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RE: Roadway Materials Report
KN 23880 – Spirit Lake Cutoff Curves
Bonner County, Idaho

Greetings:

STRATA has prepared this Roadway Materials Report for the proposed Spirit Lake Cutoff Curves project (KN 23880), located in Bonner County, Idaho. The purpose of our geotechnical engineering evaluation was to explore subsurface soil conditions within the proposed new road alignment and provide geotechnical recommendations to support project planning, design, and construction. We accomplished our geotechnical services referencing our authorized agreement between J-U-B Engineers, Inc. (J-U-B) and STRATA, executed August 3, 2023. This report was updated based on draft report feedback provided by J-U-B, Bonner County (the County), and the Local Highway Technical Assistance Council (LHTAC).

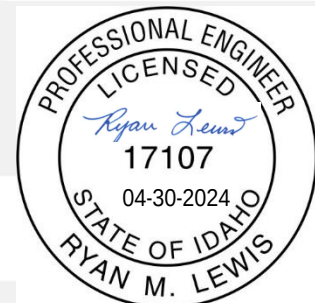
This report summarizes our field evaluation, laboratory test results, engineering analysis, and presents our geotechnical findings, opinions, and recommendations for the project. Individual portions of this report cannot be relied upon without the supporting text of related sections.

We appreciate the opportunity to continue our working relationship with J-U-B, the County, and LHTAC and we look forward to our continued involvement during the design and construction phases. We strive to provide quality, innovative, and timely geoprofessional services. Please contact us if you have any questions or comments.

Sincerely,
STRATA

Steven J. Litalien, E.I.
Staff Engineer

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STRATA

Roadway Materials Report

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PROJECT NO: A023(880)
KEY NO: 23880
PROJECT: SPIRIT LAKE CUTOFF CURVES
COUNTY: BONNER

240.00 ROADWAY MATERIALS REPORT

240.01 INTRODUCTION

This Roadway Materials Report was prepared referencing Section 240.00 of the 2020 Idaho Transportation Department (ITD) Materials Manual. This report presents the results of our geotechnical investigation and pavement estimating data for improvements planned on Spirit Lake Cutoff Road located in Bonner County, Idaho.

Spirit Lake Cutoff Road is a north-south traversing rural collector diagonally connecting the arterial Dufort Road to the north and SH-41 to the south. The current layout of the alignment results in long straight stretches interspersed with approximately 90-degree sharp curves that impose hazardous driving conditions in both fair and foul weather. The Local Highway Technical Assistance Council (LHTAC) seeks to improve several of these curves on Spirit Lake Cutoff Road where the highest density of vehicle crashes occur. The tightest curve along this stretch is the 3500 block near Beare Road. Improvements will include realigning the approximately 1000-foot-long stretch of road, increasing the curve radius from the current 157 feet to 650 feet or greater, which is more appropriate for the speed limit, and adding guardrails on the outside of the curve. The increase to the curve radius will also require the intersection with Beare Road to be redesigned. J-U-B Engineers, Inc. (J-U-B) was selected to perform civil design for the project and STRATA was subcontracted by J-U-B to provide geotechnical services for the project.

The existing ground surface at the 3500 block of Spirit Lake Cutoff Road gradually declines approaching the curve from the east (southbound) with a slope of approximately 45H: 1V, which levels off after the 90-degree curve. The total paved width is approximately 25 feet with 12-foot-wide lanes. The land surrounding this stretch is relatively undeveloped with rural residential structures present within the proximity. The closest structure being The Mountain Springs Assisted Living Center approximately 275 feet to the west.

Outside the asphalt paved surfacing, the ground surface is moderately treed and covered with mild vegetation consisting of grasses and shrubs. The alignment of the roadway is elevated approximately 3.0 to 4.0 feet higher than the surrounding ground on either side of the curve. Drainage ditches approximately 3 feet in depth follow both sides of Spirit Lake Cutoff Road through the project length.

240.02 VICINITY SKETCH

Plate 1 provides a Vicinity Sketch of the project in relation to the town of Spirit Lake. Plate 2 is an Exploration Location Plan illustrating the boring and test pit locations along the proposed alignment.

240.03.01 SOILS PROFILE

A Soils Profile showing the explorations in relation to the proposed vertical alignment is provided in Appendix B.

240.03.02 PAVEMENT CONDITION SURVEY

A pavement condition survey was not completed since the project does not include rehabilitation of existing pavement. Subsequent report sections summarize existing asphalt and aggregate thickness encountered at the site.

240.04 SOIL REPORT SUMMARY

Cuts beyond those required to remove topsoil are anticipated to be minimal for this project. Fill material will originate from approved contractor-furnished sources. As such, a soil report summary was not completed for this project.

240.04.02 BORING LOGS AND TEST PIT LOGS

Our field explorations were performed on September 27 and December 12, 2023 and consisted of advancing three (3) borings in the existing Spirit Lake Cutoff Road right-of-way (ROW) and two (2) test pits in the proposed new curve alignment located in the lot southeast of the existing curve. Two borings (B-1 and B-2) were advanced in the paved section of the northbound lane south of the curve, and one boring (B-3) was advanced in the paved section of the southbound lane east of the curve.

Borings B-1 through B-3 were all advanced to 11.5 feet below the ground surface (BGS). Pavement cores were obtained to determine the asphalt thickness, and the borings were advanced to identify and sample the subsurface aggregate and soil. Exploration locations are shown on Plate 2, *Vicinity Sketch and Exploration Location Plan*. Exploratory borings were advanced using a tracked Acker Recon drill rig equipped with 6.0-inch outside diameter hollow-stem augers. Soil samples were obtained at approximate 2.5-foot intervals, starting below the asphalt concrete (AC) pavement layer at each boring location, using a 2-inch outside diameter split-spoon sampler. Soil samples obtained in this manner are disturbed but can be used for visual classification and index testing. In addition, bulk samples of select soils were collected from the auger cuttings.

Test pits TP-1 and TP-2 were both advanced to a depth of 5.0 feet BGS. Exploratory test pits were advanced using a rubber tracked Kubota KX057-4 mini excavator equipped with a 24-inch-wide bucket and general-purpose excavation bucket teeth. Bulk samples were collected from excavation spoils. Test pit locations are also shown on Plate 2, *Exploration Location Plan*.

The soils encountered in the borings and test pits were logged and visually classified by Mr. Luke Michels, P.E. and Mr. Steven Litalien, E.I. in accordance with the *Unified Soil Classification System* (USCS). Appendix C provides laboratory test results used to confirm visual classifications in the field.

Field testing consisted of Standard Penetration Tests (SPTs) performed in general accordance with ASTM International (ASTM) D1586. The SPT consists of driving a 2-inch outside-diameter, split-spoon sampler a distance of 18 inches with a 140-pound automatic hammer falling 30 inches. For each test, the sampler is initially driven 6 inches to seat the sample, and then driven two additional 6-inch increments. The number of blows

required to drive the sampler the two additional 6-inch intervals is added together and represents the driving resistance, or SPT N-value at the sample location. The SPT N-value gives an indication of the relative density of cohesionless soils and the consistency of cohesive soils. The raw N-values reported on boring logs have not been corrected for hammer efficiency, borehole diameter, rod length, or overburden pressure.

At the conclusion of our subsurface investigation, the borings were backfilled with a combination of bentonite and aggregate and the pavement was patched with cold-mix asphalt to match the existing thickness. The test pits were backfilled and loosely compacted with the excavated spoils. The exploratory boring and test pit logs are included in Appendix A, along with a USCS summary, which should be used to interpret the soil descriptive terms in this report.

Within the existing roadway, we encountered AC pavement above base course underlain by embankment fill, all placed on native gravel. Embankment fill comprised of either silty sand with gravel (SM) or silty gravel with sand (GM) was encountered below the base course in each boring. Native gravel classifying as either silty gravel with sand (GM) or poorly graded gravel with silt and sand (GP-GM) was encountered below the embankment fill in each pavement boring.

In both test pits TP-1 and TP-2 we encountered topsoil classifying as silty sand with gravel (SM) above native gravel. A general description of each soil unit's stratigraphic location and properties is provided below:

Surficial Topsoil: We encountered a 1.25- to 1.5-foot-thick topsoil layer at the ground surface in both test pits. The topsoil classified as silty sand with gravel (SM) and was described as dark brown and moist, with in-situ moisture contents ranging from 32.4 to 34.6 percent. The topsoil had an organic content of 10.4 percent and a fines content (percent passing the No. 200 sieve) of 44.5 percent. Atterberg limits testing indicated that the topsoil was non-plastic.

Pavement: We encountered 12.0 to 13.5 inches of AC in the borings drilled within the existing Spirit Lake Cutoff Road ROW (B-1 through B-3). The AC pavement in borings B-1 and B-3 were recovered in one section, while the AC pavement recovered in B-2 was recovered in two separated sections, one 6.5 inches and one 7.0 inches in thickness.

Base Course: Base Course visually classifying as poorly graded gravel with silt and sand (GP-GM) according to ASTM D2488 was encountered below the AC in all the borings drilled within the existing pavement. The base course was 3.0 inches in thickness and was described as gray, moist, and containing fine to coarse, subrounded to angular gravel.

Embankment Fill: Fill comprised of either silty sand with gravel (SM) or silty gravel with sand (GM) according to the ASTM classification system was encountered below the base course in each boring. The embankment fill was likely used as a subbase course layer as well as general embankment fill to raise grades below the pavement. The embankment fill extended to depths ranging from 3.6 to 3.8 feet below the top of pavement. The

fill was described as light brown with dark brown and moist, with an in-situ moisture content ranging from 4.8 to 19.1 percent. The fill had a fines content ranging from 31.7 to 43.0 percent. Atterberg limits testing indicates the fill is non plastic. R-value testing performed on a sample of the embankment fill resulted in an Idaho T-8 R-value of 64.

Native Gravel: Native gravel was encountered below either the embankment fill or the topsoil in each boring and test pit and extended to the termination depths of each exploration (5.0 to 11.5 feet). The native gravel classified as either silty gravel with sand (GM) or poorly graded gravel with silt and sand (GP-GM) according to the ASTM classification system. The native gravel was described as light brown to brown and moist, with in-situ moisture contents ranging from 3.7 to 21.2 percent. Penetration resistance values ranged from 6 to 20 blows per foot, indicating a loose to medium dense soil stratum. We measured a fines content between 10.1 and 12.5 percent in the native gravel. Atterberg limits testing indicates that the native gravel has a liquid limit ranging from no-value to 27 percent and plasticity indices ranging from non-plastic to 2. The native gravel had an Idaho T-8 R-Value of 83. Cobbles were observed within the native gravel in the test pit spoils.

We did not encounter groundwater to the depths explored at the project site. We anticipate the groundwater table is more than 50 feet below the ground surface. Seasonal groundwater elevation changes due to variations in precipitation, runoff, irrigation, infiltration and other factors are possible. Since extensive sub-excavation is not expected, the potential for encountering groundwater during construction is negligible. Additional details and specific soil descriptions are included on the boring logs in Appendix A.

240.05 TOTAL DESIGN PAVEMENT THICKNESS

A pavement design section is provided in section 240.22.02 Typical Section.

240.06 SUB-SUBGRADING

Sub-subgrading (SSG) is additional excavation below pavement subgrade due to the presence of groundwater or undesirable subgrade soil. Other than the surficial topsoil in the new alignment area, we did not encounter groundwater or undesirable subgrade soils that would require removal and replacement or a thicker pavement section; as such, sub-subgrading is not required for this project.

240.07 GRADE POINTING

Grade pointing is tapered sub-subgrading to eliminate abrupt longitudinal transitions from existing pavement sections to the new pavement section or between cuts/fills required to achieve the desired superelevation. We did not identify any factors at the project site that would contribute to premature pavement failure at grade points, such as ponded water or significant layers of remnant topsoil. As such, no sub-subgrading at grade points is necessary for this project.

240.08 SPECIAL PLACEMENT

This project does not require any special placement requirements for fill generated at the project site.

240.09 COMPACTION

Class A compaction is specified for this project referencing Sections 205.03.F and 205.03G of the 2023 ITD Standard Specifications for Highway Construction (SSHC). We recommend that construction be undertaken during dry weather conditions. During wet periods of the year, wet or saturated native soil or embankment fill will be susceptible to erosion, pumping, or rutting when subject to heavy loads from rubber-tired equipment or vehicles which exert a point load. Grading and compaction should not be attempted under these conditions. If the subgrade soil becomes soft, wet, or otherwise unsuitable due to earthwork attempted during wet weather conditions, this material should be excavated to undisturbed and firm soil and backfilled with *Granular Subbase* or *Aggregate Base* as described in Section 301 and 303 of the 2023 ITD SSHC, respectively.

240.10 SLOPE DESIGN SUMMARY

This project includes embankment slopes to achieve grades in the superelevation areas and for ditches to promote drainage at the site. Slopes steeper than 2.0 H: 1.0V (horizontal: vertical) are not planned for this project. Table 1 and Table 2 below list the heights of slopes left and right of centerline along the proposed Spirit Lake Cutoff Road and Beare Road alignment, respectively. Table 3 and Table 4 below list the cut and fill heights left and right of centerline along the proposed Spirit Lake Cutoff Road and Beare Road alignment, respectively.

Table 1: Spirit Lake Cutoff Road - Slope Height Summary

Station Limits	Height of Slope Left of Centerline (feet)	Height of Slope Right of Centerline (feet)
10+50 – 11+50	Up to 3.0	Up to 2.6
11+50 – 12+50	Up to 3.2	Up to 3.0
12+50 – 13+50	Up to 3.6	Up to 3.2
13+50 – 14+50	Up to 5.3	Up to 3.4
14+50 – 15+50	Up to 4.9	Up to 2.6
15+50 – 16+50	Up to 4.2	Up to 2.6
16+50 – 17+50	Up to 5.2	Up to 2.0
17+50 – 18+50	Up to 6.3	Up to 2.6
18+50 – 19+50	Up to 6.5	Up to 2.8
19+50 – 20+50	Up to 6.1	Up to 2.6
20+50 – 21+50	Up to 2.6	Up to 2.6
21+50 – 22+50	Up to 3.1	Up to 2.6
22+50 – 23+50	Up to 2.9	Up to 2.1
23+50 – 24+50	Up to 2.6	Up to 2.6
24+50 – 25+00	Up to 2.9	Up to 2.5

Table 2: Beare Road - Slope Height Summary

Station Limits	Height of Slope Left of Centerline (feet)	Height of Slope Right of Centerline (feet)
100+50 – 101+50	Up to 8.0	Up to 6.1
101+50 – 102+50	Up to 3.4	Up to 4.8
102+50 – 103+50	Up to 2.7	Up to 2.6

Table 3: Spirit Lake Cutoff Road - Cut and Fill Summary

Station Limits	Fill Height Left of Centerline (feet)	Cut Height Left of Centerline (feet)	Fill Height Right of Centerline (feet)	Cut Height right of Centerline (feet)
10+50 – 11+50	Up to 0.7	-	Up to 0.7	-
11+50 – 12+50	Up to 2.0	-	Up to 0.9	-
12+50 – 13+50	Up to 3.2	-	Up to 1.5	-
13+50 – 14+50	Up to 2.7	-	Up to 3.7	-
14+50 – 15+50	Up to 3.9	-	Up to 3.6	Up to 0.6
15+50 – 16+50	Up to 3.4	-	Up to 2.3	Up to 1.5
16+50 – 17+50	Up to 5.9	-	Up to 4.6	Up to 0.5
17+50 – 18+50	Up to 5.3	-	Up to 4.2	-
18+50 – 19+50	Up to 5.7	-	Up to 3.7	-
19+50 – 20+50	Up to 5.5	-	Up to 3.5	Up to 1.4
20+50 – 21+50	Up to 4.8	Up to 1.3	Up to 2.3	Up to 1.9
21+50 – 22+50	Up to 0.5	Up to 0.8	Up to 1.3	Up to 3.0
22+50 – 23+50	Up to 1.1	Up to 0.3	-	Up to 1.1
23+50 – 24+50	Up to 1.0	Up to 0.2	Up to 0.3	Up to 0.5
24+50 – 25+00	Up to 0.8	-	Up to 0.3	Up to 0.2

Table 4: Beare Road - Cut and Fill Summary

Station Limits	Fill Height Left of Centerline (feet)	Cut Height Left of Centerline (feet)	Fill Height Right of Centerline (feet)	Cut Height right of Centerline (feet)
100+50 – 101+50	Up to 6.9	-	Up to 6.8	-
101+50 – 102+50	Up to 3.6	Up to 1.2	Up to 6.6	Up to 3.1
102+50 – 103+50	Up to 0.2	Up to 1.0	Up to 0.2	Up to 2.6

240.11 SLOPE DESIGN

Embankment slopes for this project are planned at a 4.0H: 1.0V or flatter slope. As such, slope improvements (i.e. mini-benches, serrations, or geosynthetic reinforcement) are not required and we did not perform a comprehensive slope stability analysis for this project.

240.12 EMBANKMENT FOUNDATION

This project includes minor cuts (less than 3 feet) and fills up to 7 feet high on flat to very gradually sloping ground. Furthermore, 4.0H: 1.0V embankment slopes are planned outside and on both sides of the roadway prism along the entire length of the alignment. Based on the subsurface and geologic conditions encountered at the site and planned improvements, we anticipate new embankment consolidation and settlement will occur during construction and will be negligible (less than 1.0 inches of total settlement) following construction completion.

To construct embankment fills at the widening areas at both ends of the new alignment, we recommend constructing an initial “base key” and benching *Granular Borrow* fill into existing embankments per Section 205.03F of the 2023 ITD-SSHC. Figure 1 below outlines our recommendations for embankment widening construction.

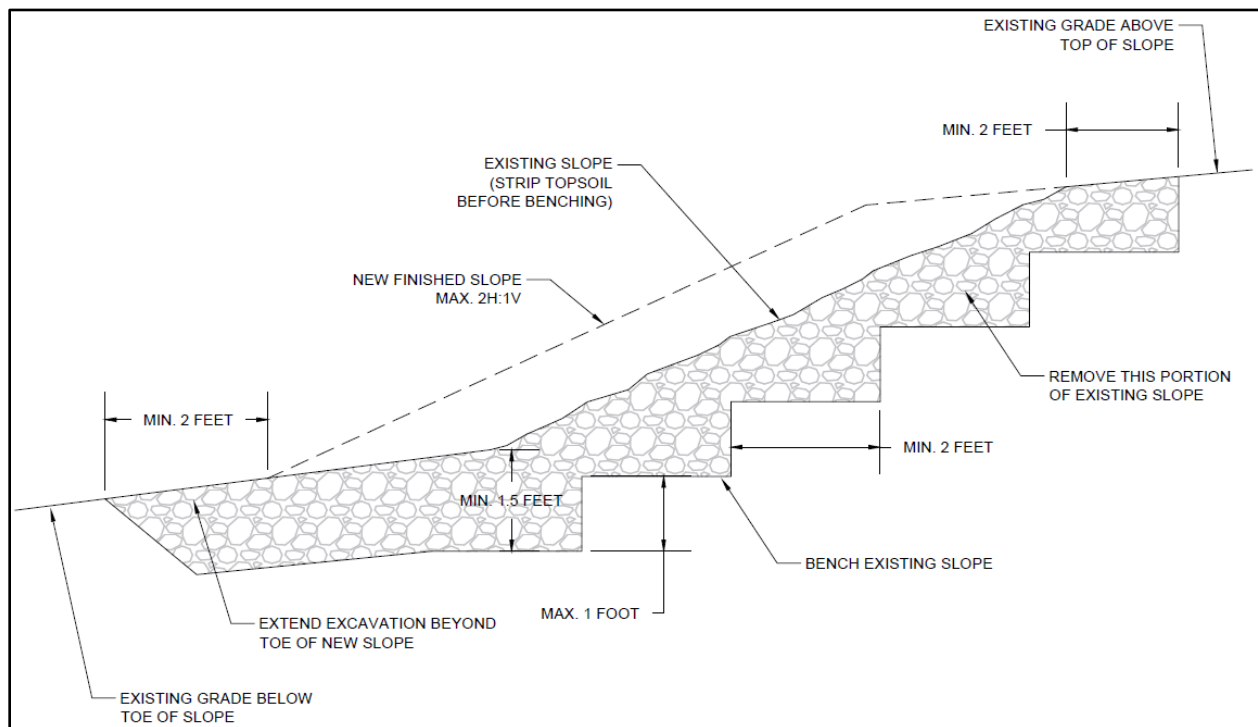


Figure 1: Embankment Widening Construction

240.13 SURFACE AND SUBSURFACE WATER

We did not encounter groundwater during our subsurface investigation within the project boundary. We anticipate the groundwater table is greater than 50 feet below the ground surface in the area. Subsurface water will not require mitigation during construction; however, the contractor could encounter surficial seeps or springs at any time of the year.

Surface water collected on the asphalt paved surface is currently directed off Spirit Lake Cutoff Road and into the ditch on both sides of the roadway alignment. The superelevation of the new roadway alignment will direct

the majority of surface water collected on Spirit Lake Cutoff Road to the inside ditch. J-U-B must properly design stormwater systems at the site to prevent surface water from collecting on the pavement surface or the adjacent ditches. Surficial water collected on the pavement surface and ditches may saturate and weaken subgrade soils and lead to reduced asphalt pavement life.

240.14 DRAINAGE

A detailed drainage design has not been provided at this time. We anticipate drainage features at the site will include ditches on both sides of the roadway to divert surface water downgradient and away from the pavement subgrade. J-U-B must properly design the drainage features at the site to prevent water from ponding, which may saturate the subgrade soil and result in a reduced pavement design life.

240.15 GEOSYNTHETICS

The use of geosynthetics is not anticipated for this project.

240.16 EXISTING ROADWAY MATERIAL

Existing asphalt pavement, base course, embankment fill, and native gravel excavated during construction may be reused as embankment fill, provided it meets the requirements of Section 205 of the 2023 ITD SSHC and is not classified as Topsoil (defined in Section 240.18). On-site base course may be reused as *Aggregate Base*, provided it meets the requirements of Section 703 of the 2023 ITD SSHC.

240.17 ROCK SUBGRADE

We do not anticipate rock subgrade will be encountered at the project site.

240.18 TOPSOIL

For the purposes of this report, we define “topsoil” as any soil layer containing greater than 3 percent organics and vegetation by weight. As such, there are “topsoil” layers encountered at the surface within the project boundary that are classified as silty sand with gravel (SM) according to the USCS classification system. Outside of currently paved areas, we encountered a 1.3- to 1.5-foot-thick topsoil layer at the ground surface. Topsoil encountered during construction shall be stripped and removed from the project site or stockpiled in a designated area selected by the Contractor and approved by the County. All subgrade soil shall be cleared of organic material. The requirements for using existing topsoil and contractor furnished topsoil are included in the 2023 ITD SSHC. If sufficient topsoil cannot be generated from the project, contractor furnished sources must be used.

240.19 PIPE

At the time this report was issued, information regarding the location of new pipes and existing pipes that will remain was not specified. Laboratory testing of site soil to determine the pH, resistivity, and soluble sulfates was performed on representative soil samples to determine the potential negative impacts to underground pipes and utilities. Aggressive soil conditions are identified if the soil has a pH of less than 4.5, the sulfate concentration is

greater than 200 parts-per-million (PPM), and the resistivity is less than 2000 ohms-cm (FHWA, 2010). Based on this definition, aggressive soil conditions are not present at this site. Laboratory test results are presented in Table 5.

Table 5: pH, Resistivity, and Sulfate Test Results

Sample Location	Soil Classification	pH	Resistivity (ohms-cm)	Sulfate (mg/kg)
B-2 (1.1'-4.0')	Embankment Fill – Silty Gravel with Sand (GM)	8.03	8,600	63.1
B-3 (4.0'-6.0')	Native Gravel – Poorly Graded Gravel with Silt and Sand (GP-GM)	7.96	10,100	43.9
TP-1 (0.0'-1.5')	Surficial Topsoil – Silty Sand with Gravel (SM)	5.73	35,300`	9.54

Based on the above laboratory test results, we anticipate the existing soil below the proposed alignment is moderately corrosive for underground structures and utilities. Selection of material for metallic utility piping within native soil at the site must account for some possible loss of wall thickness due to corrosion. Corrosion risks include reduced service life for metal pipes, increased maintenance, and possible premature replacement.

The sulfate test results indicate the native soil at the site has a mild capacity for sulfate attack of concrete, respectively.

We recommend a qualified corrosion engineer review the above data to determine the appropriate corrosion protection measures and appropriate cement type for any structures in contact with the site soil.

A survey of existing culverts and their general condition was not completed as part of this report.

240.20 RIPRAP

Riprap is not required for this project.

240.22 PAVEMENT DATA

240.22.01 PAVEMENT TYPE AND SURFACE SMOOTHNESS

Based on the traffic ESAL value of 228,600 projected for Spirit Lake Cutoff Road over a 20-year design life provided by the ITD GIS database, Table 240.25.03.1 of the 2020 ITD Materials Manual, and our discussions with Bonner County, we recommend the use of Superpave HMA Class SP-3 for this project. Roadway improvements planned for this project will have superelevation and a centerline radius of curve less than 1,000 feet. Per Section 405.03.T of the 2023 ITD SSHC, we recommend the surface smoothness schedule requirement be excluded from this project's specifications.

240.22.02 TYPICAL SECTION

We provide the following pavement design for the new alignment:

0.25 feet (3.0 inches) – Superpave HMA Class SP-3 with ½-inch aggregate (single lift per Section 240.25.05)

0.67 feet (8.0 inches) – ¾-inch Aggregate Base “Type B” (two lifts)

240.23 BASE

Aggregate Base shall consist of ¾-inch crushed aggregate conforming to “Type B” requirements in Section 703.04 – *Aggregate for Untreated Base, Treated Base, and Road Mix* of the 2023 ITD SSHC. *Granular Subbase* shall consist of crushed aggregate conforming to Section 703.11 – *Aggregate for Granular Subbase* of the 2023 ITD SSHC.

We recommend a tack coat consisting of CSS-1 diluted emulsified asphalt be placed above compacted base to act as glue and help create a bond between base course and asphalt. The emulsion should be diluted by adding an equal amount of warm water, rigorously mixed in the holding tank. We recommend an application rate of 0.08 gal/SY between base course and asphalt. Tack coats should only be applied to an area that can be covered by the same day’s paving and should not be paved over until enough time has passed to allow the tack to “break” and “set”. The tack coat breaking point is defined as the moment when enough water has separated from the asphalt to show a color change from black to brown. Poor bonding of asphalt layers to the base course can result in slippage and shoving of the pavement.

240.24 SURFACE TREATMENT

Surface treatments (i.e. seal coats) are not required for this project.

240.25 PAVING

Asphalt pavement shall conform to the specifications in Section 405 of the 2023 ITD SSHC and LHTAC special provisions. A Superpave Mix Design (Class SP-3) shall be submitted with associated “Job Mix Formula” (JMF) for approval, prior to paving. We estimate approximately 817 tons of HMA will be required for this project; per LHTAC requirements, an acceptance test strip is NOT required for this project since the estimated pavement quantity is less than 2,250 tons. Compaction acceptance shall be based on the QA manual section 405-6, which requires 3 loose mix samples for Gmm testing and 5 random cores for density testing. Additional QA testing shall include measuring the asphalt content (AASHTO T308) and gradation testing (AASHTO T30). Correlated NCAT ovens are required for determining the asphalt content; the QA and QC labs should not rely on the NCAT correction factor reported on the JMF. Since mat density shall be accepted based on asphalt cores; a nuclear gauge correlation per IR-154 is not required. We recommend the quality assurance (QA) laboratory and quality control (QC) laboratory perform a split sample comparison per IR-153 prior to asphalt production paving.

240.25.04 PERFORMANCE GRADED BINDER SELECTION

The LTPPBind output for this project (provided in Appendix D) suggests a performance grade (PG) binder of 58-28 at 5.0- to 7.0-percent by weight of mix (estimated) should be used for new asphalt pavement. To improve rutting resistance at higher temperatures and introduce polymer to stiffen the asphalt mix, the design team should consider increasing the PG binder from PG 58-28 to PG 64-28. PG 64-28 is locally available and commonly used in the project area. A minimum $\frac{1}{2}$ -percent anti-strip additive should also be used, unless the mix design indicates anti-strip additive is not required to enhance asphalt-aggregate adhesion.

240.25.05 LIFT THICKNESS AND NOMINAL MAXIMUM AGGREGATE SIZE

We recommend Superpave HMA pavement be placed in a single, 3.0-inch-thick lift referencing guidance provided in *Section 240.05.02* of the 2020 ITD Materials Manual. With a $\frac{1}{2}$ -inch nominal maximum aggregate size (NMAS) the ratio of lift thickness to NMAS (t/NMAS) is 6.0 (a minimum t/NMAS of 3 is recommended by ITD).

240.25.06 PORTLAND CEMENT CONCRETE PAVEMENT

Portland cement concrete pavement will not be included in this project.

240.25.07 REDUCED SHOULDER PAVEMENT THICKNESS

We do not recommend a reduced shoulder thickness for this project.

240.26 SEAL

Surface seal or treatments are not anticipated for this project.

240.27 DUST ABATEMENT

An estimated 2,001 MG (1MG = 1,000 gallons) of water will be required for dust abatement, assuming 0.5 gallons of water per square yard of subgrade as outlined in the equation below. Dust palliatives are not anticipated for this project.

$$\left(11,115 \frac{SY}{app}\right) \times \left(3 \frac{apps}{day}\right) \times (120 \text{ days}) \times \left(0.5 \frac{gal}{SY}\right) \times \left(\frac{MG}{1,000 \text{ gal}}\right) = 2,001 \text{ MG}$$

240.28 AGGREGATE ESTIMATING DATA

Aggregate estimating data was determined based on past experience and nearby sources, and include:

$\frac{1}{2}$ -inch aggregate at 145 pcf for Plant Mix Class SP-3 including asphalt and additives.

$\frac{3}{4}$ -inch aggregate at 146 pcf for Base including 7 percent moisture content.

240.28.01 DISCLAIMER

The unit weights presented in this report were estimated based on past project experience. This information is used by the designer for developing reasonable project quantities. The actual quantities will vary and were based on contractor-provided source, crushing operation, and mix designs.

The contractor is responsible for determining actual unit weights based on the material produced and providing adequate materials for the project, plus any losses to stockpile operation, out of specification (rejected) materials, or other wastes.

240.29 AGGREGATE SOURCES

All aggregates for the project will originate from on-site crushed base course or approved contractor-furnished sources.

240.30 CURRENT SPECIFICATION AND MINIMUM TESTING REQUIREMENTS

This Roadway Materials Report is based upon LHTAC special provisions available on the LHTAC website, the 2020 Idaho Transportation Department Materials Manual, the 2023 Standard Specifications for Highway Construction, 2024 Supplementals for the 2023 Standard Specifications, the 2024 Special Provision for 405 HMA for 2023 spec book (11/29/2023), the 2022 405 Spring Memorandum (6/12/2022), the 2024 405 Memorandum (11/29/2023), the 2020 Quality Assurance Manual, the 2023 QA Manual Buy America (BA) Supplementals, and the 2023 Quality Assurance Special Provisions (QASP) for State Acceptance for 2023 Spec Book (12/7/2023).

240.31 REFERENCES

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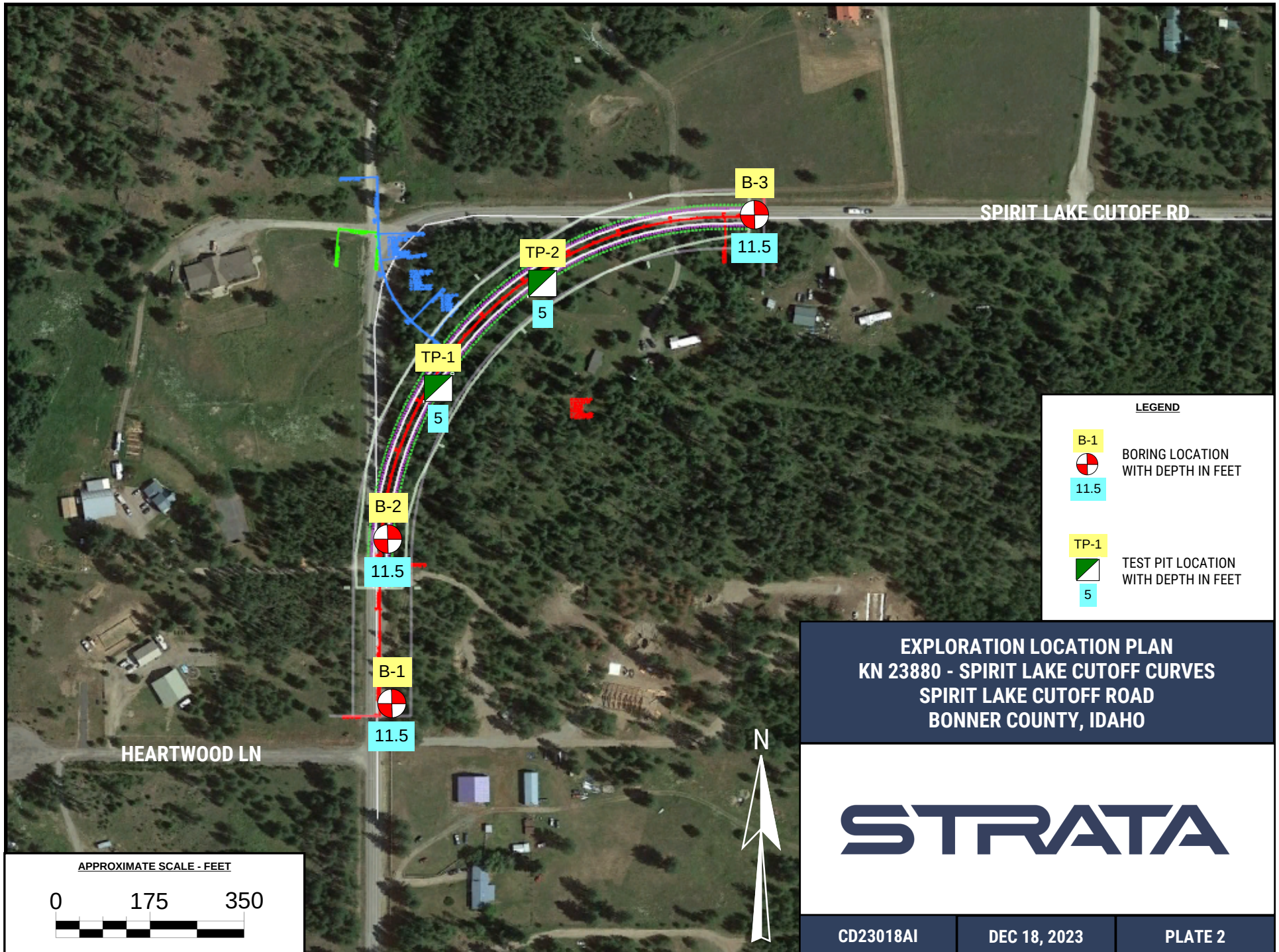
ITD April 2023 Standard Drawings.

ITD, 2020, "Idaho Transportation Department Materials Manual".

ITD, 2019, "Quality Assurance Manual".

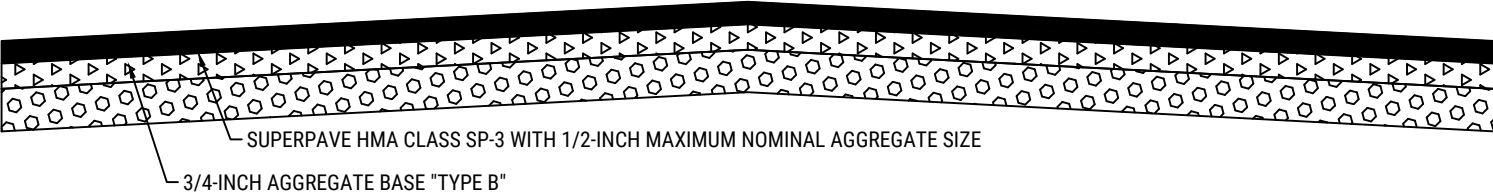
ITD, 2020, Quality Assurance Special Provision for State Acceptance.

Traffic Data Provided by ITD via email on February 16, 2024.



TYPICAL PAVEMENT SECTION

N.T.S.



PAVEMENT LAYER THICKNESS			
USE	HMA (IN)	AGGREGATE BASE (IN)	SURFACE SMOOTHNESS SCHEDULE
Spirit Lake Cutoff	3.0	8.0	1

TYPICAL PAVEMENT SECTION
KN 23880 - SPIRIT LAKE CUTOFF CURVES

Project No.:
CD23018AI

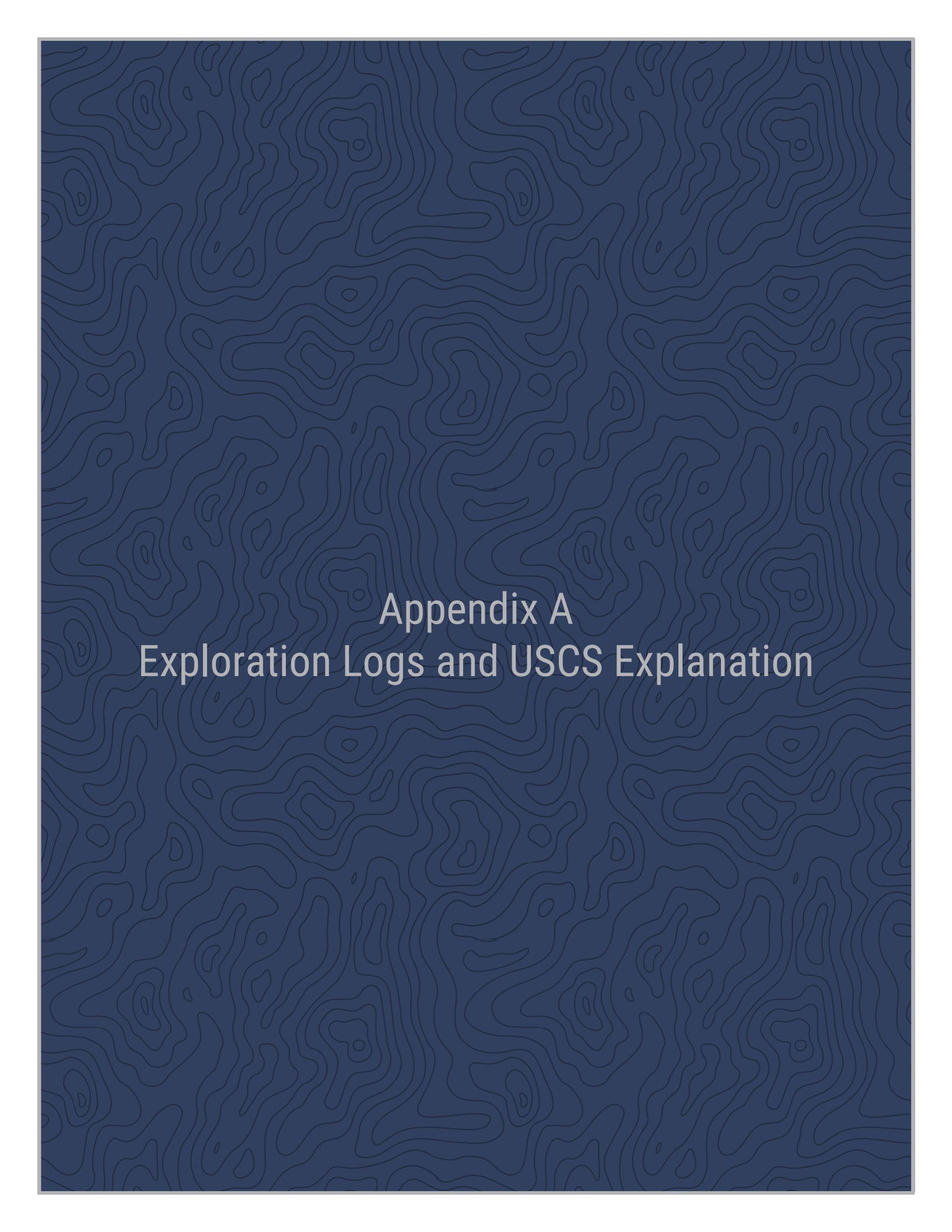
Client:
J-U-B ENGINEERS, INC.

Plate:
3

Drawing By:
L.MICHELS

Checked By:
R.LEWIS

Date:
2/24/2024

The background of the entire page is a dark blue topographic map. It features a complex pattern of white contour lines that represent elevation changes, creating a textured, wavy appearance across the entire surface.

Appendix A

Exploration Logs and USCS Explanation

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL NAMES	
COARSE GRAINED SOIL MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% COARSE FRACTION RETAINED #4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES	
		GRAVELS WITH >12% FINES		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES	
				GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	
			GC	CLAYEY GRAVELS, GRAVEL-SAND-SILT MIXTURES		
	SANDS >50% COARSE FRACTION PASSES #4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES		SW	WELL-GRADED SANDS, GRAVELY SANDS	
		SANDS WITH >12% FINES		SP	POORLY GRADED SANDS, GRAVELY SANDS	
				SM	SILTY SANDS, SAND-SILT MIXTURES	
				SC	CLAYEY SANDS, SAND CLAY MIXTURES	
FINE GRAINED SOIL 50% OR MORE PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	INORGANIC		ML	INORGANIC SILTS, SANDY OR CLAYEY SILTS	
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SANDY OR SILTY CLAYS	
		ORGANIC		OL	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY	
		SILTS AND CLAYS LIQUID LIMIT 50 OR MORE	INORGANIC		MH	INORGANIC SILTS, MICACEOUS SILTS, PLASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
	HIGHLY ORGANIC SOILS				PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOIL

SHORTHAND NOTATION

SPT - STANDARD PENETRATION TEST
 PL - PLASTIC LIMIT
 LL - LIQUID LIMIT
 PI - PLASTICITY INDEX
 MC - MOISTURE CONTENT
 DD - DRY DENSITY
 WD - WET DENSITY
 UC - UNCONFINED COMPRESSION
 OC - ORGANIC CONTENT
 BGS - BELOW GROUND SURFACE
 N.E. - NOT ENCOUNTERED

MATERIAL DESCRIPTION CONTACT

————— DISTINCT SOIL LAYER CONTACT WITHIN SOIL PROFILE
 - - - - - APPROXIMATE SOIL LAYER CONTACT WITHIN SOIL PROFILE

NOTES

- MIXED UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS ARE USED TO INDICATE DUAL SOIL CLASSIFICATIONS.
- THE SPT N-VALUE, REPORTED IN BLOWS PER FOOT, IS THE SUM OF THE NUMBER OF BLOWS REQUIRED TO DRIVE THE STANDARD SPLIT SPOON SAMPLER A DISTANCE OF 12-INCHES AFTER AN INITIAL 6-INCHES OF PENETRATION. IF A TOTAL OF 50 BLOWS ARE INSUFFICIENT TO ADVANCE ANY OF THE THREE 6-INCH INTERVALS, THE PENETRATION DEPTH AFTER 50 BLOWS IS ALSO REPORTED.

BORING LOG SYMBOLS

GRAPH SYMBOL	DESCRIPTION
	STANDARD 2-INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER
	MODIFIED CALIFORNIA 3-INCH OUTSIDE DIAMETER SAMPLER
	ROCK CORE
	SHELBY TUBE 3-INCH OUTSIDE DIAMETER SAMPLER

ADDITIONAL MATERIAL SYMBOLS

GRAPH SYMBOL	LETTER SYMBOL	TYPICAL NAMES
	AC	ASPHALT CONCRETE
	CC	PORTLAND CEMENT CONCRETE
	TS	TOPSOIL
	FL	FILL

TEST PIT LOG SYMBOLS

GRAPH SYMBOL	DESCRIPTION
	BAGGIE SAMPLE
	BULK SAMPLE
	RING SAMPLE

GROUNDWATER SYMBOLS

GRAPH SYMBOL	DESCRIPTION
	GROUNDWATER LEVEL AT TIME OF DRILLING
	GROUNDWATER LEVEL AT END OF DRILLING
	GROUNDWATER LEVEL 24 HOURS AFTER DRILLING COMPLETION
04-10-18	DATE OF GROUNDWATER READING

EXPLORATION LOG KEY - SOIL

STRATA

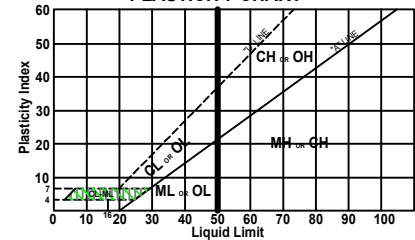
GRAIN SIZE

DESCRIPTION	SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders	>12"	>12"	Larger than basketball-size.
Cobbles	3" - 12"	3" - 12"	Fist-size to basketball-size.
Gravel	coarse	3/4" - 3"	Thumb-sized to fist sized.
	fine	#4 - 3/4"	Pea-sized to thumb-sized.
Sand	coarse	#10 - #4	Rock salt-sized to pea-sized.
	medium	#40 - #10	Sugar-sized to rock salt-sized.
	fine	#200 - #40	Flour-sized to sugar-sized.
Fines	Passing #200	<0.0029"	Flour-sized and smaller.

MODIFIERS

DESCRIPTION	%
Trace	<5
Few	5-10
Little	15-25
Some	30-45

PLASTICITY CHART



STRATIFICATION

DESCRIPTION	THICKNESS
Parting	1/16 - 1/4"
Lense	1/4 - 4"
Layer	4 - 12"

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to touch.
Moist	Slightly damp, some apparent moisture.
Wet	Saturated, visible free water, soil is below water table.

DESCRIPTION	THICKNESS
Occasional	One or less per foot of thickness.
Frequent	More than one per foot of thickness.

APPARENT RELATIVE DENSITY OF COARSE-GRAINED SOIL

APPARENT DENSITY	SPT blows/ft	CALIFORNIA SAMPLER blows/ft	D & M SAMPLER blows/ft	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	0-4	<4	<5	0-15	Easily penetrated with 1/2" reinforcing rod pushed by hand.
Loose	5-10	5-12	5-15	15-35	Difficult to penetrate with 1/2" reinforcing rod pushed by hand.
Medium Dense	11-30	12-35	15-40	35-65	Easily penetrated a foot with 1/2" reinforcing rod driven with 5-lb hammer.
Dense	31-50	35-60	40-70	65-85	Difficult to penetrate a foot with 1/2" reinforcing rod driven with 5-lb hammer.
Very Dense	>50	>60	>70	85-100	Penetrated only a few inches with 1/2" reinforcing rod driven with 5-lb hammer.

CONSISTENCY FINE-GRAINED SOIL

CONSISTENCY	SPT blows/ft	TORVANE	POCKET PENETROMETER	FIELD TEST
		UNDRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches by thumb. Extrudes between thumb and finger when squeezed in hand.
Soft	2-3	0.125-0.25	0.25-0.5	Penetrated about 1/4 inch by thumb with moderate effort. Molded by strong finger pressure.
Firm	4-7	0.25-0.5	0.5-1.0	Penetrated about 1/4 inch by thumb with moderate effort. Molded by strong finger pressure.
Stiff	8-14	0.5-1.0	1.0-2.0	Indented about 1/2 inch by thumb only with great effort.
Very Stiff	15-30	1.0-2.0	2.0-4.0	Readily indented with difficulty by thumbnail.
Hard	>30	>2.0	>4.0	Indented with difficulty by thumbnail.

REACTION WITH HCl

None	No visible reaction.
Weak	Some reaction, with bubbles forming slowly.
Strong	Violent reaction, with bubbles forming immediately.

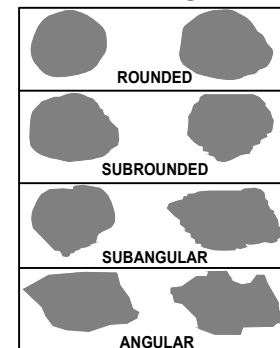
CEMENTATION

Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

STRUCTURE

Stratified	Alternating layers of varying material or color with layers at least 1/4" thick; note thickness.
Laminated	Alternating layers of varying material or color with layers at least 1/2" thick; note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small macular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soil, such as small lenses or sand scattered through a mass of clay; note thickness.
Homogeneous	Same color and thickness throughout.

PARTICLE SHAPE



EXPLORATION LOG KEY - SOIL

STRATA

TEST BOREHOLE - STRATA PROJECT.GDT - 2/20/24 23:08 - F:\CLIENTS\JUB ENGINEERS\2023\CD23018A\ KN 23880 SPIRIT LAKE CUTOFF CURVES. BONNER COUNTY\ELECTRONIC LOGS\CD23018A1 - LOGS.GPJ

Project: CD23018A - Spirit Lake Cutoff Curves										STRATA		Boring: B-1	
Client: J-U-B Engineers, Inc.					Drill Rig: Acker Recon								
Date Drilled: 09-27-2023					Borehole Diameter: 6.0"								
Depth to Groundwater: N.E.					Logged By: S. Litalien								
Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
													Note: BGS = Below Ground Surface
0	Asphalt Concrete Pavement, (12.75 inches)												
	Base Course (3 inches) Poorly Graded Gravel with Silt and Sand (GP-GM), Gray, moist, fine to coarse, angular.			10	4 5 7	12		9.7					
	Fill - Silty Gravel with Sand (GM), Light brown to brown, moist, loose to medium dense, fine to coarse rounded to subangular			12	2 2 7	9		16.7					
5	Silty Gravel with Sand (GM), Light brown to brown, moist, medium dense, fine to coarse rounded to subangular			10	4 12 5	17							
				14	7 9 9	18		4.9					
10				14	6 9 11	20							
Borehole Terminated at 11.5 Feet.													Latitude: 48.033198 Longitude: -116.872167

TEST BOREHOLE - STRATA PROJECT.GDT - 2/20/24 23:08 - F:\CLIENTS\JUB ENGINEERS\2023\CD23018A\ KN 23880 SPIRIT LAKE CUTOFF CURVES. BONNER COUNTY\ELECTRONIC LOGS\CD23018A1 - LOGS.GPJ

Project: CD23018A - Spirit Lake Cutoff Curves										STRATA			Boring: B-2	
Client: J-U-B Engineers, Inc.					Drill Rig: Acker Recon									
Date Drilled: 09-27-2023					Borehole Diameter: 6.0"									
Depth to Groundwater: N.E.					Logged By: S. Litalien									
Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks	
0	Asphalt Concrete Pavement , (13.5 inches) pavement separated into 6.5-inch and 7.0-inch sections during drilling.												Note: BGS = Below Ground Surface	
	Base Course (3 inches) Poorly Graded Gravel with Silt and Sand (GP-GM) , Gray, moist, fine to coarse, angular.			13	8 7 6	13		10.1		22.8	33	3		
	Fill - Silty Gravel with Sand (GM) , Light brown with dark brown, moist, medium dense, fine to coarse subrounded to angular			15	4 7 8	15		4.8						
5	Silty Gravel with Sand (GM) , Light brown to brown, moist, loose to medium dense, fine to coarse rounded to subangular			1	4 4 5	9				13	27	2		
				11	2 3 6	9								
10				11.5	3 8 7	15		21.2					Idaho R-Value - 83	
Borehole Terminated at 11.5 Feet.													Latitude: 48.03392 Longitude: -116.87218	

TEST BOREHOLE - STRATA PROJECT.GDT - 2/20/24 23:08 - F:\CLIENTS\JUUB ENGINEERS\2023\CD23018A\ KN 23880 SPIRIT LAKE CUTOFF CURVES.BONNER COUNTY\ELECTRONIC LOGS\CD23018A1 - LOGS.GPJ

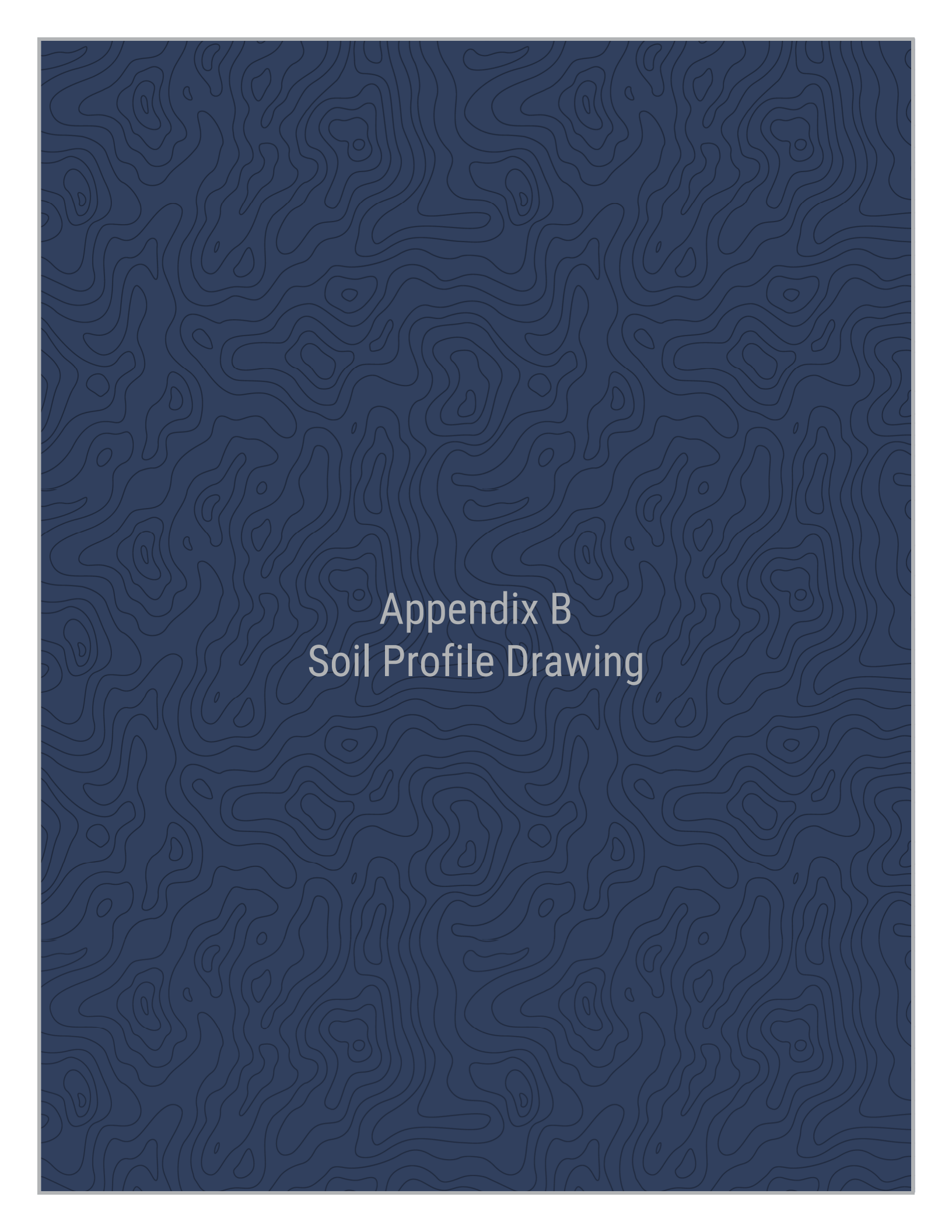
Project: CD23018A - Spirit Lake Cutoff Curves										STRATA		Boring: B-3	
Client: J-U-B Engineers, Inc.					Drill Rig: Acker Recon								
Date Drilled: 09-27-2023					Borehole Diameter: 6.0"								
Depth to Groundwater: N.E.					Logged By: S. Litalien								
Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
													Note: BGS = Below Ground Surface
0	Asphalt Concrete Pavement, (12 inches)												Idaho R-Value - 64 pH - 7.96 Resistivity - 10,100 ohms-cm Sulfate - 43.9 mg/kg dry Cobbles encountered in auger cuttings.
	Base Course (3 inches) Poorly Graded Gravel with Silt and Sand (GP-GM), Gray, moist, fine to coarse, angular.		BG	14	5 8 4	12		9.8					
	Fill - Silty Sand with Gravel (SM), Light brown with dark brown, moist, loose to medium dense, fine to coarse subrounded to angular		BG	7	1 2 4	6		19.1	43	35	1		
5	Poorly Graded Gravel with Silt and Sand (GP-GM), Light brown to brown, moist, loose to medium dense, fine to coarse rounded to subangular			10	4 6 7	13		5.8					
				8.5	4 4 5	9							
10				4.5	2 3 3	6							
Borehole Terminated at 11.5 Feet.													Latitude: 48.03562 Longitude: -116.8694

TEST PIT - STRATA PROJECT.GDT - 2/20/24 23:01 - F:\CLIENTS\JUB ENGINEERS\2023\CD23018A\ KN 23880 SPIRIT LAKE CUTOFF CURVES. BONNER COUNTY\ELECTRONIC LOGS\CD23018A - LOGS.GPJ

Project: CD23018A - Spirit Lake Cutoff Curves										STRATA		Test Pit: TP-1	
Client: J-U-B Engineers, Inc.					Equipment: Kubota KX057-4								
Date Excavated: 12-12-2023					Bucket Width: 24.0								
Depth to Groundwater: N.E.					Logged By: L. Michels								
Depth (ft)	USCS Description	Symbol	Sample Type	DCP Blows	DCP Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks	
0	Topsoil - Silty Sand with Gravel (SM), Dark brown, moist, fine to coarse rounded to subangular						32.4		44.5	NV	NP	Organic content - 10.4 percent pH - 5.73 Resistivity - 35,300 ohms-cm Sulfate - 9.54 Fines content decreased at 3.0 feet BGS.	
	Silty Gravel with Sand (GM), Brown to gray, moist, fine to coarse rounded to subangular, cobbles scattered throughout.						6.9						
5							4.1						
Terminated at 5.0 Feet.												Latitude: 48.03472 Longitude: -116.87183	

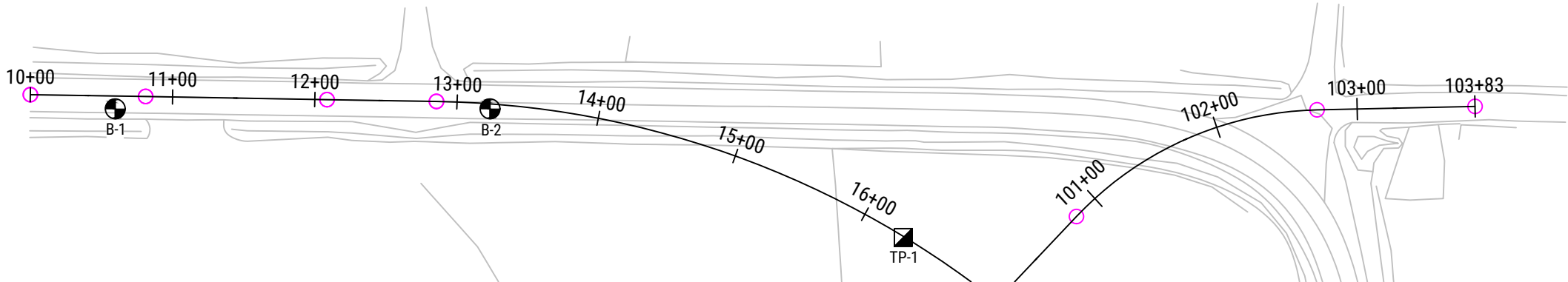
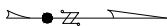
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Project: CD23018A - Spirit Lake Cutoff Curves										STRATA		Test Pit: TP-2	
Client: J-U-B Engineers, Inc.					Equipment: Kubota KX057-4								
Date Excavated: 12-12-2023					Bucket Width: 24.0								
Depth to Groundwater: N.E.					Logged By: L. Michels								
Depth (ft)	USCS Description	Symbol	Sample Type	DCP Blows	DCP Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks	
0	Topsoil - Silty Sand with Gravel (SM), Dark brown, moist, fine to coarse rounded to subangular	SM					34.6						
	Poorly Graded Gravel with Silt and Sand (GP-GM), Brown to gray, moist, fine to coarse rounded to subangular, cobbles throughout.	GP-GM					8.0		10.1	NV	NP		
							3.7					Fines content decreased at 4 feet BGS.	
5	Terminated at 5.0 Feet.											Latitude: 48.03524 Longitude: -116.87104	

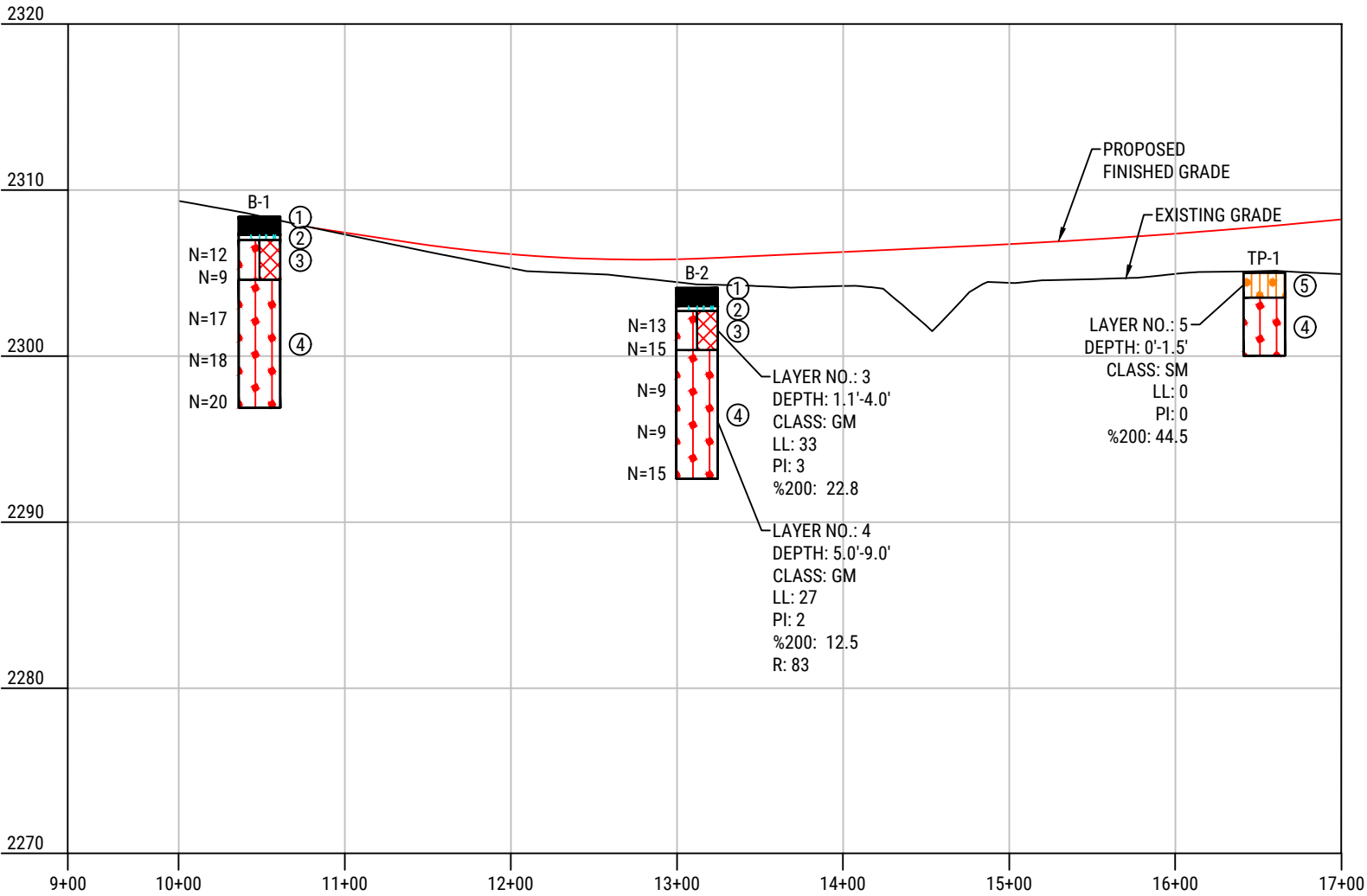
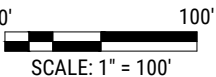
The background of the entire page is a dark blue color with a complex, repeating pattern of white contour lines. These lines form irregular, wavy shapes that resemble a topographic map or a series of concentric, elongated loops, creating a textured, organic feel.

Appendix B

Soil Profile Drawing



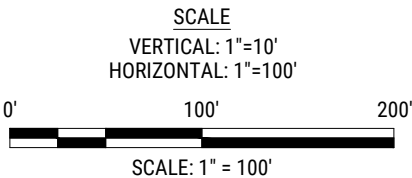
PLAN VIEW



PROFILE VIEW

LEGEND

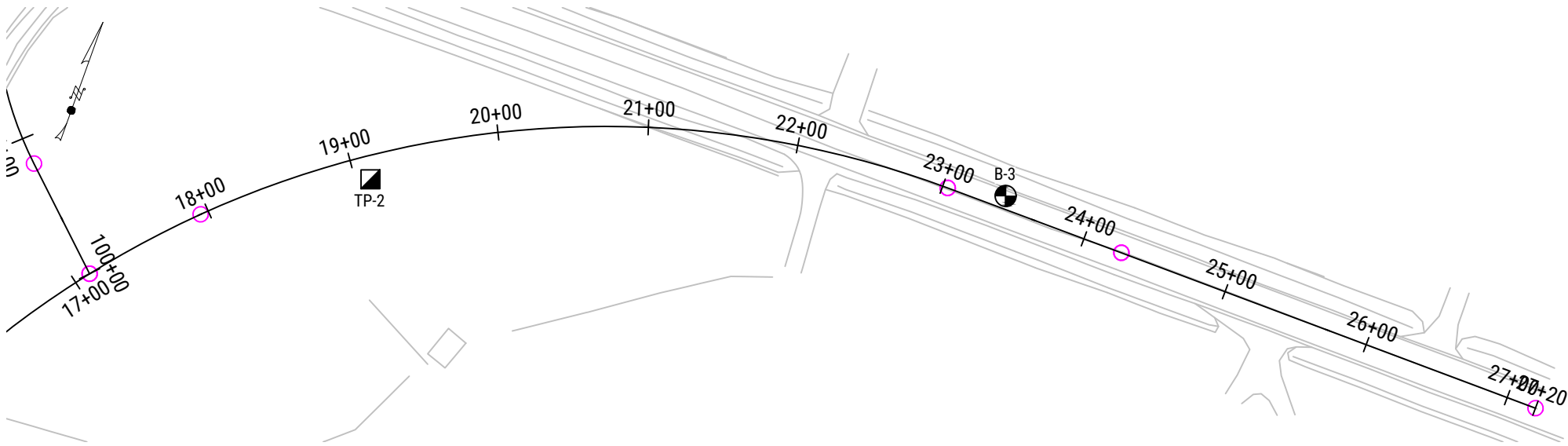
SYMBOL	DESCRIPTION
B-1	STRATA BORING DESIGNATION
TP-1	STRATA TEST PIT DESIGNATION
①	SOIL/ROCK LAYER NUMBER.
LL	LIQUID LIMIT
PI	PLASTICITY INDEX
R-VALUE	RESISTANCE VALUE
■	LAYER NO. 1 ASPHALT
■	LAYER NO. 2 BASE COURSE (GP-GM)
■	LAYER NO. 3 FILL - SILTY GRAVEL WITH SAND (GM)
■	LAYER NO. 4 SILTY GRAVEL WITH SAND (GM)
■	LAYER NO. 5 TOPSOIL (SM)



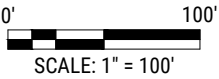
SOILS PROFILE
KN 23880 - SPIRIT LAKE CUTOFF CURVES
BONNER COUNTY, IDAHO



Project No.: CD23018AI	Drawing By: G. MORLAN
Client: J-U-B ENGINEERS, INC.	Checked By: L. MICHELS
Plate: 4	Date: 2/23/2024

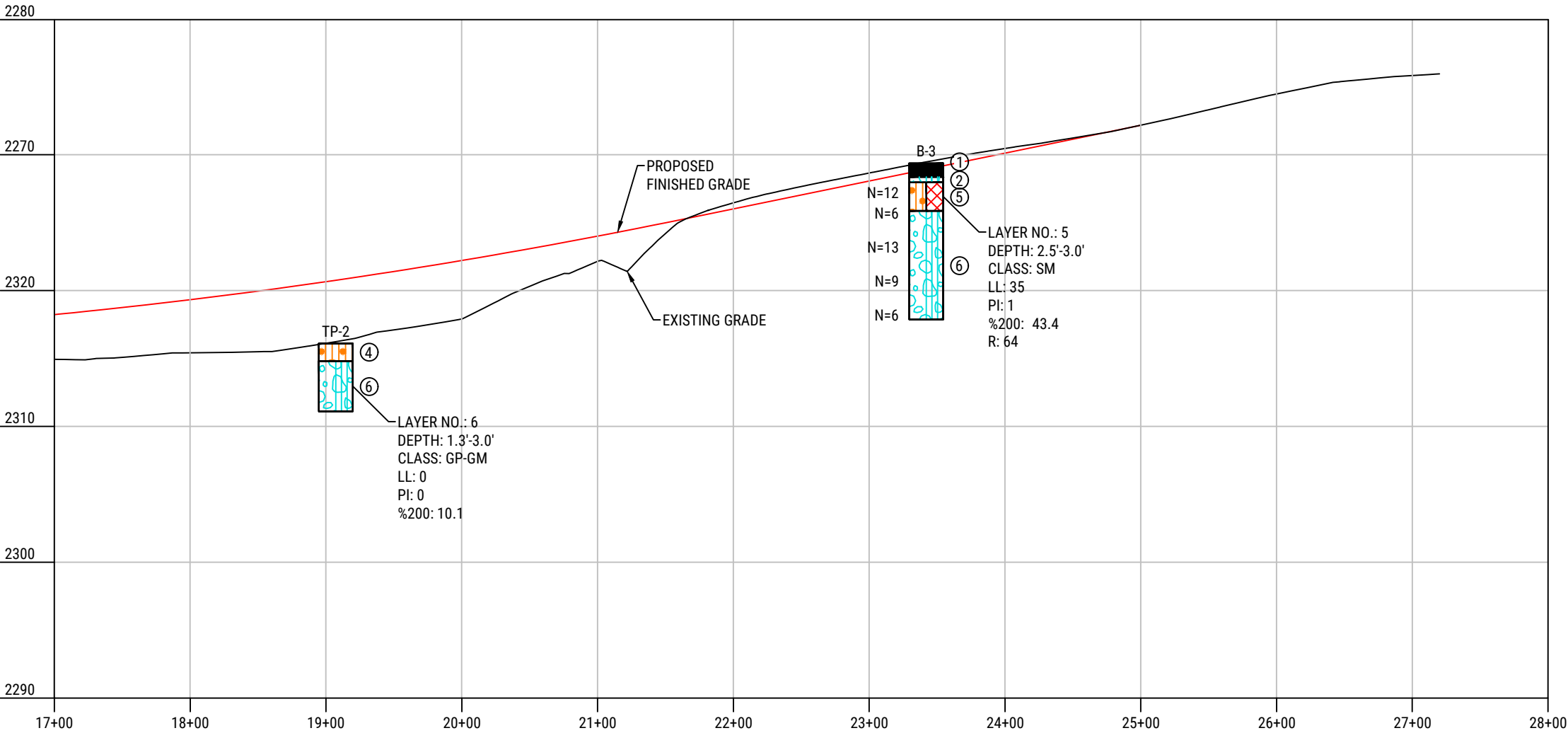


PLAN VIEW

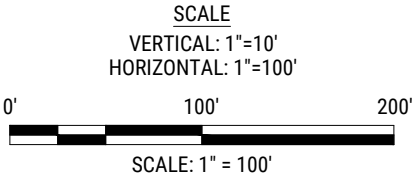


LEGEND

SYMBOL	DESCRIPTION
B-1	STRATA BORING DESIGNATION
TP-1	STRATA TEST PIT DESIGNATION
①	SOIL/ROCK LAYER NUMBER.
LL	LIQUID LIMIT
PI	PLASTICITY INDEX
R-VALUE	RESISTANCE VALUE
	LAYER NO. 1 ASPHALT
	LAYER NO. 2 BASE COURSE (GP-GM)
	LAYER NO. 3 SILTY GRAVEL WITH SAND (GM)
	LAYER NO. 4 TOPSOIL (SM)
	LAYER NO. 5 FILL - SILTY SAND WITH GRAVEL (SM)
	LAYER NO. 6 POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)



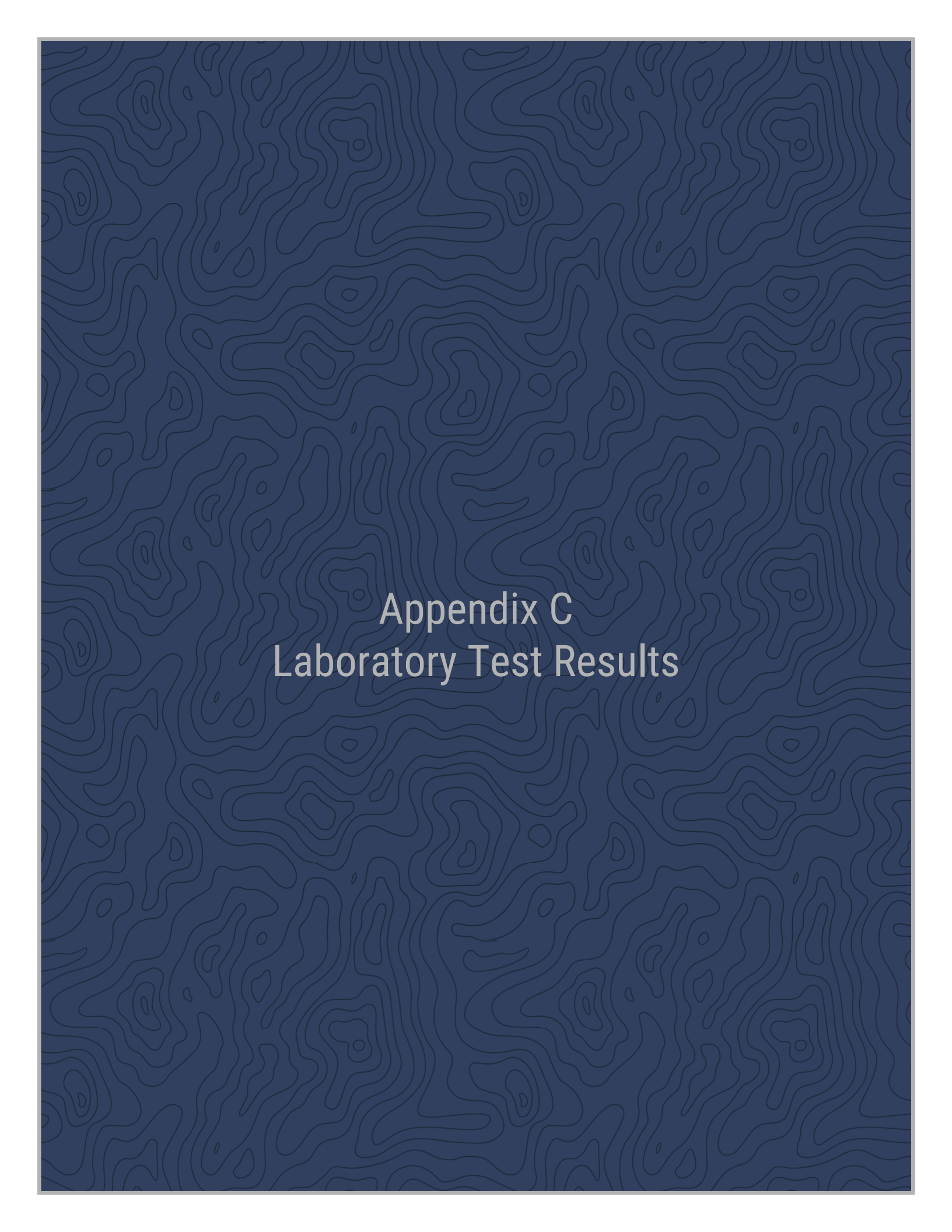
PROFILE VIEW



SOILS PROFILE
KN 23880 - SPIRIT LAKE CUTOFF CURVES
BONNER COUNTY, IDAHO



Project No.:	CD23018AI	Drawing By:	G. MORLAN
Client:	J-U-B ENGINEERS, INC.	Checked By:	L. MICHELS
Plate:	5	Date:	2/23/2024

The background of the entire page is a dark blue color with a complex, repeating pattern of white, irregular, wavy lines. These lines resemble contour lines on a topographic map, creating a textured, organic appearance.

Appendix C

Laboratory Test Results



Summary of Laboratory Test Results

Project: Spirit Lake Cutoff Curves
Client: J-U-B Engineers, Inc.

ITD Project No. / Key No.:
STRATA Project No.:

KN 23880
CD23018AI

Location	Depth	Soil	Passing	Passing	Idaho T-8	Chemistry Suite			In-Situ	Atterberg Limits			Organic Content (%)
	(feet)	Class.	No. 200 (%)	No. 4 (%)	R-Value	pH	Resistivity (ohm-cm)	Sulfate (mg/kg)	Moisture (%)	LL	PL	PI	
B-1	1.1-2.6								9.7				
B-1	2.5-4.0								16.7				
B-1	7.5-9.0								4.9				
B-2	1.1-2.6								10.1				
B-2	1.1-4.0	Silty gravel with sand (GM)	22.8	56.0		8.03	8,600	63.1		33	30	3	
B-2	2.5-4.0								4.8				
B-2	5.0-9.0	Silty gravel with sand (GM)	12.5	43.0	83					27	25	2	
B-2	10.0-11.5								21.2				
B-3	1.0-2.5								9.8				
B-3	2.5-3.0	Silty sand with gravel (SM)	43.4	80.0	64					35	34	1	
B-3	2.5-4.0								19.1				
B-3	4.0-6.0					7.96	10,100	43.9					
B-3	5.0-6.5								5.8				
TP-1	0.0-1.5	Silty sand with gravel (SM)	44.5	73.0		5.73	35,300	9.54	32.4	0	0	-	10.4
TP-1	2.5								6.9				
TP-1	4.5								4.1				
TP-2	0.0-1.3								34.6				
TP-2	1.3-3.0	Poorly graded gravel with silt and sand (GP-GM)	10.1	36.0					8.0	0	0	-	
TP-2	4.5								3.7				



ASTM D6913-17

Report Date: 10/30/2023

Hayden
1016 West Hayden Avenue
Hayden, ID 83835
Phone: 208.772.2428

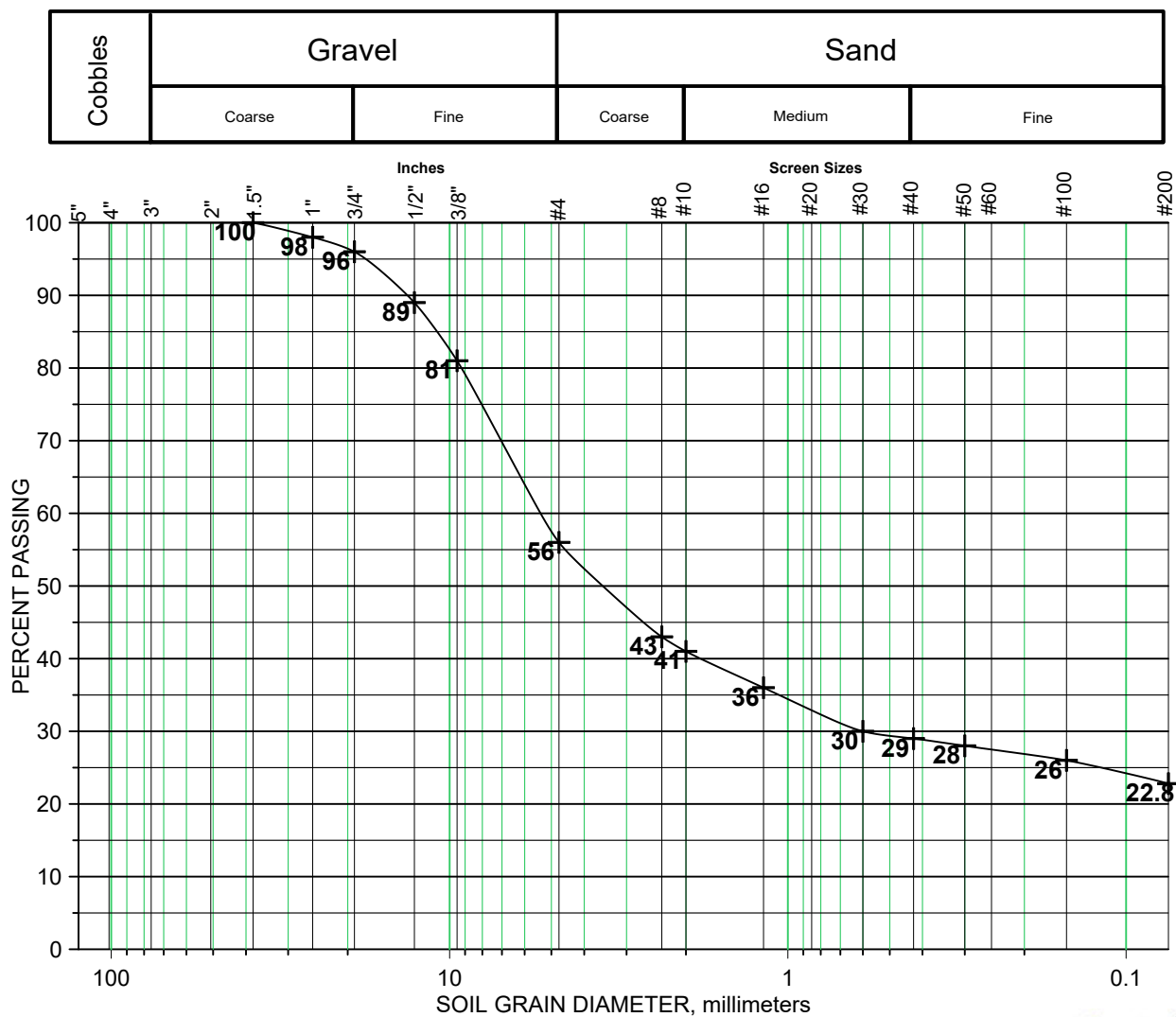
Client
J-U-B Engineers, Inc.

Project
CD23018AI
Spirit Lake Cutoff Curves
Bonner County, ID

SAMPLE INFORMATION

SAMPLE NO.:	48846	SAMPLE DATE:	9/27/2023
SPECIMEN SIZE:	Bulk	TEST DATE:	10/25/2023
USCS CLASSIFICATION:	Silty gravel with sand (GM)	SAMPLED BY:	S. Litalien
		TESTED BY:	G. Hausmann

METHOD:	ASTM D1452 - Sampling by Auger Boring	BORING NO.:	B-2
		DEPTH (FT):	1.1'-4.0'



Luke Michels, P.E.
Engineering Services Manager

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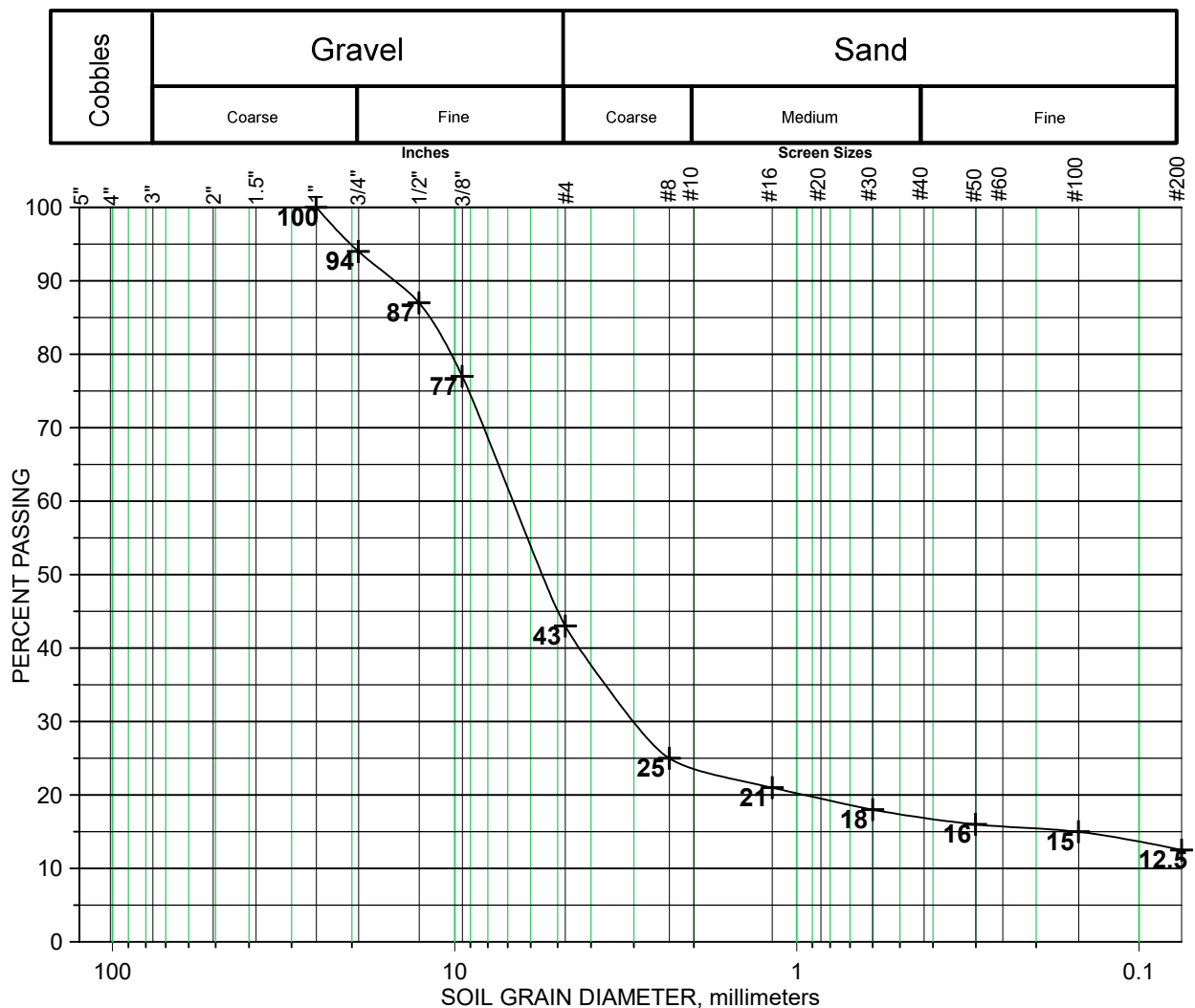
Boise
8653 West Hackamore Drive
Boise, ID 83709
Phone: 208.376.8200

Client
J-U-B Engineers, Inc.

Project
CD23018AI
Spirit Lake Cutoff Curves
KN23880

SAMPLE INFORMATION

SAMPLE NO.:	48689	SAMPLE DATE:	9/27/2023
SPECIMEN SIZE:	Bulk	TEST DATE:	10/26/2023
USCS CLASSIFICATION:	Silty Gravel with Sand (GM)	SAMPLED BY:	S. Litalien
		TESTED BY:	J. Bingaman
METHOD:	Bulk Exploration	BORING NO.:	B-2
		DEPTH (FT):	5.0 - 9.0



Keith Wildman
Reviewed by Keith Wildman
Laboratory Services Coordinator

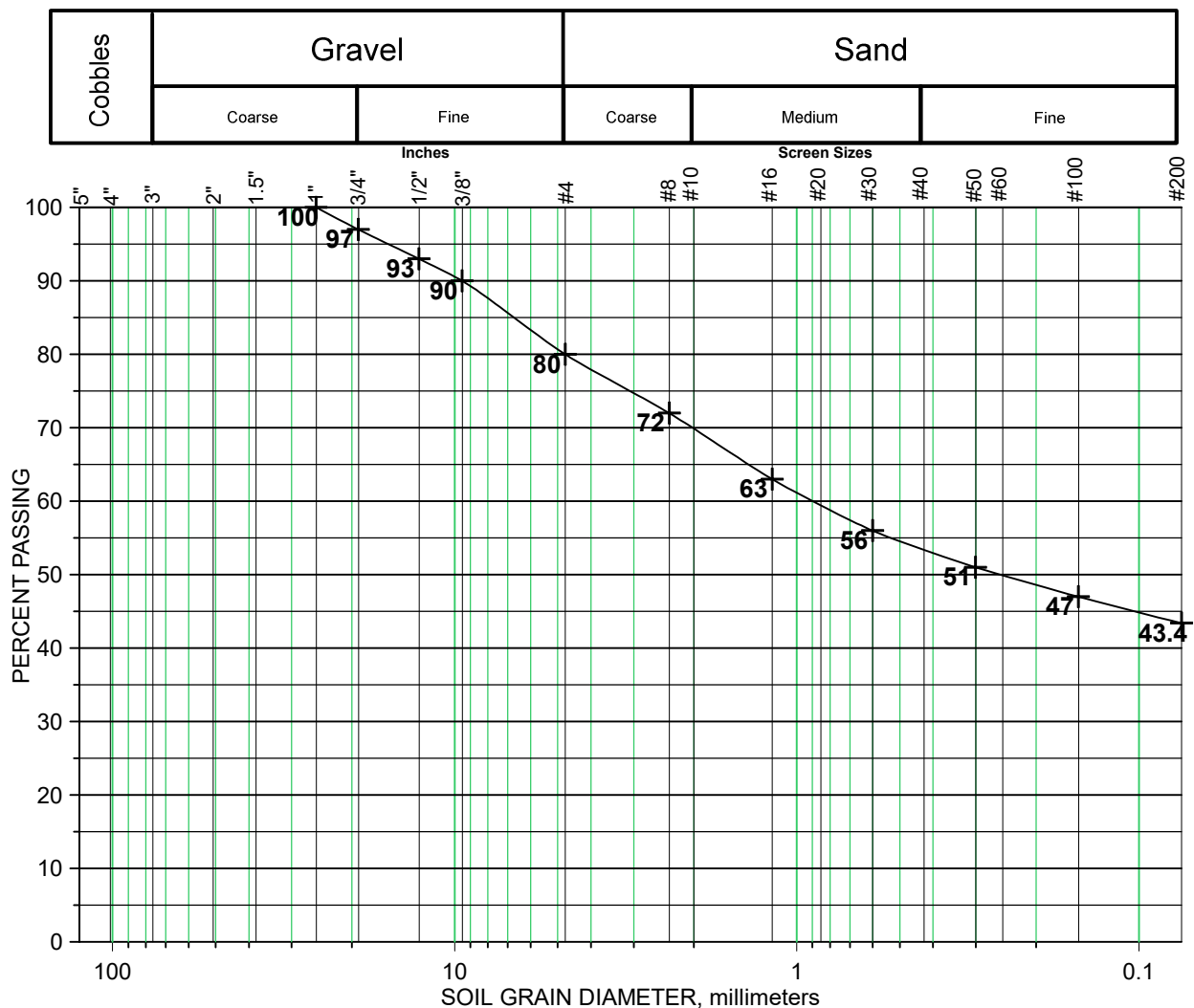
Boise
8653 West Hackamore Drive
Boise, ID 83709
Phone: 208.376.8200

Client
J-U-B Engineers, Inc.

Project
CD23018AI
Spirit Lake Cutoff Curves
KN23880

SAMPLE INFORMATION

SAMPLE NO.:	48690	SAMPLE DATE:	9/27/2023
SPECIMEN SIZE:	Bulk	TEST DATE:	10/26/2023
USCS CLASSIFICATION:	Silty Sand with Gravel (SM)	SAMPLED BY:	S. Litalien
		TESTED BY:	J. Bingaman
METHOD:	Bulk Exploration	BORING NO.:	B-3
		DEPTH (FT):	2.5 - 3.0



Keith Wildman
Reviewed by Keith Wildman
Laboratory Services Coordinator



ASTM D6913-17

Report Date: 12/18/2023

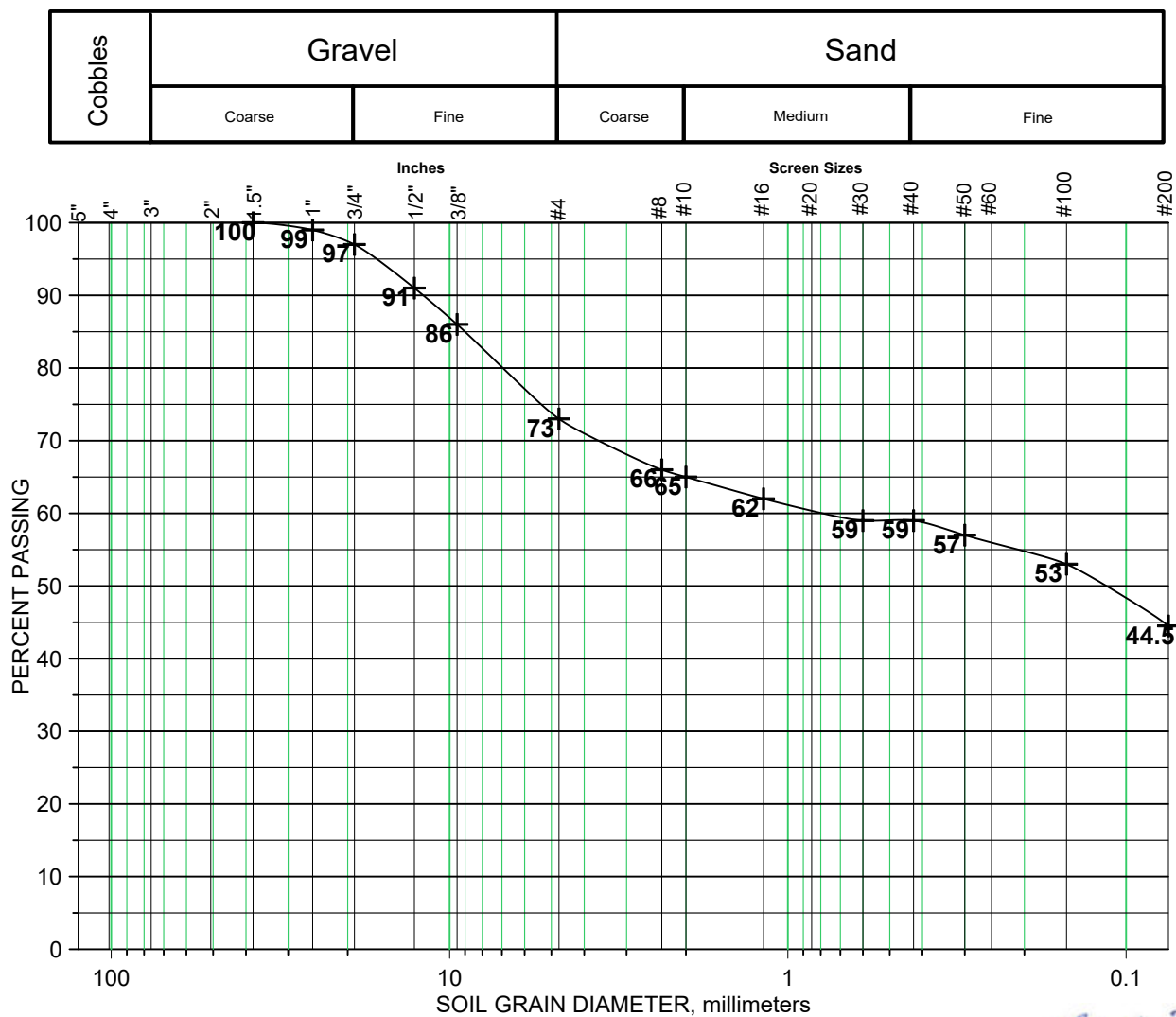
Hayden
1016 West Hayden Avenue
Hayden, ID 83835
Phone: 208.772.2428

Client
J-U-B Engineers, Inc.

Project
CD23018AI
KN 23880 - Spirit Lake Cutoff Curves
Bonner County, Idaho

SAMPLE INFORMATION

SAMPLE NO.:	49803	SAMPLE DATE:	12/12/2023
SPECIMEN SIZE:	Bulk	TEST DATE:	12/17/2023
USCS CLASSIFICATION:	Silty sand with gravel (SM)	SAMPLED BY:	L. Michels
		TESTED BY:	J. Imel
METHOD:	Bulk	BORING NO.:	TP-1
		DEPTH (FT):	0.0-1.5



Reviewed by: Luke Michels, P.E.
Engineering Services Manager

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ASTM D6913-17

Report Date: 12/18/2023

Hayden
1016 West Hayden Avenue
Hayden, ID 83835
Phone: 208.772.2428

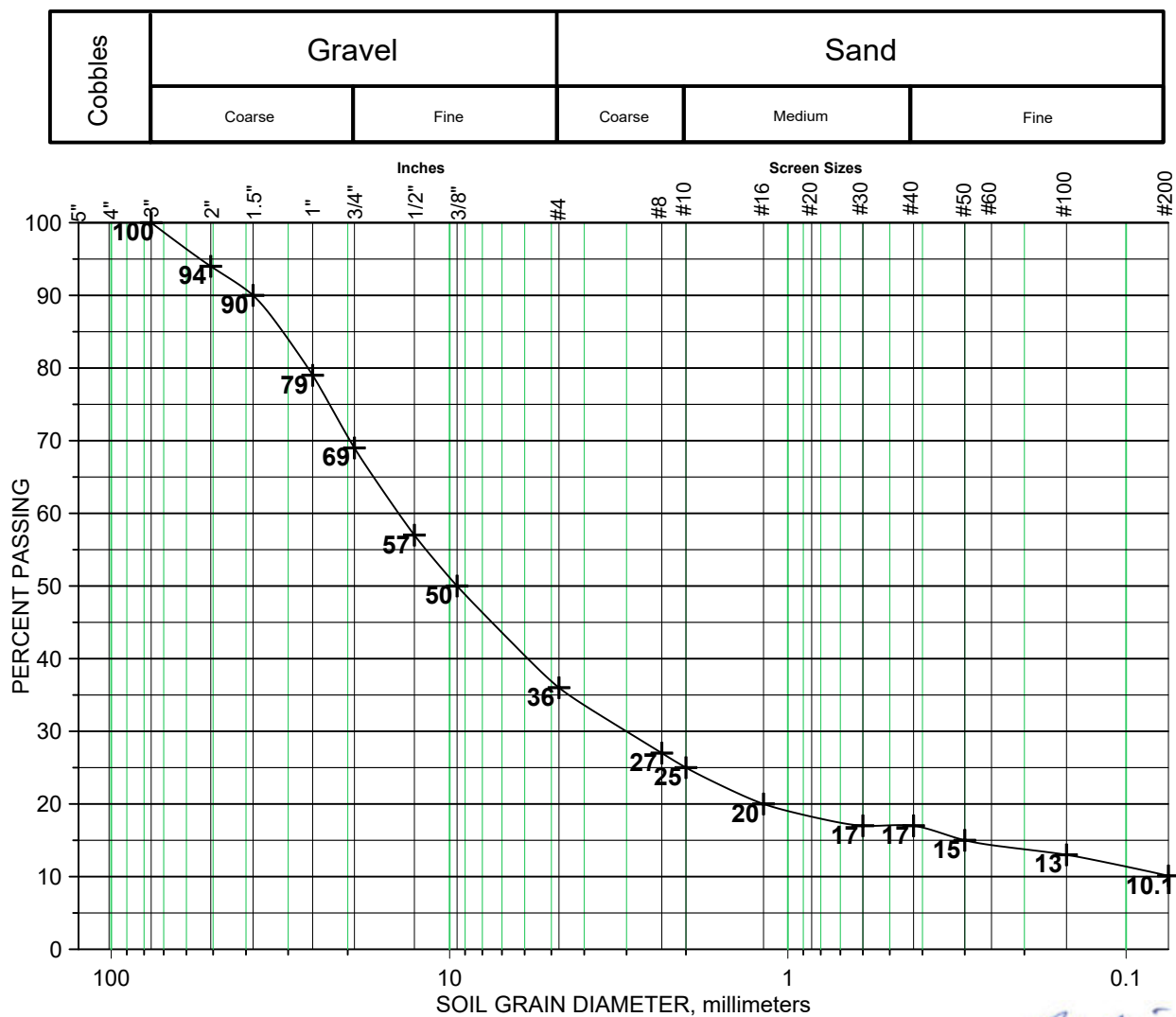
Client
J-U-B Engineers, Inc.

Project
CD23018AI
KN 23880 - Spirit Lake Cutoff Curves
Bonner County, Idaho

SAMPLE INFORMATION

SAMPLE NO.:	49804	SAMPLE DATE:	12/12/2023
SPECIMEN SIZE:	Bulk	TEST DATE:	12/18/2023
USCS CLASSIFICATION:	Poorly graded gravel with silt and sand (GP-GM)	SAMPLED BY:	L. Michels
		TESTED BY:	G. Hausmann

METHOD:	Bulk	BORING NO.:	TP-2
		DEPTH (FT):	1.3-3.0



Reviewed by: Luke Michels, P.E.
Engineering Services Manager

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Idaho T-8

Client

J-U-B Engineers, Inc

Report Date: 10/3/2023

Project

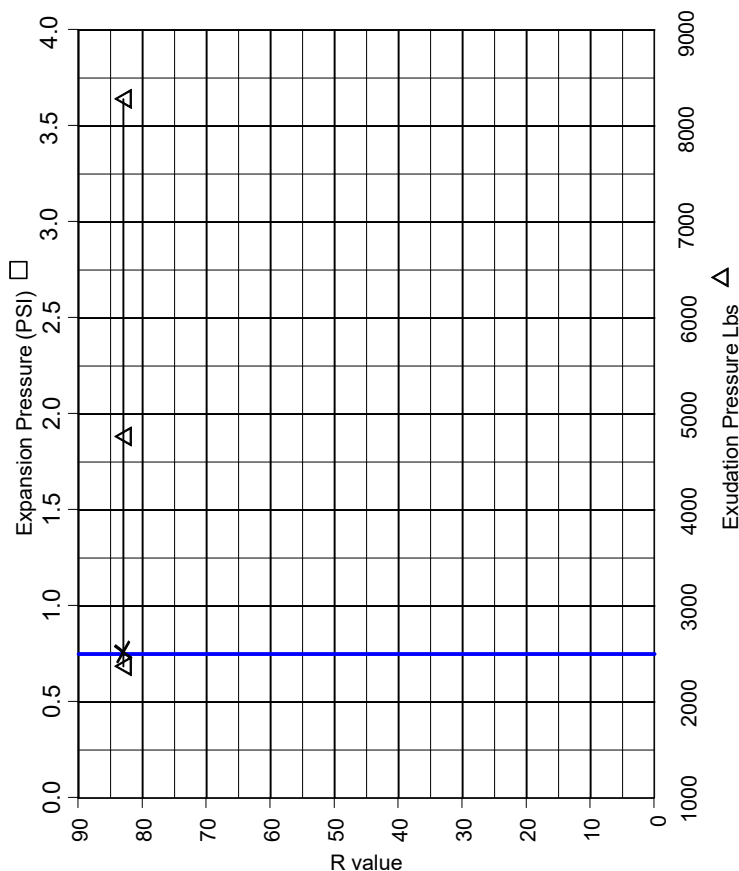
Boise
8653 W. Hackamore Drive
Boise, ID 83709
Phone: 208.376.8200

CD23018AI
Spirit Lake Cutoff Curves
KN23880

SAMPLE INFORMATION

SAMPLE No.: 48689 **SAMPLE DATE:** 9/27/2023 **BORING No.:** B-2
SPECIMEN SIZE: Bulk **TEST DATE:** 10/23/2023 **DEPTH (FT):** 5.0-9.0
USCS CLASSIFICATION: Silty Gravel with Sand (GM) **SAMPLED BY:** S. Litalien
TESTED BY: J. Willhite
METHOD: Bulk Exploration

R-VALUE: 83



R VALUE DATA

Percolation:	Fast	Point 1	Point 2	Point 3
Exudation, PSI		189	379	659
Dry Density, PCF		125.5	125.9	120.1
Moisture Content, %		9.1	8.1	7.6
Exp. Pressure, PSI		0.00	0.00	0.00

GRADATION: AASHTO T-11, T27

SCREEN SIZE	AS RECEIVED % PASSING	AS TESTED % PASSING
4"		
3"		
2"		
1"		
3/4"	94	100
1/2"		
3/8"		
No. 4		
No. 8		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

Keith Wildman
Reviewed by Keith Wildman
Laboratory Services Coordinator

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Idaho T-8

Client

J-U-B Engineers, Inc.

Report Date: 07/21/2023

Project

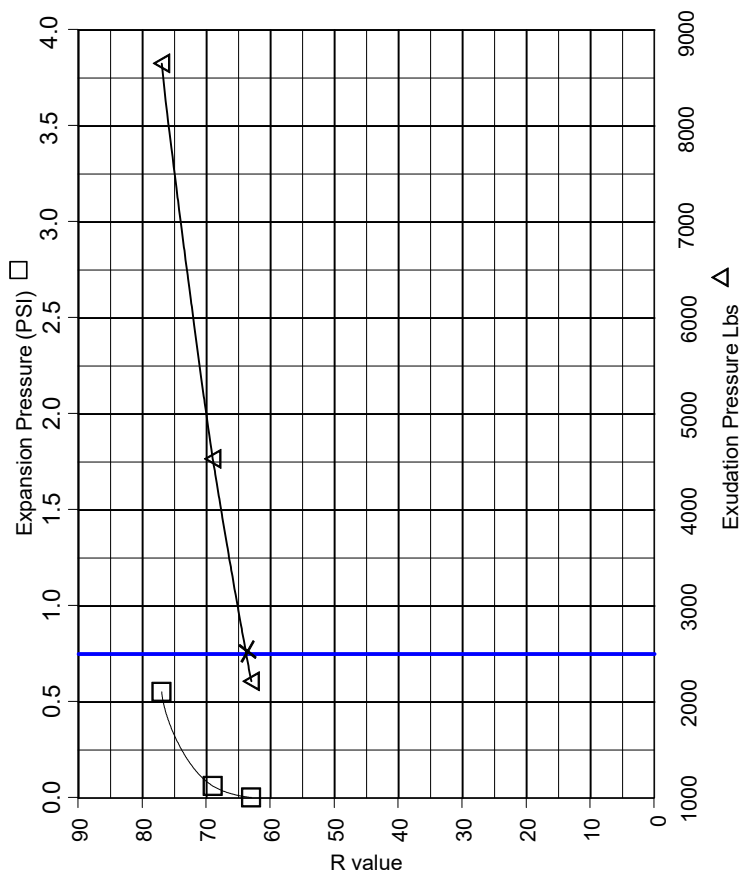
Boise
8653 W. Hackamore Drive
Boise, ID 83709
Phone: 208.376.8200

CD23018AI
Spirit Lake Cutoff Curves
KN23880

SAMPLE INFORMATION

SAMPLE No.: 48689 **SAMPLE DATE:** 9/27/2023 **BORING No.:** B-3
SPECIMEN SIZE: Bulk **TEST DATE:** 10/23/2023 **DEPTH (FT):** 2.5-3.0
USCS CLASSIFICATION: Silty Sand with Gravel (SM) **SAMPLED BY:** S. Litalien
TESTED BY: J. Willhite
METHOD: Bulk Exploration

R-VALUE: 64



R VALUE DATA

Percolation:	Fast	Point 1	Point 2	Point 3
Exudation, PSI		176	360	688
Dry Density, PCF		107.1	108.1	109.4
Moisture Content, %		15.5	14.9	13.9
Exp. Pressure, PSI		0.00	0.06	0.55

GRADATION: AASHTO T-11, T27

SCREEN SIZE	AS RECEIVED % PASSING	AS TESTED % PASSING
4"		
3"		
2"		
1"		
3/4"	97	100
1/2"		
3/8"		
No. 4		
No. 8		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

Keith Wildman
Reviewed by Keith Wildman
Laboratory Services Coordinator

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Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - email spokane@anateklabs.com

Client: Strata, Inc. (Hayden)
Address: 1016 W. Hayden Avenue
Hayden, ID 83835
Attn: Luke Michels

Work Order: WDJ1728
Project: CD23018A
Reported: 11/12/2023 13:12

Analytical Results Report

Sample Location: B-2 1.0-1.4
Lab/Sample Number: WDJ1728-01 **Collect Date:** 09/27/23 00:00
Date Received: 10/25/23 16:10 **Collected By:** Steve Litalien
Matrix: Soil

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
% Solids	87.3	%	0.100	11/3/23 15:23	ELS	SM 2540 G	
pH	8.03	pH Units	0.996	11/2/23 20:48	ILG	EPA 9045D	
Resistivity	8600	ohms-cm	1.00	11/6/23 15:34	ILG	ASTM G 57a	
Sulfate	63.1	mg/kg dry	1.52	11/3/23 5:24	ELS	EPA 300.0	

Anatek Labs, Inc.

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504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - email spokane@anateklabs.com

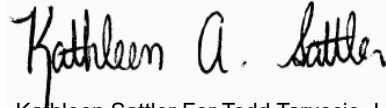
Sample Location: B-3 4.0-6.0'
Lab/Sample Number: WDJ1728-02 Collect Date: 09/27/23 00:00
Date Received: 10/25/23 16:10 Collected By: Steve Litalien
Matrix: Soil

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
% Solids	92.7	%	0.100	11/3/23 15:23	ELS	SM 2540 G	
pH	7.96	pH Units	0.982	11/2/23 20:50	ILG	EPA 9045D	
Resistivity	10100	ohms-cm	1.00	11/6/23 15:41	ILG	ASTM G 57a	
Sulfate	43.9	mg/kg dry	1.21	11/3/23 4:44	ELS	EPA 300.0	

Anatek Labs, Inc.

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504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - email spokane@anateklabs.com

Authorized Signature,



Kathleen Sattler For Todd Taruscio, Laboratory Manager

PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte

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The results reported related only to the samples indicated.

Anatek Labs, Inc.

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504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - email spokane@anateklabs.com

Quality Control Data

Inorganics

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BDK0114 - W Ions										
Blank (BDK0114-BLK1)										
Sulfate	ND		1.50	mg/kg wet						
Prepared & Analyzed: 11/2/2023										
LCS (BDK0114-BS1)										
Sulfate	4.05			mg/L	4.00		101	90-110		
Prepared & Analyzed: 11/2/2023										

Chain of Custody Record

Anatek

1282 Alturas Drive, Moscow
504 E Sprague Ste D, Spokane

WDJ1728



Due: 11/09/23

Turn

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www.anateklabs.com/pricing-lists

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☐ Next Day* _____ ☒ Email _____
☐ 2nd Day* _____
☐ Other* _____

*All rush order requests must have prior approval

[illegible]

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Anatek Labs, Inc.

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504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - email spokane@anateklabs.com

Client: Strata, Inc. - CdA
Address: 1016 W. Hayden Avenue
Hayden, ID 83835
Attn: Luke Michels

Work Order: WDL0541
Project: CD23018A1
Reported: 12/31/2023 07:07

Analytical Results Report

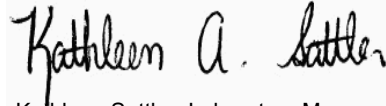
Sample Location: TP- 1 0.0'-1.5'
Lab/Sample Number: WDL0541-01 **Collect Date:** 12/12/23 00:00
Date Received: 12/14/23 15:05 **Collected By:** Steve Litalien
Matrix: Soil

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
% Solids	67.2	%	0.100	12/18/23 19:56	SBS	SM 2540 G	
pH	5.73	pH Units	0.984	12/14/23 12:13	ILG	EPA 9045D	
Resistivity	35300	ohms-cm	1.00	12/15/23 14:36	ILG	ASTM G 57a	
Sulfate	9.54	mg/kg dry	2.00	12/23/23 22:30	ELS	EPA 300.0	

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - email spokane@anateklabs.com

Authorized Signature,



Kathleen Sattler, Laboratory Manager

PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte

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504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - email spokane@anateklabs.com

Quality Control Data

Inorganics

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BDL1092 - W Ions										
Blank (BDL1092-BLK1)										
Sulfate	ND		1.50	mg/kg wet						
LCS (BDL1092-BS1)										
Sulfate	10.0			mg/L	10.0		100	90-110		

Chain of Custody Record

Anate
1282 Alturas Drive, Mo
504 E Sprague Ste D, Sp

WDL0541



Due: 01/01/24

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2nd Day*

Other*

Phone

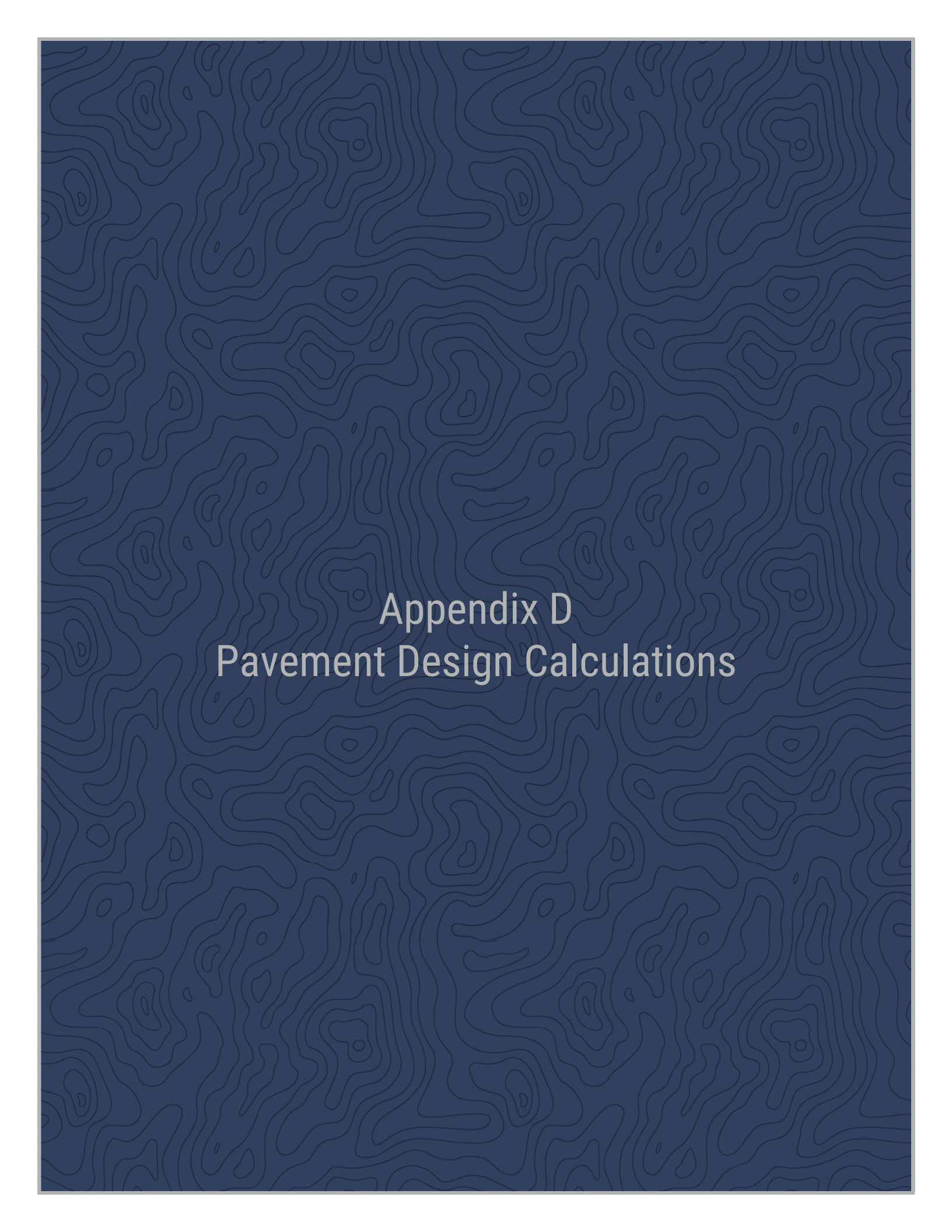
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Note Special Instructions/Comments

[illegible]

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The background of the entire page is a dark blue topographic map. It features a complex pattern of white contour lines that form irregular, wavy shapes across the surface, representing elevation changes. The lines are more densely packed in some areas and more spread out in others, creating a textured, organic appearance.

Appendix D Pavement Design Calculations

Projected Commercial and 18,000 Equivalent Single Axle Loadings (ESALS)			
Project Number:	CD23018AI	Key Number:	23880
County:	Bonner	District:	District_1
Route:	OH-Off Highway	From Measure:	2.789
RouteID:	02536AOH000	To Measure:	3.672
Last year with data:	2022		
Starting to Cumulate in:	2023	Requested By:	Steve Litalien
Cumulating ESALs up to:	2063	Email:	slitalien@stratageotech.com

$419,000 - 38,000 = 381,000 \text{ ESALs}$
 $60\% \text{ of } 381,000 = 228,600 \text{ ESALs}$

$T.I. = 9.0(228,600/10^6)^{0.119}$
 $T.I. = 7.5$

Projection Year	Projection ADTs			Rigid Pavement ESALs (In 1000s)				Flexible Pavement ESALs (In 1000s)			
				Both Directions		50% Direction of Travel		Both Directions		50% Direction of Travel	
	Total (AADT)	Passenger (PAADT)	Commercial (CAADT)	rigid_year value	rigid_cumulative	rigid_50percent_year value	rigid_50percent_cumulative	flexible_year value	flexible_cumulative	flexible_50percent_year value	flexible_50percent_cumulative
2023	2104	1944	160	25	25	13	13	19	19	10	10
2024	2108	1948	160	25	49	13	25	19	38	10	19
2025	2112	1952	160	25	74	13	37	19	57	10	29
2026	2116	1956	161	25	99	13	50	19	76	10	38
2027	2120	1959	161	25	124	13	62	19	94	10	47
2028	2124	1963	161	25	149	13	75	19	113	10	57
2029	2128	1967	161	25	173	13	87	19	132	10	66
2030	2132	1971	161	25	198	13	99	19	151	10	76
2031	2136	1975	161	25	223	13	112	19	170	10	85
2032	2140	1979	162	25	248	13	124	19	189	10	95
2033	2144	1983	162	25	273	13	137	19	208	10	104
2034	2148	1987	162	25	298	13	149	19	227	10	114
2035	2153	1990	162	25	323	13	162	19	247	10	124
2036	2157	1994	162	25	348	13	174	19	266	10	133
2037	2161	1998	162	25	373	13	187	19	285	10	143
2038	2165	2002	163	25	398	13	199	19	304	10	152
2039	2169	2006	163	25	423	13	212	19	323	10	162
2040	2173	2010	163	25	448	13	224	19	342	10	171
2041	2177	2014	163	25	473	13	237	19	361	10	181
2042	2181	2018	163	25	499	13	250	19	381	10	191
2043	2185	2021	163	25	524	13	262	19	400	10	200
2044	2189	2025	164	25	549	13	275	19	419	10	210

FLEXIBLE ASPHALT PAVEMENT DESIGN - GRAVEL EQUIVALENCY (GE) METHOD

Project: Spirit Lake Cutoff Curves
Project No: CD23018AI
Date: 16-Feb-24
Section: ROW

Design Subgrade Support R-value: 60

Estimated Traffic Index (T.I.): 7.5 (to nearest 0.5)

Regional Climate Factor, F: 1.10 (see figure 510.04.01.1
ITD Materials Manual)

Material Substitution Ratios

Asphalt: 2.00

Base: 1.00

Subbase: 0.85

Aggregate Base Course Minimum Support R-value: 80

Subbase Minimum Support R-value: 60

Minimum Design Gravel Equivalence (GE)= 1.056 feet

Recommended Asphalt Concrete Thickness: 0.264 feet

Design Asphalt Thickness: 0.25 feet (0.15 feet min.)
3.0 inch (0.25 feet min. on ATPB)

Recommended Aggregate Base Course Thickness: 0.556 feet

Design Base Thickness: 0.67 feet (0.35 feet min.)
(round to next 0.05 feet) 8.0 inch (ATB, ATPB, UTB)

Recommended Subbase Course Thickness: 0.000 feet

Design Subbase Thickness: 0.00 feet (0.35 feet min., if used
(round to next 0.05 feet) 0.0 inch or 2 x max particle size)

DESIGN PAVEMENT SECTION:

Asphalt concrete: 0.25 feet

Base course: 0.67 feet

Subbase course: 0.00 feet

GE Provided : 1.17 feet

Minimum GE Required: 1.06 feet

LTPPBind 3.1 Program Output For Asphalt Binder Grade Selection

Waha Road Improvements
Project No.: CD23017AI

PG Binder Selection

Parameter	A=28 km	B=28 km	C=35 km	D=47 km	E=48 km
Station ID	✓WA5844	✓ID0667	✓ID1956	✓ID8137	✓ID7386
Elevation, m	1983	1927	1997	1951	2211
Degree-Days >10 C	2506	1967	2537	2191	2258
Low Air Temperature, C	-25.2	-20.8	-20.3	-22.1	-24.4
Low Air Temp. Std Dev	5.5	4.3	4.7	4.7	4.9

Input Data

Latitude, Degree

47.95

Lowest Yearly Air Temperature, C

-22.6

Yearly Degree-Days>10 Deg.C

2292

Low Air Temp. Standard Dev., Deg C

4.8

Temperature Adjustments

Base HT PG

52

Desired Reliability, %

98

Depth of Layer, mm

0

Traffic Adjustments for HT

Traffic Speed

Traffic Loading	Fast	Slow
Up to 3 M. ESAL	0.0	2.8
3 to 10 M. ESAL	7.8	10.3
10 to 30 M. ESAL	13.2	15.5
Above 30 M. ESAL	15.5	17.7

PG Temperature	HIGH	LOW
PG Temp. at 50% Reliability	50.2	-18.3
PG Temp. at Desired Reliability	54.5	-26.6
Adjustments for Traffic	2.8	
Adjustments for Depth	0.0	0.0
Adjusted PG Temperature	57.3	-26.6
Selected PG Binder Grade	58	-28

?

Recalculate PG

Save

Cancel

STRATA