APPENDIX A – GEOTECHNICAL INVESTIGATION

Rifle Falls SFU - Isolation Building
SCA23A

Huddleston-Berry
Engineering & Testing, LLC

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October 26, 2023
Project#01963-0010

Colorado Parks and Wildlife
6060 Broadway
Denver, Colorado 80216

Attention: Mr. Jordan Hasz

Subject: Geotechnical Investigation
Rifle Falls Iso Building
Rifle, Colorado

Dear Mr. Hasz,

This letter presents the results of a geotechnical investigation conducted by Huddleston-Berry Engineering & Testing, LLC (HBET) at the Rifle Falls Hatchery in Rifle, Colorado. The site location is shown on Figure 1. The scope of our investigation included evaluating the subsurface conditions at the site to aid in developing foundation recommendations for the proposed structure.

Site Conditions

At the time of the investigation, the site was occupied by miscellaneous hatchery infrastructure and East Rifle Creek. However, the proposed building site was relatively open with a general slight slope down to the south. Vegetation in the vicinity of the building site consisted primarily of weeds and grasses. The project site was located within Rifle Falls State Park.

Subsurface Investigation

The subsurface investigation included two test pits as shown on Figure 2 – Site Plan. The test pits were excavated to depths of 8.0 and 9.0 feet below the existing ground surface. Typed test pit logs are included in Appendix A.

As indicated on the logs, the subsurface conditions encountered in the test pits were fairly consistent. The test pits encountered 0.5 to 1.0 foot of topsoil above brown, moist, medium dense to loose silt with sand soils that extended to the bottom of TP-1 and to a depth of 7.0 feet in TP-2. The silt soils in TP-2 were underlain by brown, moist, loose silty sand soils to the bottom of the excavation. Groundwater was not encountered in the subsurface at the time of the investigation.

Laboratory Testing

Laboratory testing was conducted on samples of the native soils encountered in the test pits. The testing included grain size analysis, Atterberg limits determination, natural moisture content and density determination, swell/consolidation testing, and maximum dry density and optimum moisture content (Proctor) determination. The laboratory testing results are included in Appendix B.

The laboratory testing results indicated that the native silt soils are moderately plastic. In addition, the silt soils were indicated to be slightly collapsible, with up to approximately 2.0% collapse measured in the laboratory.

The silty sand soils were indicated to be non-plastic. In general, based upon the Atterberg limits and our experience with similar soils in the vicinity of the subject site, the native sand soils are also anticipated to be slightly collapsible.

Foundation Recommendations

Based upon the results of the subsurface investigation and nature of the proposed construction, shallow foundations are recommended. Spread footings and monolithic (turndown) structural slabs are both appropriate foundation alternatives. However, as discussed previously, the native soils were indicated to be slightly collapsible. Therefore, in order to provide a stable bearing stratum and limit the potential for excessive differential movements, it is recommended that the foundations be constructed above a minimum of 24-inches of structural fill.

The native soils are suitable for reuse as structural fill. Imported structural fill should consist of a granular, non-expansive, ***non-free draining*** material with greater than 10% passing the #200 sieve and Liquid Limit of less than 30. However, all proposed imported structural fill materials should be approved by HBET.

For spread footing foundations, the footing areas may be trenched. However, for monolithic slab foundations, the structural fill should extend across the entire building pad area to a depth of 24-inches below the turndown edges. Structural fill should extend laterally beyond the edges of the foundation a distance equal to the thickness of structural fill.

Prior to placement of structural fill, it is recommended that the bottoms of the foundation excavations be scarified to a depth of 6 to 8-inches, moisture conditioned, and re-compacted to a minimum of 95% of the standard Proctor maximum dry density, within ±2% of the optimum moisture content as determined in accordance with ASTM D698. Structural fill should be moisture conditioned, placed in maximum 8-inch loose lifts, and compacted to a minimum of 95% of the standard Proctor maximum dry density for fine grained soils or modified Proctor maximum dry density for coarse grained soils, within ±2% of the optimum moisture content as determined in accordance with ASTM D698 or D1557C, respectively.

Structural fill should be extended to within 0.1-feet of the bottom of the foundation. No more than 0.1-feet of gravel should be placed below the footings or turndown edge as a leveling course.

For structural fill consisting of approved imported granular materials and foundation building pad preparation as recommended, a maximum allowable bearing capacity of 1,500 psf may be used. In addition, a modulus of 150 pci may be used for structural fill consisting of the native soils and a modulus of 200 pci may be used for approved imported structural fill materials. Foundations subject to frost should be at least 36-inches below the finished grade.

Any stemwalls or retaining walls should be designed to resist lateral earth pressures. For backfill consisting of the native soils or imported granular, non-free draining, non-expansive material, we recommend that the walls be designed for an active equivalent fluid unit weight of 45 pcf in areas where no surcharge loads are present. An at-rest equivalent fluid unit weight of 65 pcf is recommended for braced walls. Lateral earth pressures should be increased as necessary to reflect any surcharge loading behind the walls.

Water soluble sulfates are common to the soils in Western Colorado. Therefore, at a minimum, Type I-II sulfate resistant cement is recommended for construction at this site.

Non-Structural Floor Slab and Exterior Flatwork Recommendations

In order to reduce the potential for excessive differential movements, it is recommended that non-structural floating floor slabs be constructed above a minimum of 18-inches of structural fill with subgrade preparation, structural fill materials, and fill placement be in accordance with the *Foundation Recommendations* section of this report. It is recommended that exterior flatwork be constructed above a minimum of 12-inches of structural fill.

Drainage Recommendations

Grading and drainage are critical for the long-term performance of the structure and grading around the structure should be designed to carry precipitation and runoff away from the structure. It is recommended that the finished ground surface drop at least twelve inches within the first ten feet away from the structure. It is also recommended that landscaping within five feet of the structure include primarily desert plants with low water requirements. In addition, it is recommended that irrigation, including drip lines, within ten feet of foundations be minimized.

HBET recommends that downspout extensions be used which discharge a minimum of 15 feet from the structure or beyond the backfill zone, whichever is greater. However, if subsurface downspout drains are utilized, they should be carefully constructed of solid-wall PVC and should daylight a minimum of 15 feet from the structure. In addition, an impermeable membrane is recommended below subsurface downspout drain lines. Dry wells should not be used.

General Notes

The recommendations included above are based upon the results of the subsurface investigation and on our local experience. These conclusions and recommendations are valid only for the proposed construction.

As discussed previously, the subsurface conditions encountered in the test pits were fairly consistent. However, the precise nature and extent of any subsurface variability may not become evident until construction. As a result, it is recommended that HBET provide construction materials testing and engineering oversight during the entire construction process.

It is important to note that the recommendations herein are intended to reduce the risk of structural movement and/or damage, to varying degrees, associated with volume change of the native soils. However, HBET cannot predict long-term changes in subsurface moisture conditions and/or the precise magnitude or extent of volume change. Where significant increases in subsurface moisture occur due to poor grading, improper stormwater management, utility line failure, excess irrigation, or other cause, either during construction or the result of actions of the property owner, several inches of movement are possible. In

addition, any failure to comply with the recommendations in this report releases Huddleston-Berry Engineering & Testing, LLC of any liability with regard to the structure performance.

We are pleased to be of service to your project. Please contact us if you have any questions or comments regarding the contents of this report.

Respectfully Submitted:
Huddleston-Berry Engineering and Testing, LLC

Michael A. Berry, P.E.
Vice President of Engineering

FIGURES

FIGURE 1
Site Location Map

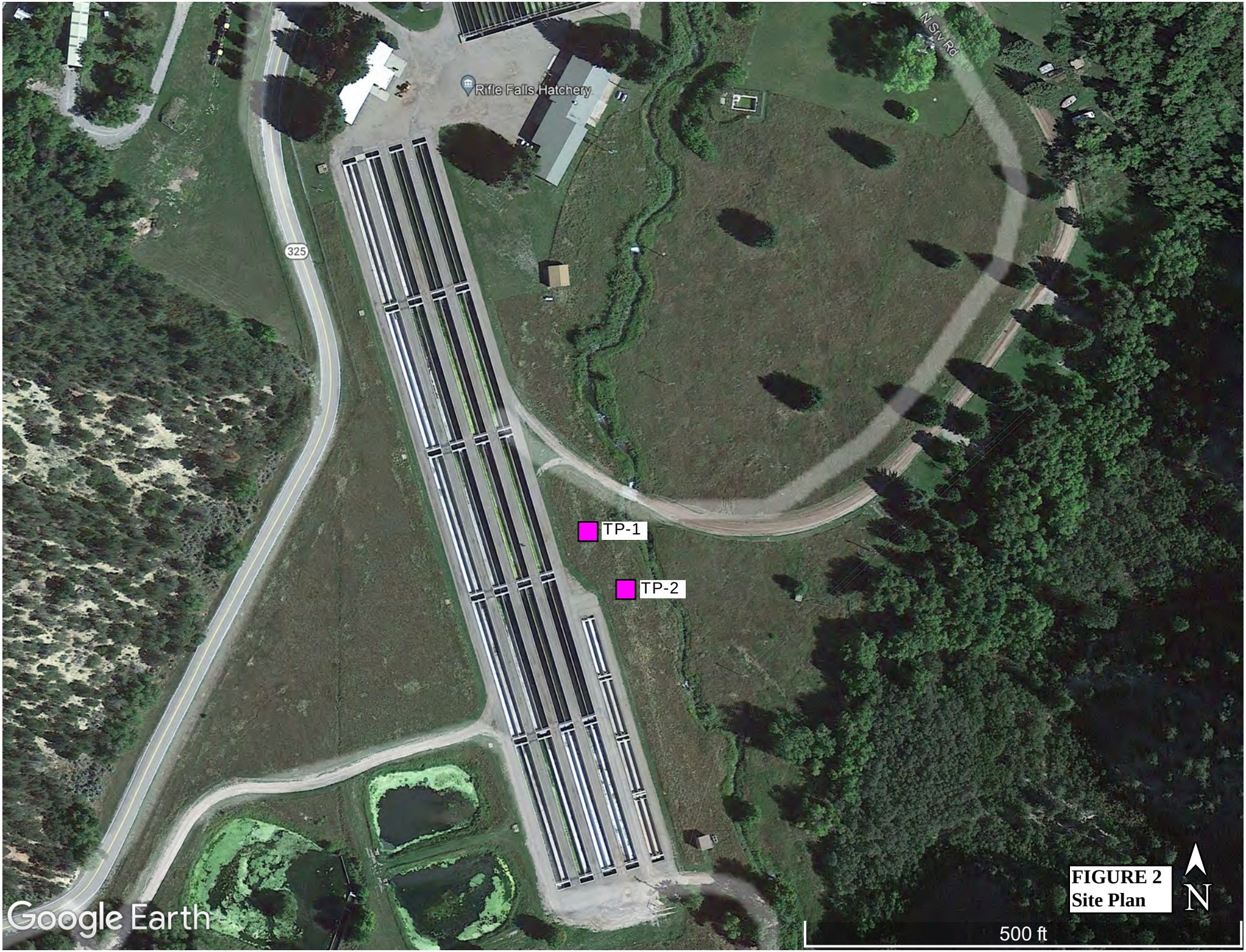

FIGURE 2
Site Plan

APPENDIX A
Typed Test Pit Logs

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-1

CLIENT Colorado Parks and Wildlife
PROJECT NAME Rifle Falls Iso Building
PROJECT NUMBER 01963-0010
PROJECT LOCATION Rifle, CO
DATE STARTED 9/21/23 **COMPLETED** 9/21/23
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION Dry
LOGGED BY TEC **CHECKED BY** MAB
AT END OF EXCAVATION Dry
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Sandy Silt with Organics (TOPSOIL)										
		SILT with Sand (ML), brown, moist, medium dense to loose										
			MC 1				67	7				
2.5		GB-1: Lab Classified	GB 1					7	32	31	1	77
5.0												
7.5												
		Bottom of test pit at 9.0 feet.										

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TEST PIT NUMBER TP-2

CLIENT Colorado Parks and Wildlife
PROJECT NAME Rifle Falls Iso Building
PROJECT NUMBER 01963-0010
PROJECT LOCATION Rifle, CO
DATE STARTED 9/21/23 **COMPLETED** 9/21/23
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Client
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION Dry
LOGGED BY TEC **CHECKED BY** MAB
AT END OF EXCAVATION Dry
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Sandy Silt with Organics (TOPSOIL)										
		SILT with Sand (ml), brown, moist, medium dense to loose										
2.5												
5.0												
7.5		Silty SAND (SM), brown, moist, loose GB-1: Lab Classified	GB 1					10	NP	NP	NP	16
		Bottom of test pit at 8.0 feet.										

APPENDIX B
Laboratory Testing Results

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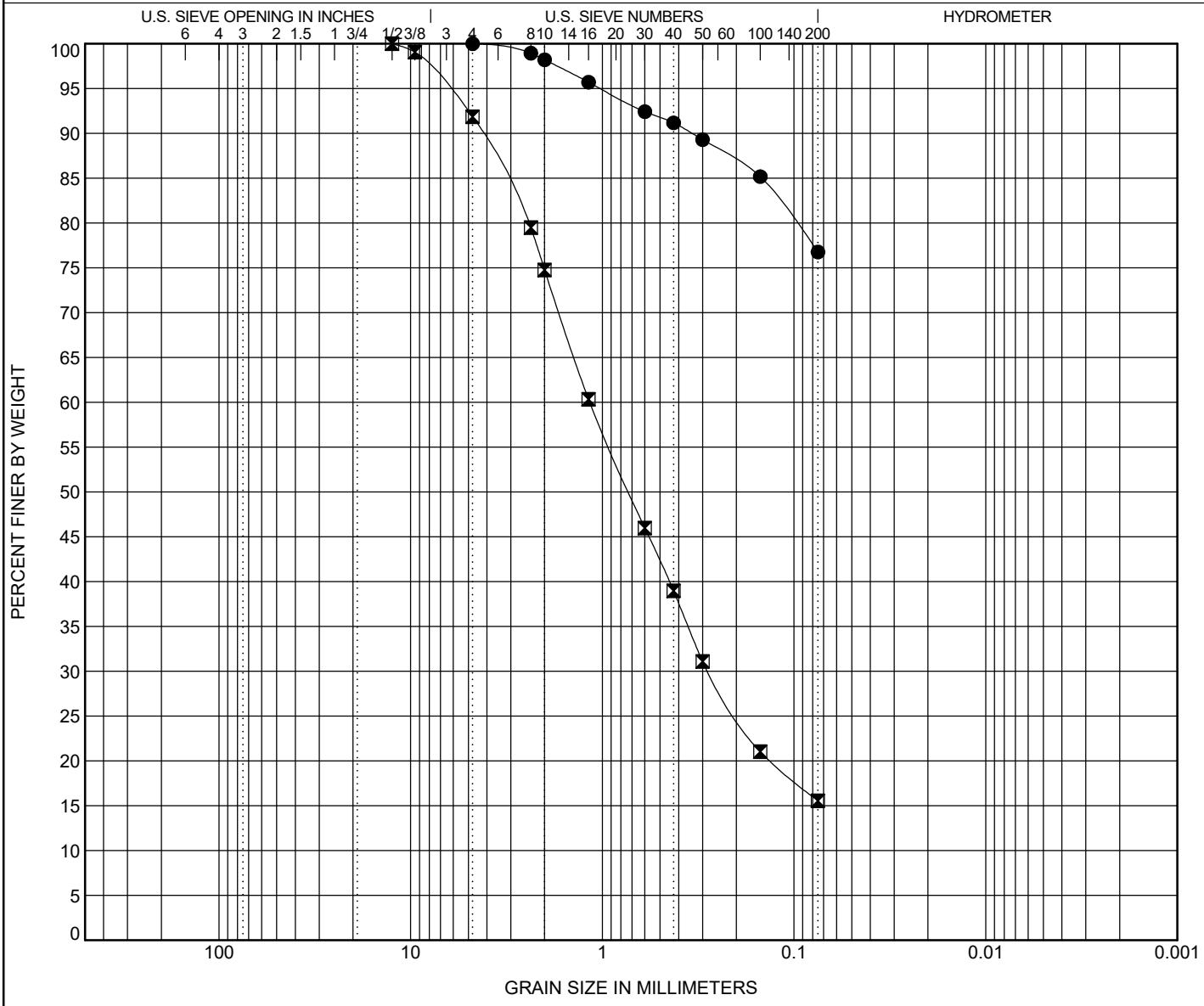
GRAIN SIZE DISTRIBUTION

CLIENT Colorado Parks and Wildlife **PROJECT NAME** Rifle Falls Iso Building

PROJECT NUMBER 01963-0010 **PROJECT LOCATION** Rifle, CO



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● TP-1, GB-1 9/21	SILT with SAND(ML)	32	31	1		
⊠ TP-2, GB-1 9/21	SILTY SAND(SM)	NP	NP	NP		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TP-1, GB-1 9/21	4.75				0.0	23.2	76.8	
⊠ TP-2, GB-1 9/21	12.5	1.162	0.279		8.1	76.3	15.6	

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ATTERBERG LIMITS' RESULTS

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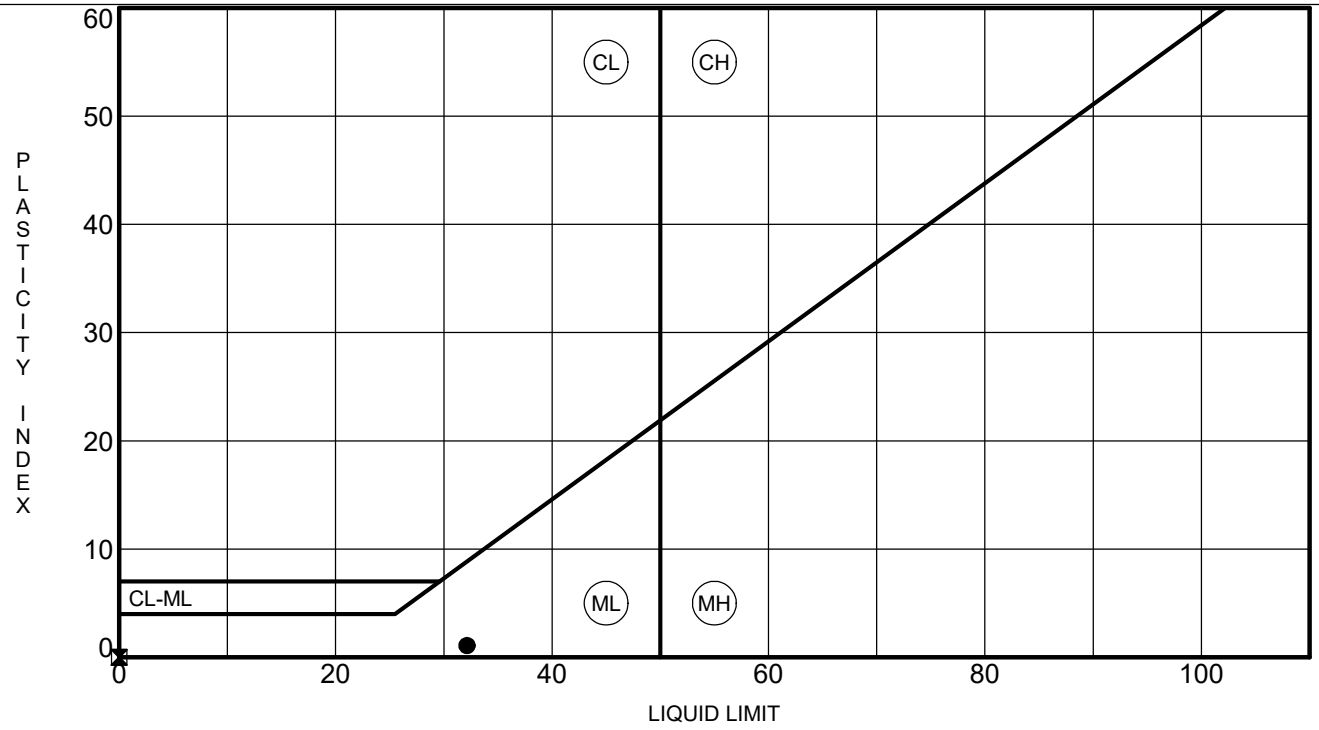
PROJECT NUMBER 01963-0010 **PROJECT LOCATION** Rifle, CO



	Specimen Identification		LL	PL	PI	#200	Classification
●	**TP-1, GB-1**	**9/21**	**32**	**31**	**1**	**77**	**SILT with SAND(ML)**
⧓	**TP-2, GB-1**	**9/21**	**NP**	**NP**	**NP**	**16**	**SILTY SAND(SM)**

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CONSOLIDATION TEST

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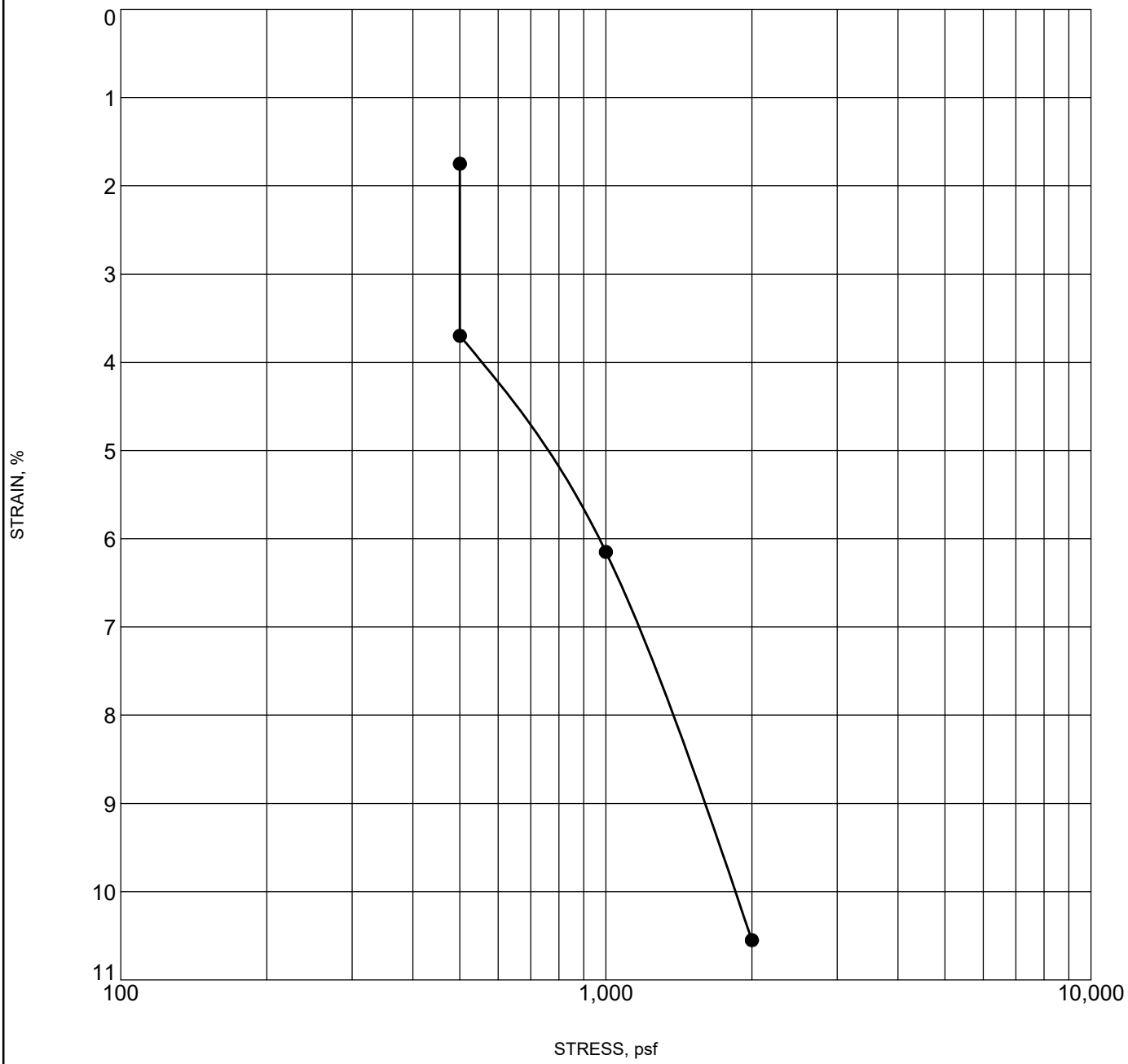
PROJECT NUMBER 01963-0010 **PROJECT LOCATION** Rifle, CO



Specimen Identification	Classification	γ_d	MC%
● TP-1, MC-1 2.0		67	7

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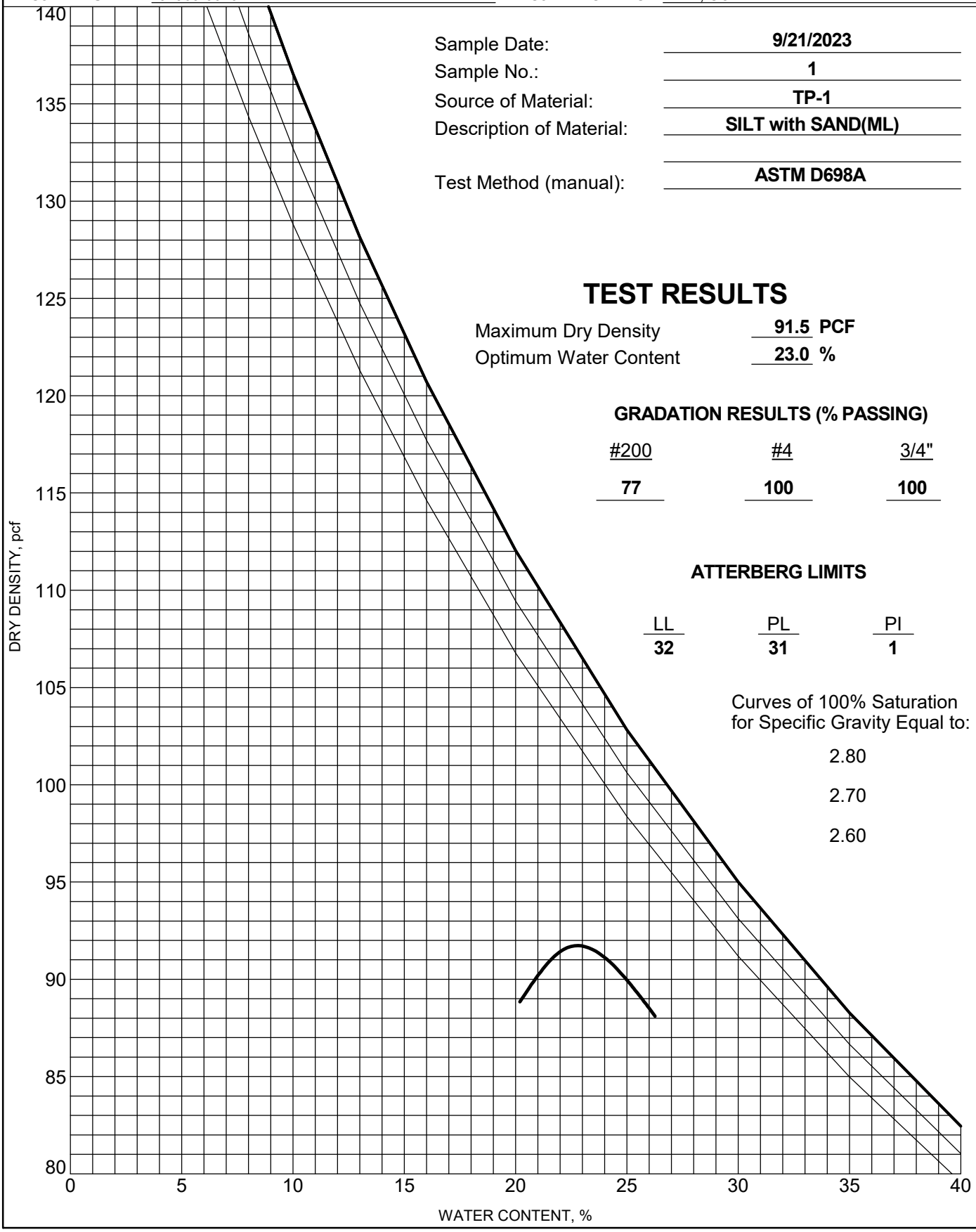
MOISTURE-DENSITY RELATIONSHIP

CLIENT Colorado Parks and Wildlife
PROJECT NAME Rifle Falls Iso Building
PROJECT NUMBER 01963-0010
PROJECT LOCATION Rifle, CO



Sample Date: **9/21/2023**
Sample No.: **1**
Source of Material: **TP-1**
Description of Material: **SILT with SAND(ML)**
Test Method (manual): **ASTM D698A**

TEST RESULTS

Maximum Dry Density **91.5** PCF
Optimum Water Content **23.0** %

GRADATION RESULTS (% PASSING)

#200	#4	3/4"
77	100	100

ATTERBERG LIMITS

LL	PL	PI
32	31	1

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

COMPACTION 01963-0010 RIFLE FALLS BUILDING.GPJ GINT US LAB.GDT 10/26/23