

GEOTECHNICAL ENGINEERING REPORT

Clear Creek Park Phase III Parking Improvements
Laramie County, Wyoming

June 11, 2025

Prepared For:

AVI, p.c.
Attn: Tristan D. Cordier
1103 Old Town Lane, Suite 101
Cheyenne, Wyoming 82009

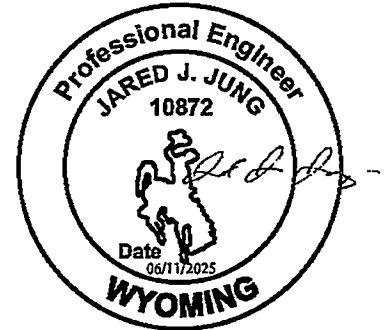
Prepared by:

JB Engineers
205 Co Rd 128, #400
Cheyenne, Wyoming 82007



June 11, 2025

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RE: Geotechnical Engineering Report (01-25046)
Clear Creek Park Phase III Parking Improvements
Laramie County, Wyoming

Dear Mr. Cordier:

This report presents the results of the geotechnical engineering study for the proposed Clear Creek Park Phase III Parking Improvements in Cheyenne, Laramie County, Wyoming. The geotechnical engineering report was prepared to evaluate the subsurface conditions at the site and to provide geotechnical opinions and recommendations to support the proposed planning, design and construction of the project. We completed our services referencing our proposal dated March 7, 2025.

The report has been prepared to summarize the data obtained during this study, and to present conclusions and recommendations based on the proposed construction and subsurface conditions encountered. A discussion of geotechnical engineering considerations, opinions and recommendations related to construction is included in this report.

JB Engineers,

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PURPOSE AND SCOPE OF STUDY

This report presents the results of the geotechnical engineering study for the proposed Clear Creek Park Phase III Parking Improvements in Cheyenne, Laramie County, Wyoming. The geotechnical engineering report was prepared to evaluate the subsurface conditions at the site and to provide geotechnical opinions and recommendations to support the proposed planning, design and construction of the project. We completed our services referencing our proposal dated March 7, 2025.

The field exploration program consisted of drilling five (5) exploratory borings to obtain information on the subsurface conditions at the site. The borings were generally located as shown on the Boring Location Diagram in **Appendix A**. Samples of the soil obtained during the field exploration were tested in our laboratory to determine physical and engineering characteristics and analyzed to develop design opinions and recommendations. The results of the field and laboratory testing are presented herein.

The report has been prepared to summarize the data obtained during this study, and to present conclusions and recommendations based on the proposed construction and subsurface conditions encountered. A discussion of geotechnical engineering considerations, opinions and recommendations related to construction is included in this report.

PROJECT INFORMATION

EXISTING SITE CONDITIONS

The site is located at the Clear Creek Park located at 251 Southwest Drive in Cheyenne, Wyoming. The area of the west parking lot is currently covered partially in grass, and partially in gravel drive and parking area surfacing; the area of the east parking lot is currently partially surfaced with a gravel drive and mainly vegetated with prairie grass and weeds; and the north parking area is currently partially surfaced with a gravel drive and some prairie grasses and trees. The grades within each area are relatively flat with less than 4 feet of elevations relief across parking area. Photographs of the project areas are provided below:



Photograph 1. View of West Parking Lot



Photograph 2. View of East Parking Area



Photograph 3. View of North Parking Area

PROPOSED CONSTRUCTION

The project will include the design and construction of three areas (West Parking Lot, East Parking Lot, and North Parking Lot) to include gravel surfacing and a bid alternate for asphalt paved parking areas and drive lanes and drive lane between the west and east parking lots. In addition, some concrete pavements will be installed for ADA accessibility and removal and replacement of a culvert between the north and south parking lots.

FIELD EXPLORATION

JB Engineers conducted the field exploration on March 12, 2025. Five (5) borings were drilled at the site to a depth of 6.5 feet. The approximate boring locations are shown on the Boring Location Diagram in **Appendix A**. The elevation of the boring locations was provided by AVI, p.c.

The bore holes were advanced through the on-site soils with a CME-45 truck-mounted drill rig using 4-inch diameter solid-stem auger. JB Engineers personnel logged the borings. Samples of the subsurface soils were obtained using a 1-3/8 inch inside diameter split barrel samplers. The samplers were driven into the various strata using a 140 lb. hammer falling 30 inches. The total number of blows required to advance the samplers each of three consecutive 6-inch increments was recorded and the sum of the second and third 6-inch increments was recorded as the penetration resistance value or SPT-N value. The testing was performed in accordance with ASTM D1586, Split Barrel Sampling. Penetration resistance values provide an indication of the relative density of granular soils or consistency of fine-grained soils. Depths at which the samples were obtained, and the penetration resistance values are shown on the boring logs in **Appendix A**.

The borings were checked for groundwater during our investigation. Groundwater was encountered at the bottom of borings BH-2 and BH-4 (6.5 feet). Groundwater was not noted in the remaining borings; however, it should be anticipated below a depth of 5 feet. The borings were backfilled with auger cuttings upon completion of drilling.

LABORATORY TESTING

Samples of soil obtained during the field exploration were observed and visually classified in accordance with ASTM D2487, which is based on the Unified Soil Classification System. Samples were selected for testing to determine the engineering and physical properties in general accordance with ASTM or other generally recognized procedures. The following table summarizes the tests performed for this project:

Test	ASTM Designation
Natural Water Content	D2216
Particle Size Analysis	D1140
Atterberg Limits	D4318
Standard Proctor	D698
Water Soluble Sulfate	

Results of all laboratory tests are summarized on the Laboratory Test Summary in **Appendix B**, presented on the figures provided in **Appendix B**, and shown on the boring logs in **Appendix A**. The laboratory data, along with the visual field logging information, were used to prepare the final exploratory boring logs.

SUBSURFACE CONDITIONS

Topsoil was generally 3.5 to 8 inches in thickness at the site. In addition, some areas were covered with existing gravel drives and parking areas. Contractors shall verify topsoil depths when bidding project to determine topsoil stripping depths. The soils below the surfacing generally consisted of sands classifying as clayey sand (SC) and silty sand (SM). The sands extended to the maximum depth explored in each boring. A description of soil types encountered within the borings is provided below:

CLAYEY SAND (SC) TO SILTY SAND (SM)

Sands varying in classification from clayey sand (SC) to silty sand (SM) extended to the maximum depth explored, 6.5 feet. The sand contained trace amounts of gravel and suspected cobbles were encountered in boring BH-4 at a depth of 3 feet. The sands were dark brown to brown in color and in-situ moisture contents varied from moist to wet. The sands varied in plasticity from being non-plastic (silty sands) to having plasticity indices ranging from 21 to 22 percent (clayey sands). Based on the results of standard proctor testing the in-situ moisture content of the upper 5 feet at the site were erratic and moisture conditioning will be required to achieve compaction. Additional laboratory test results are presented in **Appendix B**.

GROUNDWATER

Groundwater was encountered at the bottom of borings BH-2 and BH-4 at the time of drilling. Based on in-situ moisture contents, we suspect that groundwater is at or near 6 feet in the borings at the site. Numerous factors contribute to fluctuations of groundwater levels, and evaluation of such factors is beyond the scope of this study. We expect that groundwater may be encountered during utility excavations during construction depending on design depths.

GEOTECHNICAL ENGINEERING OPINIONS AND RECOMMENDATIONS

The recommended design and construction criteria presented below must be observed for the geotechnical engineering aspects of the project. The following construction details should be considered when preparing the project documents.

EARTHWORK

Site Grading

We understand that grading will be minimal in each parking lot to establish design subgrade elevations (<2 feet). Areas of the site contained clayey sand with a high percentage of fines and will tend to pump when moisture contents are elevated. Contractors shall be prepared to scarify and dry these soils to establish a construction platform prior to grading activities. All site grading shall be constructed as specified in the **Compaction Requirements** section of this report.

Site Preparation

Prepare the site by following the general recommendations provided below:

- Strip and remove any topsoil, existing parking area features (guard rails/existing parking blocks), trees, and any other deleterious materials from the proposed parking lot areas. Compact any soil disturbance related to the demolition of the removal of existing below grade features (if any) per the **Compaction Requirements** section of this report.
- Proof roll any areas to receive fill with a loaded 10-ton dump truck (or engineer approved equivalent) to check for loose or soft areas prior to placing new fill.
- Install a separation fabric on the prepared soils that are exposed to prevent migration of fines into the base course layer (either gravel surfacing or asphalt and base course surfacing). The separation fabric can be reduced in areas where the existing gravel surfacing or silty sand is exposed by the Engineer during construction. Use a Mirafi 140N separation fabric or engineer approved equivalent.
- Track in crushed angular rock into subgrade until a stable construction platform is achieved during culvert removal and replacement planned between north and south parking lots if unstable conditions are noted during construction at the bottom of the culvert. Use a No. 57 concrete rock or 2-to-4-inch railroad ballast type material. As an alternative, use Mirafi RS380i geotextile or engineer approved equivalent on exposed subgrade and a minimum of 12 inches of aggregate base meeting the requirements of WYDOT grading "W" base course to stabilize subgrade if needed.
- All fill and backfill must be approved by the geotechnical engineer. On-site soils can be used as fill material. All material must be processed into pieces smaller than 3 inches prior to being used as fill.

Excavation/Trench Construction

Excavations required for site grading and culvert removal and replacement will extend into the clayey to silty sand soils encountered at the site. Conventional heavy-duty earth moving equipment will be sufficient for the proposed excavations at the site. Some cemented lenses and gravel lenses were encountered with depth. Heavy duty excavation may be required to advance excavations that extend through these lenses. While it is the responsibility of the contractor to provide safe working

conditions and to comply with OSHA standards in connection with underground excavations, the following guidelines are provided for planning purposes. The subgrade soil and trench conditions must be evaluated during construction by the contractor's competent person.

Plan excavations with water collection points and utilize conventional sumps and pumps to remove nuisance water runoff or precipitation. If site soil excavations are not immediately backfilled, they may degrade when exposed to runoff and require over-excavation and replacement with structural fill. We recommend construction activities and excavation backfilling be performed as rapidly as possible following excavation to reduce the potential for subgrades to degrade under construction traffic.

Groundwater was encountered at the bottom of borings BH-2 and BH-4. If excavations extend below a depth of 5 feet, the groundwater shall be dewatered to a minimum depth of 12 inches below excavation floors.

Fill Material Requirements

On-site native soils can be used as site grading and culvert backfill material provided they are free of vegetation, construction demolition debris and organic matter. Import material shall meet the following requirements prior to being imported to the site:

Gradation / Index Property	Percent Passing (ASTM C136)
3-inch Sieve	100
No. 4 Sieve	40-100
No. 200 Sieve	5-50
Atterberg Limits (ASTM D4318)	Value
Liquid Limit (ASTM D4318)	40 Maximum
Plasticity Index	15 Maximum

Additional import material can be submitted for approval.

Compaction Requirements

Place fill in thin (8-inch maximum), uniform lifts and compacted to the following minimum percentages of the maximum dry unit weight as determined by ASTM D698 (Standard Proctor):

Area	Compaction (% of ASTM D698)
Mass Grading	95
Culvert Backfill	95
Overlot Fill (non-structural areas)	90

Place all on-site fill material within minus 4 percent to plus 2 percent of the optimum moisture as determined by ASTM D698. Base course shall be moisture conditioned to achieve compaction. The following shall be implemented during construction:

- **Mass Grading:** One compaction test every 5,000 square feet per each foot lift of backfill.
- **Culvert Backfill:** One compaction test every 50 linear feet (lf) of trench per each 12-inch lift of backfill.

The contractor must understand and plan for the time required to process soil to meet the report requirements. Difficulty achieving required compaction may impact construction costs, schedules, and other project aspects. Allowing time and space (i.e., lay-down area) to process excavated site soil and facilitate proper moisture conditioning during dry weather is critical if the contractor plans to re-use the site soil as fill. Proper moisture conditioning or drying can help reduce compaction efforts and the need to import dry soil or aggregate.

PAVEMENT DESIGN

The primary purpose of a pavement section is the distribution of concentrated wheel loads to the subgrade in a manner such that the subgrade is not over-stressed. Performance of the pavement section is directly related to the strength of the subgrade soils, and the characteristics of the traffic loading. For purposes of designing a pavement section, subgrade soils are represented by a soil support value for flexible pavements (asphaltic concrete). This representative value is empirically related to strength.

Pavement design procedures are based upon strength properties of the subgrade soils and pavement materials, along with the design traffic conditions (especially truck traffic). Subgrade strength decreases when the subgrade is wetted, and is further reduced when saturated. Therefore, proper drainage, both surface and subsurface, is essential for adequate pavement performance.

Based on the facility use, we expect traffic to mainly consist of passenger vehicles and on occasional garbage truck. We recommend a minimum pavement section based on the traffic assumptions.

Recommended Pavement Section

Use the following minimum pavement sections provided in the table below:

Material	Base Course Thickness, inches	Asphalt Thickness, inches
¹⁾ Gravel Surfacing	²⁾ 8	--
¹⁾ Asphalt Surfacing	6	4

- 1) Install a separation fabric on prepared subgrade (Mirafi 140N or engineer approved equivalent).
- 2) Use material meeting requirements of WYDOT Grading "GR" for gravel surfacing.

LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the design data submitted to JB Engineers, data obtained from the exploratory boring drilled at the locations indicated on the Boring Location Diagram, and the proposed construction discussed in this report. The nature and extent of subsurface variations across the site may not become evident until construction. During construction, if fill, soil, bedrock or water conditions appear to be different from those described herein, this office should be advised at once so that we may re-evaluate the recommendations made.

This report has been prepared for the exclusive use by our client for design purposes. We are not responsible for technical interpretations by others of our exploratory information which has not been described or documented in this report. As the project evolves, we should provide continued consultation and field services during construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted. Significant design changes may require additional analysis or modifications of the recommendations presented herein. We recommend on-site observation of excavations and foundation bearing strata and testing of all fill by a representative of the geotechnical engineer.

Appendix A – Boring Location Diagram

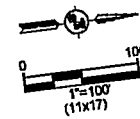
Key to Symbols

Subsurface Diagram – West Parking Area (BH-1/BH-2)

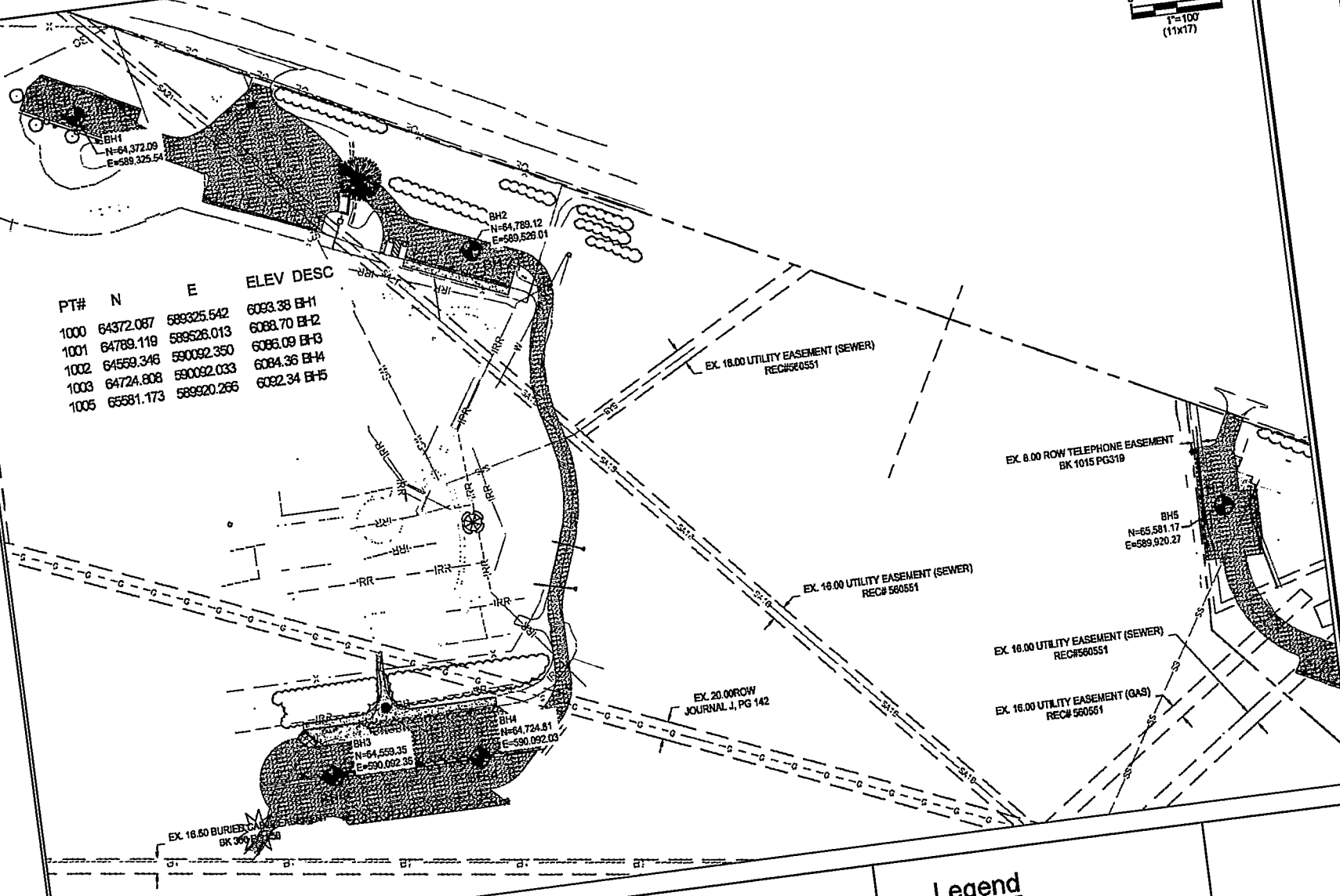
Subsurface Diagram – East Parking Area (BH-3/BH-4)

Subsurface Diagram – North Parking Area (BH-5)

Boring Logs (BH-1 through BH-5)




PT#	N	E	ELEV	DESC
1000	64372.087	589325.542	6093.38	BH-1
1001	64789.119	589526.013	6088.70	BH-2
1002	64559.346	590092.350	6085.09	BH-3
1003	64724.808	590092.033	6084.36	BH-4
1005	65581.173	589920.266	6092.34	BH-5



BORING LOCATION DIAGRAM
 Clear Creek Park Phase III
 251 Southwest Drive
 Cheyenne, Wyoming

Legend

 BORING LOCATION

Project No: 01-25046

IB

CLIENT AVI, p.c.

PROJECT NAME Clear Creek Park Phase III Parking Improvements

PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)



SC: USCS Clayey Sand



SM: USCS Silty Sand



TOPSOIL: Topsoil

SAMPLER SYMBOLS



Split Spoon

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200 - PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION

▽ Water Level at Time
Drilling, or as Shown
▼ Water Level at End of
Drilling, or as Shown
▽ Water Level After 24
Hours, or as Shown



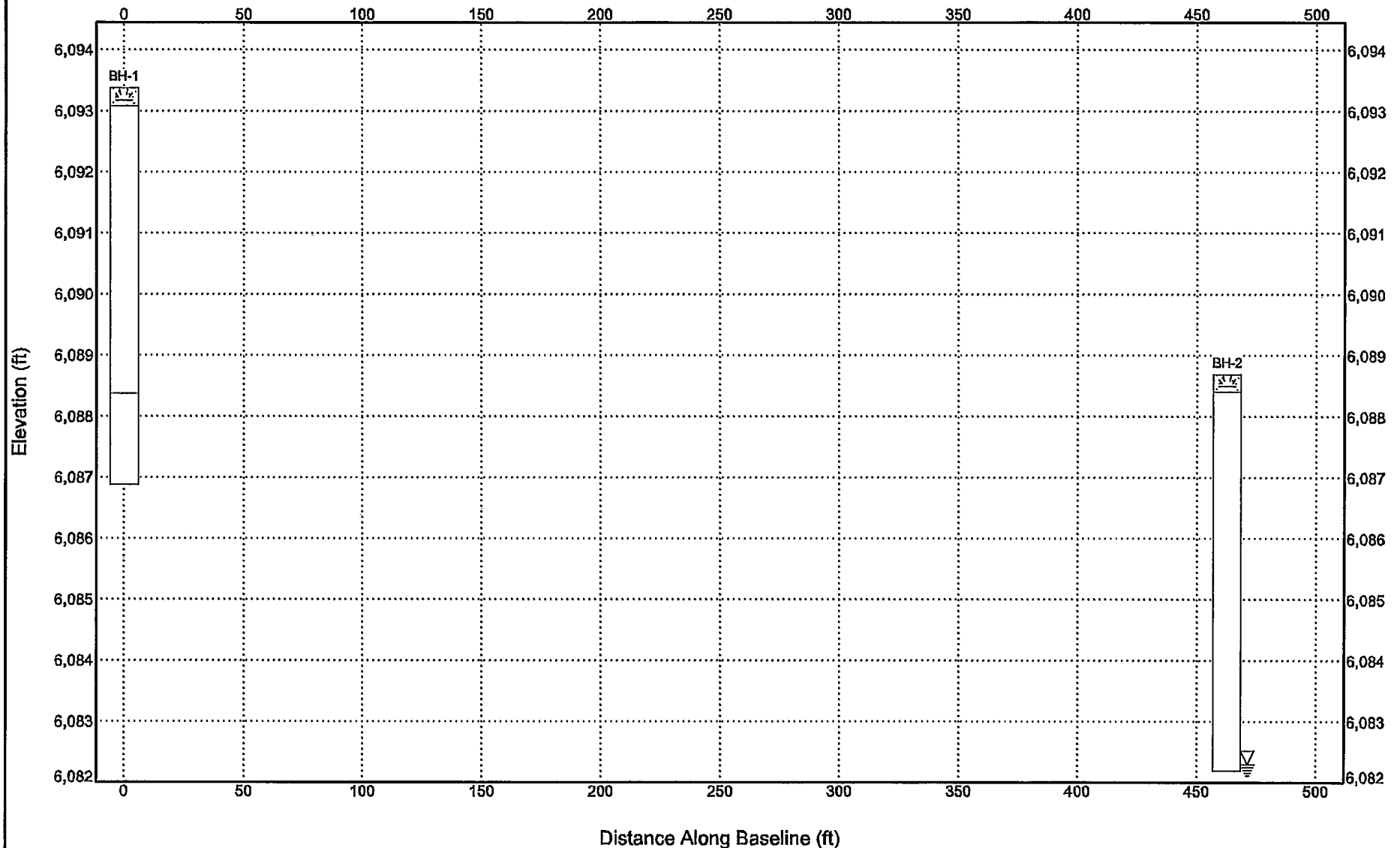
SUBSURFACE DIAGRAM West Parking Lot

CLIENT AVI, p.c.

PROJECT NAME Clear Creek Park Phase III Parking Improvements

PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY





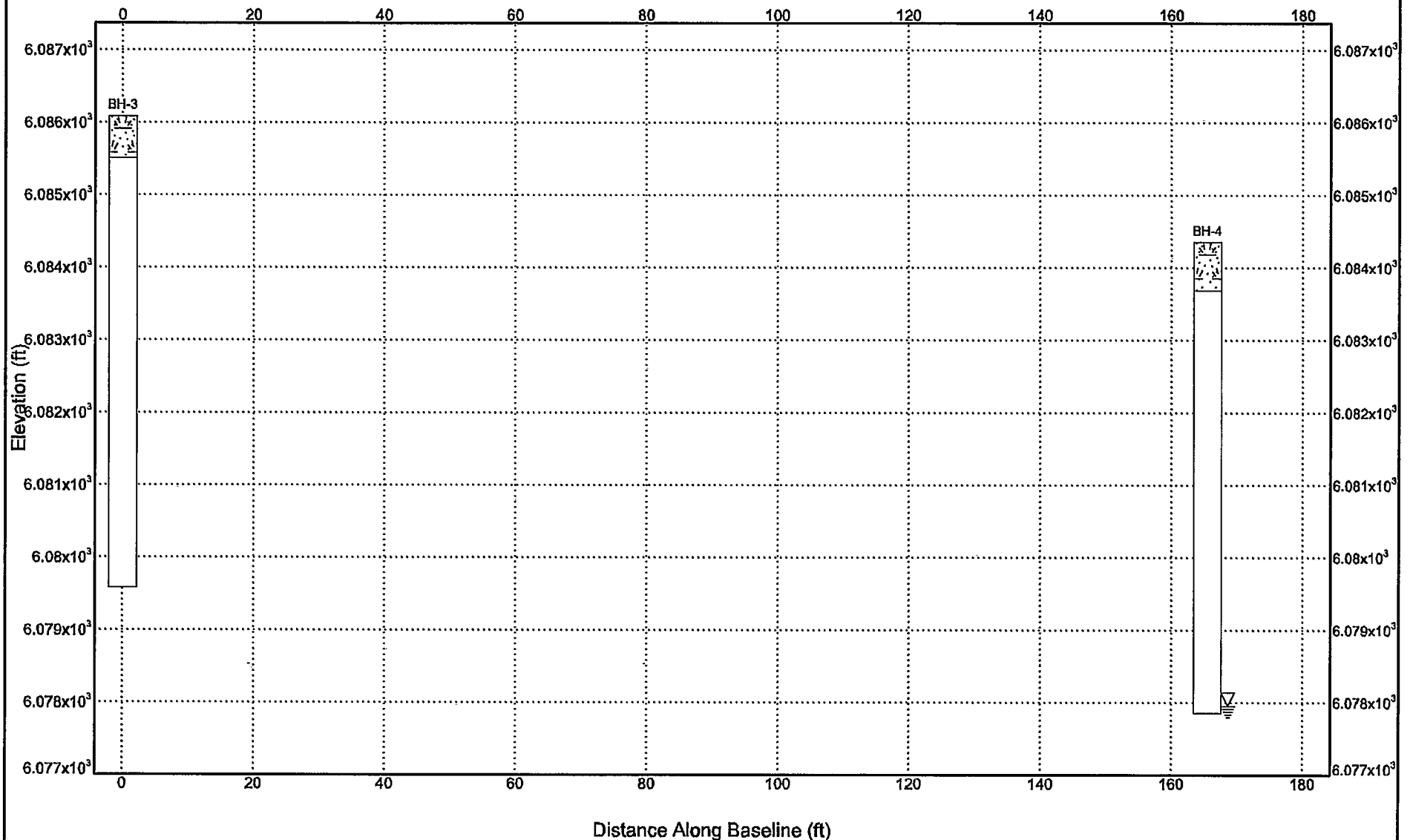
SUBSURFACE DIAGRAM East Parking Lot

CLIENT AVI, p.c.

PROJECT NAME Clear Creek Park Phase III Parking Improvements

PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY





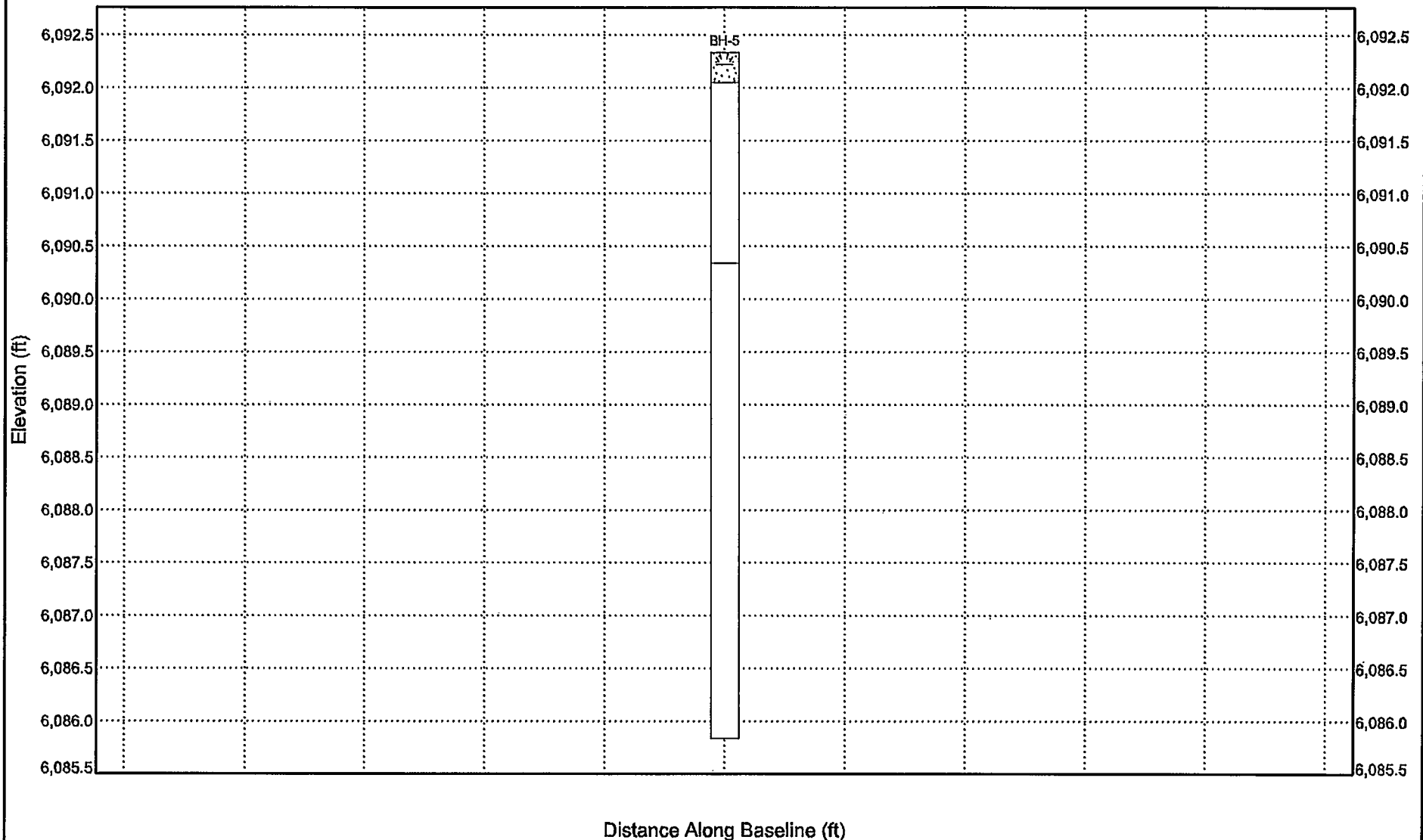
SUBSURFACE DIAGRAM North Parking Lot

CLIENT AVI, p.c.


PROJECT NAME Clear Creek Park Phase III Parking Improvements

PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY



[illegible]

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT - N	Dry Density (pcf)	TEST RESULTS				Remarks Note: BGS = Below Ground Surface
								Pocket Penetrometer, TSF ▲				
								0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5				
								SPT, N-Value ●				
								% Passing No. 200 Sieve ★				
PL MC LL 20 40 60 80												
TOPSOIL, prairie grass, approximately 3½ inches thick (SC) CLAYEY SAND, trace gravel, loose, moist, dark brown	0.0	6088.7										
		6088.4										
	2.5				7 4 4	8						
			SC									
	5.0				5 8 12	20						
becomes light brown at 5 feet		6082.2										
Borehole Terminated at 6.5 Feet.												
Project Name: Clear Creek Park Phase III Parking Improvements Project Number: 01-25046 Client: AVI, p.c. Date Drilled: 3/12/2025 Drill Rig: CME-45 Borehole Dia.: 4" Groundwater Depth: 6.4' Drilled By: Quality Drilling Logged By: K. Dutton								<div style="display: flex; align-items: center;"> <div style="flex: 1;">  </div> <div style="flex: 1; text-align: center;"> BORING LOG BH-2 </div> </div> <div style="text-align: right; margin-top: 10px;"> Sheet 1 Of 1 </div>				

[illegible]

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT - N	Dry Density (pcf)	TEST RESULTS			Remarks						
								Pocket Penetrometer, TSF ▲									
								0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5									
								SPT, N-Value ●									
								% Passing No. 200 Sieve ★									
PL MC LL 20 40 60 80																	
TOPSOIL, prairie grass, approximately 8 inches thick	0.0	6084.4									Note: BGS = Below Ground Surface 						
(SC) CLAYEY SAND, medium dense, moist, dark brown		6083.7															
					3 4 8	12											
suspected thin (<3") cobbles at 3 feet	2.5																
			SC														
becomes loose at light brown at 5 feet	5.0				8 4 3	7											
becomes loose and wet at 6.5 feet		6077.9															
Borehole Terminated at 6.5 Feet.																	

Project Name: Clear Creek Park Phase III Parking Improvements			
Project Number: 01-25046		Client: AVI, p.c.	
Date Drilled: 3/12/2025	Drill Rig: CME-45	Borehole Dia.: 4"	
Groundwater Depth: 6.4'	Drilled By: Quality Drilling	Logged By: K. Dutton	

	BORING LOG
	BH-4
	Sheet 1 Of 1

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT - N	Dry Density (pcf)	TEST RESULTS				Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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Appendix B – Laboratory Test Results



SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

CLIENT AVI, p.c.

PROJECT NAME Clear Creek Park Phase III Parking Improvements

PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Classification	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio
BH-1	1.0	NP	NP	NP	4.75	15	SM	2.3			
BH-1	5.0							35.3			
BH-2	1.0	41	20	21	4.75	40	SC	14.8			
BH-1/2/3/4	2.0	NP	NP	NP	25	25	SM				
BH-2	5.0							11.1			
BH-3	1.0	36	14	22	4.75	42	SC	14.2			
BH-3	5.0							15.6			
BH-4	1.0	35	14	21	4.75	18	SC	22.0			
BH-4	5.0							16.0			
BH-5	1.0	NP	NP	NP	4.75	33	SM	6.0			
BH-5	1.0-5.0	36	15	21	25	28	SC				
BH-5	5.0							7.9			



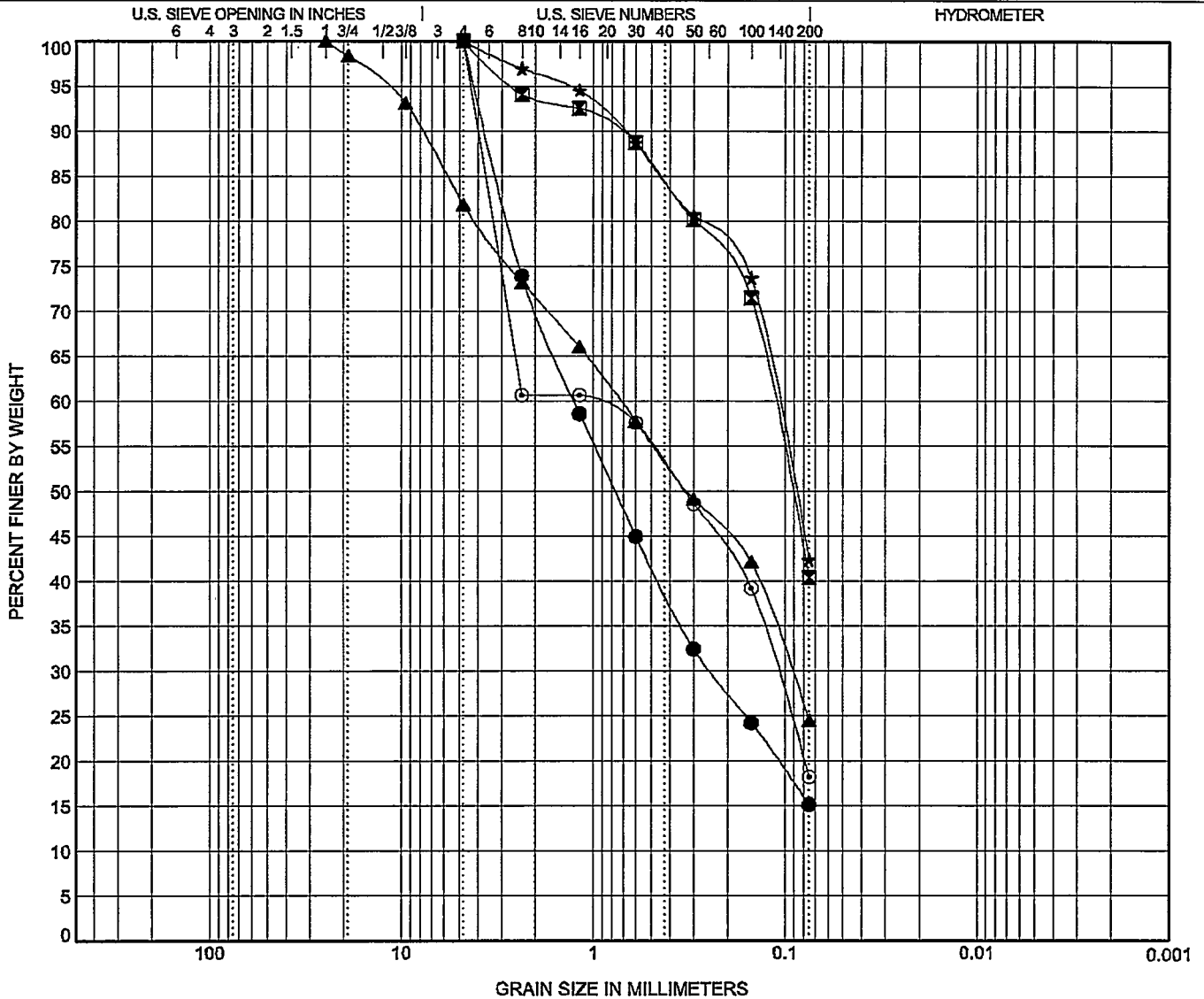
GRAIN SIZE DISTRIBUTION

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PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY





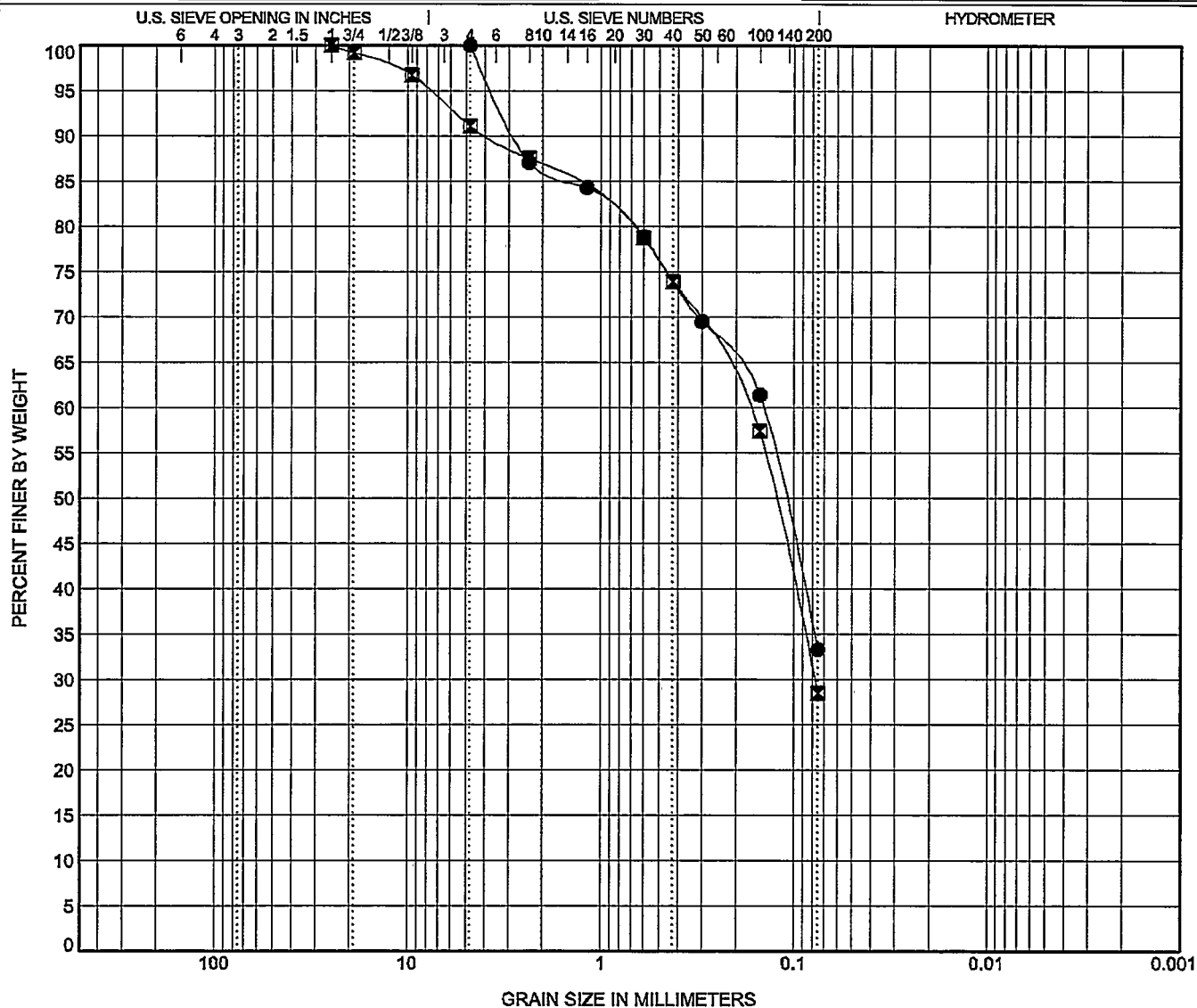
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PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY



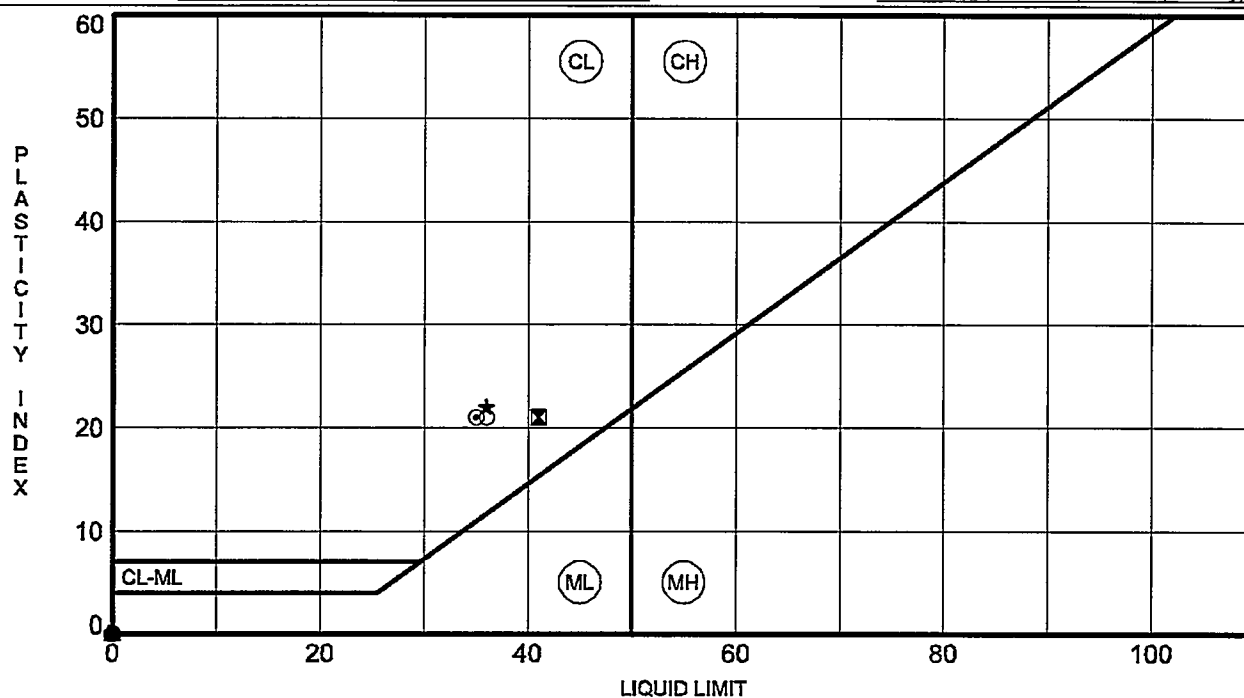
ATTERBERG LIMITS' RESULTS

CLIENT AVI, p.c.

PROJECT NAME Clear Creek Park Phase III Parking Improvements

PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY

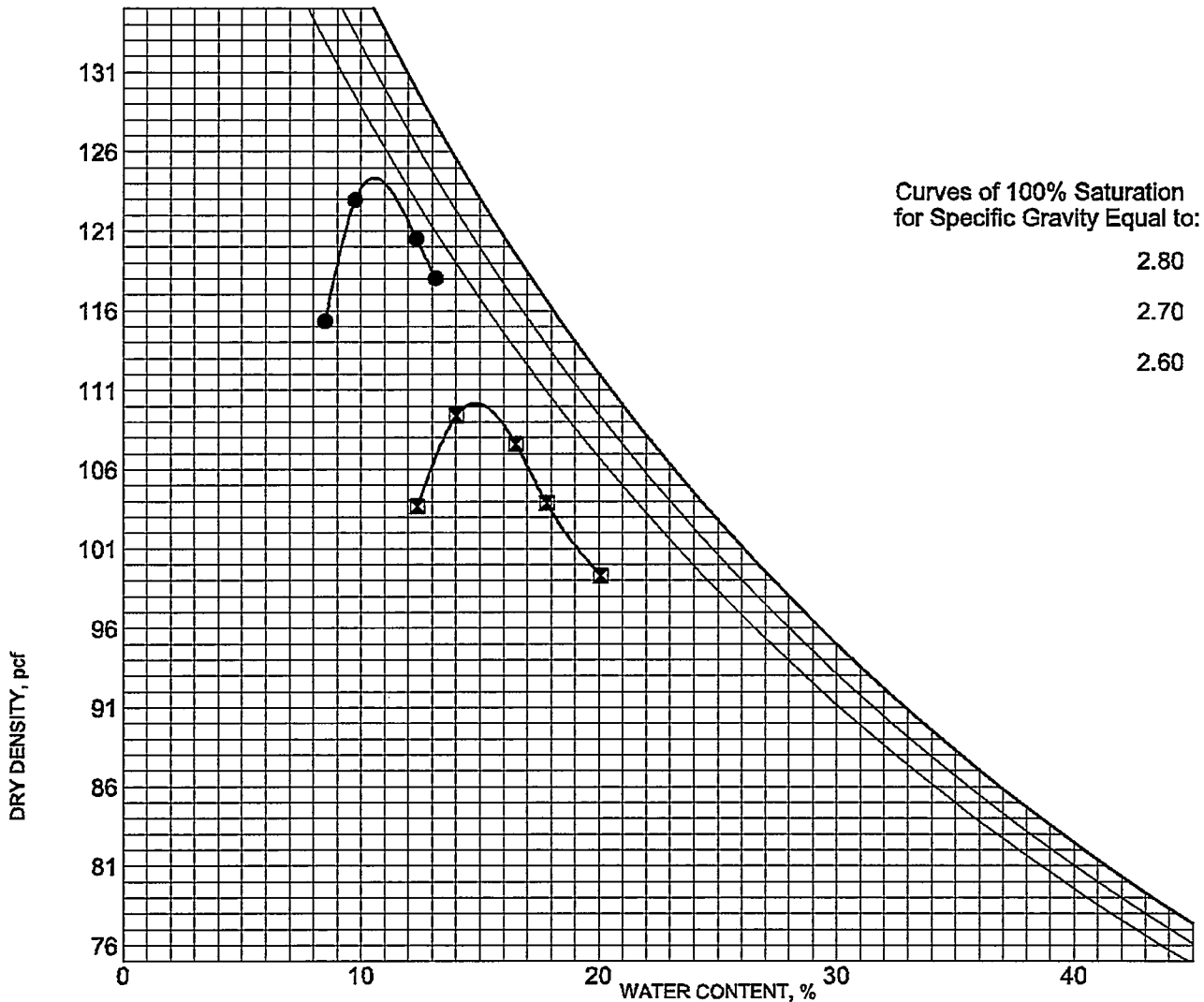
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CLIENT AVI, p.c.

PROJECT NAME Clear Creek Park Phase III Parking Improvements

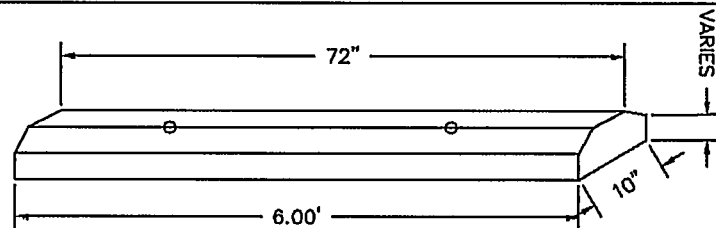
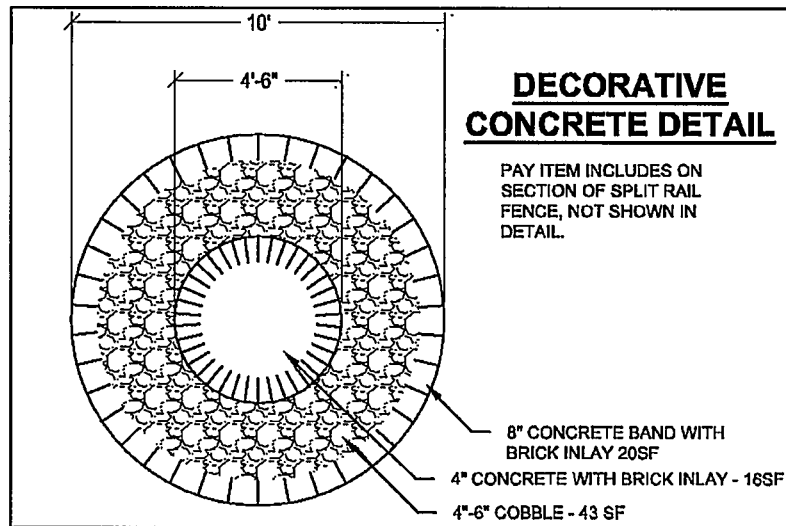
PROJECT NUMBER 01-25046

PROJECT LOCATION 251 Southwest Drive, Laramie, County, WY

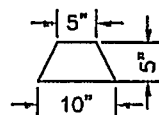


BOREHOLE	DEPTH	Description of Materials
● BH-1/2/3/4	2.0	SILTY SAND with GRAVEL(SM)
☒ BH-5	2.0	CLAYEY SAND(SC)

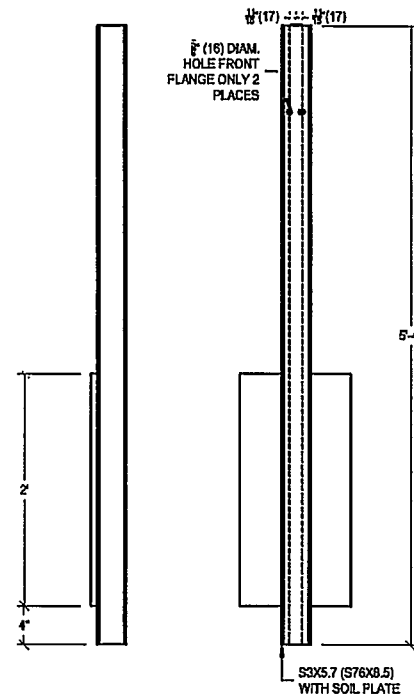
BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
● BH-1/2/3/4	2.0	ASTM D698 Method A	NP	NP	NP	124.3 PCF	10.6 %
☒ BH-5	2.0	ASTM D698 Method A	36	15	21	110.2 PCF	13.3 %



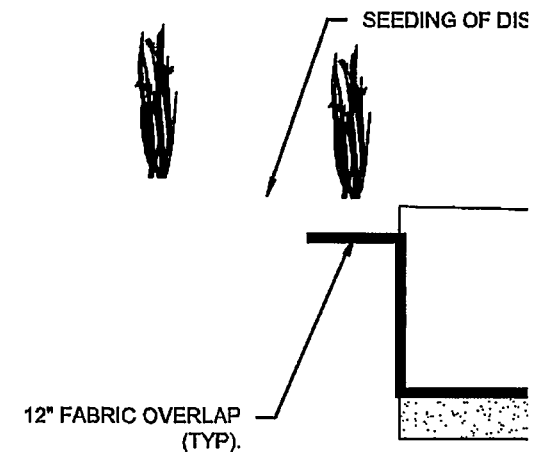
REINFORCED WITH TWO #2 REBAR FULL LENGTH OF BLOCK
CAN USE #2 PINS 30" IN LENGTH FOR ANCHORING PARKING BLOCK



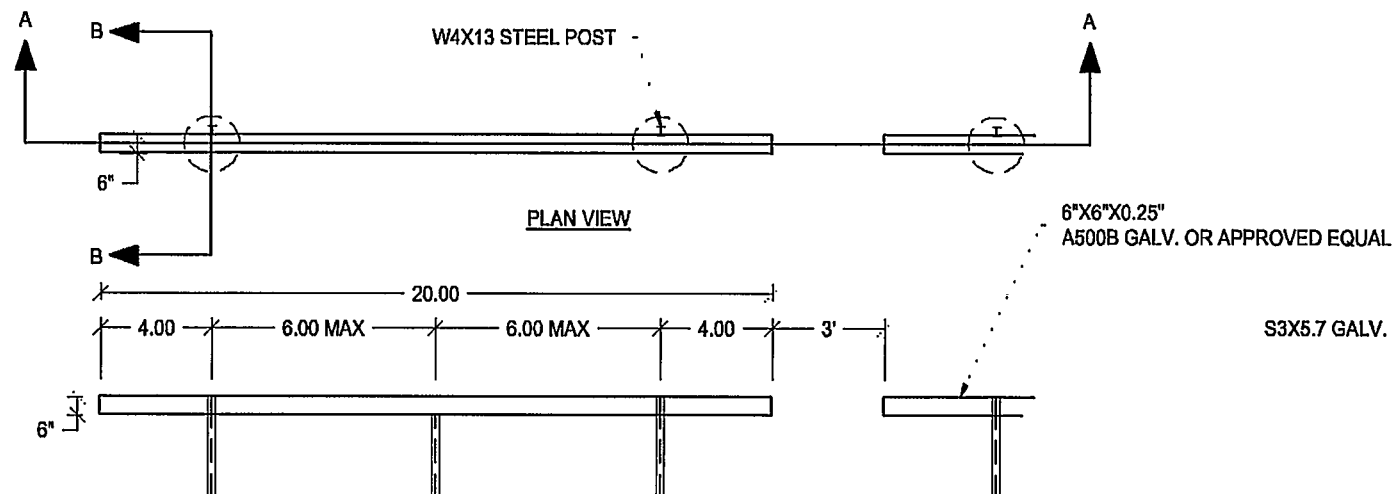
PRECAST CONCRETE PARKING BLOCK
NTS

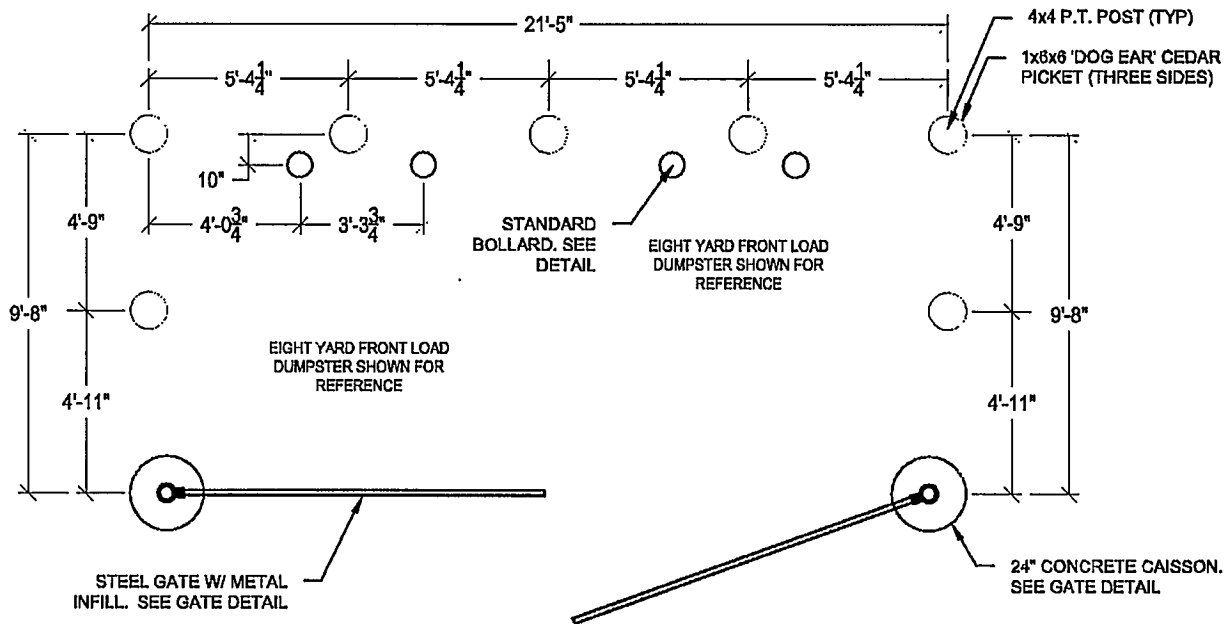


TYPE A POST
NTS



TYPIC





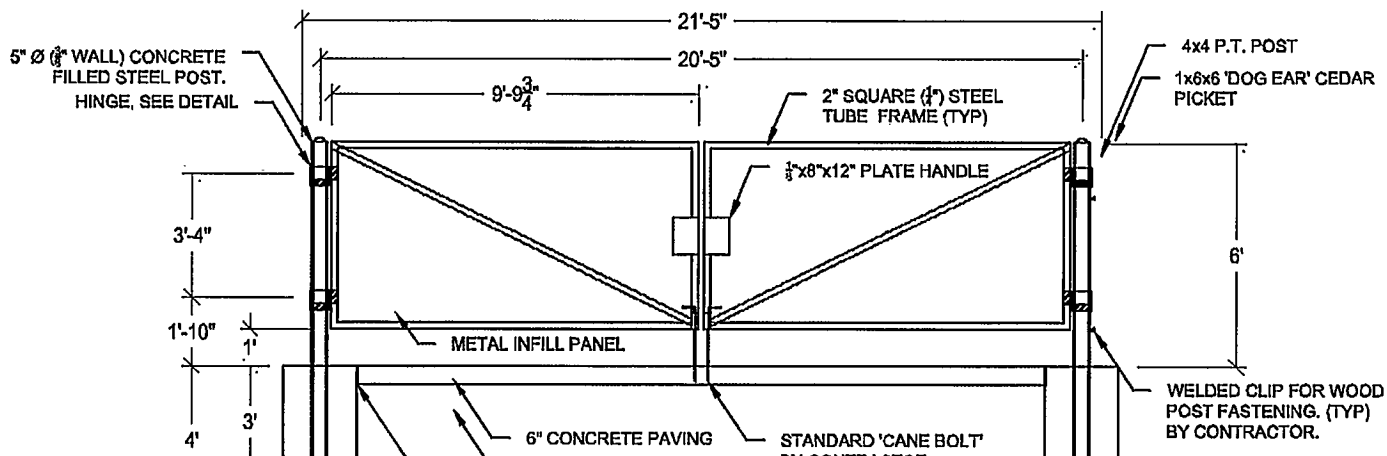
TRASH ENCLOSURE PLAN

4

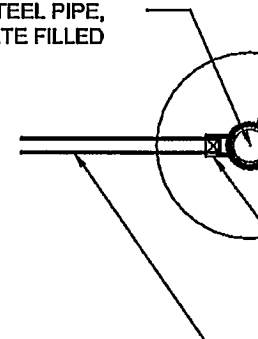
2x6 CED.

6" CONCRETE PA
8" CRUSHED
GRADIN

TYPICA



5" Ø STEEL PIPE,
CONCRETE FILLED



GATE HINGE

EXISTING TREE LINE
CONTRACTOR TO TRIM TREES AS NECESSARY FOR TRASH ENCLOSURE

SEE TRASH ENCLOSURE DETAIL SHEET

PROPOSED ADA STALL
[CLEARZONE]

6" BOLLARD ALONG ADA STALL CLEARZONE

8.00 SIDEWALK
4" CONC. / 4" CB

20.00 CONCRETE PAVING
6" CONC. / 8" CB

10.97

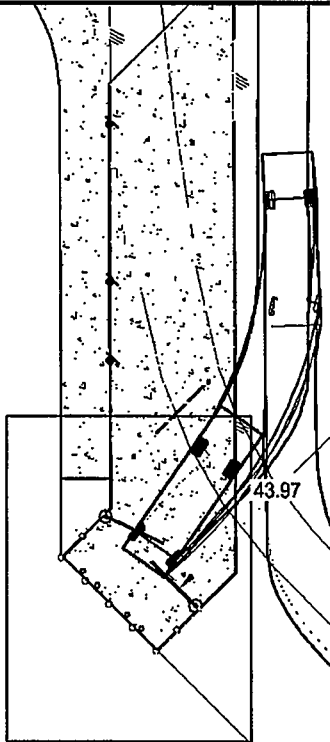
106°44'32"

21.08

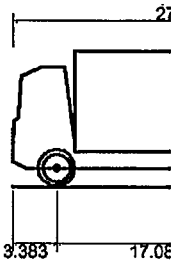
90°0'0"

17.83

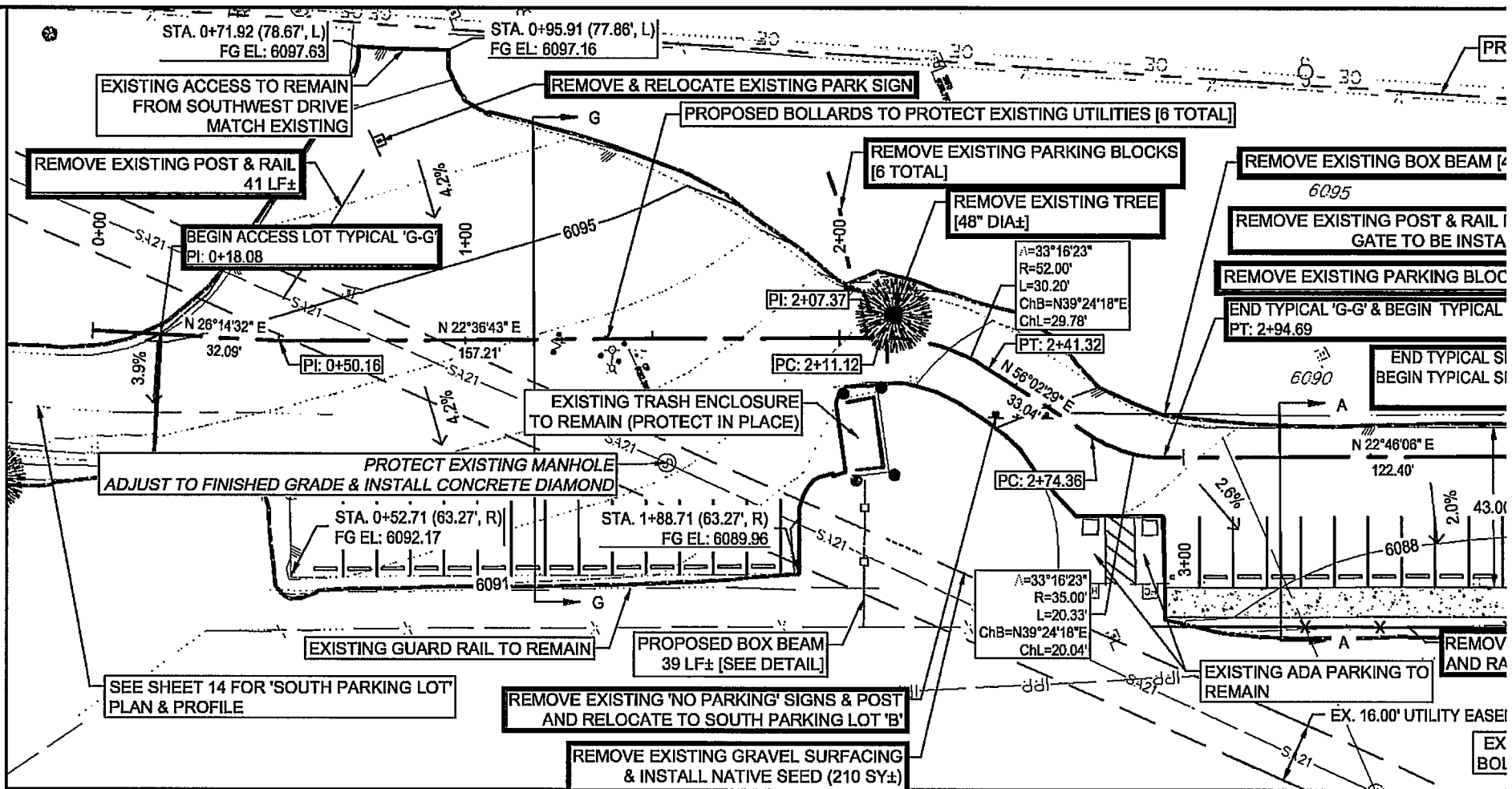
PROPOSED ASPHALT PAVING
4" HPM PVMT / 6" CB



SEE INSET 'A'



Hino 338 M



6100

STA: 0+18.08
 EL: 6095.10

FINISHED GRADE

PVI STA: 1+62.58
 PVI EL: 6093.44
 K: 20.07
 LENGTH: 50.00

PVC: 1+37.58
 EL: 6093.73
 PVT: 1+87.58
 EL: 6092.53

PVI STA: 2+95.16
 PVI EL: 6088.61
 K: 37.03
 LENGTH: 127.64

+31.34
 390.93
 +58.98
 388.48