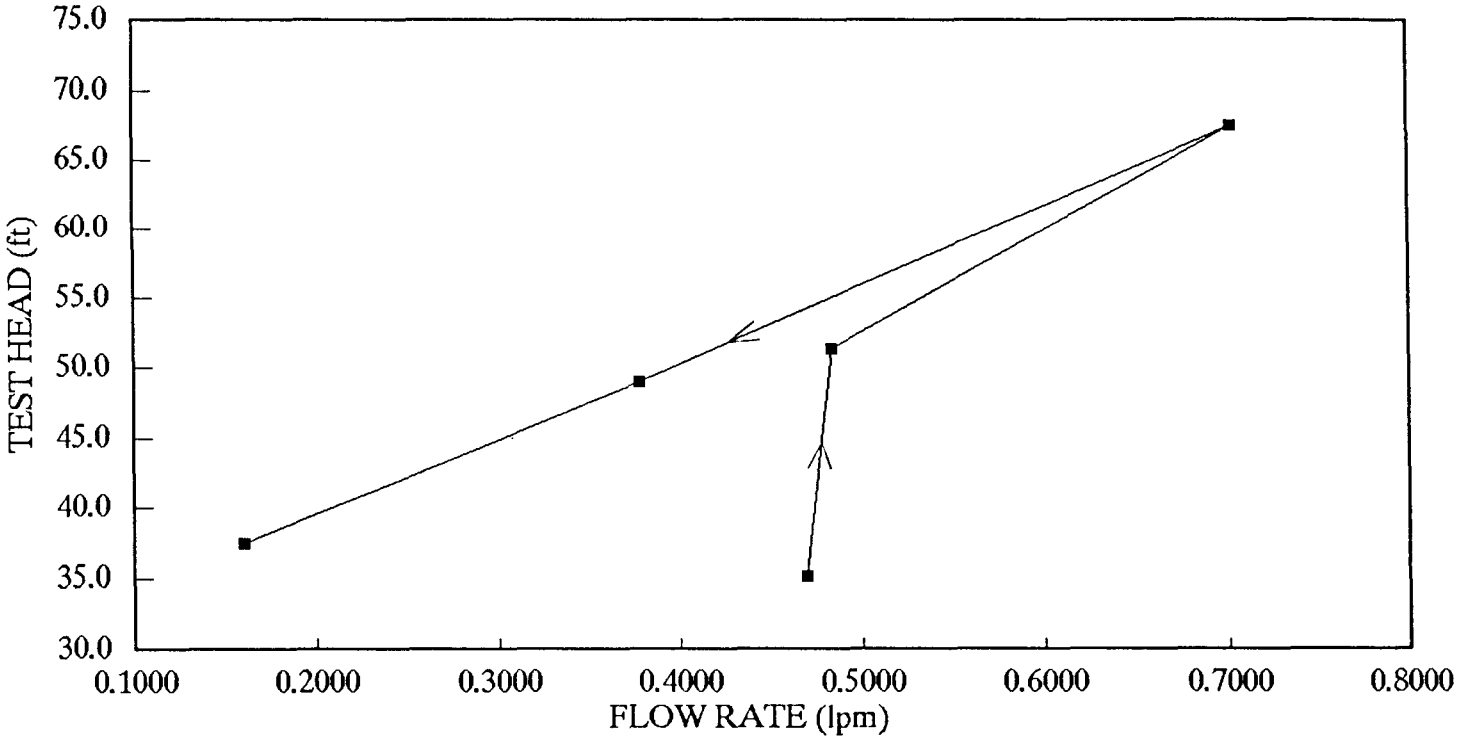
MT MILLIGAN PACKER TEST RESULTS

HOLE 682, TEST INTERVAL NO. 1



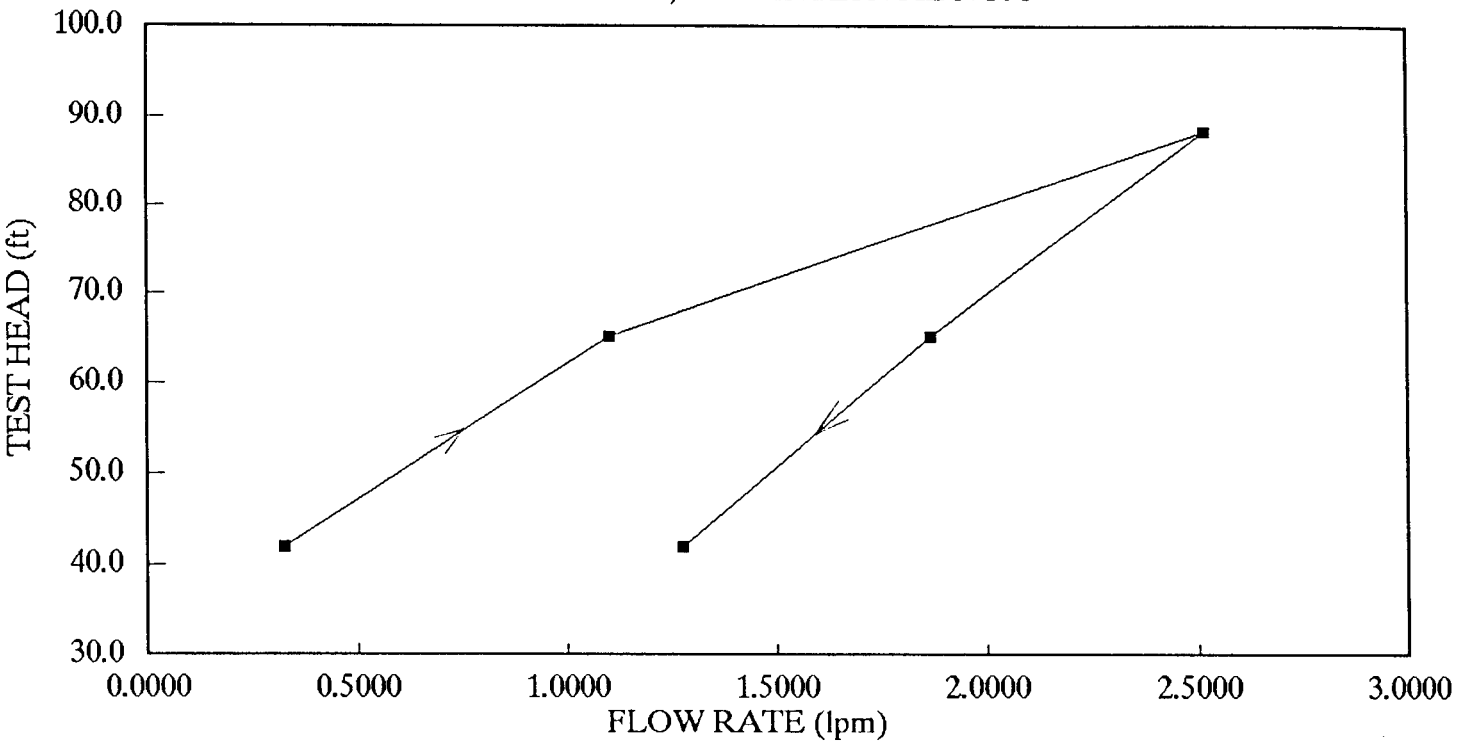
MT MILLIGAN PACKER TEST RESULTS

HOLE 682, TEST INTERVAL NO. 2



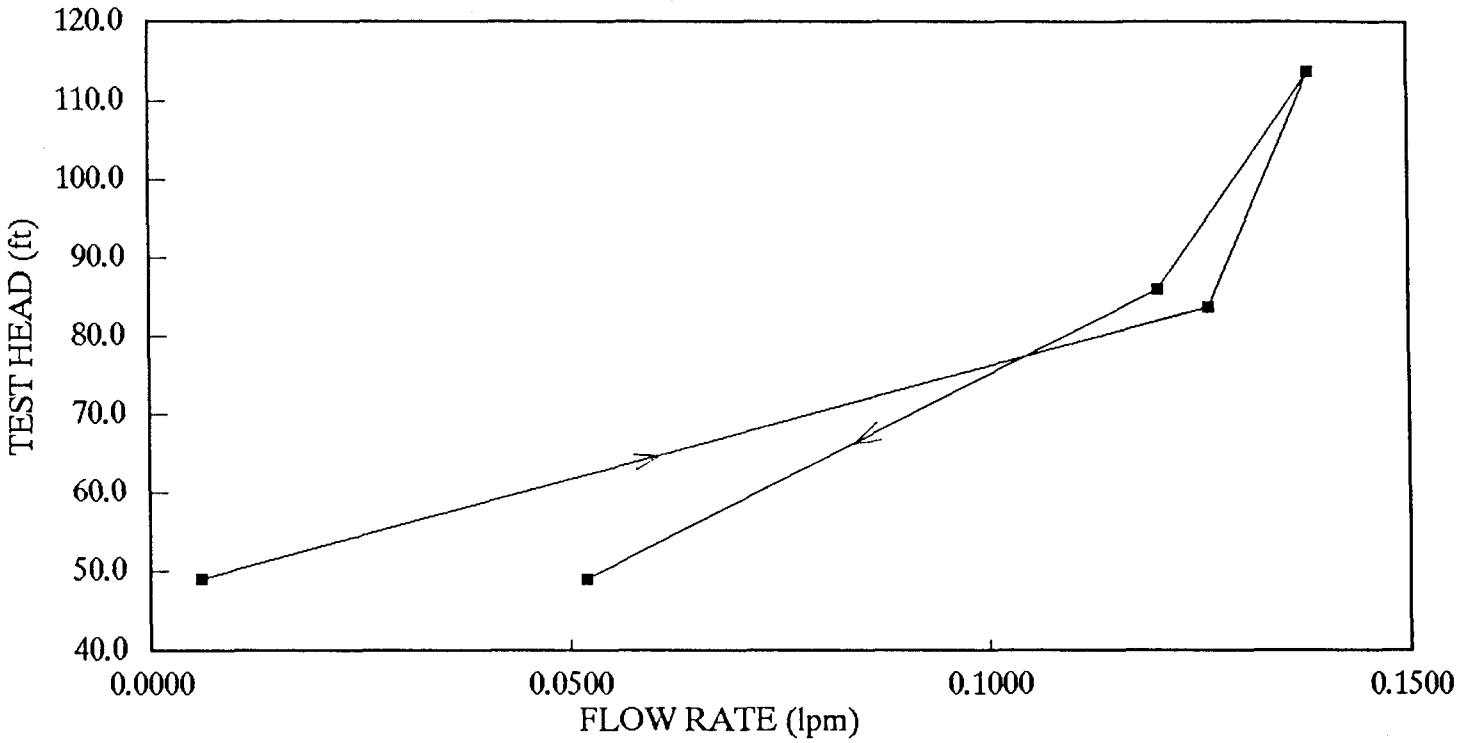
MT MILLIGAN PACKER TEST RESULTS

HOLE 682, TEST INTERVAL NO. 3



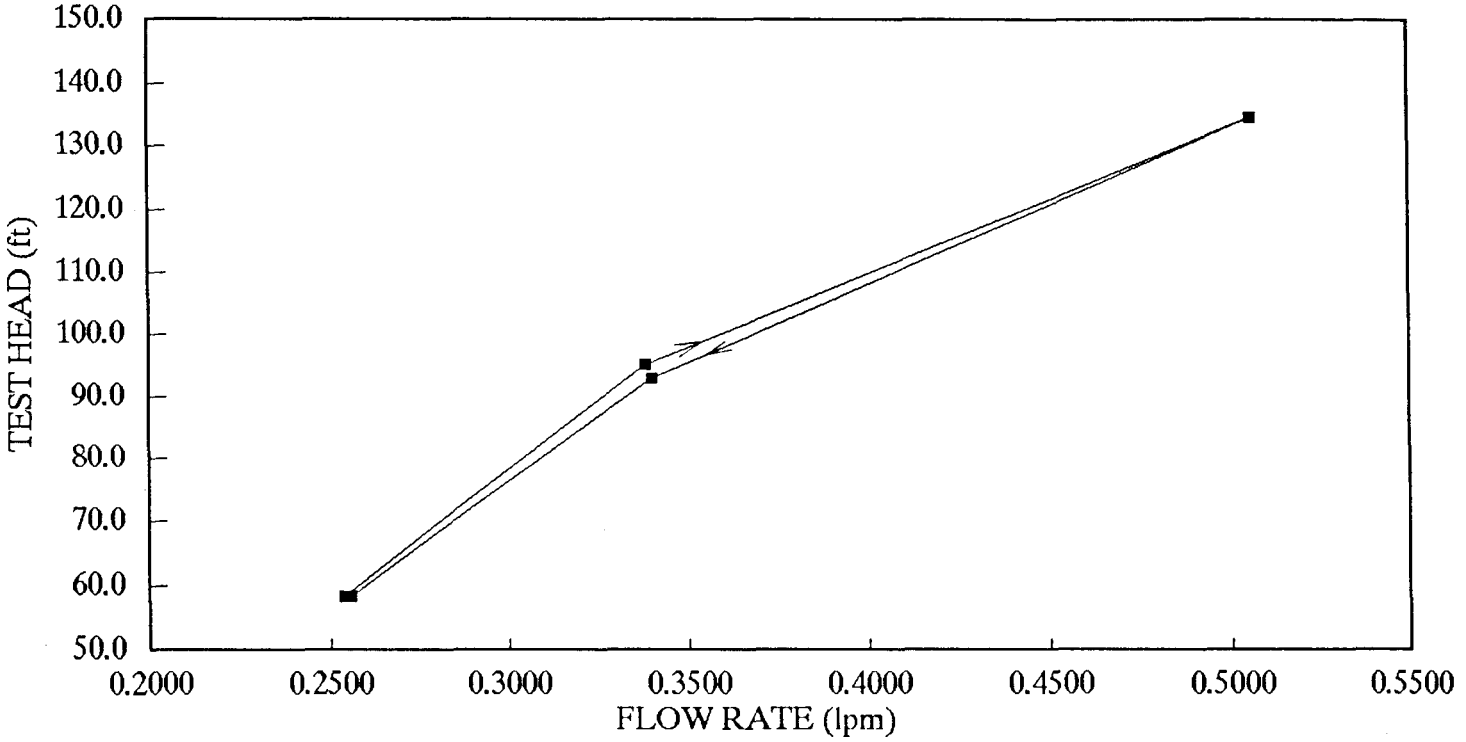
MT MILLIGAN PACKER TEST RESULTS

HOLE 682, TEST INTERVAL NO. 4



MT MILLIGAN PACKER TEST RESULTS

HOLE 682, TEST INTERVAL NO. 5



PACKER TESTING CALCULATION SHEET

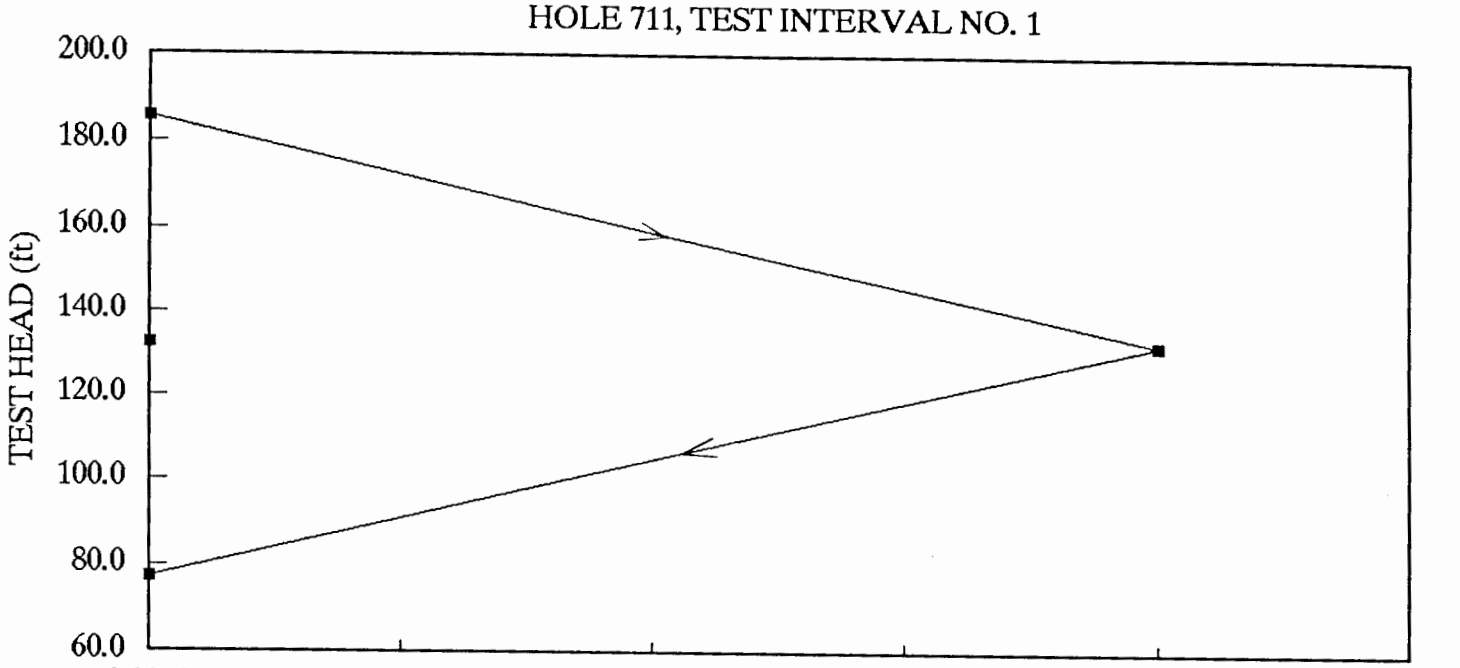
PROJECT: MOUNT MILLIGAN
LOCATION: SOUTH EMBANKMENT TAILINGS AREA
HOLE No: 90-711
TEST DATE: JULY 17 to JULY 18, 1990
COORDINATES(m) N: 6 110 330 E: 444 200
REF. ELEV.(m) 1005.14

HOLE DIAMETER (inches): 2.98
DEPTH TO GDW TABLE BELOW DATUM(ft): 24
BEDROCK DEPTH(ft): 107
TESTED BY: KGB/MDG
ANGLE FROM VERTICAL (deg): 0

TEST No.	INTERVAL (ft) from	to	METER RDG (litres) init	final	ELAPSED TIME (min)	FLOW RATE (lpm)	GAUGE PRESSURE (psi)	HEAD CORR'N (ft)	TEST HEAD (ft)	PERMEABILITY (cm/sec)	COMMENTS
1	133	141	5.87	5.87	5	0.000	23.0	0.0	77.1	0.0E+00	Bedrock
1	133	141	5.91	5.91	5	0.000	47.0	0.0	132.5	0.0E+00	
1	133	141	5.95	5.95	5	0.000	70.0	0.0	185.7	0.0E+00	
1	133	141	5.94	5.95	5	0.002	47.0	0.0	132.5	2.2E-08	
1	133	141	5.92	5.92	5	0.000	23.0	0.0	77.1	0.0E+00	

MT MILLIGAN PACKER TEST RESULTS

HOLE 711, TEST INTERVAL NO. 1

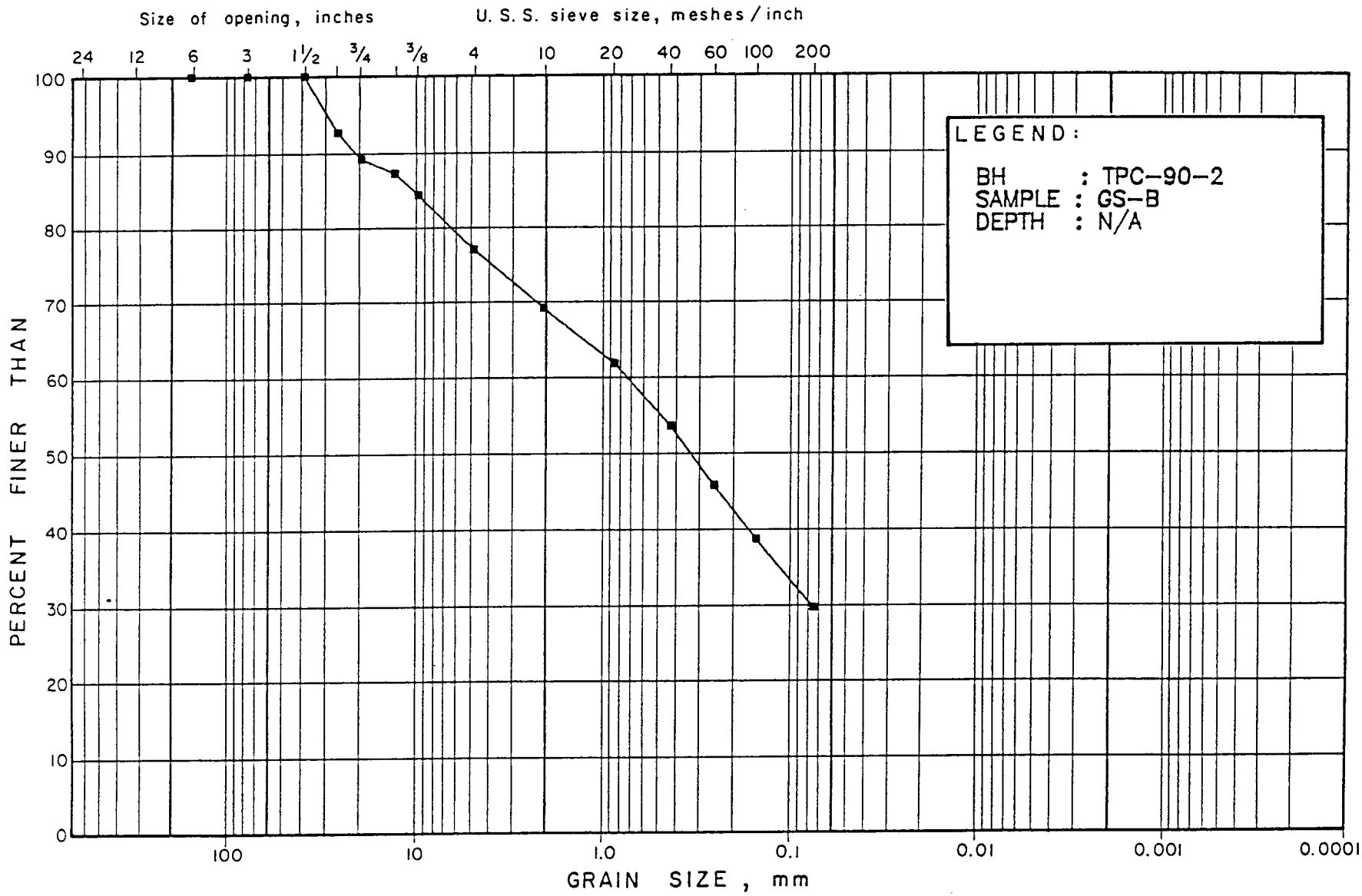


APPENDIX E

OVERBURDEN GRADATIONS

PROJ. NO. 9021082 D DRAWN REVIEWED DATE AUG-22-90

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	SILT SIZE	CLAY SIZE
								fine grained	

GRAIN SIZE DISTRIBUTION

Figure

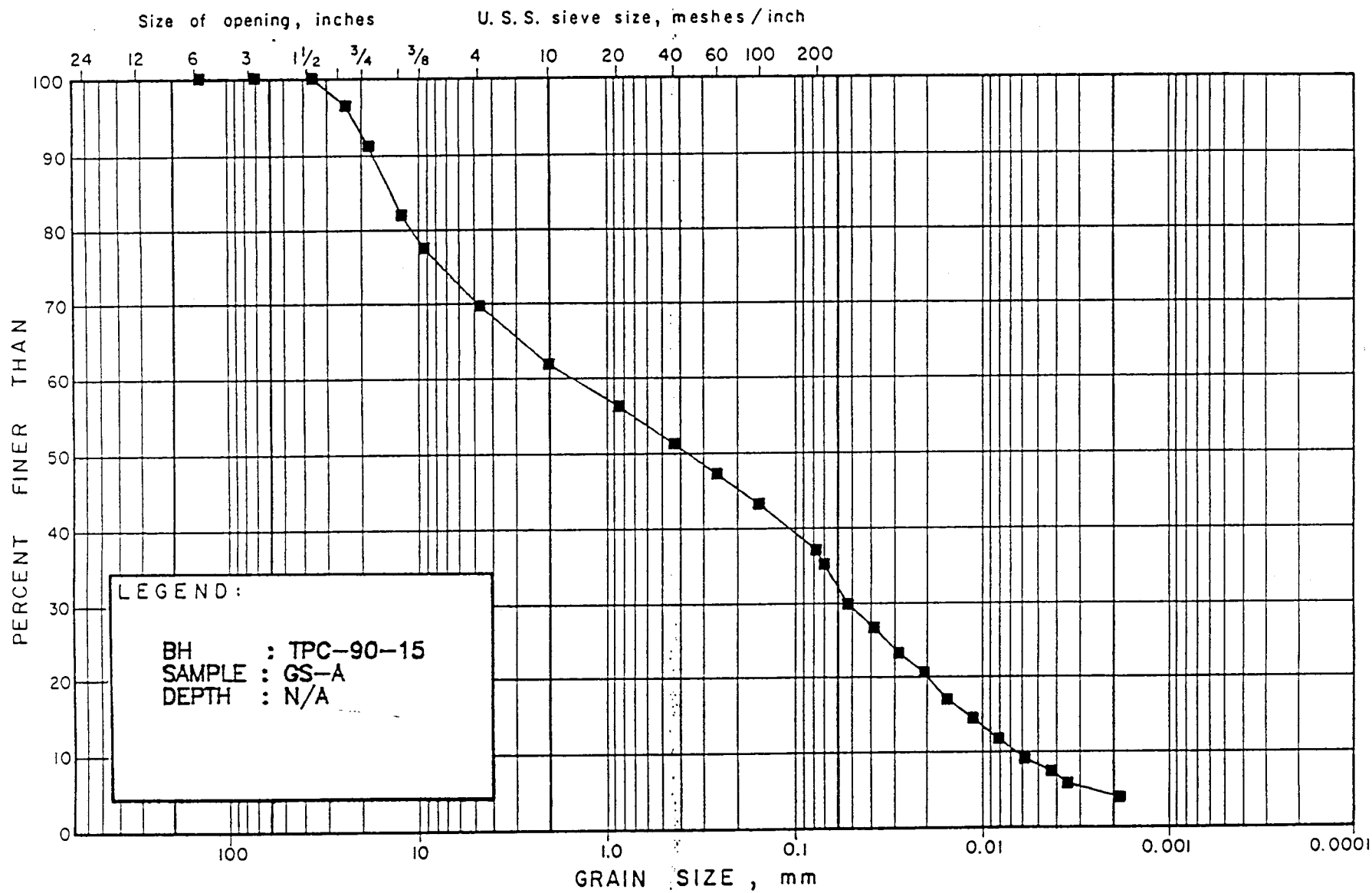
E-1

Golder Associates

PROJECT NO. 9021062 D DRAWN ..... REVIEWED ..... DATE AUG-22-90

GRAIN SIZE DISTRIBUTION

M.I.T. GRAIN SIZE SCALE



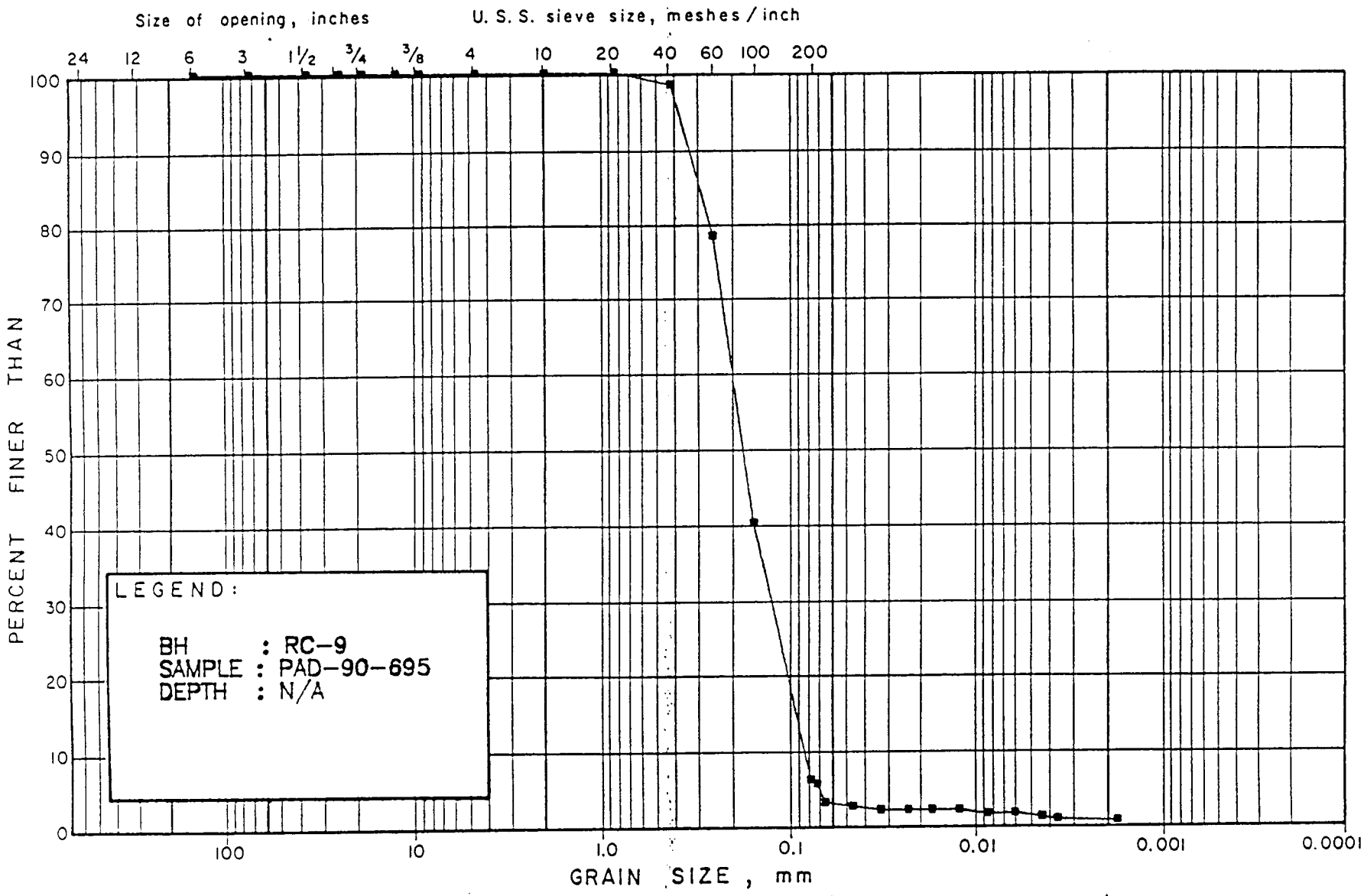
BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

Figure E-2

Golder Associates

PROJ NO. 9021082 D DRAWN ..... REVIEWED ..... DATE AUG-22-90

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

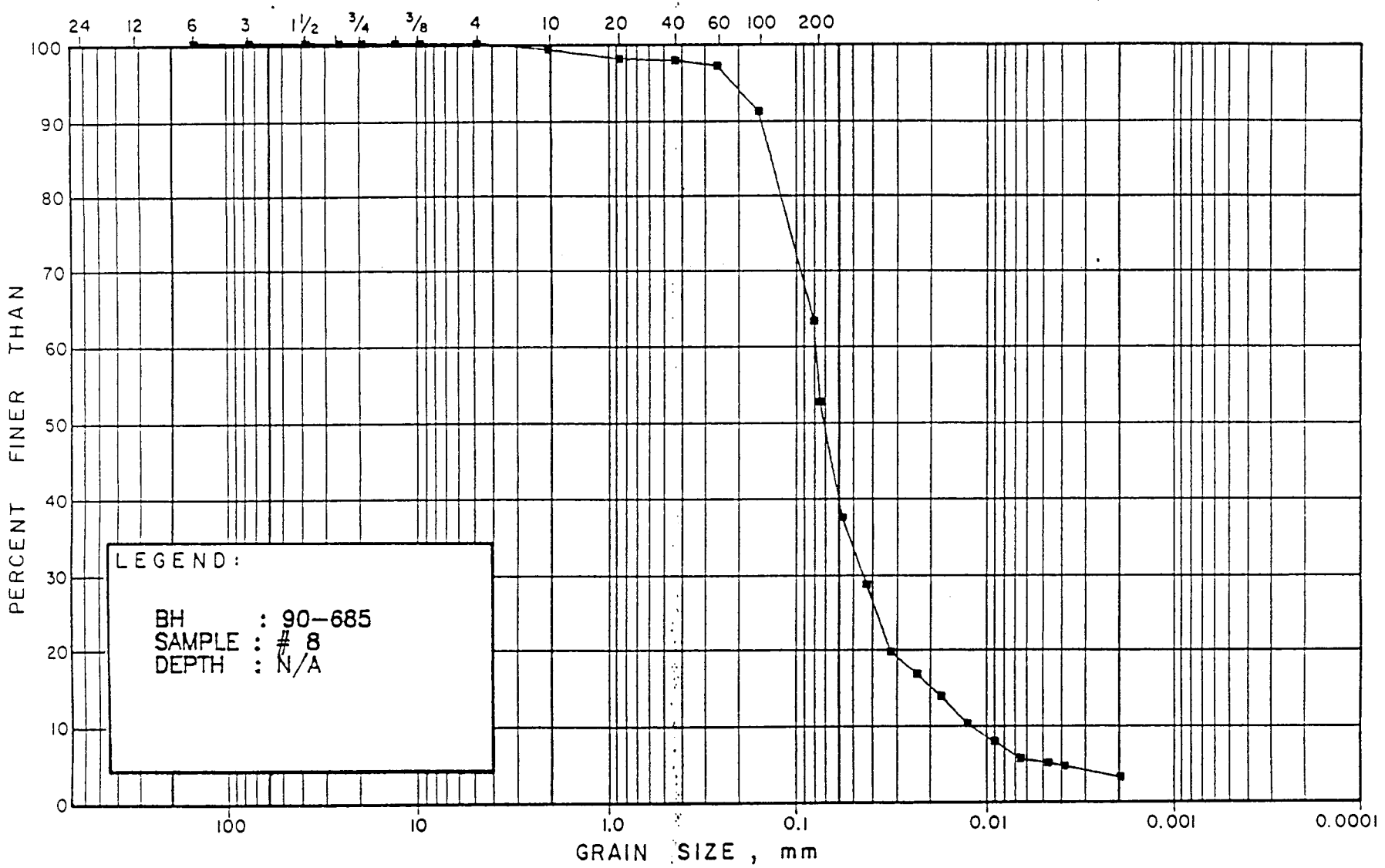
Figure

E-3

Golder Associates

PROJ... NO. 9021062 D DRAWN ..... REVIEWED ..... DATE AUG-22-90

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE
		coarse	medium	fine	coarse	medium	fine	fine grained	

GRAIN SIZE DISTRIBUTION

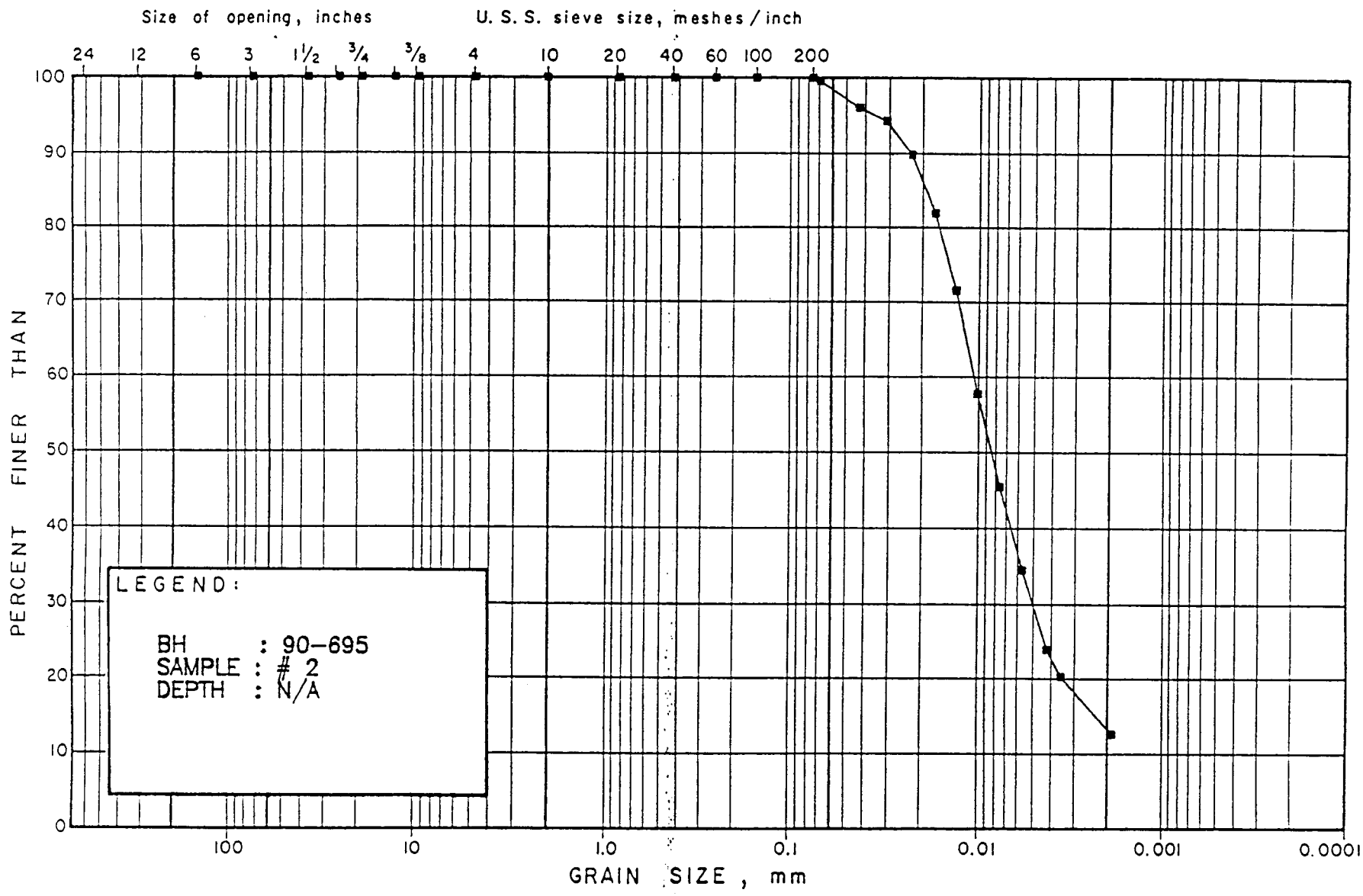
Figure

E-4

Golder Associates

PRO. NO. 9021062 D DRAWN REVIEWED DATE AUG-22-90

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			FINE GRAINED	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

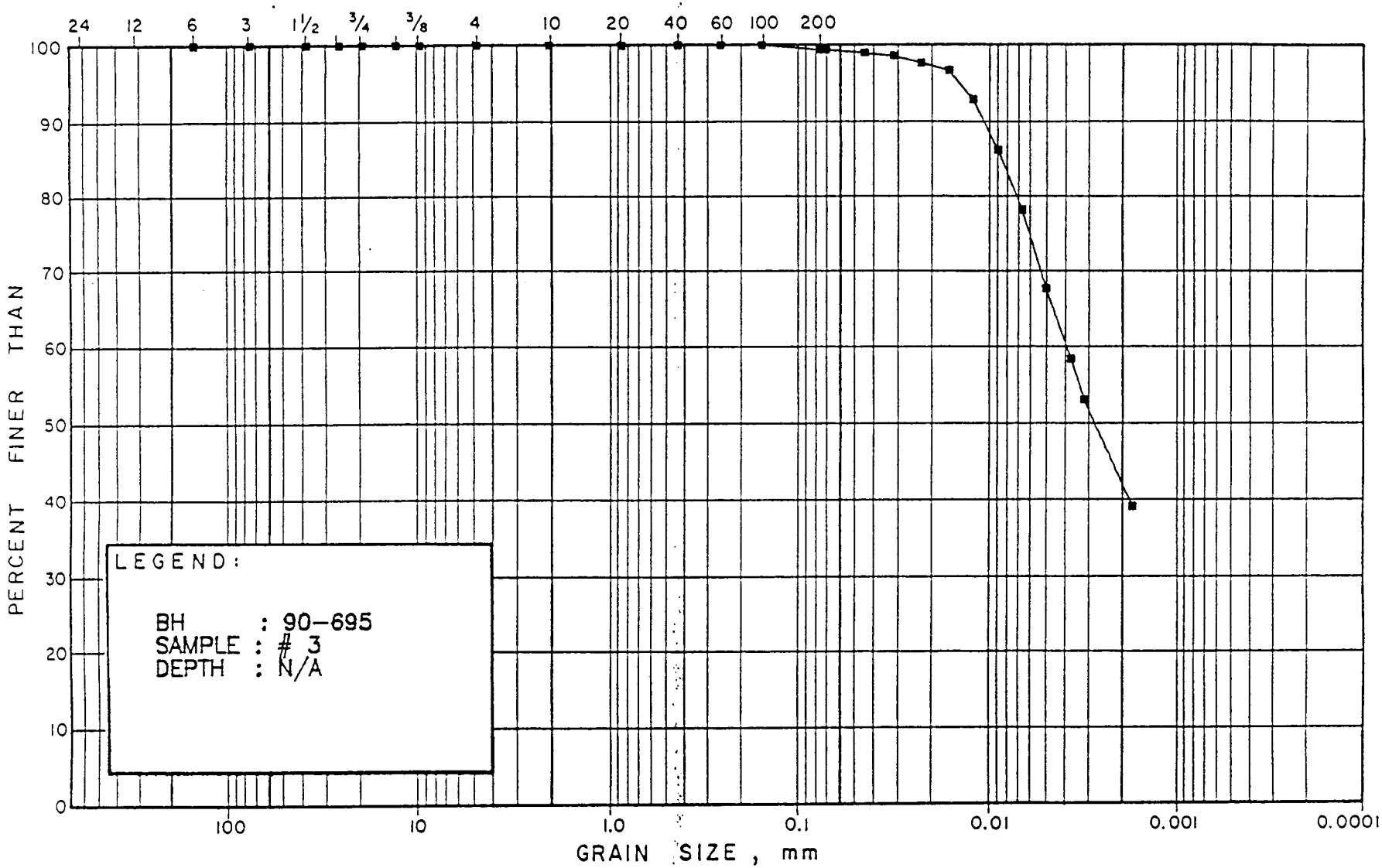
Figure

E-5

Golder Associates

PROJ... NO. 9021062 D ... DRAWN ... REVIEWED ... DATE AUG-22-90

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

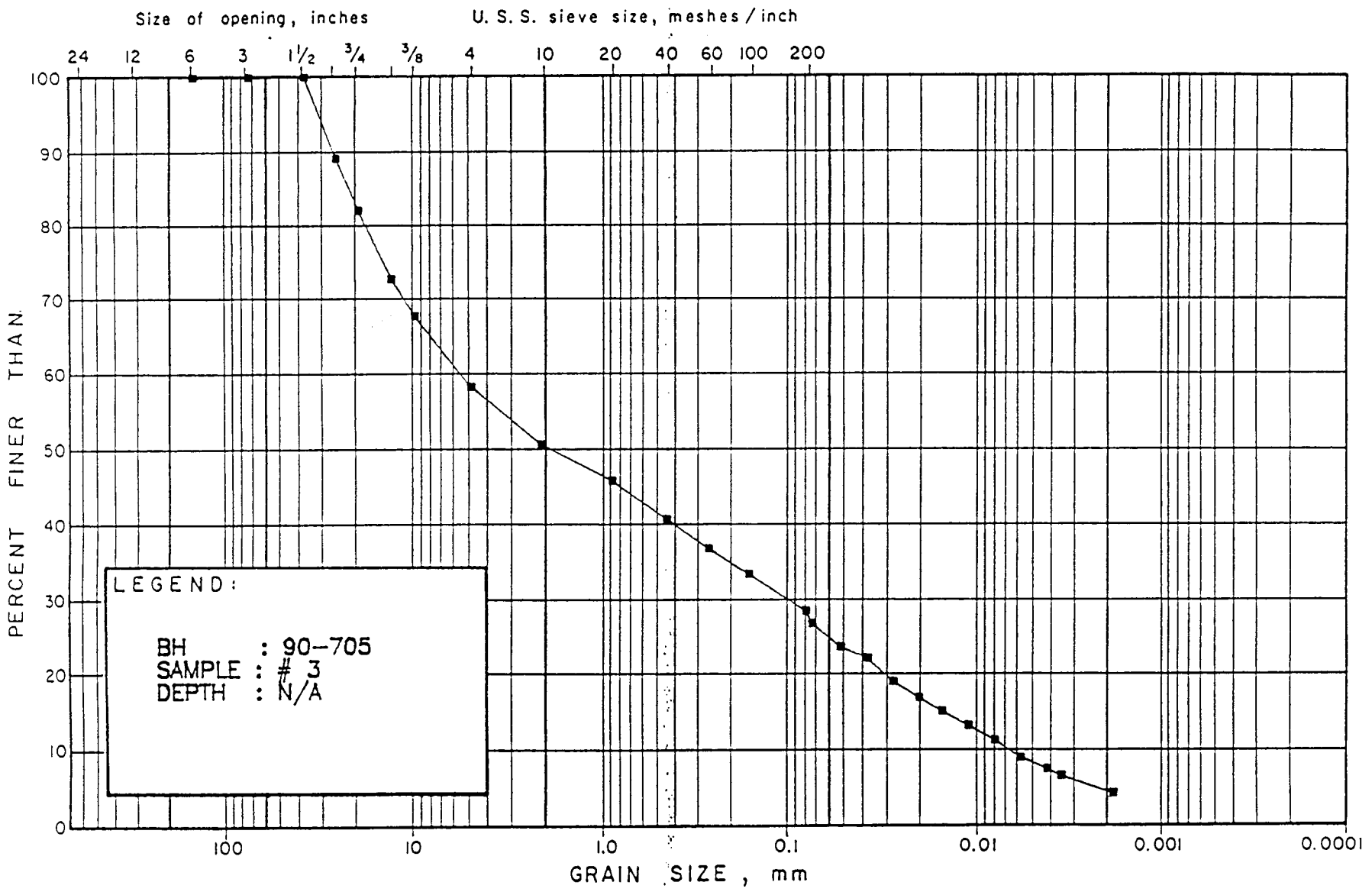
Figure

E-6

Golder Associates

PROJ. NO. 9021062 D DRAWN REVIEWED DATE AUG-22-90

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

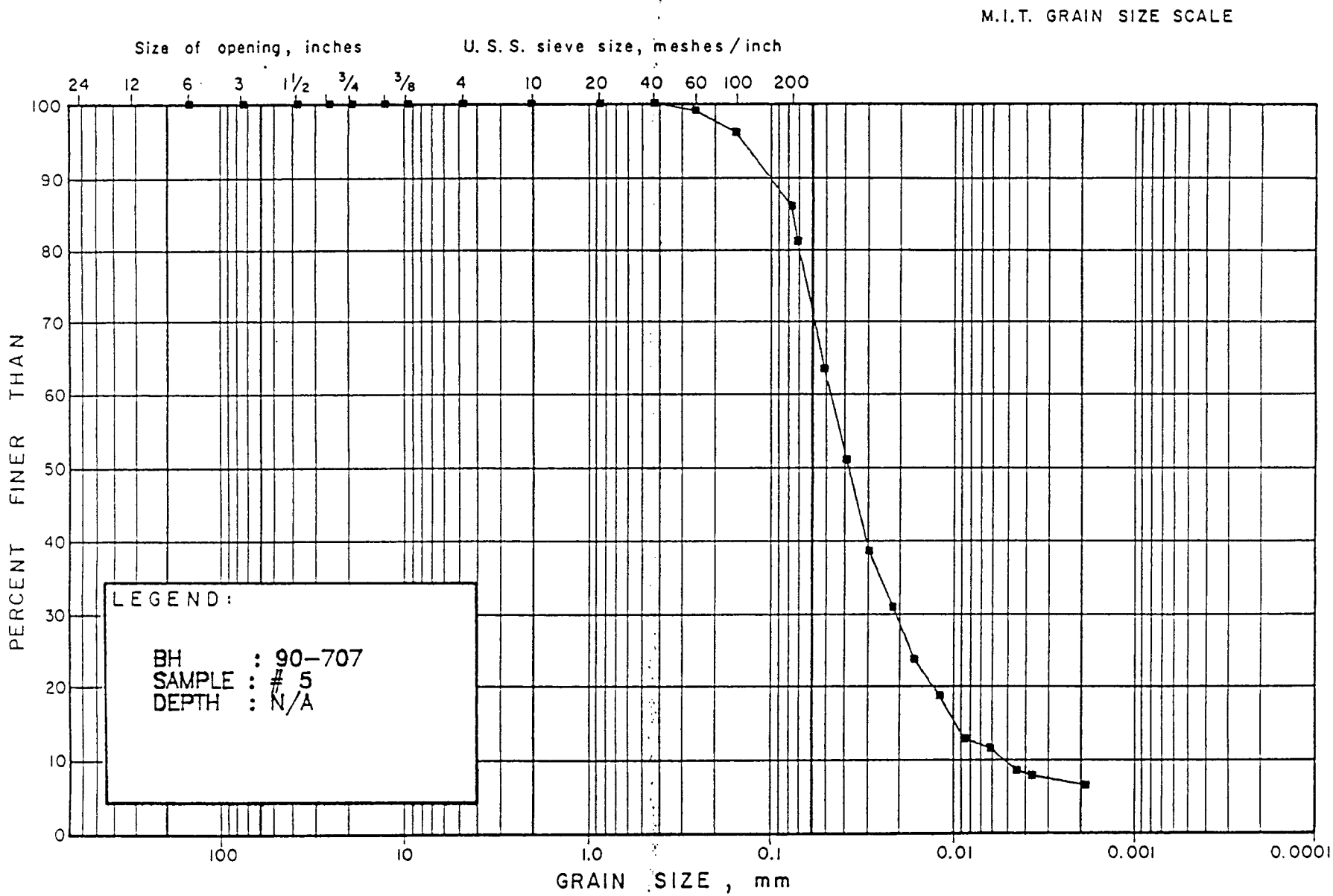
E-7

Golder Associates

PROJ. NO. 9021062 D DRAWN REVIEWED DATE AUG-22-90

GRAIN SIZE DISTRIBUTION

Figure

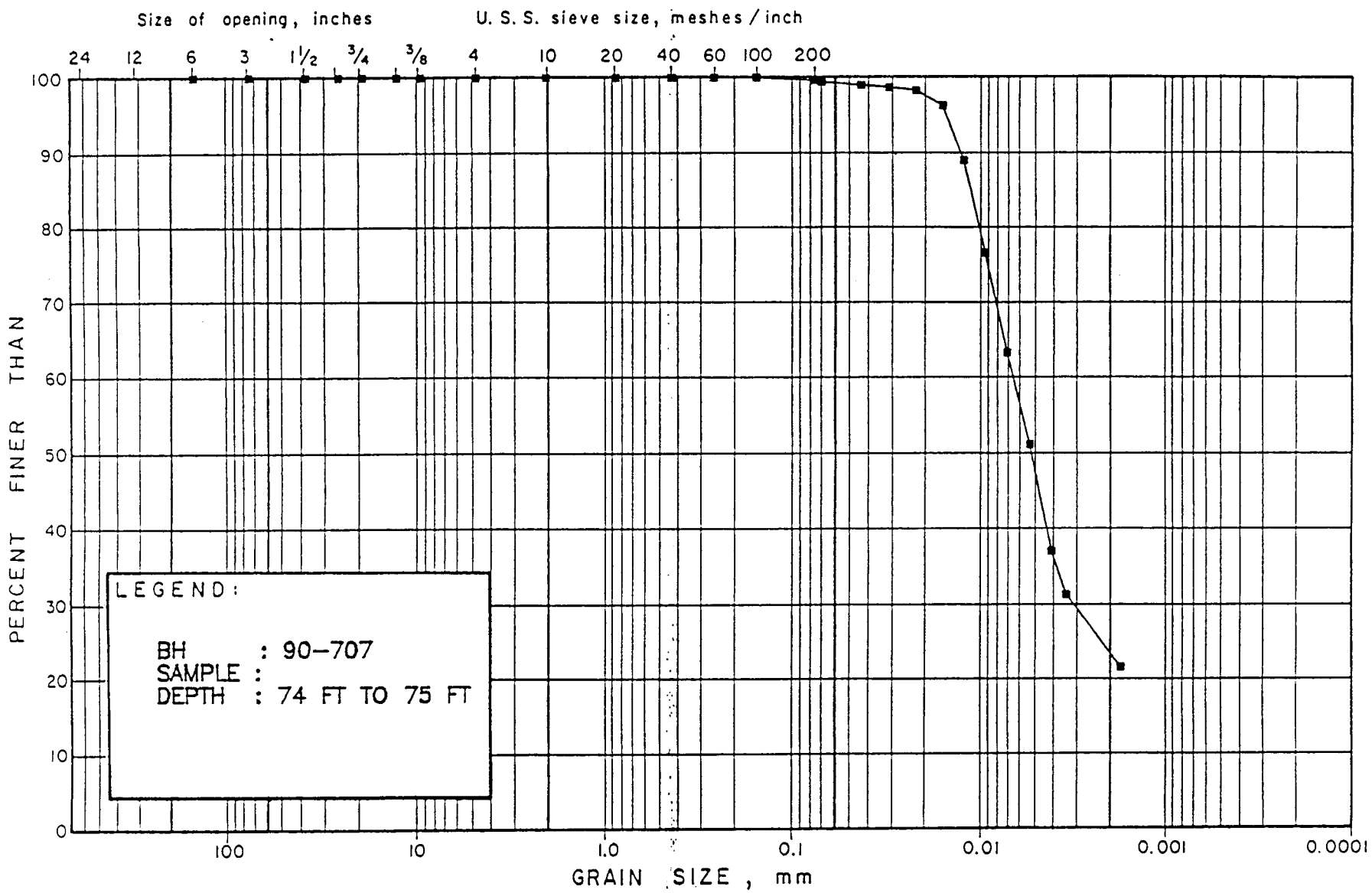


E-8

Golder Associates

PROJ NO. 9021062 D DRAWN REVIEWED DATE AUG 22 90

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			fine grained	
		coarse	medium	fine	coarse	medium	fine	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

Figure

E-9

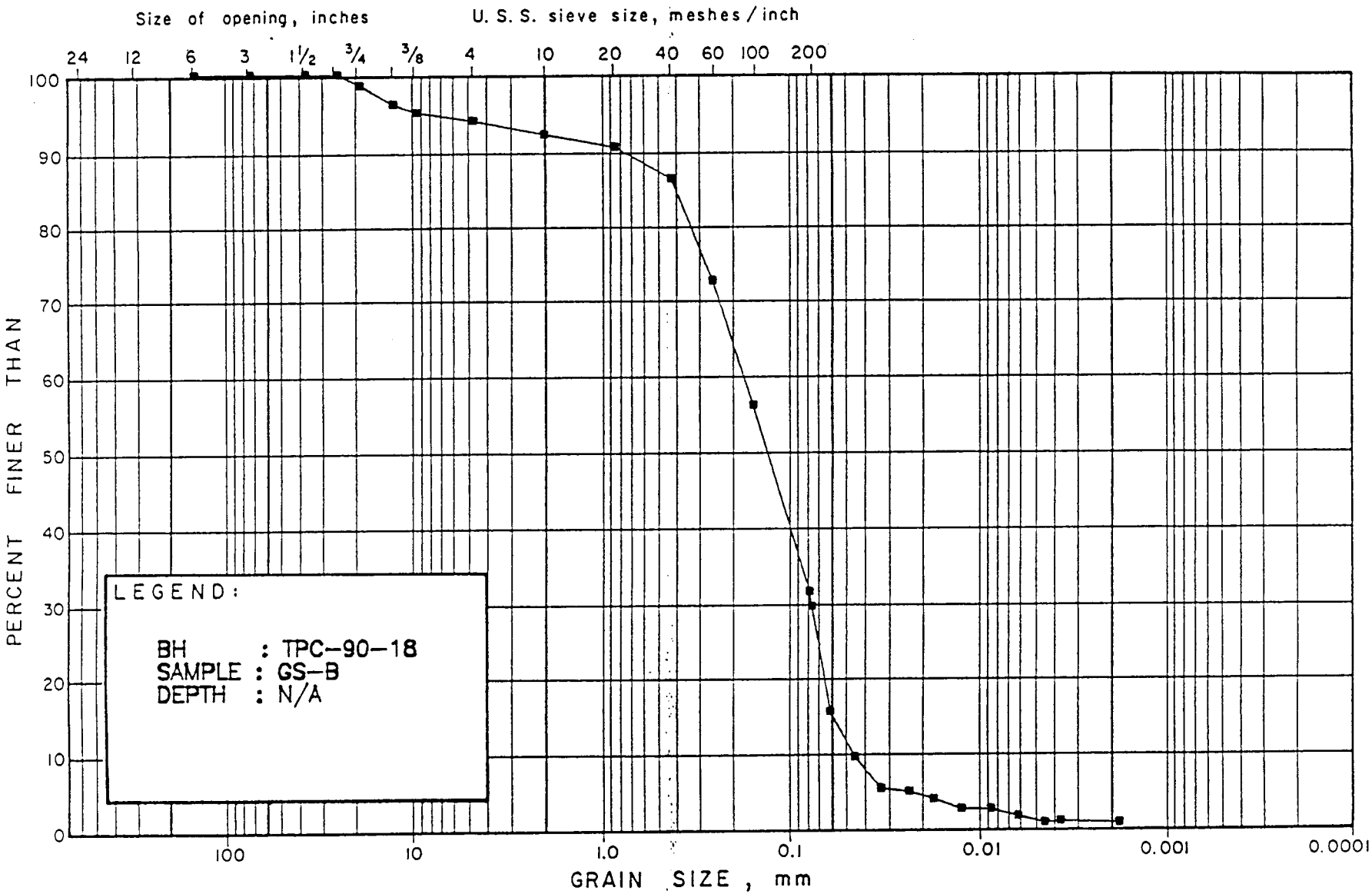
Golder Associates

PROJECT 9021062 D DRAWN ..... REVIEWED ..... DATE AUG-22-90

GRAIN SIZE DISTRIBUTION

Figure

M.I.T. GRAIN SIZE SCALE



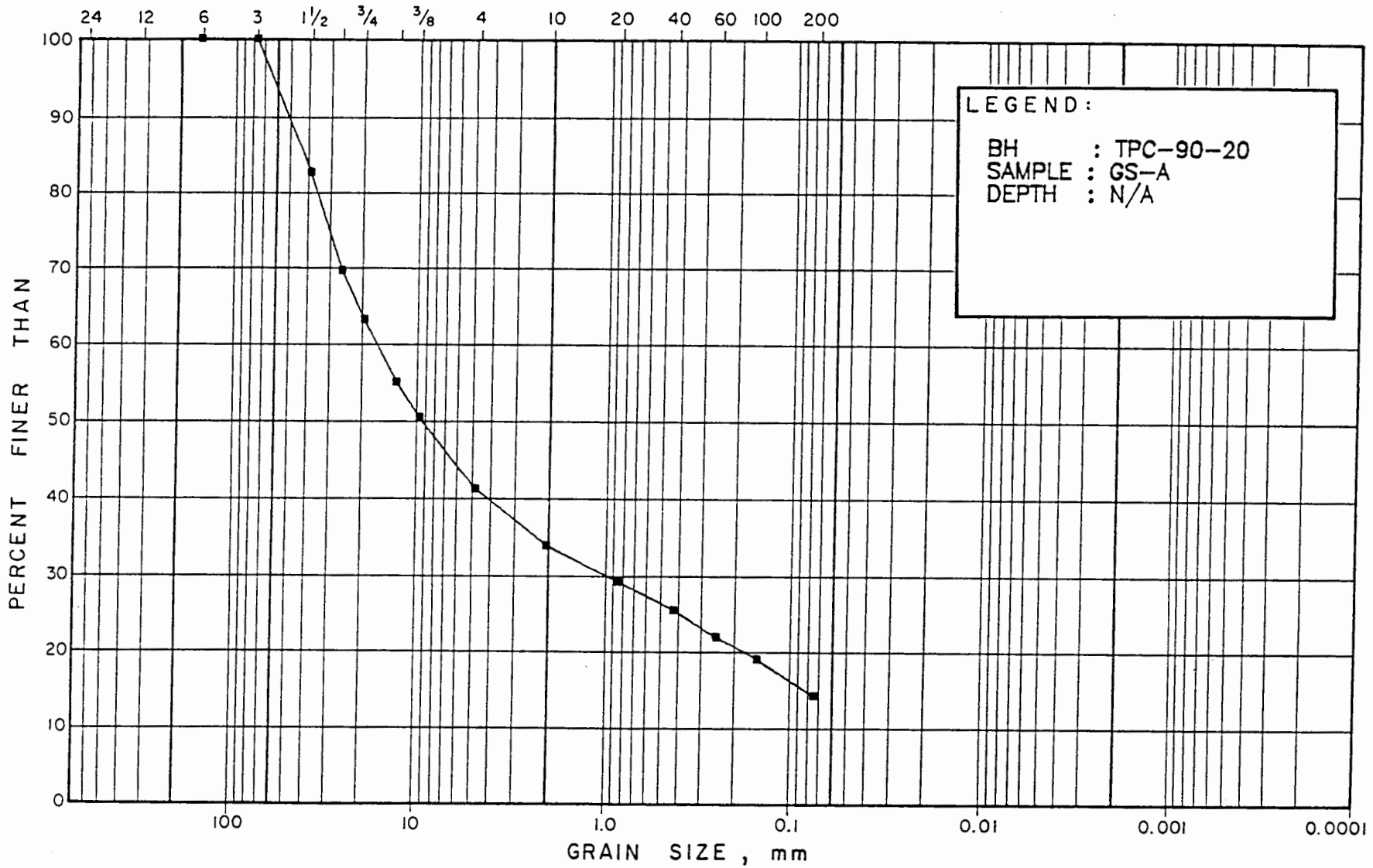
BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE: coarse	GRAVEL SIZE: medium	GRAVEL SIZE: fine	SAND SIZE: coarse	SAND SIZE: medium	SAND SIZE: fine	fine grained: SILT SIZE	fine grained: CLAY SIZE

E-10

Golder Associates

PROJECT 9021062 D DRAWN REVIEWED DATE AUG-22-90

M.I.T. GRAIN SIZE SCALE



BOULDER SIZE	COBBLE SIZE	GRAVEL SIZE			SAND SIZE			SILT SIZE	CLAY SIZE
		coarse	medium	fine	coarse	medium	fine	fine grained	

GRAIN SIZE DISTRIBUTION

Figure

E-11

Golder Associates