P. MACHIBRODA ENGINEERING LTD.

CONSULTING
GEOTECHNICAL
GEOENVIRONMENTAL
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Member of the Association of Consulting Engineers of Canada

INTERIM REPORT
SLOPE STABILITY STUDY
EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SASKATCHEWAN
PMEL FILE NO. S08-6559
NOVEMBER 19, 2008

PREPARED FOR:

TOWN OF OUTLOOK
BOX 518
OUTLOOK, SASKATCHEWAN
S0L 2N0

ATTN: MR. TRENT MICHELMAN, ADMINISTRATOR

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1.0 INTRODUCTION

The following interim report has been prepared to present the initial results of a slope stability study currently being conducted to assess the potential for slope instability along the East Bank of the South Saskatchewan River in the Town of Outlook, Saskatchewan.

The Terms of Reference for this investigation were presented in PMEL Proposal No. 0505-4941 dated May 5, 2008. Authorization to perform this work was provided on May 29, 2007.

The field test drilling and soil sampling was performed on August 13 and 15, 2008; August 27, 2008 and September 24, 2008. Groundwater monitoring was performed on September 24, 2008, October 9, 2008 and November 17, 2008.

1.1 Background

The Town of Outlook is located on the east side of the South Saskatchewan River. The Town of Outlook has a number of developments and infrastructure on the east bank of the river bank slope including a Regional Park and swimming pool; the Skytrail Bridge (former CP Rail Bridge); a pump house for potable water; a sewage pumping station; and storm sewer outfalls.

It is understood that the Town of Outlook is concerned with the potential for slope instability and potential effects to existing infrastructure [a regional park and swimming pool; the Skytrail Bridge; a pump house (potable water); a sewage pumping station; and storm sewer outfalls] by slope failures.

The river bank in the study area rises approximately 45 metres above the elevation of the South Saskatchewan River over a distance of approximately 260 metres (i.e., 6:1 horizontal to vertical). Site topography to the north of the Skytrail Bridge is defined by parallel troughs and ridges (i.e., consistent with previous landslide activity).

Utilities in the area include, but are not limited to overhead electrical power, a water force main from the pumphouse to the water treatment plant, storm outfalls and underground natural gas.

Historic bore hole records for the former CP rail bridge (currently the Skytrail Bridge) revealed that the South Saskatchewan River in the area of the study site has been in-filled with approximately 30 metres of river alluvium (i.e., sand, silt and clay). It is anticipated that initial slope instability would have occurred when the South Saskatchewan River had eroded into the clay shale.

For the purpose of this investigation, it is assumed that the existing slope is meta-stable (i.e., at or near a Factor of Safety of 1.0).

2.0 FIELD INVESTIGATION

2.1 Visual Review

A visual review of the study site was conducted on August 5, 2008. Select photographs taken of the subject property have been included in Appendix B, while brief summaries of the observations made during the review are presented in the following sub-sections.

The visual site review revealed the presence of tension cracks at the crest of river bank proximate the east abutment of the Skytrail Bridge; structural distress to the Skytrail Bridge; and cracks and settlement in the asphalt pavement around the Sewage Pumping Station. The presence of tension cracks and structural distress to the Skytrail Bridge are consistent with slope instability.

2.2 Field Test Drilling

Four test holes, located as shown on the Site Plan, Drawing No. S08-6559-1, were dry drilled using our truck-mounted, continuous flight, solid stem auger drill rig. The test holes were 150 mm in diameter and were extended to depths of 14.0 to 52.5 metres below existing ground surface.

Test hole drill logs were compiled during test drilling to record the soil stratification, the groundwater conditions, the position of unstable sloughing soils and the depths at which cobblestones and/or boulders were encountered.

Disturbed samples of auger cuttings, collected during test drilling, were sealed in plastic bags to minimize moisture loss. The soil samples were taken to our laboratory for analysis.

Piezometers (slotted, 50 mm diameter PVC pipe) were installed in each Test Hole for groundwater monitoring purposes.

3.0 FIELD DRILL LOGS

The field drill logs recorded during test drilling have been shown plotted on Drawing Nos. S08-6559-2 to 5B, inclusive.

3.1 Soil Profile

Detailed descriptions of the site stratigraphy are presented on the Test Hole Logs, Drawing Nos. S08-6559-2 through 5B, inclusive, while a stratigraphic section of the site has been shown plotted on Drawing No. S08-6559-6. In general the site stratigraphy consisted of glacial till overlying clay shale.

3.2 Groundwater Conditions, Sloughing

Seepage and sloughing conditions were encountered during test drilling. The depths at which seepage and sloughing conditions were encountered have been shown plotted on the Field Drill Logs, Drawings Nos. S08-6559-2 through 5B, inclusive.

A summary of the measured groundwater elevations recorded during this investigation is presented in Table I. An examination of Table I revealed that the depth to groundwater on November 17, 2008 ranged from 7.8 to 34.9 metres below grade.

TABLE I. RECORDED GROUNDWATER LEVELS

Test Hole No.	Ground Surface Elevation (metres)	Piezometer Rim Elevation (metres)	Recorded Groundwater Elevation (metres)		
			Sept. 24, 2008	Oct. 9, 2008	Nov. 17, 2008
08-1	500.2	501.2	483.5	487.8	483.7
08-2	510.0	511.1	496.4	500.8	500.8
08-3	525.4	526.6	491.6	NM	490.5
08-4	494.9	495.7	Dry	486.6	486.9

It should be recognized that the recorded water levels have not stabilized. Higher and potentially perched groundwater levels should be expected following piezometer stabilization.

3.3 Cobblestones and Boulders

The glacial till consisted of a heterogeneous mixture of gravel, sand, silt and clay-sized particles. The glacial till strata also contained sorted deposits of the above particle sizes. In addition to the sorted deposits, a random distribution of larger particle sizes in the cobblestone range (60 to 200 mm) and boulder-sized range (larger than 200 mm) should be expected at the subject site.

It should be recognized that the statistical probability of encountering cobblestones and/or boulders in the four small diameter Test Holes drilled at this site was low. Intertill deposits of cobblestones, boulders, boulder pavements and isolated deposits of saturated sand or gravel should be anticipated. The frequency of encountering such deposits will increase proportionately with the number of holes drilled.

4.0 LABORATORY ANALYSIS

The soil classification and index tests performed during this investigation consisted of a visual classification of the soil, water contents, Atterberg limits, and grain size distribution analysis.

The results of the soil classification and index tests conducted on representative samples of soil have been plotted on the drill logs alongside the corresponding depths at which the samples were recovered, as shown on Drawing Nos. S08-6559-2 to 5B, inclusive.

The results of the grain size distribution analyses have been plotted on Drawing Nos. S08-6559-7 to 10, inclusive.

5.0 SLOPE STABILITY

A theoretical slope stability analysis was performed to quantify the Factor of Safety of the East Bank of the South Saskatchewan River in the Town of Outlook, Saskatchewan. The theoretical slope stability analysis was performed using the SLOPE/W computer program available through Geo-Slope International Ltd.[1] The General Limit Equilibrium method was used for all analysis.

5.1 Input for Analysis

5.1.1 Surface Geometry

Horizontal and vertical survey control was performed to establish the plan location and vertical elevation of the test hole locations, as well as one transect of the river bank profile. The results of the elevation survey have been shown plotted on Stratigraphic Section A-A', Drawing No. S08-6559-6.

5.1.2 Soil Stratigraphy

The stratigraphic units as well as the lithologic boundaries were interpreted from the results of the subsurface soils investigation and historic bore hole records for the CP Rail Bridge. The slope was analyzed for composite failure consistent with slope instability in clay shale along the South and North Saskatchewan Rivers.

5.1.3 Piezometric Conditions

The piezometric surface for the slope stability analysis was based on recorded water levels. A hydrostatic pore pressure condition was used for the slope stability analysis.

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[1] Geo-Slope International Ltd., 1993. Slope/W User's Manual, A Comprehensive Program for Slope Stability Analysis, Geo-Slope International Ltd., Calgary, Alberta.

5.1.4 Soil Properties

The soil properties obtained during this investigation, as well as the suggested design strength parameters used for the slope stability analysis have been presented in Table II. The design strength parameters were selected to reflect the presence of secondary structures including slickensiding; jointing and breccia; stress history and physical soil properties. These values of soil strength parameters used for analysis were consistent with published soil strength parameters for this geographic region.

TABLE II. SOIL PARAMETERS FOR ANALYSIS

Material Type	Unit Weight (kN/m^3)	Effective Cohesion (kPa)	Internal Angle of Friction (Degrees)
Alluvium (Sand/Silt)	19.0	0.0	30.0
Glacial Till	21.5	5.0	27.0
Clay Shale (Undisturbed)	18.0	5.0	15.0
Clay Shale (disturbed)	18.0	5.0	6.0

5.2 Results of Analysis

The results of the stability analysis for the existing slope have been presented in Table III.

TABLE III. SLOPE STABILITY ANALYSIS RESULTS

Stratigraphic Section	Inferred Shear Zone Elevation (Metres)	Calculated Factor of Safety
A-A'	450	1.0

An examination of Table II revealed the calculated Factor of Safety (FS) for the existing slope is approximately 1.0 and, that the most probable failure zone is deep within the clay shale strata (i.e., 35 metres below existing River Elevation). The Factor of Safety of a slope (FS) is defined as the ratio of the available shear strength of the soil, to the minimum shear strength required to maintain stability. A Factor of Safety of equal to or less than 1 would indicate the potential for slope failure.

6.0 DISCUSSION OF RESULTS

A slope stability study was performed to quantify the existing Factor of Safety of the East Bank of the South Saskatchewan River in the Town of Outlook, Saskatchewan. The stability analysis confirmed that the east bank of the South Saskatchewan River in the Town of Outlook is meta-stable (i.e., at or near a Factor of Safety of 1.0) and that the probable failure mode is a deep seated composite slip surface at nominal Elevation 450 metres (i.e., 35 metres below the river elevation).

Based on the results of the initial test drilling and historic bore hole records for the alluvium deposits in the South Saskatchewan River, the installation of one deep slope indicator located proximate Test Hole No. 08-1, is proposed. The slope indicator will extend to a depth of at least 10 metres below the elevation of the probable slip plane (i.e., to nominal elevation 440 metres). Once installed, the slope indicator would be monitored to more accurately determine the location of the slip plane and to determine the rate of lateral slope movement.

Initial monitoring results will be used in the preparation of design considerations and recommendations for any remedial measures.

7.0 LIMITATIONS

The presentation of the summary of the field drill logs and interim slope stability analysis has been completed as authorized. Four, 150 mm diameter test holes were completed at this site. A field drill log was compiled for each Test Hole during test drilling which, we believe, was representative of the subsurface conditions at the Test Hole locations at the time of test drilling. Variations in the subsurface conditions from that shown on the drill logs at locations other than the exact Test Hole locations should be anticipated.

The Terms of Reference for this slope stability study did not include any environmental assessment of the site. No detectable evidence of environmentally sensitive materials such as hydrocarbon odour was detected during the actual time of the field test drilling program. If, on the basis of any knowledge, other than that formally communicated to us, there is reason to suspect that environmentally sensitive materials may exist, then additional test holes should be drilled and samples recovered for chemical analysis.

The subsurface investigation necessitated the drilling of deep test holes. Each Test Hole was backfilled with auger cuttings at the completion of drilling. Please be advised that some settlement of the backfill material will occur which may leave a depression or an open hole. It is the responsibility of the client to inspect the site and backfill, as required, to ensure that the ground surface at each Test Hole location is maintained level with the existing grade.

This report has been prepared for the exclusive use of the Town of Outlook and their agents for specific application to the east bank in the Town of Outlook, Saskatchewan. It has been prepared in accordance with generally accepted geotechnical engineering practices and no other warranty, express or implied, is made.

Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. PMEL accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

If this report has been transmitted electronically, it has been digitally signed and secured with personal passwords to lock the document. Due to the possibility of digital modification, only originally signed reports and those reports sent directly by PMEL can be relied upon without fault.

We trust that this report fulfills your requirements for this project. Should you require additional information, please contact us.

P. MACHIBRODA ENGINEERING LTD.

Frank Hynes, P. Eng., M. Eng.

Paul Machibroda, P.Eng., P. Geo, FCSCE

FH/PM:clb

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
P. MACHIBRODA ENGINEERING LTD.
Number 172
Permission to Consult held by:

Discipline	Sk. Reg. No.	Signature
Geotechnical	01365	P. Machibroda

08-11-20

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MEMBER 9670
08 11 19
YR. MN. DAY
SASKATCHEWAN

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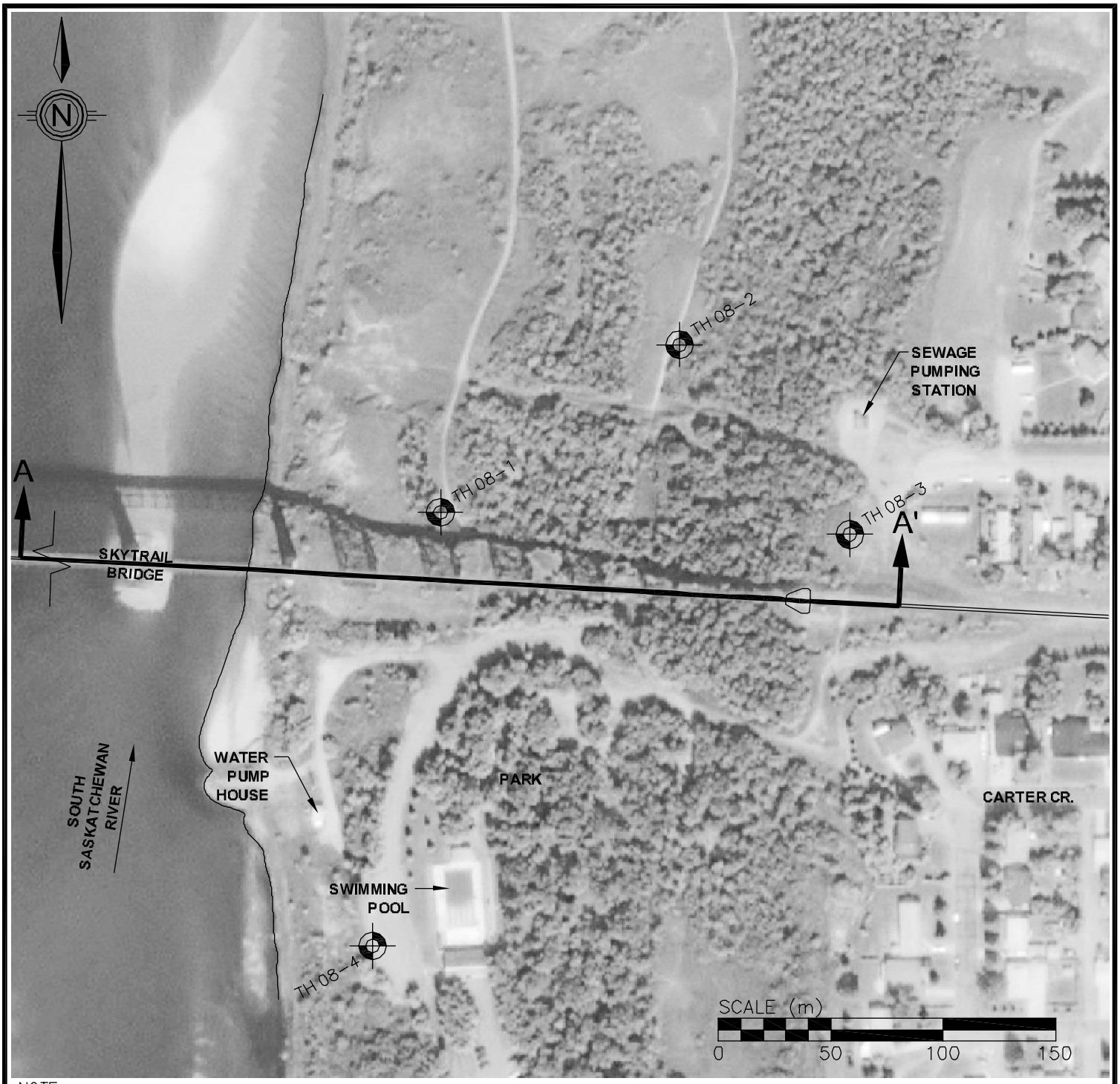
DRAWINGS



NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM GOOGLE EARTH PRO ©2008, IMAGE ©2008 DIGITALGLOBE.
3. BENCHMARK DESCRIPTION: PMEL SURVEY REFERENCE TO TOWN OF OUTLOOK BENCHMARK No: 85VOL13 LOCATED ON THE NORTHEAST CORNER OF 1st AVENUE AND McKENZIE STREET NORTH. DATUM ELEV. = 531.800 m.

LEGEND — PMEL TEST HOLE (PIEZOMETER INSTALLED)

CONSULTING GEOENVIRONMENTAL GEOTECHNICAL ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

2623 B FAITHFULL AVENUE
SASKATOON, SK
S7K 5W2

DRAWING TITLE:

SITE PLAN - TEST HOLE LOCATIONS

PROJECT:

SLOPE STABILITY STUDY
EAST BANK, SOUTH SASKATCHEWAN RIVER, OUTLOOK, SK

APPROVED BY:	DRAWN BY:	DRAWING NUMBER:
F. HYNES	G. SOLTYS	S08-6559-1
DATE: NOVEMBER, 2008	SCALE: 1:2500	

PIEZO. ELEV.= 501.2 m

TEST HOLE 08-1

ELEV: 500.2 m

DEPTH (m)	N	U	γ_w	Pw	Lw	w	
0	PP						**SILT,** some clay, trace sand, stiff, medium plastic, moist, brown.
	BENTONITE SEAL						
1						8.1	
2	CUTTINGS						**GLACIAL TILL,** clay, some silt, some sand, trace gravel, very stiff to hard, medium plastic, moist, brown, oxide stained, gypsum crystals.
3						12.9	
	50 mm diam. SCH 40, PVC RISER PIPE						
4							
				15	46	14.5	
5							
6							
				20.7		15.1	
7							
						15.2	
8							
9						17.4	
10							
						19.5	
11							

488.7 m NOV 17/08

CONTINUED ON NEXT PAGE

LEGEND:

TOPSOIL, GRAVEL, SAND, SILT, CLAY, CLAY SHALE, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE, SPLIT SPOON, CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

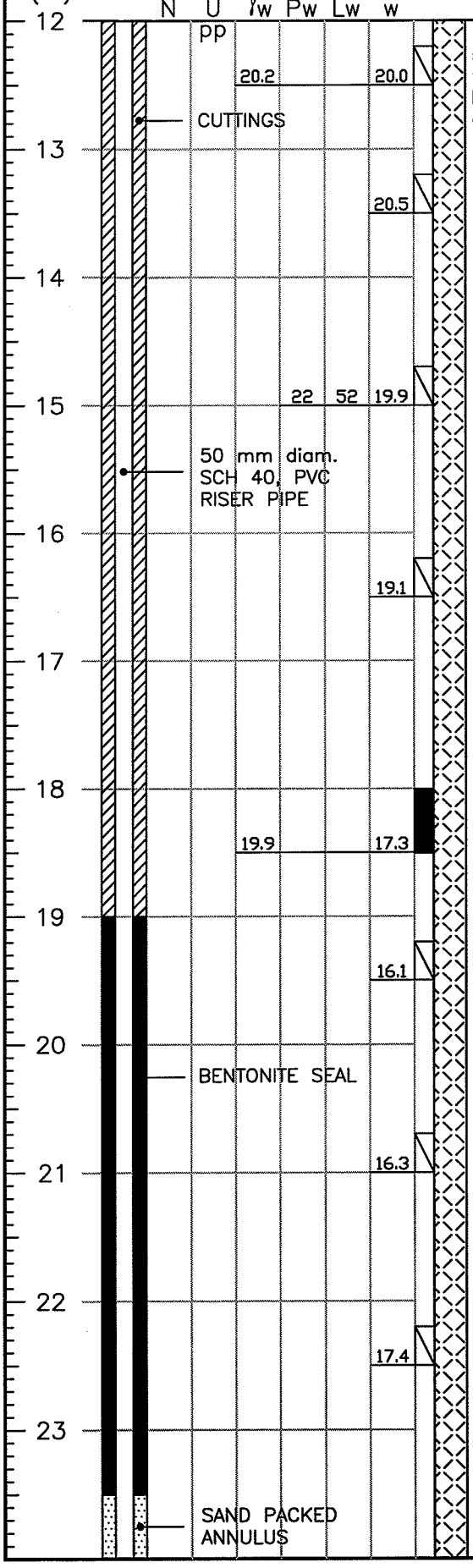
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
AUG 13/08	S08-6559-2

TEST HOLE 08-1

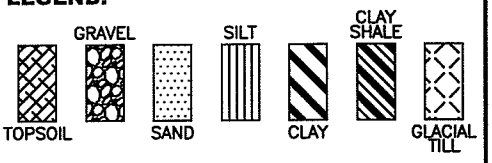


GLACIAL TILL, clay, some silt, some sand, trace gravel, very stiff to hard, medium plastic, moist, brown, oxide stained, gypsum crystals.

–grey below 15.0 m.

CONTINUED ON NEXT PAGE

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

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P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

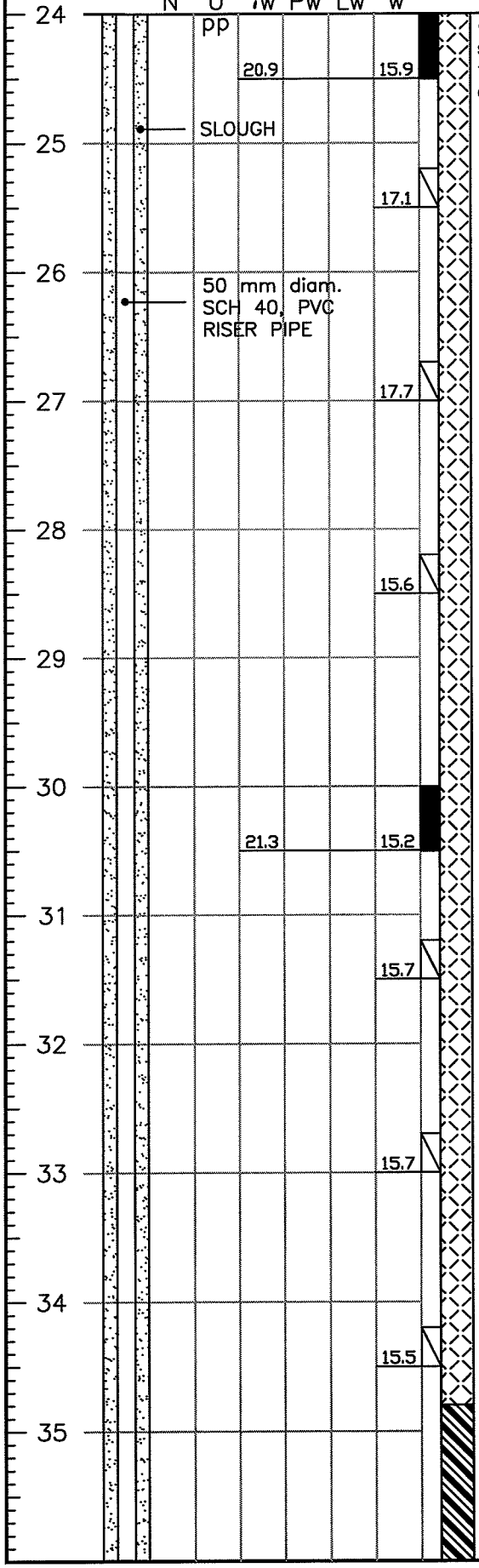
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	DRAWING NUMBER:
AUG 13/08	S08-6559-2A

TEST HOLE 08-1

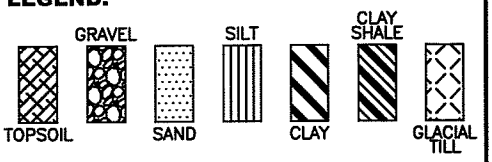


GLACIAL TILL, clay, some silt, some sand, trace gravel, very stiff to hard, medium plastic, moist, grey.

CLAY SHALE, silty, some sand, very stiff to hard, highly plastic, moist, grey.

CONTINUED ON NEXT PAGE

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

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I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

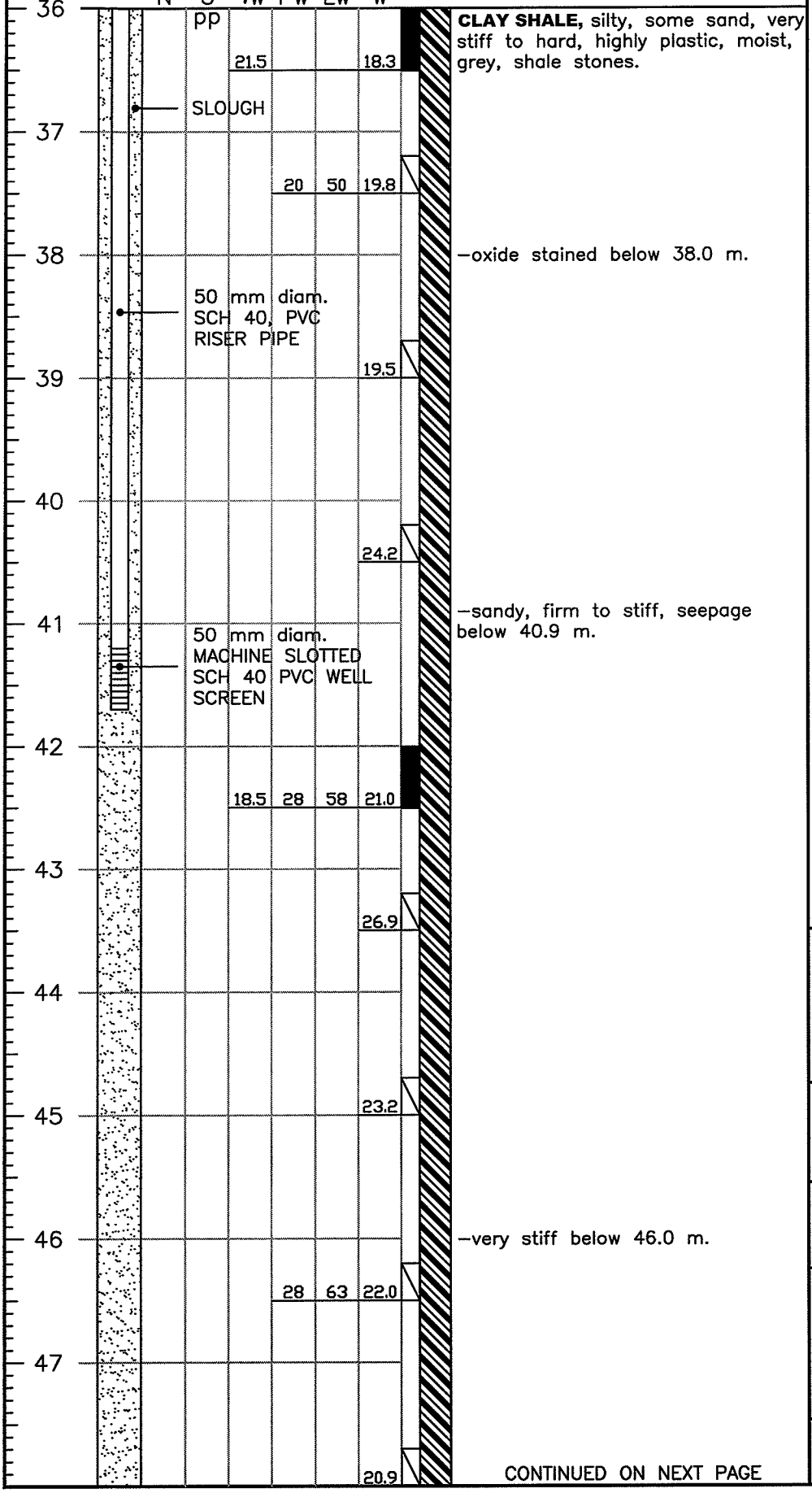
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	DRAWING NUMBER:
AUG 13/08	S08-6559-2B

TEST HOLE 08-1



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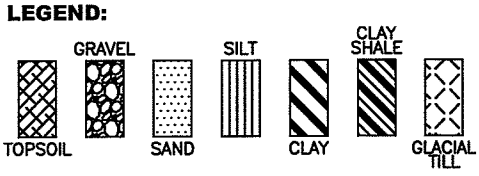

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▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

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FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

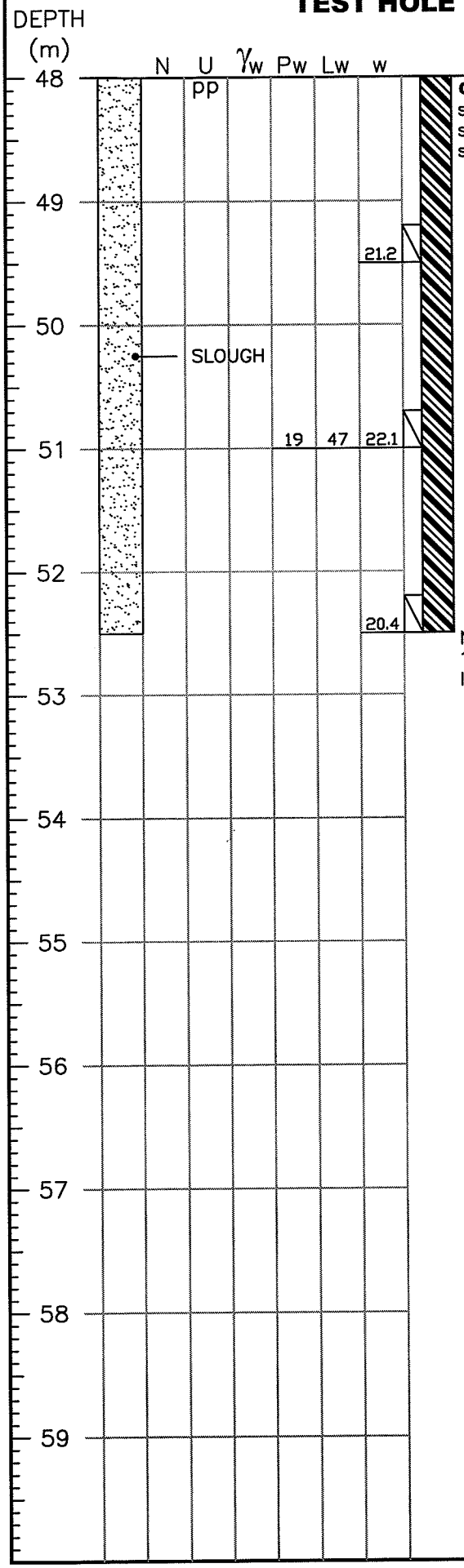
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
AUG 13/08	S08-6559-2C

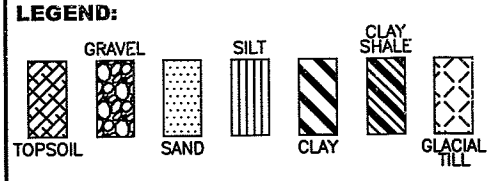
TEST HOLE 08-1



CLAY SHALE, silty, sandy, very stiff, highly plastic, moist, grey, shale stones, oxide stained, seepage.

NOTE:
1. Test Hole sloughed to 24.0 m I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

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pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

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FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

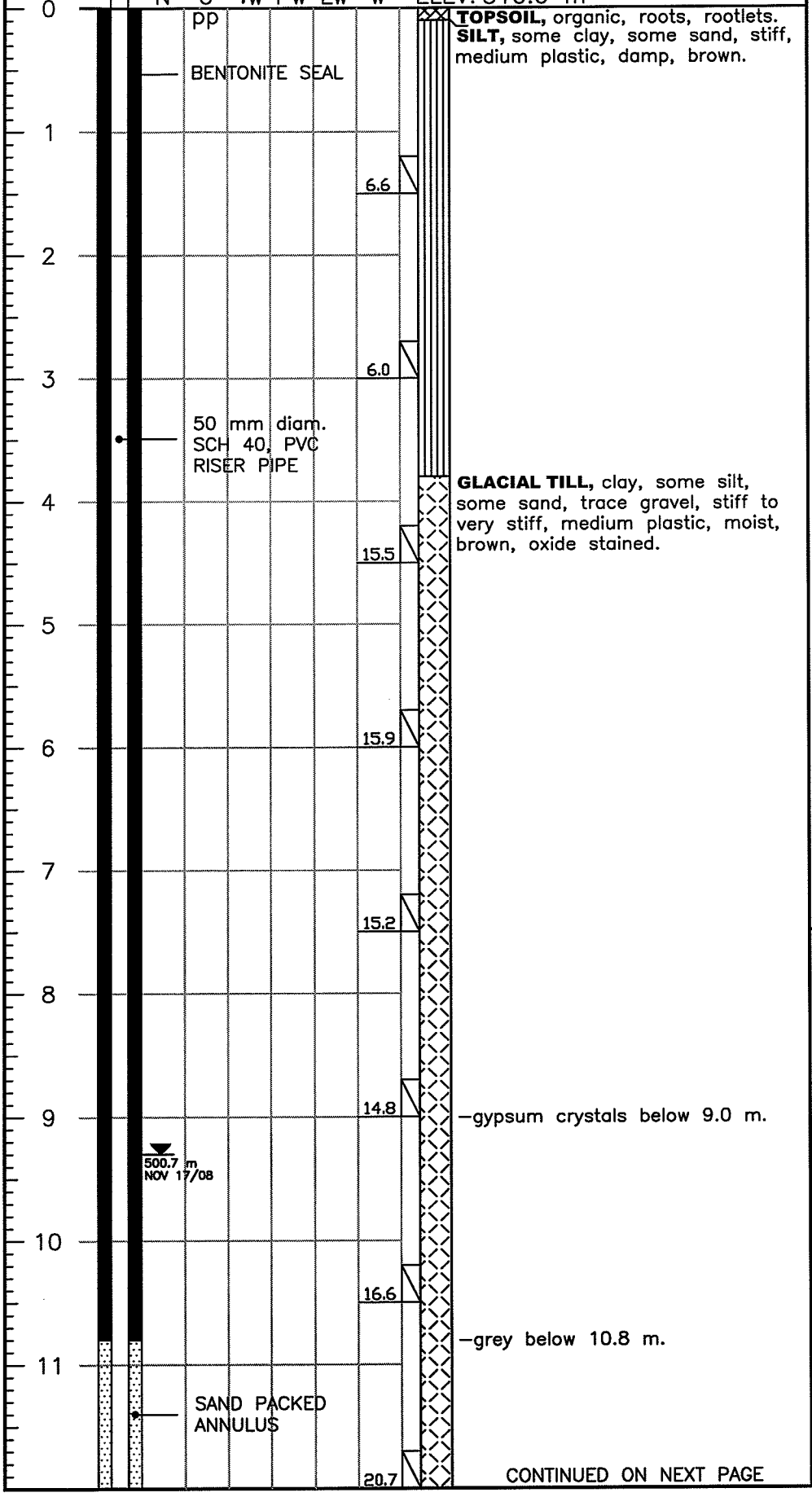
NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
AUG 13/08	S08-6559-2D

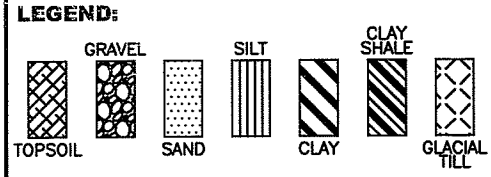
PIEZO. ELEV.= 511.1 m

TEST HOLE 08-2

ELEV: 510.0 m



LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

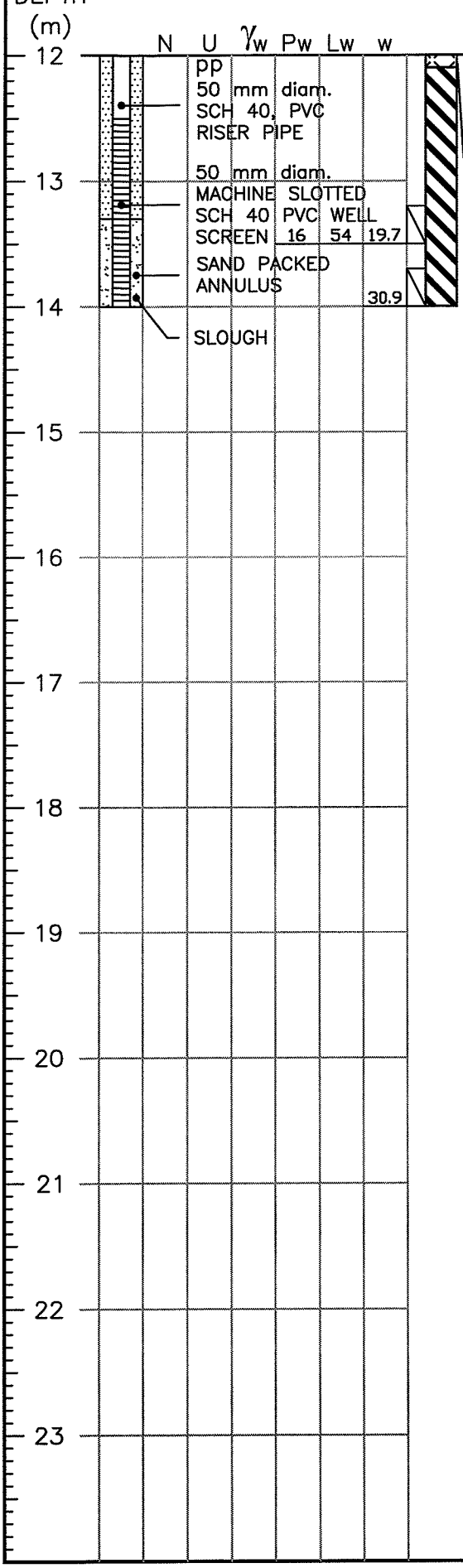
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	DRAWING NUMBER:
SEP 24/08	S08-6559-3

TEST HOLE 08-2



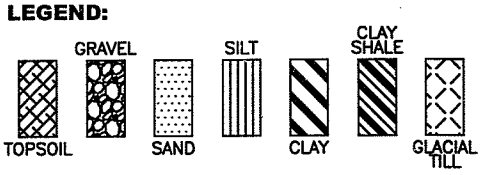
GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff to very stiff, medium plastic, moist, grey, oxide stained, gypsum crystals.

CLAY, some silt, some sand, firm, highly plastic, moist, brown.

–sandy, low plastic, seepage below 13.5 m.

NOTE:
1. Test Hole sloughed to 13.3 m I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE | SPLIT SPOON | CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	DRAWING NUMBER:
SEP 24/08	S08-6559-3A

PIEZO. ELEV.= 526.6 m

TEST HOLE 08-3

ELEV: 525.4 m

DEPTH (m)	N	U	γ_w	Pw	Lw	w
0		pp				
1						7.9
2						
3						10.6
4						9.0
5						
6						12.6
7						13.7
8						
9						15.5
10						16.6
11						

BENTONITE SEAL

CUTTINGS

50 mm diam. SCH 40, PVC RISER PIPE

TOPSOIL, dark brown, roots, rootlets.

SILT, some clay, some sand, stiff, medium plastic, damp, light brown.

GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff to very stiff, medium plastic, moist, brown, oxide stained, gypsum crystals.

–very stiff to hard, grey below 10.8 m.

CONTINUED ON NEXT PAGE

LEGEND:

TOPSOIL, GRAVEL, SAND, SILT, CLAY, CLAY SHALE, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE, SPLIT SPOON, CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

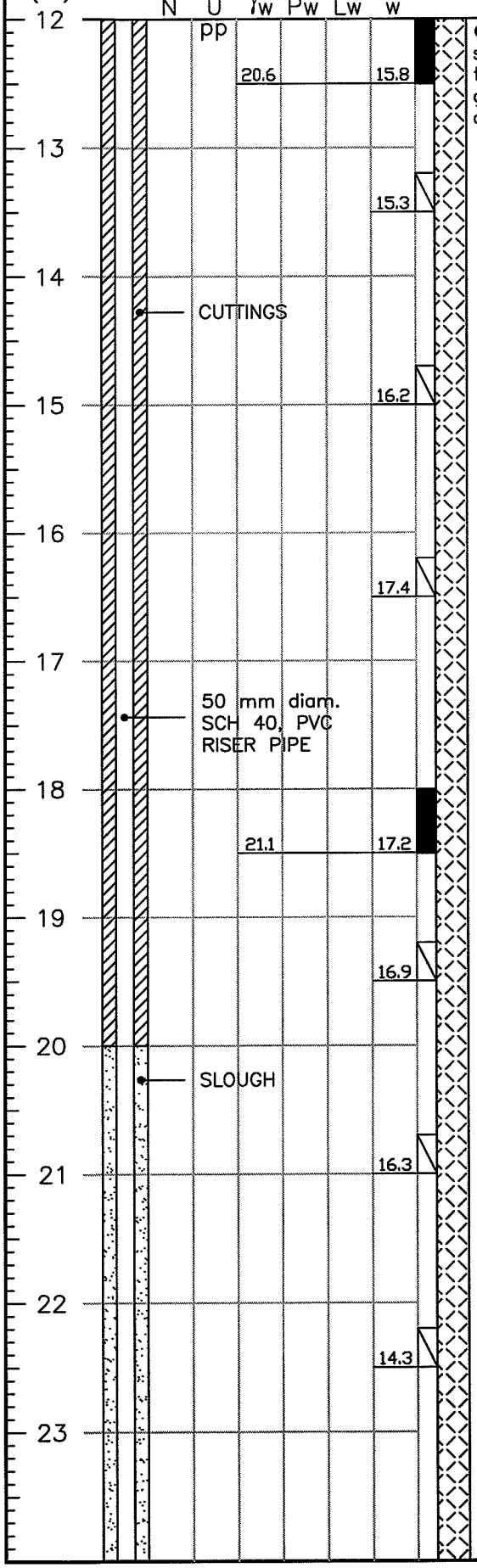
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	DRAWING NUMBER:
AUG 14/08	S08-6559-4

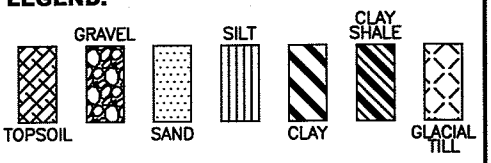
TEST HOLE 08-3



GLACIAL TILL, clay, some silt, some sand, trace gravel, very stiff to hard, medium plastic, moist, grey, oxide stained, gypsum crystals.

CONTINUED ON NEXT PAGE

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

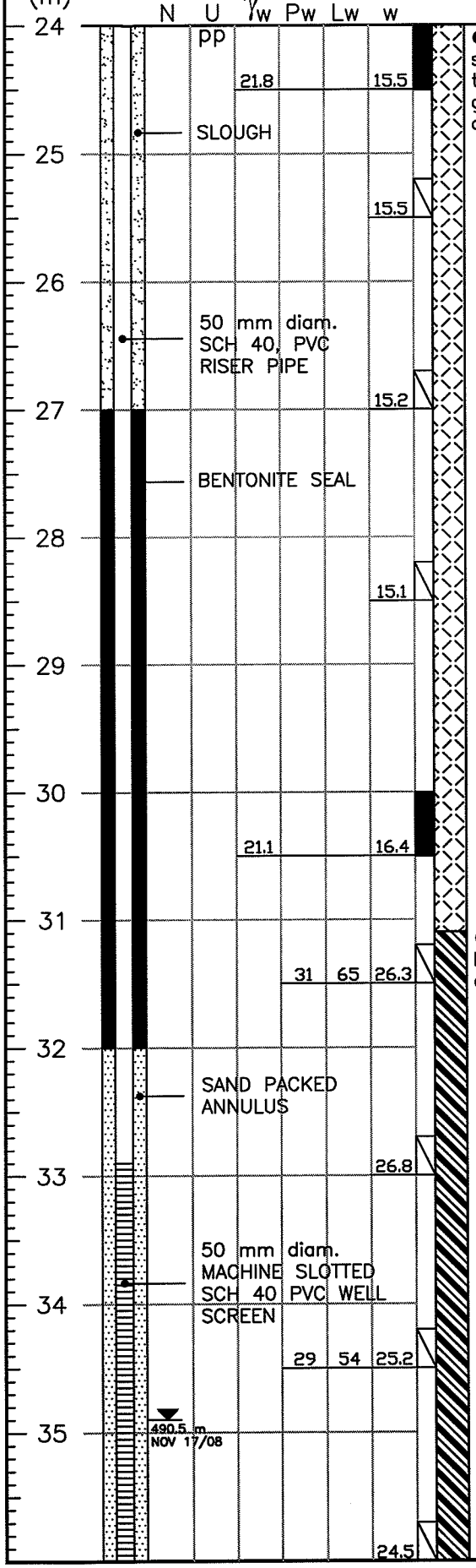
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
AUG 14/08	S08-6559-4A

TEST HOLE 08-3

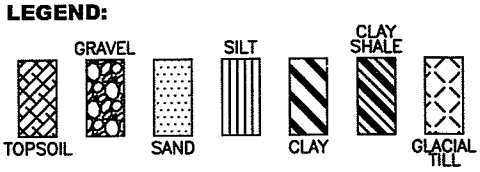


GLACIAL TILL, clay, some silt, some sand, trace gravel, very stiff to hard, medium plastic, moist, grey, oxide stained, gypsum crystals.

CLAY SHALE, some silt, very stiff, highly plastic, moist, light grey to grey, seepage.

CONTINUED ON NEXT PAGE

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

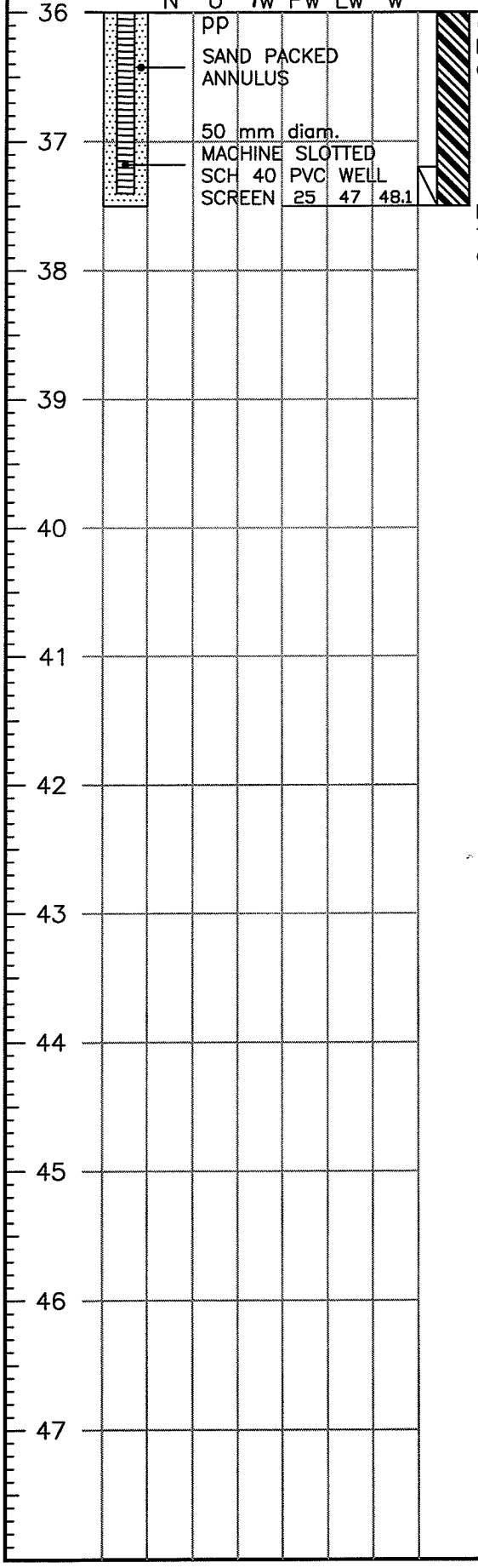
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
AUG 14/08	S08-6559-4B

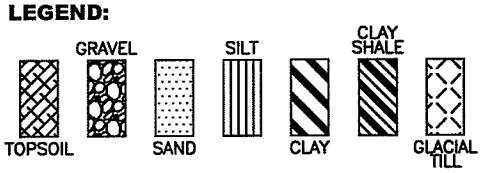
TEST HOLE 08-3



CLAY SHALE, some silt, very stiff, highly plastic, moist, light grey to grey, seepage.

NOTE:
1. Test Hole open to 37.5 m and dry I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
AUG 14/08	S08-6559-4C

PIEZO. ELEV.= 495.7 m

TEST HOLE 08-4

ELEV: 494.9 m

DEPTH (m)	N	U	γ_w	Pw	Lw	w
0						
1						8.3
2						
3						7.4
4						
5						8.5
6						11.2
7						17.9
8						
9						14.0
10						16.0
11						

pp

BENTONITE SEAL

50 mm diam. SCH 40, PVC RISER PIPE

CUTTINGS

486.9 m NOV 17/08

2.0

4.0

FILL, sand and gravel, trace silt, compact to dense, well graded, fine to coarse grained, moist, brown.

SAND, trace silt, compact, poorly graded, fine grained, moist, brown, oxide stained.

–dense below 5.5 m.

SILT, sandy, trace clay, firm, low plastic, moist, brown, oxide stained.

GLACIAL TILL, clay, silty, some sand, trace gravel, stiff, medium plastic, moist, brown, oxide stained, gypsum crystals.

–hard below 9.1 m.

18.4

CONTINUED ON NEXT PAGE

LEGEND:

FILL, GRAVEL, SAND, SILT, CLAY, CLAY SHALE, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE, SPLIT SPOON, CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

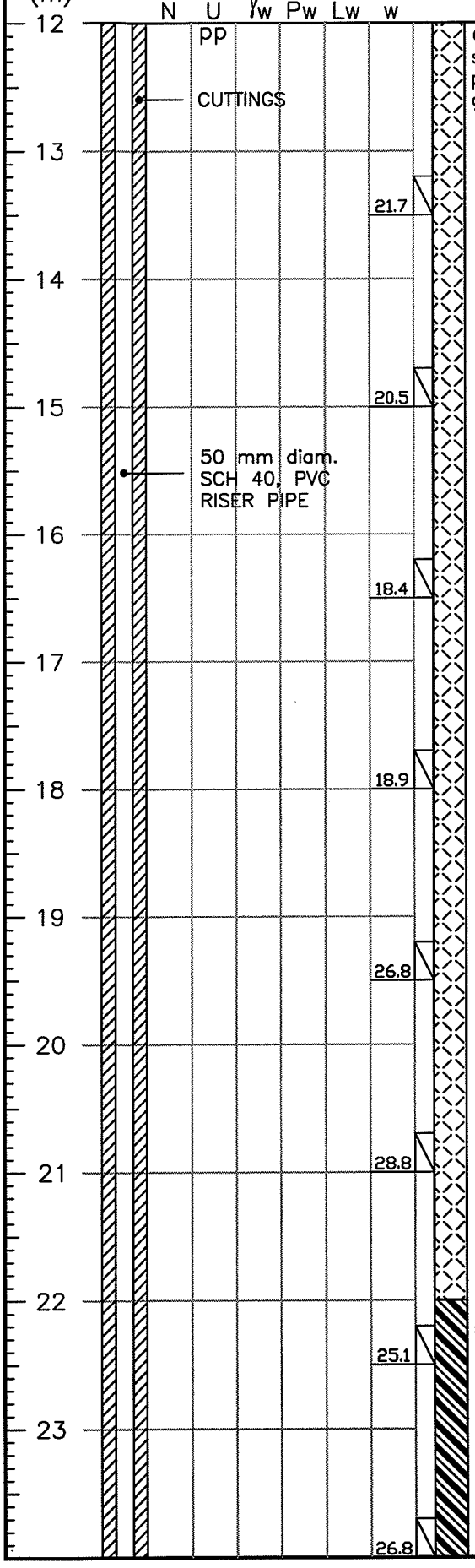
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	DRAWING NUMBER:
AUG 27/08	S08-6559-5

TEST HOLE 08-4

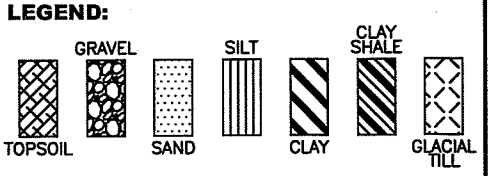


GLACIAL TILL, clay, silty, some sand, trace gravel, hard, medium plastic, moist, brown, oxide stained, gypsum crystals.

CLAY SHALE, silty, trace sand, very stiff, highly plastic, moist, grey.

CONTINUED ON NEXT PAGE

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

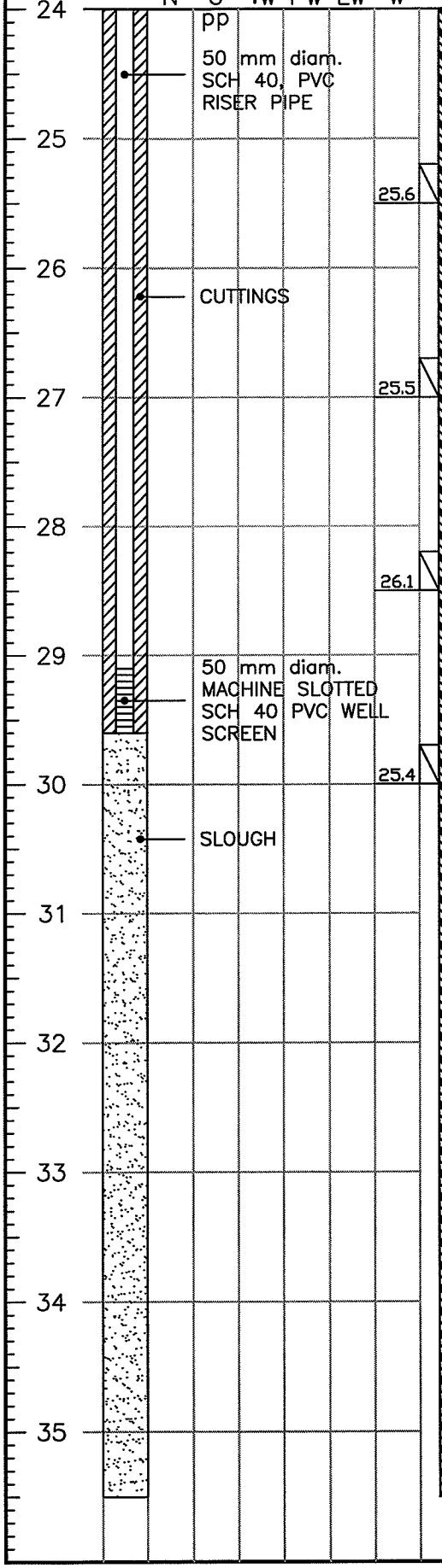
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
AUG 27/08	S08-6559-5A

TEST HOLE 08-4



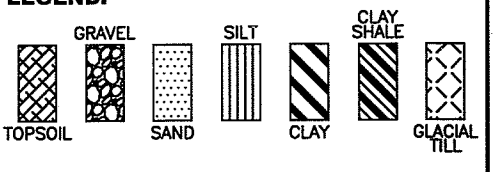
CLAY SHALE, silty, trace sand, very stiff, highly plastic, moist, grey.

–wet, seepage, sloughing below 34.0 m.

–sandy below 35.0 m.

NOTE:
1. Test Hole sloughed to 29.6 m I.A.D.

LEGEND:



w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:

SLOPE STABILITY STUDY

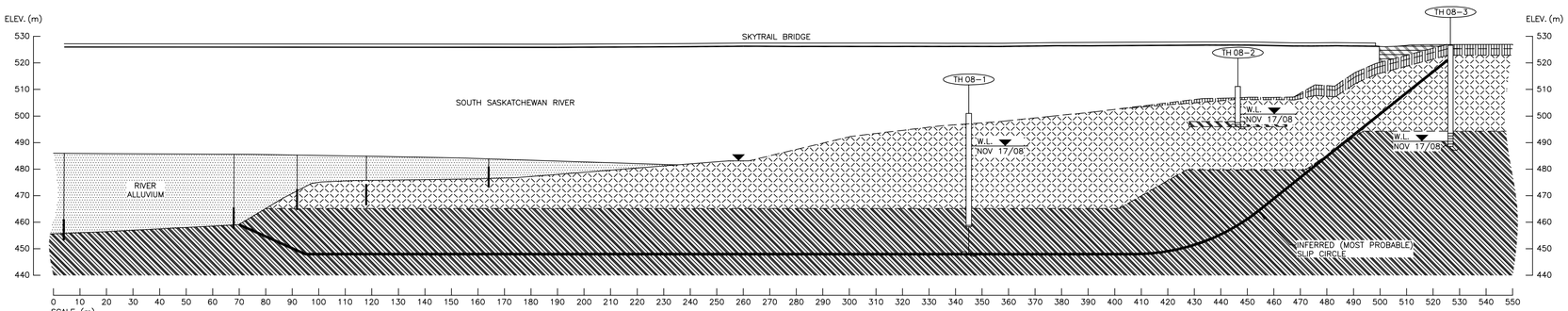
LOCATION:

EAST BANK
SOUTH SASKATCHEWAN RIVER
OUTLOOK, SK

NORTHING: **EASTING:**

DATE DRILLED:	**DRAWING NUMBER:**
AUG 27/08	S08-6559-5B

STRATIGRAPHIC SECTION A–A'



LEGEND

- RIVER ALLUVIUM
- CLAY
- GLACIAL TILL
- SILT
- CLAY SHALE
- FILL CLAY
- W.L. NOV 17/08 — RECORDED WATER LEVEL

LIMITATIONS

THIS STRATIGRAPHIC SECTION IS A SUMMARY OF SUBSURFACE FIELD CONDITIONS INFERRED FROM DATA ENCOUNTERED AT SPECIFIC TEST HOLE LOCATIONS AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS AND, IN TIME, MAY CHANGE AT THE SPECIFIC LOCATION OF ANY TEST HOLE.

P. MACHIBRODA ENGINEERING LTD.

CONSULTING
GEOENVIRONMENTAL
GEOTECHNICAL
ENGINEERS

2623 B FAITHFULL AVENUE
SASKATOON, SK
S7K 5W2

DRAWING TITLE: STRATIGRAPHIC SECTION A - A'

PROJECT: SLOPE STABILITY STUDY - EAST BANK, SOUTH SASKATCHEWAN RIVER, OUTLOOK, SK

APPROVED BY: F. HYNES	DRAWN BY: G. SOLTYS
DATE: NOVEMBER, 2008	DRAWING NUMBER: S08-6559-6
SCALE: AS SHOWN	

GRAIN SIZE DISTRIBUTION TEST REPORT

Project: SLOPE STABILITY STUDY

EAST BANK, SOUTH SASKATCHEWAN RIVER, OUTLOOK, SK

Project No.: S08-6559

Date Tested: OCTOBER 7, 2008

Test Hole No.: 08-1

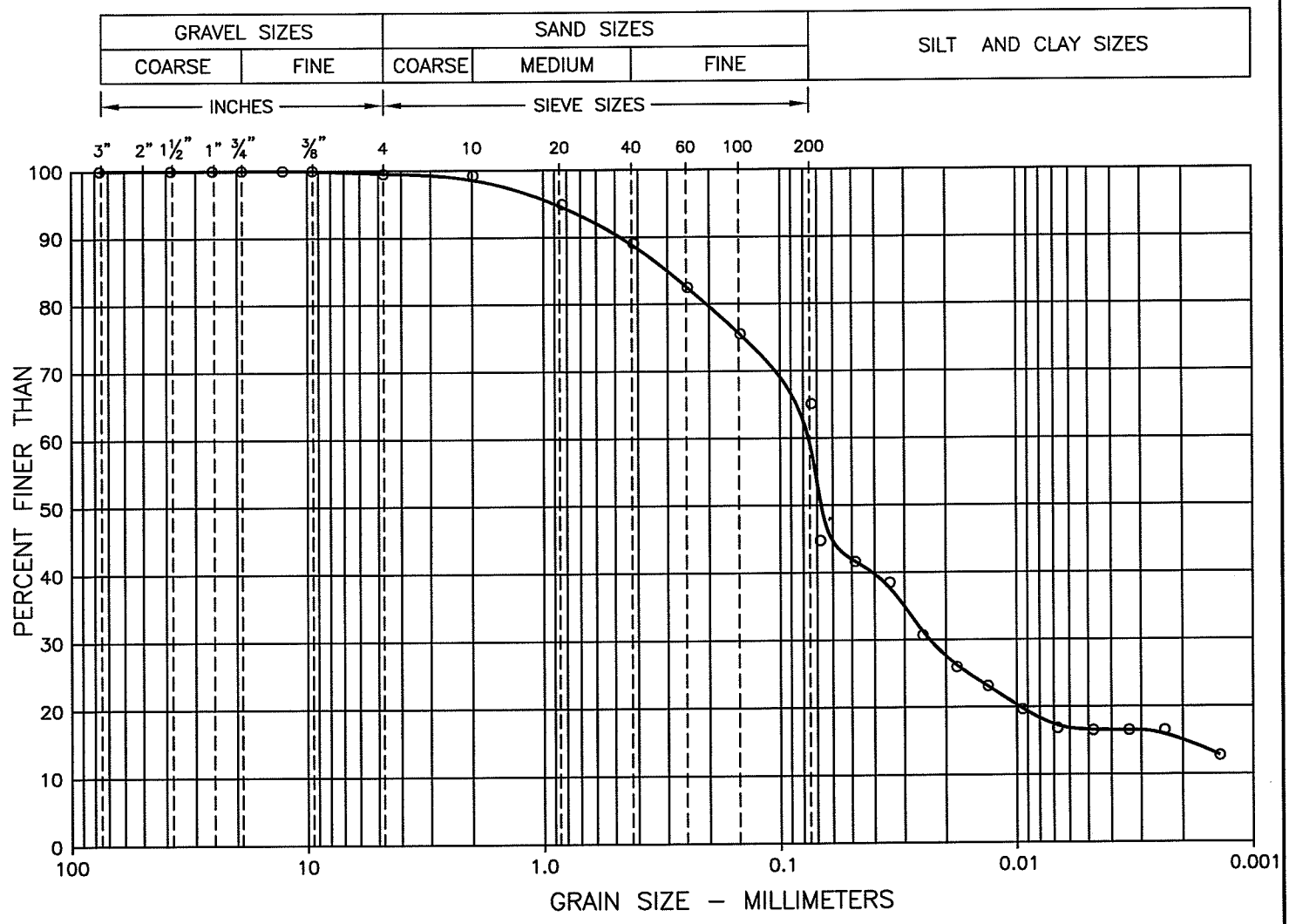
Sample No.: 3

Depth (m): 4.5

Remarks:

Material Description

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
0	34	51	15



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

S08-6559-7

GRAIN SIZE DISTRIBUTION TEST REPORT

Project: SLOPE STABILITY STUDY

EAST BANK, SOUTH SASKATCHEWAN RIVER, OUTLOOK, SK

Project No.: S08-6559

Date Tested: OCTOBER 7, 2008

Test Hole No.: 08-1

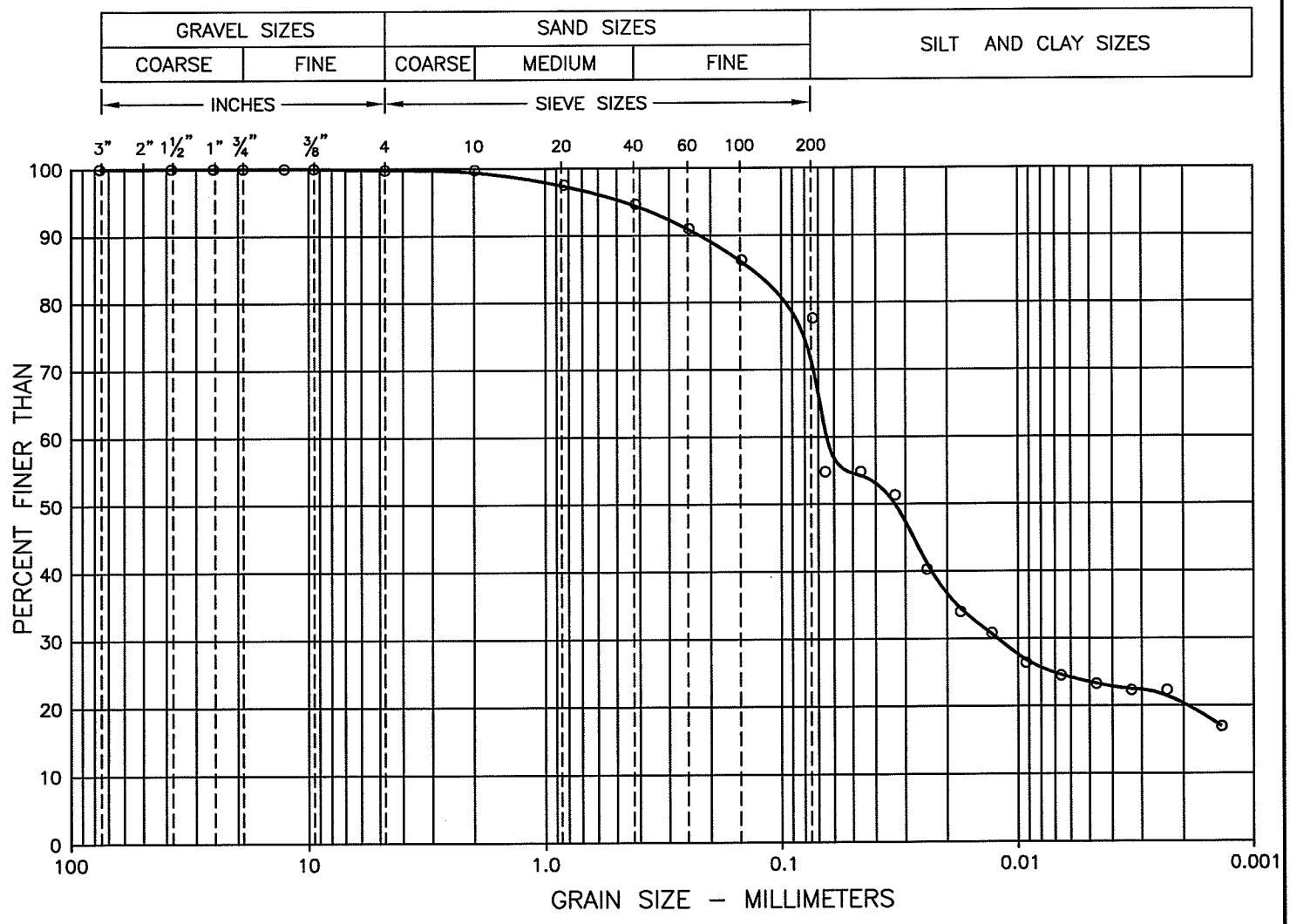
Sample No.: 10

Depth (m): 15.0

Remarks:

Material Description

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
0	22	58	20



P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.

S08-6559-8

GRAIN SIZE DISTRIBUTION TEST REPORT

Project: SLOPE STABILITY STUDY

EAST BANK, SOUTH SASKATCHEWAN RIVER, OUTLOOK, SK

Project No.: S08-6559

Date Tested: OCTOBER 7, 2008

Test Hole No.: 08-1

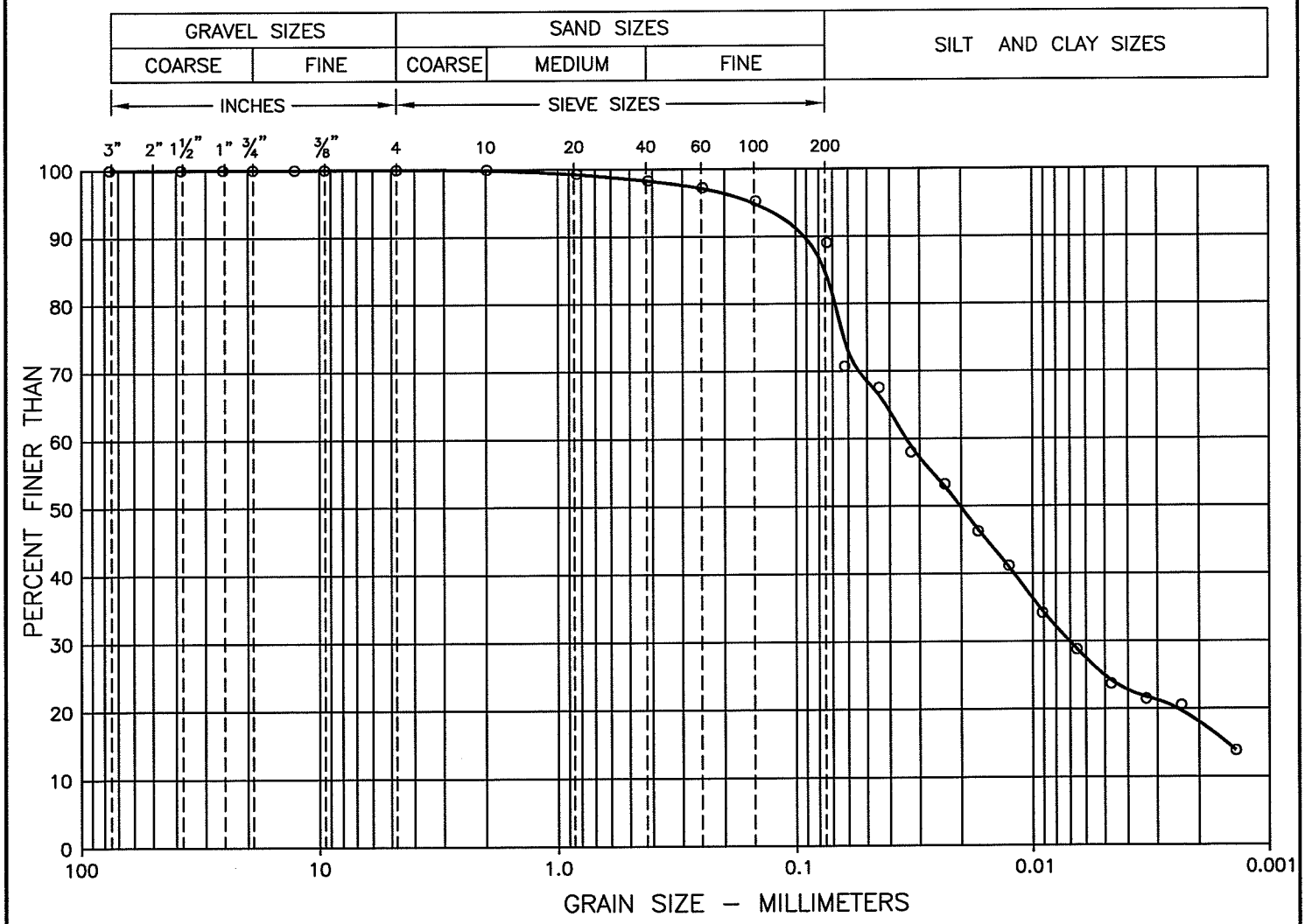
Sample No.: 25

Depth (m): 37.5

Remarks:

Material Description

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
0	11	71	18



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DRAWING NO.

S08-6559-9

GRAIN SIZE DISTRIBUTION TEST REPORT

Project: SLOPE STABILITY STUDY

EAST BANK, SOUTH SASKATCHEWAN RIVER, OUTLOOK, SK

Project No.: S08-6559

Date Tested: OCTOBER 7, 2008

Test Hole No.: 08-2

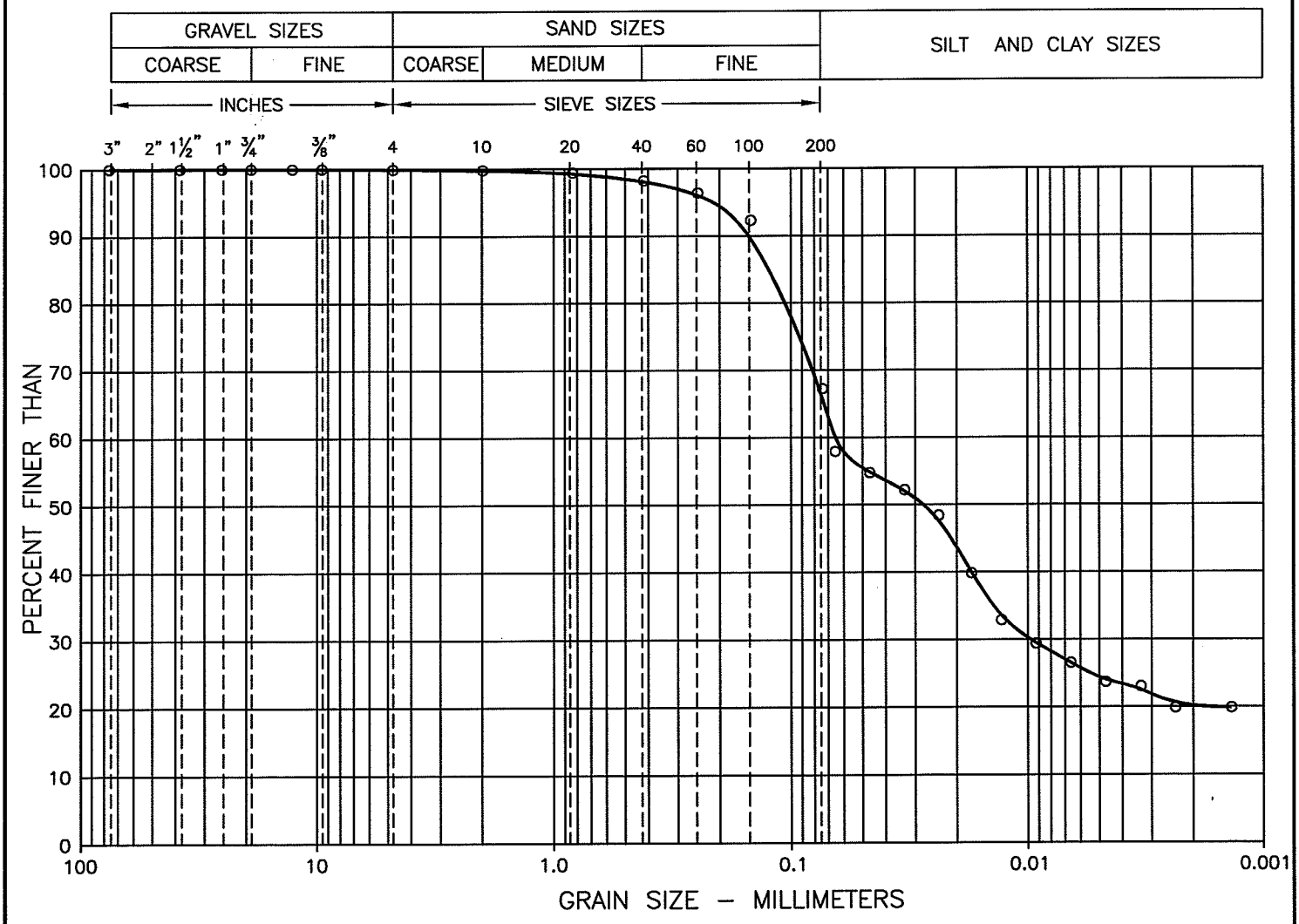
Sample No.: 208

Depth (m): 13.5

Remarks:

Material Description

% Gravel Sizes	% Sand Sizes	% Silt Sizes	% Clay Sizes
0	33	47	20



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S08-6559-10

APPENDIX A

EXPLANATION OF TERMS ON TEST HOLE LOGS

CLASSIFICATION OF SOILS

Coarse-Grained Soils: Soils containing particles that are visible to the naked eye. They include gravels and sands and are generally referred to as cohesionless or non-cohesive soils. Coarse-grained soils are soils having more than 50 percent of the dry weight larger than particle size 0.080 mm.

Fine-Grained Soils: Soils containing particles that are not visible to the naked eye. They include silts and clays. Fine-grained soils are soils having more than 50 percent of the dry weight smaller than particle size 0.080 mm.

Organic Soils: Soils containing a high natural organic content.

Soil Classification By Particle Size

Clay – particles of size	< 0.002 mm
Silt – particles of size	0.002 – 0.060 mm
Sand – particles of size	0.06 – 2.0 mm
Gravel – particles of size	2.0 – 60 mm
Cobbles – particles of size	60 – 200 mm
Boulders – particles of size	>200 mm

TERMS DESCRIBING CONSISTENCY OR CONDITION

Coarse-grained soils: Described in terms of compactness condition and are often interpreted from the results of a Standard Penetration Test (SPT). The standard penetration test is described as the number of blows, N, required to drive a 51 mm outside diameter (O.D.) split barrel sampler into the soil a distance of 0.3 m (from 0.15 m to 0.45 m) with a 63.5 kg weight having a free fall of 0.76 m.

Compactness Condition	SPT N-Index (blows per 0.3 m)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	Over 50

Fine-Grained Soils: Classified in relation to undrained shear strength.

Consistency	Undrained Shear Strength (kPa)	N Value (Approximate)	Field Identification
Very Soft	<12	0-2	Easily penetrated several centimetres by the fist.
Soft	12-25	2-4	Easily penetrated several centimetres by the thumb.
Firm	25-50	4-8	Can be penetrated several centimetres by the thumb with moderate effort.
Stiff	50-100	8-15	Readily indented by the thumb, but penetrated only with great effort.
Very Stiff	100-200	15-30	Readily indented by the thumb nail.
Hard	>200	>30	Indented with difficulty by the thumbnail.

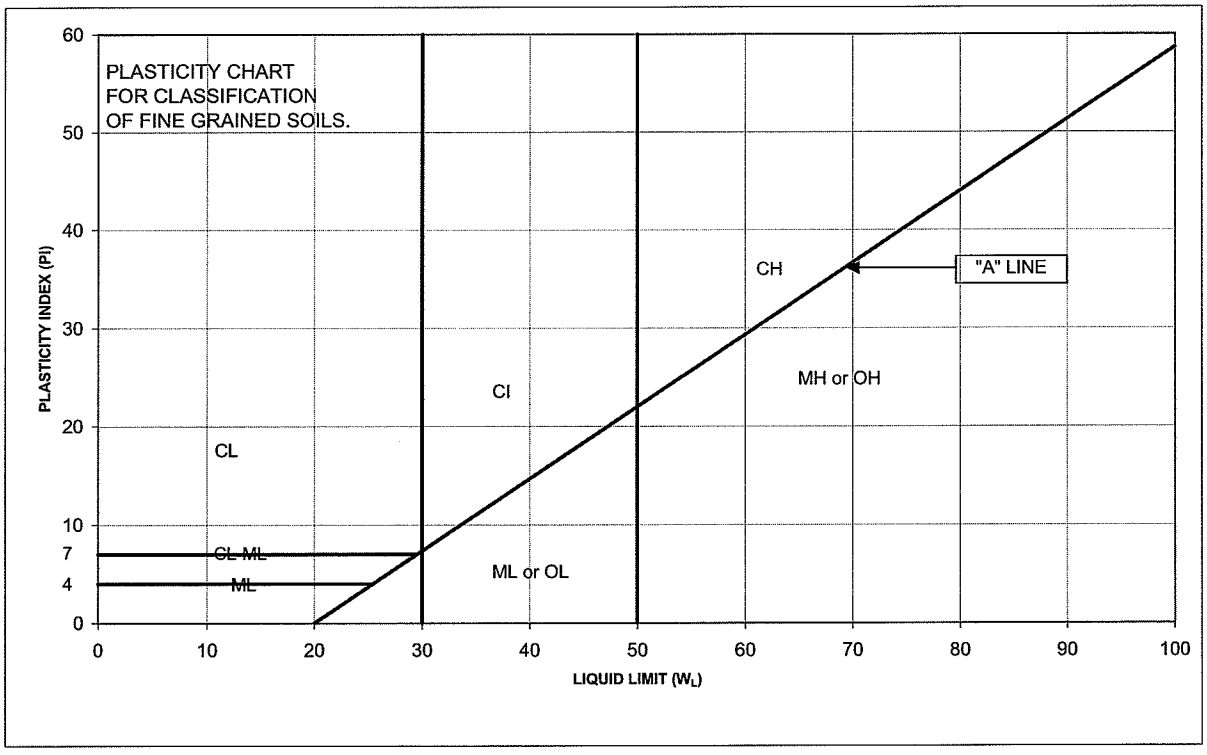
Organic Soils: Readily identified by colour, odour, spongy feel and frequently by fibrous texture.

DESCRIPTIVE TERMS COMMONLY USED TO CHARACTERIZE SOILS

Poorly Graded	- predominance of particles of one grain size.
Well Graded	- having no excess of particles in any size range with no intermediate sizes lacking.
Mottled	- marked with different coloured spots.
Nuggety	- structure consisting of small prismatic cubes.
Laminated	- structure consisting of thin layers of varying colour and texture.
Slickensided	- having inclined planes of weakness that are slick and glossy in appearance.
Fissured	- containing shrinkage cracks.
Fractured	- broken by randomly oriented interconnecting cracks in all 3 dimensions.

SOIL CLASSIFICATION SYSTEM (MODIFIED U.S.C.)

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR AND OFTEN FIBROUS TEXTURE
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN NO. 200 SIEVE SIZE)	GRAVELS More than half coarse fraction larger than No. 4 sieve size	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES <5% FINES	$C_u = \frac{D_{60}}{D_{10}} > 4 \quad C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = 1 \text{ to } 3$
			GP	POORLY-GRADED GRAVELS AND GRAVEL-SAND MIXTURES <5% FINES	NOT MEETING ALL ABOVE REQUIREMENTS FOR GW
		DIRTY GRAVELS	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES >12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR PI < 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES >12% FINES	ATTERBERG LIMITS ABOVE "A" LINE WITH PI > 7
	SANDS More than half coarse fraction smaller than No. 4 sieve size	CLEAN SANDS	SW	WELL-GRADED SANDS, GRAVELLY SANDS MIXTURES <5% FINES	$C_u = \frac{D_{60}}{D_{10}} > 6 \quad C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = 1 \text{ to } 3$
			SP	POORLY-GRADED SANDS OR GRAVELLY SANDS <5% FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR SW
		DIRTY SANDS	SM	SILTY SANDS, SAND-SILT MIXTURES >12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR PI < 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES >12% FINES	ATTERBERG LIMITS ABOVE "A" LINE WITH PI >7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSING NO. 200 SIEVE SIZE)	SILTS Below "A" line on plasticity chart; negligible organic content		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	$W_L < 50$
			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	$W_L > 50$
	CLAYS Above 'A" line on plasticity chart; negligible organic content		CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	$W_L < 30$
			CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	$W_L > 30 < 50$
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	$W_L > 50$
	ORGANIC SILTS & ORGANIC CLAYS Below "A" line on plasticity chart		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	$W_L < 50$
			OH	ORGANIC CLAYS OF HIGH PLASTICITY	$W_L > 50$



APPENDIX B

PHOTOGRAPHS

PHOTOGRAPH NO. S08-6559-1 Tension crack.

PHOTOGRAPH NO. S08-6559-2 Pavement distress south side Skytrail Bridge.

PHOTOGRAPH NO. S08-6559-3 Bridge distress.

PHOTOGRAPH NO. S08-6559-4 Bridge distress.

PHOTOGRAPH NO. S08-6559-5 **Swimming Pool and Water Pumphouse.**

PHOTOGRAPH NO. S08-6559-6 **Landslide topography looking north.**

PHOTOGRAPH NO. S08-6559-7 Bridge distress.

PHOTOGRAPH NO. S08-6559-8 Bridge distress.

PHOTOGRAPH NO. S08-6559-9 Bridge distress.

PHOTOGRAPH NO. S08-6559-10 Water Pumphouse.

PHOTOGRAPH NO. S08-6559-11 Asphalt distress – Sewage Pumping Station.

PHOTOGRAPH NO. S08-6559-12 Asphalt distress – Sewage Pumping Station.