Geotechnical Findings Report

November 3, 2025

Attn: Justin Ireys, AML Program Manager
Alaska Department of Natural Resources, DMLW

Re: Geotechnical Findings Report – Healy, Center Pit

Mr. Ireys,

RECON LLC (RECON) has completed geotechnical services in support of road design for accessing the Upper Study Area south of Center Pit, near Healy, Alaska. This Geotechnical Findings Report (GFR) presents the findings from the subsurface investigation.

PROJECT UNDERSTANDING

The goal for the overall project included establishing access to the south side of Center Pit, described as the "*Upper Study Area*". RECON was contracted to provide DNR with site investigation and road design services from the existing access road on the north side of Center Pit to the *Upper Study Area* on the south of Center Pit. The *Upper Study Area* is on an alluvial terrace near 2,120 feet elevation, while the end of the current access road is near 2,030 feet elevation. The design criteria for the proposed road included a design life of 20 years and the ability to safely accommodate two-way traffic of large earthmoving equipment up to 85 tons. To support the road design, RECON completed this geotechnical investigation along the proposed road alignment.

SCOPE OF WORK

The scope of work for the geotechnical investigation consisted of developing an understanding of subsurface conditions using site observations, geological mapping, and test pits. The information gathered was specifically intended to inform the route selection and engineering for the proposed access road. A description of the field effort, encountered subsurface conditions, anticipated challenges, recommendations, a map and table showing the exploration locations, test pit logs, field photographs, and laboratory test results are presented in the

following sections. A preferred route based on the field findings is included on the map in Appendix A.

FIELD EFFORT

RECON completed an initial site reconnaissance on August 27, 2025 to gain an understanding of the general site conditions and project goals. This visit was used to scope the geotechnical investigations. Based on the information collected, it was determined that a combination of surface mapping and test pits would provide the needed information.

RECON staff Peppi Bolz, Isaac Rowland, and Zach LeBlanc met with DNR staff at the site on September 22, 2025 to complete the geotechnical investigation described in this report. Weather conditions were overcast with intermittent light rain and snow, no wind, and temperatures near 35°F.

During the September site visit, the RECON team observed four test pits, dug one test hole by hand, and observed surface material conditions along potential routes and in exposed cuts. Test pits were specifically sited to provide cross sections of several different materials expected to be encountered during road construction. The top of the terrace was not feasible to access with equipment, but the open face of the pit wall provided an excellent cross section of the near surface geology.

Test Pits

Scarsella Bros, Inc. provided a CAT 349L Excavator and operator to advance the test pits. The excavator was outfitted with a 50-inch-wide bucket. Test pits were backfilled with the excavated material. Table 1 presents test pit locations. A site map with test pit locations is included in Appendix A. RECON collected several samples from the test pits for later review and laboratory testing. Appendix B presents the test pit logs and Appendix C presents laboratory testing results. One test hole was hand-dug on the alluvial terrace to note overburden thickness. Locations of the test pits and test hole were collected using a handheld GPS.

Table 1: Exploration Locations (Datum: WGS84)

Identifier	Type	Latitude	Longitude	Total Depth[1]
TP-1	Test Pit	63.88131	-148.66206	18.0
TP-2	Test Pit	63.88118	-148.66125	14.0
TP-3	Test Pit	63.88102	-148.66058	8.0
TP-4	Test Pit	63.88178	-148.66163	8.0
TH-1	Test Hole (hand dug)	63.87930	-148.65926	1.0

Notes:
[1] Feet below ground surface

FINDINGS

Descriptions of site observations, summary of geologic conditions, subsurface conditions, and anticipated challenges are presented in the following sections.

Site Observations

Center Pit is part of a northeast-southwest trending abandoned coal pit. The site is located 11 miles east of Healy and 500 feet south of Healy Creek. The overall pit complex consists of the connected Center Pit (southwest) and Apex Pit (northeast). Center Pit is partially filled with water. Pit sidewalls are steep with slope angles near 30 to 35°. Coal seams are visible in the pit walls on the north side (see Figure 1).

Figure 1: Center Pit (view northwest, note coal seam and contact between sedimentary rocks and alluvial terrace gravel).

The site is located on an alluvial terrace that is about 200 feet above the current Healy Creek floodplain. The elevation difference between the end of the existing Center Pit access road and the top of the terrace is about 100 feet. Natural slopes from the top of the terrace towards Healy Creek are steep, with slope angles up to 30°.

Overburden on the alluvial terrace consists of silt with organics and is relatively thin (generally less than 1 foot-thick). Figure 2 shows an abandoned road on the alluvial terrace south of Center Pit. Road construction on the alluvial terrace is expected to involve removal of overburden and minimal grading.

Figure 2: Old road south of Center Pit.

Natural vegetation cover includes spruce, aspen, and birch trees up to 10-inch in diameter. Thick sections of alders were noted along some previously disturbed areas.

Historic mining equipment and objects were noted west of Center Pit.

Previous access: A historic access road from a bridge at Coal Creek to Center Pit was re-established in Summer 2025. The access road to Apex crossed the Healy Creek floodplain and entered Apex on the northeast side. This access has since been washed out by Healy Creek and has not been re-established.

The elevated area surrounding the pit contains a network of old roads and trails (see Figure 2). These roads were likely accessed from the east via Apex and via a narrow road that followed the east slope of Coal Creek valley 0.5 mile west of Center Pit. This abandoned trail is steep with grades up to 30% and several sections that have been eroded by slope failures.

Spoil piles are visible in aerial imagery and elevation data north of the pit. Spoil pile surfaces are uneven and partially covered with alders and small trees (see Figure 3).

Figure 3: Surface of spoil pile north of Center Pit (view west).

Summary of Site Geologic Conditions

The site is within the Healy Creek valley. Healy Creek is a westerly flowing stream that flows into the Nenana River about 10 miles west of the site near Healy, Alaska, along the north flank of the Alaska Range. Headwaters of Healy Creek are approximately 15 miles east of the site near Cody Pass.

Hills north and south of the Healy Creek valley reach up to 3,000 and 6,000 feet, respectively and are generally composed of Birch Creek Schist of Precambrian or Paleozoic age with basalt and latite dikes of Tertiary age (Wahrhaftig, 1970).

Tertiary sedimentary rocks extend from the study site west along the Healy Creek valley and unconformably overlie the Birch Creek Schist. The coal-bearing group of these tertiary sedimentary deposits include (from oldest to youngest): The Healy Creek Formation, Sanctuary Formation, Suntrana Formation, and Grubstake and Lignite Formations. These formations commonly consist of cyclic repetitions of conglomerate, sandstone, siltstone, shale, claystone and coal (from oldest to youngest) and are generally poorly to moderately consolidated (Wahrhaftig, 1944 and 1970).

The younger tertiary Nenana Gravel unit consists of poorly consolidated pebble to boulder conglomerate and coarse sandstone and overlies the coal-bearing group north of Healy Creek between the Nenana River and Gold Run Creek (approximately 1.5 miles west of the site).

Quaternary alluvial, alluvial terrace, and pediment gravel deposits overlie parts of the tertiary sedimentary sequence along the Healy Creek floodplain and on the lower-lying slopes of the valley, up to one mile from Healy Creek. Alluvial terrace deposits at the site were deposited on top of the coal-bearing sequence by Coal Creek as part of an alluvial fan (Wahrhaftig, 1944 and 1970).

Tertiary rocks in the Healy Creek valley are bounded to the north by a steeply dipping fault which up-thrust Birch Creek Schist north of the fault. The axis of a syncline parallels the fault to the south. Beds south of the fold dip 25 to 40° to the north and beds north of the fold dip 65 to 90° south (Wahrhaftig, 1944, see Figure 4). The coal seam exposed in the northern slope of Center Pit dips approximately 40° towards the northwest.

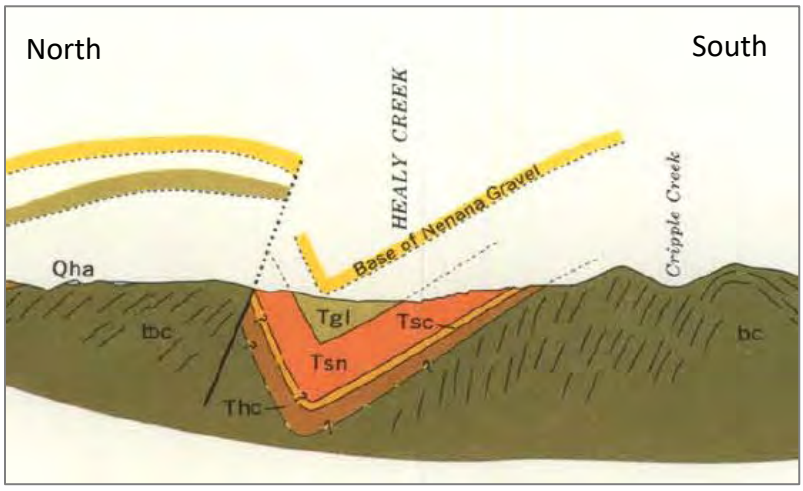


Figure 4: Geologic cross section near Cripple Creek (modified after Wahrhaftig, 1970).

Notes:
Bc = Birch Creek Schist, Thc = Healy Creek Formation, Tsc = Sanctuary Formation, Tsn = Suntrana Formation, Tgl = Grubstake and Lignite Creek Formations

Subsurface Conditions

Subsurface conditions in the area generally consist of sand and gravel alluvial terrace deposits with cobbles and occasional boulders overlying northerly dipping, highly weathered, extremely friable sedimentary bedrock with coal seams. A thin (1-inch to 6-inch thick) layer of silty organic overburden overlies the alluvial terrace deposits.

Silty organic overburden: Dark brown, loose, Silt (ML) with organics (roots and decomposed).

Alluvial terrace deposits: Gray-brown, loose, well-graded Gravel with Sand (GW) and trace fines; fine to coarse, subangular to subrounded gravel and sand with up to 10 percent cobbles by volume (see Figure 1).

Clay: An approximately 3-foot thick layer of clay (see Figure 5) was encountered overlying highly weathered sandstone bedrock in TP-2. Clay was not noted in TP-3 between the sandstone bedrock and alluvial terrace deposits. Clay was also encountered in two borings performed by others near the Cripple Creek Crossing. It was unclear whether the clay layer is part of the sedimentary rock sequence and thus highly weathered claystone or clay that was deposited after erosion of the sedimentary rock and prior to the deposition of alluvial gravel.

Figure 5: Gray, moist to wet clay in excavator bucket.

Sandstone bedrock: Light gray, extremely weathered and friable sandstone bedrock (Figure 6) consisting of fine- to medium-grained sand outcrops along the existing road cut and within Center Pit. Sandstone can be dislodged by hand and crumbles with little pressure. The top of sandstone appears to be nearly horizontal (likely due to glacial and fluvial erosion). Sandstone is overlain by approximately 50 to 70 feet of alluvial terrace deposits. Clay was encountered between the sandstone and alluvial terrace deposits in one test pit.

Figure 6: Sandstone in road cut (view north). Note RECON field staff for scale.

A **coal seams** is visible in the slope on the north side of Center Pit (see Figure 1). The seam dips approximately 40° towards the northwest and was estimated at 20 feet thick.

Very hard, brown **chert** was noted in colluvium near the coal seam. The excavator operator noted that this material had been encountered in excavations elsewhere and was extremely difficult to rip.

Spoil piles consist of well-graded gravel with silt and sand (GW-GM) to well-graded sand with silt and gravel (SW-SM) and are made up of highly weathered and decomposed sand and

siltstone bedrock, coal fragments, and alluvial gravel with sand and cobbles. Fines content likely varies and is elevated compared to the alluvial gravel.

Water was not observed in any of the test pits. A seep was noted west of the access road near elevation 2,018 feet (see Figure 7). The seep is likely connected to the water in the pit which is near 2,020 feet elevation.

Figure 7: Seep (indicated by blue arrow) west of re-established access road to bottom of Center Pit (view south).

Frost-susceptible soils: Organic silty overburden, clay, and spoil pile material is likely frost susceptible due to elevated fines contents.

Permafrost was not observed at the site.

Anticipated Challenges

RECON considered several routes to connect the existing access road to the area south of Center Pit. The preferred route crosses part of the spoil pile north of Center Pit and then climbs along the western pit sidewall (see map in Appendix A). The route will primarily consist of a side-cut into the existing pit slope and is expected to produce a significant volume of good quality alluvial gravel material.

Anticipated challenges for this route include:

- Steep terrain with loose soils.
- Water management during and after construction.
- Potential for encountering clay and/or chert layers during construction.
- Potential for rutting due to highly weathered sandstone.
- The seep north of the pit appears to be hydraulically connected to the water level in the pit.
- Managing the substantial material excavated from side cut construction.

RECOMMENDATIONS

RECON makes the following recommendations specific to the proposed road construction:

- Optimize the proposed road route to avoid the coal and chert seams to the extent feasible.
- Remove any clay layers encountered and back-fill with compacted gravel.
- Over-excavate the road sections through friable sedimentary rock and replace with compacted gravel.
- Monitor construction through spoil piles for potentially deleterious material or sections with significantly elevated fines contents. Over-excavate deleterious material and material with elevated fines content and replace with compacted gravel.
- Establish proper drainage during and after construction.
- Minimize impact to the existing seep north of the pit. Do not excavate in or near the seep.
- Utilize the alluvial gravels for embankment construction.

CONCLUSIONS

RECON completed geotechnical field investigations to support the identification and design of a preferred access alternative from existing infrastructure to the “Upper Study Area” south of Center Pit. The field investigations identified potential challenges and confirmed expected subsurface conditions at the site. Based on the geotechnical field investigations, the preferred

route along the inside wall of Center Pit is a feasible option that should be pursued for design and construction.

We appreciate the opportunity to provide geotechnical engineering services to DNR. Please contact us with any questions.

Sincerely,

Peppi (Patrizia) Bolz, PE, CPG
RECON LLC

Attachments:
A – Site Map
B – Test Pit Logs

References

Csejtey, Bela, Jr., Mullen, M.W., Cox, D.P., Gilbert, W.G., Yeend, W.E., Smith, T.E., Wahrhaftig, Clyde, Craddock, Campbell, Brewer, W.M., Sherwood, K.W., Hickman, R.G., Stricker, G.D., St. Aubin, D.R., and Goerz, D.J., III, 1986, Geology and geochronology of the Healy Quadrangle, Alaska: U.S. Geological Survey Open-File Report 86-396, 92 p., 4 sheets, scale 1:250,000.

Csejtey, Bela, Jr., Mullen, M.W., Cox, D.P., and Stricker, G.D., 1992, Geology and geochronology of the Healy Quadrangle, south-central Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map 1961, 63 p., 2 sheets, scale 1:250,000.

Wahrhaftig, Clyde, and Freedman, Jacob, 1944, Coal deposits in the valley of the Healy River, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 67-5, 13 p., 6 sheets. https://doi.org/10.14509/817

Wahrhaftig, Clyde, and Black, R.F., 1958, Quaternary and engineering geology in the central part of the Alaska Range: U.S. Geological Survey Professional Paper 293, 118 p., 7 sheets.

Wahrhaftig, Clyde, 1970, Geologic map of the Healy D-4 Quadrangle, Alaska: U.S. Geological Survey Geologic Quadrangle Map 806, 1 sheet, scale 1:63,360.

Appendix A

Site Map

148°39'40"W 148°39'30"W 148°39'20"W 148°39'10"W 148°39'0"W

63°52'55"N

63°52'50"N

63°52'45"N

2000 ft
2050 ft
2100 ft
2150 ft
TP-04
TP-01
TP-02
TP-03
TH-01

LEGEND

Proposed Access Route Options
- Primary
- Alternate 1

D Test Hole (Hand Dug)

D Test Pit

Prominent Elevation Points

50ft Contours

10ft Contours

0 75 150 300 450 600 750 Feet

DNR / Center Pit

Map and Engineering by RECON LLC
565 W Recon Cir, Palmer, AK 99645
NAD 1983 Alaska State Plane Z4 (usft)
Imagery by RECON
Elevation provided by DNR

Center Pit
Completed Test Pits

1" = 150'
1:1,800

10/28/2025

Map Area
Fairbanks
Anchorage
1:15,000,000

Project: DNR_Healy_CenterPit_TestPit_ReportMap_251020

Layout: MapLayout_11x17L_BlkB1

Appendix B

Test Pit Logs

TEST PIT: TP-1

Project: Healy Center Pit
Method: Track-Mounted Excavator
Rig Type: CAT 349

Client: DNR

Logged By: P. Bolz
Date Started: 09/22/2025
Date Completed: 09/22/2025

Lat / long: 63.88131, -148.66206
Datum: WGS84
Surface Elevation: 2026.6'
Depth: 18'

Comments On spoil pile.

Depth (ft)	Sample Number	Frozen=	Graphic Log	Material Description
0				Light brown, loose, *Well-graded Sand with Silt and Gravel* (SW-SM); moist; with organics (roots) to 0.5 feet; fine to coarse, subangular to subrounded gravel and sand; few cobbles and coal fragments throughout.
5	S-1			S-1: 44% Gravel; 48% Sand; 8% Fines
				- Brown below about 8 feet.
10				
15				
				18.0

Bottom of Test Pit near 18 feet.

TEST PIT: TP-2

Project: Healy Center Pit
Method: Track-Mounted Excavator
Rig Type: CAT 349

Client: DNR

Logged By: P. Bolz
Date Started: 09/22/2025
Date Completed: 09/22/2025

Lat / long: 63.88118, -148.66125
Datum: WGS84
Surface Elevation: 2047.7'
Depth: 14'

Comments In natural slope south of spoil pile.

Depth (ft)	Frozen=	Graphic Log	Material Description	
			Dark brown, *Topsoil*; moist to wet; with organics (roots).	0.2
			Light brown, very loose, *Poorly Graded Sand* (SP); moist to wet; fine to coarse sand; trace fines.	2.0
5			Brown, very loose, *Poorly Graded Gravel with Sand* (GP); moist to wet; subangular to subrounded gravel and sand; few cobbles; trace fines.	9.0
10			Gray, soft to firm, *Lean Clay* (CL); moist to wet.	12.0
			Light gray, fine to medium grained, **SANDSTONE**, highly weathered.	14.0

Bottom of Test Pit near 14 feet due to sloughing.

TEST PIT: TP-3

Project: Healy Center Pit
Method: Track-Mounted Excavator
Rig Type: CAT 349

Client: DNR

Logged By: P. Bolz
Date Started: 09/22/2025
Date Completed: 09/22/2025

Lat / long: 63.88102, -148.66058
Datum: WGS84
Surface Elevation: 2045.2'
Depth: 8'

Comments In west slope of road cut.

Depth (ft)	Sample Number	Frozen=	Graphic Log	Material Description	
	S-1			Light brown, very loose, *Well-graded Gravel with Sand* (GW); moist to wet; trace fines.	
				S-1: 65% Gravel; 35% Sand	2.0
5				Light gray, fine to medium grained, **SANDSTONE**, highly weathered.	
					8.0

Bottom of Test Pit near 8 feet.

TEST PIT: TP-4

Project: Healy Center Pit
Method: Track-Mounted Excavator
Rig Type: CAT 349

Logged By: P. Bolz
Date Started: 09/22/2025
Date Completed: 09/22/2025

Lat / long: 63.88178, -148.66163
Datum: WGS84
Surface Elevation: 2005.3'
Depth: 8'

Client: DNR

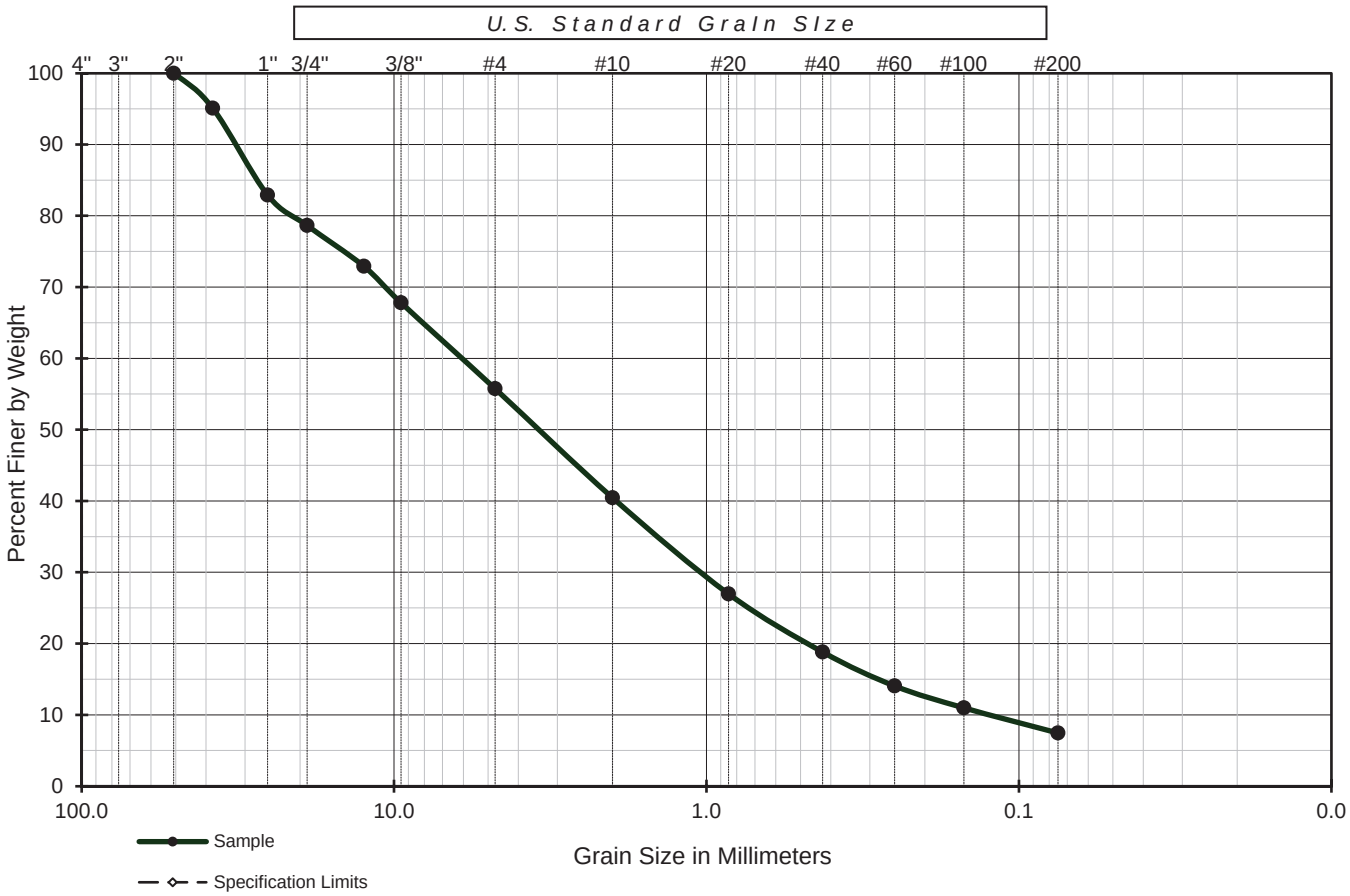
Comments Along western shoulder of access road.

Depth (ft)	Frozen=	Graphic Log	Material Description
5			Light brown, *Well-graded Gravel with Silt and Sand* (GW-GM); moist; fine to coarse, subangular to subrounded gravel and sand; few cobbles and coal fragments throughout. - Brown below about 6 feet.
			8.0

Bottom of Test Pit near 8 feet.

Appendix C

Laboratory Test Results



Sieve Size	Percent Passing by Weight	Specification Limits Minimum	Maximum
6			
5			
4			
3			
2	100		
1.5	95		
1	83		
3/4	79		
1/2	73		
3/8	68		
4	56		
No. 10	41		
No. 20	27		
No. 40	19		
No. 60	14		
No. 100	11		
No. 200	7.5		

USCS Sample Classification		
Well-Graded Sand with Silt and Gravel		
SW-SM	Cu = 49.	Cc = 1.42

Sampled by: Recon LLC

Sample Location: TP-01

SW Sample Identification: **S-1**

Reviewed by: Amber Larson
Lab Manager
10/16/25 10:13

DNR Healy
Recon LLC

GRAIN SIZE DISTRIBUTION

ASTM C136

October 16, 2025 | 105404-037

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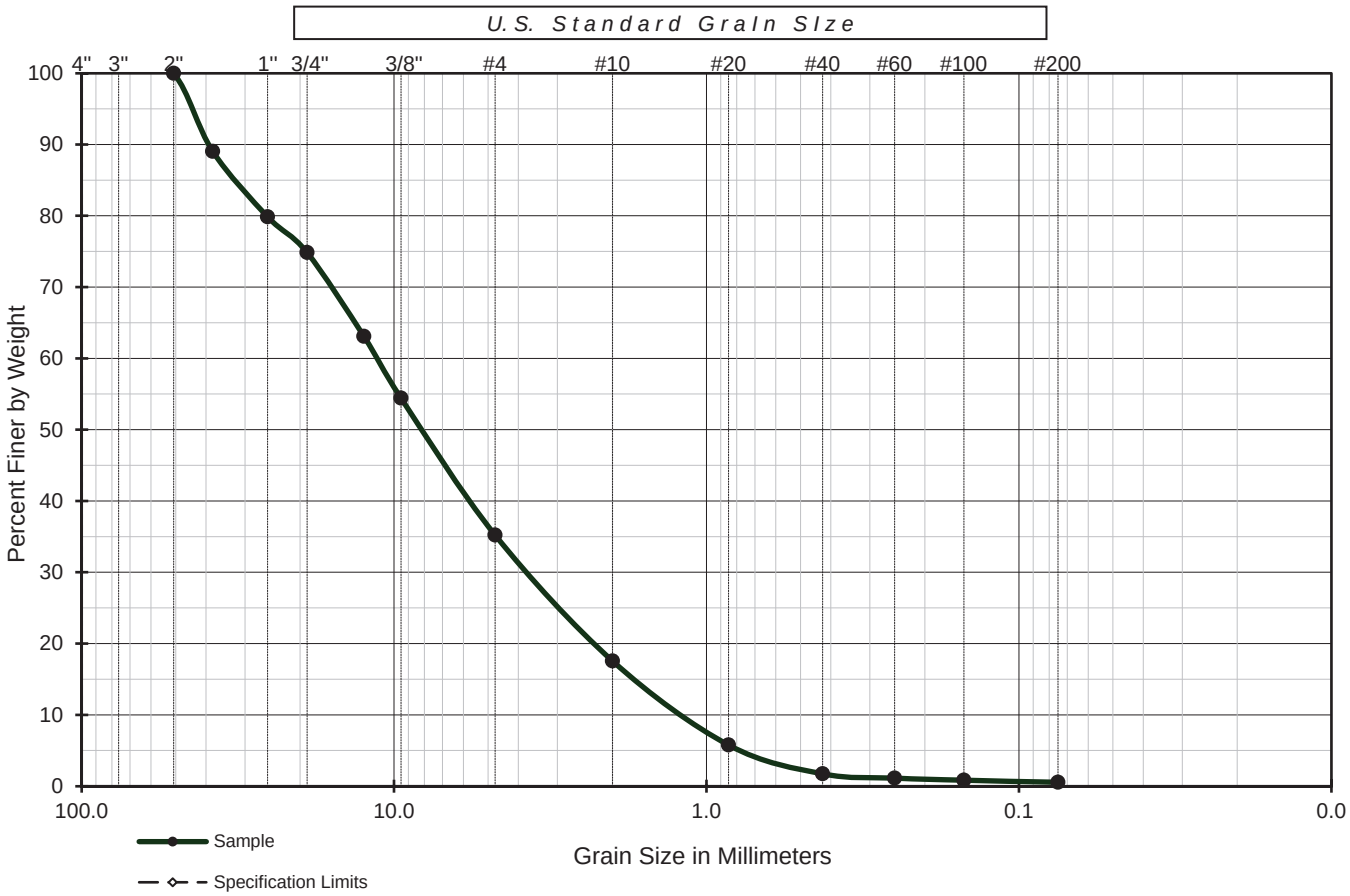
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

TP-01, S-1



Sieve Size	Percent Passing by Weight	Specification Limits Minimum	Maximum
6			
5			
4			
3			
2	100		
1.5	89		
1	80		
3/4	75		
1/2	63		
3/8	54		
4	35		
No. 10	18		
No. 20	6		
No. 40	2		
No. 60	1		
No. 100	1		
No. 200	0.6		

USCS Sample Classification		
Well-Graded Gravel with Sand		
GW	Cu = 9.8	Cc = 1.03

Sampled by: Recon LLC

Sample Location: TP-03

SW Sample Identification: **S-1**

Reviewed by: Amber Larson
Lab Manager
10/16/25 10:13

DNR Healy
Recon LLC

GRAIN SIZE DISTRIBUTION

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TP-03, S-1