APPENDIX A
GEOTECHNICAL REPORT

Stantec Consulting Ltd.
199 Henlow Bay
Winnipeg MB R3Y 1G4

March 5, 2025

Project/File: 113708660

Ron Bruce
Stantec Consulting Ltd.
1-59 Scurfield Blvd.
Winnipeg, Manitoba R3Y 1V2

Good day Ron,

Reference: 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals - Geotechnical Investigation

Stantec Consulting Ltd. (Stantec) was retained to undertake a factual geotechnical investigation for the 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals project in Winnipeg, Manitoba. Use of this report is subject to the Statement of General Conditions provided in Appendix A.

The coring and drilling program was conducted from December 17, 2024, to February 7, 2025. A total of 15 locations were investigated with pavement coring and/or subsurface geotechnical drilling. Pavement coring was performed by Stantec's geotechnical field technologist, and drilling services were provided by Paddock Drilling Ltd. under the supervision of Stantec's technologist. A Borehole Location Plan is provided in Appendix B.

1. Pavement Coring

A total of 15 pavement core samples were recovered to determine the in-place pavement thickness. The existing pavement thicknesses are summarized in Table 1 below, and the core photographs are provided in Appendix C.

2. Geotechnical Drilling

A total of 9 boreholes were investigated by geotechnical drilling. The boreholes were terminated at a depth of 2.5 m below the pavement, which resulted in borehole depths of 2.7 m. Soil samples were obtained directly from the auger flights at depths of 0.6 m, 0.9 m, 1.2 m, 1.6 m, 2.0 m, and 2.5 m from the bottom of the existing pavement. The testholes were examined for evidence of sloughing and groundwater seepage upon completion of drilling.

A buried concrete slab was encountered beneath the granular base course material in boreholes BH-93, BH-95, BH-96, BH-97, BH-98, BH-99, and BH-100. The buried concrete slab's thickness ranged from 0.25 m to 0.35 m.

The borehole records are provided in Appendix D. The soil classification used in the borehole records is as per ASTM D2487 – *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).*

3. Existing Surface Pavement Thicknesses

The existing surface pavement thicknesses are provided in the following table:

Borehole No.	Lane	Asphalt Thickness (mm)	Concrete Thickness (mm)	Total Pavement Thickness (mm)
93	Pembina Hwy, SB Curb Lane	180	0	180
94	Pembina Hwy, SB Curb Lane	190	0	190
95	Pembina Hwy, SB Curb Lane	200	0	200
96	Pembina Hwy, SB Curb Lane	205	0	205
97	Pembina Hwy, SB Curb Lane	220	0	220
98	Pembina Hwy, SB Curb Lane	180	0	180
99	Pembina Hwy, SB Curb Lane	190	0	190
100	Pembina Hwy, SB Curb Lane	190	0	190
101	Pembina Hwy, SB Curb Lane	0	260	260
102	Pembina Hwy, SB Curb Lane	190	0	190
103	Pembina Hwy, SB Curb Lane	180	0	180
104	Pembina Hwy, SB Curb Lane	150	0	150
276	Pembina Hwy, SB Shoulder	130	0	130
277	Pembina Hwy, SB Shoulder	135	0	135
278	Pembina Hwy, SB Left-Turn Lane	180	0	180

4. Laboratory Testing

Laboratory determination of moisture content (ASTM D2216) was conducted on all soil samples. The results are provided on the attached borehole records.

In addition, the following laboratory tests were conducted on select samples:

- ASTM D4318 - *Liquid Limit, Plastic Limit, and Plasticity Index of Soils*
- ASTM D7928 - *Particle-Size Distribution of Fine-Grained Soils Using The Sedimentation Analysis*
- ASTM D698 - *Laboratory Compaction Characteristics of Soil Using Standard Effort*
- ASTM D1883 - *California Bearing Ratio (CBR) of Laboratory-Compacted Soils*

The CBR tests were performed on test specimens compacted to 95% of the maximum dry density under soaked conditions.

The laboratory test reports are provided in Appendix E.

5. Closure

Please contact the undersigned if you have any questions regarding this report.

Regards,

Stantec Consulting Ltd.

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Attachment: Appendix A – Statement of General Conditions
Appendix B – Borehole Location Plan
Appendix C – Core Photographs
Appendix D – Borehole Records
Appendix E – Laboratory Test Reports
- Atterberg Limits Test Reports
- Particle-Size Analysis Reports
- Standard Proctor Test Reports
- CBR Test Reports

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Appendix A

Statement of General Conditions

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site-specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

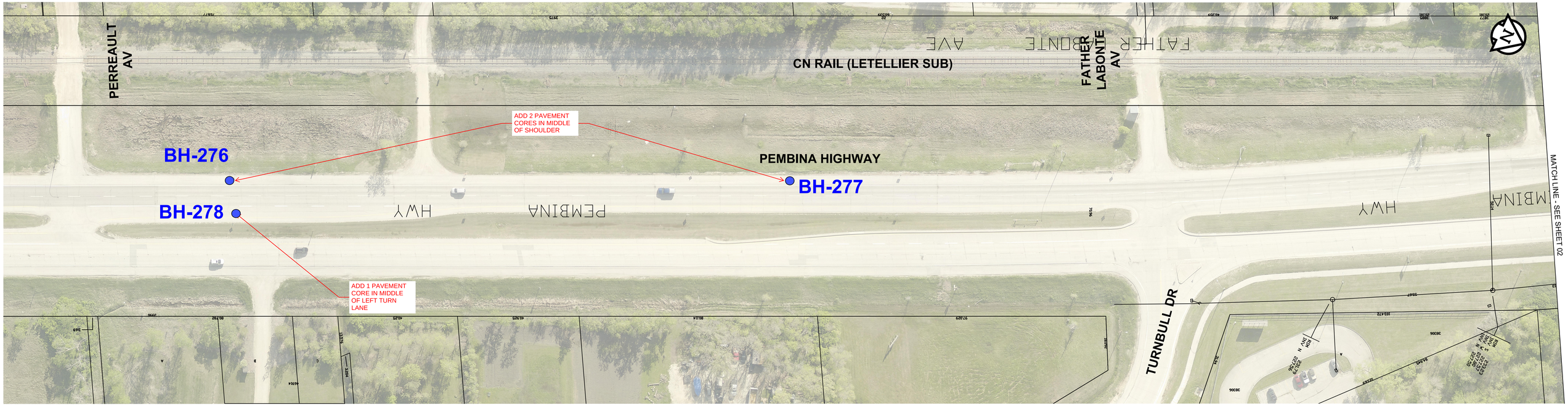
INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock, and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc.), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

Appendix B

Borehole Location Plan



DATE OF AIR PHOTO: MAY, 2024

SCALE: 1:500

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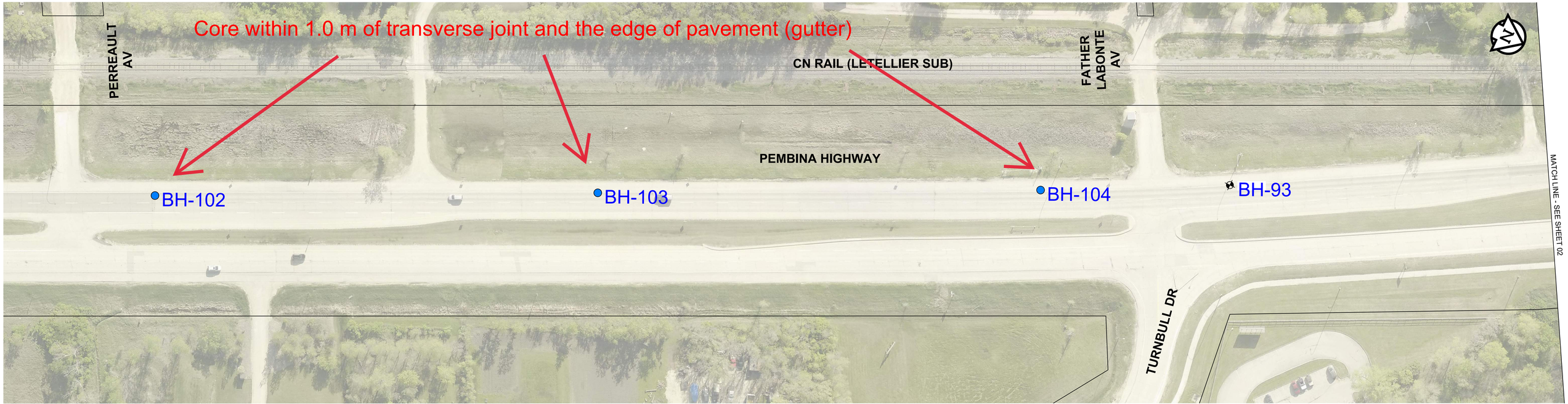
CITY OF WINNIPEG - PUBLIC WORKS DEPARTMENT

2025 REGIONAL STREETS

PEMBINA HIGHWAY SOUTHBOUND

SHEET 01



DATE OF AIR PHOTO: MAY, 2024

SCALE: 1:500

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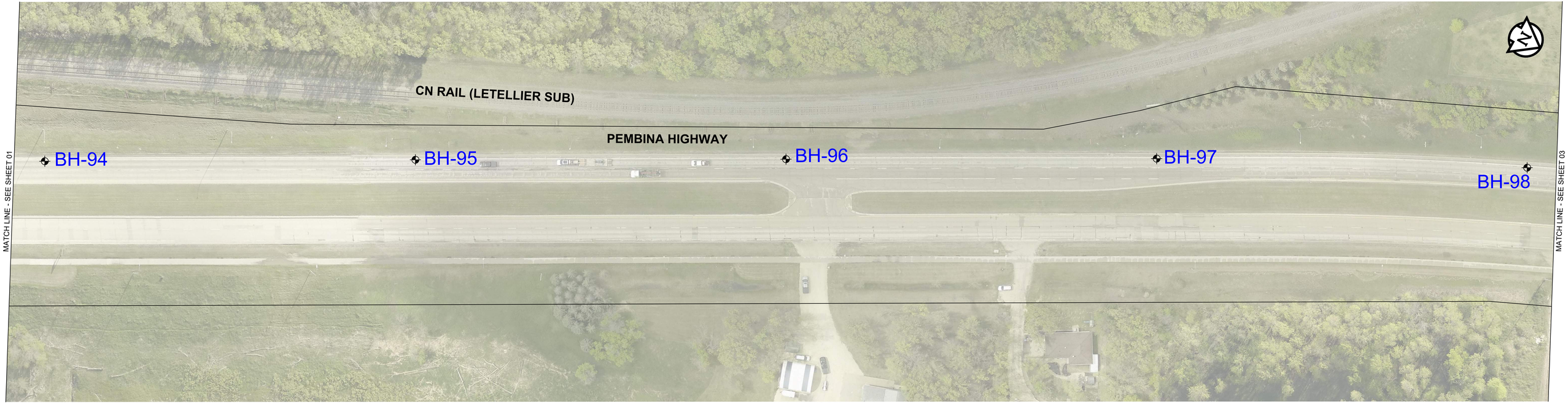
CITY OF WINNIPEG - PUBLIC WORKS DEPARTMENT
2025 REGIONAL STREETS
PEMBINA HIGHWAY SOUTHBOUND

LEGEND
- CORE HOLE LOCATION
- TEST HOLE LOCATION

SHEET 01



DATE OF AIR PHOTO: MAY, 2024

SCALE: 1:500

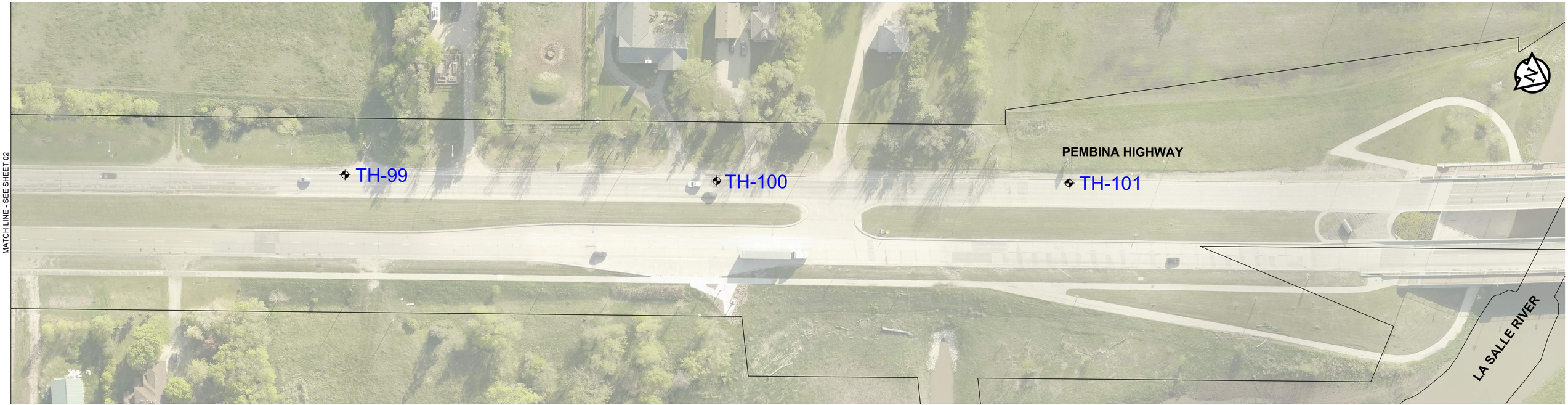
0 5 10 20 30m

CITY OF WINNIPEG - PUBLIC WORKS DEPARTMENT
2025 REGIONAL STREETS
PEMBINA HIGHWAY SOUTHBOUND

LEGEND

- CORE HOLE LOCATION
- TEST HOLE LOCATION

SHEET 02



DATE OF AIR PHOTO: MAY, 2024

SCALE: 1:500

0 5 10 20 30m

CITY OF WINNIPEG - PUBLIC WORKS DEPARTMENT
2025 REGIONAL STREETS
PEMBINA HIGHWAY SOUTHBOUND

LEGEND

CORE HOLE LOCATION

TEST HOLE LOCATION

SHEET 03

Appendix C

Core Photographs

Figure 1 – Core Sample No. 93 – SB Curb Lane

Figure 2 – Core Sample No. 94 - SB Curb Lane

Figure 3 – Core Sample No. 95 - SB Curb Lane

Figure 4 – Core Sample No. 96 – SB Curb Lane

Figure 5 – Core Sample No. 97 – SB Curb Lane

Figure 6 – Core Sample No. 98 – SB Curb Lane

Figure 7 – Core Sample No. 99 – SB Curb Lane d

Figure 8 – Core Sample No. 100 – SB Curb Lane

Figure 9 – Core Sample No. 101 – SB Curb Lane

Figure 10 – Core Sample No. 102 – SB Curb Lane

Figure 11 – Core Sample No. 103 – SB Curb Lane

Figure 12 – Core Sample No. 104 – SB Curb Lane

Figure 13 – Core Sample No. 276 – SB Shoulder

Figure 14 – Core Sample No. 277 – SB Shoulder

Figure 15 – Core Sample No. 278 – SB Left-Turn Lane

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Appendix D

Borehole Records

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis

Rootmat	vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	mixture of soil and humus capable of supporting vegetative growth
Peat	mixture of visible and invisible fragments of decayed organic matter
Till	unstratified glacial deposit which may range from clay to boulders
Fill	material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure

Desiccated	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of regular alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	> 75 mm in thickness
Seam	2 mm to 75 mm in thickness
Parting	< 2 mm in thickness

Terminology describing soil types

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris)

Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on Page 2. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

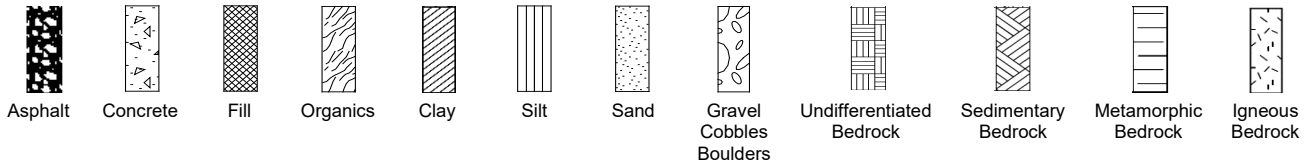
Terminology describing consistency of cohesive soils

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc. Not all bedrock strata plots are shown.



SAMPLE TYPE

AS, BS, GS		Auger sample; bulk sample; grab sample
DP		Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS		Piston sample
SO		Sonic tube
SS		Split spoon sample (obtained by performing the Standard Penetration Test)
ST		Shelby Tube or thin wall tube
SV		Shear vane
RC *HQ, NQ, BQ, etc.*		Rock Core; samples obtained with the use of standard size diamond coring bits.

WATER LEVEL

Measured:
in standpipe, piezometer, or well

Inferred:
seepage noted or water level measured during or at completion of drilling

RECOVERY FOR SOIL SAMPLES

The recovery is recorded as the length of the soil sample recovered in the direct push, split spoon sampler, Shelby Tube, or sonic tube.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test (SPT): the number of blows of a 140-pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50 for 75 mm or 50/75 mm). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60-degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Total Core Recovery (TCR) denotes the sum of all measurable rock core recovered in one drill run. The value is noted as a percentage of recovered rock core based on the total length of the drill run.

Solid Core Recovery (SCR) is defined as total length of solid core divided by the total drilled length, presented as a percentage. Solid core is defined as core with one full diameter.

Rock Quality Designation (RQD) is a modified core recovery that incorporates only pieces of solid core that are equal to or greater than 10 cm (4") along the core axis. It is calculated as the total cumulative length of solid core (> 10 cm) as measured along the centerline of the core divided by the total length of borehole drilled for each drill run or geotechnical interval, presented as a percentage. RQD is determined in accordance with ASTM D6032.

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock quality

Rock Mass Quality	Rock Quality Designation Number (RQD)	Alternate (Colloquial) Rock Mass Quality	
Very Poor Quality	0-25	*Very Severely Fractured*	*Crushed*
Poor Quality	25-50	*Severely Fractured*	*Shattered or Very Blocky*
Fair Quality	50-75	*Fractured*	*Blocky*
Good Quality	75-90	*Moderately Jointed*	*Sound*
Excellent Quality	90-100	*Intact*	*Very Sound*

Terminology describing rock strength

Strength Classification	Grade	Field Estimates of Uniaxial Compressive Strength	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	Indented by thumbnail	<1
Very Weak	R1	Crumbles under firm blows of geological hammer, can be peeled with a pocketknife	1 – 5
Weak	R2	Peeled by pocketknife with difficulty, shallow indentations made by firm blow with point of geological hammer	5 – 25
Medium Strong	R3	Cannot be scraped or peeled with a pocketknife, can be fractured with single firm blow of geological hammer	25 – 50
Strong	R4	More than one blow with geological hammer to fracture	50 – 100
Very Strong	R5	Many blows with geological hammer to fracture	100 – 250
Extremely Strong	R6	Can only be chipped with geological hammer	>250

Terminology describing rock weathering

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

Terminology describing rock with respect to discontinuity and bedding spacing

Spacing (mm)	Discontinuities Spacing	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

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BOREHOLE RECORD

BH-93

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **February 07 2025** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**ASPHALT**						
		FILL: granular material, 19 mm						
		CONCRETE						
1		Black fat clay (CH) **FILL** - some organics - trace fine to medium sand		AS				
				BS				Sieve/Hydro at 1.4 m G 0% S 4% M 38% C 58%
		Very stiff grey **FAT CLAY (CH)**		AS				
2				AS				
				AS				
3		**End of Borehole** • Borehole terminated at a depth of 2.7 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd.	Logged By: LP
Drilling Method: 125 mm SSA	Reviewed By: GB
Completion Depth: 2.7 m	Page 1 of 1

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BOREHOLE RECORD

BH-94

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **December 18 2024** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**ASPHALT**						
		FILL: crushed limestone, 19 mm						
		Stiff black **FAT CLAY (CH)**		AS				
1				AS				
				AS				
				AS				
2		Firm brown **SILTY CLAY (CL-ML)** - trace sand		AS				
				AS				
3		**End of Borehole** • Borehole terminated at a depth of 2.6 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd.	Logged By: LP
Drilling Method: 125 mm SSA	Reviewed By: GB
Completion Depth: 2.6 m	Page 1 of 1

Printed Mar 5 2025 07:57:00 SOIL 113708660.GPJ 3/5/25

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BOREHOLE RECORD

BH-95

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **February 07 2025** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**ASPHALT**						
		FILL: granular material, 19 mm						
		CONCRETE						
		FILL: tan, granular material, 10 mm		AS				
1				AS				
		Black fat clay (CH) **FILL** - trace fine gravel		AS				
		Firm grey **FAT CLAY (CH)**		AS				
2		- silty below 2.3 m		AS				
				AS				
3		**End of Borehole** • Borehole terminated at a depth of 2.7 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd. Logged By: LP

Drilling Method: 125 mm SSA Reviewed By: GB

Completion Depth: 2.7 m Page 1 of 1

Printed Mar 5 2025 07:57:01 SOIL 113708660.GPJ 3/5/25

Stantec

BOREHOLE RECORD

BH-96

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **February 07 2025** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**ASPHALT**						
		FILL: granular material, 19 mm						
		CONCRETE						
		FILL: tan granular material, 19 mm		AS				
1		Black fat clay (CH) **FILL**		AS				
				AS				
				BS				Sieve/Hydro at 1.4 m G 0% S 5% M 39% C 57%
		Firm brown **FAT CLAY (CH)**		AS				
2				AS				
				AS				
3		**End of Borehole** • Borehole terminated at a depth of 2.7 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd.	Logged By: LP
Drilling Method: 125 mm SSA	Reviewed By: GB
Completion Depth: 2.7 m	Page 1 of 1

Printed Mar 5 2025 07:57:03 SOIL 113708660.GPJ 3/5/25

BOREHOLE RECORD

BH-97

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **February 07 2025** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**ASPHALT**						
		FILL: granular material, 19 mm						
		CONCRETE						
		Black fat clay (CH) **FILL** - trace fine sand, trace fine gravel		AS				
1				AS				
				AS				
		Stiff grey **FAT CLAY (CH)**		AS				
2				AS				
				AS				
3		**End of Borehole** • Borehole terminated at a depth of 2.7 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd. Logged By: LP

Drilling Method: 125 mm SSA Reviewed By: GB

Completion Depth: 2.7 m Page 1 of 1

Stantec

BOREHOLE RECORD

BH-98

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **February 06-07 2025** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**ASPHALT**						
		FILL: granular material, 19 mm						
		CONCRETE						
		Grey **FAT CLAY (CH)** - some organics		AS				
1				AS				
				BS				Sieve/Hydro at 1.4 m G 0% S 6% M 47% C 47%
				AS				
2				AS				
				AS				
3		**End of Borehole** • Borehole terminated at a depth of 2.7 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd.	Logged By: LP
Drilling Method: 125 mm SSA	Reviewed By: GB
Completion Depth: 2.7 m	Page 1 of 1

BOREHOLE RECORD

BH-99

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **February 06 2025** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**ASPHALT**						
		FILL: granular material, 19 mm						
		CONCRETE						
1		Black fat clay (CH) **FILL** - some organics		AS				
		Firm brown **SILTY CLAY (CL-ML)**		AS				
2				AS				
				AS				
3				AS				
		End of Borehole • Borehole terminated at a depth of 2.7 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd. Logged By: LP

Drilling Method: 125 mm SSA Reviewed By: GB

Completion Depth: 2.7 m Page 1 of 1

Stantec

BOREHOLE RECORD

BH-100

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **February 06 2025** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**ASPHALT**						
		FILL: granular material, 19 mm						
		CONCRETE						
		FILL: granular material, 10 mm		AS				
1		Black fat clay (CH) **FILL** - some organics		AS				
				AS				
		Firm brown **FAT CLAY (CH)**		AS				
2				AS				
				AS				
3		**End of Borehole** • Borehole terminated at a depth of 2.7 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd.	Logged By: LP
Drilling Method: 125 mm SSA	Reviewed By: GB
Completion Depth: 2.7 m	Page 1 of 1

Printed Mar 5 2025 07:56:56 SOIL 113708660.GPJ 3/5/25

Stantec

BOREHOLE RECORD

BH-101

CLIENT: **Stantec Consulting Ltd.** PROJECT NO.: **113708660**

PROJECT: **2025 Pembina Hwy Southbound Reconstruction and Rehabilitation Pavement Renewals** BH ELEVATION: **N/A**

LOCATION: **Winnipeg, MB** DATUM: **N/A**

DATE BORED: **December 18 2024** WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0		**CONCRETE**						
		FILL: crushed limestone, 19 mm						
		Stiff black **FAT CLAY (CH)**		AS				
1				AS				
				AS				
				BS				Sieve/Hydro at 1.5 m G S M C 0% 7% 51% 42%
		- brown below 1.8 m		AS				
2				AS				
				AS				
3		**End of Borehole** • Borehole terminated at a depth of 2.6 m. • No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • Borehole backfilled in accordance with the City of Winnipeg Street Cuts Manual.						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

▲ LABORATORY TEST ◆ FIELD VANE TEST

★ POCKET PENETROMETER □ POCKET SHEAR VANE

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

✖ SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL

ELEVATION (m)

BACKFILL SYMBOL: ASPHALT GROUT CONCRETE BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Maple Leaf Drilling Ltd.	Logged By: LP
Drilling Method: 125 mm SSA	Reviewed By: GB
Completion Depth: 2.6 m	Page 1 of 1

Printed Mar 5 2025 07:56:58 SOIL 113708660.GPJ 3/5/25

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Appendix E

Laboratory Testing Reports

- Atterberg Limits
- Particle-Size Analysis
- Standard Proctor
- California Bearing Ratio

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg, MB R3Y 1G4
Tel: (204) 488-6999

ASTM D4318 - LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS (LL METHOD B - ONE-POINT)

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1V2

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals

PROJECT NO. 113708660

REPORT NO. 1

DATE SAMPLED: 2025.Feb.07
SAMPLED BY: Stantec Consulting Ltd.

DATE RECEIVED: 2025.Feb.07
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.26
TESTED BY: Madison Murphy

MATERIAL IDENTIFICATION

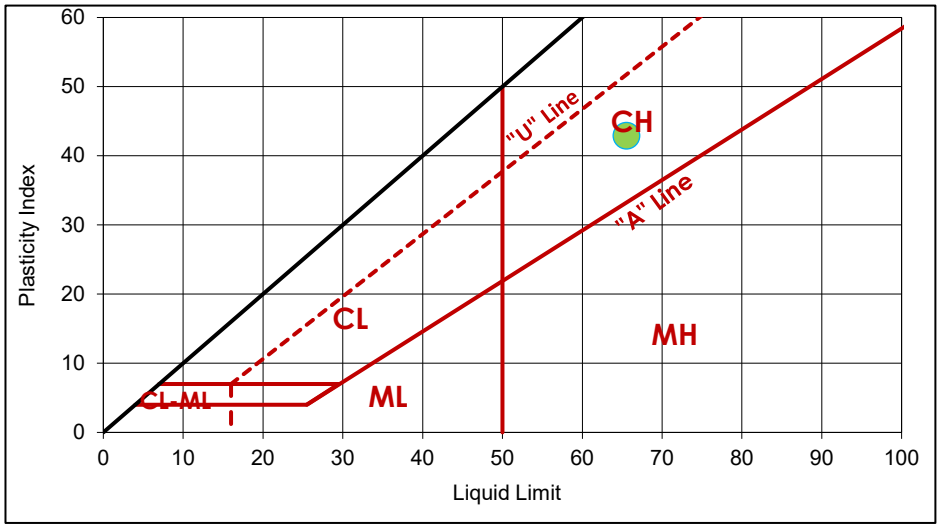
CLIENT FIELD ID BH-93, 1.4 m

STANTEC SAMPLE NO. 5740

LIQUID LIMIT		
TRIAL	1	2
BLOWS	24	24
MC (%)	66	66

PLASTIC LIMIT		
TRIAL	1	2
MC (%)	22	23

LIQUID LIMIT, LL	66
PLASTIC LIMIT, PL	23
PLASTICITY INDEX, PI	43
AS REC'D MC (%)	27.7



COMMENTS
No comments.

REPORT DATE 2025.Feb.27

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg, MB R3Y 1G4
Tel: (204) 488-6999

ASTM D4318 - LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS (LL METHOD B - ONE-POINT)

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1V2

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals

PROJECT NO. 113708660

REPORT NO. 2

DATE SAMPLED: 2025.Feb.07
SAMPLED BY: Stantec Consulting Ltd.

DATE RECEIVED: 2025.Feb.07
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.26
TESTED BY: Madison Murphy

MATERIAL IDENTIFICATION

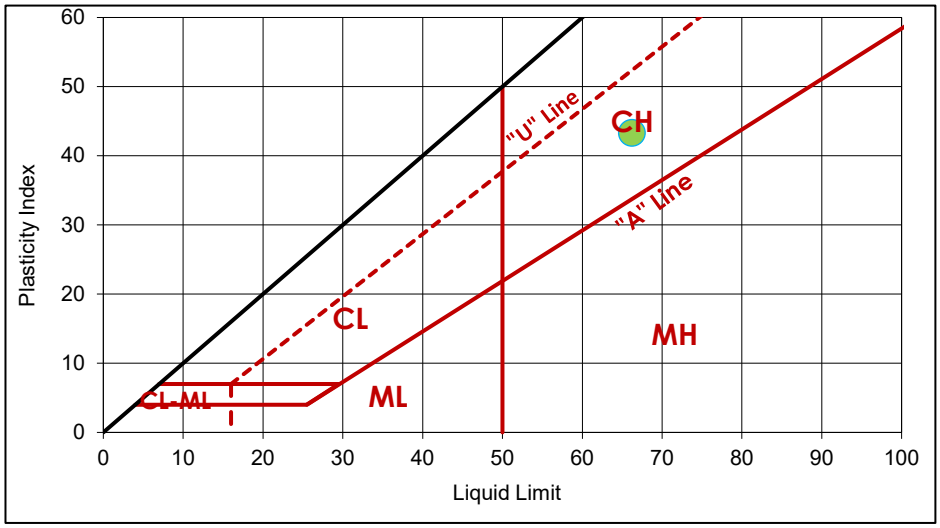
CLIENT FIELD ID BH-96, 1.4 m

STANTEC SAMPLE NO. 5741

LIQUID LIMIT		
TRIAL	1	2
BLOWS	28	29
MC (%)	65	65

PLASTIC LIMIT		
TRIAL	1	2
MC (%)	23	23

LIQUID LIMIT, LL	66
PLASTIC LIMIT, PL	23
PLASTICITY INDEX, PI	43
AS REC'D MC (%)	33.3



COMMENTS
No comments.

REPORT DATE 2025.Feb.27

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg, MB R3Y 1G4
Tel: (204) 488-6999

ASTM D4318 - LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS (LL METHOD B - ONE-POINT)

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1V2

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals

PROJECT NO. 113708660

REPORT NO. 3

DATE SAMPLED: 2025.Feb.07
SAMPLED BY: Stantec Consulting Ltd.

DATE RECEIVED: 2025.Feb.07
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.26
TESTED BY: Madison Murphy

MATERIAL IDENTIFICATION

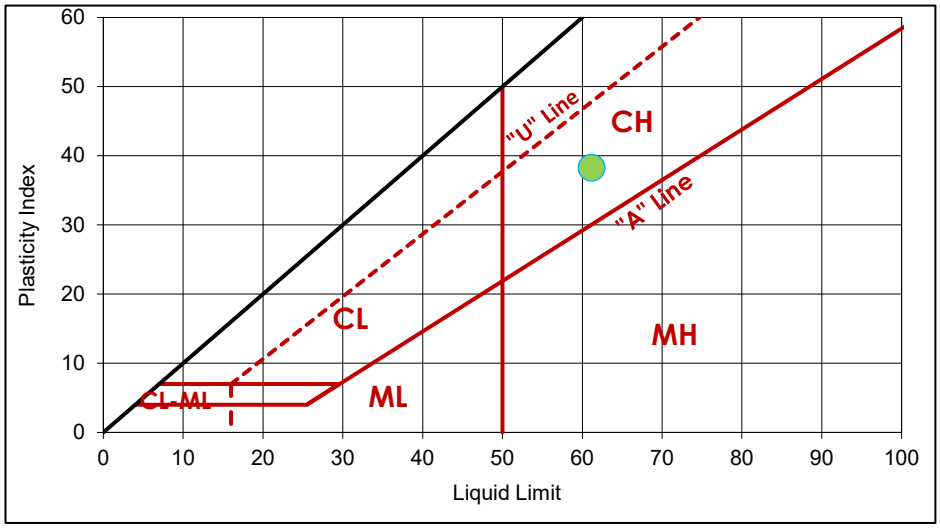
CLIENT FIELD ID BH-98, 1.4 m

STANTEC SAMPLE NO. 5742

	LIQUID LIMIT	
TRIAL	1	2
BLOWS	29	29
MC (%)	60	60

	PLASTIC LIMIT	
TRIAL	1	2
MC (%)	23	23

LIQUID LIMIT, LL	61
PLASTIC LIMIT, PL	23
PLASTICITY INDEX, PI	38
AS REC'D MC (%)	25.6



COMMENTS
No comments.

REPORT DATE 2025.Feb.27

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg, MB R3Y 1G4
Tel: (204) 488-6999

ASTM D4318 - LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS (LL METHOD B - ONE-POINT)

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1V2

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals

PROJECT NO. 113708660

REPORT NO. 4

DATE SAMPLED: 2024.Dec.18
SAMPLED BY: Stantec Consulting Ltd.

DATE RECEIVED: 2024.Dec.18
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.26
TESTED BY: Madison Murphy

MATERIAL IDENTIFICATION

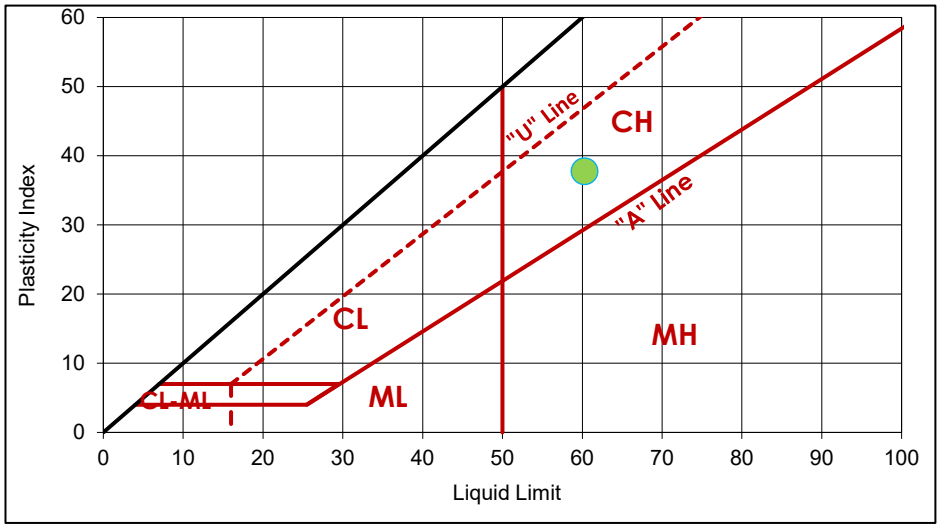
CLIENT FIELD ID BH-101, 1.5 m

STANTEC SAMPLE NO. 5743

	LIQUID LIMIT	
TRIAL	1	2
BLOWS	28	29
MC (%)	59	59

	PLASTIC LIMIT	
TRIAL	1	2
MC (%)	23	22

LIQUID LIMIT, LL	60
PLASTIC LIMIT, PL	23
PLASTICITY INDEX, PI	38
AS REC'D MC (%)	27.9



COMMENTS
No comments.

REPORT DATE 2025.Feb.27

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg, MB R3Y 1G4
Tel: (204) 488-6999

ASTM D7928 - PARTICLE-SIZE DISTRIBUTION OF FINE-GRAINED SOILS USING THE SEDIMENTATION ANALYSIS

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1V2

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals

PROJECT NO. 113708660

REPORT NO. 1

DATE SAMPLED: 2025.Feb.07
SAMPLED BY: Stantec Consulting Ltd.

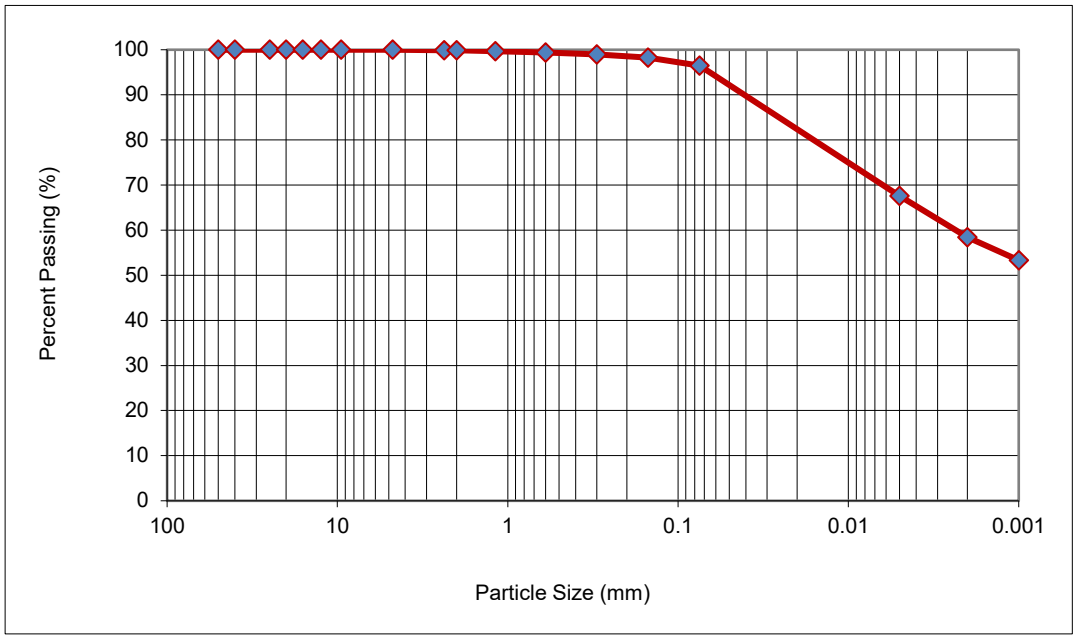
DATE RECEIVED: 2025.Feb.07
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.24
TESTED BY: Madison Murphy

MATERIAL IDENTIFICATION

CLIENT FIELD ID BH-93, 1.4 m

STANTEC SAMPLE NO. 5740



Sieve Size (mm)	% Passing
50.0	100.0
40.0	100.0
25.0	100.0
20.0	100.0
16.0	100.0
12.5	100.0
9.5	100.0
4.75	100.0
2.36	99.9
2.00	99.9
1.18	99.7
0.600	99.4
0.300	99.0
0.150	98.3
0.075	96.5
0.005	67.6
0.002	58.4
0.001	53.3

Gravel	Sand			Silt	Clay	Colloids
	Coarse	Medium	Fine			
0.0	0.1	0.8	2.6	38.1	58.4	53.3

COMMENTS
No comments.

REPORT DATE 2025.Feb.26

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg, MB R3Y 1G4
Tel: (204) 488-6999

ASTM D7928 - PARTICLE-SIZE DISTRIBUTION OF FINE-GRAINED SOILS USING THE SEDIMENTATION ANALYSIS

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1V2

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals

PROJECT NO. 113708660

REPORT NO. 2

DATE SAMPLED: 2025.Feb.07
SAMPLED BY: Stantec Consulting Ltd.

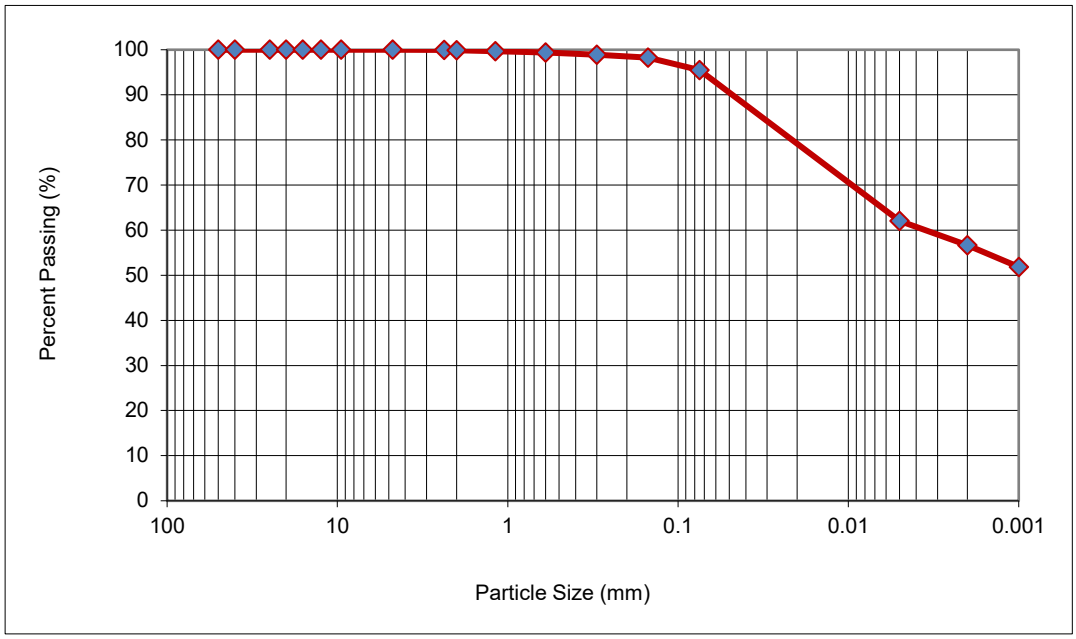
DATE RECEIVED: 2025.Feb.07
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.24
TESTED BY: Madison Murphy

MATERIAL IDENTIFICATION

CLIENT FIELD ID BH-96, 1.4 m

STANTEC SAMPLE NO. 5741



Sieve Size (mm)	% Passing
50.0	100.0
40.0	100.0
25.0	100.0
20.0	100.0
16.0	100.0
12.5	100.0
9.5	100.0
4.75	100.0
2.36	100.0
2.00	99.9
1.18	99.7
0.600	99.4
0.300	98.9
0.150	98.3
0.075	95.5
0.005	62.0
0.002	56.7
0.001	51.9

Gravel	Sand			Silt	Clay	Colloids
	Coarse	Medium	Fine			
0.0	0.1	0.8	3.6	38.8	56.7	51.9

COMMENTS
No comments.

REPORT DATE 2025.Feb.26

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg, MB R3Y 1G4
Tel: (204) 488-6999

ASTM D7928 - PARTICLE-SIZE DISTRIBUTION OF FINE-GRAINED SOILS USING THE SEDIMENTATION ANALYSIS

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1V2

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals

PROJECT NO. 113708660

REPORT NO. 3

DATE SAMPLED: 2025.Feb.07
SAMPLED BY: Stantec Consulting Ltd.

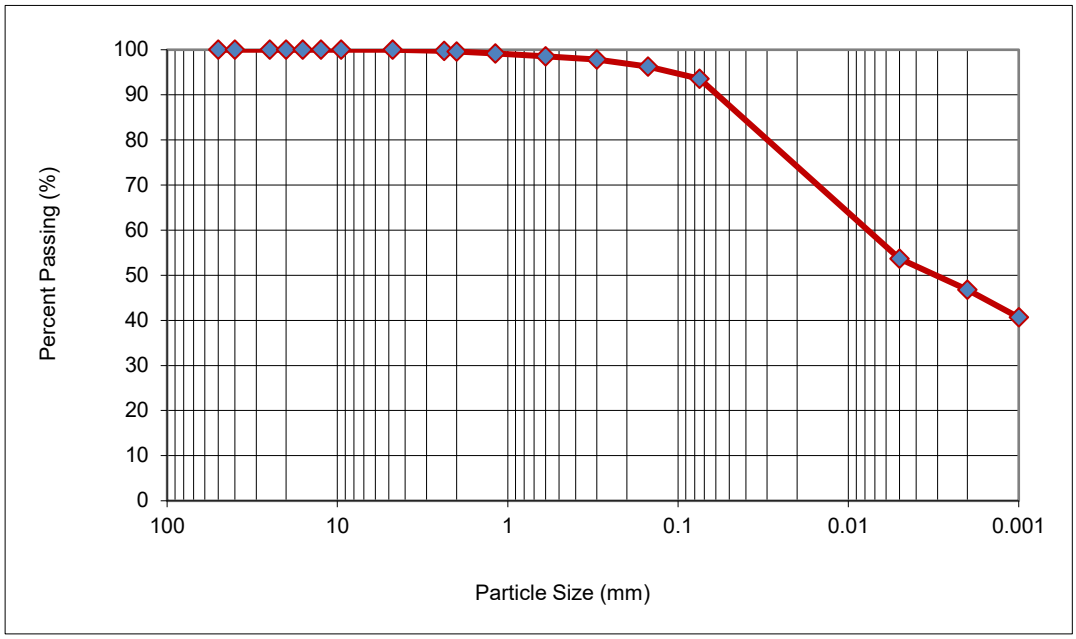
DATE RECEIVED: 2025.Feb.07
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.24
TESTED BY: Madison Murphy

MATERIAL IDENTIFICATION

CLIENT FIELD ID BH-98, 1.4 m

STANTEC SAMPLE NO. 5742



Sieve Size (mm)	% Passing
50.0	100.0
40.0	100.0
25.0	100.0
20.0	100.0
16.0	100.0
12.5	100.0
9.5	100.0
4.75	100.0
2.36	99.7
2.00	99.6
1.18	99.2
0.600	98.6
0.300	97.8
0.150	96.2
0.075	93.6
0.005	53.7
0.002	46.8
0.001	40.7

Gravel	Sand			Silt	Clay	Colloids
	Coarse	Medium	Fine			
0.0	0.4	1.5	4.5	46.8	46.8	40.7

COMMENTS
No comments.

REPORT DATE 2025.Feb.26

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg, MB R3Y 1G4
Tel: (204) 488-6999

ASTM D7928 - PARTICLE-SIZE DISTRIBUTION OF FINE-GRAINED SOILS USING THE SEDIMENTATION ANALYSIS

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1V2

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction and Rehabilitation Pavement Renewals

PROJECT NO. 113708660

REPORT NO. 4

DATE SAMPLED: 2024.Dec.18
SAMPLED BY: Stantec Consulting Ltd.

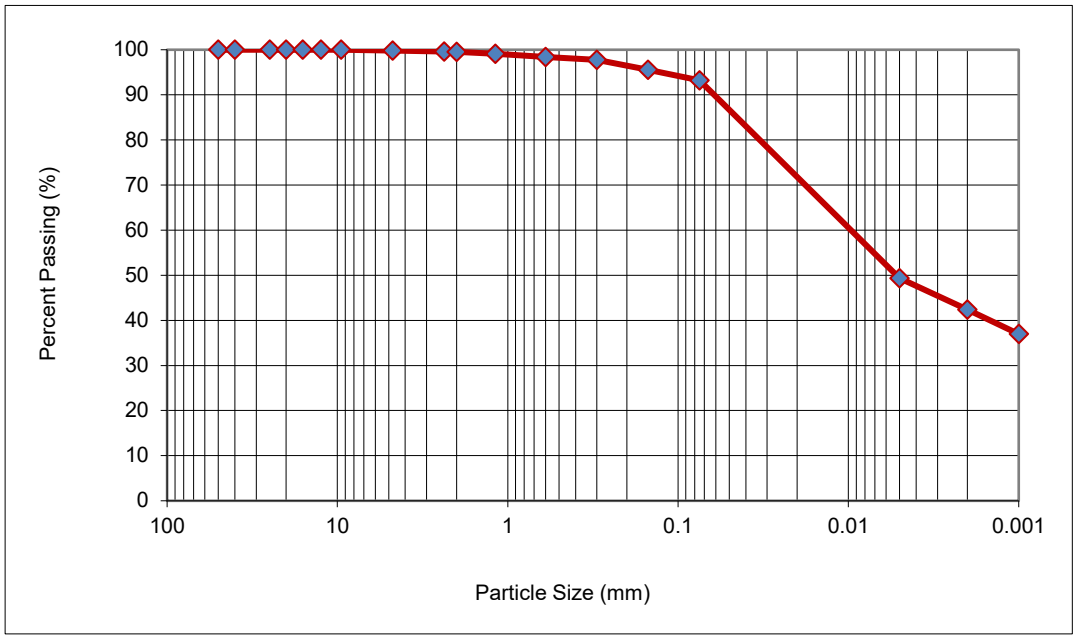
DATE RECEIVED: 2024.Dec.18
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.24
TESTED BY: Madison Murphy

MATERIAL IDENTIFICATION

CLIENT FIELD ID BH-101, 1.5 m

STANTEC SAMPLE NO. 5743



Sieve Size (mm)	% Passing
50.0	100.0
40.0	100.0
25.0	100.0
20.0	100.0
16.0	100.0
12.5	100.0
9.5	100.0
4.75	99.8
2.36	99.6
2.00	99.5
1.18	99.1
0.600	98.4
0.300	97.8
0.150	95.5
0.075	93.2
0.005	49.3
0.002	42.4
0.001	37.0

Gravel	Sand			Silt	Clay	Colloids
	Coarse	Medium	Fine			
0.2	0.3	1.5	4.8	50.8	42.4	37.0

COMMENTS
No comments.

REPORT DATE 2025.Feb.26

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

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CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

PROCTOR TEST REPORT

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Blvd.
Winnipeg, MB
R3Y 1G4

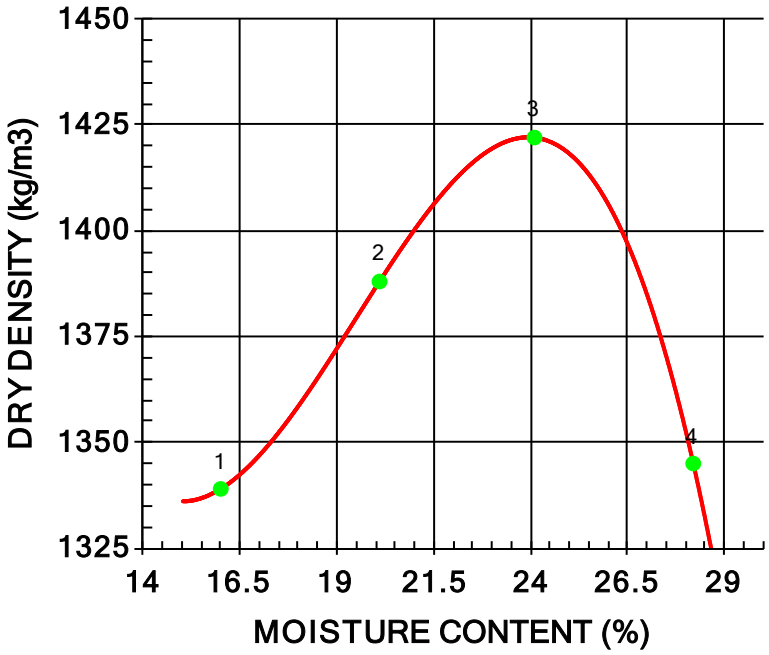
CLIENT Stantec Consulting Ltd.
C.C.

ATTN: Ron Bruce

PROJECT 2025 Pembina Hwy SB Reconstruction & Rehabilitation Renewals

PROJECT NO. 113708660
PROCTOR NO. 1 DATE SAMPLED 2025.Feb.07 DATE RECEIVED 2025.Feb.10 DATE TESTED 2025.Feb.14

INSITU MOISTURE	35.5 %	COMPACTION STANDARD	Standard Proctor, ASTM D698
TESTED BY	Madison Murphy		
MATERIAL IDENTIFICATION		COMPACTION PROCEDURE	A: 101.6mm Mold, Passing 4.75mm
MAJOR COMPONENT	Subgrade		
SIZE	Fat Clay (CH)	RAMMER TYPE	Manual
DESCRIPTION		PREPARATION	Moist
SUPPLIER	Existing Material	OVERSIZE CORRECTION METHOD	None
SOURCE	BH-93, 1.4 m	RETAINED 4.75mm SCREEN	N/A %



TRIAL NUMBER	WET DENSITY (kg/m³)	DRY DENSITY (kg/m³)	MOISTURE CONTENT (%)
1	1553	1339	16.0
2	1667	1388	20.1
3	1765	1422	24.1
4	1724	1345	28.2

	MAXIMUM DRY DENSITY (kg/m³)	OPTIMUM MOISTURE CONTENT (%)
CALCULATED	1420	24.0
OVERSIZE CORRECTED		

COMMENTS

Stantec Sample No. 5740.

Page 1 of 1 2025.Feb.18 Stantec Consulting Ltd. REVIEWED BY: Jason Thompson, C.E.T.

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PROCTOR TEST REPORT

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Blvd.
Winnipeg, MB
R3Y 1G4

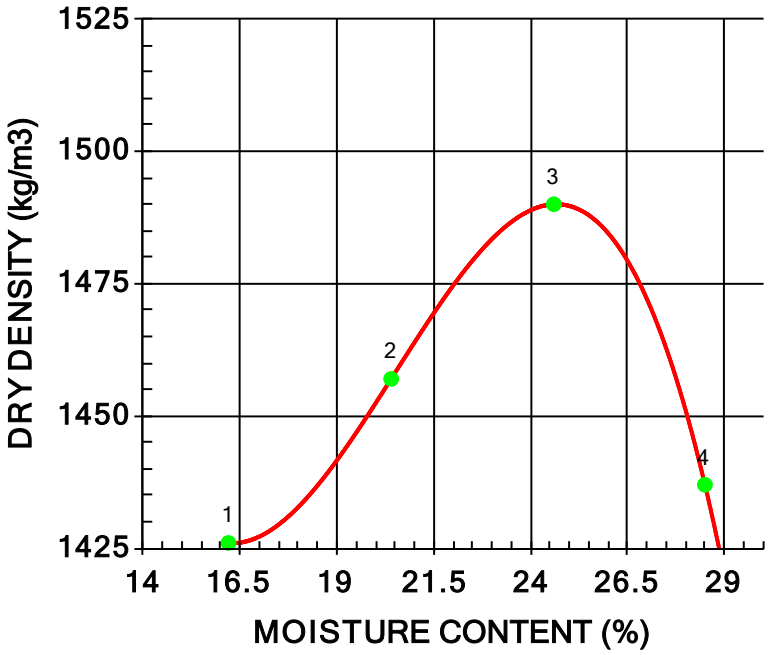
CLIENT Stantec Consulting Ltd.
C.C.

ATTN: Ron Bruce

PROJECT 2025 Pembina Hwy SB Reconstruction & Rehabilitation Renewals

PROJECT NO. 113708660
PROCTOR NO. 2 DATE SAMPLED 2025.Feb.07 DATE RECEIVED 2025.Feb.10 DATE TESTED 2025.Feb.14

INSITU MOISTURE	32.8 %	COMPACTION STANDARD	Standard Proctor, ASTM D698
TESTED BY	Madison Murphy		
MATERIAL IDENTIFICATION		COMPACTION PROCEDURE	A: 101.6mm Mold, Passing 4.75mm
MAJOR COMPONENT	Subgrade		
SIZE	Fat Clay (CH)	RAMMER TYPE	Manual
DESCRIPTION		PREPARATION	Moist
SUPPLIER	Existing Material	OVERSIZE CORRECTION METHOD	None
SOURCE	BH-96, 1.4 m	RETAINED 4.75mm SCREEN	N/A %



TRIAL NUMBER	WET DENSITY (kg/m³)	DRY DENSITY (kg/m³)	MOISTURE CONTENT (%)
1	1657	1426	16.2
2	1754	1457	20.4
3	1857	1490	24.6
4	1846	1437	28.5

	MAXIMUM DRY DENSITY (kg/m³)	OPTIMUM MOISTURE CONTENT (%)
CALCULATED	1490	24.5
OVERSIZE CORRECTED		

COMMENTS

Stantec Sample No. 5741.

 2025.Feb.26 Stantec Consulting Ltd. REVIEWED BY: Jason Thompson, C.E.T.

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PROCTOR TEST REPORT

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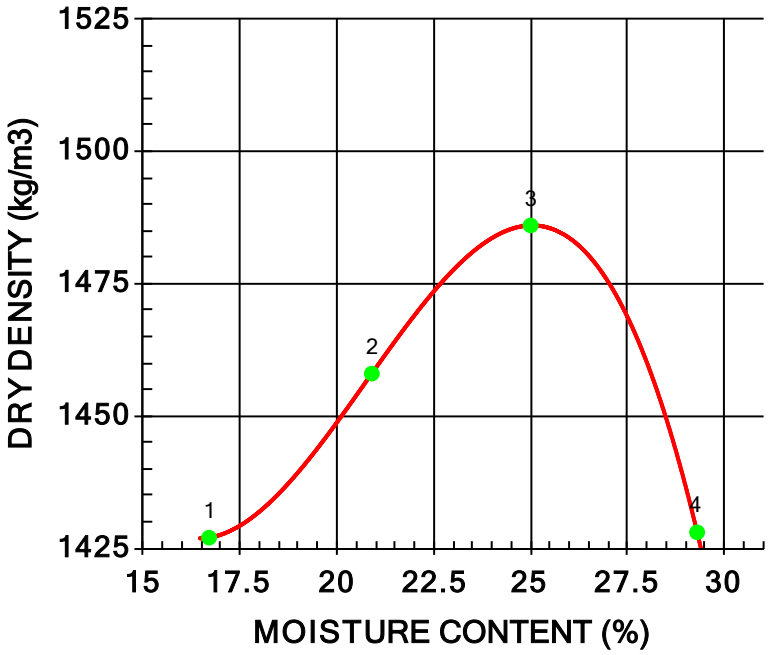
CLIENT Stantec Consulting Ltd.
C.C.

ATTN: Ron Bruce

PROJECT 2025 Pembina Hwy SB Reconstruction & Rehabilitation Renewals

PROJECT NO. 113708660
PROCTOR NO. 3 DATE SAMPLED 2025.Feb.07 DATE RECEIVED 2025.Feb.10 DATE TESTED 2025.Feb.14

INSITU MOISTURE	25.3 %	COMPACTION STANDARD	Standard Proctor, ASTM D698
TESTED BY	Madison Murphy		
MATERIAL IDENTIFICATION		COMPACTION PROCEDURE	A: 101.6mm Mold, Passing 4.75mm
MAJOR COMPONENT	Subgrade		
SIZE	Fat Clay (CH)	RAMMER TYPE	Manual
DESCRIPTION		PREPARATION	Moist
SUPPLIER	Existing Material	OVERSIZE CORRECTION METHOD	None
SOURCE	BH-98, 1.4 m	RETAINED 4.75mm SCREEN	N/A %



TRIAL NUMBER	WET DENSITY (kg/m³)	DRY DENSITY (kg/m³)	MOISTURE CONTENT (%)
1	1665	1427	16.7
2	1763	1458	20.9
3	1858	1486	25.0
4	1847	1428	29.3

	MAXIMUM DRY DENSITY (kg/m³)	OPTIMUM MOISTURE CONTENT (%)
CALCULATED	1490	25.0
OVERSIZE CORRECTED		

COMMENTS

Stantec Sample No. 5742.

 2025.Feb.26 Stantec Consulting Ltd. REVIEWED BY: Jason Thompson, C.E.T.

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PROCTOR TEST REPORT

TO Stantec Consulting Ltd.
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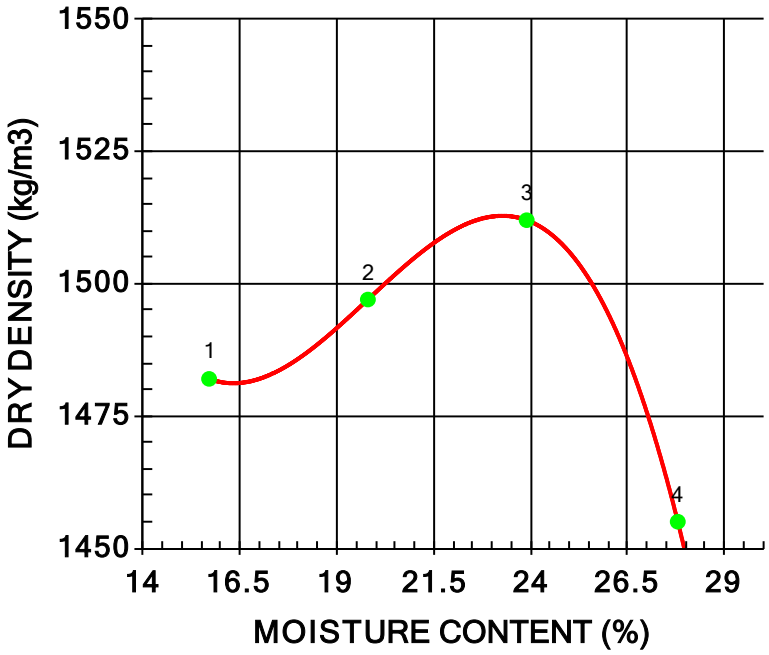
CLIENT Stantec Consulting Ltd.
C.C.

ATTN: Ron Bruce

PROJECT 2025 Pembina Hwy SB Reconstruction & Rehabilitation Renewals

PROJECT NO. 113708660
PROCTOR NO. 4 DATE SAMPLED 2025.Feb.07 DATE RECEIVED 2025.Feb.10 DATE TESTED 2025.Feb.14

INSITU MOISTURE	26.6 %	COMPACTION STANDARD	Standard Proctor, ASTM D698
TESTED BY	Madison Murphy		
MATERIAL IDENTIFICATION		COMPACTION PROCEDURE	A: 101.6mm Mold, Passing 4.75mm
MAJOR COMPONENT	Subgrade		
SIZE	Fat Clay (CH)	RAMMER TYPE	Manual
DESCRIPTION		PREPARATION	Moist
SUPPLIER	Existing Material	OVERSIZE CORRECTION METHOD	None
SOURCE	BH-101, 1.5 m	RETAINED 4.75mm SCREEN	N/A %



TRIAL NUMBER	WET DENSITY (kg/m³)	DRY DENSITY (kg/m³)	MOISTURE CONTENT (%)
1	1715	1482	15.7
2	1794	1497	19.8
3	1873	1512	23.9
4	1859	1455	27.8

	MAXIMUM DRY DENSITY (kg/m³)	OPTIMUM MOISTURE CONTENT (%)
CALCULATED	1510	23.5
OVERSIZE CORRECTED		

COMMENTS

Stantec Sample No. 5743.

Page 1 of 1 2025.Feb.26 Stantec Consulting Ltd. REVIEWED BY: Jason Thompson, C.E.T.

Stantec Consulting Ltd.
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ASTM D1883 - CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
Winnipeg, Manitoba
R3Y 1G4

ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction & Rehabilitation Renewals

PROJECT NO. 113708660

REPORT NO. 1

DATE SAMPLED: 2025.Feb.07
SAMPLED BY: Stantec Consulting Ltd.

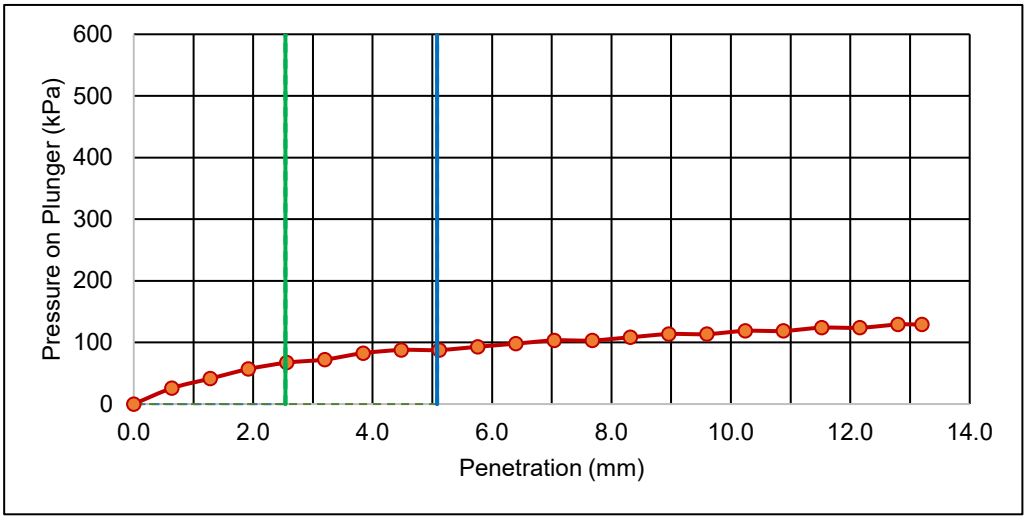
DATE RECEIVED: 2025.Feb.07
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.18
TESTED BY: Donald Elaizar

MATERIAL IDENTIFICATION

MATERIAL USE	Subgrade	SUPPLIER	Existing Material
MAX. NOMINAL SIZE	< 4.75 mm	SOURCE	In Situ
MATERIAL TYPE	Clay	SAMPLE LOCATION	BH-93, 1.4 m
SPECIFICATION ID	Not Applicable	STANTEC SAMPLE NO.	5740

IMMERSION PERIOD	96 ± 2 hr	TARGET MAX. DRY DENSITY	1420 kg/m^3
CONDITION OF SAMPLE	Soaked	TARGET OPTIMUM MOISTURE	24.0 %
SURCHARGE MASS	4.54 kg		
+19 mm OVERSIZE	0 %	AS-COMPACTED DRY DENSITY	1349 kg/m^3
SWELL OF SAMPLE	8.57 %	AS-COMPACTED MOISTURE	24.0 %
POST-TEST MOISTURE	50.1 %	AS-COMPACTED % COMPACTION	95 %



CBR VALUE AT 2.54 mm PENETRATION
1.0

CBR VALUE AT 5.08 mm PENETRATION
0.9

COMMENTS
Sample prepared to 95% of the maximum dry density at the optimum moisture content as determined from ASTM D698.

REPORT DATE 2025.Feb.24

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

Stantec Consulting Ltd.
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ASTM D1883 - CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

TO Stantec Consulting Ltd.
#1 - 59 Scurfield Boulevard
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ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction & Rehabilitation Renewals

PROJECT NO. 113708660

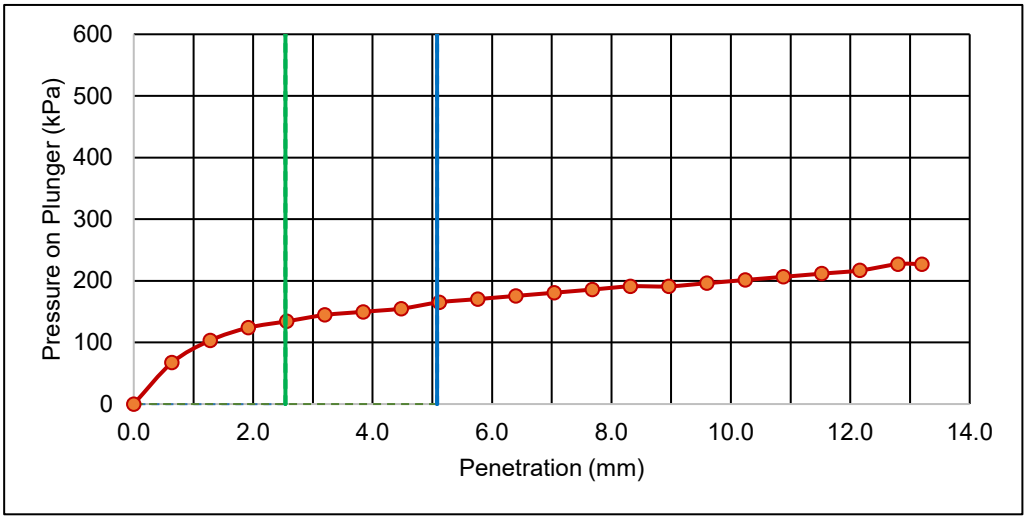
REPORT NO. 2

DATE SAMPLED:	2025.Feb.07	DATE RECEIVED:	2025.Feb.07	DATE TESTED:	2025.Feb.18
SAMPLED BY:	Stantec Consulting Ltd.	SUBMITTED BY:	Stantec Consulting Ltd.	TESTED BY:	Donald Elaizar

MATERIAL IDENTIFICATION

MATERIAL USE	Subgrade	SUPPLIER	Existing Material
MAX. NOMINAL SIZE	< 4.75 mm	SOURCE	In Situ
MATERIAL TYPE	Clay	SAMPLE LOCATION	BH-96, 1.4 m
SPECIFICATION ID	Not Applicable	STANTEC SAMPLE NO.	5741

IMMERSION PERIOD	96 ± 2 hr	TARGET MAX. DRY DENSITY	1490 kg/m^3
CONDITION OF SAMPLE	Soaked	TARGET OPTIMUM MOISTURE	24.5 %
SURCHARGE MASS	4.54 kg		
+19 mm OVERSIZE	0 %	AS-COMPACTED DRY DENSITY	1417 kg/m^3
SWELL OF SAMPLE	4.77 %	AS-COMPACTED MOISTURE	24.4 %
POST-TEST MOISTURE	41.6 %	AS-COMPACTED % COMPACTION	95 %



CBR VALUE AT 2.54 mm PENETRATION
1.9

CBR VALUE AT 5.08 mm PENETRATION
1.6

COMMENTS
Sample prepared to 95% of the maximum dry density at the optimum moisture content as determined from ASTM D698.

REPORT DATE 2025.Feb.24

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

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ASTM D1883 - CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

TO Stantec Consulting Ltd.
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ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction & Rehabilitation Renewals

PROJECT NO. 113708660

REPORT NO. 3

DATE SAMPLED: 2025.Feb.07
SAMPLED BY: Stantec Consulting Ltd.

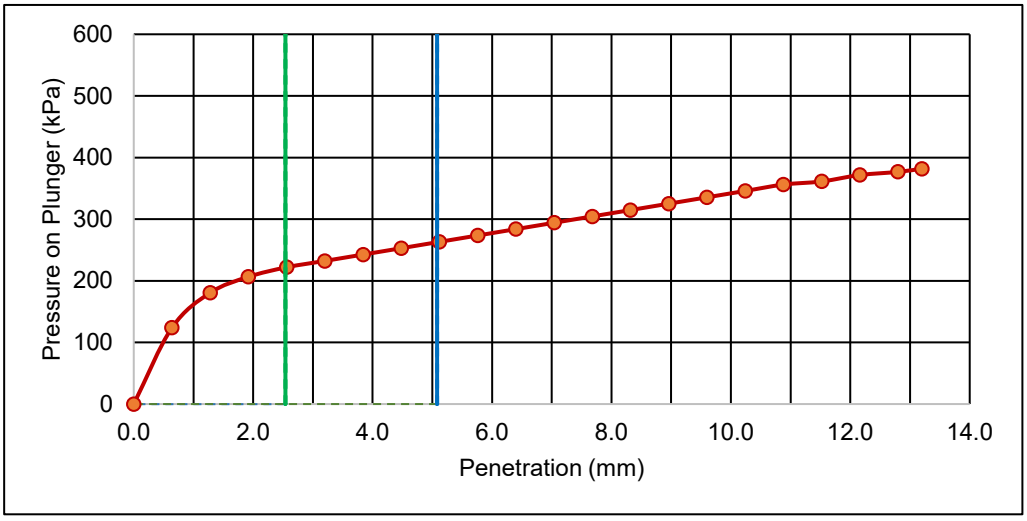
DATE RECEIVED: 2025.Feb.07
SUBMITTED BY: Stantec Consulting Ltd.

DATE TESTED: 2025.Feb.18
TESTED BY: Donald Elaizar

MATERIAL IDENTIFICATION

MATERIAL USE	Subgrade	SUPPLIER	Existing Material
MAX. NOMINAL SIZE	< 4.75 mm	SOURCE	In Situ
MATERIAL TYPE	Clay	SAMPLE LOCATION	BH-98, 1.4 m
SPECIFICATION ID	Not Applicable	STANTEC SAMPLE NO.	5742

IMMERSION PERIOD	96 ± 2 hr	TARGET MAX. DRY DENSITY	1490 kg/m^3
CONDITION OF SAMPLE	Soaked	TARGET OPTIMUM MOISTURE	25.0 %
SURCHARGE MASS	4.54 kg		
+19 mm OVERSIZE	0 %	AS-COMPACTED DRY DENSITY	1417 kg/m^3
SWELL OF SAMPLE	2.77 %	AS-COMPACTED MOISTURE	24.9 %
POST-TEST MOISTURE	36.6 %	AS-COMPACTED % COMPACTION	95 %



CBR VALUE AT 2.54 mm PENETRATION
3.2

CBR VALUE AT 5.08 mm PENETRATION
2.6

COMMENTS
Sample prepared to 95% of the maximum dry density at the optimum moisture content as determined from ASTM D698.

REPORT DATE 2025.Feb.24

REVIEWED BY Guillaume Beauce, P.Eng.
Geotechnical Engineer - Materials Testing Services

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ASTM D1883 - CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

TO Stantec Consulting Ltd.
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ATTN Ron Bruce

PROJECT 2025 Pembina Highway Southbound Reconstruction & Rehabilitation Renewals

PROJECT NO. 113708660

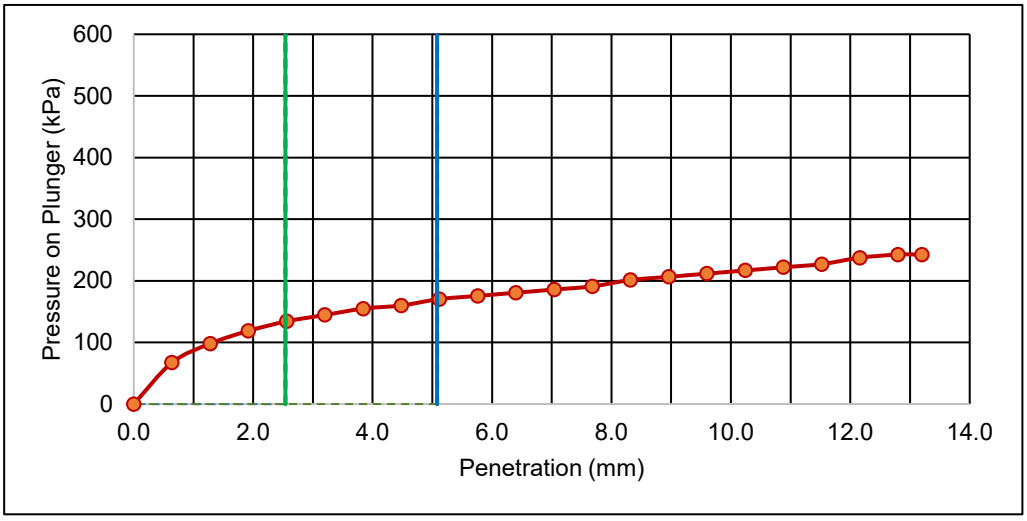
REPORT NO. 4

DATE SAMPLED:	2024.Dec.18	DATE RECEIVED:	2024.Dec.18	DATE TESTED:	2025.Feb.18
SAMPLED BY:	Stantec Consulting Ltd.	SUBMITTED BY:	Stantec Consulting Ltd.	TESTED BY:	Donald Elaizar

MATERIAL IDENTIFICATION

MATERIAL USE	Subgrade	SUPPLIER	Existing Material
MAX. NOMINAL SIZE	< 4.75 mm	SOURCE	In Situ
MATERIAL TYPE	Clay	SAMPLE LOCATION	BH-101, 1.5 m
SPECIFICATION ID	Not Applicable	STANTEC SAMPLE NO.	5743

IMMERSION PERIOD	96 ± 2 hr	TARGET MAX. DRY DENSITY	1510 kg/m^3
CONDITION OF SAMPLE	Soaked	TARGET OPTIMUM MOISTURE	23.5 %
SURCHARGE MASS	4.54 kg		
+19 mm OVERSIZE	0 %	AS-COMPACTED DRY DENSITY	1434 kg/m^3
SWELL OF SAMPLE	4.60 %	AS-COMPACTED MOISTURE	23.5 %
POST-TEST MOISTURE	39.0 %	AS-COMPACTED % COMPACTION	95 %



CBR VALUE AT 2.54 mm PENETRATION
1.9

CBR VALUE AT 5.08 mm PENETRATION
1.7

COMMENTS
Sample prepared to 95% of the maximum dry density at the optimum moisture content as determined from ASTM D698.

REPORT DATE 2025.Feb.24

REVIEWED BY Guillaume Beauce, P.Eng.
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