St. Lawrence Testing & Inspection Co. Ltd.

P.O. Box 997, Cornwall, ON, Canada K6H 5V1
814 Second Street W., Phone (613) 938-2521
E-mail: slt@ontarioeast.net Fax (613) 938-7395

July 31, 2009

Mr. Morris McCormick, P. Eng.
Corporation of the City of Cornwall
Environmental Services
861 Second Street West
Cornwall, ON
K6J 1H5

RE: Cornwall Waste Water Treatment Plant Expansion
Preliminary Geotechnical Subsurface Investigation
Report No. 09C181

Dear Mr. McCormick:

In accordance with verbal instructions received from you, this report is submitted, outlining the results of a geotechnical subsurface investigation carried out at the existing waste water treatment plant at 2800 Montreal Rd. in Cornwall, Ontario.

A) DESCRIPTION OF FIELD WORK

Prior to starting, we asked you to have your staff clear services. This was done. The proposed borehole locations requested by the consultant, J.L. Richards & Associates Limited, were staked out in the field by your staff prior to drilling.

Drilling, sampling and the installation of ground water monitoring wells were carried out on July 13 and 14, 2009 by Eastern Ontario Diamond Drilling of Hawkesbury, Ontario. Supervision was by the undersigned geotechnical

engineer. The boreholes were placed exactly at the stakes and to the depths requested by J.L. Richards & Associates Limited. The boreholes were advanced by split spoon sampler. Standard Penetration tests were conducted along with the split spoon sampling. The recovered samples were placed in glass jars for later lab detailed examination and gradation tests. The results are found attached in the borehole logs and gradation data sheets.

The sketch provided to us from J.L. Richards & Associates Limited is attached to the report.

B). GROUND WATER MONITORING WELLS

Following is the data for each well.

Borehole # 1: Elevation 63.09

Deep Well: 13.72 to 12.19 m. encased in sand

Hole Plug: 12.19 to 7.62 m.

Shallow Well: 7.62 to 6.10 m. encased in sand

Hole Plug: 6.10 to surface

Borehole # 2: Elevation 61.85

Deep Well: 12.19 to 10.67 m. encased in sand

Hole Plug: 10.67 to 6.10 m.

Shallow Well: 6.10 to 4.57 m. encased in sand

Hole Plug: 4.57 to surface

Borehole # 3: Elevation 60.49

Deep Well: 10.67 to 9.14 m. encased in sand

Hole Plug: 9.14 to 4.57 m.

Shallow Well: 4.57 to 3.05 m. encased in sand

Hole Plug: 3.05 to surface

Water level readings were taken on July 15, 16, 17, 23 and 27, 2009.

The surveying for the geodetic elevations at the ground surface of the wells was done by our 2 man crew on July 27, 2009.

C) STRATIGRAPHY

The stratigraphy at the 3 boreholes is virtually identical as far as soil composition. The soil varies from a sandy silt to a gravelly silt and sand. It is predominantly a gravelly silt and sand with occasional cobbles and boulders.

The glacial till at Borehole 1 is mainly very dense, and is compact from 4.5 to 7.5 m. It is brown to 4.5 m. and grey below, and is consistently moist throughout.

The glacial till at Borehole 2 is mainly dense, and is compact from 6.0 to 9.0 m., becoming very dense below 9.0 m. It is brown to 6.0 m. and grey below, and is consistently moist throughout.

The glacial till at Borehole 3 is mainly compact throughout. It is brown to 4.5 m. and is grey below, and is consistently moist throughout.

D) GROUND WATER READINGS

	July 15	July 16	July 17	July 23	July 27	Bottom Depth of Well
Borehole 1						
Deep	13.06	13.05	13.07	13.04	13.07	13.72
Shallow	dry	dry	dry	dry	dry	7.62
Borehole 2						
Deep	12.00	11.97	11.95	12.00	11.91	12.19
Shallow	dry	dry	dry	dry	dry	6.10
Borehole 3						
Deep	dry	dry	10.48	10.16	9.87	10.67
Shallow	dry	dry	4.35	4.34	4.26	4.57

We had originally considered pumping down the piezometers and recording the rise at regular intervals. However as shown by the readings, there was so little ground water infiltration that pumping down and taking readings the same day would have shown virtually no infiltration.

E) GEOTECHNICAL DISCUSSIONS

Following are the comments on the items listed in the J.L. Richards and Associates July 02, 2009 memo.

Standard excavation by conventional equipment is acceptable. This was how the last addition was done and there was nothing unusual or difficult noted during our inspection. In order to meet the Ontario Occupational Health and Safety Act, the bottom 1.2 m. can be vertical and the side slopes above can be at a 1 to 1 side slope. Trying to drive sheet piles through the dense to very dense till will be very difficult bordering on the impossible for the depths being considered. If it is not possible to have a 1 to 1 side slope, the excavation should be done vertically. Sheet piling can then be driven at the bottom to a depth of 1.5 to 3.0 m. The top can be anchored back to provide the top stability.

Temporary dewatering can be considered using standard sump and pump methods. The expected ground water infiltration is expected to be minimal as noted by the piezometer readings. Assuming electric pumps are available to pump 14 m., this would be the ideal pumping system in that they can operate around the clock without regular maintenance. If the height is too high, then pumps halfway, or each third of the way can be considered. Given the minimal infiltration, the volume of water to be pumped will also be minimal. This should be reviewed further during the detailed design phase. It should be noted that a permit to take water from the Ministry of Environment under the Water Resources Act will be required if the groundwater volume to be managed during construction is anticipated to exceed 50,000 L/day. Depending on the size of the excavation, one pump at each corner of the excavation would be adequate. With minimal infiltration, there is little likelihood of differential settlement from the existing structures. The bearing capacity values are also very high.

Based on the piezometer readings taken during this investigation, the need for anti buoyancy measures is expected to be minimal. It may be possible to control uplift pressures caused by the groundwater table through a permanent dewatering system established at an appropriate elevation. The need for anti buoyancy measures or permanent dewatering arrangements should be reviewed further during the detailed design phase.

The bearing capacity at elevation 50 is 400 KPa at Boreholes 1 and 2, and 200 KPa at Borehole 3, all S.L.S. The U.L.S. values are 50% higher. Assuming that the structures normally rest on a gravel pad, we recommend a minimum of 300 mm. of Granular "A", compacted to 100% Standard Proctor Density. The bearing on the surface is 200 KPa S.L.S. A geotextile should be placed on the glacial till surface to prevent mud from mixing with the Granular "A".

It is not recommended to place the existing soils against the tanks. The backfill against the tanks should be quarry stone, either Granular "B" Type 2 or Granular "A", and compacted in maximum 300 mm. lifts to 95% Standard Proctor Density. The width of the granular fill should be 1.0 m. minimum. The standard procedure is to place a 300 mm. lift adjacent to the tank then follow through with glacial till fill outside of the granulars to the granular height, then repeat this to the top. This also allows the seepage of the ground water to fall to the bottom exterior of the tank which can then be controlled by the exterior pumping system.

The K factors of the glacial till at this site are Ka (active) 0.25 and Kp (passive) 7.0. The site class of the glacial till for seismic design is Site Class C.

St. Lawrence Testing
& Inspection Co. Ltd.

Report No. 09C181
Continued

Respectfully submitted

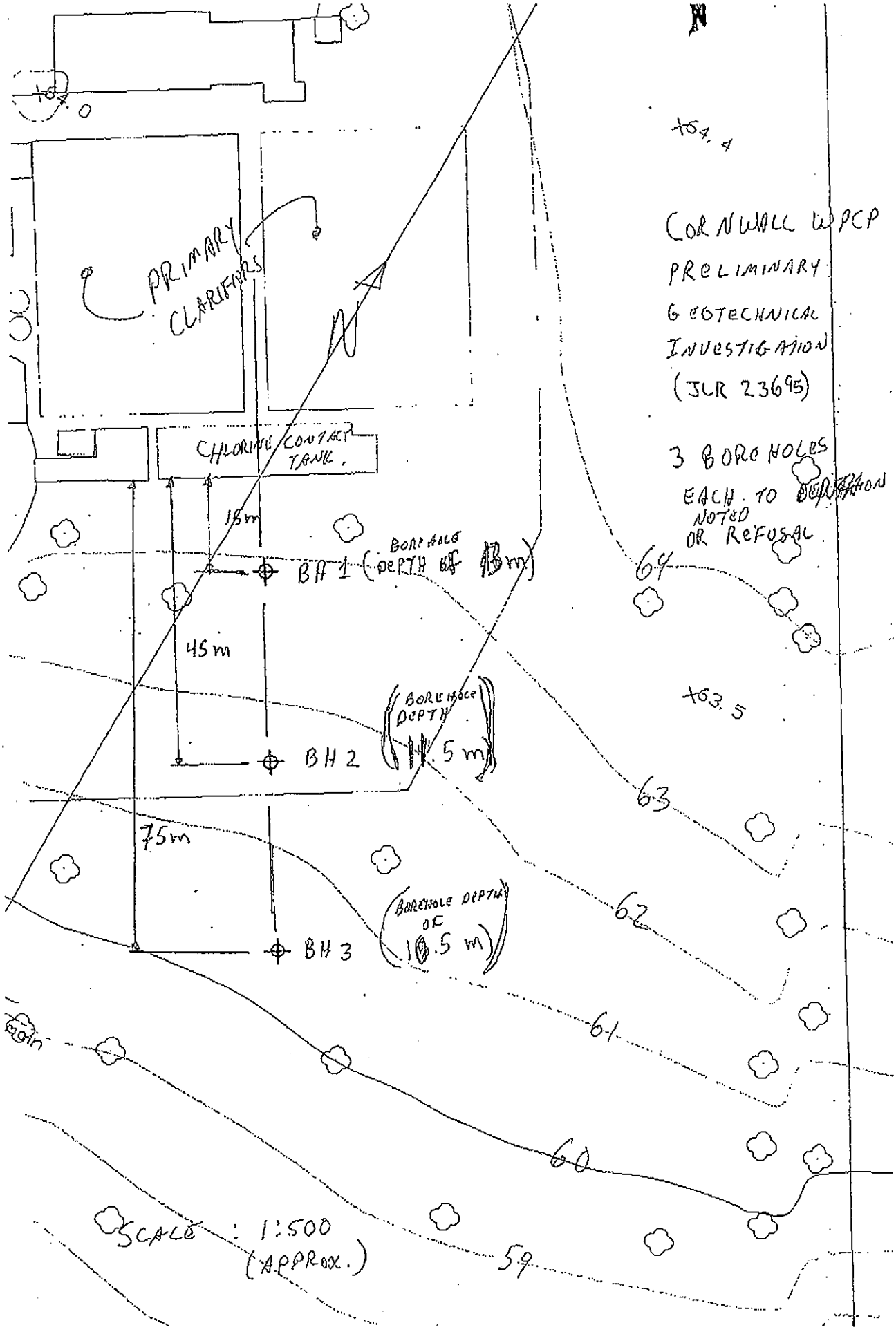
ST. LAWRENCE TESTING & INSPECTION CO. LTD.

REGISTERED PROFESSIONAL ENGINEER
G. G. McINTEE
PROVINCE OF ONTARIO

G.G. McIntee, P. Eng.

GGM:njw

c.c. J.L. Richards & Associates – Dan Lalonde


N
64.0
64.4
PRIMARY CLARIFIERS
CHLORINE CONTACT TANK.
CORNWALL WPCP
PRELIMINARY
GEOTECHNICAL
INVESTIGATION
(JLR 23695)
3 BOREHOLES
EACH TO DEPTH AS NOTED OR REFUSAL.
15m
BOREHOLE DEPTH OF 15m
BH 1
45m
BOREHOLE DEPTH OF 14.5 m
BH 2
63.5
64
63
75m
BOREHOLE DEPTH OF 10.5 m
BH 3
62
61
60
59
SCALE : 1:500
(APPROX.)

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OFFICE BOREHOLE RECORD

REPORT NO. 09C181
BOREHOLE NO. 1
CASING HF Auger
DATUM Geodetic

CLIENT City of Cornwall Environmental Services
LOCATION City of Cornwall WWTP, 2800 Montreal Rd.
DATE OF BORING July 13, 2009 DATE OF WL READING July 15 to 27/09

DEPTH	ELEVATION / DEPTH	SOIL DESCRIPTION	STRAT. PLOT	WATER CONDITIONS	CONDITION	TYPE	NUMBER	RECOVERY	N - VALUE	LABORATORY TESTS PERFORMED
0	63.09									
	62.11	180 mm. Topsoil Fill 600 mm. Glacial Till Topsoil	Fill			SS	1	70	35	
1	.98	Silt & Sand Till Brown, moist, gravelly, very dense with occasional cobbles and boulders, becoming grey and compact below 4.5 m., then very dense below 7.5 m. and with more silt content below 12.0 m.				SS	2	100	54	+
2						SS	3	100	72	
3						SS	4	0	68	+
4						SS	5	50	27	
5										
6						SS	6	70	22	
7						SS	7	90	60	
8						SS	8	70	93	+
10						SS	9	90	67	
12						SS	10	100	62	
	49.37									
14	13.72	Termination of borehole								

LAB TEST RESULTS

WATER CONTENT & ATTERBERG LIMITS. WP W WL

DYNAMIC PENETRATION TEST BLOWS PER FOOT. K... 0 20 40 60

APPENDIX

St. Lawrence Testing & Inspection Co. Ltd.

OFFICE BOREHOLE RECORD

REPORT NO. 09C181

CLIENT City of Cornwall Environmental Services — BOREHOLE NO. 2

LOCATION City of Cornwall WWTP, 2800 Montreal Rd. — CASING HF Auger

DATE OF BORING July 13, 14/09 — DATE OF WL READING July 15 to 27/09 — DATUM Geodetic

DEPTH	ELEVATION / DEPTH	SOIL DESCRIPTION	STRAT. PLOT	WATER CONDITIONS	SAMPLE CONDITION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY	N-VALUE	LABORATORY TESTS PERFORMED
0	61.85									
	60.97	300 mm. Topsoil 300 mm. Glacial Till Fill Topsoil				SS	1	90	9	
1	.88	Silt & Sand Till Brown, moist, gravelly, dense, with occasional cobbles and boulders, becoming grey and compact below 6.0 m. then very dense below 9.0 m.				SS	2	70	20	
2						SS	3	70	43	
3						SS	4	60	36	
4										
5						SS	5	90	39	
6						SS	6	90	22	
7										
8						SS	7	80	20	
9										
11						SS	8	100	89	
						SS	9	100	102	
	49.66									
13	12.19	Termination of borehole								

LAB TEST RESULTS

WATER CONTENT & ATTERBERG LIMITS. WP W WL

DYNAMIC PENETRATION TEST BLOWS PER FOOT. . . .K. . . .

0 20 40 60

APPENDIX

St. Lawrence Testing & Inspection Co. Ltd.

OFFICE BOREHOLE RECORD

REPORT NO. 09C181

CLIENT City of Cornwall Environmental Services — BOREHOLE NO. 3

LOCATION City of Cornwall WWTP, 2800 Montreal Rd. — CASING HF Auger

DATE OF BORING July 14/09 — DATE OF WL READING July 15 to 27/09 — DATUM Geodetic

SOIL PROFILE					SAMPLES						
DEPTH	ELEVATION / DEPTH	SOIL DESCRIPTION	STRAT. PLOT	WATER CONDITIONS	CONDITION	TYPE	NUMBER	RECOVERY	N - VALUE	LABORATORY TESTS PERFORMED	LAB TEST RESULTS
0	60.49										WATER CONTENT & ATTERBERG LIMITS. WP W WL
	60.21	Topsoil									DYNAMIC PENETRATION TEST BLOWS PER FOOT. X ... 0 20 40 60
	.28	Silt & Sand Till									
1		Brown, moist, gravelly, compact with occasional cobbles and boulders, becoming grey below 4.5 m.			X	SS	1	90	20		
					X	SS	2	30	30	+	
2					X	SS	3	100	28		
3					X	SS	4	100	30	+	
4											
					X	SS	5	50	18		
5											
6					X	SS	6	10	27		
7											
					X	SS	7	90	18		
8											
10					X	SS	8	90	18		
11											
	49.82										
	10.67	Termination of borehole									

APPENDIX

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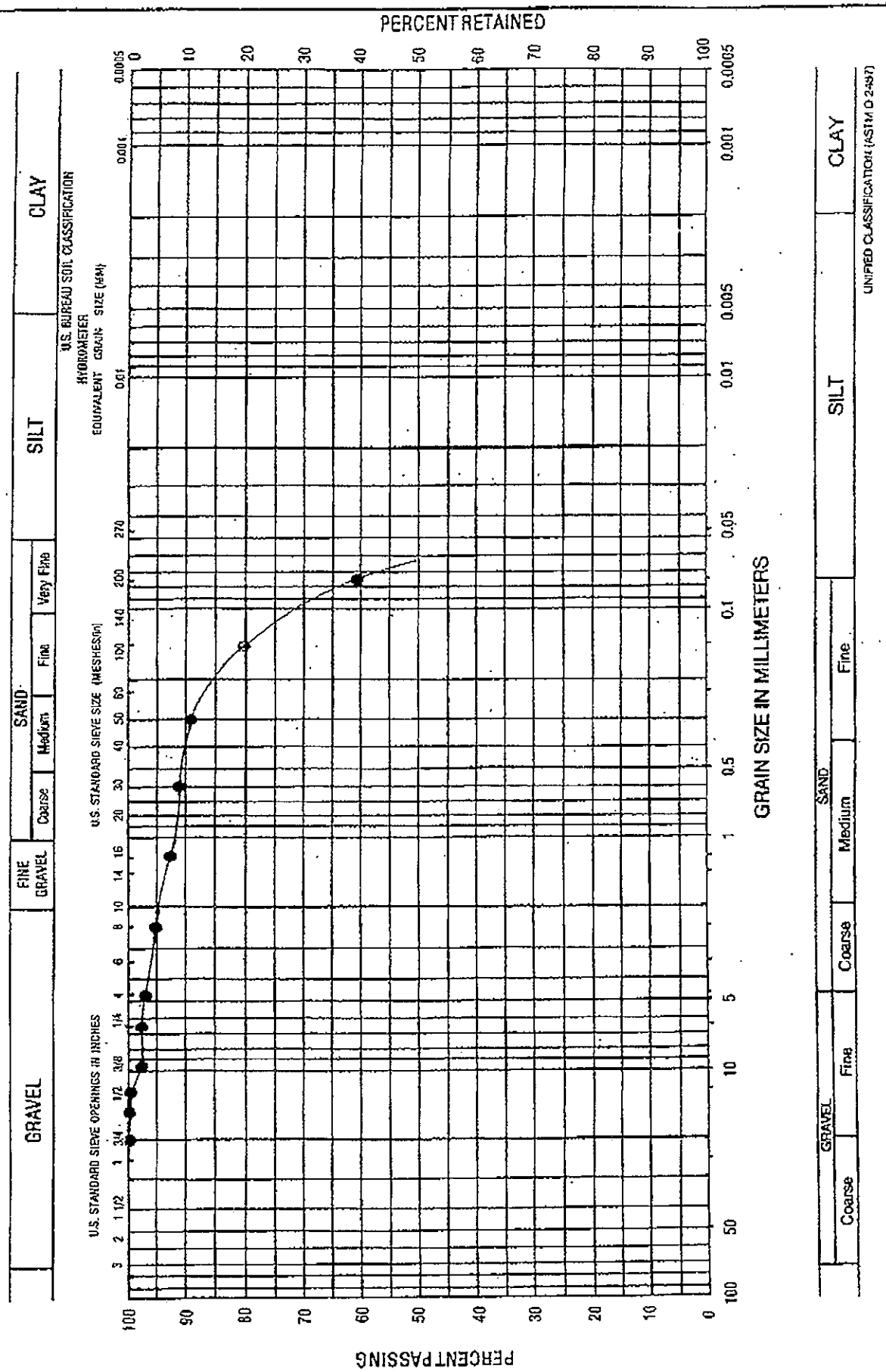
GRAIN SIZE DISTRIBUTION

09C181



BOREHOLE No. 1

SAMPLE No. 10

DEPTH 12.19 to 12.80 m.

DESCRIPTION Sandy silt

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GRAIN SIZE DISTRIBUTION

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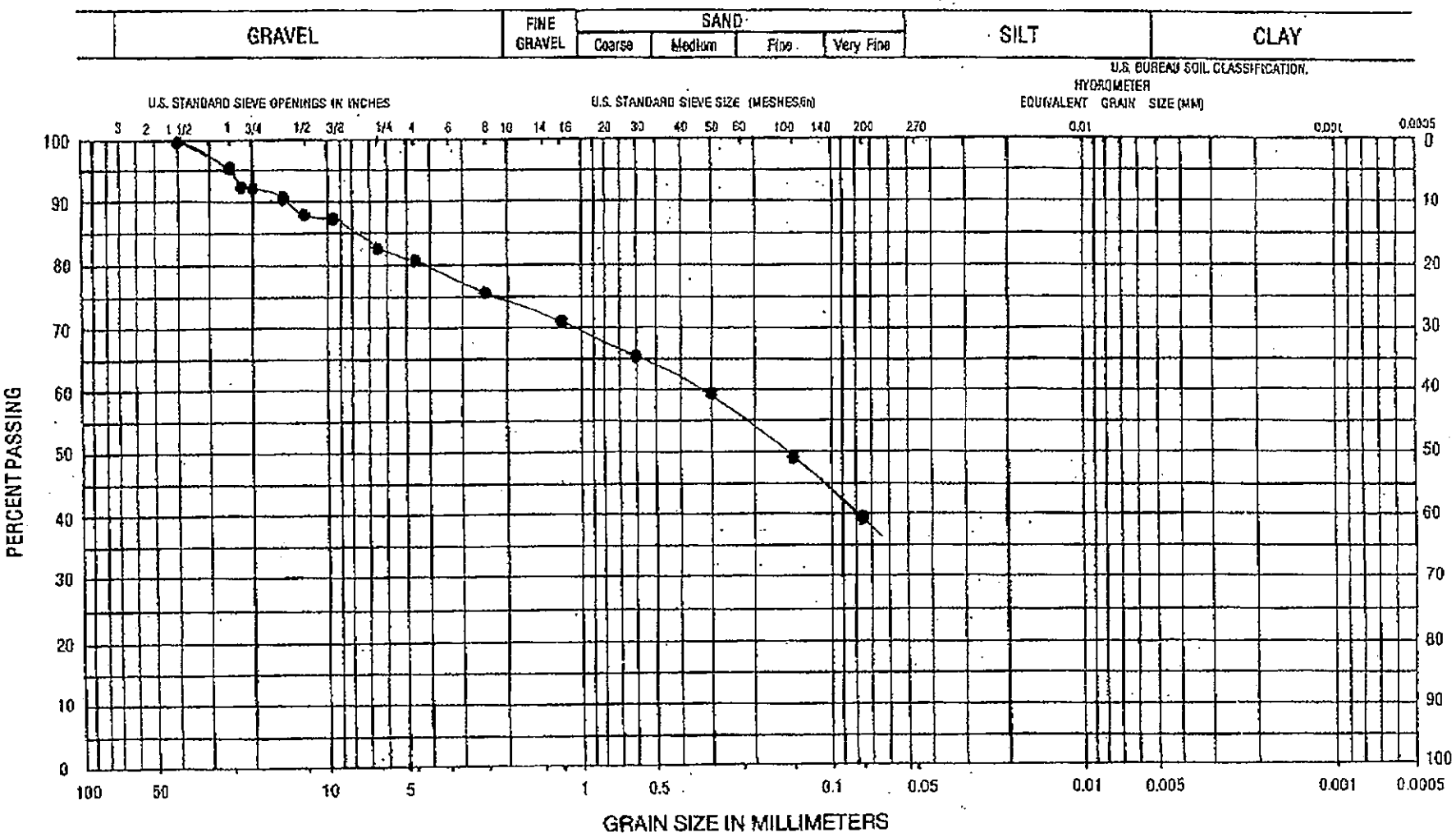

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

UNIFIED CLASSIFICATION (ASTM D 2487)

BOREHOLE No.	SAMPLE No.	DEPTH	DESCRIPTION
1	3	2.29 to 2.90 m.	Gravelly silt and sand

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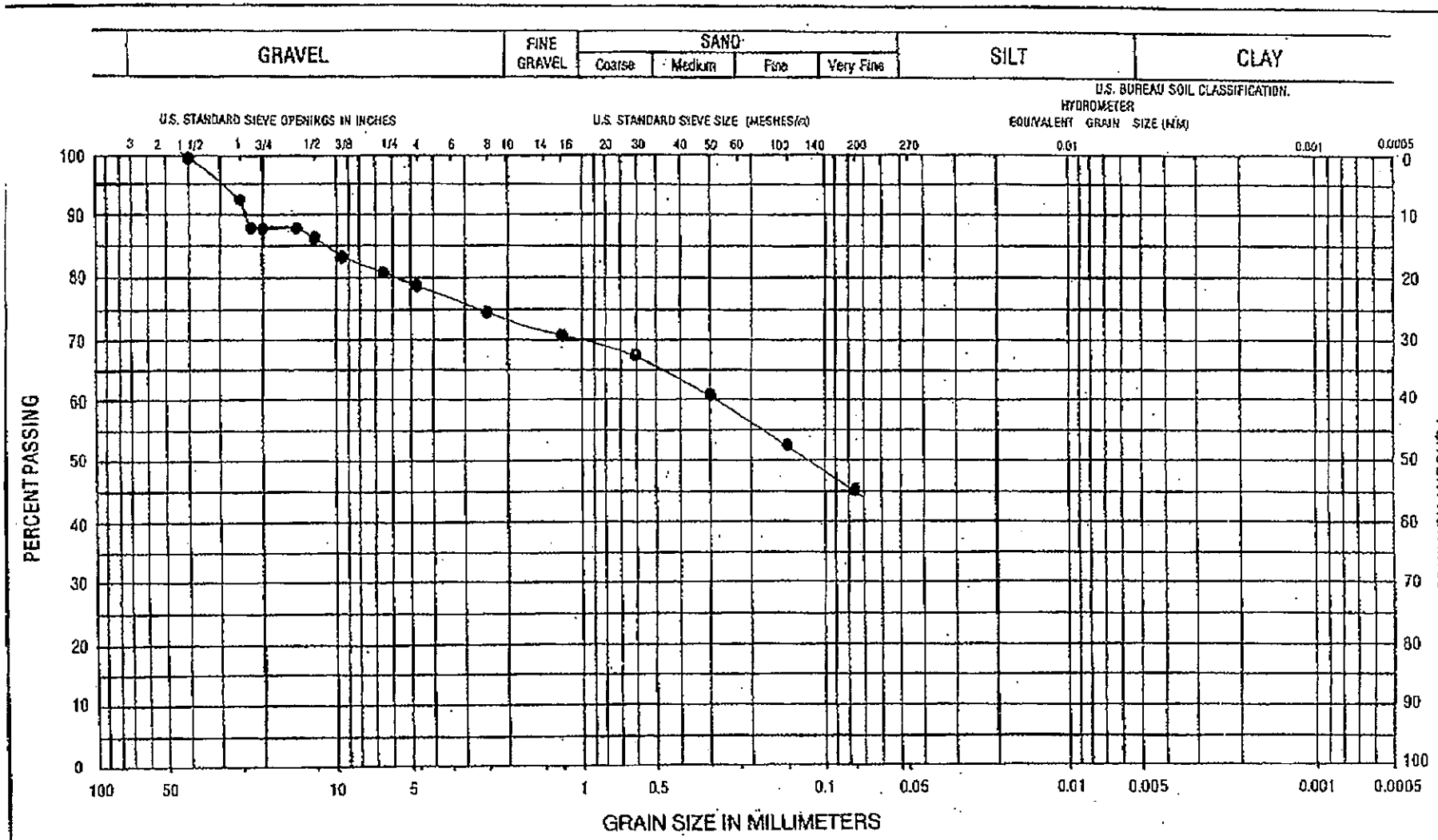
GRAIN SIZE DISTRIBUTION

09C181



GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

UNIFIED CLASSIFICATION (ASTM D 2487)

BOREHOLE No.	SAMPLE No.	DEPTH	DESCRIPTION
2	7	7.62 to 8.23 m.	Sandy gravelly silt

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GRAIN SIZE DISTRIBUTION

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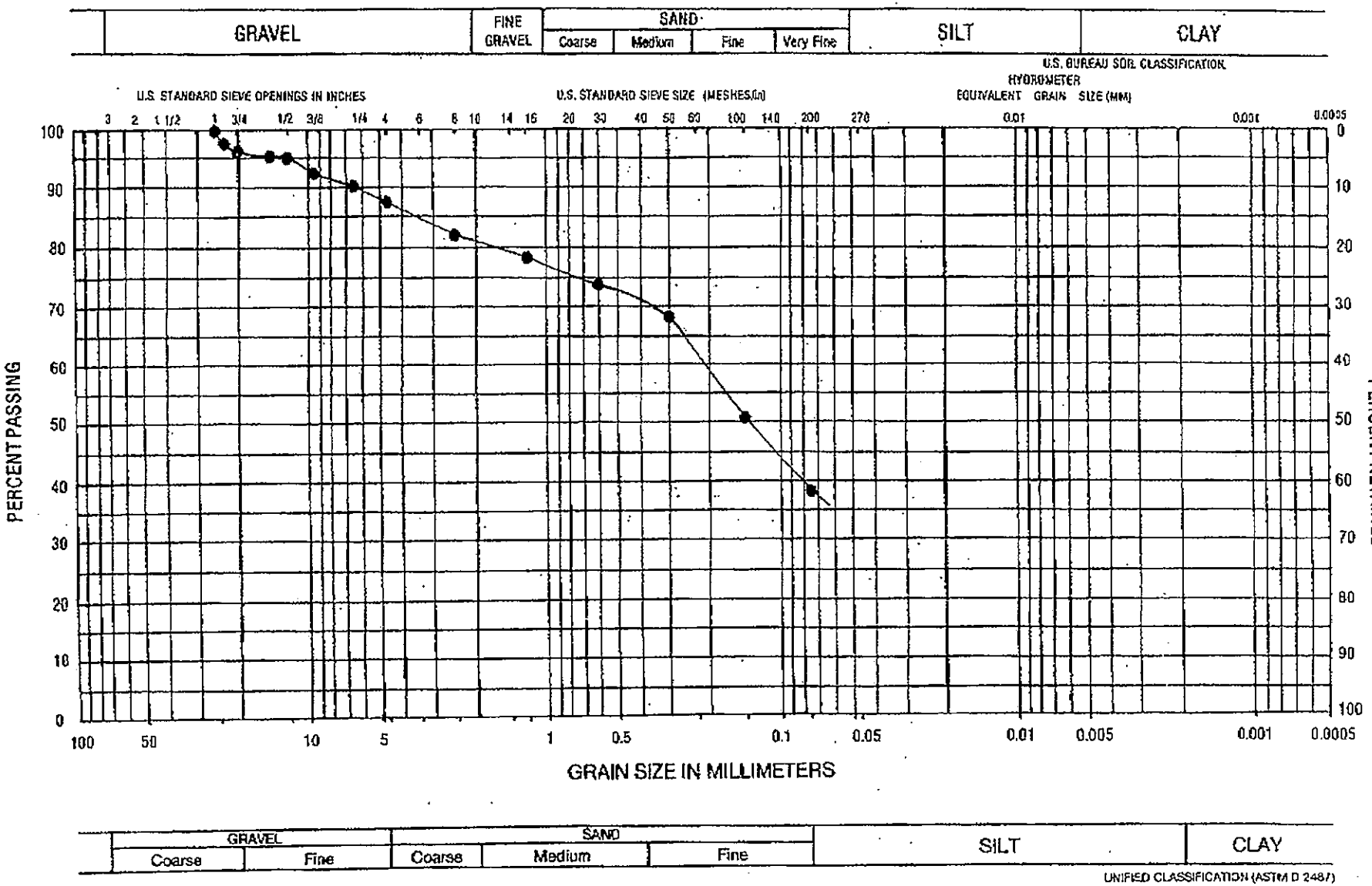

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

UNIFIED CLASSIFICATION (ASTM D 2487)

BOREHOLE No.	SAMPLE No.	DEPTH	DESCRIPTION
2	9	10.67 to 11.28 m.	Silty sand with gravel

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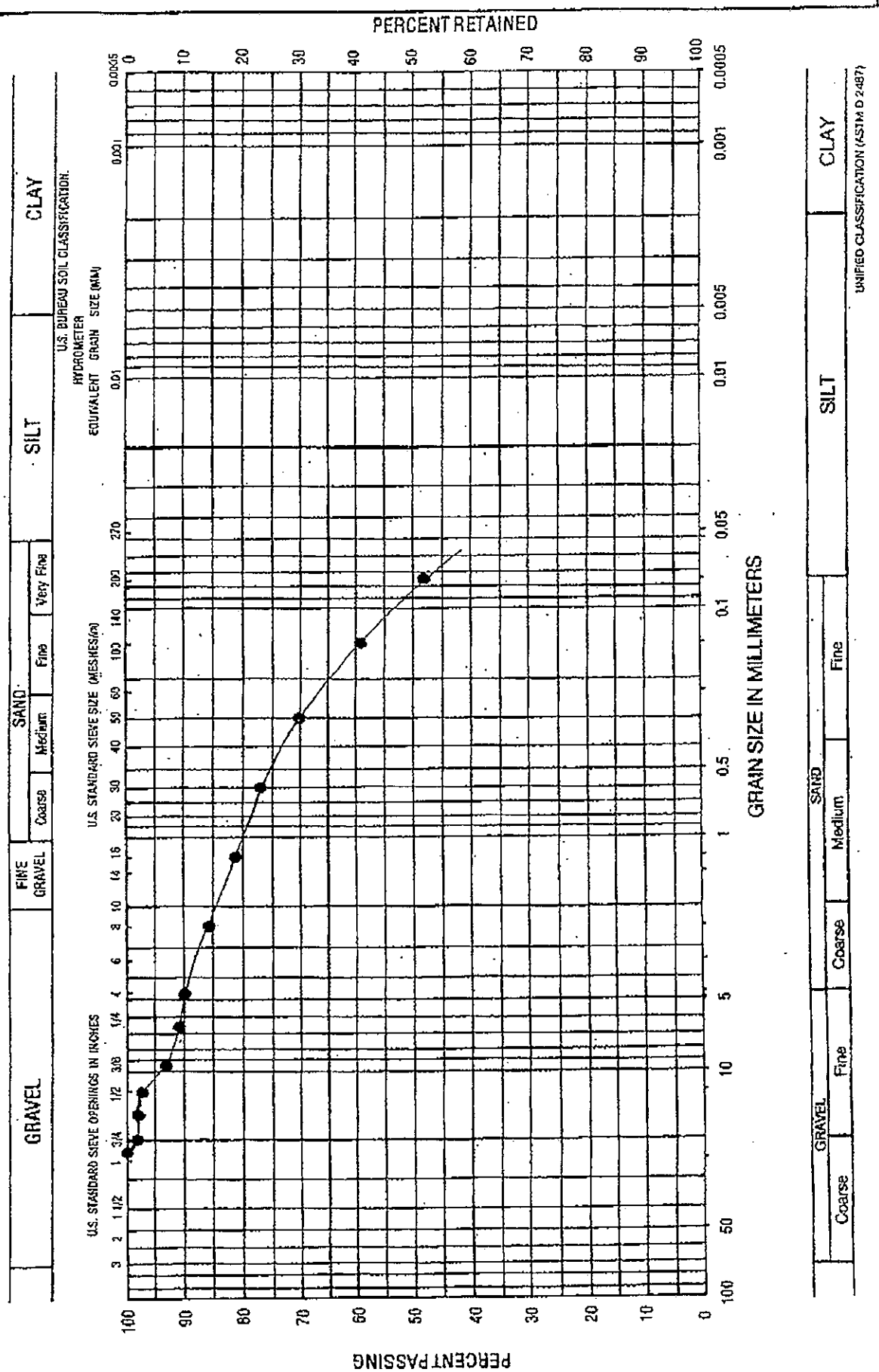
GRAIN SIZE DISTRIBUTION

09C181



BOREHOLE No. 3

SAMPLE No. 1

DEPTH .76 to 1.37 m.

DESCRIPTION Silt and sand with gravel

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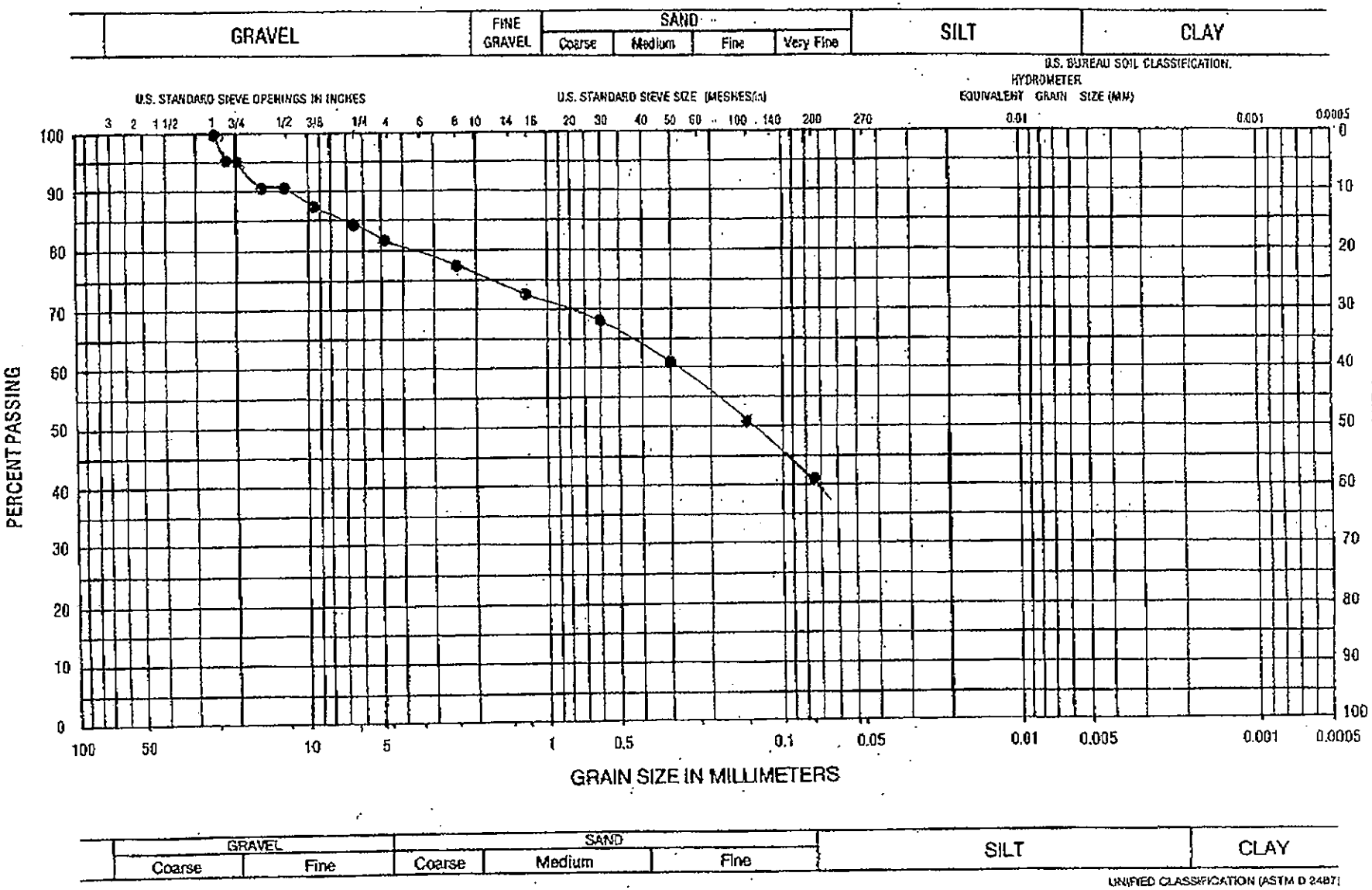
GRAIN SIZE DISTRIBUTION

09C181



GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

UNIFIED CLASSIFICATION (ASTM D 2487)

BOREHOLE No.	SAMPLE No.	DEPTH	DESCRIPTION
3	5	4.57 to 5.18 m.	Gravelly silt and sand