ADDENDUM #1

2025 STREET REHABILITATION UNIT 1 – KATE SMITH NEIGHBORHOOD
PHASE 2 – FEDERALLY FUNDED
BID # 24/25-016 / PWP # WA-2025-358
BIDS DUE NO LATER THAN: 1:45 PM ON MAY 28, 2025
PUBLIC BID OPENING: 2:00 PM ON MAY 28, 2025

This addendum is to notify all potential proposers of clarifications made to the Bid documents as stated below.

A) **Geotechnical Investigation Reports Titled (Total of 3 separate reports):**
   a. **City of Sparks FY25 Unit 1 Dated February 2024 by Lumos & Associates, Inc.**
   b. **City of Sparks FY24 Unit 2 Dated February 2024 by Lumos & Associates, Inc.**
   c. **City of Sparks FY25 Street Rehabilitation Dated November 2024 by Lumos & Associates, Inc.**

Please note and adjust your bid according to the revisions, additions, deletions, clarifications, or modifications as presented on this Addendum #1, which are made a part of this bid. NOTE: To avoid disqualification, this Addendum 1 (and any other addenda) must be signed by an authorized representative of the bidding firm in the space provided and must be submitted with your firm's sealed proposal. Failure to return this addendum, duly signed, may be cause for rejection of the bid. ALL ADDENDA SHOULD BE SIGNED AND PLACED IN SEQUENTIAL ORDER AND ATTACHED TO THE FRONT OF THE BID PACKAGE, COMPLETE WITH ALL REQUIRED DOCUMENTS.

_____
CONTRACTOR BUSINESS NAME

X_____
Authorized Signature

_____
Printed Name of Person Signing

_____
Amber Sosa, P.E.
City Engineer

May 16, 2025

GEOTECHNICAL INVESTIGATION REPORT

CITY OF SPARKS FY25 UNIT 1
SPARKS, NV

11500.154

FEBRUARY 2024

PREPARED FOR:
CITY OF SPARKS
DEPARTMENT OF PUBLIC WORKS
ATTN: BOB SCHRICKER
431 PRATER WAY
SPARKS, NV 89431

PREPARED BY:
LUMOS & ASSOCIATES, INC.
808 E. COLLEGE PARKWAY, SUITE 101
CARSON CITY, NV 89706
775.883.7077

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1.0 INTRODUCTION

This report presents the results of Lumos & Associates, Inc.'s Geotechnical Analysis for the proposed roadway rehabilitation project located in Sparks, NV. A vicinity map is included as Plate 1 and a site map is included as Plate 2.

It is our understanding that the proposed project will consist of roadway reconstruction. Roadway reconstruction operations include asphalt pavement replacement and roadbed modification on the existing asphalt, aggregate base, and/or underlying soils. Plate 2 shows the project streets scheduled for reconstruction. We have assumed that final grades at the site will be approximately the same as the existing grades.

The purpose of our investigation was to characterize the site geology and soil conditions, describe the native soils and determine their engineering properties as they relate to the proposed construction. The investigation was also intended to identify possible adverse geologic, soil, and/or water table conditions. However, this study did not include an environmental assessment or an evaluation for soil and/or groundwater contamination at the site.

This report concludes with recommendations for pavement design. In addition, information such as logs of all explorations (Appendix A) and laboratory test data (Appendix B) are provided in this report.

2.0 GEOLOGIC SETTING

The proposed project is located in the northeastern section of the Truckee Meadows, a broad valley bounded on the west by the tall granitic and volcanic peaks of the Sierra Nevada Mountains (Carson Range), and on the east by the by the lower volcanic peaks of the Virginia and Pah Rah Range. Younger volcanic hills also bound the valley on the north and south. Faults bound the valley from the mountains as is typical of the Basin and Range province. Sediments have filled the valley from a number of tributaries and ancestral lakes during the Quaternary period (2 million years ago to present day). The dominant sediment source has been and continues to be, the Truckee River and its ancestral counterparts. Stream deposits were particularly voluminous after glacial periods. Since the end of the last glacial period, some 10,000 years ago, arid erosional forces combined with faulting have been the predominant processes to shape the region. These processes have created large alluvial fans that surround the valley floor of the Truckee Meadows.

In 2011 the near surface geology of the Reno/Sparks area was mapped by Ramelli, Henry, and Walker. Their mapping shows undivided younger and older Tahoe age fluvial deposits (Qrt) and Tioga age fluvial deposits (Qr2) underlie the site. Both of these deposits are Truckee River deposits which generally are comprised of poorly bedded gravels, sands, and fine grained soils. Plate 3 shows their mapping.

3.0 SITE CONDITIONS AND FIELD EXPLORATION

At the time of our investigation the project roadways had been previously paved with asphalt concrete. Where visible, the project streets generally had moderate alligator cracking, moderate surface wear, and moderate block cracking.

The current field investigation included a subsurface exploration. The location of the subsurface explorations were determined by using existing features at the site. Therefore, the approximate location of the subsurface explorations should be considered accurate only to the degree implied by the methods used.

Our subsurface investigation included seven (7) test pits located within the project streets. Test pit explorations were excavated to a maximum depth of five (5) feet below existing grade (b.e.g.). Additionally, seven (7) core hole explorations were conducted within the existing project streets. Core hole explorations were dug to a maximum depth of two (2) feet. The locations of the exploratory excavations within the proposed site are shown on Plate 2. The subsurface soils were continuously logged and visually classified in the field by our Geotechnician in accordance with the Unified Soil Classification System (USCS). Representative soil samples were collected at each material change within the test pit and core hole locations. Soil samples were subsequently transported to our Reno geotechnical laboratory for testing and additional analysis.

The native soils encountered consisted generally of clayey sands (SC), silty sands (SM), poorly graded sand with silt (SP-SM), Silty Gravel (GM), and clayey gravels (GC). Aggregate base was only encountered in six of the fourteen explorations. The direct asphalt supporting material varied between aggregate base, clayey gravel, silty sand, and clayey sand materials. Table 1 on the next page presents the existing pavement sections within the project streets.

TABLE 1
THICKNESSES OF EXISTING PAVEMENT SECTIONS

Exploration	Asphalt (inches)	Direct Supporting Layer (inches)	Subgrade	Exploration	Asphalt (inches)	Direct Supporting Layer (inches)	Subgrade
Core #1	2.25	1.75 (Base)	SM	Test Pit #1	2.5	14 (SM)	SC
Core #2	4.5	7.5 (SM)	SM & SP-SM	Test Pit #2	4	8 (SM)	SC & GM
Core #3	3.5	1.75 (Base)	SM & SC	Test Pit #4	4	6 (SM)	GC
Core #4	4	+14 (SM)	-	Test Pit #5	4	4 (Base)	SM & GM
Core #7	5	7 (SC)	SP-SM	Test Pit #6	4.25	10 (GC)	SP-SM
Core #8	4	4 (Base)	SM & GC	Test Pit #7	4.5	6 (Base)	SC
Core #10	4	9 (SM)	SC	Test Pit #8	5	6 (Base)	SM

4.0 FIELD AND LABORATORY TEST DATA

Laboratory tests performed on representative samples included sieve analysis (including fines), Atterberg limits, R-value, expansion index, and sulfate content. Much of this data is displayed on the "logs" of the subsurface explorations to facilitate correlation. Field descriptions presented on the logs have been modified, where appropriate, to reflect laboratory test results. The logs of the subsurface explorations are included in Appendix A of this report as Plates A-1 through A-14. A key to the logs, explaining the symbols and nomenclature, is included as Plate A-15.

Individual laboratory test results are presented in Appendix B as Plates B-1 through B-4. Laboratory testing was performed per ASTM standards, except when test procedures are briefly described and no ASTM standard is specifically referenced in the report. Atterberg limits were determined using the dry method of preparation.

4.1 Analytical Testing: Western Environmental Testing Laboratory (WET Lab) of Sparks, Nevada conducted the sulfate content laboratory testing. Test results are included (on WET Lab letterhead) in Appendix B on Plate B-4.

Laboratory prepared cement treated pulverized asphalt/base/subgrade compression specimens were compacted and tested. Specimens were comprised of thirty-five percent (35%) pulverized asphalt, fifteen percent (15%) aggregate base, forty percent (40%) silty sand, and ten percent (10%) clayey sand in order to simulate the existing pavement section. Specimen cement contents were 2%, 4%, and 6% by dry weight of the maximum dry density. Cement treated materials compression results are provided in Appendix D.

The soil samples obtained during this investigation will be held in our laboratory for 30 days from the date of this report. The samples may be retained longer at an additional cost to the client or obtained from this office upon request.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

The following recommendations are based upon the construction and our understanding and assumptions of the proposed improvements, as outlined in the introduction of this report, and based on our findings during the field exploration and laboratory testing phases of this project. If changes in the construction project are proposed, they should be presented to Lumos & Associates, Inc. Geotechnical Department, so that the recommendations provided herein can be reviewed and modified as necessary. As a minimum, final construction drawings should be submitted to the Lumos Geotechnical Department for review prior to actual construction and verification that our geotechnical design recommendations have been implemented.

5.2 General Site Grading

5.2.1 Clearing and Grubbing

Prior to placement of fill and/or the proposed improvements, the areas to receive fill and/or improvements shall be cleared and grubbed. Clearing and grubbing is not anticipated under the existing roadway. Clearing and grubbing may be required if improvements will be placed outside of the existing roadway. Where required, clearing and grubbing is anticipated to be as much as six (6) inches, or more, where thicker vegetation/roots are present.

Root- or organic-laden soils encountered during excavations, should be stockpiled in a designated area on site for later use in landscaping, or removed off site as directed by the owner. Excavated soils free from any organics, debris or otherwise unsuitable material and with particles no larger than four (4) inches in maximum dimension may be stockpiled and moisture conditioned for later use as compacted fill provided it meets the criteria for structural fill soils.

Exposed excavation surfaces to support any of the proposed improvements should be observed and approved by a Lumos representative. Upon re-compaction and prior to placing any fill, the re-compacted surface should be proof-rolled to identify any possible yielding surfaces. Proof-rolling should be conducted with a heavy rubber-tire loader with a fully loaded bucket, or a fully loaded water truck, and observed and approved by a Lumos representative.

5.2.2 Unsuitable Subgrade Mitigation

Unstable conditions due to yielding and/or pumping soils may be encountered on site. Additionally, the exposed soils may yield or pump under heavy equipment loads or where vibratory equipment draws up water. If yielding or pumping conditions are encountered, the soils should be scarified in place, allowed to dry as necessary and re-compacted, where applicable. Alternatively, the unsuitable or saturated soil should be removed, the exposed surface leveled and compacted/tamped as much as practical without causing further pumping, and covered (including the sides) with geotextile stabilizing fabric (Mirafi HP370 or other equivalent). The fabric should then be covered with at least twelve (12) inches of four (4) to six (6) inch **angular rock fill** with enough fines to fill the inter-rock pore spaces. Placement should be by end dumping. No traffic or other action should be allowed over the fabric, which may cause it to deflect/deform prior to cobble placement. Test sections should be used to determine the minimum thickness and/or number of layers required for stabilization.

Stabilization should be evaluated by proof-rolling standards commensurate with the equipment used, and approved by a Lumos representative. The placement of the stabilizing rock-fill may require additional over-excavation to maintain appropriate grading elevations. A filter fabric (Mirafi 180N or equal) should also be placed over the cobble rock fill to prevent piping of fines from covering soils into the stabilizing rock matrix.

5.2.3 Structural Fill

Properly compacted structural fill soils to be used on site should consist of non-expansive materials (LL less than 35 and/or a PI less than 12 and/or Expansion Index less than 20), have an R-Value of at least 30, should be free of contaminants, organics (less than two percent (2%)), rubble, or natural rock larger than three inches in largest dimension. All structural fill soils shall also be non-corrosive and have a water soluble sulfate content of less than 0.1%. Structural fill soils shall also meet the following gradation requirements (Table 1):

TABLE 2
STRUCTURAL FILL BACKFILL GRADATION

Sieve Size	% Passing
4"	100
¾"	70 - 100
#40	15 - 65
#200	5 – 35

Import structural fill soils should be tested and approved prior to being placed or delivered on-site (**seven day advanced notice**).

Prior to placement of structural fill, the site subgrade shall be scarified to a depth of twelve (12) inches, moisture conditioned to within two percent (2%) of optimum, and re-compacted to a minimum of **ninety percent (90%)** as determined by the ASTM D1557 Standard.

Structural fill should be placed only on compacted sub-grade or on compacted fill in loose lifts not exceeding eight (8) inches, moisture conditioned to within two percent (2%) of optimum, and compacted to at least **ninety percent (90%)** relative compaction as determined by the ASTM D1557 Standard. Lift thickness may be increased, at the discretion of the Geotechnical Engineer, provided the contractor can demonstrate that adequate compaction is being achieved.

Fill material should not be placed, spread or compacted while the ground is frozen or during unfavorable weather conditions. When site grading is interrupted by heavy rain or snow, grading or filling operations should not resume until a Lumos representative approves the moisture content and density conditions of the subgrade or previously placed fill.

Landscape areas should be cleared of all objectionable material. In cut areas, no other work is necessary except grading to proper elevation. In landscape areas, fill should be placed in loose lifts not exceeding eight inches and compacted to at least **ninety percent (90%)** relative compaction to prevent erosion.

Water should not be allowed to pond on pavements or adjacent to structures, and measures should be taken to reduce surface water infiltration into the subgrade soils. A representative of Lumos should be present during site grading operations to ensure any unforeseen or concealed conditions within the site are identified and properly mitigated, and to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction and stability of the subgrade soils. The soils engineer may reject any material that does not meet engineering characteristics, compaction, and stability requirements. Further, recommendations of this report are based upon the assumption that earthwork construction will conform to recommendations set forth in this section of the report.

6.0 PAVEMENT DESIGN

6.1 Pulverization, Cement Treatment, and Asphalt Concrete

Lumos recommends pulverizing the existing asphalt, aggregate base, and/or subgrade soils to a depth of twelve (12) inches. The pavement structural section was determined for the asphalt concrete utilizing a resistance value (R-Value) of 3 (Native Clayey Gravel with Sand) and an R-Value of 80 for the cement treated recycled aggregate base. For this project, we have assumed a Traffic Index (TI) value of 5 due to the anticipated low traffic volume. Refer to Table 3 for the recommended asphalt pavement section. The pulverized material shall meet the gradation requirements of Type 1 Recycled Aggregate Base. The pulverized material shall be regraded to accommodate four (4) inches of asphalt. The remaining eight (8) inches of pulverized material shall be cement treated. The regraded pulverized material shall be moisture conditioned to at least two percent (2%) over optimum, six and one-half percent (6.5%) cement added by dry weight of aggregate, and compacted to a minimum of **ninety-five percent (95%)** relative density of the ASTM D1557 standard. The compacted cement treated pulverized material shall be sealed with a coat of CSS applied at a rate of between 0.15 gallons to 0.25 gallon per square-yard within twenty-four (24) hours of compaction. The cement treated pulverized material shall be kept moist until the cure seal is placed. Following placement of the cure the prepared material shall be allowed to cure for a minimum of seven (7) days and reach a compressive strength of at least three-hundred pounds per square inch (300 psi) prior to paving. Immediately prior to paving, the cement treated pulverized materials shall be "microcracked", utilizing a vibratory roller. Microcracking shall be completed prior to paving and to the satisfaction of the Geotechnical Engineer. See Appendix C and D for the Pavement Calculations and Cement Treated Specimen Compression Test Data.

TABLE 3
PULVERIZATION REQUIREMENTS AND PAVEMENT STRUCTURAL SECTION

TRAFFIC INDEX	PULVERIZATION DEPTH	CEMENT TREATED RECYCLED BASE THICKNESS	ASPHALT THICKNESS
5	12″	8″	4″

We recommend a Type III, PG64-28NV, 50 blow Marshall mix targeting three percent (3%) air voids. The asphalt concrete shall be compacted to between ninety-three percent (93%) and ninety-eight percent (98%) of the theoretical maximum ("Rice") specific gravity.

7.0 CORROSION AND CHEMICAL ATTACK

Tested soils have a mild sulfate content of 150 parts per million. However, Type II cement (meeting ASTM C150) is recommended for all concrete and cement in direct contact with on-site soil.

All exterior concrete should have between four and one half and seven and one-half percent (4.5%-7.5%) entrained air, a maximum water-cement ratio of 0.45 and comply with all other ACI recommendations for concrete placed in areas subject to freezing. A minimum compressive strength of 4,000 psi is recommended for all external concrete. All concrete shall be placed pursuant to ACI recommendations.

8.0 MOISTURE PROTECTION, EROSION AND DRAINAGE

The finish surfaces around all structures should slope away from the foundations and toward appropriate drop inlets or other surface drainage devices. It is recommended that within ten feet of any structure a minimum slope of five percent (5%) be used for soil subgrade and a minimum of one percent (1%) be used for pavement. These grades should be maintained for the life of the structures.

9.0 CONSTRUCTION SPECIFICATIONS

All work shall be governed by the latest adopted revision of the Standard Specifications and Standard Details for Public Works Construction, as distributed by The City of Sparks, except as modified herein.

10.0 LIMITATIONS

This report has been prepared in accordance with the currently accepted engineering practices in Northern Nevada and Northern California. The analysis and recommendations in this report are based upon exploration performed at the locations shown on the site plan, the proposed improvements as described in the Introduction section of this report and upon the property in its condition as of the date of this report. Lumos makes no guarantee as to the continuity of conditions as subsurface variations may occur between or beyond exploration points and over time. Any subsurface variations encountered during construction should be immediately reported to Lumos so that, if necessary, Lumos' recommendations may be modified.

This report has been prepared for and provided directly to The City of Sparks ("The Client"), and any and all use of this report is expressly limited to the exclusive use of the Client. The Client is responsible for determining who, if anyone, shall be provided this report, including any designers and subcontractors whose work is related to this project. Should the Client decide to provide this report to any other individual or entity, Lumos shall not be held liable for any use by those individuals or entities to whom this report is provided. The Client agrees to indemnify, defend and hold harmless Lumos, its agents and employees from any claims resulting from unauthorized users.

If this report is utilized in the preparation of an Engineer's Estimate of Probable Construction Costs, then the preparer of the estimate acknowledges that the report recommendations are based on the subsurface conditions found at the specific locations investigated on site; that subsurface conditions may vary outside these locations; and that no guaranty or warranty, express or implied, is made that the conditions encountered are representative of the entire site. The preparer of the estimate agrees to indemnify, defend and hold harmless Lumos & Associates, its agents and employees from any and all claims, causes of action or liability arising from any claims resulting from the use of the report in the preparation of an Engineer's Cost Estimate.

This report is not intended for, nor should be utilized for, bidding purposes. If it is utilized for bidding purposes, Client acknowledges that the report recommendations are based on the subsurface conditions found at the specific locations investigated on site; that subsurface conditions may vary outside these locations; and that no guaranty or warranty, express or implied, is made that the conditions encountered are representative of the entire site. The Client agrees to indemnify, defend and hold harmless Lumos & Associates, Inc., its agents and employees from any and all claims, causes or action or liability arising from any claims resulting from the use of the report for bidding purposes.

As explained above, subsurface variations may exist and as such, beyond the express findings located in this report, no warranties express, or implied, are made by this report. No affirmation of fact, including but not limited to statements regarding suitability for use of performance shall be deemed to be a warranty or guaranty for any purpose.

Jeremy Macaluso, P.E.
Geotechnician
Lumos & Associates, Inc.

Mitch Burns, P.E., C.E.M.
Materials Engineering Manager
Lumos & Associates, Inc.

References

American Society for Testing and Materials (ASTM), 2020, Annual Book of ASTM Standards, West Conshohocken, PA

Caltrans, Highway Design Manual, March 20, 2020, Topic 633 – Engineering Procedures for New Construction and Reconstruction

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Ramelli, A.R., Henry, C.D., Walker, J.P., with contributions by Bell, J.W., Cashman, P.H., dePolo, C.M., Garside, L.J., House, P.K., Trexler, J,H., and Widmer, M.C., 2011, Preliminary revised geologic maps of the Reno urban area, Nevada, Nevada Bureau of Mines and Geology, Open File Report 2011-07, 1:24,000

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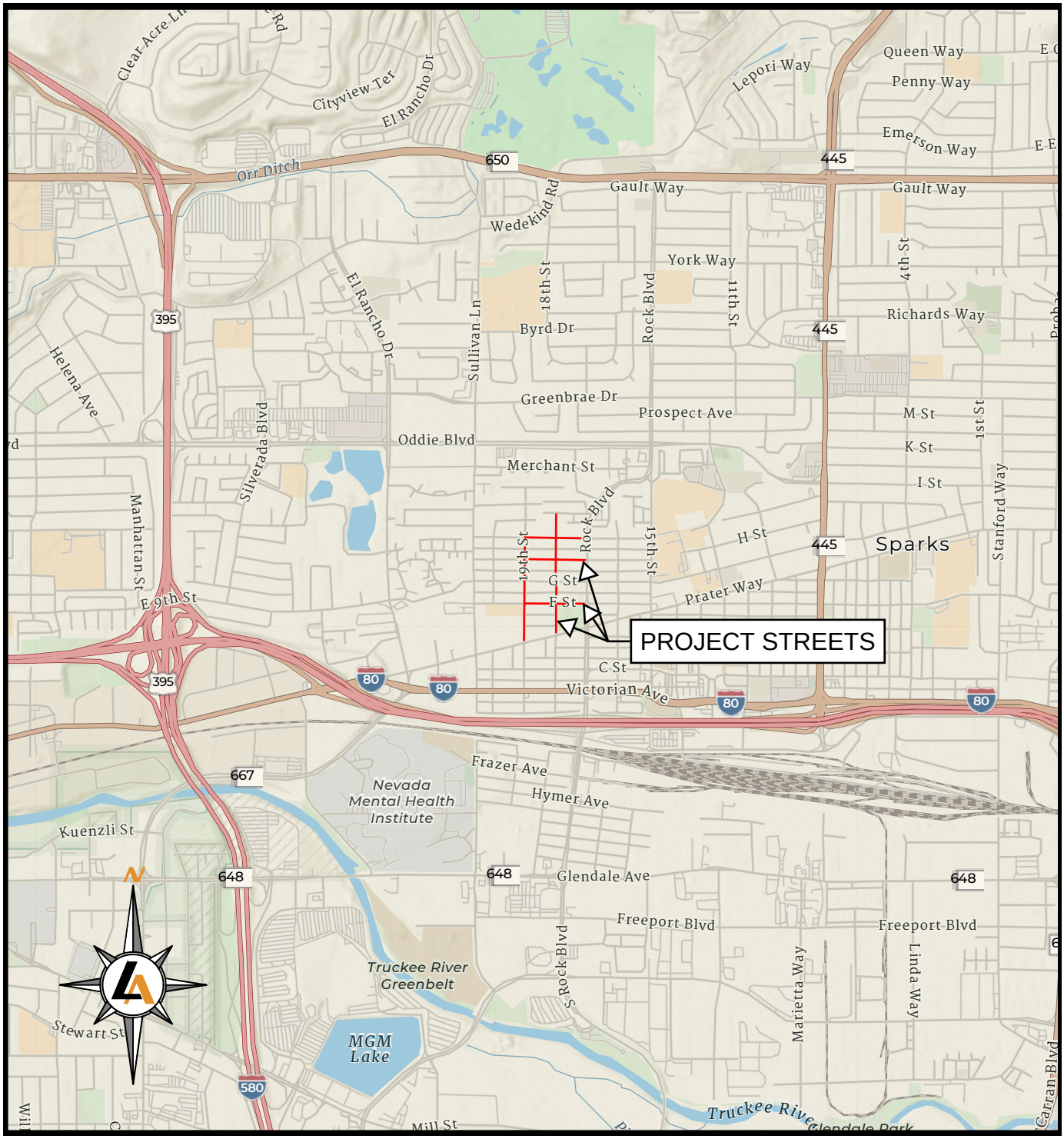
Washoe County, 2016, Standard Specifications for Public Works Construction, "Orange Book", Washoe County, NV



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City of Sparks FY25 Unit 1

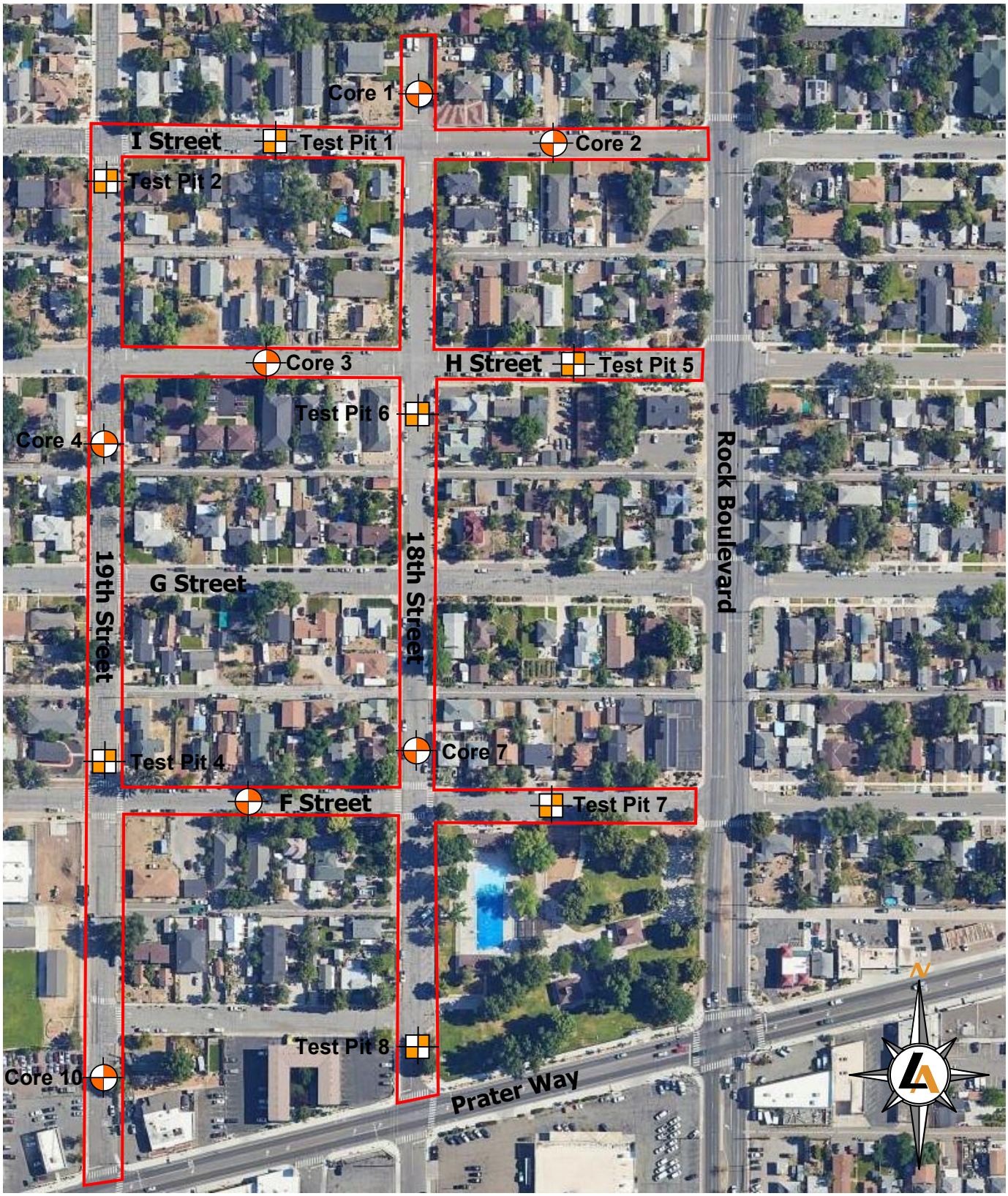
PROJECT VICINITY MAP

Job Number: 11500.154

Date: January 2024

PLATE

1



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City of Sparks FY25 Unit 1

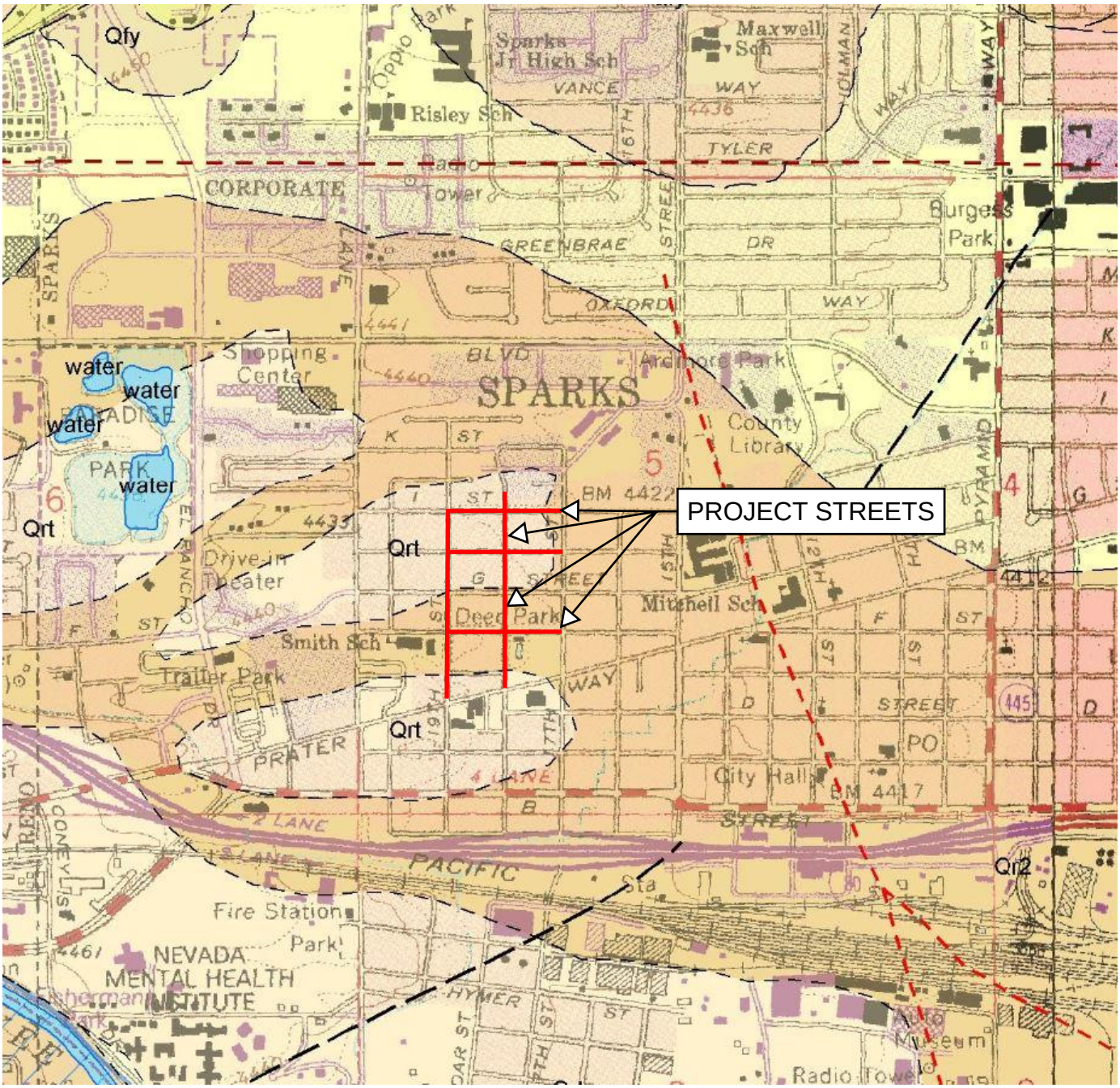
PROJECT SITE MAP

Job Number: 11500.154

Date: January 2024

PLATE

2



Qrt	**Undivided Younger and Older Tahoe Age Fluvial Deposits (Truckee River Deposits)**
Qr2	**Probable and Definite Tioga Age Fluvial Deposits (Truckee River Deposits)**

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City of Sparks FY25 Unit 1

PROJECT GEOLOGIC MAP

Job Number: 11500.154

Date: January 2024

PLATE 3

APPENDIX A

Field Exploration Logs

LUMOS & ASSOCIATES

CORE HOLE No. Core #01

Logged By: **J. Macaluso**
Date Logged: **1/8/2024**
Drill Type: **Core Drill**

Total Depth: **2 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			2.25" Asphalt Top 0.25" - Slurry Overlay Bottom 2" - Poor Quality										
			0.2										
		Z	**1.75" Material Similar to Aggregate Base**										
			0.3										
0.5		Z	**Medium Brown Silty SAND (SM)** Moist, Medium Dense Estimated: Trace Gravel 70% Medium to Fine Sand 30% Non-Plastic Silt										
			1.0										
1.0		Z	**Light Brown Clayey SAND (SC)** Moist, Medium Dense Estimated: 70% Medium to Fine Sand 30% Moderately Plastic Clay										
1.5													
			2.0										
2.0			Core Hole terminated at 2 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG COS FY25 UNIT 1.GPJ US LAB.GDT 1/30/24

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City of Sparks FY25 Unit 1

LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE
A-1

CORE HOLE No. Core #02

Logged By: **J. Macaluso**
Date Logged: **1/8/2024**
Drill Type: **Core Drill**
Total Depth: **2.08 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4.5" Asphalt Top 2.25" - Good Quality Bottom 2.25" - Very Deteriorated 0.4										
0.5		Z	**7.5" Light Brown Silty SAND (SM)** Moist, Medium Dense 1.0	13.7			NP	NP	8.8	59.1	32.1		
1.0		Z	**Light Brown Silty SAND with Gravel (SM)** Moist, Medium Dense Estimated: 40% Coarse to Fine Gravel 40% Medium to Fine Sand 20% Non-Plastic Silt 1.6										
1.5		Z	**Medium Brown Poorly Graded SAND with Silt and Gravel (SP-SM)** Moist, Loose to Medium Dense Estimated: 40% Coarse to Fine Gravel 50% Coarse to Fine Sand 10% Non-Plastic Silt 2.1										
2.0			Core Hole terminated at 2.08 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG COS FY25 UNIT 1.GPJ US LAB.GDT 1/30/24

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City of Sparks FY25 Unit 1

LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE
A-2

CORE HOLE No. Core #03

Logged By: **J. Macaluso**
Date Logged: **1/8/2024**
Drill Type: **Core Drill**
Total Depth: **2 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			3.5" Asphalt Very Deteriorated 0.3										
		Z	**Material Similar to Aggregate Base** 0.4										
0.5		Z	**Medium Brown Silty SAND (SM)** Moist, Medium Dense Estimated: 70% Medium to Fine Sand 30% Non-Plastic Silt 0.8										
1.0		Z	**Medium Brown Clayey SAND (SC)** Moist, Medium Dense Estimated: Trace Gravel 70% Medium to Fine Sand 30% Moderately Plastic Clay 1.6										
1.5		Z	**Light Brown Clayey SAND (SC)** Moist, Medium Dense Estimated: Trace Gravel 80% Medium to Fine Sand 20% Low Plastic Clay 2.0										
2.0			Core Hole terminated at 2 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG COS FY25 UNIT 1.GPJ US LAB.GDT 1/30/24

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City of Sparks FY25 Unit 1

LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE
A-3

CORE HOLE No. Core #04

Logged By: **J. Macaluso**
Date Logged: **1/8/2024**
Drill Type: **Core Drill**
Total Depth: **1.5 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Top 1.5" - Slurry Overlay Bottom 2.5" - Poor Quality										
			0.3										
0.5		Z	**Light Brown Silty SAND (SM)** Moist, Medium Dense Estimated: 10% Medium Gravel 60% Medium to Fine Sand 30% Low Plastic Silt										
1.0													
1.5			1.5										
			Core Hole terminated at 1.5 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG COS FY25 UNIT 1.GPJ US LAB.GDT 1/30/24

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City of Sparks FY25 Unit 1

LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE
A-4

CORE HOLE No. Core #07

Logged By: **J. Macaluso**
Date Logged: **1/8/2024**
Drill Type: **Core Drill**
Total Depth: **2 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			5" Asphalt 0.4										
0.5		Z	**Medium Brown Clayey SAND (SC)** Moist, Medium Dense Estimated: 10% Gravel 60% Coarse to Fine Sand 30% Low to Moderately Plastic Clay 1.0										
1.0			**Medium Brown Poorly Graded SAND with Silt (SP-SM)** Moist, Medium Dense Estimated: Trace Gravel 90% Medium to Fine Sand 10% Silt										
1.5		Z											
2.0			2.0										

Core Hole terminated at 2 feet.
Core Holes Filled with Soil and Capped with Non-Shrink Grout.

CORE HOLE LOG COS FY25 UNIT 1.GPJ US LAB.GDT 1/30/24

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City of Sparks FY25 Unit 1

LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE
A-5

CORE HOLE No. Core #08

Logged By: **J. Macaluso**
Date Logged: **1/8/2024**
Drill Type: **Core Drill**
Total Depth: **1.75 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Top 1.5" - Good Quality Bottom 2.5" - Poor Quality										
			0.3										
0.5		N	**4" Material Similar to Aggregate Base**										
			0.7										
			Medium Brown Silty SAND (SM) Moist, Medium Dense Estimated: 10% Medium to Fine Gravel 60% Coarse to Fine Sand 30% Low Plastic Silt										
1.0		N											
			1.3										
			Light Brown Clayey GRAVEL with Sand (GC) Moist, Medium Dense Estimated: 40% Coarse to Fine Gravel 40% Coarse to Fine Sand 20% Moderately Plastic Clay										
1.5		N											
			1.8										
			Core Hole terminated at 1.75 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG COS FY25 UNIT 1.GPJ US LAB.GDT 1/30/24

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LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE
A-6

CORE HOLE No. Core #10

Logged By: **J. Hartley**
Date Logged: **1/9/2024**
Drill Type: **Core Drill**

Total Depth: **2 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Top 2" - Good Quality Bottom 2" - Poor Quality										
			0.3										
0.5		Z	**Brown Silty SAND with Gravel (SM)** Moist, Medium Dense Estimated: 10% Gravel 60% Coarse to Fine Sand 30% Silt										
1.0			1.1										
		Z	**Brown Clayey SAND (SC)** Moist, Medium Dense Estimated: 70% Coarse to Fine Sand 30% Low to Moderately Plastic Clay										
1.5													
2.0			2.0										
			Core Hole terminated at 2 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG COS FY25 UNIT 1.GPJ US LAB.GDT 1/30/24

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City of Sparks FY25 Unit 1

LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE
A-7

TEST PIT No. TP #01

Logged By:	**B. Sexton**	Total Depth:	**4 feet**
Date Logged:	**1/8/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
		B	**2.5" Asphalt** Poor Quality											
			0.2											
		B	**14" Import - Silty SAND with Gravel** Moist, Medium Dense Estimated: 20% Coarse to Fine Gravel 60% Coarse to Fine Sand 20% Non-Plastic Silt											
1			1.4											
		B	**Brown Clayey SAND (SC)** Moist, Medium Dense Estimated: 65% Coarse to Fine Sand 35% Low to Moderately Plastic Clay											
2														
3														
4			4.0											

Test pit terminated at 4 feet.
Test pit backfilled without compaction verification.

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City of Sparks FY25 Unit 1

LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE A-8

TEST PIT No. TP #02

Logged By:	**B. Sexton**	Total Depth:	**5 feet**
Date Logged:	**1/8/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
			4" Asphalt Top 1.75" - Slurry Overlay Bottom 2.75" Poor Quality											
			0.3											
		B	**Fill - Silty SAND with Gravel (SM)** Moist, Medium Dense Estimated: 20% Gravel 50% Coarse to Fine Sand 30% Non-Plastic Silt											
1			1.0											
			Brown Clayey SAND (SC) Moist, Medium Dense											
2		B		15.1			32	14	2.6	67.9	29.5			
3			3.5											
			Gray Brown Silty GRAVEL with Sand (GM) Moist, Medium Dense Estimated: 10% Unclassifiable Rounded Cobble up to 8" in Maximum Diameter with the Remaining Soil Matrix Consisting of 50% Coarse to Fine Gravel 35% Coarse to Fine Sand 15% Silt											
4		B												
5			5.0											

Test pit terminated at 5 feet.
Test pit backfilled without compaction verification.

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City of Sparks FY25 Unit 1

LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE A-9

TEST PIT No. TP #04

Logged By:	**B. Sexton**	Total Depth:	**4 feet**
Date Logged:	**1/8/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
			4" Asphalt Poor Condition											
			0.3 **6" Import - Silty SAND with Gravel (SM)** Moist, Medium Dense Estimated: 20% Gravel 50% Coarse to Fine Sand 30% Non-Plastic Silt											
1			0.8 **Brown Clayey GRAVEL with Sand (GC)** Moist, Medium Dense Estimated: 50% Coarse to Fine Gravel 25% Coarse to Fine Sand 25% Low to Moderately Plastic Clay											
2		B												
3														
4			4.0											

Test pit terminated at 4 feet.
Test pit backfilled without compaction verification.

LUMOS_TP_FULL_PAGE WITH R-V AND SHEAR_COS FY25 UNIT 1.GPJ US_LAB.GDT 1/30/24

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LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE

A-10

TEST PIT No. TP #05

Logged By:	**B. Sexton**	Total Depth:	**4 feet**
Date Logged:	**1/9/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
		B	**4" Asphalt** Poor Condition											
		B	0.3 **4" Material Similar to Aggregate Base**											
1			0.7 **Light Brown Silty SAND (SM)** Moist, Medium Dense Estimated: 70% Coarse to Fine Sand 30% Silt											
2		B												
3			3.0 **Brown Silty GRAVEL with Sand (GM)** Moist, Medium Dense Estimated: 50% Coarse to Fine Gravel 30% Coarse to Fine Sand 20% Silt											
4			4.0 Test pit terminated at 4 feet. Test pit backfilled without compaction verification.											

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City of Sparks FY25 Unit 1

LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE

A-11

TEST PIT No. TP #06

Logged By:	**B. Sexton**	Total Depth:	**4 feet**
Date Logged:	**1/9/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
			4.25" Asphalt Poor Condition											
			0.4											
		B	**10" Brown Clayey GRAVEL with Sand (GC)** Moist, Medium Dense	13.2			47	30	47.7	27.7	15.0	13	3	
1			1.2											
		B	**Brown Poorly Graded SAND with Silt and Gravel (SP-SM)** Moist, Medium Dense Estimated: 15% Gravel 75% Coarse to Fine Sand 10% Silt											
2														
3														
4			4.0											

Test pit terminated at 4 feet.
Test pit backfilled without compaction verification.

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City of Sparks FY25 Unit 1

LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE A-12

TEST PIT No. TP #07

Logged By:	**B. Sexton**	Total Depth:	**4.5 feet**
Date Logged:	**1/9/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
		B	**4.5" Asphalt** Poor Condition											
		B	0.4 **6" Material Similar to Aggregate Base**											
1			0.9 **Brown Clayey SAND (SC)** Moist, Medium Dense											
2		B		15.1			31	12	0.7	69.1	30.2			
3														
4			4.5											

Test pit terminated at 4.5 feet.
Test pit backfilled without compaction verification.

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City of Sparks FY25 Unit 1

LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE A-13

TEST PIT No. TP #08

Logged By:	**B. Sexton**	Total Depth:	**4.5 feet**
Date Logged:	**1/9/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
			5" Asphalt Poor Condition											
			0.4 **6" Material Similar to Aggregate Base**											
			0.9 **Brown Silty SAND with Gravel (SM)** Moist, Medium Dense Estimated: 35% Unclassifiable Rounded Cobble and Boulders up to 18" in Maximum Diameter with the Remaining Soil Matrix Consisting of 15% Coarse to Fine Gravel 60% Coarse to Fine Sand 25% Silt											
1														
2		B												
3														
4			4.5 Test pit terminated at 4.5 feet. Test pit backfilled without compaction verification.											

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City of Sparks FY25 Unit 1

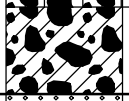
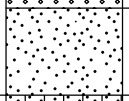
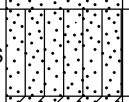
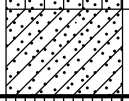
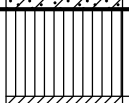
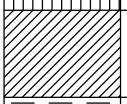
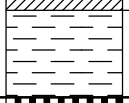
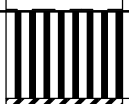
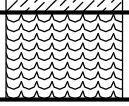
LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE

A-14

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Other Tests

AN	ANALYTICAL TEST (pH, Soluble Sulfate, and Resistivity)
C	CONSOLIDATION TEST
DS	DIRECT SHEAR TEST
MD	MOISTURE DENSITY CURVE

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City of Sparks FY25 Unit 1

LEGEND

Job Number: 11500.154

Date: January 2024

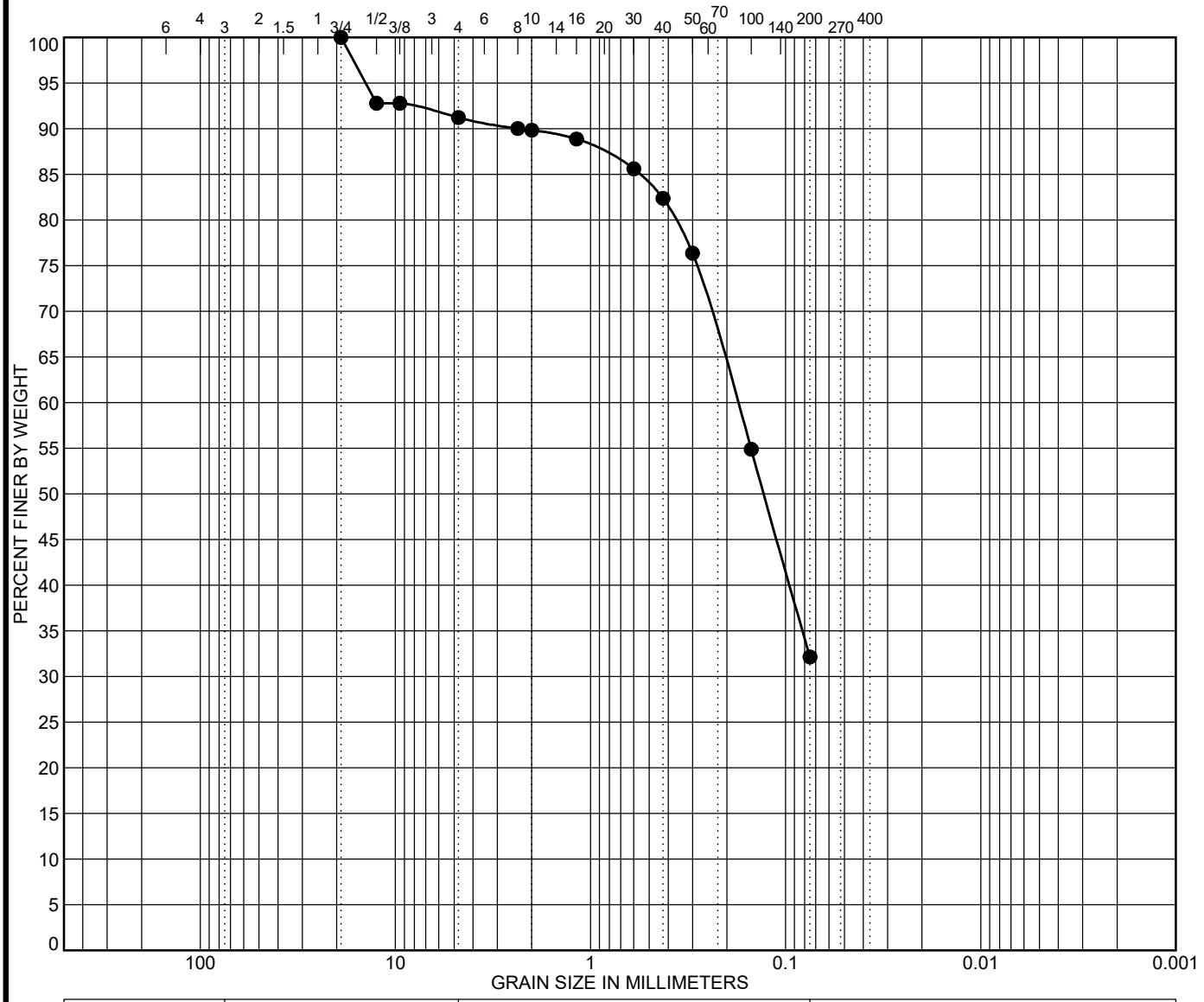
PLATE

A-15

APPENDIX B

Soils Laboratory Test Results

LUMOS & ASSOCIATES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Date: 1/10/2024						
Core #02	Classification	LL	PL	PI	Cc	Cu
Depth: 0.38	Light Brown Silty SAND (SM)	NP	NP	NP		
Sample Location	Core #2, 4.5"-12"					
USCS	SM					
AASHTO						

Specimen Identification								
Core #02	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
Depth: 0.38	19	0.177			8.8	59.1	32.1	

Natural Moisture	13.7 %	**Direct Shear**		**Absorption %**		
R-Value		**Max Dry Density**		**Soundness**		
Expansion Index		**Specific Gravity**		**S.E.**		

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City of Sparks FY25 Unit 1

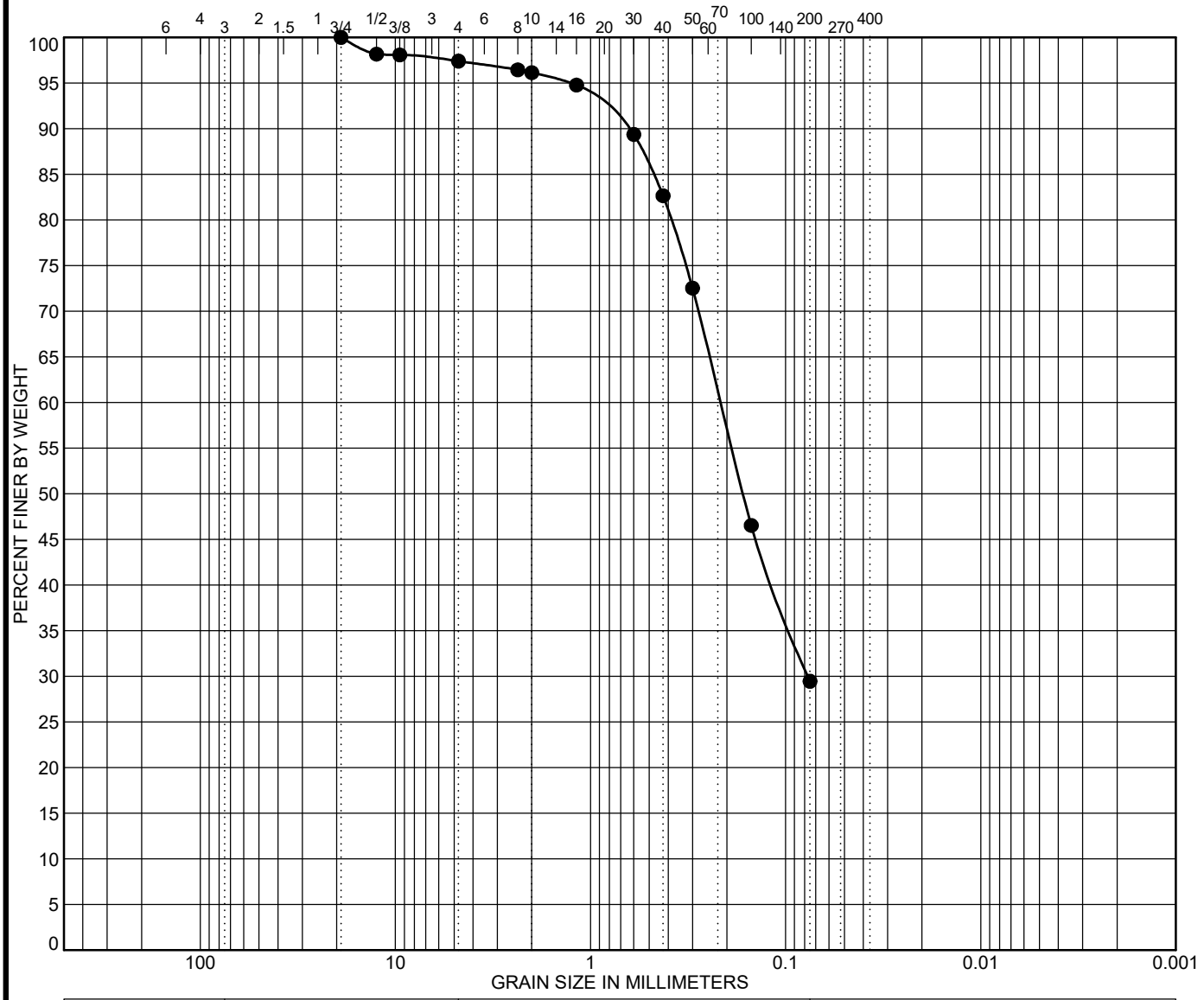
GRAIN SIZE DISTRIBUTION

Job Number: 11500.154 Date: January 2024

PLATE

B-1.1

LUMOS_GRAIN_SIZE_COS FY25 UNIT 1.GPJ US LAB.GDT 1/17/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Date: 1/10/2024	LL	PL	PI	Cc	Cu
●	**TP #02**	Classification					
	Depth: 2	Brown Clayey SAND (SC)	32	19	13		
	Sample Location	Test Pit #2, 2'-3'					
	USCS	SC					
	AASHTO						

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP #02**								
	Depth: 2	19	0.215	0.077		2.6	67.9	29.5	

Natural Moisture	15.1 %		**Direct Shear**		**Absorption %**		
R-Value			**Max Dry Density**		**Soundness**		
Expansion Index			**Specific Gravity**		**S.E.**		

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City of Sparks FY25 Unit 1

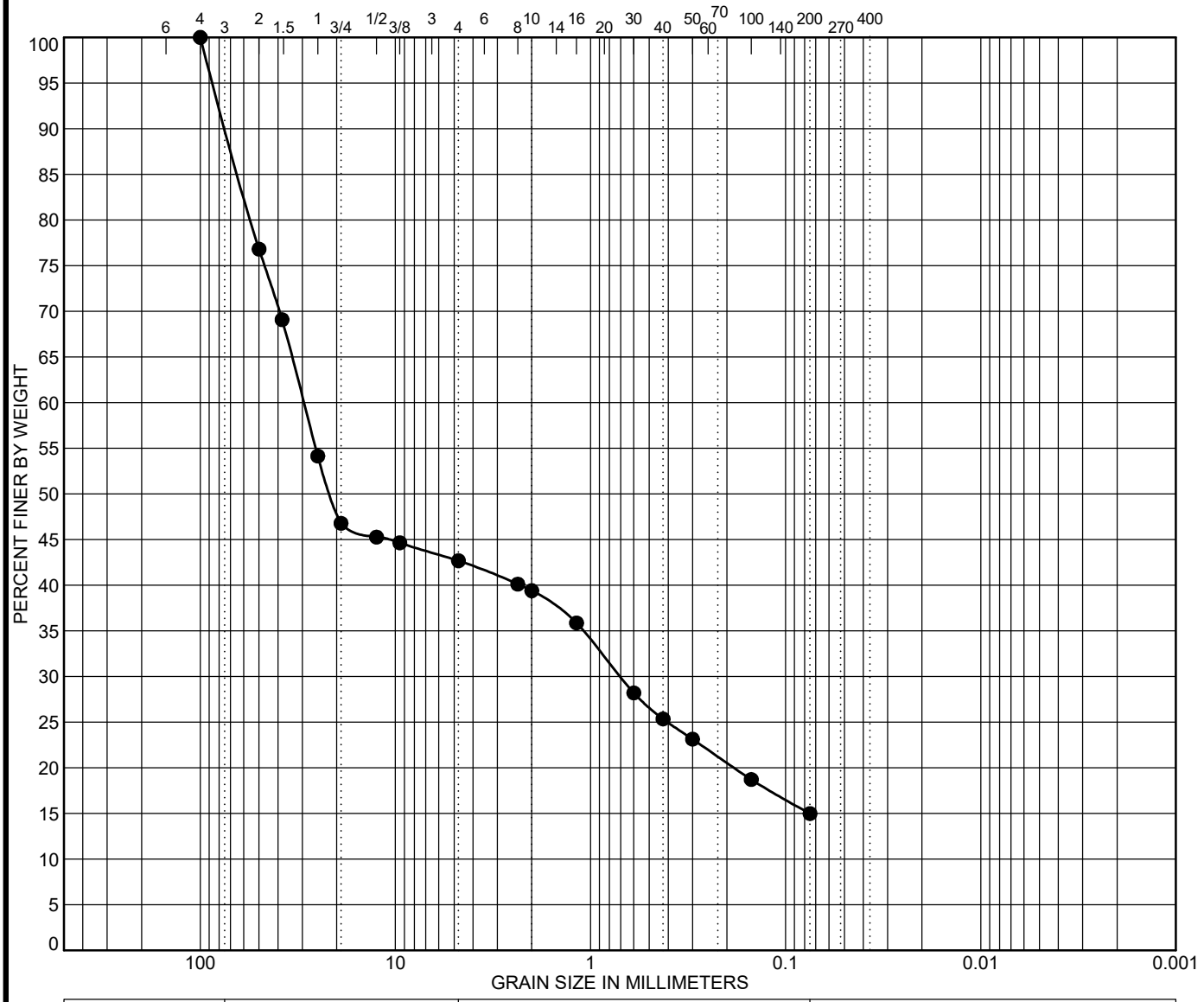
GRAIN SIZE DISTRIBUTION

Job Number: 11500.154 Date: January 2024

PLATE

B-1.2

LUMOS_GRAIN_SIZE_COS FY25 UNIT 1.GPJ US_LAB.GDT 1/17/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Date: 1/10/2024	LL	PL	PI	Cc	Cu
● **TP #06**	Classification					
Depth: 0.35	Brown Clayey GRAVEL with Sand (GC)	47	17	30		
Sample Location	Test Pit #6, 4" - 14"					
USCS	GC					
AASHTO						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **TP #06**								
Depth: 0.35	100	29.492	0.703		47.7	27.7	15.0	

Natural Moisture	13.2 %		**Direct Shear**		**Absorption %**	
R-Value	3		**Max Dry Density**		**Soundness**	
Expansion Index	13		**Specific Gravity**		**S.E.**	

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City of Sparks FY25 Unit 1

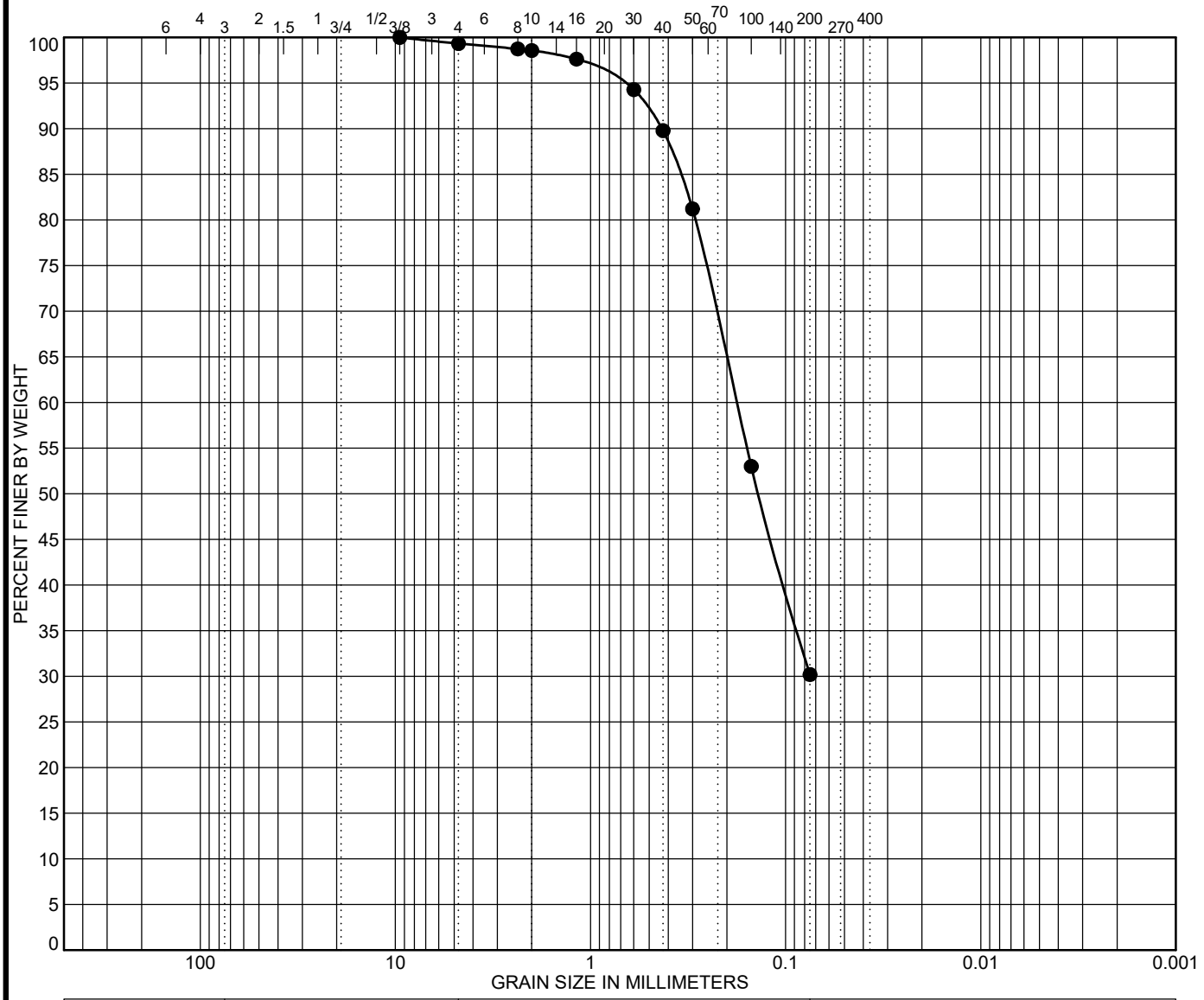
GRAIN SIZE DISTRIBUTION

Job Number: 11500.154 Date: January 2024

PLATE

B-1.3

LUMOS_GRAIN_SIZE_COS FY25 UNIT 1.GPJ US_LAB.GDT 1/17/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Date: 1/10/2024					
●	**TP #07**	Classification	LL	PL	PI	Cc	Cu
	Depth: 2	Brown Clayey SAND (SC)	31	19	12		
	Sample Location	Test Pit #7, 2'-3'					
	USCS	SC					
	AASHTO						

	Specimen Identification								
●	**TP #07**	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
	Depth: 2	9.5	0.178			0.7	69.1	30.2	

Natural Moisture	15.1 %		**Direct Shear**		**Absorption %**		
R-Value			**Max Dry Density**		**Soundness**		
Expansion Index			**Specific Gravity**		**S.E.**		

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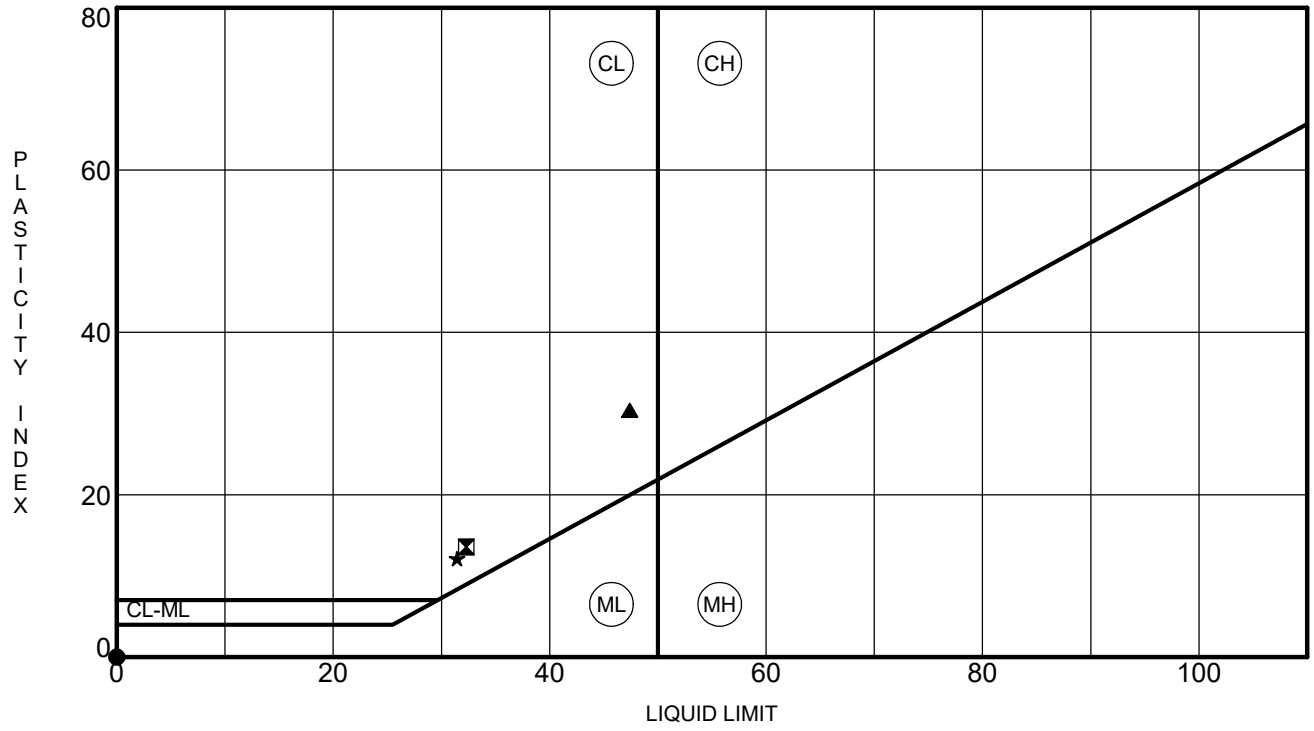
City of Sparks FY25 Unit 1

GRAIN SIZE DISTRIBUTION

Job Number: 11500.154 Date: January 2024

PLATE

B-1.4



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**Core #02**	**0.4**	**NP**	**NP**	**NP**	**32**	Light Brown Silty SAND (SM)
⊠	**TP #02**	**2.0**	**32**	**19**	**13**	**29**	Brown Clayey SAND (SC)
▲	**TP #06**	**0.4**	**47**	**17**	**30**	**15**	Brown Clayey GRAVEL with Sand (GC)
★	**TP #07**	**2.0**	**31**	**19**	**12**	**30**	Brown Clayey SAND (SC)

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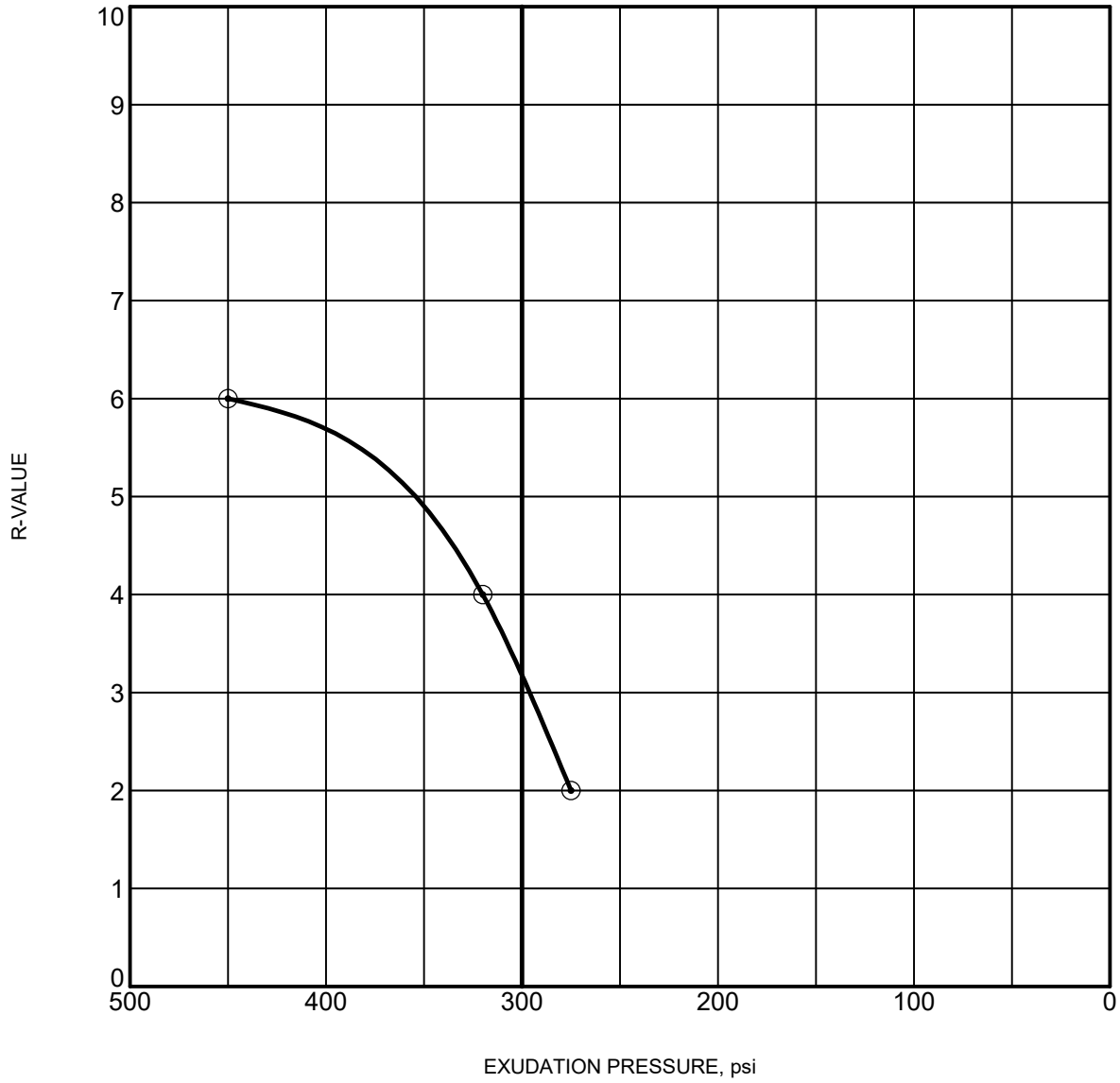
City of Sparks FY25 Unit 1

ATTERBERG LIMITS' RESULTS

Job Number: 11500.154 Date: January 2024

PLATE

B-2



Test Data

Specimen No.	Water Content (%)	Dry Density (pcf)	Expansion (psf)	Exudation (psi)	Test R-Value*
1	**16.2**	**114.3**	**0.0**	**275.0**	**2.0**
2	**15.8**	**117.3**	**0.0**	**320.0**	**4.0**
3	**14.8**	**118.5**	**13.0**	**450.0**	**6.0**

* Reported values have been corrected for sample height, where required.

Test Result

Specimen Identification		Classification	R-Value
TP #06	**0.4**	**Brown Clayey GRAVEL with Sand (GC)**	**3**

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City of Sparks FY25 Unit 1

RESISTANCE VALUE TEST

Job Number: 11500.154 Date: January 2024

PLATE

B-3

Western Environmental Testing Laboratory
Analytical Report

Lumos & Associates, Inc.
950 Sandhill Road, Suite 100
Reno, NV 89521
Attn: Mitch Burns
Phone: (775) 827-6111 **Fax:** (775) 827-6122

Date Printed: 1/16/2024
OrderID: *24010311*

PO\Project: *COS 24-25 Roads/ 11500.154/ Task 1/ MTB*

Customer Sample ID: TP-2 2ft-3ft
WETLAB Sample ID: 24010311-001

Collect Date/Time: 1/8/2024
Receive Date: 1/11/2024 16:10

Analyte	Method	Results	Units	DF	RL	Analyzed	LabID
Anions by Ion Chromatography							
Sulfate	EPA 300.0	150	mg/kg	10	15	1/15/2024	NV00925
Sample Preparation							
10:1 DI Water Extraction	WL 10.0	Complete		1		1/12/2024	NV00925

DF=Dilution Factor, RL = Reporting Limit (minimum 3X the MDL), ND = Not Detected <RL or <MDL (if listed)

SPARKS
475 E. Greg Street, Suite 119
Sparks, Nevada 89431
tel (775) 355-0202
fax (775) 355-0817
EPA LAB ID: NV00925 - ELAP No: 2523

ELKO
1084 Lamoille Hwy
Elko, Nevada 89801
tel (775) 777-9933
fax (775) 777-9933
EPA LAB ID: NV00926

LAS VEGAS
3230 Polaris Ave. Suite 4
Las Vegas, Nevada 89102
tel (702) 475-8899
fax (702) 622-2868
EPA LAB ID: NV00932

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City of Sparks FY25 Unit 1

SOIL SULFATE CONTENT

Job Number: 11500.154 Date: January 2024

PLATE
B-4

APPENDIX C

Pavement Calculations

LUMOS & ASSOCIATES

Job Number: 11500.154
Project: City of Sparks FY25 Unit 1 Rehab
Client: The City of Sparks
Description: Pavement Calculations
By: J. Macaluso

R-Value for CTB = 80 (Assumed)
R-Value for Native Soils = 3
TI (Local Road) = 5 (Light Traffic)

$GE=0.0032*(TI)*(100-R)$

$Gf_{(AC,Local)}=2.5$, $Gf_{(Cement\ Treated\ Soil)}=1.2$, $Gf_{(subgrade)}=1$
$t_{layer}=GE/Gf$

Local Road Pavement Section : Asphalt and Cement Treated Recycled Material

$GE_{AC}=0.0032*(5)*(100-80)=0.32'$
$t_{AC}=(0.32/2.5)*(12"/1')=1.54"$ **USE 4" Asphalt Concrete**
$GE_{AC}=(4"*2.5)/(12")=0.83'$

$GE_{CTB(Pulv.)}=0.0032*(5)*(100-3)=1.55'$
$t_{CTB(Pulv.)}=((1.55'-0.83')/1.2)*(12"/1')=7.2"$ **USE 8" Cement Treated Pulverized Material**

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City of Sparks FY25 Unit 1

PAVEMENT DESIGN

Job Number: 11500.154 Date: January 2024

PLATE

C-1

APPENDIX D

Cement Treated Pulverized Asphalt/Subgrade Mix Design

LUMOS & ASSOCIATES

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**2025 Street Rehab Unit 1**
		PROJECT NO.:	**11500.154**
		LOCATION:	Sparks, Nevada
		CONTRACTOR:	-
SAMPLED BY:	B. Sexton	DATE RECEIVED:	1/9/2024
WEATHER:	Lab Molded	TIME:	-
AIR TEMP:	-	MOLDED BY:	Z. Lim
DATE MOLDED:	1/15/23		

MATERIAL DESCRIPTION: **CTB Lab Blend - 2025 Streets - 35% AC, 15% Base, 40% SM, 10% SC**
6% Cement at 2% Over Optimum Moisture Content

SAMPLE LOCATION: **TP-1, TP-7, C-1, C-3, C-8**

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
R-21-24	4.01	12.63	7	1/22/23	4,646	370
R-22-24	4.01	12.63	7	1/22/23	4,681	370
R-23-24	4.01	12.63	7	1/22/23	4,379	345
			Average Compressive Strength 7-Day :			360

Minimum Specified Strength: 300 psi

REMARKS:

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results ☐

Respectively Submitted by:

M. Burns
Materials Engineering Manager

LUMOS & ASSOCIATES
Lumos & Associates
808 E. College Parkway, Suite 101
Carson City, NV 89703
775.883.7077
Fax: 775.883.7114
mburns@lumosinc.com

City of Sparks FY25 Unit 1
LABORATORY CEMENT TREATMENT MIX DESIGN
Job Number: 11500.154 Date: January 2024

PLATE D-1.1

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**2025 Street Rehab Unit 1**
		PROJECT NO.:	**11500.154**
		LOCATION:	Sparks, Nevada
		CONTRACTOR:	-
SAMPLED BY:	B. Sexton	DATE RECEIVED:	1/9/2024
WEATHER:	Lab Molded	TIME:	-
AIR TEMP:	-	MOLDED BY:	Z. Lim
DATE MOLDED:	1/15/23		

MATERIAL DESCRIPTION: **CTB Lab Blend - 2025 Streets - 35% AC, 15% Base, 40% SM, 10% SC**
4% Cement at 2% Over Optimum Moisture Content

SAMPLE LOCATION: **TP-1, TP-7, C-1, C-3, C-8**

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
R-18-24	4.01	12.63	7	1/22/23	3,150	250
R-19-24	4.01	12.63	7	1/22/23	3,057	240
R-20-24	4.01	12.63	7	1/22/23	3,563	280
			Average Compressive Strength 7-Day :			260

Minimum Specified Strength: 300 psi

REMARKS:

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results ☐

Respectively Submitted by:
M. Burns
Materials Engineering Manager

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City of Sparks FY25 Unit 1
LABORATORY CEMENT TREATMENT MIX DESIGN
Job Number: 11500.154 Date: January 2024

PLATE D-1.2

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**2025 Street Rehab Unit 1**
		PROJECT NO.:	**11500.154**
		LOCATION:	Sparks, Nevada
		CONTRACTOR:	-
SAMPLED BY:	B. Sexton	DATE RECEIVED:	1/9/2024
WEATHER:	Lab Molded	TIME:	-
AIR TEMP:	-	MOLDED BY:	Z. Lim
DATE MOLDED:	1/15/23		

MATERIAL DESCRIPTION: **CTB Lab Blend - 2025 Streets - 35% AC, 15% Base, 40% SM, 10% SC**
2% Cement at 2% Over Optimum Moisture Content

SAMPLE LOCATION: **TP-1, TP-7, C-1, C-3, C-8**

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
R-15-24	4.01	12.63	7	1/22/23	1,912	150
R-16-24	4.01	12.63	7	1/22/23	1,852	145
R-17-24	4.01	12.63	7	1/22/23	1,825	145
			Average Compressive Strength 7-Day :			145

Minimum Specified Strength: 300 psi

REMARKS:

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results ☐

Respectively Submitted by:
M. Burns
Materials Engineering Manager

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City of Sparks FY25 Unit 1
LABORATORY CEMENT TREATMENT MIX DESIGN
Job Number: 11500.154 Date: January 2024

PLATE D-1.3

GEOTECHNICAL INVESTIGATION REPORT

CITY OF SPARKS FY24 UNIT 2
SPARKS, NV

11500.154

FEBRUARY 2024

PREPARED FOR:
CITY OF SPARKS
DEPARTMENT OF PUBLIC WORKS
ATTN: BOB SCHRICKER
431 PRATER WAY
SPARKS, NV 89431

PREPARED BY:
LUMOS & ASSOCIATES, INC.
808 E. COLLEGE PARKWAY, SUITE 101
CARSON CITY, NV 89706
775.883.7077

TABLE OF CONTENTS

List of Plates

List of Appendices

1.0 INTRODUCTION

This report presents the results of Lumos & Associates, Inc.'s Geotechnical Analysis for the proposed roadway rehabilitation project located in Sparks, NV. A vicinity map is included as Plate 1 and a site map is included as Plate 2.

It is our understanding that the proposed project will consist of roadway reconstruction. Roadway reconstruction operations include asphalt pavement replacement and roadbed modification on the existing asphalt, aggregate base, and/or underlying soils. Plate 2 shows the project streets scheduled for reconstruction. We have assumed that final grades at the site will be approximately the same as the existing grades.

The purpose of our investigation was to characterize the site geology and soil conditions, describe the native soils and determine their engineering properties as they relate to the proposed construction. The investigation was also intended to identify possible adverse geologic, soil, and/or water table conditions. However, this study did not include an environmental assessment or an evaluation for soil and/or groundwater contamination at the site.

This report concludes with recommendations for pavement design. In addition, information such as logs of all explorations (Appendix A) and laboratory test data (Appendix B) are provided in this report.

2.0 GEOLOGIC SETTING

The proposed project is located in the northeastern section of the Truckee Meadows, a broad valley bounded on the west by the tall granitic and volcanic peaks of the Sierra Nevada Mountains (Carson Range), and on the east by the by the lower volcanic peaks of the Virginia and Pah Rah Range. Younger volcanic hills also bound the valley on the north and south. Faults bound the valley from the mountains as is typical of the Basin and Range province. Sediments have filled the valley from a number of tributaries and ancestral lakes during the Quaternary period (2 million years ago to present day). The dominant sediment source has been and continues to be, the Truckee River and its ancestral counterparts. Stream deposits were particularly voluminous after glacial periods. Since the end of the last glacial period, some 10,000 years ago, arid erosional forces combined with faulting have been the predominant processes to shape the region. These processes have created large alluvial fans that surround the valley floor of the Truckee Meadows.

In 2011 the near surface geology of the Reno/Sparks area was mapped by Ramelli, Henry, and Walker. Their mapping shows undivided younger and older Tahoe age fluvial deposits (Qrt) and Tioga age fluvial deposits (Qr2) underlie the site. Both of these deposits are Truckee River deposits which generally are comprised of poorly bedded gravels, sands, and fine grained soils. Plate 3 shows their mapping.

3.0 SITE CONDITIONS AND FIELD EXPLORATION

At the time of our investigation the project roadways had been previously paved with asphalt concrete. Where visible, the project streets generally had moderate alligator cracking, moderate surface wear, and moderate block cracking.

The current field investigation included a subsurface exploration. The location of the subsurface explorations were determined by using existing features at the site. Therefore, the approximate location of the subsurface explorations should be considered accurate only to the degree implied by the methods used.

Our subsurface investigation included two (2) test pits located within the project streets. Test pit explorations were excavated to a maximum depth of four and one half (4.5) feet below existing grade (b.e.g.). Additionally, three (3) core hole explorations were conducted within the existing project streets. Core hole explorations were dug to a maximum depth of two (2) feet. The locations of the exploratory excavations within the proposed site are shown on Plate 2. The subsurface soils were continuously logged and visually classified in the field by our Geotechnician in accordance with the Unified Soil Classification System (USCS). Representative soil samples were collected at each material change within the test pit and core hole locations. Soil samples were subsequently transported to our Reno geotechnical laboratory for testing and additional analysis.

The native soils encountered consisted generally of clayey sands (SC), silty sands (SM), and poorly graded gravels with clay (GP-GC). Aggregate base was only encountered in four of the five explorations. Table 1 presents the existing pavement sections within the project streets.

TABLE 1
THICKNESSES OF EXISTING PAVEMENT SECTIONS

Exploration	Asphalt (inches)	Direct Supporting Layer (inches)	Subgrade	Exploration	Asphalt (inches)	Direct Supporting Layer (inches)	Subgrade
Core #5	3	5 (Base)	SM & SC	Test Pit #3	5	7 (Base)	GP-GC
Core #6	4	4 (SM)	SM & SC	Test Pit #9	4.5	5 (Base)	GP-GC
Core #9	5	2 (Base)	SC & SM	-	-	-	-

4.0 FIELD AND LABORATORY TEST DATA

Laboratory tests performed on representative samples included sieve analysis (including fines), Atterberg limits, R-value, expansion index, and sulfate content. Much of this data is displayed on the "logs" of the subsurface explorations to facilitate correlation. Field descriptions presented on the logs have been modified, where appropriate, to reflect laboratory test results. The logs of the subsurface explorations are included in Appendix A of this report as Plates A-1 through A-5. A key to the logs, explaining the symbols and nomenclature, is included as Plate A-6.

Individual laboratory test results are presented in Appendix B as Plates B-1 through B-4. Laboratory testing was performed per ASTM standards, except when test procedures are briefly described and no ASTM standard is specifically referenced in the report. Atterberg limits were determined using the dry method of preparation.

4.1 Analytical Testing: Western Environmental Testing Laboratory (WET Lab) of Sparks, Nevada conducted the sulfate content laboratory testing. Test results are included (on WET Lab letterhead) in Appendix B on Plate B-4.

Laboratory prepared cement treated pulverized asphalt/base/subgrade compression specimens were compacted and tested. Specimens were comprised of thirty-five percent (35%) pulverized asphalt, thirty percent (30%) aggregate base, twenty-five percent (25%) silty sand, and ten percent (10%) clayey sand in order to simulate the existing pavement section. Specimen cement contents were 2%, 4%, and 6% by dry weight of the maximum dry density. Cement treated materials compression results are provided in Appendix D.

The soil samples obtained during this investigation will be held in our laboratory for 30 days from the date of this report. The samples may be retained longer at an additional cost to the client or obtained from this office upon request.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

The following recommendations are based upon the construction and our understanding and assumptions of the proposed improvements, as outlined in the introduction of this report, and based on our findings during the field exploration and laboratory testing phases of this project. If changes in the construction project are proposed, they should be presented to Lumos & Associates, Inc. Geotechnical Department, so that the recommendations provided herein can be reviewed and modified as necessary. As a minimum, final construction drawings should be submitted to the Lumos Geotechnical Department for review prior to actual construction and verification that our geotechnical design recommendations have been implemented.

5.2 General Site Grading

5.2.1 Clearing and Grubbing

Prior to placement of fill and/or the proposed improvements, the areas to receive fill and/or improvements shall be cleared and grubbed. Clearing and grubbing is not anticipated under the existing roadway. Clearing and grubbing may be required if improvements will be placed outside of the existing roadway. Where required, clearing and grubbing is anticipated to be as much as six (6) inches, or more, where thicker vegetation/roots are present.

Root- or organic-laden soils encountered during excavations, should be stockpiled in a designated area on site for later use in landscaping, or removed off site as directed by the owner. Excavated soils free from any organics, debris or otherwise unsuitable material and with particles no larger than four (4) inches in maximum dimension may be stockpiled and moisture conditioned for later use as compacted fill provided it meets the criteria for structural fill soils.

Exposed excavation surfaces to support any of the proposed improvements should be observed and approved by a Lumos representative. Upon re-compaction and prior to placing any fill, the re-compacted surface should be proof-rolled to identify any possible yielding surfaces. Proof-rolling should be conducted with a heavy rubber-tire loader with a fully loaded bucket, or a fully loaded water truck, and observed and approved by a Lumos representative.

5.2.2 Unsuitable Subgrade Mitigation

Unstable conditions due to yielding and/or pumping soils may be encountered on site. Additionally, the exposed soils may yield or pump under heavy equipment loads or where vibratory equipment draws up water. If yielding or pumping conditions are encountered, the soils should be scarified in place, allowed to dry as necessary and re-compacted, where applicable. Alternatively, the unsuitable or saturated soil should be removed, the exposed surface leveled and compacted/tamped as much as practical without causing further pumping, and covered (including the sides) with geotextile stabilizing fabric (Mirafi HP370 or other equivalent). The fabric should then be covered with at least twelve (12) inches of four (4) to six (6) inch **angular rock fill** with enough fines to fill the inter-rock pore spaces. Placement should be by end dumping. No traffic or other action should be allowed over the fabric, which may cause it to deflect/deform prior to cobble placement. Test sections should be used to determine the minimum thickness and/or number of layers required for stabilization.

Stabilization should be evaluated by proof-rolling standards commensurate with the equipment used, and approved by a Lumos representative. The placement of the stabilizing rock-fill may require additional over-excavation to maintain appropriate grading elevations. A filter fabric (Mirafi 180N or equal) should also be placed over the cobble rock fill to prevent piping of fines from covering soils into the stabilizing rock matrix.

5.2.3 Structural Fill

Properly compacted structural fill soils to be used on site should consist of non-expansive materials (LL less than 35 and/or a PI less than 12 and/or Expansion Index less than 20), have an R-Value of at least 30, should be free of contaminants, organics (less than two percent (2%)), rubble, or natural rock larger than three inches in largest dimension. All structural fill soils shall also be non-corrosive and have a water soluble sulfate content of less than 0.1%. Structural fill soils shall also meet the following gradation requirements (Table 1):

TABLE 2
STRUCTURAL FILL BACKFILL GRADATION

Sieve Size	% Passing
4"	100
¾"	70 - 100
#40	15 - 65
#200	5 – 35

Import structural fill soils should be tested and approved prior to being placed or delivered on-site (**seven day advanced notice**).

Prior to placement of structural fill, the site subgrade shall be scarified to a depth of twelve (12) inches, moisture conditioned to within two percent (2%) of optimum, and re-compacted to a minimum of **ninety percent (90%)** as determined by the ASTM D1557 Standard.

Structural fill should be placed only on compacted sub-grade or on compacted fill in loose lifts not exceeding eight (8) inches, moisture conditioned to within two percent (2%) of optimum, and compacted to at least **ninety percent (90%)** relative compaction as determined by the ASTM D1557 Standard. Lift thickness may be increased, at the discretion of the Geotechnical Engineer, provided the contractor can demonstrate that adequate compaction is being achieved.

Fill material should not be placed, spread or compacted while the ground is frozen or during unfavorable weather conditions. When site grading is interrupted by heavy rain or snow, grading or filling operations should not resume until a Lumos representative approves the moisture content and density conditions of the subgrade or previously placed fill.

Landscape areas should be cleared of all objectionable material. In cut areas, no other work is necessary except grading to proper elevation. In landscape areas, fill should be placed in loose lifts not exceeding eight inches and compacted to at least **ninety percent (90%)** relative compaction to prevent erosion.

Water should not be allowed to pond on pavements or adjacent to structures, and measures should be taken to reduce surface water infiltration into the subgrade soils. A representative of Lumos should be present during site grading operations to ensure any unforeseen or concealed conditions within the site are identified and properly mitigated, and to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction and stability of the subgrade soils. The soils engineer may reject any material that does not meet engineering characteristics, compaction, and stability requirements. Further, recommendations of this report are based upon the assumption that earthwork construction will conform to recommendations set forth in this section of the report.

6.0 PAVEMENT DESIGN

6.1 Pulverization, Cement Treatment, and Asphalt Concrete

Lumos recommends pulverizing the existing asphalt, aggregate base, and/or subgrade soils to a depth of ten (10) inches. The pavement structural section was determined for the asphalt concrete utilizing a resistance value (R-Value) of 14 (Native Poorly Graded Gravel with Clay and Sand) and an R-Value of 80 for the cement treated recycled aggregate base. For this project, we have assumed a Traffic Index (TI) value of 5 due to the anticipated low traffic volume. Refer to Table 3 for the recommended asphalt pavement section. The pulverized material shall meet the gradation requirements of Type 1 Recycled Aggregate Base. The pulverized material shall be regraded to accommodate four (4) inches of asphalt. The remaining six (6) inches of pulverized material shall be cement treated. The regraded pulverized material shall be moisture conditioned to at least two percent (2%) over optimum, four and one-half percent (4.5%) cement added by dry weight of aggregate, and compacted to a minimum of **ninety-five percent (95%)** relative density of the ASTM D1557 standard. The compacted cement treated pulverized material shall be sealed with a coat of CSS applied at a rate of between 0.15 gallons to 0.25 gallon per square-yard within twenty-four (24) hours of compaction. The cement treated pulverized material shall be kept moist until the cure seal is placed. Following placement of the cure the prepared material shall be allowed to cure for a minimum of seven (7) days and reach a compressive strength of at least three-hundred pounds per square inch (300 psi) prior to paving. Immediately prior to paving, the cement treated pulverized materials shall be "microcracked", utilizing a vibratory roller. Microcracking shall be completed prior to paving and to the satisfaction of the Geotechnical Engineer. See Appendix C and D for the Pavement Calculations and Cement Treated Specimen Compression Test Data.

TABLE 3
PULVERIZATION REQUIREMENTS AND PAVEMENT STRUCTURAL SECTION

TRAFFIC INDEX	PULVERIZATION DEPTH	CEMENT TREATED RECYCLED BASE THICKNESS	ASPHALT THICKNESS
5	10"	6"	4"

We recommend a Type III, PG64-28NV, 50 blow Marshall mix targeting three percent (3%) air voids. The asphalt concrete shall be compacted to between ninety-three percent (93%) and ninety-eight percent (98%) of the theoretical maximum ("Rice") specific gravity.

7.0 CORROSION AND CHEMICAL ATTACK

Tested soils have a mild sulfate content of 23 parts per million. However, Type II cement (meeting ASTM C150) is recommended for all concrete and cement in direct contact with on-site soil.

All exterior concrete should have between four and one half and seven and one-half percent (4.5%-7.5%) entrained air, a maximum water-cement ratio of 0.45 and comply with all other ACI recommendations for concrete placed in areas subject to freezing. A minimum compressive strength of 4,000 psi is recommended for all external concrete. All concrete shall be placed pursuant to ACI recommendations.

8.0 MOISTURE PROTECTION, EROSION AND DRAINAGE

The finish surfaces around all structures should slope away from the foundations and toward appropriate drop inlets or other surface drainage devices. It is recommended that within ten feet of any structure a minimum slope of five percent (5%) be used for soil subgrade and a minimum of one percent (1%) be used for pavement. These grades should be maintained for the life of the structures.

9.0 CONSTRUCTION SPECIFICATIONS

All work shall be governed by the latest adopted revision of the Standard Specifications and Standard Details for Public Works Construction, as distributed by The City of Sparks, except as modified herein.

10.0 LIMITATIONS

This report has been prepared in accordance with the currently accepted engineering practices in Northern Nevada and Northern California. The analysis and recommendations in this report are based upon exploration performed at the locations shown on the site plan, the proposed improvements as described in the Introduction section of this report and upon the property in its condition as of the date of this report. Lumos makes no guarantee as to the continuity of conditions as subsurface variations may occur between or beyond exploration points and over time. Any subsurface variations encountered during construction should be immediately reported to Lumos so that, if necessary, Lumos' recommendations may be modified.

This report has been prepared for and provided directly to The City of Sparks ("The Client"), and any and all use of this report is expressly limited to the exclusive use of the Client. The Client is responsible for determining who, if anyone, shall be provided this report, including any designers and subcontractors whose work is related to this project. Should the Client decide to provide this report to any other individual or entity, Lumos shall not be held liable for any use by those individuals or entities to whom this report is provided. The Client agrees to indemnify, defend and hold harmless Lumos, its agents and employees from any claims resulting from unauthorized users.

If this report is utilized in the preparation of an Engineer's Estimate of Probable Construction Costs, then the preparer of the estimate acknowledges that the report recommendations are based on the subsurface conditions found at the specific locations investigated on site; that subsurface conditions may vary outside these locations; and that no guaranty or warranty, express or implied, is made that the conditions encountered are representative of the entire site. The preparer of the estimate agrees to indemnify, defend and hold harmless Lumos & Associates, its agents and employees from any and all claims, causes of action or liability arising from any claims resulting from the use of the report in the preparation of an Engineer's Cost Estimate.

This report is not intended for, nor should be utilized for, bidding purposes. If it is utilized for bidding purposes, Client acknowledges that the report recommendations are based on the subsurface conditions found at the specific locations investigated on site; that subsurface conditions may vary outside these locations; and that no guaranty or warranty, express or implied, is made that the conditions encountered are representative of the entire site. The Client agrees to indemnify, defend and hold harmless Lumos & Associates, Inc., its agents and employees from any and all claims, causes or action or liability arising from any claims resulting from the use of the report for bidding purposes.

As explained above, subsurface variations may exist and as such, beyond the express findings located in this report, no warranties express, or implied, are made by this report. No affirmation of fact, including but not limited to statements regarding suitability for use of performance shall be deemed to be a warranty or guaranty for any purpose.

Jeremy Macaluso, P.E.
Geotechnician
Lumos & Associates, Inc.

Mitch Burns, P.E., C.E.M.
Materials Engineering Manager
Lumos & Associates, Inc.

References

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Caltrans, Highway Design Manual, March 20, 2020, Topic 633 – Engineering Procedures for New Construction and Reconstruction

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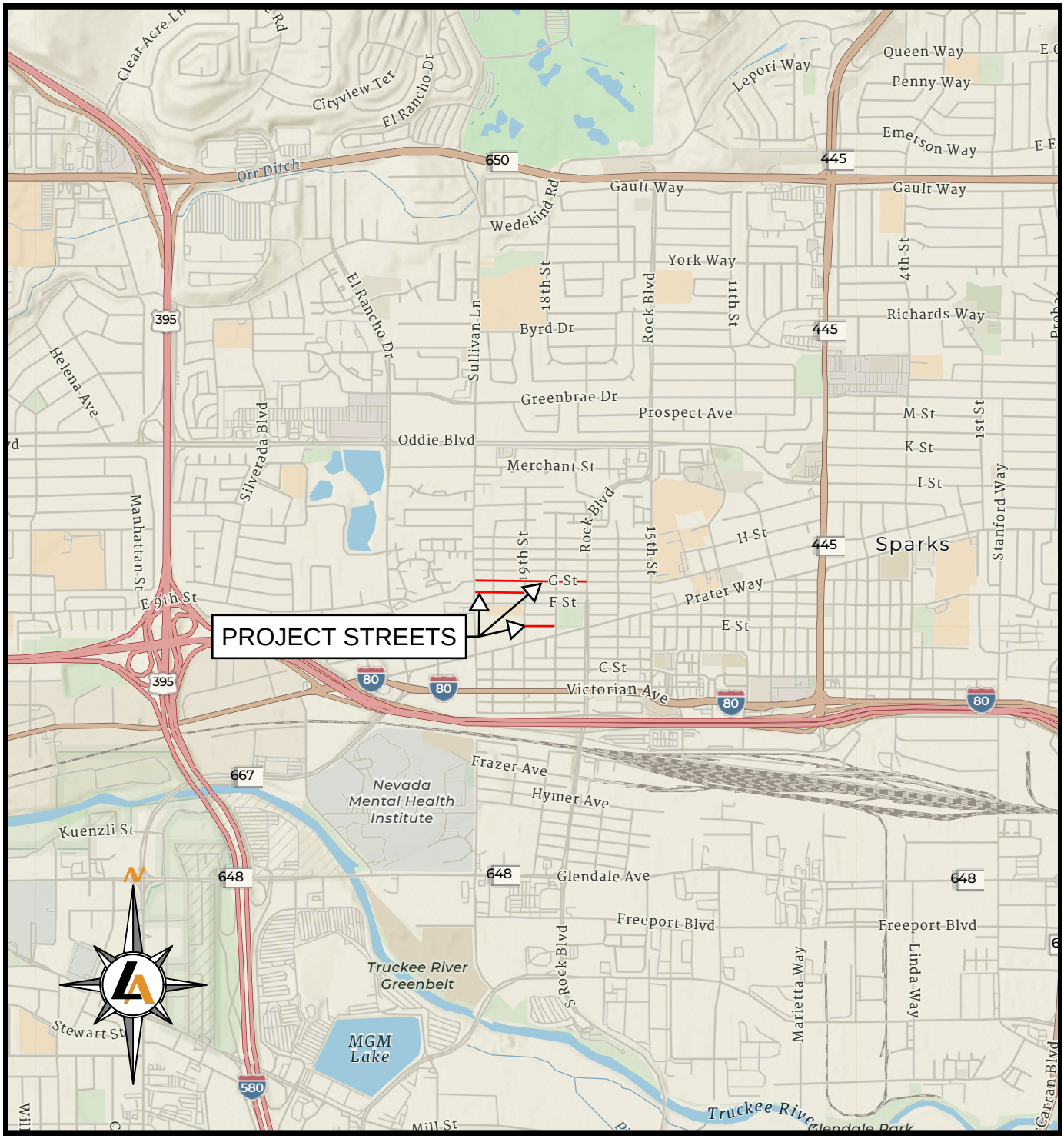

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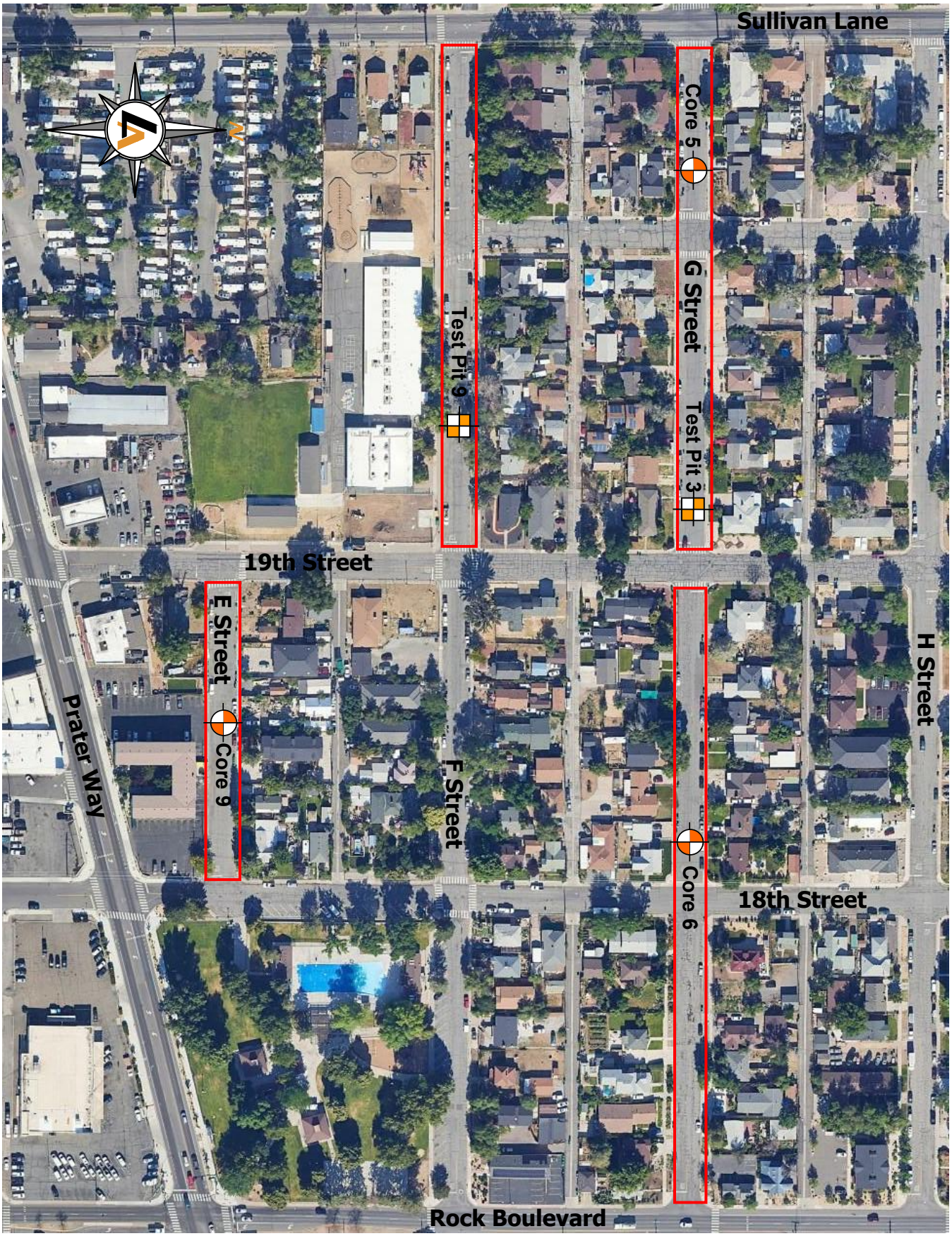
City of Sparks FY24 Unit 2

PROJECT VICINITY MAP

Job Number: 11500.154

Date: January 2024

PLATE 1



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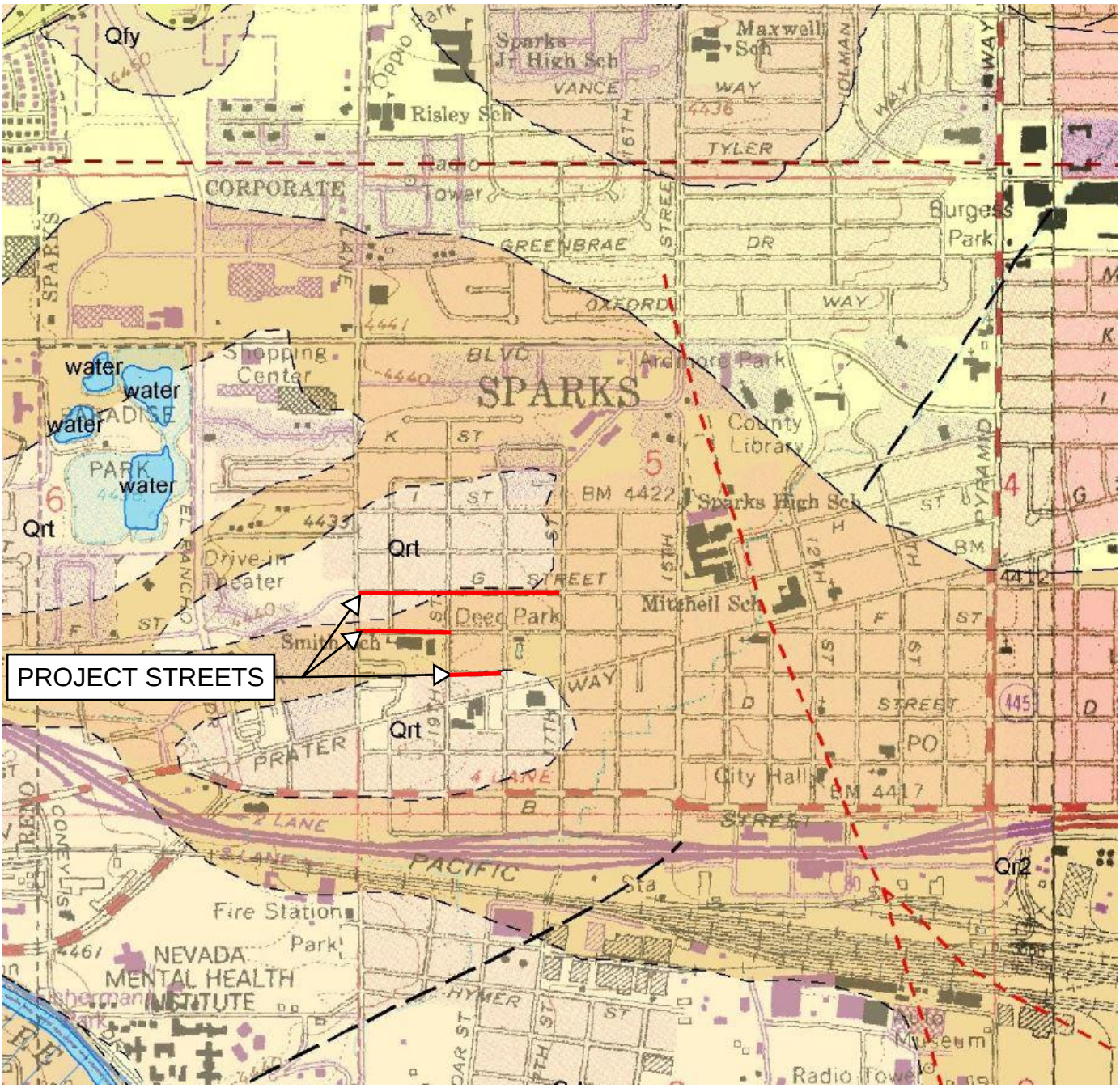
City of Sparks FY24 Unit 2

PROJECT SITE MAP

Job Number: 11500.154

Date: January 2024

PLATE 2



Qrt	**Undivided Younger and Older Tahoe Age Fluvial Deposits (Truckee River Deposits)**
Qr2	**Probable and Definite Tioga Age Fluvial Deposits (Truckee River Deposits)**

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City of Sparks FY24 Unit 2

PROJECT GEOLOGIC MAP

Job Number: 11500.154

Date: January 2024

PLATE 3

APPENDIX A

Field Exploration Logs

LUMOS & ASSOCIATES

CORE HOLE No. Core #5

Logged By: **J. Macaluso**
Date Logged: **1/8/2024**
Drill Type: **Core Drill**
Total Depth: **2 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			3" Asphalt Highly Deteriorated 0.3										
0.5		Z	**5" Material Similar to Aggregate Base** 0.7										
1.0		Z	**Dark Brown Silty SAND with Gravel (SM)** Moist, Medium Dense Estimated: 40% Coarse to Fine Gravel 40% Coarse to Fine Sand 20% Non-Plastic Silt 1.2										
1.5		Z	**Medium Brown Clayey SAND (SC)** Moist, Loose to Medium Dense	12.3			27	11	9.3	66.5	24.2		
2.0			2.0										

Core Hole terminated at 2 feet.
Core Holes Filled with Soil and Capped with Non-Shrink Grout.

CORE HOLE LOG FY 24 UNIT 2.GPJ US LAB.GDT 1/17/24

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City of Sparks FY24 Unit 2

LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE A-1

CORE HOLE No. Core #6

Logged By:	**J. Macaluso**	Total Depth:	**2 feet**
Date Logged:	**1/8/2024**	Water Depth:	**No groundwater encountered**
Drill Type:	**Core Drill**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Two Lifts Top 2" - Good Quality Bot 2" - Deteriorated										
			0.3										
0.5		Z	**Dark Brown Silty SAND with Gravel (SM)** Moist, Medium Dense Estimated: 20% Medium to Fine Gravel 60% Coarse to Fine Sand 20% Non-Plastic Silt										
			0.7										
		Z	**Medium Brown Silty SAND (SM)** Moist, Medium Dense Estimated: 10% Medium to Fine Gravel 70% Medium to Fine Sand 20% Non-Plastic Silt										
1.0			1.0										
			Medium Brown Clayey SAND (SC) Moist, Medium Dense Estimated: 10% Coarse to Fine Gravel 60% Coarse to Fine Sand 30% Moderately Plastic Clay										
1.5		Z											
			2.0										
2.0			Core Hole terminated at 2 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG FY 24 UNIT 2.GPJ US LAB.GDT 1/17/24

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City of Sparks FY24 Unit 2

LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154 Date: January 2024

PLATE

A-2

CORE HOLE No. Core #9

Logged By: **J. Hartley**
Date Logged: **1/9/2024**
Drill Type: **Core Drill**

Total Depth: **2 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			5" Asphalt Two Lifts Top 3" Good Quality Bottom 2" Deteriorated										
			0.4										
0.5		N	**2" Material Similar to Aggregate Base**										
			0.6										
		N	**Medium Brown Clayey SAND with Gravel (SC)** Moist, Medium Dense Estimated: 20% Medium to Fine Gravel, 50% Coarse to Fine Sand, 20% Clay										
			0.8										
1.0		N	**Light Brown Silty SAND (SM)** Moist, Medium Dense Estimated: 70% Coarse to Fine Sand 30% Silt										
1.5													
			2.0										
2.0			Core Hole terminated at 2 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG FY 24 UNIT 2.GPJ US LAB.GDT 1/17/24

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LOG OF EXPLORATORY CORE HOLE

Job Number: 11500.154
Date: January 2024

PLATE
A-3

TEST PIT No. TP #3

Logged By:	**B. Sexton**	Total Depth:	**4 feet**
Date Logged:	**1/8/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
		B	**5" Asphalt** Poor Condition											
			0.4											
		B	**7" Material Similar to Aggregate Base**											
			1.0											
1			**Brown Poorly Graded GRAVEL with Clay, Sand, and Cobble (GP-GC)** Moist, Medium Dense Estimated: 10% Unclassifiable Round Cobble up to 8" in Diameter with the Remaining Soil Matrix Consisting of 50% Coarse to Fine Gravel, 40% Coarse to Fine Sand, 10% Clay											
2		B												
3														
4			4.0											

Test pit terminated at 4 feet.
Test pit backfilled without compaction verification.

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City of Sparks FY24 Unit 2

LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE A-4

LUMOS_TP_FULL_PAGE WITH R-V AND SHEAR_FY 24 UNIT 2.GPJ US_LAB.GDT 1/17/24

TEST PIT No. TP #9

Logged By:	**B. Sexton**	Total Depth:	**4.5 feet**
Date Logged:	**1/9/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plastic Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	Expansion Index	R-Value	Direct Shear
		B	**4.5" Asphalt** Poor Condition											
			0.4											
		B	**5" Material Similar to Aggregate Base**											
			0.8											
1			**Brown Poorly Graded Gravel with Clay, Sand, and Cobble (GP-GC)** Estimated: 20% Unclassifiable Cobble up to 12" in Diameter											
2		B		6.2			36	20	50.9	35.3	10.1	0	14	
3														
4														
			4.5											

Test pit terminated at 4.5 feet.
Test pit backfilled without compaction verification.

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City of Sparks FY24 Unit 2

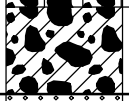
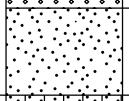
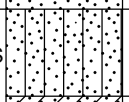
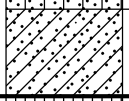
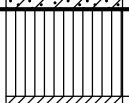
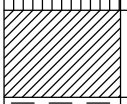
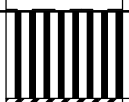
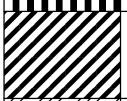
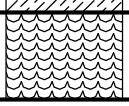
LOG OF EXPORATORY TEST PIT

Job Number: 11500.154 Date: January 2024

PLATE A-5

LUMOS_TP_FULL_PAGE WITH R-V AND SHEAR_FY 24 UNIT 2.GPJ US_LAB.GDT 1/17/24

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Other Tests

AN	ANALYTICAL TEST (pH, Soluble Sulfate, and Resistivity)
C	CONSOLIDATION TEST
DS	DIRECT SHEAR TEST
MD	MOISTURE DENSITY CURVE

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City of Sparks FY24 Unit 2

LEGEND

Job Number: 11500.154

Date: January 2024

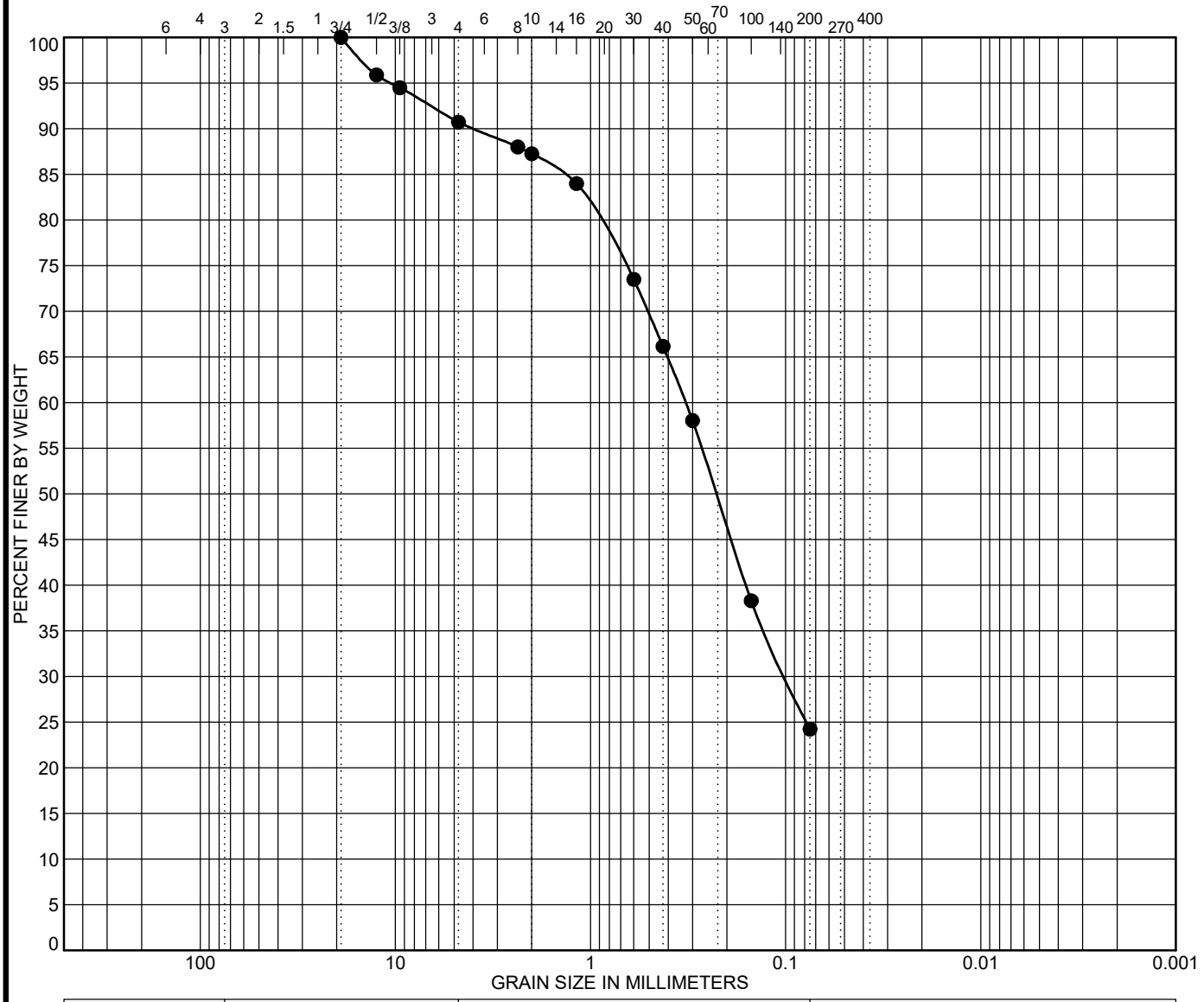
PLATE

A-6

APPENDIX B

Soils Laboratory Test Results

LUMOS & ASSOCIATES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Date: 1/10/2024						
Core #5	Classification	LL	PL	PI	Cc	Cu
Depth: 1.17	Medium Brown Clayey SAND (SC)	27	16	11		
Sample Location	Core #5, 14"-24"					
USCS	SC					
AASHTO						

Specimen Identification								
Core #5	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
Depth: 1.17	19	0.326	0.1		9.3	66.5	24.2	

Natural Moisture	12.3 %	**Direct Shear**		**Absorption %**		
R-Value		**Max Dry Density**		**Soundness**		
Expansion Index		**Specific Gravity**		**S.E.**		

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Carson City, NV 89703
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Fax: 775.883.7114
mburns@lumosinc.com

City of Sparks FY24 Unit 2

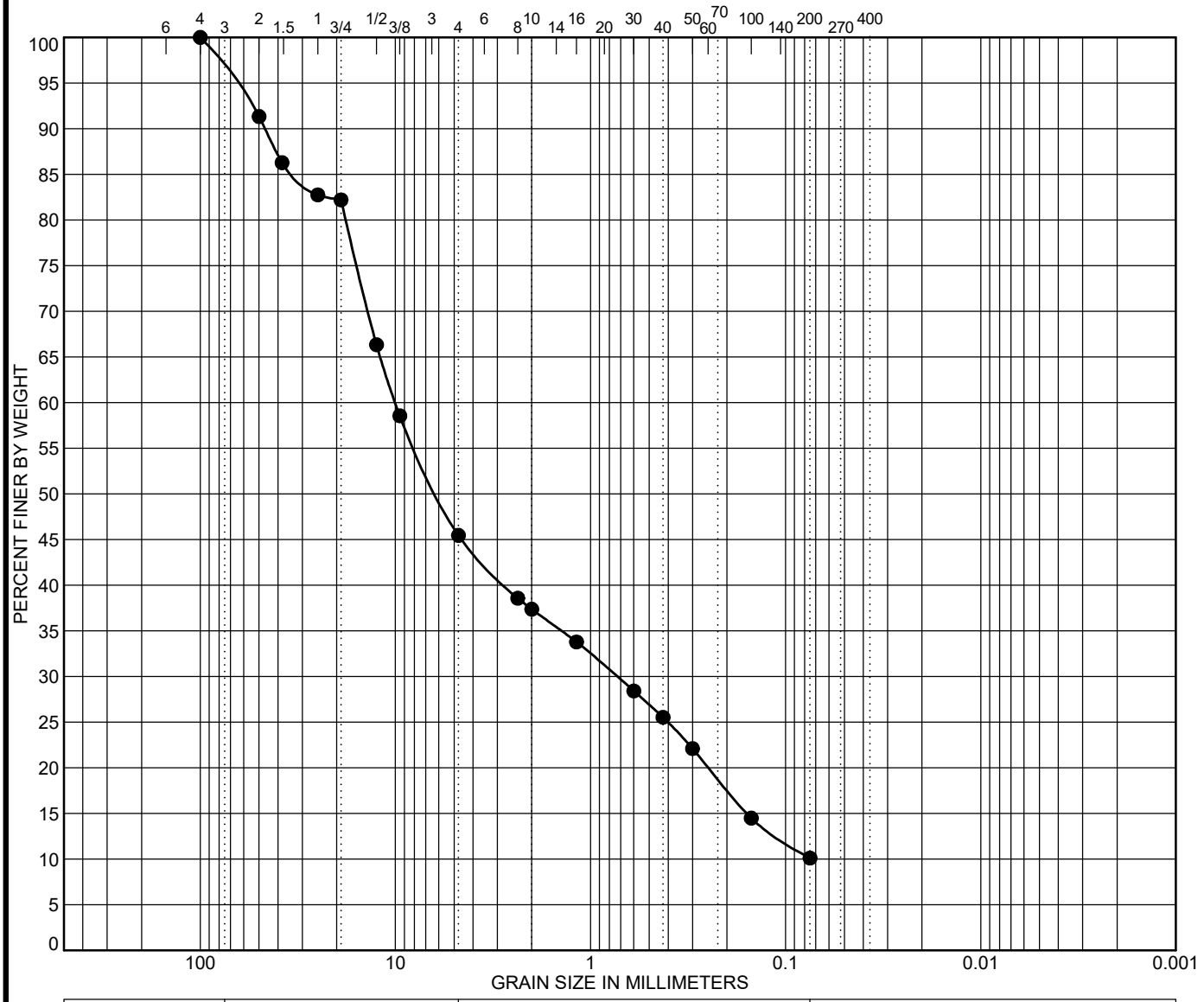
GRAIN SIZE DISTRIBUTION

Job Number: 11500.154 Date: January 2024

PLATE

B-1.1

LUMOS GRAIN SIZE FY 24 UNIT 2.GPJ US LAB.GDT 1/17/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Date: 1/10/2024					
●	**TP #9**	Classification	LL	PL	PI	Cc	Cu
	Depth: 2	Brown Poorly Graded GRAVEL with Clay and Sand	36	16	20	0.7	135.7
	Sample Location	Test Pit #9, 2'-3'					
	USCS	GP-GC					
	AASHTO						

	Specimen Identification								
●	**TP #9**	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
	Depth: 2	100	9.998	0.733		50.9	35.3	10.1	

Natural Moisture	6.2 %		**Direct Shear**		**Absorption %**		
R-Value	14		**Max Dry Density**		**Soundness**		
Expansion Index	0		**Specific Gravity**		**S.E.**		

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City of Sparks FY24 Unit 2

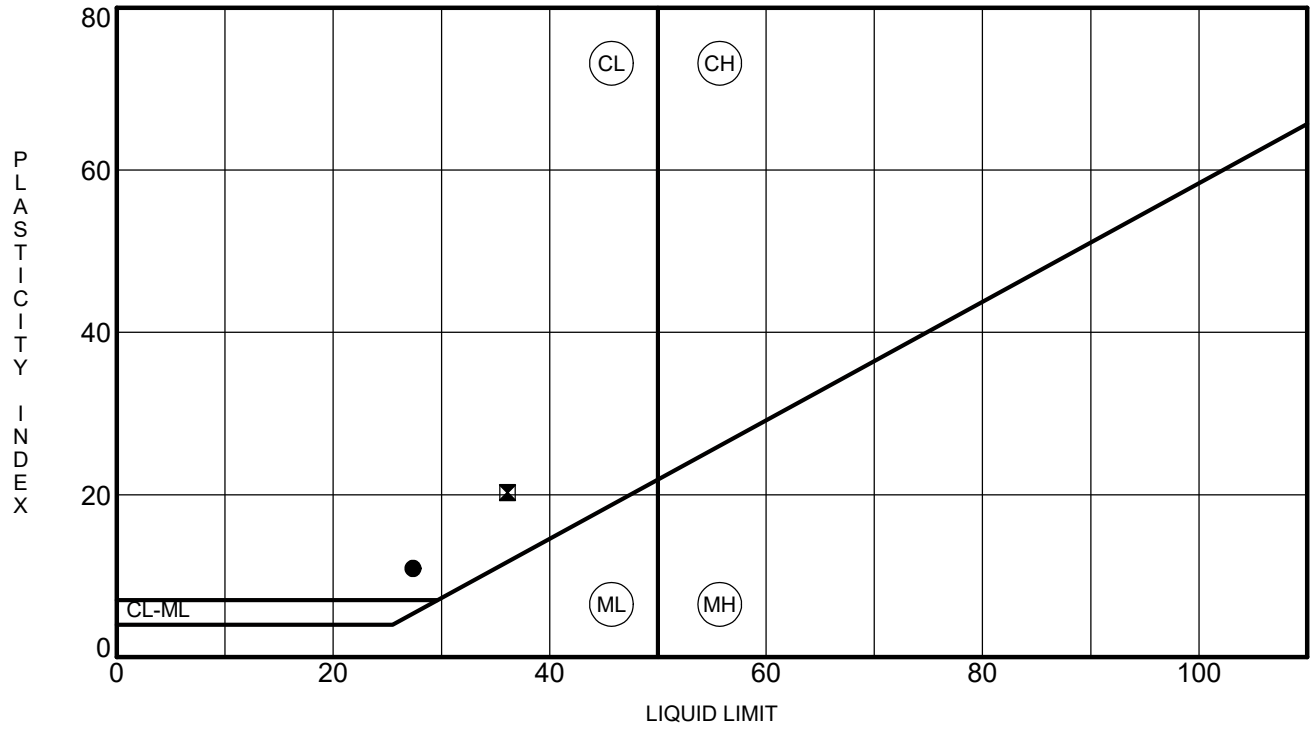
GRAIN SIZE DISTRIBUTION

Job Number: 11500.154 Date: January 2024

PLATE

B-1.2

LUMOS GRAIN SIZE FY 24 UNIT 2.GPJ US LAB.GDT 1/17/24



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**Core #5**	**1.2**	**27**	**16**	**11**	**24**	Medium Brown Clayey SAND (SC)
⧓	**TP #9**	**2.0**	**36**	**16**	**20**	**10**	Brown Poorly Graded GRAVEL with Clay and Sand

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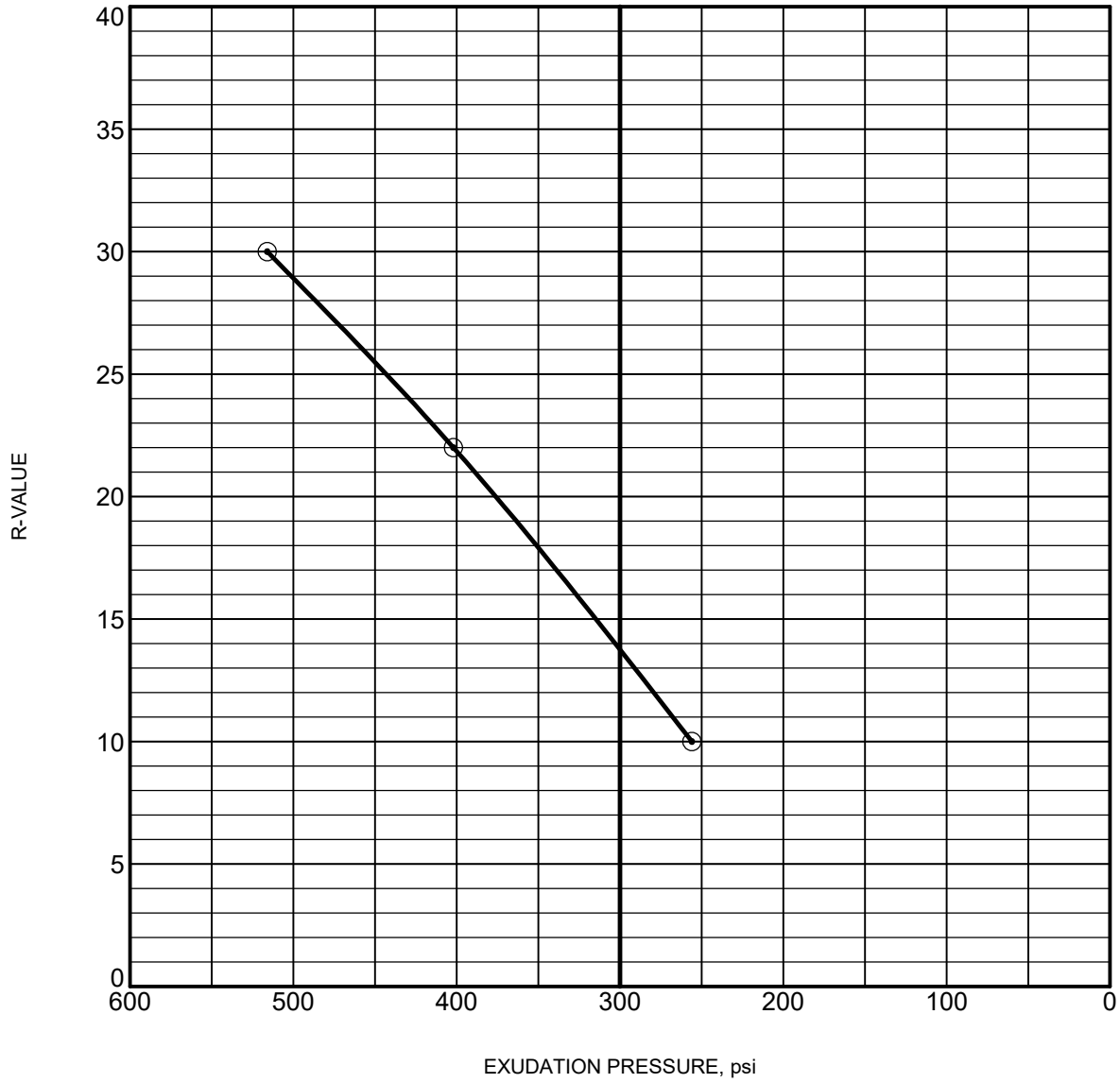
City of Sparks FY24 Unit 2

ATTERBERG LIMITS' RESULTS

Job Number: 11500.154 Date: January 2024

PLATE

B-2



Test Data

Specimen No.	Water Content (%)	Dry Density (pcf)	Expansion (psf)	Exudation (psi)	Test R-Value*
1	**11.1**	**126.0**	**0.0**	**256.0**	**10.0**
2	**10.0**	**127.6**	**0.0**	**402.0**	**22.0**
3	**11.7**	**129.6**	**0.0**	**516.0**	**30.0**

* Reported values have been corrected for sample height, where required.

Test Result

Specimen Identification		Classification	R-Value
TP #9	**2.0**	**Brown Poorly Graded GRAVEL with Clay and Sand**	**14**

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City of Sparks FY24 Unit 2

RESISTANCE VALUE TEST

Job Number: 11500.154 Date: January 2024

PLATE

B-3

Western Environmental Testing Laboratory
Analytical Report

Lumos & Associates, Inc.
950 Sandhill Road, Suite 100
Reno, NV 89521
Attn: Mitch Burns
Phone: (775) 827-6111 **Fax:** (775) 827-6122

Date Printed: 1/16/2024
OrderID: *24010311*
PO\Project: *COS 24-25 Roads/ 11500.154/ Task 1/ MTB*

Customer Sample ID: TP-9 2ft-3ft
WETLAB Sample ID: 24010311-002
Collect Date/Time: 1/9/2024
Receive Date: 1/11/2024 16:10

Analyte	Method	Results	Units	DF	RL	Analyzed	LabID
Anions by Ion Chromatography							
Sulfate	EPA 300.0	23	mg/kg	10	15	1/15/2024	NV00925
Sample Preparation							
10:1 DI Water Extraction	WL 10.0	Complete		1		1/12/2024	NV00925

DF=Dilution Factor, RL = Reporting Limit (minimum 3X the MDL), ND = Not Detected <RL or <MDL (if listed)

SPARKS
475 E. Greg Street, Suite 119
Sparks, Nevada 89431
tel (775) 355-0202
fax (775) 355-0817
EPA LAB ID: NV00925 - ELAP No: 2523

ELKO
1084 Lamoille Hwy
Elko, Nevada 89801
tel (775) 777-9933
fax (775) 777-9933
EPA LAB ID: NV00926

LAS VEGAS
3230 Polaris Ave. Suite 4
Las Vegas, Nevada 89102
tel (702) 475-8899
fax (702) 622-2868
EPA LAB ID: NV00932

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City of Sparks FY24 Unit 2

SOIL SULFATE CONTENT

Job Number: 11500.154 Date: January 2024

PLATE
B-4

APPENDIX C

Pavement Calculations

LUMOS & ASSOCIATES

Job Number: 11500.154
Project: City of Sparks FY24 Unit 2 Rehab
Client: The City of Sparks
Description: Pavement Calculations
By: J. Macaluso

R-Value for CTB = 80 (Assumed)
R-Value for Native Soils = 14
TI (Local Road) = 5 (Light Traffic)

$GE=0.0032*(TI)*(100-R)$

$Gf_{(AC,Local)}=2.5$, $Gf_{(Cement\ Treated\ Soil)}=1.2$, $Gf_{(subgrade)}=1$
$t_{layer}=GE/Gf$

Local Road Pavement Section : Asphalt and Cement Treated Recycled Material

$GE_{AC}=0.0032*(5)*(100-80)=0.32'$
$t_{AC}=(0.32/2.5)*(12"/1')=1.54"$ **USE 4" Asphalt Concrete**
$GE_{AC}=(4"*2.5)/(12")=0.83'$

$GE_{CTB(Pulv.)}=0.0032*(5)*(100-14)=1.4'$
$t_{CTB(Pulv.)}=((1.4'-0.83')/1.2)*(12"/1')=5.7"$ **USE 6" Cement Treated Pulverized Material**

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City of Sparks FY24 Unit 2

PAVEMENT DESIGN

Job Number: 11500.154 Date: January 2024

PLATE

C-1

APPENDIX D

Cement Treated Pulverized Asphalt/Subgrade Mix Design

LUMOS & ASSOCIATES

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**2024 Street Rehab Unit 2**
		PROJECT NO.:	**11500.154**
		LOCATION:	Sparks, Nevada
		CONTRACTOR:	-
SAMPLED BY:	B. Sexton	DATE RECEIVED:	1/9/2024
WEATHER:	Lab Molded	TIME:	-
AIR TEMP:	-	MOLDED BY:	Z. Lim
DATE MOLDED:	1/15/23		

MATERIAL DESCRIPTION: **CTB Lab Blend - 2024 Streets - 35% AC, 30% Base, 25% SM, 10% SC**
6% Cement at 2% Over Optimum Moisture Content

SAMPLE LOCATION: **TP-3, TP-9, C-5, C-9**

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
R-12-24	4.01	12.63	7	1/22/23	6,445	510
R-13-24	4.01	12.63	7	1/22/23	6,650	525
R-14-24	4.01	12.63	7	1/22/23	6,194	490
			Average Compressive Strength 7-Day :			510

Minimum Specified Strength: 300 psi

REMARKS:

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results ☐

Respectively Submitted by:
M. Burns
Materials Engineering Manager

LUMOS & ASSOCIATES
Lumos & Associates
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Carson City, NV 89703
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City of Sparks FY24 Unit 2
LABORATORY CEMENT TREATMENT MIX DESIGN
Job Number: 11500.154 Date: January 2024

PLATE D-1.1

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**2024 Street Rehab Unit 2**
		PROJECT NO.:	**11500.154**
		LOCATION:	Sparks, Nevada
		CONTRACTOR:	-
SAMPLED BY:	B. Sexton	DATE RECEIVED:	1/9/2024
WEATHER:	Lab Molded	TIME:	-
AIR TEMP:	-	MOLDED BY:	Z. Lim
DATE MOLDED:	1/15/23		

MATERIAL DESCRIPTION: **CTB Lab Blend - 2024 Streets - 35% AC, 30% Base, 25% SM, 10% SC**
4% Cement at 2% Over Optimum Moisture Content

SAMPLE LOCATION: **TP-3, TP-9, C-5, C-9**

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
R-9-24	4.01	12.63	7	1/22/23	4,300	340
R-10-24	4.01	12.63	7	1/22/23	4,408	350
R-11-24	4.01	12.63	7	1/22/23	4,099	325
			Average Compressive Strength 7-Day :			340

Minimum Specified Strength: 300 psi

REMARKS:

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results ☐

Respectively Submitted by:
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Materials Engineering Manager

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City of Sparks FY24 Unit 2
LABORATORY CEMENT TREATMENT MIX DESIGN
Job Number: 11500.154 Date: January 2024

PLATE D-1.2

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**2024 Street Rehab Unit 2**
		PROJECT NO.:	**11500.154**
		LOCATION:	Sparks, Nevada
		CONTRACTOR:	-
SAMPLED BY:	B. Sexton	DATE RECEIVED:	1/9/2024
WEATHER:	Lab Molded	TIME:	-
AIR TEMP:	-	MOLDED BY:	Z. Lim
DATE MOLDED:	1/15/23		

MATERIAL DESCRIPTION: **CTB Lab Blend - 2024 Streets - 35% AC, 30% Base, 25% SM, 10% SC**
2% Cement at 2% Over Optimum Moisture Content

SAMPLE LOCATION: **TP-3, TP-9, C-5, C-9**

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
R-6-24	4.01	12.63	7	1/22/23	2,366	185
R-7-24	4.01	12.63	7	1/22/23	2,157	170
R-8-24	4.01	12.63	7	1/22/23	2,346	185
			Average Compressive Strength 7-Day :			180

REMARKS:

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results ☐

Respectively Submitted by:
M. Burns
Materials Engineering Manager

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City of Sparks FY24 Unit 2
LABORATORY CEMENT TREATMENT MIX DESIGN
Job Number: 11500.154 Date: January 2024

PLATE D-1.3

GEOTECHNICAL INVESTIGATION REPORT

CITY OF SPARKS FY25 STREET REHABILITATION

SPARKS, NEVADA

JN: 11800.120

NOVEMBER, 2024

PREPARED FOR:
CITY OF SPARKS
431 PRATER WAY
SPARKS, NV 89431

LUMOS & ASSOCIATES

808 E. COLLEGE PKWY SUITE 101
CARSON CITY, NV 89706
775-883-7077

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LIST OF APPENDICES

1.0 INTRODUCTION

This report presents the results of Lumos & Associates, Inc.'s Geotechnical Analysis for the proposed City of Sparks FY25 street rehabilitation project located in Sparks, Nevada. A vicinity map is included as Plate 1 and a site map is included as Plate 2.

It is our understanding that the proposed project will consist of asphalt roadway reconstruction/rehabilitation. The project scope also includes the replacement of associated concrete flatwork. We have assumed that final grades at the site will be approximately the same as the existing grades. This investigation was divided into two components; a new pavement investigation along new FY 25 project streets and collection of additional soil information on previously investigated FY 25 streets. The new FY 25 project streets include I Street and H Street between 19th Street and Sullivan Lane and 20th Street between F Street and I Street. The previously investigated project streets where additional soil information was collected include F Street between 19th Street and 18th Street and 19th Street between H Street and G Street. The project limits described above are presented on the figure below.

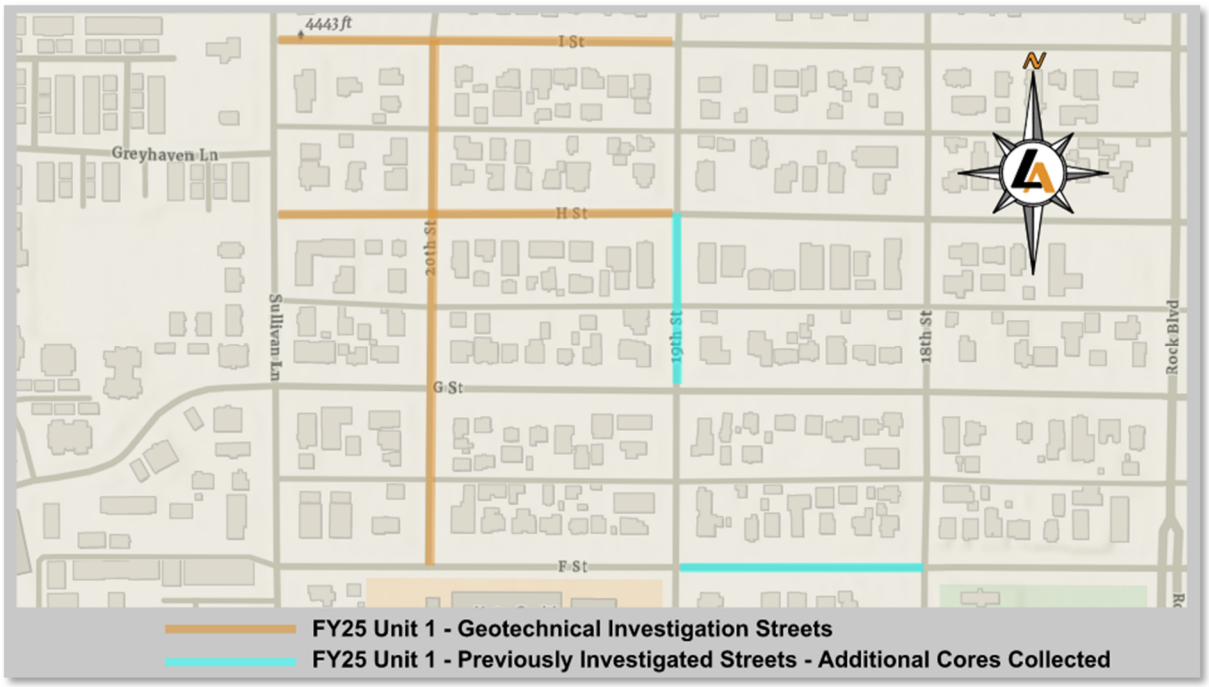

Figure 1: Project Limits Map

The purpose of our investigation was to characterize the site geology and soil conditions, describe the native soils and determine their engineering properties as they relate to the proposed construction. The investigation was also intended to identify possible adverse geologic, soil, and/or water table conditions. However, this study did not include an environmental assessment or an evaluation for soil and/or groundwater contamination at the site.

This report concludes with recommendations for site grading and asphalt pavement improvements. In addition, information such as logs of all explorations (Appendix A), laboratory test data (Appendix B), and pulverized cement treated asphalt/base/subgrade compression test reports (Appendix E) are provided in this report.

The recommendations contained herein have been prepared based on our understanding and assumptions of the proposed construction, as outlined above. Re-evaluation of the recommendations presented in this report should be conducted after the final site grading and construction plans are completed, if there are any variations from the assumptions described herein.

It is possible that subsurface discontinuities may exist between and beyond exploration points. Such discontinuities are beyond the evaluation of the Engineer at this time. No guarantee of the consistency of site geology and sub-surface conditions is implied or intended.

2.0 GEOLOGIC SETTING

Sparks is located in the western portion of the Great Basin geomorphic province. The Great Basin is characterized by internal drainage and large normal fault-bounded valleys (grabens) separated by high mountain ranges (horst). The Sierra Nevada province to the west is characterized by large granite masses that have been uplifted and tilted a few degrees toward the west. Overlying the granites are older oceanic meta-sedimentary rocks.

More specifically the project streets are located within the eastern half of the Truckee Meadows, a broad valley bounded on the west by the tall granite peaks of the Sierra Nevada Mountains, and on the east by the lower volcanic peaks of the Virginia Range. Younger volcanic rocks also bound the valley on the north and south. Faults separate the valley from the surrounding mountains as is typical of the Basin and Range province. Sediments filled the valley from a number of tributaries and ancestral lakes during the late Tertiary period. The dominant sediment source has been, and continues to be, the Truckee River and its ancestral counterparts. Stream deposits were particularly voluminous after glacial periods. Since the end of the last glacial period, some 10,000 years ago, arid erosional forces combined with faulting have been the predominant processes to shape the region. These processes have created large alluvial fans that surround the valley floor of the Truckee Meadows. The surface geology in this area has been mapped by Alan R. Ramelli, Et al. (2011). Their mapping shows undivided younger and older Tahoe age fluvial deposits (Qrt) and Tioga age fluvial deposits (Qr2) underlie the site. Both of these deposits are Truckee River deposits which generally are comprised of poorly bedded gravels, sands, and fine grained soils. Which is consistent with what was encountered during our field investigation. Their geologic mapping is presented on Plate 3.

3.0 SITE CONDITIONS AND FIELD EXPLORATION

At the time of our investigation the site was paved. The pavement is generally in poor condition, with various types of cracking and fatigue stresses observed. Severe alligator cracking and medium severity block cracking and potholes were encountered throughout the project streets. The image below, taken on 19th Street, illustrates such pavement stresses.

Image 1: General Pavement Condition (Condition Shown Similar Throughout Project Streets)

The current investigation included test pit and asphalt core hole subsurface explorations. Five test pits and two core holes were excavated along the new FY 25 project streets and four core holes were excavated along the previously investigated FY 25 project streets (See Plate 2). The location of the subsurface explorations were determined by using existing features at the site. Therefore, the approximate location of the subsurface explorations should be considered accurate only to the degree implied by the methods used.

The five test pits were excavated to an approximate depth of four (4) to four and one-half (4.5) feet below-existing-grade (b.e.g.) utilizing a Case 590 backhoe. The six core hole explorations were dug to a maximum depth of one and one-half (1.5) feet. The locations of the exploratory test pits and core holes within the site are shown on Plate 2. The subsurface soils were continuously logged and visually classified in the field by our Geotechnician in accordance with the Unified Soil Classification System (USCS). Representative soil samples were collected at each material change within the subsurface explorations and subsequently transported to our Carson City geotechnical laboratory for testing and additional analysis.

The native soils encountered consisted generally of clayey sands (SC), silty sands (SM), clayey gravel (GC) and poorly graded gravels (GP and GP-GM). Cobbles were encountered in four of the five test pit excavations. Generally, cobbles were encountered at depths below two (2) feet, excluding test pit #2 where a cobbles were encountered at ten (10) inches (b.e.g.). Table 1 presents the existing pavement sections encountered during our investigation.

TABLE 1: EXISTING PAVEMENT SECTIONS AND SUBGRADE DESCRIPTION

Exploration	Asphalt Thickness (in.)	Base Course Thickness (in.)	Subgrade Material
New FY 25 Project Streets (I St, H St, & 20th St)			
TP #1	4	5	Clayey Sand (SC) and Clayey Gravel with Sand and Cobble (GC)
TP #2	5	5	Poorly Graded Gravel with Sand and Cobble (GP)
TP #3	4	5	Clayey Sand (SC) and Poorly Graded Gravel with Silt, Sand, and Cobble (GP-GM)
TP #4	4	8	Clayey Sand with Gravel Fill (SC) and Silty Sand with Gravel (SM)
TP #5	5	6	Clayey Sand with Gravel Fill (SC) and Clayey Gravel with Sand and Cobble (GC)
Core #1	4.25	5.75 Struct. Fill	Clayey Sand with Gravel (SC)
Core #2	4	8	Silty Sand with Gravel (SM)
Previously Investigated FY 25 Streets (F St & 19th St)			
Core #3	4	0	Clayey Sand (SC)
Core #4	4	0	Clayey Sand with Gravel (SC)
Core #5	4	0	Silty Sand with Gravel Fill (SM)
Core #6	4	0	Silty Sand with Gravel Fill (SM)

4.0 FIELD AND LABORATORY TEST DATA

Field data was developed from samples taken and tests conducted during the field exploration and laboratory testing phases of this project. Representative soil samples were obtained for each material encountered in the exploratory excavations. All the samples were subsequently transported to our Carson City geotechnical laboratory for testing and analysis.

Laboratory tests performed on representative samples included sieve analysis (including fines), Atterberg limits, R-value, expansion index, and soil sulfate content. Much of this data is displayed on the "logs" of the subsurface explorations to facilitate correlation. Field descriptions presented on the logs have been modified, where appropriate, to reflect laboratory test results. The logs of the subsurface explorations are included in Appendix A of this report as Plates A-1 through A-11. A key to the logs is included as Plate A-12.

Individual laboratory test results are presented in Appendix B as Plates B-1 through B-4. Laboratory testing was performed per ASTM standards, except when test procedures are briefly described and no ASTM standard is specifically referenced in the report. Atterberg limits were determined using the dry method of preparation.

Analytical Testing: Western Environmental Testing Laboratory (WET Lab) conducted this testing. Analytical testing included determination of the site soil's sulfate content. One sample was delivered to WET Lab's Sparks office. Analytical test results are presented on Plate B-4.

The soil samples obtained during this investigation will be held in our laboratory for 30 days from the date of this report. The samples may be retained longer at an additional cost to the client or obtained from this office upon request.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

From a geotechnical viewpoint, the site is considered suitable for the proposed improvements when prepared as recommended herein.

The following recommendations are based upon the construction and our understanding and assumptions of the proposed improvements, as outlined in the introduction of this report, and based on our findings during the field exploration and laboratory testing phases of this project. If changes in the construction project are proposed, they should be presented to Lumos & Associates, Inc. Geotechnical Department, so that the recommendations provided herein can be reviewed and modified as necessary. As a minimum, final construction drawings should be submitted to the Lumos Geotechnical Department for review prior to actual construction and verification that our geotechnical design recommendations have been implemented. Demolition shall be completed as specified in Appendix D.

5.2 General Site Grading

5.2.1 Clearing and Grubbing

Prior to placement of fill and/or the proposed improvements, the areas to receive fill and/or improvements shall be cleared and grubbed. Clearing and grubbing is not anticipated under the existing roadway. Clearing and grubbing may be required if improvements will be placed outside of the existing roadway. Where required, clearing and grubbing is anticipated to be as much as six (6) inches, or more, where thicker vegetation/roots are present.

Root- or organic-laden soils encountered during excavations, should be stockpiled in a designated area on site for later use in landscaping, or removed off site as directed by the owner. Excavated soils free from any organics, debris or otherwise unsuitable material and with particles no larger than four (4) inches in maximum dimension may be stockpiled and moisture conditioned for later use as compacted fill provided it meets the criteria for structural fill soils.

Exposed excavation surfaces to support any of the proposed improvements should be observed and approved by a Lumos representative. Upon re-compaction and prior to placing any base, the re-compacted surface should be proof-rolled to identify any possible yielding surfaces. Proof-rolling should be conducted with a heavy rubber-tire loader with a fully loaded bucket, or a fully loaded water truck, and observed and approved by a Lumos representative.

5.2.2 Unsuitable Subgrade Mitigation

Unstable conditions due to yielding and/or pumping soils may be encountered on site. Additionally, the exposed soils may yield or pump under heavy equipment loads or where vibratory equipment draws up water. If yielding or pumping conditions are encountered, the soils should be scarified in place, allowed to dry as necessary and re-compacted, where applicable. Alternatively, the unsuitable or saturated soil should be removed, the exposed surface leveled and compacted/tamped as much as practical without causing further pumping, and covered (including the sides) with geotextile stabilizing fabric (Mirafi HP370 or other equivalent). The fabric should then be covered with at least twelve (12) inches of four (4) to six (6) inch **angular rock fill** with enough fines to fill the inter-rock pore spaces. Placement should be by end dumping. No traffic or other action should be allowed over the fabric, which may cause it to deflect/deform prior to cobble placement. Test sections should be used to determine the minimum thickness and/or number of layers required for stabilization.

Stabilization should be evaluated by proof-rolling standards commensurate with the equipment used, and approved by a Lumos representative. The placement of the stabilizing rock-fill may require additional over-excavation to maintain appropriate grading elevations. A filter fabric (Mirafi 180N or equal) should also be placed over the cobble rock fill to prevent piping of fines from covering soils into the stabilizing rock matrix.

5.2.3 Structural Fill

Properly compacted structural fill soils to be used on site should consist of non-expansive materials (LL less than 35 and/or a PI less than 12 and/or Expansion Index less than 20), have an R-Value of at least 30, should be free of contaminants, organics (less than two percent (2%)), rubble, or natural rock larger than 4 inches in largest dimension. All structural fill soils shall also be non-corrosive and have a water soluble sulfate content of less than 0.1%. Structural fill soils shall also meet the following gradation requirements (Table 2):

TABLE 2
STRUCTURAL FILL GRADATION

Sieve Size	% Passing
4"	100
3/4"	70 - 100
#40	15 - 65
#200	5 - 35

Import structural fill soils should be tested and approved prior to being placed or delivered on-site (**seven day advanced notice**).

Prior to placement of structural fill, the site subgrade shall be scarified to a depth of twelve (12) inches, moisture conditioned to within two percent (2%) of optimum, and re-compacted to a minimum of **ninety percent (90%)** as determined by the ASTM D1557 Standard.

Structural fill should be placed only on compacted sub-grade or on compacted fill in loose lifts not exceeding eight (8) inches, moisture conditioned to within two percent (2%) of optimum, and compacted to at least **ninety percent (90%)** relative compaction as determined by the ASTM D1557 Standard. Lift thickness may be increased, at the discretion of the Geotechnical Engineer, provided the contractor can demonstrate that adequate compaction is being achieved.

Fill material should not be placed, spread or compacted while the ground is frozen or during unfavorable weather conditions. When site grading is interrupted by heavy rain or snow, grading or filling operations should not resume until a Lumos representative approves the moisture content and density conditions of the subgrade or previously placed fill.

Landscape areas should be cleared of all objectionable material. In cut areas, no other work is necessary except grading to proper elevation. In landscape areas, fill should be placed in loose lifts not exceeding eight inches and compacted to at least **ninety percent (90%)** relative compaction to prevent erosion.

Water should not be allowed to pond on pavements or adjacent to structures, and measures should be taken to reduce surface water infiltration into the subgrade soils.

A representative of Lumos should be present during site grading operations to ensure any unforeseen or concealed conditions within the site are identified and properly mitigated, and to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction and is dependent upon compaction and stability of the subgrade soils. The soils engineer may reject any material that does not meet engineering characteristics, compaction, and stability requirements. Further recommendations of this report are based upon the assumption that earthwork construction will conform to recommendations set forth in this section of the report.

6.0 PAVEMENT DESIGN

6.1 Pulverization, Cement Treatment, and Asphalt Concrete

Lumos recommends pulverizing the existing asphalt, aggregate base, and/or subgrade soils to a depth of twelve (12) inches. The pavement structural section was determined for the asphalt concrete utilizing a resistance value (R-Value) of 7 (Native Clayey Sand with Gravel) and an R-Value of 80 for the cement treated recycled aggregate base. For this project, we have assumed a Traffic Index (TI) value of 5 due to the anticipated low traffic volume. Refer to Table 3 for the recommended asphalt pavement section. The pulverized material shall meet the gradation requirements of Type 1 Recycled Aggregate Base. The pulverized material shall be regraded to accommodate four (4) inches of asphalt. The remaining eight (8) inches of pulverized material shall be cement treated. The regraded pulverized material shall be moisture conditioned to at least two percent (2%) over optimum, five percent (5%) cement added by dry weight of aggregate, and compacted to a minimum of **ninety-five percent (95%)** relative density of the ASTM D1557 standard. The compacted cement treated pulverized material shall be sealed with a coat of CSS applied at a rate of between 0.15 gallons to 0.25 gallon per square-yard within twenty-four (24) hours of compaction. The cement treated pulverized material shall be kept moist until the cure seal is placed. Following placement of the cure the prepared material shall be allowed to cure for a minimum of seven (7) days or until a minimum compressive strength of at least three-hundred pounds per square inch (300 psi) is achieved (we anticipate a 3 day cure will reach the specified strength). The minimum compressive strength shall be achieved prior to paving. Immediately prior to paving, the cement treated pulverized materials shall be "microcracked", utilizing a vibratory roller. Microcracking shall be completed prior to paving and to the satisfaction of the Geotechnical Engineer. See Appendix C and E for the Pavement Calculations and Cement Treated Specimen Compression Test Data.

TABLE 3
PULVERIZATION REQUIREMENT AND PAVEMENT SECTION

Traffic Index	Pulverization Depth	Cement Treated Recycled Base Thickness	Asphalt Thickness
5	12″	8″	4″

***See Appendix C for the Pavement Calculations**

We recommend a Type III, PG64-28NV, 50 blow Marshall mix targeting three percent (3%) air voids. The asphalt concrete shall be compacted to between ninety-three percent (93%) and ninety-eight percent (98%) of the theoretical maximum ("Rice") specific gravity.

All mix designs for asphalt concrete should be submitted to the Geotechnical Engineer for review and approval a minimum of seven (7) days prior to paving.

7.0 CORROSION AND CHEMICAL ATTACK

The on-site soil was tested and has a non-detectable amount of sulfate when evaluated utilizing EPA method 300. However, Type II cement (meeting ASTM C150) is recommended for all concrete in direct contact with on-site soil.

All exterior concrete should have between four and one half and seven and one half percent (4.5%-7.5%) entrained air, a maximum water-cement ratio of 0.45 and comply with all other ACI recommendations for concrete placed in areas subject to freezing. A minimum compressive strength of 4,000 psi is recommended for all external concrete. All concrete shall be placed pursuant to ACI recommendations.

8.0 CONSTRUCTION SPECIFICATIONS

All work shall be governed by the latest adopted revision of the Standard Specifications and Standard Details for Public Works Construction, as distributed by The City of Sparks, except as modified herein.

9.0 LIMITATIONS

This report has been prepared in accordance with the currently accepted engineering practices in Northern Nevada. The analysis and recommendations in this report are based upon exploration performed at the locations shown on the site plan, the proposed improvements as described in the Introduction section of this report and upon the property in its condition as of the date of this report. Lumos makes no guarantee as to the continuity of conditions as subsurface variations may occur between or beyond exploration points and over time. Any subsurface variations encountered during construction should be immediately reported to Lumos so that, if necessary, Lumos' recommendations may be modified.

This report has been prepared for and provided directly to the City of Sparks ("The Client"), and any and all use of this report is expressly limited to the exclusive use of the Client. The Client is responsible for determining who, if anyone, shall be provided this report, including any designers and subcontractors whose work is related to this project. Should the Client decide to provide this report to any other individual or entity, Lumos shall not be held liable for any use by those individuals or entities to whom this report is provided. The Client agrees to indemnify, defend and hold harmless Lumos, its agents and employees from any claims resulting from unauthorized users.

If this report is utilized in the preparation of an Engineer's Estimate of Probable Construction Costs, then the preparer of the estimate acknowledges that the report recommendations are based on the subsurface conditions found at the specific locations investigated on site; that subsurface conditions may vary outside these locations; and that no guaranty or warranty, express or implied, is made that the conditions encountered are representative of the entire site. The preparer of the estimate agrees to indemnify, defend and hold harmless Lumos & Associates, its agents and employees from any and all claims, causes of action or liability arising from any claims resulting from the use of the report in the preparation of an Engineer's Cost Estimate.

This report is not intended for, nor should be utilized for, bidding purposes. If it is utilized for bidding purposes, Client acknowledges that the report recommendations are based on the subsurface conditions found at the specific locations investigated on site; that subsurface conditions may vary outside these locations; and that no guaranty or warranty, express or implied, is made that the conditions encountered are representative of the entire site. The Client agrees to indemnify, defend and hold harmless Lumos & Associates, its agents and employees from any and all claims, causes or action or liability arising from any claims resulting from the use of the report for bidding purposes.

As explained above, subsurface variations may exist and as such, beyond the express findings located in this report, no warranties express, or implied, are made by this report. No affirmation of fact, including but not limited to statements regarding suitability for use of performance shall be deemed to be a warranty or guaranty for any purpose.

Jeremy Macaluso, P.E.
Geotechnician
Lumos & Associates, Inc.

Mitch Burns, P.E.
Materials Engineering Manager
Lumos & Associates, Inc.

REFERENCES

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Caltrans, Highway Design Manual, March 20, 2020, Topic 633 – Engineering Procedures for New Construction and Reconstruction

Ramelli, Alan R., Henry, C.D., Walker, J.P., *with contributions by Bell, J.W., Cashman, P.H., dePolo, C.M., Garside, L.J., House, P.K., Trexler, J.H., and Widmer, M.C., 2011, Preliminary Revised Geologic Maps of the Reno Urban Areas, Nevada, Nevada Bureau of Mines and Geology, 1:24,000*

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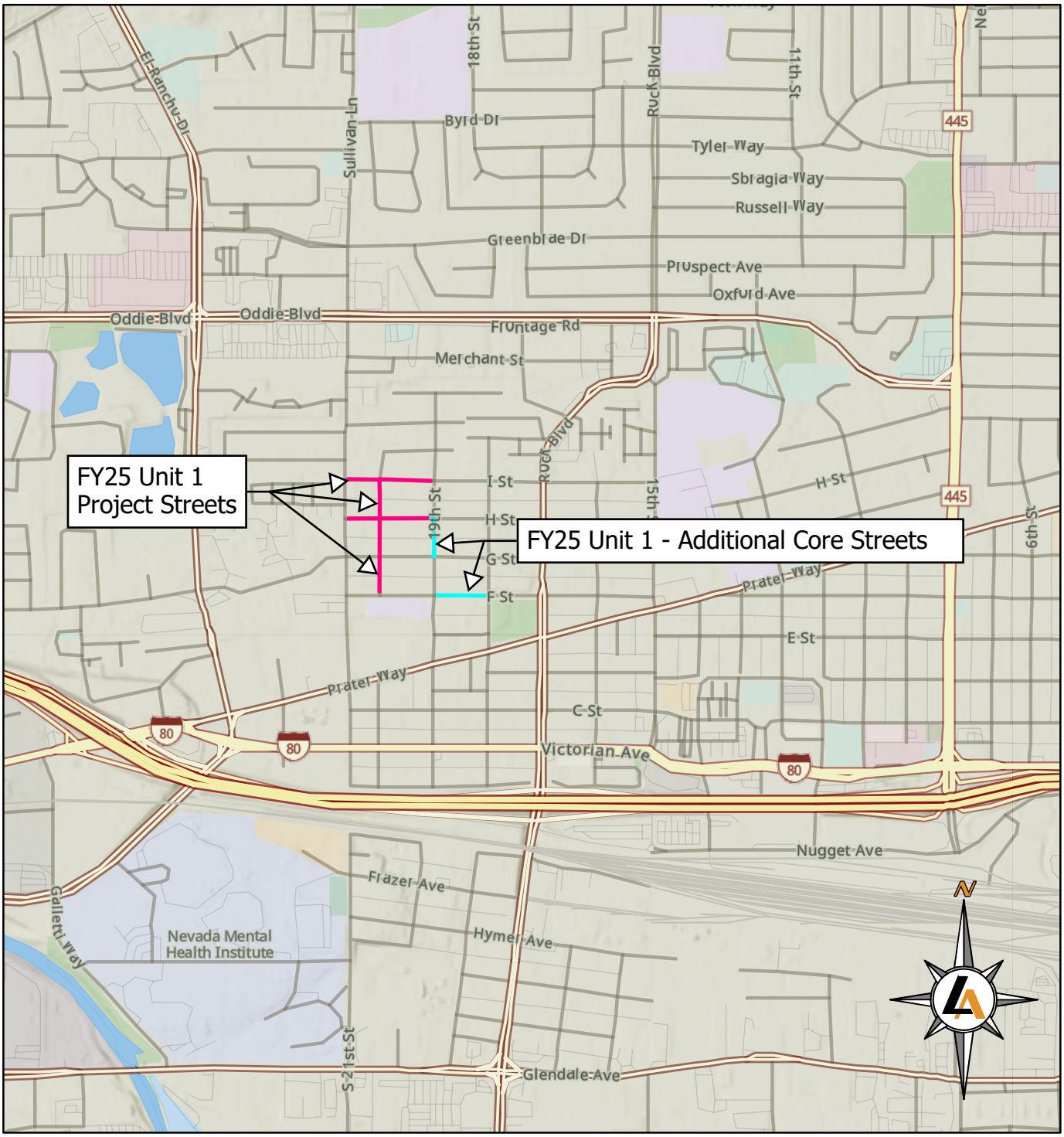

11/19/2024

1:18,980

0 0.13 0.25 0.5 mi

0 0.2 0.4 0.8 km

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FY25 Street Rehabilitation

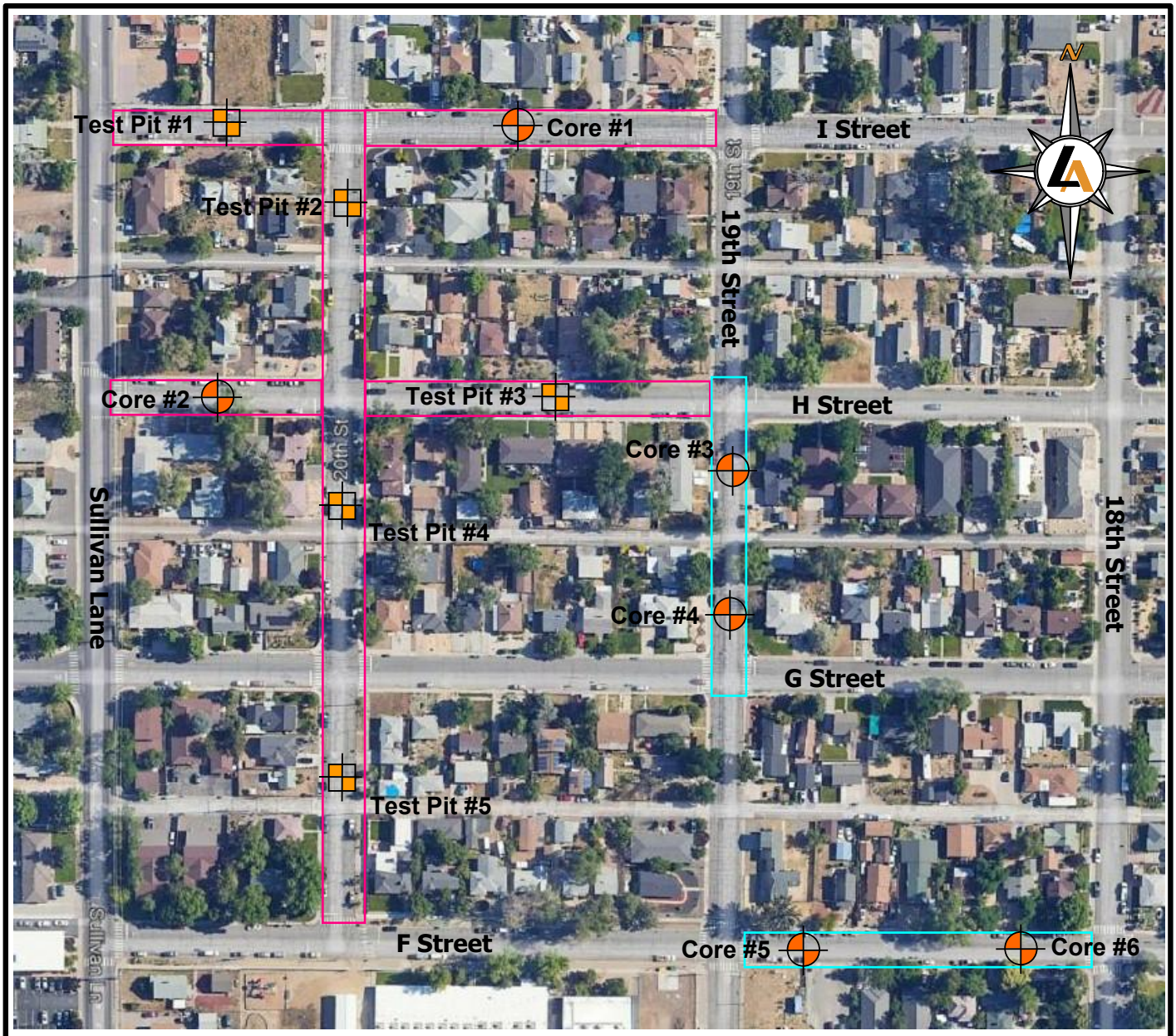
PROJECT VICINITY MAP

Job Number: 11800.120

Date: November 2024

PLATE

1



FY25 Unit 1 - Geotechnical Investigation Streets

FY25 Unit 1 - Previously Investigated Streets - Additional Cores Collected

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FY25 Street Rehabilitation

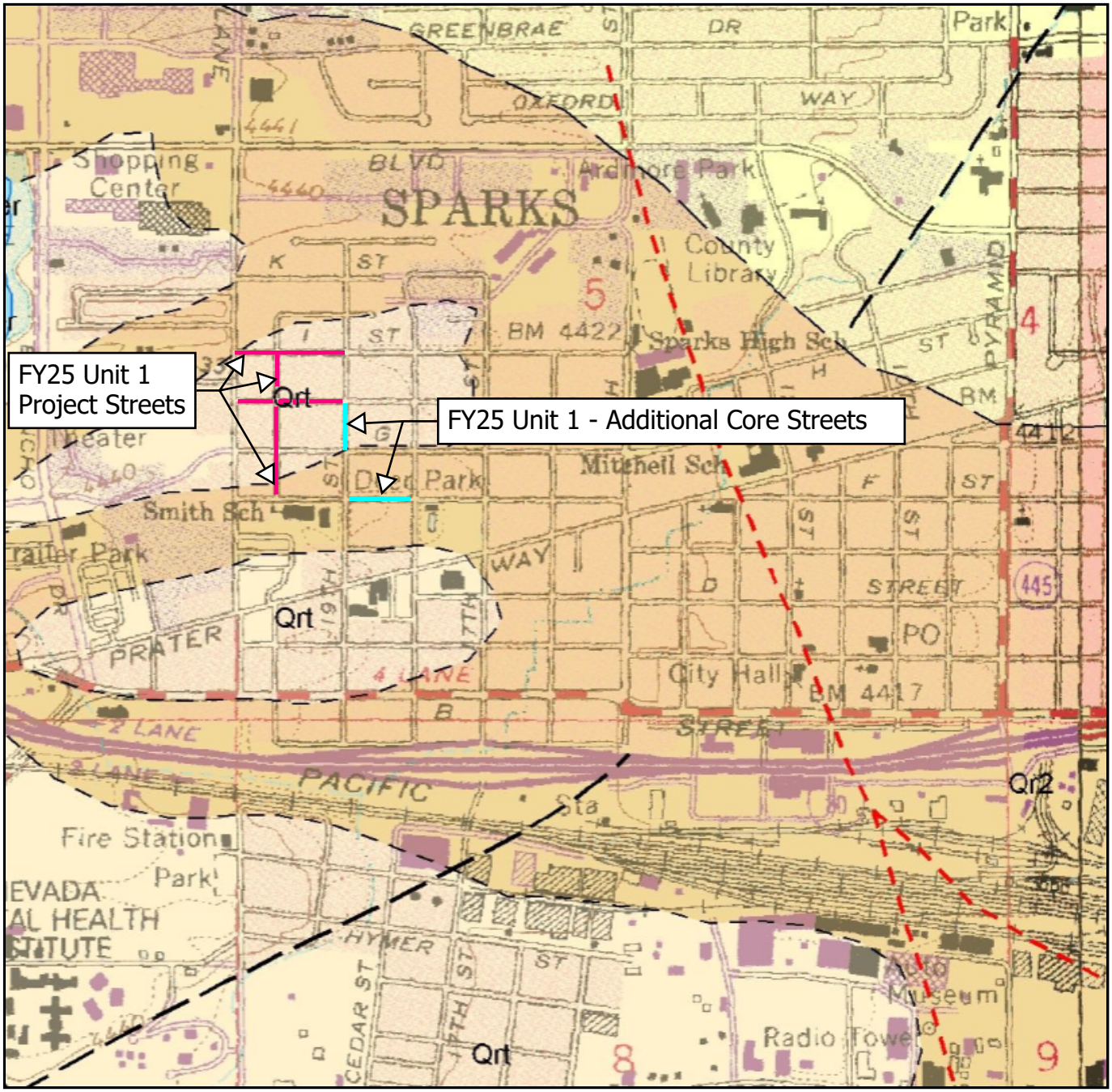
PROJECT SITE MAP

Job Number: 11800.120

Date: November 2024

PLATE

2



Truckee River Deposits

Qr3, Qr4, Qrt **Younger and older Tahoe age; Qrt undivided**

Qr2, Qrti **Probable and definite Tioga age**

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FY25 Street Rehabilitation

PROJECT GEOLOGIC MAP

Job Number: 11800.120

Date: November 2024

PLATE

3

APPENDIX A

FIELD EXPLORATION

LUMOS & ASSOCIATES

TEST PIT No. TP #1

Logged By:	**J. Macaluso**	Total Depth:	**4 feet**
Date Logged:	**11/6/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**ExistingNot Surveyed**

Percolation Test | Split Spoon | Ziplock Sample | Core Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
		B	**4" Asphalt** 0.3										
		B	**5" Aggregate Base** 0.8										
1		B	**Medium Brown Clayey SAND (SC)** Medium Dense, Moist	13.6			31	10	6.5	63.7	29.7	20	41
2		B	**Medium Brown Clayey GRAVEL with Sand & Cobble (GC)** Medium Dense, Moist Estimated: 10% Unclassifiable Subrounded Cobble up to 5" in Maximum Dimension with the Remaining Soil Matrix Consisting of 40% Coarse to Fine Gravel 40% Coarse to Fine Sand 20% Low to Medium Plastic Clay Percentage of Clay Decreases with Depth 4.0										
3													
4													

Test pit terminated at 4 feet.
Test Pit backfilled without compaction verification.

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FY25 Street Rehabilitation

LOG OF EXPLORATORY

Job Number: 11800.120 Date: November 2024

PLATE

A-1

TEST PIT No. TP #2

Logged By:	**J. Macaluso**	Total Depth:	**4.5 feet**
Date Logged:	**11/6/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**ExistingNot Surveyed**

Percolation Test | Split Spoon | Ziplock Sample | Core Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			5" Asphalt 0.4										
		B	**5" Aggregate Base** 0.8										
1			**Brown Poorly Graded GRAVEL with Sand & Cobble (GP)** Medium Dense, Moist Estimated: 20% Unclassifiable Subrounded Cobble up to 12" in Maximum Dimension										
2		B											
3													
4			4.5										

Test pit terminated at 4.5 feet.
Test Pit backfilled without compaction verification.

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FY25 Street Rehabilitation

LOG OF EXPLORATORY

Job Number: 11800.120 Date: November 2024

PLATE

A-2

TEST PIT No. TP #3

Logged By:	**J. Macaluso**	Total Depth:	**4.5 feet**
Date Logged:	**11/6/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**ExistingNot Surveyed**

Percolation Test | Split Spoon | Ziplock Sample | Core Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt 0.3										
			5" Aggregate Base 0.8										
1		B	**Medium Brown Clayey SAND (SC)** Medium Dense, Moist Estimated: Trace Gravel 80% Medium to Fine Sand 20% Low Plastic Clay Percentage of Clay Decreases with Depth										
2													
3			3.5										
4		B	**Brown Poorly Graded GRAVEL with Silt, Sand, & Cobble (GP-GM)** Medium Dense, Moist Estimated: 20% Unclassifiable Subrounded Cobble up to 10" in Maximum Dimension with the Remaining Soil Matrix Consisting of 50% Coarse to Fine Gravel 40% Coarse to Fine Sand 10% Silt 4.5										

Test pit terminated at 4.5 feet.
Test Pit backfilled without compaction verification.

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FY25 Street Rehabilitation

LOG OF EXPLORATORY

Job Number: 11800.120 Date: November 2024

PLATE A-3

TEST PIT No. TP #4

Logged By:	**J. Macaluso**	Total Depth:	**4.5 feet**
Date Logged:	**11/6/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**ExistingNot Surveyed**

Percolation Test | Split Spoon | Ziplock Sample | Core Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt 0.3										
		B	**8" Aggregate Base** 1.0										
1		B	**Brown Clayey SAND with Gravel (SC)** ***FILL*** Medium Dense, Moist, Mottled, Debris: Concrete & Metal 2.0	15.7			32	15	18.9	53.4	27.7	7	
2			**Brown Silty SAND with Gravel (SM)** Medium Dense, Moist Estimated: 20% Fine Gravel 60% Coarse to Fine Sand 20% Low Plastic Silt										
3													
4		B	4.5										

Test pit terminated at 4.5 feet.
Test Pit backfilled without compaction verification.

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FY25 Street Rehabilitation

LOG OF EXPLORATORY

Job Number: 11800.120 Date: November 2024

PLATE A-4

TEST PIT No. TP #5

Logged By:	**J. Macaluso**	Total Depth:	**4 feet**
Date Logged:	**11/6/2024**	Water Depth:	**No groundwater encountered**
Equipment Type:	**Case 590 Backhoe**	Ground Elev.:	**ExistingNot Surveyed**

Percolation Test | Split Spoon | Ziplock Sample | Core Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			5" Asphalt 0.4										
			6" Aggregate Base 0.9										
1		B	**Brown Clayey SAND with Gravel (SC)** ***FILL*** Medium Dense, Moist, Debris: Metal & Wood Estimated: 20% Coarse to Fine Gravel 50% Coarse to Fine Sand 30% Medium Plastic Clay 1.8										
2		B	**Brown Clayey GRAVEL with Sand & Cobble (GC)** Medium Dense, Moist Estimated: 20% Unclassifiable Subrounded Cobble up to 10" in Maximum Dimension with the Remaining Soil Matrix Consisting of 50% Coarse to Fine Gravel 30% Coarse to Fine Sand 20% Low to Medium Plastic Clay										
3													
4			4.0										

Test pit terminated at 4 feet.
Test Pit backfilled without compaction verification.

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FY25 Street Rehabilitation

LOG OF EXPLORATORY

Job Number: 11800.120 Date: November 2024

PLATE

A-5

CORE HOLE No. Core #1

Logged By: **J. Macaluso**
Date Logged: **11/7/2024**
Drill Type: **Core Drill/Hand Excavation**

Total Depth: **1.5 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4.25" Asphalt Top 2" Moderate Quality Bottom 2.25" Poor Quality										
			0.4										
0.5		B	**5.75" Dark Brown Structural Fill/Aggregate Base** Dense, Moist, 2" Minus Material Largely Unfractured Gravel Estimated: 40% Coarse to Fine Gravel 40% Coarse to Fine Sand 20% Non-Plastic Silt										
			0.8										
1.0		B	**Medium Brown Clayey SAND with Gravel (SC)** Medium Dense, Moist Estimated: 30% Coarse to Fine Gravel (2.5" Maximum - Subrounded) 50% Coarse to Fine Sand 20% Clay										
			1.5										
1.5			Core Hole terminated at 1.5 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG SPARKS FY25.GPJ US LAB.GDT 11/25/24

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FY25 Street Rehabilitation

LOG OF EXPLORATORY CORE HOLE

Job Number: 11800.120
Date: November 2024

PLATE
A-6

CORE HOLE No. Core #2

Logged By:	**J. Macaluso**	Total Depth:	**1.5 feet**
Date Logged:	**11/7/2024**	Water Depth:	**No groundwater encountered**
Drill Type:	**Core Drill/Hand Excavation**	Ground Elev.:	**Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Top 1" Slurry - Poor Quality Bottom 3" Asphalt - Poor Quality										
			0.3										
		B	**8" Aggregate Base** Dense, Moist										
0.5													
			1.0										
1.0		B	**Medium Brown Silty SAND with Gravel (SM)** Medium Dense, Moist Estimated: 30% Fine Gravel 50% Coarse to Fine Sand 20% Non-Plastic Silt										
			1.5										
1.5			Core Hole terminated at 1.5 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG SPARKS FY25.GPJ US_LAB.GDT 11/25/24

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FY25 Street Rehabilitation

LOG OF EXPLORATORY CORE HOLE

Job Number: 11800.120 Date: November 2024

PLATE

A-7

CORE HOLE No. Core #3

Logged By: **J. Macaluso**
Date Logged: **11/7/2024**
Drill Type: **Core Drill/Hand Excavation**

Total Depth: **1.5 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Top 2" Slurry - Poor Quality Bottom 2" Asphalt - Poor Quality										
			0.3										
0.5		B	**Medium Brown Clayey SAND (SC)** Medium Dense, Moist	11.0			33	15	13.6	58.5	27.9		
1.0													
1.5			1.5										

Core Hole terminated at 1.5 feet.
Core Holes Filled with Soil and Capped with Non-Shrink Grout.

CORE HOLE LOG SPARKS FY25.GPJ US_LAB.GDT 11/25/24

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FY25 Street Rehabilitation

LOG OF EXPLORATORY CORE HOLE

Job Number: 11800.120
Date: November 2024

PLATE
A-8

CORE HOLE No. Core #4

Logged By: **J. Macaluso**
Date Logged: **11/7/2024**
Drill Type: **Core Drill/Hand Excavation**

Total Depth: **1 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Top 2" Slurry - Good Quality Bottom 2" Asphalt - Poor Quality										
			0.3										
0.5		B	**Brown Clayey SAND with Gravel (SC)** Loose to Medium Dense, Moist Estimated: 30% Coarse to Fine Gravel 50% Coarse to Fine Sand 20% Medium Plastic Clay Fines Decrease with Depth Gravel Increases with Depth										
1.0			1.0										
			Core Hole terminated at 1 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG SPARKS FY25.GPJ US_LAB.GDT 11/25/24

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FY25 Street Rehabilitation

LOG OF EXPLORATORY CORE HOLE

Job Number: 11800.120
Date: November 2024

PLATE
A-9

CORE HOLE No. Core #5

Logged By: **J. Macaluso**
Date Logged: **11/7/2024**
Drill Type: **Core Drill/Hand Excavation**
Total Depth: **1 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Top 2" Slurry - Moderate Quality Bottom 2" Asphalt - Very Poor Quality										
			0.3										
0.5		B	**Brown Silty SAND with Gravel (SM)** ***FILL*** Medium Dense, Moist, Contains Clay Chunks	7.8			NP	NP	21.7	59.2	19.1		
			1.0										
1.0			Core Hole terminated at 1 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG SPARKS FY25.GPJ US_LAB.GDT 11/25/24

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FY25 Street Rehabilitation

LOG OF EXPLORATORY CORE HOLE

Job Number: 11800.120
Date: November 2024

PLATE
A-10

CORE HOLE No. Core #6

Logged By: **J. Macaluso**
Date Logged: **11/7/2024**
Drill Type: **Core Drill/Hand Excavation**

Total Depth: **1.5 feet**
Water Depth: **No groundwater encountered**
Ground Elev.: **Existing**

Percolation Test | Split Spoon | Ziplock Sample | California Sampler | Bulk Sample | Static Water Table

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Natural Moisture Content, %	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit, %	Plasticity Index, %	Gravel, % (3" - #4 Sieve)	Sand, % (#4 - #200 Sieve)	Fines, % (< #200 Sieve)	R-Value	Expansion Index
			4" Asphalt Top 2" Moderate Quality Bottom 2" Very Poor Quality										
			0.3										
0.5		B	**Brown Silty SAND with Gravel (SM)** ***FILL*** Medium Dense, Moist, Contains Clay Chunks Estimated: 20% Coarse to Fine Gravel - 2" Maximum 60% Coarse to Fine Sand 20% Fines										
1.0													
			1.5										
1.5			Core Hole terminated at 1.5 feet. Core Holes Filled with Soil and Capped with Non-Shrink Grout.										

CORE HOLE LOG SPARKS FY25.GPJ US_LAB.GDT 11/25/24

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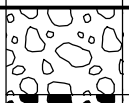
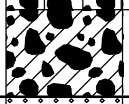
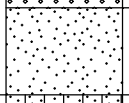
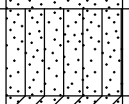
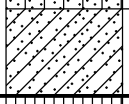
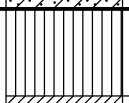
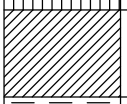
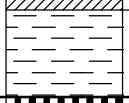
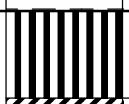
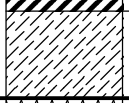
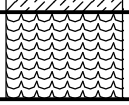
FY25 Street Rehabilitation

LOG OF EXPLORATORY CORE HOLE

Job Number: 11800.120
Date: November 2024

PLATE
A-11

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Other Tests

AN	ANALYTICAL TEST (pH, Soluble Sulfate, and Resistivity)
C	CONSOLIDATION TEST
DS	DIRECT SHEAR TEST
MD	MOISTURE DENSITY CURVE

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FY25 Street Rehabilitation

LEGEND

Job Number: 11800.120

Date: November 2024

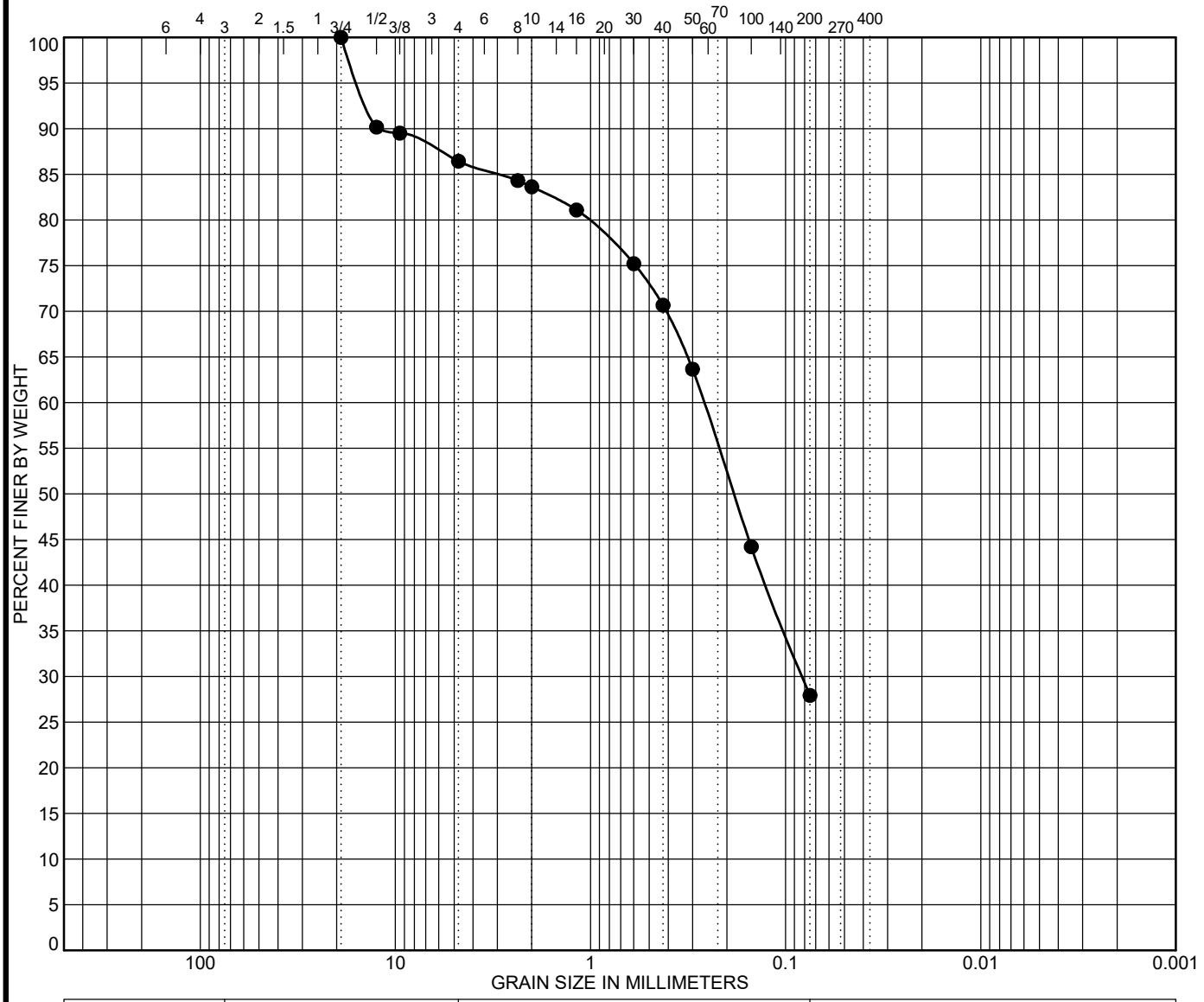
PLATE

A-12

APPENDIX B

SOILS LABORATORY TEST RESULTS

LUMOS & ASSOCIATES



Specimen Identification	Date: 11/8/2024								
● **Core #3**	Classification					LL	PL	PI	Cc	Cu
Depth:0.333	Medium Brown Clayey SAND (SC)					33	17	16		
Sample Location	Core #3, 4" - 18"									
USCS	SC									
AASHTO										

Specimen Identification								
● **Core #3**	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
Depth:0.333	19	0.263	0.082		13.6	58.5	27.9	

Natural Moisture	11.0 %	**Direct Shear**		**Absorption %**	
R-Value		**Max Dry Density**		**Soundness**	
Expansion Index		**Specific Gravity**		**S.E.**	

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FY25 Street Rehabilitation

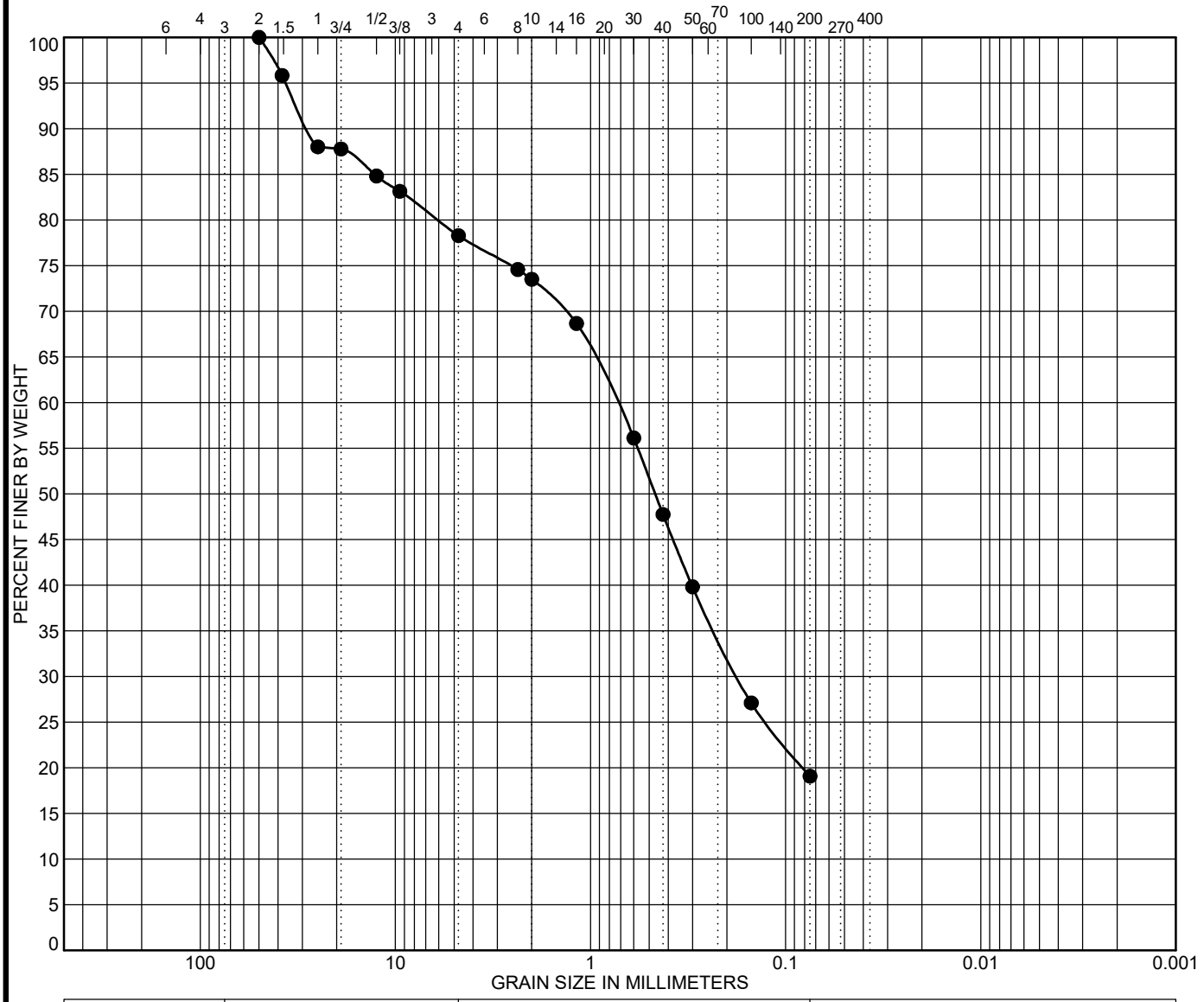
GRAIN SIZE DISTRIBUTION

Job Number: 11800.120

Date: November 2024

PLATE

B-1.1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Date: 11/8/2024						
●	**Core #5**	Classification	LL	PL	PI	Cc	Cu	
	Depth:0.333	Brown Silty SAND with Gravel (SM)	NP	NP	NP			
	Sample Location	Core #5, 4" - 12"						
	USCS	SM						
	AASHTO							

	Specimen Identification								
●	**Core #5**	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
	Depth:0.333	50	0.74	0.176		21.7	59.2	19.1	

Natural Moisture	7.8 %		**Direct Shear**		**Absorption %**		
R-Value			**Max Dry Density**		**Soundness**		
Expansion Index			**Specific Gravity**		**S.E.**		

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FY25 Street Rehabilitation

GRAIN SIZE DISTRIBUTION

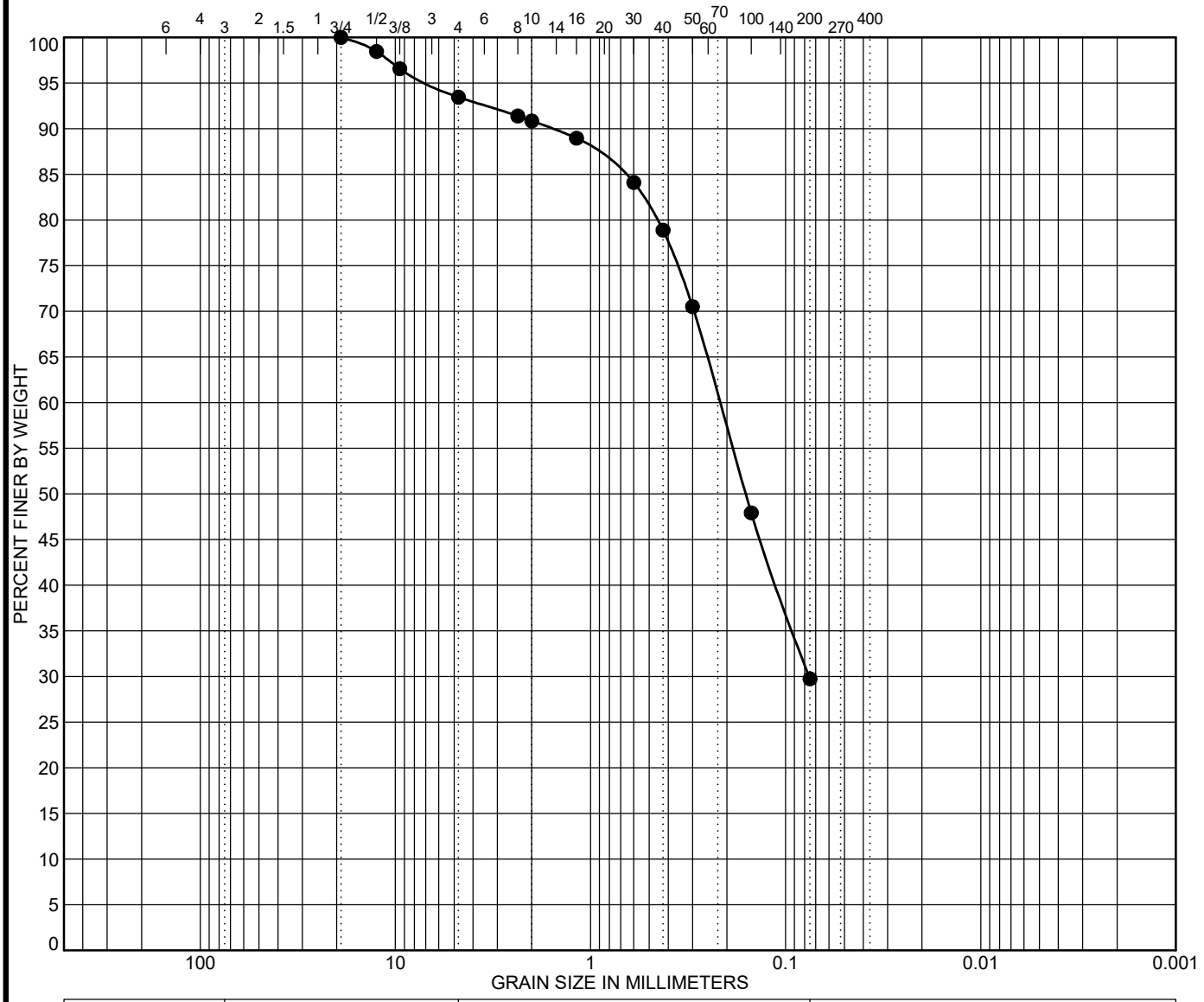
Job Number: 11800.120

Date: November 2024

PLATE

B-1.2

LUMOS GRAIN SIZE SPARKS FY25.GPJ US LAB.GDT 11/25/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Date: 11/8/2024					
●	**TP #1**	Classification	LL	PL	PI	Cc	Cu
	Depth: 1	Medium Brown Clayey SAND (SC)	31	21	10		
	Sample Location	Test Pit #1, 1' - 1.5'					
	USCS	SC					
	AASHTO						

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP #1**								
	Depth: 1	19	0.217	0.076		6.5	63.7	29.7	

Natural Moisture	13.6 %		**Direct Shear**		**Absorption %**		
R-Value	20		**Max Dry Density**		**Soundness**		
Expansion Index	41		**Specific Gravity**		**S.E.**		

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FY25 Street Rehabilitation

GRAIN SIZE DISTRIBUTION

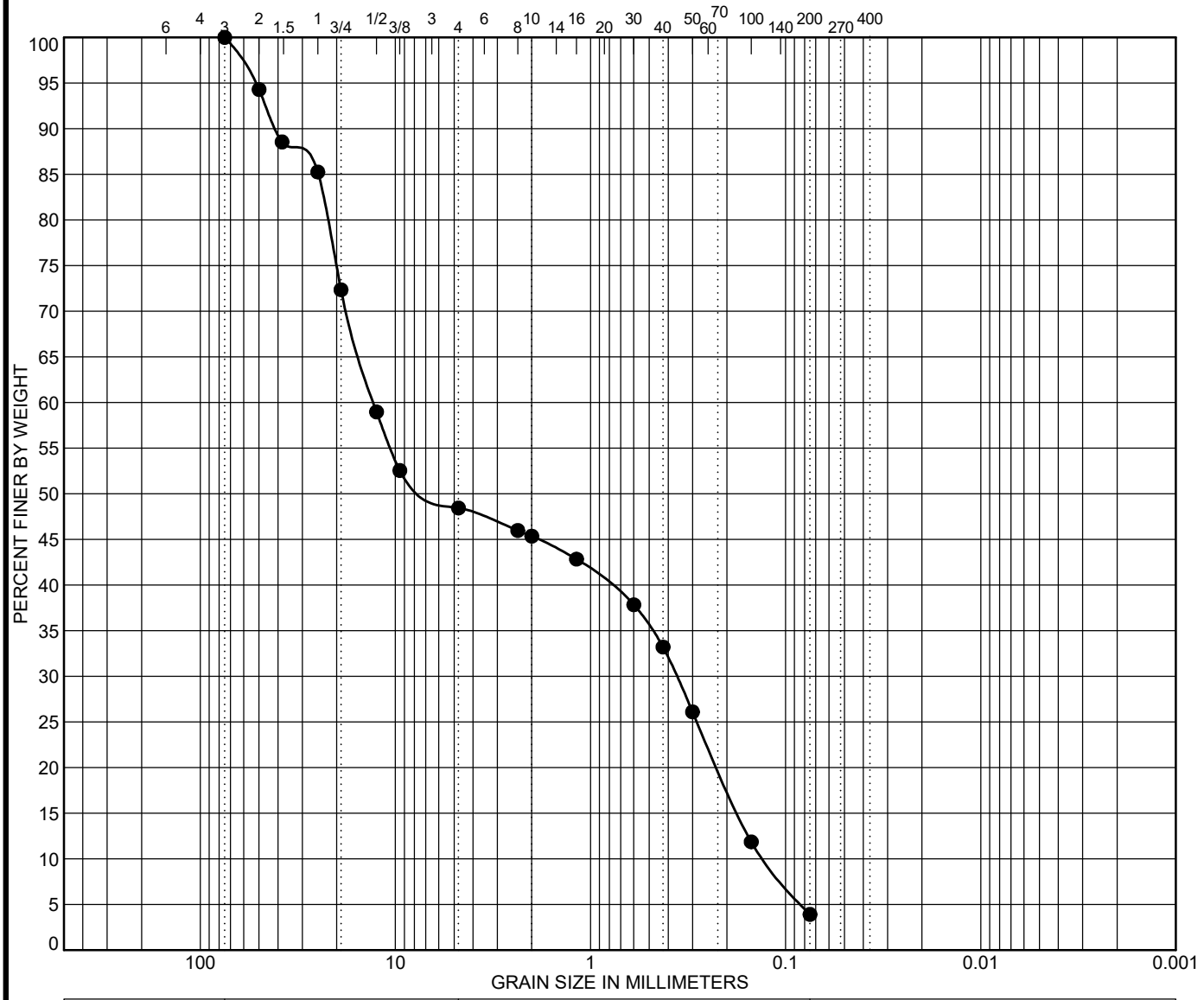
Job Number: 11800.120

Date: November 2024

PLATE

B-1.3

LUMOS GRAIN SIZE SPARKS FY25.GPJ US LAB.GDT 11/25/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Date: 11/8/2024	LL	PL	PI	Cc	Cu
●	**TP #2**	Classification					
	Depth: 1.5	Brown Poorly Graded GRAVEL with Sand (GP)	NP	NP	NP	0.1	101.2
	Sample Location	Test Pit #2, 1.5' - 2'					
	USCS	GP					
	AASHTO						

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP #2**								
	Depth: 1.5	75	12.911	0.363	0.128	51.6	44.5	3.9	

	Natural Moisture	10 %	**Direct Shear**		**Absorption %**		
	R-Value	17	**Max Dry Density**		**Soundness**		
	Expansion Index		**Specific Gravity**		**S.E.**		

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FY25 Street Rehabilitation

GRAIN SIZE DISTRIBUTION

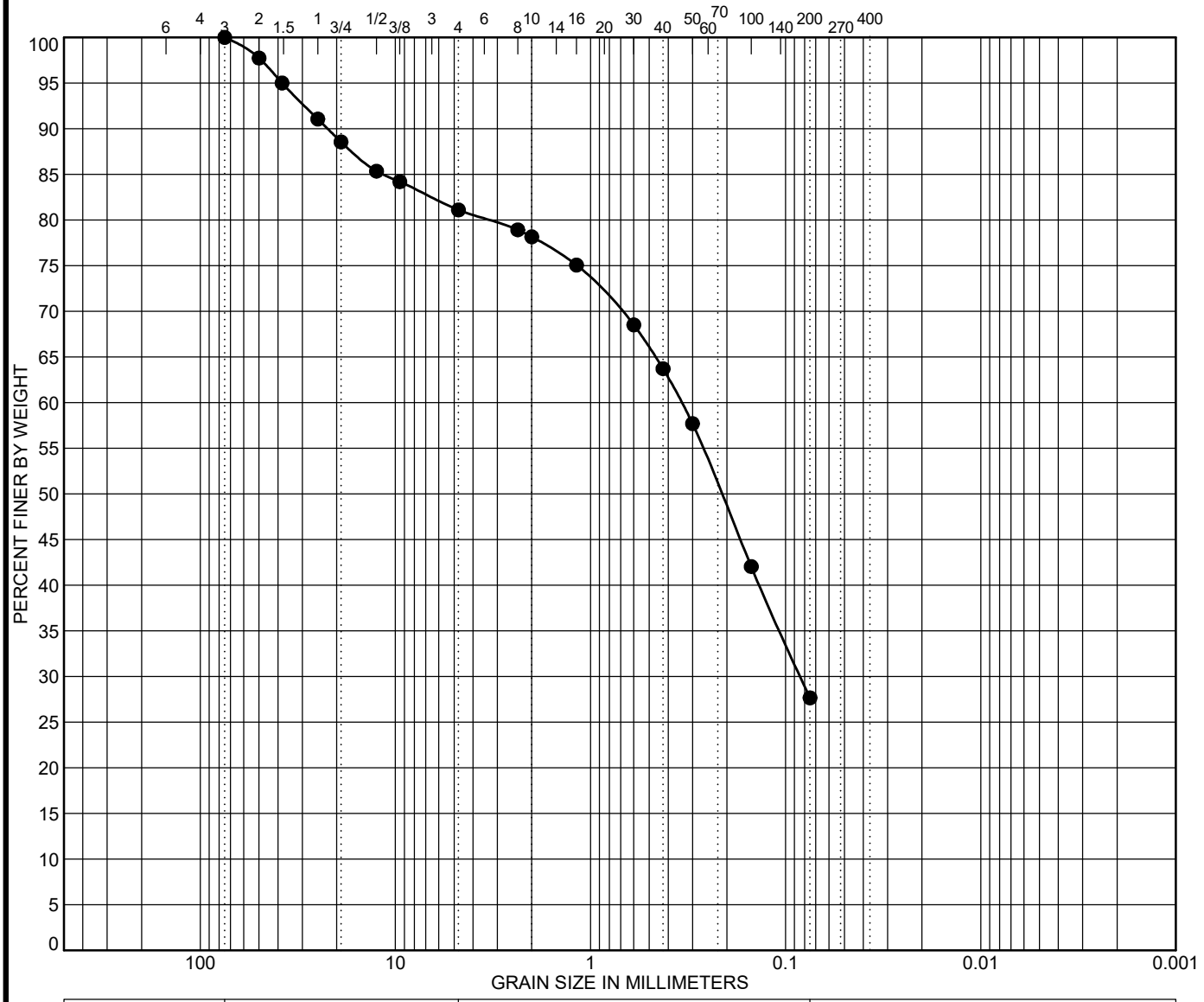
Job Number: 11800.120

Date: November 2024

PLATE

B-1.4

LUMOS GRAIN SIZE SPARKS FY25.GPJ US LAB.GDT 11/25/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Date: 11/8/2024	LL	PL	PI	Cc	Cu
●	**TP #4**	Classification					
	Depth: 1	Brown Clayey SAND with Gravel (SC)	32	18	14		
	Sample Location	Test Pit #4, 1' - 1.5'					
	USCS	SC					
	AASHTO						

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP #4**								
	Depth: 1	75	0.343	0.084		18.9	53.4	27.7	

Natural Moisture	15.7 %		**Direct Shear**		**Absorption %**		
R-Value	7		**Max Dry Density**		**Soundness**		
Expansion Index			**Specific Gravity**		**S.E.**		

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FY25 Street Rehabilitation

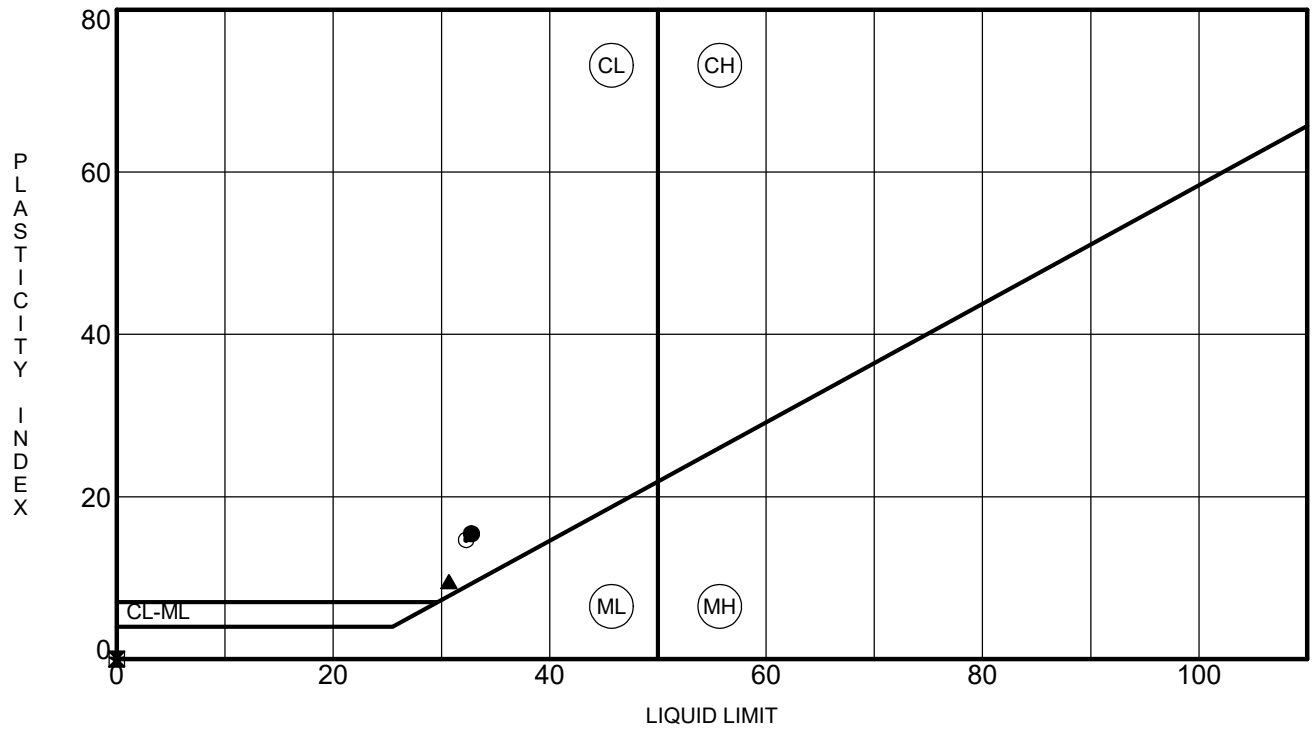
GRAIN SIZE DISTRIBUTION

Job Number: 11800.120 Date: November 2024

PLATE

B-1.5

LUMOS GRAIN SIZE SPARKS FY25.GPJ US LAB.GDT 11/25/24



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**Core #3**	**0.3**	**33**	**17**	**16**	**28**	Medium Brown Clayey SAND (SC)
⊠	**Core #5**	**0.3**	**NP**	**NP**	**NP**	**19**	Brown Silty SAND with Gravel (SM)
▲	**TP #1**	**1.0**	**31**	**21**	**10**	**30**	Medium Brown Clayey SAND (SC)
★	**TP #2**	**1.5**	**NP**	**NP**	**NP**	**4**	Brown Poorly Graded GRAVEL with Sand (GP)
⊙	**TP #4**	**1.0**	**32**	**18**	**14**	**28**	Brown Clayey SAND with Gravel (SC)

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FY25 Street Rehabilitation

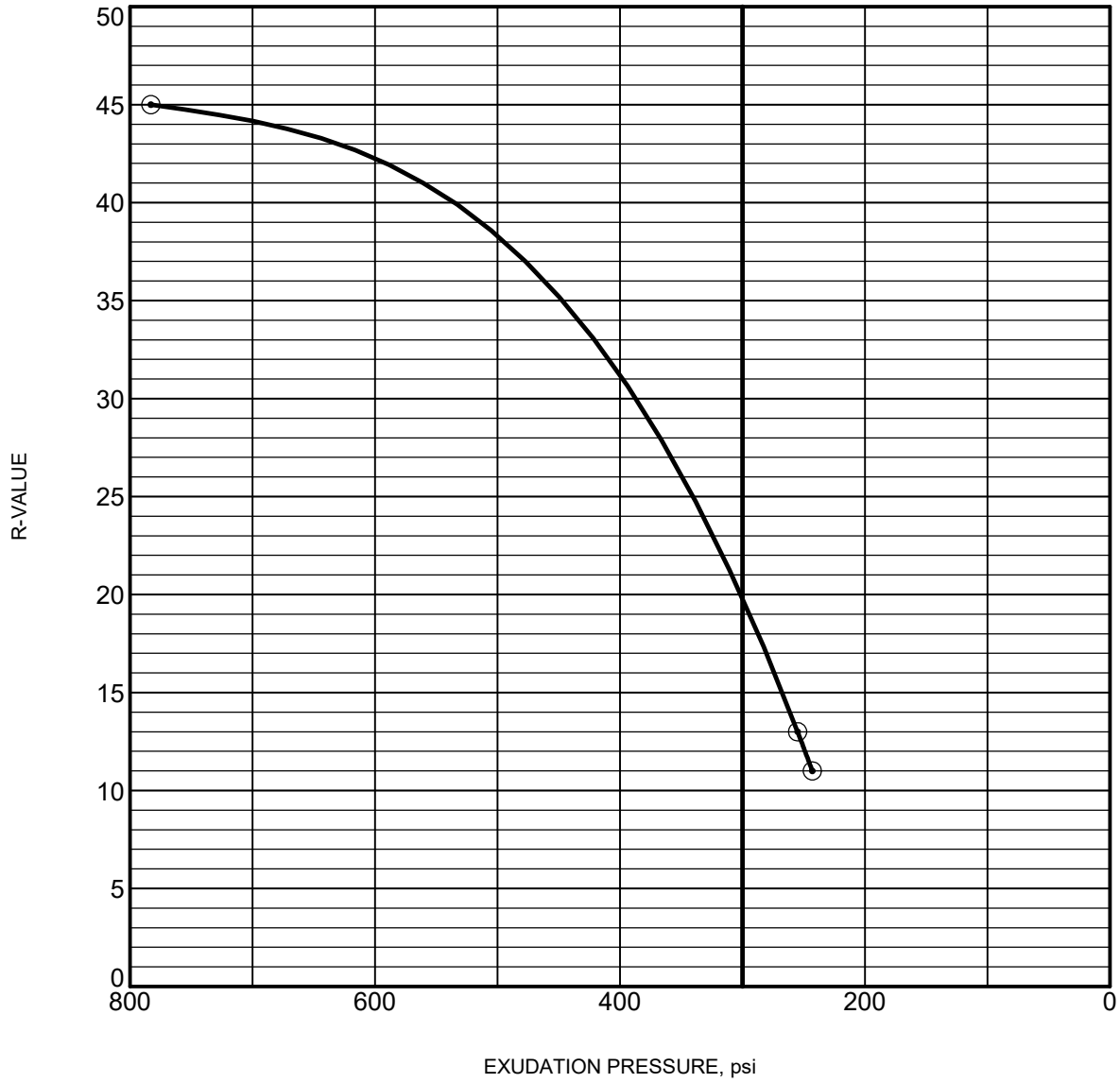
ATTERBERG LIMITS' RESULTS

Job Number: 11800.120 Date: November 2024

PLATE

B-2

LUMOS ATTERBERG LIMITS SPARKS FY25.GPJ US_LAB.GDT 11/25/24



Test Data

Specimen No.	Water Content (%)	Dry Density (pcf)	Expansion (psf)	Exudation (psi)	Test R-Value*
1	**17.9**	**113.6**	**0.0**	**243.0**	**11.0**
2	**17.5**	**113.4**	**0.0**	**255.0**	**13.0**
3	**12.6**	**124.2**	**95.0**	**783.0**	**45.0**

* Reported values have been corrected for sample height, where required.

Test Result

Specimen Identification		Classification	R-Value
TP #1	**1.0**	**Medium Brown Clayey SAND (SC)**	**20**

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FY25 Street Rehabilitation

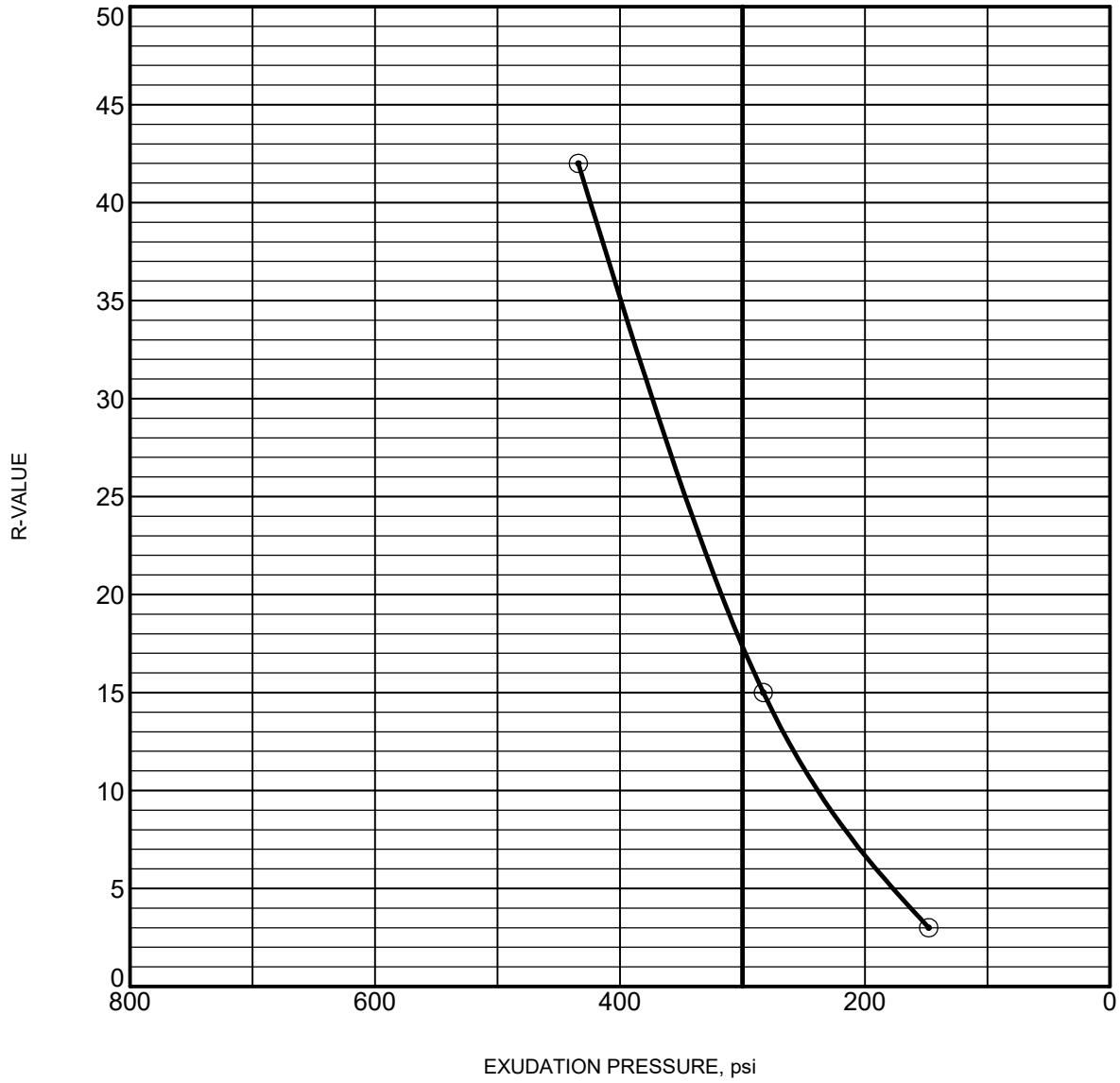
RESISTANCE VALUE TEST

Job Number: 11800.120 Date: November 2024

PLATE

B-3.1

R_VALUE_SPARKS FY25.GPJ_US_LAB.GDT 11/25/24



Test Data

Specimen No.	Water Content (%)	Dry Density (pcf)	Expansion (psf)	Exudation (psi)	Test R-Value*
1	**14.6**	**123.6**	**0.0**	**148.0**	**3.0**
2	**14.3**	**123.3**	**0.0**	**283.0**	**15.0**
3	**12.8**	**125.8**	**0.0**	**434.0**	**42.0**

* Reported values have been corrected for sample height, where required.

Test Result

Specimen Identification		Classification	R-Value
TP #2	**1.5**	**Brown Poorly Graded GRAVEL with Sand (GP)**	**17**

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FY25 Street Rehabilitation

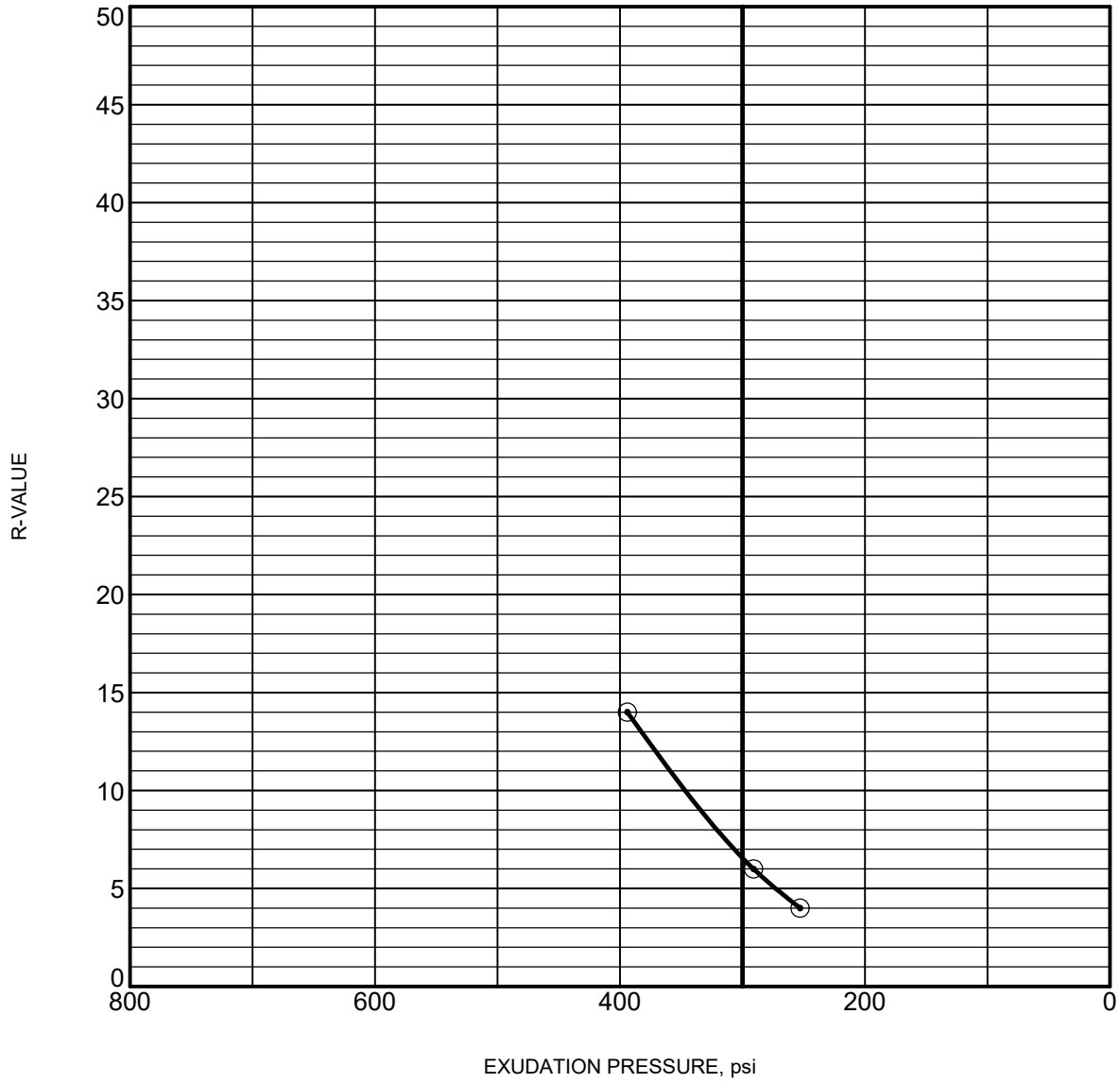
RESISTANCE VALUE TEST

Job Number: 11800.120 Date: November 2024

PLATE

B-3.2

R_VALUE_SPARKS FY25.GPJ_US_LAB.GDT 11/25/24



Test Data

Specimen No.	Water Content (%)	Dry Density (pcf)	Expansion (psf)	Exudation (psi)	Test R-Value*
1	**18.8**	**110.3**	**0.0**	**253.0**	**4.0**
2	**17.0**	**113.1**	**13.0**	**291.0**	**6.0**
3	**14.8**	**118.9**	**65.0**	**394.0**	**14.0**

* Reported values have been corrected for sample height, where required.

Test Result

Specimen Identification		Classification	R-Value
TP #4	**1.0**	**Brown Clayey SAND with Gravel (SC)**	**7**

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FY25 Street Rehabilitation

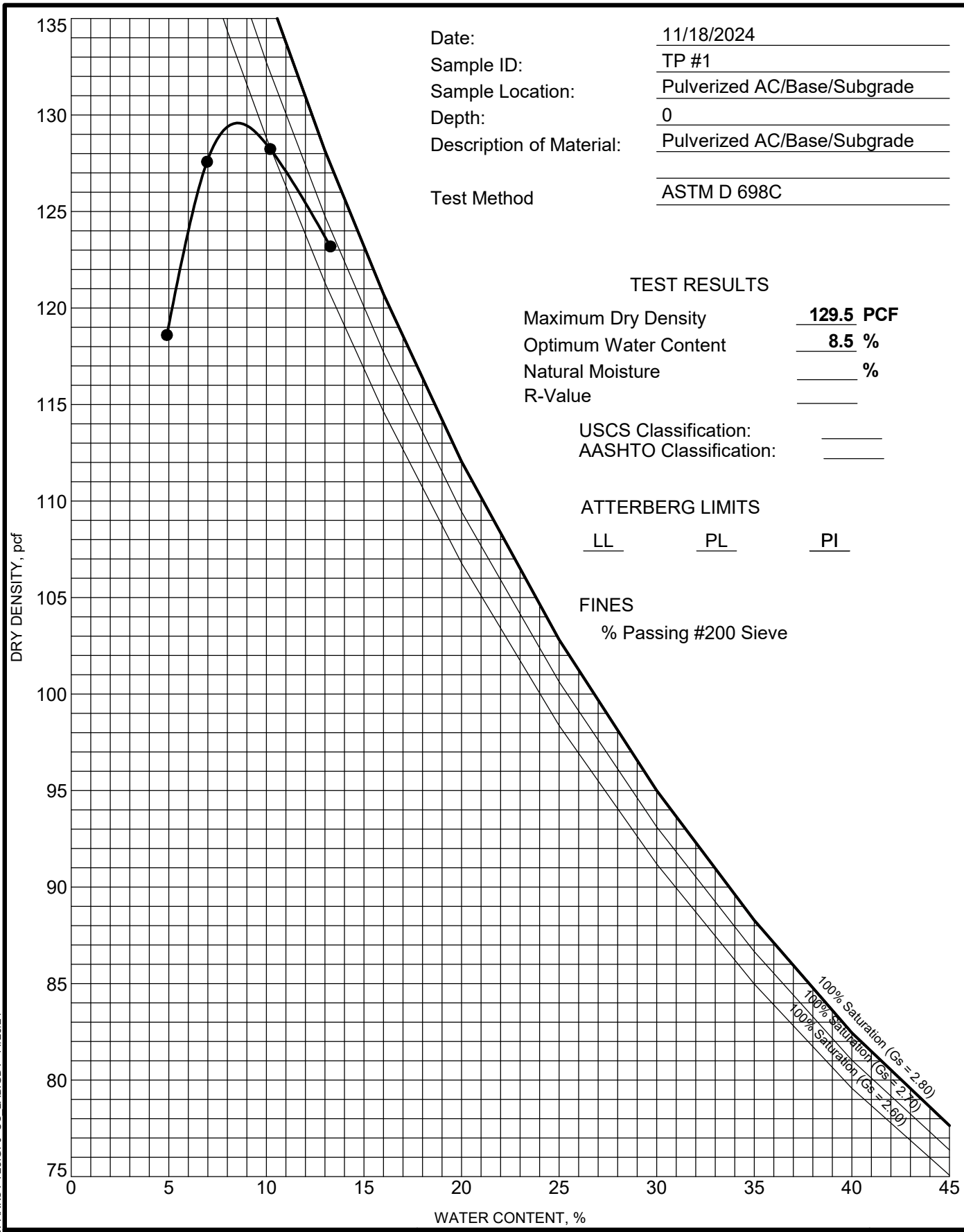
RESISTANCE VALUE TEST

Job Number: 11800.120 Date: November 2024

PLATE

B-3.3

R_VALUE_SPARKS FY25.GPJ US_LAB.GDT 11/25/24



Date: 11/18/2024
Sample ID: TP #1
Sample Location: Pulverized AC/Base/Subgrade
Depth: 0
Description of Material: Pulverized AC/Base/Subgrade

Test Method: ASTM D 698C

TEST RESULTS

Maximum Dry Density	**129.5**	**PCF**
Optimum Water Content	**8.5**	**%**
Natural Moisture		**%**
R-Value		

USCS Classification:
AASHTO Classification:

ATTERBERG LIMITS

LL PL PI

FINES

% Passing #200 Sieve

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FY25 Street Rehabilitation

MOISTURE-DENSITY CURVE

Job Number: 11800.120 Date: November 2024

PLATE

B-4

LUMOS_COMPACTION_SPARKS FY25.GPJ_US_LAB.GDT 11/25/24

Western Environmental Testing Laboratory
Analytical Report

Lumos & Associates, Inc.
950 Sandhill Road, Suite 100
Reno, NV 89521
Attn: Mitch Burns
Phone: (775) 827-6111 **Fax:** (775) 827-6122

Date Printed: 11/13/2024
OrderID: *24110260*
PO\Project: *FY25 Rehab/11800.120/MTB/Task 1*

Customer Sample ID: TP-3 1ft-1.5ft
WETLAB Sample ID: 24110260-001
Collect Date/Time: 11/8/2024
Receive Date: 11/11/2024 09:11

Analyte	Method	Results	Units	DF	RL	Analyzed	LabID
Anions by Ion Chromatography							
Sulfate	EPA 300.0	ND	mg/kg	10	15	11/12/2024	NV00925
Sample Preparation							
10:1 DI Water Extraction	WL 10.0	Complete		1		11/11/2024	NV00925

DF=Dilution Factor, RL = Reporting Limit (minimum 3X the MDL), ND = Not Detected <RL or <MDL (if listed)

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FY25 Street Rehabilitation

SOIL SULFATE CONTENT

Job Number: 11800.120 Date: November 2024

PLATE
B-5

APPENDIX C

PAVEMENT DESIGN

LUMOS & ASSOCIATES

Job Number: 11800.120
Project: City of Sparks FY25 Rehabilitation
Description: Pavement Calculations
By: J. Macaluso

R-Value for CTB = 80 (Assumed)
R-Value for Native Clayey Sand with Gravel = 7
TI (Local Road) = 5 (Light Traffic)

$GE=0.0032*(TI)*(100-R)$

$Gf_{(AC,Local)}=2.5$, $Gf_{(Cement\ Treated\ Soil)}=1.2$, $Gf_{(subgrade)}=1$
$t_{layer}=GE/Gf$

Local Road Pavement Section : Asphalt and Cement Treated Recycled Material

$GE_{AC}=0.0032*(5)*(100-80)=0.32'$
$t_{AC}=(0.32/2.5)*(12"/1')=1.54"$ **USE 4" Asphalt Concrete**
$GE_{AC}=(4"*2.5)/(12")=0.83'$

$GE_{CTB(Pulv.)}=0.0032*(5)*(100-7)=1.49'$
$t_{CTB(Pulv.)}=((1.49'-0.83')/1.2)*(12"/1')=6.6"$ **USE 8" Cement Treated Pulverized Material**

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FY25 Street Rehabilitation

PAVEMENT DESIGN

Job Number: 11800.120 Date: November 2024

PLATE

C-1

APPENDIX D

SPECIFICATIONS FOR DEMOLITION

LUMOS
& ASSOCIATES

SPECIFICATIONS FOR DEMOLITION

Demolition shall include the removal of all designated structures/improvements to be removed, i.e. concrete structures, asphalt pavements, utilities, pipes and unsuitable material within the project area. Excavations caused by removal of existing improvements and utilities shall be cleared of all wastes, debris, and any loose/soft soils, and backfilled with properly compacted fill, as specified under the General Site Grading section of this report. All fill compaction should be performed under observation and testing by the Geotechnical Engineer.

Broken concrete, asphalt, and other materials shall be considered waste and shall be removed from the site.

Any existing drain lines, wires, utilities, etc., which are to remain on the site shall be protected from damage. Buried drain lines, pipe conduits, utilities, etc. which are necessarily cut shall be either carefully and permanently capped at the property line as specified by the City Engineer or re-routed as necessary. Utility lines not specifically noted for disposition, but which are encountered in the work area shall be capped, extended, protected or re-routed as necessary for completion of the work, as directed.

All work shall be performed in accordance with the Federal Occupational Safety and Health Administration, the local Division of Occupational Safety and Health requirements, and applicable ordinances of the governing municipality.

Care shall be taken not to damage adjoining utilities or structures to remain after completion of the work. Finished work damaged by operations during demolition and site preparation shall be repaired or replaced to the satisfaction of the Owner at no cost to the Owner.

All materials resulting from demolition and site preparation not designated by the Owner to be recovered or to be relocated by the Contractor shall be removed promptly and disposed of off the site.

Upon completion of demolition and site preparation, the site shall be "raked clean" – if applicable – and all waste, rubble, debris, etc. shall be removed and disposed of off the site.

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FY25 Street Rehabilitation

SPECIFICATIONS FOR DEMOLITION

Job Number: 11800.120 Date: November 2024

PLATE

D-1

APPENDIX E

CEMENT TREATED ASPHALT/BASE/SUBGRADE COMPRESSION TEST REPORTS

LUMOS & ASSOCIATES

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**FY 25 Street Rehab**
		PROJECT NO.:	**11800.120**
		LOCATION:	Sparks, NV
		CONTRACTOR:	N/A
SAMPLED BY:	J. Macaluso	DATE RECEIVED:	11/7/24
WEATHER:	N/A	TIME:	PM
AIR TEMP:	N/A	MOLDED BY:	M.A./K.F.
DATE MOLDED:	11/19/24		

MATERIAL DESCRIPTION: 40% AC, 30% Base, and 30% Subgrade - Lab Mix
2.5% Cement at 2% Over Optimum Moisture

SAMPLE LOCATION: Various Locations

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
CC-2779-24	4.01	12.63	3	11/22/24	2,610	205
CC-2780-24	4.07	13.01	3	11/22/24	3,440	265
CC-2781-24	4.08	13.07	3	11/22/24	3,265	250
CC-2782-24	4.07	13.01	7	11/26/24	3,315	255
CC-2783-24	4.07	13.01	7	11/26/24	3,810	295
CC-2784-24	4.03	12.76	7	11/26/24	3,240	255
			Average Compressive Strength 3-Day:			240
			Average Compressive Strength 7-Day:			270

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

REMARKS:

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results

Respectively Submitted by:
Mitch Burns

Carson City • El Dorado Hills • Fallon • Lake Tahoe • Reno

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FY25 Street Rehabilitation
CEMENT TREATED SPECIMEN COMPRESSION TESTS (2.5%)
Job Number: 11800.120 Date: November 2024

PLATE E-1

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**FY 25 Street Rehab**
		PROJECT NO.:	**11800.120**
		LOCATION:	Sparks, NV
		CONTRACTOR:	N/A
SAMPLED BY:	J. Macaluso	DATE RECEIVED:	11/7/24
WEATHER:	N/A	TIME:	PM
AIR TEMP:	N/A	MOLDED BY:	M.A./K.F.
DATE MOLDED:	11/19/24		

MATERIAL DESCRIPTION: 40% AC, 30% Base, and 30% Subgrade - Lab Mix
5% Cement at 2% Over Optimum Moisture

SAMPLE LOCATION: Various Locations

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
CC-2786-24	4.04	12.82	3	11/22/24	5,400	420
CC-2787-24	4.05	12.88	3	11/22/24	4,790	370
CC-2788-24	4.06	12.95	3	11/22/24	4,805	370
CC-2789-24	4.08	13.07	7	11/26/24	5,565	425
CC-2790-24	4.04	12.82	7	11/26/24	5,485	430
CC-2791-24	4.05	12.88	7	11/26/24	6,620	515
			Average Compressive Strength 3-Day:			385
			Average Compressive Strength 7-Day:			455

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

REMARKS:

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results

Respectively Submitted by:

Mitch Burns

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FY25 Street Rehabilitation

CEMENT TREATED SPECIMEN COMPRESSION TESTS

Job Number: 11800.120 Date: November 2024

PLATE E-2

LUMOS & ASSOCIATES

CEMENT TREATED BASE COMPRESSION TESTS

REPORT TO:	**City of Sparks**	PROJECT NAME:	**FY 25 Street Rehab**
		PROJECT NO.:	**11800.120**
		LOCATION:	Sparks, NV
		CONTRACTOR:	N/A
SAMPLED BY:	J. Macaluso	DATE RECEIVED:	11/7/24
WEATHER:	N/A	TIME:	PM
AIR TEMP:	N/A	MOLDED BY:	M.A./K.F.
DATE MOLDED:	11/19/24		

MATERIAL DESCRIPTION: 40% AC, 30% Base, and 30% Subgrade - Lab Mix
7.5% Cement at 2% Over Optimum Moisture

SAMPLE LOCATION: Various Locations

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

LAB NO.	DIAMETER (INCHES)	AREA (SQ.IN)	TEST AGE	DATE TESTED	TOTAL LOAD-LBS.	UNIT LOAD PSI
CC-2793-24	4.05	12.88	3	11/22/24	4,280	330
CC-2794-24	4.04	12.82	3	11/22/24	5,220	405
CC-2795-24	4.04	12.82	3	11/22/24	6,845	535
CC-2796-24	4.05	12.88	7	11/26/24	7,070	550
CC-2797-24	4.04	12.82	7	11/26/24	7,525	585
CC-2798-24	4.03	12.76	7	11/26/24	5,725	450
			Average Compressive Strength 3-Day:			425
			Average Compressive Strength 7-Day:			530

Testing and Sampling were performed in accordance with ASTM D-558, C-1632, C-1633. Standards as applicable.

REMARKS:

CAPPING ☐ UNBONDED ☒ BONDED

TEST RESULTS: ☐ COMPLY ☐ DO NOT COMPLY

Client Notified of Test Results

Respectively Submitted by:

Mitch Burns

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FY25 Street Rehabilitation

CEMENT TREATED SPECIMEN COMPRESSION TESTS

Job Number: 11800.120 Date: November 2024

PLATE E-3

CEMENT TREATED BASE COMPRESSION TESTS

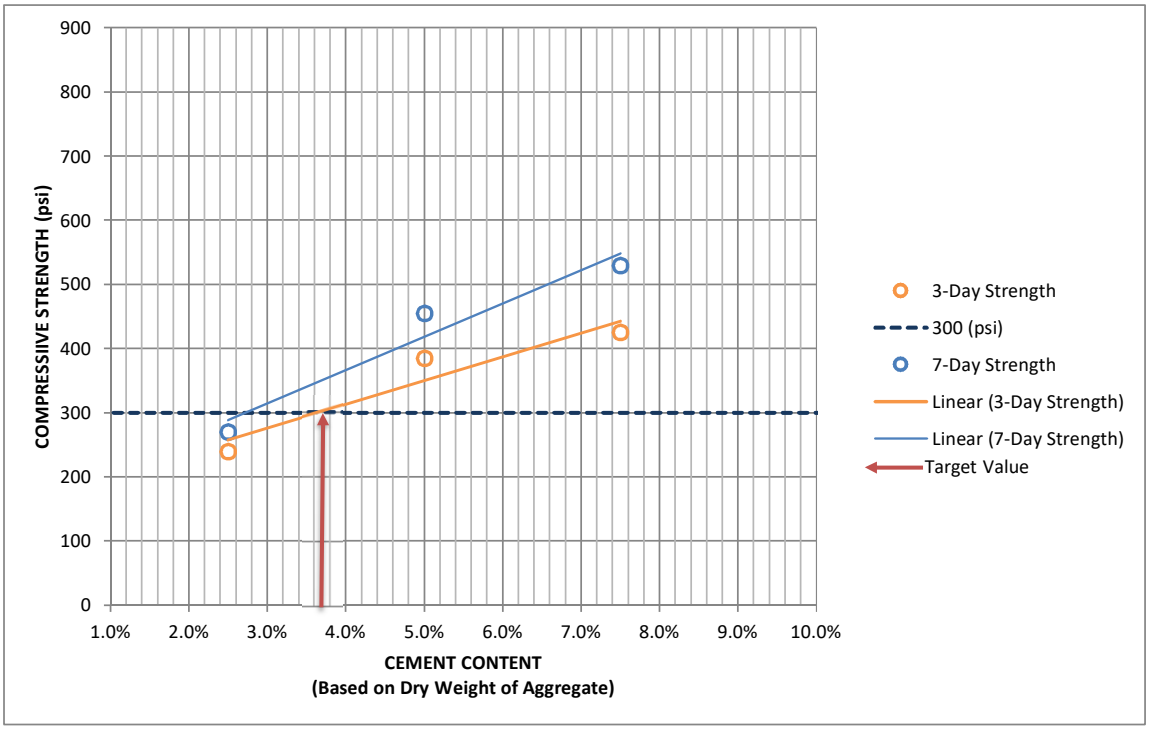
REPORT TO:	**City of Sparks**	PROJECT NAME:	**FY 25 Street Rehab**
		PROJECT NO.:	**11800.120**
		LOCATION:	Sparks, NV
		DATE RECEIVED:	11/7/2024
SAMPLED BY:	J. Macaluso	MOLDED BY:	M.A./K.F.
DATE MOLDED:	11/19/2024		

MATERIAL DESCRIPTION: 40% AC, 30% Base, and 30% Subgrade - Lab Mix
2% Over Optimum Moisture

SAMPLE LOCATION: Various Locations

SAMPLE TYPE: LABORATORY DESIGN X FIELD SAMPLE

TEST AGE	Percent Cement		
	2.5%	5.0%	7.5%
3-DAY Strength (psi)	**240**	**385**	**425**
7-DAY Strength (psi)	**270**	**455**	**530**



Reviewed by:

LUMOS & ASSOCIATES

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FY25 Street Rehabilitation

CEMENT TREATED BASE SUMMARY GRAPH

Job Number: 11800.120 Date: November 2024

PLATE E-4