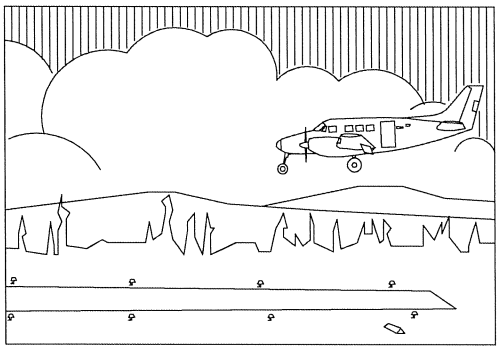
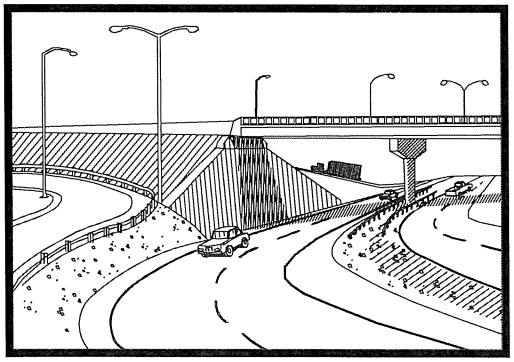
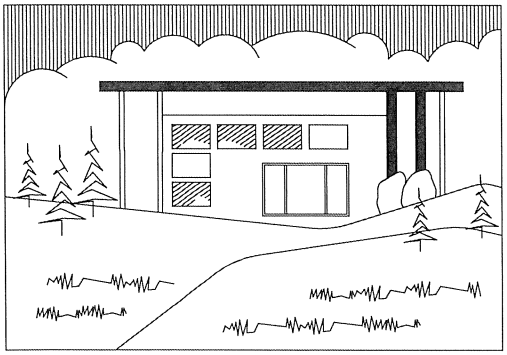
Geotechnical Investigation

AMBLER MINING DISTRICT ACCESS
PHASE 2
GATES OF THE ARCTIC NATIONAL PARK AND JIM RIVER LANDSLIDES

AKSAS: 63812

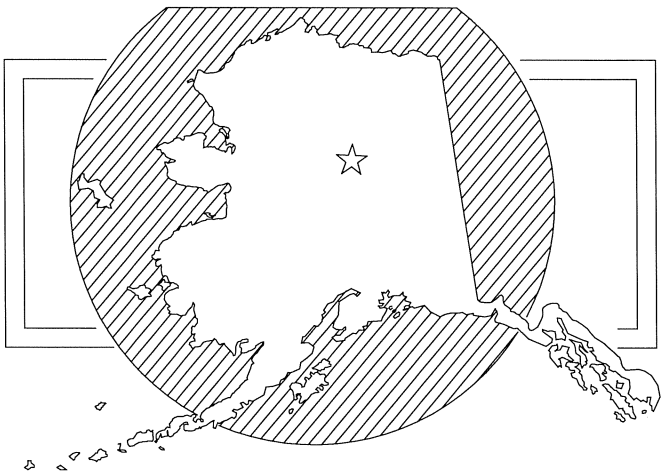






STATE OF ALASKA

Department of Transportation and Public Facilities



NORTHERN REGION

MARCH 2015

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GEOTECHNICAL INVESTIGATION
AMBLER MINING DISTRICT ACCESS
PHASE 2
GATES OF THE ARCTIC NATIONAL PARK AND JIM RIVER LANDSLIDES
AKSAS 63812

JANUARY 2015

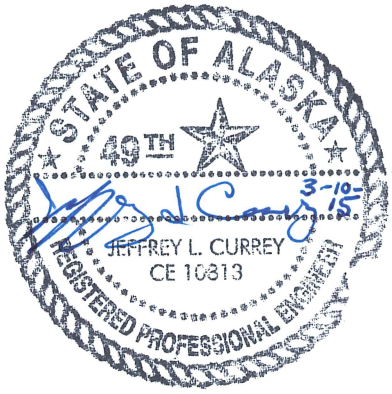
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Introduction

In August 2014 NRMS (Northern Region Materials Section) Engineering Geologist II Garrett Speeter and DOWL HKM Geologist Paul Pribyl conducted geologic reconnaissance traverses in 7 areas throughout Gates of The Arctic National Park. This document includes test hole locations, laboratory data, ground temperature data, and geologic/geotechnical interpretations collected during that time. The seven areas presented in this report were selected by the National Parks Service, DOWL HKM, and the Alaska Department of Transportation and Public Facilities because they all contain geomorphologic landforms, geologic deposits, material resources, and/or hazards that could impact the construction of the transportation corridor through Gates of The Arctic National Park. Furthermore, these seven areas were explored to aid the National Park Service in its attempt to define a practical, effective, route through Gates of The Arctic National Park. Each area was investigated with a series of drilling supported foot traverses. Geotechnical and geological information was collected in each traverse in areas selected in the field that best represented the major features-of-interest in each of the seven areas. Time was also taken to investigate recent and ongoing landslides in the Prospect Creek/Jim River area (located in the proposed northern route on the far-east side approximately 92 miles east of the drilling footprint for this study (Figure 1)). The Jim River Slides are useful analogies to potential geologic hazards in Gates of The Arctic National Park and are directly related to the Ambler Mining District Access project.

Comments are a synthesis of observations by Engineering Geologist II Garrett Speeter during a helicopter supported drilling program initiated in the summer of 2014 and were aided by field observations and oral communication with DOWL HKM geologist Paul Pribyl.

This report documents physical site conditions and subsurface geotechnical conditions, provides interpretation of anticipated site conditions, and recommends design and construction criteria for the project. This report is intended to serve as a geotechnical guide during project design and a geotechnical reference during construction.

This report represents the third phase of work completed on the Ambler Mining District Access Corridor by NRMS staff. All three phases are summarized below:

Phase 0

Geotechnical reconnaissance including brief geologic hazards description, broad-scale terrain unit mapping, reconnaissance alignment drilling, and extensive sampling for potential material sites (including riprap) was conducted by NRMS personnel in the summers of 2011 and 2012. The final report was published in 2013 and is listed in the "Past Reports" section of this report.

Phase 1

NRMS personnel drilled material sites between Gates of The Arctic National Park and the Koyukuk River using an air-portable CME-45 drill and Helicopter operated by Soloy Helicopters. The final report was published in 2014 and is listed in the "Past Reports" section of this report.

Phase 2 (this report)

NRMS personnel conducted 15 helicopter supported foot traverses in 7 areas of geologic interest and drilled 108 test holes with hand augers to document geotechnical conditions relevant to the selection process for determining a practical route through Gates of The Arctic National Park for the Ambler Mining District Access Corridor.

Summary

In Summary the major discoveries in each area are as follows (Figure 3):

Jim River (Figure 1)

- Burning of forest and organic mat has led to rapid thawing of permafrost;
- Surface water has further accelerated melting and increased erosion leading to structural instability and widespread landslides.

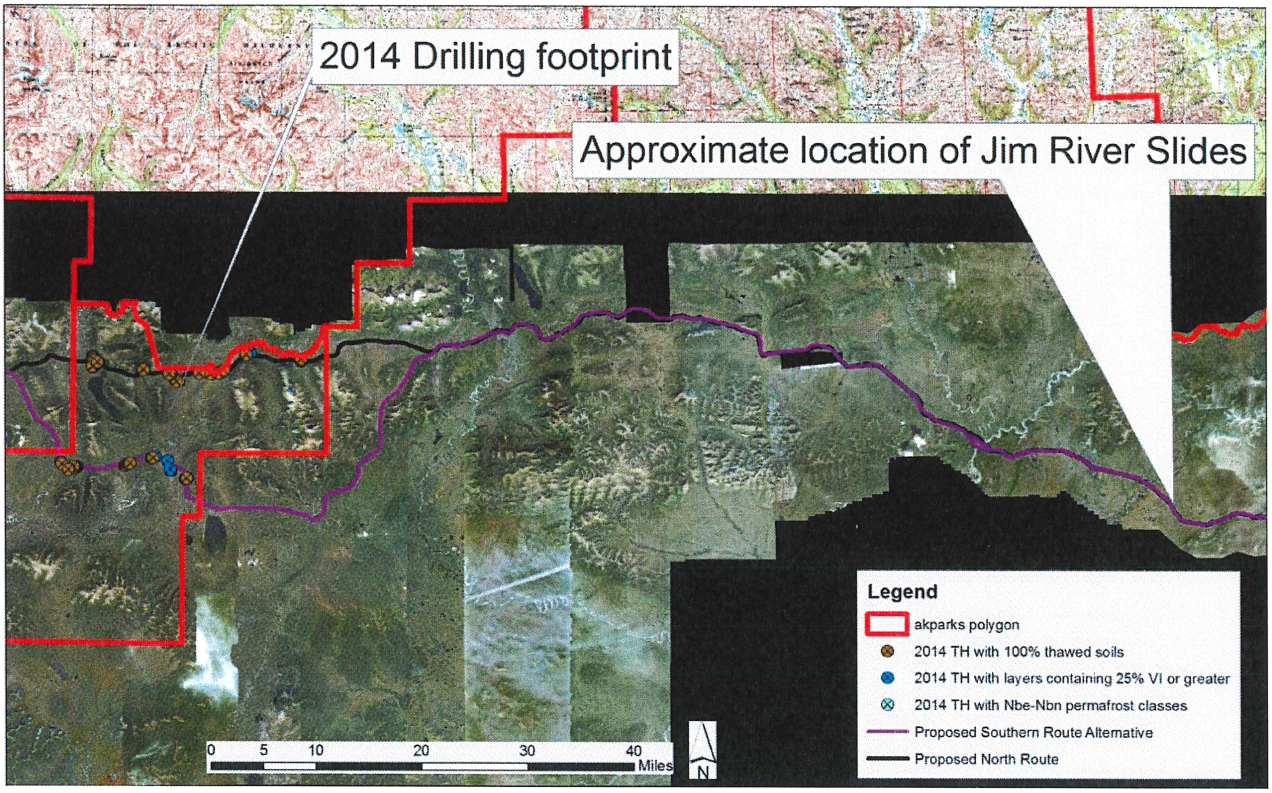


Figure 1. Location map Jim River slides.

Area 1

- Potential muskeg hazard (Traverse 1 and 2);
- Potential slope stability hazard (Traverse 2);
- Fen and its groundwater recharge (Traverse 3);
- Thermally unstable permafrost (Traverse 1 and 2).

Area 2

- Shallow bedrock in east-southeast part of area (Traverse 5);
- Thermally unstable permafrost (Traverse 4, 5, and 6).

Area 3

- Potentially thermally unstable permafrost (Traverse 7).

Area 4

- Shallow bedrock and thawed glacial deposits (Traverse 9);
- Thawed glacial deposits (Traverse 10 and 11).

Area 5

- Potential material site (Traverse 15);
- Potential borrow site (Traverse 12);
- Burned, thawed, loose silt analogous to soils at Jim River (Traverse 14).

Area 6

- Thermally unstable permafrost (Traverse 16, 17, and 18).

Area 7

- Potential muskeg hazard (Traverse 19).

Past Reports

Data and field observations from previous geotechnical reconnaissance studies conducted by the Alaska Department of Transportation and Public Facilities can be found in:

Speeter, G, G., 2013, Reconnaissance Material Site Report Ambler Mining District Access AKSAS:63812. Geotechnical Investigation Report, Alaska Department of Transportation and Public Facilities, 243p

Speeter, G. G., 2014, Material Site Report Ambler Mining District Access Phase 1 AKSAS 63812. Material Site Report, Alaska Department of Transportation and Public Facilities, 113p.

Field Investigation

Fieldwork took place from August 16-28, 2014. Field investigations were completed by NRMS Engineering Geologist II Garrett Speeter, DOWL HKM Geologist Paul Pribyl, and subsistence advisers Alan Ticket (from Kobuk) and Harding Sam (from Alatna). Geologists completed 18 traverses in seven areas (Figure 4) of geologic interest along the north and south routes through

Gates of The Arctic National Park. Areas of interest were selected based on interpretation of aerial photographs and satellite imagery and observations made in the field. Test holes were drilled along each traverse utilizing either a 3 inch SIPRE hollow stem core drill or a 2 inch Tanaka solid stem auger drill to collect geotechnical information (Appendix B). Soils were logged in the field in accordance with the Unified Soil Classification System. Test hole locations were recorded utilizing a recreational grade Garmin 72 GPS receiver with an estimated position accuracy of 50 feet and NAD83 geographic datum. Thaw consolidation analyses were performed on SIPRE cores in the field (Appendix B). Samples were collected from auger cuttings, drill cores, or test pits excavated in the field. Samples were submitted to the Northern Region Materials Laboratory in Fairbanks for analyses that include: moisture content, organics content, gradation, and quality analyses (LA Abrasion and Degradation).

Laboratory Testing

Selected samples were submitted to the Northern Region Materials Laboratory for testing. The testing program included gradation, organic content, LA Abrasion, Degradation, and sodium sulfate soundness.

Table 1. List of tests and standards offered by NRMS Materials Laboratory.

Test Method	AASHTO	ASTM
Index Tests		
Gradation	T27	C136
Minus #200 Gradation	T11	C117
Hydrometer	T88	D422
Liquid Limit	T89	D4318
Plastic Limit	T90	D4318
Moisture Content – Aggregate Soil	T255 T265	C566 D2216
Organic Content (Burn)	T267	
Proctor	T180	D1557
USCS Classification	D2487	
Fine Specific Gravity	T100	D854
Coarse Specific Gravity	T85	D127
Quality Tests		
Degradation	T13	
Los Angeles Abrasion	T96	C131
Sodium Soundness	T104	C88
Nordic Abrasion	ATM 312	



Figure 2. Eurocopter AS350 B2. Drilling operations were supported by a Eurocopter AS350 B2 operated by Soloy Helicopters.

Notes on slope stability near Jim River and thermal instability of permafrost

Widespread fires near Jim River/Prospect Creek during the 2013 field season resulted in damage to the forest and organic mat which reduced its effectiveness as an insulator. Heavy rains in this area during the 2014 field season contributed to extensive thaw in thermally unstable permafrost near the Jim River/Prospect Creek area and increased erosion (Figure 3). In 2012 areas shown in the photos were un-burned and stable. Recon data collected by NRMS field studies in 2013 and 2014 (see past reports section) suggested that frozen soil near the surface was thermally unstable around the ice road to Bettles. Temperature data presented later in this report shows relatively high temperatures in permafrost could be commonplace throughout the corridor, and at least within Gates of The Arctic National Park. The 2014 landslides around Jim River presented below provide good evidence that frozen soils at this latitude are thermally unstable and can easily result in structural failures if the organic mat is compressed, removed, or burned and/or exposed to surface water that accelerates melting and erosion.

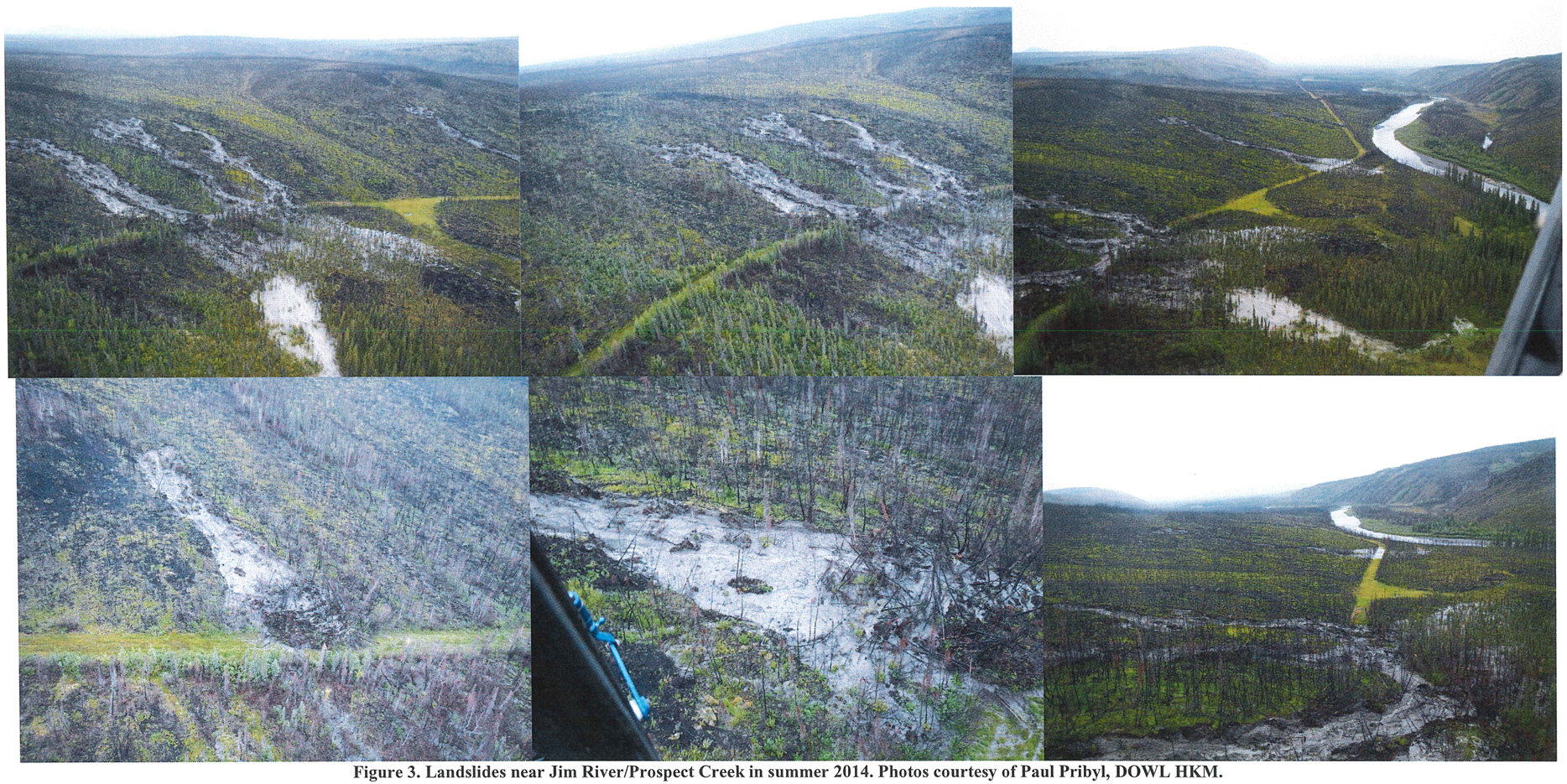


Figure 3. Landslides near Jim River/Prospect Creek in summer 2014. Photos courtesy of Paul Pribyl, DOWL HKM.

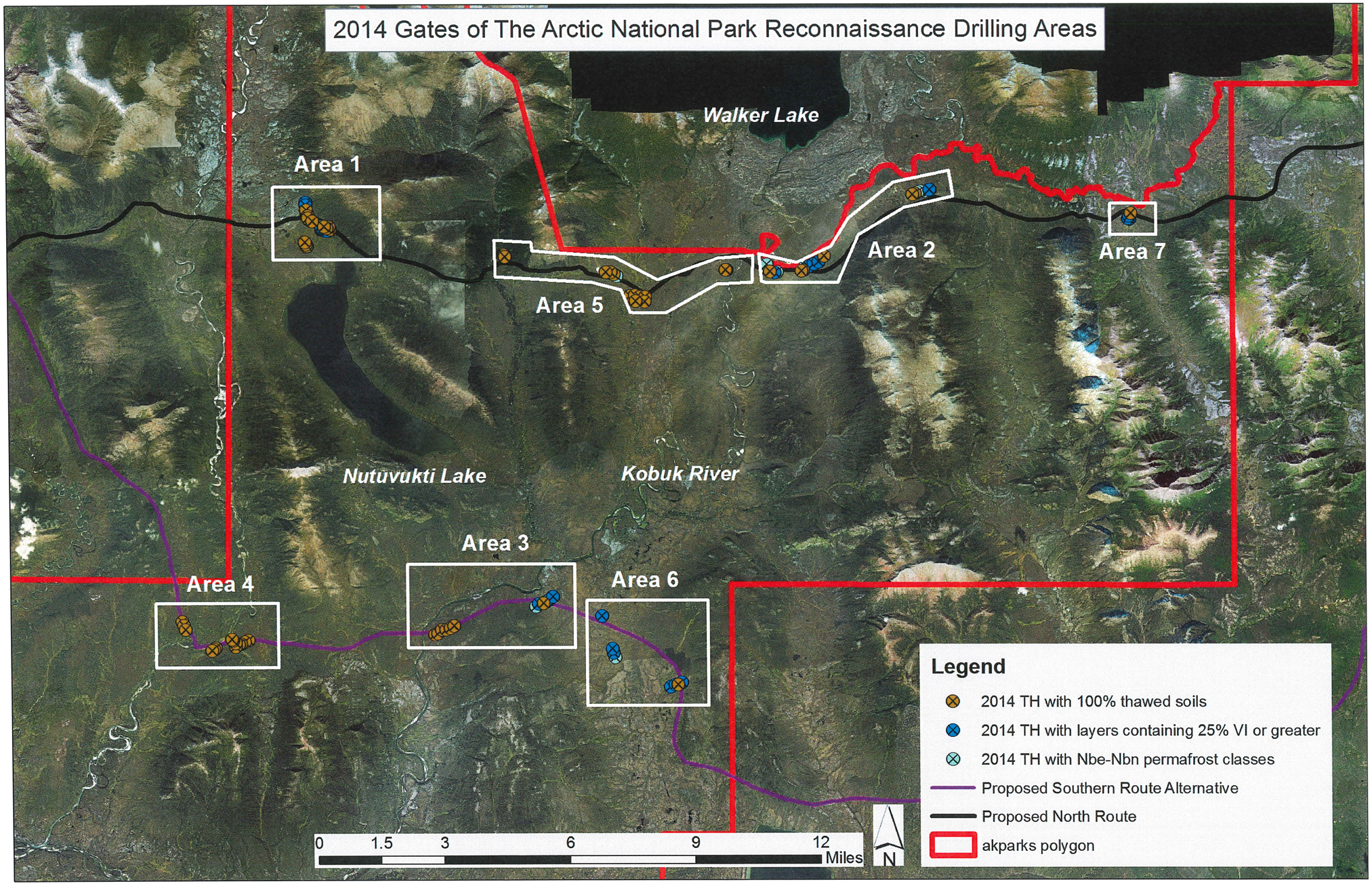


Figure 4. Project area map.
***Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.**

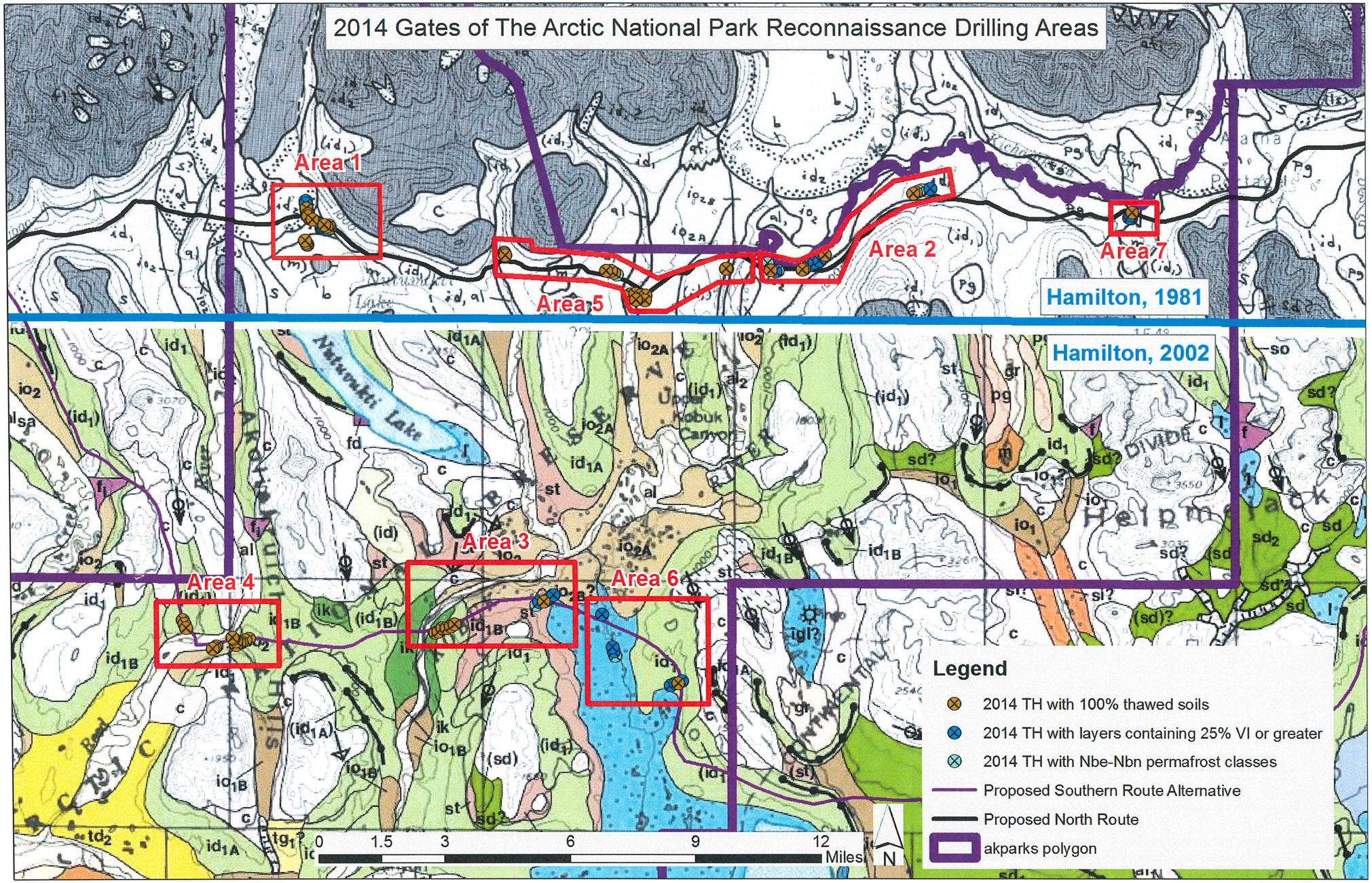


Figure 5. Geologic map of 2014 project area.*Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Area 1

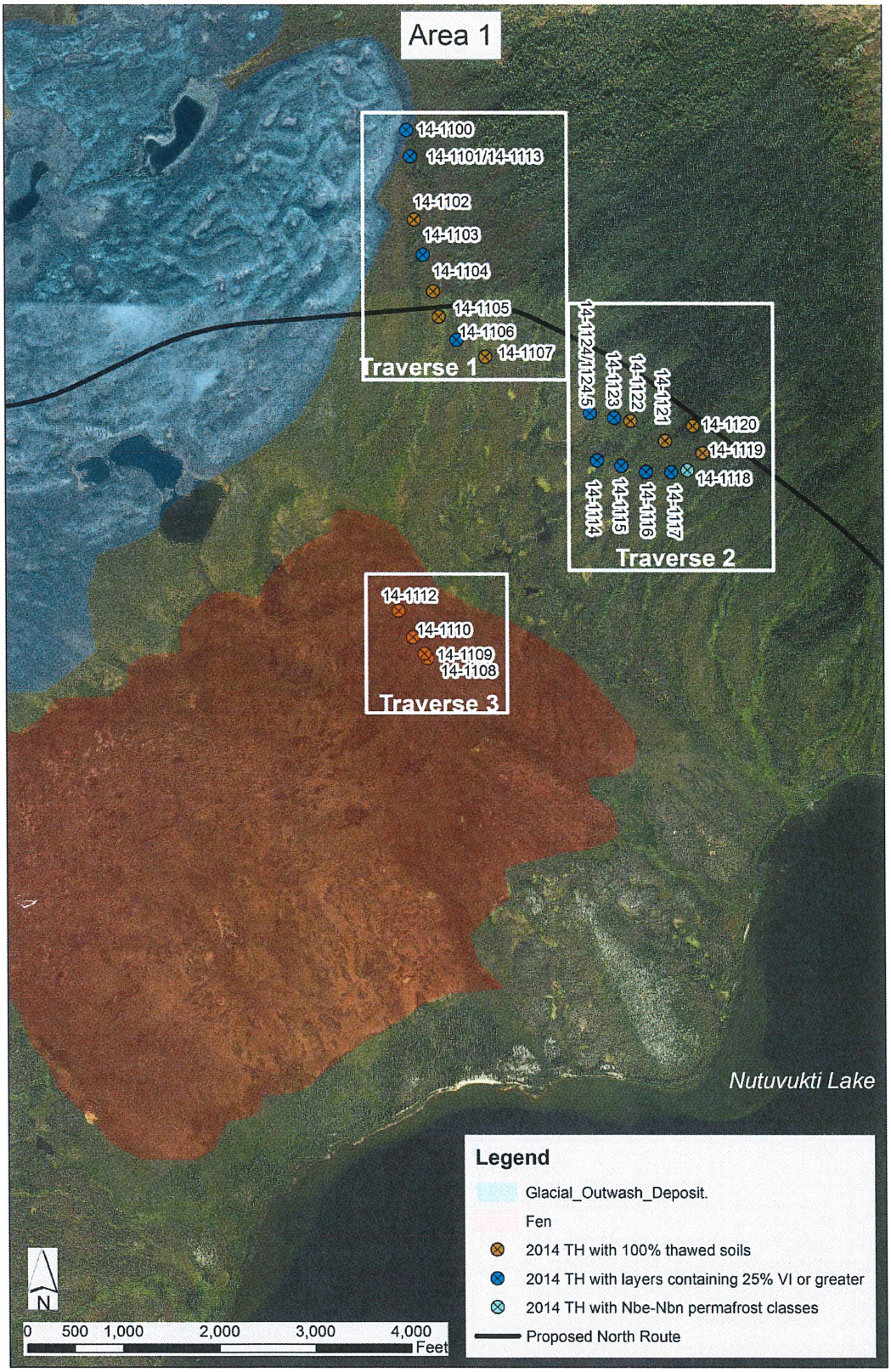


Figure 6. Map of Area 1. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Area 1 is located on the west end of the northern route through Gates of The Arctic National Park at the north shore of Nutuvukti Lake. This area contains potential design hurdles including Muskeg (Traverse 1 and 2), thaw-unstable massive ice (Traverse 1 and 2), unstable soil slopes (Traverse 2) and the Nutuvukti Lake Fen (Traverse 3).

Traverse 1

Table 2. Summary of traverses in Area 1.

Traverse 1				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1100	SS	none	Ice rich silt and massive ice	10
14-1101	SS	15' thermistor and data logger	Ice rich silt and massive ice	15
14-1102	SS	none	Thawed silt	4
14-1103	SS	none	Ice rich silt and massive ice	6.5
14-1104	SS	none	Thawed silt above glacial outwash (silty sand with gravel)	6
14-1105	SS	none	Thawed silt above glacial outwash (silty gravel)	8
14-1106	SS	none	Ice rich silt and massive ice	8.5
14-1107	SS	none	Thawed silt above glacial outwash (gravel)	7.5
14-1113	SIPRE	none	Ice rich silt and massive ice	5

Test holes drilled in Traverse 1 (Figure 6 and Table 2) intercepted either thawed or frozen silt that varied in thickness from 5 feet thick to at least 15 feet thick. Three out of nine test holes in Traverse 1 encountered sand and gravel deposits beneath the silt layer. Design relevant data collected by Traverse 1 is as follows:

- Thaw consolidation tests from cores collected from SIPRE hole TH14-113 reported:
  - 29% consolidation from samples collected at depths of 1 to 2 feet;
  - 30% consolidation from samples collected at depths of 2 to 3 feet;
  - 75% consolidation from samples collected at depths of 3 to 5 feet.
- Five test holes (Table 1) in this traverse intercepted silt with massive ice to depths of at least 8.5 feet. Test holes that encountered massive ice were often located next to areas with thawed silt (as evidenced by nearby test holes) this suggests that ice along the traverse is thermally unstable.
- Table 3 shows the temperature readings measured by the thermistor and data logger installed in TH14-1101:

Table 3. Temperature data from data logger installed in TH14-1101 data measured 8-27-14.

Sensor number	Depth (Feet)	Temperature (°C)
15	1	1.692
16	3	0.314
17	5	-0.690
18	7	-0.878
19	9	-1.067
20	11	-1.129
21	13	-1.129

- Thermally unstable ice intercepted by test holes in Traverse 1 will be more susceptible to thawing if the organic mat is compressed and/removed during the construction process. Soils containing massive ice intercepted by test holes in Traverse 1 are thaw-unstable and have the potential to consolidate 75% or more which will lead to significant structural damage if thawed.

Traverse 2

Table 4. Traverse 2.

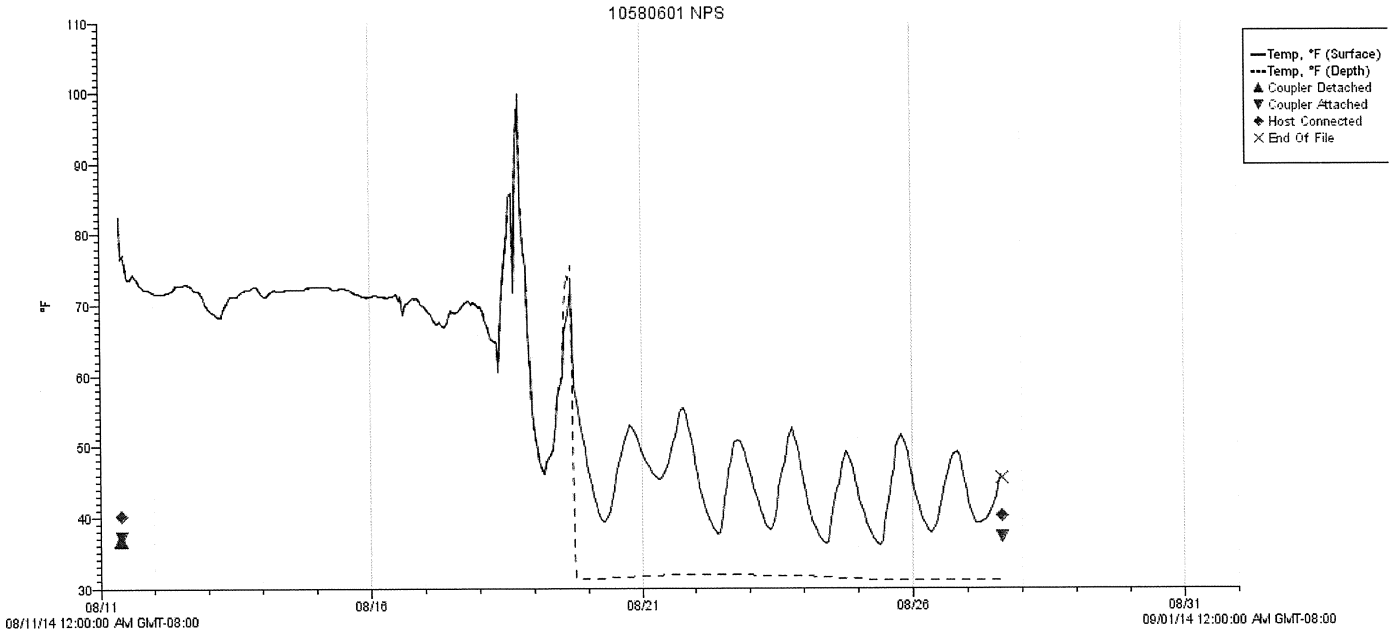
Traverse 2				
Hole ID	Type	Equipment installed	General geologic description	Total depth
14-1114	SS	none	Ice rich silt and massive ice	10
14-1115	SS	none	Ice rich silt and massive ice	10
14-1116	SS	none	Ice rich silt and massive ice	8
14-1117	SS	none	Silt over colluvium (Silt with schistose gravel)	5
14-1118	SS	none	Colluvium (Silt with schistose gravel)	3
14-1119	SS	none	Colluvium (Silt with schistose gravel)	5
14-1120	SS	none	Colluvium (Silt with schistose gravel)	5
14-1121	SS	none	Silt over colluvium (Silt with schistose gravel)	3
14-1122	SS	none	Colluvium (poorly-graded gravel with silt)	7
14-1123	SS	none	Ice rich silt and massive ice	7.5
14-1124	SS	none	Ice rich silt and massive ice	7
14-1124.5	SIPRE	NPS S/N 10580601 Data Logger	Ice rich silt and massive ice	5.5

Test holes in Traverse 2 (Figure 6 and Table 4) intercepted frozen silt with massive ice on the west side of the traverse and colluvium on the east side of the traverse. Design relevant data collected by Traverse 2 is as follows:

- Massive ice and frozen silt encountered on west side of Traverse 2 is at least 10 feet deep.
- The existing "Final Alignment" trends mostly through colluvium near Traverse 2.
- Colluvial deposits are typically thawed.
- Thaw consolidation tests from cores collected by SIPRE TH14-1124.5 reported:
  - 78% consolidation from samples collected at depths of 3 to 4 feet;
  - 50% consolidation from samples collected at depths of 4 to 5 feet.

- Landslides converted to minor drainages and tree trunks bent down slope near 14-1120 suggest that the colluvial slope is undergoing minor landslides and solifluction creep. Soil slope stability may be a concern where the proposed alignment skirts the hillside near Traverse 2 and along Nutuvukti Lake.
- Temperature data recovered by NPS HOBO logger S/N10580601 reported temperatures just below freezing at a depth of 6 feet, suggesting that frozen soil in this area is thermally unstable and a <1° temperature rise would cause widespread melting in this area.
- Thermally unstable ice intercepted by test holes in Traverse 2 will be more susceptible to thawing if the organic mat is compressed and/removed during the construction process. Soils containing massive ice intercepted by test holes in Traverse 2 are thaw-unstable and have the potential to consolidate 78% or more which will lead to significant structural damage if thawed.
- Thermally unstable soils and increased erosion observed in Traverse 2 suggest that this area could have widespread slide problems similar to those seen in Jim River if the organic mat is disturbed or the forest is burned.

Figure 7. Temperature data from HOBO logger installed in TH14-1124.



Traverse 3

Table 5. Traverse 3.

Traverse 3				
Hole ID	Type	Equipment installed	General geologic description	Total depth
14-1108	SS	none	fen	10
14-1109	SS	none	fen	9.5
14-1110	SS	none	fen	8
14-1112	SS	none	fen	8

Test holes drilled in Traverse 3 (Figure 6 and Table 5) were drilled in the fen (Figure 6, outlined in red) in the southwest corner of Area 1. Design relevant data collected by Traverse 3 is as follows:

- Test holes in the fen intercepted approximately 8 to 10 feet of floating organics in water, at a depth of approximately 5 feet the organics become noticeably more decomposed and contain some silt.
- At depths of approximately 8 to 10 feet the fen is sitting on cold, possibly frozen, silt with gravel. Most of the aggregates observed were graphite schist.
- Water supply for the fen appears to be from drainages flowing through glacial outwash deposits to the north. These drainages are visible in the Area 1 map (Figure 6).
- Groundwater recharge to the Nutuvukti Lake Fen appears to be coming from drainage flowing through glacial outwash deposits to the north. This observation is consistent with observations published by Swanson, 1995. Diligent planning will be required to insure construction does not interfere with drainage recharge of the fen.

Area 1 Photographs



Figure 8. Data Logger installed in TH14-1101.



Figure 9. Glacial outwash deposit west of TH14-1100.



Figure 10. Helicopter landed on Fen.

Area 1 Test Hole Log

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1100
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Ice rich silt and massive ice	Dates Drilled	8/17/2014 - 8/17/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Rain.	Latitude, Longitude	N67.04042, W154.73886
Vegetation	Willows, tundra grasses, scattered black spruce	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

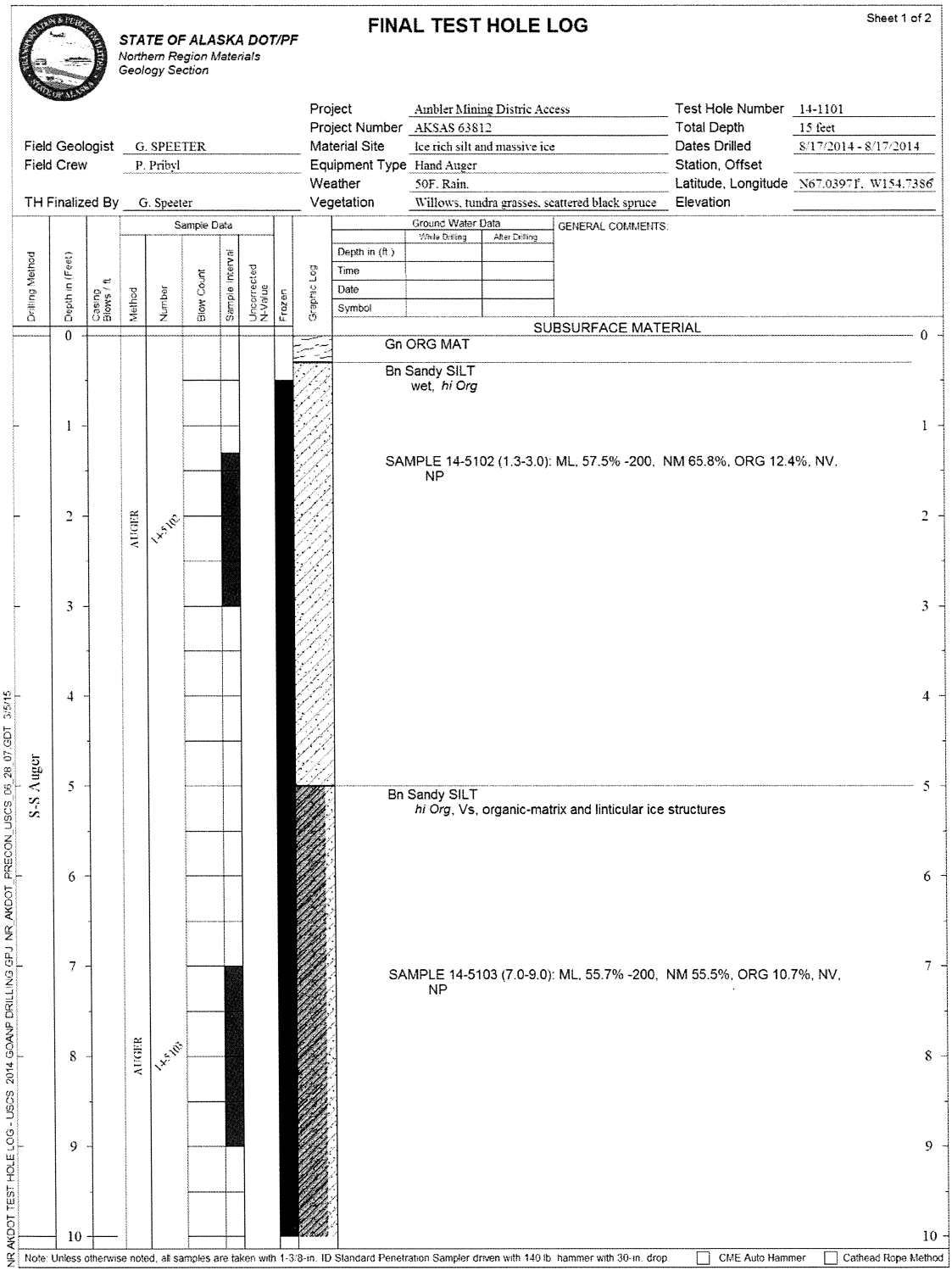
Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

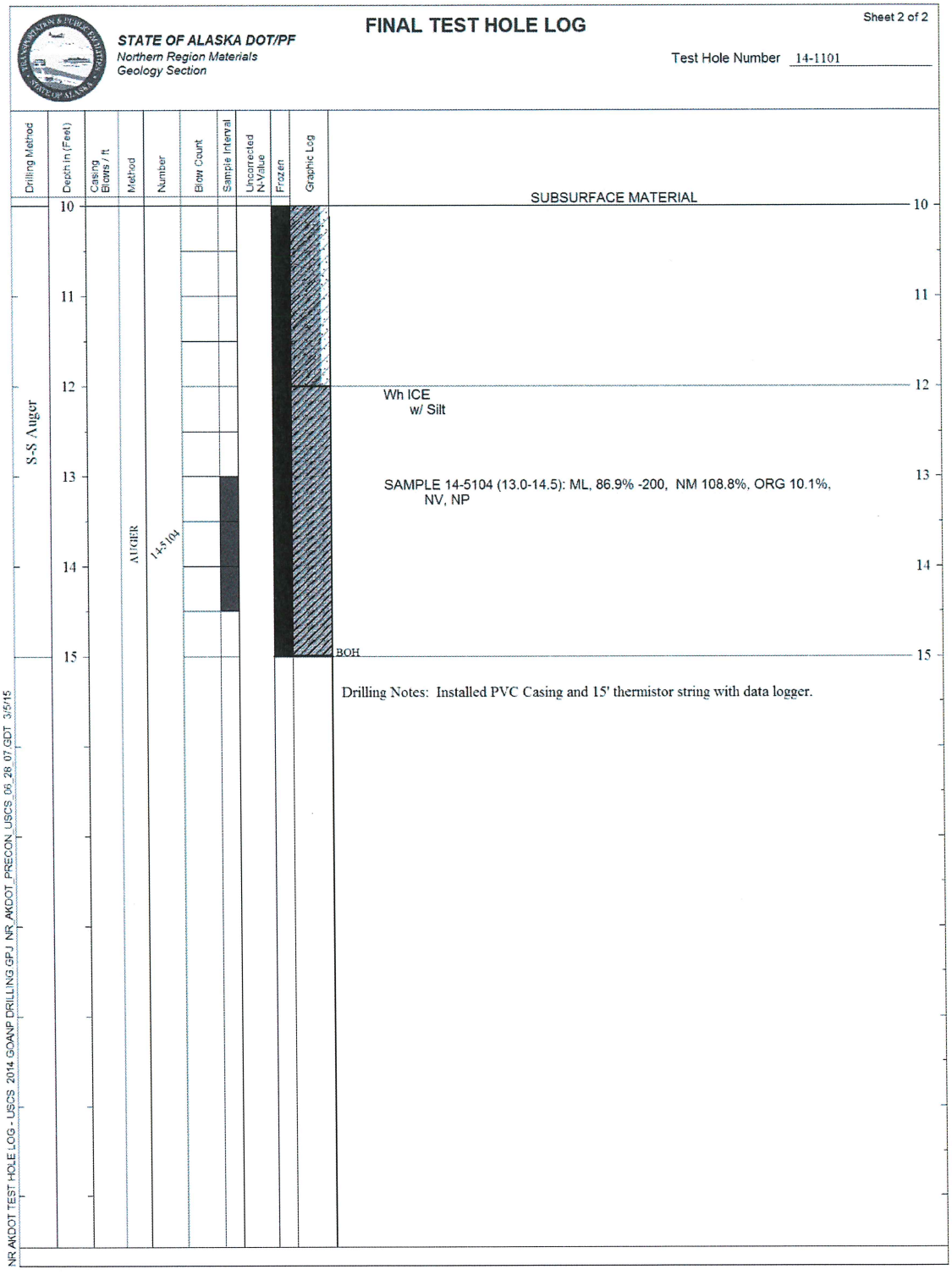
GENERAL COMMENTS
Drilled near glacial outwash deposit.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT
	1									Gy SILT wet
	2									Gy SILT Nbe
	3									Gy SILT Vs, Layered ice structures. 85% VI visual estimate.
	4									
	5									
	6									
	7									
	8									
	9									
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06.28.07.GDT 3/5/15


STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
FINAL TEST HOLE LOG
Sheet 1 of 2
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Ice rich silt and massive ice
Equipment Type: Hand Auger
Weather: 50F. Rain.
Vegetation: Willows, tundra grasses, scattered black spruce
Test Hole Number: 14-1101
Total Depth: 15 feet
Dates Drilled: 8/17/2014 - 8/17/2014
Station, Offset:
Latitude, Longitude: N67.0397f, W154.7386
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5102
AUGER
14-5103
Gn ORG MAT
Bn Sandy SILT
wet, hi Org
SAMPLE 14-5102 (1.3-3.0): ML, 57.5% -200, NM 65.8%, ORG 12.4%, NV, NP
Bn Sandy SILT
hi Org, Vs, organic-matrix and linticular ice structures
SAMPLE 14-5103 (7.0-9.0): ML, 55.7% -200, NM 55.5%, ORG 10.7%, NV, NP
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
Sheet 2 of 2
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Test Hole Number 14-1101
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5104
Wh ICE
w/ Silt
SAMPLE 14-5104 (13.0-14.5): ML, 86.9% -200, NM 108.8%, ORG 10.1%,
NV, NP
BOH
Drilling Notes: Installed PVC Casing and 15' thermistor string with data logger.
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1102
Project Number	AKSAS 63812	Total Depth	4 feet
Material Site	Thawed silt	Dates Drilled	8/17/2014 - 8/17/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Rain.	Latitude, Longitude	N67.03786, W154.73825
Vegetation	Dwarf black spruce, tundra grasses.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)	3.5	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS:
Scattered thaw boils nearby. Shallow standing water.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log
	0								
	1		AUGER	14-5105					
	2								
	3		AUGER	14-5106					
	4								

SUBSURFACE MATERIAL

0 Gn-Bn ORG MAT

Bn SILT
w/ Sand
wet, *hi Org*
SAMPLE 14-5105 (0.5-2.0): ML, 73.6% -200, NM 78.6%, ORG 15.6%, NV, NP

1

2

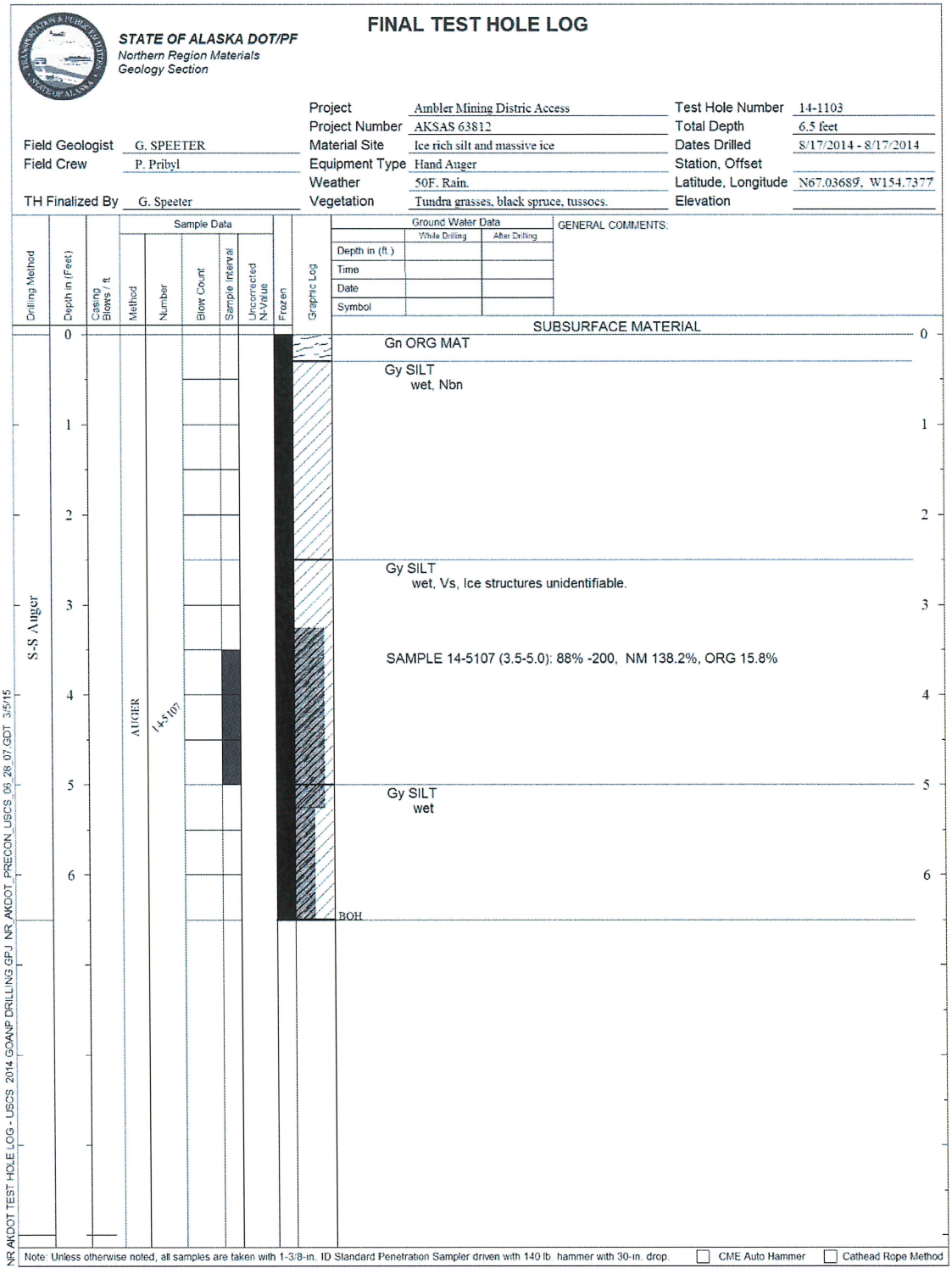
Bn SILT
w/ Sand
wet, *hi Org*, water possibly peirched on ice.
SAMPLE 14-5106 (2.5-3.5): ML, 72.5% -200, NM 62.7%, ORG 9.0%, NV, NP

3

4 BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06_26_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Ice rich silt and massive ice
Equipment Type: Hand Auger
Weather: 50F. Rain.
Vegetation: Tundra grasses, black spruce, tussocs.
Test Hole Number: 14-1103
Total Depth: 6.5 feet
Dates Drilled: 8/17/2014 - 8/17/2014
Station, Offset:
Latitude, Longitude: N67.03689, W154.7377
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS:
Drilling Method
Depth in (Feet)
Casing Blows / ft.
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5107
Gn ORG MAT
Gy SILT
wet, Nbn
Gy SILT
wet, Vs, Ice structures unidentifiable.
SAMPLE 14-5107 (3.5-5.0): 88% -200, NM 138.2%, ORG 15.8%
Gy SILT
wet
BOH
0
1
2
3
4
5
6
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1104
Project Number	AKSAS 63812	Total Depth	6 feet
Material Site	Thawed silt above glacial outwash	Dates Drilled	8/17/2014 - 8/17/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Rain.	Latitude, Longitude	N67.0358f, W154.73688
Vegetation	tundra grasses, black spruce, tussocs, blue berries	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Pretty dry area

Drilling Method: S-S Auger
Sample Data: Casing Blows / ft; Method: AUGER; Number: 14-5108; Blow Count; Sample Interval; Uncorrected N-Value; Frozen; Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT

Gy SILT
wet, *hi Org*

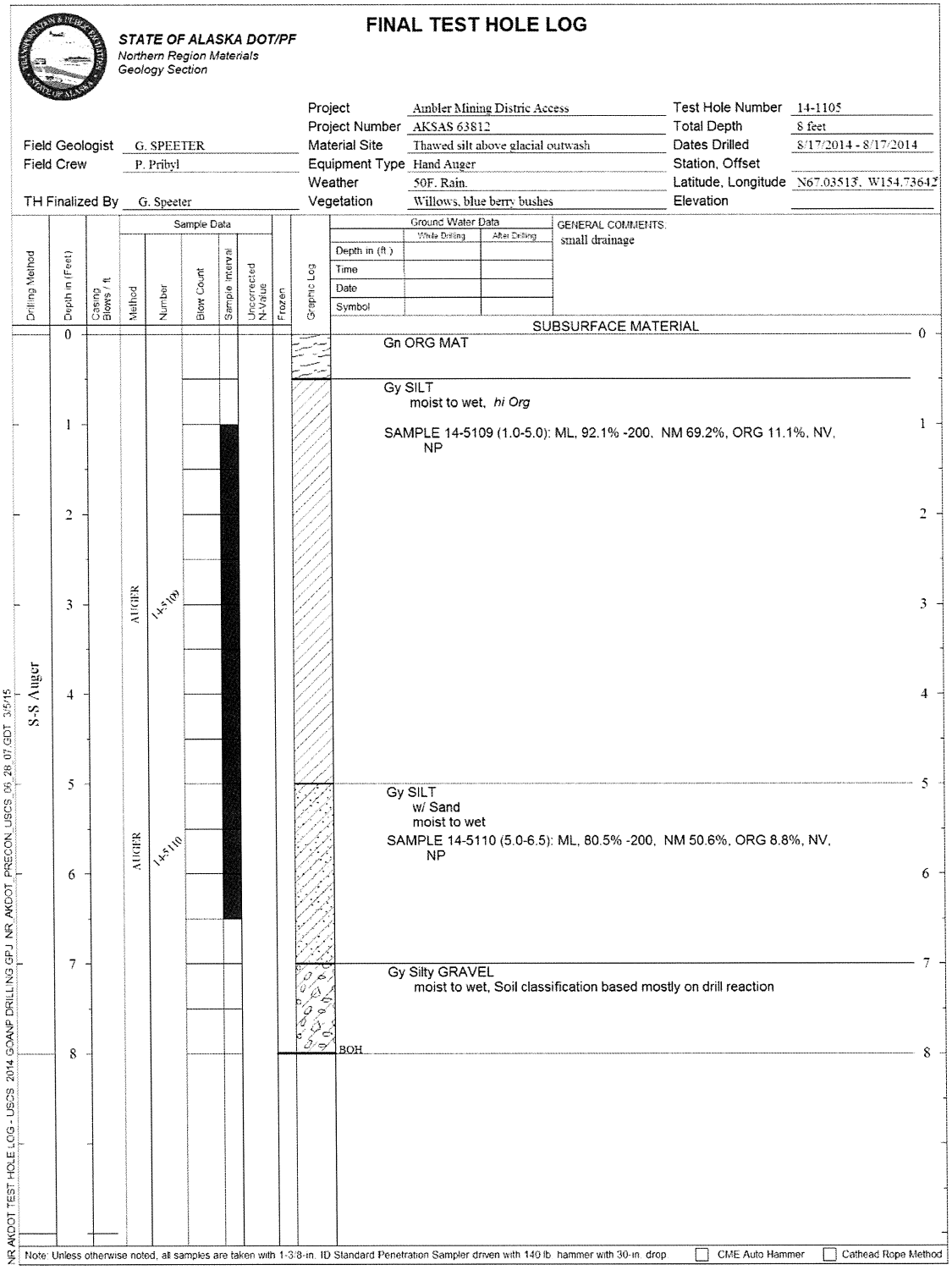
SAMPLE 14-5108 (2.0-4.5): ML, 91.5% -200, NM 74.2%, ORG 13.5%, NV, NP

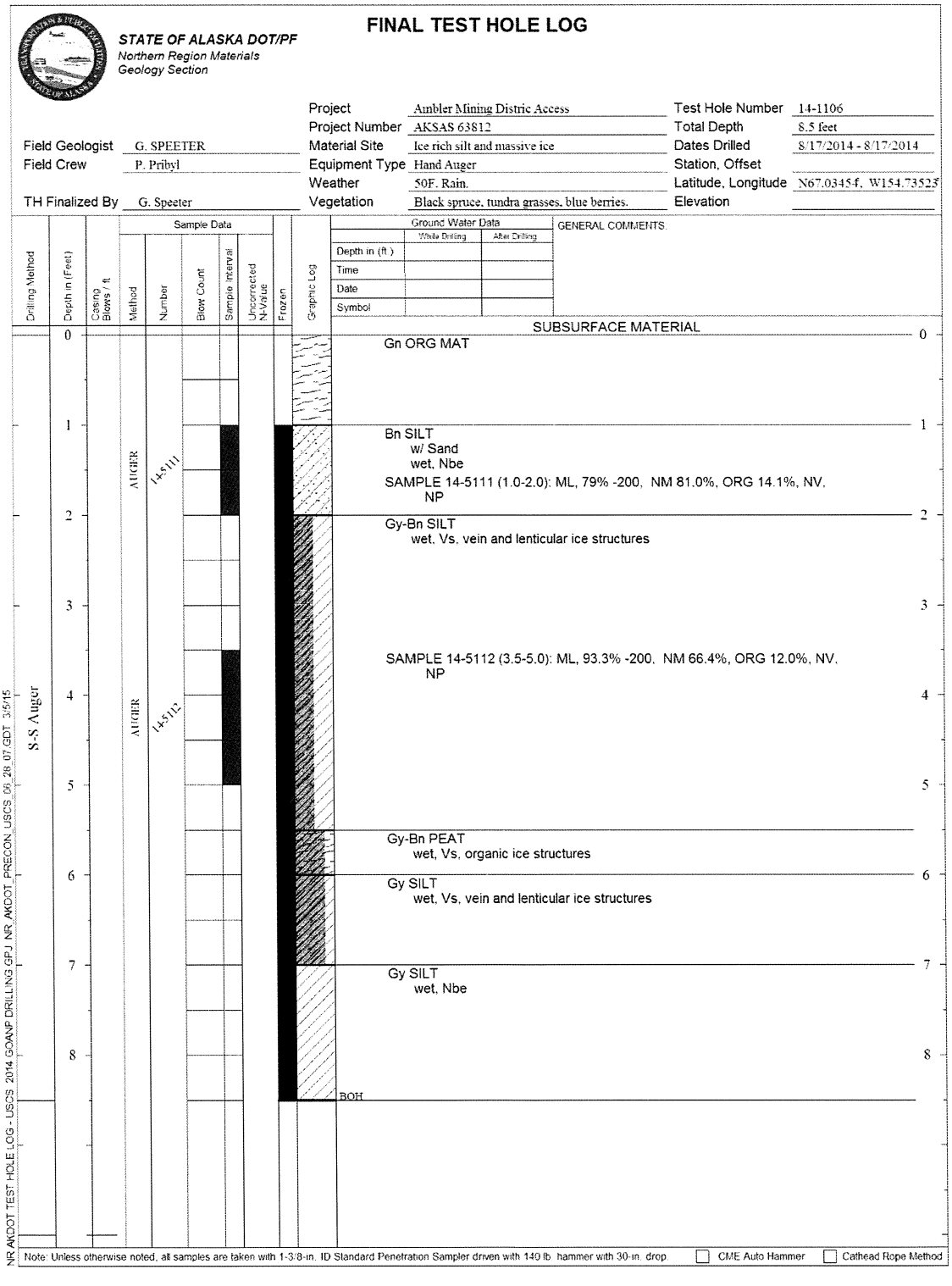
Gy-Bn Silty SAND
w/ Gravel
wet, Soil call based largly on drill reaction.

6 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Thawed silt above glacial outwash
Equipment Type Hand Auger
Weather 50F. Rain.
Vegetation Willows, blue berry bushes
Test Hole Number 14-1105
Total Depth 8 feet
Dates Drilled 8/17/2014 - 8/17/2014
Station, Offset
Latitude, Longitude N67.03513°, W154.73643°
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS:
small drainage
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5109
AUGER
14-5110
Gn ORG MAT
Gy SILT
moist to wet, hi Org
SAMPLE 14-5109 (1.0-5.0): ML, 92.1% -200, NM 69.2%, ORG 11.1%, NV, NP
Gy SILT
w/ Sand
moist to wet
SAMPLE 14-5110 (5.0-6.5): ML, 80.5% -200, NM 50.6%, ORG 8.8%, NV, NP
Gy Silty GRAVEL
moist to wet, Soil classification based mostly on drill reaction
BOH
0
1
2
3
4
5
6
7
8
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
FINAL TEST HOLE LOG
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Ice rich silt and massive ice
Equipment Type: Hand Auger
Weather: 50F. Rain.
Vegetation: Black spruce, tundra grasses, blue berries.
Test Hole Number: 14-1106
Total Depth: 8.5 feet
Dates Drilled: 8/17/2014 - 8/17/2014
Station, Offset:
Latitude, Longitude: N67.0345-f, W154.73525
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5111
AUGER
14-5112
Gn ORG MAT
Bn SILT
w/ Sand
wet, Nbe
SAMPLE 14-5111 (1.0-2.0): ML, 79% -200, NM 81.0%, ORG 14.1%, NV, NP
Gy-Bn SILT
wet, Vs, vein and lenticular ice structures
SAMPLE 14-5112 (3.5-5.0): ML, 93.3% -200, NM 66.4%, ORG 12.0%, NV, NP
Gy-Bn PEAT
wet, Vs, organic ice structures
Gy SILT
wet, Vs, vein and lenticular ice structures
Gy SILT
wet, Nbe
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1107
Project Number	AKSAS 63812	Total Depth	7.5 feet
Material Site	Thawed silt above glacial outwash	Dates Drilled	8/17/2014 - 8/17/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Rain.	Latitude, Longitude	N67.03395, W154.73365
Vegetation	Tall grass, black spruce trees.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Area likely has standing water during wet season.

Drilling Method: S-S Auger
Sample Data: Method: AUGER; Number: 14-5113

SUBSURFACE MATERIAL

0 — Gn ORG MAT
wet, Wet grass

1 — Rd-Bn PEAT
wet

2 — Gy SILT
wet

3 — SAMPLE 14-5113 (3.0-5.0): ML, 90.9% -200, NM 57.0%, ORG 11.9%, NV, NP

4

5

6

7 — Based on drill reaction

BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1108
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Fen	Dates Drilled	8/18/2014 - 8/18/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	55F. Nice.	Latitude, Longitude	N67.02535, W154.73726
Vegetation	Fen	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)	0.5	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS.

Drilling Method: S-S Auger

Sample Data: Casing Blows / ft | Method | Number | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

SUBSURFACE MATERIAL

0 – ORG MAT
wet, floating organic mat. Fen.

5 – ORG MAT
w/ Silt
wet, Wet decomposed organics with silt

8 – Gy SILT
w/ Gravel
wet, cold but not frozen.

10 – BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1109
Project Number	AKSAS 63812	Total Depth	9.5 feet
Material Site	Fen	Dates Drilled	8/18/2014 - 8/18/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	55F. Nice.	Latitude, Longitude	N67.0255F, W154.7372F
Vegetation	Fen	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)	0.5	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS.

Drilling Method: S-S Auger

Sample Data: Casing Blows / ft. | Method | Number | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

SUBSURFACE MATERIAL

0 Gn-Bn ORG MAT
wet, Organic mat in water. Fen.

8 Gy SILT
w/ Gravel
wet, Cold but not frozen

9 BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1110
Project Number	AKSAS 63812	Total Depth	8 feet
Material Site	Fen	Dates Drilled	8/18/2014 - 8/18/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	55F. Nice.	Latitude, Longitude	N67.026', W154.73898'
Vegetation	Fen	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)	0.5	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS

Sample Data: Drilling Method | Depth in (Feet) | Casing Blows / ft. | Method | Number | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

S-S Auger

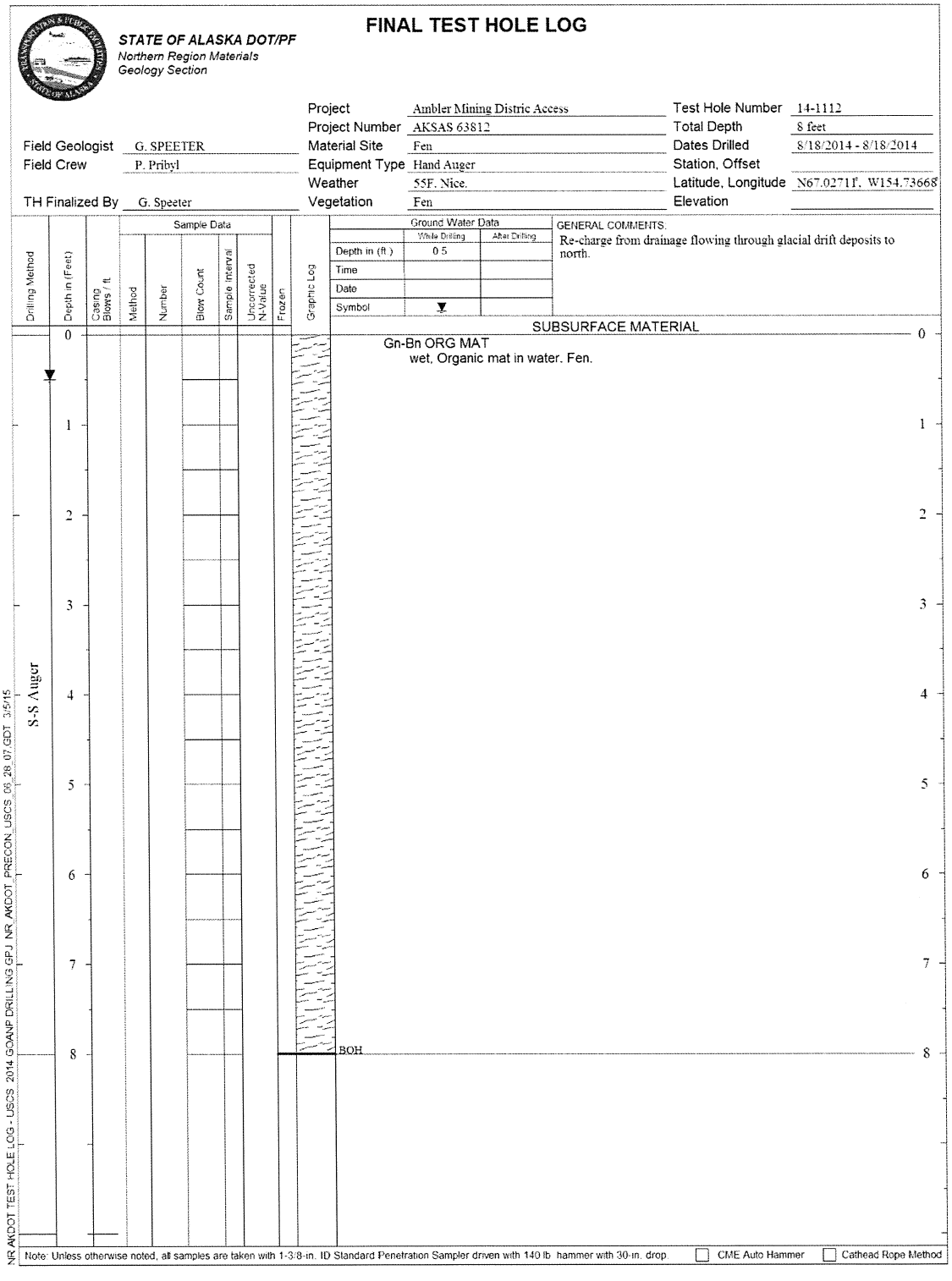
SUBSURFACE MATERIAL

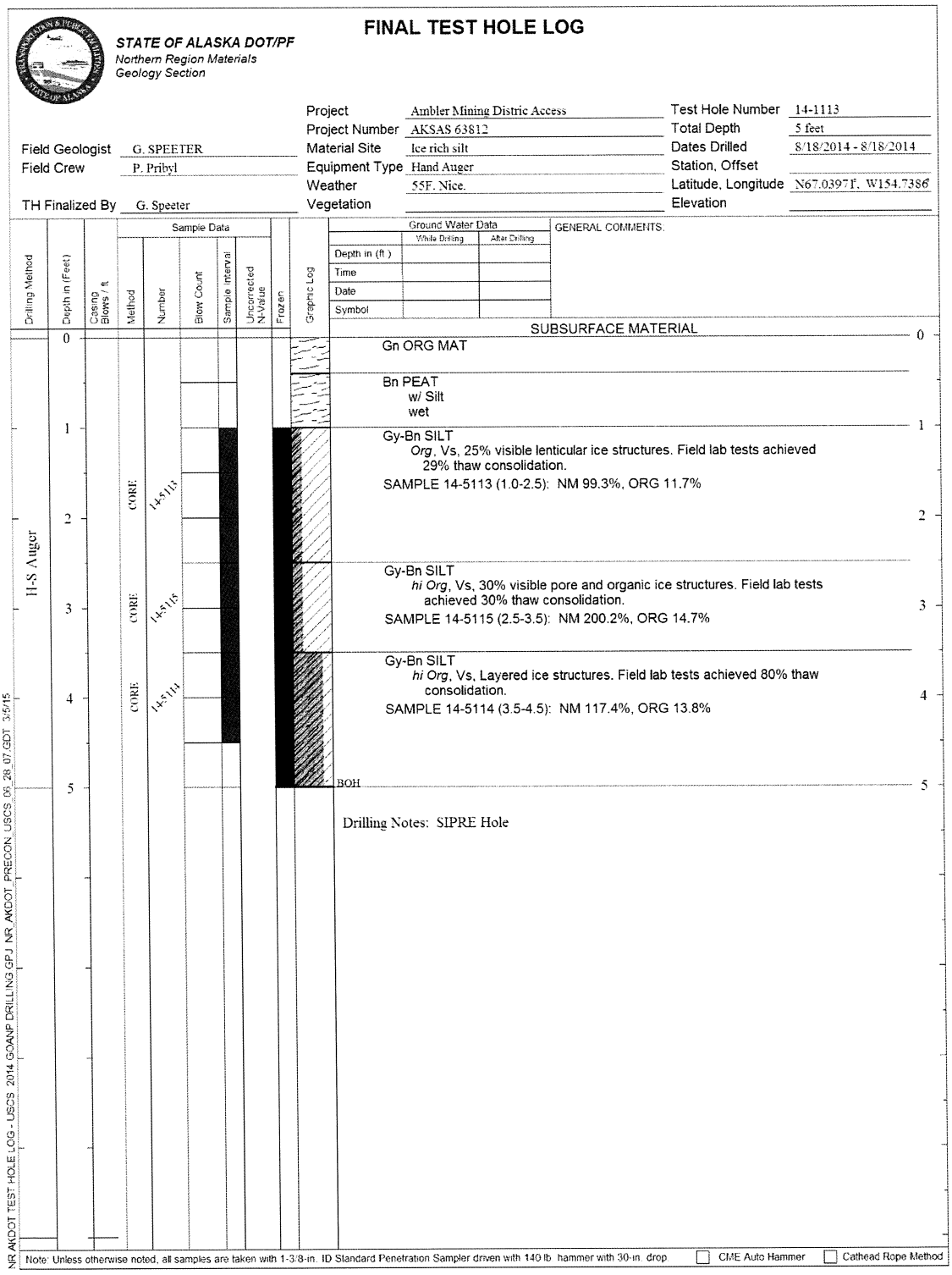
0 Gn-Bn ORG MAT
wet, Organic mat in water. Fen.

8 BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Fen
Equipment Type: Hand Auger
Weather: 55F. Nice.
Vegetation: Fen
Test Hole Number: 14-1112
Total Depth: 8 feet
Dates Drilled: 8/18/2014 - 8/18/2014
Station, Offset:
Latitude, Longitude: N67.02711°, W154.73668°
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft): 0.5
Time:
Date:
Symbol:
GENERAL COMMENTS:
Re-charge from drainage flowing through glacial drift deposits to north.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
Gn-Bn ORG MAT
wet, Organic mat in water. Fen.
BOH
0
1
2
3
4
5
6
7
8
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Ice rich silt
Equipment Type Hand Auger
Weather 55F. Nice.
Vegetation
Test Hole Number 14-1113
Total Depth 5 feet
Dates Drilled 8/18/2014 - 8/18/2014
Station, Offset
Latitude, Longitude N67.0397F, W154.7386
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
H-S Auger
CORE
14-5113
CORE
14-5115
CORE
14-5114
Gn ORG MAT
Bn PEAT
w/ Silt
wet
Gy-Bn SILT
Org, Vs, 25% visible lenticular ice structures. Field lab tests achieved 29% thaw consolidation.
SAMPLE 14-5113 (1.0-2.5): NM 99.3%, ORG 11.7%
Gy-Bn SILT
hi Org, Vs, 30% visible pore and organic ice structures. Field lab tests achieved 30% thaw consolidation.
SAMPLE 14-5115 (2.5-3.5): NM 200.2%, ORG 14.7%
Gy-Bn SILT
hi Org, Vs, Layered ice structures. Field lab tests achieved 80% thaw consolidation.
SAMPLE 14-5114 (3.5-4.5): NM 117.4%, ORG 13.8%
BOH
Drilling Notes: SIPRE Hole
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1114
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Ice rich silt and massive ice	Dates Drilled	8/19/2014 - 8/19/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Hot.	Latitude, Longitude	N67.03095, W154.72487
Vegetation		Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.
Test hole drilled adjacent small lake

Drilling Method: S-S Auger
Sample Data: Casing Blows / ft; Method: AUGER; Number: 14-5115.5; Blow Count; Sample Interval; Uncorrected N-Value; Frozen; Graphic Log

SUBSURFACE MATERIAL

0 — ORG MAT
Gy SILT
wet, Nbe

1

2

Wh-Bn ICE
w/ Silt
Vs, Massive ice structure with occasional silt in layers.

3

4

5

6 — SAMPLE 14-5115.5 (6.0-7.0): NM 105.4%

7

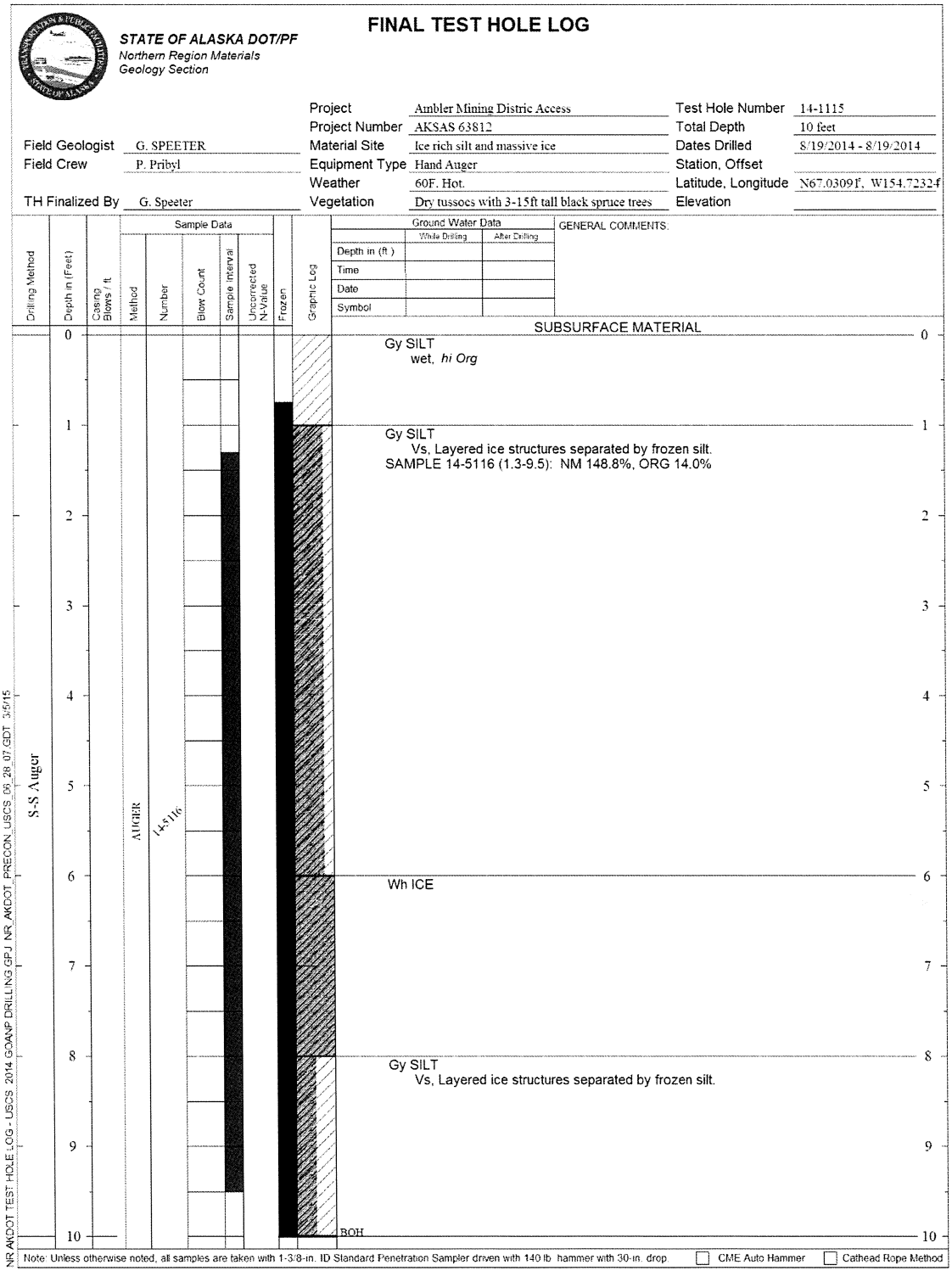
8

9

10 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Ice rich silt and massive ice
Equipment Type: Hand Auger
Weather: 60F. Hot.
Vegetation: Dry tussocs with 3-15ft tall black spruce trees
Test Hole Number: 14-1115
Total Depth: 10 feet
Dates Drilled: 8/19/2014 - 8/19/2014
Station, Offset:
Latitude, Longitude: N67.0309f, W154.7232f
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS:
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5116
Gy SILT
wet, hi Org
Gy SILT
Vs, Layered ice structures separated by frozen silt.
SAMPLE 14-5116 (1.3-9.5): NM 148.8%, ORG 14.0%
Wh ICE
Gy SILT
Vs, Layered ice structures separated by frozen silt.
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1116
Project Number	AKSAS 63812	Total Depth	8 feet
Material Site	Ice rich silt and massive ice	Dates Drilled	8/19/2014 - 8/19/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Hot.	Latitude, Longitude	N67.03095, W154.72148
Vegetation	Dry tussocs with 3-15ft tall black spruce trees	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

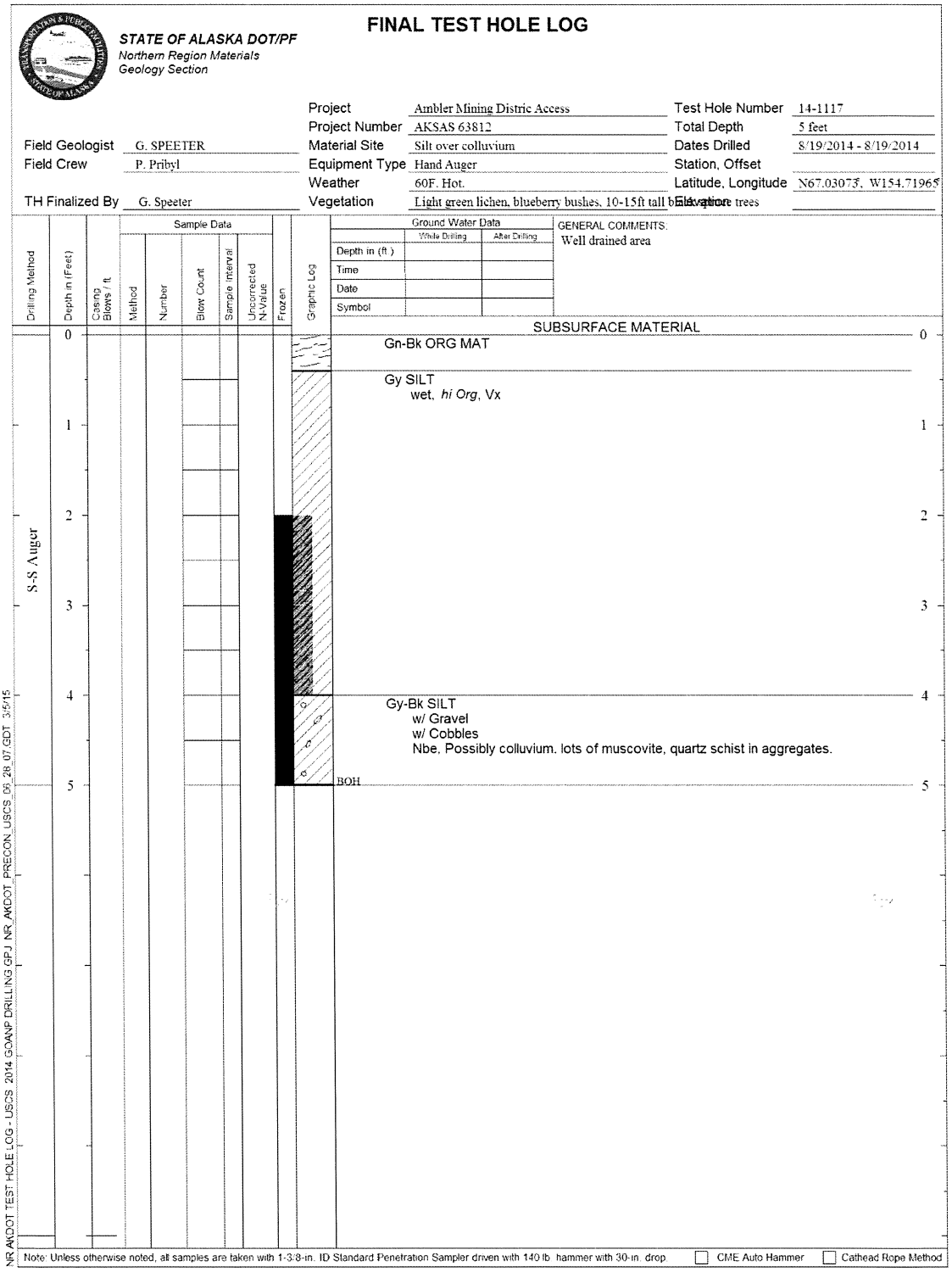
Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5117						Gn-Bn ORG MAT
										Gy SILT *hi Org*
	1									Gy SILT *Org*, Vs, Cm scale reticulate ice structures. 50 to 75% VI. SAMPLE 14-5117 (1.0-5.0): NM 59.4%
	2									
	3									
	4									
	5									Gy SILT *Org*, Cm scale reticulate ice structures.
	6									
	7									
	8									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Silt over colluvium
Equipment Type Hand Auger
Weather 60F. Hot.
Vegetation Light green lichen, blueberry bushes, 10-15ft tall bl[illegible] trees
Test Hole Number 14-1117
Total Depth 5 feet
Dates Drilled 8/19/2014 - 8/19/2014
Station, Offset
Latitude, Longitude N67.03073, W154.71965
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Sample Data
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS:
Well drained area
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
Gn-Bk ORG MAT
Gy SILT
wet, hi Org, Vx
Gy-Bk SILT
w/ Gravel
w/ Cobbles
Nbe, Possibly colluvium. lots of muscovite, quartz schist in aggregates.
BOH
0
1
2
3
4
5
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR_AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1118
Project Number	AKSAS 63812	Total Depth	3 feet
Material Site	Colluvium	Dates Drilled	8/19/2014 - 8/19/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Hot.	Latitude, Longitude	N67.03082', W154.71844'
Vegetation	Light green lichen. 7-15 foot tall black spruce trees	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

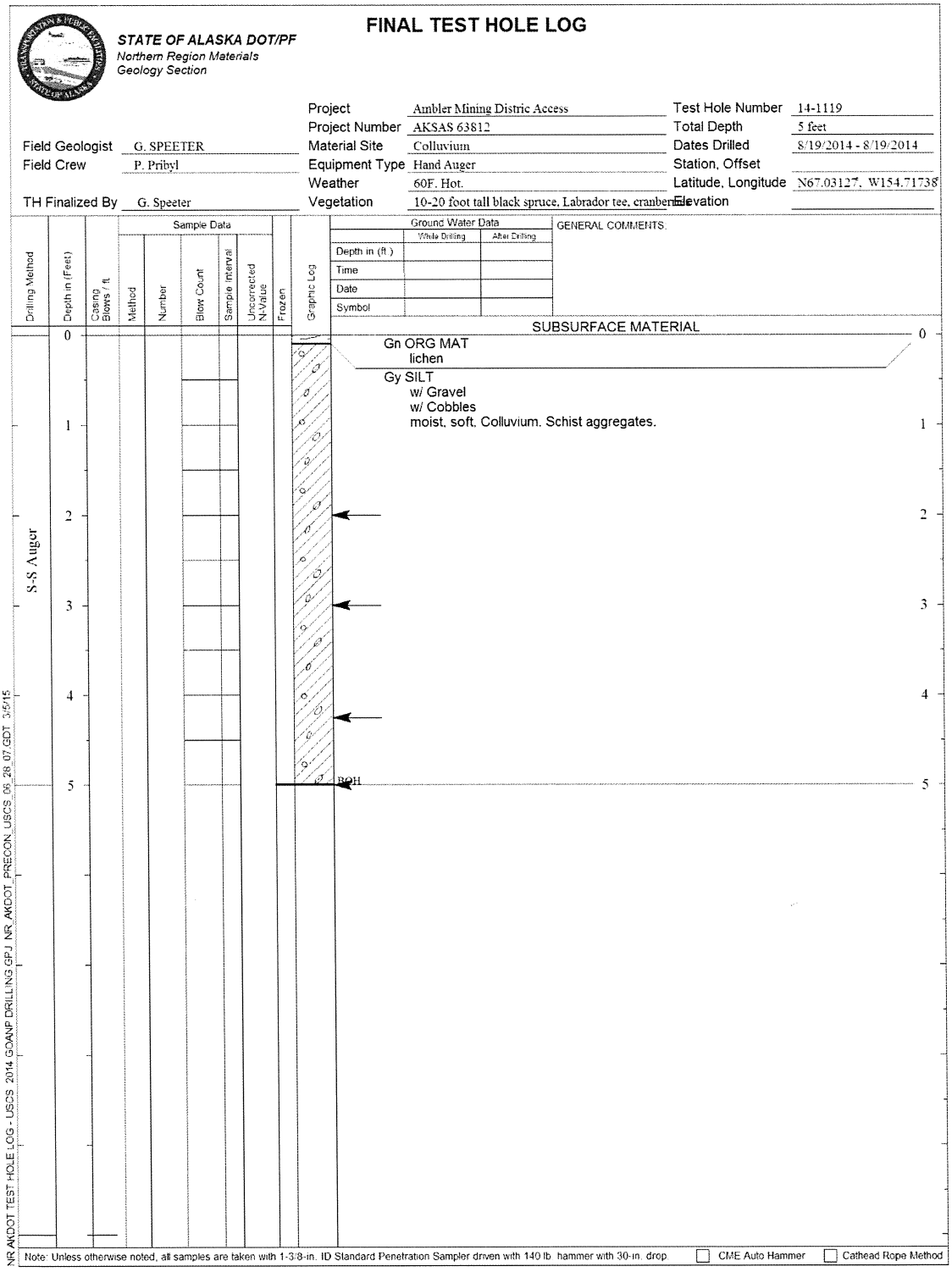
Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn-Bn ORG MAT
	1									Gy-Bn SILT w/ Gravel w/ Cobbles and Boulders wet, *Org*, colluvium. Roots.
	2									
	3									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Colluvium
Equipment Type Hand Auger
Weather 60F. Hot.
Vegetation 10-20 foot tall black spruce, Labrador tee, cranberry
Test Hole Number 14-1119
Total Depth 5 feet
Dates Drilled 8/19/2014 - 8/19/2014
Station, Offset
Latitude, Longitude N67.03127, W154.71738
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
Gn ORG MAT
lichen
Gy SILT
w/ Gravel
w/ Cobbles
moist, soft. Colluvium. Schist aggregates.
BOH
0
1
2
3
4
5
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1120
Project Number	AKSAS 63812	Total Depth	5 feet
Field Geologist	G. SPEETER	Material Site	Colluvium	Dates Drilled	8/19/2014 - 8/19/2014
Field Crew	P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
		Weather	60F. Hot.	Latitude, Longitude	N67.03212°, W154.71815°
TH Finalized By	G. Speeter	Vegetation	Birch, Black Spruce, Aspen, Willows	Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Slides and small drainages. Trees show evidence of solifluction creep

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT lichen
										Gy SILT w/ Gravel w/ Cobbles moist, soft. Colluvium. Schist aggregates.
	1									
	2									
	3									
	4									
	5									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1121
Project Number	AKSAS 63812	Total Depth	3 feet
Field Geologist: G. SPEETER	Material Site	Silt over colluvium	Dates Drilled	8/19/2014 - 8/19/2014
Field Crew: P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
	Weather	60F. Hot.	Latitude, Longitude	N67.03167, W154.72002
TH Finalized By: G. Speeter	Vegetation	Black spruce, willows, lichen, deep organic mat.	Elevation	

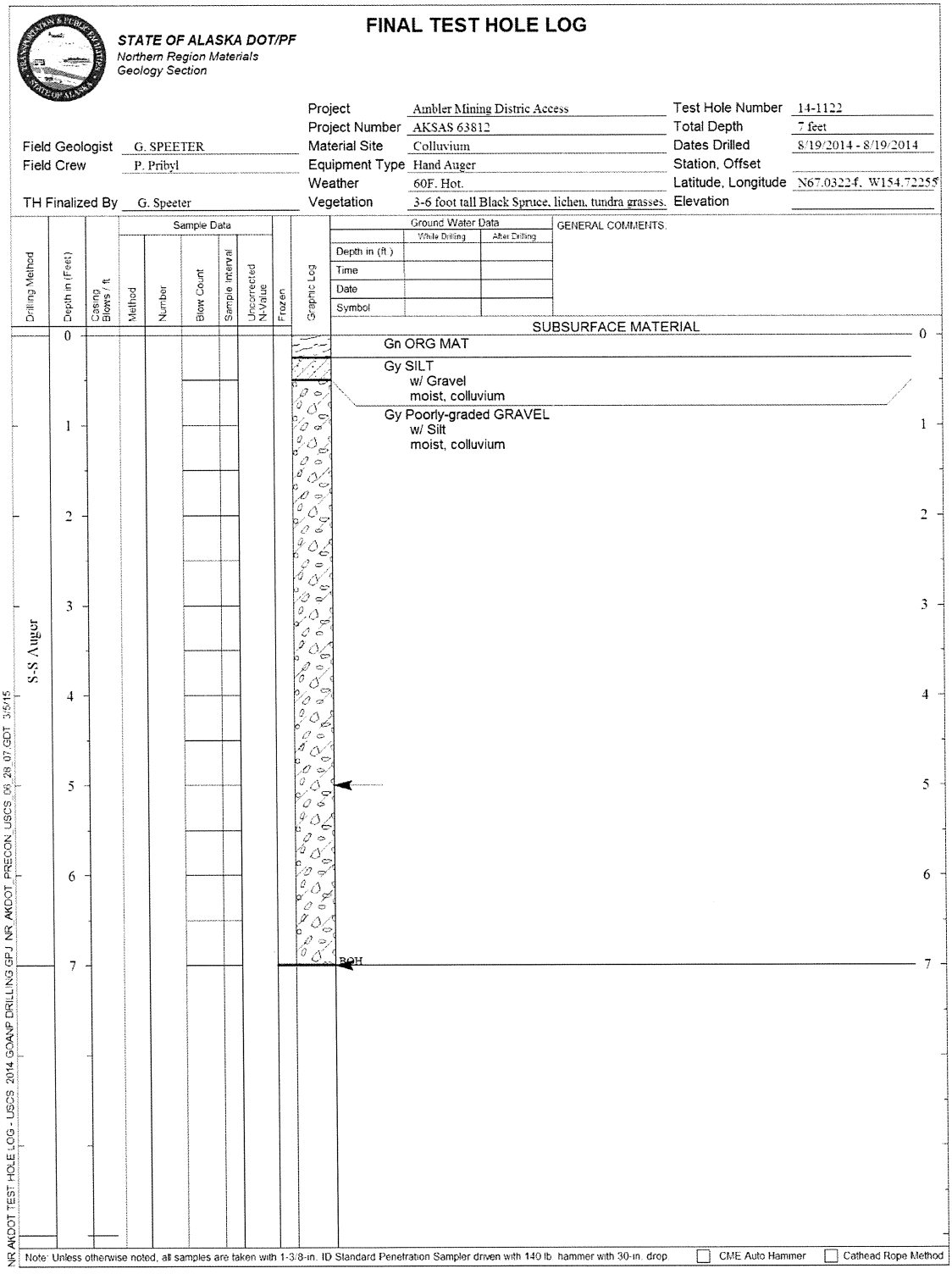
Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT
										Bn SILT wet
	1									Gy SILT w/ Gravel w/ Cobbles wet, colluvium
	2									
	3									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Colluvium
Equipment Type Hand Auger
Weather 60F. Hot.
Vegetation 3-6 foot tall Black Spruce, lichen, tundra grasses.
Test Hole Number 14-1122
Total Depth 7 feet
Dates Drilled 8/19/2014 - 8/19/2014
Station, Offset
Latitude, Longitude N67.0322-f, W154.72255
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Sample Data
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
Gn ORG MAT
Gy SILT
w/ Gravel
moist, colluvium
Gy Poorly-graded GRAVEL
w/ Silt
moist, colluvium
S-S Auger
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1123
Project Number	AKSAS 63812	Total Depth	7.5 feet
Material Site	Ice rich silt and massive ice	Dates Drilled	8/19/2014 - 8/19/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Hot.	Latitude, Longitude	N67.03223, W154.7238
Vegetation	Tussocs, grasses, 3-10 foot tall Black Spruce.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)	1.0	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS.

Drilling Method: S-S Auger

Sample Data: Casing Blows / ft | Method | Number | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

Depth in (Feet)	SUBSURFACE MATERIAL
0	Gn ORG MAT
	Gy SILT Nbn
2	Wh ICE w/ Silt
7	based on drill reaction
	BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1124
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Ice rich silt and massive ice	Dates Drilled	8/19/2014 - 8/19/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Hot.	Latitude, Longitude	N67.03235, W154.72554
Vegetation	Tussocs, Grasses, and 3-10 foot Black Spruce	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Sample Data: Casing Blows / ft | Method: AUGER | Number: 14-5118 | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

SUBSURFACE MATERIAL

0 Gn ORG MAT

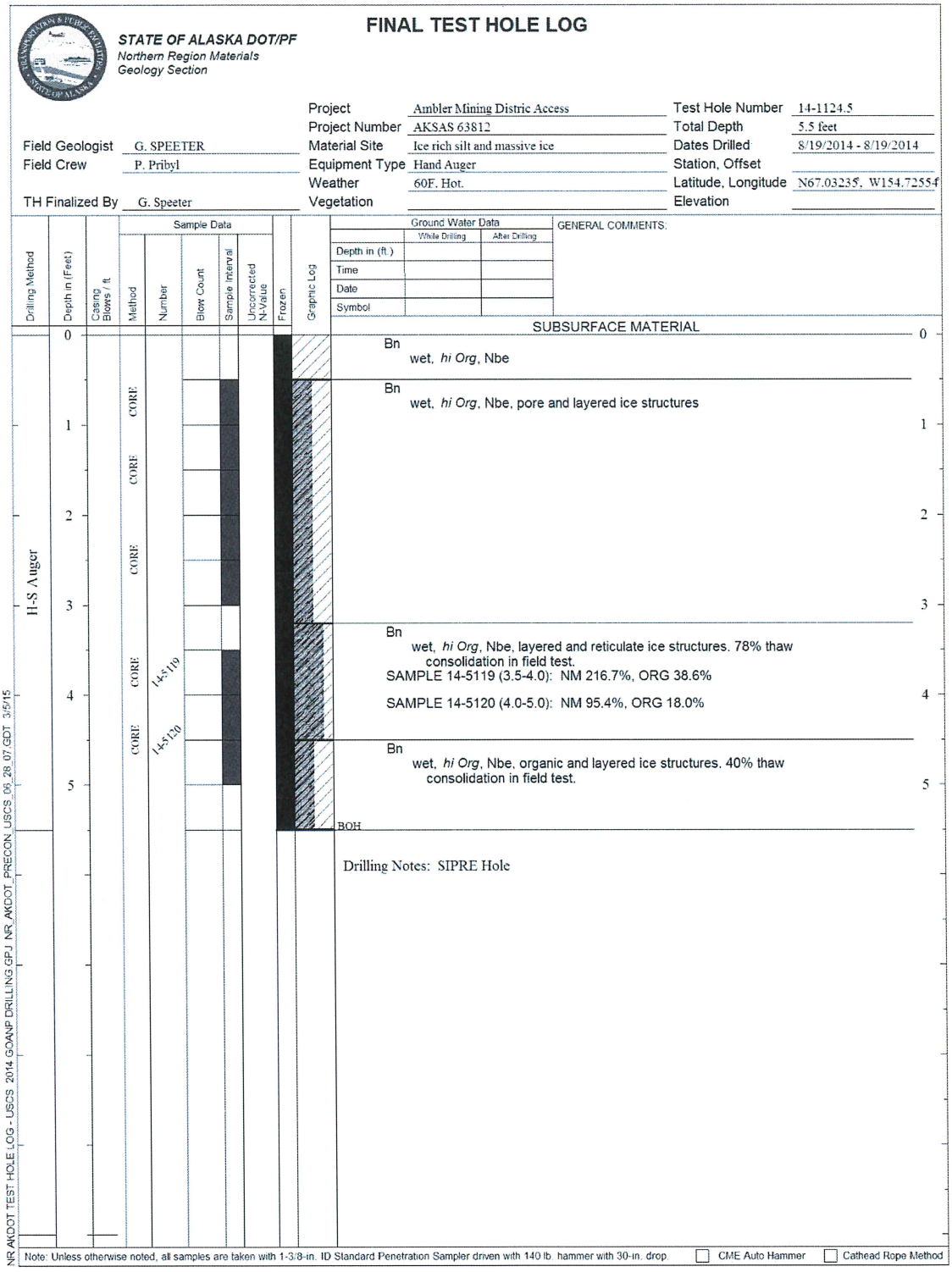
Gy SILT
Vs, Stratified ice structures
SAMPLE 14-5118 (0.5-5.0): NM 86.9%, ORG 17.9%

7 BOH

Drilling Notes: Installed NPS S/N10580601 HOBO logger

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06_28_07.GDT 3/5/15



FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1124.5
Project Number	AKSAS 63812	Total Depth	5.5 feet
Material Site	Ice rich silt and massive ice	Dates Drilled	8/19/2014 - 8/19/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Hot.	Latitude, Longitude	N67.03235', W154.7255
Vegetation		Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
H-S Auger	0		CORE							Bn wet, *hi Org*, Nbe
	1		CORE							Bn wet, *hi Org*, Nbe, pore and layered ice structures
	2		CORE							
	3		CORE	14-5119						Bn wet, *hi Org*, Nbe, layered and reticulate ice structures. 78% thaw consolidation in field test. SAMPLE 14-5119 (3.5-4.0): NM 216.7%, ORG 38.6%
	4		CORE	14-5120						SAMPLE 14-5120 (4.0-5.0): NM 95.4%, ORG 18.0%
	5									Bn wet, *hi Org*, Nbe, organic and layered ice structures. 40% thaw consolidation in field test.
										BOH

Drilling Notes: SIPRE Hole

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

Area 1 Laboratory Data

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Ambler Mining Distric Access
PROJECT NUMBER:	63812
AKSAS NUMBER:	G. Speeter
SAMPLED BY:	Area 1 GOANP
MATERIAL SOURCE:	

TEST HOLE NUMBER		14-1101	14-1101	14-1101	14-1102	14-1102	14-1103	14-1104
DEPTH (feet)		1.3-3.0	7.0-9.0	13.0-14.5	0.5-2.0	2.5-3.5	3.5-5.0	2.0-4.5
LATITUDE		N67.03971°	N67.03971°	N67.03971°	N67.03786°	N67.03786°	N67.03689°	N67.03584°
LONGITUDE		W154.7386°	W154.7386°	W154.7386°	W154.73825°	W154.73825°	W154.7377°	W154.73688°
LAB NUMBER		**14-5102**	**14-5103**	**14-5104**	**14-5105**	**14-5106**	**14-5107**	**14-5108**
DATE SAMPLED		17-Aug-14	17-Aug-14	17-Aug-14	17-Aug-14	17-Aug-14	17-Aug-14	17-Aug-14
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"							
	0.375"							
	#4							
	#8		99			97		
	#10		99			96		
	#16	99	97		99	94		
	#30	95	90		98	92		
Sand	**#40**	94	87	99	97	90		
	#50	91	82	98	95	88	98	99
	#60	88	80	97	94	87	98	99
	#80	80	73	94	90	84	96	98
	#100	74	69	93	86	82	95	97
Silt/Clay	**#200**	57.5	55.7	86.9	73.6	72.5	88.0	91.5
Hydro	**0.02**							
	0.005							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV	NV	NV		NV
PLASTIC INDEX		NP	NP	NP	NP	NP		NP
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		SaSi	SaSi	SaSi	(SiSa)	(SiSa)	(Si)	(Si)
NATURAL MOISTURE		65.8	55.5	108.8	78.6	62.7	138.2	74.2
ORGANICS		12.4	10.7	10.1	15.6	9.0	15.8	13.5
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]	Org[1]	Org[1]	hi Org[1]	Org[1]	hi Org[1]	Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Ambler Mining Distric Access
PROJECT NUMBER:	63812
AKSAS NUMBER:	G. Speeter
SAMPLED BY:	Area 1 GOANP
MATERIAL SOURCE:	

TEST HOLE NUMBER		14-1105	14-1105	14-1106	14-1106	14-1107	14-1113	14-1113
DEPTH (feet)		1.0-5.0	5.0-6.5	1.0-2.0	3.5-5.0	3.0-5.0	1.0-2.5	3.5-4.5
LATITUDE		N67.03513°	N67.03513°	N67.03454°	N67.03454°	N67.03398°	N67.03971°	N67.03971°
LONGITUDE		W154.73642°	W154.73642°	W154.73523°	W154.73523°	W154.73368°	W154.7386°	W154.7386°
LAB NUMBER		**14-5109**	**14-5110**	**14-5111**	**14-5112**	**14-5113**	**14-5113**	**14-5114**
DATE SAMPLED		17-Aug-14	17-Aug-14	17-Aug-14	17-Aug-14	17-Aug-14	18-Aug-14	18-Aug-14
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"							
	0.375"		98					
	#4		96					
	#8							
	#10							
	#16		95					
	#30	99		99		99		
Sand	**#40**	98		98		99		
	#50	97		97		98		
	#60	97		96	99	97		
	#80	96		94	99	96		
	#100	96	86	92	98	95		
Silt/Clay	**#200**	92.1	80.5	79.0	93.3	90.9		
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV	NV	NV		
PLASTIC INDEX		NP	NP	NP	NP	NP		
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si)	(Si w/Sa)	(Si)	(Si w/Sa)	(Si)	(Si)	(Si)
NATURAL MOISTURE		69.2	50.6	81.0	66.4	57.0	99.3	117.4
ORGANICS		11.1	8.8	14.1	12.0	11.9	11.7	13.8
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]	Org[1]	Org[1]	Org[1]	Org[1]	Org[1]	Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Ambler Mining Distric Access
PROJECT NUMBER: 63812
AKSAS NUMBER:
SAMPLED BY: G. Speeter
MATERIAL SOURCE: Area 1 GOANP

TEST HOLE NUMBER		14-1113	14-1114	14-1116	14-1124	14-1124.5	14-1124.5	
DEPTH (feet)		2.5-3.5	6.0-7.0	1.0-5.0	0.5-5.0	3.5-4.0	4.0-5.0	
LATITUDE		N67.03971°	N67.03095°	N67.03098°	N67.03235°	N67.03235°	N67.03235°	
LONGITUDE		W154.7386°	W154.72487°	W154.72148°	W154.72554°	W154.72554°	W154.72554°	
LAB NUMBER		**14-5115**	**14-5115.5**	**14-5117**	**14-5118**	**14-5119**	**14-5120**	
DATE SAMPLED		18-Aug-14	19-Aug-14	19-Aug-14	19-Aug-14	19-Aug-14	19-Aug-14	
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"							
	0.375"							
	#4							
	#8							
	#10							
	#16							
	#30							
Sand	**#40**							
	#50							
	#60							
	#80							
	#100							
Silt/Clay	**#200**							
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT								
PLASTIC INDEX								
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si)	(Si)	(Si)	(Si)	(Si)	(Si)	
NATURAL MOISTURE		200.2	105.4	59.4	86.9	216.7	95.4	
ORGANICS		14.7			17.9	38.6	18.0	
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]			hi Org[1]	hi Org[1]	hi Org[1]	

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

Area 2

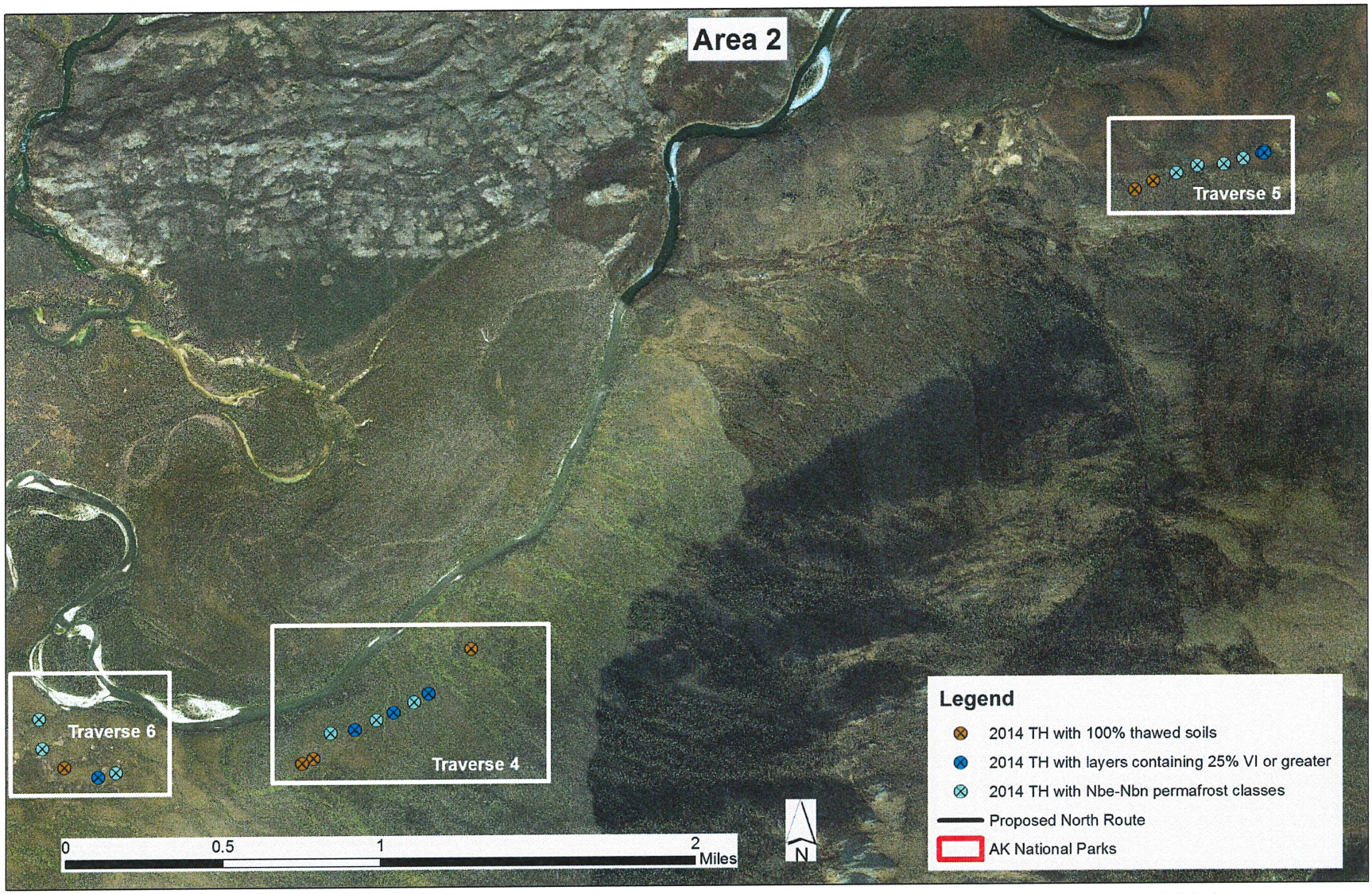


Figure 11. Overview map of Area 2. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Area 2 (Figure 11) is located south of widespread glacial outwash planes and ice contact deposits around Walker Lake north of the Kobuk River. South of the Kobuk River the proposed north route travels through Traverse 4 (Figure 12) and 5 (Figure 13) which documented glacial drift deposits composed of windblown loess over silty sand that was underlain by colluvial material, regolyth, or shallow metamorphic bedrock and silty gravel or alluvial deposits blanketed by loess or alluvial silt (Traverse 6, Figure 16).

Traverse 4

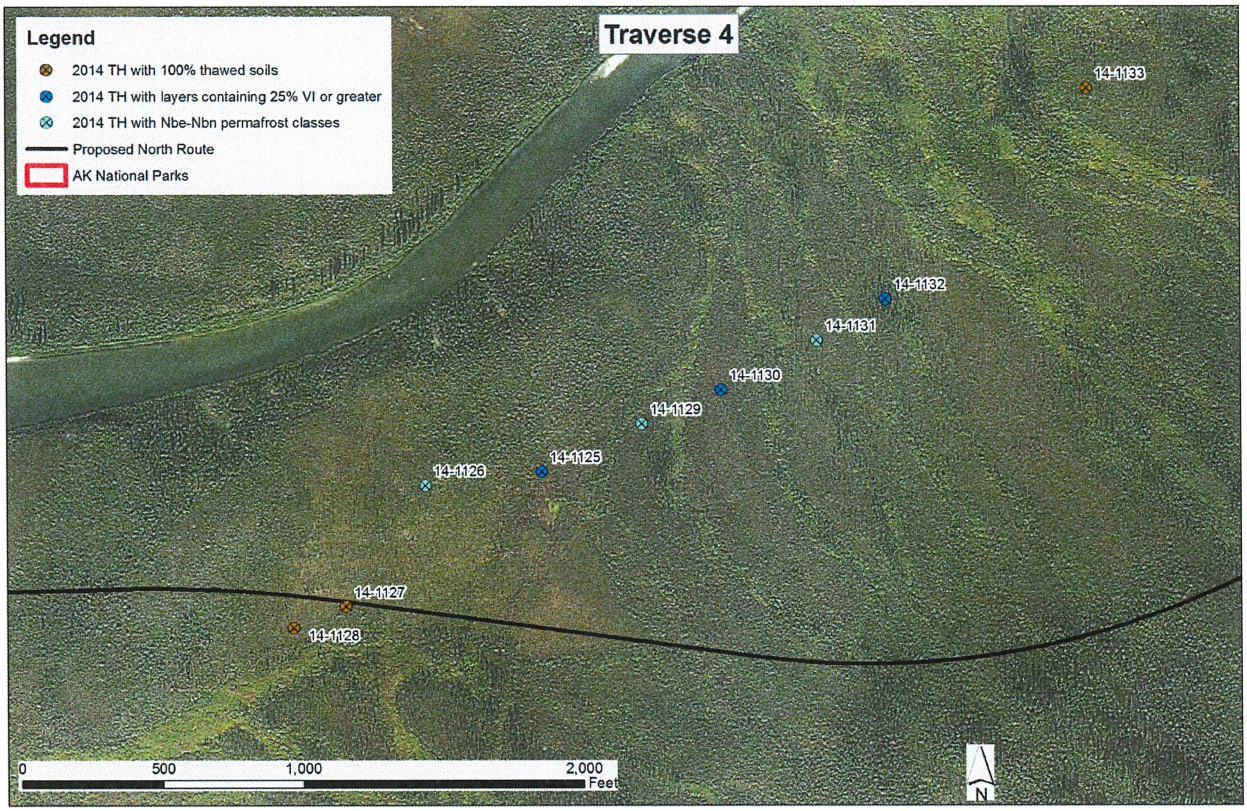


Figure 12. Traverse 4. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Table 6. Traverse 4.

Traverse 4				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1125	SS	15' thermistor and data logger	Deep ice rich silt over glacial outwash (silty gravel)	15
14-1126	SS	none	Silt over glacial outwash/aluuvium (silty gravel)	7
14-1127	SS	none	Silt over glacial outwash/alluvium (silty sand with gravel)	7
14-1128	SS	none	Silt over glacial outwash/alluvium (Silty sand)	7.5
14-1129	SS	none	Silt >10 feet deep.	10
14-1130	SS	none	Ice rich silt	5
14-1131	SS	none	Silt over bedrock	5.5
14-1132	SS	none	Silt over bedrock	5
14-1133	SS	none	Shallow silt over alluvial material (poorly-graded sand)	5.5

Test holes in Traverse 4 (Figure 12 and Table 6) intercepted frozen silt and/or thawed silt over glacial outwash/alluvium on the west end of the traverse and frozen silt over bedrock (mostly graphite schist or phyllite) on the east side of traverse. Bedrock exposures along the Kobuk River north of Traverse 4 and sporadic bedrock outcrops between Traverse 4 and 5 suggest shallow bedrock is present from the east side of Traverse 4 to the west side of Traverse 5. Bedrock was observed to be covered by approximately 0 to 15 feet of overburden where exposed along Kobuk River. Slate, phyllite, and graphite, muscovite, quartz, schist are among lithologies present in bedrock outcrops on the Kobuk River. Bedrock was field classified as medium weak and finely foliated with close fracture spacing, moderate weathering, quartz boudins, and microcrystalline quartz veins. Design relevant data collected by Traverse 4 is as follows:

- TH14-1125 intercepted approximately 13 feet of frozen silt with massive ice. A thermistor with data logger was installed in this test hole. Data from thermistor in TH14-1125 is posted below.
- Temperature data collected from TH14-1125 suggest massive ice and frozen soil in the area is potentially thermally unstable because temperatures are within 0.5 to 0.75°F below freezing.
- Thermally unstable ice intercepted by test holes in Traverse 4 will be more susceptible to thawing if the organic mat is compressed and/removed during the construction process. Soils containing massive ice intercepted by test holes in Traverse 4 are thaw-unstable.

Table 7. Temperature data from TH14-1125. Measurements taken 8-27-14

Sensor number	Depth (Feet)	Temperature (°C)
10	1	4.45
11	3	-0.19
12	5	-0.31
13	7	-0.38
14	9	-0.44
15	11	-0.44
16	13	-0.50

Traverse 5

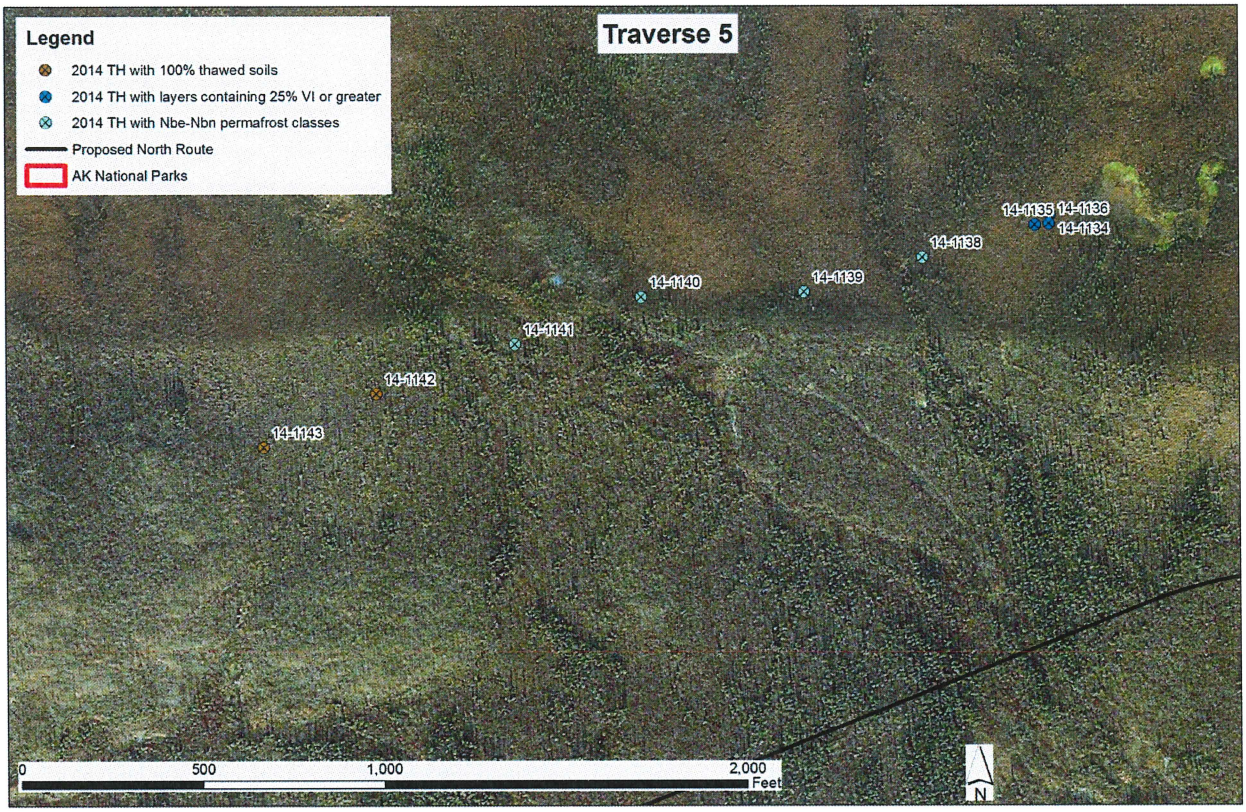


Figure 13. Traverse 5. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Table 8. Traverse 5.

Traverse 5				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1134	SS	none	Deep silt with massive ice over clay	13
14-1135	SS	NPS S/N 165806021 Data Logger	Shallow silt with massive ice over alluvial material (silty sand with gravel)	6
14-1136	SS	Temporary thermistor installed to 12.5 feet	Deep silt with massive ice over clay	15
14-1138	SS	none	Frozen silt over colluvium and bedrock (graphite schist)	10
14-1139	SS	none	Silt and frozen silt > 10 feet deep.	10
14-1140	SS	none	Silt and frozen silt > 10 feet deep.	10
14-1141	SS	none	Silt and frozen silt > 10 feet deep.	10
14-1142	SS	none	Thawed silt over colluvium and bedrock (graphite schist)	5.5
14-1143	SS	none	Thawed silt over colluvium and bedrock (graphite schist)	5

Test holes in Traverse 5 (Figure 13 and Table 8) intercepted silt with massive ice on the east end of the traverse, thawed or frozen (without massive ice) in the middle of the traverse, and thawed silt over colluvium or bedrock on the west end of the traverse. Colluvial exposures and bedrock exposures throughout the east side of Area 2 (Figure 11) suggest shallow depths to bedrock. Design relevant data collected by Traverse 5 is as follows:

- Temperature data from data logger in TH14-1135 indicates that ice rich silt and massive ice in this area was 31.491°F on 8-27-14. Ice rich soil intercepted by TH14-1135 contained massive ice at depths of <5 feet. The shallow depth and relatively warm temperature of massive ice in this area suggests that it is potentially thermally unstable. Compression of the organic mat during construction could reduce insulating ability of the organic mat and result in thawing (Figures 14 and 15).
- Temperature data from a temporary thermistor installed in TH14-1136 indicate that temperature of frozen soils in the area remain greater than or equal to 1°F below freezing until a depth of approximately 12 feet below the surface.

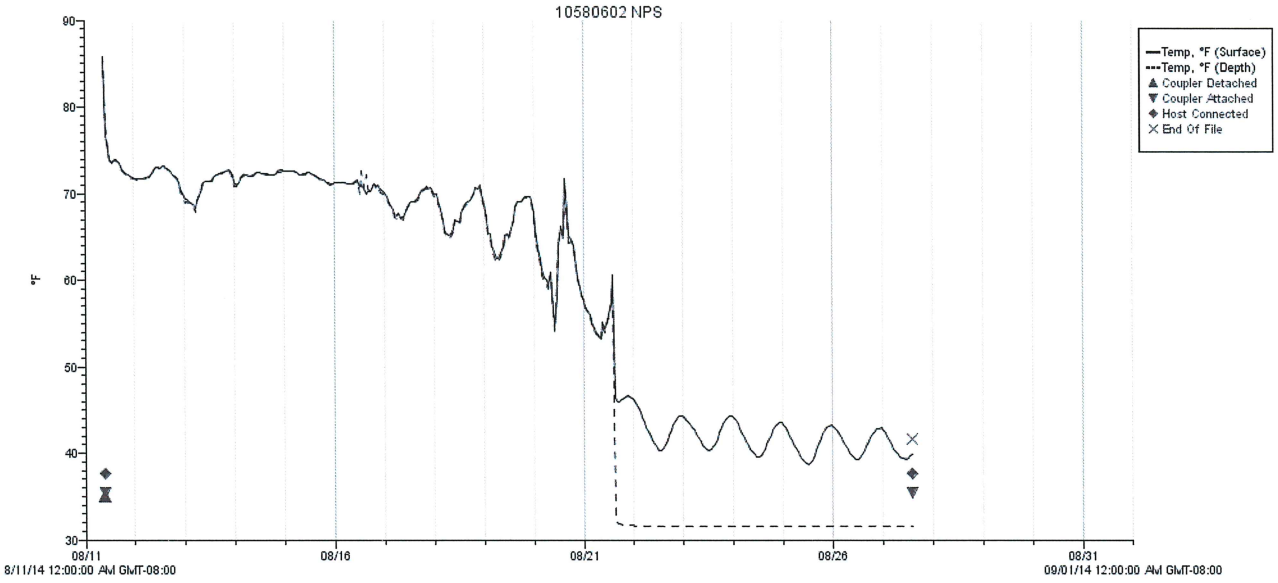


Figure 14. Temperature data from 14-1135 measured 8-27-14.

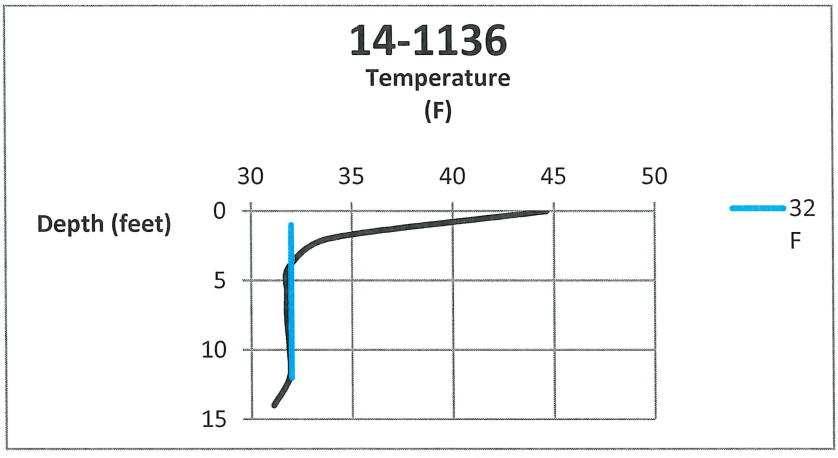


Figure 15. Temperature data from 14-1136 measured 8-17-14.

Traverse 6

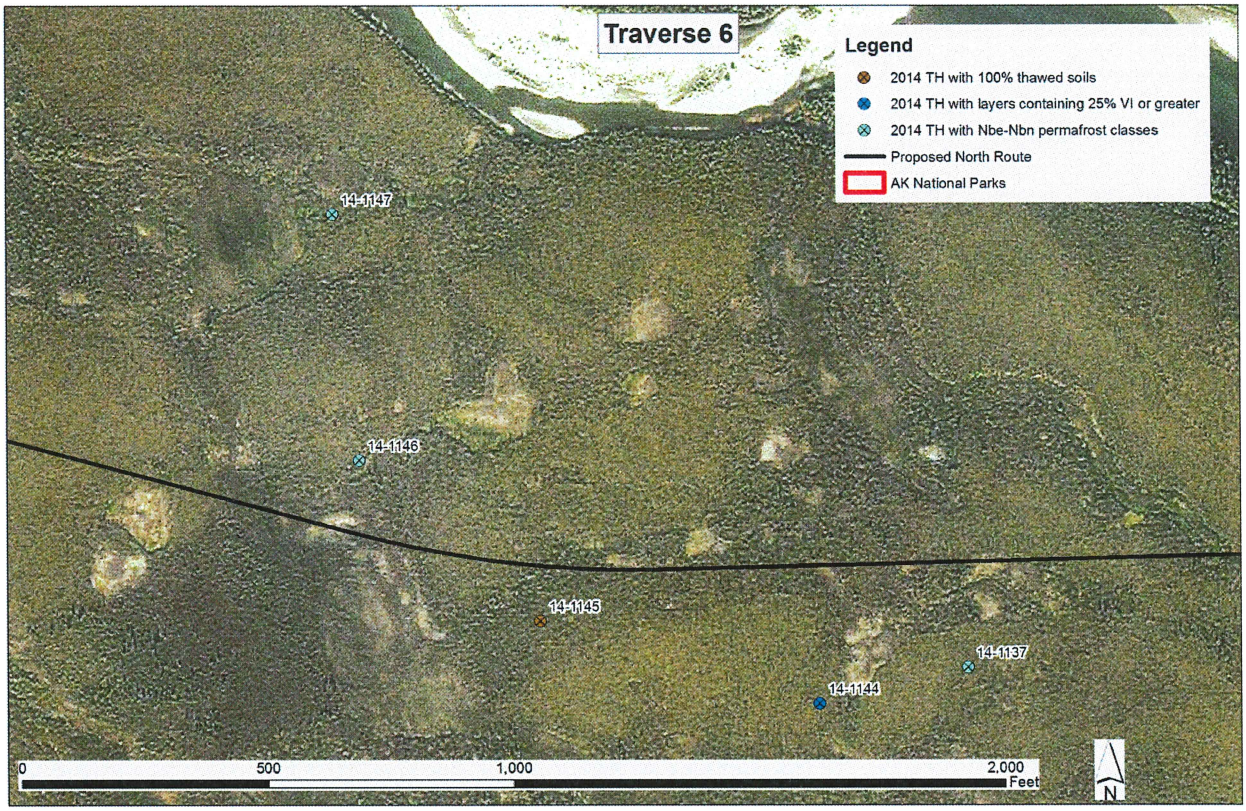


Figure 16. Traverse 6. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Table 9. Traverse 6.

Traverse 6				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1137	SS	NPS S/N 105805991 Data Logger	Frozen silt	6.5
14-1144	SS	none	Frozen silt over alluvial material (gravel)	6.5
14-1145	SS	none	Thawed silt over alluvial material (gravel)	6
14-1146	SS	none	Frozen silt over alluvial material	5
14-1147	SS	none	Frozen silt over alluvial material	3

Test holes in Traverse 6 (Figure 16 and Table 9) intercepted mostly frozen silt above alluvial material. Frozen silt along Traverse 6 was generally equal to or less than six feet deep and composed of Nbn or Nbe (Appendix A) or pore ice permafrost classes. Design relevant data collected by Traverse 6 is as follows:

- TH14-1144 is the only test hole in Traverse 6 that intercepted massive ice. TH14-1144 intercepted a 5 foot thick layer of silt with 75% visible thaw un-stable segregated ice.

- The data logger installed in TH14-1137 (Figure 17) recorded temperatures of 31.239 on 8-27-14. The relatively warm temperature of frozen soil in this area suggests that it is borderline thermally unstable.

- Thermally unstable ice intercepted by test holes in Traverse 6 will be more susceptible to thawing if the organic mat is compressed and/removed during the construction process. Soils containing massive ice intercepted by test holes in Traverse 6 are thaw-unstable.

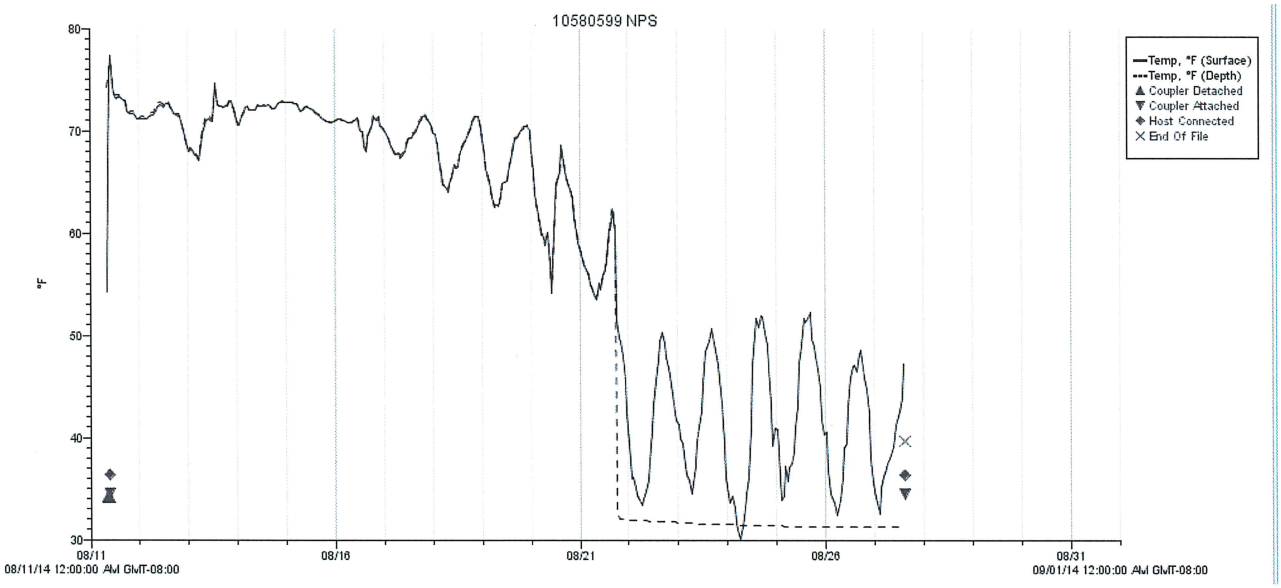


Figure 17. Temperature data from 14-1137 collected 8-27-14.

Area 2 Photographs



Figure 18. Data logger installed in TH14-1125.

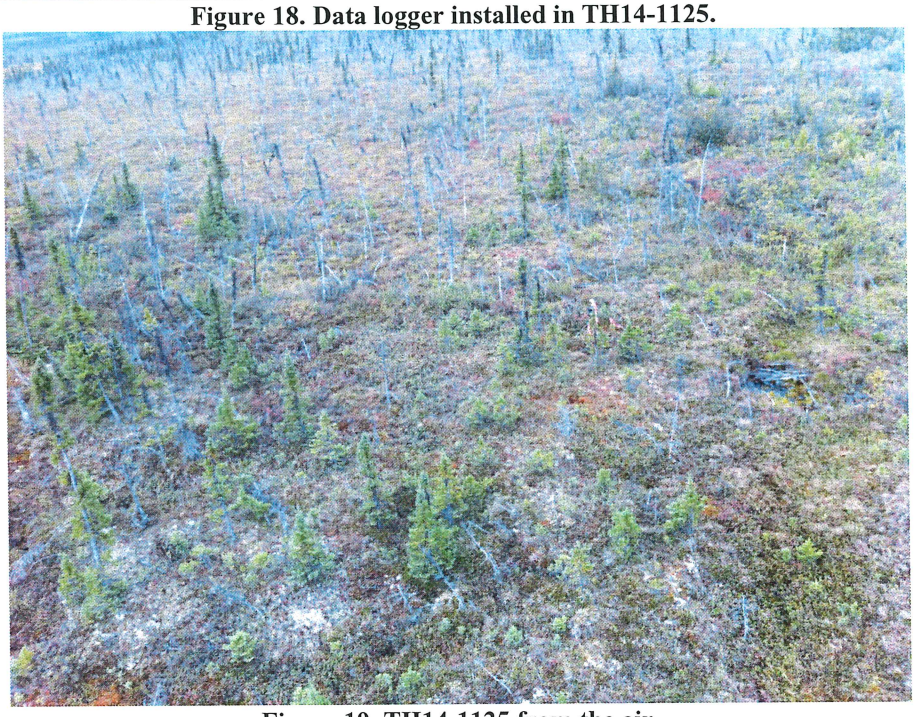


Figure 19. TH14-1125 from the air.



Figure 20. Bedrock outcrop on The Kobuk River northeast of Traverse 4. Outcrop consists of slate, phyllite, and muscovite or graphite schist that is finely foliated, medium weak, moderately weathered, with close fracture spacing, abundant quartz boudins and microcrystalline quartz veins and 0 to 10-feet of silty overburden. Foliations orientations had east-west strikes and dips of 29 to 48 degrees south.



Figure 21. Looking north at alluvial deposits on the Kobuk River north of TH14-1141.

Area 2 Test Hole Logs

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1125
Project Number	AKSAS 63812	Total Depth	15 feet
Field Geologist	G. SPEETER	Material Site	Deep ice rich silt over glacial outwash	Dates Drilled	8/20/2014 - 8/20/2014
Field Crew	P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
		Weather	60F. Breeze.	Latitude, Longitude	N67.01936, W154.29814
TH Finalized By	G. Speeter	Vegetation	Tussocs, Grasses, scattered Black Spruce.	Elevation	

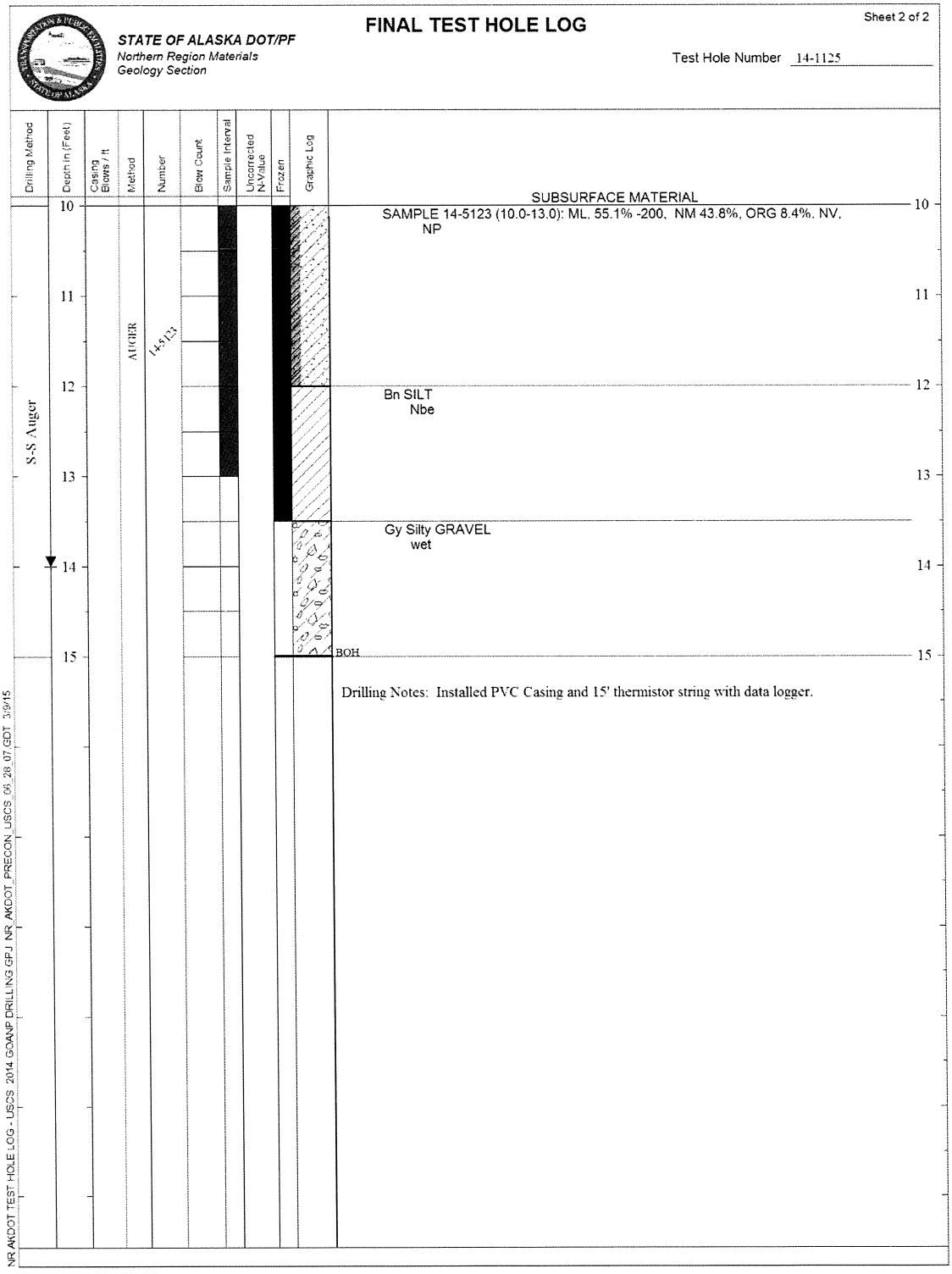
Ground Water Data	While Drilling	After Drilling
Depth in (ft.)	14.0	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS:
20M from that lake

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Sample Data: Number	Sample Data: Blow Count	Sample Data: Sample Interval	Sample Data: Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5121						Gn ORG MAT
	1									Bn SILT Vs, pore and layered ice structures SAMPLE 14-5121 (0.5-4.5): NM 118.8%, ORG 4.3%
	2									
	3									
	4									
	5									SAMPLE 14-5122 (5.0-9.0): NM 95.1%, ORG 6.5%
	6		AUGER	14-5122						Bn SILT Vx, pore ice structures
	7									Bn SILT Vs, pore and layered ice structures
	8									Bn SILT w/ Sand Vx, pore ice structures
	9									
	10									

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06.28.07.GDT 3/9/15


FINAL TEST HOLE LOG
Sheet 2 of 2
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Test Hole Number 14-1125
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5123
SAMPLE 14-5123 (10.0-13.0): ML, 55.1% -200, NM 43.8%, ORG 8.4%, NV, NP
Bn SILT
Nbe
Gy Silty GRAVEL
wet
BOH
Drilling Notes: Installed PVC Casing and 15' thermistor string with data logger.
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/9/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1126
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Silt over glacial outwash/aluuvium	Dates Drilled	8/20/2014 - 8/20/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Breeze.	Latitude, Longitude	N67.01887, W154.30008
Vegetation	Tussocs, grasses, Black Spruce	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger
Depth in (Feet)
Casing Blows / ft
Sample Data: Method: AUGER; Number: 14-5124; Blow Count; Sample Interval; Uncorrected N-Value; Frozen
Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT
Nbe

Sandy SILT
hi Org, Nbe

1 — SAMPLE 14-5124 (1.0-4.0): ML, 68.7% -200, NM 44.7%, ORG 10.8%, NV, NP

2

3

4

Bn SILT
w/ Sand
Nbe, looks alluvial

5 — Gy Silty GRAVEL
Nbe

6

7 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1127
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Silt over glacial outwash/alluvium	Dates Drilled	8/20/2014 - 8/20/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Breeze.	Latitude, Longitude	N67.01822, W154.3028
Vegetation	Burned Black Spruce. deep dry tussocs, tundra gras	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

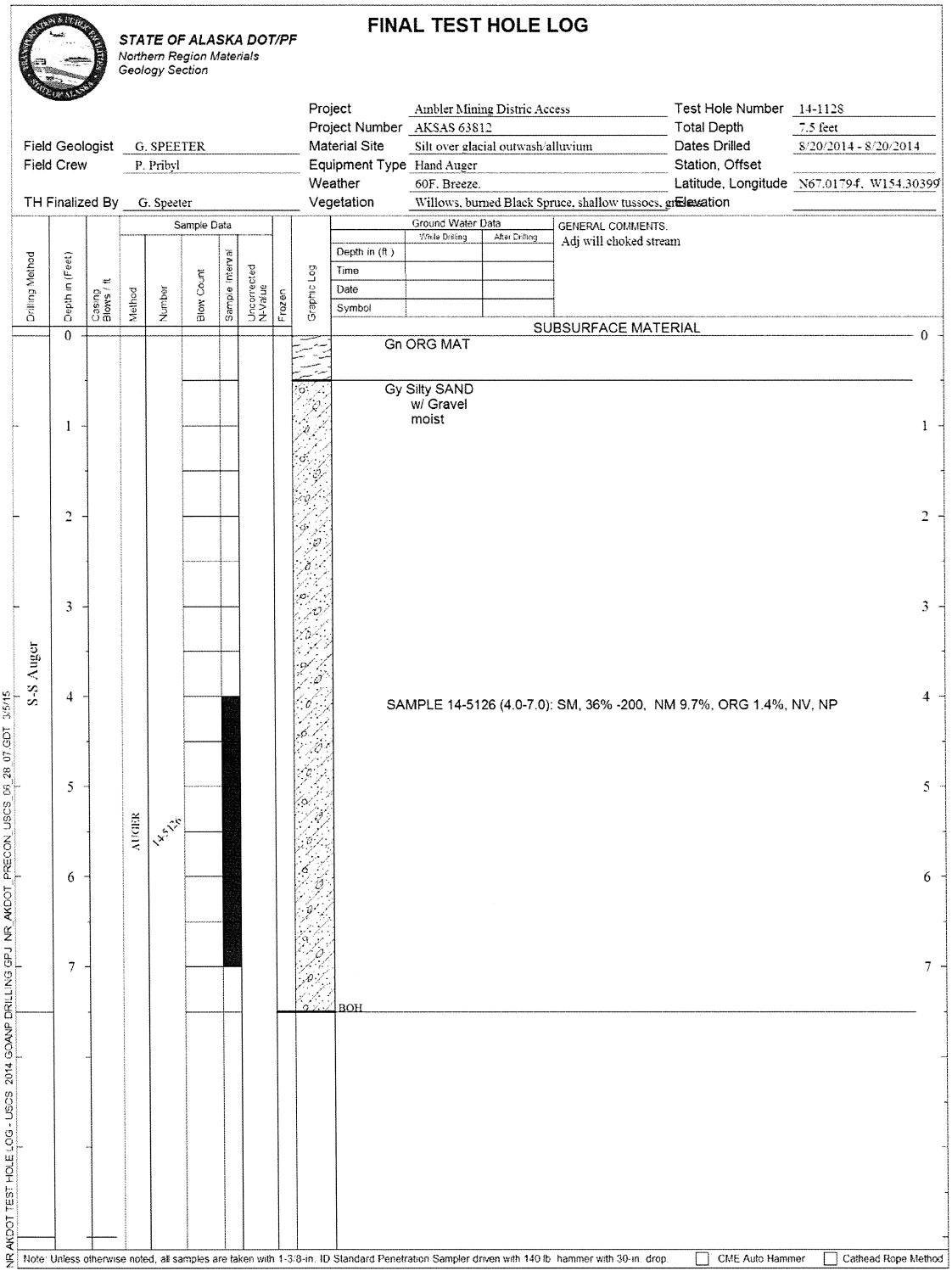
Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5125						Gn ORG MAT
	1									Gy SILT w/ Sand moist
	2									Bn Poorly-graded SAND w/ Silt & Gravel moist
	3									Gy Silty SAND w/ Gravel moist SAMPLE 14-5125 (2.5-6.5): SM, 37.8% -200. NM 23.8%, ORG 4.2%, NV, NP
	4									
	5									
	6									
	7									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Silt over glacial outwash/alluvium
Equipment Type Hand Auger
Weather 60F. Breeze.
Vegetation Willows, burned Black Spruce, shallow tussocs, grass
Test Hole Number 14-1128
Total Depth 7.5 feet
Dates Drilled 8/20/2014 - 8/20/2014
Station, Offset
Latitude, Longitude N67.0179-f, W154.30399
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS.
Adj will choked stream
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5126
Gn ORG MAT
Gy Silty SAND
w/ Gravel
moist
SAMPLE 14-5126 (4.0-7.0): SM, 36% -200, NM 9.7%, ORG 1.4%, NV, NP
BOH
0
1
2
3
4
5
6
7
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1129
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Silt >10 feet deep.	Dates Drilled	8/20/2014 - 8/20/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Breeze.	Latitude, Longitude	N67.0199-f, W154.29535
Vegetation	Scattered willows, scattered Black Spruce, lichen.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.
Drilled in minor drainage

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5127						Gn ORG MAT
	1									Bn SILT wet, *hi Org*
	6									Bn SILT w/ Sand Nbe SAMPLE 14-5127 (6.0-8.0): 72.9% -200, NM 59.8%, ORG 13.4%
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1130
Project Number	AKSAS 63812	Total Depth	5 feet
Field Geologist	G. SPEETER	Material Site	Ice rich silt	Dates Drilled	8/20/2014 - 8/20/2014
Field Crew	P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
		Weather	60F. Breeze.	Latitude, Longitude	N67.02026, W154.2934
TH Finalized By	G. Speeter	Vegetation	Willows, lichen, scattered Black Spruce	Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Drilled in willow choked drainage

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
	0									Gn ORG MAT
	1									Gy-Bn SILT *hi Org*, Nbn
	2									Gy SILT Vs, Layered ice structures. SAMPLE 14-5128 (2.5-5.0): NM 218.5%, ORG 26.9%
	3									
	4		AUGER	14-5L3						
	5									BOH Rd PEAT Refusal at 5.1 feet. Bedrock?

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1131
Project Number	AKSAS 63812	Total Depth	5.5 feet
Field Geologist: G. SPEETER	Material Site	Silt over bedrock	Dates Drilled	8/20/2014 - 8/20/2014
Field Crew: P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
	Weather	60F, Breeze.	Latitude, Longitude	N67.02078, W154.29117
TH Finalized By: G. Speeter	Vegetation	Willows, lichen, scattered Black Spruce	Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Drilled in willow choked drainage

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT
	1									Gy-Bn SILT *hi Org*, Nbn
	2									
	3									
	4									
	5									BOH Rd PEAT Refusal at 5.6 feet. Bedrock?

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1132
Project Number	AKSAS 63812	Total Depth	5.5 feet
Material Site	Silt over bedrock	Dates Drilled	8/20/2014 - 8/20/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Breeze.	Latitude, Longitude	N67.02117, W154.28943
Vegetation	10-20foot tall Black Spruce, lichen, cranberries	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

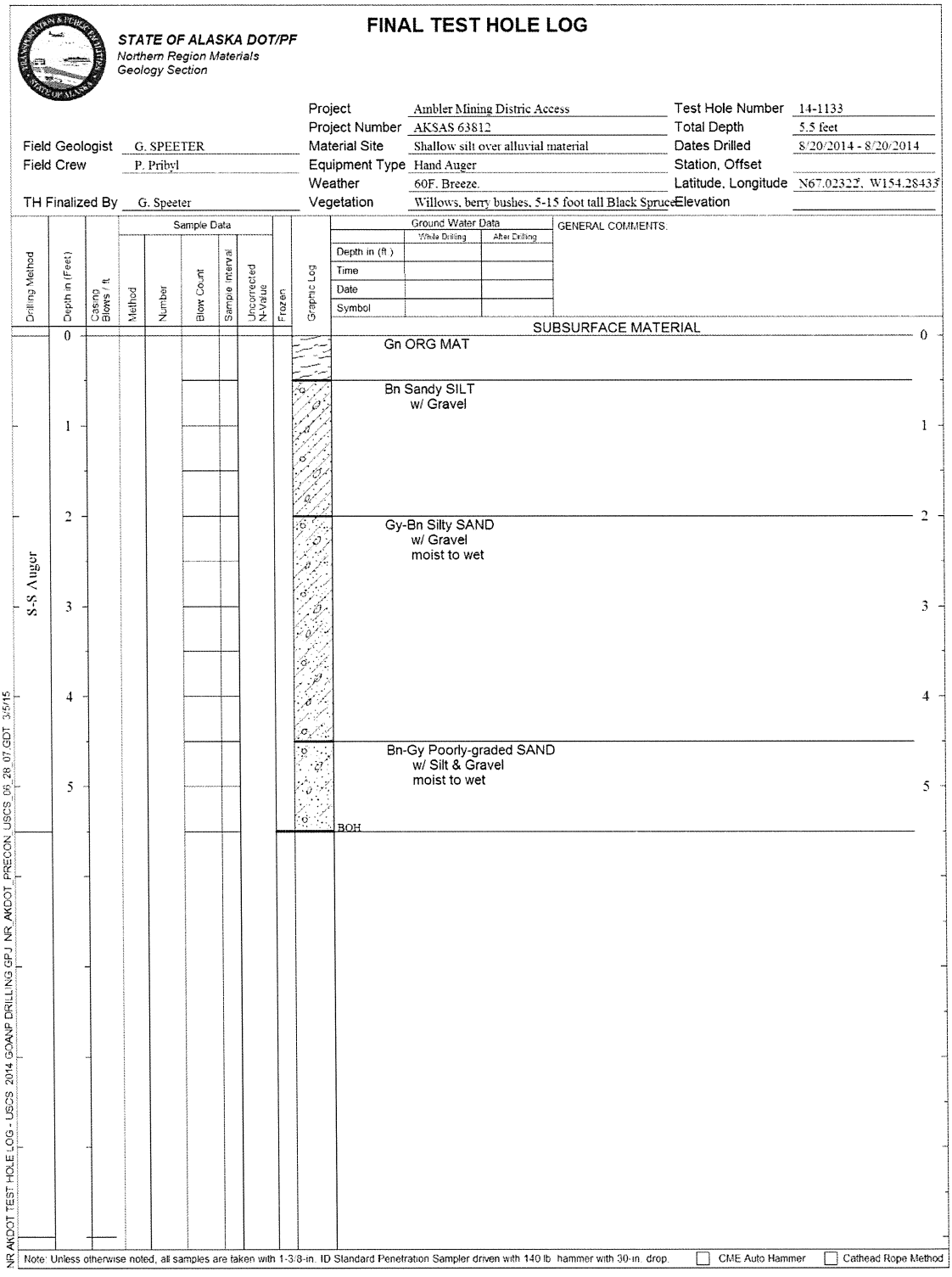
GENERAL COMMENTS.

Drilling Method: S-S Auger
Sample Data: Method: AUGER; Number: 14-5129; Blow Count; Sample Interval; Uncorrected N-Value; Frozen; Graphic Log

Depth in (Feet)	SUBSURFACE MATERIAL
0	Gn ORG MAT
1	Gy SILT *hi Org*, Nbn
2	
3	Gy SILT Vx SAMPLE 14-5129 (3.0-5.0): NM 61.1%, ORG 11.5%
4	
5	BOH Rd PEAT refusal at 5.6-feet. Bedrock?

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GJANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Shallow silt over alluvial material
Equipment Type: Hand Auger
Weather: 60F. Breeze.
Vegetation: Willows, berry bushes, 5-15 foot tall Black Spruce
Test Hole Number: 14-1133
Total Depth: 5.5 feet
Dates Drilled: 8/20/2014 - 8/20/2014
Station, Offset:
Latitude, Longitude: N67.02322°, W154.28435°
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Sample Data
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
Gn ORG MAT
Bn Sandy SILT
w/ Gravel
Gy-Bn Silty SAND
w/ Gravel
moist to wet
Bn-Gy Poorly-graded SAND
w/ Silt & Gravel
moist to wet
BOH
0
1
2
3
4
5
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1134
Project Number	AKSAS 63812	Total Depth	13 feet
Material Site	Deep silt with massive ice over clay	Dates Drilled	8/21/2014 - 8/21/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Rain.	Latitude, Longitude	N67.04613°, W154.19212°
Vegetation	Deep tussocs, 5-10 foot tall Black Spruce, blue berries	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

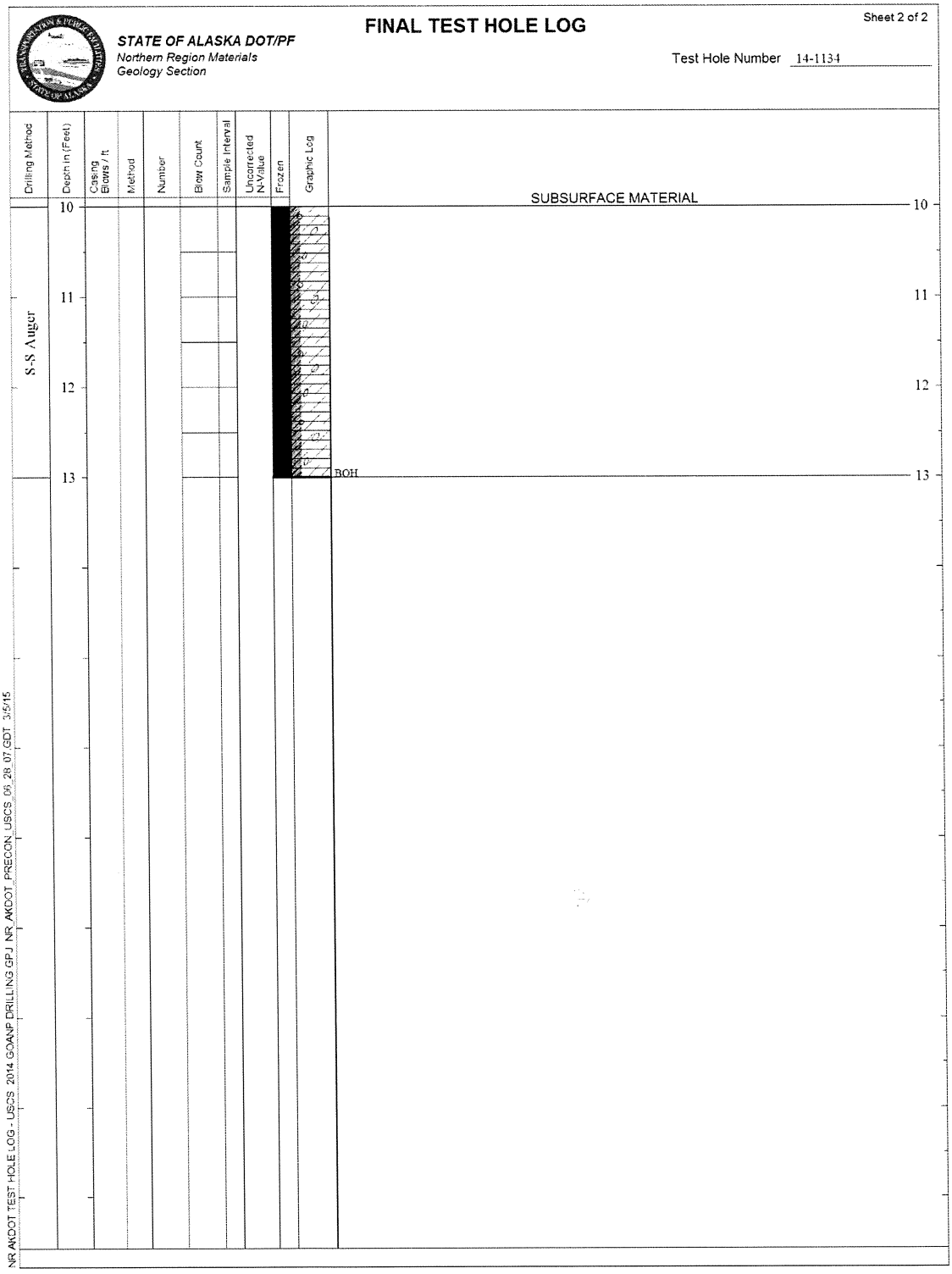
Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5130						Gn ORG MAT
	1									Gy SILT *hi Org*
	2									
	3									Gy SILT w/ Gravel *hi Org*
	4									
	5									Wh ICE w/ Silt SAMPLE 14-5130 (5.5-8.5): NM 41.4%
	6									
	7									
	8									
	9									Gy Silty CLAY w/ Gravel Vs, linticular ice
	10									

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
Sheet 2 of 2
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Test Hole Number 14-1134
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
10
11
12
13
BOH
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1135
Project Number	AKSAS 63812	Total Depth	6 feet
Field Geologist	G. SPEETER	Material Site	Shallow silt with massive ice over alluvial materia
Field Crew	P. Pribyl	Dates Drilled	8/21/2014 - 8/21/2014
		Equipment Type	Hand Auger
		Station, Offset	
		Weather	50F. Rain.
		Latitude, Longitude	N67.04606, W154.19241
TH Finalized By	G. Speeter	Vegetation	Deep tussocs, Black Spruce 2-15 feet tall.
		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

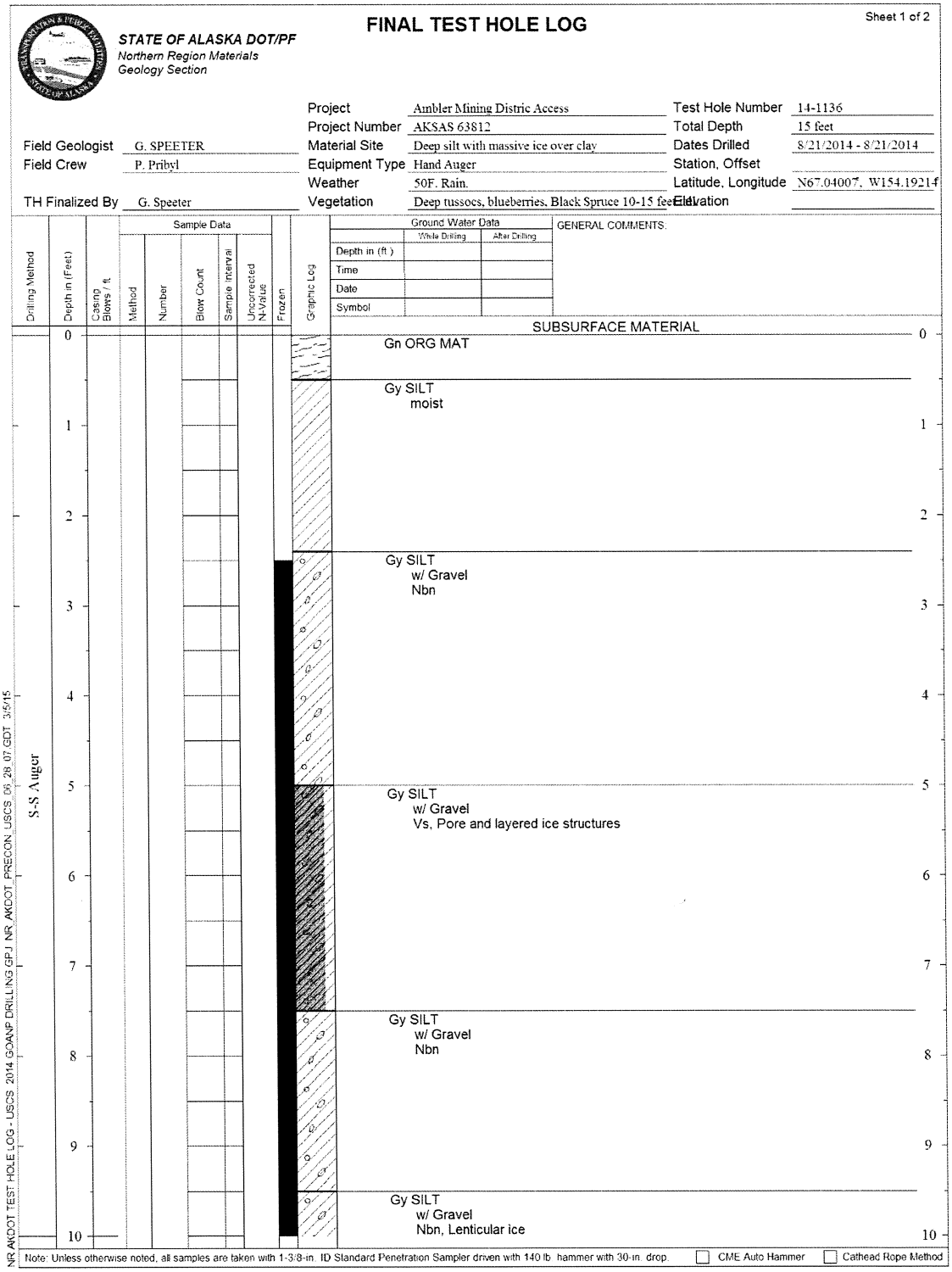
GENERAL COMMENTS:

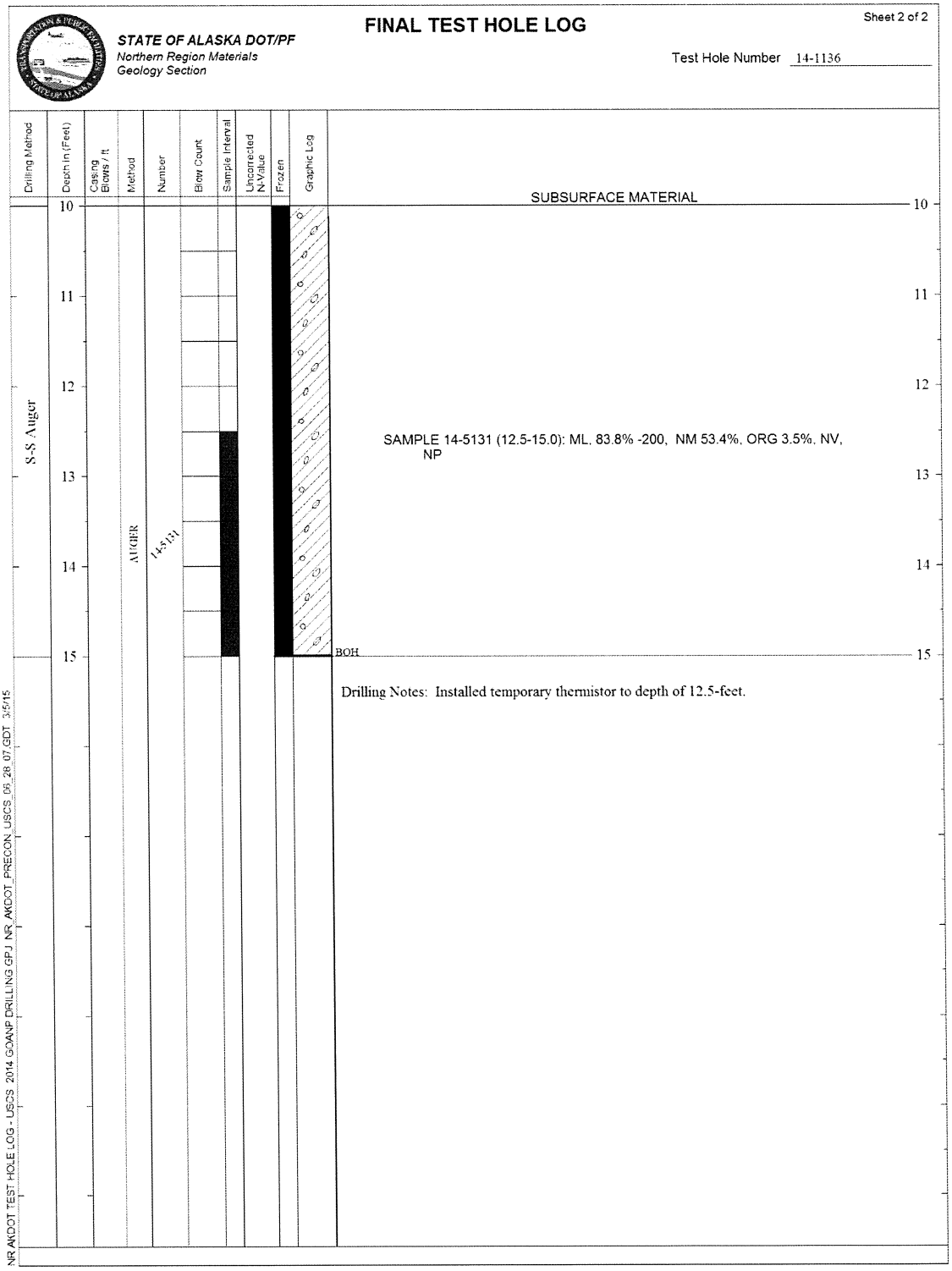
Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT
	1									Gy SILT w/ Gravel
	2									Gy SILT Vx
	3									
	4							?		Bn-Tn Silty SAND w/ Gravel Nbn, looks alluvial.
	5							?		
	6							?		BOH

Drilling Notes: Installed NPS HOBO data logger S/N16580602

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
Sheet 1 of 2
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Deep silt with massive ice over clay
Equipment Type Hand Auger
Weather 50F. Rain.
Vegetation Deep tussocs, blueberries, Black Spruce 10-15 feet tall
Test Hole Number 14-1136
Total Depth 15 feet
Dates Drilled 8/21/2014 - 8/21/2014
Station, Offset
Latitude, Longitude N67.04007, W154.19214
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
Gn ORG MAT
Gy SILT
moist
Gy SILT
w/ Gravel
Nbn
Gy SILT
w/ Gravel
Vs, Pore and layered ice structures
Gy SILT
w/ Gravel
Nbn
Gy SILT
w/ Gravel
Nbn, Lenticular ice
0
1
2
3
4
5
6
7
8
9
10
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
FINAL TEST HOLE LOG
Sheet 2 of 2
Test Hole Number 14-1136
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5131
10
11
12
13
14
15
SAMPLE 14-5131 (12.5-15.0): ML, 83.8% -200, NM 53.4%, ORG 3.5%, NV, NP
BOH
Drilling Notes: Installed temporary thermistor to depth of 12.5-feet.
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1137
Project Number	AKSAS 63812	Total Depth	6.5 feet
Material Site	Frozen silt	Dates Drilled	8/21/2014 - 8/21/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Rain.	Latitude, Longitude	N67.01749, W154.32578
Vegetation	Deep tussocs, blueberries, Black Spruce 10-15 feet tall	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5132						Gn ORG MAT
	1									Bn SILT
	2									Gy SILT w/ Sand Nbe
	3									SAMPLE 14-5132 (2.5-6.5): ML, 77.9% -200, NM 44.1%, ORG 9.5%, NV, NP
	4									
	5									
	6									BOH

Drilling Notes: Installed NPS HOBO data logger S/N 10580599

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1138
Project Number	AKSAS 63812	Total Depth	10 feet
Field Geologist	G. SPEETER	Material Site	Frozen silt over colluvium and bedrock	Dates Drilled	8/22/2014 - 8/22/2014
Field Crew	P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
		Weather	60F. Nice.	Latitude, Longitude	N67.0458', W154.19446'
TH Finalized By	G. Speeter	Vegetation	Deep tussocks, willows, blueberry bushes, burned Elevation since 10 feet tall.		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Drilled near willow choked stream.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5133						Gn ORG MAT
	1									Gy SILT moist to wet, *hi Org*
	2									Gy SILT Nbn
	3									
	4									
	5									Gy SILT w/ Gravel moist, lots of angular graphite schist and quartz aggrigates. Colluvium. SAMPLE 14-5133 (5.0-9.0): ML, 55% -200, NM 24.6%, ORG 5.0%, NV, NP
	6									
	7									
	8									
	9									Gy BEDROCK mod strong graphite schist.
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1139
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Silt and frozen silt > 10 feet deep.	Dates Drilled	8/22/2014 - 8/22/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.0456', W154.1968'
Vegetation	Tussocks, blueberries, Black spruce 2-20 feet tall.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Sample Data: Method: AUGER; Number: 14-5134; Blow Count; Sample Interval; Uncorrected N-Value; Frozen; Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT

Gy SILT
moist to wet

4 — Gy SILT
Vx, 5-10% visible pore ice structures

SAMPLE 14-5134 (5.0-10.0): ML, 96% -200, NM 63.3%, ORG 9.6%, NV, NP

10 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1140
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Silt and frozen silt > 10 feet deep.	Dates Drilled	8/22/2014 - 8/22/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.0455, W154.19975
Vegetation	Deep wet tussocks.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Sample Data: Method: AUGER; Number: 14-5135; Blow Count; Sample Interval; Uncorrected N-Value; Frozen; Graphic Log

SUBSURFACE MATERIAL

0 – Gn ORG MAT

Gy SILT
moist

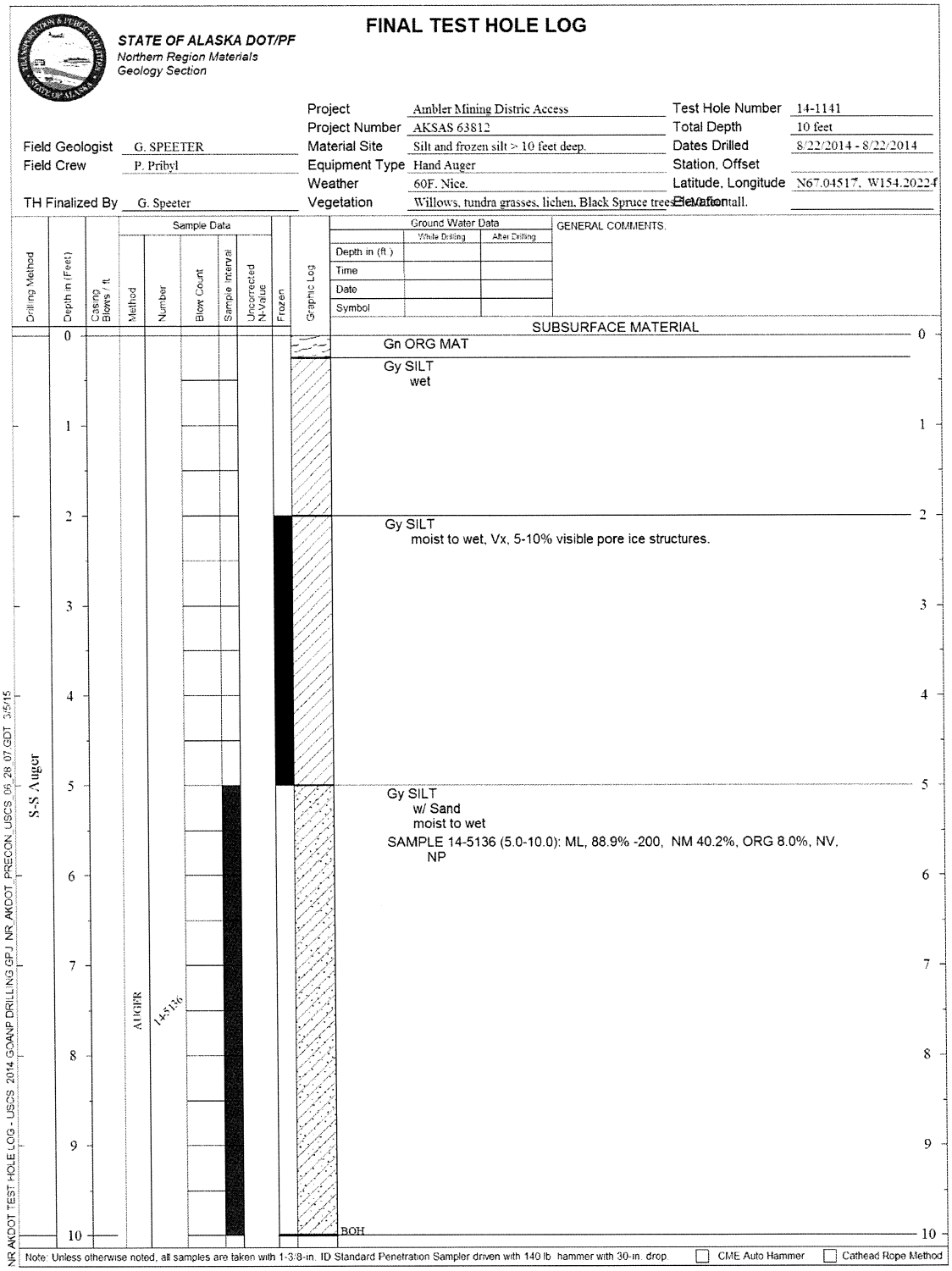
2 – Gy SILT
Nbe

4 – Gy SILT
w/ Sand
moist
SAMPLE 14-5135 (5.0-10.0): ML, 73.2% -200, NM 39.6%, ORG 7.4%, NV, NP

10 – BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Silt and frozen silt > 10 feet deep.
Equipment Type Hand Auger
Weather 60F. Nice.
Vegetation Willows, tundra grasses, lichen, Black Spruce trees < 6 feet tall.
Test Hole Number 14-1141
Total Depth 10 feet
Dates Drilled 8/22/2014 - 8/22/2014
Station, Offset
Latitude, Longitude N67.04517, W154.20224
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS:
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5136
Gn ORG MAT
Gy SILT
wet
Gy SILT
moist to wet, Vx, 5-10% visible pore ice structures.
Gy SILT
w/ Sand
moist to wet
SAMPLE 14-5136 (5.0-10.0): ML, 88.9% -200, NM 40.2%, ORG 8.0%, NV, NP
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GJANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1142
Project Number	AKSAS 63812	Total Depth	5.5 feet
Material Site	Thawed silt over colluvium and bedrock	Dates Drilled	8/22/2014 - 8/22/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.04493°, W154.20509°
Vegetation	Willows, lichen moss, Black Spruce.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)	4.0	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS:

Drilling Method: S-S Auger

Depth in (Feet)	Casing Blows / ft.	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
0									Gn ORG MAT
									Bn PEAT
1									Gy SILT moist, *Org*
2									
									Gy SILT w/ Gravel wet, angular quartz and graphite schist aggrigates. Colluvium.
3									
4 ▼									Gy BEDROCK, soft highly weathered quartz, graphite, mica schist.
5									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1143
Project Number	AKSAS 63812	Total Depth	5 feet
Material Site	Thawed silt over colluvium and bedrock	Dates Drilled	8/22/2014 - 8/22/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.04432°, W154.2071°
Vegetation	Willows, scattered Black Spruce, tundra grass.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

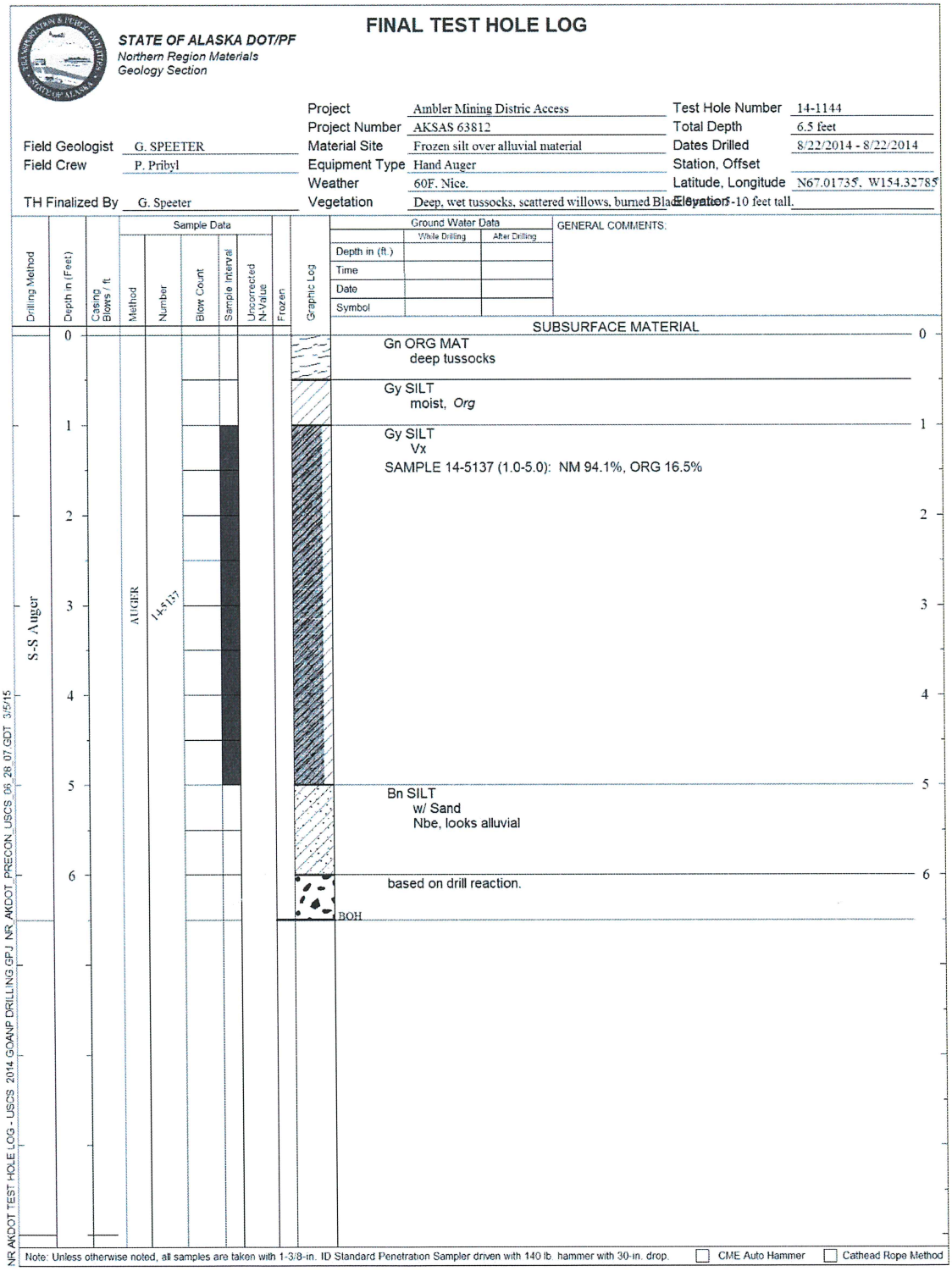
Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

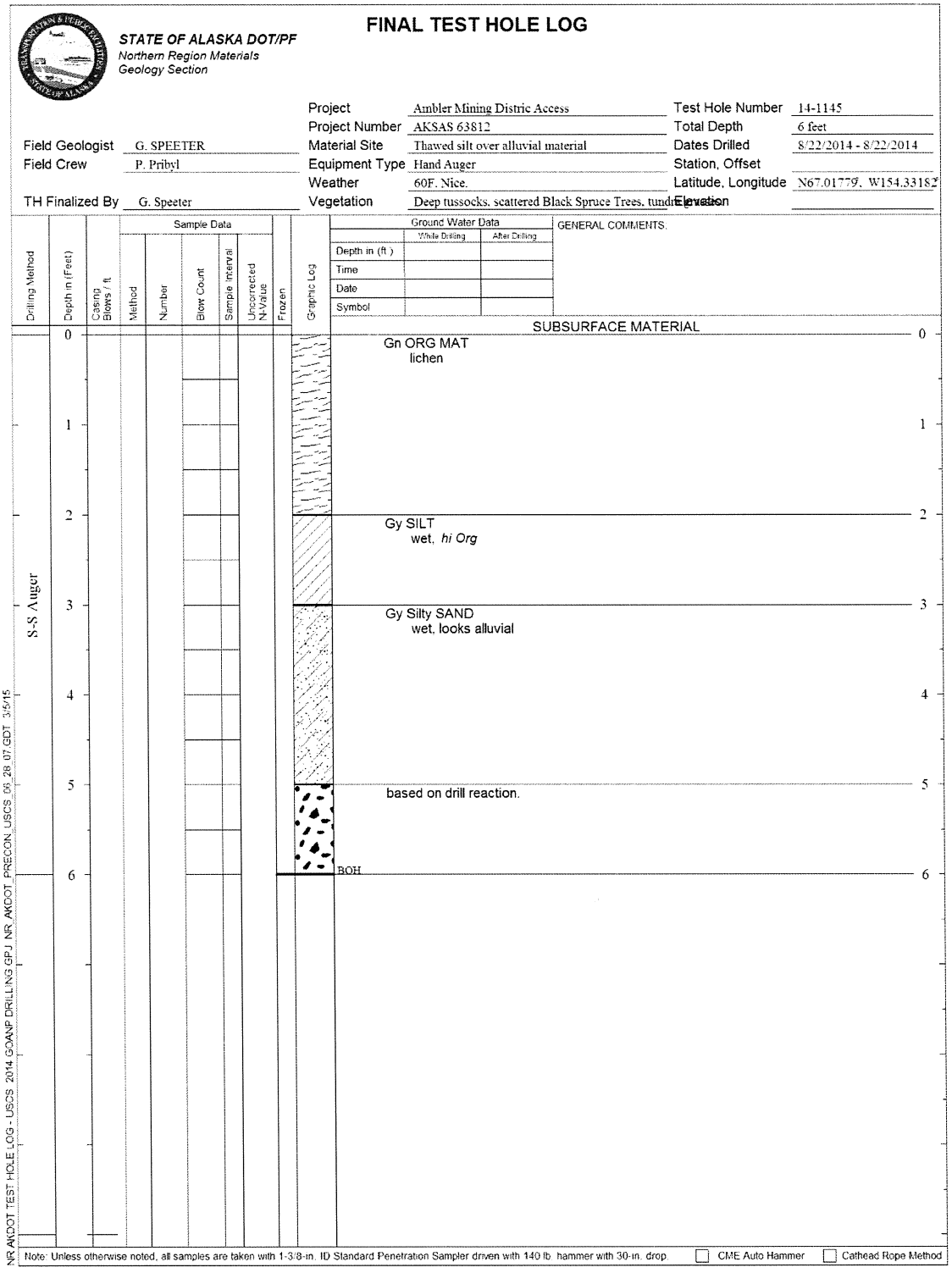
GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT
										Gy SILT moist, *hi Org*
	1									
										Gy SILT w/ Gravel moist
	2									
	3									
										Gy BEDROCK, soft moist, highly weathered quartz, graphite schist.
	4									
	5									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Frozen silt over alluvial material
Equipment Type Hand Auger
Weather 60F. Nice.
Vegetation Deep, wet tussocks, scattered willows, burned Black Spruce 5-10 feet tall.
Test Hole Number 14-1144
Total Depth 6.5 feet
Dates Drilled 8/22/2014 - 8/22/2014
Station, Offset
Latitude, Longitude N67.01735, W154.32785
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS:
Drilling Method
Depth in (Feet)
Casing Blows / ft.
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5137
Gn ORG MAT
deep tussocks
Gy SILT
moist, Org
Gy SILT
Vx
SAMPLE 14-5137 (1.0-5.0): NM 94.1%, ORG 16.5%
Bn SILT
w/ Sand
Nbe, looks alluvial
based on drill reaction.
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Thawed silt over alluvial material
Equipment Type Hand Auger
Weather 60F. Nice.
Vegetation Deep tussocks, scattered Black Spruce Trees, tundra
Test Hole Number 14-1145
Total Depth 6 feet
Dates Drilled 8/22/2014 - 8/22/2014
Station, Offset
Latitude, Longitude N67.01779, W154.33182
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
Gn ORG MAT
lichen
Gy SILT
wet, hi Org
Gy Silty SAND
wet, looks alluvial
based on drill reaction.
BOH
0
1
2
3
4
5
6
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1146
Project Number	AKSAS 63812	Total Depth	5 feet
Material Site	Frozen silt over alluvial material	Dates Drilled	8/22/2014 - 8/22/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.01865, W154.33444
Vegetation	Deep tussocks. Black Spruce 3-10 feet tall, willow	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.
Drilled 50 feet away from oxbow lake off the Kobuk River.

Drilling Method: S-S Auger

Sample Data: Depth in (Feet) | Casing Blows / ft | Method | Number | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT
lichen between deep tussocks

1 — Gy SILT
wet

2 — Gy SILT
Vx, pore ice structures. refusal at 5-feet. boulder?

3

4

5 — BOH

Drilling Notes: Refusal on boulder?

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1147
Project Number	AKSAS 63812	Total Depth	3 feet
Material Site	Frozen silt over alluvial material	Dates Drilled	8/22/2014 - 8/22/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.02056, W154.33418
Vegetation		Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT deep tussocks
	1									Gy SILT Nbn. refusal at 3 feet. Boulder?
	2									
	3									BotH

Drilling Notes: Refusal on boulder?

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

Area 2 Laboratory Data

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Ambler Mining Distric Access
PROJECT NUMBER: 63812
AKSAS NUMBER:
SAMPLED BY: G. Speeter
MATERIAL SOURCE: Area 2 GOANP

TEST HOLE NUMBER		14-1125	14-1125	14-1125	14-1126	14-1127	14-1128	14-1129
DEPTH (feet)		0.5-4.5	5.0-9.0	10.0-13.0	1.0-4.0	2.5-6.5	4.0-7.0	6.0-8.0
LATITUDE		N67.01936°	N67.01936°	N67.01936°	N67.01887°	N67.01822°	N67.01794°	N67.01994°
LONGITUDE		W154.29814°	W154.29814°	W154.29814°	W154.30008°	W154.3028°	W154.30399°	W154.29535°
LAB NUMBER		**14-5121**	**14-5122**	**14-5123**	**14-5124**	**14-5125**	**14-5126**	**14-5127**
DATE SAMPLED		20-Aug-14	20-Aug-14	20-Aug-14	20-Aug-14	20-Aug-14	20-Aug-14	20-Aug-14
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"						97	
	0.5"					95	94	
	0.375"			98		95	92	
	#4			91		88	83	
	#8				95			
	#10				95			
	#16			83	93	82	75	99
	#30				90			95
Sand	**#40**				88			94
	#50				86			91
	#60				84			89
	#80				80			85
	#100			66	78	51	49	82
Silt/Clay	**#200**			55.1	68.7	37.8	36.0	72.9
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT				NV	NV	NV	NV	
PLASTIC INDEX				NP	NP	NP	NP	
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si)	(Si)	(SaSi)	(SaSi)	(SiSa)	(SiSa)	(Si w/Sa)
NATURAL MOISTURE		118.8	95.1	43.8	44.7	23.8	9.7	59.8
ORGANICS		4.3	6.5	8.4	10.8	4.2	1.4	13.4
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		sl Org[1]	Org[1]	Org[1]	Org[1]	sl Org[1]		Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Ambler Mining Distric Access
PROJECT NUMBER: 63812
AKSAS NUMBER:
SAMPLED BY: G. Speeter
MATERIAL SOURCE: Area 2 GOANP

TEST HOLE NUMBER		14-1130	14-1132	14-1134	14-1136	14-1137	14-1138	14-1139
DEPTH (feet)		2.5-5.0	3.0-5.0	5.5-8.5	12.5-15.0	2.5-6.5	5.0-9.0	5.0-10.0
LATITUDE		N67.02026°	N67.02117°	N67.04613°	N67.04007°	N67.01749°	N67.0458°	N67.0456°
LONGITUDE		W154.2934°	W154.28943°	W154.19212°	W154.19214°	W154.32578°	W154.19446°	W154.19681°
LAB NUMBER		**14-5128**	**14-5129**	**14-5130**	**14-5131**	**14-5132**	**14-5133**	**14-5134**
DATE SAMPLED		20-Aug-14	20-Aug-14	21-Aug-14	21-Aug-14	21-Aug-14	22-Aug-14	22-Aug-14
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"							
	0.375"						96	
	#4				95		84	
	#8							
	#10							
	#16				92		76	
	#30					99		
Sand	**#40**					99		
	#50					98		100
	#60					98		99
	#80					96		98
	#100				86	93	61	98
Silt/Clay	**#200**				83.8	77.9	55.0	96.0
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT					NV	NV	NV	NV
PLASTIC INDEX					NP	NP	NP	NP
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si)	(Si)	(Si)	(Si w/Gr)	(Si w/Sa)	(Si w/Gr)	(Si)
NATURAL MOISTURE		218.5	61.1	41.4	53.4	44.1	24.6	63.3
ORGANICS		26.9	11.5		3.5	9.5	5.0	9.6
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		hi Org[1]	Org[1]		sl Org[1]	Org[1]	Org[1]	Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Ambler Mining Distric Access
PROJECT NUMBER:	
AKSAS NUMBER:	63812
SAMPLED BY:	G. Speeter
MATERIAL SOURCE:	Area 2 GOANP

TEST HOLE NUMBER		14-1140	14-1141	14-1144				
DEPTH (feet)		5.0-10.0	5.0-10.0	1.0-5.0				
LATITUDE		N67.0455°	N67.04517°	N67.01735°				
LONGITUDE		W154.19975°	W154.20224°	W154.32785°				
LAB NUMBER		**14-5135**	**14-5136**	**14-5137**				
DATE SAMPLED		22-Aug-14	22-Aug-14	22-Aug-14				
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"							
	0.375"							
	#4							
	#8	98						
	#10	98						
	#16	94						
	#30	89						
Sand	**#40**	87						
	#50	84	99					
	#60	83	99					
	#80	80	97					
	#100	79	96					
Silt/Clay	**#200**	73.2	88.9					
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV					
PLASTIC INDEX		NP	NP					
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si w/Sa)	(Si)	(Si)				
NATURAL MOISTURE		39.6	40.2	94.1				
ORGANICS		7.4	8.0	16.5				
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]	Org[1]	hi Org[1]				

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

Area 3

Test holes on the east side of Area 3 intercepted glacial lake deposits composed of stratified fine sediments and upland silt with scattered mounds of glacial drift (Traverse 7). Test holes on the west side of Area 3 intercepted thawed end moraines covered by thawed silt (Traverse 8).

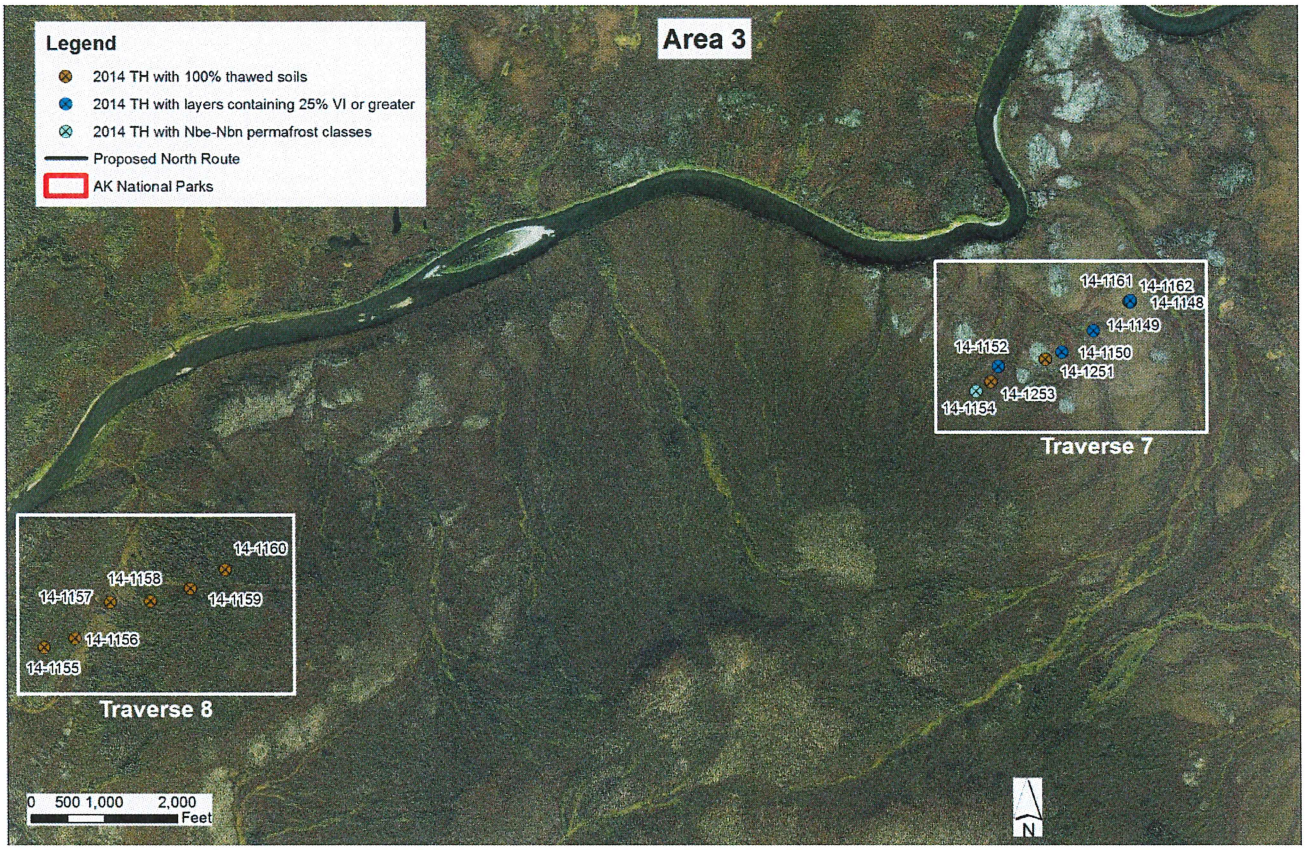


Figure 22. Map of Area 3. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Traverse 7

Table 10. Traverse 7.

Traverse 7				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1148	SS	none	Silt with massive ice over drift gravel (silty gravel)	8.5
14-1149	SS	none	Silt with massive ice and clay	8
14-1150	SS	none	Silt with massive ice	9
14-1151	SS	none	Thawed glacial drift deposits (silty sand)	10
14-1152	SS	none	Silt with massive ice	10
14-1153	SS	none	Thawed glacial drift deposits (silty sand with gravel)	10
14-1154	SS	none	Thawed and frozen silt over glacial drift deposits (silty sand with gravel)	4
14-1161	SS	NPS S/N 10580600 Data Logger	Silt with massive ice	7
14-1162	SIPRE	none	Silt with massive ice	3.3

Test holes in Traverse 7 (Figure 22 and Table 10) intercepted silt with massive ice in 7 of 10 test holes. Scattered, mound shaped, thawed glacial drift deposits were observed along the traverse. Most test holes in Traverse 7 intercepted glacial drift gravels below the frozen layer of silt at the surface. Design relevant data collected by Traverse 7 is as follows:

- The data logger installed in TH14-1161 (Figure 23) recorded temperatures of 31.440°F on 8-27-14. The relatively warm temperature of frozen soil in this area suggests that it is borderline thermally unstable.
- Thaw consolidation tests run on ice cores collected from TH14-1162 reported:
  - 47% thaw consolidation from cores collected at depths of 1.5 to 2.5 feet;
  - 53% thaw consolidation from cores collected at depths of 2.5 to 3.3 feet.

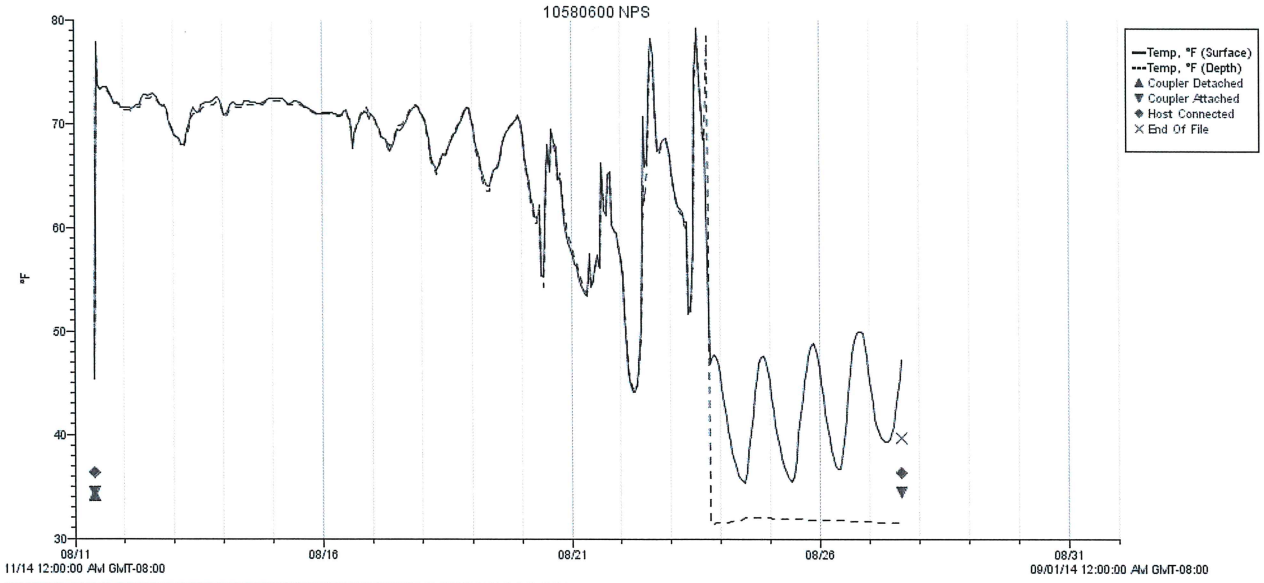


Figure 23. Temperature data from TH14-1161.

Traverse 8

Table 11. Traverse 8.

Traverse 8				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1155	SS	none	Thawed silt over glacial drift deposits (silt with gravel)	6
14-1156	SS	none	Thawed glacial drift deposits (well graded sand with silt and gravel)	7
14-1157	SS	none	Thawed silt>10 feet deep	10
14-1158	SS	none	Thawed silt	7
14-1159	SS	none	Thawed silt over colluvium (silty gravel)?	4.5
14-1160	SS	none	Thawed silt over colluvium (silty gravel)?	5

Test holes in Traverse 8 (Figure 22 and Table 11) intercepted thawed silt over glacial drift and/or colluvial material. No frozen soil was encountered by test holes in this traverse.

Area 3 Test Hole Logs

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1148
Project Number	AKSAS 63812	Total Depth	8.5 feet
Material Site	Silt with massive ice over outwash gravel	Dates Drilled	8/22/2014 - 8/22/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N66.90475, W154.52261
Vegetation	Deep tussocks, thin Black Spruce 2-10 feet tall, tu	Elevation	s.

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Sample Data: Method, Number, Blow Count, Sample Interval, Uncorrected N-Value, Frozen

Drilling Method: S-S Auger

Depth in (Feet) / Casing Blows / ft

SUBSURFACE MATERIAL

0 — Gn ORG MAT
tussock

Gy SILT
Vx

1 — Wh ICE

2 — Gy Silty SAND
Vx

SAMPLE 14-5147 (3.5-6.5): SM, 37.4% -200, NM 14.6%, ORG 2.3%, NV, NP

3

4

5

6 — Bn SILT
w/ Gravel
Nbe

7

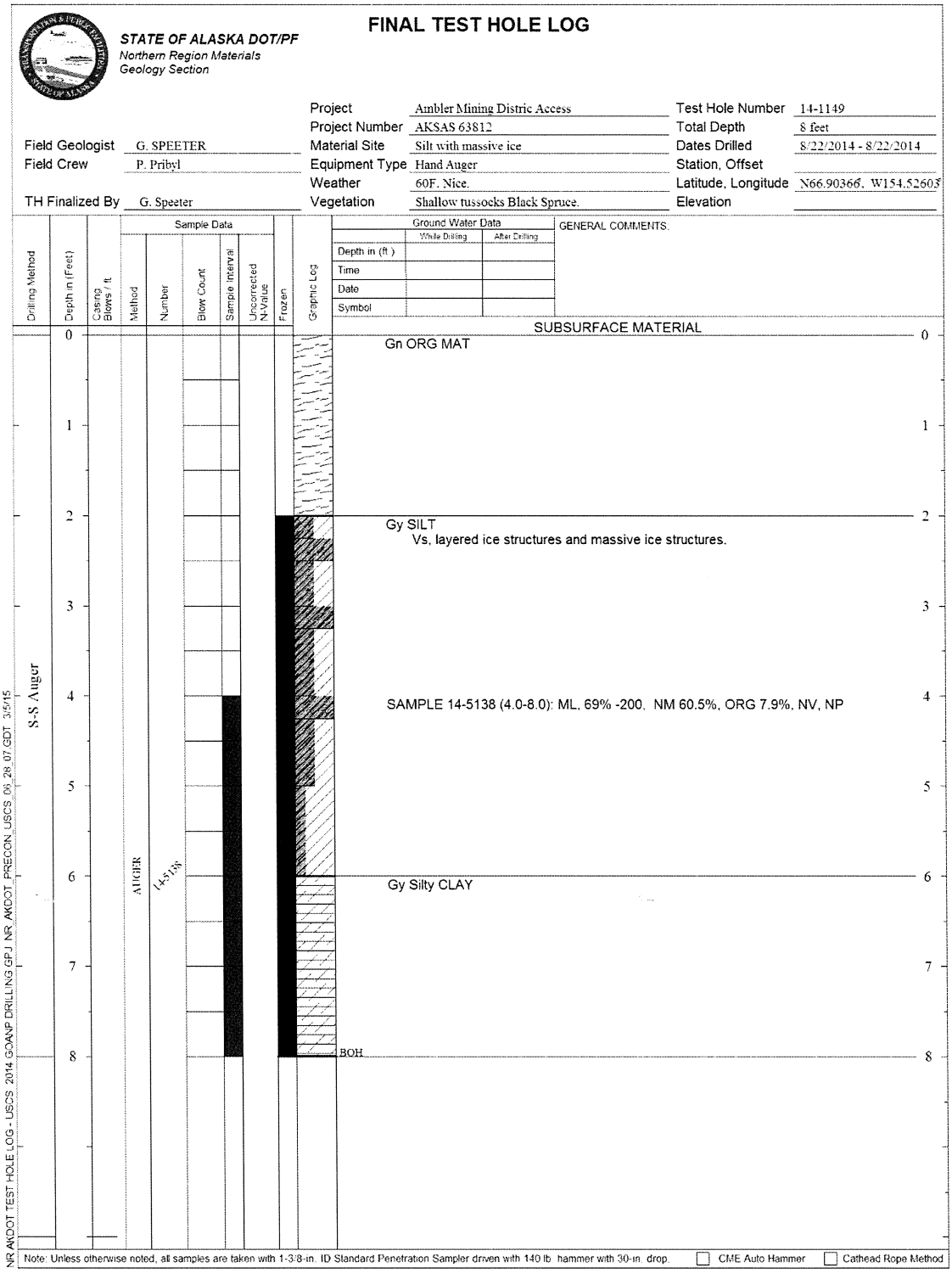
8 — Gy Silty GRAVEL
Nbe

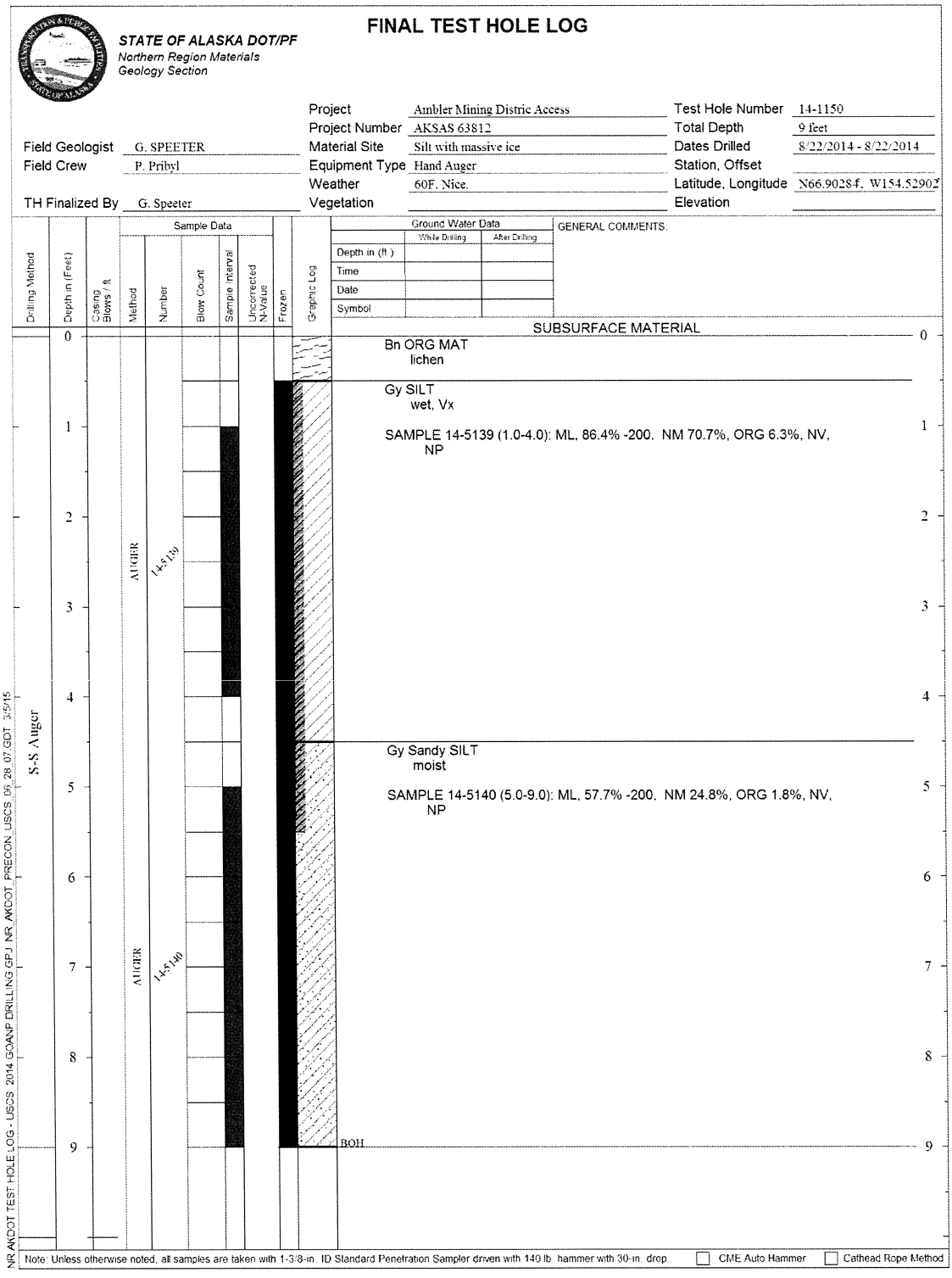
BOH

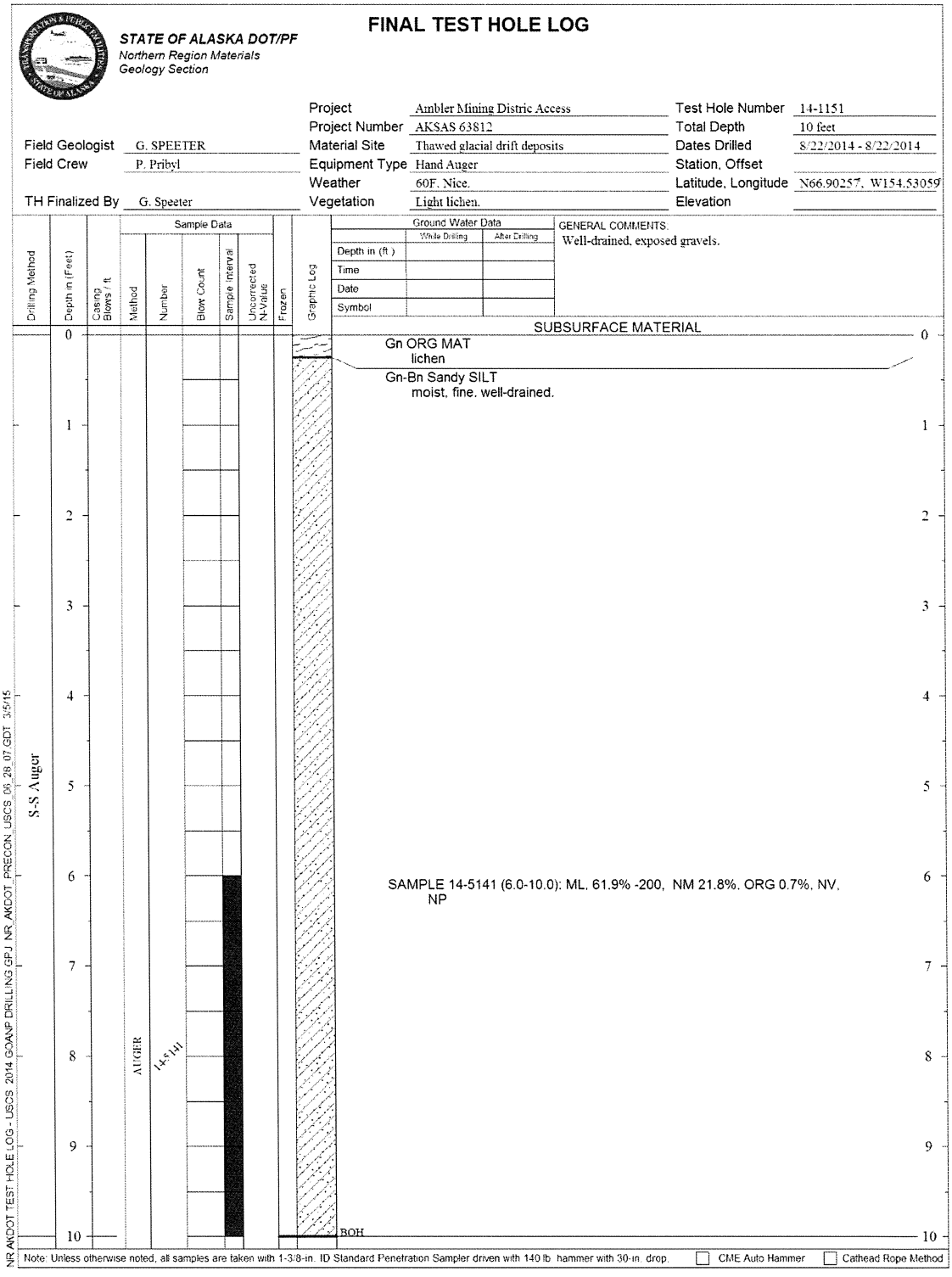
AUGER 14-5147

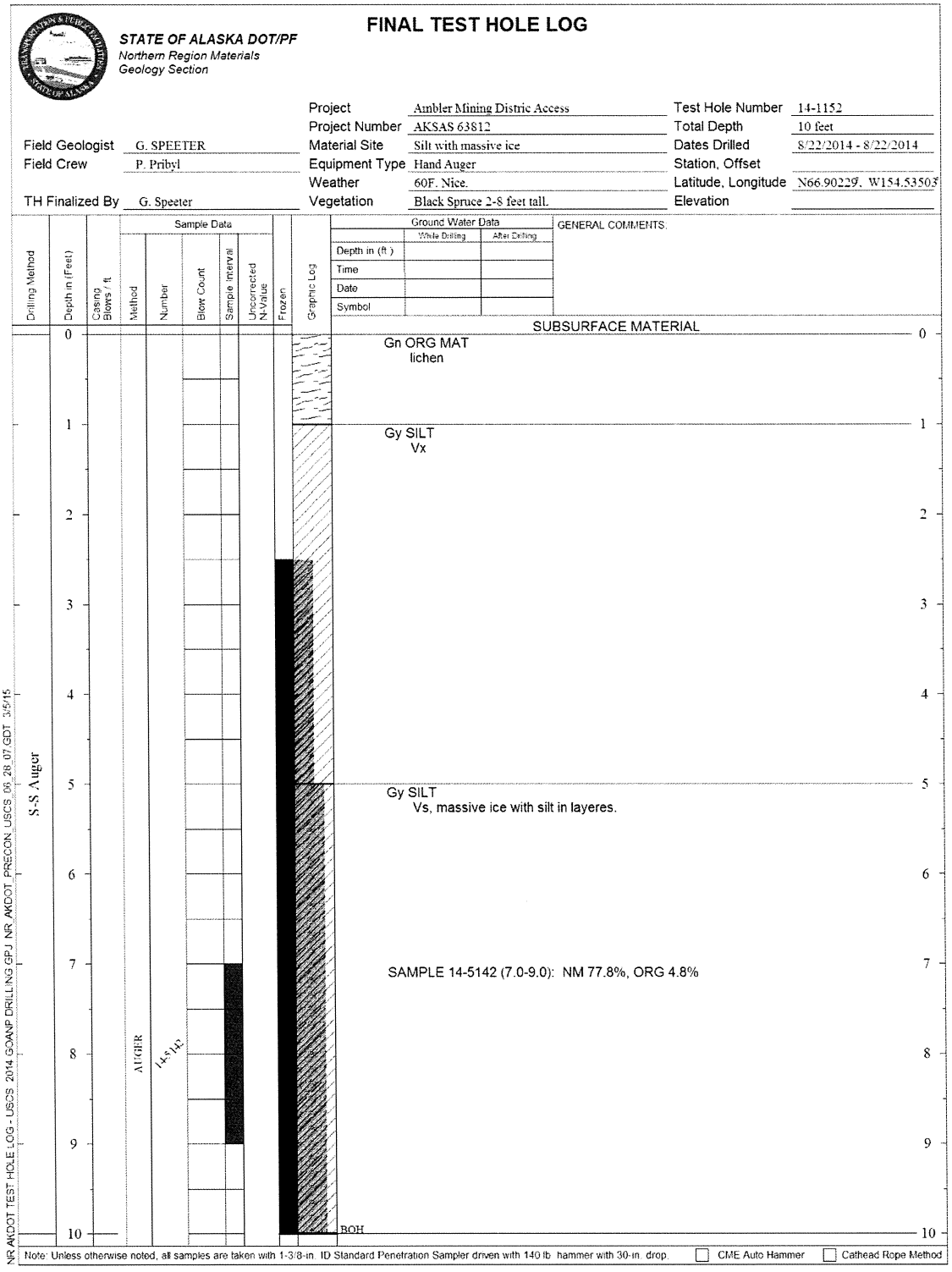
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

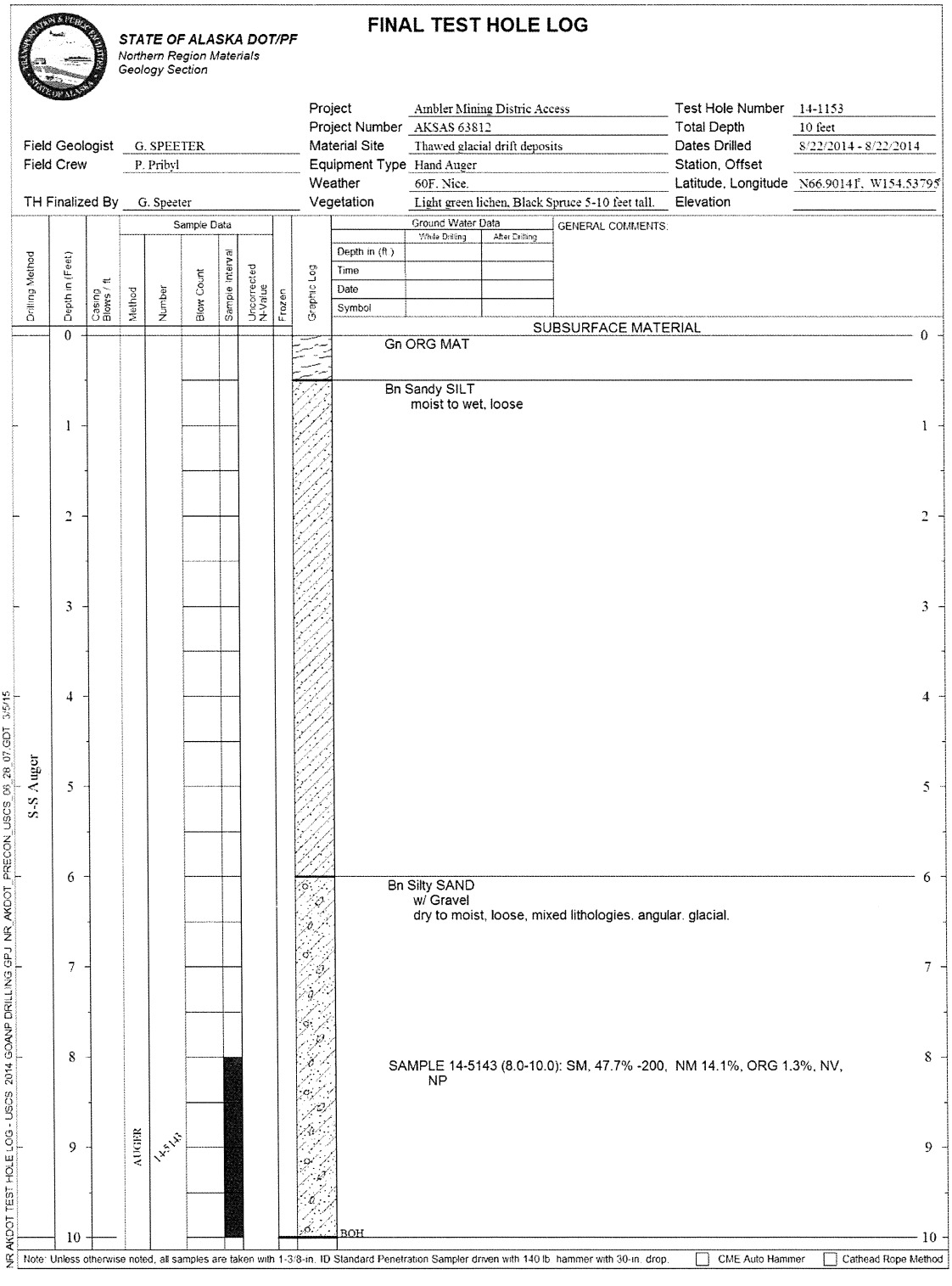
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Silt with massive ice
Equipment Type Hand Auger
Weather 60F. Nice.
Vegetation Shallow tussocks Black Spruce.
Test Hole Number 14-1149
Total Depth 8 feet
Dates Drilled 8/22/2014 - 8/22/2014
Station, Offset
Latitude, Longitude N66.90366, W154.52605
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS:
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5138
Gn ORG MAT
Gy SILT
Vs, layered ice structures and massive ice structures.
SAMPLE 14-5138 (4.0-8.0): ML, 69% -200, NM 60.5%, ORG 7.9%, NV, NP
Gy Silty CLAY
BOH
0
1
2
3
4
5
6
7
8
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_09_28_07.GDT 3/5/15
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Silt with massive ice
Equipment Type: Hand Auger
Weather: 60F. Nice.
Vegetation:
Test Hole Number: 14-1150
Total Depth: 9 feet
Dates Drilled: 8/22/2014 - 8/22/2014
Station, Offset:
Latitude, Longitude: N66.9028-f, W154.5290
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5139
AUGER
14-5140
Bn ORG MAT
lichen
Gy SILT
wet, Vx
SAMPLE 14-5139 (1.0-4.0): ML, 86.4% -200, NM 70.7%, ORG 6.3%, NV, NP
Gy Sandy SILT
moist
SAMPLE 14-5140 (5.0-9.0): ML, 57.7% -200, NM 24.8%, ORG 1.8%, NV, NP
BOH
0
1
2
3
4
5
6
7
8
9
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Thawed glacial drift deposits
Equipment Type: Hand Auger
Weather: 60F. Nice.
Vegetation: Light lichen.
Test Hole Number: 14-1151
Total Depth: 10 feet
Dates Drilled: 8/22/2014 - 8/22/2014
Station, Offset:
Latitude, Longitude: N66.90257, W154.53059
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS.
Well-drained, exposed gravels.
Drilling Method
Depth in (Feet)
Casing Blows / ft.
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
Gn ORG MAT
lichen
Gn-Bn Sandy SILT
moist, fine, well-drained.
SAMPLE 14-5141 (6.0-10.0): ML, 61.9% -200, NM 21.8%, ORG 0.7%, NV, NP
S-S Auger
AUGER
14-5141
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Silt with massive ice
Equipment Type: Hand Auger
Weather: 60F. Nice.
Vegetation: Black Spruce 2-8 feet tall.
Test Hole Number: 14-1152
Total Depth: 10 feet
Dates Drilled: 8/22/2014 - 8/22/2014
Station, Offset:
Latitude, Longitude: N66.90229, W154.53503
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS:
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5142
Gn ORG MAT
lichen
Gy SILT
Vx
Gy SILT
Vs, massive ice with silt in layeres.
SAMPLE 14-5142 (7.0-9.0): NM 77.8%, ORG 4.8%
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Thawed glacial drift deposits
Equipment Type Hand Auger
Weather 60F. Nice.
Vegetation Light green lichen. Black Spruce 5-10 feet tall.
Test Hole Number 14-1153
Total Depth 10 feet
Dates Drilled 8/22/2014 - 8/22/2014
Station, Offset
Latitude, Longitude N66.90141°, W154.53795°
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS:
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5143
Gn ORG MAT
Bn Sandy SILT
moist to wet, loose
Bn Silty SAND
w/ Gravel
dry to moist, loose, mixed lithologies. angular. glacial.
SAMPLE 14-5143 (8.0-10.0): SM, 47.7% -200, NM 14.1%, ORG 1.3%, NV, NP
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1154
Project Number	AKSAS 63812	Total Depth	4 feet
Material Site	Thawed and frozen silt over glacial drift deposits	Dates Drilled	8/22/2014 - 8/22/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N66.90099°, W154.54008°
Vegetation	Blueberries, Black Spruce 10-15 feet tall.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

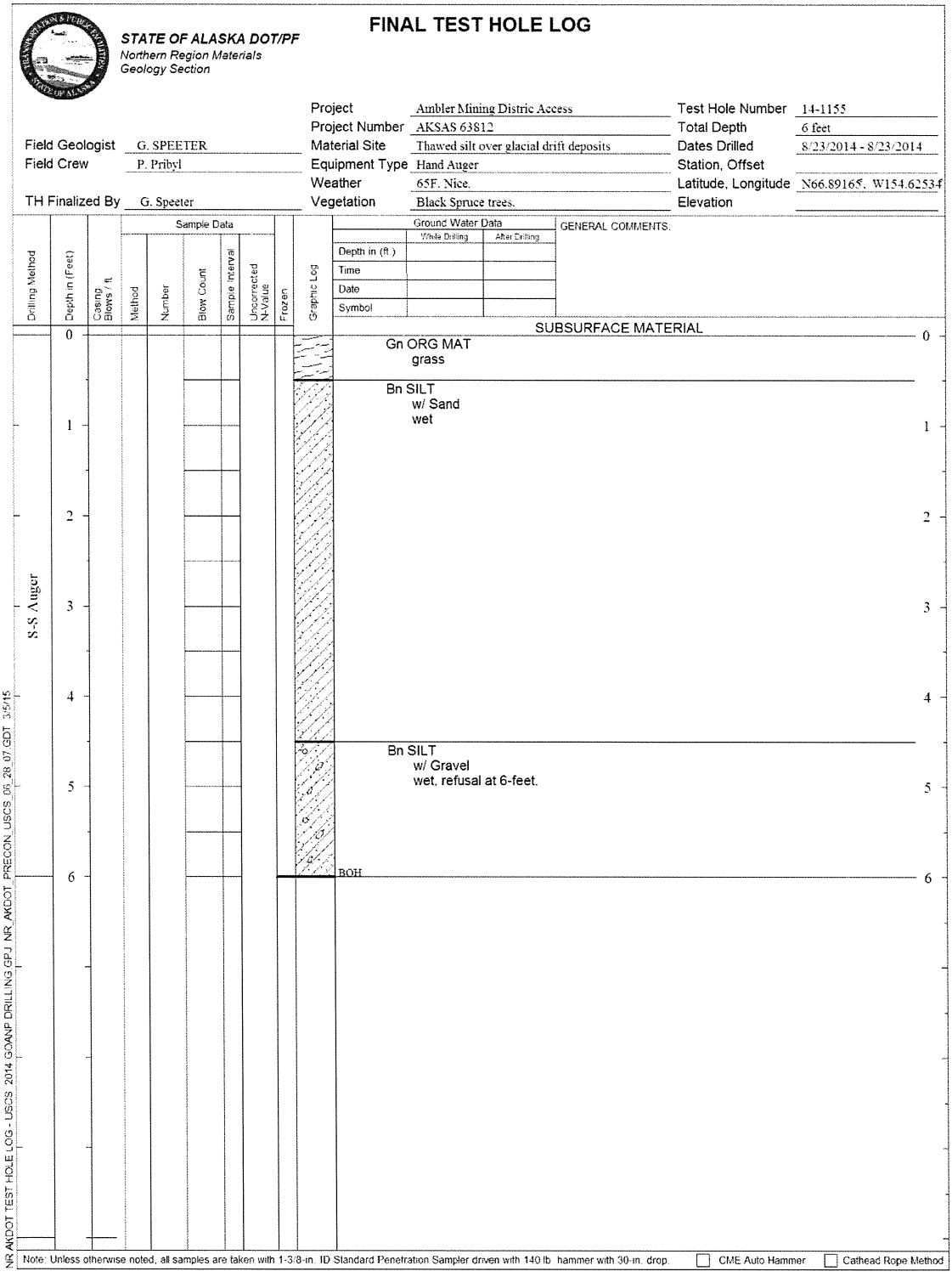
Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

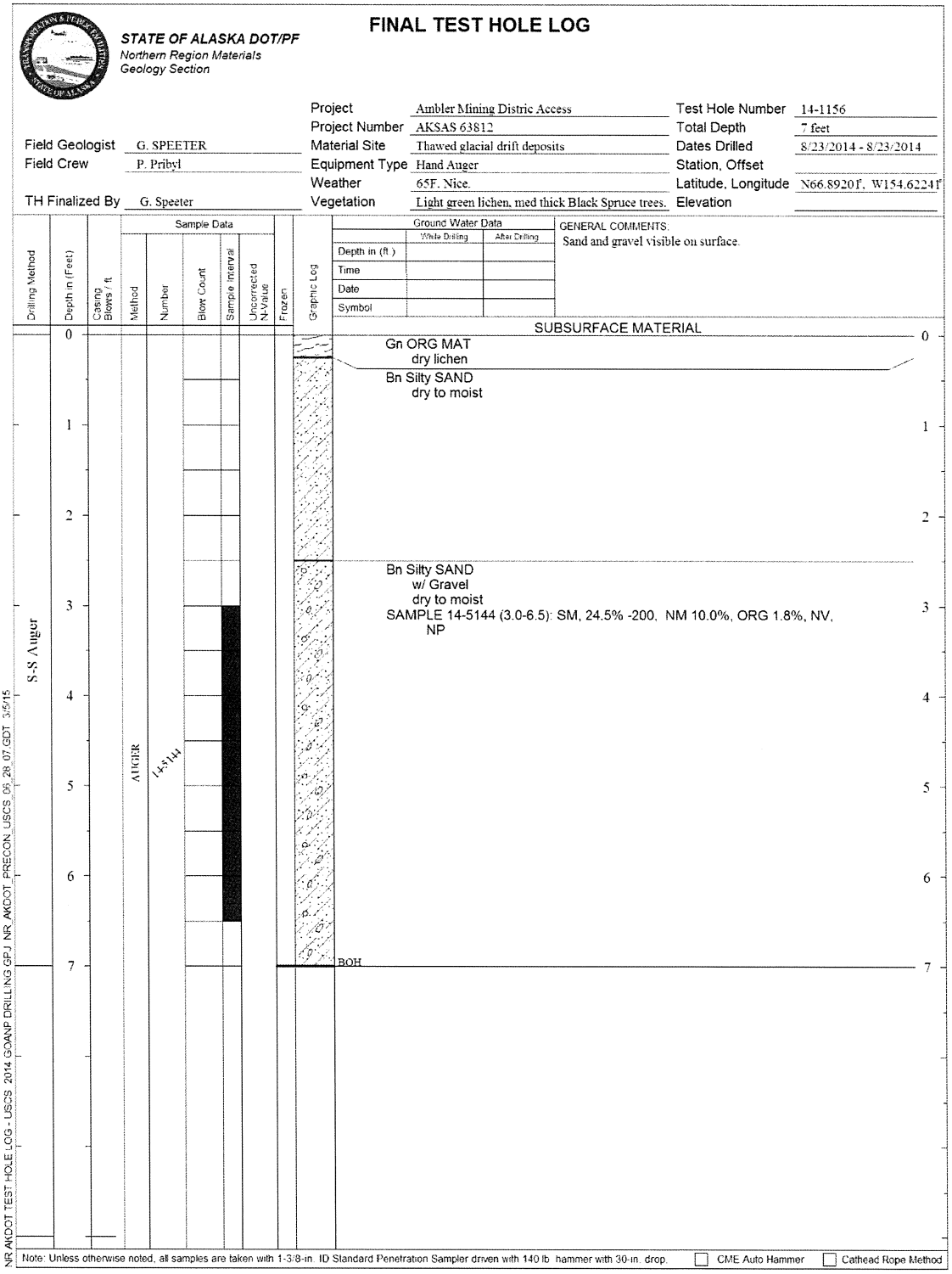
GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT
	1									Gy SILT wet, *Org*, Nbn
	2									
	3									Bn Silty SAND w/ Gravel 1'-. Mixed lithologies.
	4									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Thawed silt over glacial drift deposits
Equipment Type Hand Auger
Weather 65F. Nice.
Vegetation Black Spruce trees.
Test Hole Number 14-1155
Total Depth 6 feet
Dates Drilled 8/23/2014 - 8/23/2014
Station, Offset
Latitude, Longitude N66.89165, W154.62534
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS.
SUBSURFACE MATERIAL
S-S Auger
0
1
2
3
4
5
6
Gn ORG MAT
grass
Bn SILT
w/ Sand
wet
Bn SILT
w/ Gravel
wet, refusal at 6-feet.
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Ambler Mining Distric Access
Project Number: AKSAS 63812
Material Site: Thawed glacial drift deposits
Equipment Type: Hand Auger
Weather: 65F. Nice.
Vegetation: Light green lichen, med thick Black Spruce trees.
Test Hole Number: 14-1156
Total Depth: 7 feet
Dates Drilled: 8/23/2014 - 8/23/2014
Station, Offset:
Latitude, Longitude: N66.8920f, W154.62241f
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS:
Sand and gravel visible on surface.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
1-5144
Gn ORG MAT
dry lichen
Bn Silty SAND
dry to moist
Bn Silty SAND
w/ Gravel
dry to moist
SAMPLE 14-5144 (3.0-6.5): SM, 24.5% -200, NM 10.0%, ORG 1.8%, NV, NP
BOH
0
1
2
3
4
5
6
7
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1157
Project Number	AKSAS 63812	Total Depth	10 feet
Field Geologist	G. SPEETER	Material Site	Thawed silt>10 feet deep	Dates Drilled	8/23/2014 - 8/23/2014
Field Crew	P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
		Weather	65F. Nice.	Latitude, Longitude	N66.89339, W154.61906
TH Finalized By	G. Speeter	Vegetation	Willows. Black Spruce.	Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5145						Bn SILT w/ Gravel moist SAMPLE 14-5145 (0.0-5.0): ML, 88.3% -200, NM 32.1%, ORG 6.4%, NV, NP
	5		AUGER	14-5146						Gy SILT moist SAMPLE 14-5146 (5.0-10.0): ML, 92.8% -200, NM 29.0%, ORG 5.1%, NV, NP
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1158
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Thawed silt	Dates Drilled	8/23/2014 - 8/23/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.89343, W154.61525
Vegetation	Alders, willows, Black Spruce, lichen.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Sample Data: Method | Number | Blow Count | Sample Interval | Uncorrected N-Value | Frozen

Drilling Method: S-S Auger

Depth in (Feet)	SUBSURFACE MATERIAL
0	Gn ORG MAT dry to moist
1	Gy Silty SAND w/ Gravel dry to moist
3	SAMPLE 14-5147 (3.5-6.5): SM, 37.4% -200, NM 14.6%, ORG 2.3%, NV, NP
7	BOH

Method: AUGER
Number: 14-5147

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1159
Project Number	AKSAS 63812	Total Depth	4.5 feet
Material Site	Thawed silt over colluvium?	Dates Drilled	8/23/2014 - 8/23/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F, Nice.	Latitude, Longitude	N66.89393, W154.61151
Vegetation	Alders, Black Spruce, willows.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT lichen alder willows
	1									Gy SILT moist
	2									
	3									Bn-Gy Silty GRAVEL wet
	4									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR ANDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1160
Project Number	AKSAS 63812	Total Depth	5 feet
Material Site	Thawed silt over colluvium?	Dates Drilled	8/23/2014 - 8/23/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.89465', W154.60817'
Vegetation	Thick alders and Black Spruce, willows, lichens.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5148						Gn ORG MAT lichen
	1									Gy Sandy SILT w/ Gravel wet SAMPLE 14-5148 (1.0-2.5): ML, 54.3% -200, NM 31.1%, ORG 5.1%, NV, NP
	2									
	3									Gy Silty GRAVEL wet
	4									
	5									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1161
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Silt with massive ice	Dates Drilled	8/23/2014 - 8/23/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.9047 f, W154.52248
Vegetation	Deep tussocks. Black Spruce 2-10 feet tall.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Next to thaw lake.

Drilling Method: S-S Auger

Sample Data: Method: AUGER; Number: 14-5149; Blow Count; Sample Interval; Uncorrected N-Value; Frozen; Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT
tussock
Gy SILT
hi Org, Vx

1 — Wh ICE
Vs, massive ice structures

SAMPLE 14-5149 (2.0-5.0): NM 94.9%

2
3
4
5
6
7 — BOH

Drilling Notes: Installed NPS HOBO data logger S/N10580600

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1162
Project Number	AKSAS 63812	Total Depth	3.3 feet
Material Site	Silt with massive ice	Dates Drilled	8/23/2014 - 8/23/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.90479, W154.52246
Vegetation		Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
H-S Auger	0									Gn ORG MAT
	1									Gy SILT moist, *hi Org*
	2		CORE	14-5150						Gy SILT *hi Org*, Vs, linticular, layered, and reticulate ice structures. SAMPLE 14-5150 (1.5-2.5): NM 29.1%, ORG 6.0%
	3		CORE	14-5151						SAMPLE 14-5151 (2.8-3.3): NM 84.3%, ORG 4.4% BOH

Drilling Notes: SIPRE hole

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

Area 3 Laboratory Data

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Ambler Mining Distric Access
PROJECT NUMBER:	63812
AKSAS NUMBER:	G. Speeter
SAMPLED BY:	Area 3 GOANP
MATERIAL SOURCE:	

TEST HOLE NUMBER		14-1149	14-1150	14-1150	14-1151	14-1152	14-1153	14-1156
DEPTH (feet)		4.0-8.0	1.0-4.0	5.0-9.0	6.0-10.0	7.0-9.0	8.0-10.0	3.0-6.5
LATITUDE		N66.90366°	N66.90284°	N66.90284°	N66.90257°	N66.90229°	N66.90141°	N66.89201°
LONGITUDE		W154.52603°	W154.52902°	W154.52902°	W154.53059°	W154.53503°	W154.53795°	W154.62241°
LAB NUMBER		**14-5138**	**14-5139**	**14-5140**	**14-5141**	**14-5142**	**14-5143**	**14-5144**
DATE SAMPLED		22-Aug-14	22-Aug-14	22-Aug-14	22-Aug-14	22-Aug-14	22-Aug-14	23-Aug-14
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"							97
	0.375"						99	92
	#4						96	84
	#8	98		99				
	#10	98		99				
	#16	97		98			93	75
	#30	96		97				
Sand	**#40**	95		95				
	#50	92		92				
	#60	89	99	90				
	#80	84	98	85	99			
	#100	80	97	81	95		66	30
Silt/Clay	**#200**	69.0	86.4	57.7	61.9		47.7	24.5
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV	NV		NV	NV
PLASTIC INDEX		NP	NP	NP	NP		NP	NP
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si)	(Si)	(SaSi)	(SaSi)	(Si)	(SiSa)	(SiSa w/Gr)
NATURAL MOISTURE		60.5	70.7	24.8	21.8	77.8	14.1	10.0
ORGANICS		7.9	6.3	1.8	0.7	4.8	1.3	1.8
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]	Org[1]			sl Org[1]		

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Ambler Mining Distric Access
PROJECT NUMBER: 63812
AKSAS NUMBER: G. Speeter
SAMPLED BY: Area 3 GOANP
MATERIAL SOURCE:

TEST HOLE NUMBER		14-1157	14-1157	14-1158	14-1160	14-1161	14-1162	14-1162
DEPTH (feet)		0.0-5.0	5.0-10.0	3.5-6.5	1.0-2.5	2.0-5.0	1.5-2.5	2.8-3.3
LATITUDE		N66.89339°	N66.89339°	N66.89343°	N66.89465°	N66.90474°	N66.90479°	N66.90479°
LONGITUDE		W154.61906°	W154.61906°	W154.61525°	W154.60817°	W154.52248°	W154.52246°	W154.52246°
LAB NUMBER		**14-5145**	**14-5146**	**14-5147**	**14-5148**	**14-5149**	**14-5150**	**14-5151**
DATE SAMPLED		23-Aug-14	23-Aug-14	23-Aug-14	23-Aug-14	23-Aug-14	23-Aug-14	23-Aug-14
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"			97				
	0.375"	98		94	99			
	#4	97		83	95			
	#8							
	#10		100					
	#16	96	99	72	89			
	#30		99					
Sand	**#40**		99					
	#50		98					
	#60		97					
	#80		96					
	#100	91	95	46	66			
Silt/Clay	**#200**	88.3	92.8	37.4	54.3			
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV	NV			
PLASTIC INDEX		NP	NP	NP	NP			
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si w/Gr)	(Si)	(SiSa w/Gr)	(Si)	(Si)	(Si)	(Si)
NATURAL MOISTURE		32.1	29.0	14.6	31.1	94.9	29.1	84.3
ORGANICS		6.4	5.1	2.3	5.1		6.0	4.4
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]	Org[1]	sl Org[1]	Org[1]		Org[1]	sl Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

Area 4

Surficial deposits in Area 4 are mostly thawed granular deposits including alluvium, glacial outwash deposits, and glacial drift deposits. Traverse 9 and 10 (Figure 24) were drilled in glacial drift ice contact deposits and till composed of thawed sand and gravel overlain by thawed silt and/or silty sand. Bedrock and colluvial material was intercepted at the bottom of test holes on Traverse 9 and is exposed along the Reed River. Test holes in Traverse 11 intercepted thawed glacial outwash composed of silty sand, silty gravel, and well-or poorly-graded sand.

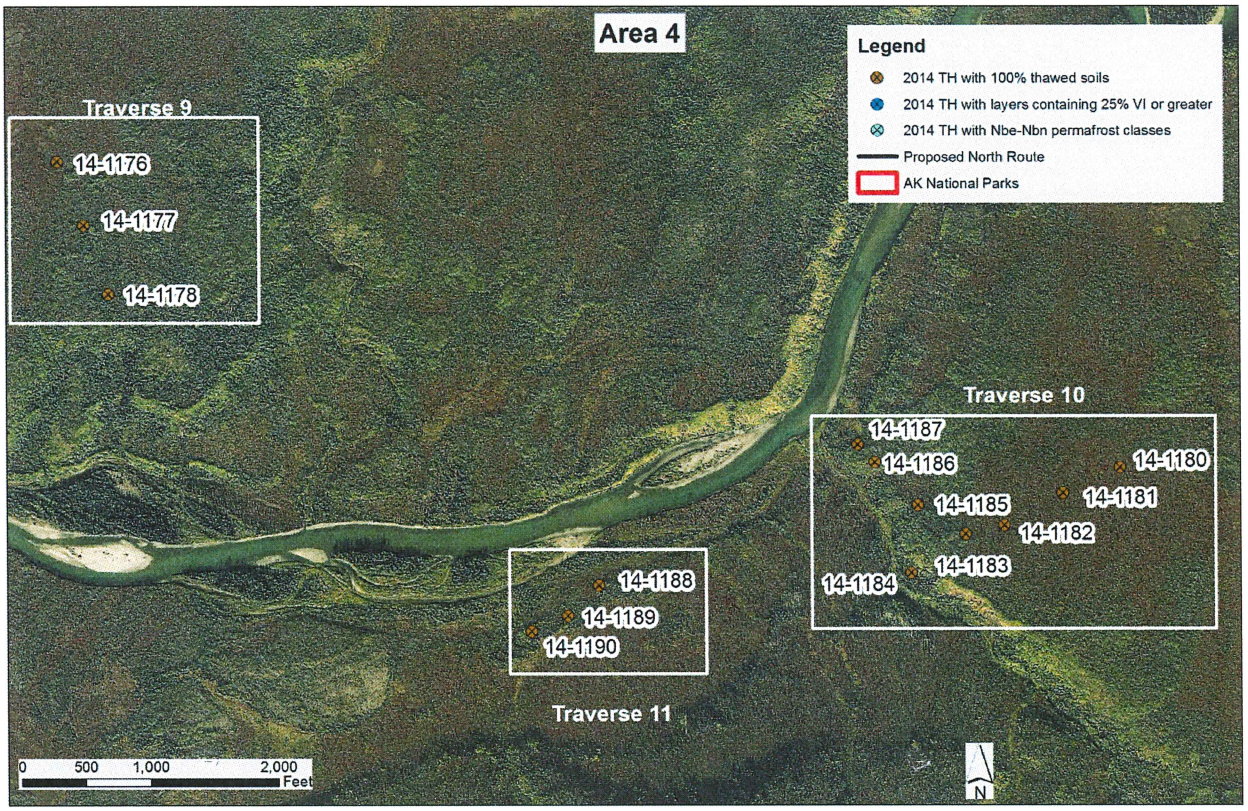


Figure 24. Map of Area 4. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Traverse 9

Table 12. Traverse 9.

Traverse 9				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1176	SS	none	Highly weathered bedrock.	10
14-1177	SS	none	Weathered bedrock (andesite)	7
14-1178	SS	none	Weathered bedrock (andesite)	3

Test holes in Traverse 9 (Figure 24 and Table 9) intercepted highly weathered bedrock. Recovery of identifiable cuttings was difficult but bedrock appeared to be highly weathered

andesite. Bedrock exposed in river bank below the traverse was field classified as highly weathered, hydrothermally altered, conglomerate.

Traverse 10

Table 13. Traverse 10.

Traverse 10				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1180	SS	none	Thawed silt and sandy silt	10
14-1181	SS	none	Thawed silt and sandy silt	10
14-1182	SS	none	Thawed silt and sandy silt	7
14-1183	SS	none	Glacial drift sand over bedrock (andesite)	3.5
14-1184	SS	none	Colluvium over bedrock (andesite)	3.5
14-1185	SS	none	Glacial drift sand (well-graded sand with gravel)	4
14-1186	SS	none	Glacial drift sand (well-graded sand with gravel)	3.5
14-1187	SS	none	Glacial drift sand (well-graded sand with gravel)	4

Test holes in Traverse 10 (Figure 24 and Table 13) intercepted thawed silt and glacial drift deposits. Glacial drift deposits exposed at the surface were well drained and composed of sand and gravel.

Traverse 11

Table 14. Traverse 11.

Traverse 11				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1188	SS	none	Glacial outwash (silty sand and silty gravel)	7.5
14-1189	SS	none	Glacial outwash (well and poorly-graded sand with gravel	4
14-1190	SS	none	Glacial outwash (poorly-graded sand with gravel)	4

Test holes in Traverse 11 (Figure 24 and Table 14) were drilled in glacial outwash deposits. Soils encountered in these test holes were sands and gravels with silt.

Area 4 Photographs



Figure 25. Bedrock exposed on the Reed River south of Traverse 9. Hydrothermally altered conglomerate is clast supported and full of rounded to sub-angular clasts composed of: granite, chert, quartzite, gneiss, and andesite. The outcrop is weak to very weak with close to wide fracture spacing and abundant quartz-filled slicken sided surfaces.



Figure 26. Looking west down Reed River between Traverses 9 and 11.

Area 4 Test Hole Logs

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1176
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	highly weathered bedrock.	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.8952', W154.84547
Vegetation	Scattered Black Spruce, blueberries.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger
Depth in (Feet)
Casing Blows / ft
Sample Data: Method: AUGER; Number: 14-5162; Blow Count; Sample Interval; Uncorrected N-Value; Frozen
Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT

Rd Silty SAND
w/ Gravel
dry to moist. Contained angular fravels with similar lithologies. Oxidized.
Can roll thread easily and quickly.

SAMPLE 14-5162 (4.5-9.5): SM, 29.4% -200, NM 14.4%, ORG 4.2%, LL 30, PI 7

10 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1177
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Weathered bedrock (andesite)	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.8938 f, W154.8440 f
Vegetation	tall black Spruce and Birch. Lichen.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bn SILT w/ Gravel
	1									Rd SILT, soft w/ Gravel Extremly soft weathered andesite
	2									
	3									
	4									
	5									Rd-Gy Poorly-graded GRAVEL, soft w/ Silt Soft weathered andesite SAMPLE 14-5163 (5.0-7.0): return to geologist
	6		AUGER	14-5163						
	7									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1178
Project Number	AKSAS 63812	Total Depth	3 feet
Material Site	Weathered bedrock (andesite)	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.89237, W154.84268
Vegetation	Flat lichen. Black Spruce and Birch trees.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Tn Sandy SILT w/ Gravel till
	1									Rd-Bk Poorly-graded GRAVEL, soft w/ Silt Extremly weathered andisite
	2									
	3									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1180
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Thawed silt and sandy silt	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.88892, W154.78796
Vegetation	Deep lichen, willows, Black Spruce 2-20 feet tall.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Sample Data: Method: A16GR; Number: 14-5164; Blow Count; Sample interval; Uncorrected N-Value; Frozen

Graphic Log

SUBSURFACE MATERIAL

0 Gn ORG MAT
lichen

Gy SILT
moist

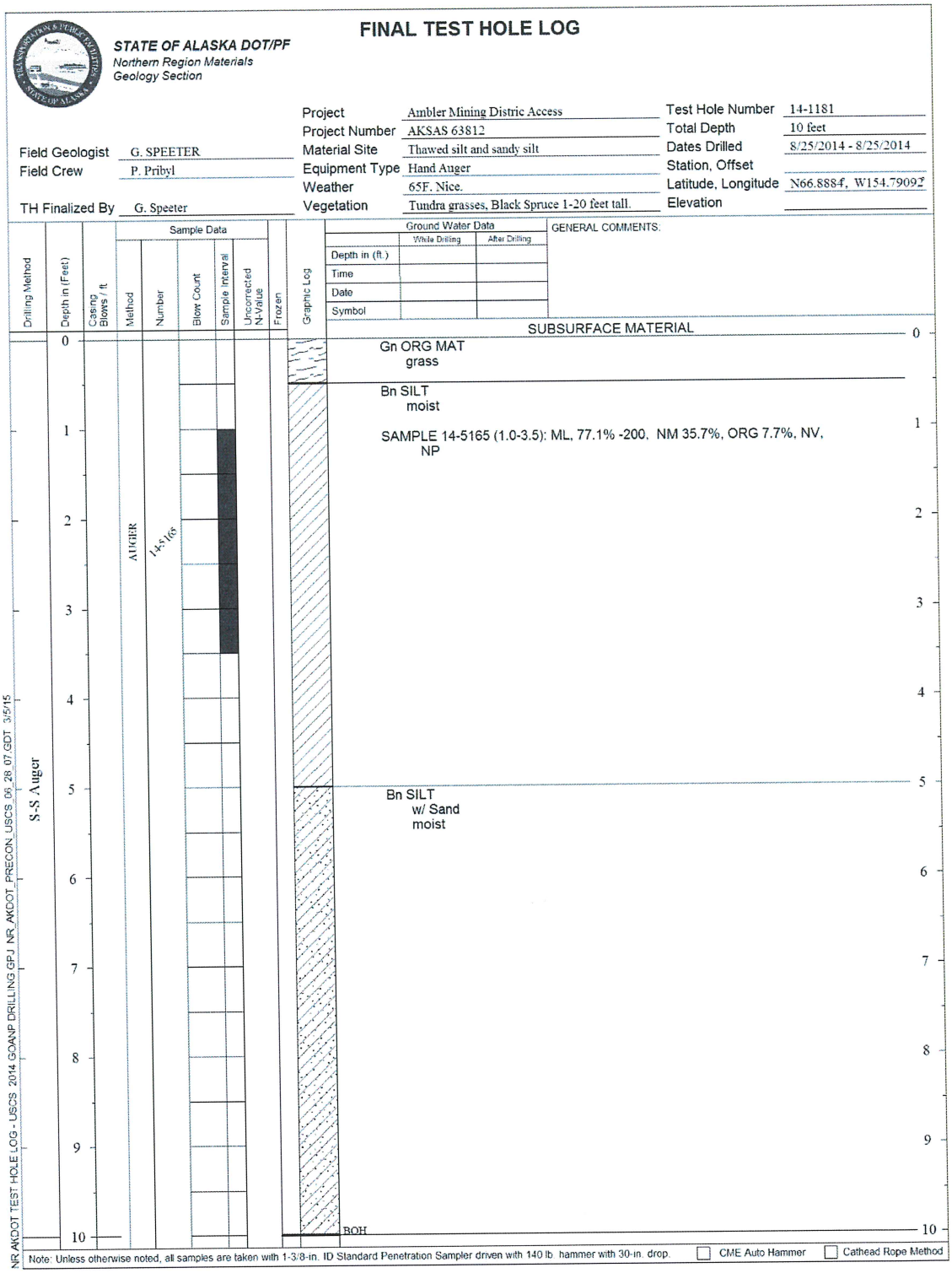
Tn Sandy SILT
dry to moist

SAMPLE 14-5164 (8.0-9.5): ML, 66.1% -200, NM 28.8%, ORG 5.8%, NV, NP

10 BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_09_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Thawed silt and sandy silt
Equipment Type Hand Auger
Weather 65F. Nice.
Vegetation Tundra grasses, Black Spruce 1-20 feet tall.
Test Hole Number 14-1181
Total Depth 10 feet
Dates Drilled 8/25/2014 - 8/25/2014
Station, Offset
Latitude, Longitude N66.8884, W154.79092
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS:
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5165
Gn ORG MAT
grass
Bn SILT
moist
SAMPLE 14-5165 (1.0-3.5): ML, 77.1% -200, NM 35.7%, ORG 7.7%, NV, NP
Bn SILT
w/ Sand
moist
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1182
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Thawed silt and sandy silt	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.88763°, W154.79419°
Vegetation	Tall lichen, Black Spruce, blueberries.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

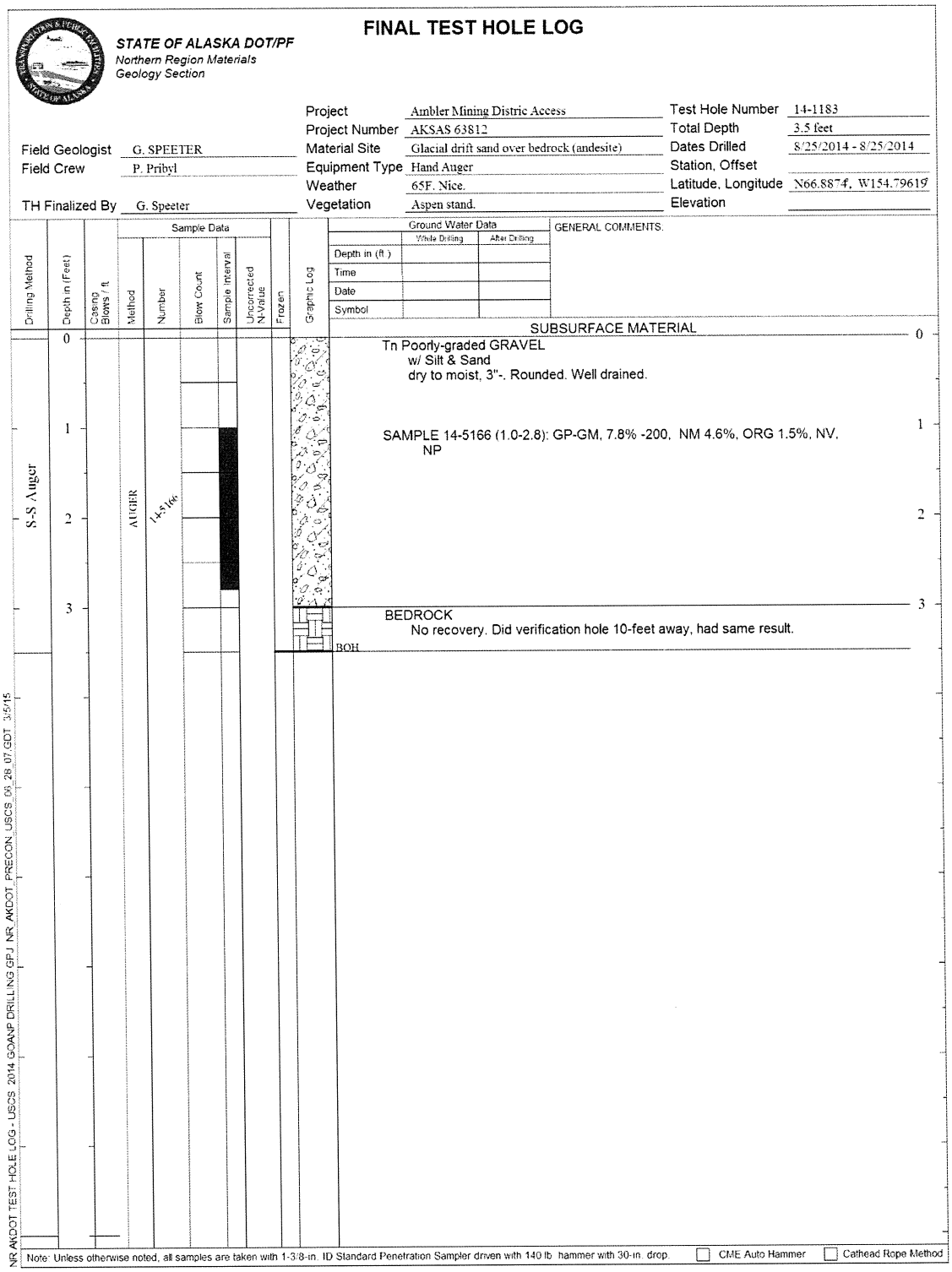
Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft.	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT lichen
	1									Bn SILT moist to wet
	2									
	3									
	4									Tn-Bn Sandy SILT w/ Gravel moist to wet
	5									
	6									
	7									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Glacial drift sand over bedrock (andesite)
Equipment Type Hand Auger
Weather 65F. Nice.
Vegetation Aspen stand.
Test Hole Number 14-1183
Total Depth 3.5 feet
Dates Drilled 8/25/2014 - 8/25/2014
Station, Offset
Latitude, Longitude N66.8874, W154.79619
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS.
Drilling Method
Depth in (Feet)
Casing Blows / ft.
Sample Data
Method
Number
Blow Count
Sample interval
Uncorrected N-Value
Frozen
Graphic Log
S-S Auger
AUGER
14-5166
SUBSURFACE MATERIAL
Tn Poorly-graded GRAVEL
w/ Silt & Sand
dry to moist, 3"-. Rounded. Well drained.
SAMPLE 14-5166 (1.0-2.8): GP-GM, 7.8% -200, NM 4.6%, ORG 1.5%, NV, NP
BEDROCK
No recovery. Did verification hole 10-feet away, had same result.
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1184
Project Number	AKSAS 63812	Total Depth	3.5 feet
Material Site	Colluvium over bedrock (andesite)	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.8866, W154.79926
Vegetation	aspens and light lichens.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Drilled at base of 50-ffoot tall glacial drift deposit.

Drilling Method	Depth in (Feet)	Casing Blows / ft.	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gy Silty GRAVEL dry to moist, looks like colluvium. Andesite aggrigates.
	1									
	2									
	3									Gy BEDROCK Andesite BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1185
Project Number	AKSAS 63812	Total Depth	4 feet
Material Site	Glacial drift sand and gravel	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.888°, W154.79893°
Vegetation	Shallow dry lichen. Aspens.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log
S-S Auger	0								
	1								
	2								
	3								
	4								

SUBSURFACE MATERIAL

0 Bn Well-graded SAND
w/ Gravel
dry to moist, Clean. 1"- gravel. Refusal on a cobble at 4-feet.

4 BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1186
Project Number	AKSAS 63812	Total Depth	3.5 feet
Material Site	Glacial drift sand and gravel	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.8891', W154.80127'
Vegetation	Light green lichens and Aspen.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log
S-S Auger	0								
	1								
	2								
	3								

SUBSURFACE MATERIAL

Bn Well-graded SAND
w/ Gravel
dry to moist, well-drained. Refusal on a cobble.

BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1187
Project Number	AKSAS 63812	Total Depth	4 feet
Material Site	Glacial drift sand and gravel	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.88943, W154.80219
Vegetation	Light green lichens and Aspen.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bn Well-graded SAND w/ Silt & Gravel wet, Auger suck.
	1									
	2									
	3									
	4									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1188
Project Number	AKSAS 63812	Total Depth	7.5 feet
Material Site	Glacial outwash	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.88626, W154.81009
Vegetation	Black Spruce, Alders, Aspens, willows.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Sample Data: Casing Blows / ft. | Method: AUGER | Number: 14-5167 | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

SUBSURFACE MATERIAL

0 – Gy Silty SAND
w/ Gravel
dry to moist, Glacial outwash. 1"-.

2 – Gy Silty GRAVEL
w/ Sand
dry to moist
SAMPLE 14-5167 (2.0-7.5): GM, 14.5% -200, NM 6.0%, ORG 3.9%, NV, NP

7 – BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_09_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1189
Project Number	AKSAS 63812	Total Depth	4 feet
Material Site	Glacial outwash	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.88557, W154.8176
Vegetation	Dry lichen, Black Spruce, Alders.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bn Poorly-graded SAND w/ Gravel moist, Fine SP.
	1									
	2									Bn Well-graded SAND w/ Gravel w/ Cobbles moist
	3									
	4									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1190
Project Number	AKSAS 63812	Total Depth	4 feet
Material Site	Glacial outwash	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N66.88526, W154.89175
Vegetation	Light shallow lichen.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5166						Gn ORG MAT lichen
	1									Tn-Bn Poorly-graded SAND w/ Gravel dry to moist, well-drained.
	2									Bn Poorly-graded SAND w/ Silt & Gravel w/ Cobbles dry to moist, well-drained. SAMPLE 14-5168 (2.5-3.5): SP-SM, 10.8% -200, NM 6.6%, ORG 1.9%, NV, NP
	3									
	4									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

Area 4 Laboratory Data

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Ambler Mining Distric Access
PROJECT NUMBER: 63812
AKSAS NUMBER:
SAMPLED BY: G. Speeter
MATERIAL SOURCE: Area 4 GOANP

TEST HOLE NUMBER		14-1176	14-1180	14-1181	14-1183	14-1188	14-1190	
DEPTH (feet)		4.5-9.5	8.0-9.5	1.0-3.5	1.0-2.8	2.0-7.5	2.5-3.5	
LATITUDE		N66.8952°	N66.88892°	N66.8884°	N66.8874°	N66.88626°	N66.88526°	
LONGITUDE		W154.84547°	W154.78796°	W154.79092°	W154.79619°	W154.81009°	W154.89173°	
LAB NUMBER		**14-5162**	**14-5164**	**14-5165**	**14-5166**	**14-5167**	**14-5168**	
DATE SAMPLED		25-Aug-14	25-Aug-14	25-Aug-14	25-Aug-14	25-Aug-14	25-Aug-14	
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**				92			
	0.75"				80	81		
	0.5"	97			76	73	98	
	0.375"	91			69	66	95	
	#4	65		99	53	51	80	
	#8							
	#10							
	#16	45		98	39	34	70	
	#30		99					
Sand	**#40**		98					
	#50		95					
	#60		93					
	#80		86					
	#100	33	81	84	10	18	20	
Silt/Clay	**#200**	29.4	66.1	77.1	7.8	14.5	10.8	
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		30	NV	NV	NV	NV	NV	
PLASTIC INDEX		7	NP	NP	NP	NP	NP	
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(SiSa)	(SaSi)	(Si)	(PGGr w/Si&Sa)	(SiGr w/Sa)	(PGSa w/Si&Gr)	
NATURAL MOISTURE		14.4	28.8	35.7	4.6	6.0	6.6	
ORGANICS		4.2	5.8	7.7	1.5	3.9	1.9	
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		sl Org[1]	Org[1]	Org[1]		sl Org[1]		

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

Area 5

Traverse 15 (Figure 27 and Figure 31) was conducted to evaluate a glacial drift deposit composed of stratified compact till gravels as a potential material source. Traverse 14 (Figure 27 and Figure 30) was conducted to evaluate surficial deposits in an area with abundant thaw boils and burned areas that were identified from the air. Traverse 12 (Figure 27 and Figure 28) was conducted to evaluate a broad, flat, glacial outwash terrace as a potential material source. Traverse 13 (Figure 29) was conducted in glacial drift sand to evaluate the nearby area as a river crossing on the Kobuk River.

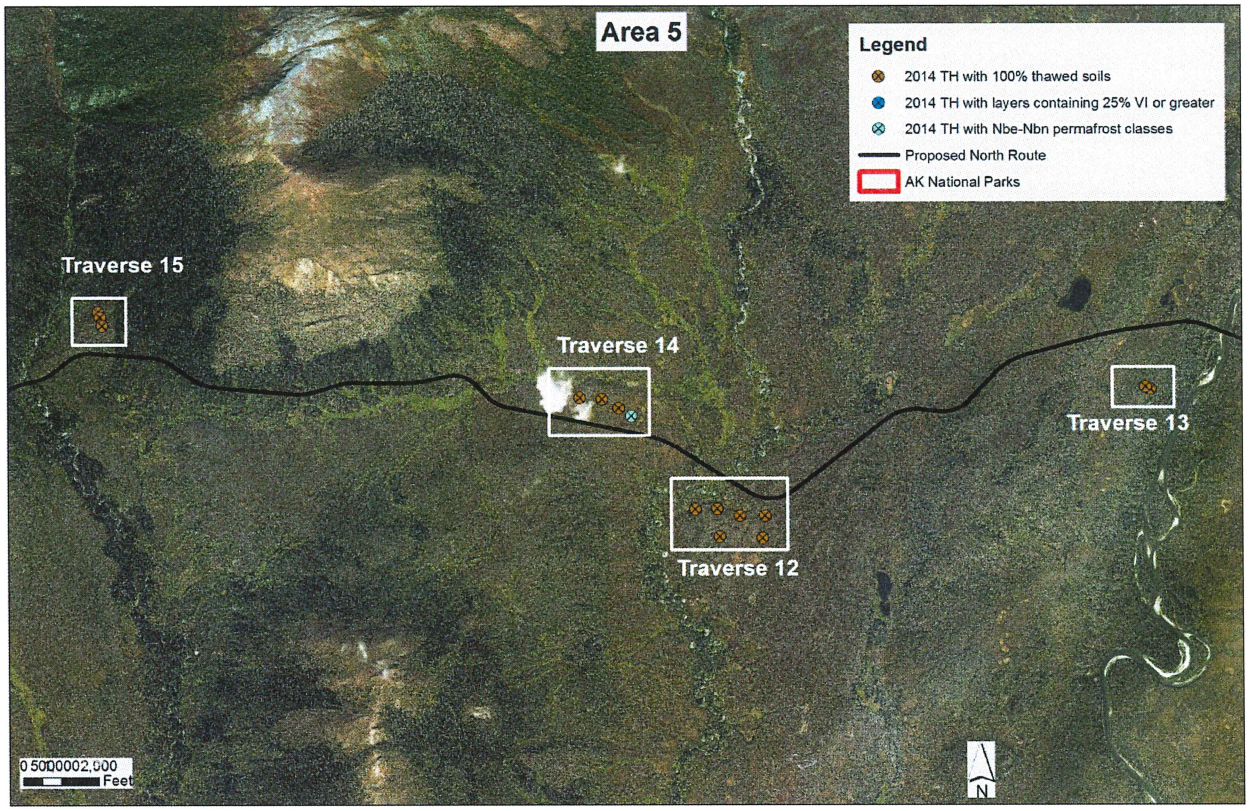


Figure 27. Area 5 overview map. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Traverse 12

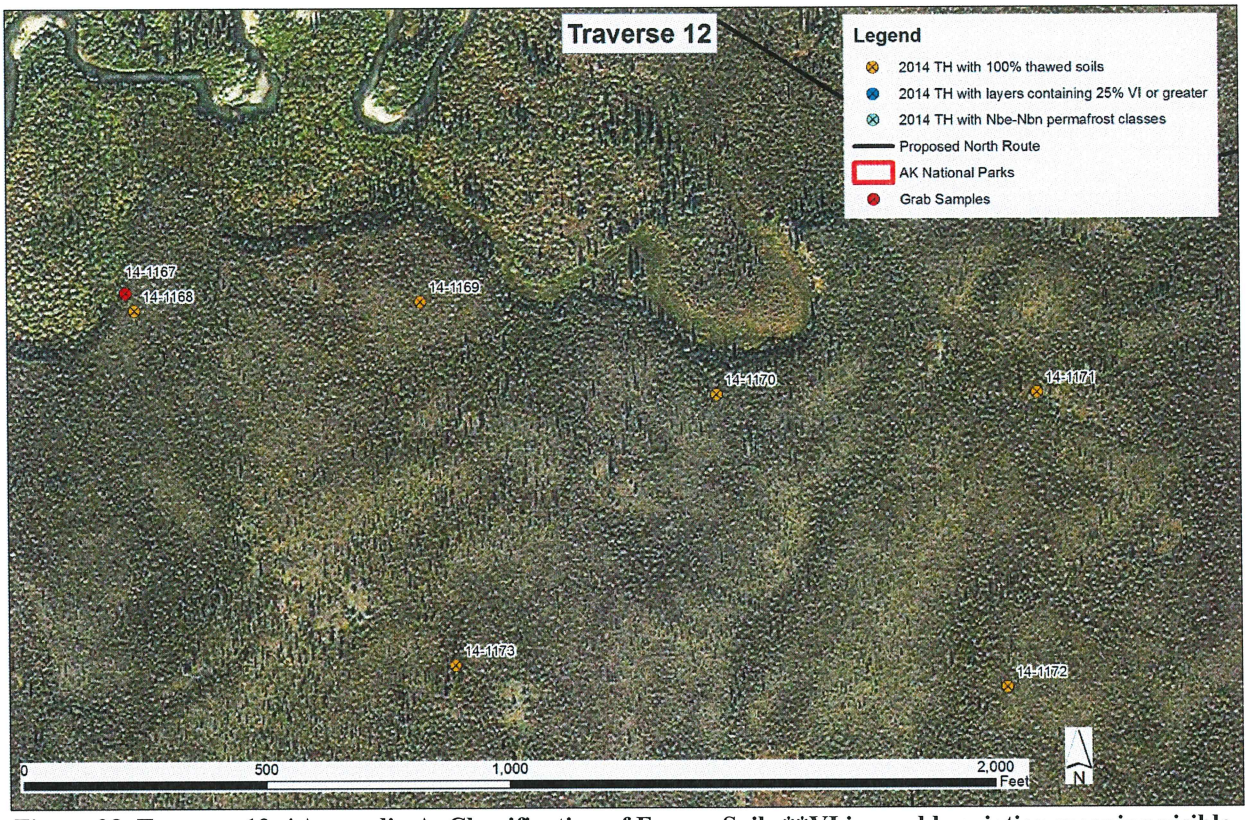


Figure 28. Traverse 12. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Table 15. Traverse 12.

Traverse 12				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1168	SS	none	Glacial outwash terrace (well-graded sand)	10
14-1169	SS	none	Glacial outwash terrace (silty sand)	10
14-1170	SS	none	Glacial outwash terrace (silty sand)	10
14-1171	SS	none	Glacial outwash terrace (well and poorly-graded sand)	10
14-1172	SS	none	Glacial outwash terrace (well and poorly-graded sand)	10
14-1173	SS	none	Glacial outwash terrace (well and poorly-graded sand)	10

Test holes in Traverse 12 (Figure 28 and Table 15) were drilled to evaluate a glacial outwash terrace that looked like a good deposit for a potential material site. The deposit is at the midpoint of the northern route through Gates of The Arctic National Park. Test holes intercepted mostly well and poorly-graded sands and silty sands in the deposit which suggests material in this deposit is too fine grained to produce crushed aggregate products.

Traverse 13

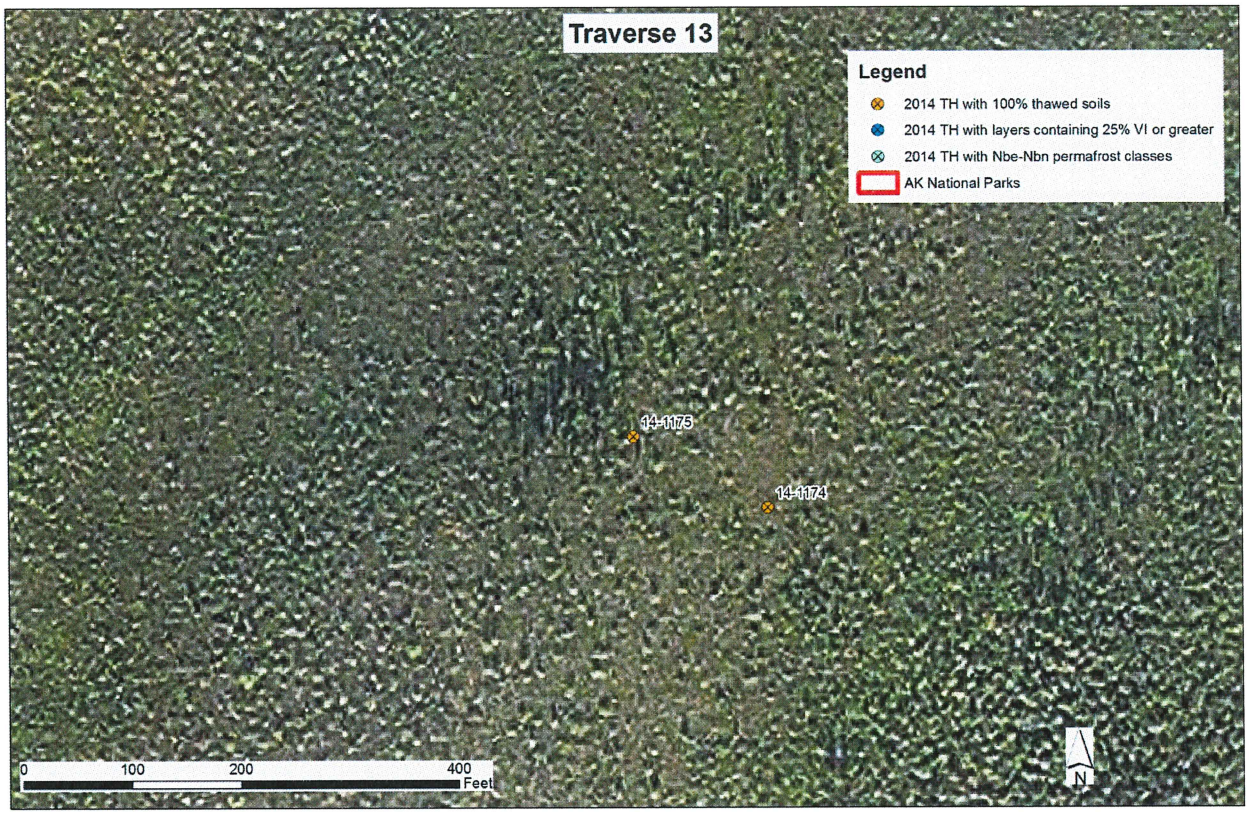


Figure 29. Traverse 13. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Table 16. Traverse 13.

Traverse 13				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1174	SS	none	Glacial outwash sand (silty sand)	10
14-1175	SS	none	Glacial outwash sand (silty sand)	10

Test holes in Traverse 13 (Figure 29 and Table 16) were drilled to explore the bluffs on the side (west side) of the Kobuk River opposite Area 2 (Figure 11). Test holes indicate that the bluff is composed mostly of deep glacial outwash sand.

Traverse 14

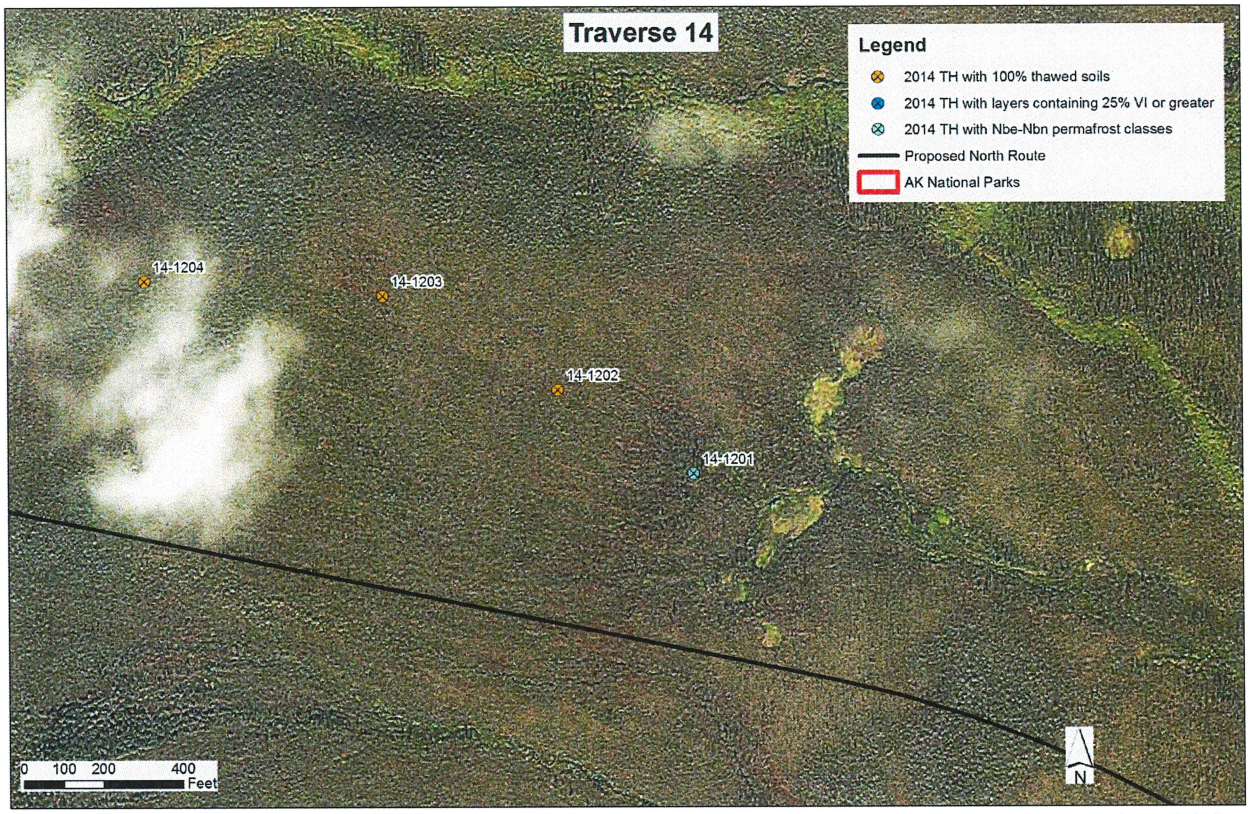


Figure 30. Traverse 14. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Table 17. Traverse 14.

Traverse 14				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1201	SS	none	Thawed and frozen silt	10
14-1202	SS	none	Thawed silt above colluvium	6
14-1203	SS	none	Thawed silt and clay	10
14-1204	SS	none	Thawed silt	7

Test holes in Traverse 14 (Figure 30 and Table 17) were drilled to investigate a largely burned, tussock covered, area that has several large thaw boils that are visible from the air. Test holes in Traverse 14 encountered mostly thawed silt. Colluvial material was present in TH14-1202.

- Loose thawed and/or thawing silt in this area could destabilize if heavy rains increase surface erosion.

Traverse 15

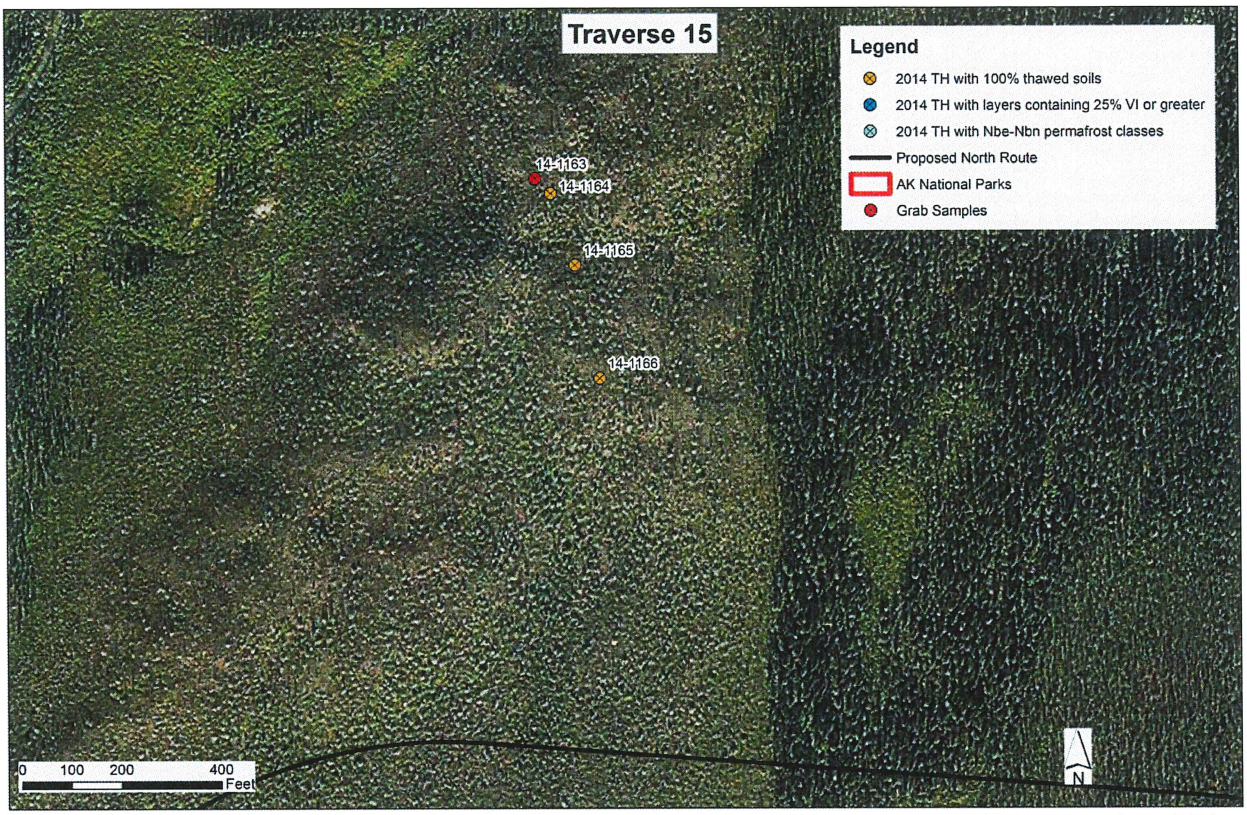


Figure 31. Traverse 15. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Table 18. Traverse 15.

Traverse 15				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1164	SS	none	Thawed glacial drift (well-graded gravel)	10
14-1165	SS	none	Thawed glacial drift (well-graded gravel)	10
14-1166	SS	none	Thawed glacial drift (well-graded gravel)	4

Test holes in Traverse 15 (Figure 31 and Table 18) were drilled to evaluate a large glacial drift deposit as a potential material source. All three test holes encountered glacial drift deposits composed of well-graded gravels and/or silty gravel. A grab sample was collected for gradation and quality analyses.

Area 5 Photographs



Figure 32. Solid stem auger drilling with Tenaka drill in glacial drift deposits on Traverse 15.

Area 5 Test Hole Logs

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1163
Project Number	AKSAS 63812	Total Depth	0.5 feet
Field Geologist	G. SPEETER	Material Site	Thawed glacial drift
Dates Drilled	8/24/2014 - 8/24/2014
Field Crew	P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
		Weather	60F. Nice.	Latitude, Longitude	N67.02335, W154.56532
TH Finalized By	G. Speeter	Vegetation	Black Spruce. Alders.	Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS
Glacial drift deposit. Irregular shaped mounds up to 50-feet tall. Adjacent stream. Lightly vegitated. Material looks consistant from mound to mound.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
	0									Bn Well-graded GRAVEL w/ Sand
										BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1164
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Thawed glacial drift	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.02325, W154.56508
Vegetation	Sparse Black Spruce, Birch, Alders.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS.
Drilled on top of "knob shaped" glacial drift deposit.

Drilling Method	Depth in (Feet)	Casing Blows / ft.	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log
S-S Auger	0–10								

SUBSURFACE MATERIAL

Bn Well-graded GRAVEL
w/ Sand
w/ Cobbles
3"-. Angular. Glacial Drift. Clean and well-drained.

BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1165
Project Number	AKSAS 63812	Total Depth	10 feet
Field Geologist	G. SPEETER	Material Site	Thawed glacial drift	Dates Drilled	8/24/2014 - 8/24/2014
Field Crew	P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
		Weather	60F. Nice.	Latitude, Longitude	N67.0228', W154.5647'
TH Finalized By	G. Speeter	Vegetation	Black Spruce and Alder.	Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Drilled in depression below 15 foot tall mound in glacial deposits.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bn Silty SAND moist
	1									Gy Well-graded GRAVEL w/ Sand moist, 3"-. angular. well drained.
	2									
	3									
	4									
	5									
	6									
	7									
	8		AUGER	14-5154						Bn Silty GRAVEL moist, 3"-. SAMPLE 14-5154 (8.0-10.0): NM 19.7%
	9									
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1166
Project Number	AKSAS 63812	Total Depth	4 feet
Field Geologist	G. SPEETER	Material Site	Thawed glacial drift	Dates Drilled	8/24/2014 - 8/24/2014
Field Crew	P. Pribyl	Equipment Type	Hand Auger	Station, Offset	
		Weather	60F. Nice.	Latitude, Longitude	N67.02222, W154.56438
TH Finalized By	G. Speeter	Vegetation	Black Spruce.	Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS
Drilled on top of glacial drift mound.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bn-Gy Well-graded GRAVEL w/ Silt & Sand moist, 3"-. Angular. <5% cobbles.
	1									
	2									Bn Well-graded GRAVEL w/ Sand w/ Cobbles moist, Refusal on cobble. 3"-. Clean and well-drained.
	3									
	4									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 06 28 07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1167
Project Number	AKSAS 63812	Total Depth	0.5 feet
Material Site	Glacial outwash terrace	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.00909, W154.45432
Vegetation	Willows. Black Spruce.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Immateur sand. Glacial outwash terrace.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
	0									SUBSURFACE MATERIAL — 0
										Bn Poorly-graded SAND w/ Gravel
										BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

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FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1168
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Glacial outwash terrace	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.009F, W154.45422
Vegetation	Scattered Black Spruce, light lichen, willows.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Sample Data: Method | Number | Blow Count | Sample Interval | Uncorrected N-Value | Frozen

Drilling Method: S-S Auger

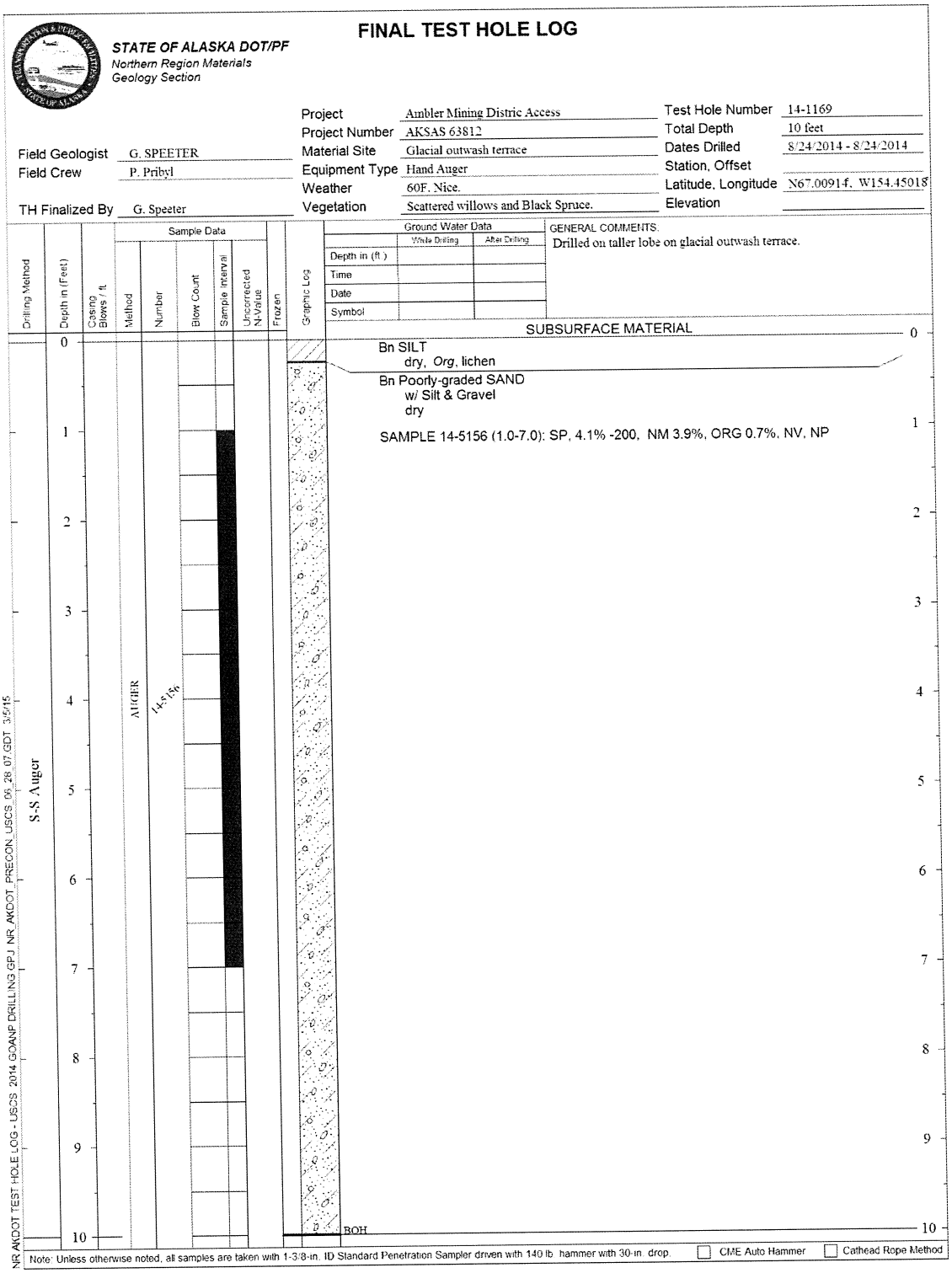
SUBSURFACE MATERIAL

Bn Well-graded SAND
w/ Gravel
moist, 2"-. Rounded. Immature sand, lots of angular mica grains.

BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GIANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Glacial outwash terrace
Equipment Type Hand Auger
Weather 60F. Nice.
Vegetation Scattered willows and Black Spruce.
Test Hole Number 14-1169
Total Depth 10 feet
Dates Drilled 8/24/2014 - 8/24/2014
Station, Offset
Latitude, Longitude N67.00914, W154.45018
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS:
Drilled on taller lobe on glacial outwash terrace.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
Bn SILT
dry, Org, lichen
Bn Poorly-graded SAND
w/ Silt & Gravel
dry
SAMPLE 14-5156 (1.0-7.0): SP, 4.1% -200, NM 3.9%, ORG 0.7%, NV, NP
S-S Auger
AUGER
14-5156
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1170
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Glacial outwash terrace	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.00867, W154.44586
Vegetation	Willows	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft.	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5157						Bn Sandy SILT dry to moist
	1									
	2									Bn Silty SAND dry
	3									SAMPLE 14-5157 (3.5-7.0): NM 2.9%, ORG 0.5%
	4									
	5									Bn Well-graded SAND w/ Gravel dry to moist, Immateur glacial drift sand. 1"-.
	6									
	7									
	8									
	9									
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1171
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Glacial outwash terrace	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.00865, W154.44128
Vegetation	Scattered willows and Black Spruce.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5158						Bn SILT w/ Sand SAMPLE 14-5158 (0.5-1.0): ML, 57.2% -200, NM 26.4%, ORG 5.8%, NV, NP
	1									
	2									Tn Poorly-graded SAND w/ Silt moist, Fine immateur sand. Well-drained.
	3									
	4									
	5									
	6									
	7									Tn Well-graded SAND w/ Gravel moist, 1"-. Immateur glacial outwash sand.
	8									
	9									
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1172
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Glacial outwash terrace	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.0070f, W154.44176
Vegetation	Willows Black Spruce.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bn Silty SAND moist
	1									
	2									Bn Poorly-graded SAND w/ Silt moist, fine grained.
	3									
	4									
	5									Tn Well-graded SAND w/ Gravel 1"-.
	6									
	7									
	8									
	9									
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1173
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Glacial outwash terrace	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.00713, W154.44968
Vegetation	Scattered willows and Black Spruce.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5159						Bn Silty SAND moist
	1									
	2									Tn Poorly-graded SAND w/ Silt moist, Fine grained. Immature.
	3									
	4									
	5									
	6									
	7									Bn-Tn Well-graded SAND w/ Gravel moist, 0.5"-. Well-drained. immature
	8									SAMPLE 14-5159 (8.0-10.0):
	9									
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1174
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Glacial outwash sand	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.0181f, W154.3697
Vegetation	Alder willows, Black Spruce, Alder.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Drilled on bluffs on south bank of Kobuk River.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT
	1									Bn Silty SAND moist
	2									Bn Poorly-graded SAND moist
	3									
	4									
	5									
	6									
	7									Bn Silty SAND w/ Gravel moist
	8									
	9									
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1175
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Glacial outwash sand	Dates Drilled	8/24/2014 - 8/24/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	60F. Nice.	Latitude, Longitude	N67.01825, W154.3706°
Vegetation	Alder willows, Black Spruce, Alder.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Drilled on bluffs on south bank of Kobuk River.

Drilling Method: S-S Auger
Casing Blows / ft.
Sample Data: Method, Number, Blow Count, Sample Interval, Uncorrected N-Value, Frozen
Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT
lichen mat
Bn SILT
Tn Sandy SILT
moist

1

2 — Tn SILT
w/ Sand
moist, Very fine.

SAMPLE 14-5160 (2.5-5.0): ML, 95% -200, NM 24.7%, ORG 2.3%, NV, NP

3

4 — AUGER 14-5160

5

6 — Gy-Bn Silty SAND
dry to moist, Fine
SAMPLE 14-5161 (6.0-9.0): SM, 28.2% -200, NM 9.3%, ORG 1.2%, NV, NP

7 — AUGER 14-5161

8

9

10 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1201
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Thawed and frozen silt	Dates Drilled	8/27/2014 - 8/27/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	40F. rain.	Latitude, Longitude	N67.01558, W154.46574
Vegetation	Light green lichen, Blueberries, burned Black Spruce, tall.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Sample Data: Casing Blows / ft | Method | Number | Blow Count | Sample interval | Uncorrected N-Value | Frozen

Graphic Log

SUBSURFACE MATERIAL

0 – Gn ORG MAT
light green lichen

Bn SILT
w/ Sand
moist to wet, Nbn

SAMPLE 14-5179 (6.0-8.5): ML, 74.5% -200, NM 59.6%, ORG 8.1%, NV, NP

AUGER 14-5179

10 – BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GSANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1202
Project Number	AKSAS 63812	Total Depth	6 feet
Material Site	Thawed silt above colluvium	Dates Drilled	8/27/2014 - 8/27/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	40F. rain.	Latitude, Longitude	N67.01632, W154.46834
Vegetation	Lichens, blueberries, burned spruce 10-15 feet tall	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)	4.5	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS:

Drilling Method: S-S Auger
Sample Data: Method: AUGER; Number: 14-5180

SUBSURFACE MATERIAL

0 – Gn ORG MAT
lichen/peat

1 – Gy SILT
w/ Sand
dry to moist
SAMPLE 14-5180 (1.5-3.5): ML, 71.5% -200, NM 53.0%, ORG 10.4%, NV, NP

4 – Gy SILT
w/ Sand
wet

6 – BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1203
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Thawed silt and clay	Dates Drilled	8/27/2014 - 8/27/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	40F. rain.	Latitude, Longitude	N67.01709, W154.47179
Vegetation	Lichens blueberries burned black spruce.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger
Sample Data: Casing Blows / ft. | Method: AUGER | Number: 14-5181 | Blow Count | Sample Interval | Uncorrected N-Value | Frozen
Graphic Log

SUBSURFACE MATERIAL

0 – Gn ORG MAT

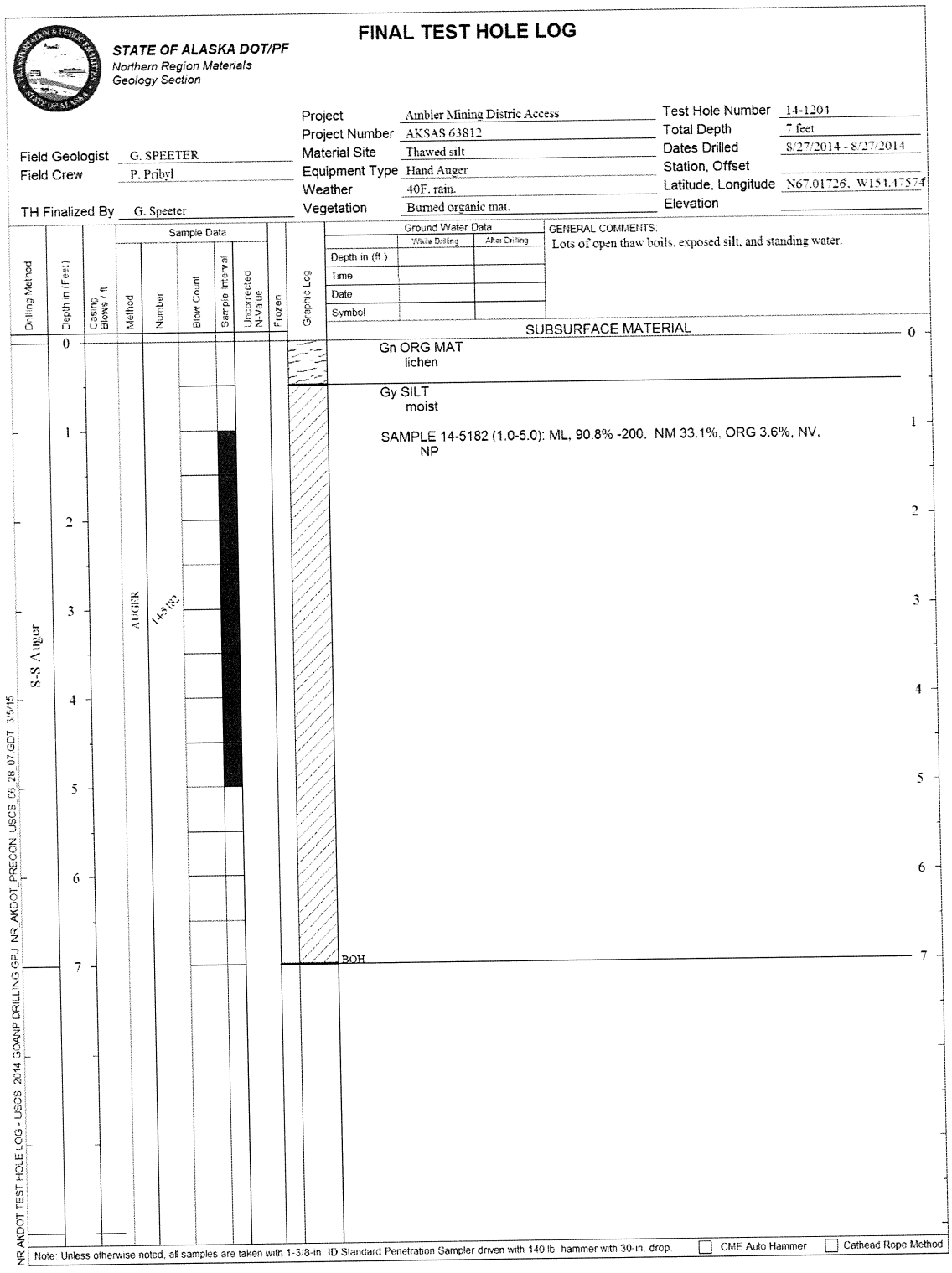
Gy SILT
wet

6 – Gy SILT
moist to wet, makes moisture barrier.
SAMPLE 14-5181 (6.0-10.0): ML, 95.7% -200, NM 41.4%, ORG 5.2%, NV, NP

10 – BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Thawed silt
Equipment Type Hand Auger
Weather 40F, rain.
Vegetation Burned organic mat.
Test Hole Number 14-1204
Total Depth 7 feet
Dates Drilled 8/27/2014 - 8/27/2014
Station, Offset
Latitude, Longitude N67.01726, W154.47574
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS.
Lots of open thaw boils, exposed silt, and standing water.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5182
Gn ORG MAT
lichen
Gy SILT
moist
SAMPLE 14-5182 (1.0-5.0): ML, 90.8% -200, NM 33.1%, ORG 3.6%, NV, NP
BOH
0
1
2
3
4
5
6
7
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS 05_28_07.GDT 3/5/15
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method

Area 5 Laboratory Data

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Ambler Mining Distric Access
PROJECT NUMBER: 63812
AKSAS NUMBER:
SAMPLED BY: G. Speeter
MATERIAL SOURCE: Area 5 GOANP

TEST HOLE NUMBER		14-1165	14-1169	14-1170	14-1171	14-1175	14-1175	14-1201
DEPTH (feet)		8.0-10.0	1.0-7.0	3.5-7.0	0.5-1.0	2.5-5.0	6.0-9.0	6.0-8.5
LATITUDE		N67.02281°	N67.00914°	N67.00867°	N67.00865°	N67.01825°	N67.01825°	N67.01558°
LONGITUDE		W154.56477°	W154.45018°	W154.44586°	W154.44128°	W154.37067°	W154.37067°	W154.46574°
LAB NUMBER		**14-5154**	**14-5156**	**14-5157**	**14-5158**	**14-5160**	**14-5161**	**14-5179**
DATE SAMPLED		24-Aug-14	24-Aug-14	24-Aug-14	24-Aug-14	24-Aug-14	24-Aug-14	27-Aug-14
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"							
	0.375"		97				97	
	#4		89		100		92	
	#8							
	#10							
	#16		78		99		81	99
	#30							97
Sand	**#40**					100		95
	#50					99		92
	#60					99		90
	#80					99		85
	#100		9		65	98	36	83
Silt/Clay	**#200**		4.1		57.2	95.0	28.2	74.5
Hydro	**0.02**							
	0.005							
	0.002							
	0.001							
LIQUID LIMIT			NV		NV	NV	NV	NV
PLASTIC INDEX			NP		NP	NP	NP	NP
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(SiGr)	(PGSa w/Si&Gr)	(SiSa)	(Si w/Sa)	(Si w/Sa)	(SiSa)	(Si w/Sa)
NATURAL MOISTURE		19.7	3.9	2.9	26.4	24.7	9.3	59.6
ORGANICS			0.7	0.5	5.8	2.3	1.2	8.1
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS					Org[1]	sl Org[1]		Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Ambler Mining Distric Access
PROJECT NUMBER:	
AKSAS NUMBER:	63812
SAMPLED BY:	G. Speeter
MATERIAL SOURCE:	Area 5 GOANP

TEST HOLE NUMBER		14-1202	14-1203	14-1204				
DEPTH (feet)		1.5-3.5	6.0-10.0	1.0-5.0				
LATITUDE		N67.01632°	N67.01709°	N67.01726°				
LONGITUDE		W154.46834°	W154.47179°	W154.47574°				
LAB NUMBER		**14-5180**	**14-5181**	**14-5182**				
DATE SAMPLED		27-Aug-14	27-Aug-14	27-Aug-14				
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"	96						
	0.375"	94						
	#4	93						
	#8							
	#10							
	#16	91		99				
	#30							
Sand	**#40**		100					
	#50		99					
	#60		99					
	#80		99					
	#100	76	98	95				
Silt/Clay	**#200**	71.5	95.7	90.8				
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV				
PLASTIC INDEX		NP	NP	NP				
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si w/Sa)	(Si)	(Si)				
NATURAL MOISTURE		53.0	41.4	33.1				
ORGANICS		10.4	5.2	3.6				
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]	Org[1]	sl Org[1]				

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

Area 6

Traverses 18 and 16 (Figure 33) were conducted to evaluate glacial lake deposits composed of stratified fine sediments that are present along a significant stretch of the proposed southern route alternative. Traverse 17 (Figure 33) was conducted to evaluate low-lying glacial drift gravels with deep, frozen, ice-rich overburden in lateral geologic contact with glacial lake deposits.

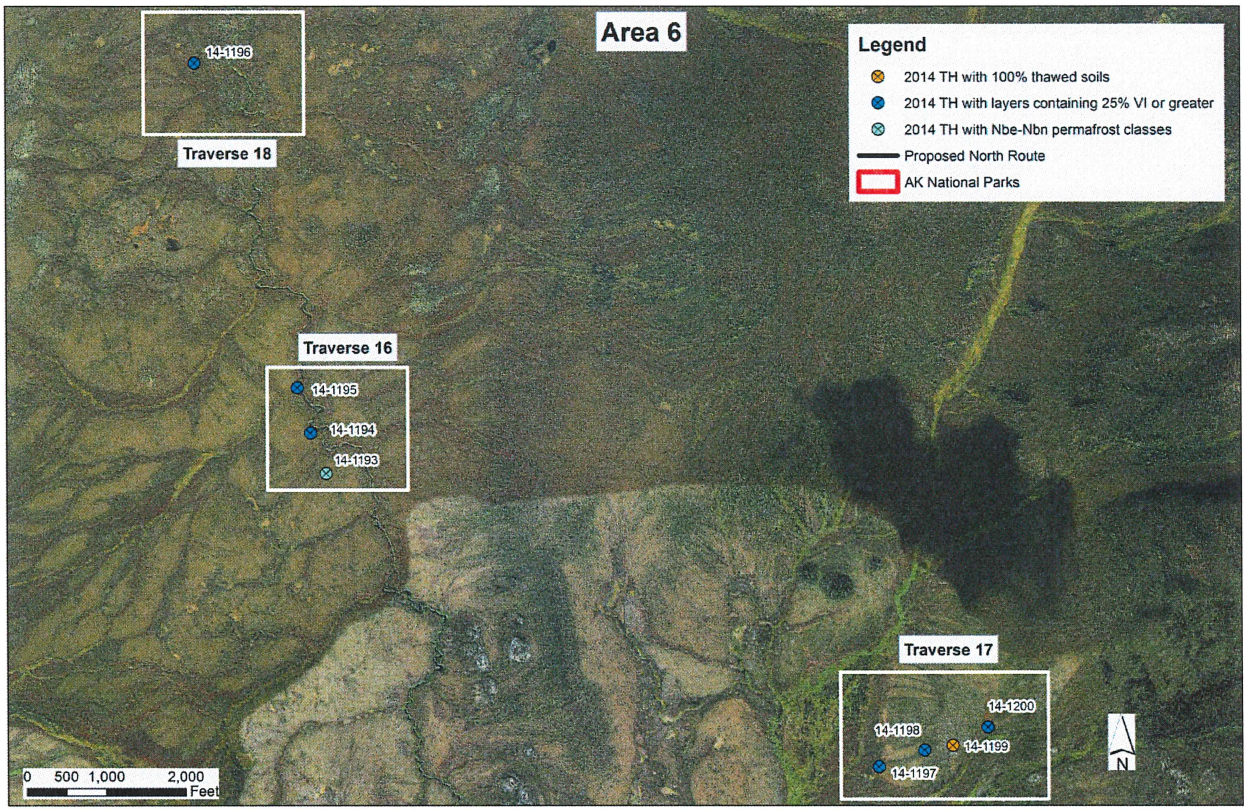


Figure 33. Area 6. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Traverse 16

Table 19. Traverse 16.

Traverse 16				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1193	SS	none	Glacial lacustrine deposits (silt)	7
14-1194	SS	none	Frozen silt over frozen glacial lacustrine sand (well and poorly graded sand)	9.5
14-1195	SS	none	Frozen silt over frozen glacial lacustrine sand (silty sand)	10

Traverse 16 (Figure 33 and Table 19) was conducted to classify glacial-lake deposits and overburden near the south route through Gates of The Arctic National Park. Frozen soils with massive ice were intercepted by two of three test holes. All three test holes intercepted frozen soil. Frozen silt at the surface was typically 5 to 7 feet thick and overlaid glacial-lake deposits composed of poorly-graded sand.

Traverse 17

Table 20. Traverse 17.

Traverse 17				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1197	SS	none	Frozen silt with massive ice	10
14-1198	SS	none	Frozen silt with massive ice	7.5
14-1199	SS	none	Thawed glacial drift (well-graded gravel with silt and sand)	5
14-1200	SS	none	Frozen silt with massive ice	10

Test holes in Traverse 17 (Figure 33 and Table 20) intercepted frozen silt with massive ice and thawed glacial drift deposits. Ice was generally confined within the silt layer above glacial drift deposits. Glacial drift deposits were sporadically exposed on the surface.

Traverse 18

Table 21. Traverse 18.

Traverse 18				
Hole ID	**Type**	**Equipment installed**	**General geologic description**	**Total depth**
14-1196	SS	Temporary thermistor installed to 13-feet	Frozen silt over frozen glacial lacustrine sand (silty sand)	15

Test hole 14-1196 (Figure 33 and Table 21) was drilled to install a temporary thermistor in an area that appeared (based on observations in the field) to best represent glacial lake deposits in the area. Temperatures recorded on 8-27-14 ranged between 31.889 and 31.776°F at depths between 4 and 12 feet. This interval contained mostly frozen soil classified as Nbe/Nbn. Temperatures lowered to 31.09°F at a depth of 14 feet where the test hole encountered 100% massive ice.

- Deposits encountered by TH14-1196 are interpreted to be thermally unstable based on relatively high temperatures of frozen soils in TH14-1196 and sporadic distribution of massive ice/thawed soil in test holes of nearby Traverses 15 (Figure 31) and 16 (Figure 33).

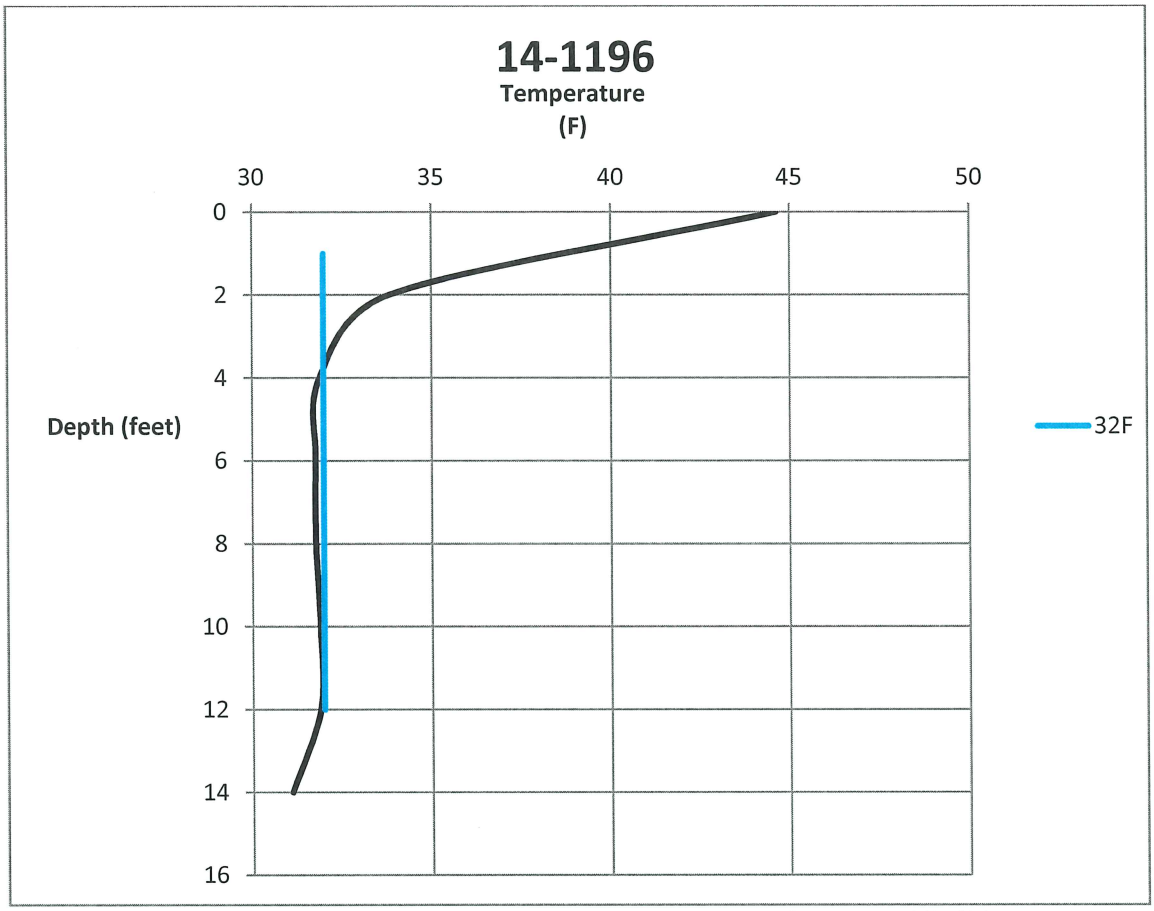


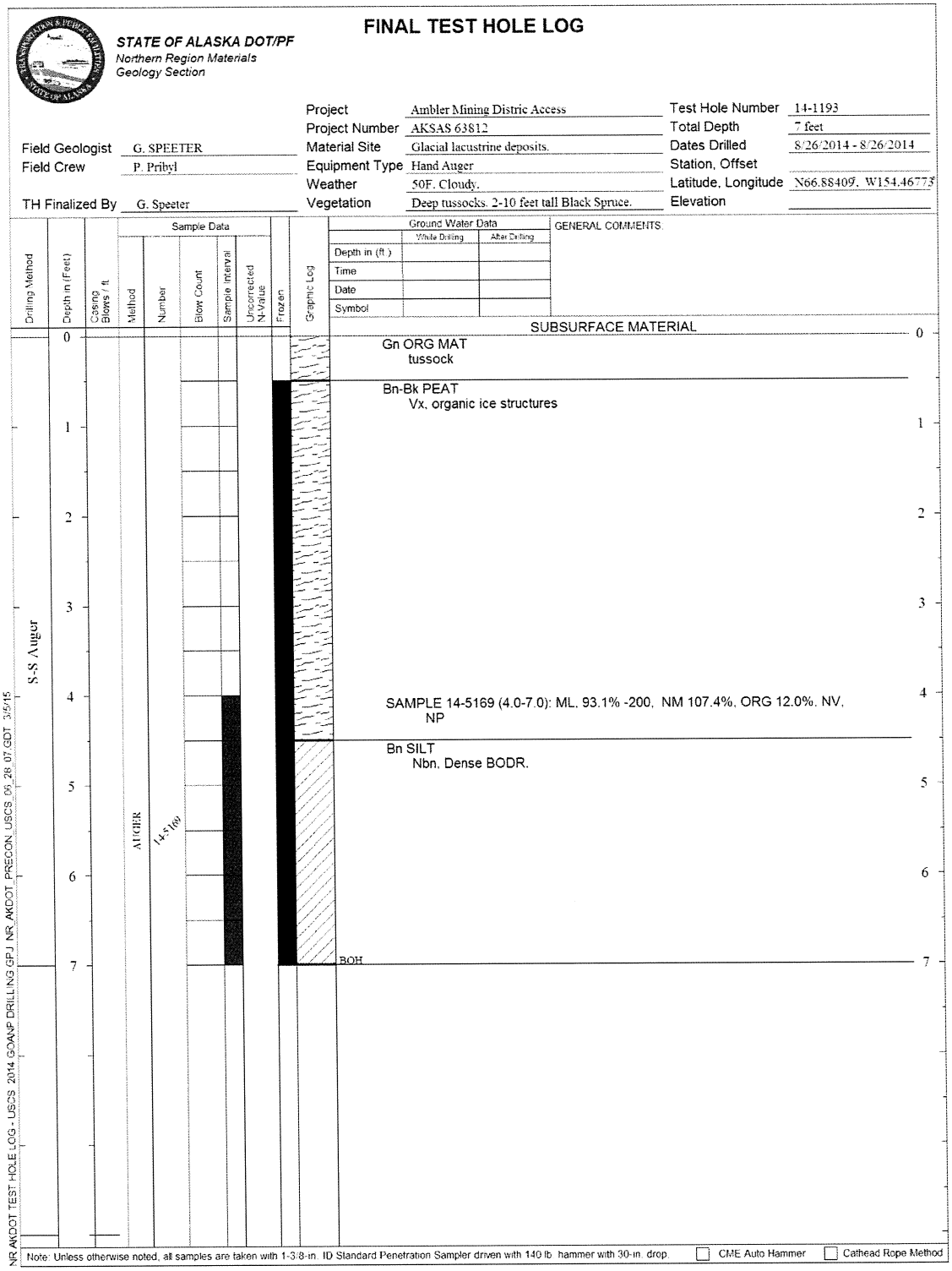
Figure 34. Temperature data from TH14-1196 collected 8/27/14.

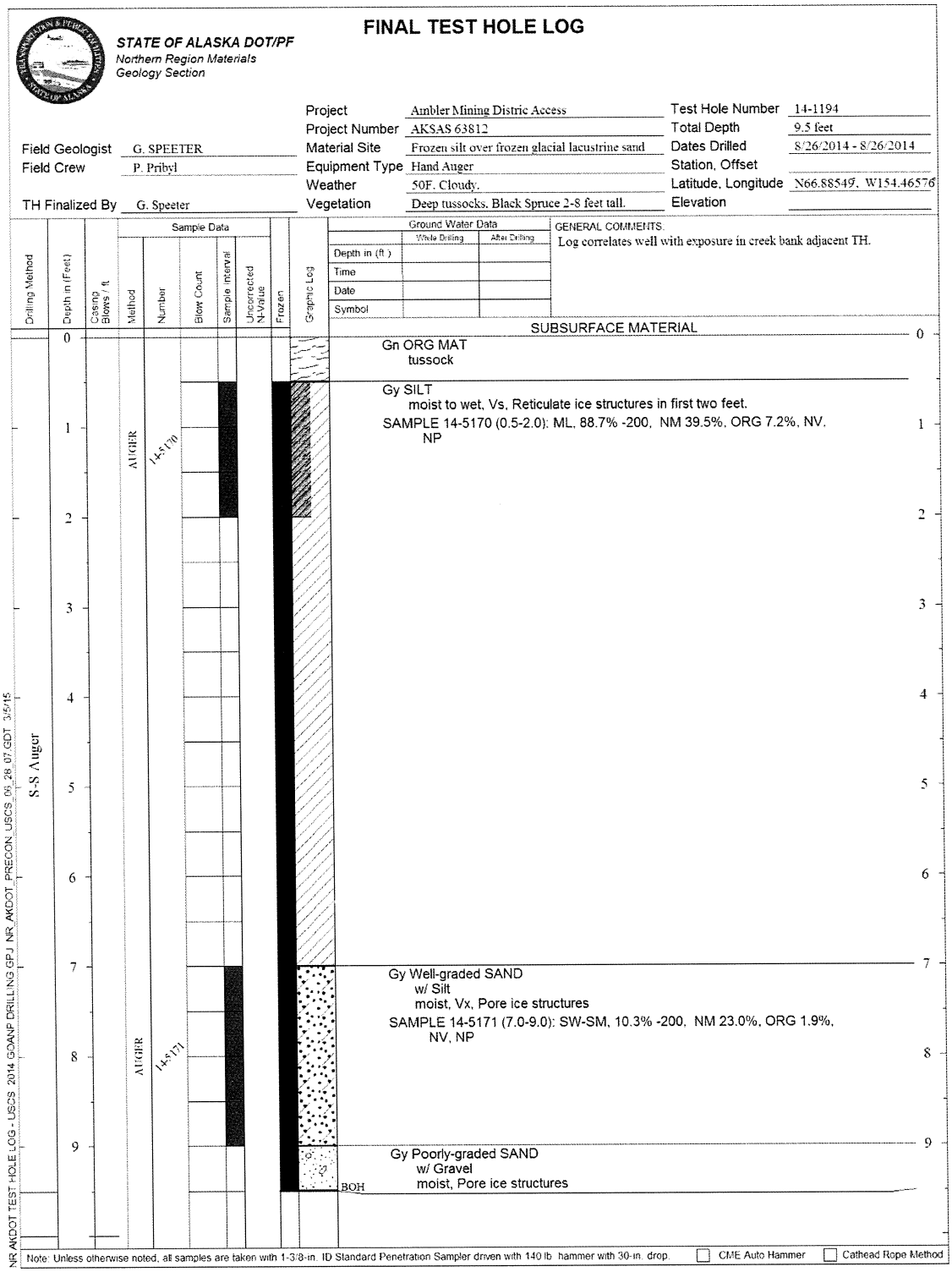
Area 6 Photographs



Figure 35. Stream running adjacent Traverse 16 exposes approximately 4-feet of silt above glacial lake deposits composed of silt with gravel.

Area 6 Test Hole Logs


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Glacial lacustrine deposits.
Equipment Type Hand Auger
Weather 50F. Cloudy.
Vegetation Deep tussocks. 2-10 feet tall Black Spruce.
Test Hole Number 14-1193
Total Depth 7 feet
Dates Drilled 8/26/2014 - 8/26/2014
Station, Offset
Latitude, Longitude N66.88409, W154.46775
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS
Sample Data
Drilling Method
Depth in (Feet)
Casing Blows / ft.
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5169
Gn ORG MAT
tussock
Bn-Bk PEAT
Vx, organic ice structures
SAMPLE 14-5169 (4.0-7.0): ML, 93.1% -200, NM 107.4%, ORG 12.0%, NV, NP
Bn SILT
Nbn, Dense BODR.
BOH
0
1
2
3
4
5
6
7
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Frozen silt over frozen glacial lacustrine sand
Equipment Type Hand Auger
Weather 50F, Cloudy.
Vegetation Deep tussocks, Black Spruce 2-8 feet tall.
Test Hole Number 14-1194
Total Depth 9.5 feet
Dates Drilled 8/26/2014 - 8/26/2014
Station, Offset
Latitude, Longitude N66.88549, W154.46576
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS
Log correlates well with exposure in creek bank adjacent TH.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5170
AUGER
14-5171
Gn ORG MAT
tussock
Gy SILT
moist to wet, Vs, Reticulate ice structures in first two feet.
SAMPLE 14-5170 (0.5-2.0): ML, 88.7% -200, NM 39.5%, ORG 7.2%, NV, NP
Gy Well-graded SAND
w/ Silt
moist, Vx, Pore ice structures
SAMPLE 14-5171 (7.0-9.0): SW-SM, 10.3% -200, NM 23.0%, ORG 1.9%, NV, NP
Gy Poorly-graded SAND
w/ Gravel
moist, Pore ice structures
BOH
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GI3ANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1195
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Frozen silt over frozen glacial lacustrine sand	Dates Drilled	8/26/2014 - 8/26/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F, Cloudy.	Latitude, Longitude	N66.88615, W154.47232
Vegetation	Deep tussock. Black spruce 2-10 feet tall.	Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	14-5172						ORG MAT tussock
	1									Gy ICE
	2									Gy SILT *Org* SAMPLE 14-5172 (2.0-4.0): 90.2% -200, NM 122.5%, ORG 10.0%
	3									
	4									
	5									Gy Silty SAND pore ice structures
	6									Bn PEAT
	7		AUGER	14-5173						Gy Silty SAND pore ice structures SAMPLE 14-5173 (7.5-9.5): SM, 35.1% -200, NM 53.7%, ORG 5.0%, NV, NP
	8									
	9									
	10									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

Sheet 1 of 2

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1196
Project Number	AKSAS 63812	Total Depth	15 feet
Material Site	Frozen silt over frozen glacial lacustrine sand	Dates Drilled	8/26/2014 - 8/26/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Cloudy.	Latitude, Longitude	N66.89826, W154.47948
Vegetation	Shallow tussocks, Light lichen, Bk Spruce 2-10 feet tall	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger
Sample Data: Method: AUGER; Number: 14-5174; Blow Count; Sample interval; Uncorrected N-Value; Frozen
Depth in (Feet); Casing Blows / ft; Graphic Log

SUBSURFACE MATERIAL

0 – Gn-Bk ORG MAT

2 – Gy SILT
moist, Nbe

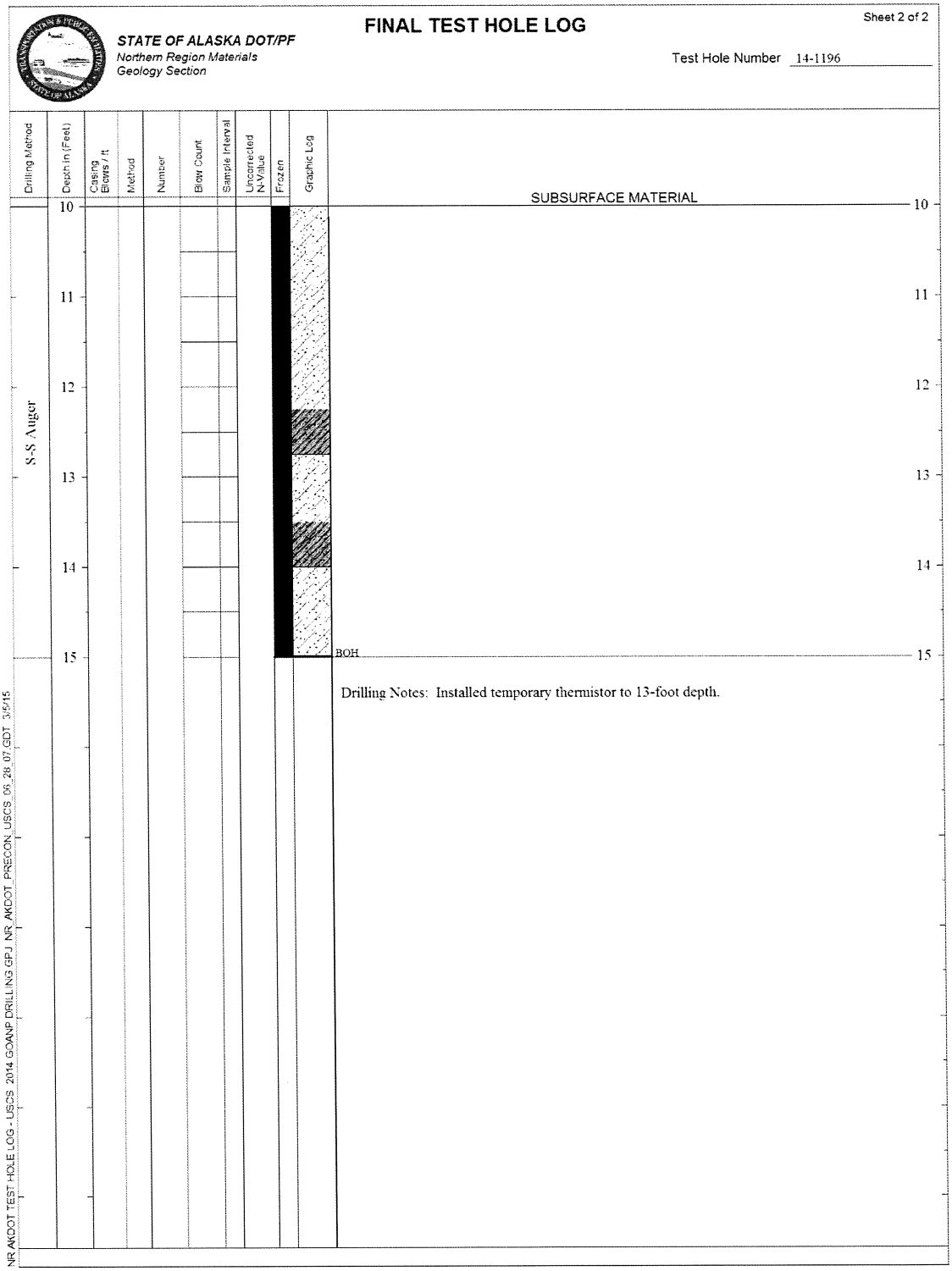
4 – Gy Silty SAND
moist, Nbn, layers of pore ice structures and 100% Ice.

SAMPLE 14-5174 (5.5-7.5): SM, 17.7% -200, NM 25.9%, ORG 1.3%, NV, NP

10

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
Sheet 2 of 2
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Test Hole Number 14-1196
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
10
11
12
13
14
15
BOH
Drilling Notes: Installed temporary thermistor to 13-foot depth.
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING GPJ NR_AKDOT_PRECON_USCS_05_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1197
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Frozen silt with massive ice	Dates Drilled	8/26/2014 - 8/26/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Cloudy.	Latitude, Longitude	N66.87402, W154.41925
Vegetation	Light colored lichens, moderatly thick Black spruce	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Sample Data: Casing Blows / ft | Method: AUGER | Number: 14-5175 | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT
lichen

1 — Bn SILT
wet, dense, Nbe

3 — SAMPLE 14-5175 (3.3-7.3): ML, 70.5% -200, NM 79.2%, ORG 17.0%, NV, NP

10 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_26_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1198
Project Number	AKSAS 63812	Total Depth	7.5 feet
Material Site	Frozen silt with massive ice	Dates Drilled	8/26/2014 - 8/26/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	50F. Cloudy.	Latitude, Longitude	N66.8746', W154.41535'
Vegetation	thick spongy lichen, grass, moderatly thick Black S[illegible] feet tall.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS.

Drilling Method	Depth in (Feet)	Casing Blows / ft.	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log
AUGER	0–7		AUGER	14-5176					

SUBSURFACE MATERIAL

0 — Gn ORG MAT
lichen+grass

Wh ICE
ICE, massive ice structure

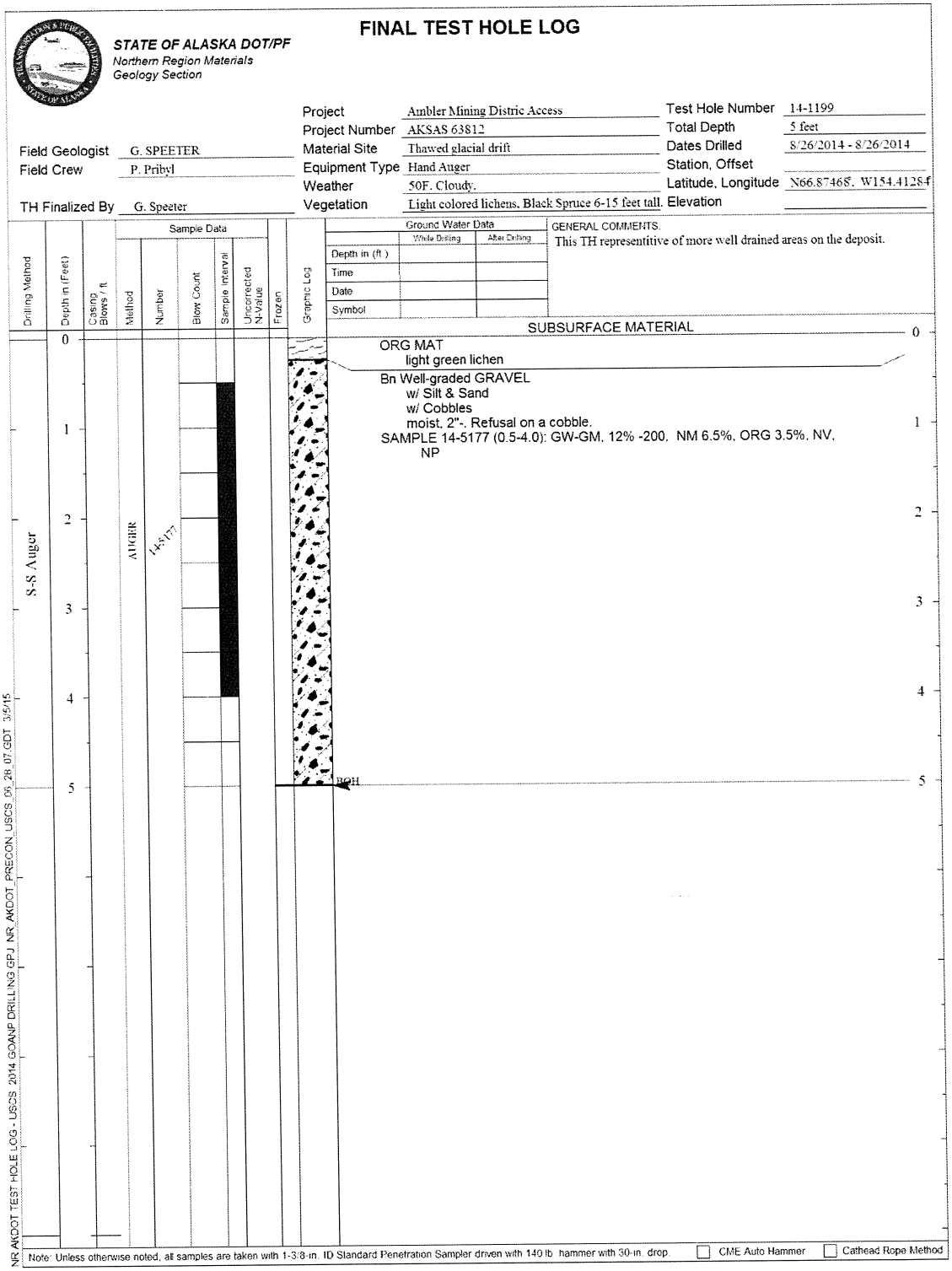
SAMPLE 14-5176 (1.0-7.0): NM 114.6%

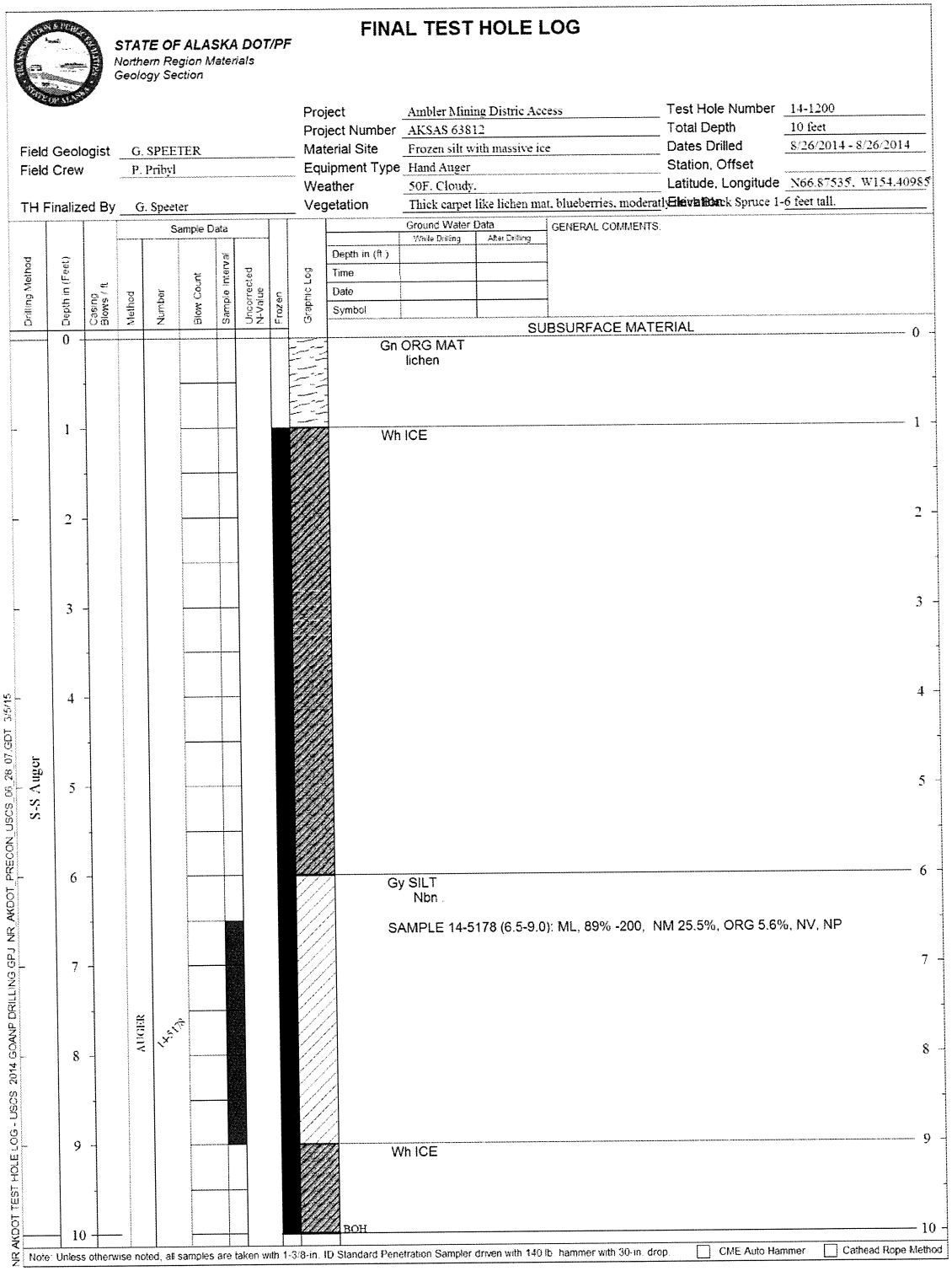
7 — Bn SILT
w/ Gravel
Nbn, easily rolls thread.

BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Thawed glacial drift
Equipment Type Hand Auger
Weather 50F. Cloudy.
Vegetation Light colored lichens. Black Spruce 6-15 feet tall.
Test Hole Number 14-1199
Total Depth 5 feet
Dates Drilled 8/26/2014 - 8/26/2014
Station, Offset
Latitude, Longitude N66.87468°, W154.41284°
Elevation
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft)
Time
Date
Symbol
GENERAL COMMENTS.
This TH representitive of more well drained areas on the deposit.
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
14-5177
ORG MAT
light green lichen
Bn Well-graded GRAVEL
w/ Silt & Sand
w/ Cobbles
moist, 2"-. Refusal on a cobble.
SAMPLE 14-5177 (0.5-4.0): GW-GM, 12% -200, NM 6.5%, ORG 3.5%, NV, NP
BOH
0
1
2
3
4
5
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Ambler Mining Distric Access
Project Number AKSAS 63812
Material Site Frozen silt with massive ice
Equipment Type Hand Auger
Weather 50F. Cloudy.
Vegetation Thick carpet like lichen mat, blueberries, moderately dense Black Spruce 1-6 feet tall.
Test Hole Number 14-1200
Total Depth 10 feet
Dates Drilled 8/26/2014 - 8/26/2014
Station, Offset
Latitude, Longitude N66.87535, W154.40985
Field Geologist G. SPEETER
Field Crew P. Pribyl
TH Finalized By G. Speeter
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS.
Drilling Method
Depth in (Feet)
Casing Blows / ft.
Sample Data
Method
Number
Blow Count
Sample Interval
Uncorrected N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
Gn ORG MAT
lichen
Wh ICE
Gy SILT
Nbn
SAMPLE 14-5178 (6.5-9.0): ML, 89% -200, NM 25.5%, ORG 5.6%, NV, NP
Wh ICE
BOH
S-S Auger
AUGER
14-5178
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

Area 6 Laboratory Data

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Ambler Mining Distric Access
PROJECT NUMBER:	
AKSAS NUMBER:	63812
SAMPLED BY:	G. Speeter
MATERIAL SOURCE:	Area 6 GOANP

TEST HOLE NUMBER		14-1193	14-1194	14-1194	14-1195	14-1195	14-1196	14-1197
DEPTH (feet)		4.0-7.0	0.5-2.0	7.0-9.0	2.0-4.0	7.5-9.5	5.5-7.5	3.3-7.3
LATITUDE		N66.88409°	N66.88549°	N66.88549°	N66.88615°	N66.88615°	N66.89826°	N66.87402°
LONGITUDE		W154.46773°	W154.46576°	W154.46576°	W154.47232°	W154.47232°	W154.47948°	W154.41925°
LAB NUMBER		**14-5169**	**14-5170**	**14-5171**	**14-5172**	**14-5173**	**14-5174**	**14-5175**
DATE SAMPLED		26-Aug-14	26-Aug-14	26-Aug-14	26-Aug-14	26-Aug-14	26-Aug-14	26-Aug-14
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"							
	0.5"							
	0.375"			97				
	#4			92				
	#8							
	#10							96
	#16			76				
	#30					99	99	90
Sand	**#40**					98	98	86
	#50					93	90	82
	#60					87	78	80
	#80	99	98		98	71	45	77
	#100	99	97	13	98	62	33	76
Silt/Clay	**#200**	93.1	88.7	10.3	90.2	35.1	17.7	70.5
Hydro	**0.02**							
	0.005							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV		NV	NV	NV
PLASTIC INDEX		NP	NP	NP		NP	NP	NP
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si)	(Si)	(WGSa w/Si)	(Si)	(PGSa w/SiCl&Gr)	(SiSa)	(Si)
NATURAL MOISTURE		107.4	39.5	23.0	122.5	53.7	25.9	79.2
ORGANICS		12.0	7.2	1.9	10.0	5.0	1.3	17.0
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]	Org[1]		Org[1]	Org[1]		hi Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Ambler Mining Distric Access
PROJECT NUMBER:	63812
AKSAS NUMBER:	G. Speeter
SAMPLED BY:	Area 6 GOANP
MATERIAL SOURCE:	

TEST HOLE NUMBER		14-1198	14-1199	14-1200				
DEPTH (feet)		1.0-7.0	0.5-4.0	6.5-9.0				
LATITUDE		N66.8746°	N66.87468°	N66.87535°				
LONGITUDE		W154.41533°	W154.41284°	W154.40985°				
LAB NUMBER		**14-5176**	**14-5177**	**14-5178**				
DATE SAMPLED		26-Aug-14	26-Aug-14	26-Aug-14				
% Passing	**3"**							
	2"							
	1.5"							
Gravel	**1.0"**							
	0.75"		85					
	0.5"		71					
	0.375"		65					
	#4		49					
	#8							
	#10							
	#16		36					
	#30			99				
Sand	**#40**			99				
	#50			98				
	#60			97				
	#80			95				
	#100		14	94				
Silt/Clay	**#200**		12.0	89.0				
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT			NV	NV				
PLASTIC INDEX			NP	NP				
USCS CLASSIFICATION								
USCS SOIL DESCRIPTION		(Si)	WGGr w/Si&Sa	(Si)				
NATURAL MOISTURE		114.6	6.5	25.5				
ORGANICS			3.5	5.6				
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS			sl Org[1]	Org[1]				

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

Area 7

Traverse 19 (Figure 36) was conducted to evaluate a low area that resembles muskeg from the air and is surrounded by large mound-shaped Piedmont gravel deposits. Piedmont gravel deposits were sampled and evaluated for use as construction materials.

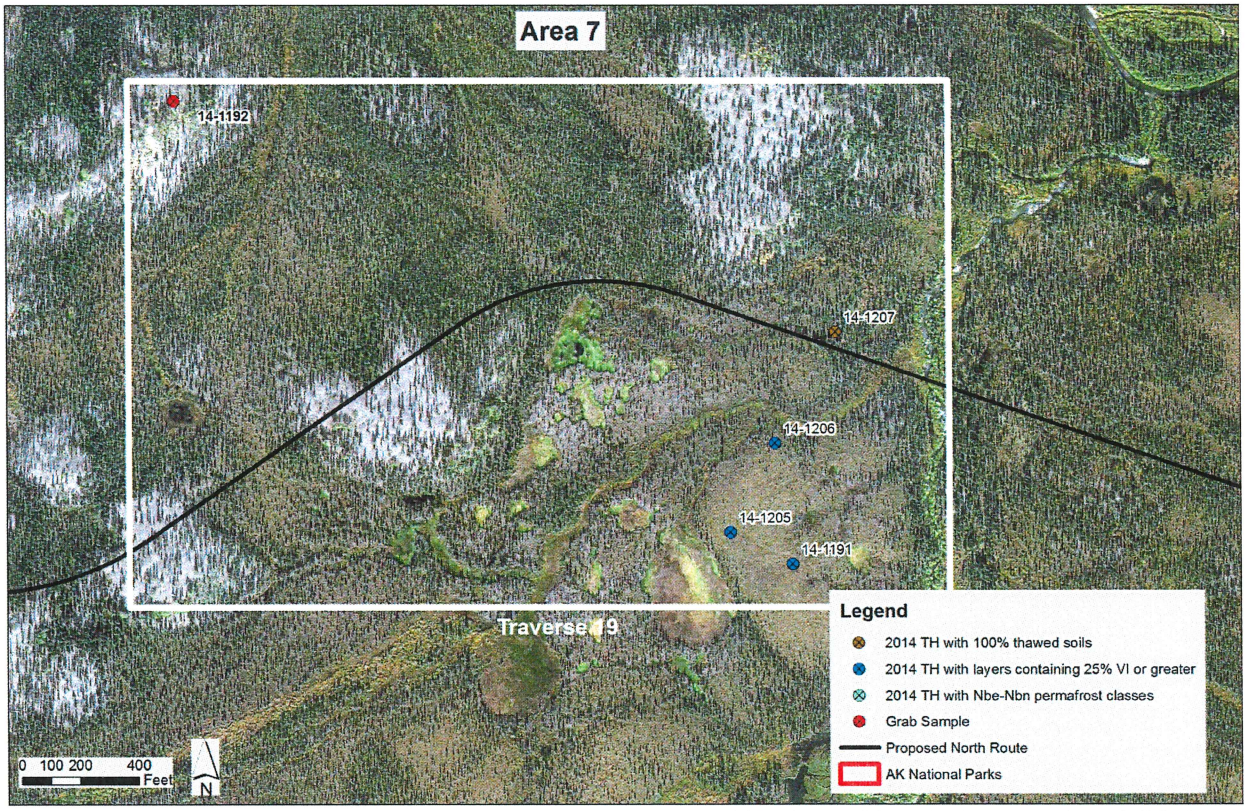


Figure 36. Area 7. *Appendix A. Classification of Frozen Soils **VI is an abbreviation meaning visible ice.

Traverse 19

Table 22. Traverse 19.

Traverse 19				
Hole ID	Type	Equipment installed	General geologic description	Total depth
14-1191	SS	none	Frozen silt over alluvium (poorly-graded sand with gravel)	7
14-1205	SS	none	Frozen silt with massive ice	10
14-1206	SS	none	Frozen silt with massive ice	7
14-1207	SS	none	Piedmont gravel (poorly-graded gravel with sand)	4

Test holes 14-1206, 14-1205, and 14-1191 (Figure 36 and Table 22) were drilled in an area that appeared to be muskeg in aerial photographs. Frozen silt with massive ice was encountered by TH14-1206, and 14-1205. TH14-1191 intercepted frozen silt over what appeared to be alluvial gravels. 14-1207 was drilled to verify the presence of piedmont gravel. Geologists in the field collected a grab sample at 14-1192 to run gradation tests on piedmont gravel to see if it is suitable for use as construction material.

Lab data from sample 14-1192 meets Standard Highways Materials Gradation Specifications for Select Types A-C and Subbase and Base Course.

Area 7 Test Hole Logs

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1191
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Frozen silt over alluvial gravels	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N67.03595, W154.01649
Vegetation	Deep wet tusocs.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Sample Data: Casing Blows / ft | Method | Number | Blow Count | Sample Interval | Uncorrected N-Value | Frozen | Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT
tussock

1 — Bn SILT
Vx

2

3

4 — Bn-Gy Poorly-graded SAND
w/ Gravel
Nbn, some pore ice structures.

5

6

7 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1192
Project Number	AKSAS 63812	Total Depth	0.5 feet
Material Site	Piedmont gravel deposit.	Dates Drilled	8/25/2014 - 8/25/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	65F. Nice.	Latitude, Longitude	N67.03992, W154.0319
Vegetation		Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Pribyl		
TH Finalized By	G. Speeter		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
	0		GS	14-5184						Bn Well-graded SAND w/ Gravel
										BOH SAMPLE 14-5184 (0.0-0.5): GP-GM, 5.6% -200, DEG 62, NV, NP

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1205
Project Number	AKSAS 63812	Total Depth	10 feet
Material Site	Frozen silt with massive ice	Dates Drilled	8/28/2014 - 8/28/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	45F. Rain.	Latitude, Longitude	N67.03608, W154.01801
Vegetation	Deep tussocs, sparse black spruce trees.	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger
Sample Data: Method: AUGER; Number: 14-5183

SUBSURFACE MATERIAL

0 – Gn ORG MAT
Tussock lichen mat

1 – Bn SILT
moist

2 – Wh-Bn ICE
w/ Silt
Ice + ...

5 – Bn SILT
moist, Vx, Lab result likely an error

SAMPLE 14-5183 (6.0-10.0): GW, 4.8% -200, NM 48.8%, ORG 7.1%, NV, NP

10 – BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1206
Project Number	AKSAS 63812	Total Depth	7 feet
Material Site	Frozen silt with massive ice	Dates Drilled	8/28/2014 - 8/28/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	45F. Rain.	Latitude, Longitude	N67.03705, W154.01693
Vegetation	Thick lichen, tussocks, blueberries, scattered black spruce	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:

Drilling Method: S-S Auger

Depth in (Feet)	Casing Blows / ft.	Sample Data: Method	Number	Blow Count	Sample Interval	Uncorrected N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
0									Gn ORG MAT Lichen and tussock mat
1									Bn SILT moist, *hi Org*
2									Gy SILT w/ Gravel Nbn
3									Wh ICE ICE
4									Gy SILT w/ Gravel Vs, layered ice structures
5									
6									
7									BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING GPJ NR_AKDOT_PRECON_USCS 05_28_07.GDT 3/5/15

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Ambler Mining Distric Access	Test Hole Number	14-1207
Project Number	AKSAS 63812	Total Depth	4 feet
Material Site	Piedmont gravel	Dates Drilled	8/28/2014 - 8/28/2014
Equipment Type	Hand Auger	Station, Offset	
Weather	45F. Rain.	Latitude, Longitude	N67.03809, W154.01548
Vegetation	Light green lichen, blueberries, willows, and black spruce	Elevation	

Field Geologist: G. SPEETER
Field Crew: P. Pribyl
TH Finalized By: G. Speeter

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Drilled on small well drained mound.

Drilling Method: S-S Auger

Sample Data: Depth in (Feet); Casing Blows / ft; Method; Number; Blow Count; Sample Interval; Uncorrected N-Value; Frozen; Graphic Log

SUBSURFACE MATERIAL

0 — Gn ORG MAT
lichen mat

Tn Silty SAND
moist

1 — Tn Poorly-graded GRAVEL
w/ Sand
w/ Cobbles
moist, cobble refusal.

2

3

4 — BOH

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS 2014 GOANP DRILLING.GPJ NR_AKDOT_PRECON_USCS_05_28_07.GDT 3/5/15

Area 7 Laboratory Data

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Ambler Mining Distric Access
PROJECT NUMBER:	
AKSAS NUMBER:	63812
SAMPLED BY:	G. Speeter
MATERIAL SOURCE:	Area 7 GOANP

TEST HOLE NUMBER		14-1205	14-1192					
DEPTH (feet)		6.0-10.0	0.0-0.5					
LATITUDE		N67.03608°	N67.03992°					
LONGITUDE		W154.01801°	W154.03197°					
LAB NUMBER		**14-5183**	**14-5184**					
DATE SAMPLED		28-Aug-14	25-Aug-14					
% Passing	**3"**							
	2"	97						
	1.5"	96	98					
Gravel	**1.0"**	88	88					
	0.75"	82	74					
	0.5"	68	57					
	0.375"	58	46					
	#4	40	30					
	#8	29	23					
	#10	27	22					
	#16	20	18					
	#30	14	14					
Sand	**#40**	11	12					
	#50	9	10					
	#60	8	9					
	#80	7	8					
	#100	6	7					
Silt/Clay	**#200**	4.8	5.6					
Hydro	**0.02**							
	0.005							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV					
PLASTIC INDEX		NP	NP					
USCS CLASSIFICATION		GW	GP-GM					
USCS SOIL DESCRIPTION		(Si)						
NATURAL MOISTURE		48.8						
ORGANICS		7.1						
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR			62					
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		Org[1]						

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: W = Well-graded; P = Poorly-graded; E = Elastic; L = Lean; F = Fat

References

Fernald, A.T., 1964, Surficial geology of the central Kobuk River valley, northwestern Alaska: U.S. Geological Survey Bulletin 1181-K, p. K1-K31, 1 sheet, scale 1:250,000.

Hamilton, T.D., 1984, Surficial geologic map of the Ambler River Quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies 1678, 1 sheet, scale 1:250,000.

Hamilton, T.D., 2002, Surficial geologic map of the Bettles Quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies 2409, 9 p.

Hamilton, T.D., 2002, Surficial geologic map of the Hughes Quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies 2408, 10 p.

Hamilton, T.D., 1981, Surficial geologic map of the Survey Pass Quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies 1320, 1 sheet, scale 1:250,000.

Hamilton, T.D., 1979, Surficial geologic map of the Wiseman Quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies 1122, 1 sheet, scale 1:250,000.

Patton, W.W., Jr., Miller, T.P., and Tailleur, I.L., 1968, Regional geologic map of the Shungnak and southern part of the Ambler River quadrangles, Alaska: U.S. Geological Survey Miscellaneous Investigations 554, 1 sheet, scale 1:250,000.

Speeter, G, G., 2013, Reconnaissance Material Site Report Ambler Mining District Access AKSAS:63812. Geotechnical Investigation Report, Alaska Department of Transportation and Public Facilities, 243p

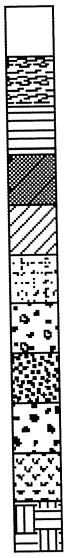
Speeter, G. G., 2014, Material Site Report Ambler Mining District Access Phase 1 AKSAS 63812. Material Site Report, Alaska Department of Transportation and Public Facilities, 113p.

Swanson, D.K., 1995, Landscape ecosystems of the Kobuk Preserve Unit, Gates of the Arctic National Park, Alaska. Technical Report NPS/ARRNR/NRTR, National Park Service, 292p

Appendix A-Symbols and Definitions

SYMBOLS AND DEFINITIONS

BASIC MATERIAL SYMBOLS



ASPHALT
PEAT
CLAY (Cl)
ICE
SILT (Si)
POORLY GRADED SAND (Sa)
POORLY GRADED GRAVEL (Gr)
WELL GRADED SAND
WELL GRADED GRAVEL
BEDROCK (Bx), soft(Type)
BEDROCK (Bx), hard(Type)

SOFT OR HARD BEDROCK BASED ON DRILLING RATE

NOTE
MAIN COMPONENT (UPPER CASE ... SOLID LINES)
MINOR COMPONENT (Title Case ... DASHED LINES OR SPARSER PATTERN)

USCS SIZE DEFINITIONS

BOULDERS (Boulders)	12"+
COBBLES (Cobbles)	3" TO 12"
GRAVEL	#4 TO 3"
ANGULAR FRAGMENTS	#10 +
SAND	#200 TO #4
SILT	#200 TO 0.005 mm
CLAY	MINUS 0.005 mm

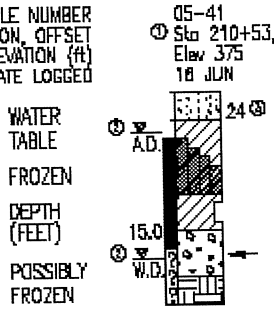
TEST RESULTS

_._%-200	= % PASSING #200 SIEVE
NM _._%	= NATURAL MOISTURE
ORG _._%	= ORGANIC CONTENT
SSc _	= SODIUM SULFATE LOSS(coarse)
SSf _	= SODIUM SULFATE LOSS(fine)
LA _	= LOS ANGELES ABRASION
DEG _	= DEGRADATION
LL _	= LIQUID LIMIT (NV = no value)
PI _	= PLASTIC INDEX (NP = non-plastic)

MISC.

Tr	= TRACE
sl	= SLIGHTLY
hi	= HIGHLY
w/_	= WITH UNSPECIFIED AMOUNT
X'ls	= CRYSTALS
TH	= TEST HOLE
TT	= TEST TRENCH
TP	= TEST PIT

TYPICAL LOG



① Station value may also be on centerline e.g. Sta 210+53, CL or lat-long format e.g. N64.56789°, W145.67890°
② W.D.= WHILE DRILLING, A.D.= AFTER DRILLING
③ "N VALUE" INDICATES STANDARD PENETRATION TEST (1.4" I.D., 2.0" O.D. SAMPLER DRIVEN WITH 140 LB. HAMMER, 30" FREE FALL) AND IS SUM OF 2nd AND 3rd 6" OF PENETRATION.

PLAN VIEW SYMBOLS



POWER AUGER TEST HOLE (TH)
HAND AUGER TEST HOLE (TH)
EXPOSED MATERIAL
PROBE
HAND DUG TEST PIT (TP)
DOZER/BACKHOE TEST TRENCH (TT)
BODY OF WATER
FLOW DIRECTION
WASTE BERM
BANK
SWAMP
TREELINE

SOIL DENSITY/CONSISTENCY DESCRIPTORS

NON-COHESIVE RELATIVE DENSITY	BLOWS/FOOT (N) VALUE	COHESIVE CONSISTENCY	BLOWS/FOOT (N) VALUE
VERY LOOSE	< 4	VERY SOFT	< 2
LOOSE	5-10	SOFT	2-4
MEDIUM DENSE	11-30	FIRM	5-8
DENSE	31-50	STIFF	9-15
VERY DENSE	> 50	VERY STIFF	16-30
		HARD	> 30

COLOR

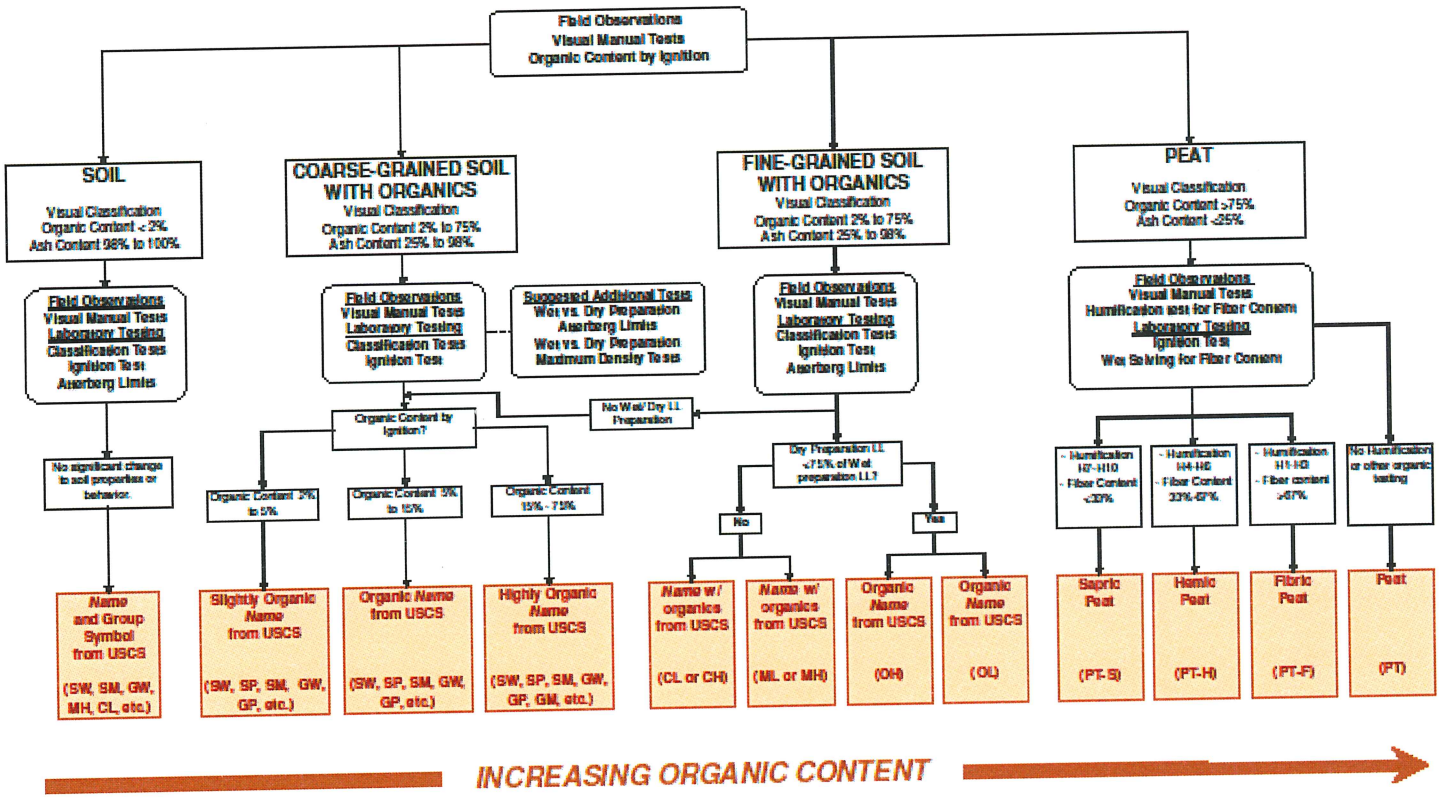
Bk = BLACK	Gy = GRAY	Tn = TAN
Bl = BLUE	Or = ORANGE	Wh = WHITE
Bn = BROWN	Rd = RED	Yw = YELLOW
Gn = GREEN		

MOISTURE

dry	= < OPTIMUM*	DUSTY, DRY TO THE TOUCH
moist	~ OPTIMUM*	DAMP, NO VISIBLE WATER
wet	= > OPTIMUM*	VISIBLE FREE WATER

* OPTIMUM MOISTURE FOR MAXIMUM DENSITY

Peat and Organic Soil Classification System



DESCRIPTION AND CLASSIFICATION OF FROZEN SOILS

Part I Description of Soil Phase (a) (Independent of Frozen State)	Major Group		Sub-Group		Field Identification (6)	Pertinent Properties of Frozen Materials which may be measured by physical tests to supplement field identification. (7)	Guide for Construction on Soils Subject to Freezing and Thawing	
	Description (2)	Designation (3)	Description (4)	Designation (5)			Thaw Characteristics (8)	Criteria (9)
Part II Description of Frozen Soil	Segregated ice is not visible by eye (b)	N	Poorly Bonded or Friable	Nf	Identify by visual examination. To determine presence of excess ice, use procedure under note (c) below and hand magnifying lens as necessary. For soils not fully saturated, estimate degree of ice saturation: Medium, Low. Note presence of crystals, or of ice coatings around larger particles.	In-Place Temperature Density and Void Ratio a) In Frozen State b) After Thawing in Place Water Content (Total H_2O, including ice) a) Average b) Distribution Strength a) Compressive b) Tensile c) Shear d) Adfreeze Elastic Properties Plastic Properties Thermal Properties Ice Crystal Structure (using optional instruments.) a) Orientation of Axes b) Crystal size c) Crystal shape d) Pattern of Arrangement	Usually Thaw-Stable	The potential intensity of ice segregation in a soil is dependent to a large degree on its void sizes and may be expressed as an empirical function of grain size as follows: Most inorganic soils containing 3 percent or more of grains finer than 0.02 mm in diameter by weight are frost-susceptible. Gravels, well-graded sands and silty sands, especially those approaching the theoretical maximum density curve, which contain 1.5 to 3 percent finer than 0.02 mm by weight without being frost-susceptible. However, their tendency to occur interbedded with other soils usually makes it impractical to consider them seperately. Soils classed as frost-susceptible under the above criteria are likely to develop significant ice segregation and frost heave if frozen at normal rates with free water readily available. Soils so frozen will fall into the thaw-unstable category. However, they may also be classed as thaw-stable if frozen with insufficient water to permit ice segregation. Soils classed as non-frost-susceptible ("NFS) under the above criteria usually occur without significant ice segregation and are not exact and may be inadequate for some structure applications exceptions may also result from minor soil variations. In permafrost areas, ice wedges, pockets, veins, or other ice bodies may be found whose mode of origin is different from that described above. Such ice may be the result of long-time surface expansion and contraction phenomena or may be glacial or other ice which has been buried under a protective earth cover.
			No excess ice Well Bonded Excess ice	Nb n e				
	Segregated ice is visible by eye. (Ice 1 inch or less in thickness) (b)	V	Individual ice crystals or inclusions	Vx	For ice phase, record the following as applicable: Location, Size, Orientation, Shape Thickness, Spacing, Pattern of arrangement, Length, Hardness, Structure, Color (per part III Below) Estimate volume of visible segregated ice present as percent of total sample volume		Usually Thaw-Unstable	
			Ice coatings on particles	Vc				
			Random or irregularly oriented ice formations	Vr				
			Stratified or distinctly oriented ice formations	Vs				
Part III Description of Substantial Ice Strata	Ice (Greater than 1 inch in thickness)	Ice	Ice with soil inclusions	Ice + Soil Type	Designate material as ICE (d) and use descriptive terms as follows, usually one item from each group, as applicable:	Same as Part II above, as applicable, with special emphasis on Ice Crystal Structure.		
			Ice without soil inclusions	Ice	Hardness: Hard, Soft (mass, not indi-crystals) Structure: Clear, Cloudy, Porous, Candled, Granular, Stratified Color: e.g.: Color-less, Gray, Blue Admixtures: e.g.: Contains Thin Silt Inclus-ions			

DEFINITIONS:

Ice Coatings on Particles are discernible layers of ice found on or below the larger soil particles in a frozen soil mass. They are sometimes associated with hoarfrost crystals, which have grown into voids produced by the freezing action.

Ice Crystal is a very small individual ice particle visible in the face of a soil mass. Crystals may be present alone or in a combination with other ice formations.

Clear ice is transparent and contains only a moderate number of air bubbles.(e)

Cloudy Ice is translucent, but essentially sound and non-pervious

Porous Ice contains numerous voids, usually interconnected and usually resulting from melting at air bubbles or along crystal interfaces from presence of salt or other materials in the water, or from the freezing of saturated snow. Though porous, the mass retains its structural unity.

Candled Ice is ice which has rotted or otherwise formed into long columnar crystals, very loosely bonded together.

Granular Ice is composed of coarse, more or less equidimensional, ice crystals weakly bonded together.

Ice Lenses are lenticular ice formations in soil occurring essentially parallel to each other, generally normal to the direction of heat loss and commonly in repeated layers.

Ice Segregation is the growth of ice as distinct lenses, layers, veins and masses in soils, commonly but not always oriented normal to direction of heat loss.

Well-bonded signifies that the soil particles are strongly held together by the ice and that the frozen soil possesses relatively high resistance to chipping or breaking.

Poorly-bonded signifies that the soil particles are weakly held together by the ice and that the frozen soil consequently has poor resistance to chipping or breaking.

Friable denotes a condition in which material is easily broken up under light to moderate pressure.

Thaw-Stable frozen soils do not, on thawing, show loss of strength below normal, long-time thawed values nor produce detrimental settlement.

Thaw-Unstable frozen soils show on thawing, significant loss of strength below normal, long-time thawed values and/or significant settlement, as a direct result of the melting of the excess ice in the soil.

Modified from: Linell, K. A. and Kaplar, C. W., 1966, Description and Classification of Frozen Soils, Proc. International Conference on Permafrost (1963), Lafayette, IN, U.S. National Academy of Sciences, Publ. 1287, pp 481-487.

NOTES:

(a) When rock is encountered, standard rock classification terminology should be used.

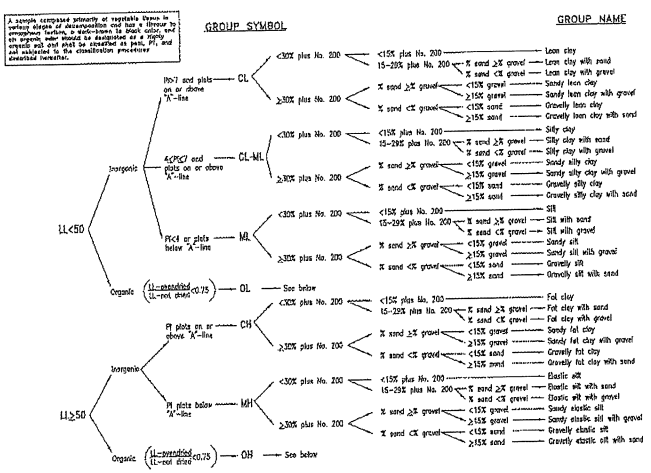
(b) Frozen soils in the N group may on close examination indicate presence of ice within the voids of the material by crystalline reflections or by a sheen on fractured or trimmed surfaces. However, the impression to the unaided eye is that none of the frozen water occupies space in excess of the original voids in the soil. The opposite is true of frozen soils in the V group.

(c) When visual methods may be inadequate, a simple field test to aid evaluation of volume of excess ice can be made by placing some frozen soil in a small jar, allowing it to melt and observing the quantity of supernatant water as a percent of total volume.

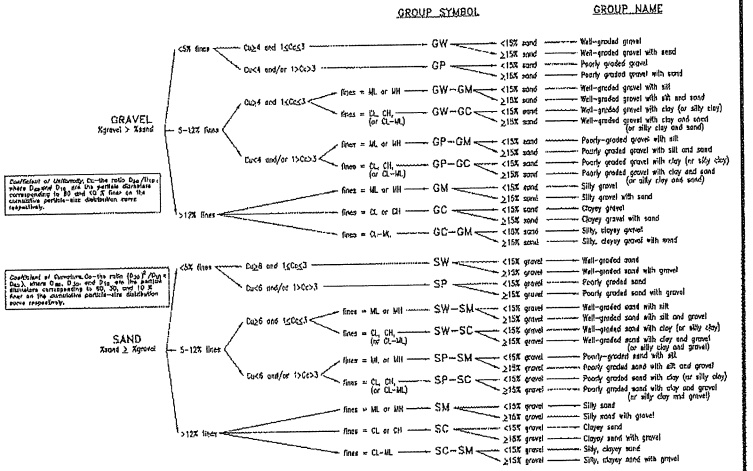
(d) Where special forms of ice, such as hoarfrost, can be distinguished, more explicit description should be given.

(e) Observer should be careful to avoid being misled by surface scratches or frost coating on the ice.

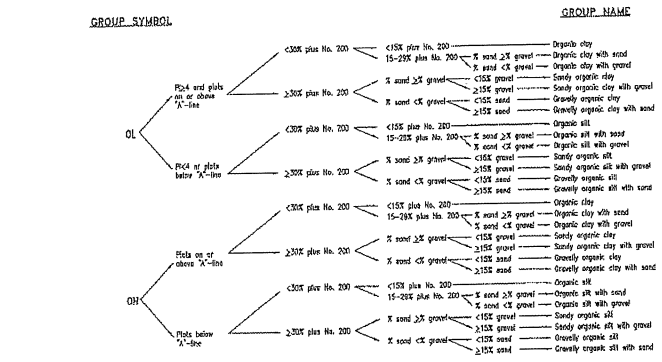
Classification of Soils for Engineering Purposes (Unified Soil Classification System)



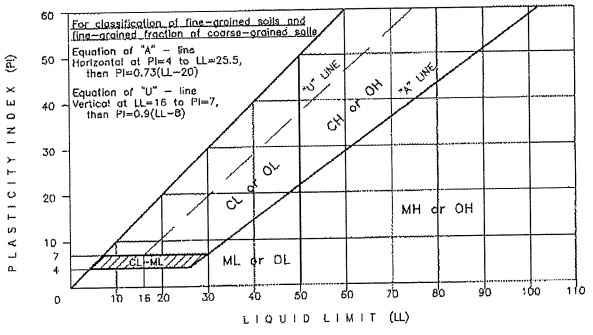
Flow Chart for Classifying Fine-Grained Soil (50% or More Passes No. 200 Sieve)



Flow Chart for Classifying Coarse-Grained Soil (More Than 50% Retained on No. 200 Sieve)



Flow Chart for Classifying Organic Fine-Grained Soil (50% or More Passes No. 200 Sieve)



Plasticity Chart

Appendix B- In-field thaw consolidation testing

Equipment

Cores for thaw consolidation testing were drilled utilizing a SIPRE auger. The SIPRE auger drills 3 inch diameter cores in one meter depth intervals.

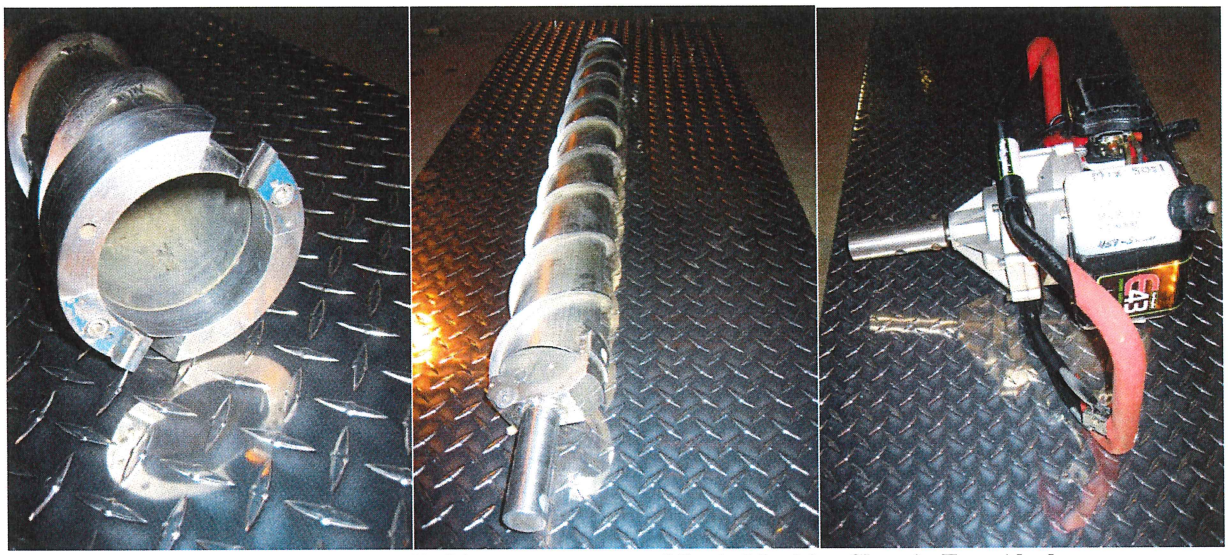


Figure 37. SIPRE drill. Pictures courtesy of Jon's Machine Shop in Fox, Alaska.

Thaw consolidation testing was completed utilizing:

- consolidation ring assembly;
- 3-5 brass liners;
- 2.4" or 2.5" porous stones that fit in the brass liners;
- A cylinder weight.



Figure 38. Thaw consolidation ring assembly with brass liner, two pore stones, ice core, and cylinder weight. Equipment courtesy of DOWL HKM.

Procedure

Thaw consolidation testing was accomplished in the field utilizing the following procedure:

- Thickness and diameters of pore stones, weights, and brass sleeves are measured in three places utilizing calipers and the numbers are recorded and averaged;
- SIPRE augers were used to collect an ice core from the last hole of the work day;
- The ice core was left in the auger and packed into insulated plastic case, loaded in helicopter, and flown back to Bettles at an altitude where ambient temperature was below 0°F.
- The 3 inch diameter ice core was re-cored using the 2.5 inch diameter brass sleeve;
- Initial volume of the core is calculated and recorded;
- 2.5 inch pore stones are placed at the top and bottom of the ice core;
- A cylinder weight is placed on top of the top pore stone;
- Ice core is allowed to thaw;
- Volumetric change is calculated and reported as a percentage of volume lost after complete thawing of the core.