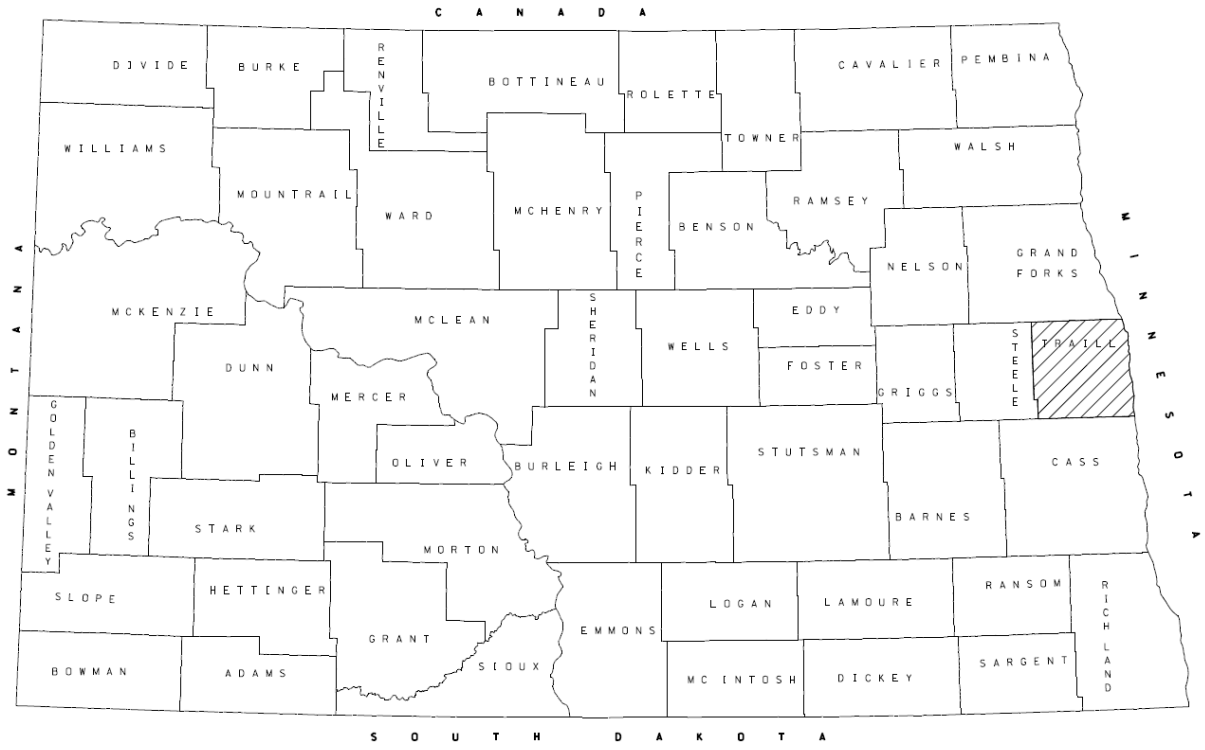
LINEAR SOILS SURVEY AND RECOMMENDATIONS

PROJECT NO. IM-8-029(203)101

PCN 23102

COUNTY Traill

I-29 NB, RP 101.328 to 110.933



PREPARED BY: Riley McAdoo-Roesler

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

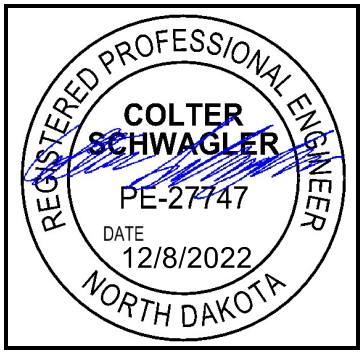
December 2022

IM-8-029(203)101

N of Kelso N to N of N Jct 200 - NB

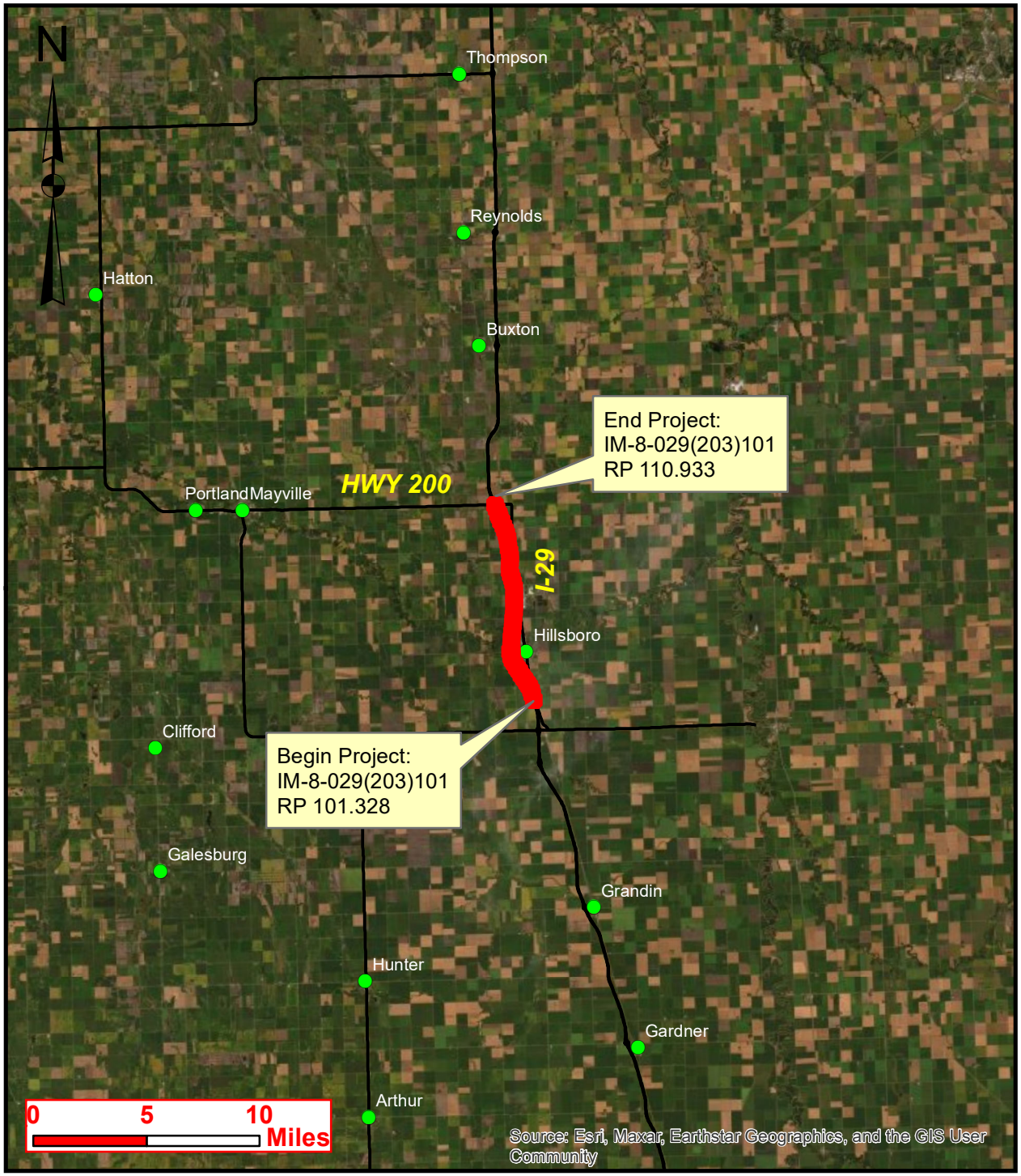
CERTIFICATION

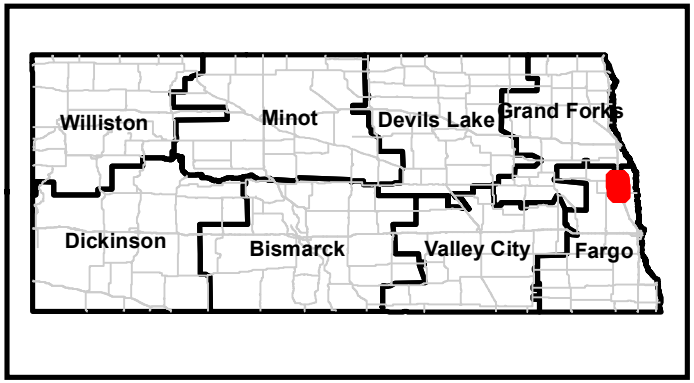
I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of North Dakota. This document was originally issued and sealed by Colter Schwagler, Registration number PE-27747 on 12/8/2022 and the original document is stored at the North Dakota Department of Transportation.



Project Location

Project: IM-8-029(203)101
PCN: 23102
Scope: Reconstruction
Location: RP 101.328 to RP 110.933





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Introduction

Location: I-29, N of Kelso N to N of N Jct 200 - NB
Reference Points: 101.328 to 110.933
Project Length: 9.605 Miles
Proposed Project Scope: Reconstruction
Investigation Scope: 1000' Intervals and Identified Maintenance Areas

Maintenance Review

Date of Maintenance Review: 03/23/2021
Materials and Research Person Conducting the Review: Jamie Naumann
Maintenance Person Conducting Review: Brian Aune

Table 1 – Identified Maintenance Areas

Location RP + Feet	Distress Identified	Maintenance Comments	Drilling Required
103+3041 to 103+3224	Broken Slab	Patching yearly, muddy underneath	No
103+4869 to 104+0000 (RAMP)	Other		Yes
104+0000 to 104+0790 (RAMP)	Transv. Cracks	Last crack seal 2020	Yes
104+0112 to 104+0268	Broken Slab	Fixed yearly for past three years	No
104+0819 to 104+1047	Broken Slab	Fixed yearly for past three years	Yes
104+1472	Broken Slab	Patched yearly for past three years	No
106+1299 to 106+1338	Broken Slab	Patched with Mastec past three years. Culvert on end of area	No
109+5250	Faulting	Other similar areas throughout project. Sinking slabs likely how problem area start.	Yes
110+1704	Broken Slab	Fixed once but sinking more	Yes

Summary of Soil Investigation

The soil investigation was completed on 6/28/2022. The investigation consisted of 61 borings.

Table 2 – Boring Locations Summary

Boring Location	Pavement Distress	Justification for Boring	Boring Depth	Boring Locations/Comments
101+1732 to 110+4626	-	Reconstruction	5 feet	Conduct borings at 1000' intervals along the project limits. A total number of approximately 44 borings.
103+4869 to 104+0000 (RAMP)	Tilting Slab	Identified Maintenance Area	10 feet	Conduct 1 boring in distressed area and one boring on either side approximately 100 feet away. A total number of 3 borings.
104+0000 to 104+0790 (RAMP)	Trans. Cracks	Identified Maintenance Area	10 feet	Conduct 3 boring in distressed area and one boring on either side approximately 100 feet away. A total number of 5 borings.
104+0819 to 104+1047	Broken Slab	Identified Maintenance Area	10 feet	Conduct 1 boring in distressed area and one boring on either side approximately 100 feet away. A total number of 3 borings.
109+5250	Faulting	Identified Maintenance Area	10 feet	Conduct 1 boring in distressed area and one boring on either side approximately 100 feet away. A total number of 3 borings.
110+1704	Broken Slab	Identified Maintenance Area	10 feet	Conduct 1 boring in distressed area and one boring on either side approximately 100 feet away. A total number of 3 borings.

Maps of the boring locations are shown in Appendix C. The lab results are included in Appendix E.

Summary of Soil Analysis

Soil Sample Distribution

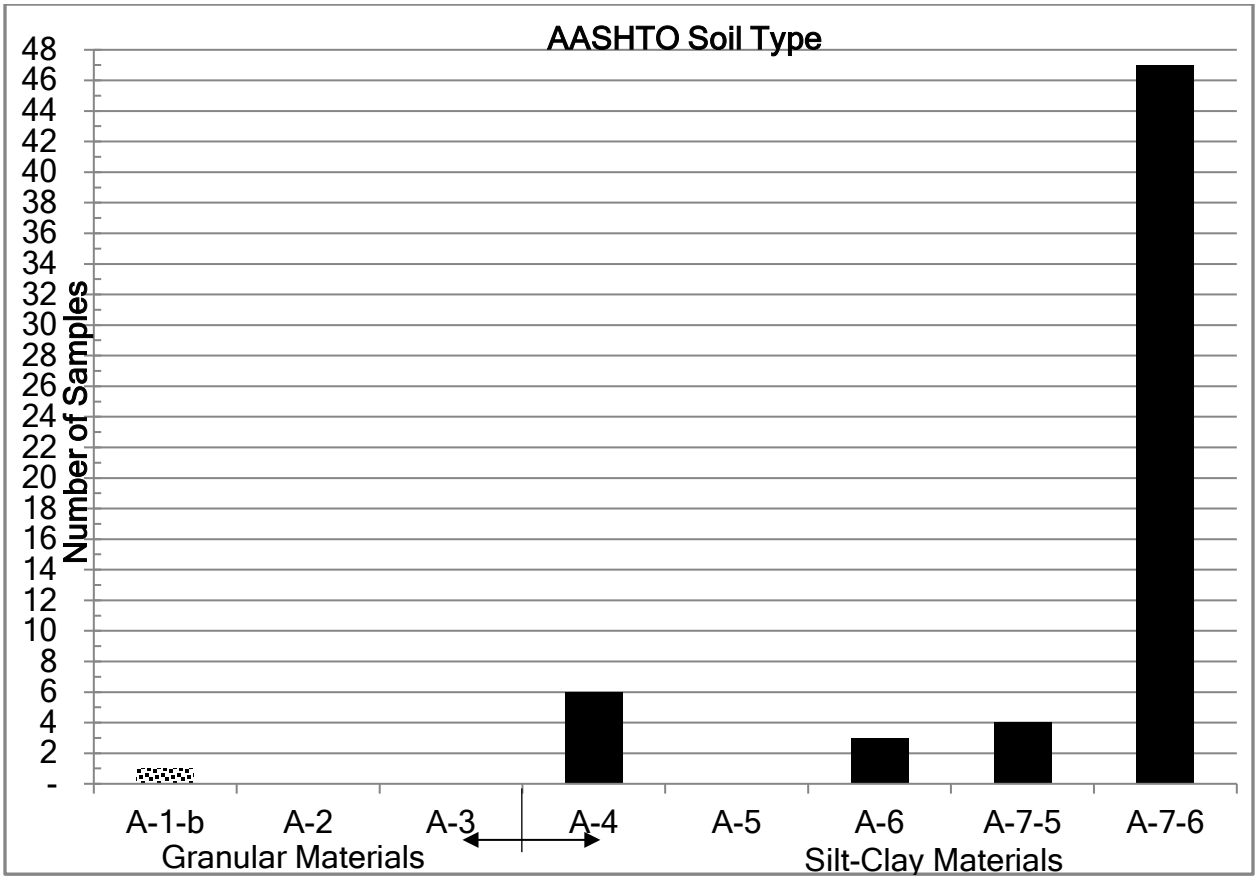


Figure 1 - Soil Sample Distribution

Design Recommendations

Project Limits – 101+1732 to 110+4614: The soils within the project limits fall within the boundaries of prehistoric Lake Agassiz. These lake-deposited-soils are part of the Sherack formation. Within the Sherack formation, the soils on this project are fat clays. The soils are typical of the surrounding area and do not require additional subgrade mitigation. However, to facilitate construction we recommend placing Geosynthetic Geogrid (Type G) on top of the existing subgrade.

Identified Maintenance Area – 103+4869 to 104+0000(Ramp): The soils within the identified maintenance area are fat clays. There is not a change in soil type, geology or water content that would in indicate that the subgrade is causing the roadway distress at this location. No subgrade mitigation is recommended.

Identified Maintenance Area – 104+0000 to 104+0790(Ramp): The soils within the identified maintenance area are fat clays. There is not a change in soil type, geology or water content that would in indicate that the subgrade is causing the roadway distress at this location. No subgrade mitigation is recommended.

Identified Maintenance Area – 104+0819 to 104+1047: The soils within the identified maintenance area are fat clays. There is not a change in soil type, geology or water content that would in indicate that the subgrade is causing the roadway distress at this location. No subgrade mitigation is recommended.

Identified Maintenance Area – 109+5250: The soils within the identified maintenance area are lean clays. There is not a change in soil type, geology or water content that would in indicate that the subgrade is causing the roadway distress at this location. No subgrade mitigation is recommended.

Identified Maintenance Area – 110+1704: The soils within the identified maintenance area are silts. There is a change in soil type that would in indicate that the subgrade is contributing to the roadway distress at this location. Therefore, it is recommended to subcut this maintenance area from top of existing pavement to a depth of 36” at RP 110+1650 to RP 110+1750.

Design Information

Pipe Replacement: If any centerline pipes are replaced, contact the Geotechnical Section for pipe backfill detail.

Compaction Method: T-99

Subgrade Prep: None

Subcut Recommendations:

Location RP + Feet	Length	Depth
110+1650 to 110+1750	100’	36”

Table 3 – Subcut Recommendations

Calculate the subcut quantity based on the lengths and depths as shown in Table 3 above and adhere to the guidelines stated below.

> **Remarks:** Replace the removed material with Class 5 aggregate and line the excavation with Geosynthetic Geogrid (Type G) in accordance with NDDOT Specification 709.

Drainage: None

Plan Notes

None

The recommendations in this report are based on the scope specified in the Introduction. If the scope of work, vertical profile or horizontal alignment is changed, in either the conceptual phase or the design phase, the Geotechnical Engineer must be notified as soon as possible to ensure that there is adequate geotechnical information addressing these areas.

APPENDIX A

SOIL CLASSIFICATION

AASHTO Classification System

Table 5.1. AASHTO Classification System

General Classification	*Granular materials (35% or less passing No. 200 Sieve (0.075 mm)*							*Silt-clay Materials More than 35% passing No. 200 Sieve (0.075 mm)*			
Group Classification	*A—1*		*A—3*	*A—2*				*A—4*	*A—5*	*A—6*	*A—7*
	A—1—a	*A—1—b*		*A—2—4*	*A—2—5*	*A—2—6*	*A—2—7*				*A—7—5 A—7—6*
(*a*) Sieve Analysis: Percent Passing											
(*i*) 2.00 mm (No. 10)	50 max										
(*ii*) 0.425 mm (No. 40)	30 max	50 max	51 min								
(*iii*) 0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
(*b*) Characteristics of fraction passing 0.425 mm (No. 40)											
(*i*) Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
(*ii*) Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min*
(*c*) Usual types of significant Constituent materials	Stone Fragments Gravel and sand		Fine Sand	Silty or Clayey Gravel Sand				Silty Soils		Clayey Soils	
(*d*) General rating as subgrade.	Excellent to Good							Fair to Poor			

* If plasticity index is equal to or less than (liquid Limit—30), the soil is A—7—5 (*i.e.* PL > 30%)
If plasticity index is greater than (Liquid Limit—30), the soil is A—7—6 (*i.e.* PL < 30%)

Unified Soil Classification System, USCS

Table 5.2 Unified Soil Classification System (Based on Material Passing 76.2-mm Sieve)

Criteria for assigning group symbols				Group symbol
Coarse-grained soils More than 50% of retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[a]	$C_u \geq 4$ and $1 \leq C_c \leq 3$[c]	GW
			$C_u < 4$ and/or $1 > C_c > 3$[c]	GP
		Gravels with Fines More than 12% fines[a,d]	$PI < 4$ or plots below "A" line (Figure 5.3)	GM
			$PI > 7$ and plots on or above "A" line (Figure 5.3)	GC
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[b]	$C_u \geq 6$ and $1 \leq C_c \leq 3$[c]	SW
			$C_u < 6$ and/or $1 > C_c > 3$[c]	SP
		Sands with Fines More than 12% fines[b,d]	$PI < 4$ or plots below "A" line (Figure 5.3)	SM
			$PI > 7$ and plots on or above "A" line (Figure 5.3)	SC
Fine-grained soils 50% or more passes No. 200 sieve	Silts and clays Liquid limit less than 50	Inorganic	$PI > 7$ and plots on or above "A" line (Figure 5.3)[e]	CL
			$PI < 4$ or plots below "A" line (Figure 5.3)[e]	ML
		Organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$; see Figure 5.3; OL zone	OL
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line (Figure 5.3)	CH
			PI plots below "A" line (Figure 5.3)	MH
		Organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$; see Figure 5.3; OH zone	OH
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor			Pt

[a] Gravels with 5 to 12% fine require dual symbols: GW-GM, GW-GC, GP-GM, GP-GC.

[b] Sands with 5 to 12% fines require dual symbols: SW-SM, SW-SC, SP-SM, SP-SC.

[c] $C_u = \frac{D_{60}}{D_{10}}$; $C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}}$

[d] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol GC-GM or SC-SM.

[e] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol CL-ML.

Plasticity Chart :

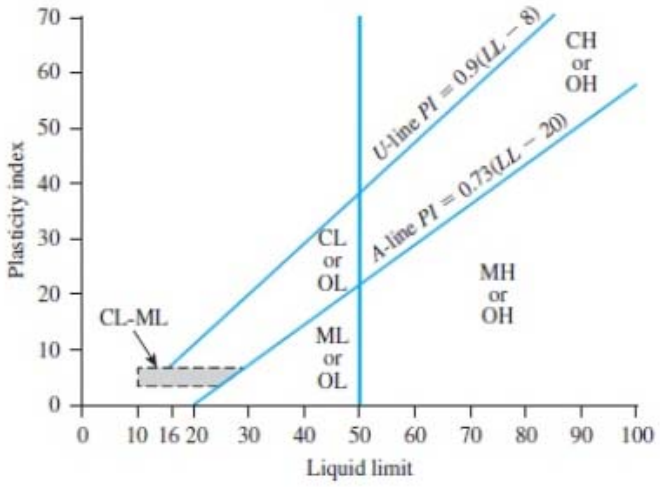


Table 7-12. Frost susceptibility classification of soils (NCHRP 1-37A).

Frost Group	Degree of Frost Susceptibility	Type of Soil	Percentage Finer than 0.075 mm (# 200) by wt.	Typical Soil Classification
F1	Negligible to low	Gravelly soils	3-10	GC, GP, GC-GM, GP-GM
F2	Low to medium	Gravelly soils	10-20	GM, GC-GM, GP-GM
		Sands	3-15	SW, SP, SM, SW-SM, SP-SM
F3	High	Gravelly Soils	Greater than 20	GM-GC
		Sands, except very fine silty sands	Greater than 15	SM, SC
		Clays PI>12	—	CL, CH
F4	Very high	All Silts	—	ML-MH
		Very Fine Silty Sands	Greater than 15	SM
		Clays PI<12	—	CL, CL-ML
		Varied clays and other fine grained, banded sediments	—	CL, ML, SM, CH

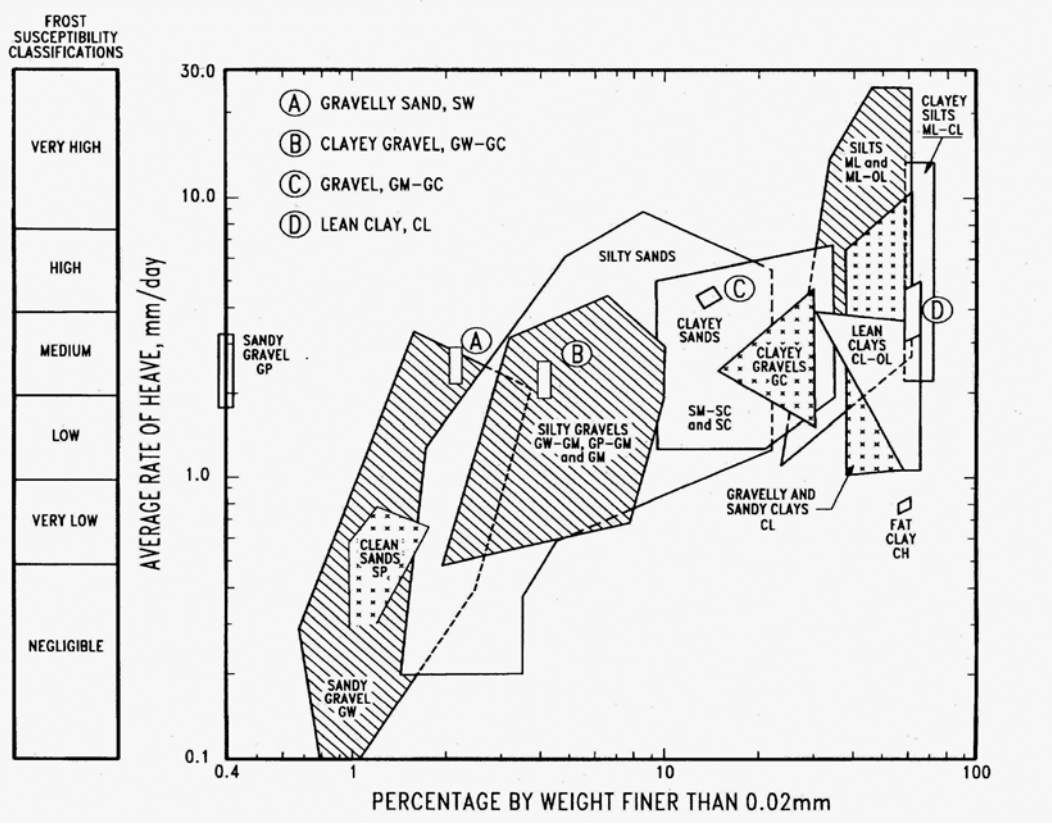


Figure 7-20. Average rate of heave versus % fines for natural soil gradations (Kaplar, 1974).

Frost Depth Map

APPENDIX B

MAINTENANCE REVIEW AND SUBSURFACE INVESTIGATION SCOPE

PAVEMENT EVALUATION LOG FOR LINEAR SOIL SURVEY

North Dakota Department of Transportation, Materials & Research
SFN 60472 (6-2017)

Sheet 1 of 1

Project Number	PCN	Date of Survey
IM-8-029(203)101	23102	03/23/2021

Section Maintenance Contact	Completed By
Brian Aune	Jamie Naumann

Highway Reference Points	Surface Types
101+0000 to 110+4198	Concrete

Location	Pavement Distress	Description	Maintenance Comment	Picture Number	Drilling Required
103+3041 to 103+3224	Broken Slab	Ravels Out. Corner breaks.	Patching yearly, muddy underneath.	1-3	No
103+4869 to 104+0000 (RAMP)	Other	Concrete section tilting slabs. Rough ride.		4	Yes
104+0000 to 104+0790 (RAMP)	Transv. Cracks	NB lane ramp asphalt only. Transverse cracks severely depressed.	Last crack seal 2020.	5-6	Yes
104+0112 to 104+0268	Broken Slab	Ravels Out. Corner breaks.	Fixed yearly for past three years.	7-8	No
104+0819 to 104+1047	Broken Slab	Driving lane only. Corner breaks.	Fixed yearly for past three years.	9-11	Yes
104+1472	Broken Slab	Driving lane only. Corner breaks.	Patched yearly for past three years.	12	No
106+1299 to 106+1338	Broken Slab	Corner breaks.	Patched with Mastec past 3 years. Culvert on end of area.	13-14	No
109+5250	Faulting	Slab sinking.	Other similar areas throughout project. Sinking slabs likely how problem areas start.	15-17	Yes
110+1704	Broken Slab	Broken slab at culvert. Driving lane.	Fixed once but sinking more.	18	Yes

Comments
All ramps have been fixed once and seem to be holding up.

1
103+3041 to 103+3224

2
103+3041 to 103+3224

3
103+3041 to 103+3224

4
103+4869 to 104+0000

5
104+0000 to 104+0790

6
104+0000 to 104+0790

7
104+0112 to 104+0268

8
104+0112 to 104+0268

9
104+0819 to 104+1047

10
104+0819 to 104+1047

11
104+0819 to 104+1047

12
104+1472

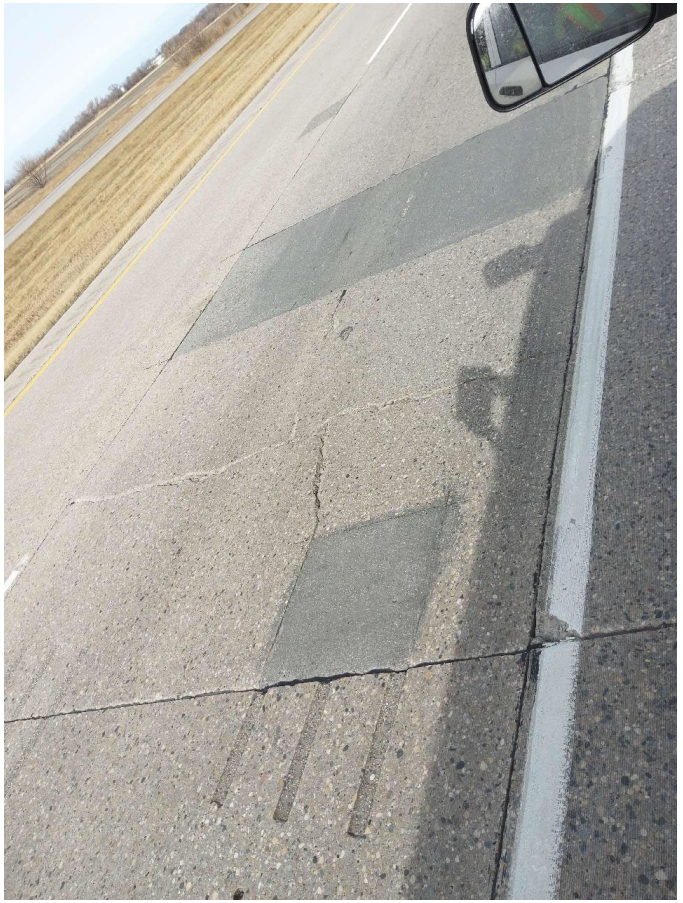
13
106+1299 to 106+1338

14
106+1299 to 106+1338

15
109+5250

16
109+5250

17
109+5250



18
110+1704

APPENDIX C

BORING LOCATIONS

Legend

- Reference Point
- Boring Location

0 2,250 4,500 Feet

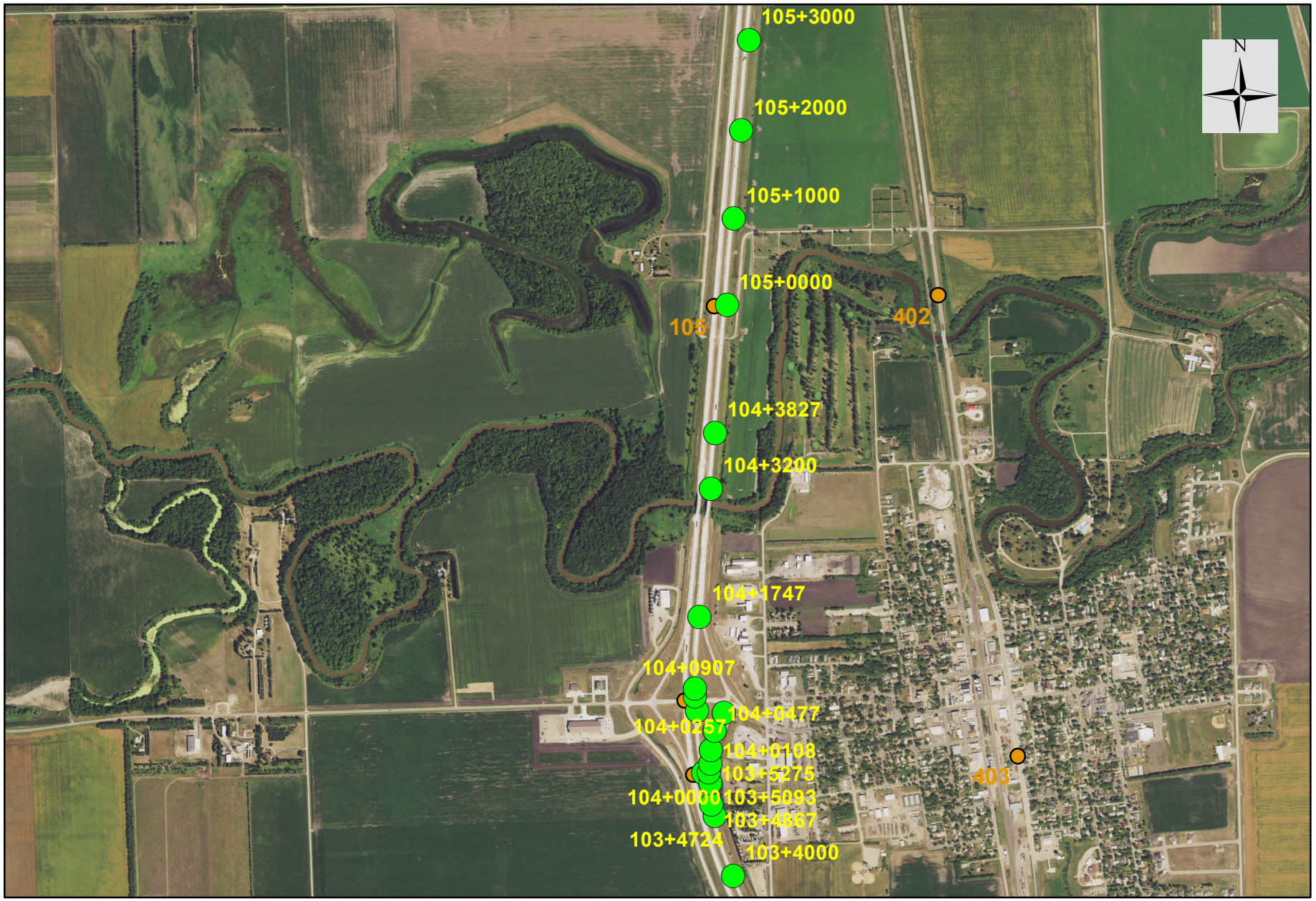
Project Number: IM-8-029(203)101

Legend

- Reference Point
- Boring Location

0 700 1,400 Feet

Project Number: IM-8-029(203)101

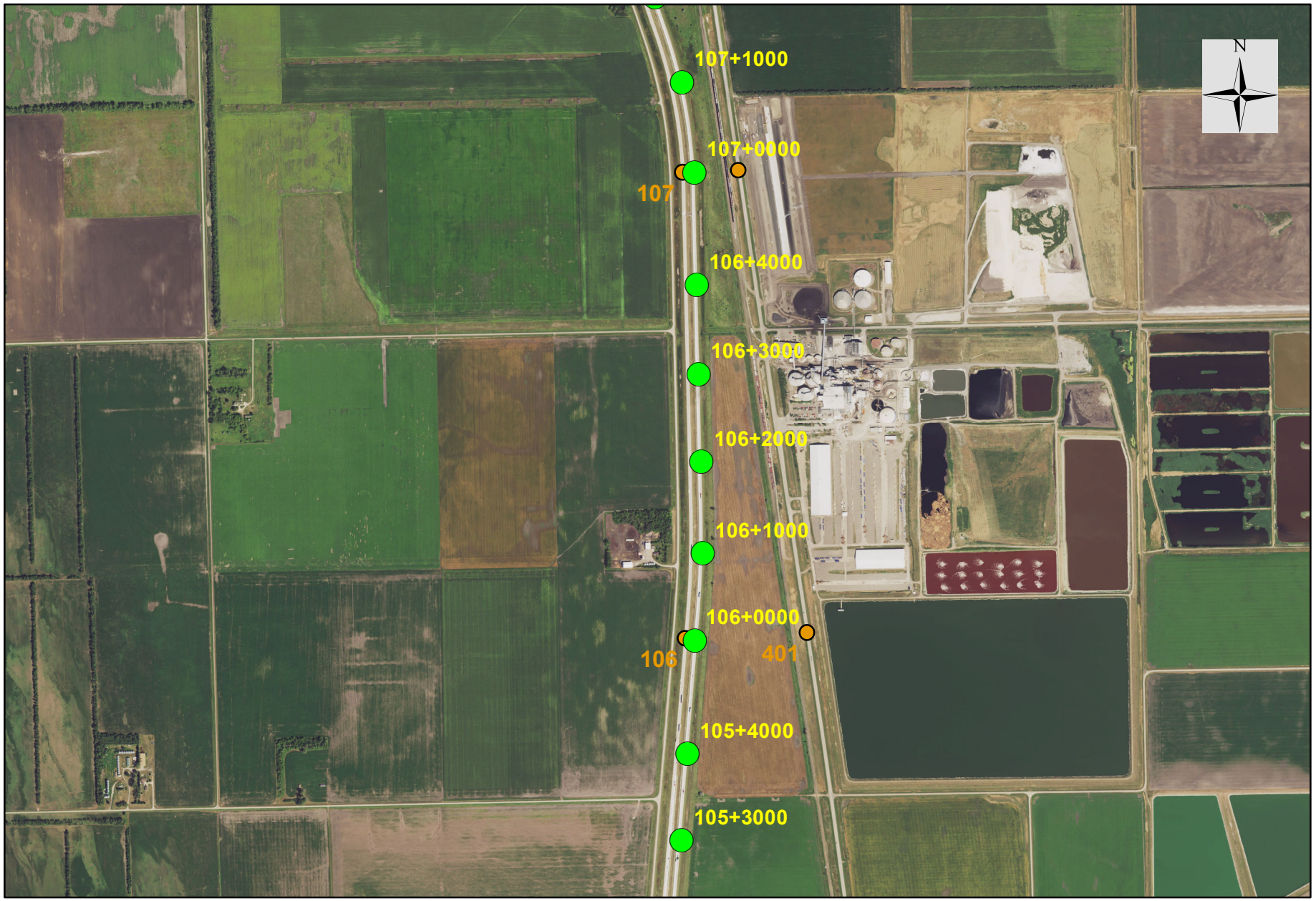


Legend

- Reference Point
- Boring Location

0 2,250 4,500 Feet

Project Number: IM-8-029(203)101



Legend

- Reference Point
- Boring Location

0 2,250 4,500 Feet

Project Number: IM-8-029(203)101

Legend

- Reference Point
- Boring Location

0 2,250 4,500 Feet

Project Number: IM-8-029(203)101

Legend

- Reference Point
- Boring Location

0 2,250 4,500 Feet

Project Number: IM-8-029(203)101

Legend

- Reference Point
- Boring Location

0 800 1,600 Feet

Project Number: IM-8-029(203)101

APPENDIX D

SUMMARY OF SOILS ANALYSIS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

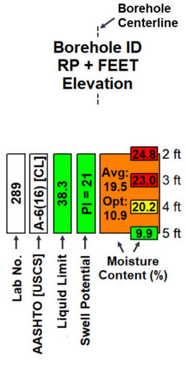
1	2	3	4	5	6
101+4000	102+0000	102+1000	102+4000	102+3000	102+4000
229	230	231	232	233	234
A-7-6(60) [CH]	A-7-6(48) [CH]	A-7-6(36) [CH]	A-7-6(48) [CH]	A-7-6(47) [CH]	A-7-6(43) [CH]
80.2	75.0	60.3	70.1	73.3	73.0
PI = 53	PI = 47	PI = 34	PI = 46	PI = 44	PI = 47
28.5 1 ft	29.4 1 ft	10.4 1.1 ft	34.8 1 ft	29.9 1 ft	31.7 1.2 ft
32.8 2 ft	37.3 2 ft	33.8 2 ft	30.5 2 ft	42.3 2 ft	21.1 2 ft
Avg: 30.1 Opt: 30.8 29.6 3 ft	Avg: 31.7 Opt: 26 30.6 3 ft	Avg: 26.9 Opt: 22.7 30.4 3 ft	Avg: 30.8 Opt: 26 25.0 3 ft	Avg: 33.8 Opt: 26 30.3 3 ft	Avg: 28.1 Opt: 26 32.4 3 ft
29.1 4 ft	33.3 4 ft	33.0 4 ft	32.8 4 ft	31.6 4 ft	29.1 4 ft
30.6 5 ft	28.1 5 ft	27.0 5 ft	30.7 5 ft	34.9 5 ft	26.1 5 ft

Depth (ft)

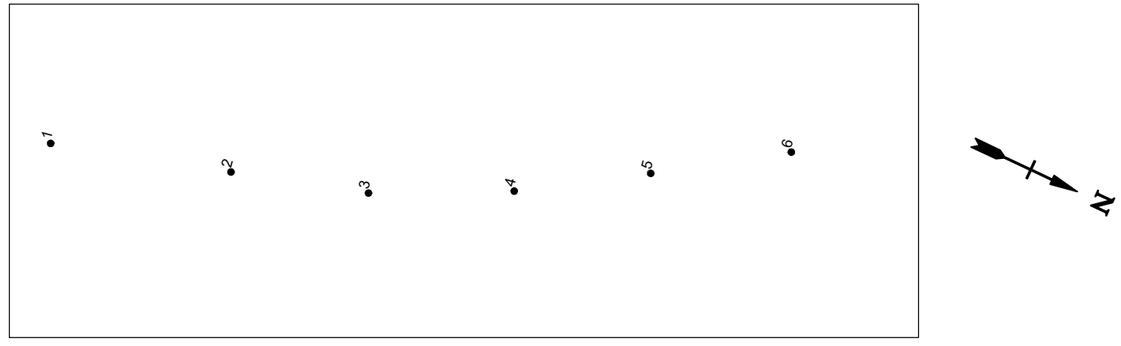
0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Boreholes Equally Spaced (0 to 1800 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



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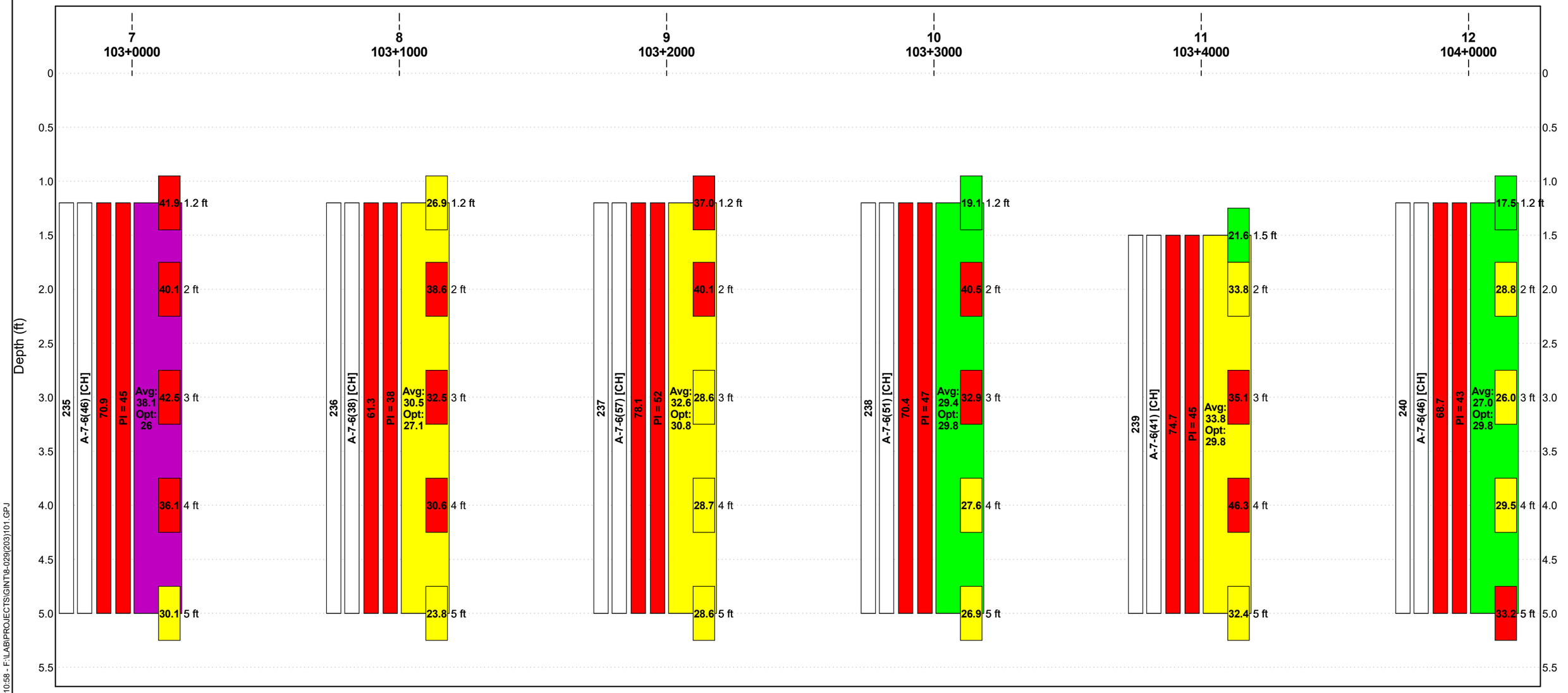
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

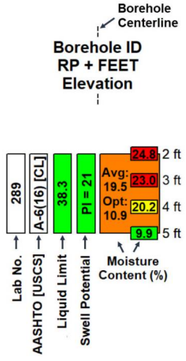
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

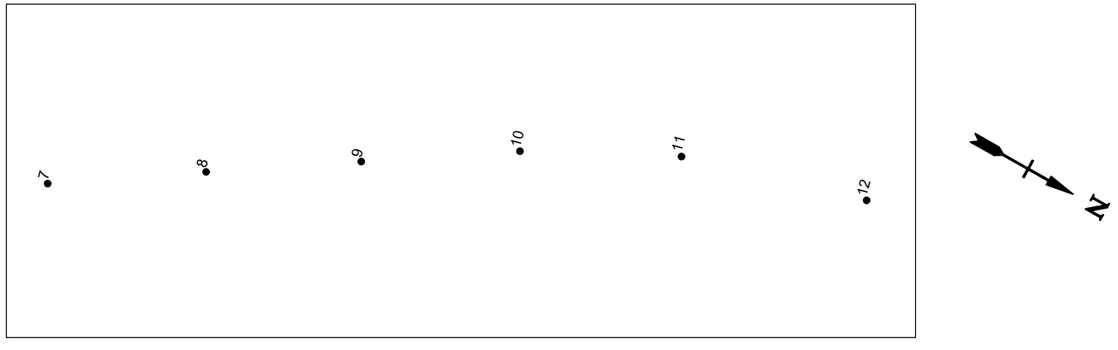


Boreholes Equally Spaced (0 to 1600 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



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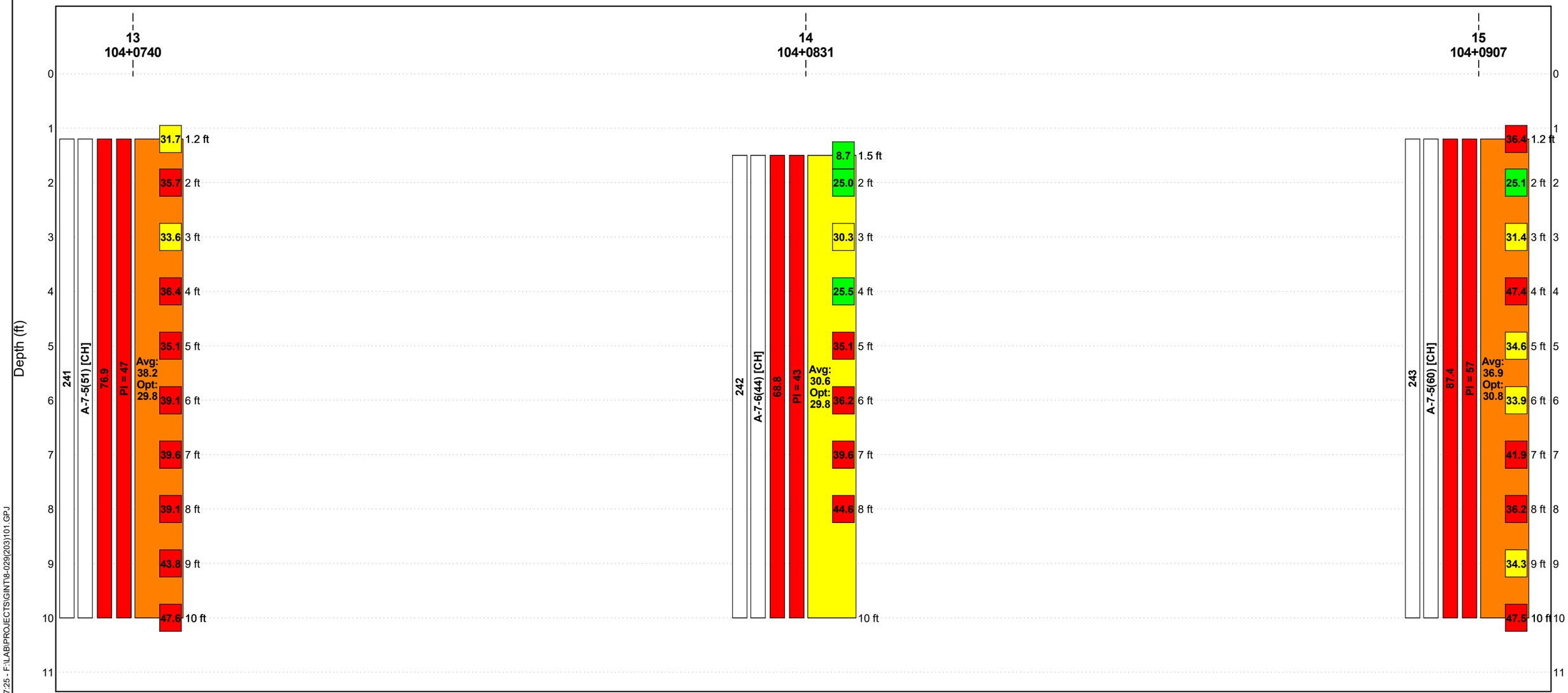
NDDOT North Dakota Department of Transportation

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

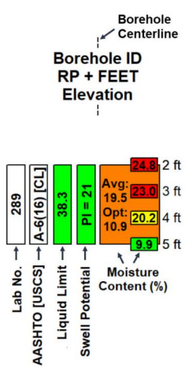
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

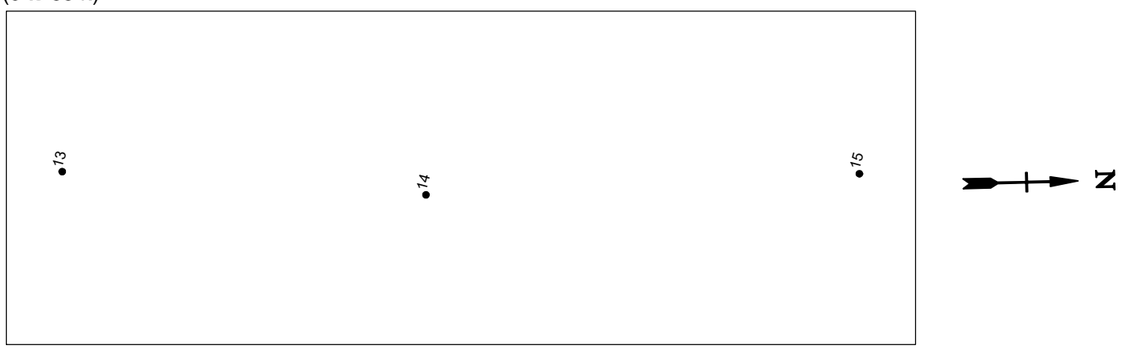


Boreholes Equally Spaced (0 to 55 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



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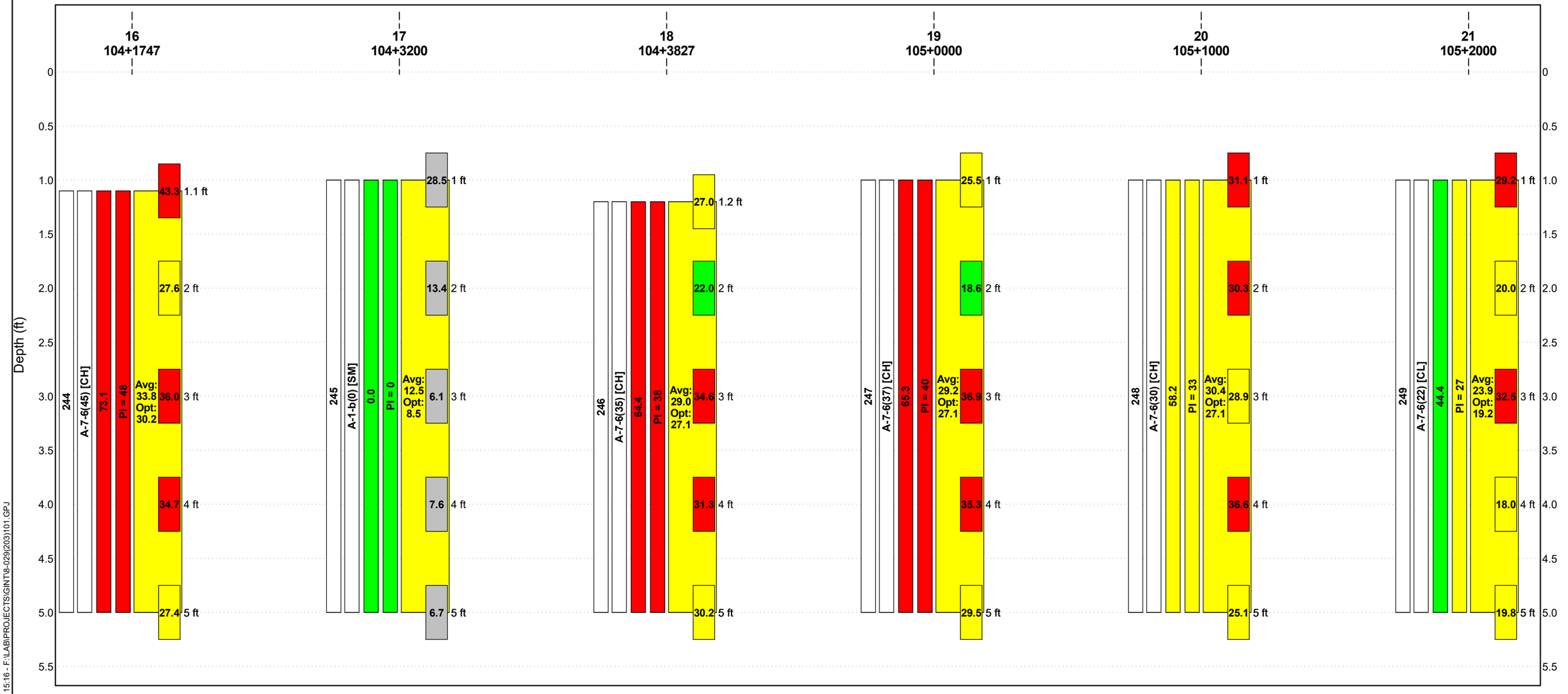
NDDOT North Dakota Department of Transportation

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

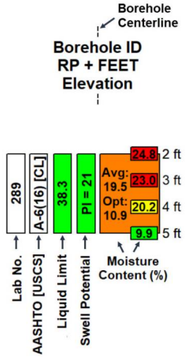
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

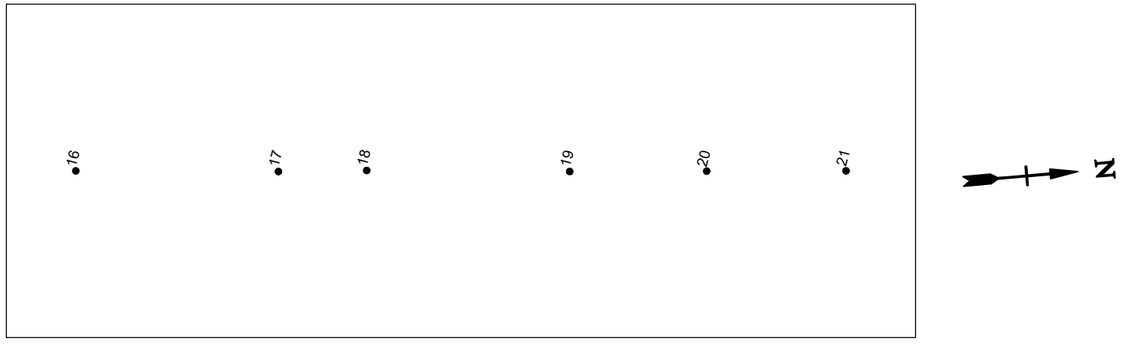


Boreholes Equally Spaced (0 to 1800 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 12/1/22 15:16 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

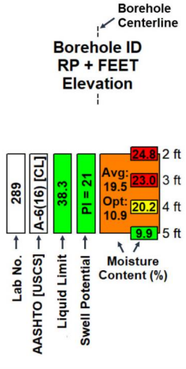
LOCATION Traill County

22	23	24	25	26	27
105+3000	105+4000	106+0000	106+1000	106+2000	106+3000
250	251	252	253	254	255
A-7-6(34) [CH]	A-6(13) [CL]	A-7-6(20) [CL]	A-7-6(45) [CH]	A-7-6(31) [CH]	A-7-6(30) [CH]
56.5	35.3	41.3	65.2	51.0	50.7
PI = 37	PI = 17	PI = 24	PI = 43	PI = 31	PI = 31
Avg: 38.9 Opt: 24.9	Avg: 24.7 Opt: 19.2	Avg: 22.0 Opt: 19.2	Avg: 29.4 Opt: 21.8	Avg: 22.8 Opt: 21.5	Avg: 24.0 Opt: 21.5
84.2 1.1 ft	30.4 1 ft	26.8 1 ft	22.5 1 ft	22.2 1 ft	23.6 1.1 ft
26.6 2 ft	27.0 2 ft	21.4 2 ft	28.0 2 ft	27.2 2 ft	21.3 2 ft
20.0 3 ft	26.0 3 ft	21.5 3 ft	33.3 3 ft	22.4 3 ft	29.7 3 ft
33.8 4 ft	18.8 4 ft	18.9 4 ft	31.9 4 ft	20.4 4 ft	21.3 4 ft
29.7 5 ft	21.3 5 ft	21.2 5 ft	31.3 5 ft	22.1 5 ft	24.0 5 ft

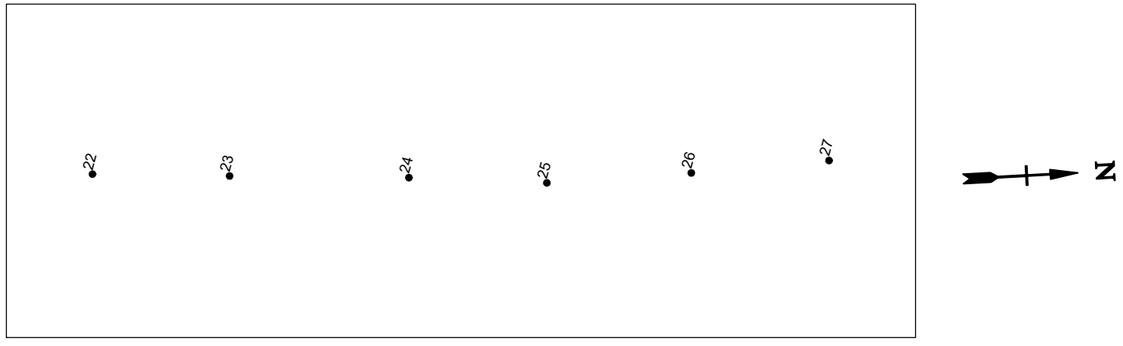
Depth (ft)

Boreholes Equally Spaced (0 to 1800 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



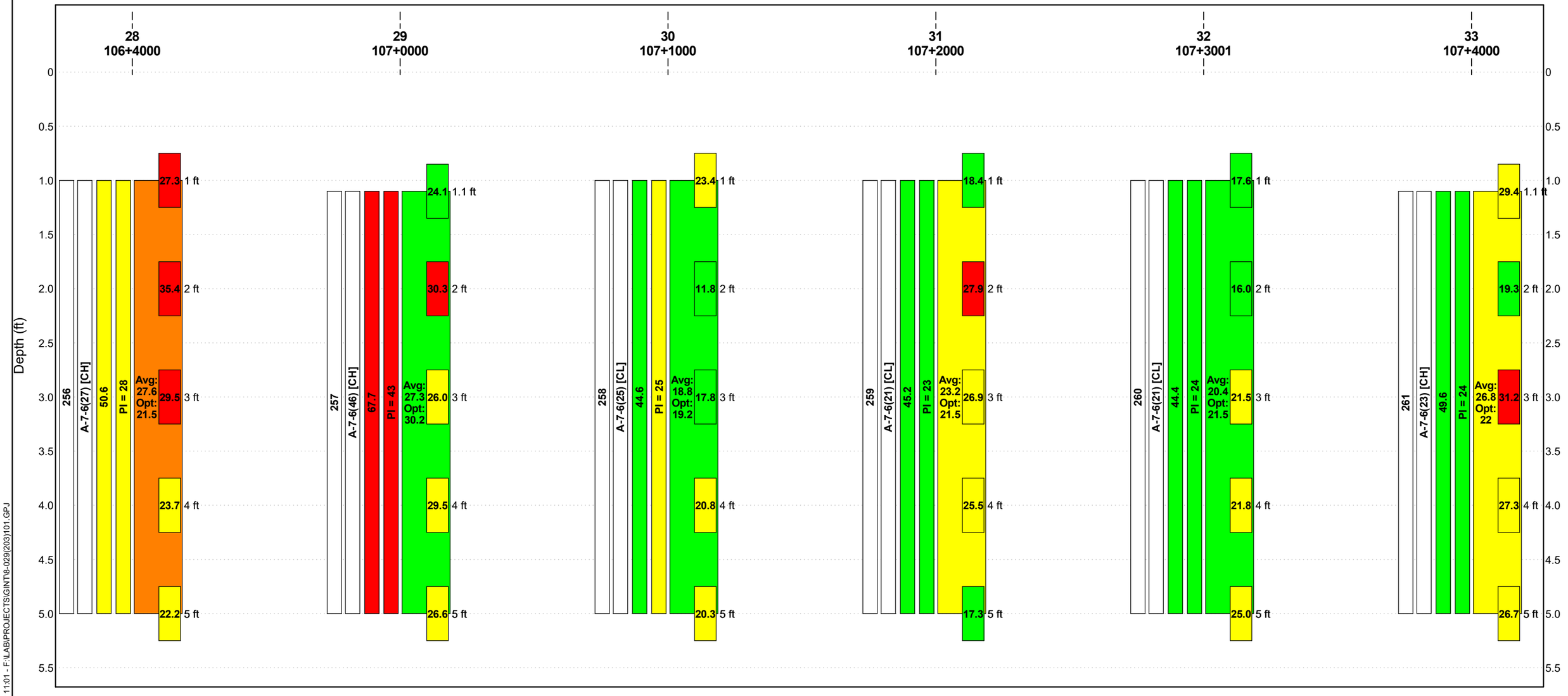
NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 12/1/22 15:14 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NDDOT North Dakota Department of Transportation

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

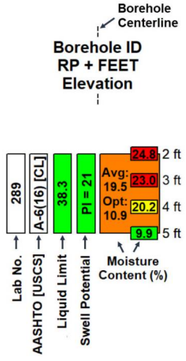
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

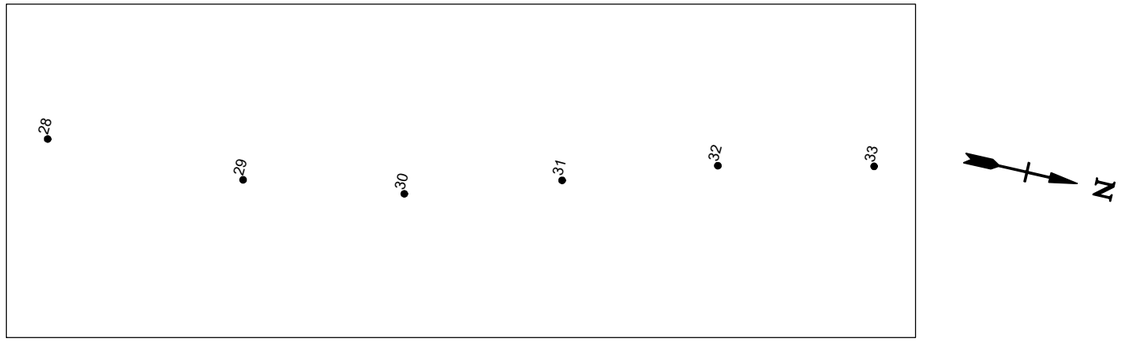


Boreholes Equally Spaced (0 to 1600 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



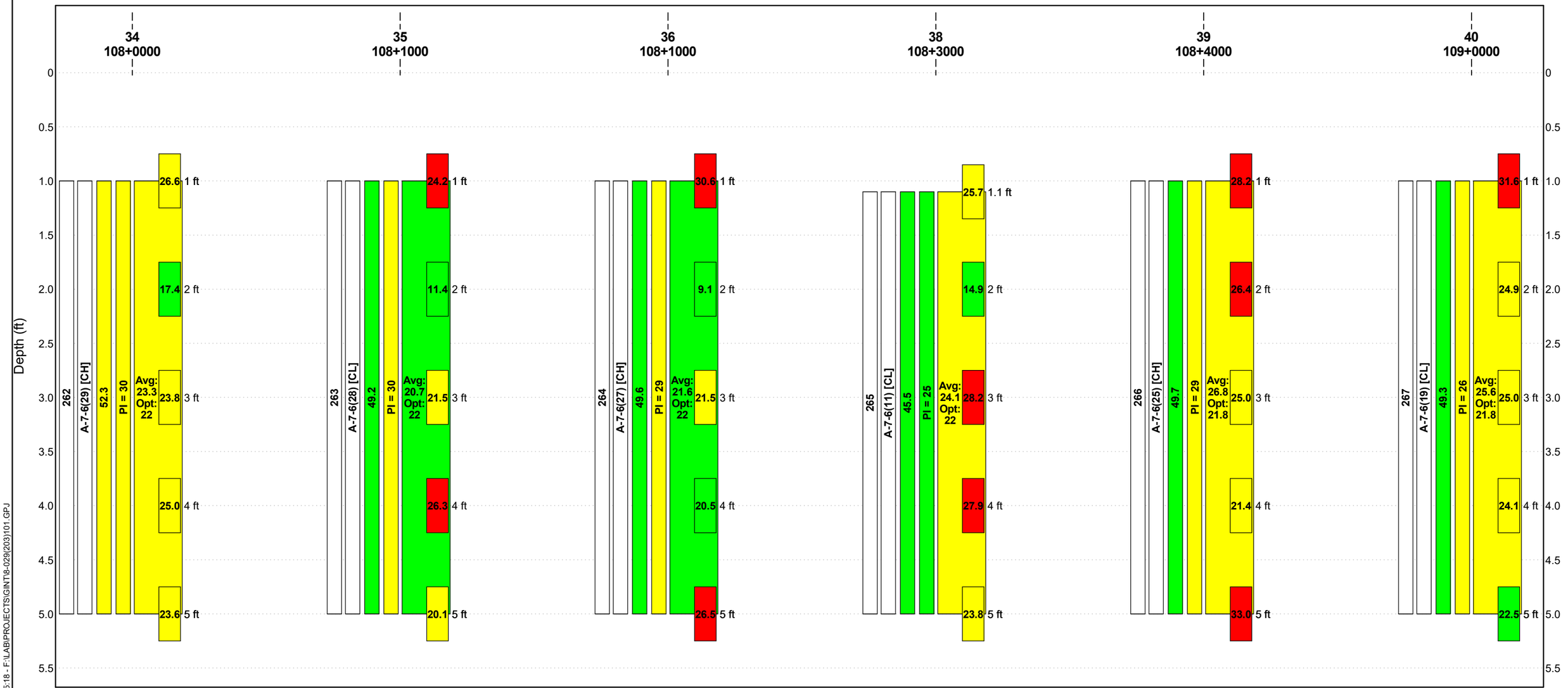
NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 11/3/22 11:01 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NDDOT
North Dakota Department of Transportation

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

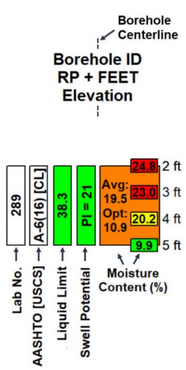
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County



Boreholes Equally Spaced (0 to 1800 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

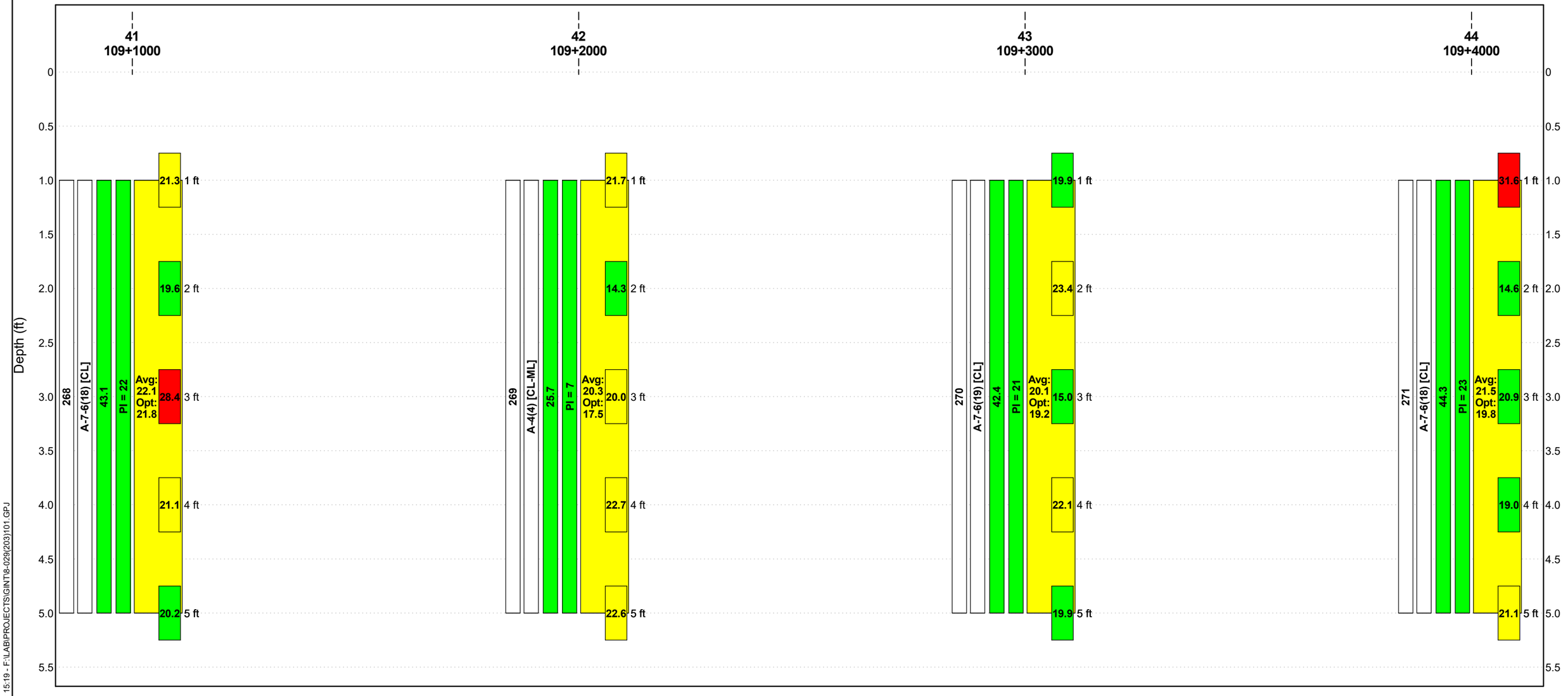
NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 12/1/22 15:18 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NDDOT North Dakota Department of Transportation

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

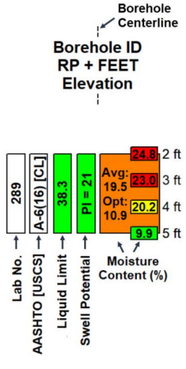
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

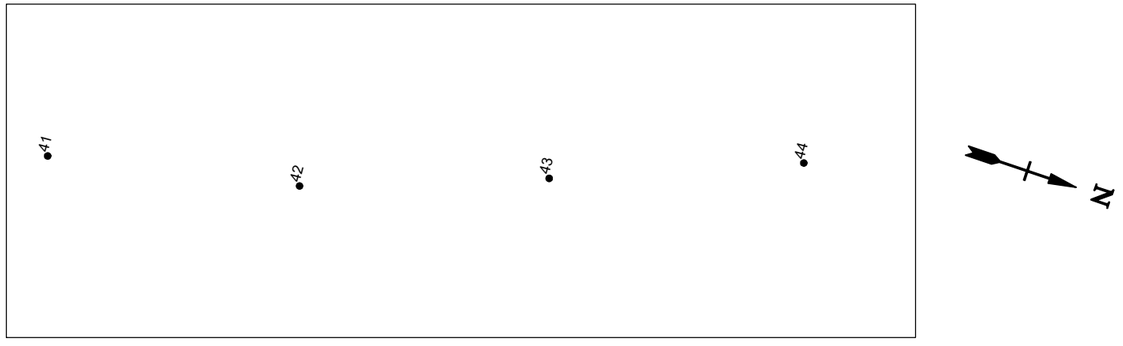


Boreholes Equally Spaced (0 to 1000 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

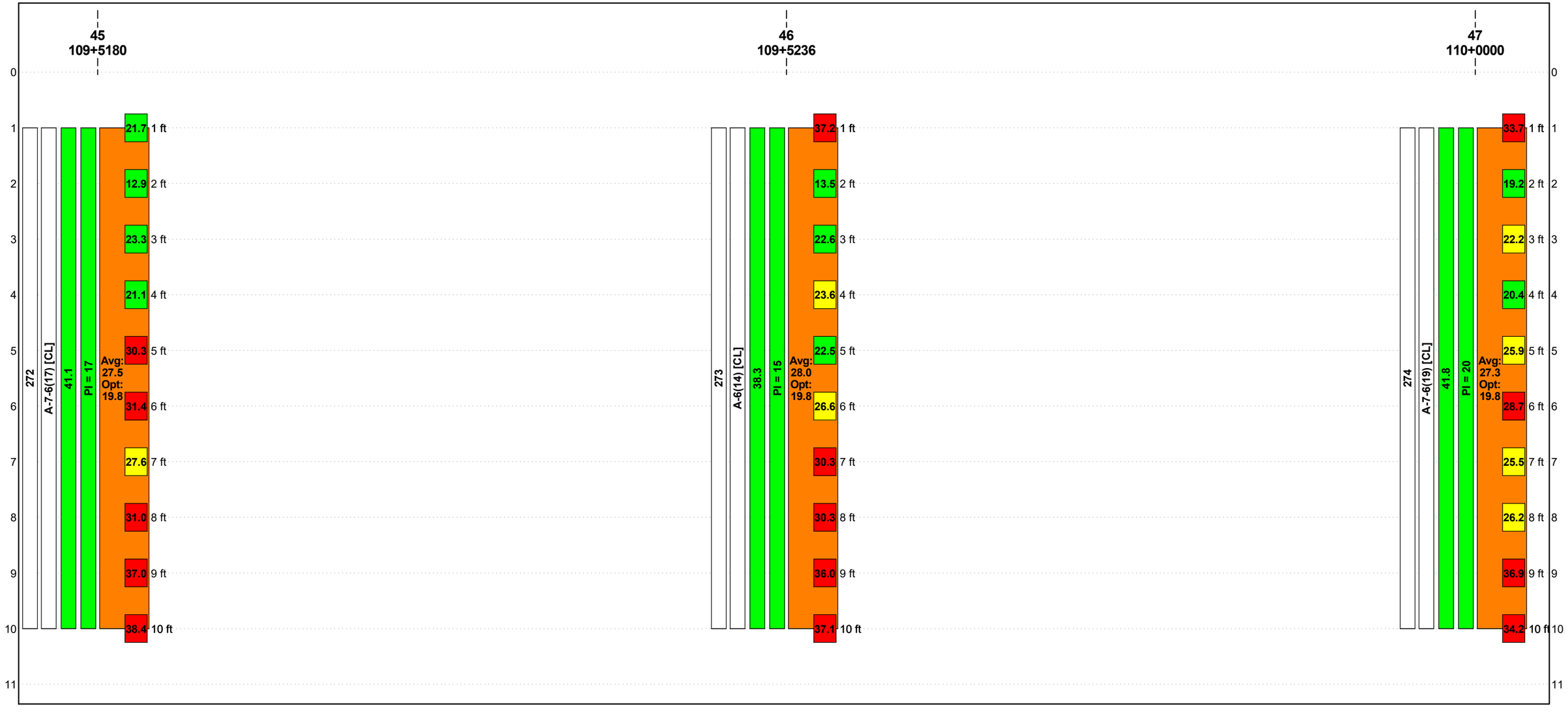


NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 12/1/22 15:19 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

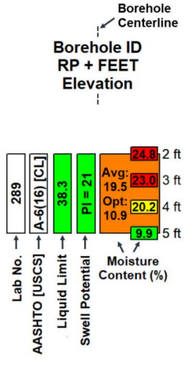
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

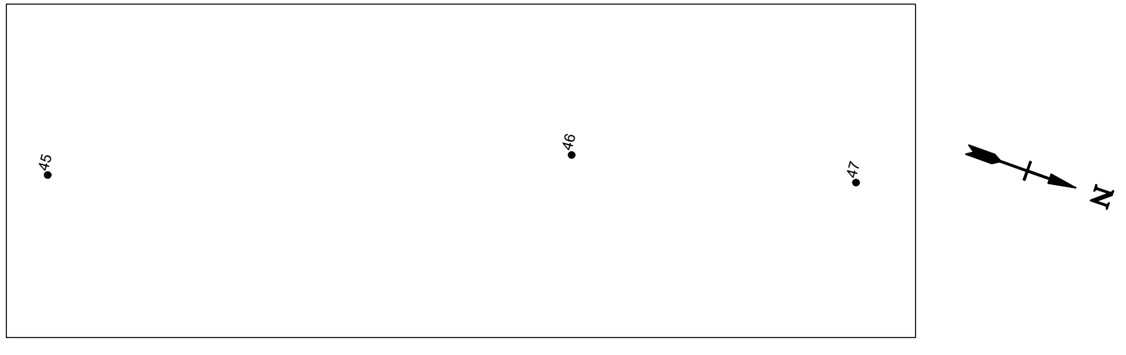


Boreholes Equally Spaced (0 to 30 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

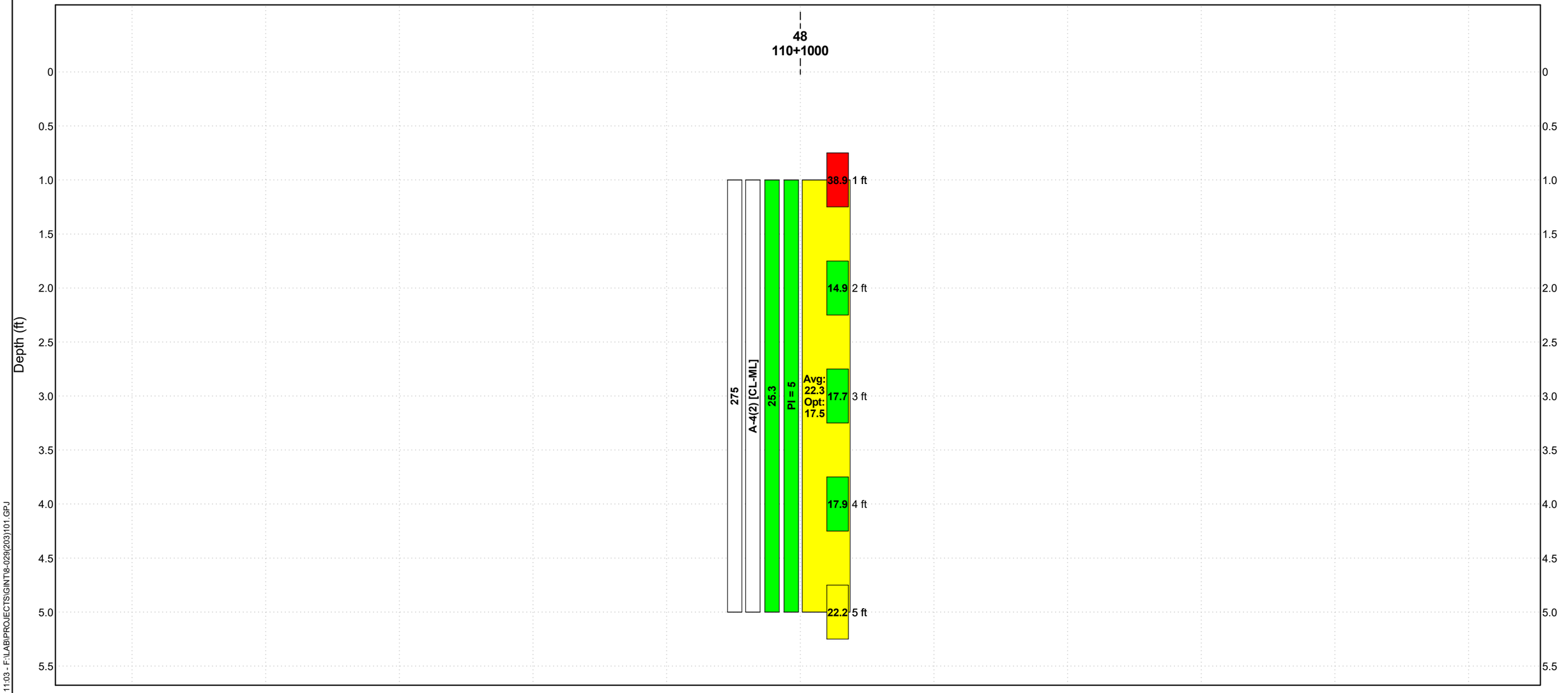


NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 11/3/22 11:03 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

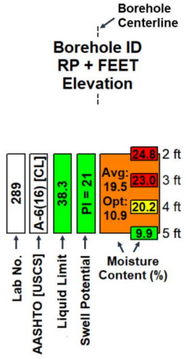
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

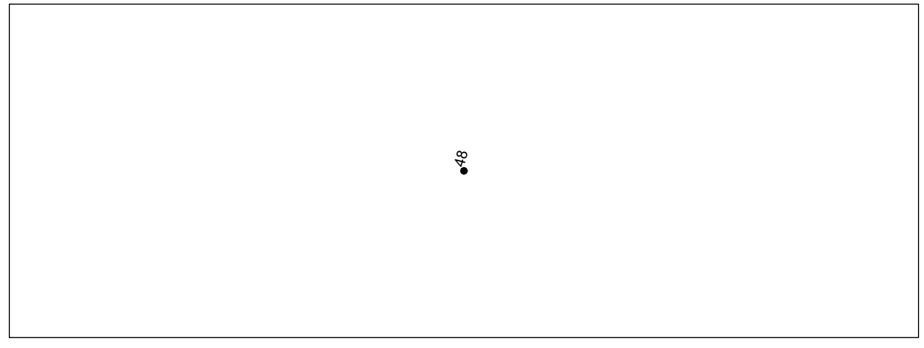


Boreholes Equally Spaced (0 to 2 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

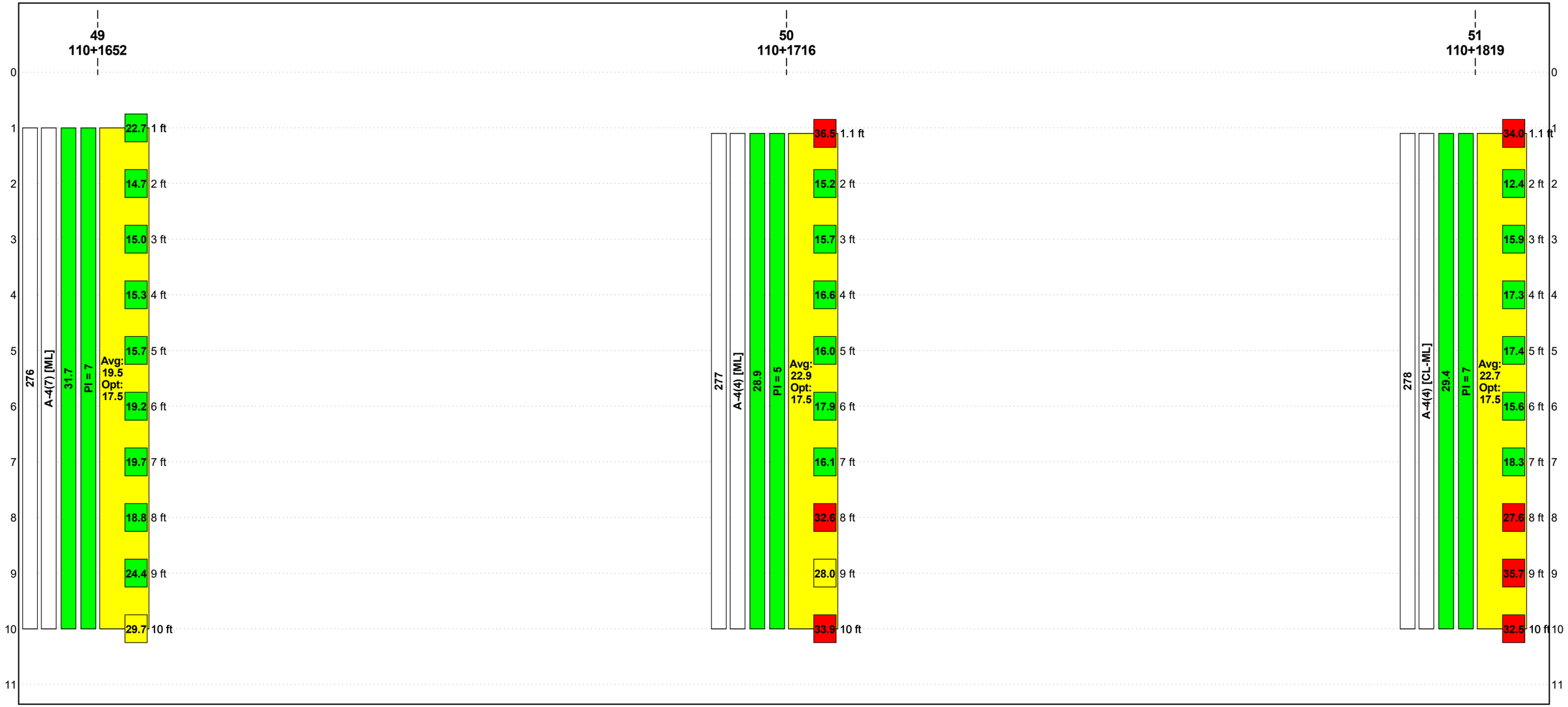


NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 11/3/22 11:03 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

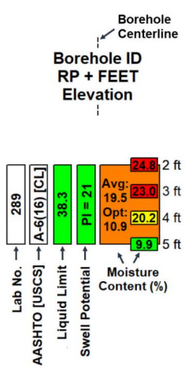
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County



Boreholes Equally Spaced (0 to 50 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 11/3/22 11:03 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

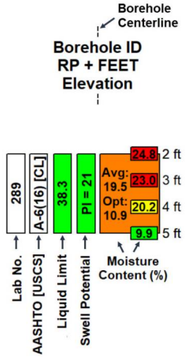
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

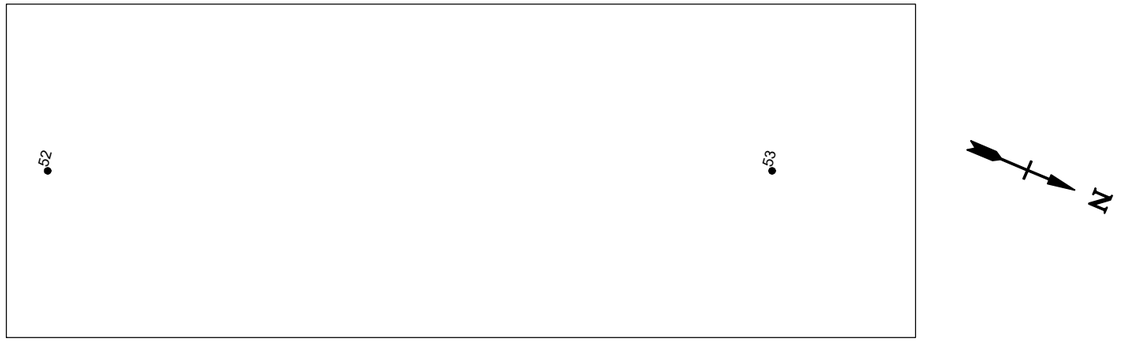
LOCATION Traill County

Boreholes Equally Spaced (0 to 350 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

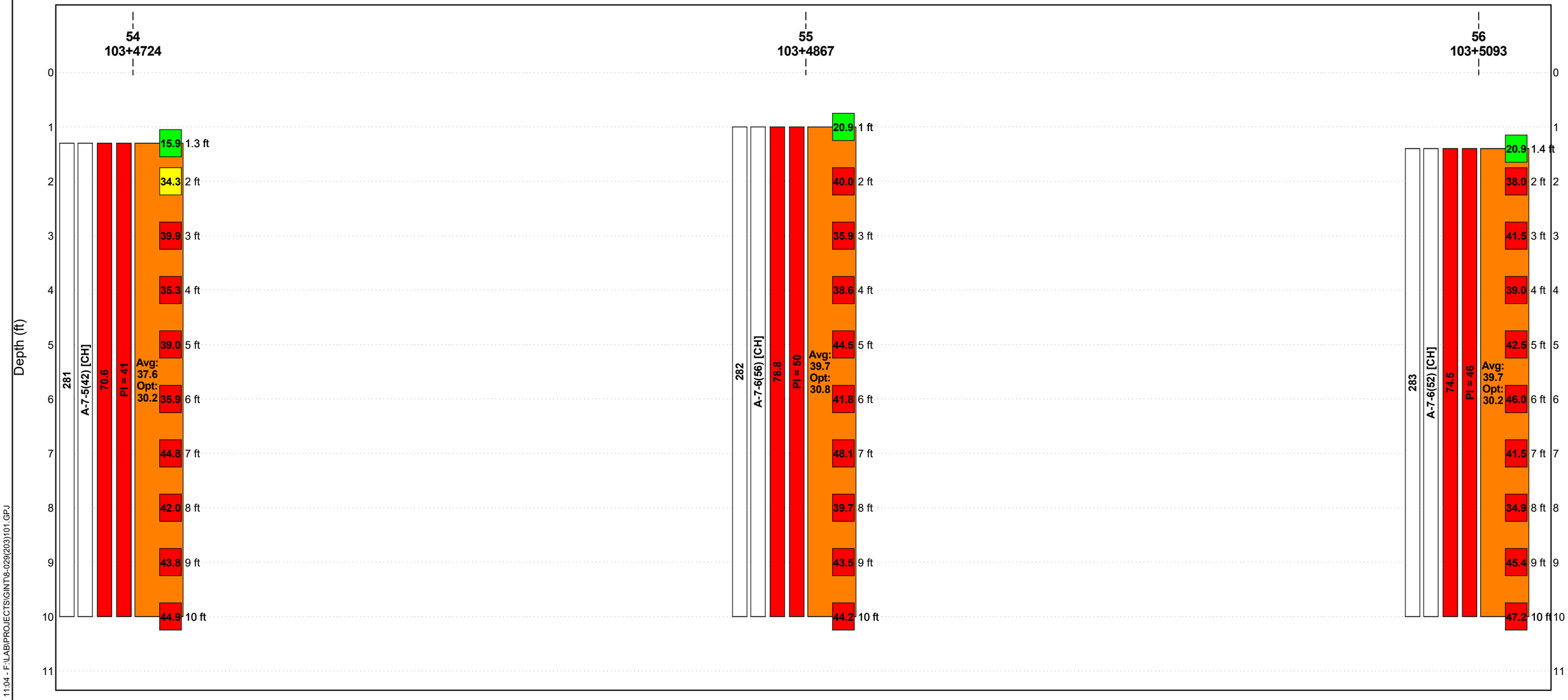


NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 12/6/22 09:21 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

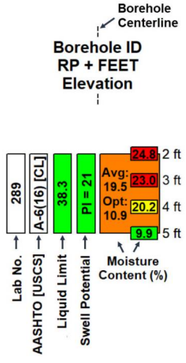
PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

LOCATION Traill County

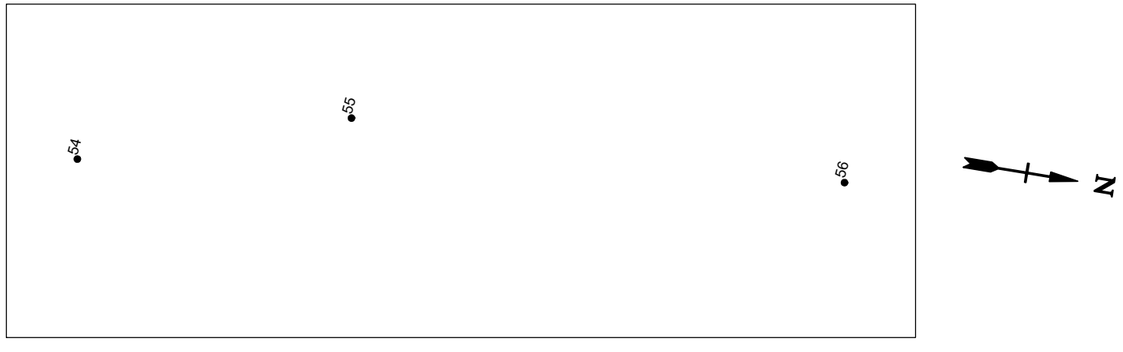


Boreholes Equally Spaced (0 to 120 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 11/3/22 11:04 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **PCN** 23102

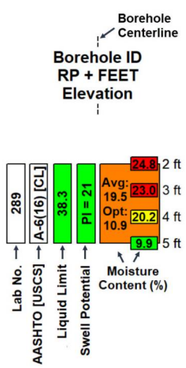
LOCATION Traill County

57	58	59	60	61
103+5275	104+0108	104+0257	104+0477	104+0700
284	285	286	287	288
A-7-6(56) [CH]	A-7-5(58) [CH]	A-7-6(46) [CH]	A-7-6(48) [CH]	A-7-6(46) [CH]
76.7	80.9	67.2	68.4	66.3
PI = 49	PI = 51	PI = 42	PI = 44	PI = 42
Avg: 34.3 Opt: 29.5	Avg: 35.0 Opt: 30.8	Avg: 33.3 Opt: 29.5	Avg: 31.4 Opt: 29.5	Avg: 31.8 Opt: 29.5
20.1 1 ft	32.9 2 ft	40.8 2 ft	27.0 2 ft	29.7 2 ft
22.3 2 ft	27.7 3 ft	30.0 3 ft	27.9 3 ft	30.8 3 ft
27.7 3 ft	30.1 4 ft	29.2 4 ft	27.3 4 ft	32.7 4 ft
36.2 4 ft	33.8 5 ft	22.8 5 ft	30.7 5 ft	34.3 5 ft
36.9 5 ft	35.4 6 ft	32.9 6 ft	31.4 6 ft	30.3 6 ft
18.7 6 ft	36.4 7 ft	33.6 7 ft	31.3 7 ft	29.0 7 ft
38.8 7 ft	28.2 8 ft	35.6 8 ft	34.9 8 ft	32.4 8 ft
45.0 8 ft	37.6 9 ft	36.2 9 ft	35.3 9 ft	33.3 9 ft
47.4 9 ft	52.4 10 ft	38.7 10 ft	36.7 10 ft	33.7 10 ft
49.6 10 ft				

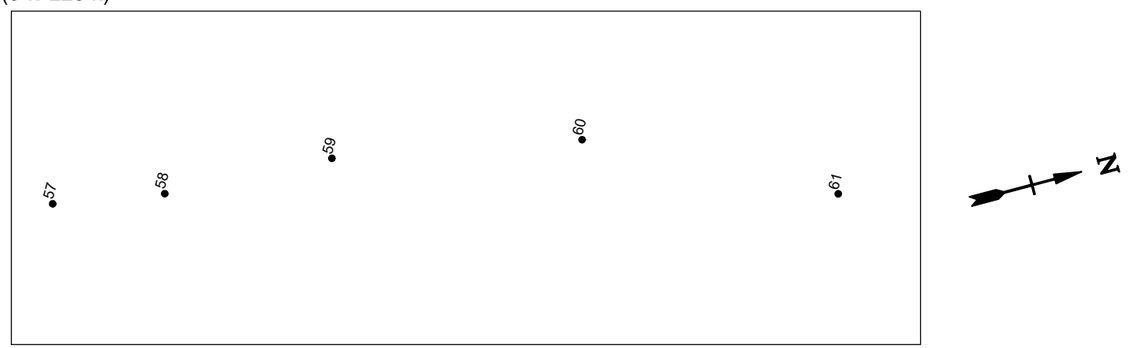
Depth (ft)

Boreholes Equally Spaced (0 to 220 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 11/3/22 11:07 - F:\LAB\PROJECTS\IGNT\8-029(203)101.GPJ

APPENDIX E

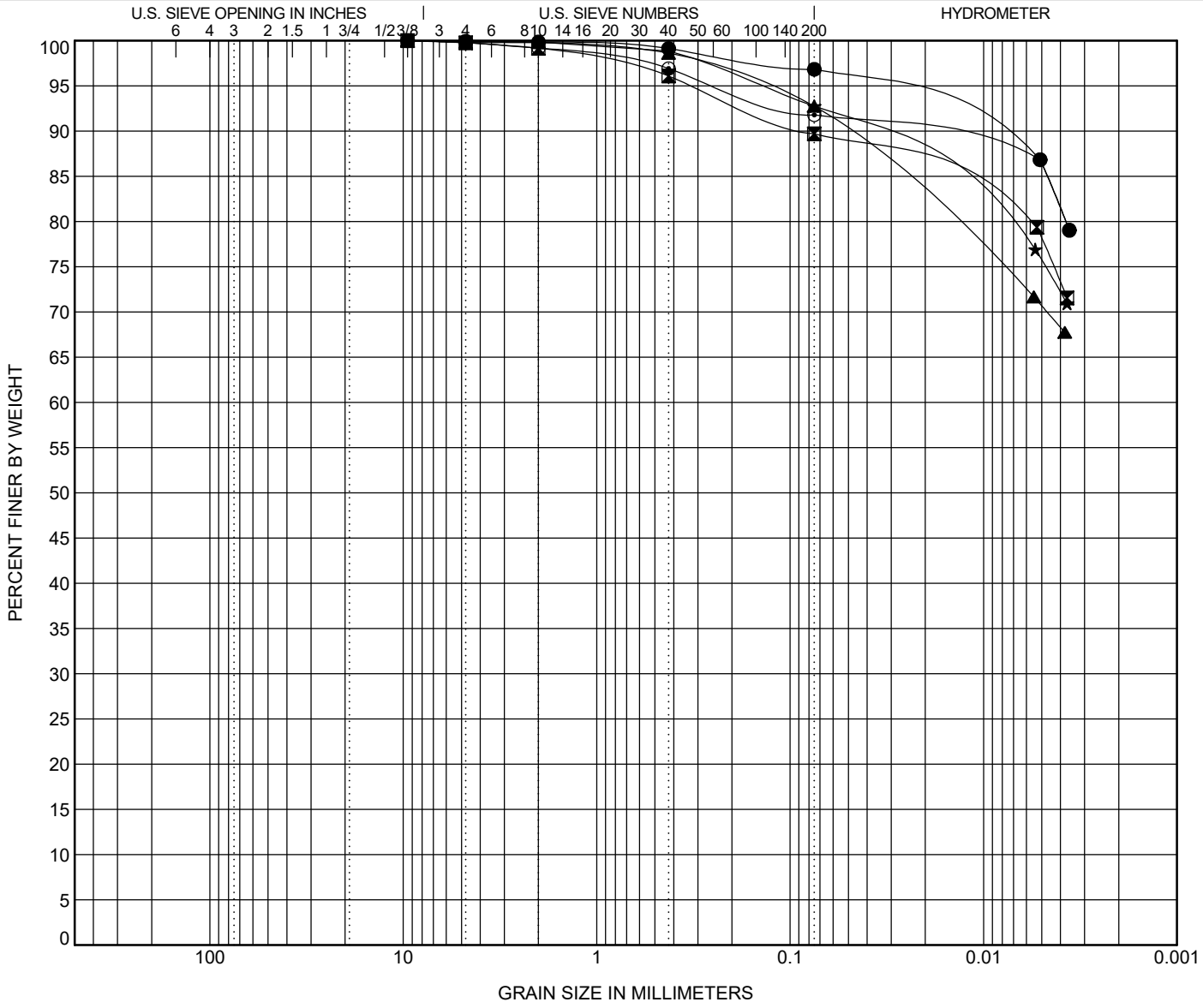
LAB RESULTS

GRAIN SIZE DISTRIBUTION

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE		DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	1	1.0	A-7-6 (60)	CH	80	27	53		
⊠	2	1.0	A-7-6 (48)	CH	75	28	47		
▲	3	1.1	A-7-6 (36)	CH	60	26	34		
★	4	1.0	A-7-6 (48)	CH	70	24	46		
⊙	5	1.0	A-7-6 (47)	CH	73	29	44		

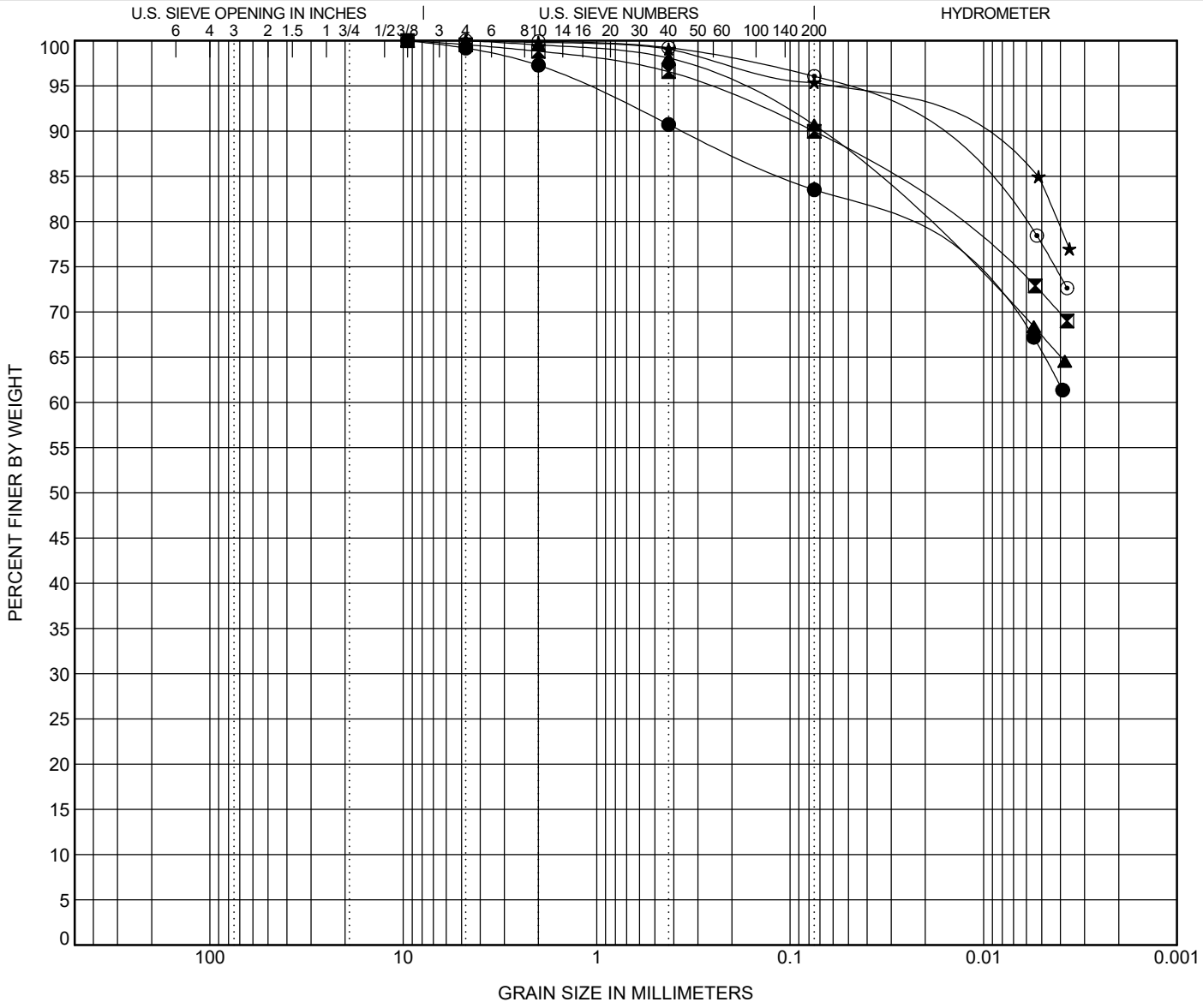
BOREHOLE		DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
●	1	1.0	9.5				0.1	3.1	96.8	
⊠	2	1.0	9.5				0.2	10.1	89.7	
▲	3	1.1	9.5				0.2	7.1	92.7	
★	4	1.0	9.5				0.0	7.2	92.8	
⊙	5	1.0	9.5				0.2	8.0	91.8	

GRAIN SIZE DISTRIBUTION

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● 6	1.2	A-7-6 (43)	CH	73	26	47		
⊠ 7	1.2	A-7-6 (46)	CH	71	26	45		
▲ 8	1.2	A-7-6 (38)	CH	61	23	38		
★ 9	1.2	A-7-6 (57)	CH	78	26	52		
⊙ 10	1.2	A-7-6 (51)	CH	70	24	46		

BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
● 6	1.2	9.5				0.8	15.7	83.5	
⊠ 7	1.2	9.5				0.4	9.6	90.0	
▲ 8	1.2	9.5				0.0	9.3	90.7	
★ 9	1.2	9.5				0.0	4.6	95.4	
⊙ 10	1.2	4.75				0.0	3.9	96.1	

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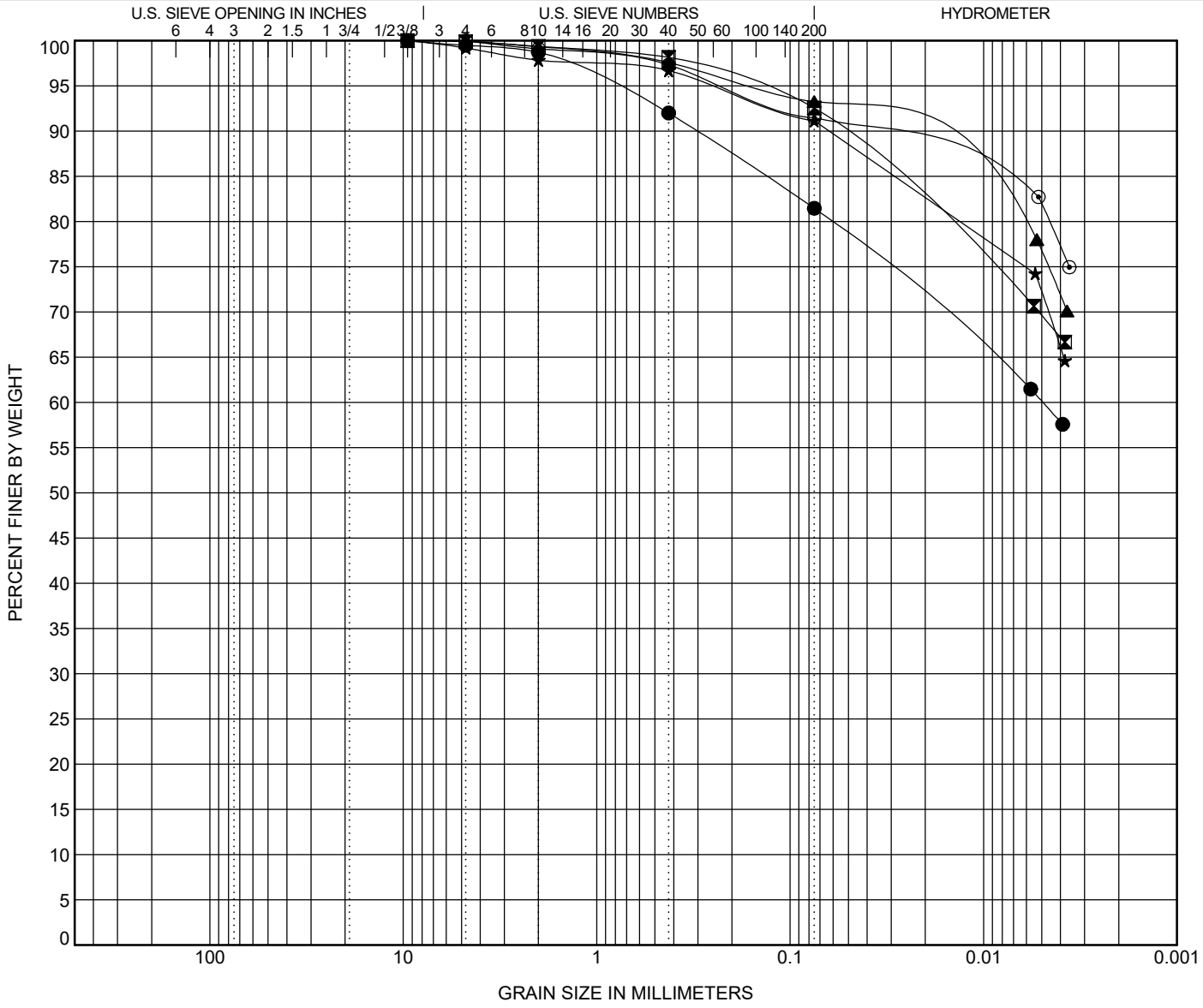
GRAIN SIZE DISTRIBUTION

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	11	1.5	A-7-6 (41)	CH	75	29	46		
⊠	12	1.2	A-7-6 (46)	CH	69	26	43		
▲	13	1.2	A-7-5 (51)	CH	77	30	47		
★	14	1.5	A-7-6 (44)	CH	69	26	43		
⊙	15	1.2	A-7-5 (60)	CH	87	30	57		

	BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
●	11	1.5	9.5				0.5	18.0	81.5	
⊠	12	1.2	9.5				0.1	7.3	92.5	
▲	13	1.2	4.75				0.0	6.7	93.3	
★	14	1.5	9.5				0.8	8.0	91.1	
⊙	15	1.2	4.75				0.0	8.5	91.5	

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PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

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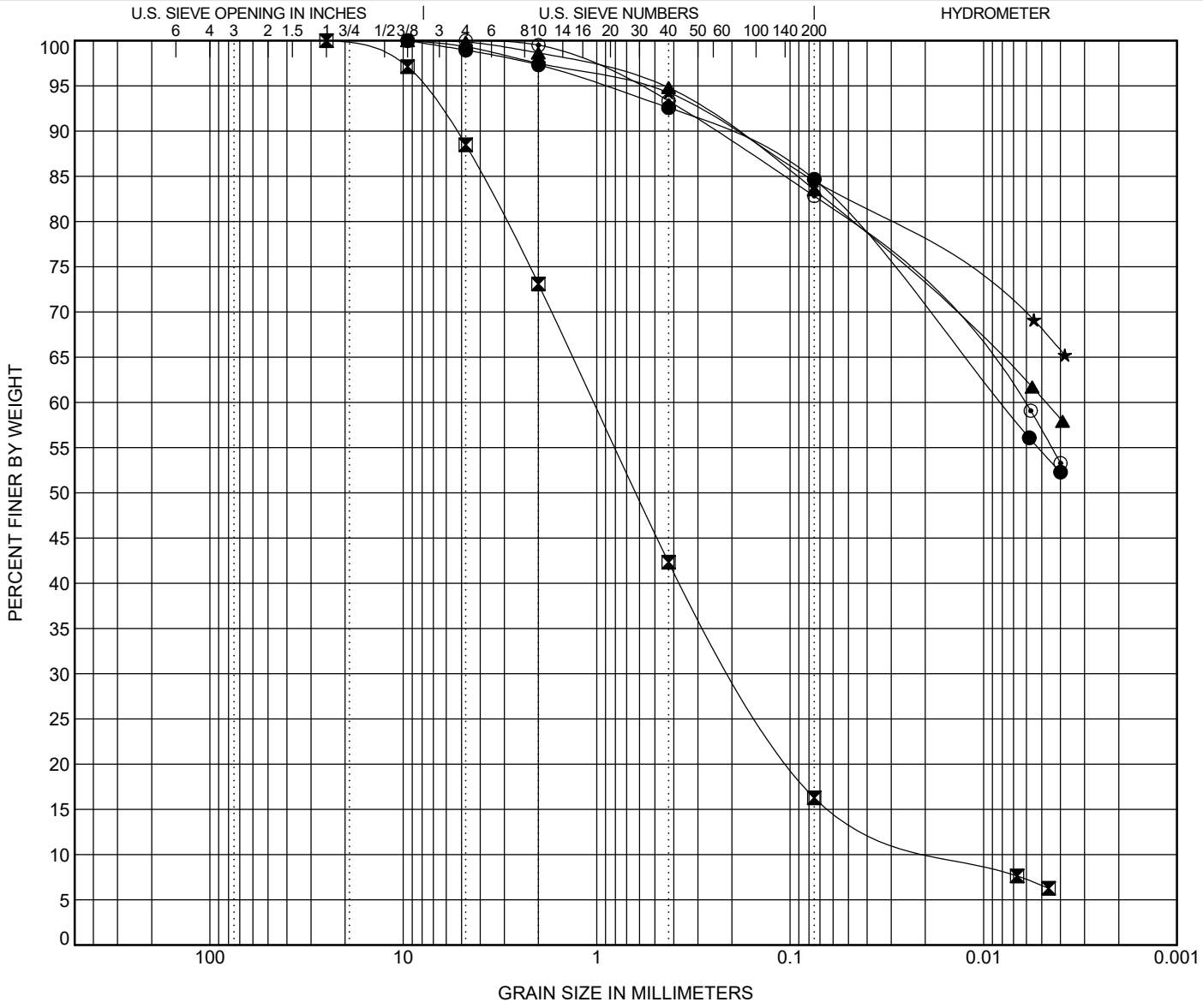

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	16	1.1	A-7-6 (45)	CH	73	25	48		
⊠	17	1.0	A-1-b (0)	SM	NP	NP	NP	2.61	79.81
▲	18	1.2	A-7-6 (35)	CH	64	26	38		
★	19	1.0	A-7-6 (37)	CH	65	25	40		
⊙	20	1.0	A-7-6 (30)	CH	58	25	33		

	BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
●	16	1.1	9.5				1.1	14.3	84.7	
⊠	17	1.0	25	0.626	0.187	0.053	11.5	72.2	16.3	
▲	18	1.2	9.5				0.1	16.3	83.5	
★	19	1.0	9.5				0.7	14.8	84.5	
⊙	20	1.0	4.75				0.0	17.2	82.8	

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BISMARCK, ND 58504

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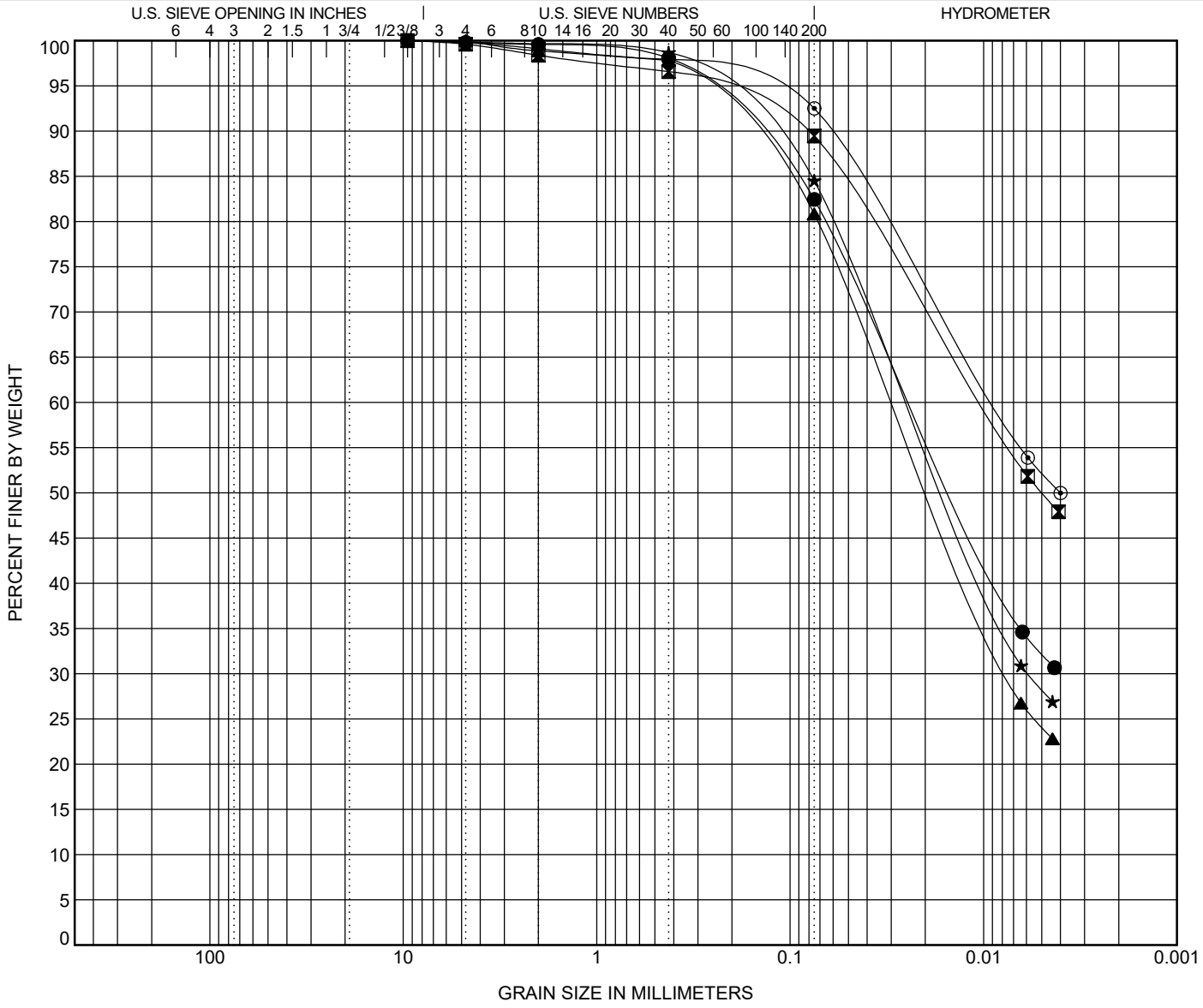
PCN 23102



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● 21	1.0	A-7-6 (22)	CL	44	17	27		
⊠ 22	1.1	A-7-6 (34)	CH	56	20	36		
▲ 23	1.0	A-6 (13)	CL	35	18	17		
★ 24	1.0	A-7-6 (20)	CL	41	17	24		
⊙ 25	1.0	A-7-6 (45)	CH	65	22	43		

BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
● 21	1.0	9.5	0.014			0.2	17.4	82.4	
⊠ 22	1.1	9.5	0.005			0.4	10.1	89.5	
▲ 23	1.0	4.75	0.018	0.007		0.0	19.2	80.8	
★ 24	1.0	9.5	0.015	0.006		0.2	15.3	84.5	
⊙ 25	1.0	9.5	0.004			0.2	7.3	92.5	

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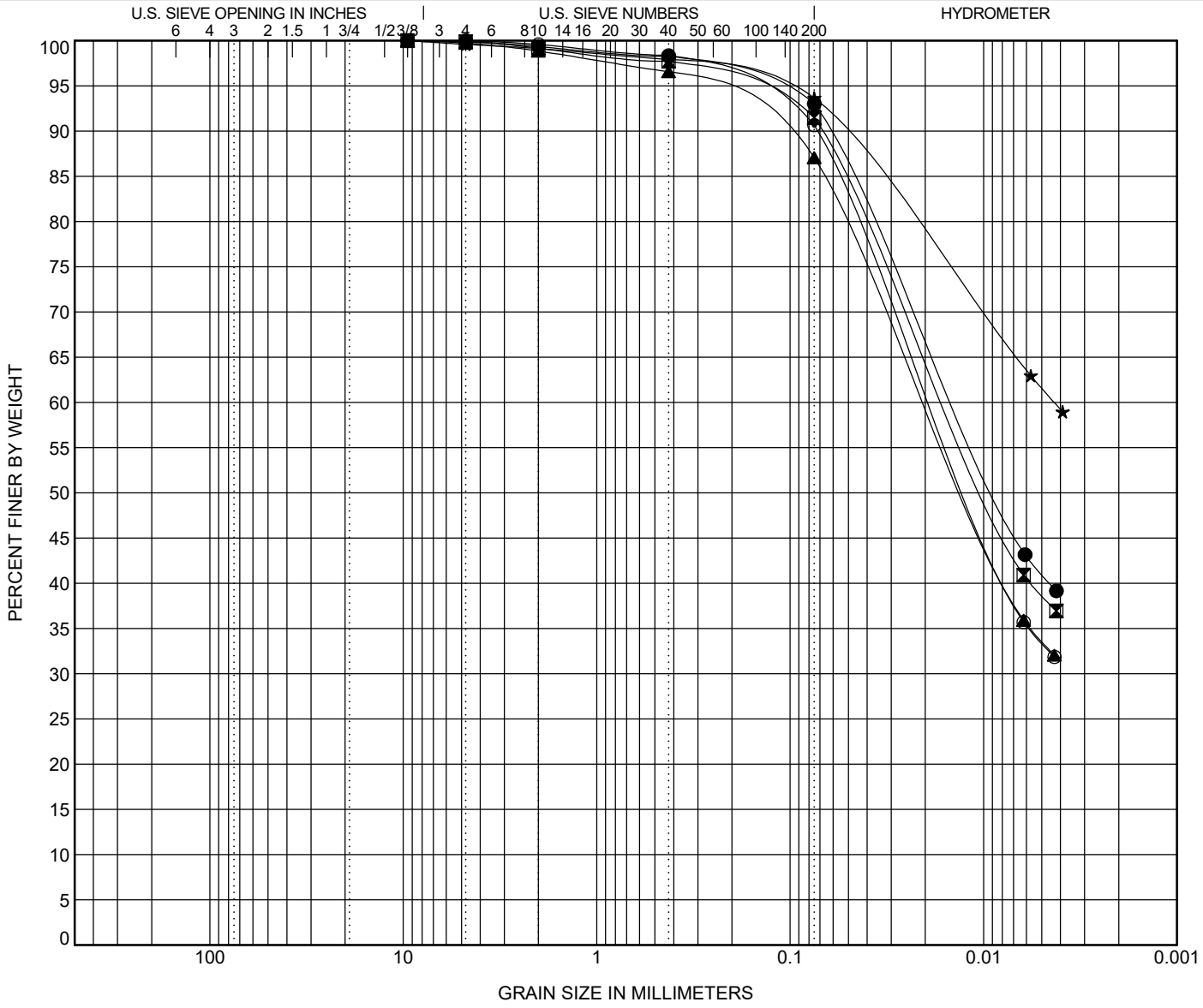

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● 26	1.0	A-7-6 (31)	CH	51	20	31		
⊠ 27	1.1	A-7-6 (30)	CH	51	20	31		
▲ 28	1.0	A-7-6 (27)	CH	51	22	29		
★ 29	1.1	A-7-6 (46)	CH	68	25	43		
⊙ 30	1.0	A-7-6 (25)	CL	45	19	26		

BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
● 26	1.0	9.5	0.009			0.1	6.9	93.0	
⊠ 27	1.1	9.5	0.01			0.1	8.4	91.5	
▲ 28	1.0	9.5	0.012			0.3	12.7	87.1	
★ 29	1.1	9.5				0.4	5.9	93.7	
⊙ 30	1.0	4.75	0.012			0.0	9.3	90.7	

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300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

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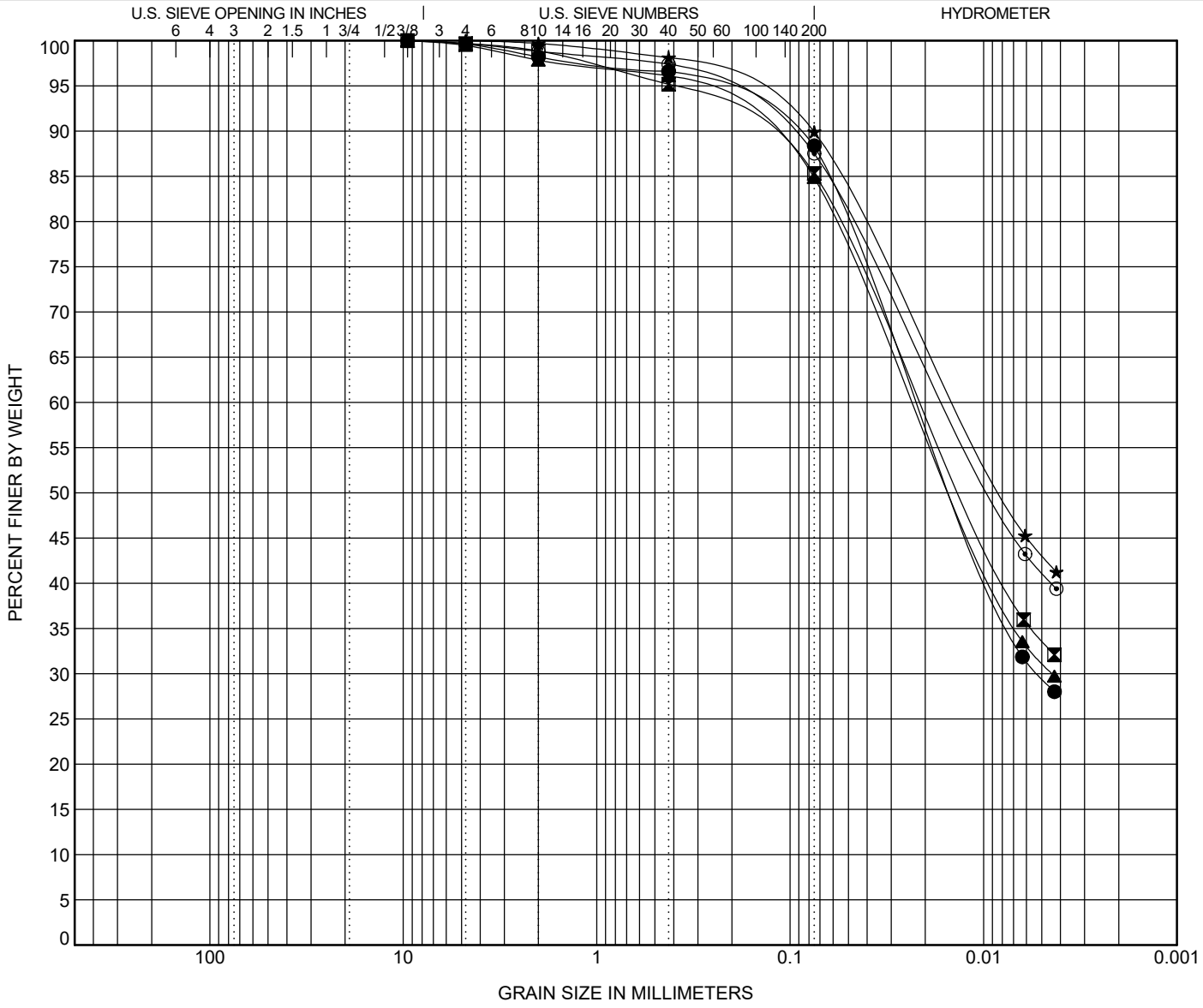

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● 31	1.0	A-7-6 (21)	CL	45	22	23		
⊠ 32	1.0	A-7-6 (21)	CL	44	20	24		
▲ 33	1.1	A-7-6 (23)	CH	50	25	25		
★ 34	1.0	A-7-6 (29)	CH	52	22	30		
⊙ 35	1.0	A-7-6 (28)	CL	49	19	30		

BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
● 31	1.0	9.5	0.014	0.005		0.4	11.2	88.4	
⊠ 32	1.0	9.5	0.013			0.3	14.4	85.3	
▲ 33	1.1	9.5	0.014	0.004		0.5	14.6	84.9	
★ 34	1.0	4.75	0.008			0.0	10.1	89.9	
⊙ 35	1.0	9.5	0.009			0.3	12.2	87.5	

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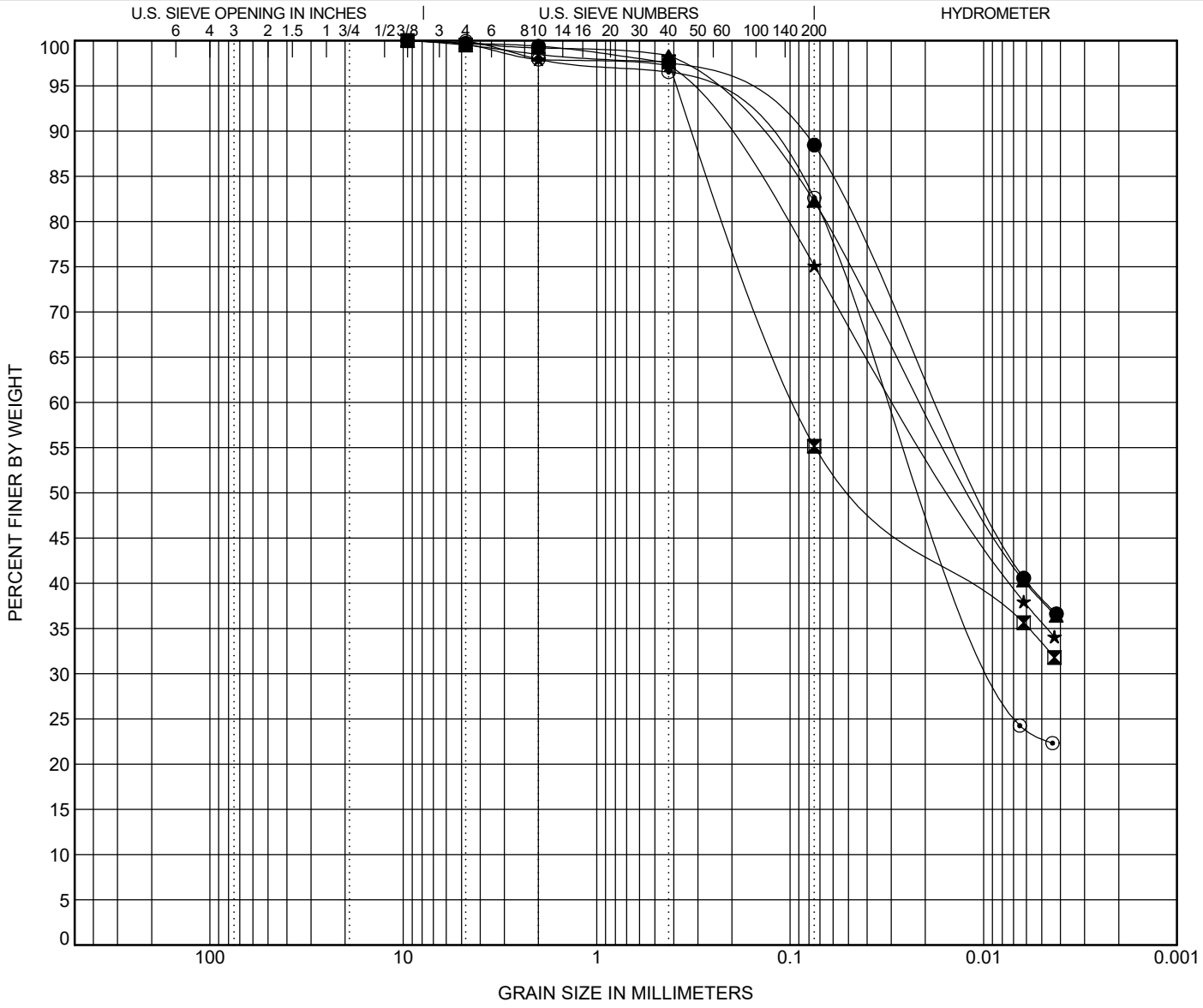
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● 36	1.0	A-7-6 (27)	CH	50	21	29		
⊠ 38	1.1	A-7-6 (11)	CL	46	21	25		
▲ 39	1.0	A-7-6 (25)	CH	50	20	30		
★ 40	1.0	A-7-6 (19)	CL	49	23	26		
⊙ 41	1.0	A-7-6 (18)	CL	43	21	22		

BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
● 36	1.0	9.5	0.01			0.3	11.3	88.5	
⊠ 38	1.1	9.5	0.039			0.5	44.4	55.2	
▲ 39	1.0	9.5	0.011			0.3	17.5	82.2	
★ 40	1.0	9.5	0.014			0.4	24.5	75.1	
⊙ 41	1.0	9.5	0.019	0.008		0.0	17.3	82.6	

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BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

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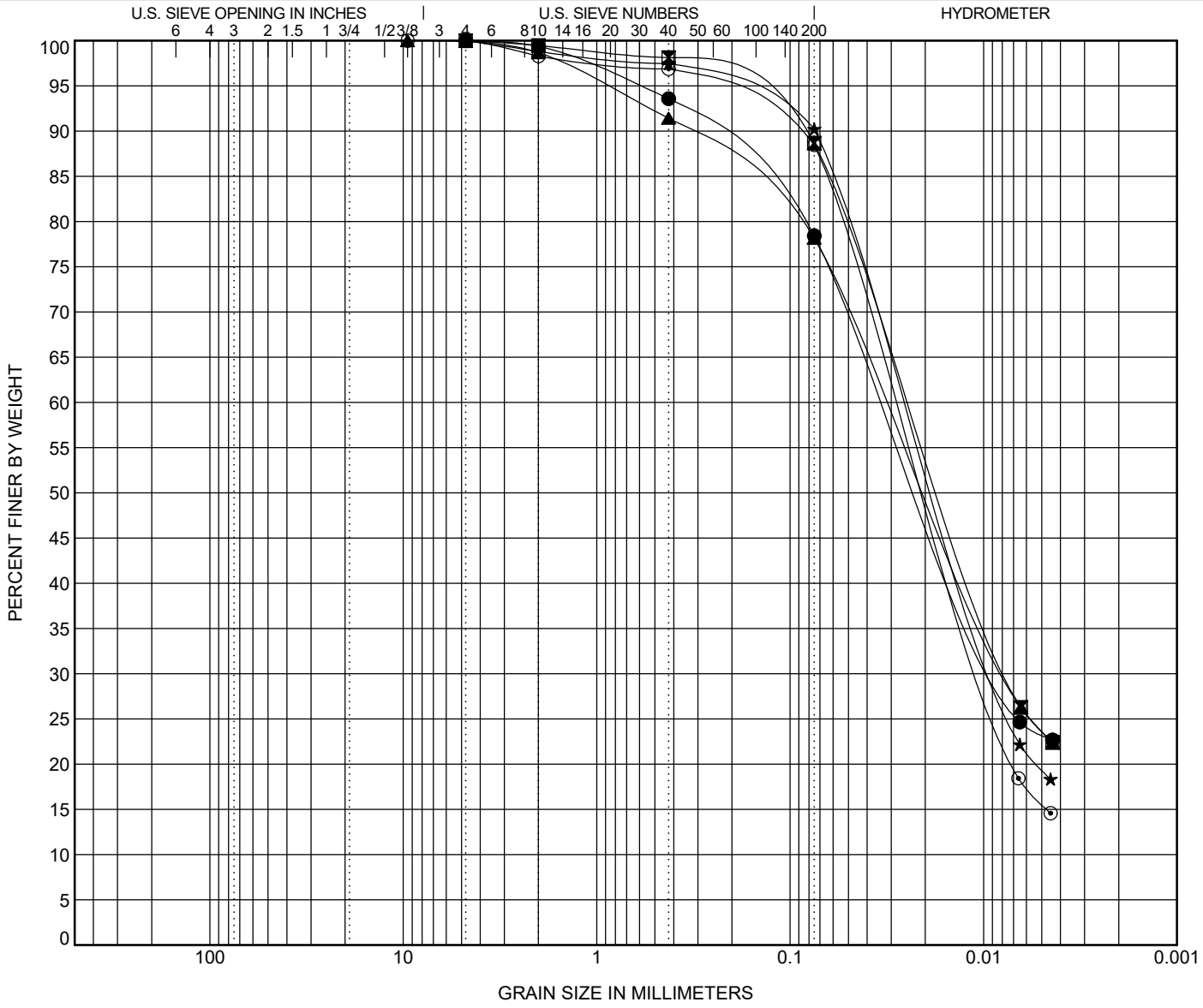

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● 42	1.0	A-4 (4)	CL-ML	26	19	7		
⊠ 43	1.0	A-7-6 (19)	CL	42	22	20		
▲ 44	1.0	A-7-6 (18)	CL	44	21	23		
★ 45	1.0	A-7-6 (17)	CL	41	24	17		
⊙ 46	1.0	A-6 (14)	CL	38	23	15		

BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
● 42	1.0	4.75	0.021	0.008		0.0	21.6	78.4	
⊠ 43	1.0	4.75	0.016	0.007		0.0	11.3	88.7	
▲ 44	1.0	9.5	0.02	0.008		0.1	21.8	78.2	
★ 45	1.0	4.75	0.018	0.009		0.0	9.8	90.2	
⊙ 46	1.0	9.5	0.02	0.01	0.005	0.0	11.5	88.5	

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300 AIRPORT ROAD
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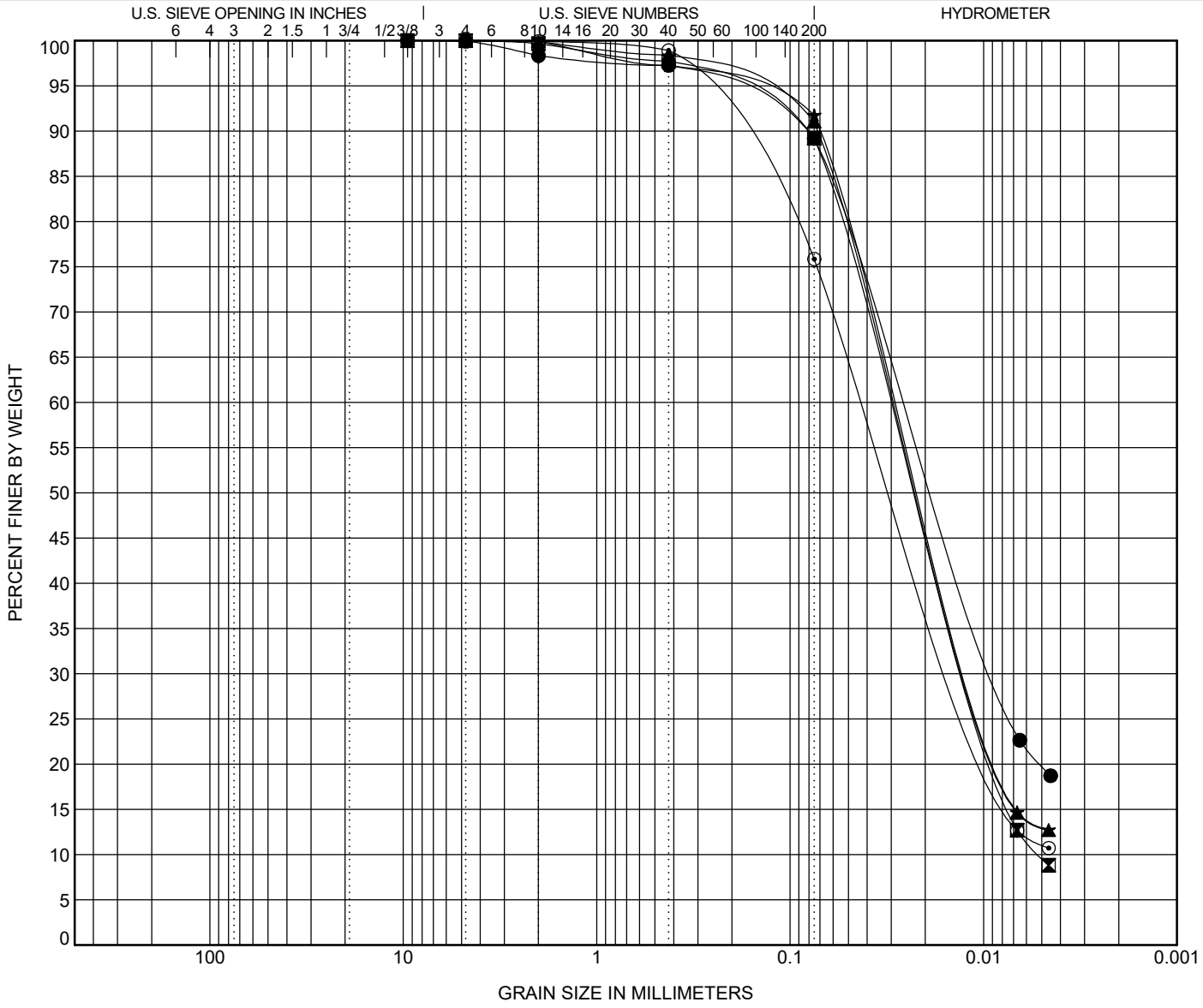

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	47	1.0	A-7-6 (19)	CL	42	22	20		
⊠	48	1.0	A-4 (2)	CL-ML	25	21	4	0.87	5.78
▲	49	1.0	A-4 (7)	ML	32	25	7		
★	50	1.1	A-4 (4)	ML	29	24	5		
⊙	51	1.1	A-4 (4)	CL-ML	29	22	7		

	BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
●	47	1.0	9.5	0.018	0.009		0.1	10.8	89.2	
⊠	48	1.0	9.5	0.022	0.012	0.007	0.0	10.8	89.2	
▲	49	1.0	4.75	0.021	0.011	0.007	0.0	9.0	91.0	
★	50	1.1	9.5	0.02	0.011	0.007	0.0	8.2	91.8	
⊙	51	1.1	4.75	0.028	0.013	0.007	0.0	24.2	75.8	

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300 AIRPORT ROAD
BISMARCK, ND 58504

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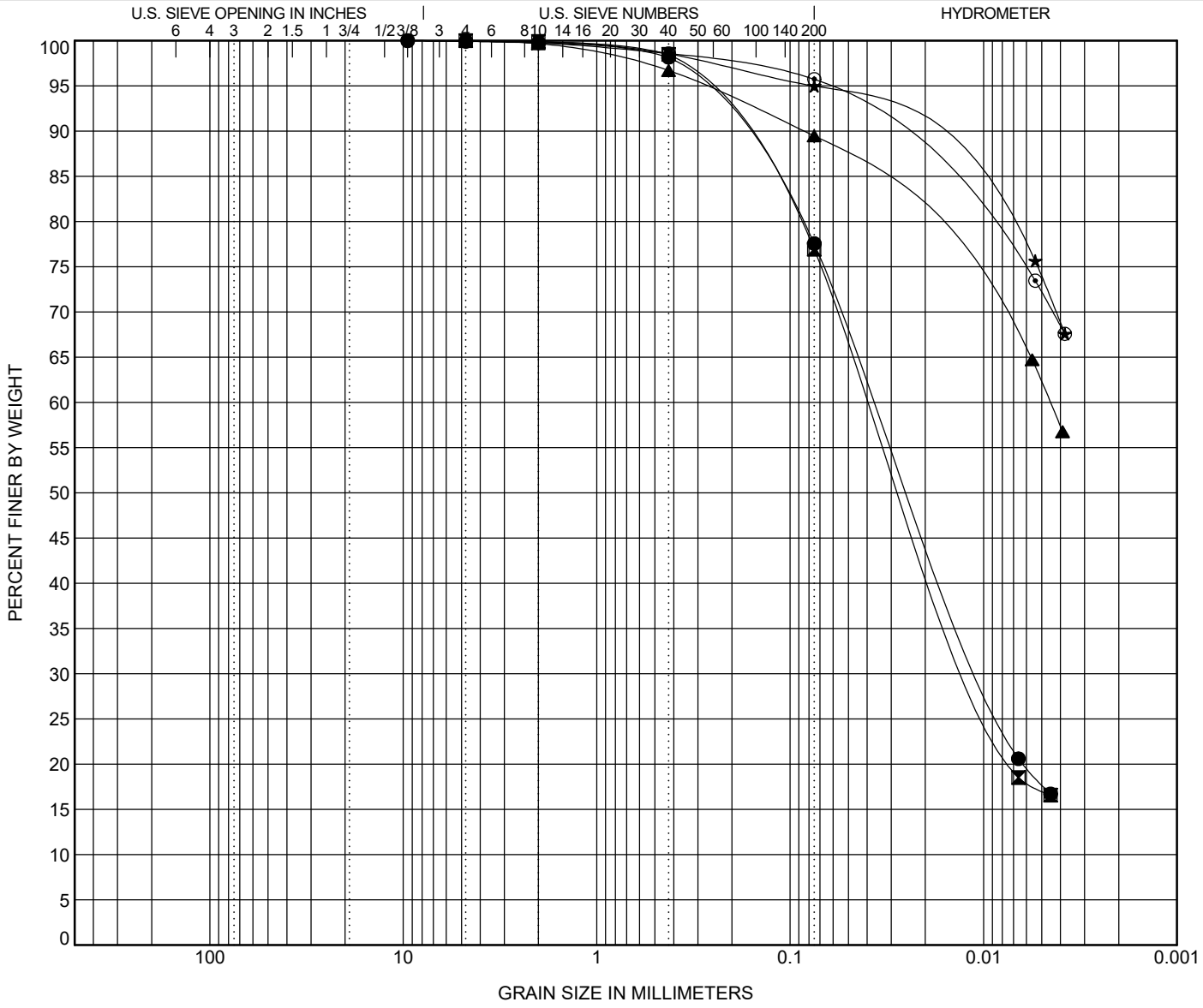

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● 52	1.0	A-4 (2)	ML	34	33	1		
⊠ 53	1.0	A-6 (8)	CL	32	20	12		
▲ 54	1.3	A-7-5 (42)	CH	71	30	41		
★ 55	1.0	A-7-6 (56)	CH	79	29	50		
⊙ 56	1.4	A-7-6 (52)	CH	74	28	46		

BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
● 52	1.0	9.5	0.023	0.01		0.1	22.4	77.6	
⊠ 53	1.0	4.75	0.024	0.011		0.0	23.1	76.9	
▲ 54	1.3	4.75				0.0	10.5	89.5	
★ 55	1.0	9.5				0.0	5.0	95.0	
⊙ 56	1.4	9.5				0.1	4.2	95.7	

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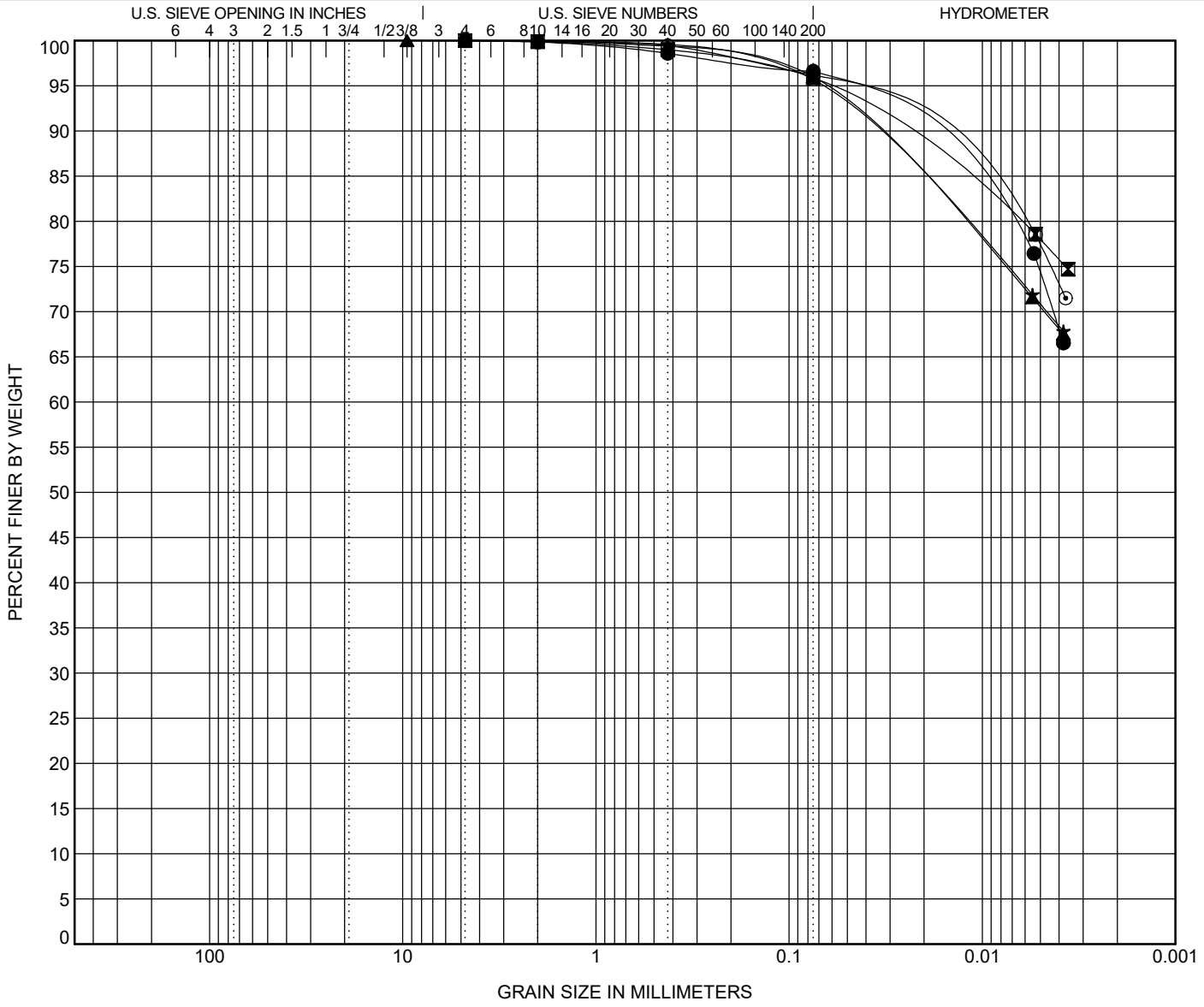

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	57	1.0	A-7-6 (56)	CH	77	28	49		
⊠	58	2.0	A-7-5 (58)	CH	81	30	51		
▲	59	2.0	A-7-6 (46)	CH	67	25	42		
★	60	2.0	A-7-6 (48)	CH	68	24	44		
⊙	61	2.0	A-7-6 (46)	CH	66	24	42		

	BOREHOLE	DEPTH	D100	D50	D30	D15	%Gravel	%Sand	%Silt	%Clay
●	57	1.0	4.75				0.0	3.4	96.6	
⊠	58	2.0	4.75				0.0	4.1	95.9	
▲	59	2.0	9.5				0.0	4.0	96.0	
★	60	2.0	4.75				0.0	4.3	95.7	
⊙	61	2.0	4.75				0.0	3.8	96.2	

MOISTURE-DENSITY RELATIONSHIP

NDDOT North Dakota Department of Transportation
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

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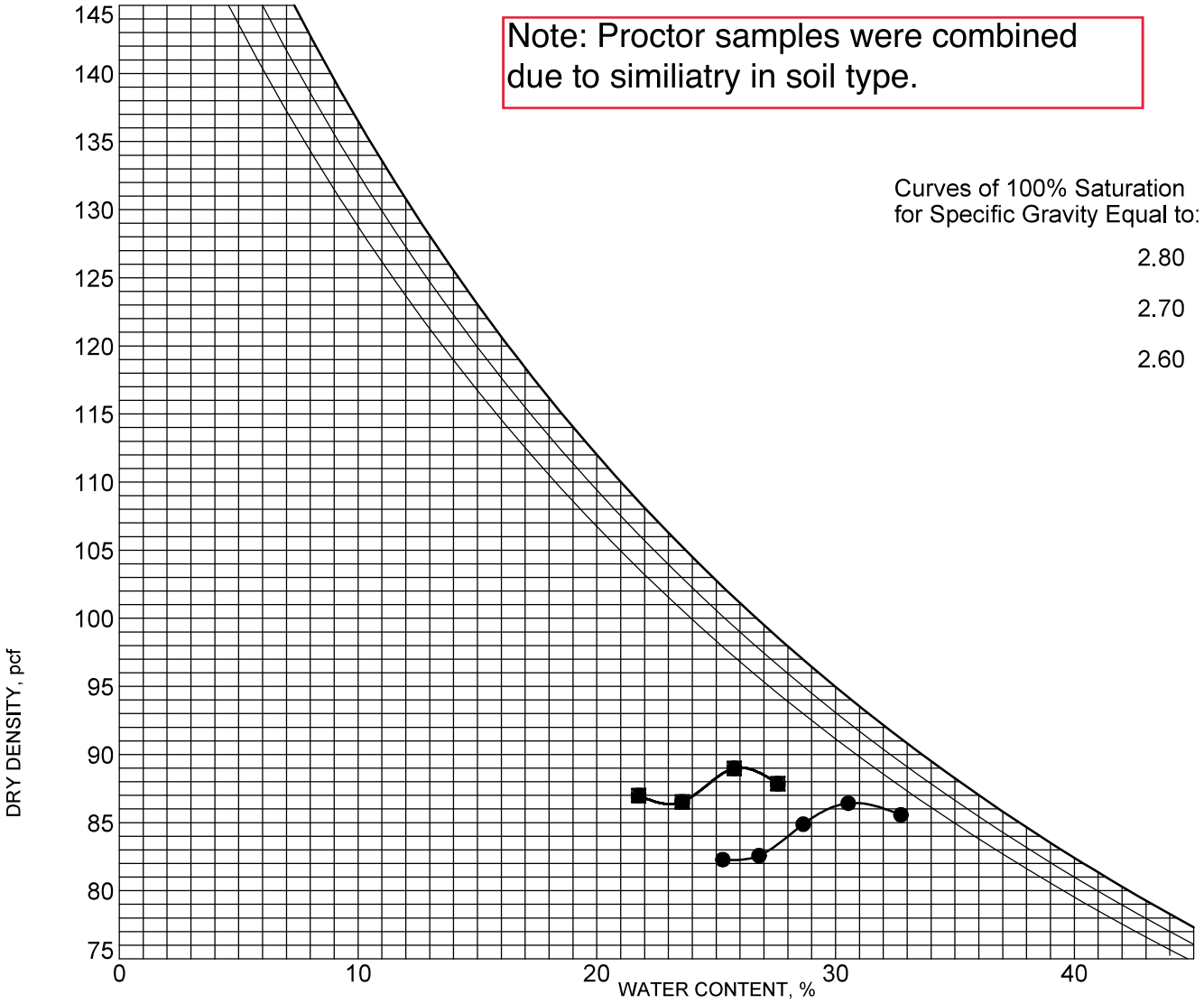

BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	1	1.0	A-7-6 (60)	FAT CLAY(CH)
⊠	2	1.0	A-7-6 (48)	FAT CLAY(CH)
▲	4	1.0	A-7-6 (48)	FAT CLAY(CH)
★	5	1.0	A-7-6 (47)	FAT CLAY(CH)
⊙	6	1.2	A-7-6 (43)	FAT CLAY with SAND(CH)
✿	7	1.2	A-7-6 (46)	FAT CLAY(CH)

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	1	1.0	AASHTO T-99 Method A	80	27	53	86.4 PCF	30.8 %
⊠	2	1.0	AASHTO T-99 Method A	75	28	47	89.0 PCF	26.0 %
▲	4	1.0	AASHTO T-99 Method A	70	24	46	89.0 PCF	26.0 %
★	5	1.0	AASHTO T-99 Method A	73	29	44	89.0 PCF	26.0 %
⊙	6	1.2	AASHTO T-99 Method A	73	26	47	89.0 PCF	26.0 %
✿	7	1.2	AASHTO T-99 Method A	71	26	45	89.0 PCF	26.0 %

MOISTURE-DENSITY RELATIONSHIP

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300 AIRPORT ROAD
BISMARCK, ND 58504

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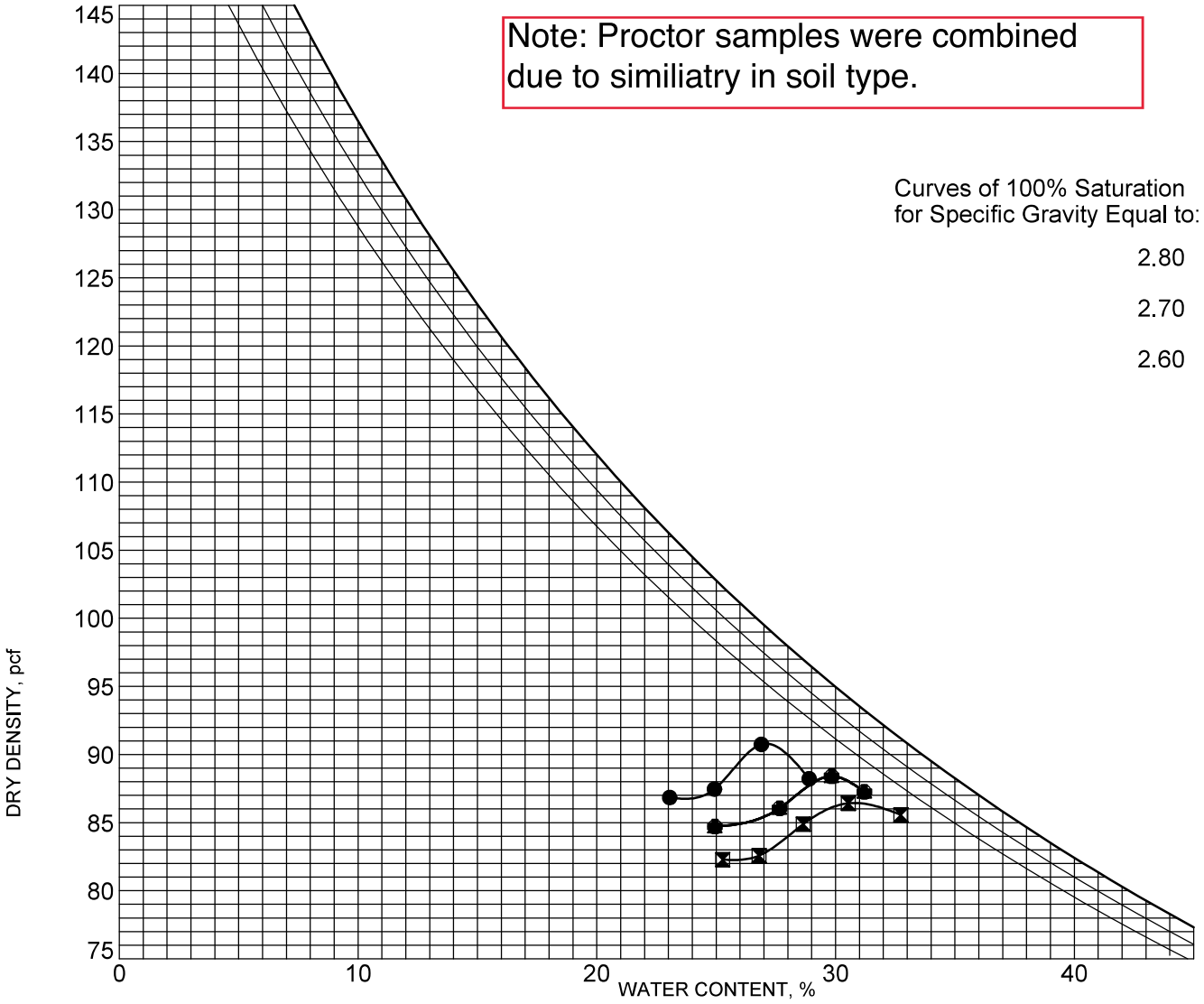
Note: Proctor samples were combined due to similiatry in soil type.



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	8	1.2	A-7-6 (38)	FAT CLAY(CH)
⊠	9	1.2	A-7-6 (57)	FAT CLAY(CH)
▲	10	1.2	A-7-6 (51)	FAT CLAY(CH)
★	11	1.5	A-7-6 (41)	FAT CLAY with SAND(CH)
⊙	12	1.2	A-7-6 (46)	FAT CLAY(CH)
✪	13	1.2	A-7-5 (51)	FAT CLAY(CH)

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	8	1.2	AASHTO T-99 Method A	61	23	38	90.8 PCF	27.1 %
⊠	9	1.2	AASHTO T-99 Method A	78	26	52	86.4 PCF	30.8 %
▲	10	1.2	AASHTO T-99 Method A	70	24	46	88.4 PCF	29.8 %
★	11	1.5	AASHTO T-99 Method A	75	29	46	88.4 PCF	29.8 %
⊙	12	1.2	AASHTO T-99 Method A	69	26	43	88.4 PCF	29.8 %
✪	13	1.2	AASHTO T-99 Method A	77	30	47	88.4 PCF	29.8 %

MOISTURE-DENSITY RELATIONSHIP

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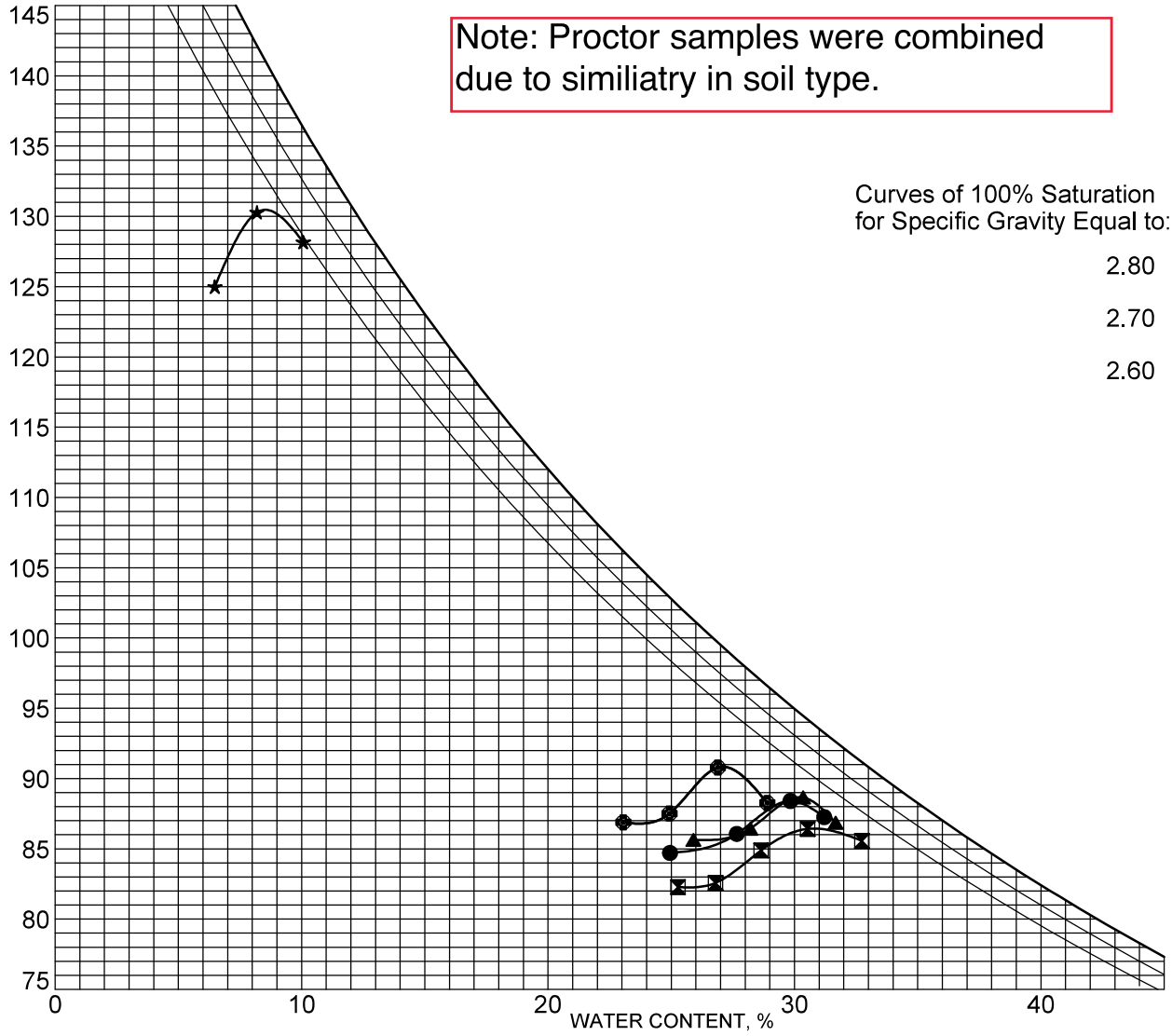
PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	14	1.5	A-7-6 (44)	FAT CLAY(CH)
⊠	15	1.2	A-7-5 (60)	FAT CLAY(CH)
▲	16	1.1	A-7-6 (45)	FAT CLAY with SAND(CH)
★	17	1.0	A-1-b (0)	SILTY SAND(SM)
⊙	18	1.2	A-7-6 (35)	FAT CLAY with SAND(CH)
✿	19	1.0	A-7-6 (37)	FAT CLAY with SAND(CH)

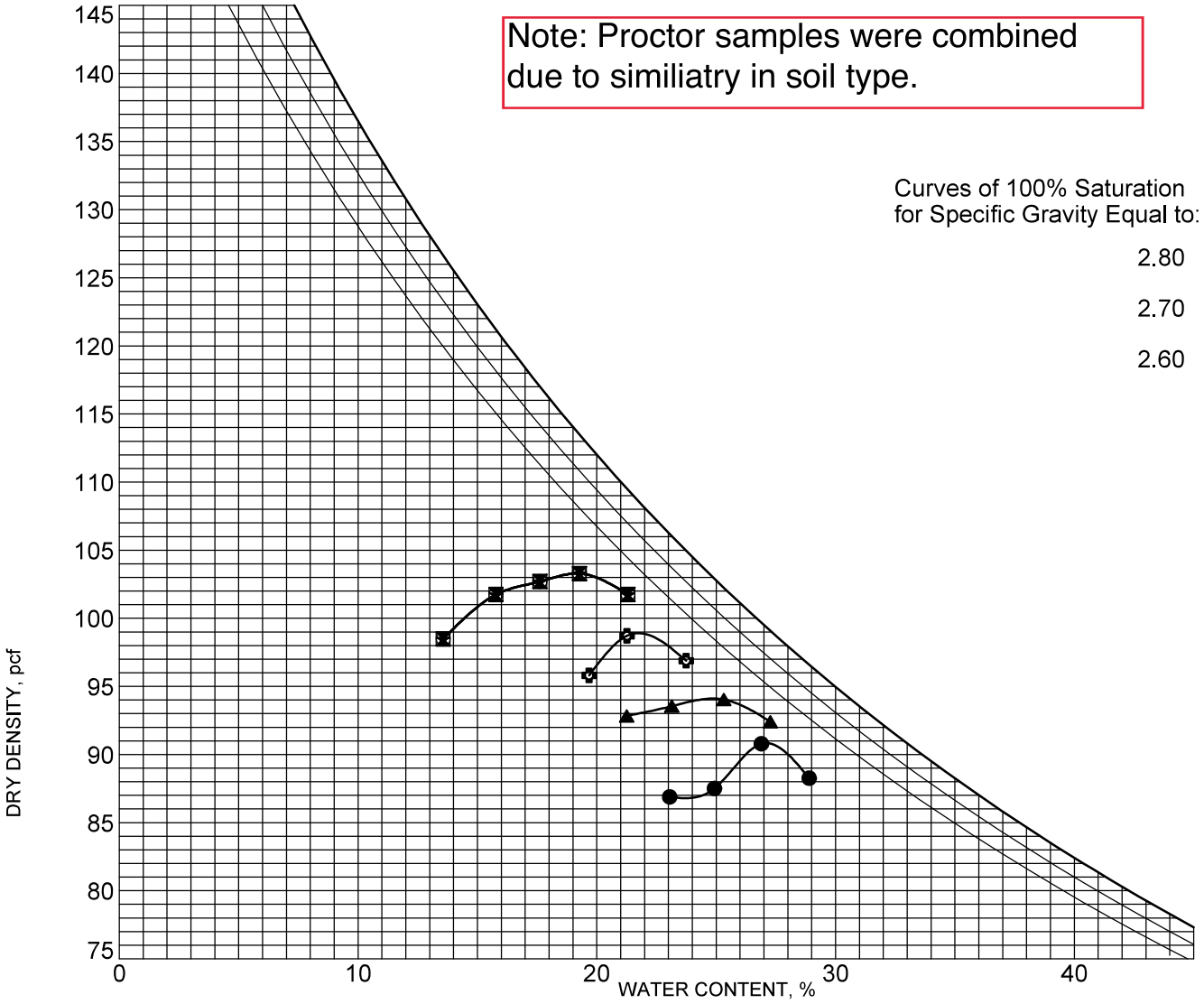
BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	14	1.5	AASHTO T-99 Method A	69	26	43	88.4 PCF	29.8 %
⊠	15	1.2	AASHTO T-99 Method A	87	30	57	86.4 PCF	30.8 %
▲	16	1.1	AASHTO T-99 Method A	73	25	48	88.7 PCF	30.2 %
★	17	1.0	AASHTO T-99 Method A	NP	NP	NP	130.5 PCF	8.5 %
⊙	18	1.2	AASHTO T-99 Method A	64	26	38	90.8 PCF	27.1 %
✿	19	1.0	AASHTO T-99 Method A	65	25	40	90.8 PCF	27.1 %

MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	20	1.0	A-7-6 (30)	FAT CLAY with SAND(CH)
⊠	21	1.0	A-7-6 (22)	LEAN CLAY with SAND(CL)
▲	22	1.1	A-7-6 (34)	FAT CLAY(CH)
★	23	1.0	A-6 (13)	LEAN CLAY with SAND(CL)
⊙	24	1.0	A-7-6 (20)	LEAN CLAY with SAND(CL)
✿	25	1.0	A-7-6 (45)	FAT CLAY(CH)

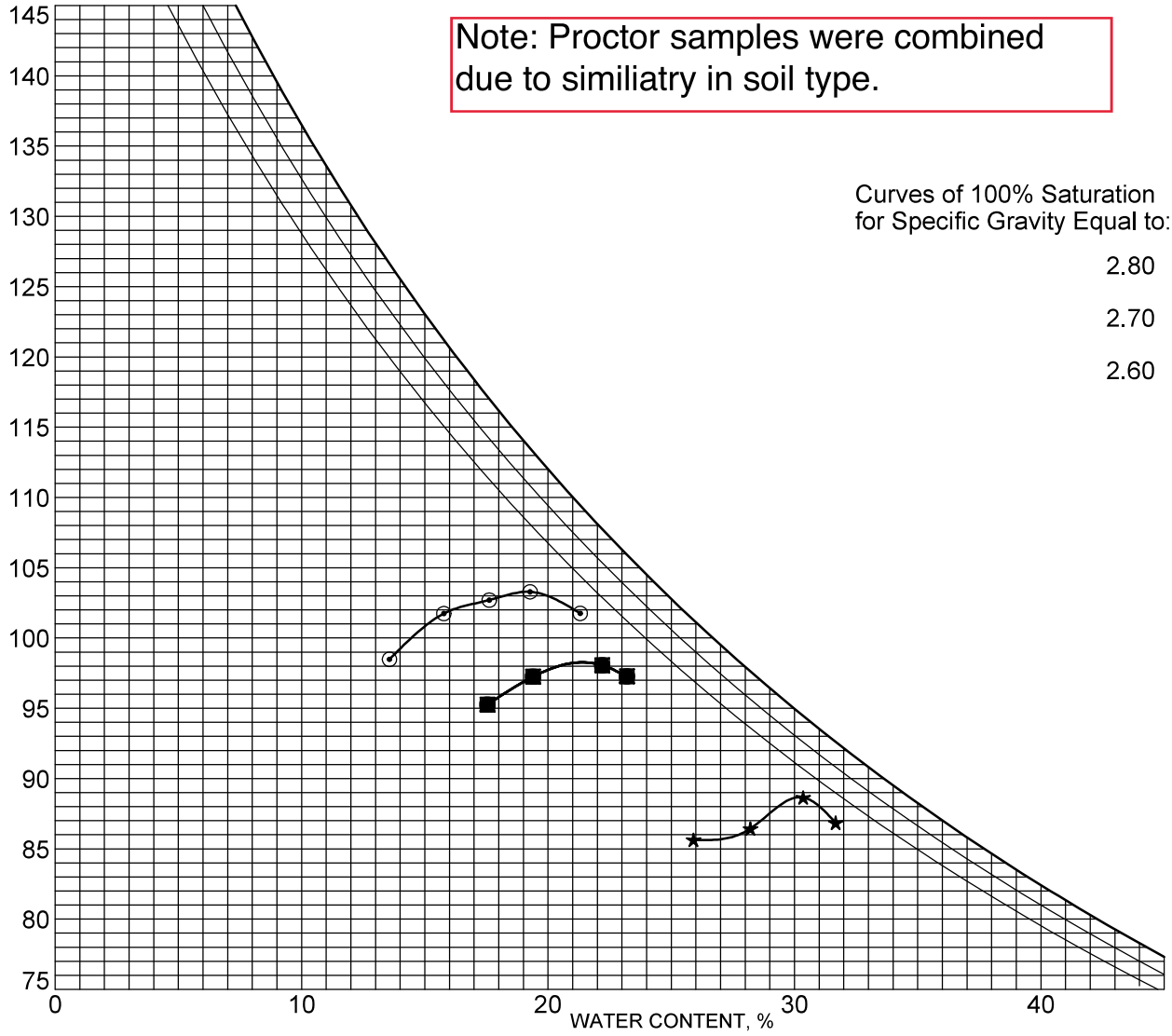
BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	20	1.0	AASHTO T-99 Method A	58	25	33	90.8 PCF	27.1 %
⊠	21	1.0	AASHTO T-99 Method A	44	17	27	103.3 PCF	19.2 %
▲	22	1.1	AASHTO T-99 Method A	56	20	36	94.1 PCF	24.9 %
★	23	1.0	AASHTO T-99 Method A	35	18	17	103.3 PCF	19.2 %
⊙	24	1.0	AASHTO T-99 Method A	41	17	24	103.3 PCF	19.2 %
✿	25	1.0	AASHTO T-99 Method A	65	22	43	98.9 PCF	21.8 %

MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



Note: Proctor samples were combined due to similiatry in soil type.

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

BOREHOLE	DEPTH	AASHTO Classification	USCS Description
● 26	1.0	A-7-6 (31)	FAT CLAY(CH)
⊠ 27	1.1	A-7-6 (30)	FAT CLAY(CH)
▲ 28	1.0	A-7-6 (27)	FAT CLAY(CH)
★ 29	1.1	A-7-6 (46)	FAT CLAY(CH)
⊙ 30	1.0	A-7-6 (25)	LEAN CLAY(CL)
✪ 31	1.0	A-7-6 (21)	LEAN CLAY(CL)

BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
● 26	1.0	AASHTO T-99 Method A	51	20	31	98.3 PCF	21.5 %
⊠ 27	1.1	AASHTO T-99 Method A	51	20	31	98.3 PCF	21.5 %
▲ 28	1.0	AASHTO T-99 Method A	51	22	29	98.3 PCF	21.5 %
★ 29	1.1	AASHTO T-99 Method A	68	25	43	88.7 PCF	30.2 %
⊙ 30	1.0	AASHTO T-99 Method A	45	19	26	103.3 PCF	19.2 %
✪ 31	1.0	AASHTO T-99 Method A	45	22	23	98.3 PCF	21.5 %

COMPACTION (MULTIPLE CURVES) - 20171219.GDT - 12/1/22 13:50 - F:\LAB\PROJECTS\GINT\8-029(203)101.GPJ

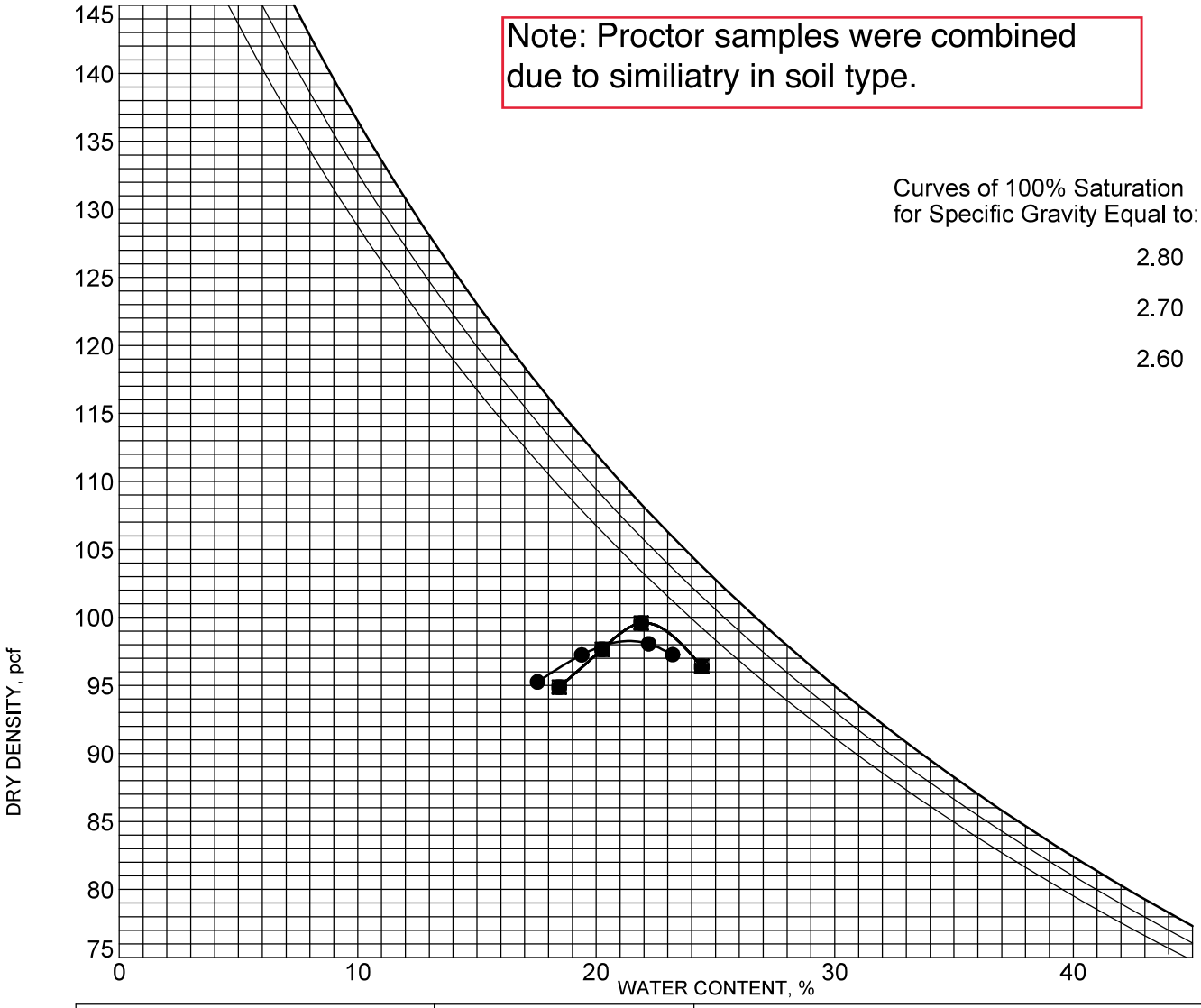
MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Note: Proctor samples were combined due to similiatry in soil type.



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	32	1.0	A-7-6 (21)	LEAN CLAY(CL)
⊠	33	1.1	A-7-6 (23)	FAT CLAY with SAND(CH)
▲	34	1.0	A-7-6 (29)	FAT CLAY(CH)
★	35	1.0	A-7-6 (28)	LEAN CLAY(CL)
⊙	36	1.0	A-7-6 (27)	FAT CLAY(CH)
✿	38	1.1	A-7-6 (11)	SANDY LEAN CLAY(CL)

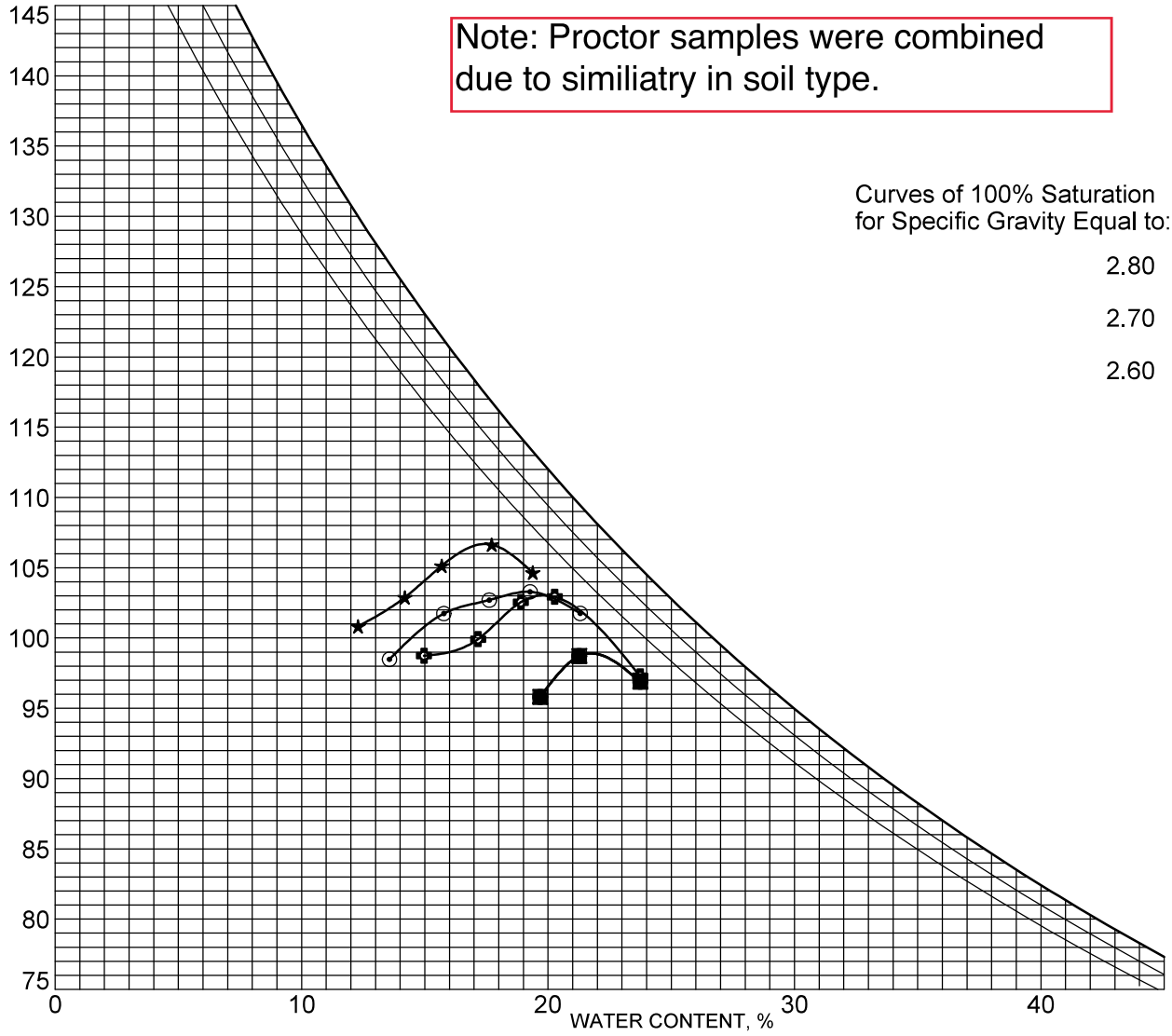
BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	32	1.0	AASHTO T-99 Method A	44	20	24	98.3 PCF	21.5 %
⊠	33	1.1	AASHTO T-99 Method A	50	25	25	99.6 PCF	22.0 %
▲	34	1.0	AASHTO T-99 Method A	52	22	30	99.6 PCF	22.0 %
★	35	1.0	AASHTO T-99 Method A	49	19	30	99.6 PCF	22.0 %
⊙	36	1.0	AASHTO T-99 Method A	50	21	29	99.6 PCF	22.0 %
✿	38	1.1	AASHTO T-99 Method A	46	21	25	99.6 PCF	22.0 %

MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	39	1.0	A-7-6 (25)	FAT CLAY with SAND(CH)
⊠	40	1.0	A-7-6 (19)	LEAN CLAY with SAND(CL)
▲	41	1.0	A-7-6 (18)	LEAN CLAY with SAND(CL)
★	42	1.0	A-4 (4)	SILTY CLAY with SAND(CL-ML)
⊙	43	1.0	A-7-6 (19)	LEAN CLAY(CL)
✿	44	1.0	A-7-6 (18)	LEAN CLAY with SAND(CL)

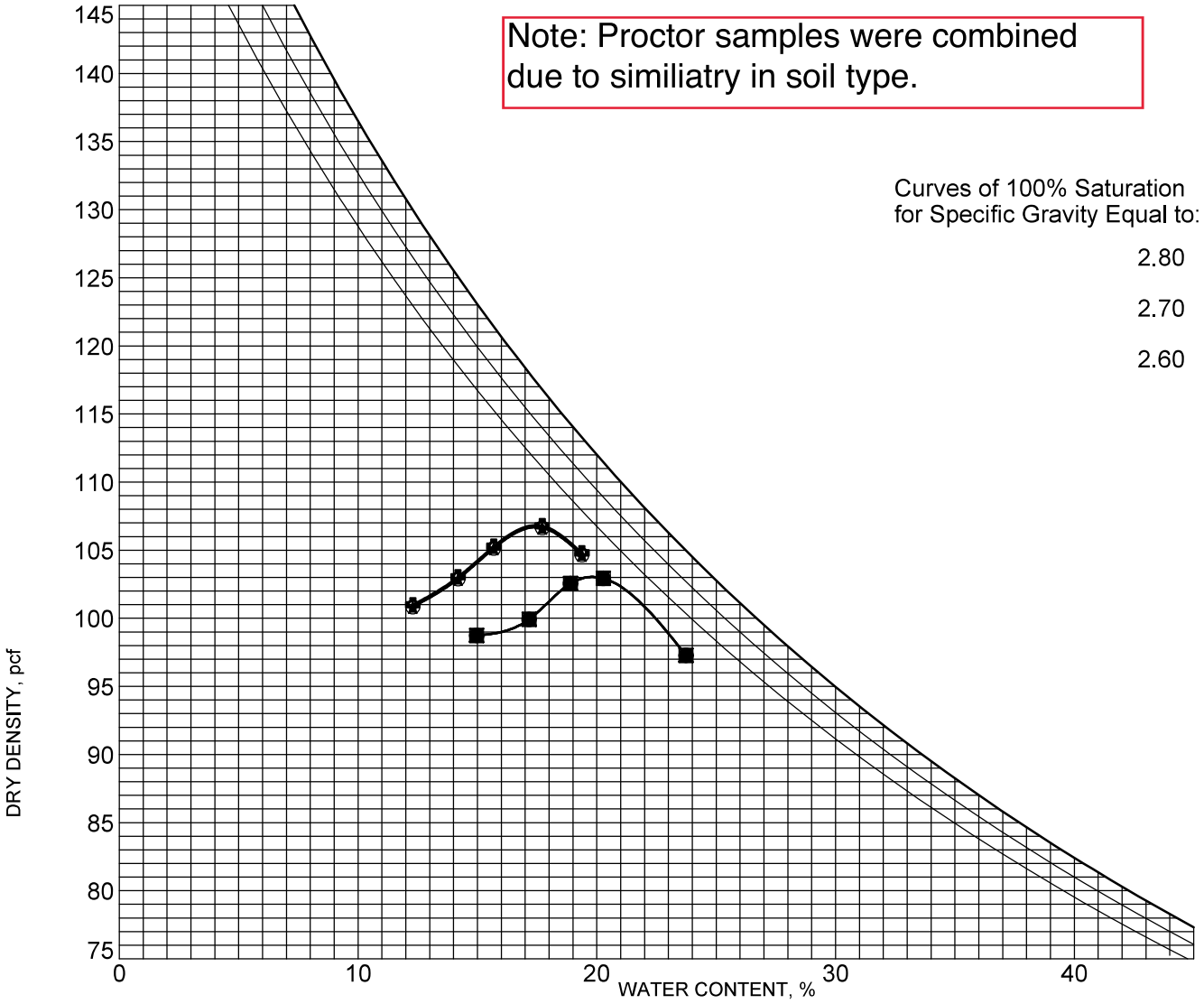
BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	39	1.0	AASHTO T-99 Method A	50	20	30	98.9 PCF	21.8 %
⊠	40	1.0	AASHTO T-99 Method A	49	23	26	98.9 PCF	21.8 %
▲	41	1.0	AASHTO T-99 Method A	43	21	22	98.9 PCF	21.8 %
★	42	1.0	AASHTO T-99 Method A	26	19	7	106.7 PCF	17.5 %
⊙	43	1.0	AASHTO T-99 Method A	42	22	20	103.3 PCF	19.2 %
✿	44	1.0	AASHTO T-99 Method A	44	21	23	103.0 PCF	19.8 %

MOISTURE-DENSITY RELATIONSHIP

NDDOT North Dakota Department of Transportation
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	45	1.0	A-7-6 (17)	LEAN CLAY(CL)
⊠	46	1.0	A-6 (14)	LEAN CLAY(CL)
▲	47	1.0	A-7-6 (19)	LEAN CLAY(CL)
★	48	1.0	A-4 (2)	SILTY CLAY(CL-ML)
⊙	49	1.0	A-4 (7)	SILT(ML)
✿	50	1.1	A-4 (4)	SILT(ML)

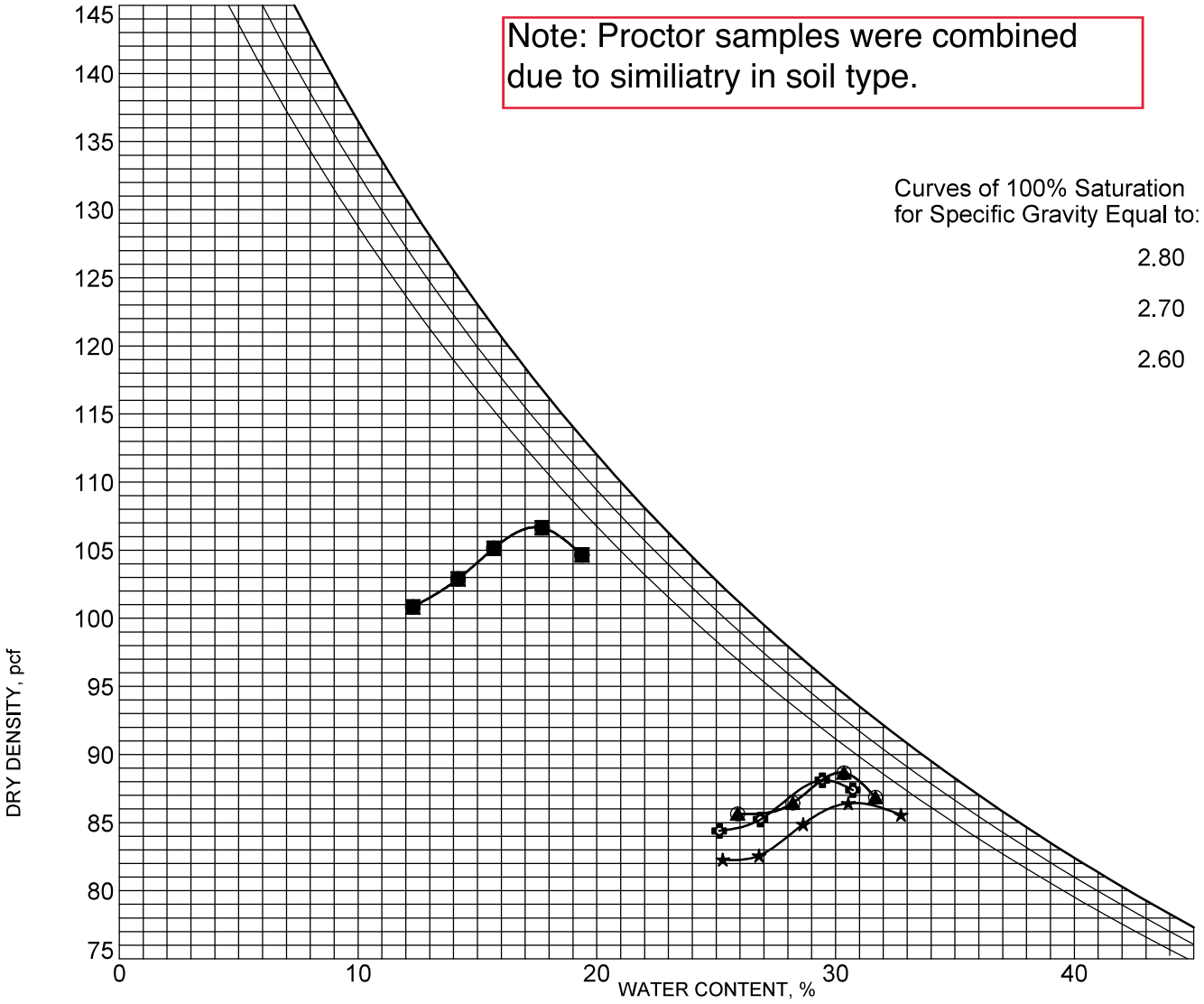
BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	45	1.0	AASHTO T-99 Method A	41	24	17	103.0 PCF	19.8 %
⊠	46	1.0	AASHTO T-99 Method A	38	23	15	103.0 PCF	19.8 %
▲	47	1.0	AASHTO T-99 Method A	42	22	20	103.0 PCF	19.8 %
★	48	1.0	AASHTO T-99 Method A	25	21	4	106.7 PCF	17.5 %
⊙	49	1.0	AASHTO T-99 Method A	32	25	7	106.7 PCF	17.5 %
✿	50	1.1	AASHTO T-99 Method A	29	24	5	106.8 PCF	17.5 %

MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	51	1.1	A-4 (4)	SILTY CLAY with SAND(CL-ML)
⊠	52	1.0	A-4 (2)	SILT with SAND(ML)
▲	54	1.3	A-7-5 (42)	FAT CLAY(CH)
★	55	1.0	A-7-6 (56)	FAT CLAY(CH)
⊙	56	1.4	A-7-6 (52)	FAT CLAY(CH)
✿	57	1.0	A-7-6 (56)	FAT CLAY(CH)

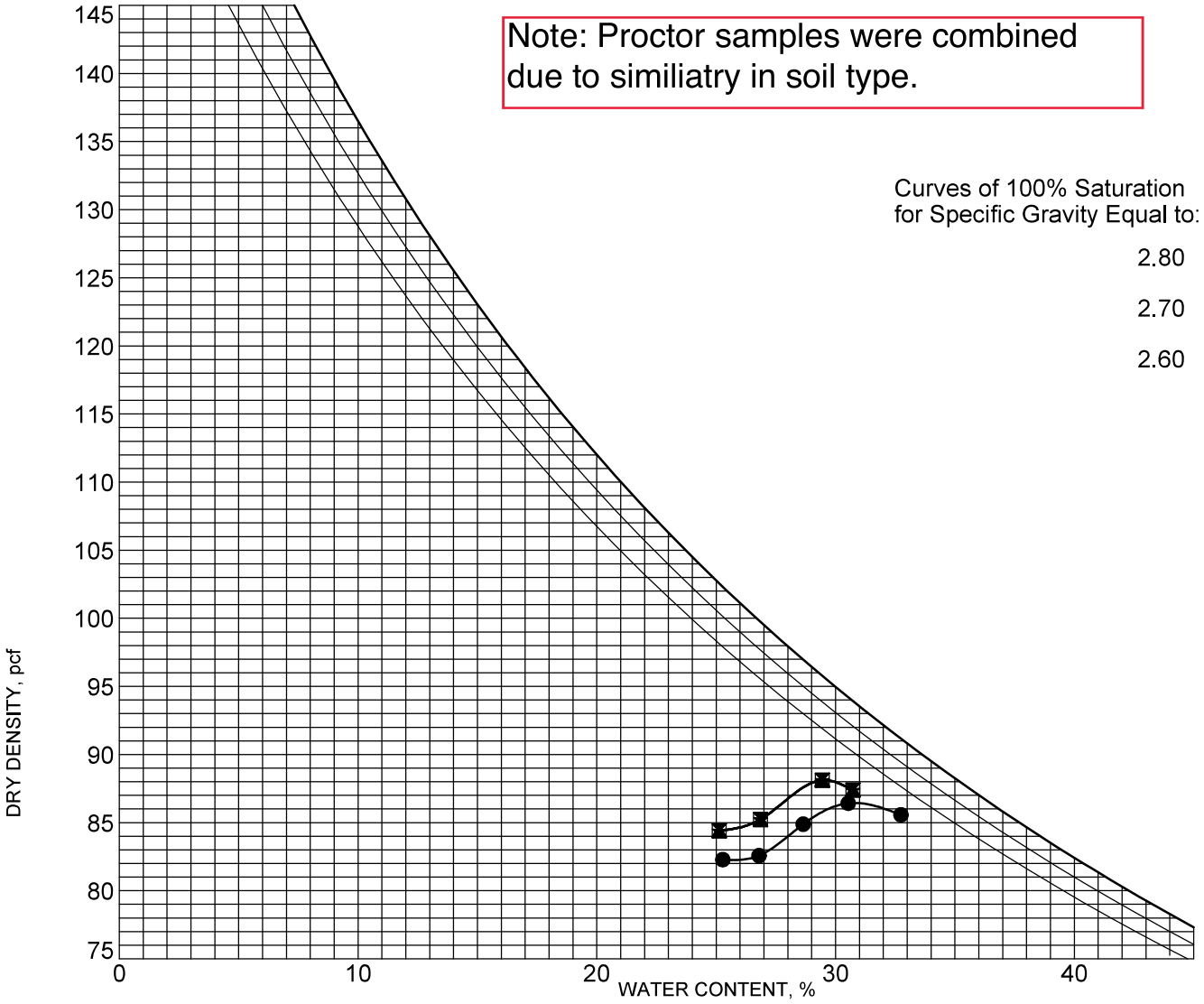
BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	51	1.1	AASHTO T-99 Method A	29	22	7	106.7 PCF	17.5 %
⊠	52	1.0	AASHTO T-99 Method A	34	33	1	106.7 PCF	17.5 %
▲	54	1.3	AASHTO T-99 Method A	71	30	41	88.7 PCF	30.2 %
★	55	1.0	AASHTO T-99 Method A	79	29	50	86.4 PCF	30.8 %
⊙	56	1.4	AASHTO T-99 Method A	74	28	46	88.7 PCF	30.2 %
✿	57	1.0	AASHTO T-99 Method A	77	28	49	88.1 PCF	29.5 %

MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102



Note: Proctor samples were combined due to similiatry in soil type.

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

	BOREHOLE	DEPTH	AASHTO Classification	USCS Description
●	58	2.0	A-7-5 (58)	FAT CLAY(CH)
⊠	59	2.0	A-7-6 (46)	FAT CLAY(CH)
▲	60	2.0	A-7-6 (48)	FAT CLAY(CH)
★	61	2.0	A-7-6 (46)	FAT CLAY(CH)

	BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	58	2.0	AASHTO T-99 Method A	81	30	51	86.4 PCF	30.8 %
⊠	59	2.0	AASHTO T-99 Method A	67	25	42	88.1 PCF	29.5 %
▲	60	2.0	AASHTO T-99 Method A	68	24	44	88.1 PCF	29.5 %
★	61	2.0	AASHTO T-99 Method A	66	24	42	88.1 PCF	29.5 %

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
1	1.0	80	27	53	9.5	97	A-7-6 (60)	CH	28.5	30.1			
1	2.0								32.8	30.1			
1	3.0								29.6	30.1			
1	4.0								29.1	30.1			
1	5.0								30.6	30.1			
2	1.0	75	28	47	9.5	90	A-7-6 (48)	CH	29.4	31.7			
2	2.0								37.3	31.7			
2	3.0								30.6	31.7			
2	4.0								33.3	31.7			
2	5.0								28.1	31.7			
3	1.1	60	26	34	9.5	93	A-7-6 (36)	CH	10.4	26.9			
3	2.0								33.8	26.9			
3	3.0								30.4	26.9			
3	4.0								33.0	26.9			
3	5.0								27.0	26.9			
4	1.0	70	24	46	9.5	93	A-7-6 (48)	CH	34.8	30.8			
4	2.0								30.5	30.8			
4	3.0								25.0	30.8			
4	4.0								32.8	30.8			
4	5.0								30.7	30.8			
5	1.0	73	29	44	9.5	92	A-7-6 (47)	CH	29.9	33.8			
5	2.0								42.3	33.8			
5	3.0								30.3	33.8			
5	4.0								31.6	33.8			
5	5.0								34.9	33.8			
6	1.2	73	26	47	9.5	84	A-7-6 (43)	CH	31.7	28.1			
6	2.0								21.1	28.1			
6	3.0								32.4	28.1			
6	4.0								29.1	28.1			
6	5.0								26.1	28.1			
7	1.2	71	26	45	9.5	90	A-7-6 (46)	CH	41.9	38.1			
7	2.0								40.1	38.1			
7	3.0								42.5	38.1			
7	4.0								36.1	38.1			
7	5.0								30.1	38.1			
8	1.2	61	23	38	9.5	91	A-7-6 (38)	CH	26.9	30.5			
8	2.0								38.6	30.5			
8	3.0								32.5	30.5			
8	4.0								30.6	30.5			
8	5.0								23.8	30.5			
9	1.2	78	26	52	9.5	95	A-7-6 (57)	CH	37.0	32.6			
9	2.0								40.1	32.6			
9	3.0								28.6	32.6			

NDDOT North Dakota Department of Transportation
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
300 AIRPORT ROAD
BISMARCK, ND 58504

SUMMARY OF LABORATORY RESULTS

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
9	4.0								28.7	32.6			
9	5.0								28.6	32.6			
10	1.2	70	24	46	4.75	96	A-7-6 (51)	CH	19.1	29.4			
10	2.0								40.5	29.4			
10	3.0								32.9	29.4			
10	4.0								27.6	29.4			
10	5.0								26.9	29.4			
11	1.5	75	29	46	9.5	81	A-7-6 (41)	CH	21.6	33.8			
11	2.0								33.8	33.8			
11	3.0								35.1	33.8			
11	4.0								46.3	33.8			
11	5.0								32.4	33.8			
12	1.2	69	26	43	9.5	93	A-7-6 (46)	CH	17.5	27.0			
12	2.0								28.8	27.0			
12	3.0								26.0	27.0			
12	4.0								29.5	27.0			
12	5.0								33.2	27.0			
13	1.2	77	30	47	4.75	93	A-7-5 (51)	CH	31.7	38.2			
13	2.0								35.7	38.2			
13	3.0								33.6	38.2			
13	4.0								36.4	38.2			
13	5.0								35.1	38.2			
13	6.0								39.1	38.2			
13	7.0								39.6	38.2			
13	8.0								39.1	38.2			
13	9.0								43.8	38.2			
13	10.0								47.6	38.2			
14	1.5	69	26	43	9.5	91	A-7-6 (44)	CH	8.7	30.6			
14	2.0								25.0	30.6			
14	3.0								30.3	30.6			
14	4.0								25.5	30.6			
14	5.0								35.1	30.6			
14	6.0								36.2	30.6			
14	7.0								39.6	30.6			
14	8.0								44.6	30.6			
14	10.0									30.6			
15	1.2	87	30	57	4.75	91	A-7-5 (60)	CH	36.4	36.9			
15	2.0								25.1	36.9			
15	3.0								31.4	36.9			
15	4.0								47.4	36.9			
15	5.0								34.6	36.9			
15	6.0								33.9	36.9			
15	7.0								41.9	36.9			

NDDOT North Dakota Department of Transportation
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
300 AIRPORT ROAD
BISMARCK, ND 58504

SUMMARY OF LABORATORY RESULTS

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
15	8.0								36.2	36.9			
15	9.0								34.3	36.9			
15	10.0								47.5	36.9			
16	1.1	73	25	48	9.5	85	A-7-6 (45)	CH	43.3	33.8			
16	2.0								27.6	33.8			
16	3.0								36.0	33.8			
16	4.0								34.7	33.8			
16	5.0								27.4	33.8			
17	1.0	NP	NP	NP	25	16	A-1-b (0)	SM	28.5	12.5			
17	2.0								13.4	12.5			
17	3.0								6.1	12.5			
17	4.0								7.6	12.5			
17	5.0								6.7	12.5			
18	1.2	64	26	38	9.5	84	A-7-6 (35)	CH	27.0	29.0			
18	2.0								22.0	29.0			
18	3.0								34.6	29.0			
18	4.0								31.3	29.0			
18	5.0								30.2	29.0			
19	1.0	65	25	40	9.5	85	A-7-6 (37)	CH	25.5	29.2			
19	2.0								18.6	29.2			
19	3.0								36.9	29.2			
19	4.0								35.3	29.2			
19	5.0								29.5	29.2			
20	1.0	58	25	33	4.75	83	A-7-6 (30)	CH	31.1	30.4			
20	2.0								30.3	30.4			
20	3.0								28.9	30.4			
20	4.0								36.6	30.4			
20	5.0								25.1	30.4			
21	1.0	44	17	27	9.5	82	A-7-6 (22)	CL	29.2	23.9			
21	2.0								20.0	23.9			
21	3.0								32.5	23.9			
21	4.0								18.0	23.9			
21	5.0								19.8	23.9			
22	1.1	56	20	36	9.5	89	A-7-6 (34)	CH	84.2	38.9			
22	2.0								26.6	38.9			
22	3.0								20.0	38.9			
22	4.0								33.8	38.9			
22	5.0								29.7	38.9			
23	1.0	35	18	17	4.75	81	A-6 (13)	CL	30.4	24.7			
23	2.0								27.0	24.7			
23	3.0								26.0	24.7			
23	4.0								18.8	24.7			
23	5.0								21.3	24.7			

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
24	1.0	41	17	24	9.5	85	A-7-6 (20)	CL	26.8	22.0			
24	2.0								21.4	22.0			
24	3.0								21.5	22.0			
24	4.0								18.9	22.0			
24	5.0								21.2	22.0			
25	1.0	65	22	43	9.5	93	A-7-6 (45)	CH	22.5	29.4			
25	2.0								28.0	29.4			
25	3.0								33.3	29.4			
25	4.0								31.9	29.4			
25	5.0								31.3	29.4			
26	1.0	51	20	31	9.5	93	A-7-6 (31)	CH	22.2	22.8			
26	2.0								27.2	22.8			
26	3.0								22.4	22.8			
26	4.0								20.4	22.8			
26	5.0								22.1	22.8			
27	1.1	51	20	31	9.5	91	A-7-6 (30)	CH	23.6	24.0			
27	2.0								21.3	24.0			
27	3.0								29.7	24.0			
27	4.0								21.3	24.0			
27	5.0								24.0	24.0			
28	1.0	51	22	29	9.5	87	A-7-6 (27)	CH	27.3	27.6			
28	2.0								35.4	27.6			
28	3.0								29.5	27.6			
28	4.0								23.7	27.6			
28	5.0								22.2	27.6			
29	1.1	68	25	43	9.5	94	A-7-6 (46)	CH	24.1	27.3			
29	2.0								30.3	27.3			
29	3.0								26.0	27.3			
29	4.0								29.5	27.3			
29	5.0								26.6	27.3			
30	1.0	45	19	26	4.75	91	A-7-6 (25)	CL	23.4	18.8			
30	2.0								11.8	18.8			
30	3.0								17.8	18.8			
30	4.0								20.8	18.8			
30	5.0								20.3	18.8			
31	1.0	45	22	23	9.5	88	A-7-6 (21)	CL	18.4	23.2			
31	2.0								27.9	23.2			
31	3.0								26.9	23.2			
31	4.0								25.5	23.2			
31	5.0								17.3	23.2			
32	1.0	44	20	24	9.5	85	A-7-6 (21)	CL	17.6	20.4			
32	2.0								16.0	20.4			
32	3.0								21.5	20.4			

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
32	4.0								21.8	20.4			
32	5.0								25.0	20.4			
33	1.1	50	25	25	9.5	85	A-7-6 (23)	CH	29.4	26.8			
33	2.0								19.3	26.8			
33	3.0								31.2	26.8			
33	4.0								27.3	26.8			
33	5.0								26.7	26.8			
34	1.0	52	22	30	4.75	90	A-7-6 (29)	CH	26.6	23.3			
34	2.0								17.4	23.3			
34	3.0								23.8	23.3			
34	4.0								25.0	23.3			
34	5.0								23.6	23.3			
35	1.0	49	19	30	9.5	88	A-7-6 (28)	CL	24.2	20.7			
35	2.0								11.4	20.7			
35	3.0								21.5	20.7			
35	4.0								26.3	20.7			
35	5.0								20.1	20.7			
36	1.0	50	21	29	9.5	88	A-7-6 (27)	CH	30.6	21.6			
36	2.0								9.1	21.6			
36	3.0								21.5	21.6			
36	4.0								20.5	21.6			
36	5.0								26.5	21.6			
38	1.1	46	21	25	9.5	55	A-7-6 (11)	CL	25.7	24.1			
38	2.0								14.9	24.1			
38	3.0								28.2	24.1			
38	4.0								27.9	24.1			
38	5.0								23.8	24.1			
39	1.0	50	20	30	9.5	82	A-7-6 (25)	CH	28.2	26.8			
39	2.0								26.4	26.8			
39	3.0								25.0	26.8			
39	4.0								21.4	26.8			
39	5.0								33.0	26.8			
40	1.0	49	23	26	9.5	75	A-7-6 (19)	CL	31.6	25.6			
40	2.0								24.9	25.6			
40	3.0								25.0	25.6			
40	4.0								24.1	25.6			
40	5.0								22.5	25.6			
41	1.0	43	21	22	9.5	83	A-7-6 (18)	CL	21.3	22.1			
41	2.0								19.6	22.1			
41	3.0								28.4	22.1			
41	4.0								21.1	22.1			
41	5.0								20.2	22.1			
42	1.0	26	19	7	4.75	78	A-4 (4)	CL-ML	21.7	20.3			

NDDOT North Dakota Department of Transportation
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300 AIRPORT ROAD
BISMARCK, ND 58504

SUMMARY OF LABORATORY RESULTS

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
42	2.0								14.3	20.3			
42	3.0								20.0	20.3			
42	4.0								22.7	20.3			
42	5.0								22.6	20.3			
43	1.0	42	22	20	4.75	89	A-7-6 (19)	CL	19.9	20.1			
43	2.0								23.4	20.1			
43	3.0								15.0	20.1			
43	4.0								22.1	20.1			
43	5.0								19.9	20.1			
44	1.0	44	21	23	9.5	78	A-7-6 (18)	CL	31.6	21.5			
44	2.0								14.6	21.5			
44	3.0								20.9	21.5			
44	4.0								19.0	21.5			
44	5.0								21.1	21.5			
45	1.0	41	24	17	4.75	90	A-7-6 (17)	CL	21.7	27.5			
45	2.0								12.9	27.5			
45	3.0								23.3	27.5			
45	4.0								21.1	27.5			
45	5.0								30.3	27.5			
45	6.0								31.4	27.5			
45	7.0								27.6	27.5			
45	8.0								31.0	27.5			
45	9.0								37.0	27.5			
45	10.0								38.4	27.5			
46	1.0	38	23	15	9.5	88	A-6 (14)	CL	37.2	28.0			
46	2.0								13.5	28.0			
46	3.0								22.6	28.0			
46	4.0								23.6	28.0			
46	5.0								22.5	28.0			
46	6.0								26.6	28.0			
46	7.0								30.3	28.0			
46	8.0								30.3	28.0			
46	9.0								36.0	28.0			
46	10.0								37.1	28.0			
47	1.0	42	22	20	9.5	89	A-7-6 (19)	CL	33.7	27.3			
47	2.0								19.2	27.3			
47	3.0								22.2	27.3			
47	4.0								20.4	27.3			
47	5.0								25.9	27.3			
47	6.0								28.7	27.3			
47	7.0								25.5	27.3			
47	8.0								26.2	27.3			
47	9.0								36.9	27.3			

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NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
300 AIRPORT ROAD
BISMARCK, ND 58504

SUMMARY OF LABORATORY RESULTS

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
47	10.0								34.2	27.3			
48	1.0	25	21	4	9.5	89	A-4 (2)	CL-ML	38.9	22.3			
48	2.0								14.9	22.3			
48	3.0								17.7	22.3			
48	4.0								17.9	22.3			
48	5.0								22.2	22.3			
49	1.0	32	25	7	4.75	91	A-4 (7)	ML	22.7	19.5			
49	2.0								14.7	19.5			
49	3.0								15.0	19.5			
49	4.0								15.3	19.5			
49	5.0								15.7	19.5			
49	6.0								19.2	19.5			
49	7.0								19.7	19.5			
49	8.0								18.8	19.5			
49	9.0								24.4	19.5			
49	10.0								29.7	19.5			
50	1.1	29	24	5	9.5	92	A-4 (4)	ML	36.5	22.9			
50	2.0								15.2	22.9			
50	3.0								15.7	22.9			
50	4.0								16.6	22.9			
50	5.0								16.0	22.9			
50	6.0								17.9	22.9			
50	7.0								16.1	22.9			
50	8.0								32.6	22.9			
50	9.0								28.0	22.9			
50	10.0								33.9	22.9			
51	1.1	29	22	7	4.75	76	A-4 (4)	CL-ML	34.0	22.7			
51	2.0								12.4	22.7			
51	3.0								15.9	22.7			
51	4.0								17.3	22.7			
51	5.0								17.4	22.7			
51	6.0								15.6	22.7			
51	7.0								18.3	22.7			
51	8.0								27.6	22.7			
51	9.0								35.7	22.7			
51	10.0								32.5	22.7			
52	1.0	34	33	1	9.5	78	A-4 (2)	ML	9.0	20.6			
52	2.0								18.3	20.6			
52	3.0								21.6	20.6			
52	4.0								23.3	20.6			
52	5.0								30.9	20.6			
53	1.0	32	20	12	4.75	77	A-6 (8)	CL	20.6	19.7			
53	2.0								22.3	19.7			

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BISMARCK, ND 58504

SUMMARY OF LABORATORY RESULTS

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
53	3.0								18.1	19.7			
53	4.0								20.9	19.7			
53	5.0								16.7	19.7			
54	1.3	71	30	41	4.75	89	A-7-5 (42)	CH	15.9	37.6			
54	2.0								34.3	37.6			
54	3.0								39.9	37.6			
54	4.0								35.3	37.6			
54	5.0								39.0	37.6			
54	6.0								35.9	37.6			
54	7.0								44.8	37.6			
54	8.0								42.0	37.6			
54	9.0								43.8	37.6			
54	10.0								44.9	37.6			
55	1.0	79	29	50	9.5	95	A-7-6 (56)	CH	20.9	39.7			
55	2.0								40.0	39.7			
55	3.0								35.9	39.7			
55	4.0								38.6	39.7			
55	5.0								44.5	39.7			
55	6.0								41.8	39.7			
55	7.0								48.1	39.7			
55	8.0								39.7	39.7			
55	9.0								43.5	39.7			
55	10.0								44.2	39.7			
56	1.4	74	28	46	9.5	96	A-7-6 (52)	CH	20.9	39.7			
56	2.0								38.0	39.7			
56	3.0								41.5	39.7			
56	4.0								39.0	39.7			
56	5.0								42.5	39.7			
56	6.0								46.0	39.7			
56	7.0								41.5	39.7			
56	8.0								34.9	39.7			
56	9.0								45.4	39.7			
56	10.0								47.2	39.7			
57	1.0	77	28	49	4.75	97	A-7-6 (56)	CH	20.1	34.3			
57	2.0								22.3	34.3			
57	3.0								27.7	34.3			
57	4.0								36.2	34.3			
57	5.0								36.9	34.3			
57	6.0								18.7	34.3			
57	7.0								38.8	34.3			
57	8.0								45.0	34.3			
57	9.0								47.4	34.3			
57	10.0								49.6	34.3			

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER IM-8-029(203)101 **LOCATION** Traill County

PCN 23102

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
58	2.0	81	30	51	4.75	96	A-7-5 (58)	CH	32.9	35.0			
58	3.0								27.7	35.0			
58	4.0								30.1	35.0			
58	5.0								33.8	35.0			
58	6.0								35.4	35.0			
58	7.0								36.4	35.0			
58	8.0								28.2	35.0			
58	9.0								37.6	35.0			
58	10.0								52.4	35.0			
59	2.0	67	25	42	9.5	96	A-7-6 (46)	CH	40.8	33.3			
59	3.0								30.0	33.3			
59	4.0								29.2	33.3			
59	5.0								22.8	33.3			
59	6.0								32.9	33.3			
59	7.0								33.6	33.3			
59	8.0								35.6	33.3			
59	9.0								36.2	33.3			
59	10.0								38.7	33.3			
60	2.0	68	24	44	4.75	96	A-7-6 (48)	CH	27.0	31.4			
60	3.0								27.9	31.4			
60	4.0								27.3	31.4			
60	5.0								30.7	31.4			
60	6.0								31.4	31.4			
60	7.0								31.3	31.4			
60	8.0								34.9	31.4			
60	9.0								35.3	31.4			
60	10.0								36.7	31.4			
61	2.0	66	24	42	4.75	96	A-7-6 (46)	CH	29.7	31.8			
61	3.0								30.8	31.8			
61	4.0								32.7	31.8			
61	5.0								34.3	31.8			
61	6.0								30.3	31.8			
61	7.0								29.0	31.8			
61	8.0								32.4	31.8			
61	9.0								33.3	31.8			
61	10.0								33.7	31.8			