The Richland-Lexington Riverbanks Park District ("Owner") requests the Request for Proposals:

CONTRACTOR
for the
SERVICE DRIVE AND GONDOLA RELATED CONSTRUCTION
RFP 2024-10-02

The delivery method will be ***Contractor*** under the framework established in the A102-2017 and A201-2017, as may be amended or supplemented during contract negotiations with awardees.

RFP KEY EVENTS / DATES

1.	Issue Request for Proposals[1]	October 18, 2024
2.	Mandatory Site Visit	October 25, 2024, at 2:00 PM EST
3.	Deadline for Questions/Clarifications[2]	October 28, 2024, by 3:00 PM EST
4.	Answers to Questions	October 30, 2024
5.	Proposal Due	November 5, 2024, at 10:00 AM EST
6.	Anticipated Interview Date	Week of November 11, 2024
7.	Anticipated Contractor Selection	Week of November 18, 2024

[1] This document and any addenda will be issued exclusively via the Owner's web page in electronic format as amendments to the end of the document at https://www.riverbanks.org/procurement/.

[2] Questions will be answered by Addendum TO THIS DOCUMENT as posted on the Owner's web page at https://www.riverbanks.org/procurement/Direct all questions in writing via e-mail to Noelle Kelley, Procurement Manager at nkelley@riverbanks.org with a copy to Maggie Stackley at mstackley@lckcs.com.Please reference "Gondola/Service Drive Construction Services" in the subject line so your question can be identified promptly.

NOTICE TO BIDDERS: **There will be a MANDATORY site visit on October 25, 2024, at 2:00 PM (EST.) at Riverbanks Zoo & Garden, 400 Rivermont Drive, Columbia, SC 29210.** Due to the importance of all bidders having a clear understanding of the scope and requirements for this project, *attendance at this meeting will be required.* Any changes that may be agreed upon as a result of this conference will be noted in an amendment to the bid invitation and posted on the Riverbanks Zoo and Garden procurement page. **Each bidder shall fully acquaint himself with conditions relating to the scope and restrictions attending the execution of the work under the conditions of this bid. The failure or omission of a bidder to acquaint himself with existing conditions shall in no way relieve him of any obligation with respect to this bid or to the contract.** All amendments to and interpretations of this solicitation shall be in writing and issued by the Procurement Manager. Richland-Lexington Riverbanks Park District DBA Riverbanks Zoo & Garden (hereinafter known as "the District") shall not be legally bound by any amendment or interpretation that is not in writing.

SUBMISSION REQUIREMENTS

Respondents shall submit four (4) sealed, original bound copies and one (1) electronic file of the response to:

RFP 2024-10-02 Service Drive and Gondola Related Construction
Attn: Noelle Kelley
400 Rivermont Drive
Columbia, SC 29210

And three (3) sealed, original bound hard copies to:

RFP 2024-10-02 Service Drive and Gondola Related Construction
Attn: Maggie Stackley
1301 Gervais Street, Suite 601
Columbia, SC 29201

Proposers shall refrain from direct or indirect communications promoting their Proposal to the Owner or any member of the Lexington-Richland Riverbanks Park Commission, other than through the formal submittal process established by the Request for Proposals (RFP). Failure to comply with submittal requirements may cause the submittal to be removed from further consideration.

1.0 INTRODUCTION

In 2023, Riverbanks Zoo and Garden leadership announced an expansion which will take advantage of the pristine Saluda River environment, to include a skyway gondola, a riverside restaurant, and a hillside primate habitat collectively known as Phase II of "Bridge to the Wild." The Zoo continues to modify and expand its existing animal habitats, SC Nature Preserve, support facilities and infrastructure. Various capital projects such as these will serve as enabling projects for the larger expansion.

While maintaining all existing Zoo and Botanical Gardens operations and guest access, Riverbanks Zoo and Garden will construct an emergency access service drive and provide site improvements, concrete plazas and foundations as well as support structures in preparation for and coordination with the gondola installation by Leitner-Poma.

1.1 The following details the current scopes of work captured in this RFP:

Service Drive Relocation - includes construction of a new asphalt drive connecting the Zoo's east parking area to existing access drive adjacent to the gondola site, plaza and pedestrian bridge. The Contractor is to include all materials labor and equipment to complete all work shown. We anticipate that the drive will be completed in two phases:

1. Partially complete service drive through installation of the first lift of asphalt, allowing the drive to be used as the main access to the east gondola station and tower foundations; as well as emergency access to the river for City of Columbia Fire Department rescue operations.

2. Upon completion of the gondola installation and associated sitework and building construction is complete, the final lift of asphalt can be placed.

B. Gondola Related Construction
   1. Installation of gondola stations, towers, rigging, and cars will be completed by Leitner-Poma under a separate contract.
   2. The selected contractor will provide all foundations for the tower and station structures, tree removal, grading, paving, underground utilities, landscaping, bathroom and ticket buildings, control buildings, queuing shelters, fencing, etc.

Design documents are complete for the service drive relocation. Design Development continues for the gondola related construction. A set of current project documents are included as part of this RFP for reference. The selected contractor will assist in providing constructability and cost savings input to the project team in development for the 100% construction set.

The award will result in the selection of a Contractor to provide preconstruction services and general construction services for the Project.

Construction on the service drive is planned to begin in November 2024. The drive and foundation work on the east side needs to be sufficiently complete to allow Leitner-Poma to mobilize and start work by January 27, 2025. By submitting a proposal, the proposer understands that this work is to commence very quickly and is prepared to submit a proposed GMP for this work in a timely fashion after selection to meet this start date.

The selected Contractor will assemble a final guaranteed maximum price (GMP) in collaboration with LCK, the owner's project representative, CLR Design and Jackson Civil Engineering representatives. In addition to the GMP, the Contractor will finalize a project schedule, logistics plan, and the procurement strategy that will be executed to deliver the project within the proposed GMP and timeline.

For the purposes of completing their proposals, firms should use the following assumptions:

- Cost of work $5-6 million, excluding the Leitner Poma scope.
- Anticipated start in November and nine (9) month duration.
- While the final contract value and construction schedule will be confirmed upon completion of the design documents, the proposed fee percentages and monthly general conditions costs will be used as the basis for any future adjustments.
- We anticipate that the work may be contracted under a single base AIA-102/201 contract using several individual GMP amendments for various phases of the work. This may be done for timing, funding or other reasons as the Owner may determine are necessary.

2.0 GENERAL INFORMATION

2.1 Riverbanks Zoo & Garden will be the legal entity with which the selected general contractor will execute the contract for construction services. Riverbanks Zoo & Garden reserves the right to alter the proposed scope of the Project, for the purpose of this Request for Proposal (RFP).

2.2 The construction agreement will be administered by Riverbanks Zoo & Garden. By way of information, all proposing firms should understand that all or any portion of the proposed project is subject to the approval of Riverbanks Zoo & Garden. Riverbanks Zoo & Garden reserves the right to accept or reject any proposal, or to terminate the agreement upon conclusion of

preconstruction phase of the scope of work.

2.3 LCK is the Project Manager and Owner's Representative for the project and will serve as the Contractor's point of contact. Dale Stigamier, President of LCK, is serving as the Project Executive. Dave Detwiler, Vice President, and Maggie Stackley, Preconstruction Services Manager, will serve as the points of contact for selection and construction. CLR Design is the architect of record with all MEP consultants under their team and Jackson Civil Engineering is providing civil engineering for the project.

2.4 After the selection committee has reviewed the RFP responses, ***if necessary,*** interviews will be scheduled with one or more of short-listed respondents. The interviews will be 60 minutes in length with 45 minutes for presentation and 15 minutes for questions and discussion. The interviews should be used by the respondents to introduce the leading members of the project team and to present the firm's approach to both the pre-construction services delivery and to the construction of the project. The interview should not be a forum for presenting past project experience except projects specifically completed by proposed team members and which are relevant to this assignment. Participants in the interview should be limited to those who will have key roles in the project.

2.5 During the interview, the respondents will be expected to demonstrate their understanding of the project through a detailed presentation and review of their site logistics, long-lead procurements and scheduling recommendations, observed challenges, technical expertise with owner equipment and installation and other relevant information—specifically pointing out any assumptions used for schedule acceleration, staffing, construction pricing, etc. Respondents will be evaluated on their thoughtful, creative, detailed approach to construction of the project and the amount of effort exhibited in studying the documents provided and gaining an understanding of the assignment.

3.0 SUBMITTAL DATA DETAIL

3.1 Selection of the final contractor will be based on the criteria detailed herein. The primary selection criteria will be the proposed fee and cost of general conditions, insurance and bonding for the project. A matrix is provided (Attachment A) which defines how project costs should be allocated to the respondents' fee and general conditions and those expenses which are to be by the Owner or included as a cost of the work. The purpose of the matrix is not to suggest that all listed items are to be included, but instead to serve as a guide for determining where the cost is to be allocated if proposed***. Proposed general conditions for the project shall be detailed by line item to coincide with the line items of the matrix***. ***Respondents must adhere to the matrix for cost allocation. General Conditions and fee expenses shall not be assumed to be included at a later date as part of the cost of the work.***

3.2 The contract form which the selected contractor will be expected to execute will be AIA Document A102-2017 – Standard Form of Agreement Between Owner and Contractor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price, and AIA Document A201-2017 - General Conditions of the Contract for Construction, both as modified by the owner (hereinafter collectively the "AIA Contract Documents"). The AIA Contract Documents will be issued to short-listed contractors for review. Respondents must provide an itemized list of any exceptions to the contract terms and conditions. ***Modifications to***

the Agreements proposed by the selected Contractor will not be considered at a later date. Terms and Conditions are considered final at the time of selection.

3.3 The selected Contractor shall provide pre-construction services in the form of means and methods advisory services including value engineering and planning for long-lead procurement packages. The Contractor shall work as a partner of the entire development team. Respondents shall provide a narrative regarding how cost will be controlled throughout the remainder of the design period and construction. The narrative should address how respondent will perform cost management throughout the estimating and construction period without unnecessarily limiting the incorporation of design elements proposed for the building.

3.4 Respondents shall include a proposed schedule for achieving project delivery. Early site release packages, pre-purchase of critical path materials, etc. should all be considered in the development of the Contractors' schedules. A narrative supporting the schedule logic should be included in the proposal, outlining the scheduling methodology, including any time-saving alternatives, the reasonableness of the schedule, critical path elements that must be met, and/or alternatives (if any) for accelerating the schedule or cost savings that might be realized through creative scheduling. Additionally, the respondent should include a plan for avoidance of material cost increases and delays in availability as well as the potential for limited subcontractor resources and weather conditions.

3.5 Provide a brief narrative which conveys the respondents' understanding of the scope and complexity of the project, and any constraints or challenges that are anticipated for successful execution of the work. Respondents should include in the narrative a logistics plan outlining how they will mobilize and execute construction including the responsibilities of the Contractor and of the owner. Respondents should also include any perceived challenges in coordinating or phasing of the work with other stakeholders in the project such as gondola installation contractor, authorities having jurisdiction and utility providers and provide an explanation of how the respondent plans to mitigate those challenges. Cost management practice and change order controls (include historical metric for typical change order percentages experienced by your firm), schedule management, quality assurance programs, drug/safety programs, communications management, punch list administration and typical closeout plan should be addressed in this narrative. The selected Contractor will be expected to deliver the project both ***on time and on budget***. This narrative should build the case for how the firm plans to successfully accomplish these requirements.

3.6 Each respondent is required to submit a detailed staffing plan and organizational chart specific to the project to include both on-site and off-site participants. If selected, the Contractor's substitutions of proposed team members shall not be made. The staffing plan should include the names and profiles of each person on the Contractor's team and the person who will be the team leader and point of contact with LCK and Riverbanks Zoo & Garden for the duration of the project.

3.7 The response to the RFP shall include a copy of the respondent's standard subcontractor agreement along with any standard attachments which may be incorporated into the subcontractor agreement.

3.8 An equipment rental schedule shall be included in the response for all trucks, small and large tools and equipment which the respondent anticipates charging to the job.

3.9 In addition to the general conditions detailed cost breakdown, respondents will be required to submit on the bid form change order rates, daily rates for extended general conditions, labor burden rate, bond rate, and liability insurance rate which will be charged to the job as well as any other ancillary pass-through costs. Respondents shall include a letter from the firm's agent regarding the firm's current bonding capacity and bond rate for the project. Contractor shall also provide a statement regarding the firm's bonding policy for sub-contractors.

3.10 Respondents shall provide a list of construction activities which the respondent may self-perform.

3.11 As part of the RFP response, Contractors are requested to provide information outlining their typical safety program/policies including PPE requirements (minimum project safety requirements include safety vests, steel toed shoes, safety glasses, and masks and/or any other local safety/health ordinance requirements). Fall protection, equipment training, and any applicable training associated with individual trades is also required. Contractors are also requested to provide their TRIR for the past (3) years along with Worker's Compensation modification rate.

3.12 Contractors are requested to provide a sample Certificate of Insurance with their bid. Minimum project insurance requirements are; 1) CGL - $5 million each occurrence, $6 million general aggregate, 2) Automotive - $5 million per accident, and 3) Workers' Compensation – statutory limits, including all employees and owners.

3.13 Case studies shall be provided for a minimum of five and not more than ten similar projects completed by Contractor. Case study narratives should include the Contractor's original contract and final contract cost for the project, original and final schedule, and any common team members to those proposed for the Riverbanks Zoo & Garden project.

3.14 Direct communications and questions concerning this RFP and general questions about the project in writing to Noelle Kelley at nkelley@riverbanks.org with a copy to Maggie Stackley at mstackley@lckcs.com.

3.15 Only written communication related to this invitation will be considered. No oral communication from the project representatives can be relied upon for proposal purposes. Unauthorized contact may result in disqualification.

3.16 Contractors intended to submit a response to this RFP should attend the mandatory site visit to review the existing site conditions and limits of construction in preparing their schedule and logistics plan. Respondents will not be provided an additional opportunity to review the site in advance of submitting the proposal and should not attempt to communicate with Riverbanks Zoo and Garden representatives or access the project area outside of the scheduled site visit.

3.17 Upon receipt, the proposal will become the property of LCK and Riverbanks Zoo & Garden for use at their discretion. The details of all proposal documents will remain confidential until and after final award.

3.18 Responses should be limited to 50 pages or less (excluding standard subcontractor agreement.) Respondents are encouraged to be succinct, to the point, and include only those materials that have been requested and other relevant information.

4.0 SELECTION CRITERIA

4.1 Criteria which will be weighed in the evaluation and selection process include:

A. Respondent's understanding of the project and its proposed project approach including the Owner's perceived quality of the following - 20%
   1. Preconstruction/value engineering services;
   2. Construction of the Work;
   3. Change order management;
   4. Historical compliance with schedule;
   5. Safety programs; and
   6. Quality assurance plan;

B. Respondent's creative approach to the project schedule and site logistics plan - 25%

C. Respondent's staffing plan - 25%
   1. Effective use of personnel resources and proposed organizational structure for the project; and
   2. Experience of proposed staff members.

D. Proposed Fee, General Conditions, and Pass-Through Expenses - 30%
   1. Reasonableness of general conditions, other costs and fees.

5.0 SUMMARY OF REQUIRED SUBMITTAL INFORMATION AND PROCESS

5.1 Proposals submitted shall include the following:

A. Cover letter/executive summary. The executive summary should summarize key elements of the submittal that in the opinion of the respondent differentiates it from others. It should answer the question, "What about your firm and your team should make you stand out as the most appropriate contractor firm for the project?"

B. An executed contractor's Proposal Form (Attachment B) completed in its entirety with all attachments and support documentation as required herein.

C. Proposed project schedule.

D. Proposed site logistics plan.

E. Typical Safety Program and Policies as well as TRIR for the past (3) years along with Worker's Compensation modification rate.

F. Narrative which details any clarifications or assumptions that should be considered by the selection committee regarding schedule, proposed cost, or the project team.

G. Organizational chart reflecting all persons/positions who would be assigned to the project, a brief description of their roles, and a resume for each including past experience with similar projects.

H. Copy of the firm's standard subcontractor contract and any supporting standard exhibits.

I. Statement regarding the respondent's subcontractor bonding policy.

J. List of work that may be self-performed.

K. Equipment Rental List.

L. Copy of Contractor's License and Qualifying Party Certificate.

M. Case studies or examples of a minimum of five (5) projects completed by the firm that are similar in scope to the proposed assignment. Include in the case study the Contractor's original contract and final contract cost for the project, value of change orders for the project, original and final schedule, and any common team members to those proposed for this project.

N. Reference letter from firm's bonding company confirming capacity for this assignment and current bond rate which will be in effect throughout the term of the project.

O. Contractor's insurance certificate.

P. One bank reference and five business references.

6.0 CONTRACTOR PAYMENT APPLICATION PROCESS:

6.1 The Contractor shall develop and implement procedures to prepare, approve, and manage all applications for progress and final payments for Sub-Contractors based on the Contractor's Certificates for Payment.

6.2 The Contractor shall submit with each Certificate for Payment a list of all contractors, subcontractors, sub-subcontractors and material suppliers that Contractor knows has furnished labor or materials to the Project. Contractor shall provide copies of lien waivers from each contractor, subcontractor, sub-subcontractor, or material supplier for all work for which the Owner has already made payment.

7.0 COORDINATION OF CONSTURCTION IMPACTS ON OWNER OPERATIONS:

7.1 During the course of construction, the Contractor shall work with the Owner to research, investigate, and identify the critical operational components that must be maintained during construction. Once identified, the Contractor shall organize and implement plans and procedures to keep these components operational. Animal welfare cannot be compromised by the construction process.

8.0 CONTRACTOR'S RESPONSIBILITIES DURING THE WARRANTY PERIOD:

8.1 Contractor shall be responsible for the coordination and execution of all warranty claims for each project for a period of one year from the established "substantial completion" date.

9.0 CONTRACTOR BILLING PROCEDURES:

9.1 Contractor shall submit to Owner a monthly statement showing in detail all monies paid out, costs accumulated, or costs incurred on account of the cost of construction and reimbursable costs during the previous month, and the amount of the Contractor's Fee then due. Upon the request of Owner, the Contractor shall provide evidence of all reimbursable costs.

9.2 Payments shall be made according to the AIA 201 terms.

Submission of Proposals:

Respondents shall submit four (4) sealed, original bound copies and one (1) electronic file of the response to:

RFP 2024-10-02 Service Drive and Gondola Related Construction
Attn: Noelle Kelley
400 Rivermont Drive
Columbia, SC 29210

And three (3) sealed, original bound hard copies to:

RFP 2024-10-02 Service Drive and Gondola Related Construction
Attn: Maggie Stackley
1301 Gervais Street, Suite 601
Columbia, SC 29201

Packages sent via express courier, or the normal mail system is a risk. Mail is routed through several departments at the zoo before being delivered to the procurement department. If the Proposal at the zoo, but not delivered to the procurement department at or before the stated time, the proposal will not be considered. The zoo advises that proposals be hand delivered.

PROTEST RIGHTS

Qualification rankings are not subject to protest. For the Proposals, the Owner's Procurement Code provides: "Right to Protest. Any actual or prospective bidder, offeror, contractor or subcontractor who is aggrieved in connection with a solicitation, an award, or intended award of a contract or any decision of the Procurement Committee pursuant to Section 4-105, may protest. The protest shall be submitted in writing to the Procurement Committee setting forth the grounds and facts applicable thereto for the protest, within seven (7) calendar days of the date of the issuance of the solicitation, the notification of the award or intended award of a contract, or any decision of the Procurement Committee, as applicable. The rights and remedies granted in this article to a disappointed bidder, offeror, contractor or subcontractor are to the exclusion of all other rights and remedies of such disappointed bidder, offeror, contractor, or subcontractor against the Owner at common law or otherwise for the loss or potential loss of an award of a contract. The Procurement Committee may in its discretion hold a hearing with notice to all interested parties including the protestor and the apparent successful bidder whose award is being protested."

END OF REQUEST FOR PROPOSALS

I. MANAGEMENT EXPENSES				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Project Superintendent(s)		X		
Assistant Superintendent(s)		X		
Field Coordinator(s)		X		
Field Engineer(s)f		X		
Corporate Executives	X			
Principal in Charge	X			
Officer in Charge	X			
Legal (Basic Service)	X			
Project Manager(s)		X		
Accounting	X			
Scheduling		X		
BIM Modeling	X			
Office Engineer(s)		X		
Project Engineer(s)		X		
Safety Director		X		
Administrative Support - On Site		X		
Administrative Support - Offsite	X			
Superintendent Transportation		X		
Off-Site Staff Travel Costs – With Owner Approval		X		
On-Site Project Manager Transportation		X		
Project Estimating	X			
Employee Bonuses, Profit Sharing, 401K, Etc.	X			
Mobilization		X		

Note: Personnel expenses are actual base salary per person assigned to the project whether full or part time plus quoted labor burden rate unless standard hourly rates are included in any proposal or Agreement and have been specifically approved by Owner at the time of Contractor's selection.

II. SAFETY, SECURITY, AND SERVICES				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Safety Equipment		X		
First Aid Supplies		X		
Handrails & Toe Boards		X		
Opening Protection		X		
Fire Extinguishers/Fire Watch		X		
Security Guard/Watchman Services		X		
Weekly Cleanup		X		
Final Cleanup (Including Pressure Washing)		X		
Temporary Fencing		X		
Covered Walkways				X
Barricades		X		
Safety Nets				X
Site Logistics Signage		X		
Debris Hauling/Removal				X
Traffic Control		X		
Roadway Maintenance		X		
Dust Controls		X		
Site Communications Technology		X		
Trash Chute & Hoppers				X
Snow & Ice Removal				X

III. FACILITIES, EQUIPMENT, AND SERVICES				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Office Trailer Rental		X		
Utility Trailer Rental		X		
Water/Ice		X		
Temporary Lighting/Wiring				X
Electricity Expenses				X
Temporary Water Services				X
Temporary Heat Expenses				X
Temporary Cooling Expenses				X
Temporary Toilets/Sewer Services		X		
Temporary Stairs				X
Temporary Enclosures/Partitions				X
Project Signs/Bulletin Boards		X		
Telephone Expenses*		X		
Temporary Roads				X
Trucks		X		
Air Compressors				X
Dewatering Equipment				X
Generators				X
Miscellaneous Equipment				X
IS Systems and Hardware		X		
Fuel/Repairs/Maintenance		X		

*Site office telephone expenses and cell phones for on-site staff only, home office phone and off-site cell phones are not part of fee.

IV. VERTICAL HOISTING				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Hoist & Tower Rental				X
Small Material Hoist Rental				X
Hoist Landings & Fronts				X
Hoist Operators				X
Hoist Safety Inspections				X
Hoist Material Skips				X
Hoist Material Hoppers				X
Erect & Dismantle Hoists				X
Fuel/Repairs/Maintenance				X
Hoist Communication				X
Crane Rental				X
Crane Operators				X
Crane Safety Inspections				X
Erect & Dismantle Crane				X
Fuel/Repairs/Maintenance				X
Crane Raising/Jumping Cost				X
Temporary Elevator Rental				X
Elevator Operation Cost				X
Elevator Repairs & Maintenance				X
Cage Rider @ Elevator				X
Safety Inspections				X
Forklift Rental				X
Forklift Operators				X
Forklift Safety Inspections				X
Fuel/Repairs/Maintenance				X
Elevator Service Costs				X

V. REPRODUCTION AND PRINTING				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Bid Package Documents		X		
Bidding Instructions		X		
Construction Documents		X		
Postage & Express Costs		X		
As-Built Documents (Drafting)		X		
As-Built Documents (Printing)		X		
Accounting Forms	X			
Field Reporting Forms	X			
Contract Agreements	X			
Schedule Report Forms	X			
Estimating Forms	X			
Cost Reporting Forms	X			
Presentation Charts & Graphics	X			
Value Analysis Studies	X			
Data Processing (In-House)	X			
Reference Materials	X			
Duplication Expense (Misc.)		X		
Shop Drawing Printing		X		
Maintenance Manuals		X		
Operation Manuals		X		
Special Forms	X			
Postage & Delivery Expense		X		

VI. QUALITY CONTROL				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Special Testing Consultants			X	
Concrete Testing			X	
Masonry Testing			X	
Compaction Testing			X	
Welding Inspections			X	
Soils Investigations			X	
Special Testing Services			X	
Stormwater Management Inspections			X	
Field Office Supplies/Materials		X		
Project Photographs		X		
Warranty Inspection Coord.		X		
Air & Water Balancing				X
Operator On-Site Training				X
Prepare Operation Manuals		X		
Prepare Maintenance Manuals		X		

VII. PERMITS AND SPECIAL FEES				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Storage Yard Rental		X		
Parking Lot Rentals		X		
Parking Fees		X		
Curb & Gutter Permits				X
Temporary Construction Signs & Permits		X		
Permanent Sign Permits				X
Staking & Layout Fees/Costs		X		
Sidewalk Permits				X
Landscape Permits				X
Building Permits				X
Plan Review Fees			X	
Tap and Impact Fees			X	
Contractor's GC Licenses	X			
Local Business Licenses		X		
Zoning Fees / Consultants			X	
Construction Equipment Licenses		X		
Construction Equipment Permits		X		
AGC. and Other Membership Fees	X			

VIII. INSURANCE AND BONDS				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Builders Risk Insurance			X	
General Liability	X			
Excess Liability Coverage if Required by Owner				X
Other Contractor Insurance Requirements	X			
Workman's Compensation*		X		
FICA Insurance*		X		
Federal Unemployment*		X		
State Unemployment*		X		
Payment Bond				X
Performance Bond				X
Off-Site Insurance	X			
Off-Site Staff Taxes	X			

*On-site staff only

IX. OTHER COSTS				
DESCRIPTION	FEE	GEN. CONDS.	OWNER COST	DIRECT COST
Construction Equipment				X
Construction Labor Costs				X
Construction Materials				X
Preliminary Soils Investigations			X	
Cost of Corrective Work	X			
Costs of Emergency Work				X
General Overhead Cost	X			
Profit/Margin	X			
Costs Over GMP	X			

Riverbanks Zoo & Garden Gondola and Service Drive
Contractor's Bid Form
Attachment B

The undersigned respondent having carefully examined the RFP, the cost allocation matrix, the construction documents, including the geotechnical report, and having clarified all questions, hereby agrees to furnish material and labor to fulfill the Contractor's responsibilities under the general conditions for the above-referenced project and to abide by the cost and billing rate schedules included herein.

Respondent further acknowledges that the projected commencement date of construction is November 2024, and that this proposal shall be valid until the commencement of construction and throughout the duration of the construction period.

1. GENERAL CONDITIONS

GMP for General Conditions for the Work: $_____
(Detailed Cost Allocation Matrix with values attached – this amount will be used to establish a monthly cost for use in future amendments)

Portion of Preconstruction Services that is Applied to the Initial Design Assist Process: (Included Above-Broken Out for Reference) $_____

Daily Rate for General Conditions for Changes in the Work: $_____

2. FEE SCHEDULE (Per Cost Allocation Matrix)

Sub-Total Contractor's Fee (Overhead and Profit) Shall be quoted as a percentage to be applied to all Amendments _____ %

Sub-Total Contractor's Fee (General Liability Insurance) _____ %

Total Contractor's Fee (Including All Above) _____ %

Proposed Fees for Changes

Proposed Change Order Fee for Contractor's Work: _____ %

Proposed Change Order Fee for Subcontractor's Work: _____ %

3. SCHEDULE

Proposed Construction Duration: (Detailed Schedule Attached) n/a

Anticipated Weather Delays (included in construction duration) _____

4. UNIT PRICES:

I. Unsuitable Soils – Excavation and Haul-off $_____

II. Structural Fill – Haul-in and Compaction $_____

III. Rock Excavation & Removal – Mechanical Means $_____

IV. Rock Excavation & Removal – Blasting $_____

V. Asphalt Pavement – 4" depth SCDOT Type 3/sy $_____/SY

VI. Concrete Pavement $_____

6. PROPOSED TEAM

(Resumes and Organization Chart Included in RFP Response)

Project Executive:_____

Superintendent(s):_____

Lead Project Manager:_____

Other:_____

7. OTHER

Payment and Performance Bond Rate:_____

Subcontractor Insurance Program Rate (if applicable):_____

Builder's Risk Insurance:_____

Labor Burden Rate:_____

8. SUBCONTRACTOR CONTRACT DOCUMENTS (Attached)

9. EQUIPMENT RENTAL RATE SCHEDULE (Attached)

10. CLARIFICATIONS/QUALIFICATIONS

Clarifications/qualifications for the above data are as follows (or attach as a separate document):

_____

_____

SIGNATURE AND ACKNOWLEDGMENTS

Respectfully submitted this _____ day of _____, 2024.

Legal Name of Respondent: _____

By (Name/Signature): _____

Printed Name: _____

Title/Position with the Firm: _____

1. Contractor hereby acknowledges receipt of the following Addenda:

1. _____;
2. _____;
3. _____;
4. _____.

Respondent's Initials: _____

Date: _____

Riverbanks Zoo & Garden Gondola and Service Drive
Affidavit of Non-Collusion
Attachment C

BIDDER'S AFFIDAVIT OF NON-COLLUSION

I hereby swear (or affirm) under penalty of perjury:

1. That I am the bidder (if the bidder is an individual), a partner in the company (if the bidder is a partnership), or an officer or employee of the responding corporation having authority to sign on its behalf (if the bidder is a corporation).

2. That the attached Proposal covering the contract for: Gondola and Service Drive Construction Services has been arrived at by the Bidder independently and has been submitted without collusion with, and without any agreement, understanding or planned common course of action with, any other contractor or vendor of materials, supplies, equipment or services described in the Request for Proposal, designed to limit independent quoting or competition:

3. That the contents of the Request for Proposal have not been communicated by the bidder or its employees or agents to any person not an employee or agent of the or its surety on any bond furnished with the Request for Proposal and will not be communicated to any such person prior to the official opening of the Request for Proposal; and

4. That I have fully informed myself regarding the accuracy of the statements made in this affidavit.

Signed: _____

Firm Name: _____

Subscribed and sworn to me this _____ day of_____ 20_____.

Notary Public:

My commission expires _____ , 20 _____ .

The attached Certificate of Familiarity must be returned with bid.

CERTIFICATE OF FAMILIARITY

The undersigned, having fully familiarized himself with the information contained within this entire solicitation and applicable amendments, submits the attached bid and other applicable information to the District, which I verify to be true and correct to the best of my knowledge. I certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm or person submitting a bid for the same materials, supplies or equipment, and is in all respects, fair and without collusion or fraud. I agree to abide by all conditions of this bid and certify that I am authorized to sign this bid. I further certify that this bid is good for a period of ninety (90) days, unless otherwise stated.

Company Name as registered with the IRS	Authorized Signature
Correspondence Address	Printed Name
City, State, Zip	Title
Date	Telephone Number/Fax Number
Remittance Address	E-mail Address (PLEASE PRINT)
City, State, Zip	
Telephone Number	Toll-Free Number if available
Federal Tax ID Number	SC Sales and Use Tax Number

INTENTIONALLY LEFT BLANK

Riverbanks Zoo and Garden Service Road Relocation & Gondola Related Construction

Exhibit A - Design Documents
- JCE Service Drive Relocation Bid Drawings dated 9/19/24
- JCE Overall Site Permit Set dated 8/13/24
- CLR Progress Set Architectural Drawings dated 10/1/24

NOTE - Work highlighted in a Red Cloud is to be completed by Lietner Poma outside of the General Contractors scope of work. The General Contractor will be responsible for all work associated with installing foundations for all the Lietner Poma structures.

CAPITAL IMPROVEMENT PROJECTS

COLUMBIA, SOUTH CAROLINA

OWNER/DEVELOPER

RIVERBANKS ZOO AND GARDEN
ERIC HELMS
DIRECTOR OF CONSTRUCTION AND PLANNING
500 WILDLIFE PARKWAY
COLUMBIA, SC 29210
PHONE (803) 602-0843
WWW.RIVERBANKS.ORG

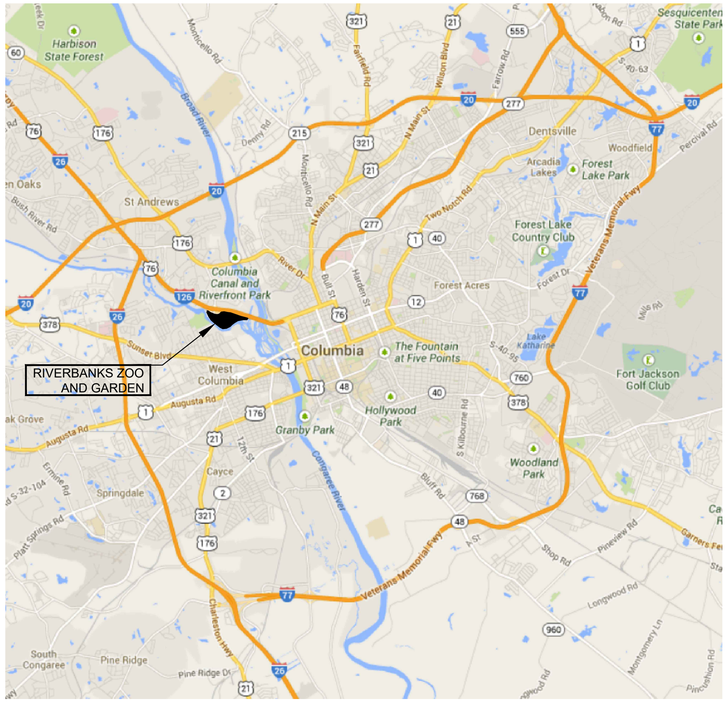
ENGINEER

JACKSON CIVIL ENGINEERING, LLC
RICHARD JACKSON, PE, CIVIL ENGINEER
221 POWELL DRIVE
LEXINGTON, SC 29072
PHONE (803) 603-0598
RICHARD@JACKSONCIVILENG.COM

PROJECT NARRATIVE

RIVERBANKS ZOO AND GARDEN IS SEEKING TO CONSTRUCT CAPITAL IMPROVEMENT PROJECTS. THIS INCLUDES THE FOLLOWING:
PHASE I - NEW SERVICE DRIVE
PHASE II - GONDOLA LIFT
PHASE III - EDUCATION CENTER

LOCATION MAP



NOT TO SCALE

SHEET INDEX

SHEET	TITLE
C100 SERIES	GENERAL INFORMATION
C200 SERIES	PHASE I - NEW SERVICE DRIVE
C300 SERIES	PHASE II - NEW GONDOLA LIFT
C300 SERIES	PHASE III - NEW EDUCATION CENTER
P52346FB	LEITNER-POMA GONDOLA LIFT ELEVATION LAYOUT

South Carolina 811
The Palmetto Utility Protection Service, Inc.
810 Dutch Square Blvd * Suite 320 * Columbia, SC 29210 - Phone (803) 939-1117

3 DAYS BEFORE DIGGING IN SOUTH CAROLINA
CALL 811
UNDERGROUND LOCATORS. CONTRACTOR SHALL CONTACT THE UNDERGROUND LOCATORS EVERY 10 DAYS FOR AN UPDATE TO UTILITY LOCATIONS.
Call 72 Hours BEFORE you DIG!

JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
CAPITAL IMPROVEMENT PROJECTS
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ
CHECKED BY: JCE
PROJECT NO: 2337
DATE: SEPT 19, 2024
SHEET TITLE: COVER SHEET AND INDEX
SHEET NO: C100

GENERAL CONSTRUCTION NOTES:

1. ALL COMMUNICATION FOR THIS PROJECT SHALL BE COORDINATED WITH THE OWNER'S REPRESENTATIVE. ANY DIRECT CONTACT BETWEEN CONTRACTOR-OWNER, CONTRACTOR-ARCHITECT AND CONTRACTOR/ENGINEER SHALL BE COORDINATED WITH THE OWNER'S REPRESENTATIVE.
2. THE CONTRACTOR SHALL FURNISH ALL MATERIALS, EQUIPMENT, AND LABOR NECESSARY TO COMPLETE ALL WORK AS INDICATED ON THE CONSTRUCTION DOCUMENTS
3. THE CONTRACTOR SHALL VISIT THE JOB SITE AND BE RESPONSIBLE FOR REVIEWING CONTRACT DOCUMENTS, FIELD CONDITIONS, DIMENSIONS AND CONFIRMING THAT THE WORK MAY BE ACCOMPLISHED AS SHOWN PRIOR TO PROCEEDING WITH CONSTRUCTION.
4. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE ARCHITECT/ENGINEER/owner's representative PRIOR TO PROCEEDING WITH THE WORK.
5. THE CONTRACTOR SHALL RECEIVE, IN WRITING, AUTHORIZATION TO PROCEED BEFORE STARTING WORK ON ANY ITEM NOT CLEARLY DEFINED OR IDENTIFIED BY THE CONTRACT DOCUMENTS.
6. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY INDICATED OTHERWISE OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDENCE.
7. ALL WORK PERFORMED AND MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES.
8. THE CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS.
9. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK, USING THE BEST SKILLS AND ATTENTION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THIS CONTRACT.
10. DETAILS ARE INTENDED TO SHOW FINAL RESULT OF DESIGN. MINOR MODIFICATIONS MAY BE REQUIRED TO SUIT JOB SITE DIMENSIONS OR CONDITIONS AND SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF THE WORK.
11. THE CONTRACTOR SHALL MAKE ALL NECESSARY PROVISIONS TO PROTECT EXISTING IMPROVEMENTS, ROADWAY, DRAINAGE WAYS, CULVERTS AND VEGETATION UNTIL SUCH ITEMS ARE TO BE DISTURBED OR REMOVED AS INDICATED ON THE CONSTRUCTION DOCUMENTS.
12. CONTRACTOR SHALL KEEP JOB SITE ARE CLEAN, HAZARD FREE AND DISPOSE OF ALL DIRT, DEBRIS AND RUBBISH. AT COMPLETION OF THE PROJECT CONTRACTOR SHALL REMOVE ALL MATERIAL AND EQUIPMENT NOT SPECIFIED AS REMAINING ON THE PROPERTY.
13. REPRESENTATIONS OF TRUE NORTH SHALL NOT BE USED TO IDENTIFY OR ESTABLISH THE BEARING OF TRUE NORTH AT THIS JOB SITE.
14. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ALL EXISTING UTILITIES WHETHER SHOWN HERON OR NOT AND TO PROTECT THEM FROM DAMAGE. CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT P.U.P.S. AT 1-800-721-7877 FOR UTILITY LOCATIONS 72 HOURS PRIOR TO START OF CONSTRUCTION.
15. PROVIDE AN AS-BUILT SURVEY BY A STATE LICENSED SURVEYOR. SIZE, LOCATION AND TYPE OF ANY UNDERGROUND UTILITIES OR IMPROVEMENTS SHALL BE ACCURATELY NOTED AND PLACED ON AS-BUILT DRAWINGS BY THE CONTRACTOR AND ISSUED TO THE ARCHITECT/ENGINEER AT THE COMPLETION OF THE PROJECT.
16. NOTICE OF TERMINATION (NOT) AND AS-BUILTS CAN BE SUBMITTED UPON A MINIMUM OF 70% UNIFORM STABILIZATION.

GENERAL STORM DRAINAGE NOTES:

1. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH SCDOT PIPE TRENCHES SC-M-714 "SUPPLEMENTAL TECHNICAL SPECIFICATION FOR PERMANENT PIPE CULVERTS" DATED APRIL 6, 2009.
2. ALL CONCRETE PIPES SHALL BE IN ACCORDANCE ASTM-C-76 CLASS III, B WALL.
3. HDPE - SMOOTH INTERIOR CORRUGATED PLASTIC PIPES & FITTINGS IN ACCORDANCE WITH ASTM-F-405 MAY BE UTILIZED ONLY WHERE SHOWN AND FROM THE FOLLOWING MANUFACTURER OR APPROVED EQUAL:
   3.1. A.D.S. - N12 MFRD. BY ADVANCED DRAINAGE SYSTEMS, INC.
   3.2. 3300 RIVERSIDE DRIVE, COLUMBUS, OHIO 43221
4. PIPE SLOPES SHALL NOT BE DECREASED FROM THOSE SHOWN WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
5. CONTRACTOR SHALL FURNISH AND INSTALL ALL BENDS, FITTINGS, ETC. AS REQUIRED TO FACILITATE CONSTRUCTION OF
6. SEE STORM DRAINAGE PROFILES FOR ADDITIONAL INFORMATION AND PIPELINE MATERIAL.

GENERAL CONSTRUCTION SEQUENCE:

1. RECEIVE NPDES COVERAGE FROM DHEC
2. PRE-CONSTRUCTION MEETING (ON-SITE IF MORE THAN 10 DISTURBED AND NON-LINEAR)
3. NOTIFY DHEC EQC REGIONAL OFFICE OR OCRM OFFICE 48 HOURS PRIOR TO BEGINNING LAND-DISTURBING ACTIVITIES
4. INSTALLATION OF CONSTRUCTION ENTRANCE(S)
5. CLEARING & GRUBBING ONLY AS NECESSARY FOR INSTALLATION OF PERIMETER CONTROLS
6. INSTALLATION OF PERIMETER CONTROLS (E.G., SILT FENCE)
7. CLEARING & GRUBBING ONLY IN AREAS OF BASINS/ TRAPS/ PONDS
8. INSTALLATION OF BASINS/ TRAPS/ PONDS AND INSTALLATION OF DIVERSIONS TO THOSE STRUCTURES (OUTLET STRUCTURES MUST BE COMPLETELY INSTALLED AS SHOWN ON THE DETAILS BEFORE PROCEEDING TO NEXT STEP; AREAS DRAINING TO THESE STRUCTURES CANNOT BE DISTURBED UNTIL THE STRUCTURES AND DIVERSIONS TO THE STRUCTURES ARE COMPLETELY INSTALLED)
9. CLEARING & GRUBBING OF SITE OR DEMOLITION (SEDIMENT & EROSION CONTROL MEASURES FOR THESE AREAS MUST ALREADY BE INSTALLED)
10. ROUGH GRADING
11. INSTALLATION OF STORM DRAIN SYSTEM AND PLACEMENT OF INLET PROTECTION AS EACH INLET IS INSTALLED
12. FINE GRADING, PAVING, ETC.
13. PERMANENT/ FINAL STABILIZATION
14. CLEAN-OUT OF DETENTION BASINS THAT WERE USED AS SEDIMENT CONTROL STRUCTURES AND RE-GRADING OF DETENTION POND BOTTOMS; IF NECESSARY, MODIFICATION OF SEDIMENT BASIN RISER TO CONVERT TO DETENTION BASIN OUTLET STRUCTURE
15. REMOVAL OF TEMPORARY SEDIMENT & EROSION CONTROL MEASURES AFTER ENTIRE AREA DRAINING TO THE STRUCTURE IS FINALLY STABILIZED (THE DEPARTMENT RECOMMENDS THAT THE PROJECT OWNER/ OPERATOR HAVE THE SWPPP PREPARER OR REGISTRATION EQUIVALENT APPROVE THE REMOVAL OF TEMPORARY STRUCTURES.)
16. PERFORM AS-BUILT SURVEYS OF ALL DETENTION STRUCTURES AND SUBMIT TO DHEC OR MS4 FOR ACCEPTANCE.
17. FINAL STABILIZATION IS 70% PERMANENT VEGETATIVE COVERAGE ACROSS 100% OF THE CONSTRUCTION SITE. 70% UNIFORM STABILITY MUST BE ACHIEVED PRIOR TO SUBMITTING AS-BUILTS AND FINALIZED N.O.T. TO SCDHEC.
18. SUBMIT NOTICE OF TERMINATION (NOT) TO DHEC AS APPROPRIATE.
19. NOTE: IF NPDES COVERAGE IS BEING ISSUED AFTER LAND-DISTURBING ACTIVITIES HAVE ALREADY STARTED (E.G., IN RESPONSE TO A NOTICE TO COMPLY, NOTICE OF VIOLATION, OR ENFORCEMENT ACTION), THEN THE CONSTRUCTION SEQUENCE MUST SPECIFICALLY INDICATE THE ITEMS THAT HAVE ALREADY OCCURRED AND THE ITEMS THAT WILL BE OCCURRING AFTER NPDES COVERAGE IS ISSUED.
20. NOTE: IF FLOWS FROM OFFSITE AREAS WILL BE DIVERTED AROUND THE SITE AND THE ON-SITE STRUCTURES ARE NOT DESIGNED TO HANDLE FLOWS FROM THE OFFSITE AREAS, THEN THE DIVERSIONS/ PIPING FOR THE OFFSITE FLOWS MUST BE INSTALLED BEFORE LAND-DISTURBING ACTIVITIES BEGIN ON THE SITE; INCLUDE THIS IN THE SEQUENCE. SEDIMENT AND EROSION CONTROL MEASURES FOR THE DISTURBED AREAS FOR THE DIVERSION/ PIPING MUST BE INSTALLED BEFORE THOSE AREAS ARE DISTURBED AND SHOULD BE SHOWN ON THE PLANS.
21. NOTE: IF AN EXISTING DETENTION/ SEDIMENT BASIN IS BEING MODIFIED TO HANDLE THE FLOWS FROM THE PROPOSED DEVELOPMENT, THEN IT MUST BE MODIFIED BEFORE LAND-DISTURBING ACTIVITIES BEGIN ON THE SITE. THIS SHOULD BE INCLUDED IN THE SEQUENCE.
22. NOTE: INCLUDE INDIVIDUAL LOT DEVELOPMENT/ CONSTRUCTION IN THE SEQUENCE IF THE SITE WILL NOT BE MASS-GRADED.
23. NOTE: INSTALLATION OF SOME PERMANENT WATER QUALITY DEVICES SHOULD OCCUR AFTER THE SITE IS STABILIZED; INCLUDE THIS IN THE SEQUENCE. CLEANOUT OF OTHER WATER QUALITY DEVICES THAT WERE USED DURING CONSTRUCTION SHOULD OCCUR AFTER SITE STABILIZATION.
24. NOTE: MAINTENANCE OF SEDIMENT AND EROSION CONTROL MEASURES MUST CONTINUE UNTIL THE SITE IS PERMANENTLY STABILIZED AND THE CONTROLS ARE REMOVED.

SEDIMENT AND EROSION CONTROL NOTES:

1. IF NECESSARY, SLOPES, WHICH EXCEED EIGHT (8) VERTICAL FEET SHOULD BE STABILIZED WITH SYNTHETIC OR VEGETATIVE MATS, IN ADDITION TO HYDROSEEDING. IT MAY BE NECESSARY TO INSTALL TEMPORARY SLOPE DRAINS DURING CONSTRUCTION. TEMPORARY BERMS MAY BE NEEDED UNTIL THE SLOPE IS BROUGHT TO GRADE.
2. STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS PRACTICABLE IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT IN NO CASE MORE THAN FOURTEEN (14) DAYS AFTER WORK HAS CEASED, EXCEPT AS STATED BELOW.
   - WHERE STABILIZATION BY THE 14TH DAY IS PRECLUDED BY SNOW COVER OR FROZEN GROUND CONDITIONS STABILIZATION MEASURES MUST BE INITIATED AS SOON AS PRACTICABLE.
   - WHERE CONSTRUCTION ACTIVITY ON A PORTION OF THE SITE IS TEMPORARILY CEASED, AND EARTH-DISTURBING ACTIVITIES WILL BE RESUMED WITHIN 14 DAYS, TEMPORARY STABILIZATION MEASURES DO NOT HAVE TO BE INITIATED ON THAT PORTION OF THE SITE.
3. ALL SEDIMENT AND EROSION CONTROL DEVICES SHALL BE INSPECTED ONCE EVERY CALENDAR WEEK. IF PERIODIC INSPECTION OR OTHER INFORMATION INDICATES THAT A BMP HAS BEEN INAPPROPRIATELY, OR INCORRECTLY, THE PERMITTEE MUST ADDRESS THE NECESSARY REPLACEMENT OR MODIFICATION REQUIRED TO CORRECT THE BMP WITHIN 48 HOURS OF IDENTIFICATION.
4. PROVIDE SILT FENCE AND/OR OTHER CONTROL DEVICES, AS MAY BE REQUIRED, TO CONTROL SOIL EROSION DURING UTILITY CONSTRUCTION. ALL DISTURBED AREAS SHALL BE CLEANED, GRADED, AND STABILIZED WITH GRASSING IMMEDIATELY AFTER THE UTILITY INSTALLATION. FILL, COVER, AND TEMPORARY SEEDING AT THE END OF EACH DAY ARE RECOMMENDED. IF WATER IS ENCOUNTERED WHILE TRENCHING, THE WATER SHOULD BE FILTERED TO REMOVE SEDIMENT BEFORE BEING PUMPED BACK INTO ANY WATERS OF THE STATE.
5. ALL EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED DURING ALL PHASES OF CONSTRUCTION UNTIL THE COMPLETION OF ALL CONSTRUCTION ACTIVITIES AND ALL DISTURBED AREAS HAVE BEEN STABILIZED. ADDITIONAL CONTROL DEVICES MAY BE REQUIRED DURING CONSTRUCTION IN ORDER TO CONTROL EROSION AND/OR OFFSITE SEDIMENTATION. ALL TEMPORARY CONTROL DEVICES SHALL BE REMOVED ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED.
6. THE CONTRACTOR MUST TAKE NECESSARY ACTION TO MINIMIZE THE TRACKING OF MUD ONTO PAVED ROADWAY(S) FROM CONSTRUCTION AREAS AND THE GENERATION OF DUST. THE CONTRACTOR SHALL DAILY REMOVE MUD/SOIL FROM PAVEMENT, AS MAY BE REQUIRED.
7. RESIDENTIAL SUBDIVISIONS REQUIRE EROSION CONTROL FEATURES FOR INFRASTRUCTURE AS WELL AS FOR INDIVIDUAL LOT CONSTRUCTION. INDIVIDUAL PROPERTY OWNERS SHALL FOLLOW THESE PLANS DURING CONSTRUCTION OR OBTAIN APPROVAL OF AN INDIVIDUAL PLAN IN ACCORDANCE WITH S.C REG. 72-300 ET SEQ. AND SCR100000.
8. TEMPORARY DIVERSION BERMS AND/OR DITCHES WILL BE PROVIDED AS NEEDED DURING CONSTRUCTION TO PROTECT WORK AREAS FROM UPSLOPE RUNOFF AND/OR TO DIVERT SEDIMENT-LADEN WATER TO APPROPRIATE TRAPS OR STABLE OUTLETS.
9. ALL WATERS OF THE STATE (WOS), INCLUDING WETLANDS, ARE TO BE FLAGGED OR OTHERWISE CLEARLY MARKED IN THE FIELD. A DOUBLE ROW OF SILT FENCE IS TO BE INSTALLED IN ALL AREAS WHERE A 50-FOOT BUFFER CAN'T BE MAINTAINED BETWEEN THE DISTURBED AREA AND ALL WOS. A 10-FOOT BUFFER SHOULD BE MAINTAINED BETWEEN THE LAST ROW OF SILT FENCE AND ALL WOS.
10. LITTER, CONSTRUCTION DEBRIS, OILS, FUELS, AND BUILDING PRODUCTS WITH SIGNIFICANT POTENTIAL FOR IMPACT (SUCH AS STOCKPILES OF FRESHLY TREATED LUMBER) AND CONSTRUCTION CHEMICALS THAT COULD BE EXPOSED TO STORM WATER MUST BE PREVENTED FROM BECOMING A POLLUTANT SOURCE IN STORM WATER DISCHARGES.
11. A COPY OF THE SWPPP, INSPECTIONS RECORDS, AND RAINFALL DATA MUST BE RETAINED AT THE CONSTRUCTION SITE OR A NEARBY LOCATION EASILY ACCESSIBLE DURING NORMAL BUSINESS HOURS, FROM THE DATE OF COMMENCEMENT OF CONSTRUCTION ACTIVITIES TO THE DATE THAT FINAL STABILIZATION IS REACHED.
12. INITIATE STABILIZATION MEASURES ON ANY EXPOSED STEEP SLOPE (3H:1V OR GREATER) WHERE LAND-DISTURBING ACTIVITIES HAVE PERMANENTLY OR TEMPORARILY CEASED, AND WILL NOT RESUME FOR A PERIOD OF 7 CALENDAR DAYS.
13. MINIMIZE SOIL COMPACTION AND, UNLESS INFEASIBLE, PRESERVE TOPSOIL.
14. MINIMIZE THE DISCHARGE OF POLLUTANTS FROM EQUIPMENT AND VEHICLE WASHING, WHEEL WASH WATER, AND OTHER WASH WATERS. WASH WATERS MUST BE TREATED IN A SEDIMENT BASIN OR ALTERNATIVE CONTROL THAT PROVIDES EQUIVALENT OR BETTER TREATMENT PRIOR TO DISCHARGE;
15. MINIMIZE THE DISCHARGE OF POLLUTANTS FROM DEWATERING OF TRENCHES AND EXCAVATED AREAS. THESE DISCHARGES ARE TO BE ROUTED THROUGH APPROPRIATE BMPS (SEDIMENT BASIN, FILTER BAG, ETC.).
16. THE FOLLOWING DISCHARGES FROM SITES ARE PROHIBITED:
    - WASTEWATER FROM WASHOUT OF CONCRETE, UNLESS MANAGED BY AN APPROPRIATE CONTROL;
    - WASTEWATER FROM WASHOUT AND CLEANOUT OF STUCCO, PAINT, FORM RELEASE OILS, CURING COMPOUNDS AND OTHER CONSTRUCTION MATERIALS;
    - FUELS, OILS, OR OTHER POLLUTANTS USED IN VEHICLE AND EQUIPMENT OPERATION AND MAINTENANCE; AND
    - SOAPS OR SOLVENTS USED IN VEHICLE AND EQUIPMENT WASHING.
17. AFTER CONSTRUCTION ACTIVITIES BEGIN, INSPECTIONS MUST BE CONDUCTED AT A MINIMUM OF AT LEAST ONCE EVERY CALENDAR WEEK AND MUST BE CONDUCTED UNTIL FINAL STABILIZATION IS REACHED ON ALL AREAS OF THE CONSTRUCTION SITE.
18. IF EXISTING BMPS NEED TO BE MODIFIED OR IF ADDITIONAL BMPS ARE NECESSARY TO COMPLY WITH THE REQUIREMENTS OF THIS PERMIT AND/OR SC'S WATER QUALITY STANDARDS, IMPLEMENTATION MUST BE COMPLETED BEFORE THE NEXT STORM EVENT WHENEVER PRACTICABLE. IF IMPLEMENTATION BEFORE THE NEXT STORM EVENT IS IMPRACTICABLE, THE SITUATION MUST BE DOCUMENTED IN THE SWPPP AND ALTERNATIVE BMPS MUST BE IMPLEMENTED AS SOON AS REASONABLY POSSIBLE.
19. A PRE-CONSTRUCTION CONFERENCE MUST BE HELD FOR EACH CONSTRUCTION SITE WITH AN APPROVED ON-SITE SWPPP PRIOR TO THE IMPLEMENTATION OF CONSTRUCTION ACTIVITIES. FOR NON-LINEAR PROJECTS THAT DISTURB 10 ACRES OR MORE THIS CONFERENCE MUST BE HELD ON-SITE UNLESS THE DEPARTMENT HAS APPROVED OTHERWISE.

GRASSING SPECIFICATIONS

GRASS/SOIL PREPARATION-
- REMOVE AND DISPOSE OF ALL ROCKS AND DEBRIS LARGER THAN 3/4'' IN DIAMETER FROM THESE AREAS.
- USE A SEED-SLITTER OVER THE ENTIRE AREA UNTIL A MIXTURE OF 180 LBS OF COMMON BERMUDA SEED, 550 LBS OF TURF TYPE FESCUE SEED, AND 500 LBS OF 18-24-12 STARTER FERTILIZER IS INSERTED INTO THE SOIL.
- AGGRESSIVELY CORE AERATE (4'' DEEP) WITH A PLUG CORER OVER THE ENTIRE AREA AND BACK DRAG SOIL INTO ANY LOW PLACES AS NEEDED.
- BRING IN 40 TONS OF TOPSOIL IN THE AREAS AS SHOWN ON THE DRAWING. 15-20 YARDS ARE NEEDED AT THE FRONT RIGHT OF THE SCHOOL. THE REMAINING SOIL IS TO BE USED AS NEEDED IN AREAS WHERE THE GROUND IS HARD.
- OVER SEED ALL SHADY AREAS WITH ADDITIONAL TURF TYPE FESCUE SEED AT THE RATE OF 3 LBS PER 1,000 SQ. FT. OR APPROXIMATELY 50 LBS TOTAL.

HYDROSEED-
- HEAVILY HYDROSEED ALL AREAS USING A MIXTURE OF 180 LBS OF COMMON BERMUDA SEED, 550 LBS OF TURF TYPE FESCUE SEED, 500 LBS OF 18-24-12 STARTER FERTILIZER, 750LBS OF LIME AND 1200-1400 LBS OF WOOD MULCH FIBER.
- WATER IN ALL AREAS ONE TIME.

GRASS MATTING-
- PROVIDE BIODEGRADABLE STRAW OR COCONUT FIBER MATTING OVER ALL SLOPED AREAS SHOWN. INCLUDE MANUFACTURER'S RECOMMENDED STEEL WIRE STAPLES, 6- INCHES LONG.
-

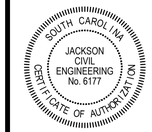
SEED PROTECTION-
- USE CAUTION TAPE AND STAKES TO BARRICADE OFF ALL SEEDED AREAS SO THAT CHILDREN DO NOT DISTURB WHEN THEY RETURN.

GENERAL GRADING NOTES:

1. THIS IS NOT A BALANCED SITE. IT IS THE SITE CONTRACTOR'S RESPONSIBILITY TO HAUL IN OR HAUL OFF DIRT AS NECESSARY TO COMPLETE CONSTRUCTION.
2. INSTALLATION OF SOIL EROSION CONTROL MEASURES AND PRACTICES WILL BE IMPLEMENTED PRIOR TO LAND DISTURBING ACTIVITIES
3. FINAL GRADING WILL CONSIST OF SPREADING TOPSOIL (4" MINIMUM) TO FINISHED GRADES AS INDICATED ON ALL DISTURBED AREAS.
4. EROSION CONTROL MEASURES WILL BE MAINTAINED AT ALL TIMES. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSTALLED AS DETERMINED BY ON-SITE INSPECTION.
5. ALL DISTURBED AREAS TO BE SODDED OR HYDROSEEDED ACCORDING TO GRASSING SPECIFICATIONS
6. UNTIL THE SITE IS STABILIZED, SEDIMENT SHALL BE REMOVED FROM PONDS AFTER EVERY SIGNIFICANT RAINFALL EVENT (GREATER THAN 0.5 INCHES). AFTER THE SITE IS STABILIZED REGRADE THE PONDS TO DESIGN DEPTH. ANY SEDIMENT REMOVED SHOULD BE PROPERLY DISPOSED OF OR USED ONSITE.
7. ALL EARTHWORK SHALL BE PERFORMED IN ACCORDANCE WITH THE RECOMMENDATIONS AND/OR UNDER THE SUPERVISION OF A SOILS CONSULTANT.

CERTIFICATION STATEMENT

"I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000."



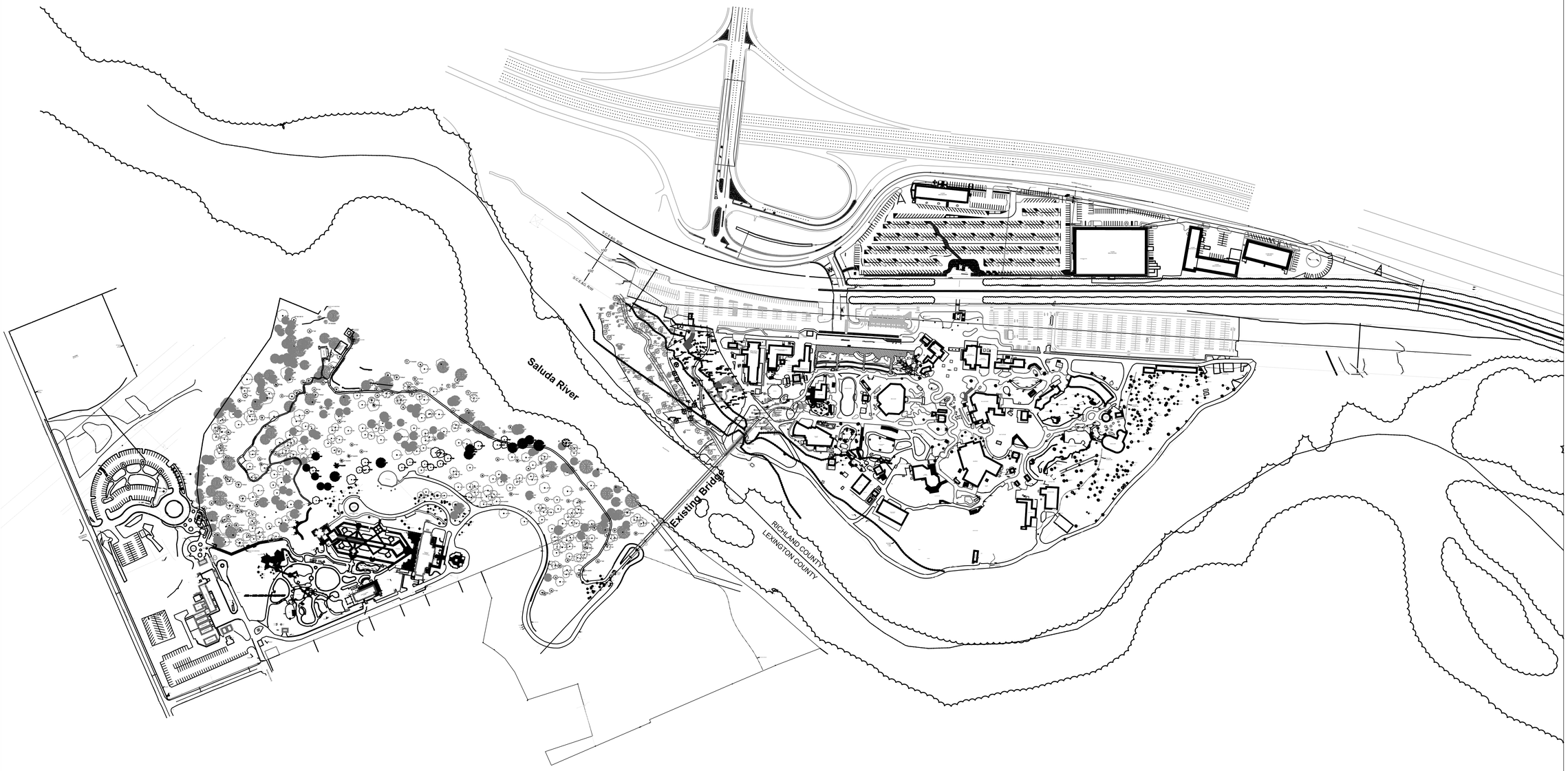
JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
CAPITAL IMPROVEMENT PROJECTS
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ
CHECKED BY: JCE
PROJECT NO: 2337
DATE: SEPT 19, 2024
SHEET TITLE: GENERAL NOTES
SHEET NO: C101



SOUTH CAROLINA
JACKSON CIVIL ENGINEERING No. 6177
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
21971
REGISTERED
RICHARD P. JACKSON, II

JACKSON
CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
CAPITAL IMPROVEMENT PROJECTS
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ

CHECKED BY: JCE

PROJECT NO: 2337

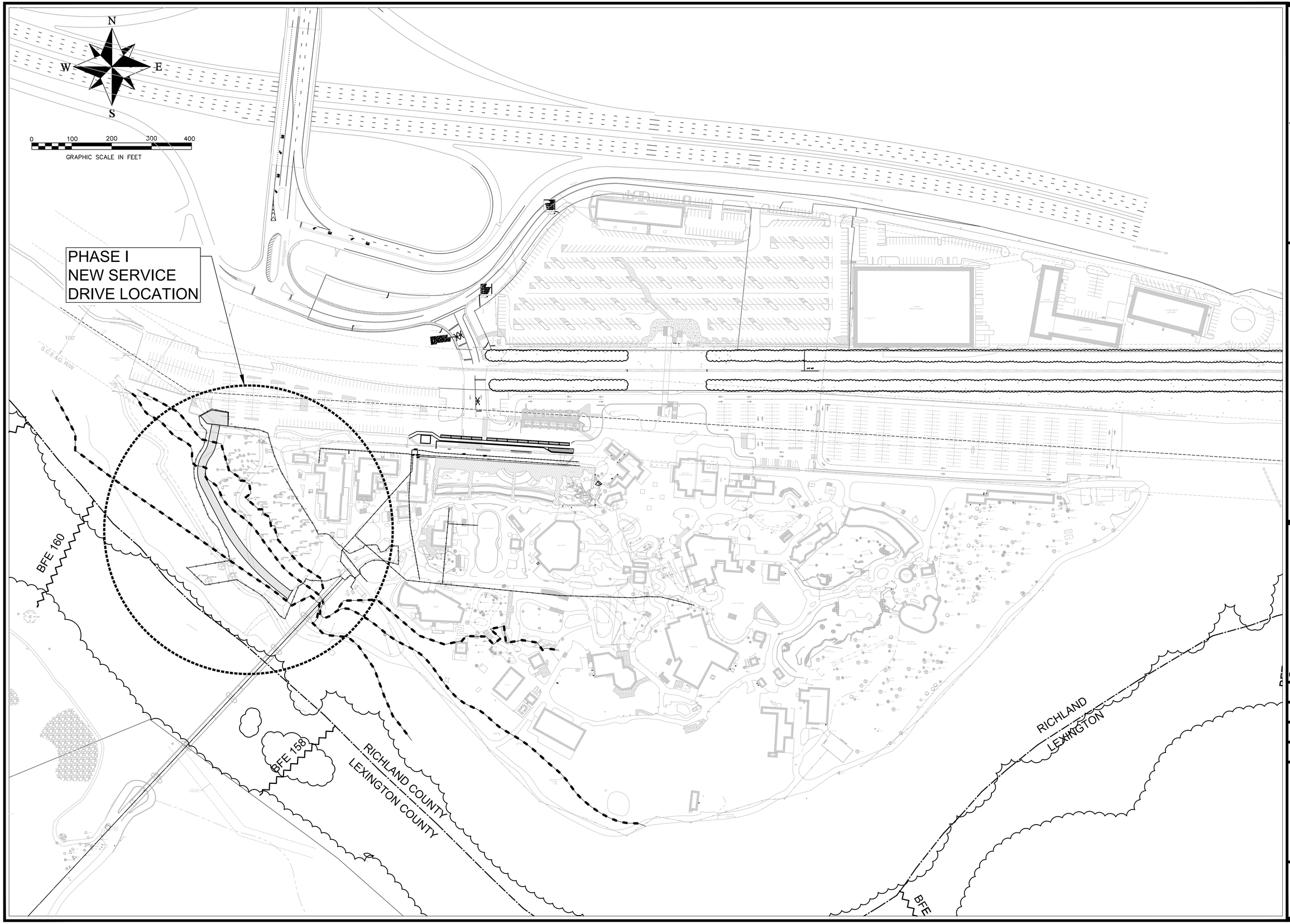
DATE: SEPT 19, 2024

SHEET TITLE:

RIVERBANKS ZOO AND GARDEN OVERALL PLAN

SHEET NO:

C102



SOUTH CAROLINA
JACKSON CIVIL ENGINEERING No. 6177
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
No. 21971
RICHARD P. JACKSON, II

JACKSON
CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ

CHECKED BY: JCE

PROJECT NO: 2337

DATE: SEPT 19, 2024

SHEET TITLE:
PHASE I
PROJECT LOCATION

SHEET NO:
C201

N

W E

S

0 30 60 90 120

GRAPHIC SCALE IN FEET

BENCHMARK:
MAG NAIL IN PAVEMENT
ELEVATION=167.41'

BFE 160

MH RIM=150.53
FLOWLINE=137.61

SALUDA RIVER

BRICK BUILDING

ANIMAL HEALTH & SCIENCE CENTER (1-STORY BRICK)

ADMINISTRATION/COMMISSARY (1-STORY BRICK)

ASPHALT DRIVE

SOUTH CAROLINA
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221 Powell Drive
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RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ

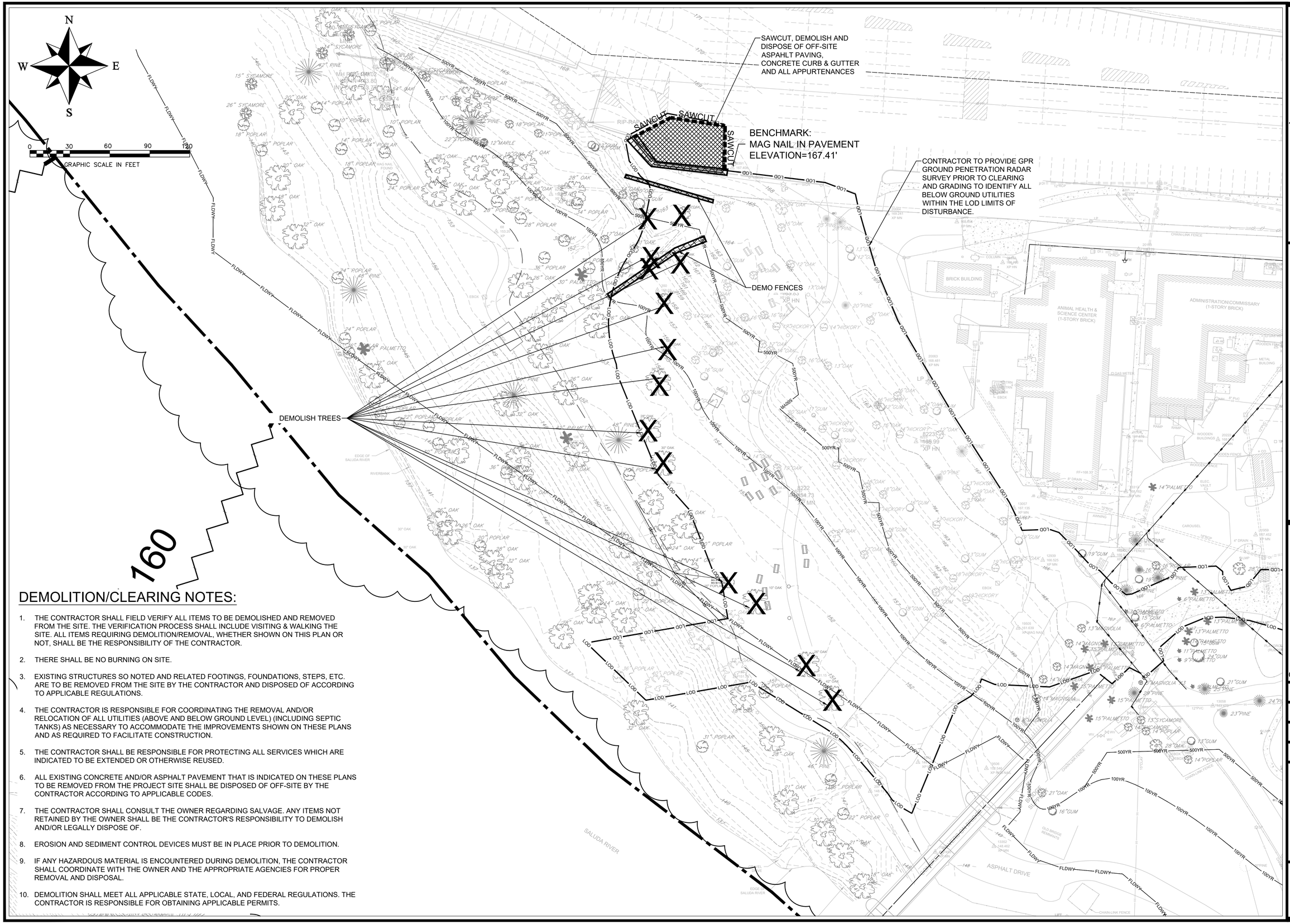
CHECKED BY: JCE

PROJECT NO: 2337

DATE: SEPT 19, 2024

SHEET TITLE:
TOPOGRAPHIC SURVEY

SHEET NO:
C202



DEMOLITION/CLEARING NOTES:

1. THE CONTRACTOR SHALL FIELD VERIFY ALL ITEMS TO BE DEMOLISHED AND REMOVED FROM THE SITE. THE VERIFICATION PROCESS SHALL INCLUDE VISITING & WALKING THE SITE. ALL ITEMS REQUIRING DEMOLITION/REMOVAL, WHETHER SHOWN ON THIS PLAN OR NOT, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
2. THERE SHALL BE NO BURNING ON SITE.
3. EXISTING STRUCTURES SO NOTED AND RELATED FOOTINGS, FOUNDATIONS, STEPS, ETC. ARE TO BE REMOVED FROM THE SITE BY THE CONTRACTOR AND DISPOSED OF ACCORDING TO APPLICABLE REGULATIONS.
4. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE REMOVAL AND/OR RELOCATION OF ALL UTILITIES (ABOVE AND BELOW GROUND LEVEL) (INCLUDING SEPTIC TANKS) AS NECESSARY TO ACCOMMODATE THE IMPROVEMENTS SHOWN ON THESE PLANS AND AS REQUIRED TO FACILITATE CONSTRUCTION.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL SERVICES WHICH ARE INDICATED TO BE EXTENDED OR OTHERWISE REUSED.
6. ALL EXISTING CONCRETE AND/OR ASPHALT PAVEMENT THAT IS INDICATED ON THESE PLANS TO BE REMOVED FROM THE PROJECT SITE SHALL BE DISPOSED OF OFF-SITE BY THE CONTRACTOR ACCORDING TO APPLICABLE CODES.
7. THE CONTRACTOR SHALL CONSULT THE OWNER REGARDING SALVAGE. ANY ITEMS NOT RETAINED BY THE OWNER SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DEMOLISH AND/OR LEGALLY DISPOSE OF.
8. EROSION AND SEDIMENT CONTROL DEVICES MUST BE IN PLACE PRIOR TO DEMOLITION.
9. IF ANY HAZARDOUS MATERIAL IS ENCOUNTERED DURING DEMOLITION, THE CONTRACTOR SHALL COORDINATE WITH THE OWNER AND THE APPROPRIATE AGENCIES FOR PROPER REMOVAL AND DISPOSAL.
10. DEMOLITION SHALL MEET ALL APPLICABLE STATE, LOCAL, AND FEDERAL REGULATIONS. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING APPLICABLE PERMITS.

SOUTH CAROLINA
JACKSON CIVIL ENGINEERING No. 6177
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SOUTH CAROLINA
REGISTERED
21971
RICHARD P. JACKSON, II

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221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ
CHECKED BY: JCE
PROJECT NO: 2337
DATE: SEPT 19, 2024
SHEET TITLE: DEMOLITION PLAN

SHEET NO: C203

INSTALL NEW 18IN ROLLED CONCRETE CURB & GUTTER

INSTALL NEW 22FT WIDE METAL SWING GATE

EXISTING RIVERWALK PATHWAY

NEW SERVICE DRIVEWAY ASPHALT PAVEMENT CLASS 3 (SEE DETAIL)

EXISTING RIVERWALK PATHWAY

100-YEAR FLOODLINE

100-YR FLOODLINE

EXISTING RIVERWALK PATHWAY

BFE 160

SALUDA RIVER

BRICK BUILDING

ANIMAL HEALTH & SCIENCE CENTER (1-STORY BRICK)

ADMINISTRATION\COMMISSARY (1-STORY BRICK)

STONE SIGN

ELEC. PANEL

CAROUSEL

ASPHALT DRIVE

CONCRETE PAVERS ON BRIDGE

BRIDGE SUPPORT

OLD BRIDGE REMNANTS

GRAPHIC SCALE IN FEET
0 30 60 90 120

N W E S

SOUTH CAROLINA
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SOUTH CAROLINA
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Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ

CHECKED BY: JCE

PROJECT NO: 2337

DATE: SEPT 19, 2024

SHEET TITLE: SITE PLAN

SHEET NO: C204

N
W
E
S
0 30 60 90 120
GRAPHIC SCALE IN FEET

BFE 160

100-YEAR FLOOD LINE

MH RIM=155.02
INV IN=143.80
INV OUT=143.70

MH RIM=150.53
FLOWLINE=137.61

MH RIM=149.85
INV IN=137.65

RIP-RAP

EX167.96

EP168.0

MAG NAIL FOUND

EDGE OF SALUDA RIVER

RIVERBANK

SALUDA RIVER

GRAVEL DRIVE

EDGE OF SALUDA RIVER

CONCRETE PAVERS ON BRIDGE

ASPHALT DRIVE

BRICK BUILDING

ANIMAL HEALTH & SCIENCE CENTER (1-STORY BRICK)

ADMINISTRATION\COMMISSARY (1-STORY BRICK)

STONE SIGN

ELEC PANEL

CAROUSEL

WOODEN BUILDINGS

METAL BUILDING

RAMP

ARMING

CHAIN-LINK FENCE

WOODEN FENCE

BRIDGE SUPPORT

OLD BRIDGE REMNANTS

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COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ

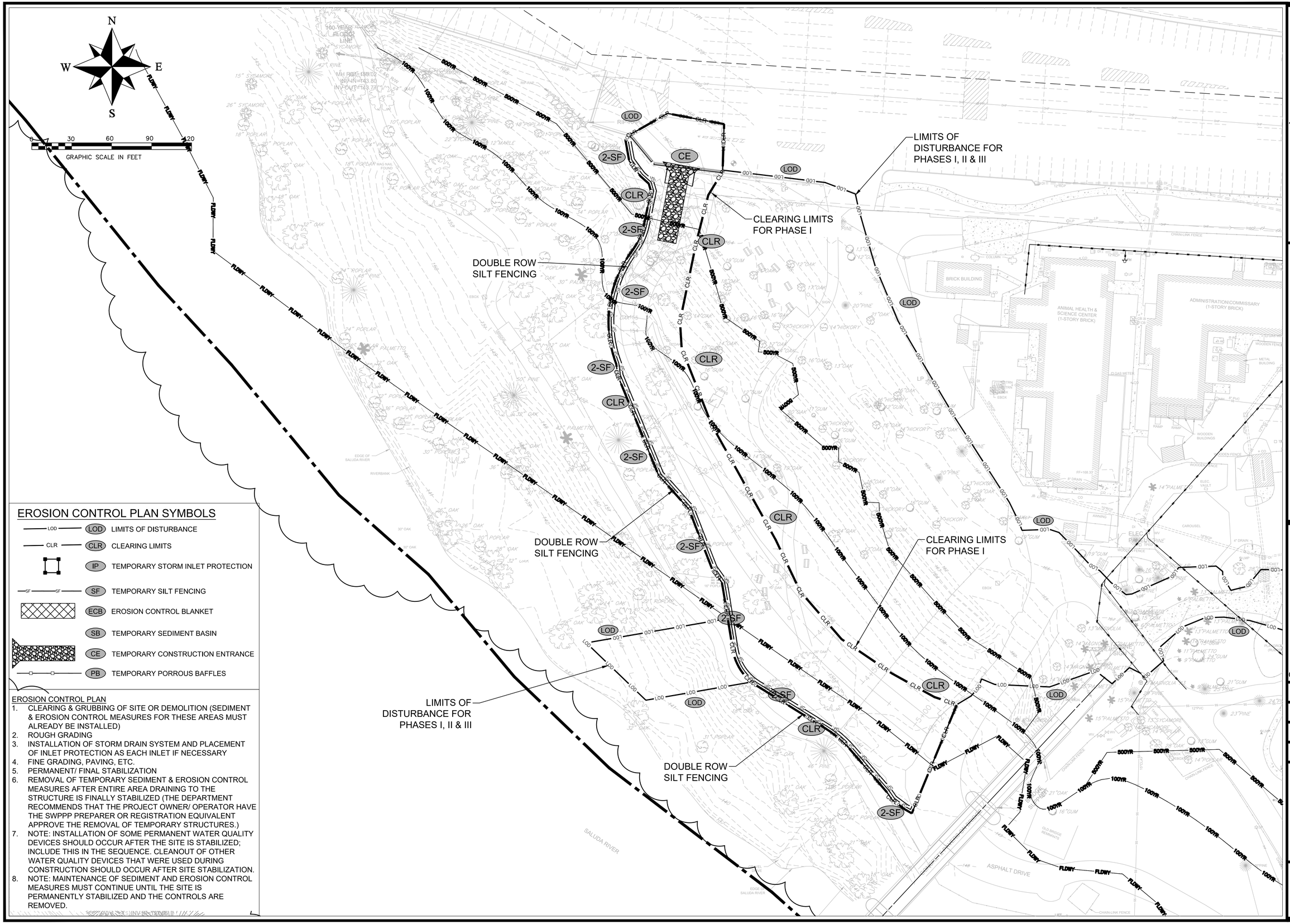
CHECKED BY: JCE

PROJECT NO: 2337

DATE: SEPT 19, 2024

SHEET TITLE: GRADING PLAN

SHEET NO: C205



EROSION CONTROL PLAN SYMBOLS

LOD	LOD	LIMITS OF DISTURBANCE
CLR	CLR	CLEARING LIMITS
	IP	TEMPORARY STORM INLET PROTECTION
SF	SF	TEMPORARY SILT FENCING
	ECB	EROSION CONTROL BLANKET
	SB	TEMPORARY SEDIMENT BASIN
	CE	TEMPORARY CONSTRUCTION ENTRANCE
	PB	TEMPORARY POROUS BAFFLES

EROSION CONTROL PLAN

1. CLEARING & GRUBBING OF SITE OR DEMOLITION (SEDIMENT & EROSION CONTROL MEASURES FOR THESE AREAS MUST ALREADY BE INSTALLED)
2. ROUGH GRADING
3. INSTALLATION OF STORM DRAIN SYSTEM AND PLACEMENT OF INLET PROTECTION AS EACH INLET IF NECESSARY
4. FINE GRADING, PAVING, ETC.
5. PERMANENT/ FINAL STABILIZATION
6. REMOVAL OF TEMPORARY SEDIMENT & EROSION CONTROL MEASURES AFTER ENTIRE AREA DRAINING TO THE STRUCTURE IS FINALLY STABILIZED (THE DEPARTMENT RECOMMENDS THAT THE PROJECT OWNER/ OPERATOR HAVE THE SWPPP PREPARER OR REGISTRATION EQUIVALENT APPROVE THE REMOVAL OF TEMPORARY STRUCTURES.)
7. NOTE: INSTALLATION OF SOME PERMANENT WATER QUALITY DEVICES SHOULD OCCUR AFTER THE SITE IS STABILIZED; INCLUDE THIS IN THE SEQUENCE. CLEANOUT OF OTHER WATER QUALITY DEVICES THAT WERE USED DURING CONSTRUCTION SHOULD OCCUR AFTER SITE STABILIZATION.
8. NOTE: MAINTENANCE OF SEDIMENT AND EROSION CONTROL MEASURES MUST CONTINUE UNTIL THE SITE IS PERMANENTLY STABILIZED AND THE CONTROLS ARE REMOVED.

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RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ

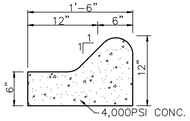
CHECKED BY: JCE

PROJECT NO: 2337

DATE: SEPT 19, 2024

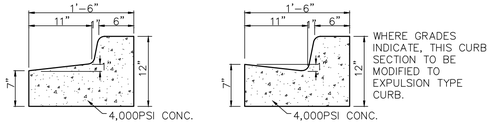
SHEET TITLE: EROSION CONTROL PLAN

SHEET NO: C206



18" ROLLED CURB AND GUTTER

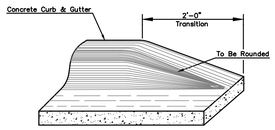
NTS



18" EXPULSION CURB **18" COLLECTION CURB**

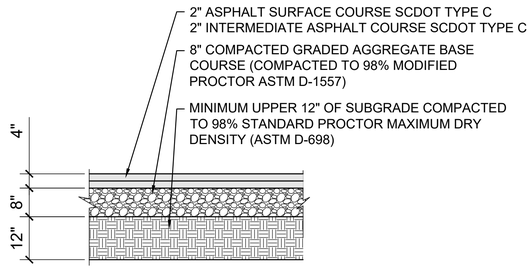
18" VERTICAL CURB & GUTTER

NTS



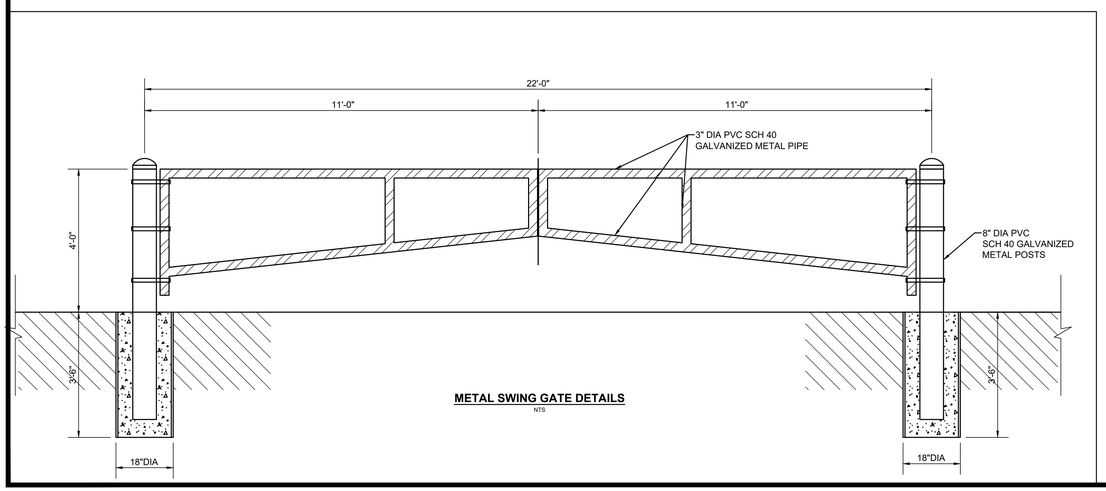
FEATHERING CURB AND GUTTER DETAIL

NTS



CLASS 3 - ASPHALT PAVING

(<65 trucks/day)



METAL SWING GATE DETAILS

NTS

SOUTH CAROLINA
JACKSON CIVIL ENGINEERING No. 6177
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SOUTH CAROLINA
REGISTERED
No. 21971
PROFESSIONAL ENGINEER
RICHARD P. JACKSON, II

JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ

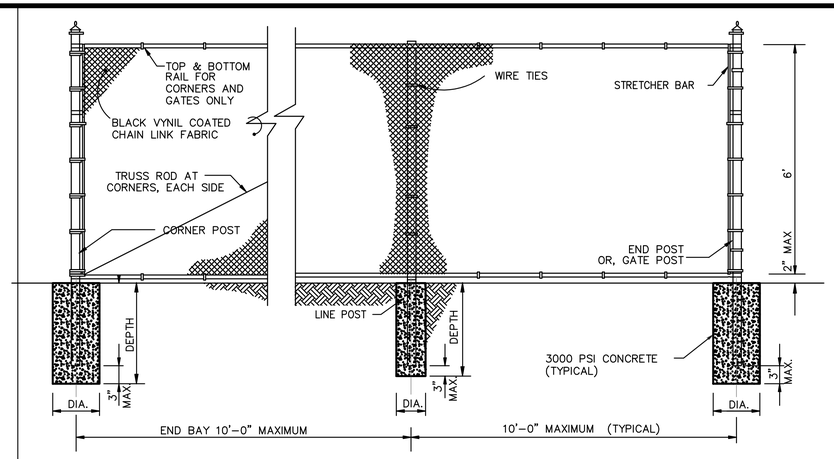
CHECKED BY: JCE

PROJECT NO: 2337

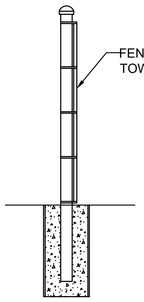
DATE: SEPT 19, 2024

SHEET TITLE: SITE DETAILS

SHEET NO: C251



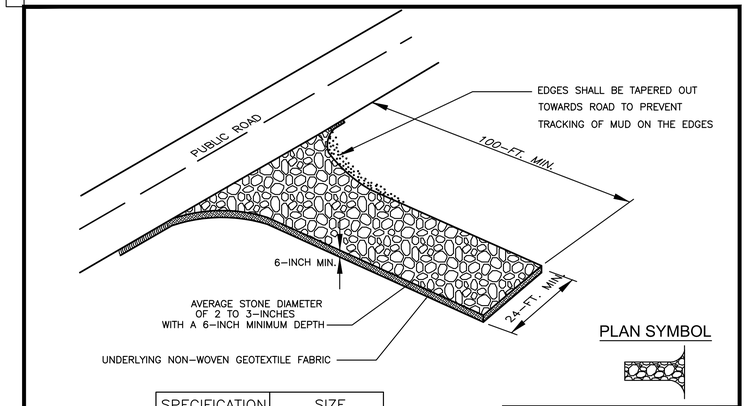
CHAIN LINK FENCE
NTS



SIDE VIEW
NTS

FENCE FOUNDATION SCHEDULE			
POST TYPE	LINE	END	GATE
6FT GALVANIZED OR BLACK VINYL COATED CHAINLINK FENCE			
FOUNDATION DIA.	10"	16"	16"
FOUNDATION DEPTH	30"	30"	30"

NOTES:
BLACK VINYL COATED OPTION
1. ALL FENCE FABRIC TO BE BLACK VINYL COATED.
2. FENCE FABRIC TO BE PLACED WITH FINISHED SIDE FACING THE SCHOOL.
3. THE FENCE IS TO BE INSTALLED 2'-0" OFF THE BACK EDGE OF THE RETAINING WALL TOP CAP.



SPECIFICATION	SIZE
ROCK PAD THICKNESS	6 INCHES
ROCK PAD WIDTH	24 FEET
ROCK PAD LENGTH	100 FEET
ROCK PAD STONE SIZE	D = 2-3 INCHES

South Carolina Department of Health and Environmental Control
CONSTRUCTION ENTRANCE
STANDARD DRAWING NO. SC-06 PAGE 1 of 2
NOT TO SCALE FEBRUARY 2014 DATE

CONSTRUCTION ENTRANCE – GENERAL NOTES

1. Stabilized construction entrances should be used at all points where traffic will egress/ingress a construction site onto a public road or any impervious surfaces, such as parking lots.
2. Install a non-woven geotextile fabric prior to placing any stone.
3. Install a culvert pipe across the entrance when needed to provide positive drainage.
4. The entrance shall consist of 2-inch to 3-inch D50 stone placed at a minimum depth of 6-inches.
5. Minimum dimensions of the entrance shall be 24-feet wide by 100-feet long, and may be modified as necessary to accommodate site constraints.
6. The edges of the entrance shall be tapered out towards the road to prevent tracking at the edge of the entrance.
7. Divert all surface runoff and drainage from the stone pad to a sediment trap or basin or other sediment trapping structure.
8. Limestone may not be used for the stone pad.

CONSTR. ENTRANCE – INSPECTION & MAINTENANCE

1. The key to functional construction entrances is weekly inspections, routine maintenance, and regular sediment removal.
2. Regular inspections of construction entrances shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall even that produces 1/2-inch or more of precipitation.
3. During regular inspections, check for mud and sediment buildup and pad integrity. Inspection frequencies may need to be more frequent during long periods of wet weather.
4. Reshape the stone pad as necessary for drainage and runoff control.
5. Wash or replace stones as needed and as directed by site inspector. The stone in the entrance should be washed or replaced whenever the entrance fails to reduce the amount of mud being carried off-site by vehicles. Frequent washing will extend the useful life of stone pad.
6. Immediately remove mud and sediment tracked or washed onto adjacent impervious surfaces by brushing or sweeping. Flushing should only be used when the water can be discharged to a sediment trap or basin.
7. During maintenance activities, any broken pavement should be repaired immediately.
8. Construction entrances should be removed after the site has reached final stabilization. Permanent vegetation should replace areas from which construction entrances have been removed, unless area will be converted to an impervious surface to serve post-construction.

South Carolina Department of Health and Environmental Control
CONSTRUCTION ENTRANCE
STANDARD DRAWING NO. SC-06 PAGE 2 of 2
GENERAL NOTES FEBRUARY 2014 DATE

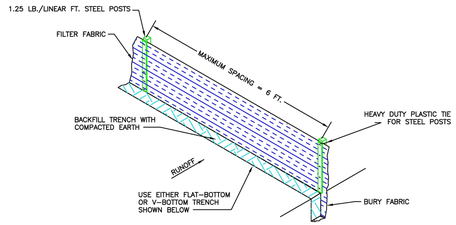
SOUTH CAROLINA JACKSON CIVIL ENGINEERING No. 6177 CERTIFICATE OF AUTHORIZATION
SOUTH CAROLINA REGISTERED 21971 PROFESSIONAL ENGINEER RICHARD P. JACKSON, II
JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

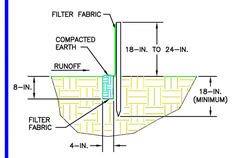
No	Description	Date

CONSTRUCTION DOCS

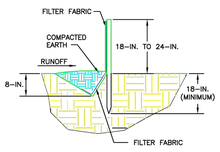
DRAWN BY: RPJ
CHECKED BY: JCS
PROJECT NO: 2337
DATE: SEPT 19, 2024
SHEET TITLE: SITE DETAILS
SHEET NO: C252



SILT FENCE INSTALLATION



FLAT-BOTTOM TRENCH DETAIL



V-SHAPED TRENCH DETAIL

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 1 of 2

APPROVED BY: SCDHEC — AUGUST, 2005 DATE

SILT FENCE DETAIL

Where and Where to Use It
Silt fence is applicable in areas:

Where the maximum sheet or overland flow path length to the fence is 100-feet.
Where the maximum slope steepness (normal [perpendicular] to fence line) is 2H:1V.
That do not receive concentrated flows greater than 0.5 cfs.

Do not place silt fence across channels or use it as a velocity control BMP.

Materials

Steel Posts
Use 48-inch long steel posts that meet the following minimum physical requirements:
Composed of high strength steel with minimum yield strength of 50,000 psi.
Have a standard "T" section with a nominal face width of 1.38-inches and nominal "T" length of 1.48-inches.
Weigh 1.25 pounds per foot (± 8%).
Have a soil stabilization plate with a minimum cross section area of 17-square inches attached to the steel posts.
Painted with a water based baked enamel paint.

Use steel posts with a minimum length of 4-feet, weighing 1.25 pounds per linear foot (± 8%) with projections to aid in fastening the fabric. Except when heavy clay soils are present on site, steel posts will have a metal soil stabilization plate welded near the bottom such that when the post is driven to the proper depth, the plate will be below the ground level for added stability.
The soil plates should have the following characteristics:
Be composed of minimum 15 gauge steel.
Have a minimum cross section area of 17-square inches.

Geotextile Filter Fabric
Filter fabric is:
Composed of fibers consisting of long chain synthetic polymers composed of at least 85% by weight of polyolefins, polyesters, or polyamides. Formed into a network such that the filaments or yarns retain dimensional stability relative to each other. Free of any treatment or coating which might adversely alter its physical properties after installation. Free of defects or flaws that significantly affect its physical and/or filtering properties. Cut to a minimum width of 36 inches.

Use only fabric appearing on SCDOT Approval Sheet #34 meeting the requirements of the most current edition of the SCDOT Standard Specifications for Highway Construction.

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 2 of 3

APPROVED BY: SCDHEC — AUGUST, 2005 DATE

SILT FENCE DETAIL

Installation
Excavate a trench approximately 6-inches wide and 6-inches deep when placing fabric by hand. Place 12-inches of geotextile fabric into the 6-inch deep trench, extending the remaining 6-inches towards the upslope side of the trench. Backfill the trench with soil or gravel and compact.Bury 12-inches of fabric into the ground when pneumatically installing silt fence with a slicing method. Purchase fabric in continuous rolls and cut to the length of the barrier to avoid joints. When joints are necessary, wrapped the fabric together at a support post with both ends fastened to the post, with a 6-inch minimum overlap. Install posts to a minimum depth of 24-inches. Install posts a minimum of 1- to 2- inches above the fabric, with no more than 3-feet of the post above the ground. Space posts to maximum 6-feet centers. Attach fabric to wood posts using staples made of heavy-duty wire at least 1½-inch long, spaced a maximum of 6-inches apart. Staple a 2-inch wide lathe over the filter fabric to securely fasten it to the upslope side of wooden posts. Attach fabric to the steel posts using heavy-duty plastic ties that are evenly spaced and placed in a manner to prevent sagging or tearing of the fabric. In call cases, ties should be affixed in no less than 4 places. Install the fabric a minimum of 24-inches above the ground. When necessary, the height of the fence above ground may be greater than 24-inches. In tidal areas, extra silt fence height may be required. The post height will be twice the exposed post height. Post spacing willremain the same and extra height fabric will be 4-, 5-, or 6-feet tall. Locate silt fence checks every 100 feet maximum and at low points. Install the fence perpendicular to the direction of flow and place the fence the proper distance from the toe of steep slopes to provide sediment storage and access for maintenance and cleanout.

Inspection and Maintenance
Inspect every seven calendar days and within 24-hours after each rainfall event that produces ½-inches or more of precipitation. Check for sediment buildup and fence integrity. Check where runoff has eroded a channel beneath the fence, or where the fence has sagged or collapsed by fence overtopping.
If the fence fabric tears, begins to decompose, or in any way becomes ineffective, replace the section of fence immediately.
Remove sediment accumulated along the fence when it reaches 1/3 the height of the fence, especially if heavy rains are expected.
Remove trapped sediment from the site or stabilize it on site.
Remove silt fence within 30 days after final stabilization is achieved or after temporary best management practices (BMPs) are no longer needed.
Permanently stabilize disturbed areas resulting from fence removal.

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 3 of 3

APPROVED BY: SCDHEC — AUGUST, 2005 DATE

SOUTH CAROLINA
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RICHARD P. JACKSON, II

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221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

CONSTRUCTION DOCS

DRAWN BY: RPJ

CHECKED BY: JCS

PROJECT NO: 2337

DATE: SEPT 19, 2024

SHEET TITLE: EROSION CONTROL DETAILS

SHEET NO: C253

CAPITAL IMPROVEMENT PROJECTS

COLUMBIA, SOUTH CAROLINA

OWNER/DEVELOPER

RIVERBANKS ZOO AND GARDEN
ERIC HELMS
DIRECTOR OF CONSTRUCTION AND PLANNING
500 WILDLIFE PARKWAY
COLUMBIA, SC 29210
PHONE (803) 602-0843
WWW.RIVERBANKS.ORG

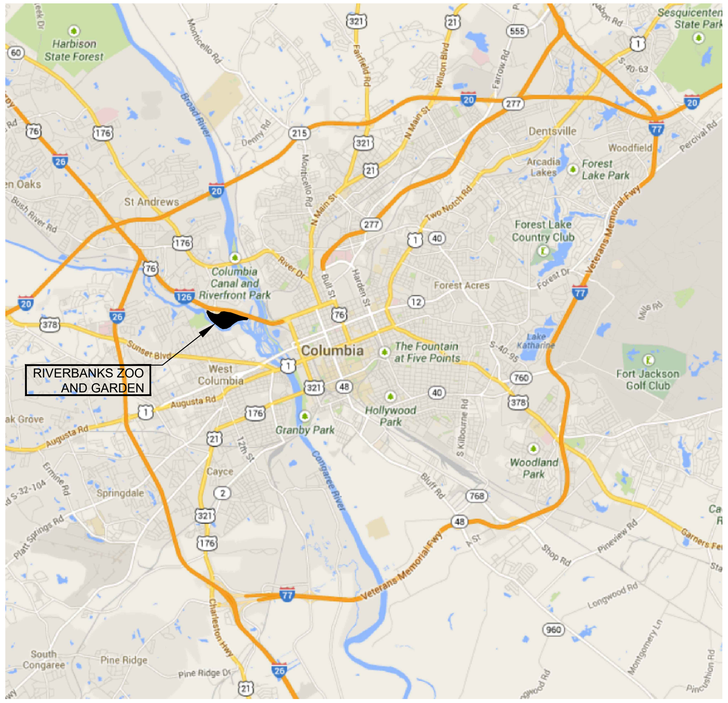
ENGINEER

JACKSON CIVIL ENGINEERING, LLC
RICHARD JACKSON, PE, CIVIL ENGINEER
221 POWELL DRIVE
LEXINGTON, SC 29072
PHONE (803) 603-0598
RICHARD@JACKSONCIVILENG.COM

PROJECT NARRATIVE

RIVERBANKS ZOO AND GARDEN IS SEEKING TO CONSTRUCT CAPITAL IMPROVEMENT PROJECTS. THIS INCLUDES THE FOLLOWING:
PHASE I - NEW SERVICE DRIVE
PHASE II - GONDOLA LIFT
PHASE III - EDUCATION CENTER

LOCATION MAP



NOT TO SCALE

SHEET INDEX

SHEET	TITLE
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C200 SERIES	PHASE I - NEW SERVICE DRIVE
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C300 SERIES	PHASE III - NEW EDUCATION CENTER
P52346FB	LEITNER-POMA GONDOLA LIFT ELEVATION LAYOUT

South Carolina 811
The Palmetto Utility Protection Service, Inc.
810 Dutch Square Blvd * Suite 320 * Columbia, SC 29210 - Phone (803) 939-1117

3 DAYS BEFORE DIGGING IN SOUTH CAROLINA
CALL 811
UNDERGROUND LOCATORS. CONTRACTOR SHALL CONTACT THE UNDERGROUND LOCATORS EVERY 10 DAYS FOR AN UPDATE TO UTILITY LOCATIONS.
Call 72 Hours BEFORE you DIG!

SOUTH CAROLINA JACKSON 16 PROFESSIONAL ENGINEER CERTIFICATE NUMBER
NOT FOR CONSTRUCTION
RICHARD P. JACKSON, II

JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
CAPITAL IMPROVEMENT PROJECTS
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

PERMIT DOCS

DRAWN BY: RPJ
CHECKED BY: JCE
PROJECT NO: 2337
DATE: AUG 13, 2024
SHEET TITLE: COVER SHEET AND INDEX
SHEET NO: C100

GENERAL CONSTRUCTION NOTES:

1. ALL COMMUNICATION FOR THIS PROJECT SHALL BE COORDINATED WITH THE OWNER'S REPRESENTATIVE. ANY DIRECT CONTACT BETWEEN CONTRACTOR-OWNER, CONTRACTOR-ARCHITECT AND CONTRACTOR/ENGINEER SHALL BE COORDINATED WITH THE OWNER'S REPRESENTATIVE.
2. THE CONTRACTOR SHALL FURNISH ALL MATERIALS, EQUIPMENT, AND LABOR NECESSARY TO COMPLETE ALL WORK AS INDICATED ON THE CONSTRUCTION DOCUMENTS
3. THE CONTRACTOR SHALL VISIT THE JOB SITE AND BE RESPONSIBLE FOR REVIEWING CONTRACT DOCUMENTS, FIELD CONDITIONS, DIMENSIONS AND CONFIRMING THAT THE WORK MAY BE ACCOMPLISHED AS SHOWN PRIOR TO PROCEEDING WITH CONSTRUCTION.
4. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE ARCHITECT/ENGINEER/owner's representative PRIOR TO PROCEEDING WITH THE WORK.
5. THE CONTRACTOR SHALL RECEIVE, IN WRITING, AUTHORIZATION TO PROCEED BEFORE STARTING WORK ON ANY ITEM NOT CLEARLY DEFINED OR IDENTIFIED BY THE CONTRACT DOCUMENTS.
6. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY INDICATED OTHERWISE OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDENCE.
7. ALL WORK PERFORMED AND MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES.
8. THE CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS.
9. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK, USING THE BEST SKILLS AND ATTENTION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THIS CONTRACT.
10. DETAILS ARE INTENDED TO SHOW FINAL RESULT OF DESIGN. MINOR MODIFICATIONS MAY BE REQUIRED TO SUIT JOB SITE DIMENSIONS OR CONDITIONS AND SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF THE WORK.
11. THE CONTRACTOR SHALL MAKE ALL NECESSARY PROVISIONS TO PROTECT EXISTING IMPROVEMENTS, ROADWAY, DRAINAGE WAYS, CULVERTS AND VEGETATION UNTIL SUCH ITEMS ARE TO BE DISTURBED OR REMOVED AS INDICATED ON THE CONSTRUCTION DOCUMENTS.
12. CONTRACTOR SHALL KEEP JOB SITE ARE CLEAN, HAZARD FREE AND DISPOSE OF ALL DIRT, DEBRIS AND RUBBISH. AT COMPLETION OF THE PROJECT CONTRACTOR SHALL REMOVE ALL MATERIAL AND EQUIPMENT NOT SPECIFIED AS REMAINING ON THE PROPERTY.
13. REPRESENTATIONS OF TRUE NORTH SHALL NOT BE USED TO IDENTIFY OR ESTABLISH THE BEARING OF TRUE NORTH AT THIS JOB SITE.
14. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ALL EXISTING UTILITIES WHETHER SHOWN HERON OR NOT AND TO PROTECT THEM FROM DAMAGE. CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT P.U.P.S. AT 1-800-721-7877 FOR UTILITY LOCATIONS 72 HOURS PRIOR TO START OF CONSTRUCTION.
15. SIZE, LOCATION AND TYPE OF ANY UNDERGROUND UTILITIES OR IMPROVEMENTS SHALL BE ACCURATELY NOTED AND PLACED ON AS-BUILT DRAWINGS BY THE CONTRACTOR AND ISSUED TO THE ARCHITECT/ENGINEER AT THE COMPLETION OF THE PROJECT.
16. NOTICE OF TERMINATION (NOT) AND AS-BUILTS CAN BE SUBMITTED UPON A MINIMUM OF 70% UNIFORM STABILIZATION.

GENERAL STORM DRAINAGE NOTES:

1. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH SCDOT PIPE TRENCHES SC-M-714 "SUPPLEMENTAL TECHNICAL SPECIFICATION FOR PERMANENT PIPE CULVERTS" DATED APRIL 6, 2009.
2. ALL CONCRETE PIPES SHALL BE IN ACCORDANCE ASTM-C-76 CLASS III, B WALL.
3. HDPE - SMOOTH INTERIOR CORRUGATED PLASTIC PIPES & FITTINGS IN ACCORDANCE WITH ASTM-F-405 MAY BE UTILIZED ONLY WHERE SHOWN AND FROM THE FOLLOWING MANUFACTURER OR APPROVED EQUAL:
   3.1. A.D.S. - N12 MFRD. BY ADVANCED DRAINAGE SYSTEMS, INC.
   3.2. 3300 RIVERSIDE DRIVE, COLUMBUS, OHIO 43221
4. PIPE SLOPES SHALL NOT BE DECREASED FROM THOSE SHOWN WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
5. CONTRACTOR SHALL FURNISH AND INSTALL ALL BENDS, FITTINGS, ETC. AS REQUIRED TO FACILITATE CONSTRUCTION OF
6. SEE STORM DRAINAGE PROFILES FOR ADDITIONAL INFORMATION AND PIPELINE MATERIAL.

GENERAL CONSTRUCTION SEQUENCE:

1. RECEIVE NPDES COVERAGE FROM DHEC
2. PRE-CONSTRUCTION MEETING (ON-SITE IF MORE THAN 10 DISTURBED AND NON-LINEAR)
3. NOTIFY DHEC EQC REGIONAL OFFICE OR OCRM OFFICE 48 HOURS PRIOR TO BEGINNING LAND-DISTURBING ACTIVITIES
4. INSTALLATION OF CONSTRUCTION ENTRANCE(S)
5. CLEARING & GRUBBING ONLY AS NECESSARY FOR INSTALLATION OF PERIMETER CONTROLS
6. INSTALLATION OF PERIMETER CONTROLS (E.G., SILT FENCE)
7. CLEARING & GRUBBING ONLY IN AREAS OF BASINS/ TRAPS/ PONDS
8. INSTALLATION OF BASINS/ TRAPS/ PONDS AND INSTALLATION OF DIVERSIONS TO THOSE STRUCTURES (OUTLET STRUCTURES MUST BE COMPLETELY INSTALLED AS SHOWN ON THE DETAILS BEFORE PROCEEDING TO NEXT STEP; AREAS DRAINING TO THESE STRUCTURES CANNOT BE DISTURBED UNTIL THE STRUCTURES AND DIVERSIONS TO THE STRUCTURES ARE COMPLETELY INSTALLED)
9. CLEARING & GRUBBING OF SITE OR DEMOLITION (SEDIMENT & EROSION CONTROL MEASURES FOR THESE AREAS MUST ALREADY BE INSTALLED)
10. ROUGH GRADING
11. INSTALLATION OF STORM DRAIN SYSTEM AND PLACEMENT OF INLET PROTECTION AS EACH INLET IS INSTALLED
12. FINE GRADING, PAVING, ETC.
13. PERMANENT/ FINAL STABILIZATION
14. CLEAN-OUT OF DETENTION BASINS THAT WERE USED AS SEDIMENT CONTROL STRUCTURES AND RE-GRADING OF DETENTION POND BOTTOMS; IF NECESSARY, MODIFICATION OF SEDIMENT BASIN RISER TO CONVERT TO DETENTION BASIN OUTLET STRUCTURE
15. REMOVAL OF TEMPORARY SEDIMENT & EROSION CONTROL MEASURES AFTER ENTIRE AREA DRAINING TO THE STRUCTURE IS FINALLY STABILIZED (THE DEPARTMENT RECOMMENDS THAT THE PROJECT OWNER/ OPERATOR HAVE THE SWPPP PREPARER OR REGISTRATION EQUIVALENT APPROVE THE REMOVAL OF TEMPORARY STRUCTURES.)
16. PERFORM AS-BUILT SURVEYS OF ALL DETENTION STRUCTURES AND SUBMIT TO DHEC OR MS4 FOR ACCEPTANCE.
17. FINAL STABILIZATION IS 70% PERMANENT VEGETATIVE COVERAGE ACROSS 100% OF THE CONSTRUCTION SITE. 70% UNIFORM STABILITY MUST BE ACHIEVED PRIOR TO SUBMITTING AS-BUILTS AND FINALIZED N.O.T. TO SCDHEC.
18. SUBMIT NOTICE OF TERMINATION (NOT) TO DHEC AS APPROPRIATE.
19. NOTE: IF NPDES COVERAGE IS BEING ISSUED AFTER LAND-DISTURBING ACTIVITIES HAVE ALREADY STARTED (E.G., IN RESPONSE TO A NOTICE TO COMPLY, NOTICE OF VIOLATION, OR ENFORCEMENT ACTION), THEN THE CONSTRUCTION SEQUENCE MUST SPECIFICALLY INDICATE THE ITEMS THAT HAVE ALREADY OCCURRED AND THE ITEMS THAT WILL BE OCCURRING AFTER NPDES COVERAGE IS ISSUED.
20. NOTE: IF FLOWS FROM OFFSITE AREAS WILL BE DIVERTED AROUND THE SITE AND THE ON-SITE STRUCTURES ARE NOT DESIGNED TO HANDLE FLOWS FROM THE OFFSITE AREAS, THEN THE DIVERSIONS/ PIPING FOR THE OFFSITE FLOWS MUST BE INSTALLED BEFORE LAND-DISTURBING ACTIVITIES BEGIN ON THE SITE; INCLUDE THIS IN THE SEQUENCE. SEDIMENT AND EROSION CONTROL MEASURES FOR THE DISTURBED AREAS FOR THE DIVERSION/ PIPING MUST BE INSTALLED BEFORE THOSE AREAS ARE DISTURBED AND SHOULD BE SHOWN ON THE PLANS.
21. NOTE: IF AN EXISTING DETENTION/ SEDIMENT BASIN IS BEING MODIFIED TO HANDLE THE FLOWS FROM THE PROPOSED DEVELOPMENT, THEN IT MUST BE MODIFIED BEFORE LAND-DISTURBING ACTIVITIES BEGIN ON THE SITE. THIS SHOULD BE INCLUDED IN THE SEQUENCE.
22. NOTE: INCLUDE INDIVIDUAL LOT DEVELOPMENT/ CONSTRUCTION IN THE SEQUENCE IF THE SITE WILL NOT BE MASS-GRADED.
23. NOTE: INSTALLATION OF SOME PERMANENT WATER QUALITY DEVICES SHOULD OCCUR AFTER THE SITE IS STABILIZED; INCLUDE THIS IN THE SEQUENCE. CLEANOUT OF OTHER WATER QUALITY DEVICES THAT WERE USED DURING CONSTRUCTION SHOULD OCCUR AFTER SITE STABILIZATION.
24. NOTE: MAINTENANCE OF SEDIMENT AND EROSION CONTROL MEASURES MUST CONTINUE UNTIL THE SITE IS PERMANENTLY STABILIZED AND THE CONTROLS ARE REMOVED.

SEDIMENT AND EROSION CONTROL NOTES:

1. IF NECESSARY, SLOPES, WHICH EXCEED EIGHT (8) VERTICAL FEET SHOULD BE STABILIZED WITH SYNTHETIC OR VEGETATIVE MATS, IN ADDITION TO HYDROSEEDING. IT MAY BE NECESSARY TO INSTALL TEMPORARY SLOPE DRAINS DURING CONSTRUCTION. TEMPORARY BERMS MAY BE NEEDED UNTIL THE SLOPE IS BROUGHT TO GRADE.
2. STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS PRACTICABLE IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT IN NO CASE MORE THAN FOURTEEN (14) DAYS AFTER WORK HAS CEASED, EXCEPT AS STATED BELOW.
   - WHERE STABILIZATION BY THE 14TH DAY IS PRECLUDED BY SNOW COVER OR FROZEN GROUND CONDITIONS STABILIZATION MEASURES MUST BE INITIATED AS SOON AS PRACTICABLE.
   - WHERE CONSTRUCTION ACTIVITY ON A PORTION OF THE SITE IS TEMPORARILY CEASED, AND EARTH-DISTURBING ACTIVITIES WILL BE RESUMED WITHIN 14 DAYS, TEMPORARY STABILIZATION MEASURES DO NOT HAVE TO BE INITIATED ON THAT PORTION OF THE SITE.
3. ALL SEDIMENT AND EROSION CONTROL DEVICES SHALL BE INSPECTED ONCE EVERY CALENDAR WEEK. IF PERIODIC INSPECTION OR OTHER INFORMATION INDICATES THAT A BMP HAS BEEN INAPPROPRIATELY, OR INCORRECTLY, THE PERMITTEE MUST ADDRESS THE NECESSARY REPLACEMENT OR MODIFICATION REQUIRED TO CORRECT THE BMP WITHIN 48 HOURS OF IDENTIFICATION.
4. PROVIDE SILT FENCE AND/OR OTHER CONTROL DEVICES, AS MAY BE REQUIRED, TO CONTROL SOIL EROSION DURING UTILITY CONSTRUCTION. ALL DISTURBED AREAS SHALL BE CLEANED, GRADED, AND STABILIZED WITH GRASSING IMMEDIATELY AFTER THE UTILITY INSTALLATION. FILL, COVER, AND TEMPORARY SEEDING AT THE END OF EACH DAY ARE RECOMMENDED. IF WATER IS ENCOUNTERED WHILE TRENCHING, THE WATER SHOULD BE FILTERED TO REMOVE SEDIMENT BEFORE BEING PUMPED BACK INTO ANY WATERS OF THE STATE.
5. ALL EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED DURING ALL PHASES OF CONSTRUCTION UNTIL THE COMPLETION OF ALL CONSTRUCTION ACTIVITIES AND ALL DISTURBED AREAS HAVE BEEN STABILIZED. ADDITIONAL CONTROL DEVICES MAY BE REQUIRED DURING CONSTRUCTION IN ORDER TO CONTROL EROSION AND/OR OFFSITE SEDIMENTATION. ALL TEMPORARY CONTROL DEVICES SHALL BE REMOVED ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED.
6. THE CONTRACTOR MUST TAKE NECESSARY ACTION TO MINIMIZE THE TRACKING OF MUD ONTO PAVED ROADWAY(S) FROM CONSTRUCTION AREAS AND THE GENERATION OF DUST. THE CONTRACTOR SHALL DAILY REMOVE MUD/SOIL FROM PAVEMENT, AS MAY BE REQUIRED.
7. RESIDENTIAL SUBDIVISIONS REQUIRE EROSION CONTROL FEATURES FOR INFRASTRUCTURE AS WELL AS FOR INDIVIDUAL LOT CONSTRUCTION. INDIVIDUAL PROPERTY OWNERS SHALL FOLLOW THESE PLANS DURING CONSTRUCTION OR OBTAIN APPROVAL OF AN INDIVIDUAL PLAN IN ACCORDANCE WITH S.C REG. 72-300 ET SEQ. AND SCR100000.
8. TEMPORARY DIVERSION BERMS AND/OR DITCHES WILL BE PROVIDED AS NEEDED DURING CONSTRUCTION TO PROTECT WORK AREAS FROM UPSLOPE RUNOFF AND/OR TO DIVERT SEDIMENT-LADEN WATER TO APPROPRIATE TRAPS OR STABLE OUTLETS.
9. ALL WATERS OF THE STATE (WOS), INCLUDING WETLANDS, ARE TO BE FLAGGED OR OTHERWISE CLEARLY MARKED IN THE FIELD. A DOUBLE ROW OF SILT FENCE IS TO BE INSTALLED IN ALL AREAS WHERE A 50-FOOT BUFFER CAN'T BE MAINTAINED BETWEEN THE DISTURBED AREA AND ALL WOS. A 10-FOOT BUFFER SHOULD BE MAINTAINED BETWEEN THE LAST ROW OF SILT FENCE AND ALL WOS.
10. LITTER, CONSTRUCTION DEBRIS, OILS, FUELS, AND BUILDING PRODUCTS WITH SIGNIFICANT POTENTIAL FOR IMPACT (SUCH AS STOCKPILES OF FRESHLY TREATED LUMBER) AND CONSTRUCTION CHEMICALS THAT COULD BE EXPOSED TO STORM WATER MUST BE PREVENTED FROM BECOMING A POLLUTANT SOURCE IN STORM WATER DISCHARGES.
11. A COPY OF THE SWPPP, INSPECTIONS RECORDS, AND RAINFALL DATA MUST BE RETAINED AT THE CONSTRUCTION SITE OR A NEARBY LOCATION EASILY ACCESSIBLE DURING NORMAL BUSINESS HOURS, FROM THE DATE OF COMMENCEMENT OF CONSTRUCTION ACTIVITIES TO THE DATE THAT FINAL STABILIZATION IS REACHED.
12. INITIATE STABILIZATION MEASURES ON ANY EXPOSED STEEP SLOPE (3H:1V OR GREATER) WHERE LAND-DISTURBING ACTIVITIES HAVE PERMANENTLY OR TEMPORARILY CEASED, AND WILL NOT RESUME FOR A PERIOD OF 7 CALENDAR DAYS.
13. MINIMIZE SOIL COMPACTION AND, UNLESS INFEASIBLE, PRESERVE TOPSOIL.
14. MINIMIZE THE DISCHARGE OF POLLUTANTS FROM EQUIPMENT AND VEHICLE WASHING, WHEEL WASH WATER, AND OTHER WASH WATERS. WASH WATERS MUST BE TREATED IN A SEDIMENT BASIN OR ALTERNATIVE CONTROL THAT PROVIDES EQUIVALENT OR BETTER TREATMENT PRIOR TO DISCHARGE;
15. MINIMIZE THE DISCHARGE OF POLLUTANTS FROM DEWATERING OF TRENCHES AND EXCAVATED AREAS. THESE DISCHARGES ARE TO BE ROUTED THROUGH APPROPRIATE BMPS (SEDIMENT BASIN, FILTER BAG, ETC.).
16. THE FOLLOWING DISCHARGES FROM SITES ARE PROHIBITED:
    - WASTEWATER FROM WASHOUT OF CONCRETE, UNLESS MANAGED BY AN APPROPRIATE CONTROL;
    - WASTEWATER FROM WASHOUT AND CLEANOUT OF STUCCO, PAINT, FORM RELEASE OILS, CURING COMPOUNDS AND OTHER CONSTRUCTION MATERIALS;
    - FUELS, OILS, OR OTHER POLLUTANTS USED IN VEHICLE AND EQUIPMENT OPERATION AND MAINTENANCE; AND
    - SOAPS OR SOLVENTS USED IN VEHICLE AND EQUIPMENT WASHING.
17. AFTER CONSTRUCTION ACTIVITIES BEGIN, INSPECTIONS MUST BE CONDUCTED AT A MINIMUM OF AT LEAST ONCE EVERY CALENDAR WEEK AND MUST BE CONDUCTED UNTIL FINAL STABILIZATION IS REACHED ON ALL AREAS OF THE CONSTRUCTION SITE.
18. IF EXISTING BMPS NEED TO BE MODIFIED OR IF ADDITIONAL BMPS ARE NECESSARY TO COMPLY WITH THE REQUIREMENTS OF THIS PERMIT AND/OR SC'S WATER QUALITY STANDARDS, IMPLEMENTATION MUST BE COMPLETED BEFORE THE NEXT STORM EVENT WHENEVER PRACTICABLE. IF IMPLEMENTATION BEFORE THE NEXT STORM EVENT IS IMPRACTICABLE, THE SITUATION MUST BE DOCUMENTED IN THE SWPPP AND ALTERNATIVE BMPS MUST BE IMPLEMENTED AS SOON AS REASONABLY POSSIBLE.
19. A PRE-CONSTRUCTION CONFERENCE MUST BE HELD FOR EACH CONSTRUCTION SITE WITH AN APPROVED ON-SITE SWPPP PRIOR TO THE IMPLEMENTATION OF CONSTRUCTION ACTIVITIES. FOR NON-LINEAR PROJECTS THAT DISTURB 10 ACRES OR MORE THIS CONFERENCE MUST BE HELD ON-SITE UNLESS THE DEPARTMENT HAS APPROVED OTHERWISE.

GRASSING SPECIFICATIONS

GRASS/SOIL PREPARATION-
- REMOVE AND DISPOSE OF ALL ROCKS AND DEBRIS LARGER THAN 3/4" IN DIAMETER FROM THESE AREAS.
- USE A SEED-SLITTER OVER THE ENTIRE AREA UNTIL A MIXTURE OF 180 LBS OF COMMON BERMUDA SEED, 550 LBS OF TURF TYPE FESCUE SEED, AND 500 LBS OF 18-24-12 STARTER FERTILIZER IS INSERTED INTO THE SOIL.
- AGGRESSIVELY CORE AERATE (4" DEEP) WITH A PLUG CORER OVER THE ENTIRE AREA AND BACK DRAG SOIL INTO ANY LOW PLACES AS NEEDED.
- BRING IN 40 TONS OF TOPSOIL IN THE AREAS AS SHOWN ON THE DRAWING. 15-20 YARDS ARE NEEDED AT THE FRONT RIGHT OF THE SCHOOL. THE REMAINING SOIL IS TO BE USED AS NEEDED IN AREAS WHERE THE GROUND IS HARD.
- OVER SEED ALL SHADY AREAS WITH ADDITIONAL TURF TYPE FESCUE SEED AT THE RATE OF 3 LBS PER 1,000 SQ. FT. OR APPROXIMATELY 50 LBS TOTAL.

HYDROSEED-
- HEAVILY HYDROSEED ALL AREAS USING A MIXTURE OF 180 LBS OF COMMON BERMUDA SEED, 550 LBS OF TURF TYPE FESCUE SEED, 500 LBS OF 18-24-12 STARTER FERTILIZER, 750LBS OF LIME AND 1200-1400 LBS OF WOOD MULCH FIBER.
- WATER IN ALL AREAS ONE TIME.

GRASS MATTING-
- PROVIDE BIODEGRADABLE STRAW OR COCONUT FIBER MATTING OVER ALL SLOPED AREAS SHOWN. INCLUDE MANUFACTURER'S RECOMMENDED STEEL WIRE STAPLES, 6- INCHES LONG.
-

SEED PROTECTION-
- USE CAUTION TAPE AND STAKES TO BARRICADE OFF ALL SEEDED AREAS SO THAT CHILDREN DO NOT DISTURB WHEN THEY RETURN.

PROJECT TIMELINE-
ALL WORK IS TO BE COMPLETED BETWEEN APRIL 16TH AND APRIL 23RD. SCHOOL WILL BE OUT FOR SPRING BREAK.

GENERAL GRADING NOTES:

1. THIS IS NOT A BALANCED SITE. IT IS THE SITE CONTRACTOR'S RESPONSIBILITY TO HAUL IN OR HAUL OFF DIRT AS NECESSARY TO COMPLETE CONSTRUCTION.
2. INSTALLATION OF SOIL EROSION CONTROL MEASURES AND PRACTICES WILL BE IMPLEMENTED PRIOR TO LAND DISTURBING ACTIVITIES
3. FINAL GRADING WILL CONSIST OF SPREADING TOPSOIL (4" MINIMUM) TO FINISHED GRADES AS INDICATED ON ALL DISTURBED AREAS.
4. EROSION CONTROL MEASURES WILL BE MAINTAINED AT ALL TIMES. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSTALLED AS DETERMINED BY ON-SITE INSPECTION.
5. ALL DISTURBED AREAS TO BE SODDED OR HYDROSEEDED ACCORDING TO GRASSING SPECIFICATIONS
6. UNTIL THE SITE IS STABILIZED, SEDIMENT SHALL BE REMOVED FROM PONDS AFTER EVERY SIGNIFICANT RAINFALL EVENT (GREATER THAN 0.5 INCHES). AFTER THE SITE IS STABILIZED REGRADE THE PONDS TO DESIGN DEPTH. ANY SEDIMENT REMOVED SHOULD BE PROPERLY DISPOSED OF OR USED ONSITE.
7. ALL EARTHWORK SHALL BE PERFORMED IN ACCORDANCE WITH THE RECOMMENDATIONS AND/OR UNDER THE SUPERVISION OF A SOILS CONSULTANT.

CERTIFICATION STATEMENT

"I have placed my signature and seal on the design documents submitted signifying that I accept responsibility for the design of the system. Further, I certify to the best of my knowledge and belief that the design is consistent with the requirements of Title 48, Chapter 14 of the Code of Laws of SC, 1976 as amended, pursuant to Regulation 72-300 et seq. (if applicable), and in accordance with the terms and conditions of SCR100000."

SOUTH CAROLINA JACKSON 16 CERTIFICATE NUMBER REGISTRATION NOT FOR CONSTRUCTION RICHARD P. JACKSON, II

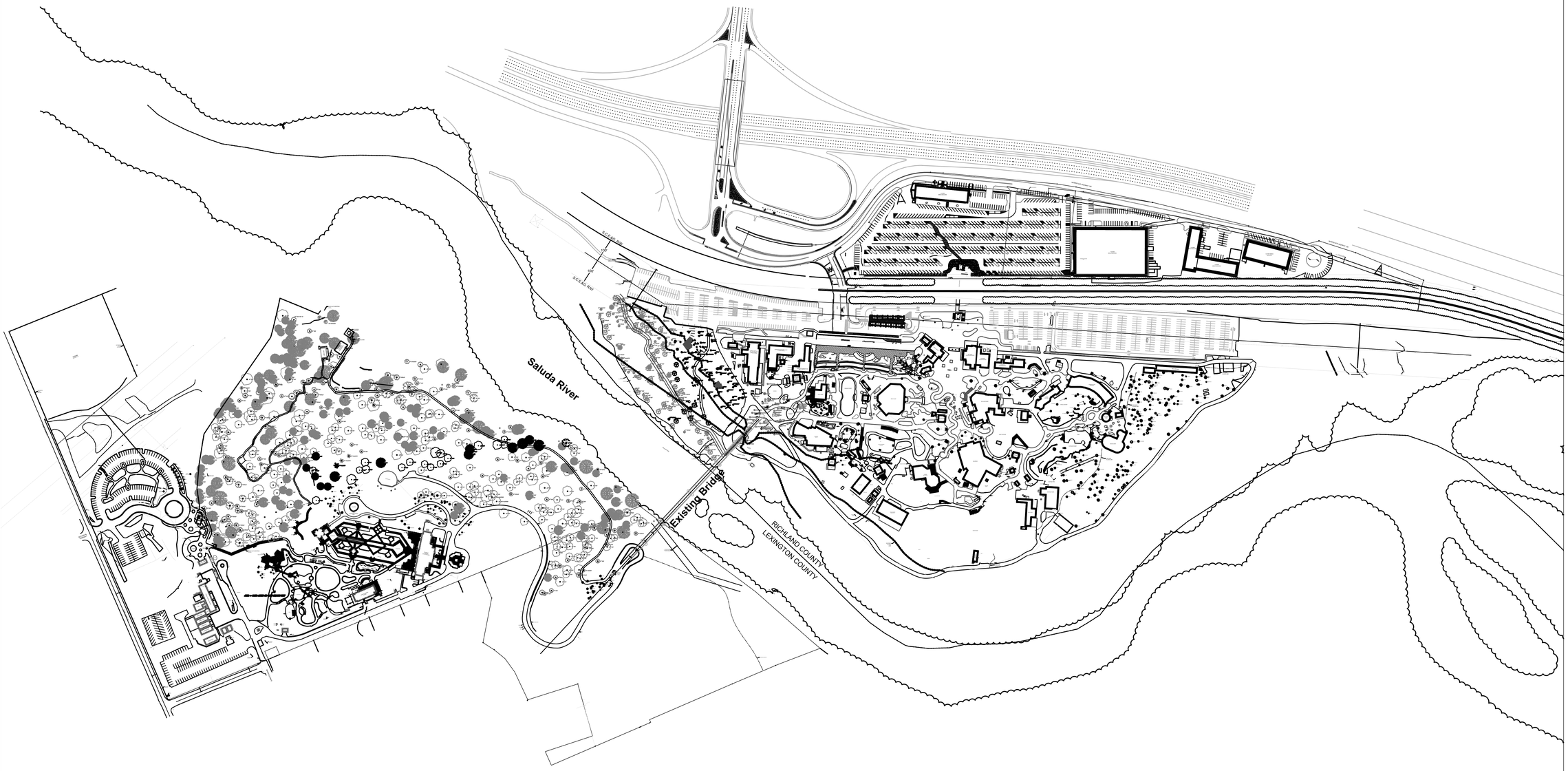
JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
CAPITAL IMPROVEMENT PROJECTS
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

PERMIT DOCS

DRAWN BY: RPJ
CHECKED BY: JCE
PROJECT NO: 2337
DATE: AUG 13, 2024
SHEET TITLE: GENERAL NOTES
SHEET NO: C101



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GRAPHIC SCALE IN FEET

SOUTH CAROLINA
JACKSON
RICHARD P.
REGISTERED LANDSCAPE ARCHITECT
NOT FOR CONSTRUCTION
APPROVAL

JACKSON
CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
CAPITAL IMPROVEMENT PROJECTS
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

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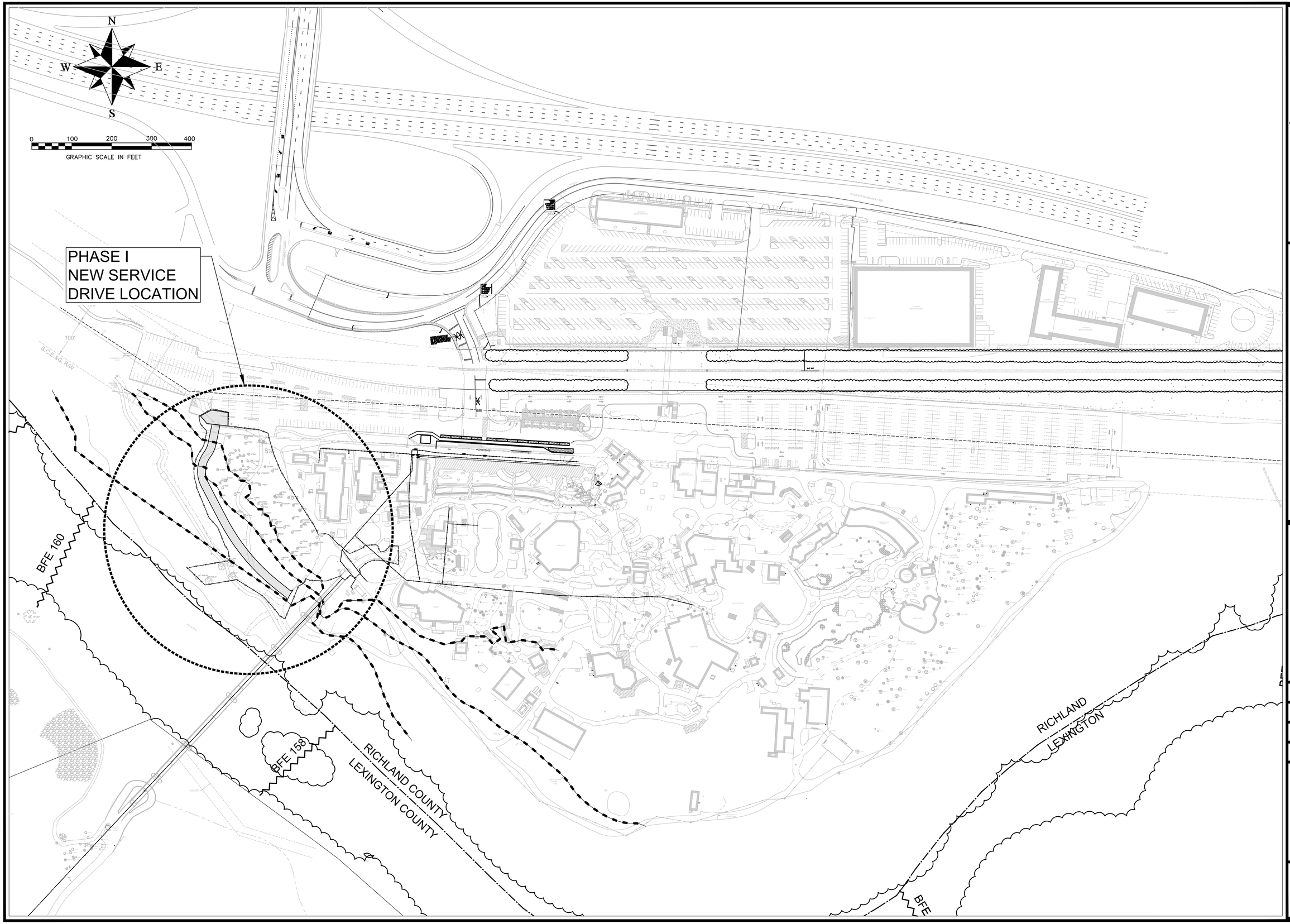
DRAWN BY: RPJ
CHECKED BY: JCE
PROJECT NO: 2337
DATE: AUG 13, 2024

SHEET TITLE:
RIVERBANKS ZOO AND GARDEN OVERALL PLAN

SHEET NO:
C102



JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
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DRAWN BY: RPJ

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PROJECT NO: 2337

DATE: AUG 13, 2024

SHEET TITLE:
PHASE I
PROJECT LOCATION

SHEET NO:
C201

N

W E

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0 30 60 90 120

GRAPHIC SCALE IN FEET

BENCHMARK:
MAG NAIL IN PAVEMENT
ELEVATION=167.41'

BFE 160

MH RIM=150.53
FLOWLINE=137.61

SALUDA RIVER

BRICK BUILDING

ANIMAL HEALTH & SCIENCE CENTER (1-STORY BRICK)

ADMINISTRATION/COMMISSARY (1-STORY BRICK)

ASPHALT DRIVE

OLD BRIDGE REMNANTS

SOUTH CAROLINA
JACKSON
RICHARD P.
1
REGISTERED
LANDSCAPE
ARCHITECT

NOT FOR CONSTRUCTION

JACKSON
CIVIL ENGINEERING

221 Powell Drive
Lexington, SC 29072

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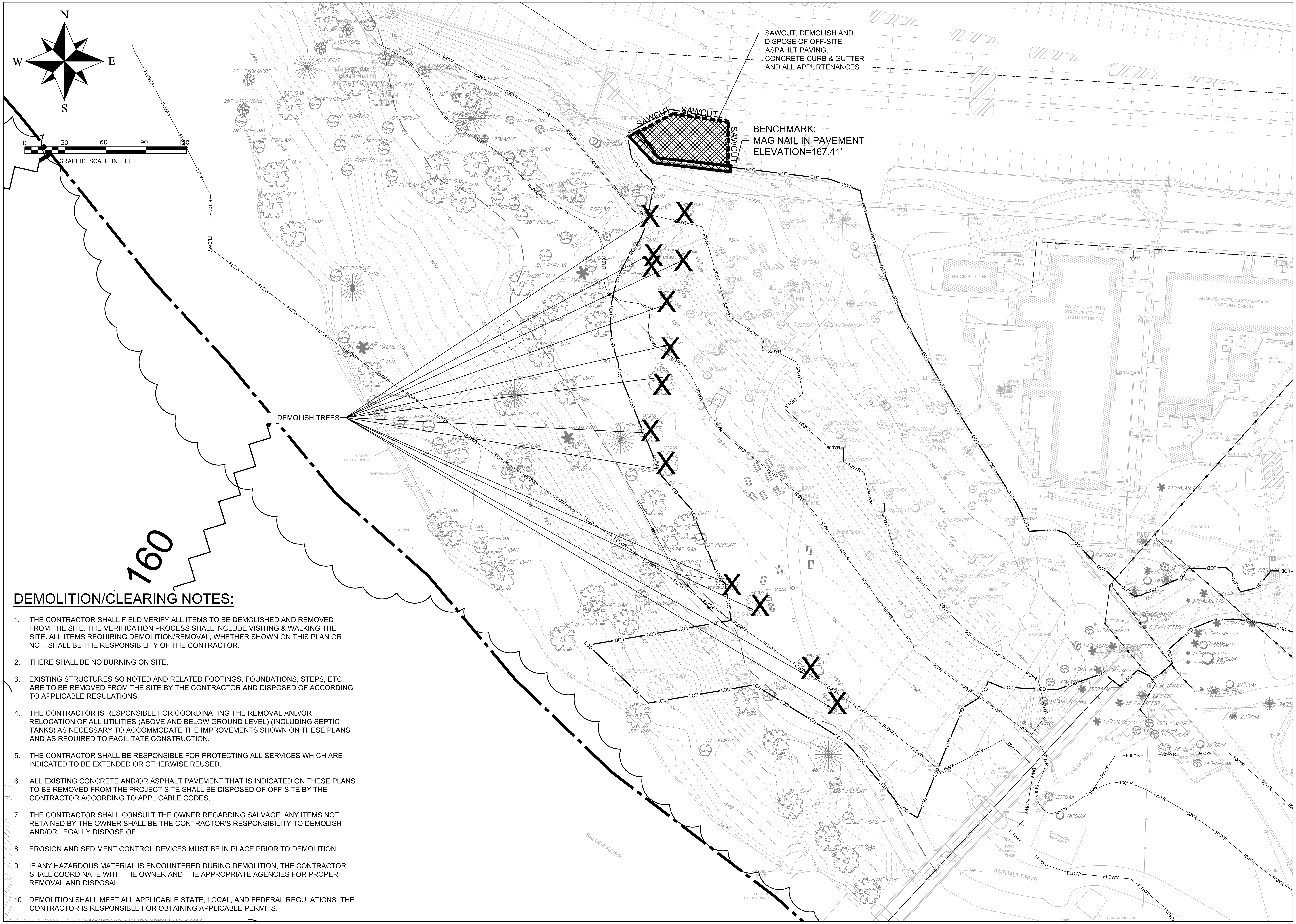
PROJECT NO: 2337

DATE: AUG 13, 2024

SHEET TITLE:
TOPOGRAPHIC SURVEY

SHEET NO:
C202



DEMOLITION/CLEARING NOTES:

1. THE CONTRACTOR SHALL FIELD VERIFY ALL ITEMS TO BE DEMOLISHED AND REMOVED FROM THE SITE. THE VERIFICATION PROCESS SHALL INCLUDE VISITING & WALKING THE SITE. ALL ITEMS REQUIRING DEMOLITION/REMOVAL, WHETHER SHOWN ON THIS PLAN OR NOT, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
2. THERE SHALL BE NO BURNING ON SITE.
3. EXISTING STRUCTURES SO NOTED AND RELATED FOOTINGS, FOUNDATIONS, STEPS, ETC. ARE TO BE REMOVED FROM THE SITE BY THE CONTRACTOR AND DISPOSED OF ACCORDING TO APPLICABLE REGULATIONS.
4. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE REMOVAL AND/OR RELOCATION OF ALL UTILITIES (ABOVE AND BELOW GROUND LEVEL) (INCLUDING SEPTIC TANKS) AS NECESSARY TO ACCOMMODATE THE IMPROVEMENTS SHOWN ON THESE PLANS AND AS REQUIRED TO FACILITATE CONSTRUCTION.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL SERVICES WHICH ARE INDICATED TO BE EXTENDED OR OTHERWISE REUSED.
6. ALL EXISTING CONCRETE AND/OR ASPHALT PAVEMENT THAT IS INDICATED ON THESE PLANS TO BE REMOVED FROM THE PROJECT SITE SHALL BE DISPOSED OF OFF-SITE BY THE CONTRACTOR ACCORDING TO APPLICABLE CODES.
7. THE CONTRACTOR SHALL CONSULT THE OWNER REGARDING SALVAGE. ANY ITEMS NOT RETAINED BY THE OWNER SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DEMOLISH AND/OR LEGALLY DISPOSE OF.
8. EROSION AND SEDIMENT CONTROL DEVICES MUST BE IN PLACE PRIOR TO DEMOLITION.
9. IF ANY HAZARDOUS MATERIAL IS ENCOUNTERED DURING DEMOLITION, THE CONTRACTOR SHALL COORDINATE WITH THE OWNER AND THE APPROPRIATE AGENCIES FOR PROPER REMOVAL AND DISPOSAL.
10. DEMOLITION SHALL MEET ALL APPLICABLE STATE, LOCAL, AND FEDERAL REGULATIONS. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING APPLICABLE PERMITS.

NOT FOR CONSTRUCTION

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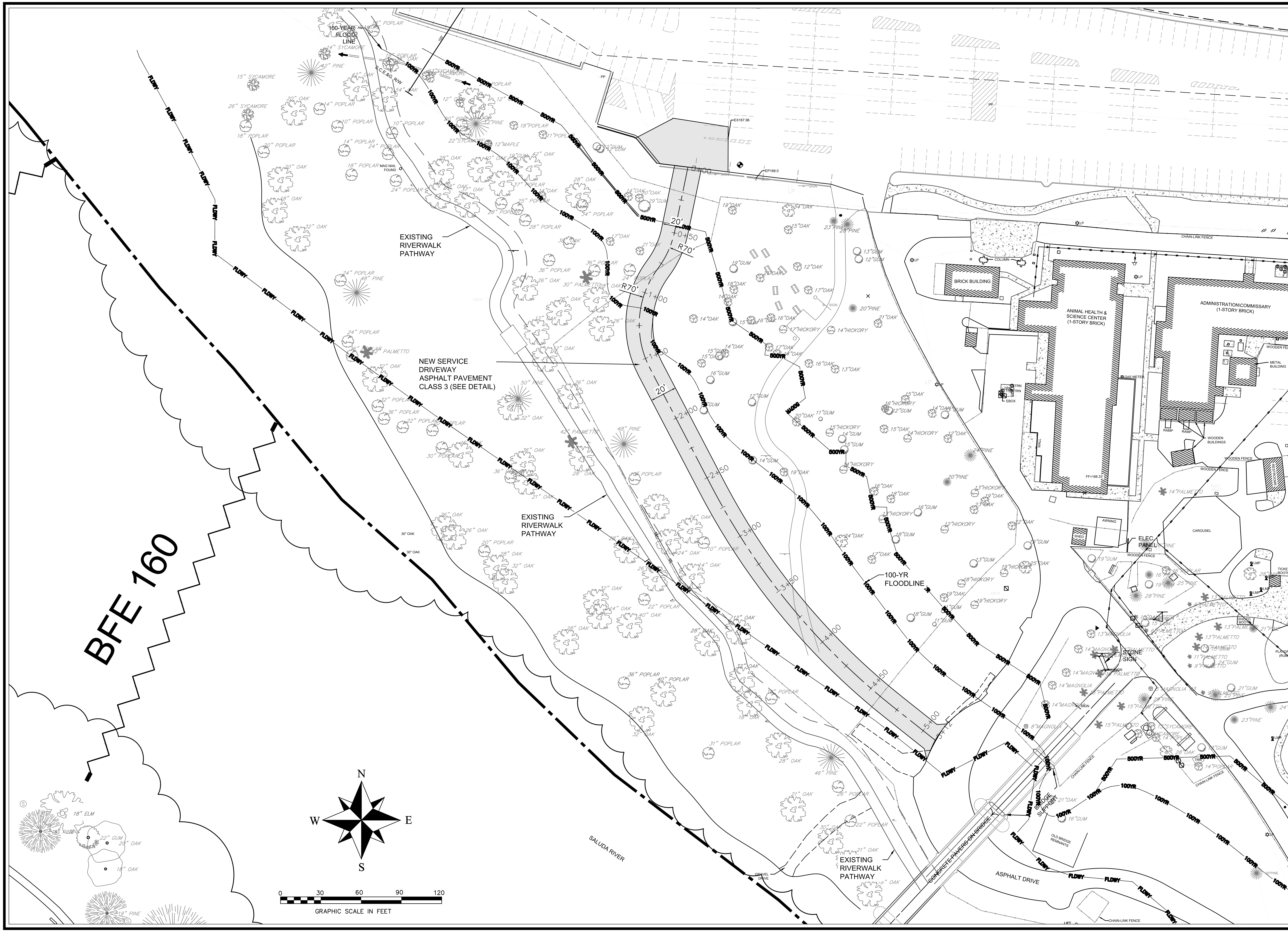
DRAWN BY: RPJ
CHECKED BY: JCE
PROJECT NO: 2337
DATE: AUG 13, 2024
SHEET TITLE: DEMOLITION PLAN
SHEET NO: C203



SOUTH CAROLINA
JACKSON
CERTIFICATE OF AUTHORIZATION
RICHARD P. JACKSON, II
NOT FOR CONSTRUCTION

JACKSON
CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

PERMIT DOCS

DRAWN BY: RPJ

CHECKED BY: JCE

PROJECT NO: 2337

DATE: AUG 13, 2024

SHEET TITLE: SITE PLAN

SHEET NO: C204

N
W
E
S

0 30 60 90 120
GRAPHIC SCALE IN FEET

BFE 160

100-YEAR FLOOD LINE

MH RIM=155.02
INV IN=143.80
INV OUT=143.77

MH RIM=150.53
FLOWLINE=137.61

MH RIM=149.85
INV IN=137.65

RIP-RAP

EX167.96

EP168.0

MAG NAIL FOUND

EDGE OF SALUDA RIVER

RIVERBANK

SALUDA RIVER

GRAVEL DRIVE

EDGE OF SALUDA RIVER

CONCRETE PAVERS ON BRIDGE

ASPHALT DRIVE

BRICK BUILDING

ANIMAL HEALTH & SCIENCE CENTER (1-STORY BRICK)

ADMINISTRATION\COMMISSARY (1-STORY BRICK)

STONE SIGN

ELEC PANEL

CAROUSEL

WOODEN BUILDINGS

METAL BUILDING

RAMP

ARMING

CHAIN-LINK FENCE

WOODEN FENCE

BRIDGE SUPPORT

OLD BRIDGE REMNANTS

SOUTH CAROLINA
JACKSON
REGISTERED
PROFESSIONAL
ENGINEER
NOT FOR CONSTRUCTION
RICHARD P. JACKSON, II

JACKSON
CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

PERMIT DOCS

DRAWN BY: RPJ

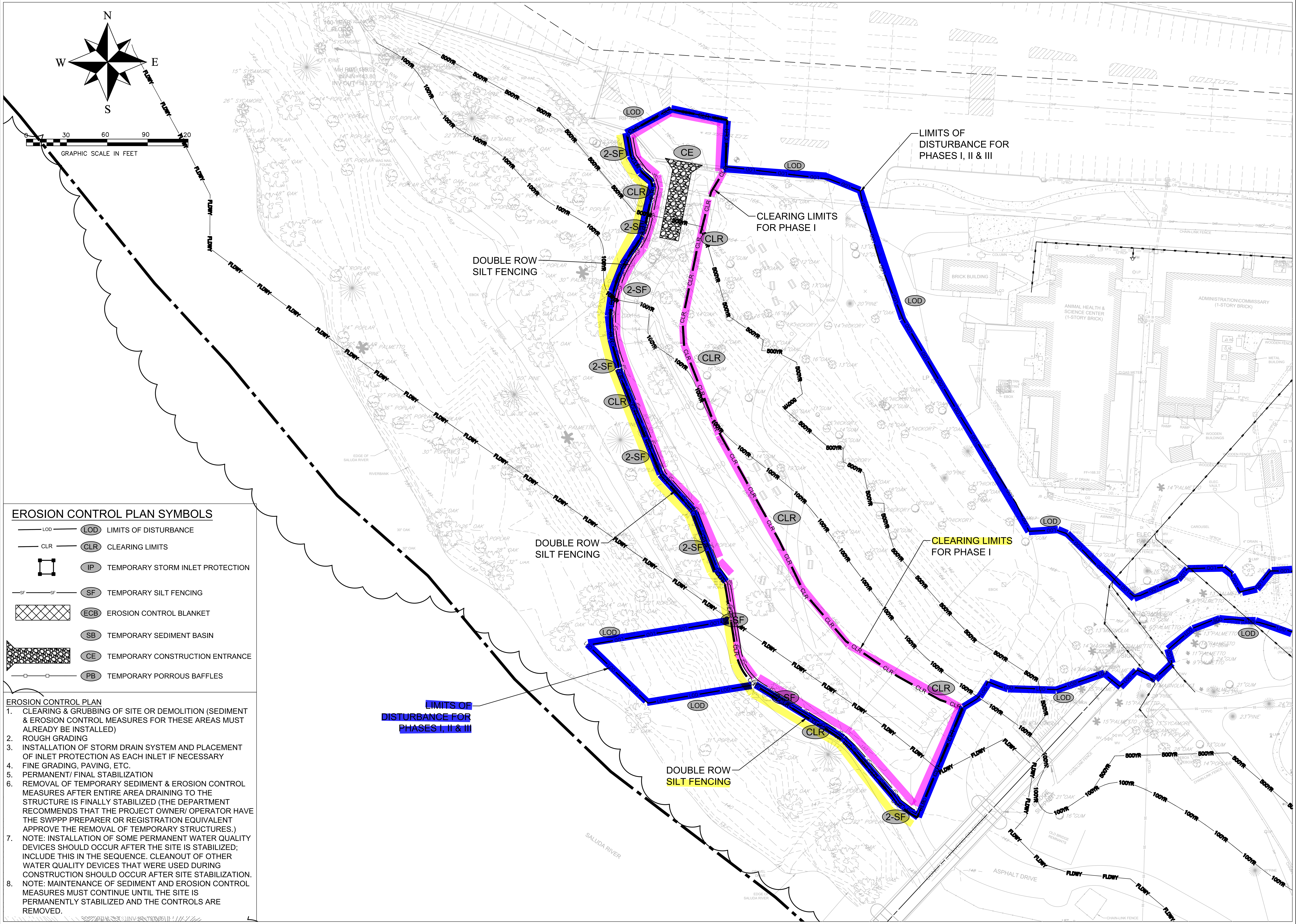
CHECKED BY: JCE

PROJECT NO: 2337

DATE: AUG 13, 2024

SHEET TITLE: GRADING PLAN

SHEET NO: C205



EROSION CONTROL PLAN SYMBOLS

Symbol	Label	Description
—— LOD ——	LOD	LIMITS OF DISTURBANCE
—— CLR ——	CLR	CLEARING LIMITS
	IP	TEMPORARY STORM INLET PROTECTION
—SF——SF—	SF	TEMPORARY SILT FENCING
	ECB	EROSION CONTROL BLANKET
	SB	TEMPORARY SEDIMENT BASIN
	CE	TEMPORARY CONSTRUCTION ENTRANCE
	PB	TEMPORARY POROUS BAFFLES

EROSION CONTROL PLAN

1. CLEARING & GRUBBING OF SITE OR DEMOLITION (SEDIMENT & EROSION CONTROL MEASURES FOR THESE AREAS MUST ALREADY BE INSTALLED)
2. ROUGH GRADING
3. INSTALLATION OF STORM DRAIN SYSTEM AND PLACEMENT OF INLET PROTECTION AS EACH INLET IF NECESSARY
4. FINE GRADING, PAVING, ETC.
5. PERMANENT/ FINAL STABILIZATION
6. REMOVAL OF TEMPORARY SEDIMENT & EROSION CONTROL MEASURES AFTER ENTIRE AREA DRAINING TO THE STRUCTURE IS FINALLY STABILIZED (THE DEPARTMENT RECOMMENDS THAT THE PROJECT OWNER/ OPERATOR HAVE THE SWPPP PREPARER OR REGISTRATION EQUIVALENT APPROVE THE REMOVAL OF TEMPORARY STRUCTURES.)
7. NOTE: INSTALLATION OF SOME PERMANENT WATER QUALITY DEVICES SHOULD OCCUR AFTER THE SITE IS STABILIZED; INCLUDE THIS IN THE SEQUENCE. CLEANOUT OF OTHER WATER QUALITY DEVICES THAT WERE USED DURING CONSTRUCTION SHOULD OCCUR AFTER SITE STABILIZATION.
8. NOTE: MAINTENANCE OF SEDIMENT AND EROSION CONTROL MEASURES MUST CONTINUE UNTIL THE SITE IS PERMANENTLY STABILIZED AND THE CONTROLS ARE REMOVED.

NOT FOR CONSTRUCTION

JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

PERMIT DOCS

DRAWN BY: RPJ

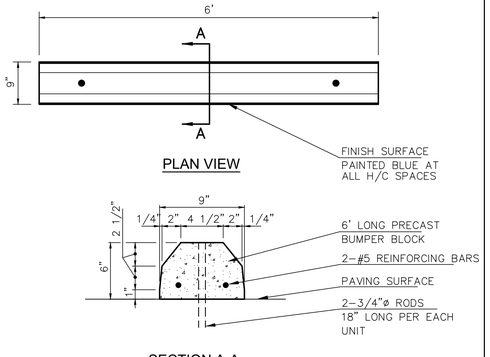
CHECKED BY: JCE

PROJECT NO: 2337

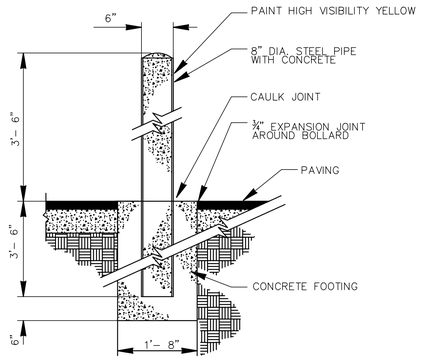
DATE: AUG 13, 2024

SHEET TITLE: EROSION CONTROL PLAN

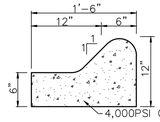
SHEET NO: C206



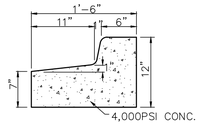
PRECAST CONCRETE WHEEL STOP
NTS



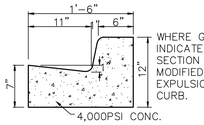
STEEL PIPE BOLLARDS
NTS



18" ROLLED CURB AND GUTTER
NTS



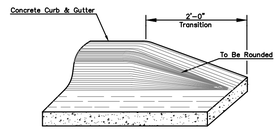
18" EXPULSION CURB



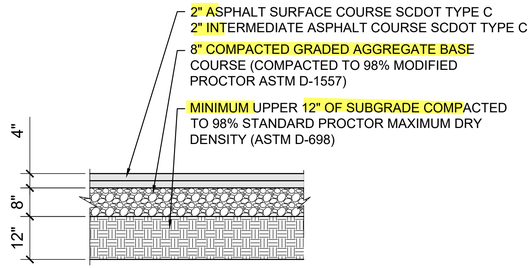
18" COLLECTION CURB

WHERE GRADES INDICATE, THIS CURB SECTION TO BE MODIFIED TO EXPULSION TYPE CURB.

18" VERTICAL CURB & GUTTER
NTS

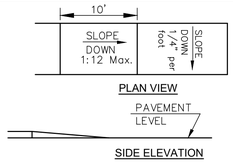


FEATHERING CURB AND GUTTER DETAIL
NTS

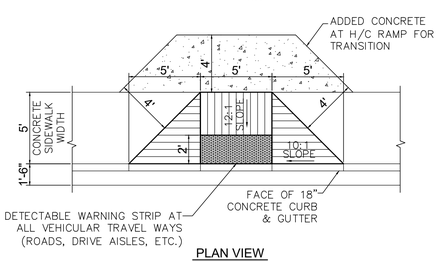


CLASS 3 - ASPHALT PAVING
(<65 trucks/day)

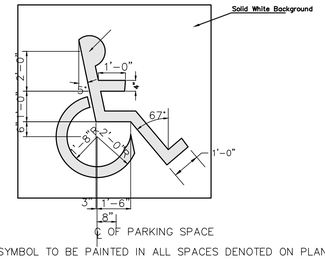
CONCRETE CURB & GUTTER & SIDEWALK DETAIL
NTS



DEPRESSED SIDEWALK FOR HANDICAP ACCESS
NTS

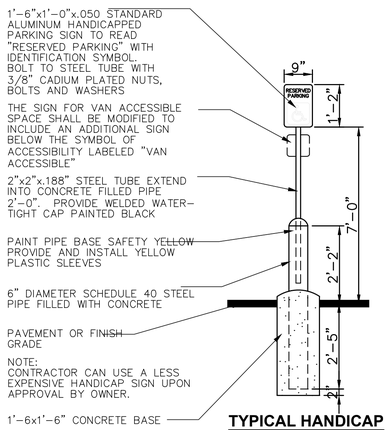


TYPICAL ADA HANDICAP RAMP CURB CUT DETAIL
NTS

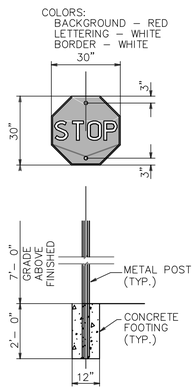


NOTE: SYMBOL TO BE PAINTED IN ALL SPACES DENOTED ON PLANS EITHER BLUE ON A WHITE BACKGROUND OR WHITE ON A BLUE BACKGROUND

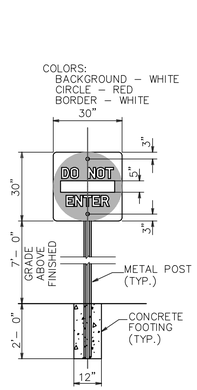
INTERNATIONAL ACCESSIBLE SYMBOL DETAIL
NTS



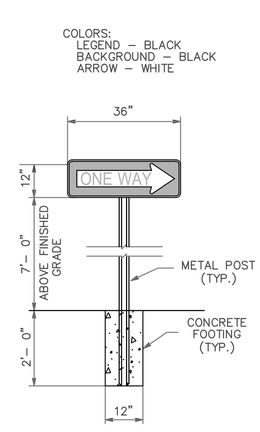
TYPICAL HANDICAP PARKING SIGN
NTS



STOP SIGN
NTS

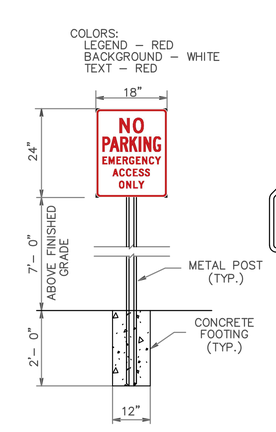


DO NOT ENTER SIGN
NTS

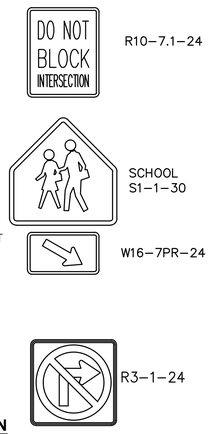


MUTCD R6-1R "ONE WAY" SIGN

R6-1L-36
R6-1R-36



EMERGENCY ACCESS ONLY SIGN



NO RIGHT TURN SIGN TO BE MOUNTED UNDERNEATH STOP SIGN ON THE SAME POST.

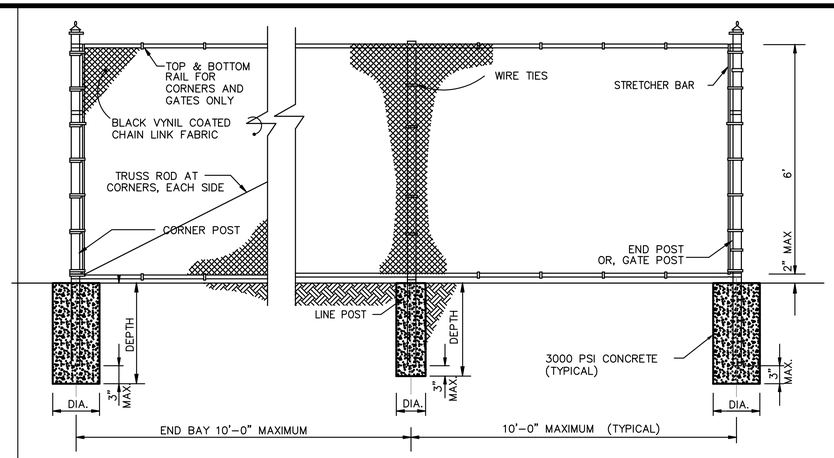
JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

NOT FOR CONSTRUCTION

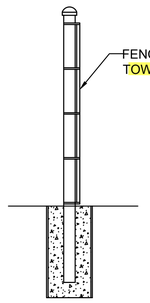
RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date
	PERMIT DOCS	

DRAWN BY: RPJ
CHECKED BY: JCE
PROJECT NO: 2337
DATE: AUG 13, 2024
SHEET TITLE: SITE DETAILS
SHEET NO: C251



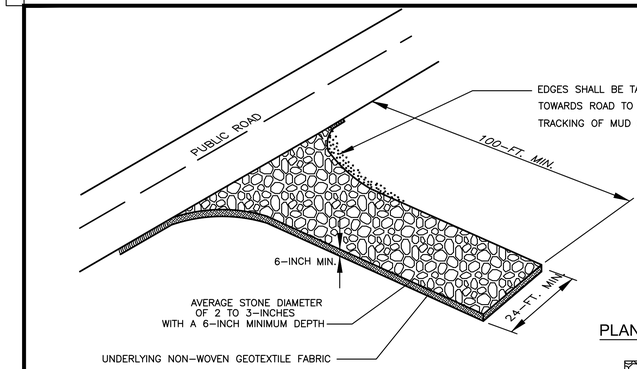
CHAIN LINK FENCE
NTS



SIDE VIEW
NTS

FENCE FOUNDATION SCHEDULE			
POST TYPE	LINE	END	GATE
6FT GALVANIZED OR BLACK VINYL COATED CHAINLINK FENCE			
FOUNDATION DIA.	10"	16"	16"
FOUNDATION DEPTH	30"	30"	30"

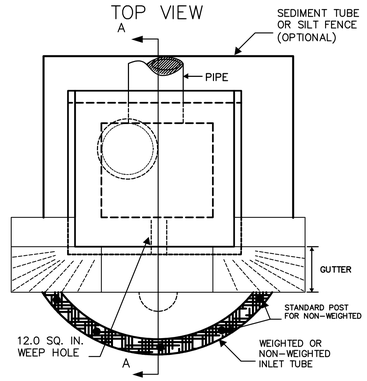
NOTES:
BLACK VINYL COATED OPTION
1. ALL FENCE FABRIC TO BE BLACK VINYL COATED.
2. FENCE FABRIC TO BE PLACED WITH FINISHED SIDE FACING THE SCHOOL.
3. THE FENCE IS TO BE INSTALLED 2'-0" OFF THE BACK EDGE OF THE RETAINING WALL TOP CAP.



PLAN SYMBOL

SPECIFICATION	SIZE
ROCK PAD THICKNESS	6 INCHES
ROCK PAD WIDTH	24 FEET
ROCK PAD LENGTH	100 FEET
ROCK PAD STONE SIZE	D = 2-3 INCHES

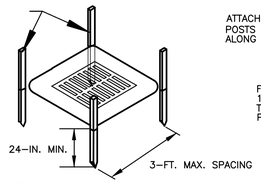
South Carolina Department of Health and Environmental Control
CONSTRUCTION ENTRANCE
STANDARD DRAWING NO. SC-06 PAGE 1 of 2
NOT TO SCALE FEBRUARY 2014 DATE



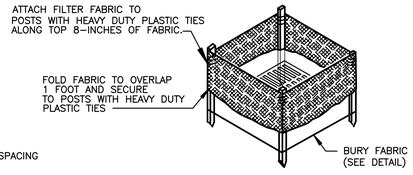
PLAN SYMBOL

F

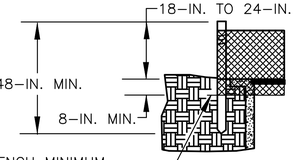
South Carolina Department of Health and Environmental Control
Type F
INLET TUBES
STANDARD DRAWING NO. SC-11 PAGE 1 of 2
NOT TO SCALE FEBRUARY 2014 DATE



POST INSTALLATION DETAIL



FILTER FABRIC INSTALLATION DETAIL



FILTER FABRIC BURIAL DETAIL

PLAN SYMBOL

A

South Carolina Department of Health and Environmental Control
Type A
FILTER FABIC INLET PROTECTION
STANDARD DRAWING NO. SC-07 PAGE 1 of 2
NOT TO SCALE FEBRUARY 2014 DATE

CONSTRUCTION ENTRANCE – GENERAL NOTES

1. Stabilized construction entrances should be used at all points where traffic will egress/ingress a construction site onto a public road or any impervious surfaces, such as parking lots.
2. Install a non-woven geotextile fabric prior to placing any stone.
3. Install a culvert pipe across the entrance when needed to provide positive drainage.
4. The entrance shall consist of 2-inch to 3-inch D50 stone placed at a minimum depth of 6-inches.
5. Minimum dimensions of the entrance shall be 24-feet wide by 100-feet long, and may be modified as necessary to accommodate site constraints.
6. The edges of the entrance shall be tapered out towards the road to prevent tracking at the edge of the entrance.
7. Divert all surface runoff and drainage from the stone pad to a sediment trap or basin or other sediment trapping structure.
8. Limestone may not be used for the stone pad.

CONSTR. ENTRANCE – INSPECTION & MAINTENANCE

1. The key to functional construction entrances is weekly inspections, routine maintenance, and regular sediment removal.
2. Regular inspections of construction entrances shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall even that produces 1/2-inch or more of precipitation.
3. During regular inspections, check for mud and sediment buildup and pad integrity. Inspection frequencies may need to be more frequent during long periods of wet weather.
4. Reshape the stone pad as necessary for drainage and runoff control.
5. Wash or replace stones as needed and as directed by site inspector. The stone in the entrance should be washed or replaced whenever the entrance fails to reduce the amount of mud being carried off-site by vehicles. Frequent washing will extend the useful life of stone pad.
6. Immediately remove mud and sediment tracked or washed onto adjacent impervious surfaces by brushing or sweeping. Flushing should only be used when the water can be discharged to a sediment trap or basin.
7. During maintenance activities, any broken pavement should be repaired immediately.
8. Construction entrances should be removed after the site has reached final stabilization. Permanent vegetation should replace areas from which construction entrances have been removed, unless area will be converted to an impervious surface to serve post-construction.

South Carolina Department of Health and Environmental Control
CONSTRUCTION ENTRANCE
STANDARD DRAWING NO. SC-06 PAGE 2 of 2
GENERAL NOTES FEBRUARY 2014 DATE

INSPECTION AND MAINTENANCE

1. The key to functional inlet protection is weekly inspection, routine maintenance, and regular sediment removal.
2. Regular inspections of all inlet protection shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall event that produces 1/2-inch or more of precipitation.
3. Attention to sediment accumulations in front of the inlet protection is extremely important. Accumulated sediment should be continually monitored and removed when necessary.
4. Remove accumulated sediment when it reaches 1/3 the height of the blocks. If a sump is used, sediment should be removed when it fills approximately 1/3 the depth of the hole.
5. Removed sediment shall be placed in stockpile storage areas or spread thinly across disturbed area. Stabilize the removed sediment after it is relocated.
6. Large debris, trash, and leaves should be removed from in front of tubes when found.
7. Replace inlet tube when damaged or as recommended by manufacturer's specifications.
8. Inlet protection structures should be removed after the disturbed areas are permanently stabilized. Remove all construction material and sediment, and dispose of them properly. Grade the disturbed area to the elevation of the drop inlet structure crest. Stabilize all bare areas immediately.

South Carolina Department of Health and Environmental Control
Type F
INLET TUBES
STANDARD DRAWING NO. SC-11 PAGE 2 of 2
GENERAL NOTES FEBRUARY 2014 DATE

TYPE A – FILTER FABRIC REQUIREMENTS

1. Silt fence must be composed of woven geotextile filter fabric that consists of the following requirements:
   - Composed of fibers consisting of long chain synthetic polymers of at least 85% by weight of polyolefins, polyesters, or polyamides that are formed into a network such that the filaments or yarns retain dimensional stability relative to each other;
   - Free of any treatment or coating which might adversely alter its physical properties after installation;
   - Free of any defects or flaws that significantly affect its physical and/or filtering properties; and,
   - Have a minimum width of 36-inches.
2. Use only fabric appearing on SC DOT's Qualified Products Listing (QPL), Approval Sheet #34, meeting the requirements of the most current edition of the SC DOT Standard Specifications for Highway Construction.
3. 12-inches of the fabric should be placed within excavated trench and toed in when the trench is backfilled.
4. Filter Fabric shall be purchased in continuous rolls and cut to the length of the barrier to avoid joints.
5. Filter Fabric shall be installed at a minimum of 24-inches above the ground.

TYPE A – POST REQUIREMENTS

1. Silt Fence posts must be 48-inch long steel posts that meet, at a minimum, the following physical characteristics.
   - Composed of a high strength steel with a minimum yield strength of 50,000 psi.
   - Include a standard "T" section with a nominal face width of 1.38-inches and a nominal "T" length of 1.48-inches.
   - Weigh 1.25 pounds per foot (± 8%)
2. Posts shall be equipped with projections to aid in fastening of filter fabric.
3. Install posts to a minimum of 24-inches. A minimum height of 1-to 2- inches above the fabric shall be maintained, and a maximum height of 3 feet shall be maintained above the ground.
4. Post spacing shall be at a maximum of 3-feet on center.

TYPE A – INSPECTION & MAINTENANCE

1. The key to functional inlet protection is weekly inspections, routine maintenance, and regular sediment removal.
2. Regular inspections of inlet protection shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall even that produces 1/2-inch or more of precipitation.
3. Attention to sediment accumulations along the filter fabric is extremely important. Accumulated sediment should be continually monitored and removed when necessary.
4. Remove accumulated sediment when it reaches 1/3 the height of the filter fabric. When a sump is installed in front of the fabric, sediment should be removed when it fills approximately 1/3 the depth of the sump.
5. Removed sediment shall be placed in stockpile storage areas or spread thinly across disturbed area. Stabilize the removed sediment after it is relocated.
6. Check for areas where stormwater runoff has eroded a channel beneath the filter fabric, or where the fabric has sagged or collapsed due to runoff overtopping the inlet protection.
7. Check for tears within the filter fabric, areas where fabric has begun to decompose, and for any other circumstance that may render the inlet protection ineffective. Removed damaged fabric and reinstall new filter fabric immediately.
8. Inlet protection structures should be removed after all the disturbed areas are permanently stabilized. Remove all construction material and sediment, and dispose of them properly. Grade the disturbed area to the elevation of the drop inlet structure crest. Stabilize all bare areas immediately.

South Carolina Department of Health and Environmental Control
Type A
FILTER FABIC INLET PROTECTION
STANDARD DRAWING NO. SC-07 PAGE 2 of 2
GENERAL NOTES FEBRUARY 2014 DATE

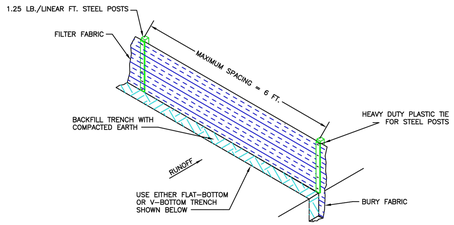
JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

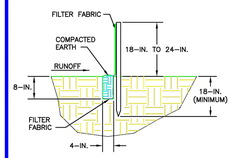
No	Description	Date

PERMIT DOCS

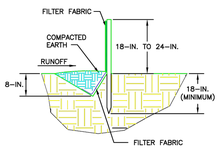
DRAWN BY: RPJ
CHECKED BY: JCS
PROJECT NO: 2337
DATE: AUG 13, 2024
SHEET TITLE: SITE DETAILS
SHEET NO: C252



SILT FENCE INSTALLATION



FLAT-BOTTOM TRENCH DETAIL



V-SHAPED TRENCH DETAIL

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 1 of 2

APPROVED BY: SCDHEC — AUGUST, 2005 DATE

SILT FENCE DETAIL

When and Where to Use It
Silt fence is applicable in areas:

Where the maximum sheet or overland flow path length to the fence is 100-feet.
Where the maximum slope steepness (normal [perpendicular] to fence line) is 2H:1V.
That do not receive concentrated flows greater than 0.5 cfs.

Do not place silt fence across channels or use it as a velocity control BMP.

Materials

Steel Posts
Use 48-inch long steel posts that meet the following minimum physical requirements:
Composed of high strength steel with minimum yield strength of 50,000 psi.
Have a standard "T" section with a nominal face width of 1.38-inches and nominal "T" length of 1.48-inches.
Weigh 1.25 pounds per foot (± 8%).
Have a soil stabilization plate with a minimum cross section area of 17-square inches attached to the steel posts.
Painted with a water based baked enamel paint.

Use steel posts with a minimum length of 4-feet, weighing 1.25 pounds per linear foot (± 8%) with projections to aid in fastening the fabric. Except when heavy clay soils are present on site, steel posts will have a metal soil stabilization plate welded near the bottom such that when the post is driven to the proper depth, the plate will be below the ground level for added stability.
The soil plates should have the following characteristics:
Be composed of minimum 15 gauge steel.
Have a minimum cross section area of 17-square inches.

Geotextile Filter Fabric
Filter fabric is:
Composed of fibers consisting of long chain synthetic polymers composed of at least 85% by weight of polyolefins, polyesters, or polyamides. Formed into a network such that the filaments or yarns retain dimensional stability relative to each other. Free of any treatment or coating which might adversely alter its physical properties after installation. Free of defects or flaws that significantly affect its physical and/or filtering properties. Cut to a minimum width of 36 inches.

Use only fabric appearing on SCDOT Approval Sheet #34 meeting the requirements of the most current edition of the SCDOT Standard Specifications for Highway Construction.

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 2 of 3

APPROVED BY: SCDHEC — AUGUST, 2005 DATE

SILT FENCE DETAIL

Installation
Excavate a trench approximately 6-inches wide and 6-inches deep when placing fabric by hand. Place 12-inches of geotextile fabric into the 6-inch deep trench, extending the remaining 6-inches towards the upslope side of the trench. Backfill the trench with soil or gravel and compact.Bury 12-inches of fabric into the ground when pneumatically installing silt fence with a slicing method. Purchase fabric in continuous rolls and cut to the length of the barrier to avoid joints. When joints are necessary, wrapped the fabric together at a support post with both ends fastened to the post, with a 6-inch minimum overlap. Install posts to a minimum depth of 24-inches. Install posts a minimum of 1- to 2- inches above the fabric, with no more than 3-feet of the post above the ground. Space posts to maximum 6-feet centers. Attach fabric to wood posts using staples made of heavy-duty wire at least 1½-inch long, spaced a maximum of 6-inches apart. Staple a 2-inch wide lathe over the filter fabric to securely fasten it to the upslope side of wooden posts. Attach fabric to the steel posts using heavy-duty plastic ties that are evenly spaced and placed in a manner to prevent sagging or tearing of the fabric. In cell cases, ties should be affixed in no less than 4 places. Install the fabric a minimum of 24-inches above the ground. When necessary, the height of the fence above ground may be greater than 24-inches. In tidal areas, extra silt fence height may be required. The post height will be twice the exposed post height. Post spacing willremain the same and extra height fabric will be 4-, 5-, or 6-feet tall. Locate silt fence checks every 100 feet maximum and at low points. Install the fence perpendicular to the direction of flow and place the fence the proper distance from the toe of steep slopes to provide sediment storage and access for maintenance and cleanout.

Inspection and Maintenance
Inspect every seven calendar days and within 24-hours after each rainfall event that produces ½-inches or more of precipitation. Check for sediment buildup and fence integrity. Check where runoff has eroded a channel beneath the fence, or where the fence has sagged or collapsed by fence overtopping.
If the fence fabric tears, begins to decompose, or in any way becomes ineffective, replace the section of fence immediately.
Remove sediment accumulated along the fence when it reaches 1/3 the height of the fence, especially if heavy rains are expected.
Remove trapped sediment from the site or stabilize it on site.
Remove silt fence within 30 days after final stabilization is achieved or after temporary best management practices (BMPs) are no longer needed.
Permanently stabilize disturbed areas resulting from fence removal.

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 3 of 3

APPROVED BY: SCDHEC — AUGUST, 2005 DATE

JACKSON CIVIL ENGINEERING
221 Powell Drive
Lexington, SC 29072

RIVERBANKS ZOO & GARDEN
PHASE I - NEW SERVICE DRIVE
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

PERMIT DOCS

DRAWN BY: RPJ

CHECKED BY: JCS

PROJECT NO: 2337

DATE: AUG 13, 2024

SHEET TITLE: EROSION CONTROL DETAILS

SHEET NO: C253

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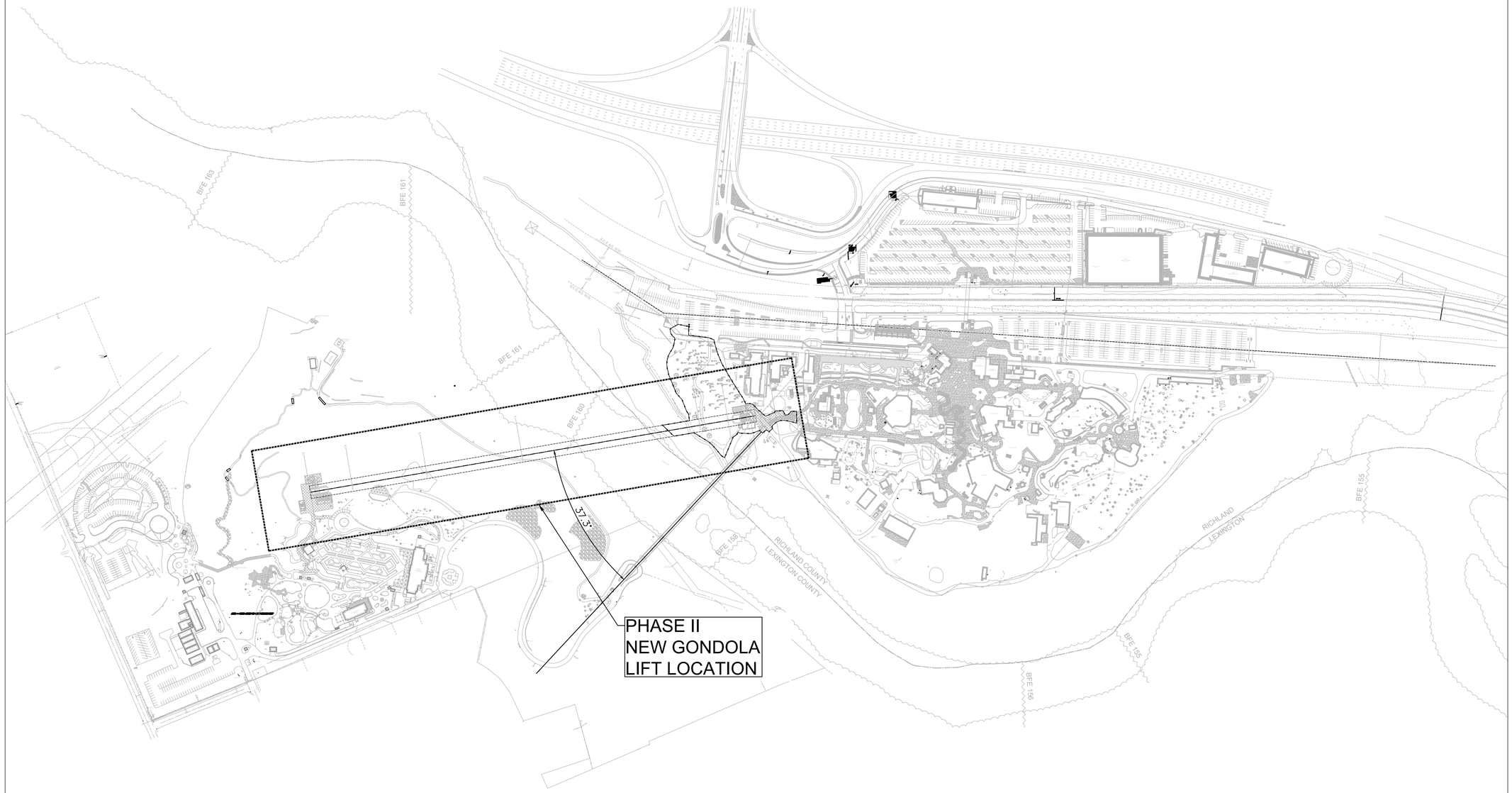
GRAPHIC SCALE IN FEET



RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN

EXHIBIT DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE

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Revisions:

No.	*Description*	*Date*

Sheet Title:

PHASE II GONDOLA LIFT WEST SIDE

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C301

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No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
WEST STATION TOPO SURVEY AREA 1

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C302

Gondola Stations

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Sheet Title
PHASE II GONDOLA LIFT
WEST STATION TOPO SURVEY AREA 2

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Project Manager:	
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Date: AUG 13, 2024	
Scale: AS NOTED	

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C303

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Sheet Title

PHASE II GONDOLA LIFT

EAST STATION TOPO SURVEY AREA3

CLR Project No.:

Project Manager:

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Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C304

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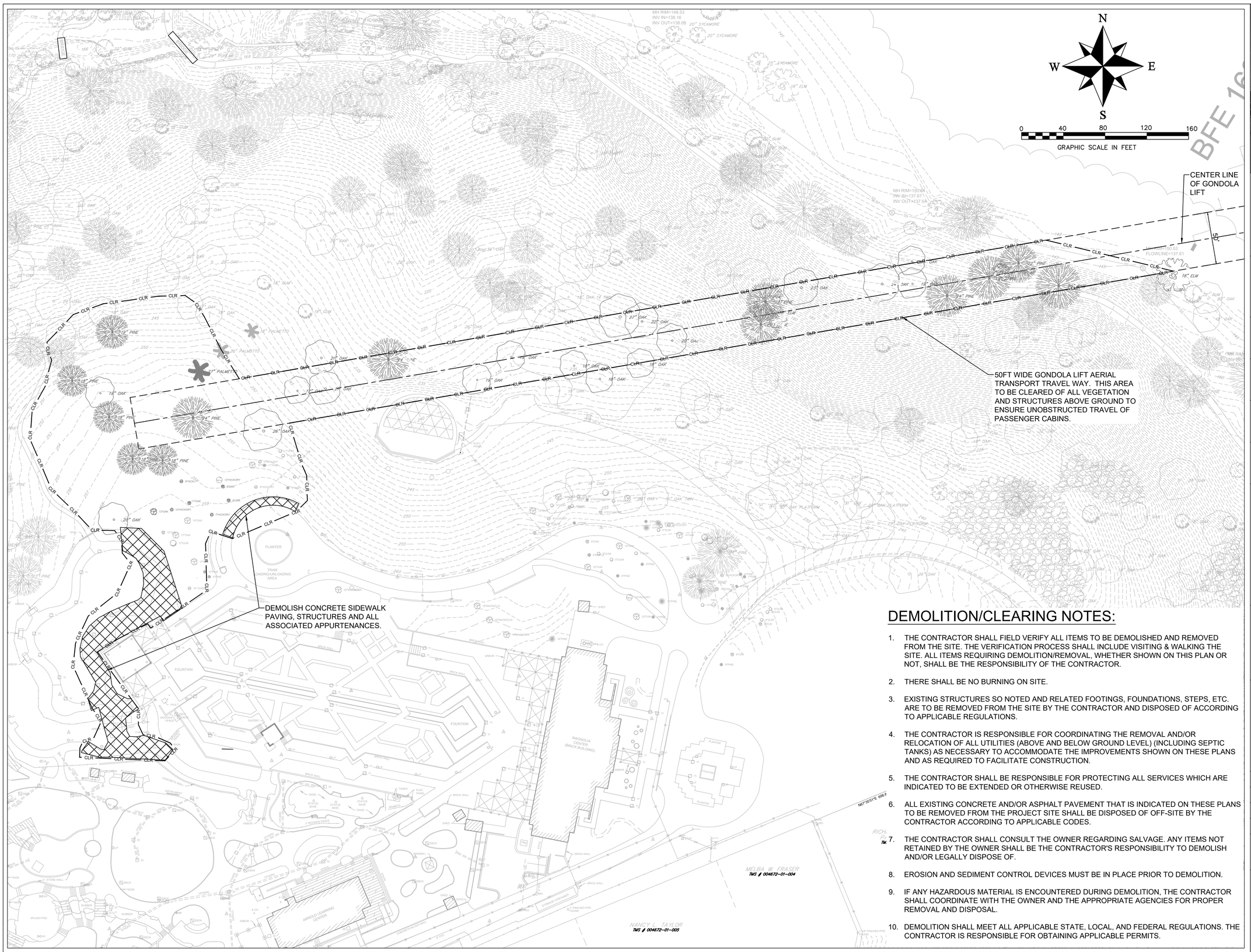

DEMOLITION/CLEARING NOTES:

1. THE CONTRACTOR SHALL FIELD VERIFY ALL ITEMS TO BE DEMOLISHED AND REMOVED FROM THE SITE. THE VERIFICATION PROCESS SHALL INCLUDE VISITING & WALKING THE SITE. ALL ITEMS REQUIRING DEMOLITION/REMOVAL, WHETHER SHOWN ON THIS PLAN OR NOT, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
2. THERE SHALL BE NO BURNING ON SITE.
3. EXISTING STRUCTURES SO NOTED AND RELATED FOOTINGS, FOUNDATIONS, STEPS, ETC. ARE TO BE REMOVED FROM THE SITE BY THE CONTRACTOR AND DISPOSED OF ACCORDING TO APPLICABLE REGULATIONS.
4. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE REMOVAL AND/OR RELOCATION OF ALL UTILITIES (ABOVE AND BELOW GROUND LEVEL) (INCLUDING SEPTIC TANKS) AS NECESSARY TO ACCOMMODATE THE IMPROVEMENTS SHOWN ON THESE PLANS AND AS REQUIRED TO FACILITATE CONSTRUCTION.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL SERVICES WHICH ARE INDICATED TO BE EXTENDED OR OTHERWISE REUSED.
6. ALL EXISTING CONCRETE AND/OR ASPHALT PAVEMENT THAT IS INDICATED ON THESE PLANS TO BE REMOVED FROM THE PROJECT SITE SHALL BE DISPOSED OF OFF-SITE BY THE CONTRACTOR ACCORDING TO APPLICABLE CODES.
7. THE CONTRACTOR SHALL CONSULT THE OWNER REGARDING SALVAGE. ANY ITEMS NOT RETAINED BY THE OWNER SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DEMOLISH AND/OR LEGALLY DISPOSE OF.
8. EROSION AND SEDIMENT CONTROL DEVICES MUST BE IN PLACE PRIOR TO DEMOLITION.
9. IF ANY HAZARDOUS MATERIAL IS ENCOUNTERED DURING DEMOLITION, THE CONTRACTOR SHALL COORDINATE WITH THE OWNER AND THE APPROPRIATE AGENCIES FOR PROPER REMOVAL AND DISPOSAL.
10. DEMOLITION SHALL MEET ALL APPLICABLE STATE, LOCAL, AND FEDERAL REGULATIONS. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING APPLICABLE PERMITS.

RIVERBANKS ZOO & GARDEN
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No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
WEST STATION DEMOLITION AREA 1

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C305

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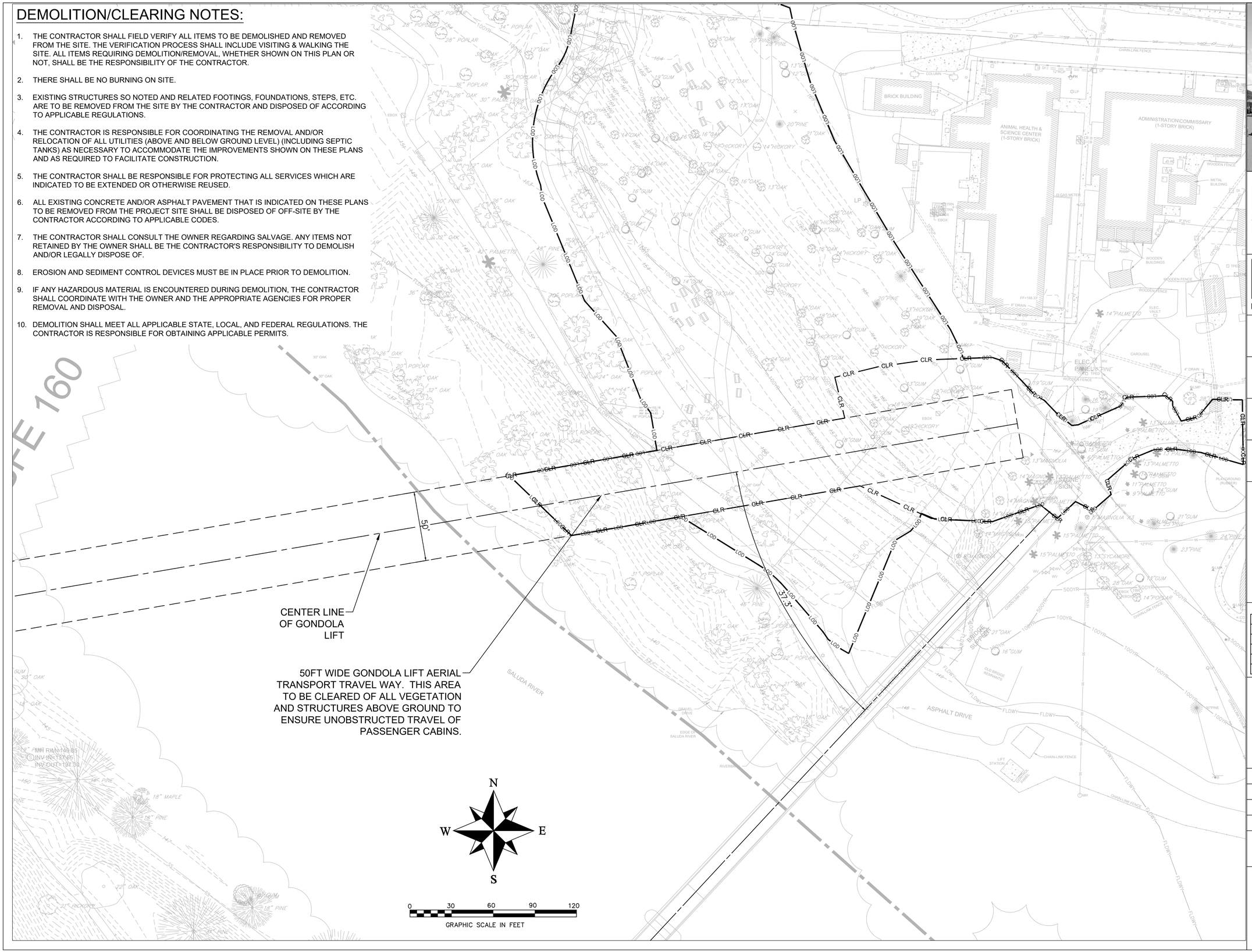

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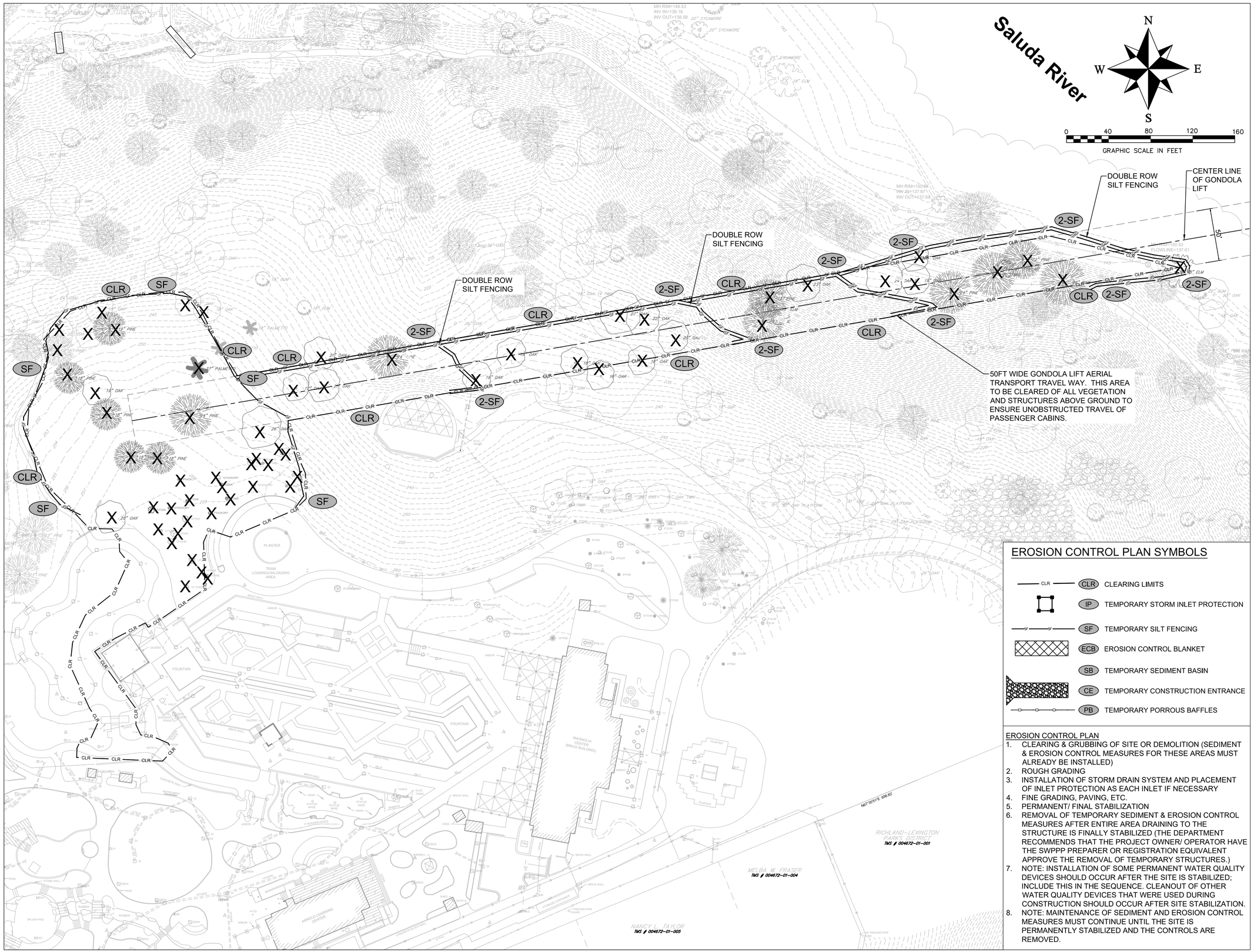
No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
EAST STATION DEMOLITION AREA 2

CLR Project No.:	
Project Manager:	
Drawn: RPJ	Checked: JCE
Date: AUG 13, 2024	
Scale: AS NOTED	

Sheet No.

C306



EROSION CONTROL PLAN SYMBOLS

CLR	CLR	CLEARING LIMITS
	IP	TEMPORARY STORM INLET PROTECTION
SF	SF	TEMPORARY SILT FENCING
	ECB	EROSION CONTROL BLANKET
	SB	TEMPORARY SEDIMENT BASIN
	CE	TEMPORARY CONSTRUCTION ENTRANCE
	PB	TEMPORARY POROUS BAFFLES

EROSION CONTROL PLAN

1. CLEARING & GRUBBING OF SITE OR DEMOLITION (SEDIMENT & EROSION CONTROL MEASURES FOR THESE AREAS MUST ALREADY BE INSTALLED)
2. ROUGH GRADING
3. INSTALLATION OF STORM DRAIN SYSTEM AND PLACEMENT OF INLET PROTECTION AS EACH INLET IF NECESSARY
4. FINE GRADING, PAVING, ETC.
5. PERMANENT/ FINAL STABILIZATION
6. REMOVAL OF TEMPORARY SEDIMENT & EROSION CONTROL MEASURES AFTER ENTIRE AREA DRAINING TO THE STRUCTURE IS FINALLY STABILIZED (THE DEPARTMENT RECOMMENDS THAT THE PROJECT OWNER/ OPERATOR HAVE THE SWPPP PREPARER OR REGISTRATION EQUIVALENT APPROVE THE REMOVAL OF TEMPORARY STRUCTURES.)
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8. NOTE: MAINTENANCE OF SEDIMENT AND EROSION CONTROL MEASURES MUST CONTINUE UNTIL THE SITE IS PERMANENTLY STABILIZED AND THE CONTROLS ARE REMOVED.

RIVERBANKS ZOO & GARDEN
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Revisions:

No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
WEST STATION EROSION CNTRL AREA 1

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C307

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No.	Description	Date

Sheet Title
PHASE II
GONDOLA LIFT
EAST STATION
EROSION CNTRL AREA 2

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C308

LIMITS OF DISTURBANCE FOR PHASES I, II & III

PHASE I EROSION CONTROL BMP'S TO REMAIN IN PLACE AND MAINTAINED

CLEARING LIMITS FOR PHASE II

DOUBLE ROW SILT FENCING

50FT WIDE GONDOLA LIFT AERIAL TRANSPORT TRAVEL WAY. THIS AREA TO BE CLEARED OF ALL VEGETATION AND STRUCTURES ABOVE GROUND TO ENSURE UNOBSTRUCTED TRAVEL OF PASSENGER CABINS.

CENTER LINE OF GONDOLA LIFT

50'

37.3'

CENTER LINE OF PEDESTRIAN BRIDGE

Saluda River

EROSION CONTROL PLAN SYMBOLS

LOD	LOD	LIMITS OF DISTURBANCE
CLR	CLR	CLEARING LIMITS
	IP	TEMPORARY STORM INLET PROTECTION
SF	SF	TEMPORARY SILT FENCING
	ECB	EROSION CONTROL BLANKET
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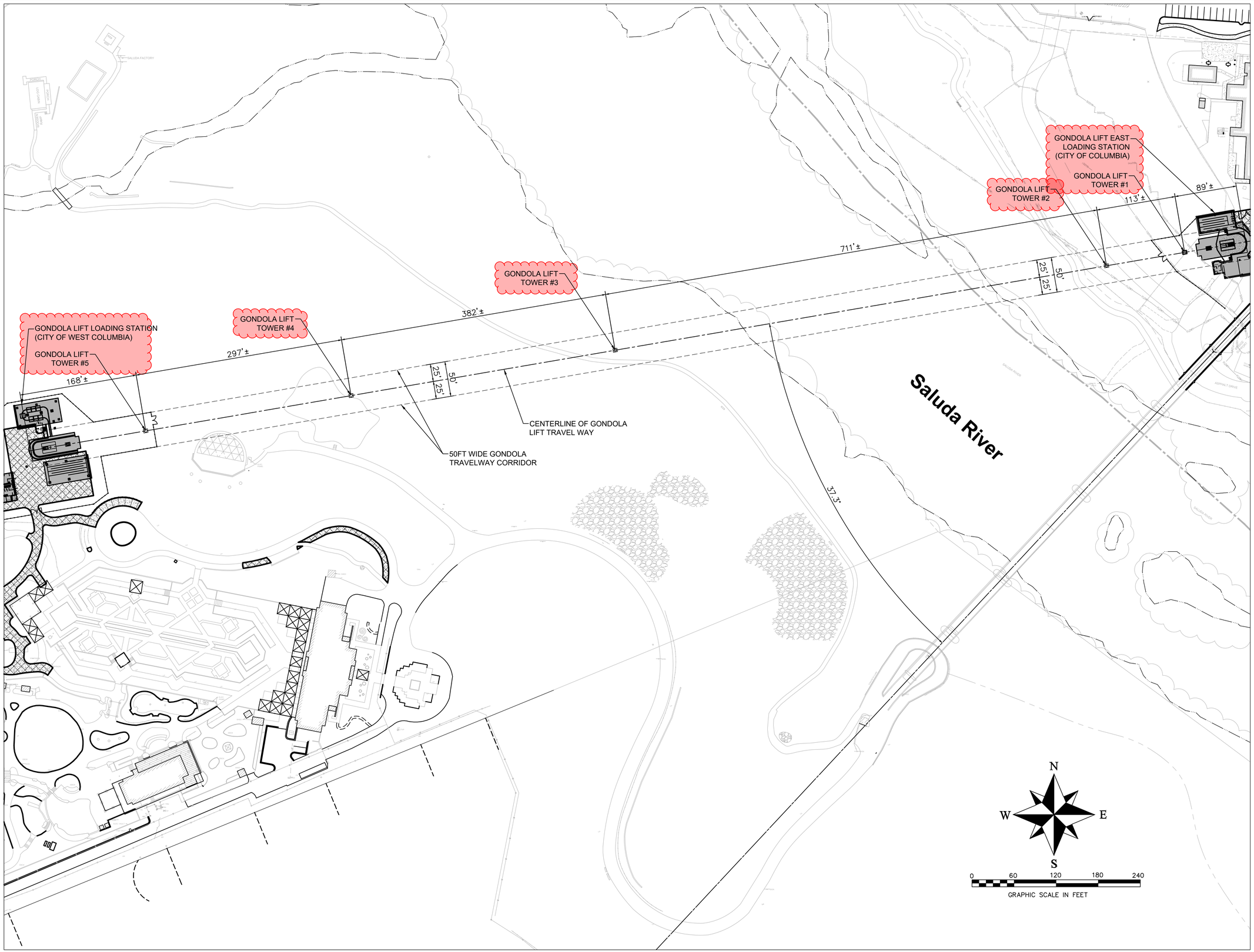

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No.	Description	Date

Sheet Title **PHASE II GONDOLA LIFT**

OVERALL SITE PLAN

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

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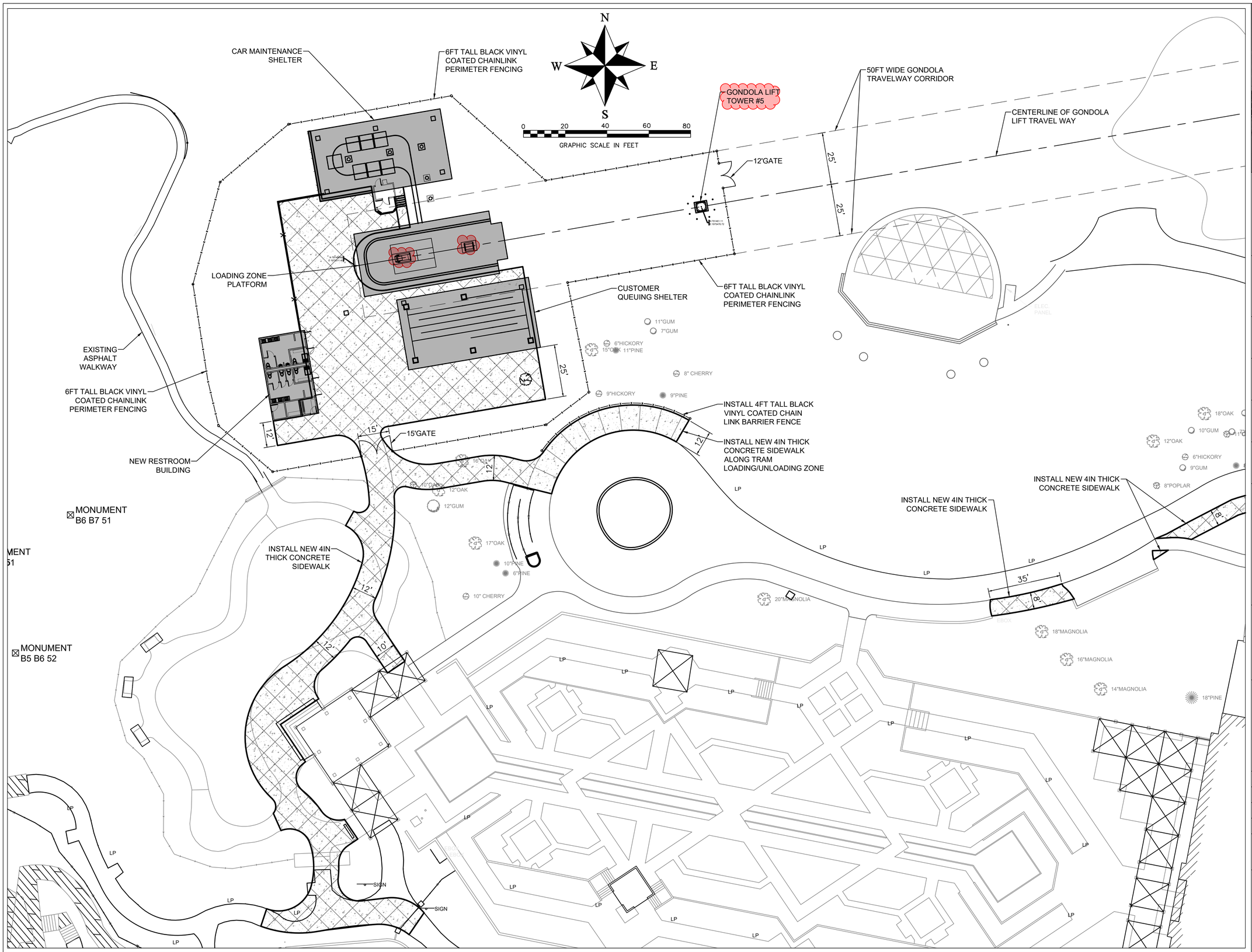
C309



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No.	Description	Date

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PHASE II GONDOLA LIFT

WEST STATION SITE PLAN AREA 1

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

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EXHIBIT DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
833 chestnut st, ste 909
philadelphia, pa 19107
34921 calle del sol
capistrano beach, ca 92624
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08-13-2024

Revisions:

No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
EAST STATION SITE PLAN AREA 2

CLR Project No.:	
Project Manager:	
Drawn: RPJ	Checked: JCE
Date: AUG 13, 2024	
Scale: AS NOTED	

Sheet No.

C311

GONDOLA LIFT TOWER #2

GONDOLA LIFT TOWER #1

50FT WIDE GONDOLA LIFT AERIAL TRANSPORT TRAVEL WAY. THIS AREA TO BE CLEARED OF ALL VEGETATION AND STRUCTURES ABOVE GROUND TO ENSURE UNOBSTRUCTED TRAVEL OF PASSENGER CABINS.

CENTER LINE OF GONDOLA LIFT

50FT WIDE GONDOLA TRAVELWAY CORRIDOR

LOADING ZONE PLATFORM

CUSTOMER QUEUING SHELTER

BRICK BUILDING

ANIMAL HEALTH & SCIENCE CENTER (1-STORY BRICK)

ADMINISTRATION/COMMISSARY (1-STORY BRICK)

CAROUSEL

ELEC. PANEL

TICKET BOOTH

PLAYGROUND (RUBBER)

STONE SIGN

CHAIN-LINK FENCE

WOODEN FENCE

OLD BRIDGE REMNANTS

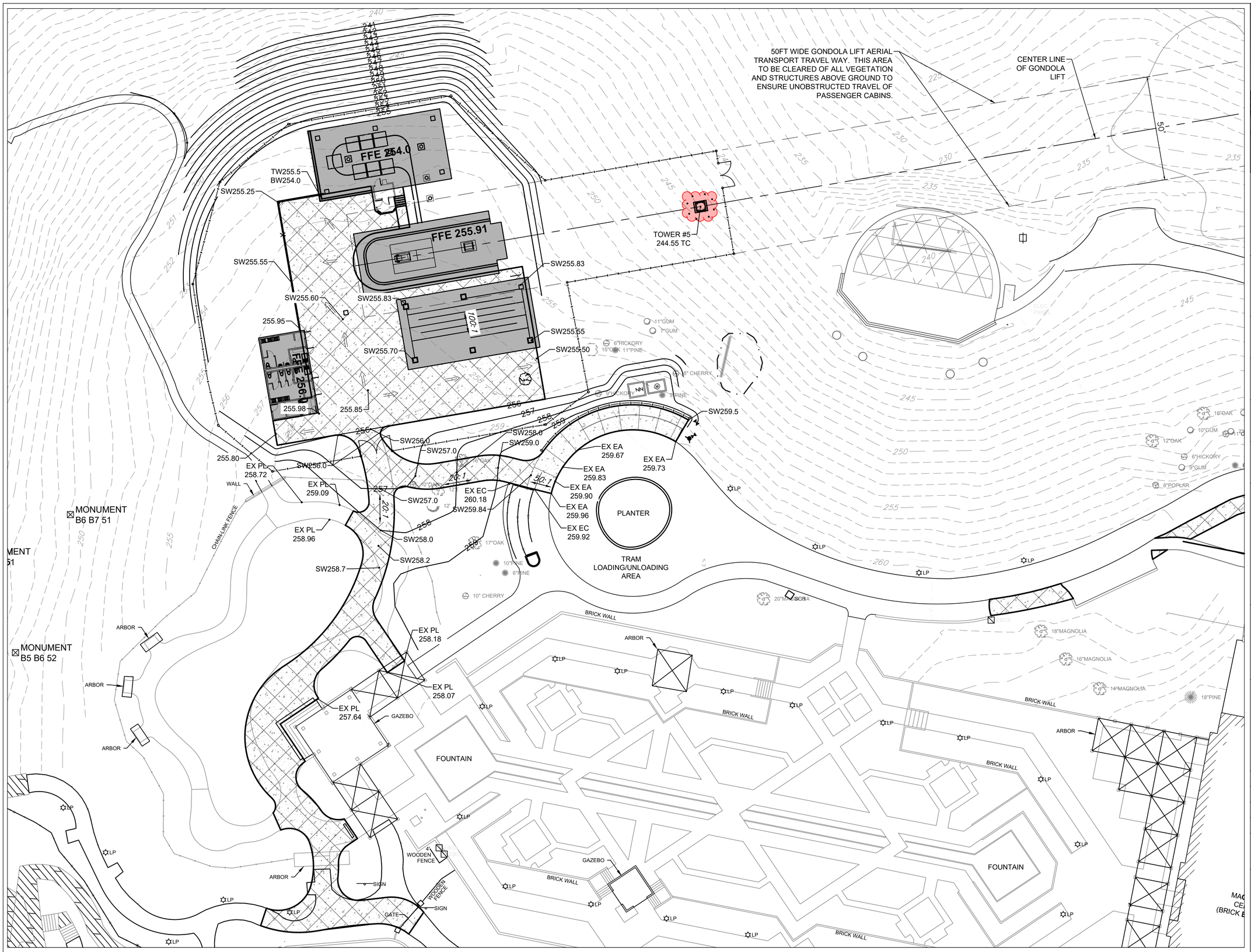
LIFT STATION CONTROL CABINET

FFE 166.70

FF=168.33

N W E S

0 30 60 90 120
GRAPHIC SCALE IN FEET



RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

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No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
WEST STATION GRADING PLAN AREA 1

CLR Project No.:

Project Manager:

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Date: JULY 26, 2024

Scale: AS NOTED

Sheet No.

C312

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PHASE II GONDOLA LIFT
EAST STATION GRADING PLAN AREA 2

CLR Project No.:	
Project Manager:	
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Date: JULY 26, 2024	
Scale: AS NOTED	

Sheet No.

C313

50FT WIDE GONDOLA LIFT AERIAL TRANSPORT TRAVEL WAY. THIS AREA TO BE CLEARED OF ALL VEGETATION AND STRUCTURES ABOVE GROUND TO ENSURE UNOBSTRUCTED TRAVEL OF PASSENGER CABINS.

CENTER LINE OF GONDOLA LIFT

50'

37.3'

TOWER #2
152.10 TC

TOWER #1
160.14 TC

BRICK BUILDING

ANIMAL HEALTH & SCIENCE CENTER (1-STORY BRICK)

ADMINISTRATION/COMMISSARY (1-STORY BRICK)

METAL BUILDING

WOODEN BUILDINGS

CAROUSEL

ELEC. PANEL

TICKET BOOTH

PHOTO BOOTH

PLAYGROUND (RUBBER)

STONE SIGN

FFE 166.70

BRIDGE SUPPORT

OLD BRIDGE REMNANTS

GENERETE PAVERS ON BRIDGE

ASPHALT DRIVE

LIFT STATION

CONTROL PANEL

CHAIN-LINK FENCE

WOODEN FENCE

GAS METER

AWNING

RAMP

SALUDA RIVER

EDGE OF SALUDA RIVER

RIVERBANK

GRAVEL DRIVE

30" OAK

N W E S

0 30 60 90 120
GRAPHIC SCALE IN FEET

NEW SANITARY SEWER DUPLEX PUMP STATION
TOP 255.0
BOTTOM 243.0
8IN INV IN 250.0
(INV IN MIN 2FT ABOVE BOTTOM)

8IN STUB-OUT TO 5FT FROM BUILDING

TIE NEW 2IN FORCE MAIN PIPING ONTO EXISTING FORCE MAIN PIPING

2.0IN DOMESTICE WATER LINE STUBBED OUT TO 5FT FROM BUILDING. SEE PLUMBING FOR CONTINUATION.

CENTER LINE OF GONDOLA LIFT

INSTALL NEW DOMESTIC WATER METER AND BACKFLOW PREVENTER IN VAULTS PER CITY OF WEST COLUMBIA REQUIREMENTS.

6X2 TEE AND 2IN GATE VALVE

INSTALL NEW FIRE HYDRANT AND GATE VALVE ON 6IN DIP FOR THE CITY OF WEST COLUMBIA

CAP END OF NEW 6IN DIP

INSTALL NEW 6IN DIP WATER MAIN FOR THE CITY OF WEST COLUMBIA WITH 15FT WIDE EASEMENT.

PLANTER

TRAM LOADING/UNLOADING AREA

EXISTING VISITOR CENTER BUILDING GREASE TRAP

FFE 254.0

FFE 255.91

FFE 256.0

100.1

AMPHITHEATER

ELEC. PANEL

FOUNTAIN

GAZEBO

ARBOR

BRICK WALL

VAULT

WOODEN FENCE

SHED

SIGN

MH

CO

WM

YI

LP

11"GUM
7"GUM
6"HICKORY
15"OAK
11"PINE
8" CHERRY
9"PINE
16"OAK
10"OAK
12"OAK
12"GUM
17"OAK
10"PINE
6"PINE
10" CHERRY
20"MAGNOLIA
18"OAK
9"GUM
12"GUM
6"PERSIMMON
6"GUM
10"GUM
11"OAK
6"SYCAMORE
6"HICKORY
9"GUM
8"PINE
8"POPLAR
9"OAK
6"MAPLE
6"GUM
20"OAK
18"MAGNOLIA
16"MAGNOLIA
14"MAGNOLIA
18"PINE

2FM
2W
6W
12"PVC
15"RCP
20:1
50:1

N
W
E
S

0 20 40 60 80
GRAPHIC SCALE IN FEET

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Sheet Title
PHASE II GONDOLA LIFT
WEST STATION UTILITY PLAN AREA1

CLR Project No.:

Project Manager:

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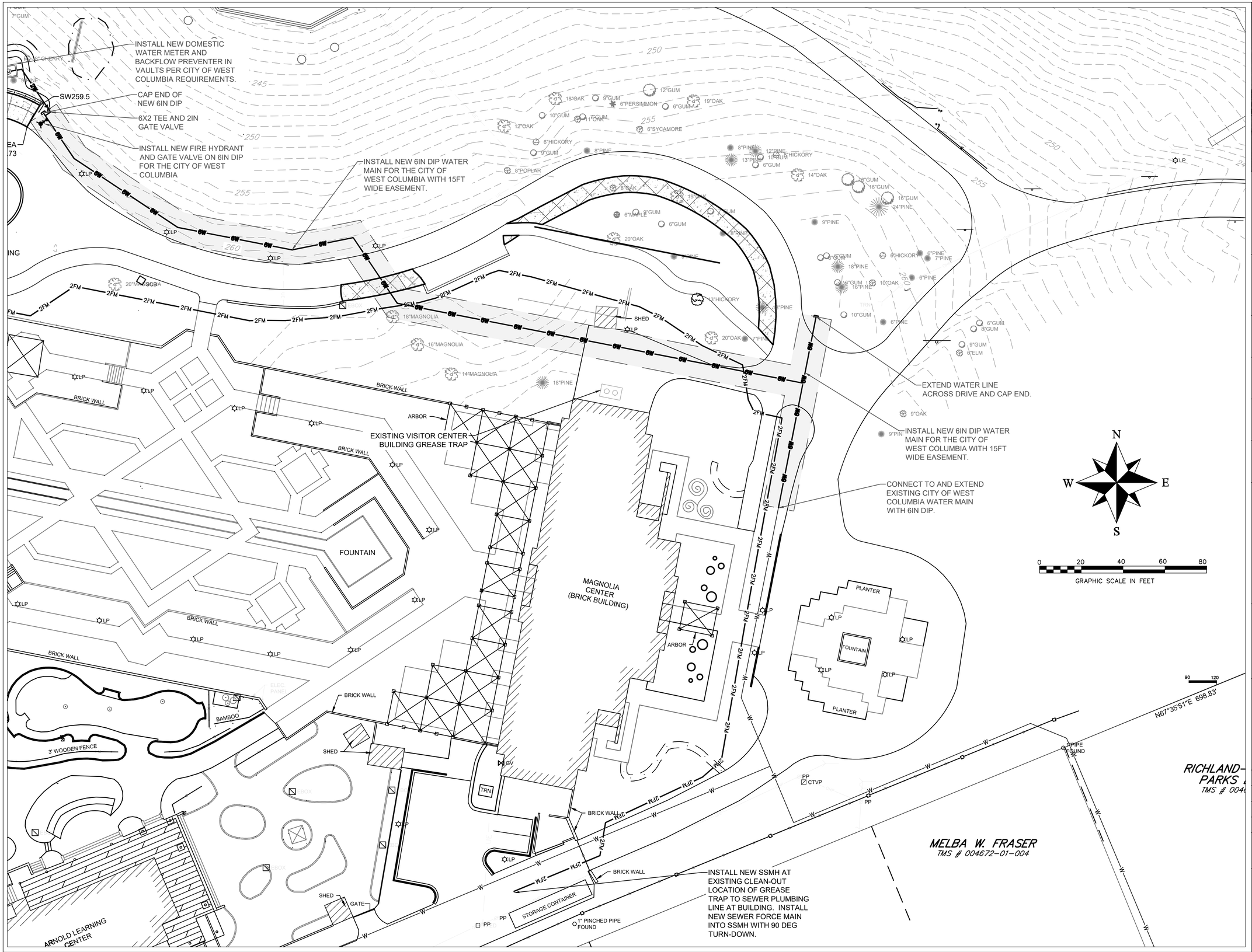
Date: JULY 26, 2024

Scale: AS NOTED

Sheet No.

C314



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Sheet Title **PHASE II GONDOLA LIFT**

WEST STATION UTILITY PLAN AREA2

CLR Project No.:

Project Manager:

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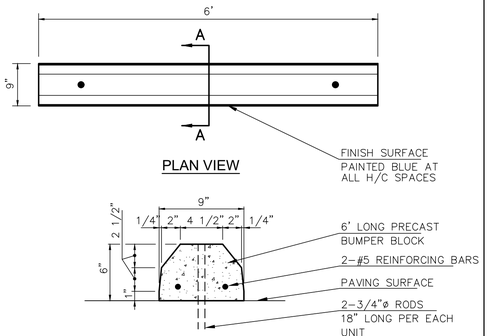
C315

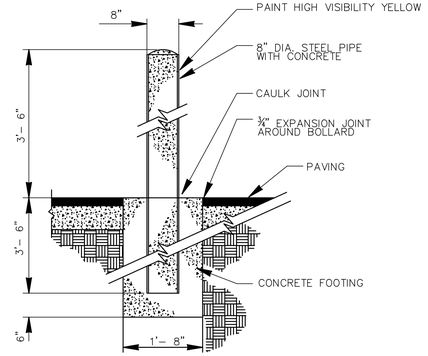


PLAN VIEW

SECTION A-A

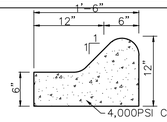
PRECAST CONCRETE WHEEL STOP

NTS



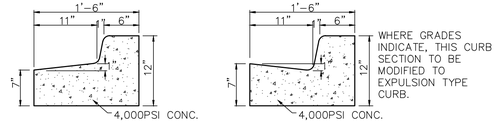
STEEL PIPE BOLLARDS

NTS



18" ROLLED CURB AND GUTTER

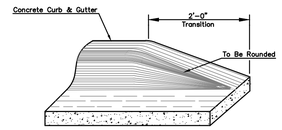
NTS



18" EXPULSION CURB **18" COLLECTION CURB**

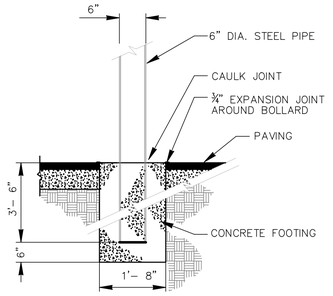
18" VERTICAL CURB & GUTTER

NTS



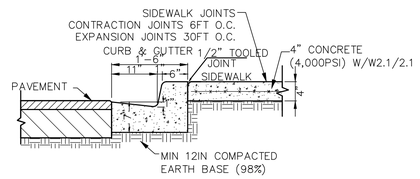
FEATHERING CURB AND GUTTER DETAIL

NTS



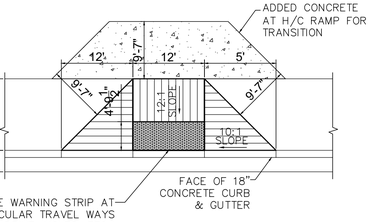
BASKETBALL GOAL SETTING

NTS



CONCRETE CURB & GUTTER & SIDEWALK DETAIL

NTS



PLAN VIEW

SIDE ELEVATION

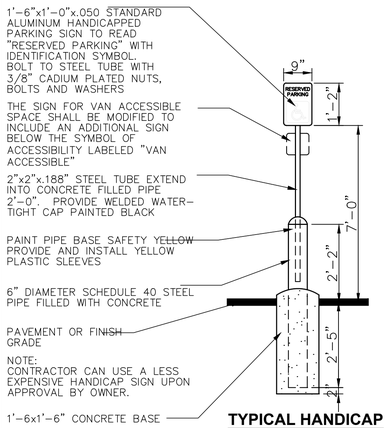
DEPRESSED SIDEWALK FOR HANDICAP ACCESS

NTS

PLAN VIEW

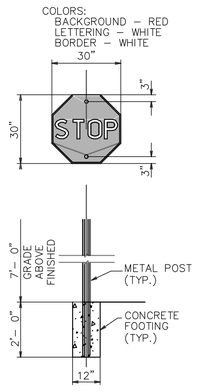
TYPICAL ADA HANDICAP RAMP CURB CUT DETAIL

NTS



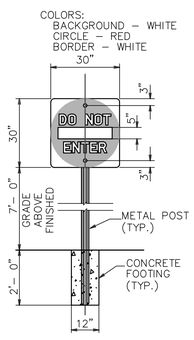
TYPICAL HANDICAP PARKING SIGN

NTS



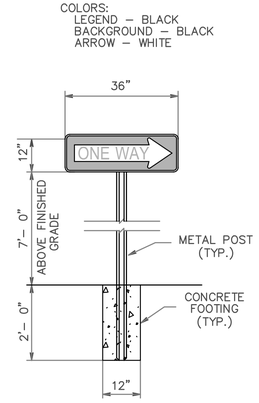
STOP SIGN

NTS

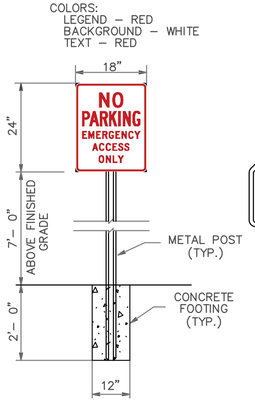


DO NOT ENTER SIGN

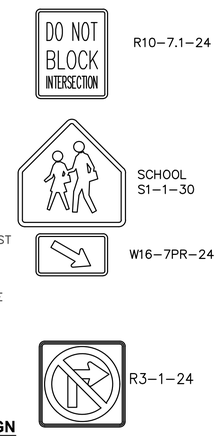
NTS



MUTCD R6-1R "ONE WAY" SIGN



EMERGENCY ACCESS ONLY SIGN



NO RIGHT TURN SIGN TO
BE MOUNTED UNDERNEATH
STOP SIGN ON THE SAME
POST.

R6-1L-36
R6-1R-36

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Sheet Title **PHASE II GONDOLA LIFT**

DETAILS
SITE

CLR Project No.:

Project Manager:

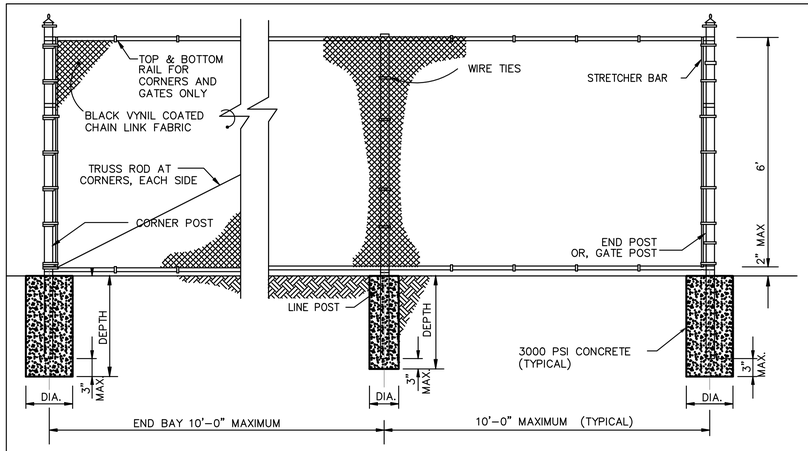
Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

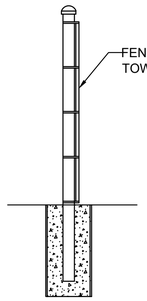
Scale: AS NOTED

Sheet No.

C351



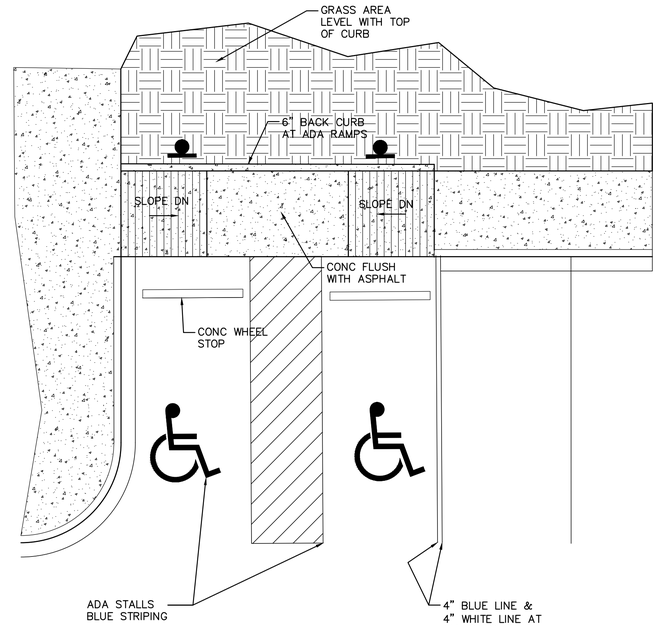
CHAIN LINK FENCE
NTS



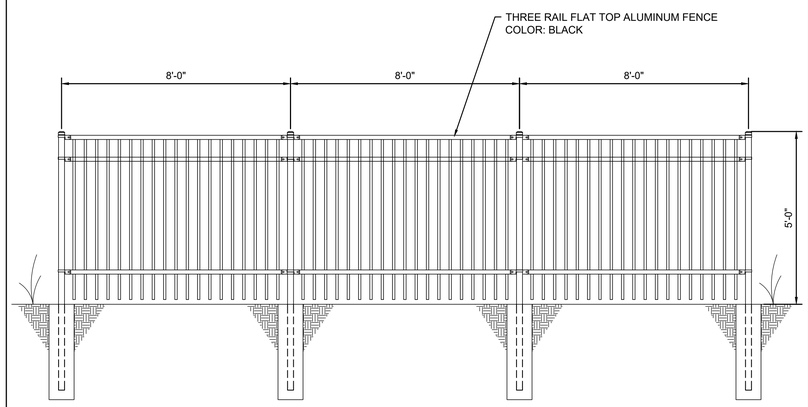
SIDE VIEW
NTS

FENCE FOUNDATION SCHEDULE			
POST TYPE	LINE	END	GATE
6FT GALVANIZED OR BLACK VINYL COATED CHAINLINK FENCE			
FOUNDATION DIA.	10"	16"	16"
FOUNDATION DEPTH	30"	30"	30"

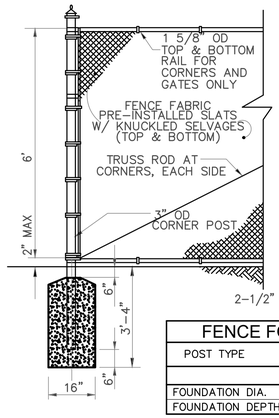
NOTES:
BLACK VINYL COATED OPTION
1. ALL FENCE FABRIC TO BE BLACK VINYL COATED.
2. FENCE FABRIC TO BE PLACED WITH FINISHED SIDE FACING THE SCHOOL.
3. THE FENCE IS TO BE INSTALLED 2'-0" OFF THE BACK EDGE OF THE RETAINING WALL TOP CAP.



ADA PARKING AND RAMPS WITH BACK CURB
NTS



5FT TALL ORNAMENTAL ALUMINUM FENCE
NTS

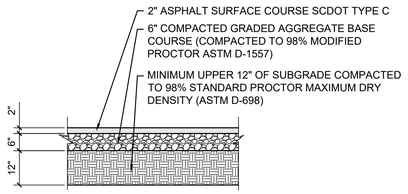


NOTES:
1. PRIVACYLINK 3½" x 5" MESH WITH SUPREME PRIVACY SLATS
2. FENCE COLOR: CEDAR TONE.

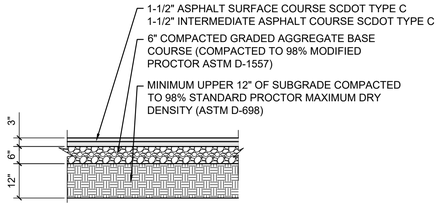
FENCE FOUNDATION SCHEDULE			
POST TYPE	LINE	END	GATE
6FT PRIVACY FENCE			
FOUNDATION DIA.	16"	22"	22"
FOUNDATION DEPTH	36"	36"	36"

CHAIN LINK FENCE FOUNDATION SCHEDULE
NTS

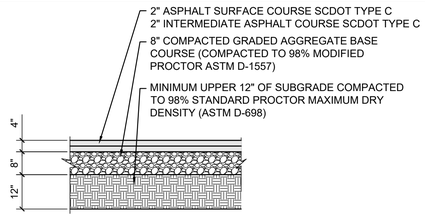
6FT TALL PRIVACY FENCE
NTS



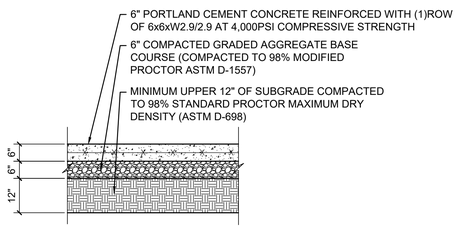
CLASS 1 - ASPHALT PAVING
(<50 cars/day)



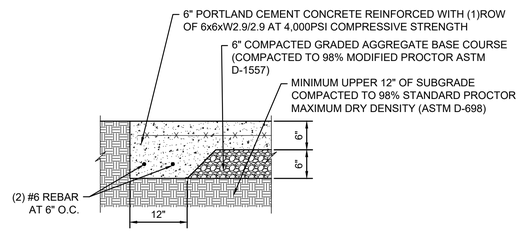
CLASS 2 - ASPHALT PAVING
(<5 trucks/day)



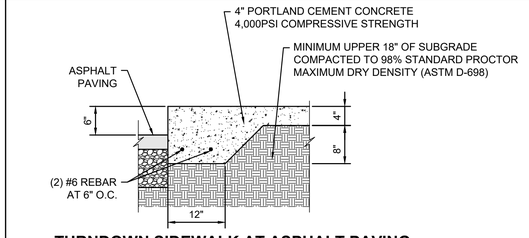
CLASS 3 - ASPHALT PAVING
(<65 trucks/day)



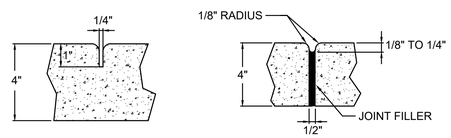
HEAVY DUTY CONCRETE PAVING
NTS

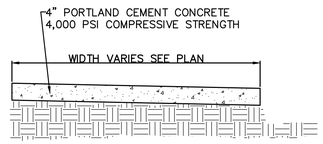


THICKENED SLAB - HEAVY DUTY CONCRETE PAVING
NTS



TURNDOWN SIDEWALK AT ASPHALT PAVING
NTS





CONCRETE SIDEWALK
NTS

RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
EXHIBIT DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
833 chestnut st, ste 909
philadelphia, pa 19107
34921 calle del sol
capistrano beach, ca 92624
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Seal:

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08-13-2024

Revisions:

No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
DETAILS SITE

CLR Project No.:

Project Manager:

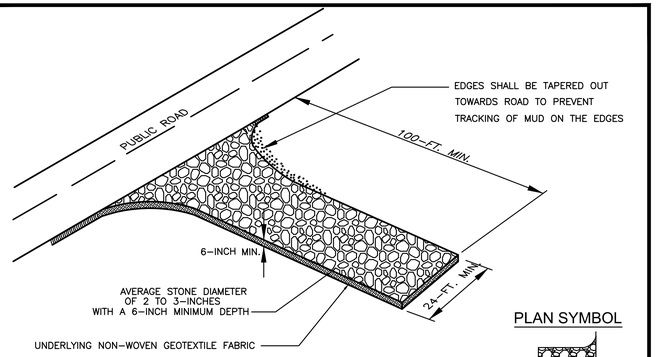
Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C352



PLAN SYMBOL

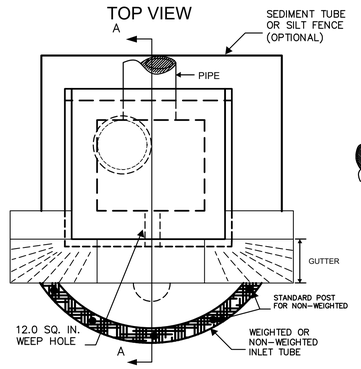
SPECIFICATION	SIZE
ROCK PAD THICKNESS	6 INCHES
ROCK PAD WIDTH	24 FEET
ROCK PAD LENGTH	100 FEET
ROCK PAD STONE SIZE	D = 2-3 INCHES

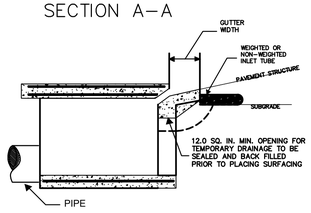
South Carolina Department of Health and Environmental Control

CONSTRUCTION ENTRANCE

STANDARD DRAWING NO. SC-06 PAGE 1 of 2

NOT TO SCALE — FEBRUARY 2014 DATE





PLAN SYMBOL

F

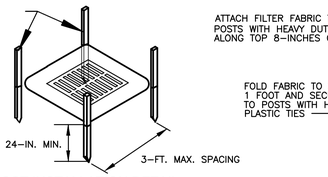
South Carolina Department of Health and Environmental Control

Type F

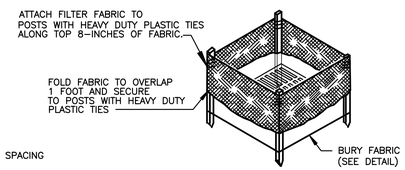
INLET TUBES

STANDARD DRAWING NO. SC-11 PAGE 1 of 2

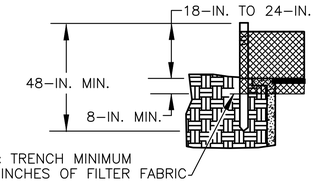
NOT TO SCALE — FEBRUARY 2014 DATE



POST INSTALLATION DETAIL



FILTER FABRIC INSTALLATION DETAIL



FILTER FABRIC BURIAL DETAIL

PLAN SYMBOL

A

South Carolina Department of Health and Environmental Control

Type A

FILTER FABIC INLET PROTECTION

STANDARD DRAWING NO. SC-07 PAGE 1 of 2

NOT TO SCALE — FEBRUARY 2014 DATE

CONSTRUCTION ENTRANCE - GENERAL NOTES

1. Stabilized construction entrances should be used at all points where traffic will egress/ingress a construction site onto a public road or any impervious surfaces, such as parking lots.
2. Install a non-woven geotextile fabric prior to placing any stone.
3. Install a culvert pipe across the entrance when needed to provide positive drainage.
4. The entrance shall consist of 2-inch to 3-inch D50 stone placed at a minimum depth of 6-inches.
5. Minimum dimensions of the entrance shall be 24-feet wide by 100-feet long, and may be modified as necessary to accommodate site constraints.
6. The edges of the entrance shall be tapered out towards the road to prevent tracking at the edge of the entrance.
7. Divert all surface runoff and drainage from the stone pad to a sediment trap or basin or other sediment trapping structure.
8. Limestone may not be used for the stone pad.

CONSTR. ENTRANCE - INSPECTION & MAINTENANCE

1. The key to functional construction entrances is weekly inspections, routine maintenance, and regular sediment removal.
2. Regular inspections of construction entrances shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall even that produces 1/2-inch or more of precipitation.

   3. During regular inspections, check for mud and sediment buildup and pad integrity. Inspection frequencies may need to be more frequent during long periods of wet weather.
4. Reshape the stone pad as necessary for drainage and runoff control.
5. Wash or replace stones as needed and as directed by site inspector. The stone in the entrance should be washed or replaced whenever the entrance fails to reduce the amount of mud being carried off-site by vehicles. Frequent washing will extend the useful life of stone pad.

   6. Immediately remove mud and sediment tracked or washed onto adjacent impervious surfaces by brushing or sweeping. Flushing should only be used when the water can be discharged to a sediment trap or basin.
7. During maintenance activities, any broken pavement should be repaired immediately.
8. Construction entrances should be removed after the site has reached final stabilization. Permanent vegetation should replace areas from which construction entrances have been removed, unless area will be converted to an impervious surface to serve post-construction.

South Carolina Department of Health and Environmental Control

CONSTRUCTION ENTRANCE

STANDARD DRAWING NO. SC-06 PAGE 2 of 2

GENERAL NOTES — FEBRUARY 2014 DATE

INSPECTION AND MAINTENANCE

1. The key to functional inlet protection is weekly inspection, routine maintenance, and regular sediment removal.
2. Regular inspections of all inlet protection shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall event that produces 1/2-inch or more of precipitation.
3. Attention to sediment accumulations in front of the inlet protection is extremely important. Accumulated sediment should be continually monitored and removed when necessary.

   4. Remove accumulated sediment when it reaches 1/3 the height of the blocks. If a sump is used, sediment should be removed when it fills approximately 1/3 the depth of the hole.
5. Removed sediment shall be placed in stockpile storage areas or spread thinly across disturbed area. Stabilize the removed sediment after it is relocated.
6. Large debris, trash, and leaves should be removed from in front of tubes when found.
7. Replace inlet tube when damaged or as recommended by manufacturer's specifications.
8. Inlet protection structures should be removed after the disturbed areas are permanently stabilized. Remove all construction material and sediment, and dispose of them properly. Grade the disturbed area to the elevation of the drop inlet structure crest. Stabilize all bare areas immediately.

South Carolina Department of Health and Environmental Control

Type F

INLET TUBES

STANDARD DRAWING NO. SC-11 PAGE 2 of 2

GENERAL NOTES — FEBRUARY 2014 DATE

TYPE A - FILTER FABRIC REQUIREMENTS

1. Silt fence must be composed of woven geotextile filter fabric that consists of the following requirements:
   - Composed of fibers consisting of long chain synthetic polymers of at least 85% by weight of polyolefins, polyesters, or polyamides that are formed into a network such that the filaments or yarns retain dimensional stability relative to each other;
   - Free of any treatment or coating which might adversely alter its physical properties after installation;
   - Free of any defects or flaws that significantly affect its physical and/or filtering properties; and,
   - Have a minimum width of 36-inches.
2. Use only fabric appearing on SC DOT's Qualified Products Listing (QPL), Approval Sheet #34, meeting the requirements of the most current edition of the SC DOT Standard Specifications for Highway Construction.
3. 12-inches of the fabric should be placed within excavated trench and toed in when the trench is backfilled.
4. Filter Fabric shall be purchased in continuous rolls and cut to the length of the barrier to avoid joints.
5. Filter Fabric shall be installed at a minimum of 24-inches above the ground.

TYPE A - POST REQUIREMENTS

1. Silt Fence posts must be 48-inch long steel posts that meet, at a minimum, the following physical characteristics.
   - Composed of a high strength steel with a minimum yield strength of 50,000 psi.
   - Include a standard "T" section with a nominal face width of 1.38-inchesand a nominal "T" length of 1.48-inches.
   - Weigh 1.25 pounds per foot (± 5%)
2. Posts shall be equipped with projections to aid in fastening of filter fabric.
3. Install posts to a minimum of 24-inches. A minimum height of 1- to 2- inches above the fabric shall be maintained, and a maximum height of 3 feet shall be maintained above the ground.
4. Post spacing shall be at a maximum of 3-feet on center.

TYPE A - INSPECTION & MAINTENANCE

1. The key to functional inlet protection is weekly inspections, routine maintenance, and regular sediment removal.
2. Regular inspections of inlet protection shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall even that produces 1/2-inch or more of precipitation.
3. Attention to sediment accumulations along the filter fabric is extremely important. Accumulated sediment should be continually monitored and removed when necessary.
4. Remove accumulated sediment when it reaches 1/3 the height of the filter fabric. When a sump is installed in front of the fabric, sediment should be removed when it fills approximately 1/3 the depth of the sump.
5. Removed sediment shall be placed in stockpile storage areas or spread thinly across disturbed area. Stabilize the removed sediment after it is relocated.
6. Check for areas where stormwater runoff has eroded a channel beneath the filter fabric, or where the fabric has sagged or collapsed due to runoff overtopping the inlet protection.
7. Check for tears within the filter fabric, areas where fabric has begun to decompose, and for any other circumstance that may render the inlet protection ineffective. Removed damaged fabric and reinstall new filter fabric immediately.
8. Inlet protection structures should be removed after all the disturbed areas are permanently stabilized. Remove all construction material and sediment, and dispose of them properly. Grade the disturbed area to the elevation of the drop inlet structure crest. Stabilize all bare areas immediately.

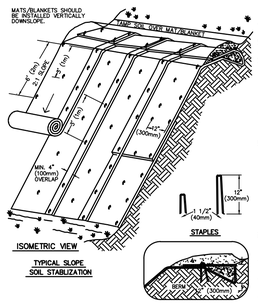
South Carolina Department of Health and Environmental Control

Type A

FILTER FABIC INLET PROTECTION

STANDARD DRAWING NO. SC-07 PAGE 2 of 2

GENERAL NOTES — FEBRUARY 2014 DATE



1. PROPER SITE PREPARATION IS ESSENTIAL TO ENSURE COMPLETE CONTACT OF THE PROTECTION MATTING WITH THE SOIL.
2. GRADE AND SHAPE AREA OF INSTALLATION.
3. REMOVE ALL ROCKS, CLODS, VEGETATIVE OR OTHER OBSTRUCTION SO THAT THE INSTALLED BLANKETS OR MATS WILL HAVE DIRECT CONTACT WITH THE SOIL.
4. PREPARE SEEDBED BY LOOSENING 2 TO 3 INCHES (50-75MM) OF TOPSOIL ABOVE FINAL GRADE.
5. INCORPORATE AMENDMENTS, SUCH AS LIME AND FERTILIZER, INTO SOIL ACCORDING TO SOIL TEST AND THE SEEDING PLAN.
6. SEED AREA BEFORE BLANKET INSTALLATION FOR EROSION CONTROL AND RE=VEGETATION. SEEDING AFTER MAT INSTALLATION IS OFTEN SPECIFIED FOR TURF REINFORCEMENT APPLICATION. WHEN SEEDING PRIOR TO BLANKET INSTALLATION, ALL CHECK SLOTS AND OTHER AREAS DISTURBED DURING INSTALLATION MUST BE RESEEDED.
7. WHERE SOIL FILLING IS SPECIFIED, SEED THE MATTING AND THE ENTIRE DISTURBED AREA AFTER INSTALLATION AND PRIOR TO FILLING THE MAT WITH SOIL.
8. ANCHORING: U-SHAPED WIRE STAPLES, METAL GEOTEXTILE STAKE PINS, OR TRIANGULAR WOODEN STAKES CAN BE USED TO ANCHOR MATS TO THE GROUND SURFACE. WIRE STAPLES SHOULD BE A MINIMUM OF 11 GAUGE. METAL STAKE PINS SHOULD BE 3/16 IN (5MM) DIA STEEL WITH A 1-1/2IN (38MM) STEEL WASHER AT THE HEAD OF THE PIN. WIRE STAPLES AND METAL STAKES SHOULD BE DRIVEN FLUSH TO THE SOIL SURFACE. ALL ANCHORS SHOULD BE 6-8 INCHES (0.15-0.2M) LONG AND HAVE SUFFICIENT GROUND PENETRATION TO RESIST PULLOUT. LONGER ANCHORS MAY BE REQUIRED FOR LOOSE SOILS.
9. INSTALLATION ON SLOPES: BEGIN AT THE TOP OF THE SLOPE AND ANCHOR ITS BLANKET IN A 6x6 IN (0.15x0.15M) TRENCH. BACK FILL TRENCH AND TAMP EARTH FIRMLY.
10. UNROLL BLANKET DOWNSLOPE IN THE DIRECTION OF THE WATER FLOW.
11. THE EDGES OF ADJACENT PARALLEL ROLLS MUST BE OVERLAPPED 2-3 IN (50-75MM) AND BE STAPLED EVERY 3 FEET (0.9M) APART.
12. LAY BLANKETS LOOSELY AND MAINTAIN DIRECT CONTACT WITH THE SOIL - DO NOT STRETCH.
13. BLANKETS SHALL BE STAPLED SUFFICIENTLY TO ANCHOR BLANKET AND MAINTAIN CONTACT WITH THE SOIL. STAPLES SHALL BE PLACED DOWN THE CENTER AND STAGGERED WITH THE STAPLES PLACED ALONG THE EDGES. STEEP SLOPES, 1:1 — 2:1, REQUIRE 2 STAPLES PER SQUARE YARD. MODERAGE SLOPES 2:1 — 3:1 REQUIRES 1-2 STAPLES PER SQUARE YARD (IE 1 STAPLE 3' O.C.).GENTLE SLOPES REQUIRE 1 STAPLE PER SQUARE YARD.
14. INSPECT AND MAINTENANCE: ALL BLANKET AND MATS SHOULD BE INSPECTED PERIODICALLY FOLLOWING INSTALLATION.
15. INSPECT INSTALLATION AFTER SIGNIFICANT RAINSTORMS TO CHECK FOR EROSION AND UNDERMINING. ANY FAILURE SHOULD BE REPAIRED IMEDIATELY.
16. IF WASHOUT OR BREAKAGE OCCURS, REINSTALL THE MATERIAL AFTER REPAIRING THE DAMAGE TO THE SLOPE OR DRAINAGEWAY.

ECB **EROSION CONTROL BLANKET**

NTS

Plant Selection
Plant seed selection should be based on the type of soil, the season of the year in which the planting is to be done, and the needs and desires of the permanent land user. Tables 3.14 and 3.15 should be used to select the desired species to be planted. Failure to carefully follow agronomic recommendations often result in an inadequate stand of permanent vegetation that provides little or no erosion control. The rates in Tables 3.14 and 3.15 are based on purity and germination standards required for certification.

The following notes apply to Tables 3.14 and 3.15.
1. In mixtures with temporary cover, the full seeding rate of permanent cover shall be used.
2. Mix means 2 or more long term species plus short term species. For dates other than optimum, call the Lexington Soil and Water Conservation District, (803) 359-3165 ext. 3.
3. A legume, such as a clover, crown vetch, and sericia should be used where it is possible.
4. The appropriate inoculants should be used.

Topsoil
If the surface soil of the seedbed is not adequate for plant growth, topsoil should be applied.

Tillage
If the area has been recently plowed, no tillage is required other than raking or Surface Roughening to break any crust that has formed and to leave a textured surface. If the soil is compacted less than 6-inches, it should be disked for optimal germination. If the soil is compacted more than 6-inches, it should be sub-soiled and disked.

Soil Testing
Information and test provider is available from the PW/SWD and the Soil and Water Conservation District Office.

Lime
Unless a specific soil test indicates otherwise, apply 1¢ tons of ground course textured agricultural limestone per acre (70 pounds per 1000 square feet).

Fertilizer
A minimum of 1000 pounds per acre of a complete 10-10-10 fertilizer (23 pounds per 1000 square feet) or equivalent should be applied during permanent seeding of grasses unless a soil test indicates a different requirement. Fertilizer and lime (if used) should be incorporated into the top 4-8 inches of the soil by disking or other means where conditions allow. Do not mix the lime and the fertilizer prior to the field application.

Seeding
The surface of the soil should be loosened just before broadcasting the seed. Seed should be evenly applied by the most convenient method available for the type of seed to be applied. Typical application methods include but are not limited to cyclone seeders, rotary spreaders, drop spreaders, broadcast spreaders, hand spreaders, cultipacker seeder, and hydro-seeders. Cover applied seed by raking or dragging a chain or brush mat, and then lightly firm the area with a roller or cultipacker. Do not roll seed that is applied with a hydro-seeder and hydro-mulch.

Mulching
All permanent seeded areas should be covered with mulch immediately upon completion of the seeding application to retain soil moisture and reduce erosion during establishment of vegetation. The mulch should be applied evenly in such a manner that it provides a minimum of 75% coverage. Typical mulch applications include straw, wood chips, bark, wood fiber, and compost mulch. The most commonly accepted mulch used in conjunction with permanent seeding is small grain straw. This straw should be dry and free from mold damage and noxious weeds. This straw may need to be anchored with netting or asphalt emulsions to prevent it from being blown or washed away. The straw mulch may be applied by hand or machine at the rate 2 tons per acre (90 pounds per 1000 square feet). Frequent inspections are necessary to check that conditions for growth are good.

Irrigation
Permanent seeded areas should be kept adequately moist, especially late in the specific growing season. Irrigate the seeded area if normal rainfall is not adequate for the germination and growth of seedlings. Water seeded areas at controlled rates that are less than the rate at which the soil can absorb water to prevent runoff. Runoff of irrigation water wastes water and can cause erosion.

Re-seeding
Inspect permanently seeded areas for failure, make necessary repairs and re-seed or overseed within the same growing season if possible. If the grass cover is sparse or patchy, re-evaluate the choice of grass and quantities of lime and fertilizer applied. If the permanent seeding has less than 40% cover, have the soil tested to determine any acidity or nutrient deficiency problems. Final stabilization by permanent seeding of the site requires that it be covered by a 70% coverage rate.

Post-Stabilization
Once areas are stabilized they can be converted to native species or for establishing on non-critical, level sites. Table 3.16 lists some native species of Lexington County that can be used.

LEXINGTON COUNTY PUBLIC WORKS DEPARTMENT

PERMANENT VEGETATION NOTES & SCHEDULE (Sheet 1 of 2)

DRAWING NO:D-11

DATE:October 2007

TABLE 3.14 PERMANENT VEGETATION SCHEDULE

Species	Rates (lbs/acr)	Optimum Dates to Plant	Remarks
Bahia Grass (Alone)	40	March 20 — June 15	Slow to become established
Bahia Grass (Mix)*	30	March 20 — June 15	Slow to become established
Bermuda Grass (Hulled) (Alone)	8-12	April — July 15	Quick cover, Sod forming, partial winter kill
Bermuda Grass (Hulled) (Mix)*	4-6	April — July 15	Quick cover, Sod forming, partial winter kill
Fescue, Tall (KY31) Alone	40	August 15 — October	Seldom seeded alone, not for dry or wet sites
Fescue, Tall (KY31) Mix*	20	August 15 — October	Seldom seeded alone, not for dry or wet sites
Sericea Lespedeza (Scarified) Alone or Mix*, (Innoculate with EL Innoculant)	40	April —June	Good for slopes, cuts, and fills that require low maintenance
Ladino Clover (Mix* only), (Innoculate with AB Innoculant)	2	August 20 — October	Naturally adds nitrogen

* For details on mixes consult the Lexington Soil and Water Conservation District, (803) 359-3165 ext. 3.

TABLE 3.15 PERMANENT VEGETATION SCHEDULE FOR STEEP SLOPES/CUT SLOPES

Species	Rates (lbs/acr)	Optimum Dates to Plant	Remarks
Weeping Lovegrass (Alone)	4	April — July 20	Quick cover, deep roots, likes dry sites, seldom used alone, clumps
Weeping Lovegrass (Mix)*	2	April — July 20	Quick cover, deep roots, likes dry sites, seldom used alone, clumps

TABLE 3.16 NATIVE SPECIES THAT CAN BE USED ON NON-CRITICAL, LEVEL SITES IN LEXINGTON COUNTY, SC

Species	Rates (lbs/acr)	Optimum Dates to Plant	Remarks
Switchgrass (Mix* with Legumes)	10, PLS**	February 10 — April 20	Mix with Sericia at 30 lbs/acre
Indian Grass (Mix)*	8, PLS**	February — April 20	Mix with Sericia at 30 lbs/acre
Little Bluestem, (Mix*)	8, PLS**	February 10 — April	

* Pure Live Seed

LEXINGTON COUNTY PUBLIC WORKS DEPARTMENT

PERMANENT VEGETATION NOTES & SCHEDULE (Sheet 2 of 2)

DRAWING NO:D-11A

DATE:October 2007

RIVERBANKS ZOO & GARDEN
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clr DESIGN
EXHIBIT DESIGN
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08-13-2024

Revisions:

No.	Description	Date

Sheet Title **PHASE II GONDOLA LIFT**

DETAILS EROSION CONTROL

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

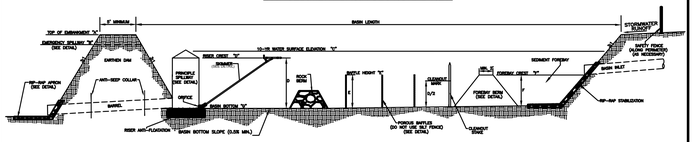
Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C353

DRY SEDIMENT BASIN SECTIONAL VIEW



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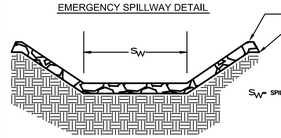

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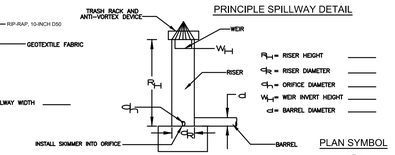


PLAN SYMBOL

SEDIMENT BASIN DESIGN TABLE

Sediment Basin Number/Name	"A"	"B"	"C"	"D"	"E"	"F"	"G"	Skimmer Size (in.)	Skimmer Orifice (in.)	Skimmer Daily Discharge Capacity (FT^3/DAY)	Skimmer Average Discharge Rate (CFS)	Dewatering Time (Days)	No. of Skimmers

South Carolina Department of Health and Environmental Control

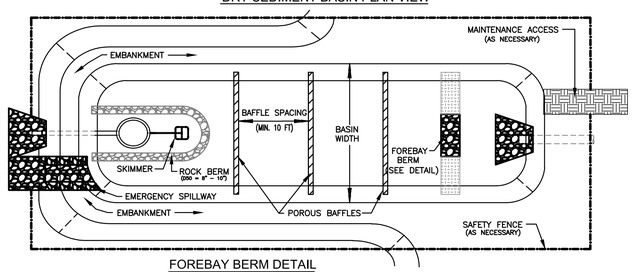
DRY SEDIMENT BASIN

STANDARD DRAWING NO. SC-01 Page 1 of 3

NOT TO SCALE

FEBRUARY 2014 DATE

DRY SEDIMENT BASIN PLAN VIEW



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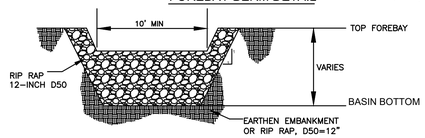


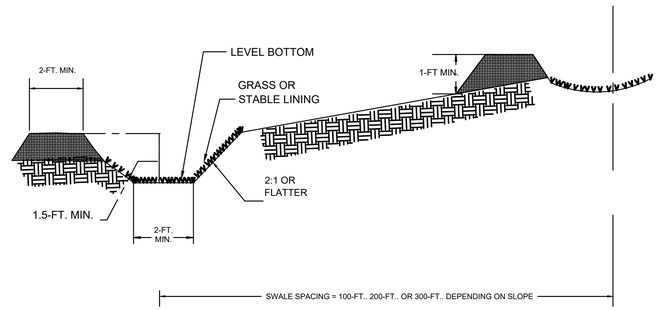
South Carolina Department of Health and Environmental Control

DRY SEDIMENT BASIN

STANDARD DRAWING NO. SC-01 Page 2 of 3

NOT TO SCALE

FEBRUARY 2014 DATE



South Carolina Department of Health and Environmental Control

DIVERSION SWALE

STANDARD DRAWING NO. RC-03 Page 1 of 2

NOT TO SCALE

JULY 31, 2005 DATE

RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
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Revisions:

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Sheet Title **PHASE II GONDOLA LIFT**

DETAILS
EROSION CONTROL

CLR Project No.:

Project Manager:

Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C354

DRY SEDIMENT BASIN - GENERAL NOTES

1. Sediment basins should not be placed in Waters of the State or USGS blue–line streams (unless approved by Federal Authorities).
2. Sediment basin's side slopes shall be seeded and, when necessary, stabilized with vegetative or synthetic matting to prevent the formation of rills and gullies.
3. Install three (3) rows of porous baffles with a minimum spacing of 10 feet. Baffles should ultimately be placed to maximize the space between each row of baffles and the basin's inlets/outlets. Only two (2) rows of baffles are necessary for basins that are less than 50 feet in length.
4. Porous Baffles should be composed of coir–based materials or TRMs with a light penetration (open spaces) between 10–35%. These materials should not have loose straw. Silt Fence may not be used as Porous Baffles.
5. Each porous baffles shall be installed across the entire width of the basin and along the basin's side slope until the height of the baffle intersects the slope.
6. Install skimmer and coupling (as necessary) to riser structure at orifice along bottom of the principle spillway's riser structure. (Refer to skimmer manufacturer for installation procedures and skimmer specifications.)
7. Skimmer should be equipped with a mechanism, such as a rope, to allow easy access to skimmer to unclogged orifice or perform other necessary maintenance.
8. Stormwater runoff entering the basin must be directed into proper BMPs to prevent erosion along side slopes and to prevent scour at the basin's inlets.
9. The forebay berm should consist of riprap, gabion, or an earthen berm with a rock filled outlet that is constructed across the bottom of the basin's width.
10. An additional cleanout stake for the forebay area is recommended and should be marked for cleanout at 50% of provided sediment storage.
11. The elevation of the emergency spillway should be at least 1 foot below the top of the embankment. The emergency spillway should not be located on fill material, when possible. Riprap and geotextile liner should be placed on all spillways that must be located on fill material.

DRY SEDIMENT BASIN – INSPECTION AND MAINTENANCE

1. The key to a functional sediment basin is weekly inspections, routine maintenance, and regular sediment removal.
2. Attention to sediment accumulations within the basin is extremely important. Accumulated sediment deposition should be continually checked and removed when necessary.
3. Remove accumulated sediment when it reaches 50% of the design sediment storage volume or 1/2 the height of the riser structure, whichever is reached first.
4. Removed sediment from the basin shall be placed in stockpile storage areas or spread thinly across the disturbed area. Stabilize the removed sediment after it is relocated.
5. Inspections of sediment basins should be conducted once every calendar week and, as recommended, within 24–hours of each rainfall event that produces ½–inch or more of precipitation.
6. All temporary sediment basins, which are not to be converted to a detention basin post–construction, should be removed within 30 days after final site stabilization is achieved.
7. Disturbed areas resulting from the removal of the sediment basin should be permanently stabilized and additional BMPs, such as silt fence, should be utilized to accept stormwater runoff from this disturbed area until final stabilization is reached.

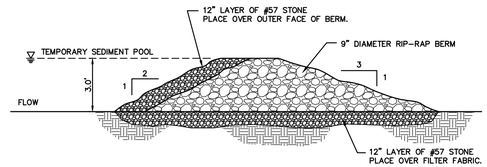
South Carolina Department of Health and Environmental Control

DRY SEDIMENT BASIN

STANDARD DRAWING NO. SC-01 Page 3 of 3

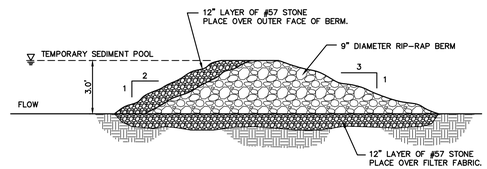
GENERAL NOTES

FEBRUARY 2014 DATE



FB **SEDIMENT FOREBAY BERM RIP-RAP DETAIL**

NTS



LS **LEVEL SPREADER RIP-RAP FILTER BERM DETAIL**

NTS

DIVERSION SWALE

Installation

The bottom width should be a minimum of 2–feet, and the bottom should be level.

The depth should be a minimum of 1.5–feet and the side slopes should be 2H:1V or flatter.

The maximum grade shall be 5%, with positive drainage to a suitable outlet.

Slopes shall be stabilized immediately using vegetation, sod, and erosion control blankets or turf reinforcement mats to prevent erosion.

The upslope side of the swale should provide positive drainage so no erosion occurs at the outlet. Provide energy dissipation measures as necessary.

Sediment–laden runoff shall be directed to a sediment trapping facility.

Inspection and Maintenance:

Swales should be inspected, every seven (7) calendar days and within 24–hours after each rainfall event that produces ½–inches or more of precipitation and repairs made as necessary.

Damage caused by construction traffic or other activity must be repaired before the end of each working day.

South Carolina Department of Health and Environmental Control

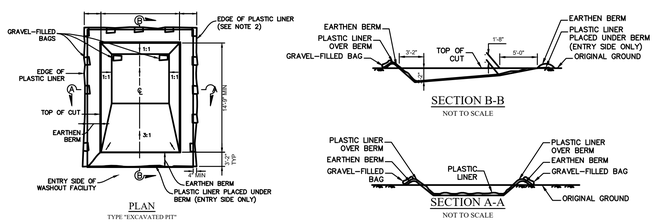
DIVERSION SWALE

STANDARD DRAWING NO. RC-03 PAGE 2 of 2

GENERAL NOTES

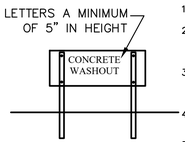
JULY 31, 2005 DATE

EXCAVATED PIT CONCRETE WASHOUT



NOTES:

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. INSTALL CONCRETE WASHOUT SIGN (24"X24", MINIMUM) WITHIN 30' OF THE TEMPORARY CONCRETE WASHOUT FACILITY.
3. TEMPORARY WASHOUT AREA MUST BE AT LEAST 50' FROM A STORM DRAIN, CREEK BANK OR PERIMETER CONTROL.
4. CLEAN OUT CONCRETE WASHOUT AREA WHEN 50% FULL.
5. THE KEY TO FUNCTIONAL CONCRETE WASHOUTS IS WEEKLY INSPECTIONS, ROUTINE MAINTENANCE, AND REGULAR CLEAN OUT.
6. SILT FENCE SHALL BE INSTALLED AROUND PERIMETER OF CONCRETE WASHOUT AREA EXCEPT FOR THE SIDE UTILIZED FOR ACCESSING THE WASHOUT.
7. A ROCK CONSTRUCTION ENTRANCE MAY BE NECESSARY ALONG ONE SIDE OF THE WASHOUT TO PROVIDE VEHICLE ACCESS.



CONCRETE WASHOUT SIGN DETAIL

South Carolina Department of Health and Environmental Control

CONCRETE WASHOUT

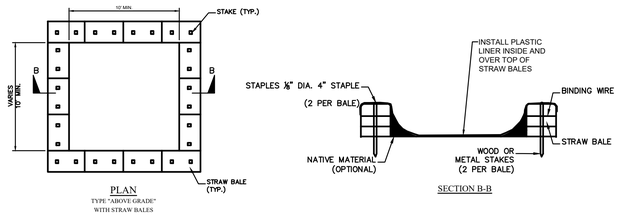
EXCAVATED PIT

STANDARD DRAWING NO. RC-08 PAGE 1 of 1

NOT TO SCALE

FEBRUARY 2014 DATE

STRAW BALE BARRIER CONCRETE WASHOUT



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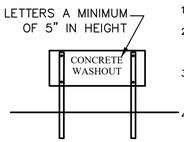


CONCRETE WASHOUT SIGN DETAIL

South Carolina Department of Health and Environmental Control

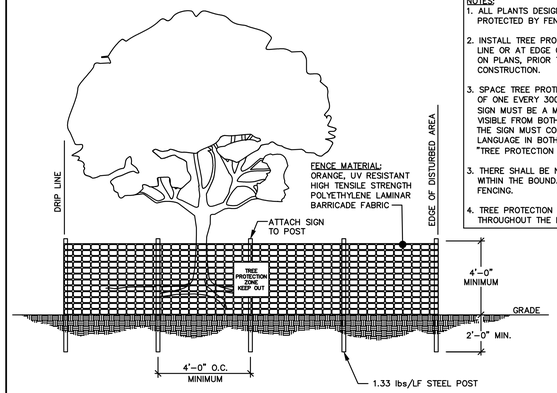
CONCRETE WASHOUT

STRAW BALES OR ABOVE GROUND

STANDARD DRAWING NO. RC-07 PAGE 1 of 1

NOT TO SCALE

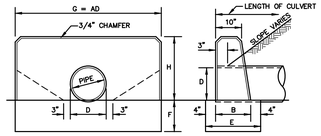
FEBRUARY 2014 DATE



NOTES:

1. ALL PLANTS DESIGNATED TO BE SAVED SHALL BE PROTECTED BY FENCING, AS ILLUSTRATED.
2. INSTALL TREE PROTECTION FENCE AT TREE DRIP LINE OR AT EDGE OF DISTURBED AREA, AS SHOWN ON PLANS, PRIOR TO COMMENCEMENT OF CONSTRUCTION.
3. SPACE TREE PROTECTION ZONE SIGNS A MINIMUM OF ONE EVERY 300 FEET. THE SIZE OF EACH SIGN MUST BE A MINIMUM OF 2' x 2' AND BE VISIBLE FROM BOTH SIDES OF THE FENCE. THE SIGN MUST CONTAIN THE FOLLOWING LANGUAGE IN BOTH ENGLISH & SPANISH: "TREE PROTECTION ZONE, KEEP OUT".
3. THERE SHALL BE NO STORAGE OF MATERIAL WITHIN THE BOUNDARIES OF THE TREE PROTECTION FENCING.
4. TREE PROTECTION FENCING SHALL BE MAINTAINED THROUGHOUT THE DURATION OF THE PROJECT.

TREE PROTECTION FENCE



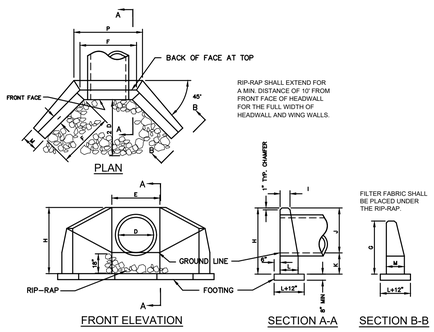
FRONT ELEVATION END ELEVATION

DIMENSIONS							QUANTITIES FOR ONE CONCRETE PIPE			
OPENING		WALL			FOOTING		CLASS "B" CONCRETE			
D	AREA SQ. FT.	G	H	B	E	F	CUBIC FEET WALL	CUBIC FEET FOOT	TOTAL CU. FT.	TOTAL CU. YD.
12"	0.8	4'-0"	2'-0"	1'-2"	1'-10"	1'-0"	6.5	7.3	13.8	0.51
15"	1.2	5'-0"	2'-3"	1'-2"	1'-10"	1'-2"	9.0	10.7	19.7	0.73
18"	1.8	6'-0"	2'-6"	1'-3"	1'-11"	1'-3"	12.5	14.4	26.9	0.99
24"	3.1	8'-0"	3'-0"	1'-4"	2'-0"	1'-4"	20.2	21.3	41.5	1.54

HEADWALL DETAIL FOR PIPES 12" TO 24" IN DIAMETER

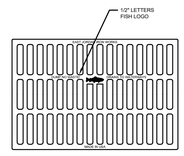
NTS

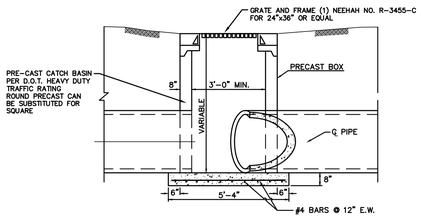
2:1 SLOPE											
D	E	G	H	I	J	K	L	M	N	P	F
30"	4'-0"	4'-0"	5'-6"	12"	3'-6"	24"	1'-6"	18"	2'-0"	5'-6"	4'-3"
36"	4'-6"	4'-3"	6'-0"	12"	4'-0"	24"	1'-8"	18"	2'-3"	5'-11"	5'-0"
42"	5'-0"	4'-6"	6'-6"	12"	4'-6"	24"	1'-10"	18"	2'-6"	6'-6"	5'-9"
48"	5'-6"	4'-9"	7'-0"	12"	5'-0"	24"	2'-0"	18"	2'-9"	7'-2"	6'-6"
54"	6'-0"	5'-0"	7'-6"	12"	5'-6"	24"	2'-2"	18"	3'-0"	7'-10"	7'-3"
60"	6'-6"	5'-3"	8'-0"	12"	6'-0"	24"	2'-4"	18"	3'-3"	8'-5"	8'-0"
72"	7'-6"	5'-9"	9'-0"	12"	7'-0"	24"	2'-8"	18"	3'-9"	9'-8"	9'-6"
84"	8'-6"	6'-3"	10'-0"	12"	8'-0"	24"	3'-0"	18"	4'-3"	11'-0"	11'-0"



CONCRETE HEADWALL DETAIL FOR PIPES 30" TO 84" IN DIAMETER

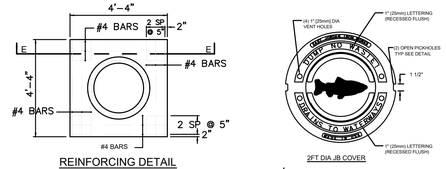
NTS





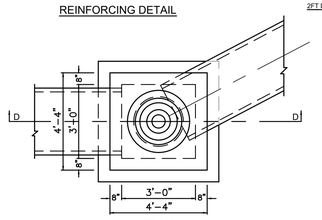
24x36 GRATE & FRAME CATCH BASIN

NTS

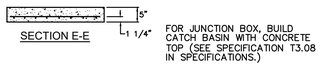


REINFORCING DETAIL

2FT DIA JB COVER

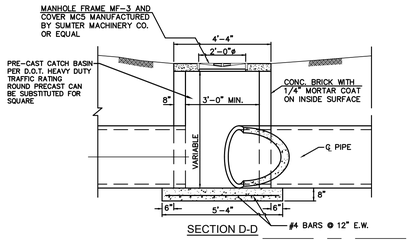


PLAN



SECTION E-E

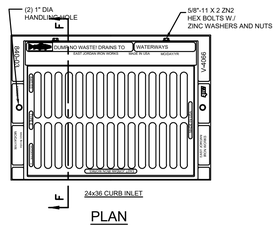
FOR JUNCTION BOX, BUILD CATCH BASIN WITH CONCRETE TOP (SEE SPECIFICATION T3.08 IN SPECIFICATIONS.)



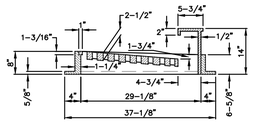
SECTION D-D

JUNCTION BOX DETAIL

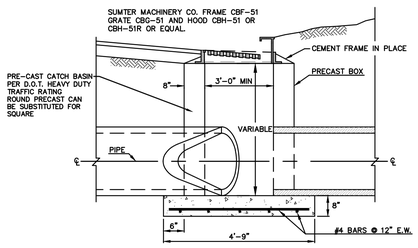
NTS



PLAN



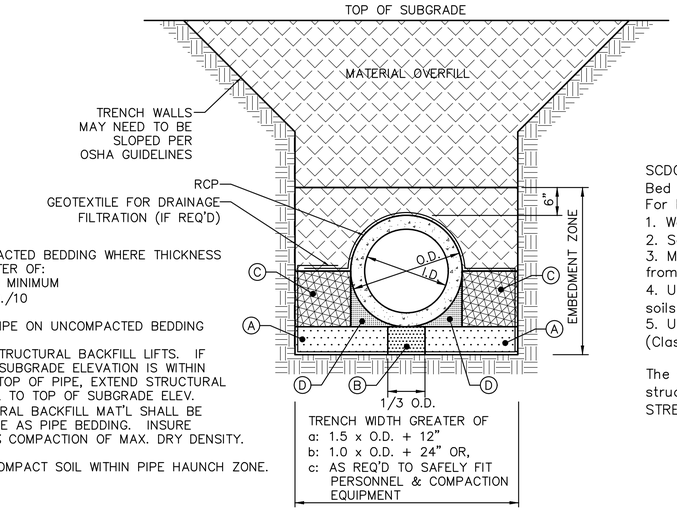
SECTION F-F



GRATE, FRAME AND HOOD CATCH BASIN DETAIL

NTS

PIPE TRENCHES PER SCDOT SC-M-714 "SUPPLEMENTAL TECHNICAL SPECIFICATIN FOR PERMANENT PIPE CULVERTS" DATED APRIL 6, 2009.



(A) UNCOMPACTED BEDDING WHERE THICKNESS IS GREATER OF:
  a: 6IN MINIMUM
  b: O.D./10

(B) PLACE PIPE ON UNCOMPACTED BEDDING

(C) PLACE STRUCTURAL BACKFILL LIFTS. IF TOP OF SUBGRADE ELEVATION IS WITHIN 3FT OF TOP OF PIPE, EXTEND STRUCTURAL BACKFILL TO TOP OF SUBGRADE ELEV. STRUCTURAL BACKFILL MAT'L SHALL BE THE SAME AS PIPE BEDDING. INSURE MIN. 95% COMPACTION OF MAX. DRY DENSITY.

(D) FULLY COMPACT SOIL WITHIN PIPE HAUNCH ZONE.

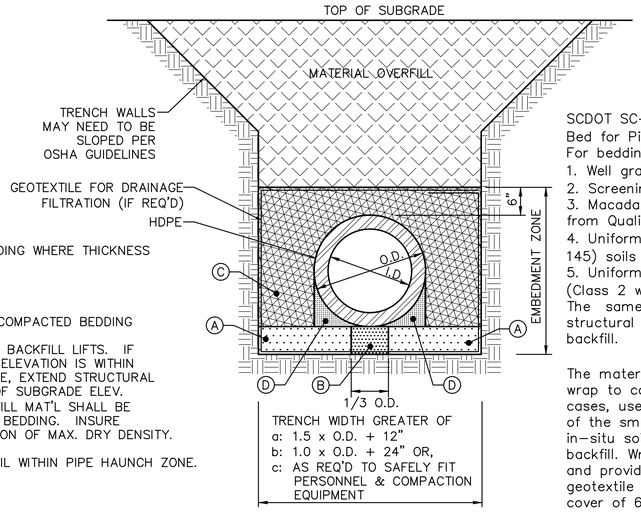
SCDOT SC-M-714 Section 1.3.3
Bed for Pipe (RCP)
For bedding material, use either:
1. Well graded A-1 (AASHTO M 145) soils
2. Screenings meeting A-1 (AASHTO M 145)
3. Macadam or Marine Limestone Graded aggregate base from Qualified Product List 2
4. Uniformly graded, coarse grained A-3 (AASHTO M 145) soils (Class 1 wrapped)
5. Uniformly graded angular stone as large as #5 stone (Class 2 wrapped, vibrated)

The same material must be used for bedding and structural backfill unless CLSM, "CONTROLLED LOW STRENGTH MATERIAL" is used for structural backfill.

RCP PIPE BEDDING

NTS

PIPE TRENCHES PER SCDOT SC-M-714 "SUPPLEMENTAL TECHNICAL SPECIFICATIN FOR PERMANENT PIPE CULVERTS" DATED APRIL 6, 2009.



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(D) FULLY COMPACT SOIL WITHIN PIPE HAUNCH ZONE.

SCDOT SC-M-714 Section 2.3.3
Bed for Pipe (HDPE)
For bedding material, use either:
1. Well graded A-1 (AASHTO M 145) soils
2. Screenings meeting A-1 (AASHTO M 145)
3. Macadam or Marine Limestone Graded aggregate base from Qualified Product List 2
4. Uniformly graded, coarse grained A-3 (AASHTO M 145) soils (Class 1 wrapped)
5. Uniformly graded angular stone as large as #5 stone (Class 2 wrapped, vibrated)
The same material must be used for bedding and structural backfill unless CLSM is used for structural backfill.

The materials marked as (wrapped) require geotextile wrap to control migration of fines into open voids. In all cases, use a geotextile that prevents the transmission of the smallest soil particles present in both the in-situ soil and the soil used for bedding and structural backfill. Wrap the entire bedding and backfill envelope and provide a minimum overlap of 2 feet at all geotextile splices. For shallow installations, provide a cover of 6 inches of soil between geotextile and hot mix asphalt.

HDPE PIPE BEDDING

NTS

RIVERBANKS ZOO & GARDEN
columbia south carolina
500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
EXHIBIT DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
833 chestnut st, ste 909
philadelphia, pa 19107
34921 calle del sol
capistrano beach, ca 92624
215.564.0250

Civil Engineer
Jackson Civil Engineering, LLC.
221 Powell Drive
Lexington, SC 29072
t: 803.603.8539

Structural Engineer
Johnson & King Engineers
1223 Elmwood Avenue
Columbia, SC 29201
t: 803.779.8830

Mechanical Engineer
MECA Consulting Associates
2330 Main Street
Columbia, SC 29201
t: 803.765.9421

Electrical Engineer
Sims Group Engineers, Inc.
800 Columbiana Drive, Suite 208
Irmo, SC 29063
t: 803.765.1007

Seal:

NOT FOR CONSTRUCTION

PERMIT DOCUMENTS
08-13-2024

Revisions:

No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
DETAILS STORM DRAINAGE

CLR Project No.:

Project Manager:

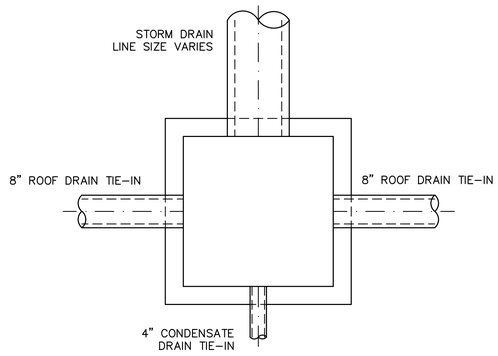
Drawn: RPJ Checked: JCE

Date: AUG 13, 2024

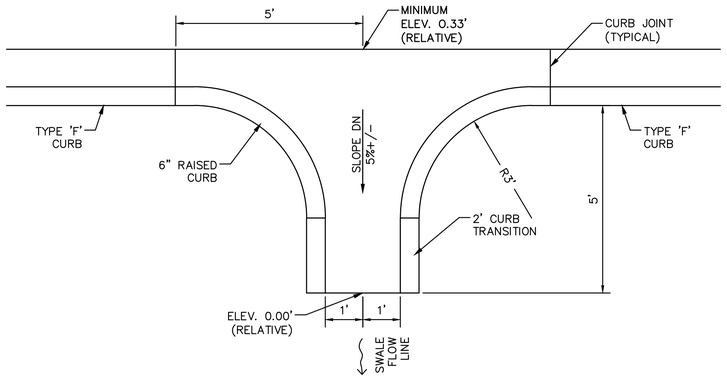
Scale: AS NOTED

Sheet No.

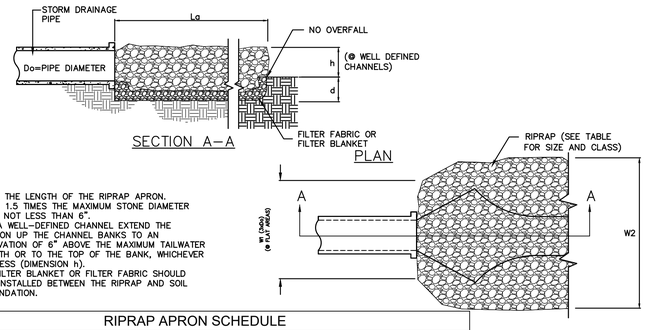
C355



STORM BOX AT BUILDING



CONCRETE OPEN FLUME



SECTION A-A

PLAN

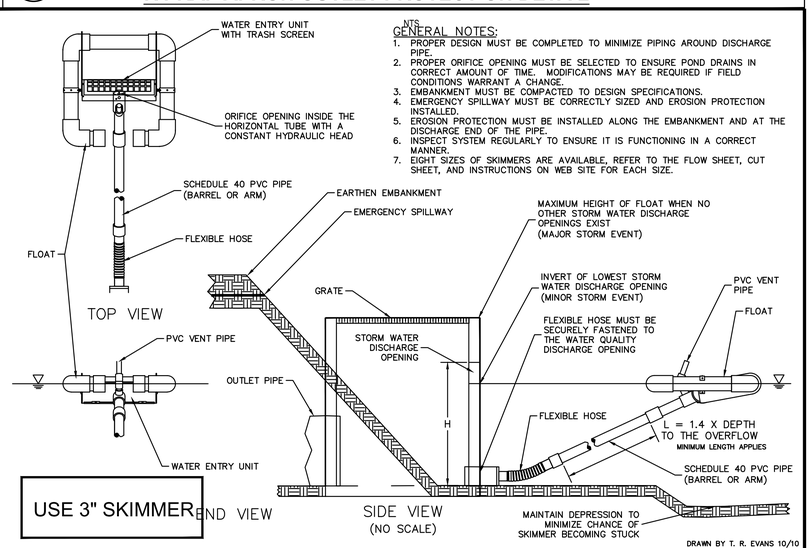
NOTES
1. L IS THE LENGTH OF THE RIPRAP APRON.
2. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER BUT NOT LESS THAN 6".
3. IN A WELL-DEFINED CHANNEL EXTEND THE APRON UP THE CHANNEL BANKS TO AN ELEVATION OF 6" ABOVE THE MAXIMUM TAILWATER DEPTH OR TO THE TOP OF THE BANK, WHICHEVER IS LESS (DIMENSION h).
4. A FILTER BLANKET OR FILTER FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION.

RIPRAP APRON SCHEDULE

OUTLET	Do (INCHES)	APRON MATERIAL (FILLING)	RIPRAP DIA. (INCHES)	RIPRAP DEPTH (d) (INCHES)	RIPRAP CLASS	Lo (MIN.) (FEET)		W2 (MIN.) (FEET)
H1	24	MEDIUM	12	18	II	16		18
L1	36	MEDIUM	12	18	II	20		23
A1	30	MEDIUM	12	18	II	22		24
B1	36	MEDIUM	12	18	II	20		23
M1	24	MEDIUM	12	18	II	16		18
P1	24	MEDIUM	12	18	II	16		18

RA

RIPRAP APRON OUTLET PROTECTION DETAIL



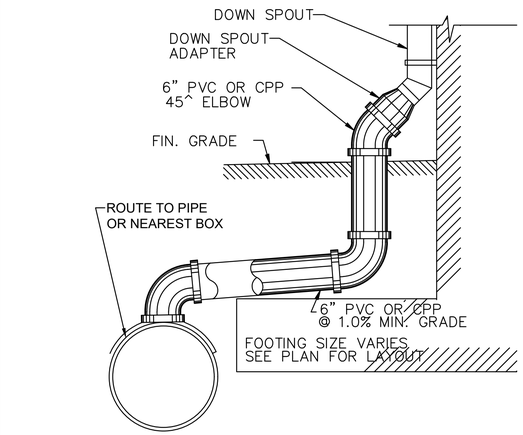
NTS

GENERAL NOTES:
1. PROPER DESIGN MUST BE COMPLETED TO MINIMIZE PIPING AROUND DISCHARGE PIPE.
2. PROPER ORIFICE OPENING MUST BE SELECTED TO ENSURE POND DRAINS IN CORRECT AMOUNT OF TIME. MODIFICATIONS MAY BE REQUIRED IF FIELD CONDITIONS WARRANT A CHANGE.
3. EMBANKMENT MUST BE COMPACTED TO DESIGN SPECIFICATIONS.
4. EMERGENCY SPILLWAY MUST BE CORRECTLY SIZED AND EROSION PROTECTION INSTALLED.
5. EROSION PROTECTION MUST BE INSTALLED ALONG THE EMBANKMENT AND AT THE DISCHARGE END OF THE PIPE.
6. INSPECT SYSTEM REGULARLY TO ENSURE IT IS FUNCTIONING IN A CORRECT MANNER.
7. EIGHT SIZES OF SKIMMERS ARE AVAILABLE, REFER TO THE FLOW SHEET, CUT SHEET, AND INSTRUCTIONS ON WEB SITE FOR EACH SIZE.

FAIRCLOTH SKIMMER® DISCHARGE SYSTEM WITH OUTLET STRUCTURE

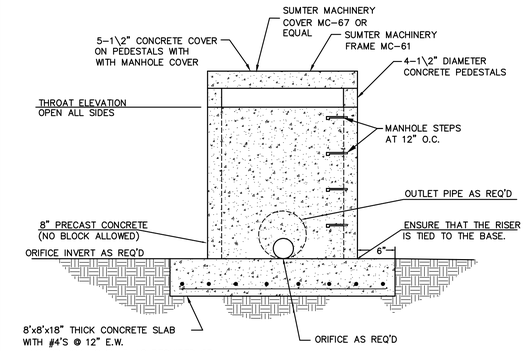
DRAWN BY T. R. EVANS 10/10

J. W. FAIRCLOTH & SON INC.
WWW.FAIRCLOTHSKIMMER.COM
TELEPHONE: (919) 732-1244
FAX: (919) 732-1266
EMAIL: WARREN@FAIRCLOTHSKIMMER.COM



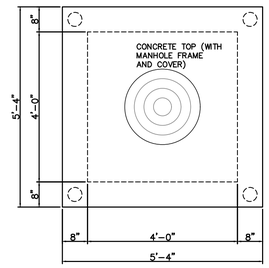
DOWNSPOUT BOOT DETAIL

NOT TO SCALE



ANCHOR BOX TO SLAB AS REQUIRED OR CAST SLAB AS INTEGRAL TO BOTTOM SECTION OF RISER. TOTAL WEIGHT OF STRUCTURE TO MEET OR EXCEED 1.2 TIMES WEIGHT OF WATER DISPLACED BY STRUCTURE.

NOTES:
1) INSIDE DIMENSIONS OF BOX = 4'x4' MIN.



PERMANENT OUTLET STRUCTURE DETAIL (TYP)

NTS

RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
EXHIBIT DESIGN
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Seal:

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PERMIT DOCUMENTS
08-13-2024

Revisions:

No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
DETAILS STORM DRAINAGE

CLR Project No.:

Project Manager:

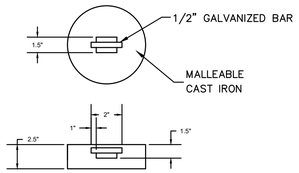
Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

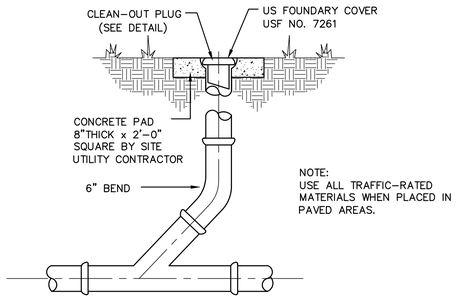
Sheet No.

C356



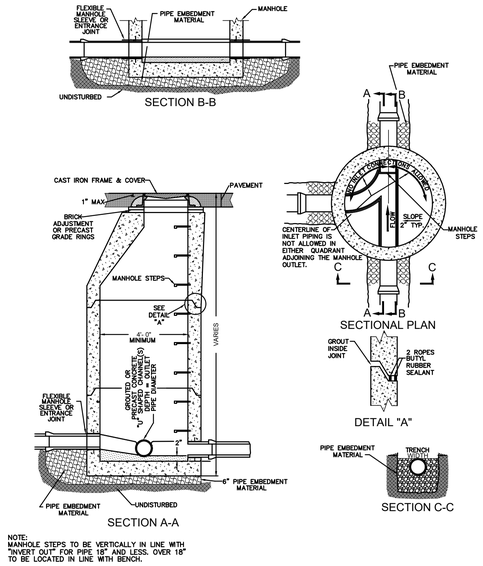
CLEANOUT PLUG DETAIL

NTS



SEWER CLEANOUT DETAIL

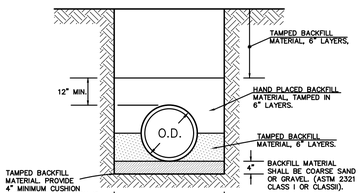
NTS



NOTE:
MANHOLE STEPS TO BE VERTICALLY IN LINE WITH "INVERT OUT" FOR PIPE 18" AND LESS. OVER 18" TO BE LOCATED IN LINE WITH BENCH.

SEWER MANHOLE DETAIL

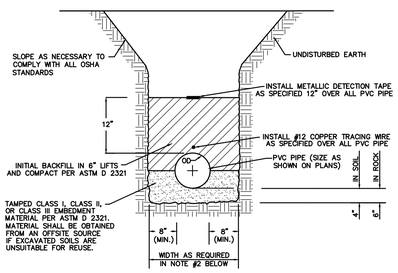
NTS



THE PIPE IS TO BE BEDDED IN COMPACTED 6" LAYERS TO THE SPRING LINE FIRST, THEN BACKFILLED WITH HAND PLACED MATERIAL COMPACTED IN 6" LAYERS TO A DEPTH OF 12" MINIMUM ABOVE THE PIPE.

PVC PIPE BEDDING AND BACKFILLING DETAIL

NTS

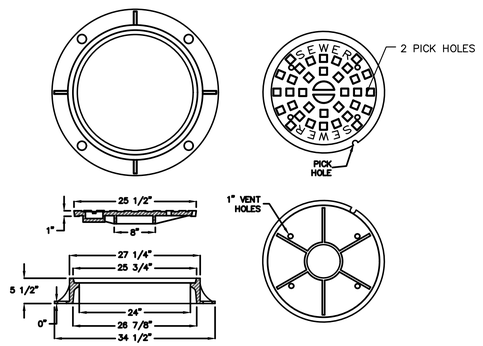


PVC WATERLINE TRENCH DETAIL

NTS

NOTES:

1. WHERE THE TRENCH WILL BE WITHIN THREE FEET OF THE EDGE OF THE EXISTING PAVEMENT, FLOWABLE FILL MAY BE REQUIRED FOR BACKFILL MATERIAL. CONSULT ENCROACHMENT PERMITS FOR SPECIFIC REQUIREMENTS.
2. MINIMUM WIDTH SHALL BE NOT LESS THAN THE GREATER OF EITHER THE PIPE OUTSIDE DIAMETER PLUS 16 IN. OR THE PIPE OUTSIDE DIAMETER TIMES 1.25 PLUS 12 IN.
3. NO BOULDERS OR STONES WILL BE USED IN INITIAL BACKFILL OR 2 FEET ABOVE TOP OF PIPE.
4. PVC PIPE NOT ALLOWED WITH LESS THAN 3'-0" COVER.



CASTINGS MEET AASHTO M306
H-20 LOADING.
CASTINGS ARE COATED WITH
ASPHALTIC BASED PAINT.
APPROX. WEGHT: 290 LBS.

CROSSING NOTES

CROSSING A WATER MAIN OVER A SEWER: WHENEVER IT IS NECESSARY FOR A WATER MAIN TO CROSS OVER A SEWER, THE WATER MAIN SHALL BE LAID AT SUCH AN ELEVATION THAT THE BOTTOM OF THE WATER MAIN IS AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER, UNLESS LOCAL CONDITIONS OR BARRIERS PREVENT AN 18 INCH VERTICAL SEPARATION; IN WHICH CASE: BOTH THE WATER MAIN AND SEWER SHALL BE CONSTRUCTED OF FERROUS MATERIALS AND WITH JOINTS THAT ARE EQUIVALENT TO WATER MAIN STANDARDS FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING.

CROSSING A WATER MAIN UNDER A SEWER: WHENEVER IT IS NECESSARY FOR A WATER MAIN TO CROSS UNDER A SEWER, BOTH THE WATER MAIN AND THE SEWER SHALL BE CONSTRUCTED OF FERROUS MATERIALS AND WITH JOINTS EQUIVALENT TO WATER MAIN STANDARDS FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING. A SECTION OF WATER MAIN PIPE SHALL BE CENTERED AT THE POINT OF CROSSING.

LATERAL SEPARATION NOTES

LATERAL SEPARATION OF SEWERS AND WATER MAINS: WATER MAINS SHALL BE LAID AT LEAST 10 FEET LATERALLY FROM EXISTING OR PROPOSED SEWERS, UNLESS LOCAL CONDITIONS OR BARRIERS PREVENT A 10 FOOT LATERAL SEPARATION, IN WHICH CASE: THE WATER MAIN IS LAID IN A SEPARATE TRENCH, WITH THE ELEVATION OF THE BOTTOM OF THE WATER MAIN AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER; OR THE WATER MAIN IS LAID IN THE SAME TRENCH AS THE SEWER WITH THE WATER MAIN LOCATED AT ONE SIDE ON A BENCH OF UNDISTURBED EARTH, AND WITH THE ELEVATION OF THE BOTTOM OF THE WATER MAIN AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER.

UTILITY CROSSING

NTS

RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
EXHIBIT DESIGN
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LANDSCAPE ARCHITECTURE
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Seal:

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08-13-2024

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No.	Description	Date

Sheet Title
PHASE II GONDOLA LIFT
DETAILS SANITARY SEWER

CLR Project No.:

Project Manager:

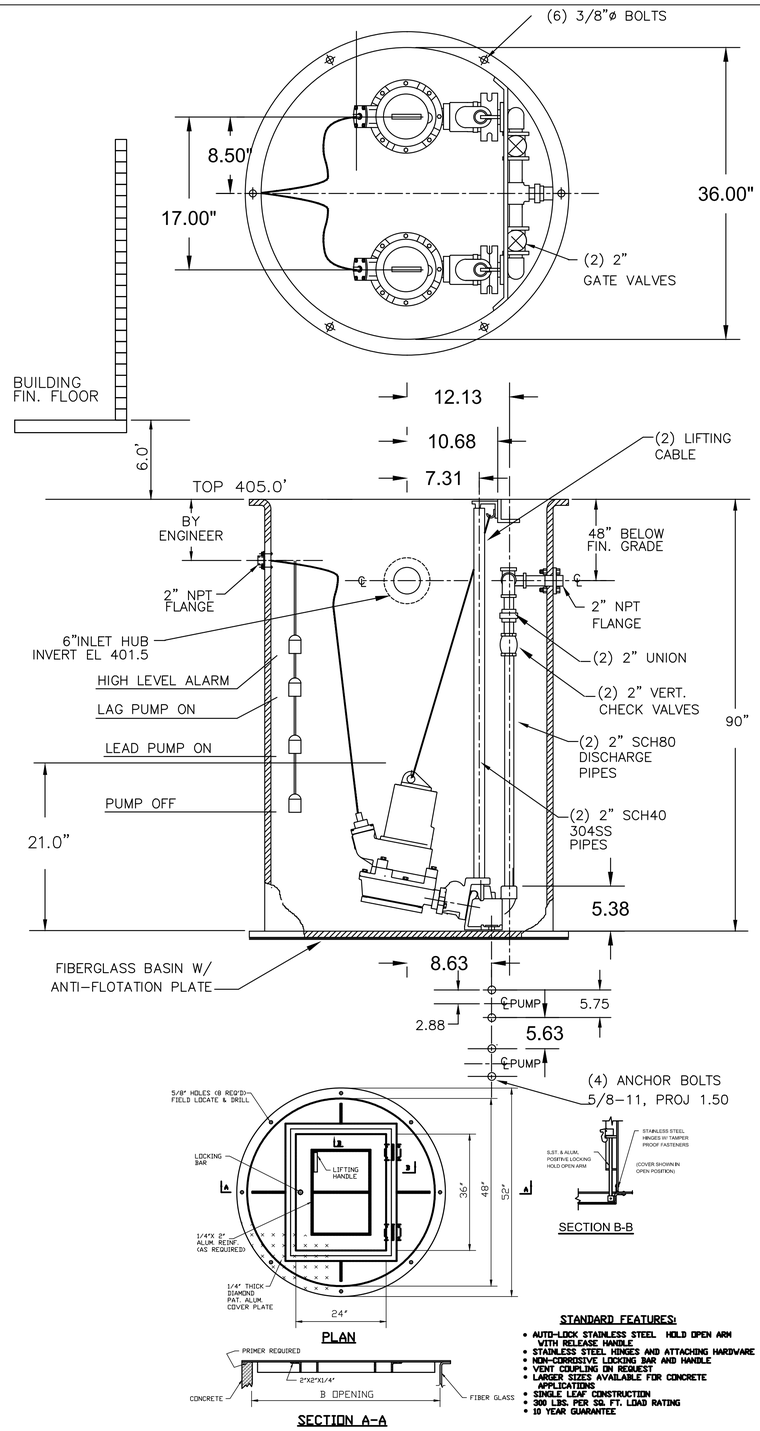
Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

Sheet No.

C357



STANDARD FEATURES:

- AUTO-LOCK STAINLESS STEEL HOLD OPEN ARM WITH RELEASE HANDLE
- STAINLESS STEEL HINGES AND ATTACHING HARDWARE
- NON-CORROSIVE LOCKING BAR AND HANDLE
- VENT COUPLING ON REQUEST
- LARGER SIZES AVAILABLE FOR CONCRETE APPLICATIONS
- SINGLE LEAF CONSTRUCTION
- 300 LBS. PER SQ. FT. LOAD RATING
- 10 YEAR GUARANTEE

Furnish two ABS heavy duty submersible grinder pumps. Pumps shall be connected to the discharge piping when lowered onto the discharge connection by one 2" dia. Sch40 304SS rail. Pump shall be centrifugal type with rotating cutter mounted on the pump shaft. The stationary cutter shall be mounted in the adjustable bottom plate. Shreading shall occur outside of volute to avoid clogging. The cutter shall be super abrasive material and hardness of 58–62 Rockwell C. Each pump shall be equiped with two seals. The lower shall be mechanical type with silicon carbide faces. The oil chamber shall be fitted with a moisture probe extending from the bottom of the motor housing into the oil chamber. The pump motor shall be air filled and have class "F" insulated moisture resistant windings. Bimetallic thermal switches shall be imbedded into each phase of the winding to sense high temperature.

Float holder and upper guide rail brackets shall be made with 304SS only.

The fiberglass basin shall be manufactured from commercial grade polyster resin.

The fiberglass valve vault shall be 24"x36"x30"

Float switches shall be UL listed type "S-RotoFloat" manufactured by Anchor Scientific, Inc. with 30 feet of STO PVC cable.

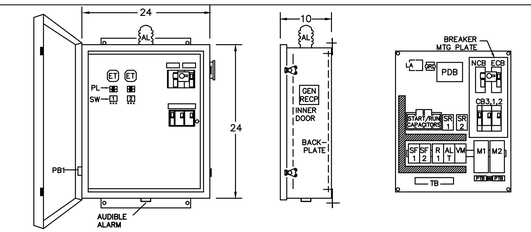
Pump Model: PIR S16/2 Impeller Dia: 136MM

No. Pumps: 2 Motor HP: 2.1

Discharge: 1-1/4" RPM: 3450

Design Flow: XXXGPM Voltage: 230

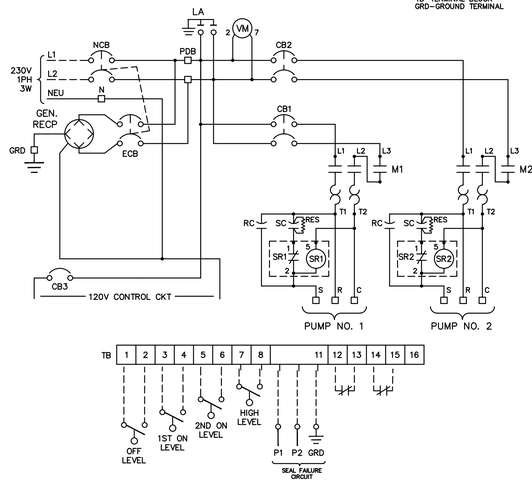
Design TDH: XXXFT Phase: SINGLE



NOTES:
1–ENCLOSURE: NEMA 3R STAINLESS STEEL
2–MATERIAL: 14 GAUGE #304 STN STL.
3–CONSTRUCTION: FORMED AND WELDED
4–FINISH: NO. 2B BRUSHED
5–HINGE: STAINLESS STEEL
6–LATCHES: STAINLESS STEEL LOCKABLE

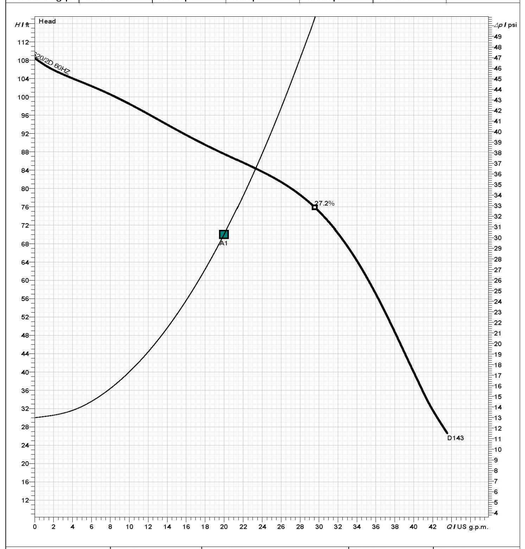
PL–TOP SEAL FAILURE/ BOTTOM PUMP RUN
SW–HOA SINGLE POLE DOUBLE THROW SWITCH
PB1–ALARM SILENCE
ET–ELAPSE TIME METER
NCB–NORMAL CIRCUIT BREAKER
ECB–EMERGENCY CIRCUIT BREAKER
PDB–POWER DISTRIBUTION BLOCK
CB–CIRCUIT BREAKER

LA–LIGHTING ARRESTOR
VM–VOLTAGE MONITOR
ALT–ALTERNATOR
SF–SEAL FAIL RELAY
SR–START RELAY
RC–RUN CAPACITOR
SC–START CAPACITOR
RES–RESISTOR
AL–ALARM LIGHT
TB–TERMINAL BLOCK
GRD–GROUND TERMINAL



Curve number	Pump performance curves	SULZER
Reference curve PIRANHA S D 60HZ	PIRANHA S D 60 HZ	

					Discharge	Frequency
					G1¼"	60 Hz
Density	Viscosity	Testnorm			Rated speed	Date
62.32 lb/ft³	1.082E-5 ft²/s	ISO9906:2012,HI 11.6/14.6≤10kW			3440 rpm	2020-10-12
Flow	Head	Shaft power	Power input	Rated power P2	Hydraulic efficiency	NPSH
23.31 US g.p.m	84.3 ft	1.97 hp	2.7 hp	2.41 hp	25.2 %	



Impeller size	N° of vanes	Impeller	Solid size	Revision
5.2/3inch	4	Macerator		

Spaix® 4, Version 4.3.12 - 2020/05/28 (Build 328)
Data version June 202

RIVERBANKS ZOO & GARDEN
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Revisions:

No.	Description	Date

Sheet Title **PHASE II GONDOLA LIFT**

DETAILS
SEWER PUMP STATION

CLR Project No.:

Project Manager:

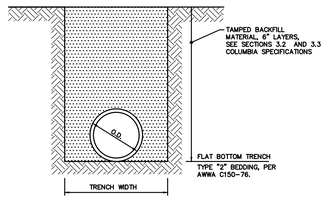
Drawn: RPJ Checked: JCE

Date: AUG 13, 2024

Scale: AS NOTED

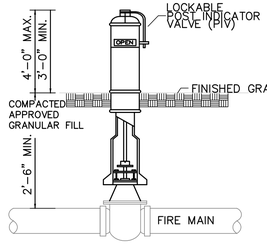
Sheet No.

C358



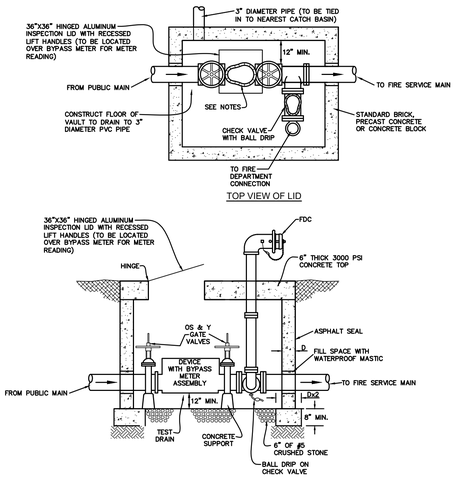
DUCTILE IRON PIPE BEDDING & BACKFILLING

NTS



POST INDICATOR VALVE DETAIL

NTS



BACKFLOW PREVENTION VAULT (FOR FIRE LINE)

NTS

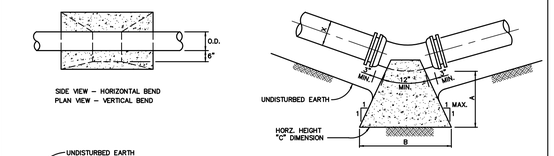
CONCRETE BLOCKING DIMENSIONS					
PIPE SIZE	A	B	C	MBA * 2 (SQ. FT.)	*1
■ DENOTES BRANCH SIZE)		TEES			
■ 6"	2'-0"	2'-0"	1'-4"	2.7	0.13
■ 8"	2'-0"	2'-6"	1'-10"	4.6	0.20
■ 10"	2'-6"	3'-6"	2'-0"	7.0	0.39
■ 12"	2'-6"	4'-6"	2'-3"	10.1	0.54
■ 16"	3'-0"	6'-0"	2'-10"	17.0	1.08
■ 18"	3'-0"	7'-0"	3'-0"	21.0	1.33
■ 24"	4'-0"	10'-0"	3'-9"	37.5	3.17
■ 30"	5'-0"	12'-0"	4'-10"	58.0	5.96
		90° BENDS			
6"	2'-0"	2'-9"	1'-3"	3.4	0.16
8"	2'-0"	3'-3"	2'-0"	6.5	0.28
10"	2'-6"	4'-0"	2'-6"	10.0	0.53
12"	2'-6"	5'-0"	2'-9"	13.8	0.73
16"	3'-0"	6'-0"	4'-0"	24.0	1.50
18"	3'-0"	7'-4"	4'-0"	29.3	1.85
24"	4'-0"	12'-0"	4'-5"	53.0	4.84
30"	6'-0"	14'-0"	5'-10"	81.7	9.97
		45° BENDS			
6"	2'-0"	2'-0"	1'-0"	2.0	0.11
8"	2'-0"	2'-6"	1'-5"	3.5	0.17
10"	2'-6"	3'-5"	1'-8"	5.2	0.29
12"	2'-6"	4'-6"	1'-8"	7.5	0.40
16"	3'-0"	6'-0"	2'-2"	13.0	0.80
18"	3'-0"	6'-4"	2'-6"	15.8	1.10
24"	3'-0"	6'-9"	4'-3"	28.7	1.75
30"	3'-6"	9'-3"	4'-9"	43.9	3.22

CONCRETE BLOCKING DIMENSIONS					
PIPE SIZE	A	B	C	MBA * 2 (SQ. FT.)	*1
		22-1/2° BENDS			
6"	2'-0"	1'-0"	1'-0"	1.0	0.08
8"	2'-0"	1'-9"	1'-0"	1.7	0.11
10"	2'-6"	2'-3"	1'-3"	2.8	0.19
12"	2'-6"	2'-6"	1'-6"	3.7	0.24
16"	3'-0"	3'-0"	2'-3"	6.5	0.48
18"	3'-0"	3'-4"	2'-6"	8.3	0.68
24"	3'-0"	4'-6"	3'-5"	15.4	1.04
30"	3'-6"	5'-0"	4'-6"	22.5	1.93
		11-1/4° BENDS			
6"	2'-0"	1'-0"	0'-6"	0.5	0.06
8"	2'-0"	1'-3"	0'-9"	0.9	0.08
10"	2'-6"	1'-6"	1'-0"	1.5	0.14
12"	2'-6"	2'-0"	1'-0"	2.0	0.17
16"	3'-0"	2'-6"	1'-4"	3.3	0.30
18"	3'-0"	2'-9"	1'-6"	4.1	0.38
24"	3'-0"	3'-3"	2'-3"	7.3	0.65
30"	3'-6"	3'-9"	3'-0"	11.2	1.22
		PLUGS *3			
12"	2'-6"	4'-6"	2'-6"	12.0	1.0

*1 – ESTIMATED C.Y. CONCRETE FOR TEES, BENDS AND PLUGS.
*2 – MINIMUM BEARING AREA (MBA) IS BASED ON SOIL BEARING CAPACITY OF 2000 PSF.
*3 – PLACE 6MIL POLYETHYLENE OVER PLUG PRIOR TO POURING CONCRETE

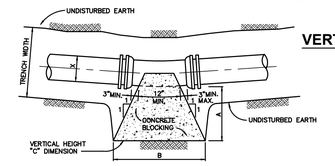
THRUST BLOCK DETAILS

NTS



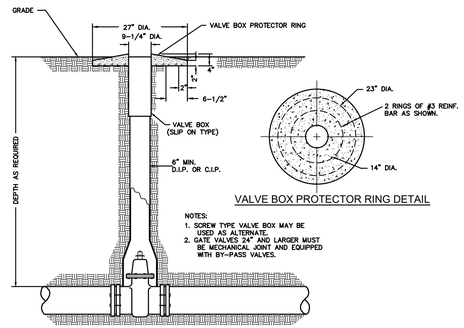
VERTICAL BLOCKING DETAIL

NTS



HORIZONTAL BLOCKING DETAIL

NTS

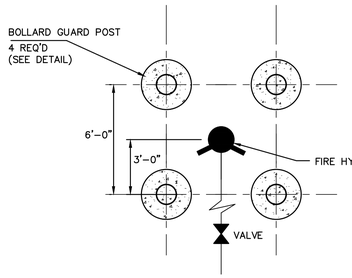


VALVE BOX PROTECTOR RING DETAIL

NOTES:
1. SCREW TYPE VALVE BOX MAY BE USED AS ALTERNATE.
2. GATE VALVES 24" AND LARGER MUST BE MECHANICAL JOINT AND EQUIPPED WITH BY-PASS VALVES.

GATE VALVE BOX DETAIL

NTS



FIRE HYDRANT BOLLARD PROTECTION DETAIL

NTS

CROSSING NOTES

CROSSING A WATER MAIN OVER A SEWER: WHENEVER IT IS NECESSARY FOR A WATER MAIN TO CROSS OVER A SEWER, THE WATER MAIN SHALL BE LAID AT SUCH AN ELEVATION THAT THE BOTTOM OF THE WATER MAIN IS AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER, UNLESS LOCAL CONDITIONS OR BARRIERS PREVENT AN 18 INCH VERTICAL SEPARATION, IN WHICH CASE: BOTH THE WATER MAIN AND SEWER SHALL BE CONSTRUCTED OF FERROUS MATERIALS AND WITH JOINTS THAT ARE EQUIVALENT TO WATER MAIN STANDARDS FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING.

CROSSING A WATER MAIN UNDER A SEWER: WHENEVER IT IS NECESSARY FOR A WATER MAIN TO CROSS UNDER A SEWER, BOTH THE WATER MAIN AND THE SEWER SHALL BE CONSTRUCTED OF FERROUS MATERIALS AND WITH JOINTS EQUIVALENT TO WATER MAIN STANDARDS FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING. A SECTION OF WATER MAIN PIPE SHALL BE CENTERED AT THE POINT OF CROSSING.

LATERAL SEPARATION NOTES

LATERAL SEPARATION OF SEWERS AND WATER MAINS: WATER MAINS SHALL BE LAID AT LEAST 10 FEET LATERALLY FROM EXISTING OR PROPOSED SEWERS, UNLESS LOCAL CONDITIONS OR BARRIERS PREVENT A 10 FOOT LATERAL SEPARATION, IN WHICH CASE: THE WATER MAIN IS LAID IN A SEPARATE TRENCH, WITH THE ELEVATION OF THE BOTTOM OF THE WATER MAIN AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER; OR THE WATER MAIN IS LAID IN THE SAME TRENCH AS THE SEWER WITH THE WATER MAIN LOCATED AT ONE SIDE ON A BENCH OF UNDISTURBED EARTH, AND WITH THE ELEVATION OF THE BOTTOM OF THE WATER MAIN AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER.

UTILITY CROSSING

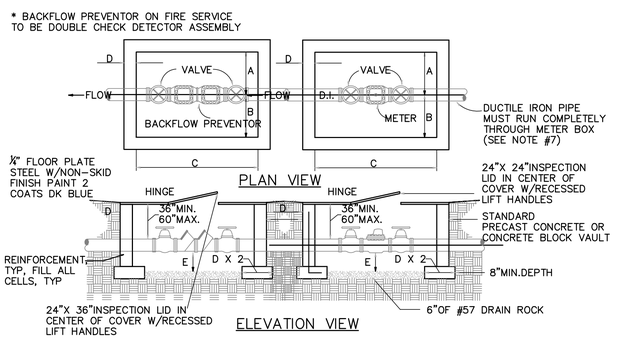
NTS

METER SIZE	3"	4"	6"	8"	10"
A	30"	30"	36"	42"	48"
B	18"	18"	24"	26"	32"
C	84"	84"	96"	104"	120"
D	6"	6"	6"	8"	8"
E	12"	12"	12"	18"	18"
ACCESS DOOR	24"	24"	24"	24"	24"

METER BOX DIMENSIONS

METER SIZE	3"	4"	6"	8"	10"
A	30"	30"	36"	42"	48"
B	30"	30"	36"	38"	54"
C	108"	108"	128"	132"	168"
D	6"	6"	6"	8"	8"
E	12"	12"	12"	18"	18"
ACCESS DOOR	24"	24"	24"	24"	24"

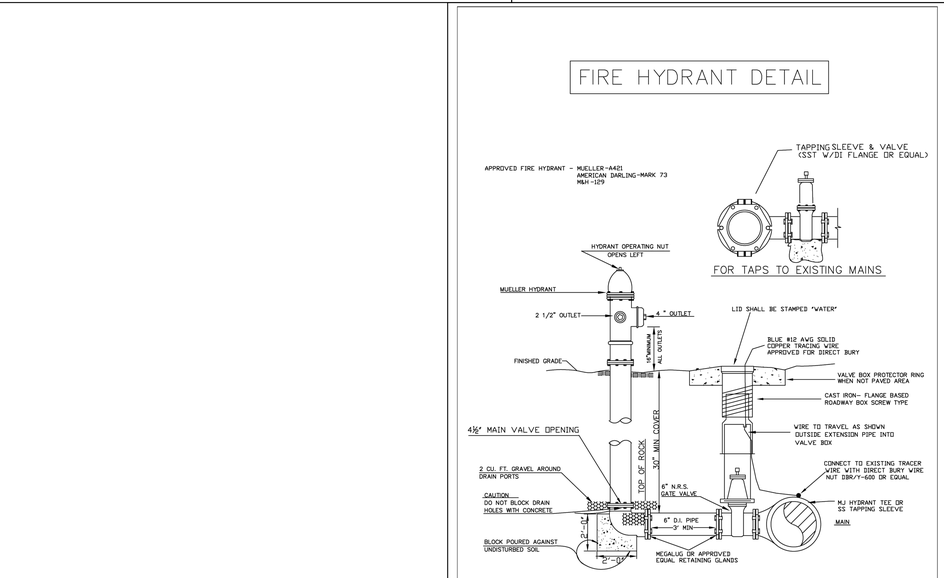
METER BOX DIMENSIONS W/ BY-PASS

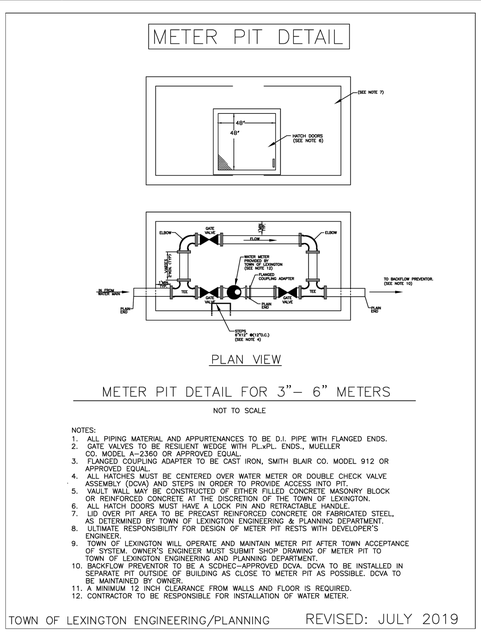


NOTES:
1. METER BOXES FOR METERS 3" AND ABOVE SHALL BE CONSTRUCTED OF THE MATERIALS AND TO THE DIMENSIONS SPECIFIED HEREIN.
2. METER BOXES CONSTRUCTED WITHIN THE TRAVELED WAY MUST WITHSTAND HEAVY SUPER-IMPOSED LOADS. EACH MUST BE DESIGNED TO MEET THE REQUIREMENTS OF THE INDIVIDUAL ENVIRONMENT IN WHICH IT IS TO BE USED. DETAILS/SHOP DRAWINGS AND DESIGN CALCULATIONS MUST BE SUBMITTED AND APPROVED PRIOR TO INSTALLATION OF THE METER.
3. METER BOXES SHALL BE PROVIDED WITH A COVER FABRICATED FROM ONE FOURTH (1/4") INCH THICK FLOOR PLATE STEEL WITH A NON-SKID SURFACE PRIMED AND PAINTED TO COVER ENTIRE BOX. COVERS MUST HAVE A HINGED 24" x 24" INSPECTION LID IN THE CENTER OF THE COVER WITH LIFT HANDLES FOR MANIPULATING THE LID. COVER HANDLES MUST LAY FLAT AND BELOW SURFACE COVER.
4. THE BOX COVER SHALL BE FLUSH WITH THE SURROUNDING GROUND SURFACE AND SHALL HAVE 2" GUIDES ALONG ADJACENT SIDES TO PREVENT LATERAL MOVEMENT.
5. THE BOX SHALL BE CONSTRUCTED OF PRECAST CONCRETE STANDARD BRICK, OR CONCRETE BLOCK USING PORTLAND CEMENT MORTAR IN A STANDARD MIXTURE.
6. SIX (6") INCHES OF #5 CRUSHED STONE SHALL BE PLACED IN THE BOTTOM OF EACH BOX. SEE "E" FOR PROPER CLEARANCE BETWEEN THE TOP OF STONE AND THE BOTTOM OF THE PIPE.
7. DUCTILE IRON PIPE MUST RUN COMPLETELY THROUGH METER BOX. METER SHALL BE INSTALLED (CUT-IN) BY LCJMWSC.
8. VALVE WITH BOX SHALL BE INSTALLED BETWEEN METER BOX AND SOURCE WATER MAIN.
9. ALL METER BOXES SHALL HAVE THE DIMENSIONS SHOWN BY THE ABOVE TABLE.

BACKFLOW AND METER VAULT

NTS





RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

CLR DESIGN
EXHIBIT DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
833 chestnut st, ste 909
philadelphia, pa 19107
34921 calle del sol
capistrano beach, ca 92624
215.564.0250

Civil Engineer
Jackson Civil Engineering, LLC.
221 Powell Drive
Lexington, SC 29072
t: 803.603.8539

Structural Engineer
Johnson & King Engineers
1223 Elmwood Avenue
Columbia, SC 29201
t: 803.779.8830

Mechanical Engineer
MECA Consulting Associates
2330 Main Street
Columbia, SC 29201
t: 803.765.9421

Electrical Engineer
Sims Group Engineers, Inc.
800 Columbiana Drive, Suite 208
Irmo, SC 29063
t: 803.765.1007

Seal:

NOT FOR CONSTRUCTION

PERMIT DOCUMENTS
08-13-2024

Revisions:

No.	Description	Date

Sheet Title **PHASE II GONDOLA LIFT**

DETAILS WATER

CLR Project No.:

Project Manager:

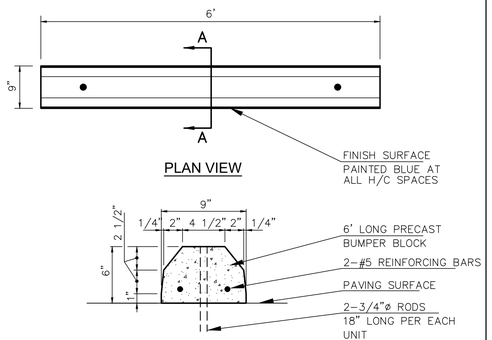
Drawn: RPJ | Checked: JCE

Date: AUG 13, 2024

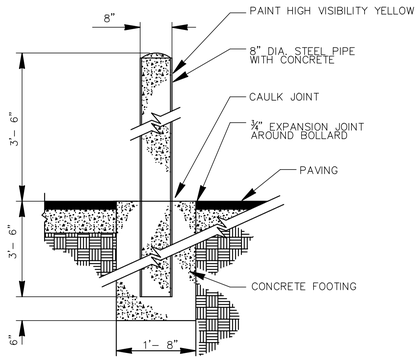
Scale: AS NOTED

Sheet No.

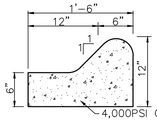
C359



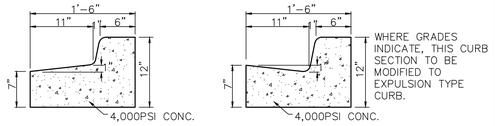
PRECAST CONCRETE WHEEL STOP
NTS



STEEL PIPE BOLLARDS
NTS

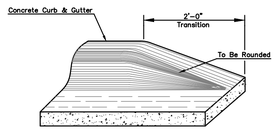


18" ROLLED CURB AND GUTTER
NTS

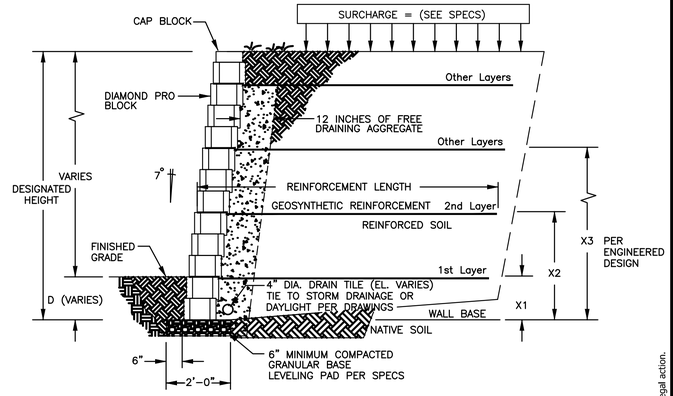


18" EXPULSION CURB **18" COLLECTION CURB**

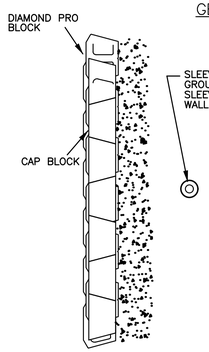
18" VERTICAL CURB & GUTTER
NTS



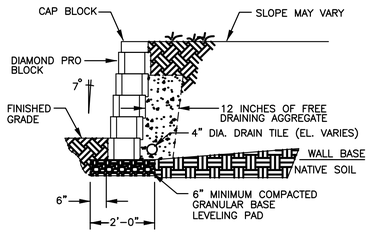
FEATHERING CURB AND GUTTER DETAIL
NTS



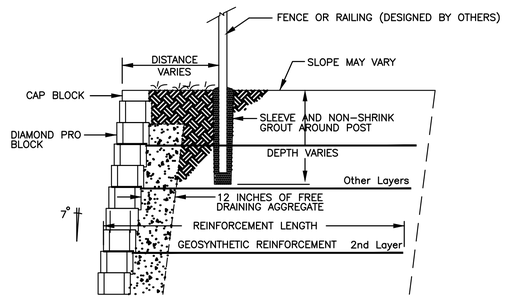
ANCHOR DIAMOND PRO
GEOSYNTHETIC REINFORCED WALL



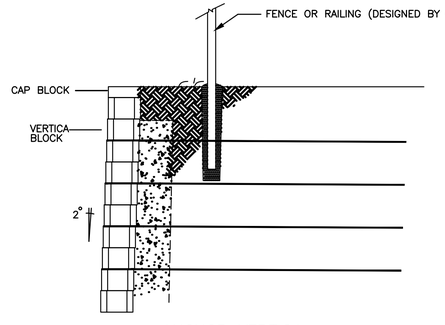
ANCHOR DIAMOND PRO
FENCE OR RAIL DETAIL



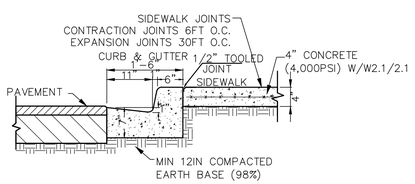
ANCHOR DIAMOND PRO
UNREINFORCED WALL



ANCHOR DIAMOND PRO
FENCE OR RAIL DETAIL

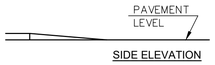


ANCHOR VERTICA
FENCE OR RAIL DETAIL



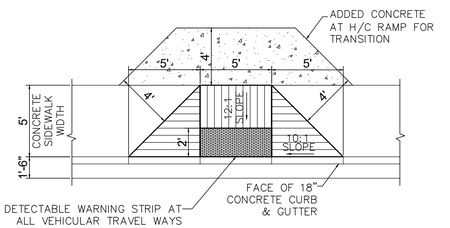
CONCRETE CURB & GUTTER & SIDEWALK DETAIL
NTS

PLAN VIEW



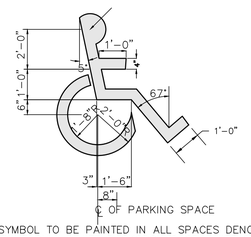
SIDE ELEVATION

DEPRESSED SIDEWALK FOR HANDICAP ACCESS
NTS



PLAN VIEW

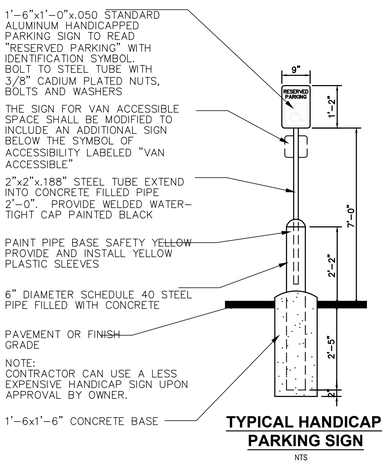
TYPICAL ADA HANDICAP RAMP CURB CUT DETAIL
NTS



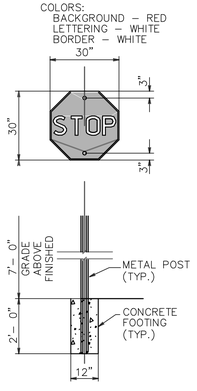
℄ OF PARKING SPACE

NOTE: SYMBOL TO BE PAINTED IN ALL SPACES DENOTED ON PLANS EITHER BLUE ON A WHITE BACKGROUND OR WHITE ON A BLUE BACKGROUND

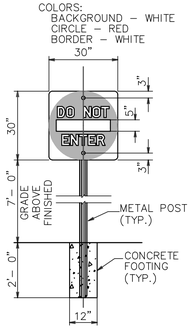
INTERNATIONAL ACCESSIBLE SYMBOL DETAIL
NTS



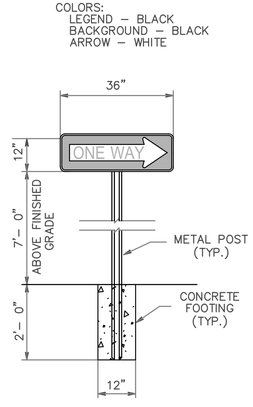
TYPICAL HANDICAP PARKING SIGN
NTS



STOP SIGN
NTS

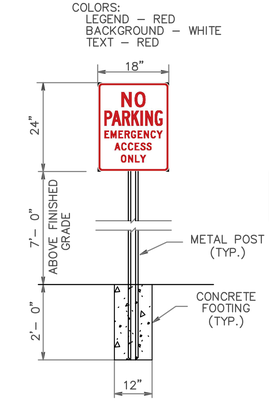


DO NOT ENTER SIGN
NTS

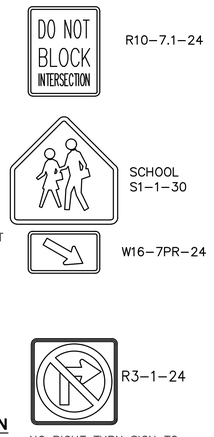


MUTCD R6-1R "ONE WAY" SIGN

R6-1L-36
R6-1R-36



EMERGENCY ACCESS ONLY SIGN



NO RIGHT TURN SIGN TO BE MOUNTED UNDERNEATH STOP SIGN ON THE SAME POST.

Jumper
Carter
Sease
ARCHITECTS
412 Meeting Street
West Columbia
South Carolina

RIVERBANKS ZOO & GARDEN
PHASE III - EDUCATION CENTER
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

DESIGN DOCS

DRAWN BY: RPJ
CHECKED BY: JCS
COMM NO: 2337
DATE: AUG 13, 2024
SHEET TITLE: SITE DETAILS
SHEET NO: C451

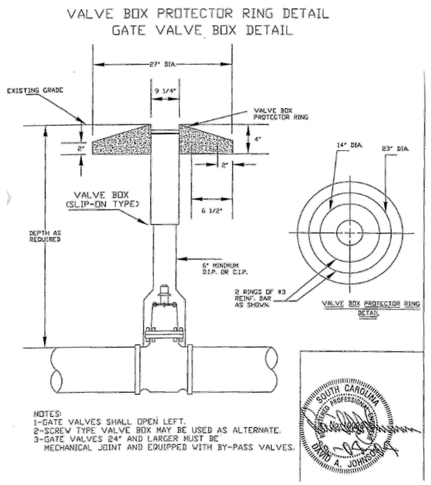


Figure 16-10. *Valve Box Protector Ring Detail; Gate Valve Box Detail*

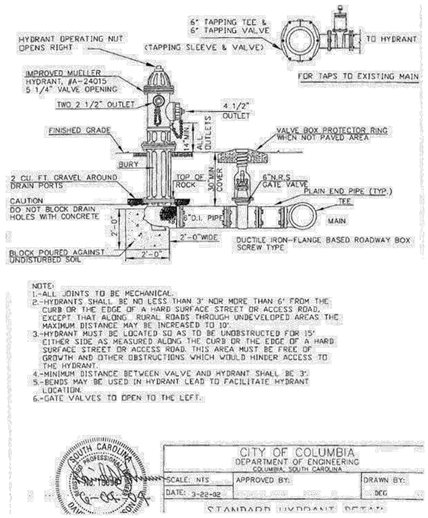
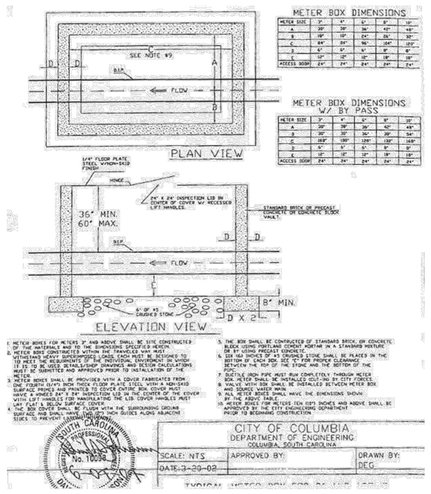


Figure 16-4. *Standard Hydrant Detail*



METER BOX DIMENSIONS					
METER SIZE	3"	4"	6"	8"	10"
A	30"	30"	36"	42"	48"
B	18"	18"	24"	26"	32"
C	84"	84"	96"	104"	120"
D	6"	6"	6"	8"	8"
E	12"	12"	12"	18"	18"
ACCESS DOOR	24"	24"	24"	24"	24"

METER BOX DIMENSIONS W/ BY-PASS					
METER SIZE	3"	4"	6"	8"	10"
A	30"	30"	36"	42"	48"
B	30"	30"	36"	38"	54"
C	108"	108"	128"	132"	168"
D	6"	6"	6"	8"	8"
E	12"	12"	12"	18"	18"
ACCESS DOOR	24"	24"	24"	24"	24"

Figure 16-2. *Typical Meter Box for Meters 3" and Above*

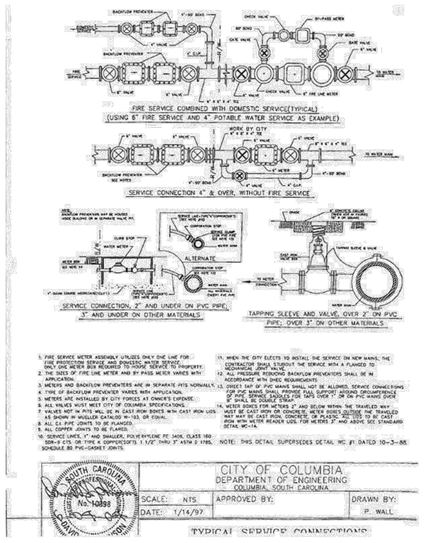
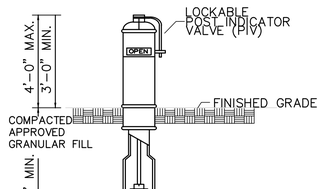


Figure 16-1. *Typical Service Connections*



POST INDICATOR VALVE DETAIL

NTS

CROSSING NOTES

CROSSING A WATER MAIN OVER A SEWER: WHENEVER IT IS NECESSARY FOR A WATER MAIN TO CROSS OVER A SEWER, THE WATER MAIN SHALL BE LAID AT SUCH AN ELEVATION THAT THE BOTTOM OF THE WATER MAIN IS AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER, UNLESS LOCAL CONDITIONS OR BARRIERS PREVENT AN 18 INCH VERTICAL SEPARATION; IN WHICH CASE: BOTH THE WATER MAIN AND SEWER SHALL BE CONSTRUCTED OF FERROUS MATERIALS AND WITH JOINTS THAT ARE EQUIVALENT TO WATER MAIN STANDARDS FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING.

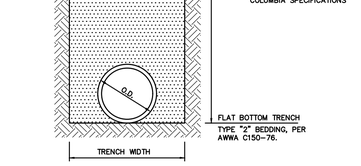
CROSSING A WATER MAIN UNDER A SEWER: WHENEVER IT IS NECESSARY FOR A WATER MAIN TO CROSS UNDER A SEWER, BOTH THE WATER MAIN AND THE SEWER SHALL BE CONSTRUCTED OF FERROUS MATERIALS AND WITH JOINTS EQUIVALENT TO WATER MAIN STANDARDS FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING. A SECTION OF WATER MAIN PIPE SHALL BE CENTERED AT THE POINT OF CROSSING.

LATERAL SEPARATION NOTES

LATERAL SEPARATION OF SEWERS AND WATER MAINS: WATER MAINS SHALL BE LAID AT LEAST 10 FEET LATERALLY FROM EXISTING OR PROPOSED SEWERS, UNLESS LOCAL CONDITIONS OR BARRIERS PREVENT A 10 FOOT LATERAL SEPARATION, IN WHICH CASE: THE WATER MAIN IS LAID IN A SEPARATE TRENCH, WITH THE ELEVATION OF THE BOTTOM OF THE WATER MAIN AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER; OR THE WATER MAIN IS LAID IN THE SAME TRENCH AS THE SEWER WITH THE WATER MAIN LOCATED AT ONE SIDE ON A BENCH OF UNDISTURBED EARTH, AND WITH THE ELEVATION OF THE BOTTOM OF THE WATER MAIN AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER.

UTILITY CROSSING

NTS



DUCTILE IRON PIPE BEDDING & BACKFILLING

NTS

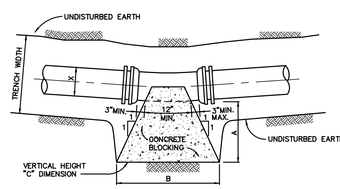
CONCRETE BLOCKING DIMENSIONS					
PIPE SIZE	X	A	B	C	MBA *2 (SQ. FT.)	*1
(■ DENOTES BRANCH SIZE)			TEES			
■ 6"	2'-0"	2'-0"	1'-4"	2.7	0.13
■ 8"	2'-0"	2'-6"	1'-10"	4.6	0.20
■ 10"	2'-6"	3'-6"	2'-0"	7.0	0.39
■ 12"	2'-6"	4'-6"	2'-3"	10.1	0.54
■ 16"	3'-0"	6'-0"	2'-10"	17.0	1.08
■ 18"	3'-0"	7'-0"	3'-0"	21.0	1.33
■ 24"	4'-0"	10'-0"	3'-9"	37.5	3.17
■ 30"	5'-0"	12'-0"	4'-10"	58.0	5.96
			90° BENDS			
6"	2'-0"	2'-9"	1'-3"	3.4	0.16
8"	2'-0"	3'-3"	2'-0"	6.5	0.28
10"	2'-6"	4'-0"	2'-6"	10.0	0.53
12"	2'-6"	5'-0"	2'-9"	13.8	0.73
16"	3'-0"	6'-0"	4'-0"	24.0	1.50
18"	3'-0"	7'-4"	4'-0"	29.3	1.85
24"	4'-0"	12'-0"	4'-5"	53.0	4.94
30"	6'-0"	14'-0"	5'-10"	81.7	9.97
			45° BENDS			
6"	2'-0"	2'-0"	1'-0"	2.0	0.11
8"	2'-0"	2'-6"	1'-5"	3.5	0.17
10"	2'-6"	3'-6"	1'-6"	5.2	0.29
12"	2'-6"	4'-6"	1'-8"	7.5	0.40
16"	3'-0"	6'-0"	2'-2"	13.0	0.80
18"	3'-0"	6'-4"	2'-6"	15.8	1.10
24"	3'-0"	6'-9"	4'-3"	28.7	1.75
30"	3'-6"	9'-3"	4'-9"	43.9	3.22

CONCRETE BLOCKING DIMENSIONS					
PIPE SIZE	X	A	B	C	MBA *2 (SQ. FT.)	*1
			22-1/2° BENDS			
6"	2'-0"	1'-0"	1'-0"	1.0	0.08
8"	2'-0"	1'-9"	1'-0"	1.7	0.11
10"	2'-6"	2'-3"	1'-3"	2.8	0.19
12"	2'-6"	2'-6"	1'-6"	3.7	0.24
16"	3'-0"	3'-0"	2'-3"	6.5	0.48
18"	3'-0"	3'-4"	2'-6"	8.3	0.68
24"	3'-0"	4'-6"	3'-5"	15.4	1.04
30"	3'-6"	5'-0"	4'-6"	22.5	1.93
			11-1/4° BENDS			
6"	2'-0"	1'-0"	0'-6"	0.5	0.06
8"	2'-0"	1'-3"	0'-9"	0.9	0.08
10"	2'-6"	1'-6"	1'-0"	1.5	0.14
12"	2'-6"	2'-0"	1'-0"	2.0	0.17
16"	3'-0"	2'-6"	1'-4"	3.3	0.30
18"	3'-0"	2'-9"	1'-6"	4.1	0.38
24"	3'-0"	3'-3"	2'-3"	7.3	0.65
30"	3'-6"	3'-9"	3'-0"	11.2	1.22
			PLUGS *3			
12"	2'-6"	4'-6"	2'-6"	12.0	1.0

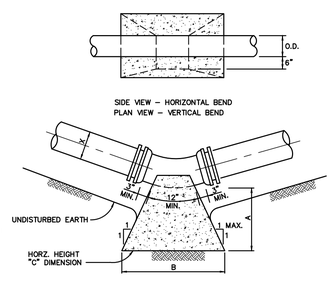
*1 – ESTIMATED C.Y. CONCRETE FOR TEES, BENDS AND PLUGS.
*2 – MINIMUM BEARING AREA (MBA) IS BASED ON SOIL BEARING CAPACITY OF 2000 PSF.
*3 – PLACE 6MIL POLYETHYLENE OVER PLUG PRIOR TO POURING CONCRETE

THRUST BLOCK DETAILS

NTS

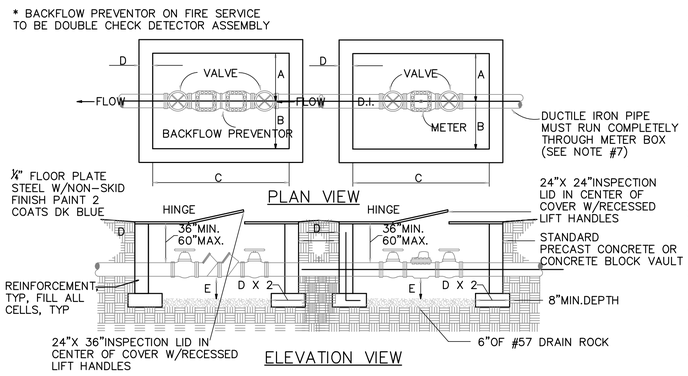


HORIZONTAL BLOCKING DETAIL



VERTICAL BLOCKING DETAIL

NTS



NOTES:
1. METER BOXES FOR METERS 3" AND ABOVE SHALL BE CONSTRUCTED OF THE MATERIALS AND TO THE DIMENSIONS SPECIFIED HEREIN.
2. METER BOXES CONSTRUCTED WITHIN THE TRAVELED WAY MUST WITHSTAND HEAVY SUPER-IMPOSED LOADS. EACH MUST BE DESIGNED TO MEET THE REQUIREMENTS OF THE INDIVIDUAL ENVIRONMENT IN WHICH IT IS TO BE USED. DETAILS/SHOP DRAWINGS AND DESIGN CALCULATIONS MUST BE SUBMITTED AND APPROVED PRIOR TO INSTALLATION OF THE METER.
3. METER BOXES SHALL BE PROVIDED WITH A COVER FABRICATED FROM ONE FOURTH (1/4") INCH THICK FLOOR PLATE STEEL WITH A NON-SKID SURFACE PRIMED AND PAINTED TO COVER ENTIRE BOX. COVERS MUST HAVE A HINGED 24" x 24" INSPECTION LID IN THE CENTER OF THE COVER WITH LIFT HANDLES FOR MANIPULATING THE LID. COVER HANDLES MUST LAY FLAT AND BELOW SURFACE COVER.
4. THE BOX COVER SHALL BE FLUSH WITH THE SURROUNDING GROUND SURFACE AND SHALL HAVE 2" GUIDES ALONG ADJACENT SIDES TO PREVENT LATERAL MOVEMENT.
5. THE BOX SHALL BE CONSTRUCTED OF PRECAST CONCRETE STANDARD BRICK, OR CONCRETE BLOCK USING PORTLAND CEMENT MORTAR IN A STANDARD MIXTURE.
6. SIX (6") INCHES OF #5 CRUSHED STONE SHALL BE PLACED IN THE BOTTOM OF EACH BOX. SEE "E" FOR PROPER CLEARANCE BETWEEN THE TOP OF STONE AND THE BOTTOM OF THE PIPE.
7. DUCTILE IRON PIPE MUST RUN COMPLETELY THROUGH METER BOX. METER SHALL BE INSTALLED (CUT-IN) BY LCJMWSC.
8. VALVE WITH BOX SHALL BE INSTALLED BETWEEN METER BOX AND SOURCE WATER MAIN.
9. ALL METER BOXES SHALL HAVE THE DIMENSIONS SHOWN BY THE ABOVE TABLE.

BACKFLOW AND METER VAULT

NTS

Jumper
Carter
Sease
ARCHITECTS
412 Meeting Street
West Columbia
South Carolina

RIVERBANKS ZOO & GARDEN
PHASE III - EDUCATION CENTER
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

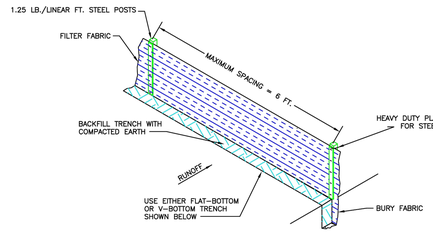
No	Description	Date

DESIGN DOCS

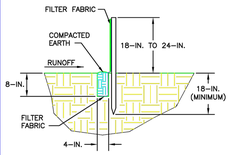
DRAWN BY: RPJ
CHECKED BY: JCS
COMM NO: 2337
DATE: AUG 13, 2024

SHEET TITLE: WATER DETAILS

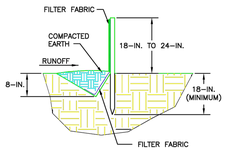
SHEET NO: C452



SILT FENCE INSTALLATION



FLAT-BOTTOM TRENCH DETAIL



V-SHAPED TRENCH DETAIL

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 1 of 2

APPROVED BY: SCDHEC — AUGUST, 2005 DATE

SILT FENCE DETAIL

Where and Where to Use It

Silt fence is applicable in areas:

Where the maximum sheet or overland flow path length to the fence is 100-feet.
Where the maximum slope steepness (normal [perpendicular] to fence line) is 2H:1V.
That do not receive concentrated flows greater than 0.5 cfs.

Do not place silt fence across channels or use it as a velocity control BMP.

Materials

Steel Posts
Use 48-inch long steel posts that meet the following minimum physical requirements:
Composed of high strength steel with minimum yield strength of 50,000 psi.
Have a standard "T" section with a nominal face width of 1.38-inches and nominal "T" length of 1.48-inches.
Weigh 1.25 pounds per foot (± 8%).
Have a soil stabilization plate with a minimum cross section area of 17-square inches attached to the steel posts.
Painted with a water based baked enamel paint.

Use steel posts with a minimum length of 4-feet, weighing 1.25 pounds per linear foot (± 8%) with projections to aid in fastening the fabric. Except when heavy clay soils are present on site, steel posts will have a metal soil stabilization plate welded near the bottom such that when the post is driven to the proper depth, the plate will be below the ground level for added stability.
The soil plates should have the following characteristics:
Be composed of minimum 15 gauge steel.
Have a minimum cross section area of 17-square inches.

Geotextile Filter Fabric
Filter fabric is:
Composed of fibers consisting of long chain synthetic polymers composed of at least 85% by weight of polyolefins, polyesters, or polyamides. Formed into a network such that the filaments or yarns retain dimensional stability relative to each other. Free of any treatment or coating which might adversely alter its physical properties after installation. Free of defects or flaws that significantly affect its physical and/or filtering properties. Cut to a minimum width of 36 inches.

Use only fabric appearing on SCDOT Approval Sheet #34 meeting the requirements of the most current edition of the SCDOT Standard Specifications for Highway Construction.

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 2 of 3

APPROVED BY: SCDHEC — AUGUST, 2005 DATE

SILT FENCE DETAIL

Installation
Excavate a trench approximately 6-inches wide and 6-inches deep when placing fabric by hand. Place 12-inches of geotextile fabric into the 6-inch deep trench, extending the remaining 6-inches towards the upslope side of the trench. Backfill the trench with soil or gravel and compact.Bury 12-inches of fabric into the ground when pneumatically installing silt fence with a slicing method. Purchase fabric in continuous rolls and cut to the length of the barrier to avoid joints. When joints are necessary, wrapped the fabric together at a support post with both ends fastened to the post, with a 6-inch minimum overlap. Install posts to a minimum depth of 24-inches. Install posts a minimum of 1- to 2- inches above the fabric, with no more than 3-feet of the post above the ground. Space posts to maximum 6-feet centers. Attach fabric to wood posts using staples made of heavy-duty wire at least 1½-inch long, spaced a maximum of 6-inches apart. Staple a 2-inch wide lathe over the filter fabric to securely fasten it to the upslope side of wooden posts. Attach fabric to the steel posts using heavy-duty plastic ties that are evenly spaced and placed in a manner to prevent sagging or tearing of the fabric. In call cases, ties should be affixed in no less than 4 places. Install the fabric a minimum of 24-inches above the ground. When necessary, the height of the fence above ground may be greater than 24-inches. In tidal areas, extra silt fence height may be required. The post height will be twice the exposed post height. Post spacing willremain the same and extra height fabric will be 4-, 5-, or 6-feet tall. Locate silt fence checks every 100 feet maximum and at low points. Install the fence perpendicular to the direction of flow and place the fence the proper distance from the toe of steep slopes to provide sediment storage and access for maintenance and cleanout.

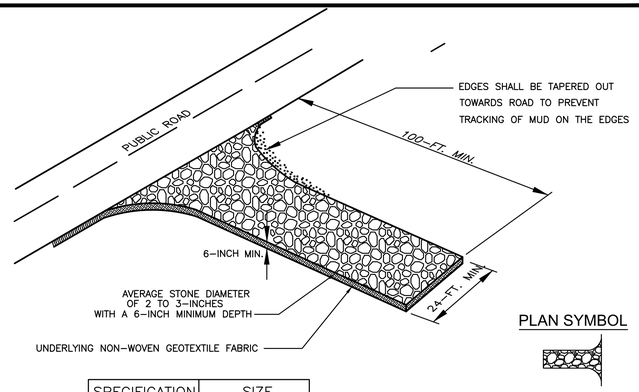
Inspection and Maintenance
Inspect every seven calendar days and within 24-hours after each rainfall event that produces ½-inches or more of precipitation. Check for sediment buildup and fence integrity. Check where runoff has eroded a channel beneath the fence, or where the fence has sagged or collapsed by fence overtopping.
If the fence fabric tears, begins to decompose, or in any way becomes ineffective, replace the section of fence immediately.
Remove sediment accumulated along the fence when it reaches 1/3 the height of the fence, especially if heavy rains are expected.
Remove trapped sediment from the site or stabilize it on site.
Remove silt fence within 30 days after final stabilization is achieved or after temporary best management practices (BMPs) are no longer needed.
Permanently stabilize disturbed areas resulting from fence removal.

South Carolina Department of Health and Environmental Control

SILT FENCE

STANDARD DRAWING NO. SC-03 Page 3 of 3

APPROVED BY: SCDHEC — AUGUST, 2005 DATE



PLAN SYMBOL

SPECIFICATION	SIZE
ROCK PAD THICKNESS	6 INCHES
ROCK PAD WIDTH	24 FEET
ROCK PAD LENGTH	100 FEET
ROCK PAD STONE SIZE	D = 2-3 INCHES

South Carolina Department of Health and Environmental Control

CONSTRUCTION ENTRANCE

STANDARD DRAWING NO. SC-06 PAGE 1 of 2

NOT TO SCALE — FEBRUARY 2014 DATE

CONSTRUCTION ENTRANCE - GENERAL NOTES

1. Stabilized construction entrances should be used at all points where traffic will egress/ingress a construction site onto a public road or any impervious surfaces, such as parking lots.
2. Install a non-woven geotextile fabric prior to placing any stone.
3. Install a culvert pipe across the entrance when needed to provide positive drainage.
4. The entrance shall consist of 2-inch to 3-inch D50 stone placed at a minimum depth of 6-inches.
5. Minimum dimensions of the entrance shall be 24-feet wide by 100-feet long, and may be modified as necessary to accommodate site constraints.
6. The edges of the entrance shall be tapered out towards the road to prevent tracking at the edge of the entrance.
7. Divert all surface runoff and drainage from the stone pad to a sediment trap or basin or other sediment trapping structure.
8. Limestone may not be used for the stone pad.

CONSTR. ENTRANCE - INSPECTION & MAINTENANCE

1. The key to functional construction entrances is weekly inspections, routine maintenance, and regular sediment removal.
2. Regular inspections of construction entrances shall be conducted once every calendar week and, as recommended, within 24-hours after each rainfall even that produces 1/2-inch or more of precipitation.

   3.During regular inspections, check for mud and sediment buildup and pad integrity. Inspection frequencies may need to be more frequent during long periods of wet weather.
4. Reshape the stone pad as necessary for drainage and runoff control.
5. Wash or replace stones as needed and as directed by site inspector. The stone in the entrance should be washed or replaced whenever the entrance fails to reduce the amount of mud being carried off-site by vehicles. Frequent washing will extend the useful life of stone pad.

   6.Immediately remove mud and sediment tracked or washed onto adjacent impervious surfaces by brushing or sweeping. Flushing should only be used when the water can be discharged to a sediment trap or basin.
7. During maintenance activities, any broken pavement should be repaired immediately.
8. Construction entrances should be removed after the site has reached final stabilization. Permanent vegetation should replace areas from which construction entrances have been removed, unless area will be converted to an impervious surface to serve post-construction.

South Carolina Department of Health and Environmental Control

CONSTRUCTION ENTRANCE

STANDARD DRAWING NO. SC-06 PAGE 2 of 2

GENERAL NOTES — FEBRUARY 2014 DATE

Jumper Carter Sease

ARCHITECTS

412 Meeting Street
West Columbia
South Carolina

SOUTH CAROLINA JACKSON REGISTERED ARCHITECT CERTIFICATION

NOT FOR CONSTRUCTION

GERARD P. JACKSON II

RIVERBANKS ZOO & GARDEN
PHASE III - EDUCATION CENTER
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

DESIGN DOCS

DRAWN BY: RPJ

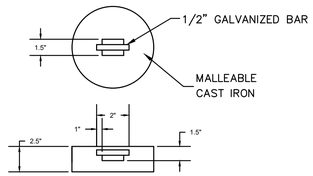
CHECKED BY: JCS

COMM NO: 2337

DATE: AUG 13, 2024

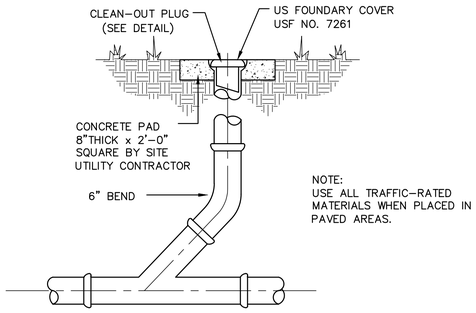
SHEET TITLE: EROSION CONTROL DETAILS

SHEET NO: C453



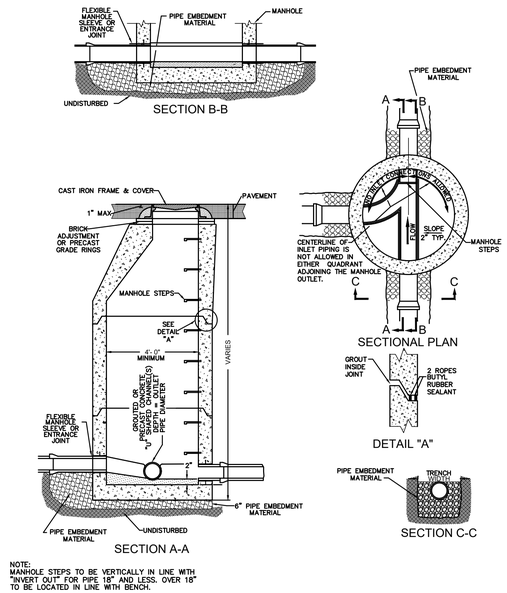
CLEANOUT PLUG DETAIL

NTS



SEWER CLEANOUT DETAIL

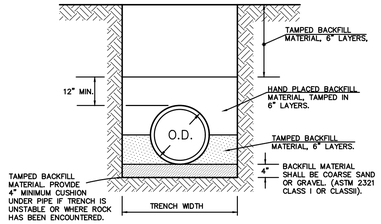
NTS



NOTE:
MANHOLE STEPS TO BE VERTICALLY IN LINE WITH "INVERT OUT" FOR PIPE 18" AND LESS. OVER 18" TO BE LOCATED IN LINE WITH BENCH.

SEWER MANHOLE DETAIL

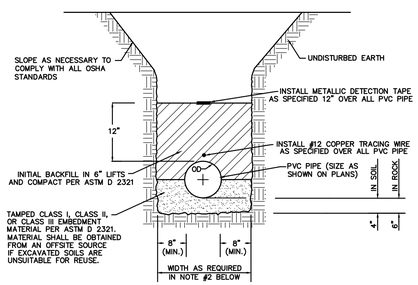
NTS



THE PIPE IS TO BE BEDDED IN COMPACTED 6" LAYERS TO THE SPRING LINE FIRST, THEN BACKFILLED WITH HAND PLACED MATERIAL COMPACTED IN 6" LAYERS TO A DEPTH OF 12" MINIMUM ABOVE THE PIPE.

PVC PIPE BEDDING AND BACKFILLING DETAIL

NTS

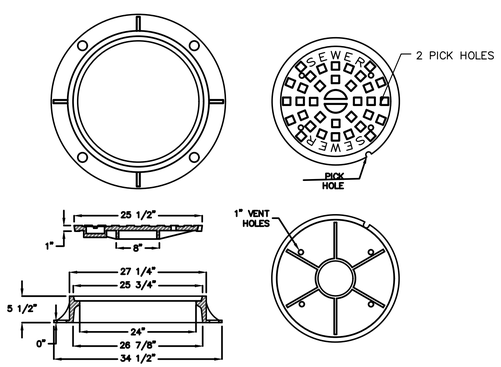


PVC WATERLINE TRENCH DETAIL

NTS

NOTES:

1. WHERE THE TRENCH WILL BE WITHIN THREE FEET OF THE EDGE OF THE EXISTING PAVEMENT, FLOWABLE FILL MAY BE REQUIRED FOR BACKFILL MATERIAL. CONSULT ENCROACHMENT PERMITS FOR SPECIFIC REQUIREMENTS.
2. MINIMUM WIDTH SHALL BE NOT LESS THAN THE GREATER OF EITHER THE PIPE OUTSIDE DIAMETER PLUS 16 IN. OR THE PIPE OUTSIDE DIAMETER TIMES 1.25 PLUS 12 IN.
3. NO BOULDERS OR STONES WILL BE USED IN INTIAL BACKFILL OR 2 FEET ABOVE TOP OF PIPE.
4. PVC PIPE NOT ALLOWED WITH LESS THAN 3'-0" COVER.



CASTINGS MEET AASHTO M306
H-20 LOADING.
CASTINGS ARE COATED WITH ASPHALTIC BASED PAINT.
APPROX. WEGHT: 290 LBS.

CROSSING NOTES

CROSSING A WATER MAIN OVER A SEWER: WHENEVER IT IS NECESSARY FOR A WATER MAIN TO CROSS OVER A SEWER, THE WATER MAIN SHALL BE LAID AT SUCH AN ELEVATION THAT THE BOTTOM OF THE WATER MAIN IS AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER, UNLESS LOCAL CONDITIONS OR BARRIERS PREVENT AN 18 INCH VERTICAL SEPARATION; IN WHICH CASE: BOTH THE WATER MAIN AND SEWER SHALL BE CONSTRUCTED OF FERROUS MATERIALS AND WITH JOINTS THAT ARE EQUIVALENT TO WATER MAIN STANDARDS FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING.

CROSSING A WATER MAIN UNDER A SEWER: WHENEVER IT IS NECESSARY FOR A WATER MAIN TO CROSS UNDER A SEWER, BOTH THE WATER MAIN AND THE SEWER SHALL BE CONSTRUCTED OF FERROUS MATERIALS AND WITH JOINTS EQUIVALENT TO WATER MAIN STANDARDS FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING. A SECTION OF WATER MAIN PIPE SHALL BE CENTERED AT THE POINT OF CROSSING.

LATERAL SEPARATION NOTES

LATERAL SEPARATION OF SEWERS AND WATER MAINS: WATER MAINS SHALL BE LAID AT LEAST 10 FEET LATERALLY FROM EXISTING OR PROPOSED SEWERS, UNLESS LOCAL CONDITIONS OR BARRIERS PREVENT A 10 FOOT LATERAL SEPARATION, IN WHICH CASE: THE WATER MAIN IS LAID IN A SEPARATE TRENCH, WITH THE ELEVATION OF THE BOTTOM OF THE WATER MAIN AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER; OR THE WATER MAIN IS LAID IN THE SAME TRENCH AS THE SEWER WITH THE WATER MAIN LOCATED AT ONE SIDE ON A BENCH OF UNDISTURBED EARTH, AND WITH THE ELEVATION OF THE BOTTOM OF THE WATER MAIN AT LEAST 18 INCHES ABOVE THE TOP OF THE SEWER.

UTILITY CROSSING

NTS

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Carter
Sease
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SOUTH CAROLINA REGISTERED LANDSCAPE ARCHITECT JACKSON

NOT FOR CONSTRUCTION

RICHARD P. JACKSON, II

RIVERBANKS ZOO & GARDEN
PHASE III - EDUCATION CENTER
500 WILDLIFE PARKWAY
COLUMBIA, SC 29202

No	Description	Date

DESIGN DOCS

DRAWN BY: RPJ

CHECKED BY: JCS

COMM NO: 2337

DATE: AUG 13, 2024

SHEET TITLE: SEWER DETAILS

SHEET NO: C454

Riverbanks Gondola

Riverbanks Zoo
South Carolina

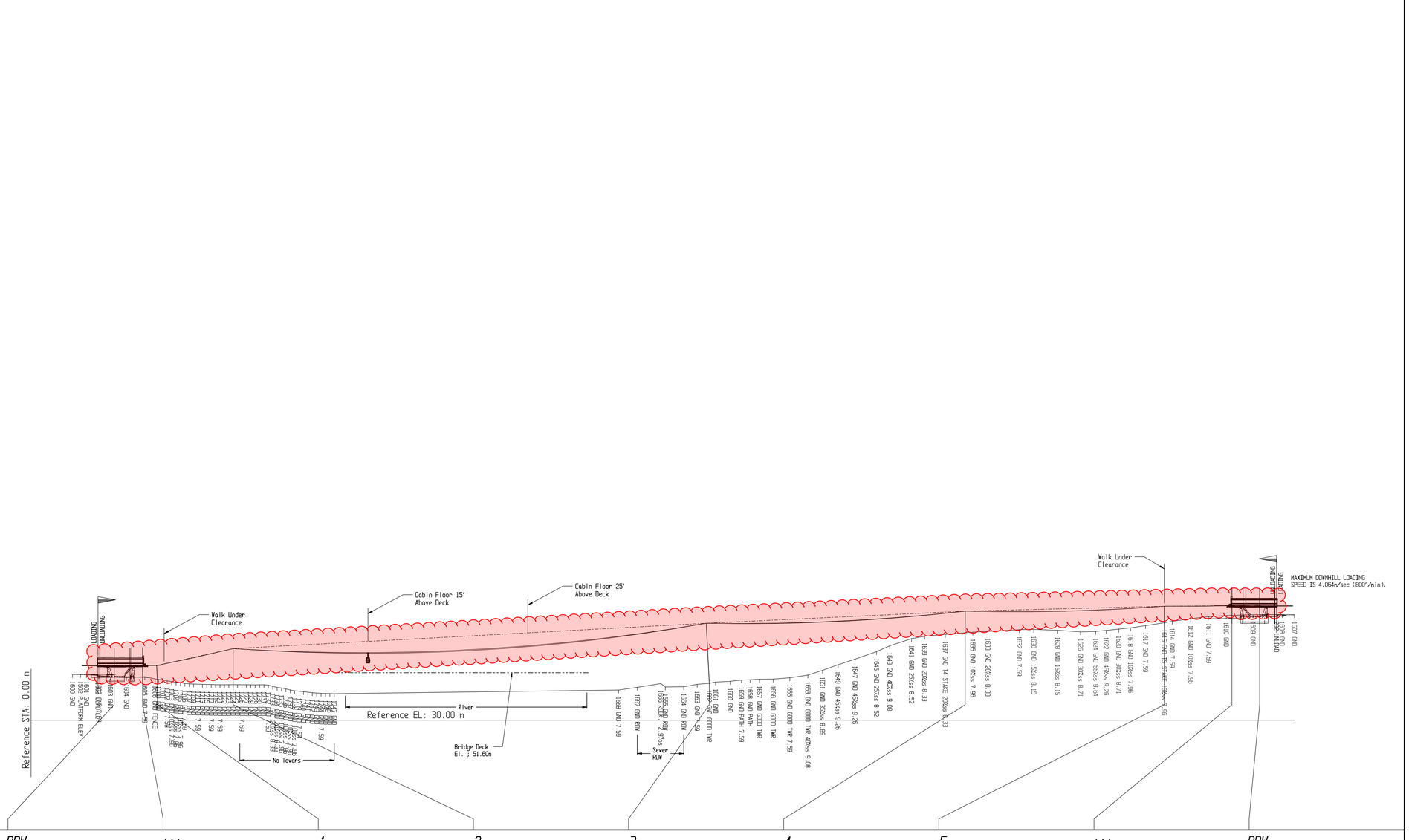
Leitner-Poma of America, Inc. - 2746 Seeber Drive - Grand Junction, CO, USA 81506
P (970) 241-4442 - F (970) 241-3023 - www.leitner-poma.com

PROFILE DATA

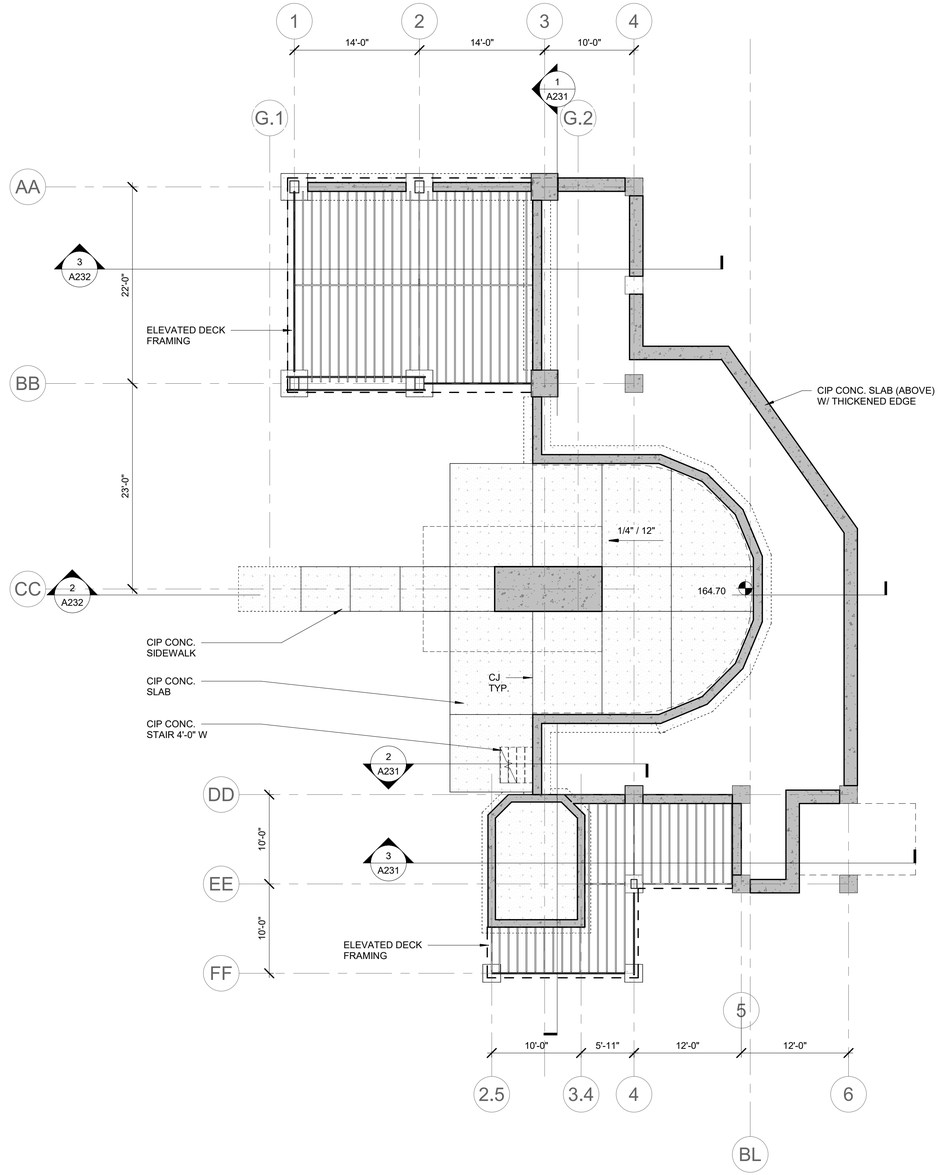
			INITIAL	FINAL
LIFT MODEL:	LPA32TG			
ROTATION:	CCW	SPEED:	4.06 m/s	4.06 m/s
CARRIER TYPE:	8 Pl Gondola	CAPACITY UP:	1000.00 pph	1500.00 pph
GRIP TYPE:	DETACHABLE	CAPACITY DOWN:	100.00 %	100.00 %
CABLE DIAMETER:	42.00 mm	SPACING:	117.04 m	78.03 m
SLOPE LENGTH:	522.06 m	INTERVAL:	28.80 sec	19.20 sec
VERTICAL RISE:	27.18 m	CARRIERS:	13	19
AVERAGE GRADE:	5.21 %	TRIP TIME:	2.17 min	2.17 min
LINE GAUGE:	5.60 m	TENSION PRESSURE:	199.67 bars	199.67 bars
DRIVE LOCATION:	TOP	TENSION FORCE:	43000.00 daN	43000.00 daN
TENSION LOCATION:	BOTTOM	ORIGIN OF SURVEY:	C. Firsching	

E											
D											
C											
B											
A											

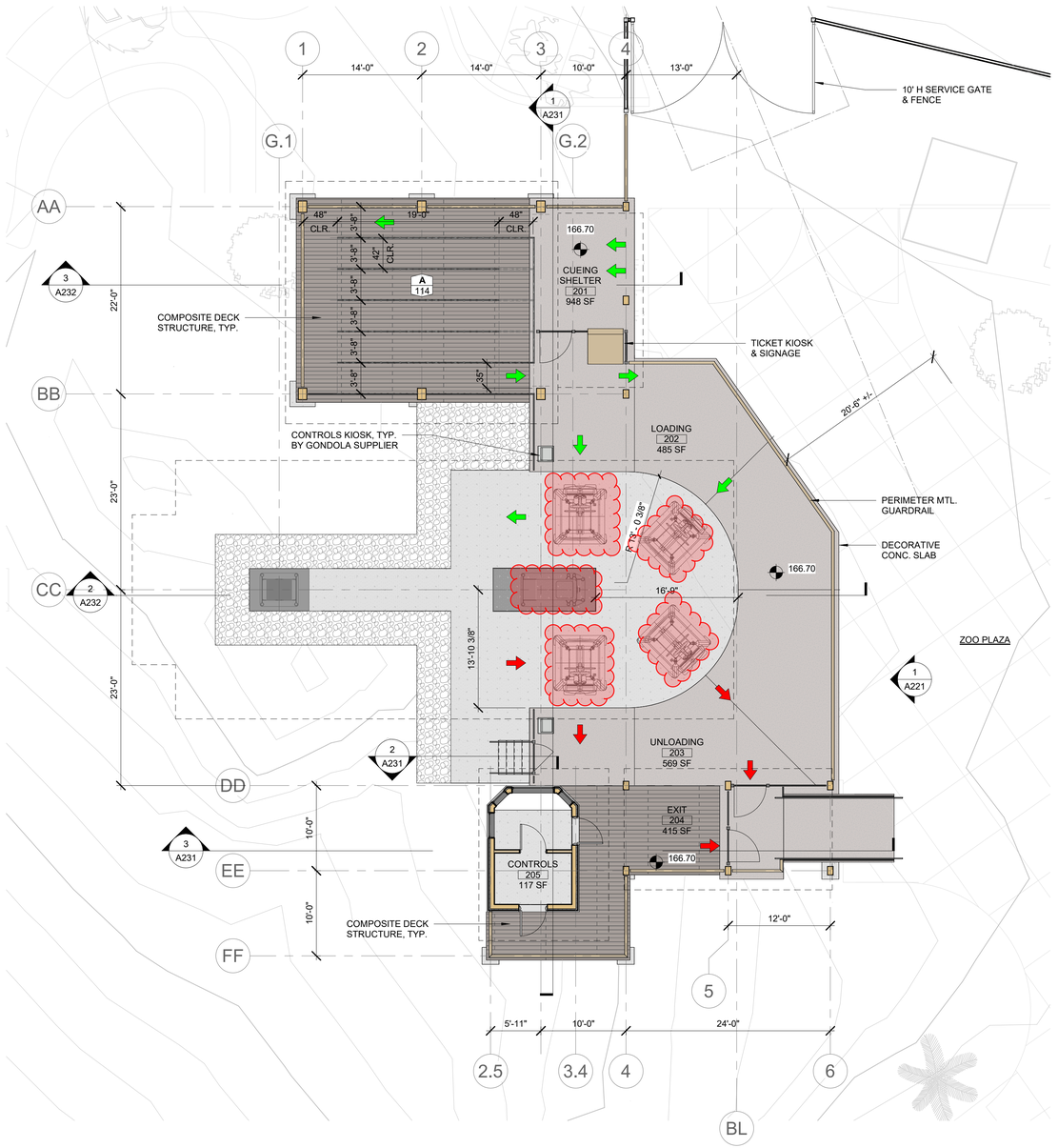
DRAWN BY: B. Shepardson	P52346fb	CHECKED BY:
DATE: February 2024		SCALE: 1/1000 1/100



	TOWER NUMBER		RBW	***	1	2	3	4	5	***	DBW
LAYOUT	TOP OF CONCRETE STATION	(m)	-----	-----	57.47	91.95	308.68	425.15	515.75	-----	-----
	TOP OF CONCRETE ELEVATION	(m)	-----	-----	48.81	46.36	46.96	69.96	74.54	-----	-----
	SLOPE DISTANCE BETWEEN TOWERS	(m)	----	----	34.57	216.73	118.72	90.72	----	----	
TOWERS	TOWER TUBE LENGTH	(m)	0.00	0.00	6.08	16.22	27.19	9.67	7.33	0.00	0.00
	INCLINATION	(%)	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00
	LINE GAUGE	(m)	RETURN BWD = 4.00	5.60	5.60	5.60	5.60	5.60	5.60	5.60	DRIVE BWD = 4.20
	UPHILL LINE EQUIPMENT		---	---	12C	12S	6S	6S	4S	---	---
	DOWNHILL LINE EQUIPMENT		---	---	12C	12S	6S	6S	4S	---	---
	FOUNDATION DRAWING NUMBER		---	---	---	---	---	---	---	---	---



2 A201 EAST TERMINAL SLAB PLAN
1/8" = 1'-0"



1 A201 EAST TERMINAL FLOOR PLAN
1/8" = 1'-0"

REFERENCE ELEVATION NOTE

1. REFERENCE ELEVATIONS SHOWN FOR A200 SERIES ARE RELATIVE TO SURVEYED/CIVIL ELEVATIONS AS FOLOWS:
2. REFERENCE ELEVATION 00.00' = CIVIL 166.70'
3. ALL GRADING INFORMATION IS SHOWN FOR REFERENCE ONLY UNO AND MUST BE CONFIRMED WITH ST DWGS.

RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
EXHIBIT DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
833 chestnut st, ste 909
philadelphia, pa 19107
34921 calle del sol
capistrano beach, ca 92624
215.564.0250

Civil Engineer
Jackson Civil Engineering, LLC.
221 Powell Drive
Lexington, SC 29072
t: 803.603.8539

Structural Engineer
Johnson & King Engineers
1223 Elmwood Avenue
Columbia, SC 29201
t: 803.779.8830

Mechanical Engineer
MECA Consulting Associates
2330 Main Street
Columbia, SC 29201
t: 803.765.9421

Electrical Engineer
Sims Group Engineers, Inc.
800 Columbiana Drive, Suite 208
Irmo, SC 29063
t: 803.765.1007

Seal:

NOT FOR CONSTRUCTION

PROGRESS SET
10-01-2024

Revisions:

No.	Description	Date

Sheet Title

GONDOLA STATION EAST TERMINAL PLANS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

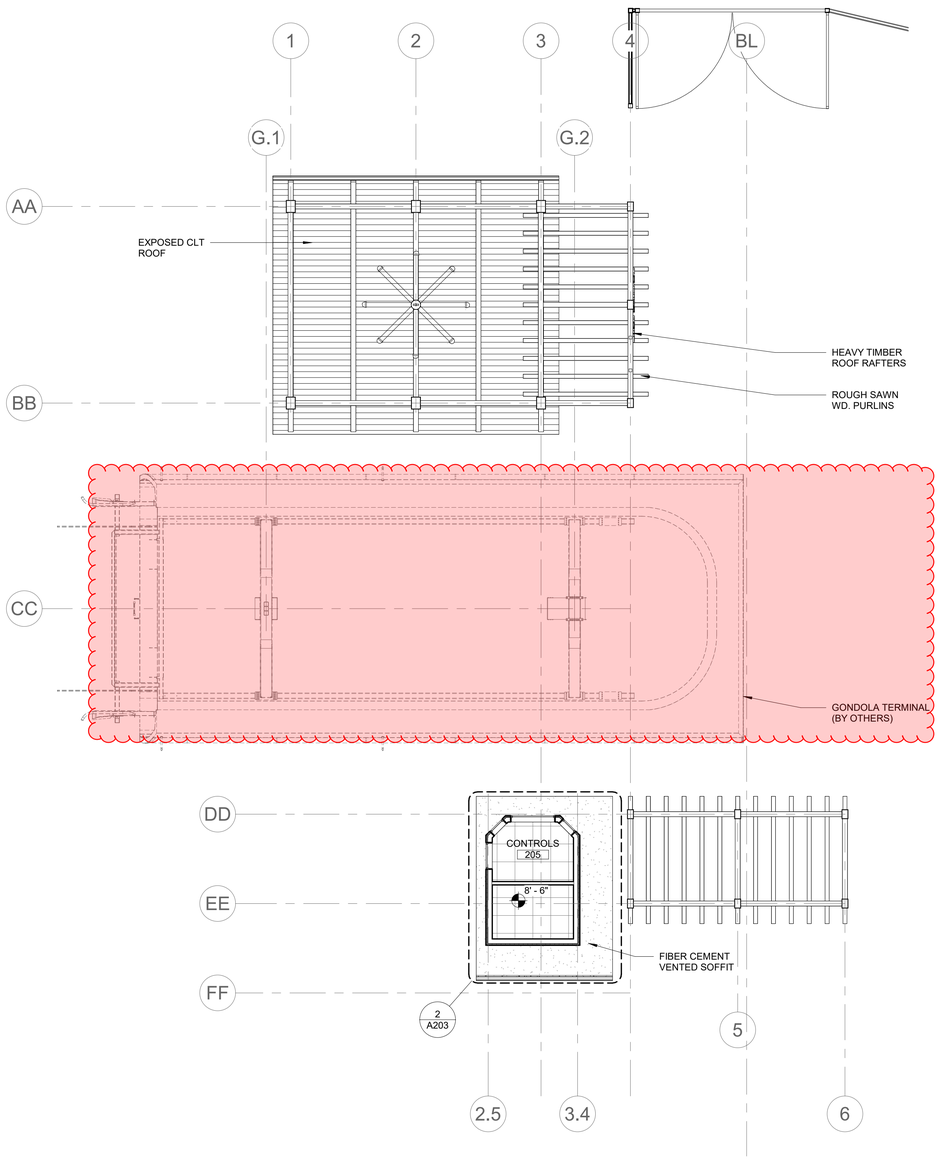
Date: 10-01-2024

Scale: As indicated

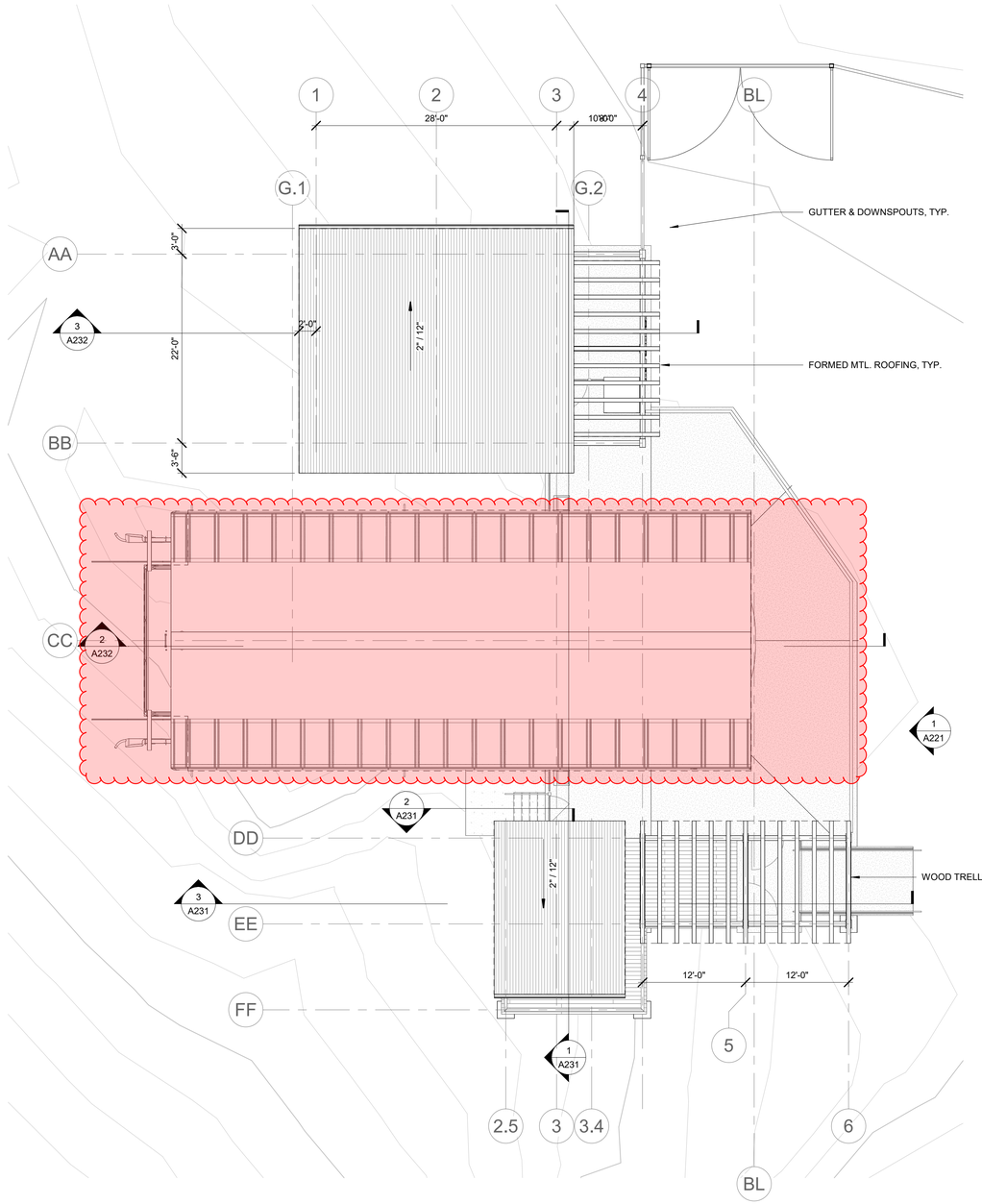
0 ft 2 4 8

Sheet No.

A201



2 A202 EAST TERMINAL REFLECTED CEILING PLAN
1/8" = 1'-0"



1 A202 EAST TERMINAL ROOF PLAN
1/8" = 1'-0"

RIVERBANKS ZOO & GARDEN
columbia♥south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
EXHIBIT DESIGN
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Mechanical Engineer
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Revisions:

No.	Description	Date

Sheet Title

GONDOLA STATION EAST TERMINAL PLANS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: Author | Checked: Checker

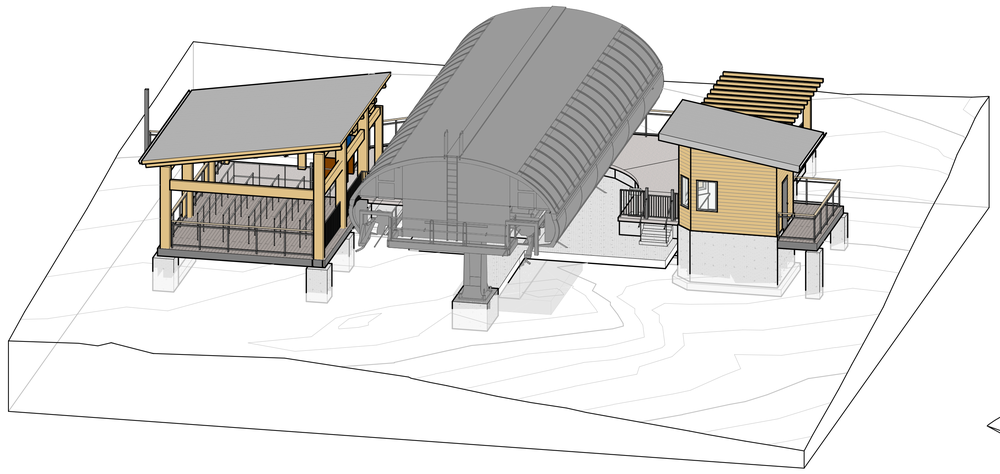
Date: 10-01-2024

Scale: 1/8" = 1'-0"

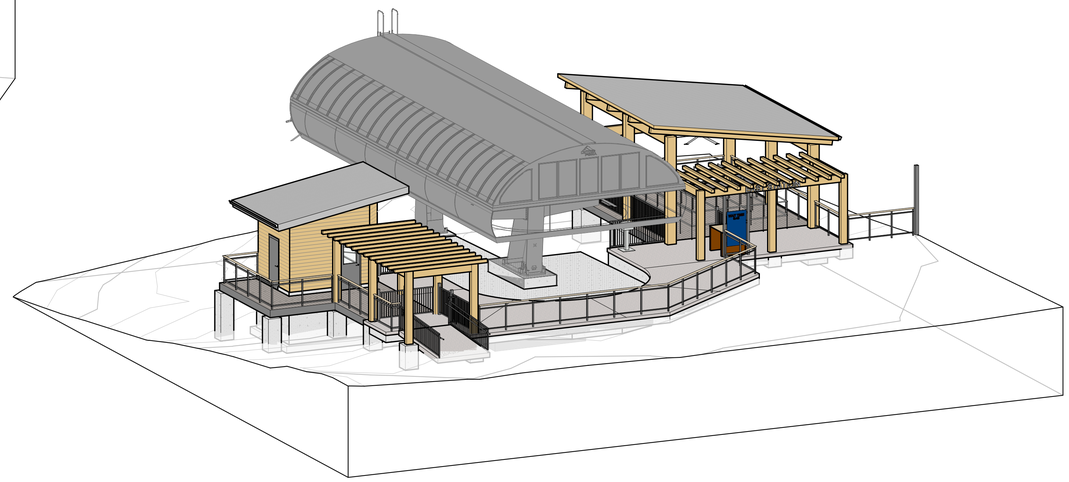
0 ft 2 4 8

Sheet No.

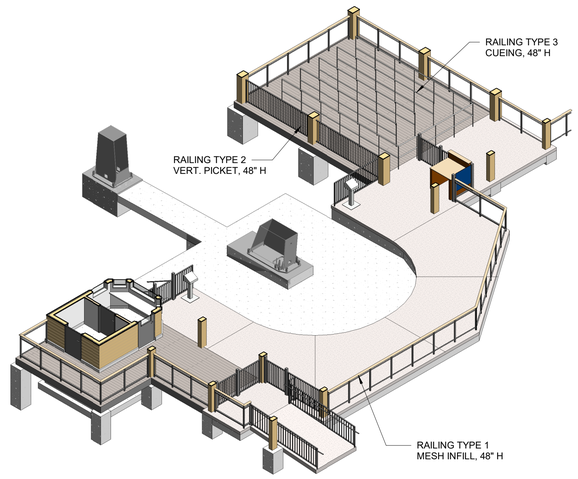
A202



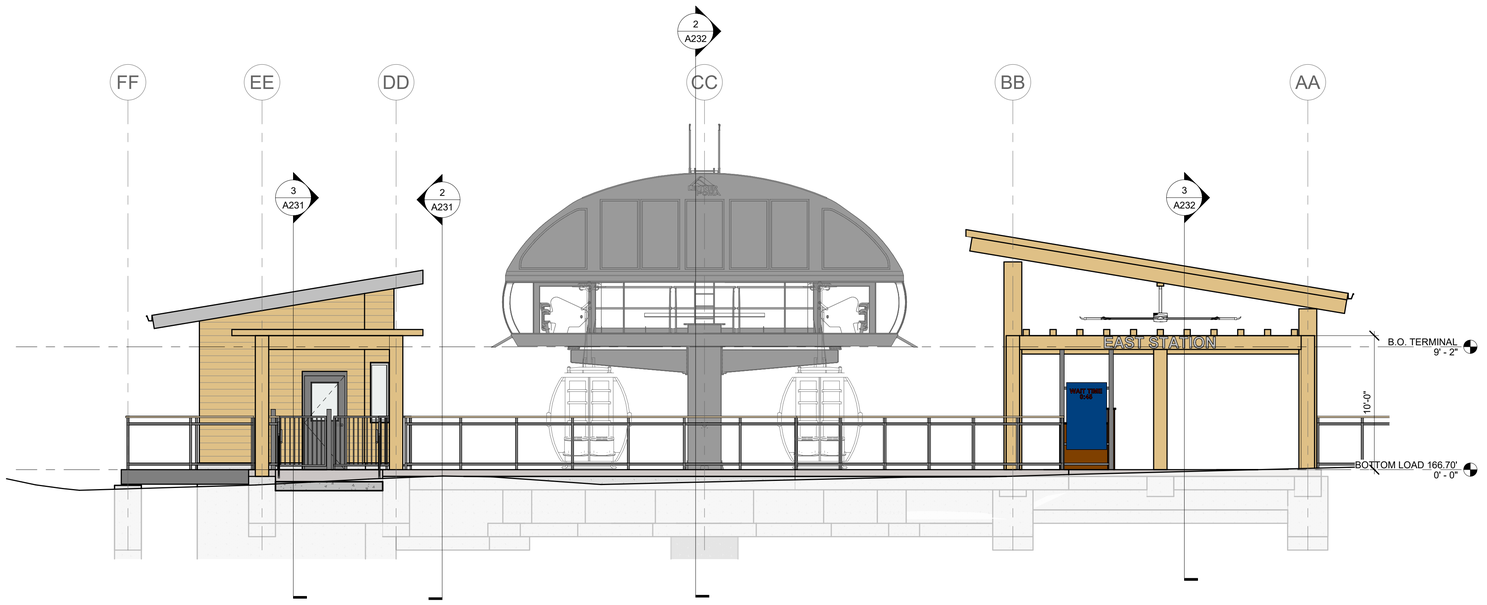
4 A221 EAST TERMINAL 3D VIEW 2



3 A221 EAST TERMINAL 3D VIEW 1



2 A221 EAST TERMINAL PLATFORM 3D VIEW



1 A221 EAST TERMINAL ELEVATION
3/16" = 1'-0"

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No.	Description	Date

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GONDOLA STATION EAST TERMINAL ELEVATION & 3D VIEWS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

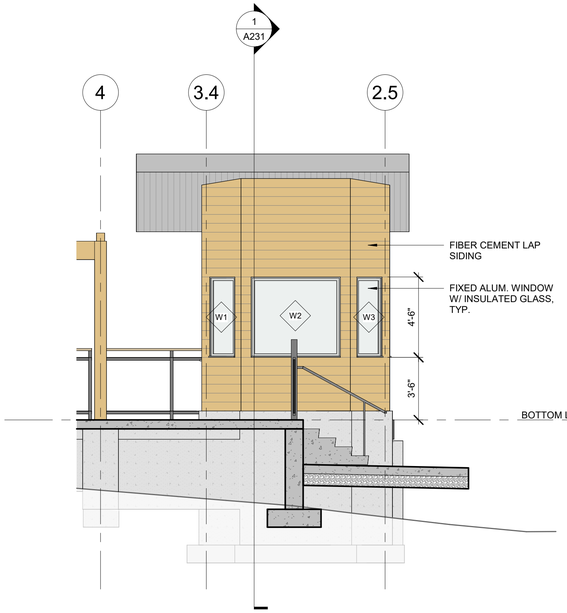
Date: 10-01-2024

Scale: 3/16" = 1'-0"

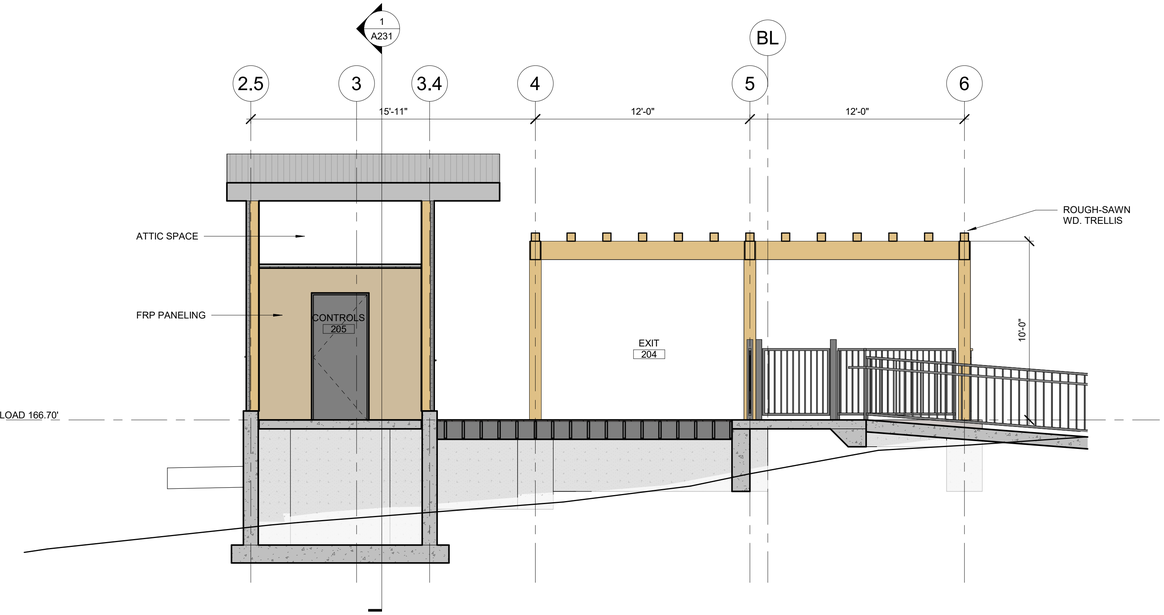
0 ft 2 4 8

Sheet No.

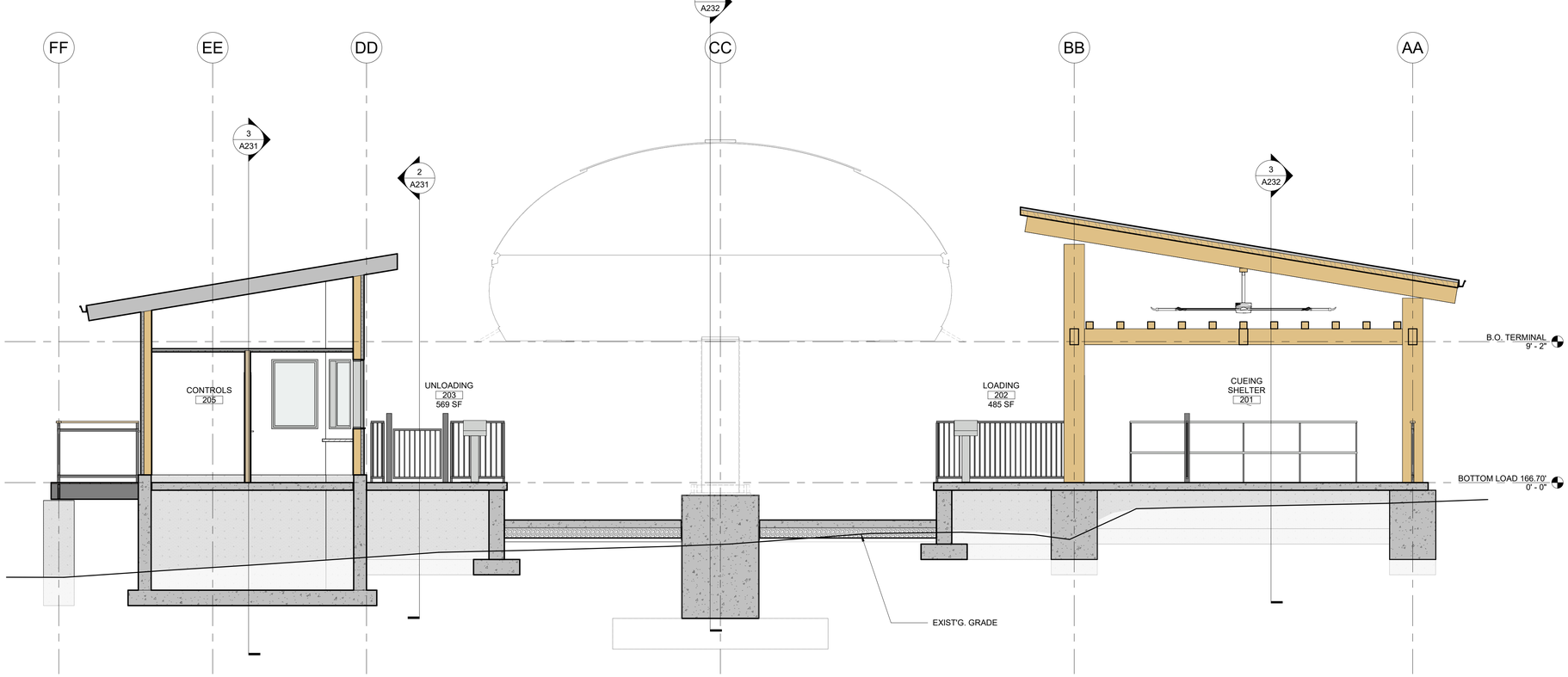
A221



2 A231 SECTION THRU STAIR
1/4" = 1'-0"



3 A231 SECTION THRU UNLOADING PLATFORM
1/4" = 1'-0"



1 A231 CROSS-SECTION THRU TERMINAL PLATFORM
1/4" = 1'-0"

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GONDOLA STATION EAST TERMINAL SECTIONS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: Author | Checked: Checker

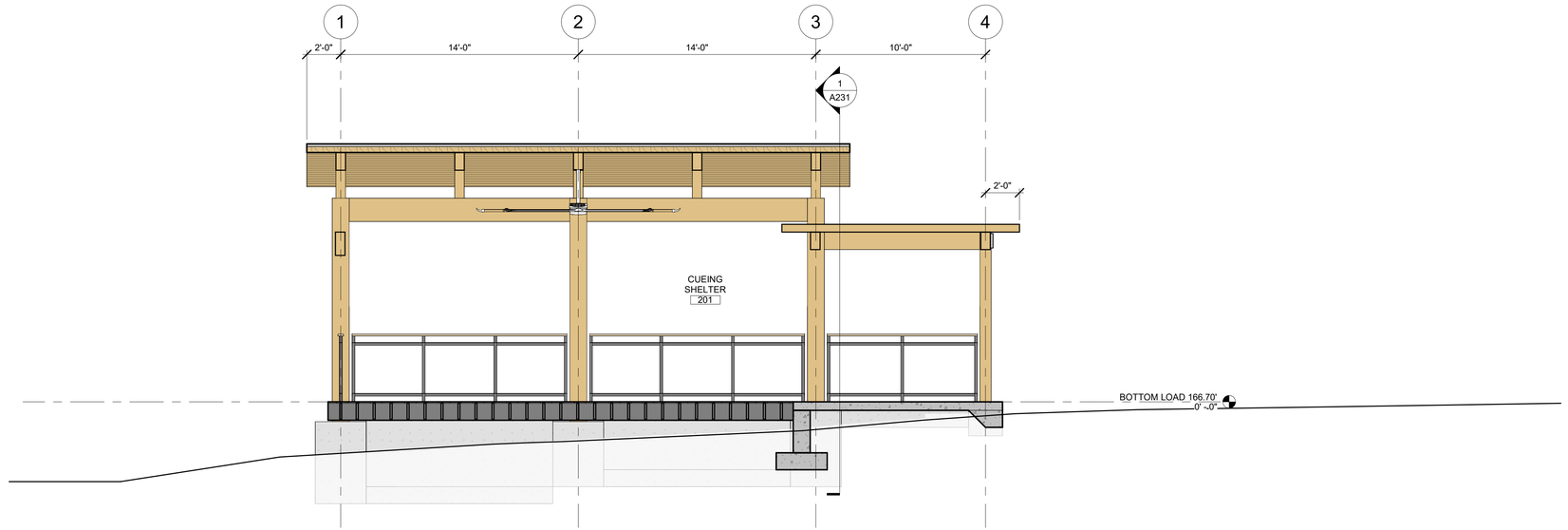
Date: 10-01-2024

Scale: 1/4" = 1'-0"

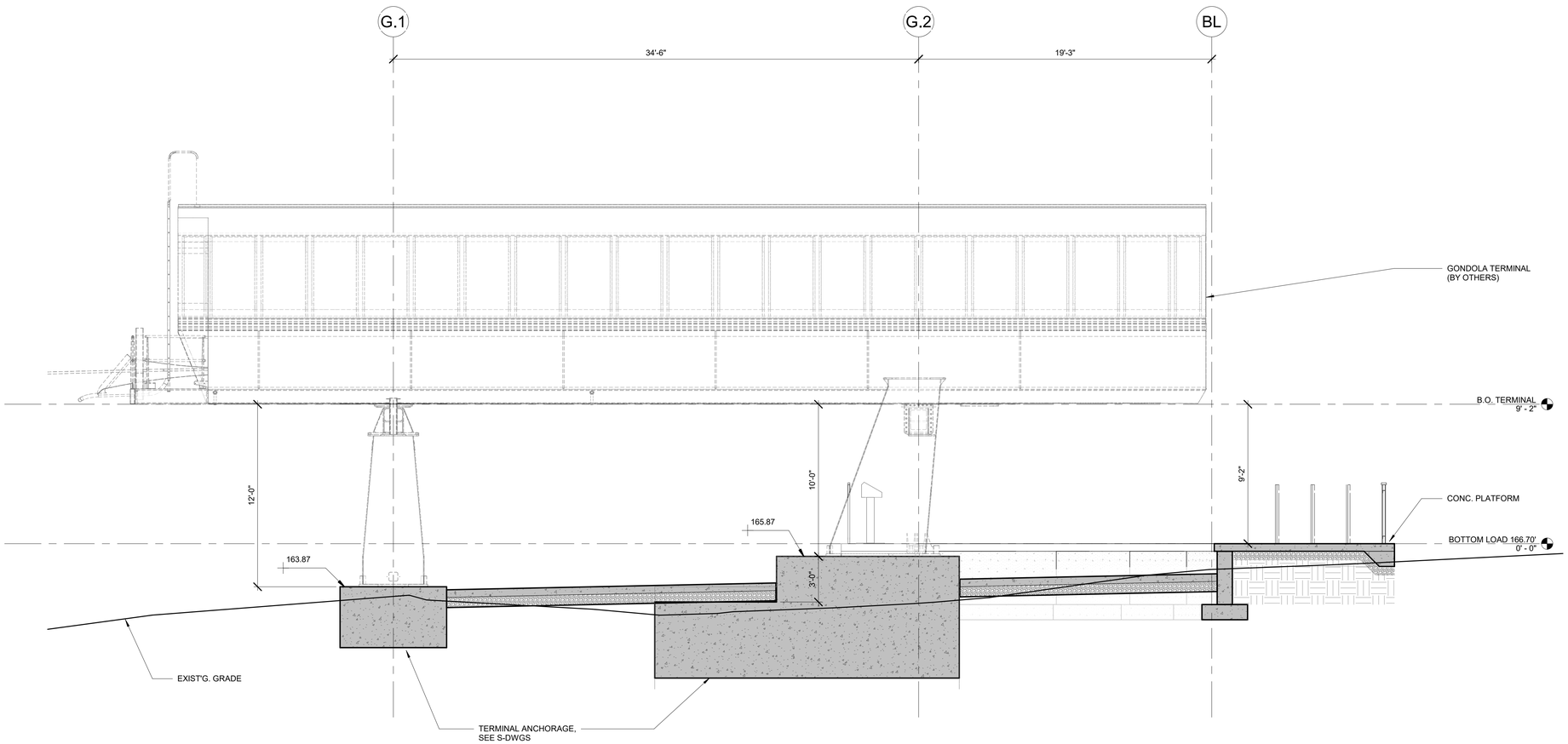
0 ft 2 4 8

Sheet No.

A231



3 A232 SECTION THRU CUEING SHELTER
1/4" = 1'-0"



2 A232 SECTION THRU END TERMINAL
1/4" = 1'-0"

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Sheet Title

GONDOLA STATION EAST TERMINAL SECTIONS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

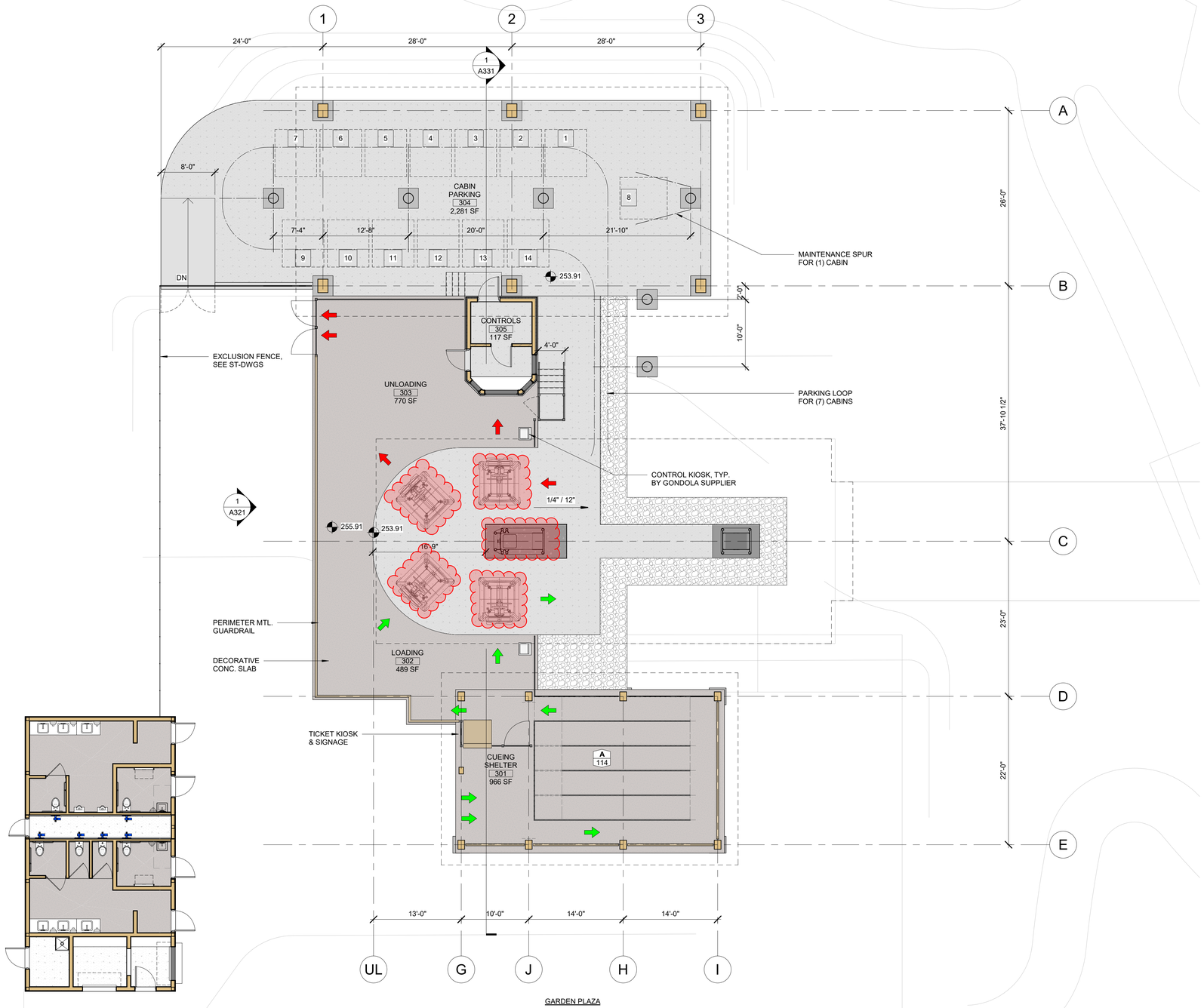
Date: 10-01-2024

Scale: 1/4" = 1'-0"

0 ft 2 4 8

Sheet No.

A232



1 A301 WEST TERMINAL FLOOR PLAN
1/8" = 1'-0"

REFERENCE ELEVATION NOTE

1. REFERENCE ELEVATIONS SHOWN FOR A300 SERIES ARE RELATIVE TO SURVEYED/CIVIL ELEVATIONS AS FOLOWS:
2. REFERENCE ELEVATION 00.00' = CIVIL 255.90'
3. ALL GRADING INFORMATION IS SHOWN FOR REFERENCE ONLY UNO AND MUST BE CONFIRMED WITH ST DWGS.

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GONDOLA STATION WEST TERMINAL PLANS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

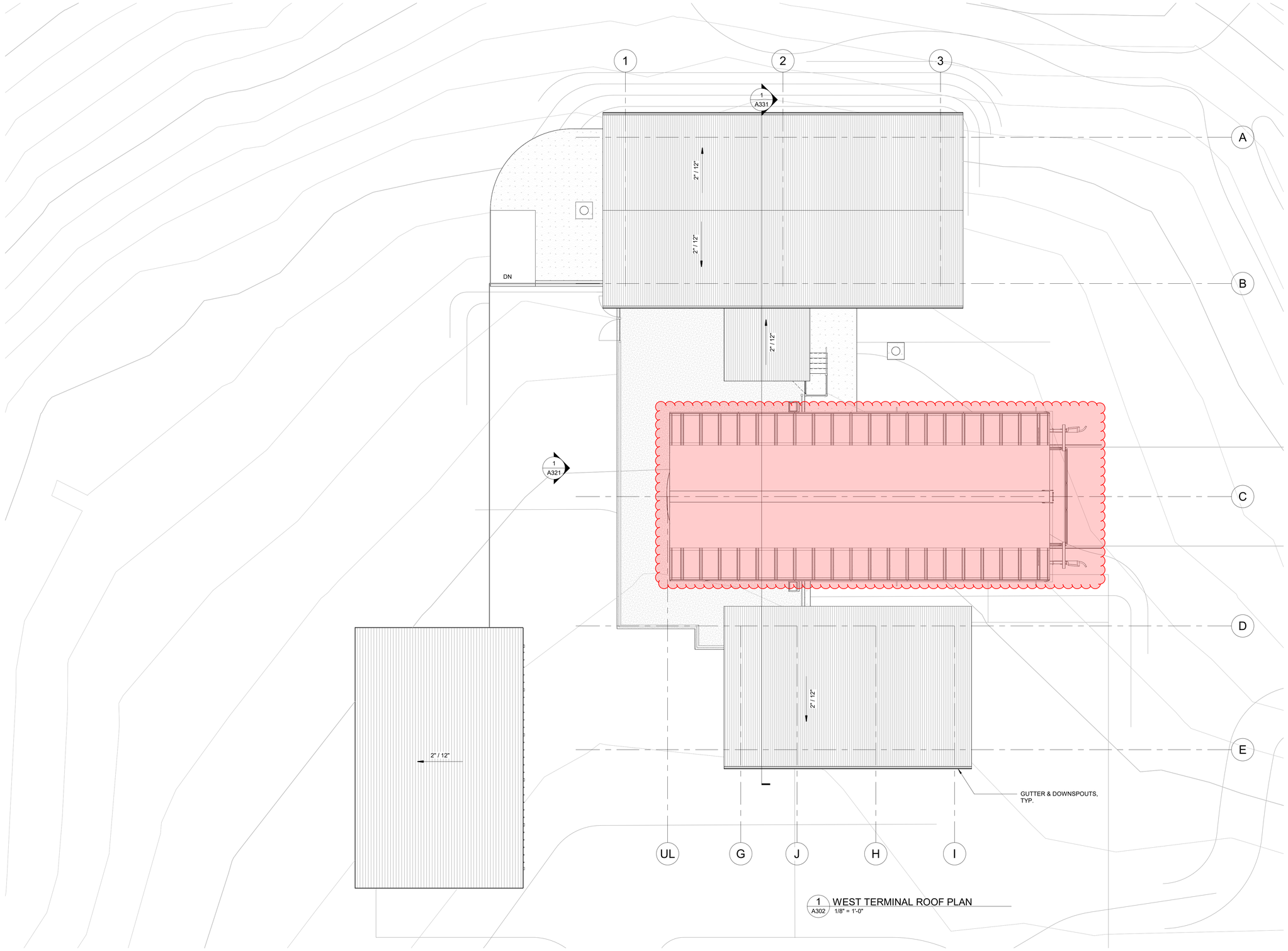
Date: 10-01-2024

Scale: As indicated

0 ft 2 4 8

Sheet No.

A301



1 A302 WEST TERMINAL ROOF PLAN
1/8" = 1'-0"

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GONDOLA STATION WEST TERMINAL PLANS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

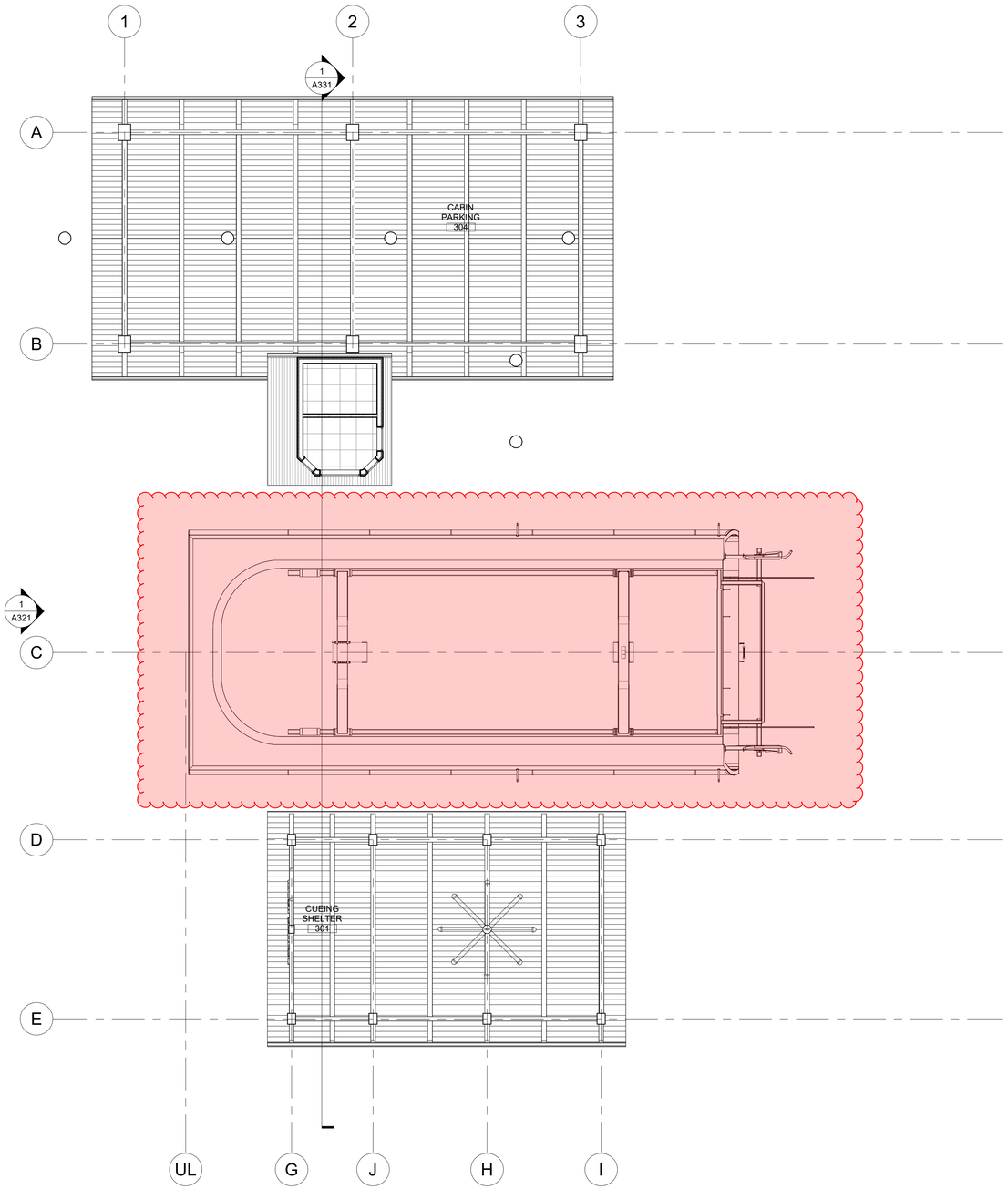
Date: 10-01-2024

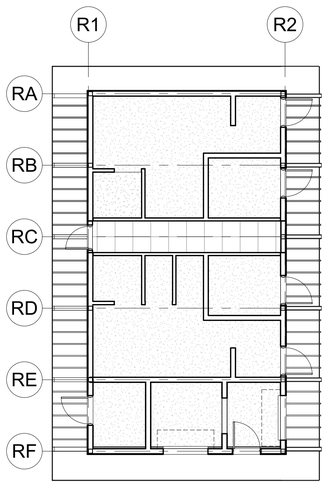
Scale: 1/8" = 1'-0"

0 ft 2 4 8

Sheet No.

A302





1 A303 WEST TERMINAL REFLECTED CEILING PLAN
1/8" = 1'-0"

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GONDOLA STATION WEST TERMINAL PLANS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

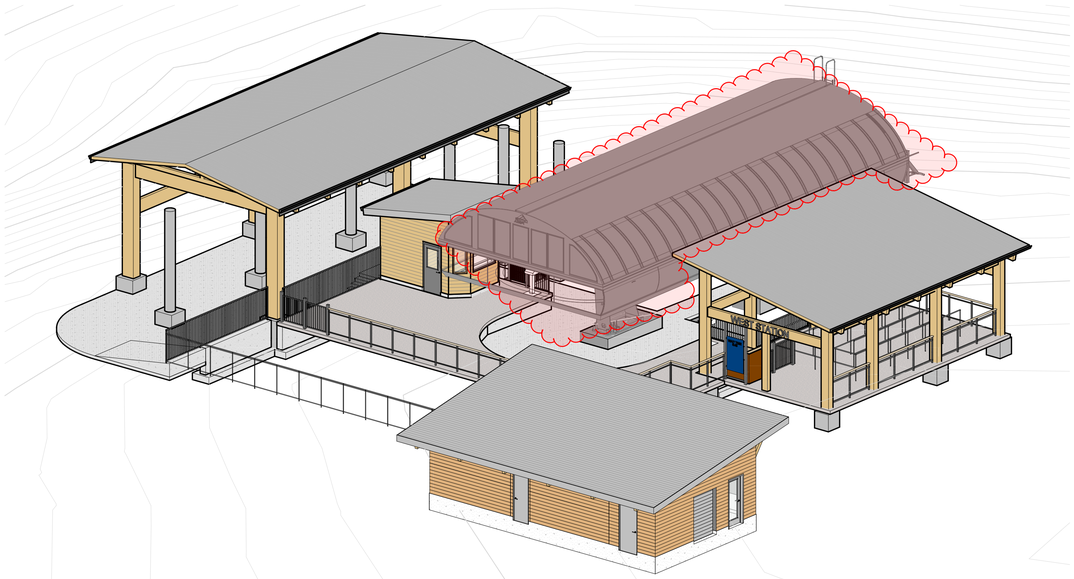
Date: 10-01-2024

Scale: 1/8" = 1'-0"

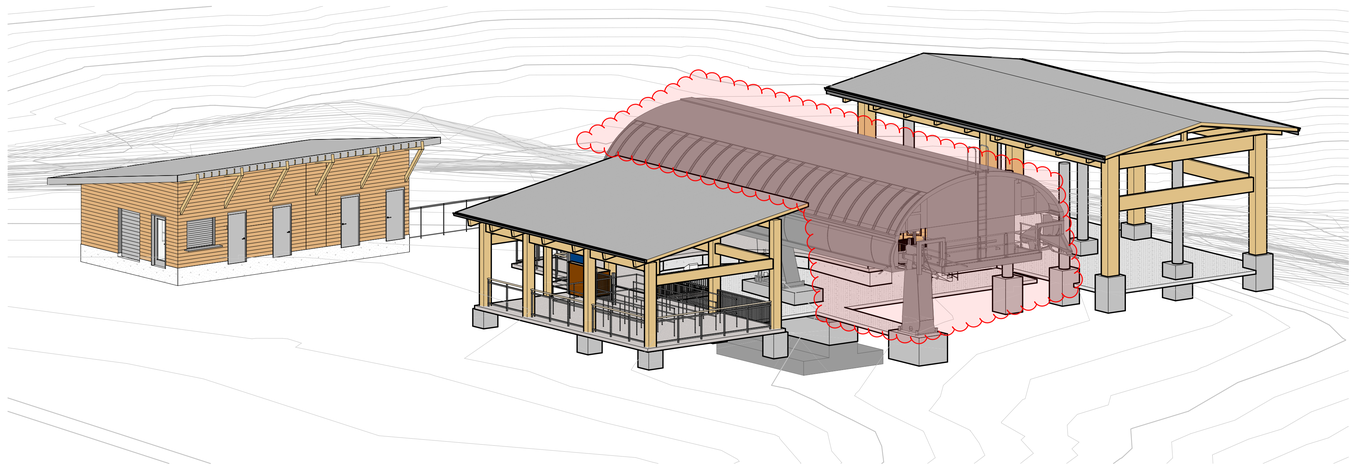
0 ft 2 4 8

Sheet No.

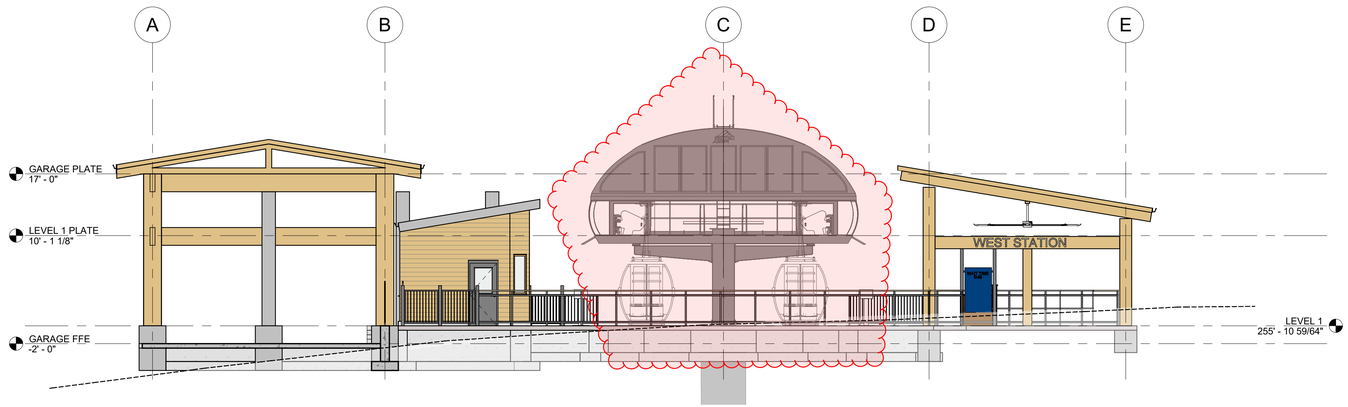
A303



3 A321 WEST TERMINAL 3D VIEW 2



2 A321 WEST TERMINAL 3D VIEW 1



1 A321 WEST TERMINAL ELEVATION 1
1/8" = 1'-0"

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GONDOLA STATION WEST TERMINAL ELEVATION & 3D VIEWS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

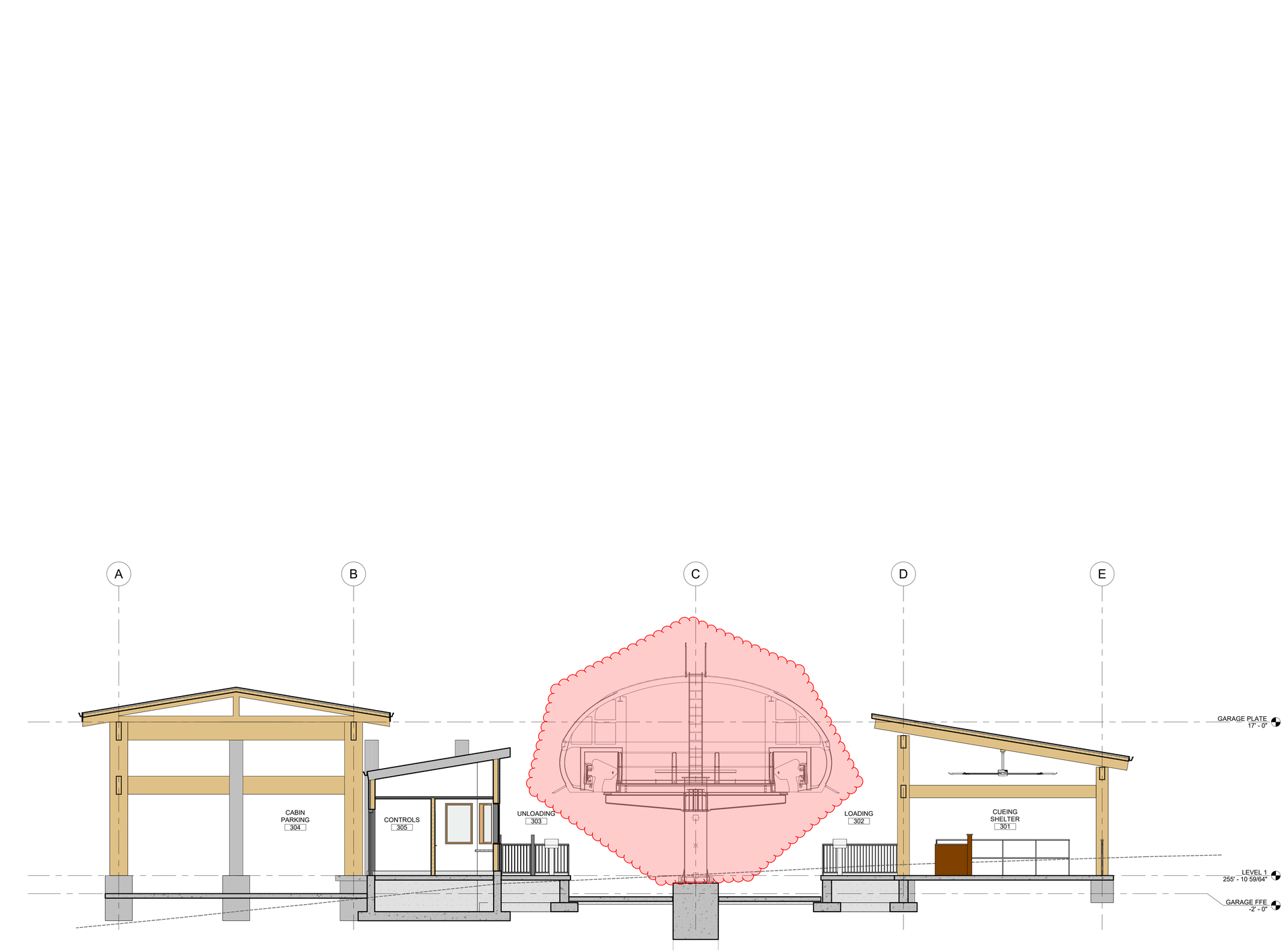
Date: 10-01-2024

Scale: 1/8" = 1'-0"

0 ft 2 4 8

Sheet No.

A321



1 A331 CROSS-SECTION THRU TERMINAL PLATFORM
3/16" = 1'-0"

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GONDOLA STATION WEST TERMINAL SECTIONS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

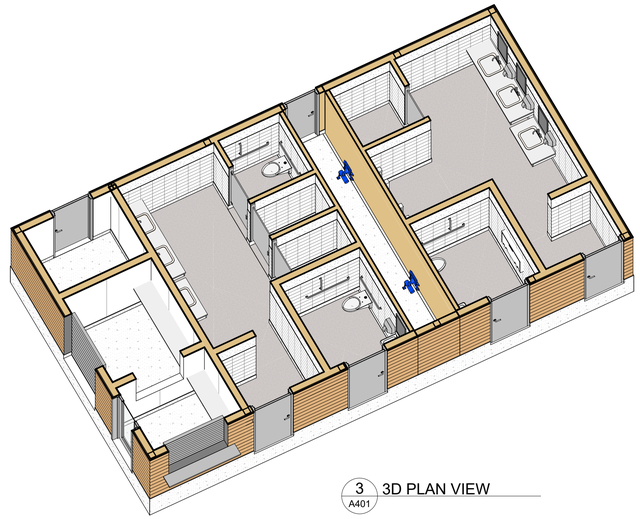
Date: 10-01-2024

Scale: 3/16" = 1'-0"

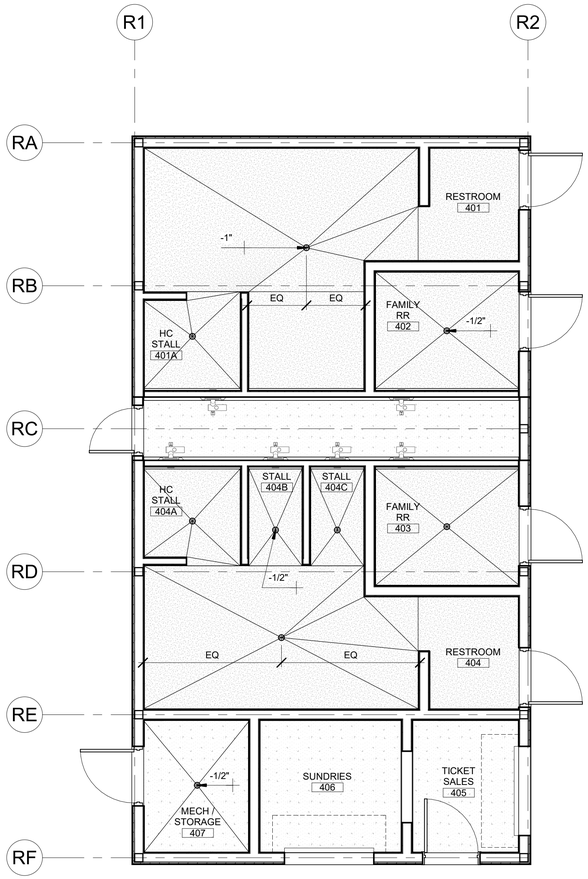
0 ft 2 4 8

Sheet No.

A331



3 A401 3D PLAN VIEW



2 A401 RESTROOM & TICKETING SLAB PLAN
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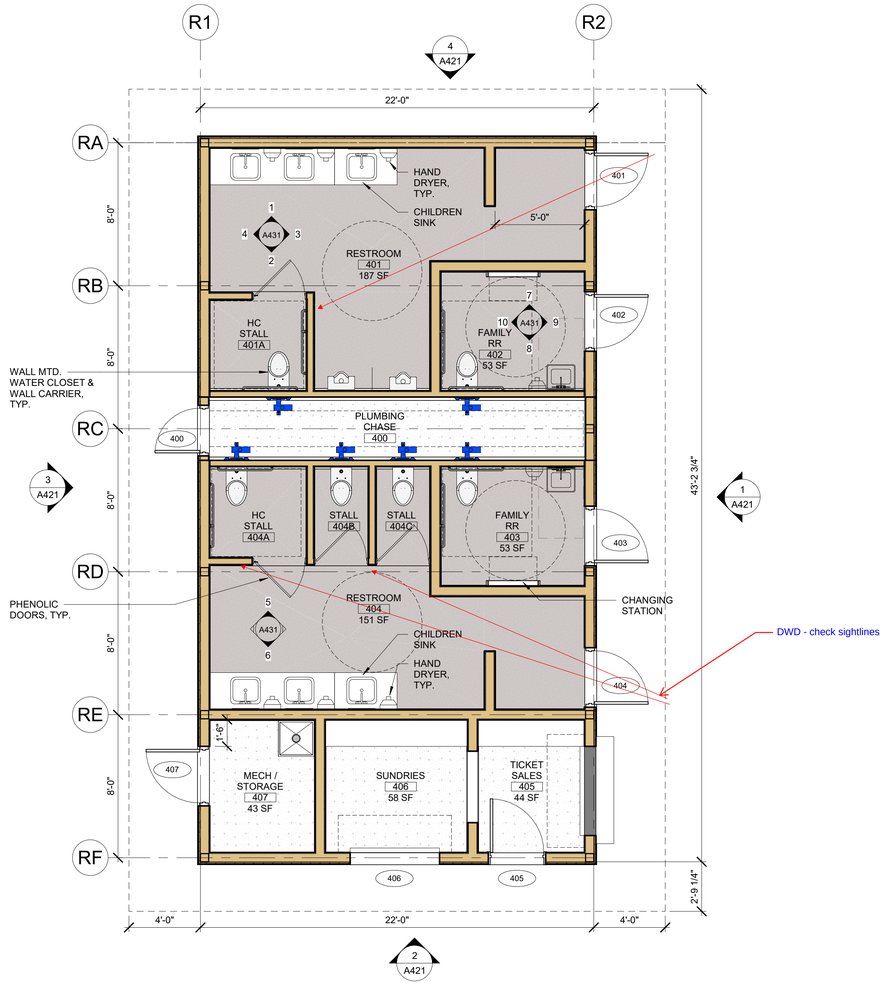

1 A401 RESTROOM & TICKETING FLOOR PLAN
1/4" = 1'-0"

REFERENCE ELEVATION NOTE

1. REFERENCE ELEVATIONS SHOWN FOR A400 SERIES ARE RELATIVE TO SURVEYED/CIVIL ELEVATIONS AS FOLOWS:
2. REFERENCE ELEVATION 00.00' = CIVIL 256.75'
3. ALL GRADING INFORMATION IS SHOWN FOR REFERENCE ONLY UNO AND MUST BE CONFIRMED WITH ST DWGS.

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RESTROOM & TICKETING BLDG PLANS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: NI

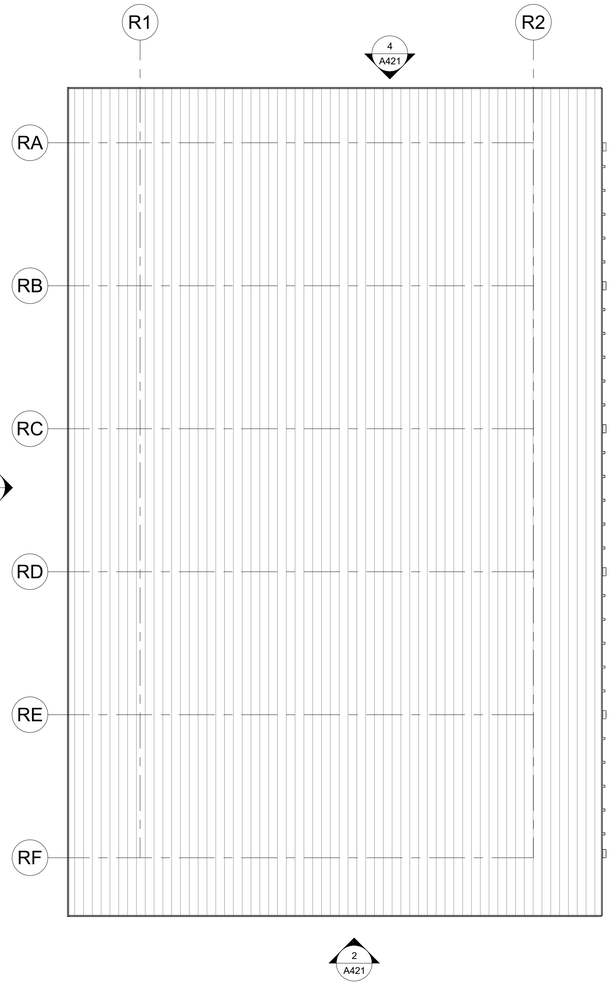
Date: 10-01-2024

Scale: 1/4" = 1'-0"

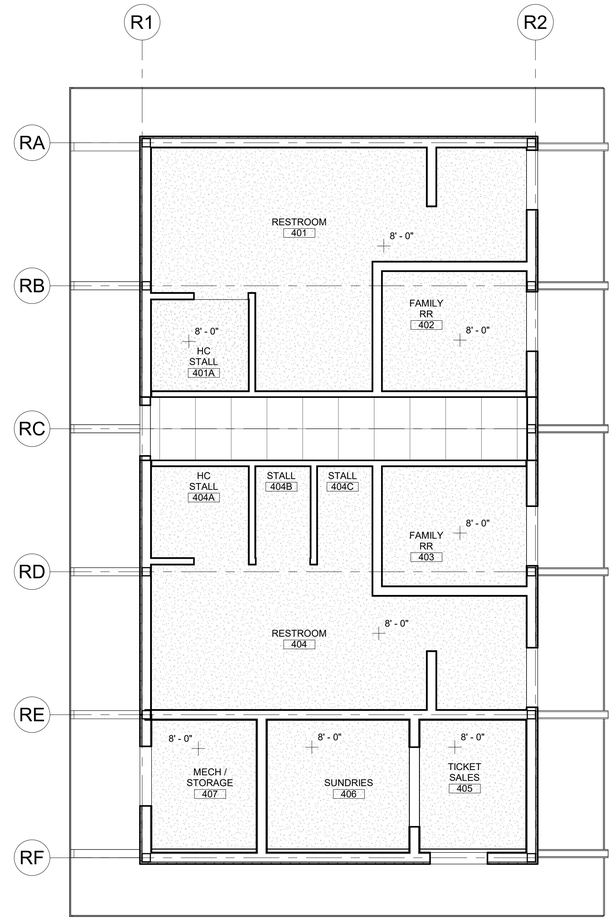
0 ft 2 4 8

Sheet No.

A401



2 A402 RESTROOM & TICKETING ROOF PLAN
1/4" = 1'-0"



1 A402 RESTROOM & TICKETING RCP
1/4" = 1'-0"

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RESTROOM & TICKETING BLDG PLANS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

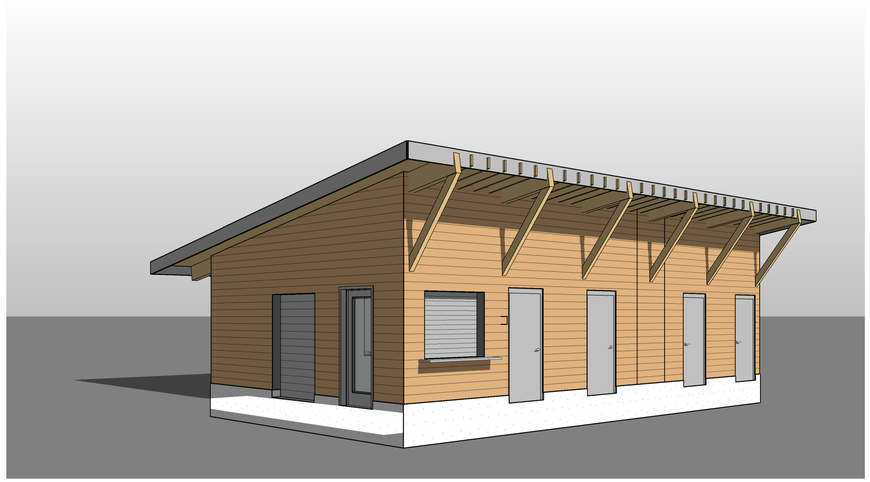
Date: 10-01-2024

Scale: 1/4" = 1'-0"

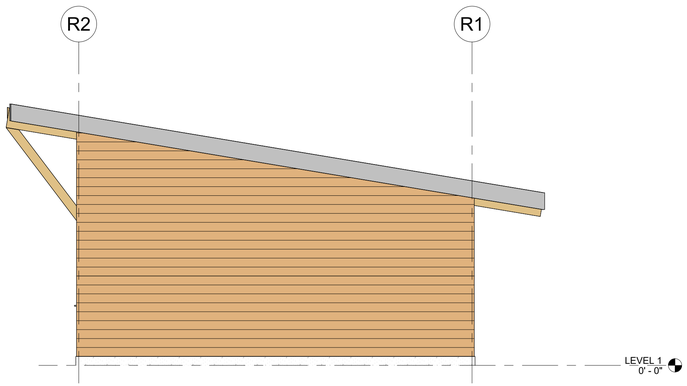
0 ft 2 4 8

Sheet No.

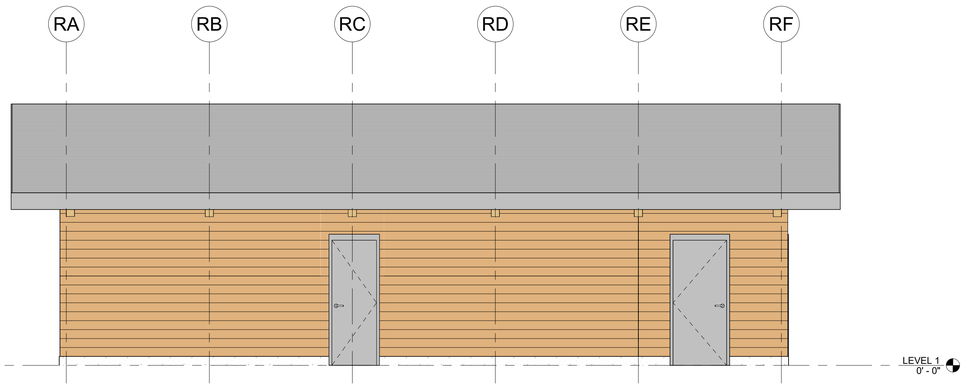
A402



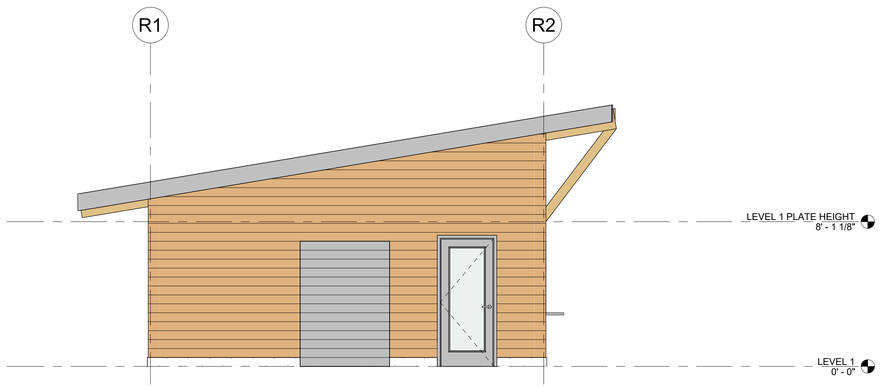
5 A421 RESTROOM & TICKETING - 3D VIEW 1



4 A421 RESTROOM & TICKETING - NORTH ELEVATION
1/4" = 1'-0"



3 A421 RESTROOM & TICKETING - WEST ELEVATION
1/4" = 1'-0"



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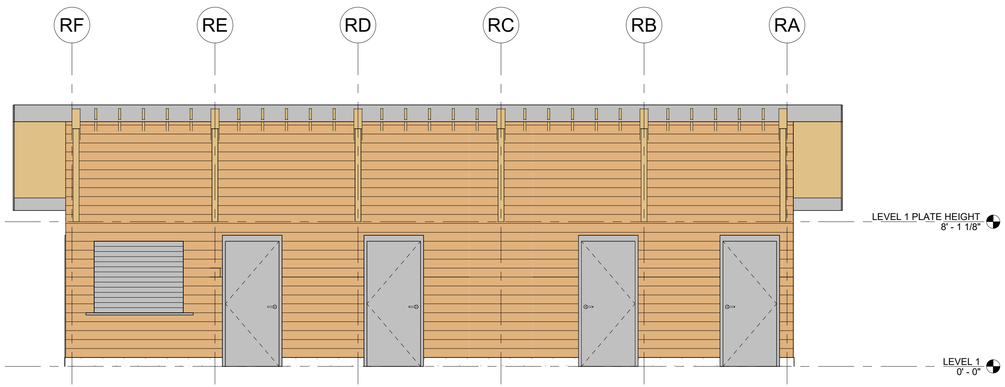

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1/4" = 1'-0"

RIVERBANKS ZOO & GARDEN
columbia south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
EXHIBIT DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
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philadelphia, pa 19107
34921 calle del sol
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Structural Engineer
Johnson & King Engineers
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Electrical Engineer
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800 Columbiana Drive, Suite 208
Irmo, SC 29063
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Seal:

NOT FOR CONSTRUCTION

PROGRESS SET
10-01-2024

Revisions:

No.	*Description*	*Date*

Sheet Title

RESTROOM & TICKETING BLDG ELEVATIONS & 3D VIEWS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: MN | Checked: CLR

Date: 10-01-2024

Scale: 1/4" = 1'-0"

0 ft 2 4 8

Sheet No.

A421

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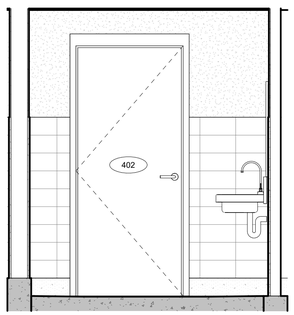

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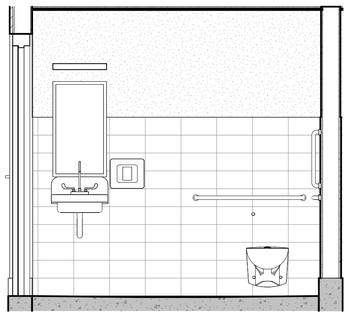

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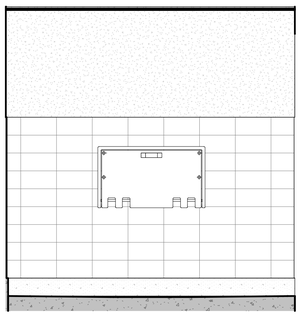

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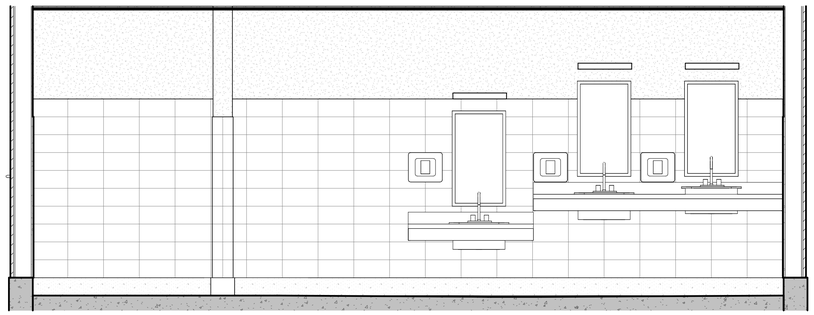

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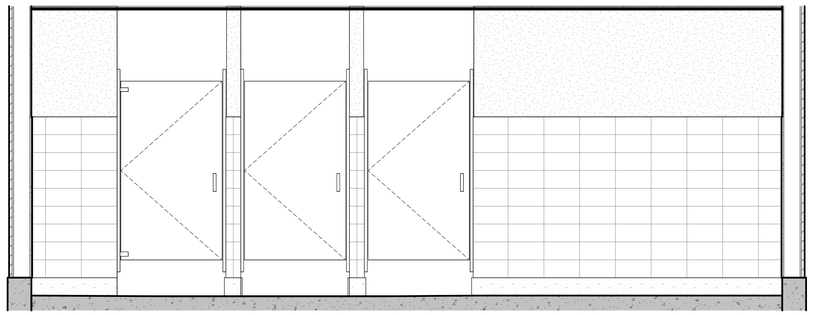

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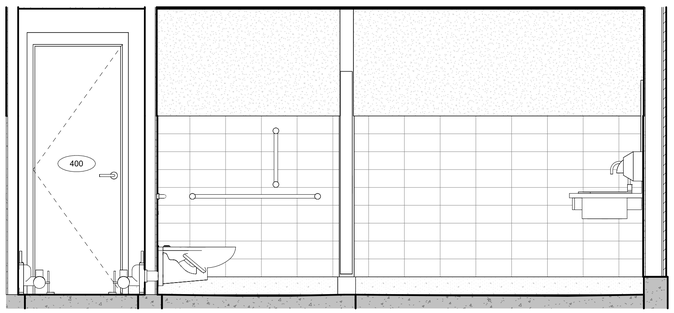

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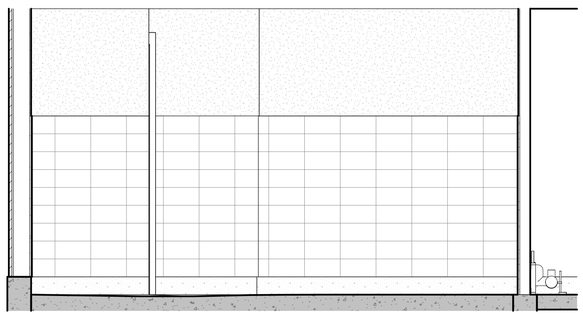

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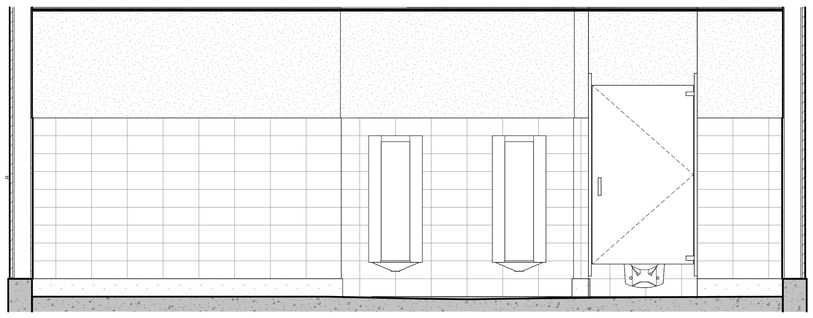

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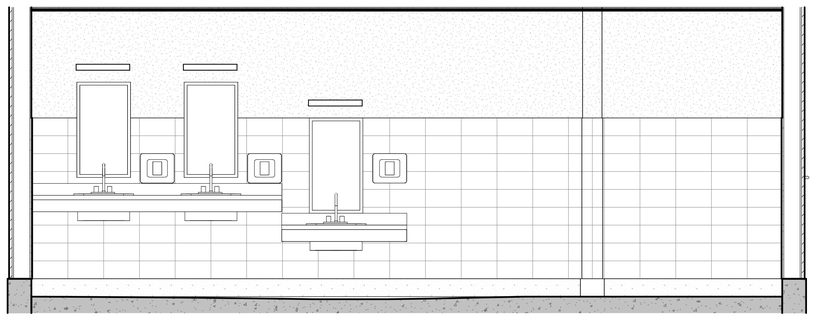

1 A431 RR 401 NORTH ELEVATION
1/2" = 1'-0"

RIVERBANKS ZOO & GARDEN
columbia♥south carolina

500 Wildlife Pkwy - Columbia, SC 29210

clr DESIGN
EXHIBIT DESIGN
ARCHITECTURE
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Seal:

NOT FOR CONSTRUCTION

PROGRESS SET
10-01-2024

Revisions:

No.	*Description*	*Date*

Sheet Title

RESTROOM INTERIOR ELEVATIONS

CLR Project No.: RVB23GON

Project Manager: GD

Drawn: Author | Checked: Checker

Date: 10-01-2024

Scale: 1/2" = 1'-0"

0 ft 2 4 8

Sheet No.

A431

Riverbanks Zoo and Garden
Service Road Relocation &
Gondola Related Construction

Exhibit B - Geotechnical Report

Report of Geotechnical Exploration – Revision 1
Riverbanks Zoo & Garden – Gondola
West Columbia/Columbia, Lexington/Richland Counties, South Carolina
S&ME Project No. 24610356

PREPARED FOR:
Riverbanks Zoo & Garden
PO Box 11129
Columbia, South Carolina 29211

PREPARED BY:
S&ME, Inc.
134 Suber Road
Columbia, South Carolina 29210

October 2, 2024

October 2, 2024

Riverbanks Zoo & Garden
PO Box 11129
Columbia, South Carolina 29211

Attention: Mr. Tommy Stringfellow – President/CEO

Reference: **Report of Geotechnical Exploration – Revision 1**
Riverbanks Zoo & Garden – Gondola
Columbia, South Carolina
S&ME Project No. 2410356

Dear Mr. Stringfellow:

As requested, S&ME, Inc. (S&ME) has completed field and laboratory testing for the above referenced site, located on the existing Riverbanks Zoo campus, located at 500 Wildlife Parkway, in Columbia, South Carolina and the Riverbanks Botanical Garden campus, located at 1300 Botanical Parkway, in West Columbia, South Carolina. Our work was performed in general accordance with S&ME Proposal No. 24610356, dated July 19, 2024, as Task MSA-2024-01 of our Master Services Agreement with Richland-Lexington Riverbanks Park District. The revisions in this report are being provided as requested in email correspondence from LCK, LLC to S&ME on September 25, 2024 regarding shallow foundation support of the tower structures.

This report provides information on the exploration and testing procedures used, our boring records, our 1-D shear wave velocity profile and our conclusions regarding site and subsurface conditions, IBC 2021 Seismic Site Class and seismic design parameters, as well as seasonal high groundwater depths, shrink/swell potential, and permeability from published literature. Also included are our recommendations regarding:

- Eastern Landing Plaza – dewatering considerations, excavation considerations, slope considerations, suitability of on-site soils for use as structural fill, fill placement and compaction, lateral earth pressures, shallow (column and mat) foundation design values and estimated settlements.
- Support Tower structures – shallow foundation design values and estimated settlements and estimated soil parameters by layer for use in deep foundation design, to be performed by others, including soil unit weight, total cohesion/undrained shear strength, effective friction angle, ultimate unit side shear and unit end bearing resistance, LPILE® lateral subgrade modulus k, LPILE® soil strain parameters ε50, and LPILE® soil type, as well as deformation modulus, and deep foundation construction considerations.
- Western Landing Plaza – site preparation, dewatering considerations, excavation considerations, slope considerations, suitability of on-site soils for use as structural fill, fill placement and compaction, lateral earth pressures, shallow (continuous wall and mat) foundation design values and estimated settlements and slab-on-grade design values.

S&ME appreciates this opportunity to work with you as your geotechnical engineering consultant on this project. Please contact us at (803) 561-9024 if you have questions or need additional information regarding this report.

Sincerely,

S&ME, Inc.

Robert C. Bruorton, P.E.
Senior Engineer/Principal Project Manager

SOUTH CAROLINA PROFESSIONAL ENGINEER
No. 26144
10-2-24
ROBERT C. BRUORTON

Matthew F. Cooke, P.G., P.E.
Office Principal

SOUTH CAROLINA
S&ME, INC.
No. C00473
CERTIFICATE OF AUTHORIZATION

Table of Contents

List of Tables

Appendices

1.0 Project Information

Initial information regarding the project was provided in email correspondence from Mr. Dale Stigamier, of LCK, LLC, to Mr. Chad Bruorton, P.E., of S&ME, on July 16, 2024. Included in the correspondence were the following:

- *Gondola Station Overall Site Plan & Section*, prepared by clr Design, dated June 12, 2024, annotated with requested boring locations.
- *Enlarged Site Layout Plan East Station*, prepared by clr Design, dated June 12, 2024, annotated with requested boring locations.
- *Enlarged Site Layout Plan West Station*, prepared by clr Design, dated June 12, 2024, annotated with requested boring locations.

Additional information was provided in email correspondence from LCK, LLC, providing tower structure details provided by representatives of Leitner-Poma of America, Inc.

1.1 Property Description

From our review of the provided information, we understand the project is located on the existing Riverbanks Zoo campus, and spans from the Zoo portion of the campus, located at 500 Wildlife Parkway, in Columbia, South Carolina, across the Saluda River to the Garden portion of the campus, located at 1300 Botanical Parkway, in West Columbia, South Carolina, as shown on the *Site Location Plan*, attached as Figure 1 in Appendix I. More specifically, the project alignment spans an undeveloped portion of the campus. From review of available on-line imagery, it appears the project site currently consists of moderate to heavy woodlands along the banks of the Saluda River. From review of the provided *Grading Plan*, it appears existing grades across the site range from roughly elevation 258 feet at the Western Landing Plaza (Garden side of the project alignment), down to roughly elevation 138 feet at the Saluda River, and back up to roughly elevation 166 feet at the Eastern Landing Plaza (Zoo side of the project alignment).

1.2 Project Information

From our review of the provided information, we understand the planned development at the site consists of a gondola transportation system across the Saluda River. Overall, the system consists of stations on each end for loading/unloading of passengers and new plazas, while the system between the stations consists of support towers for the transport cables.

The Eastern Landing Plaza, located on the Zoo side of the project, consists of a roughly $^{1}/_{3}$-acre area that will include the gondola station surrounded by wooden deck and concrete plaza that will house a queuing shelter to the north, a gathering shelter to the southeast and a control room building to the southwest. The gondola station will be supported by terminal anchorage foundations that are assumed to consist of concrete deadman anchors supported by shallow mat foundations. The queuing and gathering shelters will consist of timber framed open-air shelters assumed to be supported by shallow foundations or embedded poles. The control room building is assumed to be constructed of timber framing and supported by shallow foundations or embedded poles. Anticipated structural loading conditions were not available at the time of this report. Finished floor elevation for

the station platform was provided as elevation 164.70 feet, while the surrounding plaza finished grade was provided as elevation 166.70. Little to no grading is anticipated in this project area.

The support towers are assumed to consist of steel towers and are understood to varying in height from roughly 20 to 89 feet. The towers are understood to be supported on shallow foundations, with a potential alternate to drilled shaft deep foundations. No grading is anticipated in this project area.

The Western Landing Plaza, located on the Botanical Gardens side of the project, consists of a roughly ½-acre area that will include the gondola station surrounded by concrete plaza that will house a car maintenance shelter and control room building to the north, a queuing shelter to the southeast and a restroom building to the southwest. The gondola station will be supported by terminal anchorage foundations that are assumed to consist of concrete deadman anchors supported by shallow mat foundations. The car maintenance and queuing shelters will consist of timber framed open-air shelters assumed to be supported by shallow foundations or embedded poles. The restroom and control room buildings are assumed to be constructed of timber framing and supported by shallow continuous wall foundations and a slab-on-grade. Anticipated structural loading conditions were not available at the time of this report. Finished floor elevation for the station platform was provided as elevation 255.91 feet, while the surrounding plaza finished grade will vary from elevation 257.5 to 253 feet resulting in up to roughly 3 feet of fill and roughly 1 foot of cut required to level the area.

2.0 Exploration Procedures

The subsurface exploration of this project included the following:

- Fourteen (14) Standard Penetration Test (SPT) borings,
- One (1) hand augered boring with Dynamic Cone Penetrometer (DCP) testing, and
- One (1) MASW (Multi-Channel Analysis of Surface Waves) and MAM (Microtremor Array Method) shear-wave velocity array.

The approximate testing locations are shown on the *Testing Location Plans,* attached as Figures 2A and 2B in Appendix I.

2.1 Reconnaissance of Project Area

On August 9, 2024, a representative from S&ME visited the site to observe current site conditions and lay out the proposed soil test boring locations. Soil test boring locations were marked in the field with spray paint. Soil test boring locations were laid out using our sub-meter GPS equipment. The boring locations indicated on the attached *Testing Location Plans* must be considered as approximate. No formal survey of boring locations or elevations was conducted by S&ME.

2.2 Field Testing and Sampling

The following sections detail our field and sampling activities at the site. A summary of our exploration procedures is included in Appendix II.

2.2.1 *Site Clearing*

Clearing was performed by Palmetto State Land Management, under subcontract to S&ME, using a skid steer-mounted forestry grinder and operator on August 9, 2024, to create drill rig access pathways to the boring locations located in wooded areas. Trails approximately 12 to 15 feet wide were cleared with trees chipped in-place. No attempt was made to stack or remove downed trees from the site. Care was taken to limit site disturbance during this process.

2.2.2 *Standard Penetration Test (SPT) Soil Borings*

Fourteen (14) soil test borings with Standard Penetration Test (SPT) sampling and testing were performed between August 21 and 28, 2024, as summarized below:

Table 2-1 – Boring Summary

Test Locale	Borings
Western Landing Station	W-1 through W-5
Support Towers	T-1 through T-5
Eastern Landing Station	E-1 through E-4

The SPT soil test borings were performed using an ATV-mounted CME-550 and track-mounted D-50 drill rigs. The borings were advanced using 3¼-inch inside diameter hollow-stem auger and mud rotary drilling techniques. Borings were advanced to refusal/termination depths of roughly 7 to 40 feet below the existing ground surface.

Split-spoon samples and SPT Resistance N-values were obtained at selected intervals in general accordance with ASTM D1586. Sampling was performed using an automatic or semi-automatic hammer drop system which lifts the 140-lb hammer and allows it to drop the required 30-in distance unimpeded. This method is allowed in Section 7.4 of ASTM D1586. Standard penetration test N-values obtained using one of the available autohammer systems often vary widely from those obtained using conventional rope and cathead arrangements. While corrections to the resulting N-value have been developed for certain specific applications, N-values presented on S&ME graphical boring records represent field blow counts which are not modified to account for hammer energy variations.

To permit comparison of soil consistency measured by SPT testing using various autohammer arrangements, SPT hammer energy measurements are made on a recurring basis using a Pile Driving Analyzer (PDA) in general accordance with ASTM D4633. The SPT energy test results for the drill rig used at this site are provided below. The SPT N-values indicated on the logs are field values and were not corrected for overburden stress, rod length, borehole diameter or hammer efficiency.

Table 2-2 – S&ME Drilling Equipment Summary

Rig Make/Model	Serial No.	Carrier Type	Average SPT Energy Transfer Ratio (ETR), %
CME-550	399563	ATV	88.7
D-50	226	Track	87.5

Soil samples were obtained with a standard 1.4-inch I. D., 2-inch O. D., split barrel sampler. SPT sampling was performed at 2½-foot intervals within the upper 10 feet, then performed on approximate 5-foot centers to termination depths. The split-barrel sampler was opened at the drill site and sloughed material identified and separated from the recovered sample. The recovered sample was visually described, and a provisional field classification made by the driller. A selected portion of the sample was placed in a plastic bag and transported to our laboratory.

2.2.3 Wireline Rock Coring

At support tower boring locations, wireline rock coring was performed to explore the materials below refusal of the soil drilling tools. Upon encountering refusal at each boring location, the field boring log and provisional field classification made by the driller was provided to S&ME's geotechnical staff. Rock core locations and planned core length was initially determined based on depth or thickness of partially weathered rock (PWR), if encountered, and depth to refusal. As coring advanced, the geotechnical engineer reviewed the recovery and rock quality designation of the recovered core and made a field determination whether to continue or terminate rock coring.

Rock coring was performed using an NQ-size core barrel and wireline retrieval system in general accordance with the procedures described in ASTM D 2113. NQ size core barrel was used to produce cylindrical cores 1-7/8 inches in diameter. Core rod RPM and advance rate were closely monitored during each run to prevent plugging the bit or core blockage or damage. Water without additives was hauled to the site and circulated through the boring to flush cuttings and cool the drill bit during the coring process. Circulating water was released on the surface after completion of coring.

Procedures for preserving recovered rock core specimens follow those given for routine care of non-sensitive, non-fragile samples for which only general visual examination will be performed. Steps for routine care are described in ASTM D 5079. Rock cored in 5-foot runs were placed in sleeves or channels in specially constructed wood or cardboard core boxes. Boxes were labeled and the recovered core photographed. Completed core boxes were transported to the S&ME Columbia Office at the end of each workday. Boxes were transported flat and secured to prevent sliding or vibration. A preliminary field log of each core indicating recovery and general visual description was prepared prior to packing of the core.

2.2.4 Undisturbed Samples

Two (2) undisturbed samples were obtained in companion off-set auger borings adjacent to, or within, select SPT borings. The relatively undisturbed (UD) or intact thin-walled soil samples were obtained using a Shelby Tube sampler in general accordance with ASTM D1587. The selected undisturbed samples were obtained as shown in the table below.

Table 2-3 – Undisturbed Sample Summary

Boring No.	Test Locale	Sample No.	Depth Interval (ft)	Purpose
E-1	terminal anchorage foundations	UD-1	1 to 3	Index and CU triaxial shear testing (ASTM D4767)
W-1	terminal anchorage foundations	UD-2	2 to 4	Index and CU triaxial shear testing (ASTM D4767)

Shelby Tubes were used to attempt to obtain sufficiently intact samples for quantitative laboratory testing. Samples were obtained by pushing a 3-inch outer diameter, 16-guage, steel tube into the soil at the desired sampling intervals in general accordance with ASTM D1587. The tube, together with the encased soil, was carefully removed from the ground and length of the recovered soil measured. The ends of the tube were sealed with microcrystalline wax and labeled with applicable project information before being transported to our laboratory. Shelby tube samples were transported and stored in general accordance with ASTM D4220 for Group C samples.

2.2.5 Hand Augered Soil Borings

Due to access restrictions, one (1) hand augered soil boring (Boring E-5) was performed in conjunction with DCP testing. The boring was extended to a refusal depth of roughly 3 feet below the existing ground surface. The soils encountered were identified in the field by cuttings brought to the surface. Soils were field-classified by a geotechnical professional in general accordance with the visual-manual method described in ASTM D2488. Soil consistency was qualitatively estimated by the relative difficulty of advancing the augers.

2.2.6 Dynamic Cone Penetrometer (DCP) Testing

Single-mass DCP testing was performed at Boring E-5 in general accordance with ASTM Special Technical Publication #399. At selected intervals in the boring, the augers were withdrawn, and soil consistency measured with a single-mass dynamic cone penetrometer. The conical point of the penetrometer was first seated 1¾ inches to penetrate loose cuttings in the boring, then driven two additional 1¾-inch increments by a 15-pound hammer falling 20 inches. The number of hammer blows required to achieve this penetration was recorded. When properly evaluated by qualified professional staff, the blow count is an index to the soil strength.

2.2.7 Ground Water Measurements

Measurement of ground water was attempted in the borings and soundings shortly after drilling was completed. After a period of roughly 24 hours, ground water measurements were repeated in an attempt to obtain a stabilized ground water reading within the borings.

2.2.8 Borehole Closure

Following collection of relevant geotechnical data, boreholes were filled by slowly pouring auger cuttings into the open hole such that minimal "bridging" of the material occurred in the hole. Where borings exceed five feet in depth, a plastic hole plug was placed within the boreholes at a depth of approximately two feet below existing grade.

2.2.9 Shear Wave Velocity Measurements

On August 9, 2024, we completed a surface wave seismic survey within the accessible portion of the requested location to determine the Seismic Site Class (SW-1), as shown on the *Testing Location Plan*, attached as Figure 2B in Appendix I. The Seismic Site Class is based on the average shear wave velocity (Vs) to a depth of 100 feet (Vs100) and analysis of surface waves (Rayleigh waves) can be used to determine shear wave velocities.

Surface waves generated from either an active or passive energy source (e.g., sledgehammer striking a metal plate or background noise, respectively) are recorded at the ground surface along a spread of low-frequency sensors (i.e., geophones). Active sources typically provide relatively higher frequencies (i.e., better resolution at shallower depths) while passive sources generally provide relatively lower frequencies (e.g., greater depth at lower resolution). Seismic measurements are transformed from time domain into frequency domain from which the phase characteristics of the surface waves can be calculated. A dispersion curve (i.e., phase velocity curve vs frequency) is developed and then transformed into a one-dimensional (1D) shear wave velocity profile through an inversion and iterative process in which Vs100 is calculated.

- We used a combination of the active Multi-Channel Analysis of Surface Waves (MASW) and passive Microtremor Array Measurements (MAM) methods.
- The MASW survey was conducted using a Geometrics seismograph equipped with twenty-four (24) 4.5 Hz vertical geophones at set spacings of 5 feet along a linear array and a 16-lb sledgehammer as the energy source.
- The MAM survey was conducted using a Geometrics seismograph equipped with twenty-four (24) 4.5 Hz vertical geophones at a set spacing of 10 feet along a linear array using background noise as the energy source.
- Data analysis was conducted using the Geogiga Technology Corp. Seismic Pro™ software (SURFACE PLUS module).

Geophysical Limitations

Regardless of the thoroughness of a geophysical survey, there is always a possibility that actual conditions may not match the interpretations. The results should be considered accurate only to the degree implied by the methods used and the method's limitations and data coverage. Accordingly, the possibility exists that not all features at a project site will be located due to either subsurface soil conditions or the occurrence of features outside the lateral limits and below the depth of penetration of the methods used. The geophysical methods used for this survey also have inherent limitations. Site activity (e.g., heavy vehicle traffic, etc.) can cause noise/interference in the data sets. Depth restrictions are also associated with the MASW/MAM methods and associated energy source.

2.3 Laboratory Testing

Recovered soil samples delivered to the laboratory were visually examined by a representative of our geotechnical staff. Samples were visually evaluated to estimate the distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams, and apparent geological origin. Soils were classified in general accordance with ASTM D 2488.

Rock core samples returned to the laboratory were examined by the geologist and the percentage recovery and rock quality designation (RQD) estimated for each run. A core run was defined either as 1) a drill run defined by the length of the core barrel, on this project five feet; or 2) a change in formation or rock type could constitute the end of a core run; or 3) a core run can be a selected zone of concern. Core run lengths varied between roughly one and five feet and are indicated on the attached boring records. The length of each run is intended to divide the rock into sections of more or less similar degrees of weathering, disintegration or intact strength.

The "recovery" is the ratio of the sample length recovered in the core barrel to the total length of a single core run, expressed as a percent. Rock Quality Designation was determined in general accordance with ASTM D6032. The RQD is the percentage of the core run consisting of moderately hard or harder rock core recovered in segments 4 inches long or longer. Only those pieces or rock formed by natural joints, bedding planes, shear zones, or cleavage planes that result in surfaces of separation were considered for RQD purposes. Pieces formed by breaks in the core due to drilling or handling were not considered. Pieces were considered intact when they appeared to have been bonded together prior to coring and broken surfaces consisted of fresh rock. Where a surface could not be determined as either a natural or mechanical break, it was considered a natural break. When properly interpreted by a qualified professional, the RQD value provides a basis for preliminary design decisions involving foundations or excavation in rock.

Laboratory index and physical testing was performed on selected split-barrel soil samples, rock core samples and intact soil samples obtained at the site. The laboratory testing included the following:

Table 2-4 – Laboratory Testing Summary

Laboratory Test	Specification	Sample Type	Quantity
Natural Moisture Content	ASTM D2216	SS and UD	2
Percent Finer than #200 Sieve	ASTM D422	SS and UD	2
Atterberg Limits	ASTM D4318	SS and UD	2
Unconfined Compressive Strength	ASTM D7012	RC	5
Consolidated-Undrained (CU) Triaxial Shear	ASTM D4767	UD	2

Detailed laboratory test result data sheets and general procedures are included in Appendix III.

3.0 Site Conditions

S&ME's assessment of the geotechnical conditions began with a reconnaissance of the topography and physical features of the site. We also consulted various available topographic and geologic maps for relevant information.

3.1 Surface Conditions

As previous discussed, the project alignment spans from the Zoo portion of the campus, located at 500 Wildlife Parkway, in Columbia, South Carolina, across the Saluda River to the Garden portion of the campus, located at 1300 Botanical Parkway, in West Columbia, South Carolina.

The Eastern Landing Plaza, located on the Zoo side of the project, was observed to consist of moderate to heavy woodlands within the western portion of the area, an existing asphalt-paved service drive traversing the central portion of the area and landscaped areas of the Zoo campus within the eastern portion of the area. Existing grades slope from northeast to southwest, from roughly elevation 167 to 155 feet.

The support towers alignment spans from the Eastern to Western Landing plazas, across the Saluda River. On the eastern side of the river, the alignment was observed to consist of moderate woodlands, with an existing walking trail that parallels the river. On the western side of the river, the alignment was observed to consist of moderate

to heavy woodlands, with an existing asphalt-paved service drive traversing the alignment near the riverbank. An existing asphalt-paved walking trail was in close proximity to the western end of the alignment, while the alignment also passes in close proximity to the existing amphitheater associated with the Gardens. Various areas of surface boulders were observed. Existing grades slope towards the Saluda River, ranging from roughly elevation 162 to 137 feet on the eastern side and from roughly elevation 137 to 255 feet.

The Western Landing Plaza, located on the Botanical Gardens side of the project, was observed to consist of moderate to heavy woodlands, with an existing asphalt-paved walking trail winding across the area. Various areas of surface boulders were observed. Existing grades slope from south to north, from roughly elevation 260 to 249 feet.

3.2 Subsurface Conditions

3.2.1 Site Geology

The site lies in close proximity to the "fall line" dividing the outcrop of Cretaceous-age Coastal Plain sediments of the Black Mingo and Middendorf formations, from outcropping residual soils derived from the much older crystalline bedrock of the Carolina Piedmont. The Coastal Plain sediments represent soils eroded from a range of mountains in the northwest portion of the state approximately 65,000,000 years ago and laid down as fan or playa deposits, where they have subsequently weathered in place. Piedmont residuum has weathered in place from the parent crystalline bedrock material and the soil fabric often retains the relict rock structure.

Over most of the Columbia metropolitan area the Coastal Plain sediments rest unconformably on top of the underlying Piedmont rocks. More elevated areas are underlain by Coastal Plain derived soils to at least some depth. The underlying Piedmont residuum or bedrock may be exposed on the slopes of stream drainages or other low-lying areas. The "fall line" thus meanders erratically depending on local topography.

Subsequent geologic processes may mask the contact between the Piedmont and Coastal Plain over localized areas. At the bridge location, Coastal Plain sediments have been largely eroded by the river, exposing underlying Piedmont crystalline bedrock. From a review of local geologic mapping, the alignment and the surrounding area lies within a granitic intrusion within a larger area underlain by phyllite or schist crystalline metamorphic rocks of the Carolina Piedmont. The bridge area and the slopes to the north side of the river are underlain by very thin alluvial sediments, in turn underlain by weathered coarse grained granite or gneiss which is in many locations exposed as bedrock outcroppings or detached boulders in the riverbed or on neighboring slopes. There may also be areas of fill left from previous development of nearby areas.

The term partially weathered rock (PWR) is applied to very dense micaceous sands or silty sands of the Carolina Piedmont, which register SPT N-values in excess of 100 blows per foot. PWR generally varies widely within even small areas owing to minute differences in the chemical properties of the parent bedrock, which results in widely varying rates of weathering. Isolated lenses or seams of PWR often are present within Piedmont Residuum well above the overall PWR level within a given area.

Near-vertical, northwest- and north-trending diabase dikes of Mesozoic age are mapped on local geologic maps and are evident as boulder fields on slopes overlooking this area. The diabase is fine to coarse grained, massive, dense igneous rock composed of plagioclase, augite, olivine, and quartz

Eroded upland materials transported and deposited by water are referred to as Alluvium. The maximum particle size that can be transported in suspension in water is controlled by the flow velocity. Fast flowing rivers and streams can transport gravel, cobble, and boulder size pieces of rock. Slow moving water or standing water cannot retain the coarser materials in suspension and can only retain clays or silts.

3.2.2 USDA Soil Survey Information

From a qualitative standpoint, the USDA Natural Resources Conservation Service's Soil Surveys can often provide helpful information. The surveys map the near surface soils (i.e., depths ≤ 6 ft.) and provide general descriptions. The data is not intended to replace geotechnical evaluations and testing, but it can help identify trends. Soil maps are often a useful indication of the geologic environment governing soil behavior as well as the seasonal depth to ground water and depth to rock.

The USDA-NCSS Web Soil Survey and USDA Natural Resource Conservation Service soils map of Lexington and Richland Counties, South Carolina, issued in 1976 and 1978, respectively, were reviewed. Three (3) series were indicated within the project area:

- Cecil Fine Sandy Loam, 10 to 15 percent slopes (CeD) – Well drained, gently to strongly sloping soils formed on material that weathered from granite rock on uplands of the Piedmont Plateau.
- State Sandy Loam, 0 to 2 percent slopes (StA) – Well drained, nearly level soils formed on smooth, uniform stream terraces in the Piedmont and adjacent Coastal Plain sections of the county.
- Toccoa Loam (To) – Well drained, nearly level soils formed on flood plains of the Broad, Congaree, Saluda, and Wateree Rivers in the Coastal Plain and Piedmont Provinces.

The soil information is provided in the table below:

Table 3-1 – USDA Soil Series Survey

Soil Series	Soil Type	Depth to Seasonal High GW Table	Depth to Bedrock	Permeability with Depth	Shrink / Swell Potential	Soil Reaction Corrosive Potential
CeD	SM, MH, CL, ML, CL-ML, SM	> 6ft	6-10 ft	Slow to Moderately Rapid	Low	Medium to Very Strong Acid
StA	SM, SM-SC, ML, CL-ML	>6 ft (Apparent – year round)	> 5 ft	Slow to Moderately Rapid	Low	Medium to Very Strong Acid
To	SM, ML	2½ to 5 ft (Apparent – December to April)	> 5 ft	Moderately Rapid	Low	Slightly to Strong Acid

The USDA information provided for this site points to several items that could influence geotechnical recommendations for infrastructure within the site:

- Soil series across the site are noted to have shallow seasonal ground water conditions.
- Soil series across the site are noted to include low to medium plasticity clayey (CL) soils.
- Soil series across the site are noted to be strongly acidic.

The USDA Soil Survey for the site is shown on the *USDA Soil Survey Map*, Figure 3 in Appendix I.

3.2.3 Interpreted Subsurface Profile

The generalized subsurface conditions at the site are described below. The discussed subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring records included in Appendix II should be reviewed for specific information at each boring location. The depth and thickness of the subsurface strata indicated on the boring records was estimated based on the drill cuttings and the samples recovered. The transition between materials may be more gradual than indicated on the boring records. Information on actual subsurface conditions exists only at the specific boring locations and is relevant to the time the exploration was performed. Variations may occur and should be expected at locations remote from the boring. The stratification lines were used for our analytical purposes and, unless specifically stated otherwise, should not be used as the basis for design or construction cost estimates.

Surface Materials

Surface materials, in the form of topsoil, were encountered in several of the borings performed across the site, measuring up to roughly 4 inches in thickness. For the purpose of describing subsurface conditions, we have included in the designation "topsoil" for samples containing apparent organic content that do not appear to have been previously disturbed. We caution that surface materials may be thicker in areas not explored at this time.

Possible/"Undocumented" Fill Materials

Beneath the surface materials, borings within the Eastern Landing Plaza (E-series borings) encountered possible/"undocumented" fill materials to depths of roughly 3 to 6 feet below the existing ground surface. It is assumed that these materials were placed during previous development activities for the adjacent Zoo campus. The possible/"undocumented" fill materials consisted of fine to coarse sands with little to some low to medium plasticity fines (SM and SC). Some samples contained trace roots and trace quartz gravels.

Recovered samples of the possible/"undocumented" fill materials were typically brown, orange, yellow and red in color and were generally dry to moist to the touch. SPT N-values ranged from 4 to 12 blows per foot (bpf), while DCP blow counts ranged from 4 to 13 blows per increment (bpi), indicating very loose to medium dense relative densities.

Alluvium Deposits

Borings associated with the support towers (T-series borings) near the Saluda River (Borings T-3 and T-4) encountered alluvial deposits to depths of roughly 3½ to 6 feet below the existing ground surface. The alluvium consisted of fine to coarse sands with little to some low plasticity fines (SM). Organic wood debris was encountered from roughly 3½ to 5 feet below the existing round surface in Boring T-3 while trace roots were encountered in the upper alluvium in both borings.

Recovered samples of the alluvium were typically brown, orange and gray in color and were generally dry to moist to the touch. SPT N-values ranged from 4 to 7 bpf, indicating very loose to loose relative densities. The 11 bpf sample appeared to be elevated due to the wood debris.

River Terrace Deposits

Beneath the surface materials in Boring T-2 and the borings within the Western Landing Plaza (W-series borings) and beneath the possible/"undocumented" fill materials in Boring E-1, native river terrace deposits were encountered to depths of roughly 3½ to 13½ feet below the existing ground surface. The river terrace deposits consisted of fine to coarse sands with little to some low to medium plasticity fines (SM and SC) and fine to coarse gravels with some fine to coarse sands and little low plasticity fines (GM). Most of the sandy samples contained trace to few gravels.

Recovered samples of the river terrace deposits were typically yellow, brown, orange, gray, red and white in color and were generally dry to moist to the touch. SPT N-values ranged from 4 to 54 bpf, indicating very loose to very dense relative densities.

Piedmont Residuum

Beneath the surface materials, possible/"undocumented" fill and river terrace deposits, the borings across the alignment encountered Piedmont residual soils to depths of roughly 6 to 40 feet below the existing ground surface. The residuum consisted of fine to coarse sands with some low to medium plasticity fines (SM and SC), low plasticity silts some fine to coarse sands (ML) and medium plasticity clays with little to some fine to coarse sands (CL). Several samples contained gravels, and many samples contained rock fragments or relict rock structure.

Recovered samples of the residuum were typically brown, yellow, orange and gray with black and white mottles and were generally dry to wet to the touch. SPT N-values ranged from 5 to 84 bpf, indicating loose to very dense relative densities in the sandy soils and firm to very stiff consistencies in the silty/clayey soils.

Partially Weathered Rock (PWR)

As previously mentioned, PWR is defined as a very dense or very hard residual material exhibiting SPT N-values in excess of 100 bpf. PWR was encountered as summarized in the table below:

Table 3-2 – Summary of PWR Encountered Depth/Elevation

Area	Boring No.	Depth to PWR (ft)	Approximate Elevation of PWR (ft-MSL)
Eastern Landing Plaza	E-1	8½	154.5
	E-2	6	155
	E-3	6	154
Towers	T-1	6	154
	T-2	8½	143.5
	T-3	6	148

Recovered samples of the PWR were similar to the overlying residual soils, consisting of fine to coarse sands with little to some low to medium plasticity fines (SM and SC). Most samples either contained varying amounts of rock

fragments and/or retained the relict rock structure. Split spoon samples were typically dry to moist to the touch and were generally yellow, orange and brown in color.

Refusal to Drilling

Auger refusal is defined as material that could not be penetrated with the drill rig equipment used on the project. Auger refusal was encountered as summarized below:

Table 3-3 – Summary of Auger Refusal Depth/Elevation

Area	Boring No.	Refusal Depth (ft)	Approximate Refusal Elevation (ft-MSL)
Eastern Landing Plaza	E-1	9.6	153.4
	E-2	6.8	154.2
	E-3	7.3	152.7
Towers	T-1	13.5	146.5
	T-2	14.8	137.2
	T-3	8.5 (boulders then bedrock)	145.5
	T-4	12.8 (boulder)	217.2

Auger refusal at this site may have occurred on noncontinuous large boulders, rock ledges, lenses, seams or the top of parent bedrock. Core drilling was required to evaluate the character and continuity of the refusal material.

Igneous Rock

Upon encountering auger refusal as detailed above, the borings were advanced into the refusal materials by rock coring techniques. Carboniferous-aged to Permian-aged granite was recovered. For purpose of assigning empirical properties to the recovered cores, the recovered rock was subdivided into separate runs ranging from roughly 1 to 5 feet in length. In most cases, run length was determined by the length of the core barrel.

Recovered core examined in the laboratory was assigned descriptive terms applicable to the visual appearance and texture, degree of weathering, and apparent hardness. Recovered samples were assessed as completely weathered to fresh and very weak to strong. Rock mass quality as assessed using Deere's Rock Quality Designation (RQD) value ranged from "very poor" to "excellent" based on RQD values of 20 to 100 percent.

It is important to note that the rock encountered from roughly 9 to 17 feet and 19 to 19.9 feet in Boring T-3 and from roughly 12.8 to 16.5 feet in Boring T-4 were evaluated as being floating boulders, due to the borehole returning to soil as it was advanced.

Selected recovered samples of intact rock core representative of the granite, both boulder and bedrock, were cut to length and the ends machined flat. Specimens were compressed in a loading frame and axial load continuously applied until peak load and failure were obtained. Samples were soaked prior to testing. Peak compressive strengths are summarized below.

Table 3-4 – Rock Core Strength Summary

Boring No.	Run No.	Sample No.	Sample Depth (ft)	Unconfined Compressive Strength (psi)
T-1	RC-2	RS-1	14.5-15.4	11,093
T-2	RC-1	RS-2	16.8-17.7	15,740
T-3	RC-3	RS-3	17.9-18.8	12,158
	RC-4	RS-4	23.9-24.9	18,582
T-4	RC-1	RS-5	13.4-14.5	1,277

Ground Water

Ground water measurements were obtained at the time of boring, except where rock coring or mud rotary drilling techniques were utilized. In select borings, where the borehole was not backfilled due to it being located within an active area of the campus, ground water measurements were repeated after roughly 24-hours after termination of drilling activities, where possible, in order to obtain a delayed reading. A summary of ground water measurements is presented in the table below:

Table 3-5 – Summary of Groundwater

Boring No.	Time of Boring Measurement		Delayed Measurement	
	Depth (ft)	Elevation (ft-msl)	Depth (ft)	Elevation (ft-MSL)
T-1	NE	NA	8.7	151.3
T-4	NE	NA	11.6	218.4
W-1	10.1	245.9	NA	NA
W-2	10.1	244.9	NA	NA

Based upon our understanding of the project, it appears that ground water will likely impact construction within the tower structure locations of this site. However, it is important to note that perched ground water conditions may be encountered. Perched ground water is surface water that has infiltrated through the upper less dense/more permeable soils (such as sands) and has become trapped or perched on the underlying more dense/less permeable soils (such as clays). We note that ground water levels are influenced by precipitation, long term climatic variations, and nearby construction. Ground water levels at the site are also likely influenced by fluctuations in the level of the adjacent Saluda River. Measurements of ground water made at different times than our exploration may indicate ground water levels substantially different than indicated on the boring records in Appendix II.

3.3 Laboratory Physical Tests

3.3.1 Laboratory Index Testing

Soil index testing, including percent fines (ASTM D1140), Atterberg limits (ASTM D4318), and natural moisture (ASTM D2216), was conducted on the undisturbed samples to aid in our visual manual classifications.

3.3.2 Shear Strength Testing – Consolidated-Undrained (CU) Triaxial Shear

Shear tests were performed using the CU or "R" test method described by ASTM D4767. This test is typically applicable to fine-grained soils preserved as Group C samples as defined in ASTM D4220. Samples tested using the R test method are isotropically consolidated and sheared in compression without drainage at a constant rate of axial deformation. The shear characteristics measured under undrained conditions are applicable to field conditions where soils that have been fully consolidated under one set of stresses are subjected to a change in stress without time for further consolidation to take place. Measured pore pressures induced by the change in stress can be used to compute effective stress shear strength, which may be applied to field conditions in which full drainage can occur or to conditions in which pore pressures induced by loading can be estimated.

CU testing was performed on relatively undisturbed samples considered representative of in-place soils which would provide direct support at the anchor terminal foundations. Failure of the specimens during the tests was defined as the maximum principal stress difference (peak stress ratio) attained at any point during the test. The test results are presented in Appendix III. A description of the laboratory testing procedures and the laboratory test result data sheets are also included in Appendix III.

4.0 Building Code Seismic Provisions

Seismic induced ground shaking at the foundation is the effect taken into account by building code seismic-resistant design provisions. Other effects, such as soil liquefaction, are not addressed in building codes but must also be considered.

4.1 IBC Site Class

The 2021 edition of the International Building Code (IBC) has been adopted for use in South Carolina. We classified the site as one of the Site Classes listed in IBC Section 1613.2.2, using the procedures described in Chapter 20 of ASCE 7-16.

The initial step in site class definition is a check for the four conditions described for Site Class F, which would require a site-specific evaluation to determine site coefficients F_A and F_V. Soils vulnerable to potential failure under item 1) including quick and highly sensitive clays or collapsible weakly cemented soils were not observed in the borings. Three other conditions, 2) peats and highly organic clays; 3) very high plasticity clays (H>25 feet); and 4) very thick, soft/medium stiff clays were also not evident in the borings performed. The remaining vulnerability, liquefaction, appears unlikely at this site due to the age, density and fines content of the soils encountered.

During this exploration one (1) MASW-MAM survey (SW-1) was performed on the western side of the project alignment. An additional MASW-MAM survey (SW-1) was also performed in conjunction with the Education Center project near the eastern side of the project alignment. Surface wave measurements were obtained to a depth of approximately 92 feet on the western side of the project alignment, and 135 feet on the eastern side of the project alignment. Based on Sections 20 and Equation 20.4.1 of ASCE 7-16, the calculated weighted average Vs100 value is 1,271 to 2,238 feet per second (ft/s).

Based on this data and our knowledge of the general geologic profile of the area, we recommend Site Class C be used.

4.2 Design Spectral Values

S&ME determined the spectral response parameters for the site using the general procedures outlined under the 2021 International Building Code Section 1613.2.3. This approach utilizes a mapped acceleration response spectrum reflecting a targeted risk of structural collapse equal to 1 percent in 50 years to determine the spectral response acceleration at the top of seismic bedrock for any period. The 2021 IBC seismic provisions of Section 1613 use Chapter 20 of ASCE 7-16 to define the base rock motion spectra.

The Site Class is used in conjunction with mapped spectral accelerations S_S and S_1 to determine Site Amplification Coefficients F_A and F_V in IBC Section 1613.2.3, tables 1613.2.3(1) and 1613.2.3(2). For purposes of computation, the Code includes probabilistic mapped acceleration parameters at periods of 0.2 seconds (S_S) and 1.0 seconds (S_1), which are then used to derive the remainder of the response spectra at all other periods. The mapped S_S and S_1 values represent motion at the top of seismic bedrock, defined as the Site Class B-C boundary. The surface ground motion response spectrum, accounting for inertial effects within the soil column overlying rock, is then determined for the design earthquake using spectral coefficients F_A and F_V for the appropriate Site Class.

The design ground motion at any period is taken as 2/3 of the smoothed spectral acceleration as allowed in section 1613.2.4. The design spectral response acceleration values at short periods, S_{DS}, and at one second periods, S_{D1}, are tabulated below for the unimproved soil profile using the IBC 2021 criteria.

ASCE 7-16 was referenced for determination of peak ground acceleration values for computation of seismic hazard. Peak ground acceleration is separately mapped in ASCE 7-16 and corresponds to the geometric mean maximum credible earthquake (MCEG). The mapped PGA value is adjusted for site class effects to arrive at a design peak ground acceleration value, designated as PGA_M.

Table 4-1 – Spectral Design Values

Code	Site Class	S_s	S_1	F_a	F_v	PGA_M	S_{DS}	S_{D1}
IBC 2021	C	0.346g	0.113g	1.3	1.5	0.236g	0.3g	0.113g

Under the 2021 IBC, for a structure having a Seismic Risk Category classification of I, II, or III spectral response acceleration factors given above correspond to Seismic Design Category B as defined in section 1613.2.5 and Tables 1613.2.5(1) and 1613.2.5(2) of the 2021 IBC.

5.0 Conclusions and Recommendations

The analyses and conclusions submitted herein are based, in part, upon data obtained from the test locations. Subsurface conditions across the site may vary, as will grading and construction details. Based on the results of our exploration, the following paragraphs include our conclusions and recommendations for:

- Eastern Landing Plaza – dewatering considerations, excavation considerations, slope considerations, suitability of on-site soils for use as structural fill, fill placement and compaction, lateral earth pressures, shallow (column and mat) foundation design values and estimated settlements.
- Support Tower structures – shallow foundation design values and estimated settlements and estimated soil parameters by layer for use in deep foundation design, to be performed by others, including soil unit weight, total cohesion/undrained shear strength, effective friction angle, ultimate unit side shear and unit end bearing resistance, LPILE® lateral subgrade modulus k, LPILE® soil strain parameters ε50, and LPILE® soil type, as well as deformation modulus, and deep foundation construction considerations.
- Western Landing Plaza – site preparation, dewatering considerations, excavation considerations, slope considerations, suitability of on-site soils for use as structural fill, fill placement and compaction, lateral earth pressures, shallow (continuous wall and mat) foundation design values and estimated settlements and slab-on-grade design values.

5.1 Eastern Landing Plaza

5.1.1 Dewatering Considerations

From our review of the ground water measurements collected to date, along with our understanding of a planned plaza footprint at elevation 166.70 ft-MSL, the data suggests that ground water is not likely to be encountered during excavation activities. However, there is a potential for perched ground water conditions to be encountered. While dewatering should be the sole responsibility of the contractor, we offer the following recommendations regarding practices that have been successful in the past.

Temporary construction dewatering may be required for some construction excavations below finished grade. A temporary system that has performed adequately on previous projects with similar conditions consists of excavation and pumping from temporary sump pumps located outside of foundation bearing areas. The groundwater level should be lowered 2 feet below the construction excavation surface. No pumping should be performed directly from the exposed foundation bearing elevation, since this could result in disturbance of the bearing materials and a loss of soil strength and increased settlement. If ground water is not properly controlled during construction, the subgrade soil may be damaged and require removal and replacement.

We do not anticipate that a permanent groundwater control system will be required. This should be re-evaluated during construction based on groundwater encountered.

5.1.2 Excavation Considerations

It is understood that little to no site grading is anticipated for this plaza area, as the plaza is planned to be constructed as a raised wooden deck. However, due to the depths at which PWR was encountered, as provided in Table 3-2 above, it appears that difficult excavation may be encountered, depending on the depth of the planned foundations.

5.1.2.1 Difficult Excavation – PWR

Based on the subsurface conditions encountered, PWR may be encountered within the planned footing excavation depths across the site. It is important to note that PWR elevations shown in the borings reflect the widely spaced boring locations. No generalization of the trend between boring locations is made. Such generalization would entail substantial risk since the composition and density of the soil and rock may vary between testing locations. We emphasize that there may be substantial areas on the site where PWR or rock may occur above the level indicated by the testing.

PWR can normally be excavated by hard to very hard ripping. For confined excavations, we recommend ripping be performed with a Caterpillar 325 or equivalent using a 24-inch wide bucket equipped with rock teeth. Our experience indicates that as the consistency of partially weathered rock increases ("N" values greater than 50/4" to 50/2" as represented on the Boring Records in Appendix II) the probability that blasting will be required increases for both mass and local excavation. Based on the subsurface conditions encountered by the borings, it is our professional opinion that the majority of soils can be excavated by appropriately sized heavy construction equipment. Occasional blasting or hoe ram use to excavate local areas of more resistant material may be expected in both mass and confined excavations. The speed and ease of excavation will depend on the type of grading equipment, operator skill and the geologic structure of the material itself, such as the direction of bedding, planes of weakness, and spacing of discontinuities.

5.1.2.2 Difficult Excavation – Boulders

It is possible that isolated boulders may be encountered during excavation activities, requiring difficult excavation. Therefore, the contractor will need to take this into consideration and be prepared to provide larger/specialized equipment that is capable of stripping/ripping, dislodging and maneuvering these materials, with an alternate for blasting for trench, and deeper excavations, due to the block-like structure and confinement of the trench walls. Additionally, to facilitate the use of rock as fill and removal of the larger rock particles and boulders from the site, pneumatic equipment and/or blasting may be required.

5.1.2.3 Ripping versus Blasting

On earthwork projects requiring ripping, a controversy sometimes develops as to whether the materials can be removed by ripping or whether blasting is required. It should be noted that ripping is dependent on the equipment and techniques used as well as the operator's skill and experience. The success of the ripping operation is dependent on finding the proper combinations for the conditions encountered. Excavation of the PWR is typically much more difficult in confined excavations. Jackhammering or blasting is anticipated to be required for materials having SPT N-values in excess of 50 blows/2 inches (i.e. 50/2"), or at or near the level that auger refusal/rock is encountered.

5.1.2.4 Confined Areas

Excavation of dense to very dense or hard to very hard residual soils in confined areas will likely require pneumatic hammers or spades. Light blasting may be necessary to efficiently remove more resistant PWR, bedrock or dense boulders that could be present in confined excavations. We emphasize that the character of the soil and rock strata may vary widely between testing locations, and no trend between testing locations is implied.

5.1.2.5 Classified Excavations

For confined excavations, we suggest that material occupying an original volume of at least one-half of a cubic yard or more which cannot be excavated with a Caterpillar 325 or equivalent using a 24-inch wide bucket equipped with rock teeth.

5.1.3 Use of On-site Soils as Structural Fill

The on-site foundation excavation soils that are proposed for use as fill at the site range in USCS soil classification but are generally sands with low to medium plasticity fines (SM and SC) and medium plasticity clays with some sands (CL).

5.1.3.1 Sandy Proposed Fill Soils

Coarse grained sandy soils with low to medium plasticity fines (SM and SC), similar to those encountered in the upper strata of the exploration, are typically suitable for use as structural fill.

5.1.3.2 Medium Plasticity Proposed Fill Soils

Fine grained medium plasticity clays (CL) containing some sands, similar to those encountered in in the upper strata of the exploration, are typically marginally suitable for use as structural fill. Suitability of these soils for use depends a great deal on the moisture content of the material at time of placement.

Marginal suitability refers to the fact that fine grained soils are moisture sensitive to some degree and can be difficult to work if allowed to become wet. These difficulties can include softening of exposed subgrade soils, excessive rutting or deflection under construction traffic, and the difficulty associated with adequately drying and compacting wet soil. Moisture-related earthwork difficulties can be reduced by performing the earthwork during the typically drier months of the year (May through October).

Drainage from the site should be provided and maintained to reduce the potential for ponding of water on exposed subgrades. Before beginning to place fill, sample and test each proposed fill material to determine its maximum dry density, optimum moisture content, natural moisture content, and suitability as a structural fill material.

5.1.4 Fill Placement and Compaction

Before beginning to place fill, sample and test each proposed fill material to determine maximum dry density, optimum moisture content, natural moisture content, gradation and plasticity of the soil. Structural soil fill material should have less than 5 percent organic matter, a standard Proctor maximum dry density of 90 pcf or greater and a plasticity index (PI) of 30 percent or less.

We recommend that off-site borrow meet the organic content, PI and density requirements of this section. Testing will be required before fill placement begins to determine the optimum moisture-density condition for the fill materials. Material to be used as soil fill should be tested and approved by the geotechnical engineer before being placed.

5.1.4.1 Density and Moisture Requirements

Place fill in maximum 8-inch loose lifts and compact to at least 98 percent of maximum dry density (ASTM D698 standard Proctor) around the terminal anchorage foundations. This level of compaction can be practically achieved with area soils and has been found to provide adequate support for foundations. Fill moisture content should be maintained within +/- 3 percent of the optimum moisture content. Contractor should be prepared to wet or dry soils as necessary to achieve compaction. In addition to meeting the compaction requirement, fill material should be stable under movement of the construction equipment and should not exhibit rutting or pumping.

5.1.4.2 Compaction of Granular Soils

A vibratory sheep's-foot roller will likely be more effective for compaction of the silty and clayey sand (SM and SC) soils encountered at the site. Sheep's-foot compactors will likely be preferable because the pads better penetrate the soil and they tend to break down the natural cohesive bonds between the particles.

Sandy soils excavated above the water table are usually close enough to optimum moisture content to place and compact efficiently with little moisture conditioning required. Soils that are initially too wet or are allowed to become wet due to rainfall are more difficult to use.

5.1.4.3 Compaction of Cohesive Soils

The compaction characteristics of clayey soils (CL) with plastic properties encountered at this site will be highly dependent on the soil moisture content at the time of construction. Sheeps-foot compactors will likely be preferable because the pads better penetrate the soil, and they tend to break down the natural cohesive bonds between the particles.

The water content of these soils is usually very difficult to modify in the field. Above or below the optimum moisture content, the soils become progressively more difficult to manipulate and compact. Soils excavated above the water table are usually close enough to optimum moisture content to place and compact efficiently with little moisture conditioning required. Soils that are initially too wet or are allowed to become wet due to rainfall are more difficult to use. Drying wet clayey soils usually requires favorable weather conditions and often requires repeated disking and rolling with sheeps-foot rollers to lower the moisture content.

5.1.4.4 Monitoring and Testing

Fill placement should be witnessed by an experienced soils technician working under the guidance of the geotechnical engineer. We recommend full time observation by a qualified soils technician with testing at random intervals to confirm compaction is being achieved. Part-time testing may suffice for the parking area and utility trench fills.

5.1.5 Shallow Foundation Design and Construction

As previously discussed, the queuing and gathering shelters will consist of timber framed open-air shelters, while the control room building is assumed to be constructed of timber framing, surrounded by wooden deck, assumed to be supported by shallow foundations, consisting of isolated column foundations, or embedded poles. As

anticipated structural loading conditions were not available at the time of this report, we have assumed the following:

- queuing and gathering shelters – 60 kip column loads
- control room building – 15 kip column loads
- wooden deck – 25 kip column loads

Based on our boring data and experience in the area, shallow foundations appear suitable for support of the proposed structures. We estimated bearing capacities for typical isolated column footing configurations and dimensions using our boring data and our experience with similar soils under similar loading conditions. Estimated ultimate bearing capacity exceeds recommended allowable bearing pressures by a safety factor of at least 2 on level ground, provided that footings are designed and constructed as outlined in this report. The following represents our geotechnical recommendations regarding structural support.

5.1.5.1 Allowable Bearing Pressure

Assuming proper design and construction of proposed new foundations, a net bearing pressure of 3,000 pounds per square foot (psf) or less is recommended for isolated column footings bearing on residual soils. Excavated footings should be examined by the geotechnical engineer or representative of the geotechnical engineer prior to placement of concrete to determine that variations in the soil do not lower the allowable bearing capacity. It may be necessary to redesign footings in the field (e.g., widen or deepen footings) based on observed conditions.

5.1.5.2 Bearing Depth and Dimension

Minimum column footing widths should be at least 18 inches. Footings should have a minimum embedment depth of 12 inches below final grade. This recommendation is made to help prevent a "localized" or "punching" shear failure condition that could exist with very narrow footings.

5.1.5.3 Anticipated Settlement

We estimated compression of the bearing soils under the assumed loads considering an assumed distribution of vertical stress below the base of the footing. The stress distribution with depth we assumed considers the soil to act as a series of continuous, linearly elastic, horizontal strips of finite thickness, with frictional contact between each strip. This is the distribution by Westergaard which attempts to reproduce the effect of a soil system consisting of alternating stiff and soft layers with significantly higher stiffness in the horizontal direction than in the vertical direction. To simplify computations, the bearing soils were divided into a series of strips of finite thickness. The compression of each strip under the distributed vertical load imposed on that strip was then estimated based on field data and our experience with similar soils.

From our computations utilizing the assumed column loading conditions presented in this report, total anticipated settlement for properly constructed footings will be one-half inch or less for a 4½-foot by 4½-foot column footing for the queuing and gathering shelters, a 2¼-foot by 2¼-foot column footing for the control room building and a 3-foot by 3-foot column footing for the wooden deck and 3,000 psf allowable bearing pressure. Differential settlement between adjacent footings carrying similar loads is estimated as one-half of the total settlement or one-quarter inch or less.

5.1.5.4 Settlement Time Rate

We estimated time rate of settlement using our general experience in similar soils in the Piedmont region. A large portion of soil compression will occur elastically upon placement of structural loads where foundations bear in sandy soils. The stiff to very stiff medium-plasticity River Terrace clays are typically over-consolidated. Therefore, compression in these materials, if within bearing elevation of the planned foundations, is anticipated to occur along the re-load portion of the consolidation curve. Compression under these conditions is anticipated to be rapid and indistinguishable from elastic settlement. We anticipate that approximately 75 to 90 percent of total settlements predicted above will occur with load placement. Remaining settlements are expected to largely occur within the next 5 to 7 days.

5.1.5.5 Foundation Lateral Capacity

Lateral capacity of footings includes a soil lateral pressure and coefficient of friction as described in IBC Section 1806. Where bearing in natural soils, footings will be embedded in material mostly similar to those described as Class 4 in Table 1806.2. Where footings are cast neat against the sides of excavations in natural soils, an allowable lateral bearing pressure of 150 psf per foot depth below natural grade may be used in computations.

A coefficient of friction of 0.25 multiplied by the dead load may be used to calculate lateral sliding resistance. An increase of one-third in the allowable lateral capacity may be considered for load combinations, including wind or earthquake, unless otherwise restricted by design code provisions.

5.1.5.6 Construction and Observation of Footings

When possible, concrete should be placed the same day footings are excavated to the planned bearing elevations. Remove soils softened by water intrusion or exposure before placing concrete. The geotechnical engineer or a representative of the geotechnical engineer should observe cleaned footing excavations prior to concrete placement. S&ME should also observe undercut areas prior to backfilling to confirm that poor soils have been removed and that the exposed subgrade is suitable for support of footings. Footings designed for a bearing pressure of 3,000 psf which are required to be undercut below the design bearing elevation should be backfilled with an open-graded stone such as No. 57 stone, flowable fill or well compacted soil fill. If an open-graded stone is used, the stone should be tamped into place.

5.1.6 Mat Foundation Design and Construction

As previously discussed, the terminal anchorage foundations will consist of concrete deadman anchors supported by shallow mat foundations. As anticipated structural loading conditions were not available at the time of this report, we have assumed the lead anchor will have dimensions of roughly 7-foot long, 5-foot wide and 10-foot tall (dead-weight of roughly 52,500 pounds, area load of roughly 1,500 psf), and the tail anchor will have dimensions of roughly 21-fot long, 14-foot wide and 10-foot to 13-foot tall (dead-weight of roughly 516,600 pounds, area load of roughly 1,760 psf).

It is our understanding that these anchors will be supported by independent mat foundations. For a mat, strip footing or a raft designed to behave more or less rigidly, the uncoupled Winkler spring constant (sometimes termed K-value, coefficient of subgrade reaction, or modulus of subgrade reaction) is the ratio of pressure over displacement (K = p/□. The Winkler spring constant is approximated by estimating settlement and bearing

pressure at many points within the loaded area, and the spring value determined by dividing the pressure by the settlement at each point. Depending on configuration of load-bearing points, Winkler spring constant obtained near the edge of a rigid loaded area may be greater than near the center of the loaded area since the pressure will be the same, but the computed deflections of the loaded area will be less near the edge. Winkler spring constant is typically expressed as lbs./in^3 or by lbs./in^2/inch, psi/inch or pci.

5.1.6.1 Winkler Spring Constant

The value of the Winkler spring constant is dependent on the size of the loaded area. Deformation or bending of mat foundation under concentrated loading by frame pedestals will depend on mat stiffness and reinforcing as well as soil-mat interaction. Considering a "beam on elastic subgrade" or Winkler approach in design of foundation reinforcing, assuming an embedment depth of roughly 5½ feet below grade, a representative Winkler modulus of 58 psi/in is provided for computation of soil resistance to beam deflection across the mat foundation/loaded area.

5.1.6.2 Anticipated Settlement

We estimated compression of the bearing soils under the assumed loads considering an assumed distribution of vertical stress below the base of the mat. For modeling purposes, we computed the uniform load as an evenly distributed area load as detailed above, and the assumed area of the mat foundation to be that of the anchor, also detailed above. The stress distribution with depth we assumed considers the soil to act as a series of continuous, linearly elastic, horizontal strips of finite thickness, with frictional contact between each strip. This is the distribution by Westergaard which attempts to reproduce the effect of a soil system consisting of alternating stiff and soft layers with significantly higher stiffness in the horizontal direction than in the vertical direction. To simplify computations, the bearing soils were divided into a series of strips of finite thickness. The compression of each strip under the distributed vertical load imposed on that strip was then estimated based on field and laboratory data and our experience with similar soils.

Modeling of the assumed 21-foot long and 14-foot wide mat with a uniformly applied area load of roughly 1,760 psf at the base of the mat foundation has an anticipated total settlement of about ¼ of an inch.

5.1.6.3 Foundation Lateral Capacity

As previously mentioned, laboratory strength testing was performed as consolidated-undrained (CU) triaxial tests, and the shear test data were utilized. A set of Mohr's circles (shear stress, τ, as a function of effective consolidation stress, σ) were then plotted for each.

The maximum unit lateral resistance at the terminal anchorage is limited to not exceed a rectangular distribution of the Rankine passive soil pressure, which is generally less than the ultimate capacity of the soil to resist movement. In soils that are medium dense to very stiff in-situ or densified to 98 percent of the standard Proctor maximum dry density, the deformation required to develop the full passive soil pressure is generally small compared to the allowable movement of the anchor. In these cases, the full passive earth pressure can be assumed.

A moist unit weight of 130 pcf, friction angle of 32 degrees and cohesion of 175 psf are recommended for in-situ soil conditions. A coefficient of sliding friction of 0.35 is recommended between the soils and concrete anchorage.

5.1.6.4 Construction and Observation of Footings

When possible, concrete should be placed the same day footings are excavated to the planned bearing elevations. Remove soils softened by water intrusion or exposure before placing concrete. However, due to the large size of the mat, we expect this will not be feasible. We therefore recommend placing a 2- to 3-inch "mud mat" of lean (2000 psi) concrete in the bottom of the excavation to protect the bearing soils and provide a stable working surface for rebar installation. (The bearing grade will need to be slightly over-excavated a few inches to make sure the mud mat does not extend higher than the plan bottom-of-mat elevation.) This will help limit the potential for additional excavation of wet, softened (or frozen) soils which often results when foundation excavations are exposed to inclement weather.

The geotechnical engineer or a representative of the geotechnical engineer should observe cleaned footing excavations prior to concrete placement. S&ME should also observe undercut areas prior to backfilling to confirm that poor soils have been removed and that the exposed subgrade is suitable for support of footings. Footings designed for a bearing pressure which are required to be undercut below the design bearing elevation should be backfilled with an open-graded stone such as No. 57 stone, flowable fill or well compacted soil fill. If an open-graded stone is used, the stone should be tamped into place.

5.2 Support Tower Structures

Our evaluation and recommendations are based on the project information provided to us as documented in this report and on the data obtained from the field exploration and laboratory programs.

5.2.1 Shallow Foundation Design and Construction

Based on the provided project information, the tower structures are understood to be supported by shallow foundations, consisting of isolated column foundations. Anticipated structural loading conditions were provided as follows:

Table 5-1 – Tower Foundation Dimension/Load Summary

Tower Structure	Planned Dimensions				Provided Anticipated Reactions				
	Width (ft)	Length (ft)	Height (ft)	Embedment (ft)	Vertical (kips)	Moment		Horizontal	
						Transverse (kip-ft)	Longitude (kip-ft)	Transverse (kip)	Longitude (kip)
1	13	9	6.5	6	-7.6	190.6	33.4	8.6	-2
2	16	11	8.5	8	44.9	718.8	133.7	14.8	2.6
3	20	14	8.5	8	42.7	1621.6	55.5	20.8	0.9
4	13	9	6.5	6	19.8	300.6	13.8	9.3	0.4
5	10	7	6.5	6	13.2	148.3	4.4	6	0.2

It is understood these reactions are provided for the controlling load case due to transverse wind transient loading and that the vertical reaction does not include the mass weight of the concrete foundation. Finally, we understand up to 2 inches of settlement is tolerable.

Based on our boring data and experience in the area, shallow foundations appear suitable for support of the proposed structures. We estimated bearing capacities for typical isolated column footing configurations and dimensions using our boring data and our experience with similar soils under similar loading conditions. Estimated ultimate bearing capacity exceeds recommended allowable bearing pressures by a safety factor of at least 3 on level ground, provided that footings are designed and constructed as outlined in this report. The following represents our geotechnical recommendations regarding structural support.

5.2.1.1 Allowable Bearing Pressure

Assuming proper design and construction of proposed new foundations, the following net bearing pressures can be provided for isolated column footings bearing on residual soils.

Table 5-2 – Summary of Allowable Bearing Pressures

Tower Structure	Representative Boring No.	Foundation Embedment Depth (ft)	Anticipated Bearing Stratum	Allowable Bearing Pressure (psf)
1	T-1	6	PWR	20,000
2	T-2	8	PWR	20,000
3	T-3	8	PWR	20,000
4	T-4	6	Stiff CL	4,000
5	T-5	6	Stiff CL	4,000

Excavated footings should be examined by the geotechnical engineer or representative of the geotechnical engineer prior to placement of concrete to determine that variations in the soil do not lower the allowable bearing capacity. It may be necessary to redesign footings in the field (e.g., widen or deepen footings) based on observed conditions.

5.2.1.2 Bearing Depth and Dimension

Minimum column footing widths should be at least 36 inches. Footings should have a minimum embedment depth of 12 inches below final grade. This recommendation is made to help prevent a "localized" or "punching" shear failure condition that could exist with very narrow footings.

5.2.1.3 Anticipated Settlement

We estimated compression of the bearing soils under the provided loads considering an assumed distribution of vertical stress below the base of the footing. The stress distribution with depth we assumed considers the soil to act as a series of continuous, linearly elastic, horizontal strips of finite thickness, with frictional contact between each strip. This is the distribution by Westergaard which attempts to reproduce the effect of a soil system consisting of alternating stiff and soft layers with significantly higher stiffness in the horizontal direction than in the vertical direction. To simplify computations, the bearing soils were divided into a series of strips of finite thickness. The compression of each strip under the distributed vertical load imposed on that strip was then estimated based on field data and our experience with similar soils.

From our computations utilizing the provided reactions presented in this report, total anticipated settlement for properly constructed footings will be one inch or less for the provided footing dimensions and provided allowable bearing pressure. Differential settlement between adjacent footings carrying similar loads is estimated as one-half of the total settlement or one-half inch or less.

5.2.1.4 Settlement Time Rate

We estimated time rate of settlement using our general experience in similar soils in the Piedmont region. A large portion of soil compression will occur elastically upon placement of structural loads where foundations bear in sandy soils. The stiff to very stiff medium-plasticity residual clays are typically over-consolidated. Therefore, compression in these materials, if within bearing elevation of the planned foundations, is anticipated to occur along the re-load portion of the consolidation curve. Compression under these conditions is anticipated to be rapid and indistinguishable from elastic settlement. We anticipate that approximately 75 to 90 percent of total settlements predicted above will occur with load placement. Remaining settlements are expected to largely occur within the next 5 to 7 days.

5.2.1.5 Foundation Lateral Capacity

Lateral capacity of footings includes a soil lateral pressure and coefficient of friction, for a level ground case. We have assumed that site soils will be compacted, and foundation concrete resisting lateral loads will be cast neat against an excavated soil face. When on non-level ground the adjacent sloped soil wedge sliding resistance must equal or exceed the lateral sliding force. As the foundation bearing depth increases, both the weight of the adjacent soil wedge and available lateral sliding resistance increase.

Where bearing in natural soils, footings will be embedded in material mostly similar to those described as Class 4 (foundations bearing in sand and PWR soils) in IBC Table 1806.2. Where footings are cast neat against the sides of excavations in natural soils, an allowable lateral bearing pressure of 150 psf per foot depth below natural grade may be used in computations. A coefficient of friction of 0.25 multiplied by the dead load may be used to calculate lateral sliding resistance. An increase of one-third in the allowable lateral capacity may be considered for load combinations, including wind or earthquake, unless otherwise restricted by design code provisions.

Where bearing in natural soils, footings will be embedded in material mostly similar to those described as Class 5 in IBC Table 1806.2 (foundations bearing clays). Where footings are cast neat against the sides of excavations in natural soils, an allowable lateral bearing pressure of 100 psf per foot depth below natural grade may be used in computations. A cohesion of 130 psf multiplied by the contact area may be used to calculate lateral sliding resistance. An increase of one-third in the allowable lateral capacity may be considered for load combinations, including wind or earthquake, unless otherwise restricted by design code provisions.

5.2.1.6 Construction and Observation of Footings

When possible, concrete should be placed the same day footings are excavated to the planned bearing elevations. Remove soils softened by water intrusion or exposure before placing concrete. The geotechnical engineer or a representative of the geotechnical engineer should observe cleaned footing excavations prior to concrete placement. S&ME should also observe undercut areas prior to backfilling to confirm that poor soils have been removed and that the exposed subgrade is suitable for support of footings. Footings designed for a bearing pressure of 3,000 psf which are required to be undercut below the design bearing elevation should be backfilled

with an open-graded stone such as No. 57 stone, flowable fill or well compacted soil fill. If an open-graded stone is used, the stone should be tamped into place. If footings must remain open overnight or if rainfall is imminent, place a 2 to 4-inch thick "mud-mat" of "lean" (2000 psi) concrete on the bearing soils before placing rebar.

5.2.2 Deep Foundation Design and Construction

Based on the provided project information, the tower structures may alternately to be supported by drilled shaft deep foundations. Soil and rock properties for design of drilled shaft foundations are provided in the following sections.

5.2.2.1 Design Values

Table A-1 in Appendix IV presents soil and rock properties that may be used for design of drilled shafts for support of the tower structures. The tables should be used in conjunction with the notes and construction considerations shown below and in subsequent sections of this report:

- ϕ = Angle of Internal Friction (degrees)
- c = Cohesion (ksf)
- γ' = Effective Unit Weight (pcf)
- A Factor of Safety of at least 2 should be applied to the ultimate side shear values to determine allowable shaft capacity.
- A factor of safety of at least 3 should be applied to the ultimate end bearing values to determine allowable shaft end bearing capacity.
- Where end bearing resistance is given for drilled shafts, this value assumes that the shaft will be installed to a depth of at least 10 feet below grade.
- The lateral subgrade modulus (k) and soil strain parameter (e50) values may be used to determine lateral response using a computer program such as LPILEplus. Values shown assume static loading.
- We recommend that the upper 5 feet of side shear resistance be ignored when determining drilled shaft axial capacities.
- Values provided for lateral resistance (k and e50) assume foundation behavior may be represented by a foundation which is embedded to sufficient depth to act as a flexible beam.

5.2.2.2 Construction Considerations

Subsurface conditions were fairly consistent along the alignment. Our experience indicates that conventional drilled shaft rigs equipped with an earth auger can typically penetrate alluvium, River Terrace deposits and Piedmont residuum. A drill bit with hardened teeth (rock auger) may be needed to penetrate Piedmont residual PWR material with SPT N-values in excess of 100 blows per foot (noted as 50/_" on the boring records). A rock core barrel or rotary percussion drill will likely be needed if the towers require embedment below the depth noted as auger refusal on the boring records.

The use of temporary casing and/or drilling slurry will be necessary at some locations due to the measured depth of the ground water and potential for sloughing of less cohesive sands. Methods of drilled shaft installation may vary based on the presence of ground water, or lack thereof.

The following are recommended procedures where the "wet" methods may be required:

1. A removable steel casing will be required in the drilled shaft to prevent influx of ground water and caving of the excavation sides due to soil relaxation or sloughing of cohesionless sands. Steel casing should be extended to either the planned bottom depth or seated into medium dense sands or very stiff clays at a minimum, whichever occurs first.
2. Drilling slurry may be required in drilled shafts to maintain integrity of the base of the shaft. We recommend that a head of slurry of at least 10 feet above the water level or very loose to loose sand layers indicated in the borings be maintained continuously within the casing during shaft construction.
3. The base of the drilled shaft should be free of debris, loose soil, and cuttings. The shaft should be cleaned using an air lift system or clean out bucket equipped with a one-way flap gate that prevents spoils from re-entering the shaft.
4. Mineral slurry should meet the minimum requirements outlined in ACI 336.1 "Standard specifications for the Construction of Drilled Piers", for side resistant supported piers. Contractor should be prepared to monitor slurry properties and de-sand the slurry if required prior to installation of concrete.
5. The drilled shaft installation should be evaluated by a representative of the geotechnical engineer to confirm suitable end bearing conditions and to confirm the proper diameter and bottom cleanliness. The shafts should be evaluated immediately prior to and during concreting operations.
6. Before casing is withdrawn, the level of fresh concrete in the casing should be a minimum of 10 feet above the hydrostatic water level or very loose to loose sand layers. This level should be maintained until the casing has been withdrawn above the encountered level/layer.
7. The drilled shafts should be concreted as soon as practical after excavation to reduce the deterioration of the supporting soils due to soil caving and ground water intrusion.
8. If a drilling slurry is used, tremie methods will be necessary to install fresh concrete through the slurry. Tremie pipe should have a minimum diameter of 8 inches and be connected with watertight joints. We recommend use of a "pig" or similar device to separate the concrete from the drilling fluid in the pipe until pumping begins. Pumping should not be initiated until the tremie pipe discharge surface is at the shaft base elevation. The pipe orifice should be maintained at least 10 feet below the level of the fresh concrete in the shaft at all times.

The following are recommended procedures where the "dry" method may be required:

1. Drilling equipment should have cutting teeth that result in a hole with little or no smear or cake on the sides; a spiral like corrugated side should be produced. The shaft bottom should be free of debris, loose soil, and cuttings. The shaft should be cleaned using an air lift system or clean out bucket equipped with a one-way flap gate that prevents spoils from re-entering the shaft.
2. A removable steel casing may be needed for at least part of the shaft depth to prevent caving of the excavation sides due to soil relaxation or influx of perched ground water.
3. The drilled shaft excavations should be evaluated by a representative of the geotechnical engineer to confirm suitable end bearing conditions and to verify the proper diameter and bottom cleanliness. The shafts should be evaluated immediately prior to and during concreting operations.
4. The drilled shafts should be concreted as soon as practical after excavation to reduce the deterioration of the supporting soils due to soil caving and ground water intrusion.
5. The concrete may be allowed to fall freely through the open area in the reinforcing steel cage provided that it is not allowed to strike the rebar or the casing prior to reaching the bottom of the shaft excavation.

Concrete should also not be allowed to freefall through standing water near the bottom of the shaft. A tremie pipe should be used to place the concrete if free-falling techniques cannot be acceptably performed.

6. The protective steel casing, if installed, should be extracted as concrete is placed. However, a head of concrete should be maintained above the bottom of the casing to prevent soil and water intrusion into the concrete below the casing.

5.3 Western Landing Plaza

5.3.1 Site Preparation

Site preparation will need to include removal of unsuitable surface materials within the proposed plaza footprint. This should include surface vegetation, organic laden topsoil, stumps, root bulbs, surface debris and unstable surface or subsurface soils.

Removal of stumps and roots will result in disturbance of the upper soils. In filled areas, the upper soils will need to be stabilized prior to placing fill. Stabilization, if required, may consist of removing and replacing unstable material or, where unstable soils are thin, drying and compacting in-place.

5.3.1.1 Clearing, Grubbing and Stripping

Topsoil thickness encountered in our borings measured up to 4 inches in thickness. The organic soil stripping process may expose deeper organic soils in portions of the site than suggested by the boring data. These soils often have a similar color to topsoil but contain only minor amounts of organics. The organic content of the topsoil materials encountered at the existing ground surface was not tested, therefore, the depth of initial stripping is not known at this time, and could vary, depending on the actual organic content of the soils and the project specifications. If these soils are to remain in-place or are to be re-used as structural fill, the organic content should be tested, in general accordance with ASTM D2974.

Our experience also suggests that the movement of clearing and construction equipment during wet weather and/or on areas of standing water or saturated soils will result in degradation of the soils to depths of 1 to 2 feet. Repeated passes of equipment will cause rutting and the mixture of surface materials (organics) into what might otherwise be acceptable soils. Movement of construction equipment on saturated soils should be avoided where possible. Where organics and near surface soils become mixed, it will be necessary to remove and replace the mixed material.

5.3.1.2 Surface Preparation/Proofrolling

In most areas, surface preparation can likely be limited to proofrolling of the surface. Areas that rut, pump, or move excessively under movement of the equipment need to be stabilized prior to placement of fill soil or concrete.

After removal of topsoil and unsuitable soils/materials and cutting to grade, but prior to fill placement, the exposed ground surface should be observed by the geotechnical engineer or a representative of the geotechnical engineer to confirm that poor soils have been removed and that the exposed subgrade is suitable for support of the structures.

To aid in evaluation of the exposed soils, the area should be proofrolled using a loaded dump truck or similarly heavy piece of equipment. Areas that rut, pump, or move excessively under movement of the equipment should be stabilized prior to placement of fill soil. If left in place, soft or wet soils will exhibit substantially lower bearing for foundations and slabs. Stabilization, if required, may consist of removing and replacing unstable material with properly compacted structural fill, or where unstable soils are thin, wet/drying and compacting in-place.

Care should be taken during construction so that the subgrade soils are not disturbed more than necessary. If heavily reworked or disturbed, stabilization may be required for what could otherwise be considered an acceptable subgrade.

5.3.2 Dewatering Considerations

From our review of the ground water measurements collected to date, along with our understanding of a planned plaza footprint at elevation 255.91 ft-MSL, the data suggests that ground water is not likely to be encountered during grading or excavation activities. However, there is a potential for perched ground water conditions to be encountered. While dewatering should be the sole responsibility of the contractor, we offer the following recommendations regarding practices that have been successful in the past.

A temporary system that has performed adequately on previous projects with similar conditions consists of temporary excavations (ditches) and sump pumps. Temporary ditches should be excavated to a depth that will promote collection of the ground water and positioned/sloped to allow for positive drainage flow of this water to be diverted from the graded area. Pumping from the sumps should be maintained until fill placement is a minimum of three feet above the water level. Other means of improving drainage at the site may be accomplished with ditches located in select areas.

Continue dewatering during fill placement to maintain groundwater at its lowered elevation. If discontinued prematurely, the ground water level will rise, saturating the fill soils and preventing effective compaction. When the area has been filled more than three feet above the natural groundwater level, dewatering may be discontinued.

If ground water or infiltrating surface water is not properly controlled during construction, the subgrade soils which will support foundations, as well as pavements or floor slabs, may be damaged. Furthermore, construction equipment mobility may be impaired.

We do not anticipate that a permanent groundwater control system will be required. This should be re-evaluated during construction based on groundwater encountered.

5.3.3 Excavation Considerations

Based on review of the soil test boring data to date, along with our understanding of the planned finished grade at elevation 255.91 ft-MSL, it appears that loose to medium dense sandy (SM) soils will mostly be encountered during general excavation activities. These River Terrace deposits can be typically excavated using pans, scrapers, track or wheel-mounted excavators and front-end loaders in mass grading. The degree of difficulty that mobile equipment will encounter rises dramatically in materials exceeding about 70 to 80 blows per foot. These conditions were not encountered in our soil borings. Due to our understanding of the planned grades for this

portion of the site, difficult excavation during mass grading and foundation excavation does not appear to be likely.

5.3.4 General Comments on Slope Stability and Construction

Due to the existing and proposed grades at the site, it is understood that cut and fill slopes will be required.

5.3.4.1 Temporary Excavation Stability

Excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is usually solely responsible for site safety. This information is provided only as a service, and under no circumstances shall S&ME be assumed to be responsible for construction site safety. It is important to note that per OSHA, excavation slopes and shoring systems greater than 20 feet in height must be designed by a Professional Engineer.

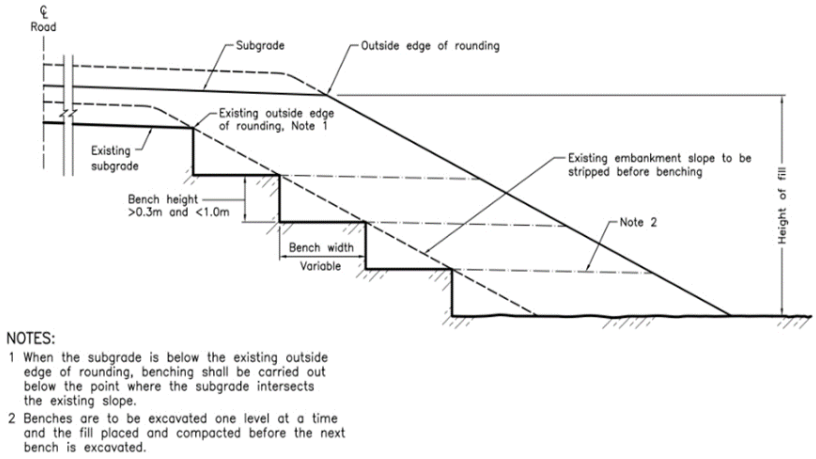
5.3.4.2 Excavation Slopes

The planned excavations at the site will be advanced through mostly River Terrace soil and appear to be planned to approach about 2 feet in height. Slope stability analysis is outside of our current scope of work; however, based upon our experience and information obtained by borings at the site, we recommend the excavated cut slopes not exceed a maximum inclination of 2H:1V (horizontal:vertical). These values are for planning purposes and will need to be confirmed during construction by direct observation of the excavated slopes, and inclinations modified, if necessary, based on the observed conditions. If these slopes are to be exceeded, then temporary/permanent retainage may be necessary.

5.3.4.3 Fill Slopes

Fill slopes approaching 3 feet are required at the site. Based upon our experience and information obtained by borings at the site, we recommend the fill slopes not exceed a maximum inclination of 2H:1V (horizontal:vertical). Slope stability analysis is outside of our current scope of work.

To ensure stability, loose material should be removed (undercut) from the toe of the proposed fill slope or compacted as indicated in this report prior to placing fill. The fill slopes should be benched into existing sloping terrain and adequately compacted. The tops and bases of slopes should be located a minimum of 3 times the height of the slope from structural limits. Furthermore, we recommend that fill slopes constructed along existing slopes or embankments steeper than 4H:1V have a keyway constructed along the slope base to help counteract sliding failure, as shown in the example detail below. The keyway width should be at least ½ of the planned slope height, and the keyway should be embedded a minimum of 2 feet into stiff to medium dense soils.



Benching for Fill Slopes constructed along Existing Slopes

We recommend that compacted fill slopes be benched and slightly over-built, (in order to minimize the presence of a loose zone of poorly compacted soils near the slope face), and then cut back to firm, well compacted soils prior to the placement of structure or vegetative cover. Upon construction of a competent slope face, the slope face should be protected from erosion.

5.3.4.4 General Slope Recommendations

Recommended slopes are preliminary and assume that groundwater is controlled at the lowest level of the excavation continuously while the excavation is open. Groundwater is assumed not to flow or emerge from soil excavation slopes. Surface water is assumed to be captured by appropriate drainage measures above the slope crest and not allowed to drain down the slope. If perched groundwater is observed emerging from the face of the slope or if surface water is adversely affecting the slope, S&ME should be contacted immediately.

It is also assumed that excavated slopes are relatively uniform such that local slopes due not significantly exceed the recommended slopes. Finally, the recommended slope inclination assumes that all slopes are monitored for indications of instability and that slopes are flattened or other measures taken if appropriate. Monitoring of the slopes during construction is presently not part of our contracted scope of services for this project.

Stability can be reduced by a number of additional factors including excessive erosion, non-uniform sloping resulting in areas of steeper grades, loose seams in the cut face, and/or ground water emerging from the cut slopes. As a result, proper channeling of surface water is critical. Surface runoff shall be directed away from the slopes via the use of berms, swales, or slope drains. For erosion protection, a protective cover of grass should be established on permanent soil slopes as soon as possible after slope construction. If loose seams are encountered within cut faces during excavation or ground water is encountered, an in-depth analysis of slope stability should be performed.

We caution against the installation of drop inlets or storm sewer lines within an improper embedment zone of the slope face, where possible over stressing and leakage may create maintenance problems or possible isolated slope failure. In general, these structures need to be installed a minimum distance of 1½ times the height of the embankment, as measured from the crest and/or toe of the slope. Furthermore, proper embedment of buried utilities beneath slope faces should be established prior to construction, with a minimum embedment for

foundation recommended to be 5 feet below the down gradient portion of the slope, while a minimum embedment for buried utilities is recommended to be 3 feet below the down gradient portion of the slope.

5.3.5 Use of On-site Soils as Structural Fill

The on-site cut soils that are proposed for use as fill at the site range in USCS soil classification but are generally sands with low to medium plasticity fines (SM and SC) and possibly medium plasticity clays with little sands (CL).

5.3.5.1 Sandy Proposed Fill Soils

Coarse grained sandy soils with low to medium plasticity fines (SM and SC), similar to those encountered in the upper strata of the exploration, are typically suitable for use as structural fill and for use as the immediate subgrade for floor slabs.

5.3.5.2 Medium Plasticity Proposed Fill Soils

Fine grained medium plasticity clays (CL) containing little sands, similar to those encountered in the upper strata of the exploration, are typically marginally suitable for use as structural fill. Suitability of these soils for use depends a great deal on the moisture content of the material at time of placement.

Marginal suitability refers to the fact that fine grained soils are moisture sensitive to some degree and can be difficult to work if allowed to become wet. These difficulties can include softening of exposed subgrade soils, excessive rutting or deflection under construction traffic, and the difficulty associated with adequately drying and compacting wet soil. Moisture-related earthwork difficulties can be reduced by performing the earthwork during the typically drier months of the year (May through October).

Drainage from the site should be provided and maintained to reduce the potential for ponding of water on exposed subgrades. Before beginning to place fill, sample and test each proposed fill material to determine its maximum dry density, optimum moisture content, natural moisture content, and suitability as a structural fill material.

5.3.6 Fill Placement and Compaction

Before beginning to place fill, sample and test each proposed fill material to determine maximum dry density, optimum moisture content, natural moisture content, gradation and plasticity of the soil. Structural soil fill material should have less than 5 percent organic matter, a standard Proctor maximum dry density of 90 pcf or greater and a plasticity index (PI) of 30 percent or less.

We recommend that off-site borrow meet the organic content, PI and density requirements of this section. Testing will be required before fill placement begins to determine the optimum moisture-density condition for the fill materials. Material to be used as soil fill should be tested and approved by the geotechnical engineer before being placed.

5.3.6.1 Density and Moisture Requirements

Place fill in maximum 8-inch loose lifts and compact to at least 98 percent of maximum dry density (ASTM D698 standard Proctor) within the plaza/building area and around the terminal anchorage foundations. This level of

compaction can be practically achieved with area soils and has been found to provide adequate support for foundations and grade slabs. Fill moisture content should be maintained within +/- 3 percent of the optimum moisture content. Contractor should be prepared to wet or dry soils as necessary to achieve compaction. In addition to meeting the compaction requirement, fill material should be stable under movement of the construction equipment and should not exhibit rutting or pumping.

5.3.6.2 Compaction of Granular Soils

A vibratory sheep's-foot roller will likely be more effective for compaction of the silty and clayey sand (SM and SC) soils encountered at the site. Sheep's-foot compactors will likely be preferable because the pads better penetrate the soil and they tend to break down the natural cohesive bonds between the particles.

Sandy soils excavated above the water table are usually close enough to optimum moisture content to place and compact efficiently with little moisture conditioning required. Soils that are initially too wet or are allowed to become wet due to rainfall are more difficult to use.

5.3.6.3 Compaction of Cohesive Soils

The compaction characteristics of clayey soils (CL) with plastic properties encountered at this site will be highly dependent on the soil moisture content at the time of construction. Sheeps-foot compactors will likely be preferable because the pads better penetrate the soil, and they tend to break down the natural cohesive bonds between the particles.

The water content of these soils is usually very difficult to modify in the field. Above or below the optimum moisture content, the soils become progressively more difficult to manipulate and compact. Soils excavated above the water table are usually close enough to optimum moisture content to place and compact efficiently with little moisture conditioning required. Soils that are initially too wet or are allowed to become wet due to rainfall are more difficult to use. Drying wet clayey soils usually requires favorable weather conditions and often requires repeated disking and rolling with sheeps-foot rollers to lower the moisture content.

Slope the fill surface to drain and prevent ponding water. If rain is expected while filling is temporarily halted, roll the surface with rubber tire or steel drum equipment to improve surface run-off.

5.3.6.4 Monitoring and Testing

Fill placement should be witnessed by an experienced soils technician working under the guidance of the geotechnical engineer. We recommend full time observation by a qualified soils technician with testing at random intervals to confirm compaction is being achieved. Part-time testing may suffice for the parking area and utility trench fills.

5.3.7 Shallow Foundation Design and Construction

As previously discussed, the queuing and car maintenance shelters will consist of timber framed open-air shelters assumed to be supported by shallow foundations or embedded poles, while the control room and restroom buildings are assumed to be constructed of timber framing assumed to be supported by shallow continuous wall

foundations and a slab on grade. As anticipated structural loading conditions were not available at the time of this report, we have assumed the following:

- queuing and car maintenance shelters – 60 kip column loads
- control room and restroom building – 3 to 5 kip per linear foot wall loads

Based on our boring data and experience in the area, shallow foundations appear suitable for support of the proposed structures. We estimated bearing capacities for typical isolated column and continuous wall footing configurations and dimensions using our boring data and our experience with similar soils under similar loading conditions. Estimated ultimate bearing capacity exceeds recommended allowable bearing pressures by a safety factor of at least 2 on level ground, provided that footings are designed and constructed as outlined in this report. The following represents our geotechnical recommendations regarding structural support.

5.3.7.1 Allowable Bearing Pressure

Assuming proper design and construction of proposed new foundations, a net bearing pressure of 4,000 pounds per square foot (psf) or less is recommended for isolated column and continuous wall footings bearing on residual soils. Excavated footings should be examined by the geotechnical engineer or representative of the geotechnical engineer prior to placement of concrete to determine that variations in the soil do not lower the allowable bearing capacity. It may be necessary to redesign footings in the field (e.g., widen or deepen footings) based on observed conditions.

5.3.7.2 Bearing Depth and Dimension

Minimum column and wall footing widths should be at least 18 inches and 12 inches, respectively. Footings should have a minimum embedment depth of 12 inches below final grade. This recommendation is made to help prevent a "localized" or "punching" shear failure condition that could exist with very narrow footings.

5.3.7.3 Anticipated Settlement

We estimated compression of the bearing soils under the provided anticipated loads considering an assumed distribution of vertical stress below the base of the footing. The stress distribution with depth we assumed considers the soil to act as a series of continuous, linearly elastic, horizontal strips of finite thickness, with frictional contact between each strip. This is the distribution by Westergaard which attempts to reproduce the effect of a soil system consisting of alternating stiff and soft layers with significantly higher stiffness in the horizontal direction than in the vertical direction. To simplify computations, the bearing soils were divided into a series of strips of finite thickness. The compression of each strip under the distributed vertical load imposed on that strip was then estimated based on field and laboratory data and our experience with similar soils.

From our computations utilizing the assumed column and wall loading conditions presented in this report, total anticipated settlement for properly constructed footings will be one-half inch or less for a 4-foot by 4-foot column footing for the queuing and car maintenance shelters, a 1½-wide continuous wall footing for the control room and restroom buildings and 4,000 psf allowable bearing pressure. Differential settlement between adjacent footings carrying similar loads is estimated as one-half of the total settlement or one-quarter inch or less.

5.3.7.4 Settlement Time Rate

We estimated time rate of settlement using our general experience in similar soils in the Piedmont region. A large portion of soil compression will occur elastically upon placement of structural loads where foundations bear in sandy soils. The stiff to very stiff medium-plasticity River Terrace clays are typically over-consolidated. Therefore, compression in these materials, if within bearing elevation of the planned foundations, is anticipated to occur along the re-load portion of the consolidation curve. Compression under these conditions is anticipated to be rapid and indistinguishable from elastic settlement. We anticipate that approximately 75 to 90 percent of total settlements predicted above will occur with load placement. Remaining settlements are expected to largely occur within the next 5 to 7 days.

5.3.7.5 Foundation Lateral Capacity

Lateral capacity of footings includes a soil lateral pressure and coefficient of friction as described in IBC Section 1806. Where bearing in natural soils, footings will be embedded in material mostly similar to those described as Class 4 in Table 1806.2. Where footings are cast neat against the sides of excavations in natural soils, an allowable lateral bearing pressure of 150 psf per foot depth below natural grade may be used in computations.

A coefficient of friction of 0.25 multiplied by the dead load may be used to calculate lateral sliding resistance. An increase of one-third in the allowable lateral capacity may be considered for load combinations, including wind or earthquake, unless otherwise restricted by design code provisions.

5.3.7.6 Construction and Observation of Footings

When possible, concrete should be placed the same day footings are excavated to the planned bearing elevations. Remove soils softened by water intrusion or exposure before placing concrete. The geotechnical engineer or a representative of the geotechnical engineer should observe cleaned footing excavations prior to concrete placement. S&ME should also observe undercut areas prior to backfilling to confirm that poor soils have been removed and that the exposed subgrade is suitable for support of footings. Footings designed for a bearing pressure of 4,000 psf which are required to be undercut below the design bearing elevation should be backfilled with an open-graded stone such as No. 57 stone, flowable fill or well compacted soil fill. If an open-graded stone is used, the stone should be tamped into place.

5.3.8 Mat Foundation Design and Construction

As previously discussed, the terminal anchorage foundations will consist of concrete deadman anchors supported by shallow mat foundations. As anticipated structural loading conditions were not available at the time of this report, we have assumed the lead anchor will have dimensions of roughly 7-foot long, 5-foot wide and 10-foot tall (dead-weight of roughly 52,500 pounds, area load of roughly 1,500 psf), and the tail anchor will have dimensions of roughly 21-fot long, 14-foot wide and 10-foot to 13-foot tall (dead-weight of roughly 516,600 pounds, area load of roughly 1,760 psf).

It is our understanding that these anchors will be supported by independent mat foundations. For a mat, strip footing or a raft designed to behave more or less rigidly, the uncoupled Winkler spring constant (sometimes termed K-value, coefficient of subgrade reaction, or modulus of subgrade reaction) is the ratio of pressure over displacement (K = p/□. The Winkler spring constant is approximated by estimating settlement and bearing

pressure at many points within the loaded area, and the spring value determined by dividing the pressure by the settlement at each point. Depending on configuration of load-bearing points, Winkler spring constant obtained near the edge of a rigid loaded area may be greater than near the center of the loaded area since the pressure will be the same, but the computed deflections of the loaded area will be less near the edge. Winkler spring constant is typically expressed as lbs./in^3 or by lbs./in^2/inch, psi/inch or pci.

5.3.8.1 Winkler Spring Constant

The value of the Winkler spring constant is dependent on the size of the loaded area. Deformation or bending of mat foundation under concentrated loading by frame pedestals will depend on mat stiffness and reinforcing as well as soil-mat interaction. Considering a "beam on elastic subgrade" or Winkler approach in design of foundation reinforcing, assuming an embedment depth of roughly 5½ feet below grade, a representative Winkler modulus of 16 psi/in is provided for computation of soil resistance to beam deflection across the mat foundation/loaded area.

5.3.8.2 Anticipated Settlement

We estimated compression of the bearing soils under the assumed loads considering an assumed distribution of vertical stress below the base of the mat. For modeling purposes, we computed the uniform load as an evenly distributed area load as detailed above, and the assumed area of the mat foundation to be that of the anchor, also detailed above. The stress distribution with depth we assumed considers the soil to act as a series of continuous, linearly elastic, horizontal strips of finite thickness, with frictional contact between each strip. This is the distribution by Westergaard which attempts to reproduce the effect of a soil system consisting of alternating stiff and soft layers with significantly higher stiffness in the horizontal direction than in the vertical direction. To simplify computations, the bearing soils were divided into a series of strips of finite thickness. The compression of each strip under the distributed vertical load imposed on that strip was then estimated based on field and laboratory data and our experience with similar soils.

Modeling of the assumed 21-foot long and 14-foot wide mat with a uniformly applied area load of roughly 1,760 psf at the base of the mat foundation has an anticipated total settlement of about ¾ of an inch.

5.3.8.3 Foundation Lateral Capacity

As previously mentioned, laboratory strength testing was performed as consolidated-undrained (CU) triaxial tests, and the shear test data were utilized. A set of Mohr's circles (shear stress, τ, as a function of effective consolidation stress, σ) were then plotted for each.

The maximum unit lateral resistance at the terminal anchorage is limited to not exceed a rectangular distribution of the Rankine passive soil pressure, which is generally less than the ultimate capacity of the soil to resist movement. In soils that are medium dense to very stiff in-situ or densified to 98 percent of the standard Proctor maximum dry density, the deformation required to develop the full passive soil pressure is generally small compared to the allowable movement of the anchor. In these cases, the full passive earth pressure can be assumed.

A moist unit weight of 130 pcf, friction angle of 42 degrees and cohesion of 75 psf are recommended for in-situ soil conditions. A coefficient of sliding friction of 0.35 is recommended between the soils and concrete anchorage.

5.3.8.4 Construction and Observation of Footings

When possible, concrete should be placed the same day footings are excavated to the planned bearing elevations. Remove soils softened by water intrusion or exposure before placing concrete. However, due to the large size of the mat, we expect this will not be feasible. We therefore recommend placing a 2- to 3-inch "mud mat" of lean (2000 psi) concrete in the bottom of the excavation to protect the bearing soils and provide a stable working surface for rebar installation. (The bearing grade will need to be slightly over-excavated a few inches to make sure the mud mat does not extend higher than the plan bottom-of-mat elevation.) This will help limit the potential for additional excavation of wet, softened (or frozen) soils which often results when foundation excavations are exposed to inclement weather.

The geotechnical engineer or a representative of the geotechnical engineer should observe cleaned footing excavations prior to concrete placement. S&ME should also observe undercut areas prior to backfilling to confirm that poor soils have been removed and that the exposed subgrade is suitable for support of footings. Footings designed for a bearing pressure which are required to be undercut below the design bearing elevation should be backfilled with an open-graded stone such as No. 57 stone, flowable fill or well compacted soil fill. If an open-graded stone is used, the stone should be tamped into place.

5.3.9 Grade Slab Support and Construction

After cut and fill placement operations are completed to achieve subgrade elevation for the plaza/building pad, the exposed surface should be proofrolled under the observation of the geotechnical engineer with a heavily loaded dump truck or pan. Areas of rutting or pumping soils may require selective undercutting or further stabilization prior to placement of the slab.

Construction of footings or utility lines within the plaza/building footprint frequently results in disturbance of the compacted soil subgrade supporting the slab. The presence of loosened or disturbed materials on the subgrade will have an adverse effect on future slab performance, even if compaction data obtained during initial soil placement indicated satisfactory compaction at that time.

5.3.9.1 Modulus of Subgrade Reaction

For computations involving concrete floors-on-grade that are not structural elements in the building (floors not supporting columns and loadbearing walls), the modulus of subgrade reaction is expressed using Westergaard's modulus of subgrade reaction (sometimes termed k-value). The value of the modulus of subgrade reaction is typically expressed as the result of a standard 12-inch x 12-inch rigid plate load test performed on the surface of the subgrade. A general procedure for load testing is given in ASTM D-1196. Units of k are given in pounds per cubic square inch, or psi per in. or, as commonly expressed, pounds per cubic inch (pci). The plate load test is no longer commonly performed in practice. Instead, subgrade reaction values are estimated from the California Bearing Ratio or from the soil classification.

A modulus of subgrade reaction (ks) of 150 pci may be assumed for design of slabs on subgrades compacted to a minimum of 98 percent of the standard Proctor maximum dry density. This value is based on published correlations between soil types and conditions expected to be present at finished subgrade at this site and small-diameter plate load tests. The modulus value is considered appropriate for point loads and small-diameter wheel loads, but it must be modified (reduced) for wide area loads.

5.3.9.2 Underslab Recommendations

Provide joints in slabs around column and along wall foundations to accommodate minor differential settlements. From our review of ACI 360 *Guide to Design of Slabs-on-Ground*, we feel that the estimated ground water level within the planned plaza/building area will be at a sufficient depth as to not require a capillary break beneath the slab-on-grade. If areas within the plaza and building will require specialized floor coverings and coatings, which may be moisture sensitive, a vapor barrier should be included in the floor slab design. The design of the vapor barrier should be in accordance with American Concrete Institute (ACI) guidelines.

5.3.9.3 General

We recommend that special care be given to providing adequate drainage away from the building area to reduce infiltration of surface water into the soils immediately supporting the slab. If the slab subgrade is allowed to become saturated, the resulting loss of strength and the resulting reduction in the bearing ratio of these soils may result in unanticipated levels of flexure or bending of the slab. Since bending or flexure is typically greatest at edges or corners of the individual slab sections, saturation of the bearing soils often results in cracking or breaking off of the corners of the slabs. Excessive flexure or deflection of the slab may also result in pumping or infiltration of fines into the joints between sections of the slab, reducing the ability of the slab to expand or contract with changes in temperature, and further reducing the life of the slab.

6.0 Qualifications of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, and bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

Appendices

Important Information About Your
Geotechnical Engineering Report

Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.

Geotechnical Findings Are Professional Opinions

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

Scope of Geotechnical Services

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

Services Are Performed for Specific Projects

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project.

Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

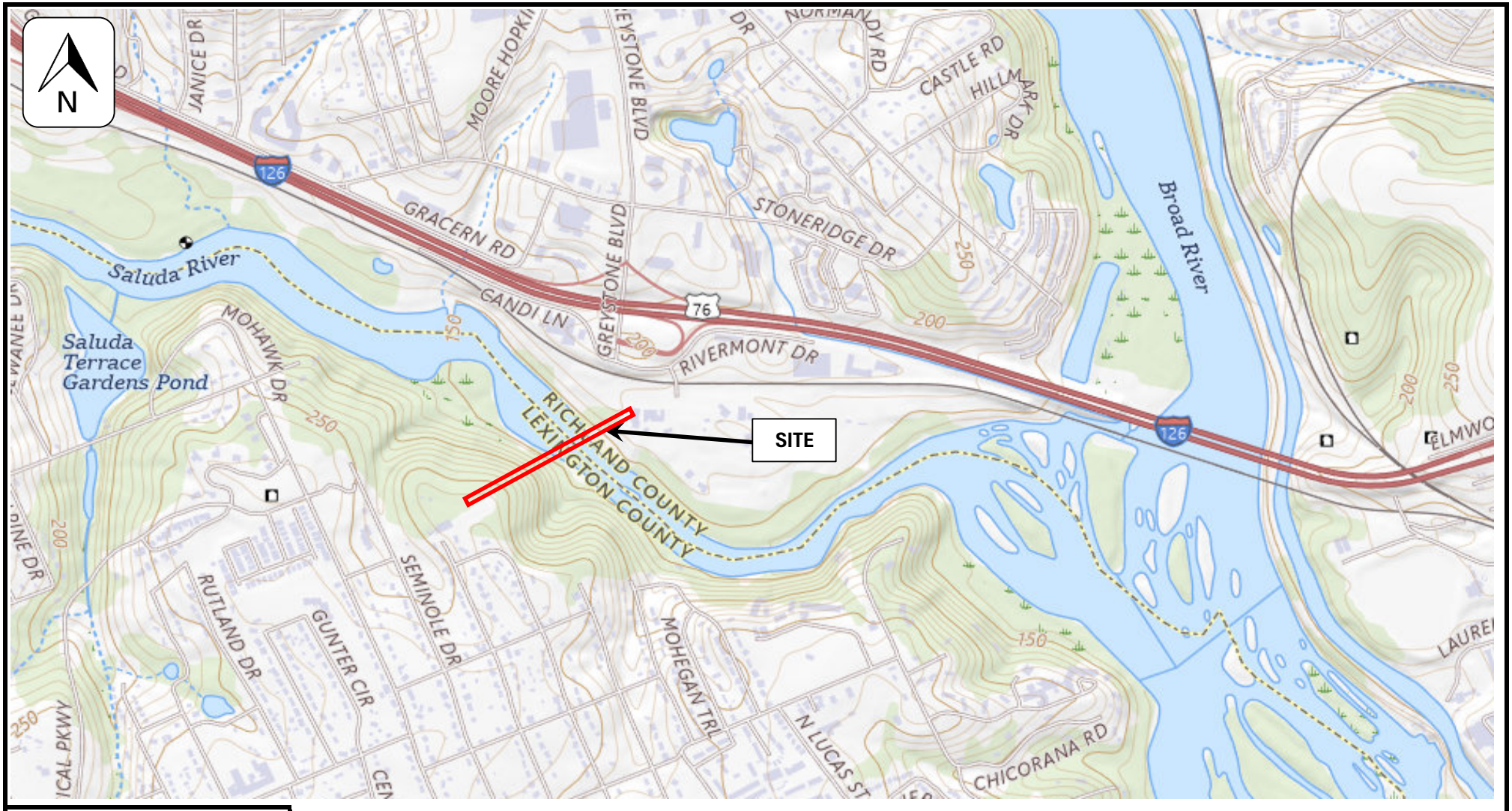
Geo-Environmental Issues

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

Geotechnical Recommendations Are Not Final

Recommendations are developed based on the geotechnical engineer's understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.

Appendix I – Figures



SOURCE: USGS National Map

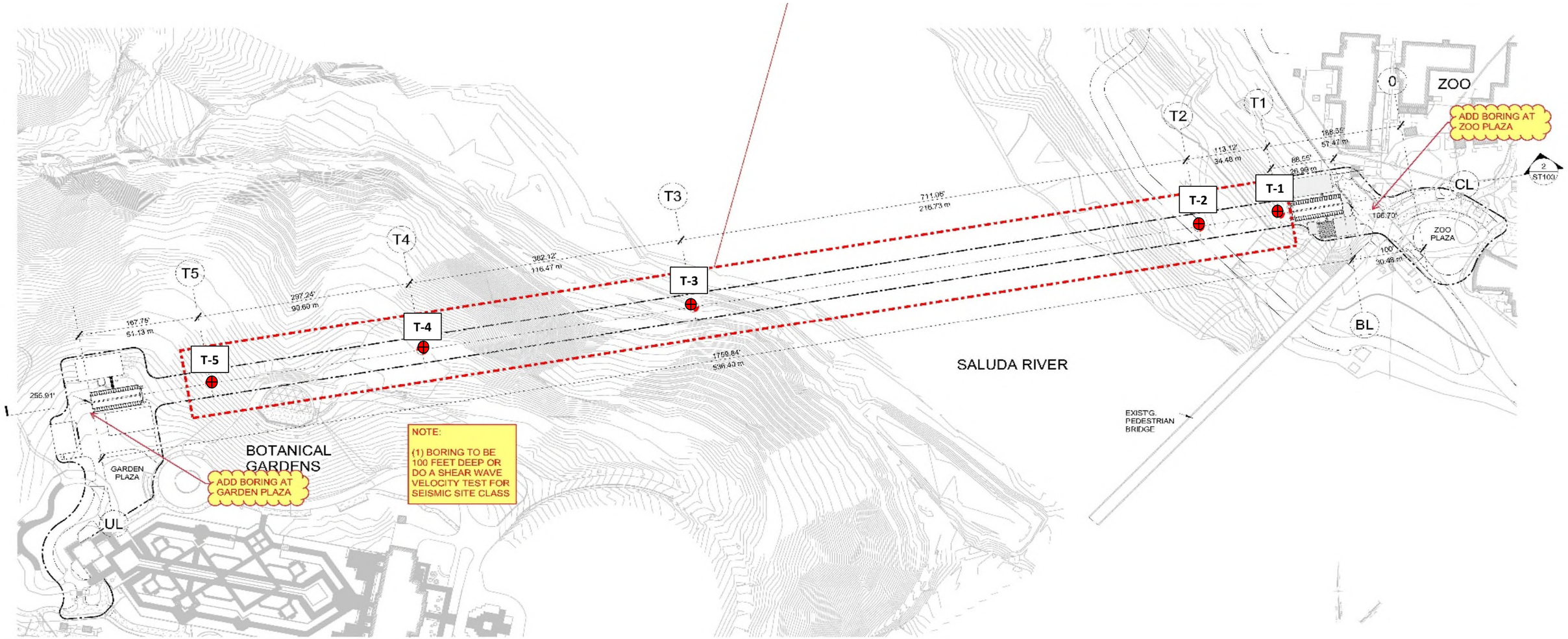
SITE LOCATION PLAN

JOB NAME:	Riverbanks Zoo - Gardens-Gondola
LOCATION:	500 Wildlife Parkway/400 Rivermont Drive
CITY, STATE:	West Columbia/Columbia, South Carolina
JOB NO.:	24610356

FIGURE NO.

1

SCALE:	N.T.S.	CHECKED BY:	MFC
DATE:	9/24/2024	DRAWN BY:	RCB



Approximate SPT Boring Location

SOURCE: Gondola Station Overall Site Layout Plan & Section, prepared by clr Design, dated 6-12-24

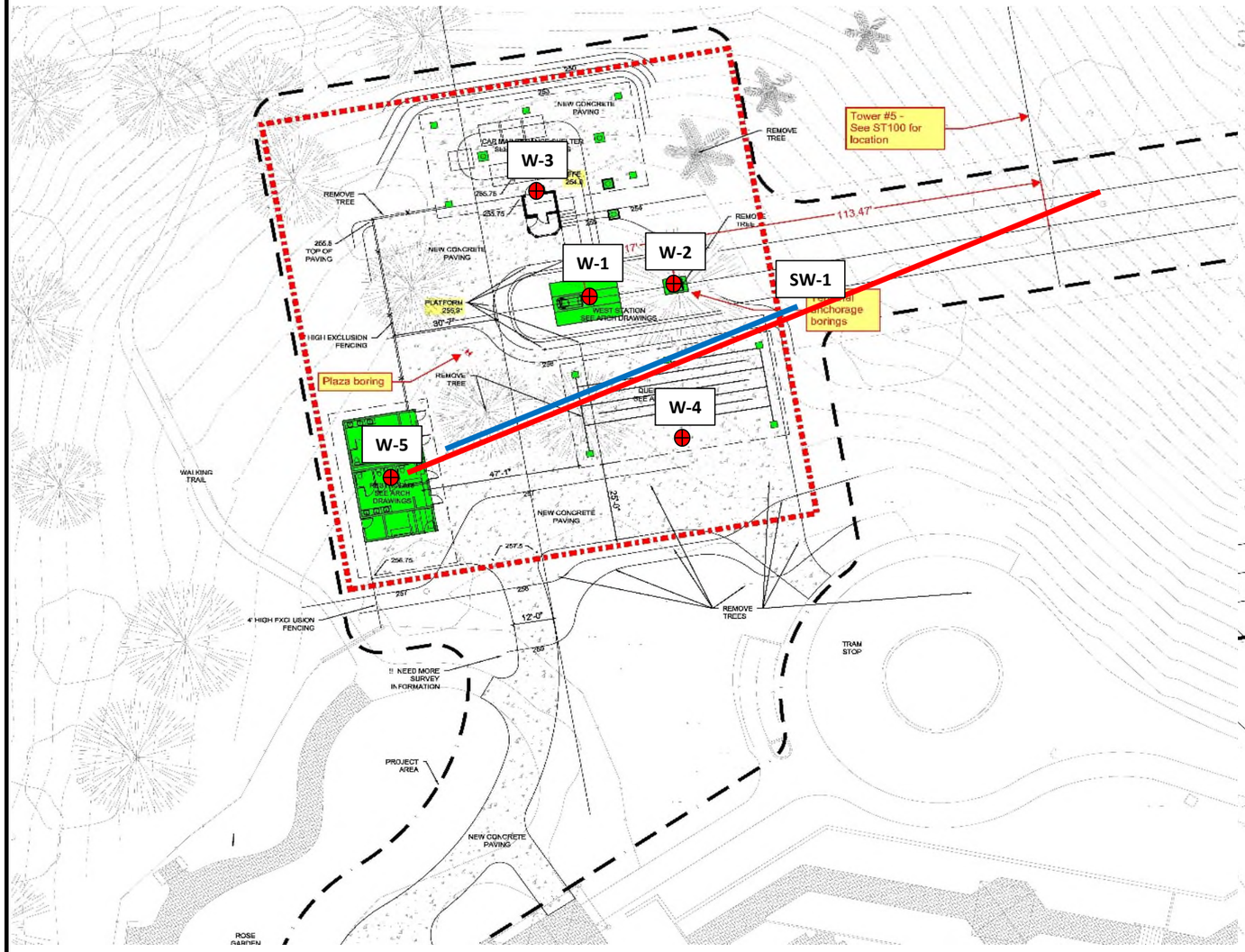
TESTING LOCATION PLAN

JOB NAME:	Riverbanks Zoo - Gardens-Gondola
LOCATION:	500 Wildlife Parkway/400 Rivermont Drive
CITY, STATE:	West Columbia/Columbia, South Carolina
JOB NO.:	24610356

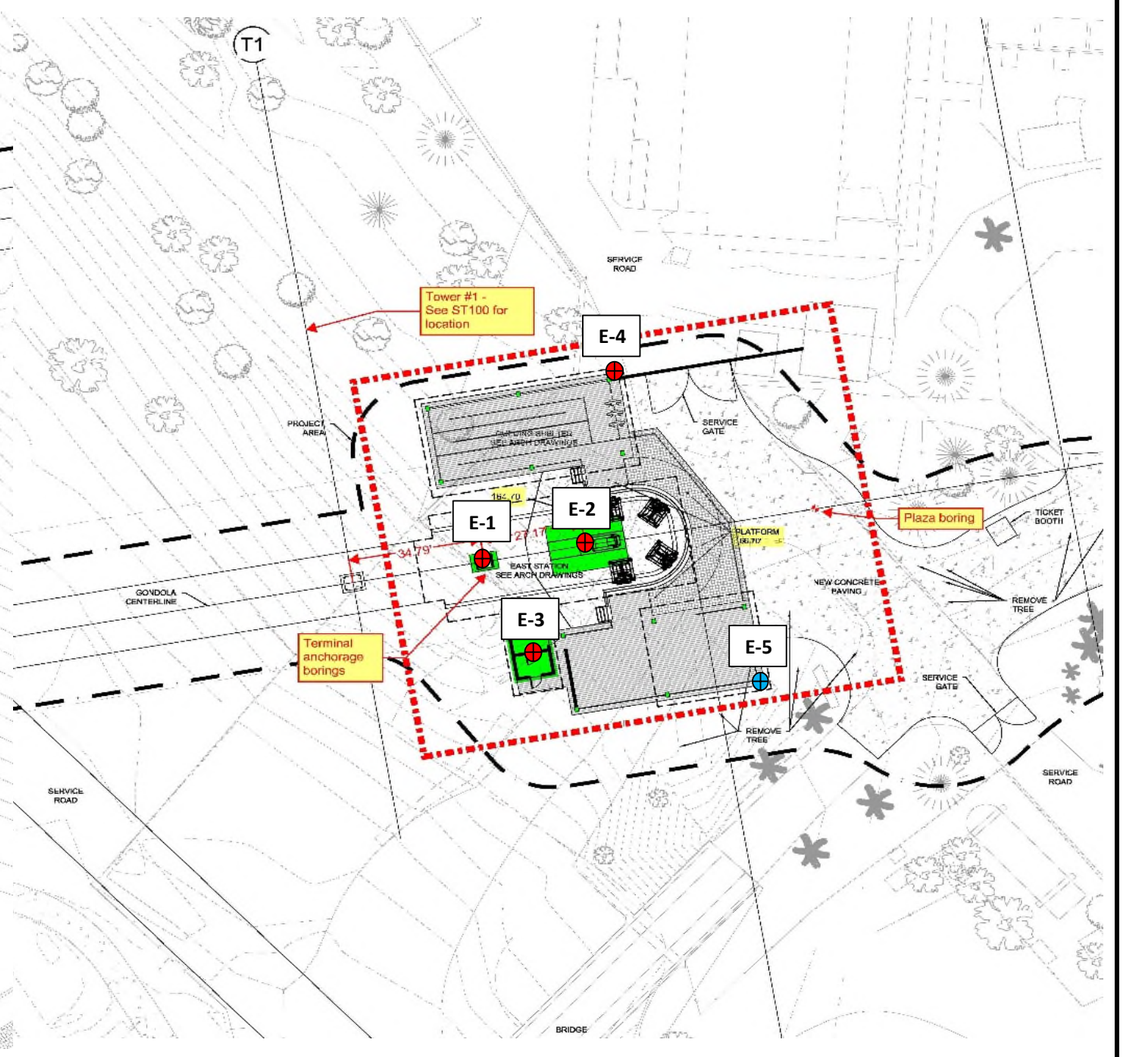
SCALE:	AS SHOWN	CHECKED BY:	MFC
DATE:	9/24/2024	DRAWN BY:	RCB

FIGURE NO.

2A



Scale: 1" = 20'-0"
0 ft 10 20 40



Scale: 1" = 20'-0"
0 ft 10 20 40

Approximate SPT Boring Location

Approximate DCP Boring Location

Approximate MASW/MAM Location

SOURCE: Enlarged Site Layout Plan East/West Station, prepared by clr Design, dated 6-12-24

TESTING LOCATION PLAN

JOB NAME:	Riverbanks Zoo - Gardens-Gondola
LOCATION:	500 Wildlife Parkway/400 Rivermont Drive
CITY, STATE:	West Columbia/Columbia, South Carolina
JOB NO.:	24610356
SCALE: AS SHOWN	CHECKED BY: MFC
DATE: 9/24/2024	DRAWN BY: RCB

FIGURE NO.

2B

SOURCE: Google Earth

USDA SOIL SURVEY MAP

JOB NAME:	Riverbanks Zoo - Gardens-Gondola
LOCATION:	500 Wildlife Parkway/400 Rivermont Drive
CITY, STATE:	West Columbia/Columbia, South Carolina
JOB NO.:	24610356

SCALE:	N.T.S	CHECKED BY:	MFC
DATE:	9/24/2024	DRAWN BY:	RCB

FIGURE NO.

3

Appendix II – Field Test Results

LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPES

(Shown in Graphic Log)


Fill


Asphalt


Concrete


Topsoil


Gravel


Sand


Silt


Clay


Organic


Silty Sand


Clayey Sand


Sandy Silt


Clayey Silt


Sandy Clay


Silty Clay


Partially Weathered Rock


Cored Rock

WATER LEVELS

(Shown in Water Level Column)

▽ = Water Level At Termination of Boring
▼ = Water Level Taken After 24 Hours
◄ = Loss of Drilling Water
HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Soft	0 to 2
Soft	3 to 4
Firm	5 to 8
Stiff	9 to 15
Very Stiff	16 to 30
Hard	31 to 50
Very Hard	Over 50

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Over 50

SAMPLER TYPES

(Shown in Samples Column)


Shelby Tube


Split Spoon


Rock Core


No Recovery

TERMS

Standard Penetration Resistance - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

REC - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

RQD - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG E-1

DATE DRILLED: **8/26/24**	ELEVATION: **163.0 ft**
DRILL RIG: **Diedrich D-50**	BORING DEPTH: **9.6 ft**
DRILLER: **S. Gowan**	WATER LEVEL: **NE TOB / NE 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Shelby Tube, Split spoon**	NORTHING: **791723** / EASTING: **1976996**
DRILLING METHOD: **3¼" H.S.A.**	

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan East Station*, prepared by clr Design, dated 6-12-24. No formal survey performed by S&ME.

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	POSSIBLE FILL - SILTY SAND (SM) - mostly fine to coarse sand, some low plasticity fines, trace roots, dry to moist, mottled grayish brown, orange and light brown, loose.			UD-1						
	- - - @ 1 ft - SHELBY TUBE FROM 1' TO 3'									
5	**RIVER TERRACE - CLAYEY SAND (SC)** - mostly fine to medium sand, some medium plasticity fines, trace roots, moist, mottled orange, yellow and light gray, medium dense.		158.0	SS-1		3	7	9		16
	- - - @ 6 ft - mostly fine to coarse sand, treace fine to coarse subrounded quartz gravel, mottled orange, light orange and dark brown.			SS-2		5	7	9		16
	PARTIALLY WEATHERED ROCK - CLAYEY SAND (SC) - mostly fine to coarse sand, some medium plasticity fines, trace fine rock fragments, moist, mottled orange, light brown and dark brown, very dense.			SS-3		3	5	50/2"		50/2"
	Boring terminated at 9.6 ft due to auger refusal									

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

NOTES:

1. ***THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.***
2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG E-2

DATE DRILLED: **8/26/24**	ELEVATION: **161.0 ft**
DRILL RIG: **Diedrich D-50**	BORING DEPTH: **6.8 ft**
DRILLER: **S. Gowan**	WATER LEVEL: **NE TOB / NE 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Split spoon**	NORTHING: **791727** / EASTING: **1977022**
DRILLING METHOD: **3¼" H.S.A.**	

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan East Station*, prepared by clr Design, dated 6-12-24. No formal survey performed by S&ME.

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	POSSIBLE FILL - CLAYEY SAND (SC) - mostly fine to coarse sand, little medium plasticity fines, trace fine subrounded quartz, dry to moist, mottled orange and brownish yellow, loose.		SS-1		2	2	2		4
	- - - @ 3.5 ft - some medium plasticity fines, absent quartz gravel, mottled orange, yellow and light gray.		SS-2		3	4	5		9
5		156.0							
	PARTIALLY WEATHERED ROCK - CLAYEY SAND (SC) - mostly fine to coarse sand, little medium plasticity fines, trace rock fragments, dry to moist, mottled brownish yellow, brown and orange, very dense.		SS-3		8	50/3"			50/3"
	Boring terminated at 6.8 ft due to auger refusal								

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

NOTES:

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3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG E-3

DATE DRILLED: **8/26/24**	ELEVATION: **160.0 ft**
DRILL RIG: **Diedrich D-50**	BORING DEPTH: **7.3 ft**
DRILLER: **S. Gowan**	WATER LEVEL: **NE TOB / NE 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Split spoon**	NORTHING: **791698** / EASTING: **1977008**
DRILLING METHOD: **3¼" H.S.A.**	

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DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	POSSIBLE FILL - SILTY SAND (SM) - mostly fine to coarse sand, little low plasticity fines, trace fine subrounded quartz gravel, moist, orange, brownish yellow and red, medium dense.			SS-1		4	5	7		12
5	**PIEDMONT RESIDUUM - SANDY LEAN CLAY (CL)** - mostly medium plasticity fines, some fine to coarse sand, trace fine subrounded quartz gravel, moist, mottled orange and light brown, stiff.		155.0	SS-2		7	7	8		15
	PARTIALLY WEATHERED ROCK - CLAYEY SAND (SC) - mostly fine to coarse sand, some medium plasticity fines, few fine rock fragments, moist, mottled orange, brownish yellow and dark brown, very dense.			SS-3		7	50/4"			50/4"
	Boring terminated at 7.3 ft due to auger refusal									

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG E-4

DATE DRILLED: **8/26/24**	ELEVATION: **166.0 ft**
DRILL RIG: **Diedrich D-50**	BORING DEPTH: **7.5 ft**
DRILLER: **S. Gowan**	WATER LEVEL: **NE TOB / NE 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Split spoon**	NORTHING: **791774** / EASTING: **1977028**
DRILLING METHOD: **3¼" H.S.A.**	

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan East Station*, prepared by clr Design, dated 6-12-24. No formal survey performed by S&ME.

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	POSSIBLE FILL - SILTY SAND (SM) - mostly fine to medium sand, little low plasticity fines, moist, brown and orange, loose.			SS-1		2	3	3		6
5	**PIEDMONT RESIDUUM - SANDY LEAN CLAY (CL)** - mostly medium plasticity fines, some fine to medium sand, trace roots, moist, mottled orange and brownish yellow, very stiff.		161.0	SS-2		4	8	9		17
	CLAYEY SAND (SC) - mostly fine to medium sand, little medium plasticty fines, moist, mottled orange and brownish yellow, medium dense.			SS-3		14	14	13		27
	Boring terminated at 7.5 ft									

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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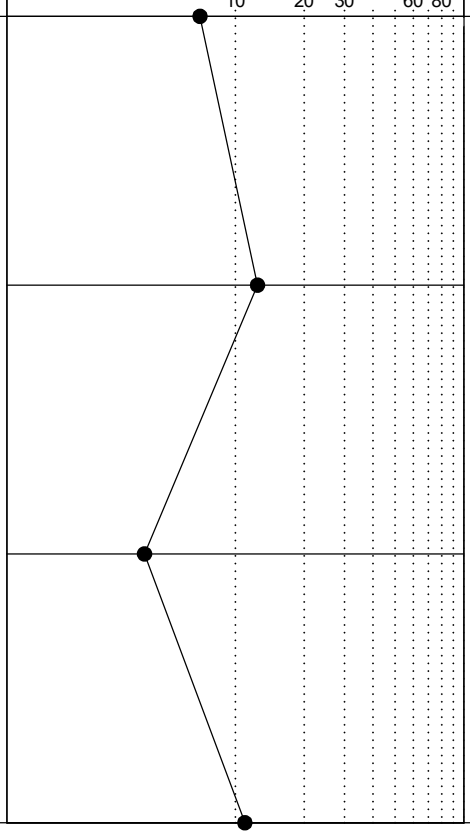
PROJECT:	Riverbanks Zoo - Gondola Columbia, South Carolina 24610356	**HAND AUGER BORING LOG: E-5**	
DATE STARTED:	**8/5/24**	DATE FINISHED:	**8/5/24**
NORTHING:	**791689**	EASTING:	**1977067**
SAMPLING METHOD:	**Hand Auger**	PERFORMED BY:	**SAM**
WATER LEVEL:	**NE TOB / NE 24HR**	ELEVATION:	**165**

NOTES: **Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan East Station*, prepared by clr Design, dated 6-12-24. No formal survey performed by S&ME.**

Depth (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (feet)	WATER LEVEL	DYNAMIC CONE PENETRATION RESISTANCE (blows/1.75 in.)	DCP VALUE
		SURFACE MATERIAL - TOPSOIL - 3 inches				
		POSSIBLE FILL - SILTY SAND (SM) - mostly fine to medium sands, some low plasticity fines, trace roots, dry to moist, reddish brown and light brown.				7
1			164.00			13
		- - - @ 1.5ft - absent roots, trace fine clay pockets.				
2			163.00			4
		- - - @ 2.5ft - moist to wet, light brown.				
3		Boring terminated at 3 ft due to auger refusal	162.00			11



1. PENETRATION RESISTANCE IS THE NUMBER OF BLOWS OF A 15 LB HAMMER FALLING 20 IN., DRIVING A 1.5 IN. O.D. 45 DEGREE CONE 1.75 IN.

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-1

DATE DRILLED: **8/21/24**	ELEVATION: **160.0 ft**
DRILL RIG: **Diedrich D-50**	BORING DEPTH: **23.5 ft**
DRILLER: **S. Gowan**	WATER LEVEL: **NE TOB / 8.7 ft 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Rock Core, Split spoon**	NORTHING: **791718** / EASTING: **1976963**
DRILLING METHOD: **3¼" H.S.A./Rock Core**	

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DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
0	**SURFACE MATERIAL - TOPSOIL** - 3 inches.		160.0							
	PIEDMONT RESIDUUM - SILTY SAND (SM) - mostly fine to coarse sands, some low plasticity fines, trace roots/organics, trace fine rock fragments, moist, brownish yellow, pale brown and brown, dense, relict rock structure.			SS-1		3	21	11		32
	- - - @ 3.5ft - mottled brownish yellow, brownish orange and pale brown, loose.			SS-2		3	2	3		5
5			155.0	SS-3		17	50/5"			50/5"
	PARTIALLY WEATHERED ROCK - SILTY SAND (SM) - mostly fine to coarse sands, some low plasticity fines, few fine to coarse rock fragments, dry, slightly laminated pale brown and brownish orange, very dense, relict rock structure.	▼		SS-4		19	50/5"			50/5"
	- - - @ 8.5ft - absent rock fragments, mottled brownish yellow, brownish orange and pale brown	HC								
10			150.0	SS-5		50/0"				50/0"
	- - - @ 13.5ft - No recovery.			RC-1		1	91%	53%		
	IGNEOUS BEDROCK - GRANITE - speckled gray, black and pale orange, medium grained, moderately weathered, strong rock, hardness=5.5-6.									
	- - - @ 13.6ft - slightly weathered, hardness=6									
15	- - - @ 14.03ft - joint.		145.0	RC-2		2	93%	87%		
	- - - @ 14.5ft - fresh, hardness=6-6.5 [UCS = 11,093 psi]									
	- - - @ 16.28ft - joint.									
	- - - @ 16.57ft - joint.									
20	- - - @ 17.68ft - joint.		140.0	RC-3		3	94%	94%		
	- - - @ 20.11ft - joint.									
	- - - @ 20.94ft - joint.									
	- - - @ 21.68ft - joint.									
	Auger refusal at 13.5 ft Boring terminated at 23.5 ft									

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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Rock Core Photo Log

Boring: T-1	Box: 1 of 1	Date: 8/21/2024	Driller: S. Gowan	Geologist: Z. Zelaya
Run: RC-1	Length: 1.0	Depth Int: 13.5′-14.5′	Recovery: 91%	RQD: 53%
Run: RC-2	Length: 5.0	Depth Int: 14.5′-19.5′	Recovery: 93%	RQD: 87%
Run: RC-3	Length: 5.0	Depth Int: 19.5′-23.5′	Recovery: 94%	RQD: 94%

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-2

DATE DRILLED: **8/22/24**	ELEVATION: **152.0 ft**
DRILL RIG: **Diedrich D-50**	BORING DEPTH: **29.8 ft**
DRILLER: **S. Gowan**	WATER LEVEL: **NE TOB / NA 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Rock Core, Split spoon**	NORTHING: **791698** / EASTING: **1976851**
DRILLING METHOD: **3¼" H.S.A./Rock Core**	

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DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	SURFACE MATERIAL - TOPSOIL - 3 inches								
	RIVER TERRACE - SILTY SAND (SM) - mostly fine to medium sands, some low plasticity fines, moist, mottled brownish yellow and brown, very loose.								
	- - - @ 3.5ft - trace roots, moist, mottled brownish yellow and gray, medium dense.		SS-1		3	2	2		4
5		147.0	SS-2		3	5	8		13
	PIEDMONT RESIDUUM - SILTY SAND (SM) - mostly fine to coarse sands, some low plasticity fines, trace fine rock fragments, moist, mottled brownish yellow, brownish orange, and pale brown, medium dense, relict rock structure.		SS-3		6	6	8		14
			SS-4		50/5"				50/5"
10	**PARTIALLY WEATHERED ROCK - SILTY SAND (SM)** - mostly fine to coarse sands, some low plasticity fines, few fine rock fragments, dry to moist, mottled brownish yellow, brownish orange and pale brown, very dense, relict rock struture.	142.0							
	- - - @ 13.5ft - No Recovery.		SS-5		50/1"				50/1"
15	**IGNEOUS BEDROCK - GRANITE** - speckled gray, black, and pale orange, medium grained, moderatley weathered, strong rock, hardness=6-6.5	137.0							
	- - - @ 14.95ft - joint. - - - @ 15.26ft - joint. - - - @ 15.27ft - slightly weathered, hardness=6.5		RC-1		1	88%	69%		
20	- - - @ 16.8 ft [UCS = 15,740 psi] - - - @ 17.78ft - joint. - - - @ 18.55ft - joint. - - - @ 18.76ft - joint. - - - @ 19.07ft - moderately weathered, hardness=5.5.	132.0	RC-2		2	100%	67%		
	- - - @ 19.8ft - speckeld black gray and brown, slightly weathered, hardness=6-6.5 - - - @ 21.55ft - joint, moderately weathered, hardness=6.								
25	- - - @ 21.63ft - joint, slightly weathered, hardness=6. - - - @ 22.32ft - joint.	127.0							

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-2

DATE DRILLED: **8/22/24**
ELEVATION: **152.0 ft**
DRILL RIG: **Diedrich D-50**
BORING DEPTH: **29.8 ft**
DRILLER: **S. Gowan**
WATER LEVEL: **NE TOB / NA 24HR**
HAMMER TYPE: **Automatic**
LOGGED BY: **RZZ**
SAMPLING METHOD: **Rock Core, Split spoon**
NORTHING: **791698**
EASTING: **1976851**
DRILLING METHOD: **3¼" H.S.A./Rock Core**

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DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
		- - - @ 22.68ft - joint. - - - @ 22.85ft - joint, moderately weathered, hardness=5.5. - - - @ 23.22ft - slightly weathered, hardness=6. - - - From 24.8ft to 25.3ft - joint, fresh, hardness=6-6.5			RC-3		3	100%	100%	10 20 30 60 80	
		Auger refusal at 14.8 ft Boring terminated at 29.8 ft									

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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Rock Core Photo Log

Boring: T-2	Box: 1 of 2	Date: 8/22/2024	Driller: S. Gowan	Geologist: Z. Zelaya
Run: RC-1	Length: 5.0	Depth Int: 14.8′-19.8′	Recovery: 88%	RQD: 69%
Run: RC-2	Length: 5.0	Depth Int: 19.8′-24.8′	Recovery: 100%	RQD: 67%

Boring: T-2	Box: 2 of 2	Date: 8/22/2024	Driller: S. Gowan	Geologist: Z. Zelaya
Run: RC-3	Length: 5.0	Depth Int: 24.8′-29.8′	Recovery: 100%	RQD: 100%

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-3

DATE DRILLED: **8/27/24** | ELEVATION: **154.0 ft**
DRILL RIG: **Diedrich D-50** | BORING DEPTH: **34.9 ft**
DRILLER: **S. Gowan** | WATER LEVEL: **NE TOB / NE 24HR**
HAMMER TYPE: **Automatic** | LOGGED BY: **RZZ**
SAMPLING METHOD: **Rock Core, Split spoon**
DRILLING METHOD: **3¼" H.S.A./Rock Core**

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NORTHING: **791578** | EASTING: **1976150**

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
0	**ALLUVIUM - SILTY SAND (SM)** - mostly fine to medium sands, little low plasticity fines, trace roots, brown, loose.								
	- - - @ 3.5 ft - Poor Recovery, spoon was blocked by coarse wood fragments from a stump.		SS-1		2	3	4		7
5		149.0	SS-2		4	3	8		11
	PARTIALLY WEATHERED ROCK - SILTY SAND (SM) - mostly fine to coarse sands, little low plasticity fines, trace fine rock fragments, light brown to pale brown, very dense.		SS-3		50/4"			50/4"	
			SS-4		50/0"			50/0"	
	IGNEOUS BEDROCK - GRANITE - gray, light brown and brown, medium grained, moderately weathered, weak rock, hardness=3.5.		RC-1		1	71%	71%		
10	- - - @ 10 ft - jointed.	144.0							
	- - - @ 10.2 ft - highly weathered, very weak rock, hardness=2.5.		RC-2		2	83%	53%		
	- - - @ 11.2 ft - completely weathered, extremely weak rock, hardness=1.5.								
15	- - - @ 11.45 ft - speckled gray, dark gray and light brown, joint, slightly weathered, very strong rock, hardness=7.5.	139.0							
	- - - @ 15.95 ft - light brown, light gray and dark gray, joint, moderately weathered, weak rock, hardness=3.5.		RC-3		3	61%	38%		
	- - - @ 16.4 ft - slightly weathered, strong rock, hardness=6								
	- - - @ 16.85 ft - joint.								
20	Drillers note that soft granular PWR core loss occured between 17'-19'.	134.0							
	- - - @ 17.9 ft [UCS = 12,158 psi]		RC-4		4	40%	20%		
	- - - @ 17.25 ft - joint.								
	- - - @ 17.7 ft - joint, highly weathered, weak rock, hardness=3								
	Drillers note that soft granular PWR core loss occured between 19.9'-22.9'.								
25	- - - @ 22.9 ft - joint.	129.0							
	- - - @ 23.45 ft - joint.								
	- - - @ 23.7 ft - joint.								
	- - - @ 23.9 ft [UCS = 18,582 psi]								

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-3

DATE DRILLED: **8/27/24**	ELEVATION: **154.0 ft**
DRILL RIG: **Diedrich D-50**	BORING DEPTH: **34.9 ft**
DRILLER: **S. Gowan**	WATER LEVEL: **NE TOB / NE 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Rock Core, Split spoon**	NORTHING: **791578** / EASTING: **1976150**
DRILLING METHOD: **3¼" H.S.A./Rock Core**	

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DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	- - - @ 24.95 ft - light gray, dark gray and light brown, slightly weathered, very strong rock, hardness=7.5.	HC		RC-5		5	96%	63%		
	- - - @ 26.25 ft - joint.									
30	- - - From 28.9' to 29.9' highly weathered, jointed, hardness=5.		124.0							
	- - - @ 30 ft - fresh, very strong rock, hardness=7.5									
	- - - @ 31.35 ft - joint, slightly weathered, hardness=6.			RC-6		6	92%	77%		
	- - - @ 32.3 ft - pale red with dark gray speckles.									
	- - - @ 33.45 ft - joint.									
	- - - @ 34 ft - joint.									
	- - - @ 34.1 - speckled dark gray, light gray and light brown.									
	Auger refusal at 8.5 ft Boring terminated at 34.9 ft									

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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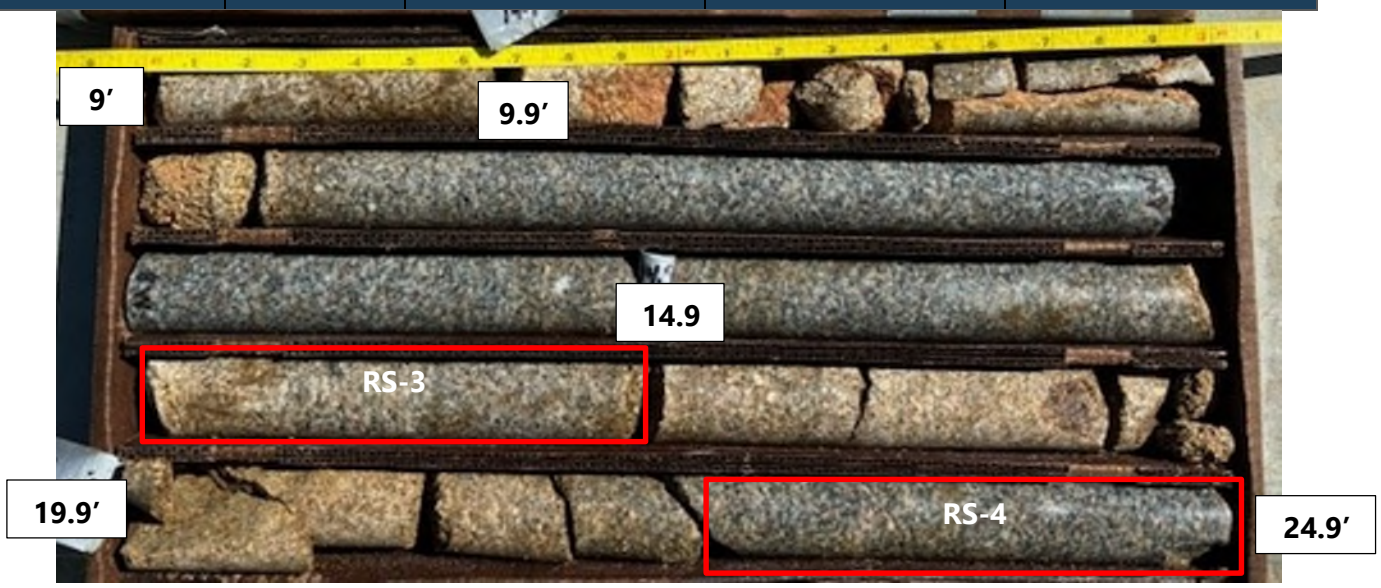
Rock Core Photo Log

Boring: T-3	Box: 1 of 2	Date: 8/27/2024	Driller: S. Gowan	Geologist: Z. Zelaya
Run: RC-1	Length: 0.9	Depth Int: 9.0′-9.9′	Recovery: 71%	RQD: 71%
Run: RC-2	Length: 5.0	Depth Int: 9.9′-14.9′	Recovery: 83%	RQD: 53%
Run: RC-3	Length: 5.0	Depth Int: 14.9′-19.9′	Recovery: 61%	RQD: 38%
Run: RC-4	Length: 5.0	Depth Int: 19.9′-24.9′	Recovery: 40%	RQD: 20%



Boring: T-3	Box: 2 of 2	Date: 8/27/2024	Driller: S. Gowan	Geologist: Z. Zelaya
Run: RC-5	Length: 5.0	Depth Int: 24.9′-29.9′	Recovery: 96%	RQD: 63%
Run: RC-6	Length: 5.0	Depth Int: 29.9′-34.9′	Recovery: 92%	RQD: 78%

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-4

DATE DRILLED: **8/27/24** | ELEVATION: **230.0 ft**

DRILL RIG: **Diedrich D-50** | BORING DEPTH: **40.0 ft**

DRILLER: **S. Gowan** | WATER LEVEL: **NE TOB / 11.6 ft 24HR**

HAMMER TYPE: **Automatic** | LOGGED BY: **RZZ**

SAMPLING METHOD: **Rock Core, Split spoon**

DRILLING METHOD: **3¼" H.S.A./Rock Core**

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation provided in LOCATION DATA table on *Gondola Station Overall Site Layout Plan & Section*, prepared by clr Design, dated 6-12-24. No formal survey performed by S&ME.

NORTHING: **791513** | EASTING: **1975774**

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	ALLUVIUM - SILTY SAND (SM) - mostly fine to coarse sands, some low plasticity fines, trace roots, dry to moist, brown, orange and gray, very loose.			SS-1		3	2	2		4
5	**PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL)** - mostly medium plasticity fines, little fine to medium sands, dry to moist, orange with light brown with gray mottles, very stiff.		225.0	SS-2		6	8	10		18
	SANDY LEAN CLAY (CL) - mostly medium plasticity fines, some fine to coarse sands, moist, orange with light orange and light brown mottles, stiff.			SS-3		3	5	7		12
10	- - - @ 8.5 ft - mottled reddish orange and light orange.	▼	220.0	SS-4		3	5	8		13
	IGNEOUS BEDROCK - GRANITE - speckled light brown, dark brown and black, medium grained, moderately weathered, weak rock, hardness=4.5.	HC		RC-1		1	91%	46%		
15	- - - @ 13.1 ft - joint. - - - @ 13.4 ft - joint. [UCS = 1,277 psi] - - - @ 15.3 ft - highly weathered joint, weak rock, hardness=4.		215.0	RC-2		2	30%	10%		
20	- - - @ 15.8 ft - highly weathered joint, weak rock, hardness=4. - - - @ 16.4 ft - completely weathered, very weak rock, hardness=1.5.		210.0							
	PIEDMONT RESIDUUM - SILTY SAND (SM) - mostly fine to coarse sands, some low plasticity fines, trace fine to coarse rock fragments, moist, mottled brownish yellow, gray and white, dense, relict rock structure.			SS-5		11	18	20		38
25			205.0							

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

NOTES:

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3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-4

DATE DRILLED: **8/27/24** | ELEVATION: **230.0 ft**

DRILL RIG: **Diedrich D-50** | BORING DEPTH: **40.0 ft**

DRILLER: **S. Gowan** | WATER LEVEL: **NE TOB / 11.6 ft 24HR**

HAMMER TYPE: **Automatic** | LOGGED BY: **RZZ**

SAMPLING METHOD: **Rock Core, Split spoon**

DRILLING METHOD: **3¼" H.S.A./Rock Core**

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation provided in LOCATION DATA table on *Gondola Station Overall Site Layout Plan & Section*, prepared by clr Design, dated 6-12-24. No formal survey performed by S&ME.

NORTHING: **791513** | EASTING: **1975774**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
30		- - - @ 28.5 ft - very dense.		200.0	SS-6		5	21	50		71
35		- - - @ 33.5 ft - absent rock fragments.		195.0	SS-7		28	40	44		84
40		**SANDY SILT (ML)** - mostly low plasticity fines, some fine to coarse sands, wet, mottled brownish yellow and light orange with black mottles, very stiff.		190.0	SS-8		6	7	9		16
		Boring terminated at 40 ft									

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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Rock Core Photo Log

Boring: T-4	Box: 1 of 1	Date: 8/27/2024	Driller: S. Gowan	Geologist: Z. Zelaya
Run: RC-1	Length: 2.3	Depth Int: 12.8′-15.1′	Recovery: 91%	RQD: 46%
Run: RC-2	Length: 5.0	Depth Int: 15.1′-20.1′	Recovery: 30%	RQD: 10%

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-5

DATE DRILLED: **8/28/24** | ELEVATION: **245.0 ft**

DRILL RIG: **Diedrich D-50** | BORING DEPTH: **40.0 ft**

DRILLER: **S. Gowan** | WATER LEVEL: **NE TOB / NA 24HR**

HAMMER TYPE: **Automatic** | LOGGED BY: **RZZ**

SAMPLING METHOD: **Split spoon**

DRILLING METHOD: **3¼" H.S.A.**

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation provided in LOCATION DATA table on *Gondola Station Overall Site Layout Plan & Section*, prepared by clr Design, dated 6-12-24. No formal survey performed by S&ME.

NORTHING: **791463** | EASTING: **1975481**

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	N VALUE
	PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL) - mostly medium plasticity fines, little fine to coarse sands, trace roots, moist, red, stiff.		SS-1		3	4	6	10
	- - - @3.5 feet - very stiff.		SS-2		7	10	11	21
5		240.0						
	- - - @6 feet - mottled red and light orange, stiff.		SS-3		3	4	7	11
	- - - @8.5 feet - little fine to medium sands, firm.		SS-4		2	3	3	6
10		235.0						
	- - - @13.5 feet - little fine to coarse sands, mottled orange, light gray, and brownish-yellow.		SS-5		2	3	5	8
15		230.0						
	- - - @18.5 feet - mottled orange and gray.		SS-6		3	3	5	8
20		225.0						
			SS-7		2	3	4	7
25		220.0						

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS
10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG T-5

DATE DRILLED: **8/28/24** | ELEVATION: **245.0 ft**

DRILL RIG: **Diedrich D-50** | BORING DEPTH: **40.0 ft**

DRILLER: **S. Gowan** | WATER LEVEL: **NE TOB / NA 24HR**

HAMMER TYPE: **Automatic** | LOGGED BY: **RZZ**

SAMPLING METHOD: **Split spoon**

DRILLING METHOD: **3¼" H.S.A.**

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation provided in LOCATION DATA table on *Gondola Station Overall Site Layout Plan & Section*, prepared by clr Design, dated 6-12-24. No formal survey performed by S&ME.

NORTHING: **791463** | EASTING: **1975481**

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
30	**SANDY SILT (ML)** - mostly low plasticity fines, some fine to medium sands, moist, mottled orange and gray, firm, relict rock structure.	215.0	SS-8		3	3	5		8
35	**SILTY SAND (SM)** - mostly fine to coarse sands, some low plasticity fines, moist, mottled greenish-gray with brownish-yellow and black mottles, medium dense, relict rock structure.	210.0	SS-9		5	8	13		21
40	- - - @38.5 feet - little low plasticity fines, mottled dark gray, greenish-gray, brownish-yellow, dense, relict rock structure.	205.0	SS-10		7	14	17		31
	Boring terminated at 40 ft								

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG W-1

DATE DRILLED: **8/27/24**	ELEVATION: **256.0 ft**
DRILL RIG: **CME-550**	BORING DEPTH: **30.0 ft**
DRILLER: **J. Stoleson**	WATER LEVEL: **10.1ft at TOB / NA 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Shelby Tube, Split spoon**	NORTHING: **791438** / EASTING: **1975340**
DRILLING METHOD: **Mud Rotary**	

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan West Station*, prepared by clr Design, dated 6-2-24. No formal survey performed by S&ME.

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	SURFACE MATERIAL - TOPSOIL - 3 inches									
	RIVER TERRACE - SILTY SAND (SM) - mostly fine to coarse sand, some low plasticity fines, trace fine to coarse subrounded quartz gravel, moist, mottled brown and orange, loose.			SS-1		6	5	4		9
	- - - @ 2 ft - SHELBY TUBE FROM 2' TO 4'			UD-2						
5			251.0							
	CLAYEY SAND (SC) - mostly fine to coarse sand, little medium plasticity fines, trace fine to coarse subrounded quartz gravel, moist, mottled orange, yellow and red, dense.			SS-2		4	20	23		43
				SS-3		10	15	21		36
10		▽	246.0							
	PIEDMONT RESIDUUM - SANDY SILT (ML) - mostly low lasticity fines, some fine to coarse sand, moist, mottled brownish yellow, orange and white, very stiff.			SS-4		4	7	10		17
15			241.0							
	- - - @ 18.5 ft - some fine to medium sand, mottled orange, light gray and white, stiff.			SS-5		4	6	7		13
20			236.0							
				SS-6		4	5	8		13
25			231.0							

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG W-1

DATE DRILLED: **8/27/24**	ELEVATION: **256.0 ft**
DRILL RIG: **CME-550**	BORING DEPTH: **30.0 ft**
DRILLER: **J. Stoleson**	WATER LEVEL: **10.1ft at TOB / NA 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan West Station*, prepared by clr Design, dated 6-2-24. No formal survey performed by S&ME.

SAMPLING METHOD: **Shelby Tube, Split spoon**
NORTHING: **791438** EASTING: **1975340**
DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
30		- - - @ 28.5 ft - little fine to medium sand, mottled light brown, gray and black.		226.0	SS-7		4	5	8	10 20 30 60 80	13
		Boring terminated at 30 ft									

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG W-2

DATE DRILLED: **8/26/24**	ELEVATION: **255.0 ft**
DRILL RIG: **CME-550**	BORING DEPTH: **30.0 ft**
DRILLER: **J. Stoleson**	WATER LEVEL: **10.1ft at TOB / NA 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Split spoon**	NORTHING: **791443** / EASTING: **1975367**
DRILLING METHOD: **Mud Rotary**	

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan West Station*, prepared by clr Design, dated 6-2-24. No formal survey performed by S&ME.

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
0	**SURFACE MATERIAL - TOPSOIL** - 3 inches									
	RIVER TERRACE - SILTY SAND (SM) - mostly fine to coarse sands, little low plasticity fines, few fine to coarse quartz gravels, trace roots, dry to moist, brown and reddish-brown, medium dense.			SS-1		4	5	7		12
				SS-2		7	11	12		23
5	**CLAYEY SAND (SC)** - mostly fine to coarse sands, some medium plasticity fines, few fine to coarse quartz gravels, moist, orange and brown, medium dense.		250.0	SS-3		18	27	27		54
	SILTY GRAVEL (GM) - mostly fine to coarse gravel quartz, some fine to coarse sands, little low plasticity fines, moist, orange, brown, white, very dense.			SS-4		10	20	22		42
10	- - - @8.5 feet - dense.	▽	245.0							
				SS-5		5	5	6		11
15	**PIEDMONT REISDUUM - SILT WITH SAND (ML)** - mostly low plasticity fines, little fine to medium sands, moist, mottled yelllow, white, orange, stiff.		240.0							
	- - - @18.5 feet - mottled brownish-yellow, orange, white.			SS-6		3	5	6		11
20		HC	235.0							
	- - - @23.5 feet - mottled brown, brownish-yellow, gray, relict rock structure.			SS-7		4	6	9		15
25			230.0							

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG W-2

DATE DRILLED: **8/26/24**
ELEVATION: **255.0 ft**
DRILL RIG: **CME-550**
BORING DEPTH: **30.0 ft**
DRILLER: **J. Stoleson**
WATER LEVEL: **10.1ft at TOB / NA 24HR**
HAMMER TYPE: **Automatic**
LOGGED BY: **RZZ**

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan West Station*, prepared by clr Design, dated 6-2-24. No formal survey performed by S&ME.

SAMPLING METHOD: **Split spoon**
NORTHING: **791443**
EASTING: **1975367**

DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
30		- - - @28.5 feet - mottled light gray, light orange, white.		225.0	SS-8		4	8	7	10 20 30 60 80	15
		Boring terminated at 30 ft									

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG W-3

DATE DRILLED: **8/28/24**	ELEVATION: **254.0 ft**
DRILL RIG: **CME-550**	BORING DEPTH: **7.5 ft**
DRILLER: **J. Stoleson**	WATER LEVEL: **NE TOB / NE 24HR**
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**
SAMPLING METHOD: **Split spoon**	NORTHING: **791474** / EASTING: **1975326**
DRILLING METHOD: **3¼" H.S.A.**	

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan West Station*, prepared by clr Design, dated 6-2-24. No formal survey performed by S&ME.

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	N VALUE
	SURFACE MATERIAL - TOPSOIL - 3 inches							
	RIVER TERRACE - SILTY SAND WITH GRAVEL (SM) - mostly fine to coarse sand, little fine to coarse subrounded quartz gravel, little low plasticity fines, dry to moist, dark brown and orange, loose.		SS-1		3	3	5	8
5	**PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL)** - mostly medium platicity fines, little fine to coarse sand, dry, mottled orange, yellow and white, very stiff.	249.0	SS-2		6	8	11	19
	- - - @ 6 ft - trace fine subrounded quuartz gravel, mottled reddish orange, brownish yellow and white, stiff, relict rock structure.		SS-3		4	5	9	14
	Boring terminated at 7.5 ft							

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS — 10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG W-4

DATE DRILLED: **8/28/24** | ELEVATION: **258.0 ft**

DRILL RIG: **CME-550** | BORING DEPTH: **7.5 ft**

DRILLER: **J. Stoleson** | WATER LEVEL: **NE TOB / NE 24HR**

HAMMER TYPE: **Automatic** | LOGGED BY: **RZZ**

NOTES: Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan West Station*, prepared by clr Design, dated 6-2-24. No formal survey performed by S&ME.

SAMPLING METHOD: **Split spoon** | NORTHING: **791394** | EASTING: **1975369**

DRILLING METHOD: **3¼" H.S.A.**

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	SURFACE MATERIAL - TOPSOIL - 4 inches									
	RIVER TERRACE - SILTY SAND WITH GRAVEL (SM) - mostly fine to coarse sand, little low plastcity fines, few fine to coarse subrounded quartz gravel, few roots, dry to moist, dark brown and orange, loose.			SS-1		2	2	5		7
				SS-2		17	23	25		48
5	**PIEDMONT RESIDUUM - CLAYEY SAND (SC)** - mostly medium to coarse sand, little fine to coarse subrounded quartz gravel, little medium plasticity fine, moist, mottled red, orange and white, dense.		253.0							
				SS-3		10	20	22		42
	Boring terminated at 7.5 ft									

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

NOTES:

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2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

PROJECT: **Riverbanks Zoo - Gondola**
Columbia, South Carolina
S&ME Project No. 24610356

BORING LOG W-5

DATE DRILLED: **8/28/24**	ELEVATION: **256.0 ft**	**NOTES:** Northing & Easting converted from Latitude & Longitude estimated from Google Earth. Elevation estimated from *Enlarged Site Layout Plan West Station*, prepared by clr Design, dated 6-2-24. No formal survey performed by S&ME.
DRILL RIG: **CME-550**	BORING DEPTH: **7.5 ft**	
DRILLER: **J. Stoleson**	WATER LEVEL: **NE TOB / NE 24HR**	
HAMMER TYPE: **Automatic**	LOGGED BY: **RZZ**	
SAMPLING METHOD: **Split spoon**	NORTHING: **791380**	EASTING: **1975281**
DRILLING METHOD: **3¼" H.S.A.**		

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	N VALUE
	SURFACE MATERIAL - TOPSOIL - 3 inches							
	RIVER TERRACE - SILTY SAND (SM) - mostly fine to coarse sand, some low plasticity fines, little fine to coarse subrounded quartz gravel, trace roots. moist, dark brown and orange, loose.		SS-1		2	2	3	5
5	**PIEDMONT RESIDUUM - CLAYEY SAND WITH GRAVEL (SC)** - mostly fine to coarse sand, some medium platicity fines, little fine to coarse subrounded quartz gravel, moist, red, orange and yellow, dense. - - - @ 6 ft - trace fine to coarse subrounded quartz gravel.	251.0	SS-2		10	17	19	36
			SS-3		5	13	23	36
	Boring terminated at 7.5 ft							

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS
10 20 30 60 80

S&ME BORING LOG 24610356 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 9/12/24

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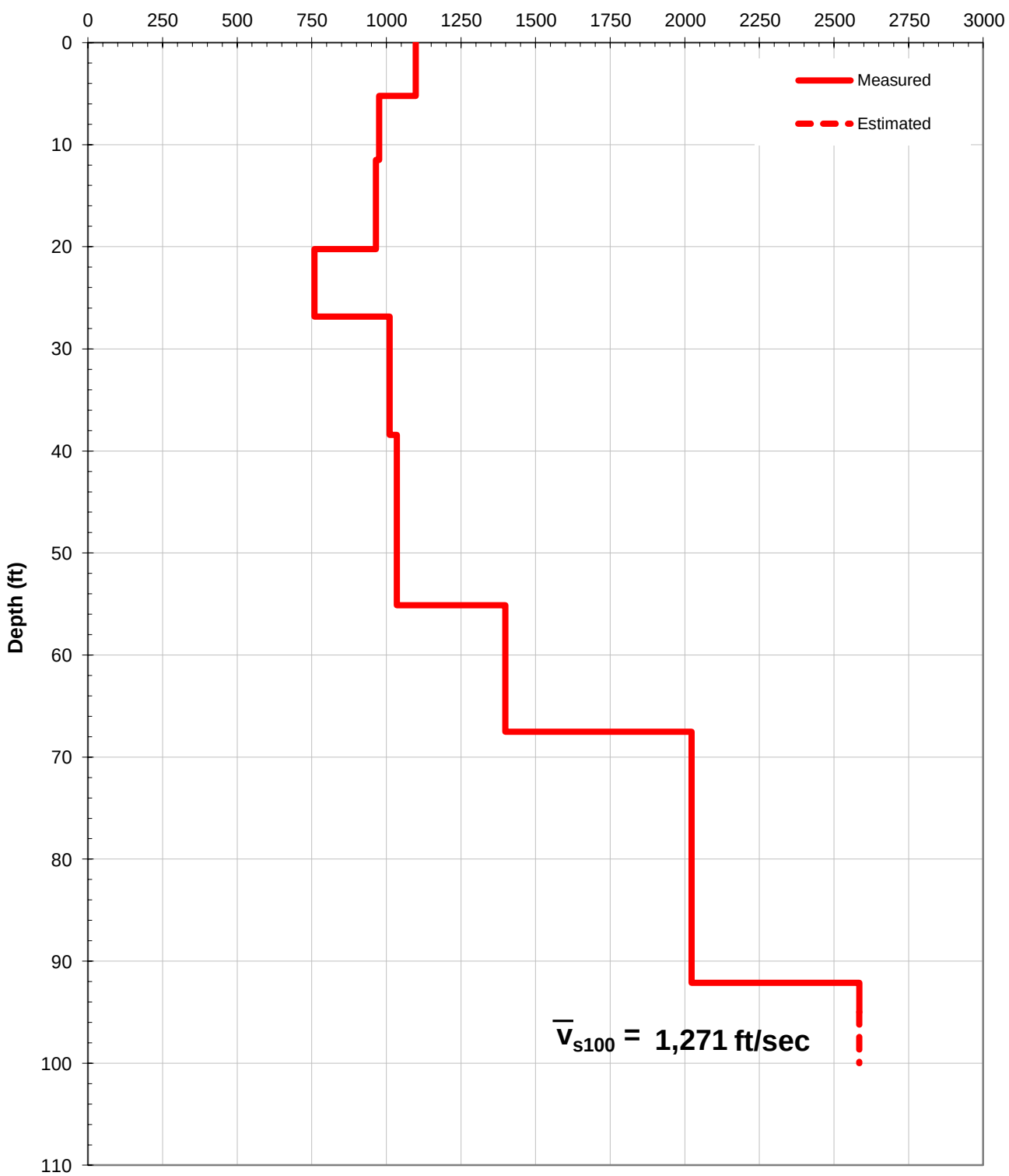
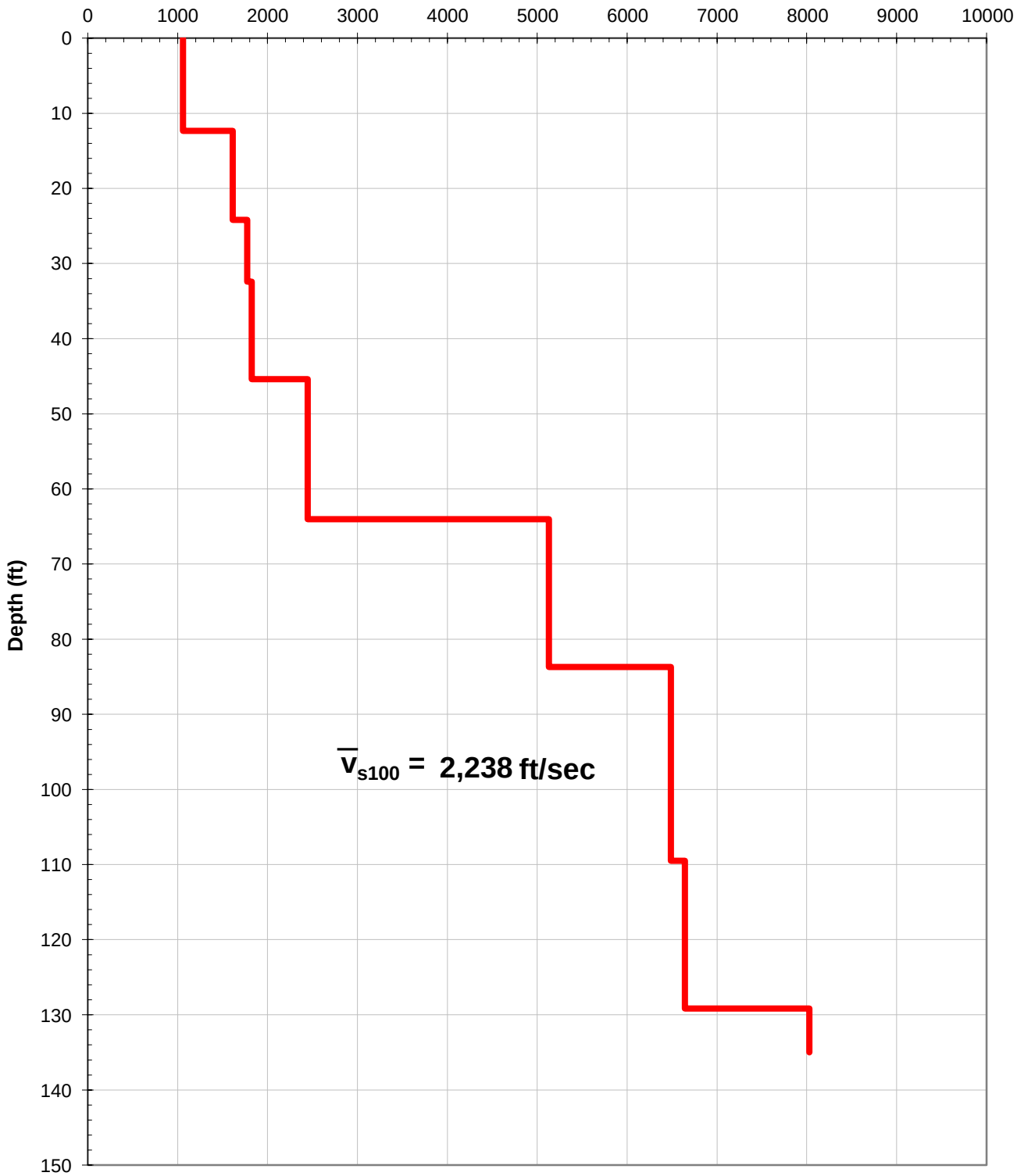
Shear Wave Velocity Profile SW-1
Riverbanks Zoo & Garden - Gondola
West Columbia/Columbia, South Carolina
S&ME Project: 2410356



Shear Wave Velocity Profile SW-1
Riverbanks Zoo & Garden - Education Center
West Columbia/Columbia, South Carolina
S&ME Project: 2410357



Summary of Field Procedures

Boring and Sampling

Soil Test Boring with Hollow-Stem Auger

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*. Borings were made by mechanically twisting a continuous steel hollow stem auger into the soil. At regular intervals, soil samples were obtained with a standard 1.4-inch I. D., 2-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

Soil Test Boring with Rotary Wash

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*. A rotary drilling process was used to advance the hole and a heavy drilling fluid was circulated in the bore holes to stabilize the sides and flush the cuttings. At regular intervals, drilling tools were removed and soil samples were obtained with a standard 1.4 inch I. D., 2-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

Hand Auger Borings

Auger borings were advanced using hand operated augers. The soils encountered were identified in the field by cuttings brought to the surface. Representative samples of the cuttings were placed in glass jars and later transported to the laboratory. Soil consistency was qualitatively estimated by the relative difficulty of advancing the augers.

Single-Mass Dynamic Cone Penetrometer (DCP)

The DCP test involves driving a rod with a tip that is a 1.5-inch outside diameter, 45° cone into the ground using a 15-pound hammer, free-falling 20 inches, in general accordance with ASTM Special Technical Publication #399, *Dynamic Cone for Shallow In-Situ Penetration Testing*. The conical point of the penetrometer is first seated 1¾ inches to penetrate loose cuttings, then driven two additional 1¾-inch increments. The number of hammer blows required to achieve this penetration is recorded. When properly evaluated by qualified professional staff, the blow count is an index to the soil strength and ability to support foundations.

Undisturbed (UD) Sampling

Split spoon or split barrel sampling provide samples suitable for visual examination and classification tests but not sufficiently intact for quantitative laboratory testing. To provide samples for quantitative tests, relatively undisturbed samples were obtained by pushing sections of 3-inch O.D., 16-guage, steel tubing (Shelby tube) into the soil at the desired sampling intervals. The procedures used generally followed those described in ASTM D1587, *Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils*. Each tube, together with the encased soil, was carefully removed from the ground and the length of the recovered soil measured. Locations and depths of undisturbed samples were recorded on each field test boring record.

Rock Core Drilling in Cased Borehole

In selected borings where refusal to the drilling tools had been encountered, steel casing was set in the hole to the refusal depth to keep the hole from caving. Materials below refusal level were then cored using a diamond studded bit fastened to the end of hollow double tube core barrel, in general accordance with the procedures described in ASTM D2113, *Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation*. In this case an NX size core barrel was used to produce cylindrical cores, 1-7/8 inches in diameter. Core rod RPM and advance rate were closely monitored to prevent plugging the bit or core blockage or damage. A circulating media was used to flush cuttings during the coring process. In this case the circulating media used was water without additives. Circulating water was released on the surface after completion of coring.

Borehole Closure

Following collection of relevant geotechnical data, boreholes were filled by slowly pouring auger cuttings into the open hole such that minimal "bridging" of the material occurred in the hole. Backfilling of the upper two feet of each hole was tamped as heavily as possible with a shovel handle or other hand held equipment, and the backfill crowned to direct rainfall away on the surface. Where boreholes exceeded five feet in depth, a plastic hole plug was firmly tamped into place within the backfill at a depth of about two feet.

Preservation and Transporting of Soil Samples with Control of Field Moisture

Procedures for preserving soil samples obtained in the field and transportation of samples to the laboratory generally followed those given in ASTM D4220, *Standard Practice for Preserving and Transporting Soil Samples* for Group B samples as defined in Section 4. Group B samples are those samples not suspected of being contaminated and for which only water content and classification, proctor, relative density, or profile logging will be performed. Group B samples also include bulk samples that are intended to be remolded in the laboratory for compaction, swell pressure, percent swell, consolidation, permeability, CBR, or shear testing. Representative samples of the cuttings or split spoon samples, or representative bulk samples, were placed in suitably identified, sealed glass jars or plastic containers and transported to the laboratory. Sample identification numbers on the containers corresponded to sample numbers recorded on field boring records or test pit records. Thin-walled tube samples were sealed at the ends with paraffin and capped with plastic end caps.

Preservation and Transporting of Intact Soil Samples

Procedures for preserving certain selected soil samples obtained in the field and transportation of those samples to the laboratory generally followed procedures given in ASTM D4220, *Standard Practice for*

Preserving and Transporting Soil Samples for Group C samples as defined in Section 4. Group C samples are intact, naturally formed or field fabricated, samples for density determination, swell pressure, percent swell, permeability testing or shear testing with or without stress-strain plots or volume change measurement, including dynamic and cyclic testing. Representative thin walled tube samples were protected against vibration or shock, or extreme heat or cold, during transport to the laboratory. Sample identification numbers on the containers corresponded to sample numbers recorded on field boring records or test pit records. Thin-walled tube samples were sealed at the ends with paraffin and capped with plastic end caps. Samples were transported in the upright position in containers providing complete encasement in cushioning or insulation for individual samples.

Preservation and Transport of Rock Core Requiring Routine Care

Procedures for preserving recovered rock core specimens followed those given for routine care of non-sensitive, non-fragile samples for which only general visual examination will be performed. Steps for routine care are described in ASTM D5079, *Standard Practices for Preserving and Transporting Rock Core Samples*, section 7.5.1. Rock cored in 5 to 10 foot runs were placed in sleeves or channels in specially constructed wood or cardboard core boxes. Empty portions of sleeves or channels were packed with wood or paper to prevent slippage of the core during transport. Boxes were transported flat and secured to prevent sliding or vibration. A preliminary field log of each core indicating recovery and general visual description was prepared prior to packing of the core.

♦ Field Tests of Earth Materials

The subsurface conditions encountered during drilling were reported on a field test boring record by the chief driller. The record contains information about the drilling method, samples attempted and sample recovery, indications of materials in the borings such as coarse gravel, cobbles, etc., and indications of materials encountered between sample intervals. Representative soil samples were placed in glass jars and transported to the laboratory along with the field boring records. Recovered samples not expended in laboratory tests are commonly retained in our laboratory for 60 days following completion of drilling. Field boring records are retained at our office.

Measurement of Static Water Levels

Water level readings were made in the open boreholes immediately after completing drilling and withdrawal of the tools. Where feasible, measurements were repeated after an elapsed period of 24 hours to gauge the stabilized water level. Procedures for measurement of liquid levels in open boreholes are described in ASTM D4750, *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*. A calibrated cable with electrical wire encased, equipped with a weighted sensing tip at one end and an electric meter at the other, was slowly lowered into each borehole until the liquid surface was penetrated by the weighted end. Contact with the water closed an electric circuit and was recorded by the meter. The depth reading on the cable was then recorded relative to a reference point on the surface. Measurements made by this method were then repeated until approximately consistent values were obtained.

Measurement of Shear Wave Velocities using Surface Geophysical Methods – MASW with Microtremor Array Measurements (MAM)

MASW (Multi-Channel Analysis of Surface Waves) and MAM (Microtremor Array Measurement) methods are techniques for near-surface characterization of shear-wave velocity (Vs). Both utilize the Rayleigh-type surface waves ("ground roll") recorded by multiple receivers (geophones) deployed on an even spacing and connected to a common recording seismograph.

MASW and MAM methods utilize energy commonly considered noise on conventional seismic reflection surveys. Surface waves (R-waves) can be used to determine shear-wave velocities (vs) as surface waves are fundamentally similar in behavior to shear waves (S-waves).

MASW provides better resolution of the Vs profile at shallow depths, while MAM under certain conditions provides better resolution at depth. S&ME typically uses a combination of both methods to define the soil profile for the 100-foot interval required by the International Building Code site classification system in Section 16. Our experience indicates using a combination of both MASW and MAM with a non-linear array geometry provides a more accurate velocity profile than using ReMiTM alone, particularly if the ReMiTM array geometry is linear.

Performing both MASW and MAM provides the greater depth of penetration of microtremor analyses (low frequency surface waves) without sacrificing resolution at shallower depths from MASW (higher frequency surface waves). In cases where sufficient penetration depth (such as 100 feet) or material velocity (such as 2,500 fps) is achieved, often only the MASW method will be performed. The report text will state whether MASW only or MASW and MAM data are used to define the profile.

MASW Measurements

An active source array uses a striking surface to generate a source wave that is received by the geophones. The most important parameter is large receiver spread. MASW is capable of separating the fundamental mode from other noise on its own if the receiver spread is large enough. Since the direction of the source wave is known, the geophones can be arranged in a linear pattern with geophones on 5 to 10 foot centers. Using the active mode typical receiver spread is 75 to 150 feet. The higher frequency surface waves detected using this approach give better resolution of velocity profile at shallow depths (typically upper 0 to 20 feet). Larger spacing may be used to try to capture deeper depths using active source information.

The typical frequency range of surface waves generated by a sledgehammer striking a metal plate is approximately 8 Hz to 80 Hz. A 250 lb. weight dropping from 4 feet (using a drill rig cathead) will generate lower frequency surface waves, however our experience indicates frequencies only as low as about 6 Hz. Accordingly, typical frequency ranges using MASW methods may only range from 6 Hz to 80 Hz.

Microtremor Array Measurements (MAM)

MAM is a passive method which records background sources of seismic energy such as vehicle traffic. This yields lower frequency surface waves, which allows resolution of velocity profile at deeper depths (typically in excess of 60 feet). MAM utilizes a two-dimensional or L-shaped array because the direction of the passive energy sources is not known. Geophone spacing using this approach is typically 30 feet, giving a 150 foot length for each leg of an L-shaped array.

Frequency ranges of microtremors and ambient noise (vehicle traffic, building vibrations, tidal effects, etc.) typically range from about 1 Hz up to 30 Hz. Most researchers recommend only low frequency passive dispersion data (less than 10 Hz) be used for the composite dispersion curve due to near field effects. At "quiet sites" however, the passive sources may be absent, thereby limiting penetration depth to what is achievable using active sources.

Signal Enhancement

The Rayleigh-type surface wave is difficult to interpret and commonly requires enhancement during both data acquisition and processing steps. Accurate dispersion curve extraction is very important element of the MASW method because any error in the dispersion curve would cause inversion to produce an inaccurate vertical Vs section. However, often other types of the seismic wave field such as the direct wave, refracted waves, guided waves, the air wave as well as higher modes of the surface wave may act as noise and interfere with extraction of accurate dispersion curves. MASW can handle such types of noise only if several acquisition parameters are met.

Signal Recording

The surface waves propagate to depths that are proportional to their frequencies (i.e., dispersion). The surface waves are recorded at the ground surface along a spread of low-frequency geophones. Recorded surface waves are transformed from time domain into frequency domain, from which the phase characteristics of the surface waves can be determined. A dispersion curve (a.k.a., phase velocity curve, slowness curve) is developed allowing the phase velocity (Cf) of particular frequency waves to be calculated. The dispersion curve is then transformed into the shear-wave velocity profile through a complex inversion and iterative processing. Where both MASW and MAM tests are performed at a single location, dispersion curves from both tests are combined prior to the inversion process.

The testing is conducted using a 16-channel GeoMetrics ES-3000 seismograph and the test data reduced using the OYO Corporation SeisImager software. Surface waves recorded as they propagate along the receiver line are analyzed through multichannel processing techniques similar to a pattern-recognition approach. Either active or passive sources can be used, or used in combination, to develop the wave frequencies required to obtain velocities to a depth of 100 feet.

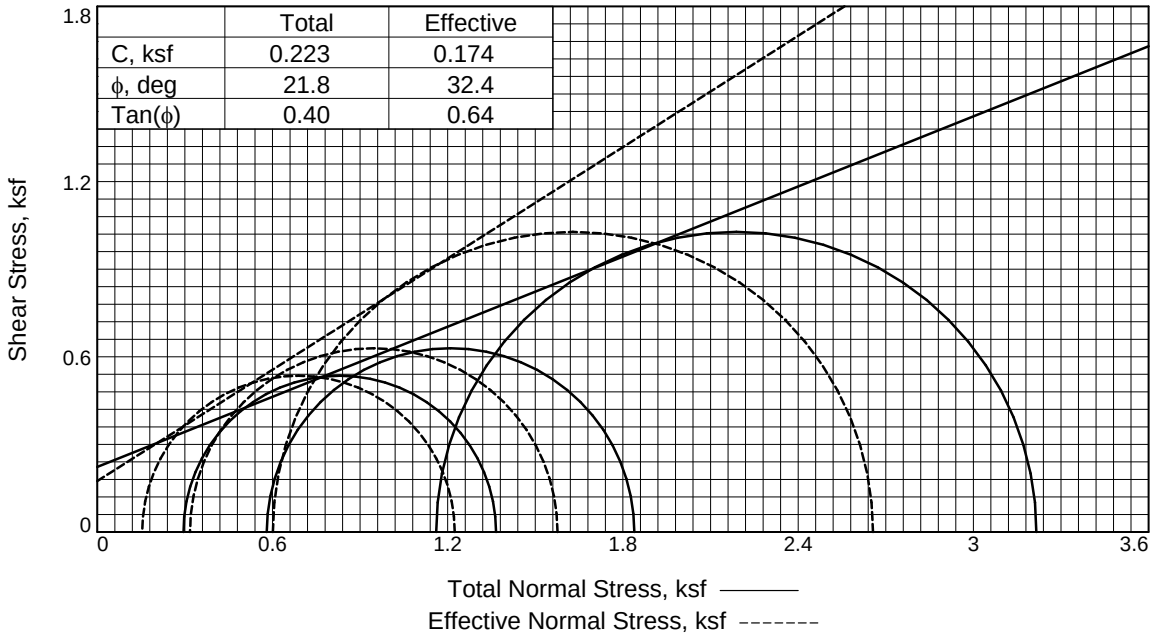
Depth of Penetration

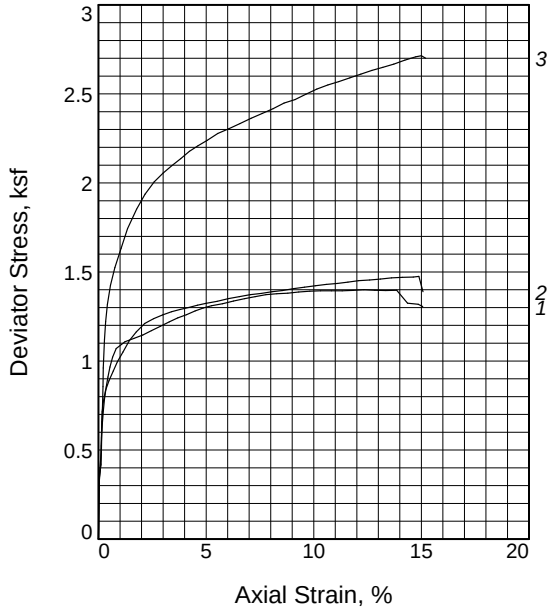
Depth of penetration using surface wave methods is mainly controlled by the shear properties of the subsurface materials and frequency range of site surface waves (generated active or ambient passive). Generally, penetration depth is greater for stiffer profiles as the signal does not attenuate as rapidly. However, because very small strain is required to determine the shear properties, sometimes velocities of very stiff materials (competent igneous or metamorphic rock) are difficult to obtain using traditional active or ambient sources.

Assuming the frequency range of the microtremors/passive sources extends lower than the geophone frequency, only the material velocity would control the penetration depth. Literature suggests velocities of up to 300 feet in depth can be measured using surface wave methods, but more typically depths range up to 100 to 140 feet. We have successfully measured velocities to depths of up to approximately 250 feet. The report will provide data to the maximum depth of resolution allowed by the soil properties and source frequencies.

Appendix III – Laboratory Test Results

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Specimen No.		1	2	3
Initial	Water Content, %	17.9	11.7	12.0
	Dry Density, pcf	94.0	106.7	109.2
	Saturation, %	62.2	56.4	61.7
	Void Ratio	0.7605	0.5504	0.5148
	Diameter, in.	2.839	2.813	2.845
	Height, in.	5.781	5.673	5.878
At Test	Water Content, %	26.4	19.0	17.7
	Dry Density, pcf	95.3	108.9	112.8
	Saturation, %	95.1	96.9	100.6
	Void Ratio	0.7365	0.5186	0.4661
	Diameter, in.	2.826	2.794	2.819
	Height, in.	5.755	5.634	5.793
Strain rate, %/min.		0.32	0.32	0.32
Eff. Cell Pressure, ksf		0.295	0.580	1.161
Fail. Stress, ksf		1.070	1.259	2.055
Total Pore Pr., ksf		10.221	10.343	10.639
Strain, %		0.8	3.0	3.0
Ult. Stress, ksf		1.306	1.389	2.700
Total Pore Pr., ksf		10.079	10.249	10.388
Strain, %		15.1	15.1	15.2
$\bar{\sigma}_1$ Failure, ksf		1.224	1.576	2.656
$\bar{\sigma}_3$ Failure, ksf		0.154	0.317	0.601

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: CLAYEY SAND (SC) - red yellow

LL= 40 **PL=** 24 **PI=** 16

Assumed Specific Gravity= 2.65

Remarks: The specimens failed with bulging. Failure selected at peak stress ratio. ASTM D 4767.

Figure 1

Client: Riverbanks Zoo & Garden

Project: Riverbanks Zoo - Garden - Gondola

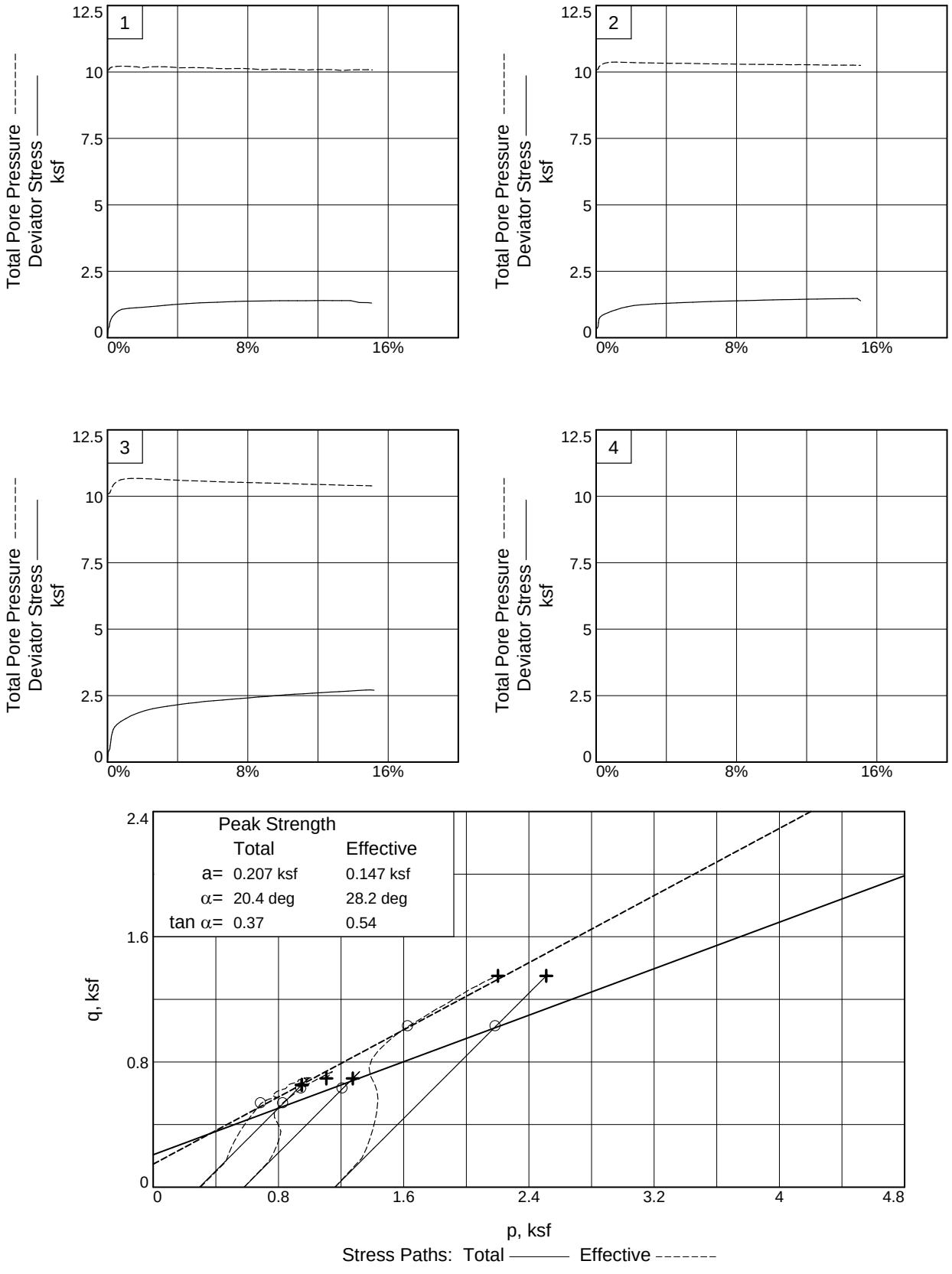
Location: UD-1

Sample Number: E-1 **Depth:** 1 - 3'

Proj. No.: 24610356 **Date Sampled:** 8/29/24

TRIAXIAL SHEAR TEST REPORT
S&ME, Inc.
Greenville, SC

Tested By: Benjamin Kovaleski - 9/17/24 **Checked By:** Robert C. Bruorton, P.E.



C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Client: Riverbanks Zoo & Garden
Project: Riverbanks Zoo - Garden - Gondola
Location: UD-1 **Depth:** 1 - 3' **Sample Number:** E-1
Project No.: 24610356 **Figure** 2

S&ME, Inc.

Tested By: Benjamin Kovaleski - 9/17/24 **Checked By:** Robert C. Bruorton, P.E.

TRIAXIAL COMPRESSION TEST 9/17/2024

CU with Pore Pressures 2:30 PM

Date: 8/29/24
Client: Riverbanks Zoo & Garden
Project: Riverbanks Zoo - Garden - Gondola
Project No.: 24610356
Location: UD-1
Depth: 1 - 3' **Sample Number:** E-1
Description: CLAYEY SAND (SC) - red yellow
Remarks: The specimens failed with bulging. Failure selected at peak stress ratio. ASTM D 4767.
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=**40 **PL=**24 **PI=**16
Test Method: ASTM D 4767 Method A

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	119.050			1140.940
Moisture content: Dry soil+tare, gms.	101.010			902.370
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	17.9	26.5	26.4	26.4
Moist specimen weight, gms.	1063.90			
Diameter, in.	2.839	2.827	2.826	
Area, in.²	6.330	6.275	6.272	
Height, in.	5.781	5.756	5.755	
Net decrease in height, in.		0.025	0.001	
Net decrease in water volume, cc.			0.400	
Wet density, pcf	110.8	120.4	120.5	
Dry density, pcf	94.0	95.2	95.3	
Void ratio	0.7605	0.7377	0.7365	
Saturation, %	62.2	95.1	95.1	

Test Readings for Specimen No. 1

Membrane modulus = 0.14 kN/cm²
Membrane thickness = 0.03 cm
Consolidation cell pressure = 72.050 psi (10.375 ksf)
Consolidation back pressure = 70.000 psi (10.080 ksf)
Consolidation effective confining stress = 0.295 ksf
Strain rate, %/min. = 0.32
Fail. Stress = 1.070 ksf **at reading no.** 12
Ult. Stress = 1.306 ksf **at reading no.** 43

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	0.301	0.301	1.00	69.957	0.301	0.000
1	0.0021	14.116	14.1	0.0	0.324	0.301	0.625	2.08	69.957	0.463	0.162
2	0.0061	18.376	18.4	0.1	0.421	0.270	0.691	2.56	70.175	0.481	0.211
3	0.0073	22.807	22.8	0.1	0.523	0.241	0.764	3.17	70.376	0.503	0.261
4	0.0084	26.012	26.0	0.1	0.596	0.223	0.819	3.67	70.501	0.521	0.298
5	0.0103	28.286	28.3	0.2	0.648	0.212	0.860	4.06	70.579	0.536	0.324
6	0.0130	31.581	31.6	0.2	0.723	0.196	0.920	4.68	70.686	0.558	0.362
7	0.0158	34.294	34.3	0.3	0.785	0.186	0.971	5.22	70.759	0.579	0.393
8	0.0205	37.317	37.3	0.4	0.854	0.176	1.029	5.86	70.830	0.603	0.427
9	0.0251	39.785	39.8	0.4	0.909	0.170	1.079	6.36	70.872	0.624	0.455
10	0.0306	42.287	42.3	0.5	0.966	0.164	1.129	6.90	70.913	0.647	0.483
11	0.0377	44.773	44.8	0.7	1.021	0.158	1.179	7.46	70.953	0.669	0.511
12	0.0474	47.002	47.0	0.8	1.070	0.154	1.224	7.96	70.982	0.689	0.535
13	0.0709	48.887	48.9	1.2	1.109	0.164	1.272	7.77	70.913	0.718	0.554
14	0.0948	49.899	49.9	1.6	1.127	0.178	1.305	7.32	70.813	0.742	0.563
15	0.1183	50.940	50.9	2.1	1.145	0.216	1.362	6.29	70.547	0.789	0.573
16	0.1414	52.267	52.3	2.5	1.170	0.177	1.347	7.61	70.821	0.762	0.585
17	0.1656	53.585	53.6	2.9	1.195	0.176	1.371	7.79	70.828	0.773	0.597
18	0.1891	54.923	54.9	3.3	1.220	0.178	1.397	7.85	70.814	0.788	0.610
19	0.2121	56.175	56.2	3.7	1.242	0.193	1.435	7.44	70.711	0.814	0.621
20	0.2356	57.240	57.2	4.1	1.260	0.217	1.477	6.82	70.546	0.847	0.630
21	0.2585	58.436	58.4	4.5	1.281	0.214	1.496	6.98	70.562	0.855	0.641
22	0.2812	59.466	59.5	4.9	1.299	0.209	1.508	7.21	70.597	0.858	0.649
23	0.3022	60.247	60.2	5.3	1.311	0.211	1.521	7.21	70.585	0.866	0.655
24	0.3318	61.094	61.1	5.8	1.322	0.221	1.542	6.99	70.518	0.881	0.661
25	0.3607	62.123	62.1	6.3	1.337	0.242	1.579	6.52	70.367	0.911	0.668
26	0.3905	63.089	63.1	6.8	1.350	0.250	1.600	6.41	70.317	0.925	0.675
27	0.4189	63.941	63.9	7.3	1.361	0.245	1.606	6.56	70.351	0.925	0.681
28	0.4476	64.812	64.8	7.8	1.372	0.245	1.617	6.61	70.351	0.931	0.686
29	0.4767	65.427	65.4	8.3	1.378	0.259	1.636	6.33	70.255	0.947	0.689
30	0.5062	65.928	65.9	8.8	1.380	0.291	1.671	5.75	70.030	0.981	0.690
31	0.5353	66.644	66.6	9.3	1.388	0.270	1.658	6.13	70.173	0.964	0.694
32	0.5648	67.224	67.2	9.8	1.392	0.267	1.659	6.20	70.193	0.963	0.696
33	0.5936	67.724	67.7	10.3	1.394	0.269	1.663	6.19	70.183	0.966	0.697
34	0.6228	68.092	68.1	10.8	1.394	0.286	1.680	5.87	70.064	0.983	0.697
35	0.6516	68.481	68.5	11.3	1.394	0.298	1.692	5.68	69.981	0.995	0.697
36	0.6803	68.973	69.0	11.8	1.396	0.284	1.681	5.91	70.074	0.983	0.698
37	0.7096	69.556	69.6	12.3	1.400	0.280	1.680	6.00	70.106	0.980	0.700
38	0.7387	69.831	69.8	12.8	1.397	0.287	1.685	5.86	70.055	0.986	0.699
39	0.7682	70.162	70.2	13.3	1.396	0.316	1.712	5.41	69.854	1.014	0.698
40	0.7974	70.631	70.6	13.9	1.397	0.297	1.694	5.70	69.985	0.996	0.698
41	0.8262	70.919	70.9	14.4	1.324	0.291	1.615	5.55	70.028	0.953	0.662
42	0.8549	71.186	71.2	14.9	1.319	0.288	1.607	5.57	70.047	0.948	0.659
43	0.8668	70.754	70.8	15.1	1.306	0.296	1.602	5.41	69.992	0.949	0.653

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	118.190			1174.990
Moisture content: Dry soil+tare, gms.	105.790			987.700
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	11.7	19.0	19.0	19.0
Moist specimen weight, gms.	1103.26			
Diameter, in.	2.813	2.794	2.794	
Area, in.²	6.215	6.131	6.129	
Height, in.	5.673	5.635	5.634	
Net decrease in height, in.		0.038	0.001	
Net decrease in water volume, cc.			0.250	
Wet density, pcf	119.2	129.6	129.6	
Dry density, pcf	106.7	108.9	108.9	
Void ratio	0.5504	0.5193	0.5186	
Saturation, %	56.4	96.9	96.9	

Test Readings for Specimen No. 2

Membrane modulus = 0.14 kN/cm²
Membrane thickness = 0.03 cm
Consolidation cell pressure = 74.030 psi (10.660 ksf)
Consolidation back pressure = 70.000 psi (10.080 ksf)
Consolidation effective confining stress = 0.580 ksf
Strain rate, %/min. = 0.32
Fail. Stress = 1.259 ksf **at reading no.** 16
Ult. Stress = 1.389 ksf **at reading no.** 42

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	0.580	0.580	1.00	70.000	0.580	0.000
1	0.0010	13.734	13.7	0.0	0.323	0.574	0.897	1.56	70.043	0.735	0.161
2	0.0061	17.752	17.8	0.1	0.417	0.556	0.973	1.75	70.169	0.764	0.208
3	0.0075	24.183	24.2	0.1	0.567	0.513	1.080	2.11	70.469	0.796	0.284
4	0.0085	28.068	28.1	0.2	0.658	0.482	1.140	2.37	70.683	0.811	0.329
5	0.0095	30.457	30.5	0.2	0.714	0.458	1.172	2.56	70.848	0.815	0.357
6	0.0126	32.810	32.8	0.2	0.769	0.422	1.191	2.82	71.101	0.806	0.385
7	0.0185	35.652	35.7	0.3	0.835	0.372	1.207	3.24	71.444	0.790	0.417
8	0.0276	38.056	38.1	0.5	0.890	0.330	1.219	3.70	71.741	0.774	0.445
9	0.0386	40.428	40.4	0.7	0.943	0.301	1.245	4.13	71.936	0.773	0.472
10	0.0496	42.751	42.8	0.9	0.996	0.290	1.286	4.43	72.016	0.788	0.498
11	0.0642	45.228	45.2	1.1	1.050	0.287	1.338	4.65	72.034	0.813	0.525
12	0.0809	48.156	48.2	1.4	1.115	0.293	1.408	4.81	71.999	0.850	0.558
13	0.0990	50.417	50.4	1.8	1.164	0.300	1.464	4.88	71.946	0.882	0.582
14	0.1209	52.674	52.7	2.1	1.211	0.308	1.519	4.94	71.894	0.913	0.605
15	0.1443	54.063	54.1	2.6	1.238	0.313	1.551	4.95	71.853	0.932	0.619
16	0.1677	55.217	55.2	3.0	1.259	0.317	1.576	4.97	71.826	0.947	0.629
17	0.1910	56.262	56.3	3.4	1.277	0.323	1.600	4.95	71.787	0.961	0.638
18	0.2136	57.042	57.0	3.8	1.289	0.328	1.617	4.93	71.754	0.972	0.645
19	0.2366	57.793	57.8	4.2	1.301	0.332	1.632	4.92	71.728	0.982	0.650
20	0.2592	58.615	58.6	4.6	1.314	0.332	1.645	4.96	71.726	0.989	0.657
21	0.2815	59.311	59.3	5.0	1.324	0.334	1.657	4.97	71.713	0.996	0.662
22	0.3105	60.140	60.1	5.5	1.335	0.338	1.673	4.95	71.682	1.006	0.668

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
23	0.3396	61.142	61.1	6.0	1.350	0.346	1.696	4.90	71.625	1.021	0.675
24	0.3684	62.000	62.0	6.5	1.361	0.352	1.714	4.87	71.584	1.033	0.681
25	0.3969	62.866	62.9	7.0	1.373	0.354	1.727	4.87	71.569	1.041	0.686
26	0.4255	63.521	63.5	7.6	1.380	0.357	1.737	4.86	71.551	1.047	0.690
27	0.4538	64.296	64.3	8.1	1.389	0.364	1.753	4.82	71.504	1.058	0.694
28	0.4816	64.954	65.0	8.5	1.396	0.371	1.766	4.76	71.455	1.069	0.698
29	0.5102	65.802	65.8	9.1	1.406	0.373	1.779	4.77	71.439	1.076	0.703
30	0.5392	66.588	66.6	9.6	1.415	0.375	1.790	4.77	71.425	1.082	0.707
31	0.5680	67.362	67.4	10.1	1.423	0.379	1.802	4.76	71.400	1.090	0.712
32	0.5964	68.098	68.1	10.6	1.430	0.384	1.814	4.73	71.367	1.099	0.715
33	0.6248	68.722	68.7	11.1	1.435	0.386	1.821	4.72	71.349	1.104	0.718
34	0.6527	69.476	69.5	11.6	1.443	0.384	1.827	4.76	71.363	1.106	0.722
35	0.6809	70.253	70.3	12.1	1.451	0.387	1.838	4.75	71.345	1.112	0.726
36	0.7097	70.869	70.9	12.6	1.455	0.392	1.847	4.71	71.307	1.120	0.728
37	0.7380	71.517	71.5	13.1	1.460	0.399	1.859	4.66	71.258	1.129	0.730
38	0.7670	72.263	72.3	13.6	1.467	0.401	1.868	4.65	71.243	1.135	0.733
39	0.7955	72.872	72.9	14.1	1.470	0.402	1.872	4.66	71.240	1.137	0.735
40	0.8240	73.378	73.4	14.6	1.472	0.403	1.875	4.65	71.229	1.139	0.736
41	0.8385	73.787	73.8	14.9	1.476	0.406	1.882	4.63	71.208	1.144	0.738
42	0.8495	73.353	73.4	15.1	1.389	0.411	1.800	4.38	71.174	1.106	0.694

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	136.500			1260.630
Moisture content: Dry soil+tare, gms.	121.880			1071.180
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	12.0	17.8	17.7	17.7
Moist specimen weight, gms.	1199.72			
Diameter, in.	2.845	2.816	2.819	
Area, in.²	6.357	6.228	6.243	
Height, in.	5.878	5.819	5.793	
Net decrease in height, in.		0.059	0.026	
Net decrease in water volume, cc.			1.250	
Wet density, pcf	122.3	132.7	132.8	
Dry density, pcf	109.2	112.6	112.8	
Void ratio	0.5148	0.4692	0.4661	
Saturation, %	61.7	100.6	100.6	

Test Readings for Specimen No. 3

Membrane modulus = 0.14 kN/cm²
Membrane thickness = 0.03 cm
Consolidation cell pressure = 78.060 psi (11.241 ksf)
Consolidation back pressure = 70.000 psi (10.080 ksf)
Consolidation effective confining stress = 1.161 ksf
Strain rate, %/min. = 0.32
Fail. Stress = 2.055 ksf **at reading no.** 17
Ult. Stress = 2.700 ksf **at reading no.** 43

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	1.161	1.161	1.00	70.000	1.161	0.000
1	0.0025	16.033	16.0	0.0	0.370	1.147	1.517	1.32	70.093	1.332	0.185
2	0.0079	21.420	21.4	0.1	0.493	1.115	1.608	1.44	70.320	1.361	0.247
3	0.0089	26.532	26.5	0.2	0.611	1.077	1.688	1.57	70.578	1.383	0.306
4	0.0106	32.074	32.1	0.2	0.738	1.033	1.772	1.71	70.884	1.403	0.369
5	0.0119	37.187	37.2	0.2	0.856	0.990	1.846	1.86	71.186	1.418	0.428
6	0.0130	41.732	41.7	0.2	0.960	0.948	1.908	2.01	71.479	1.428	0.480
7	0.0162	48.621	48.6	0.3	1.118	0.877	1.995	2.28	71.973	1.436	0.559
8	0.0191	53.158	53.2	0.3	1.222	0.819	2.042	2.49	72.369	1.430	0.611
9	0.0238	57.356	57.4	0.4	1.318	0.755	2.073	2.74	72.815	1.414	0.659
10	0.0323	62.117	62.1	0.6	1.425	0.675	2.100	3.11	73.374	1.387	0.712
11	0.0441	66.592	66.6	0.8	1.524	0.617	2.141	3.47	73.777	1.379	0.762
12	0.0609	71.563	71.6	1.1	1.633	0.579	2.213	3.82	74.037	1.396	0.817
13	0.0780	76.613	76.6	1.3	1.743	0.566	2.310	4.08	74.128	1.438	0.872
14	0.1026	81.770	81.8	1.8	1.853	0.568	2.421	4.26	74.114	1.495	0.926
15	0.1253	85.821	85.8	2.2	1.937	0.577	2.514	4.36	74.054	1.545	0.968
16	0.1498	89.294	89.3	2.6	2.006	0.589	2.595	4.41	73.973	1.592	1.003
17	0.1740	91.858	91.9	3.0	2.055	0.601	2.656	4.42	73.885	1.629	1.028
18	0.1977	94.159	94.2	3.4	2.098	0.614	2.712	4.42	73.794	1.663	1.049
19	0.2211	96.309	96.3	3.8	2.137	0.628	2.765	4.40	73.697	1.697	1.068
20	0.2445	98.558	98.6	4.2	2.177	0.642	2.819	4.39	73.603	1.730	1.089
21	0.2681	100.429	100.4	4.6	2.209	0.651	2.860	4.39	73.539	1.756	1.105
22	0.2922	102.205	102.2	5.0	2.239	0.660	2.899	4.39	73.475	1.780	1.119

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
23	0.3210	104.557	104.6	5.5	2.278	0.672	2.950	4.39	73.391	1.811	1.139
24	0.3512	106.381	106.4	6.1	2.305	0.685	2.990	4.36	73.302	1.838	1.153
25	0.3807	108.287	108.3	6.6	2.334	0.699	3.032	4.34	73.209	1.865	1.167
26	0.4107	110.278	110.3	7.1	2.363	0.708	3.071	4.34	73.147	1.889	1.182
27	0.4405	112.170	112.2	7.6	2.391	0.715	3.106	4.34	73.092	1.911	1.195
28	0.4699	114.049	114.0	8.1	2.417	0.723	3.141	4.34	73.036	1.932	1.209
29	0.4993	116.162	116.2	8.6	2.448	0.733	3.181	4.34	72.971	1.957	1.224
30	0.5288	117.753	117.8	9.1	2.468	0.742	3.210	4.33	72.909	1.976	1.234
31	0.5579	119.851	119.9	9.6	2.498	0.750	3.248	4.33	72.854	1.999	1.249
32	0.5876	121.926	121.9	10.1	2.527	0.758	3.285	4.33	72.794	2.022	1.264
33	0.6173	123.773	123.8	10.7	2.551	0.770	3.320	4.31	72.716	2.045	1.275
34	0.6469	125.384	125.4	11.2	2.569	0.781	3.350	4.29	72.634	2.066	1.285
35	0.6763	127.148	127.1	11.7	2.590	0.790	3.380	4.28	72.574	2.085	1.295
36	0.7063	128.902	128.9	12.2	2.611	0.797	3.408	4.27	72.523	2.103	1.305
37	0.7359	130.706	130.7	12.7	2.632	0.806	3.438	4.27	72.465	2.122	1.316
38	0.7653	132.354	132.4	13.2	2.650	0.817	3.467	4.24	72.386	2.142	1.325
39	0.7948	134.025	134.0	13.7	2.667	0.828	3.496	4.22	72.308	2.162	1.334
40	0.8243	135.950	135.9	14.2	2.690	0.834	3.524	4.22	72.267	2.179	1.345
41	0.8539	137.731	137.7	14.7	2.709	0.841	3.550	4.22	72.219	2.195	1.354
42	0.8691	138.472	138.5	15.0	2.715	0.844	3.559	4.21	72.196	2.202	1.357
43	0.8806	138.051	138.1	15.2	2.700	0.852	3.553	4.17	72.140	2.203	1.350

Project Name: Riverbanks Zoo – Garden – Gondola

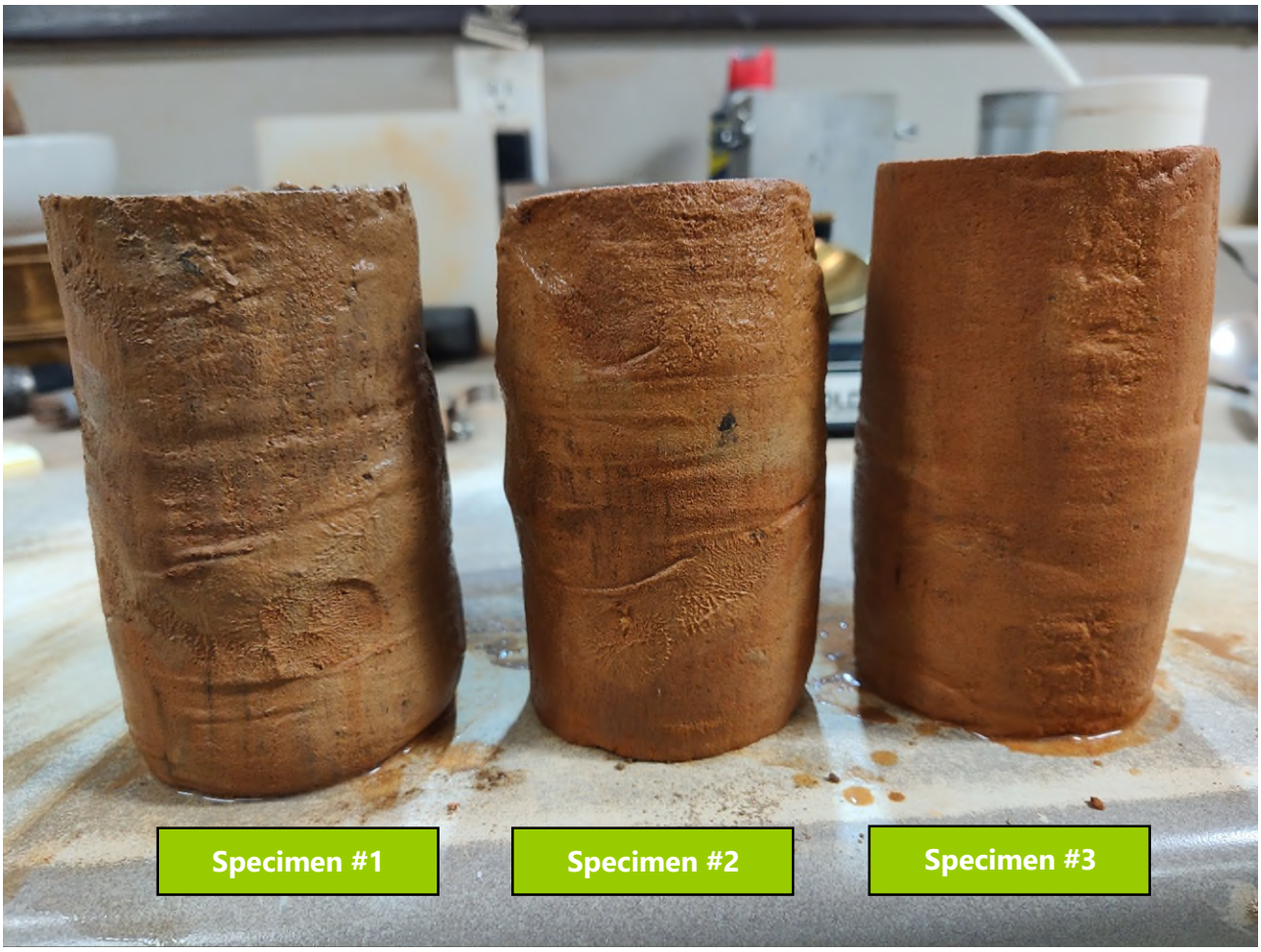
Project #: 24610356

Boring #: E-1

Depth: 1.0′ – 3.0′ (UD-1)

Sample Date: 8/29/24

Test Type: Consolidated Undrained Triaxial Shear (ASTM D4767)



Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

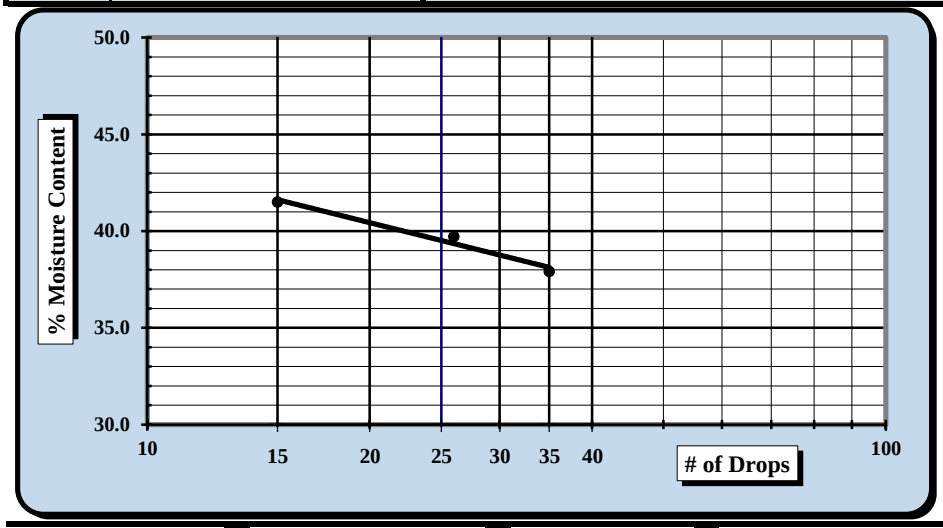
S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F Greenville, SC 29607

Project #:	24610356	Report Date:	9/17/24
Project Name:	Riverbanks Zoo - Garden - Gondola	Test Date:	9/16/24
Client Name:	Riverbanks Zoo & Garden		
Client Address:	PO Box 11129 Columbia, South Carolina 29211		

Boring #:	E-1	Log #:	77g	Sample Date:	8/29/24
Location:	UD-1	Type:	Undisturbed	Depth:	1 - 3'
Sample Description:	CLAYEY SAND (SC) - red yellow				

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	13942	10/31/2023	Grooving tool	23119	10/15/2023
LL Apparatus	23158	7/18/2023			
Oven	13978	10/1/2023			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	1	2	3				4	5	
A	Tare Weight	26.71	26.53	26.38				25.92	26.97	
B	Wet Soil Weight + A	44.86	42.73	43.02				34.77	35.34	
C	Dry Soil Weight + A	39.87	38.13	38.14				33.04	33.72	
D	Water Weight (B-C)	4.99	4.60	4.88				1.73	1.62	
E	Dry Soil Weight (C-A)	13.16	11.60	11.76				7.12	6.75	
F	% Moisture (D/E)*100	37.9%	39.7%	41.5%				24.3%	24.0%	
N	# OF DROPS	35	26	15				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**24.2%**		



One Point Liquid Limit			
N	**Factor**	**N**	**Factor**
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit	**40**
Plastic Limit	**24**
Plastic Index	**16**
Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* 43.7%

Notes / Deviations / References: Group symbol for minus #40 sieve portion only (see Sample Description for classification of entire sample).

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Benjamin J. Kovaleski	9/17/24	Brian Vaughan, P.E.	9/17/24
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D1140-3
Revision No. 1
Revision Date: 8/2/17

LABORATORY DETERMINATION OF WATER CONTENT & MATERIAL FINER THAN #200 SIEVE

ASTM D 2216 - ASTM D 1140

S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F Greenville, SC 29607

Project #:	24610356	Report Date:	9/17/24
Project Name:	Riverbanks Zoo - Garden - Gondola	Test Date(s):	9/13 - 9/17/24
Client Name:	Riverbanks Zoo & Garden		
Client Address:	PO Box 11129 Columbia, South Carolina 29211		
		Sample Dates:	8/29/24

Sampling Method: Undisturbed

Method: **A** ☐ **B** ☑ Soaked ☑ Soak Time 2+ hrs.

Sample Identification	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Tare Wt. + Dry Wt. after Wash	Water Wt.	Percent Moisture	% Passing #200
Boring #, Sample #, Depth	grams	grams	grams	grams	grams	%	%
E-1, UD-1, 1-3'	97.56	-	426.22	282.74	-	**-**	**43.7%**

Balance ID.: *13942* *Calibration Date:* *10/31/23* *#200 Sieve:* *23324* *Calibration Date:* *11/02/23*

Notes / Deviations / References: ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um)) Sieve

Method B uses a deflocculating agent such as Sodium Hexametaphosphate while soaking the specimen for at least 2 hours.

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Benjamin Kovaleski		NICET Lab Level III / 117226	9/17/24
Technician Name		*Certification Type/No.*	*Date*
Brian Vaughan, P.E.	Brian Vaughan	QA Supervisor	9/17/24
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-7012
Revision No. 1
Revision Date: 7/25/17

Unconfined Compression

(ASTM D7012 Method C)

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	24610356	Report Date:	9/12/2024
Project Name:	Riverbanks Zoo & Garden - Gondola	Test Date(s)	9/10 - 9/12/24
Client Name:	Riverbanks Zoo & Garden		
Client Address:	PO Box 11129, Columbia, SC 29211		

Dimensional Data					
Boring No.	T-1				
Sample Date	N/A				
Sample Id	RS-1				
Depth (ft)	14.5-15.4				
Average Height (in.)	4.11				
Average Diameter (in.)	1.99				
Area (in^2)	3.11				
Length to Diameter Ratio	2.07				
Mass (g)	549.00				
Unit Weight (pcf)	163.6				
Moisture Data					
Moisture (%)	0.4				
Compression Data					
Load (lbs)	34,500				
Comp. Strength (psi)	11,093				
Time / Seconds	147				
Load Rate (psi/sec)	75				
Remarks: Unconfined Compressive Strength of Rock Specimen Before/After					
					

References / Comments / Deviations:

ASTM D4543: Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Toterances.

ASTM D2216: Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

Mal Krajan		Laboratory Manager	9/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-7012
Revision No. 1
Revision Date: 7/25/17

Unconfined Compression

(ASTM D7012 Method C)

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	24610356	Report Date:	9/12/2024
Project Name:	Riverbanks Zoo & Garden - Gondola	Test Date(s)	9/10 - 9/12/24
Client Name:	Riverbanks Zoo & Garden		
Client Address:	PO Box 11129, Columbia, SC 29211		

Dimensional Data					
Boring No.	T-2				
Sample Date	N/A				
Sample Id	RS-2				
Depth (ft)	16.8-17.7				
Average Height (in.)	4.08				
Average Diameter (in.)	1.99				
Area (in^2)	3.11				
Length to Diameter Ratio	2.05				
Mass (g)	544.51				
Unit Weight (pcf)	163.5				
Moisture Data					
Moisture (%)	0.2				
Compression Data					
Load (lbs)	48,950				
Comp. Strength (psi)	15,740				
Time / Seconds	162				
Load Rate (psi/sec)	97				
Remarks: Unconfined Compressive Strength of Rock Specimen Before/After					
					

References / Comments / Deviations:

ASTM D4543: Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Toterances.

ASTM D2216: Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

Mal Krajan		Laboratory Manager	9/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-7012
Revision No. 1
Revision Date: 7/25/17

Unconfined Compression

(ASTM D7012 Method C)

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	24610356	Report Date:	9/12/2024
Project Name:	Riverbanks Zoo & Garden - Gondola	Test Date(s)	9/10 - 9/12/24
Client Name:	Riverbanks Zoo & Garden		
Client Address:	PO Box 11129, Columbia, SC 29211		

Dimensional Data					
Boring No.	T-3	T-3			
Sample Date	N/A	N/A			
Sample Id	RS-3	RS-4			
Depth (ft)	17.9-18.8	23.9-24.9			
Average Height (in.)	4.13	4.11			
Average Diameter (in.)	1.99	1.99			
Area (in^2)	3.11	3.11			
Length to Diameter Ratio	2.08	2.07			
Mass (g)	553.08	557.69			
Unit Weight (pcf)	164.0	166.2			
Moisture Data					
Moisture (%)	0.4	0.2			
Compression Data					
Load (lbs)	37,810	57,790			
Comp. Strength (psi)	12,158	18,582			
Time / Seconds	141	177			
Load Rate (psi/sec)	86	105			
Remarks: Unconfined Compressive Strength of Rock Specimen Before/After					
					

References / Comments / Deviations:

ASTM D4543: Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Toterances.

ASTM D2216: Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

Mal Krajan		Laboratory Manager	9/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-7012
Revision No. 1
Revision Date: 7/25/17

Unconfined Compression

(ASTM D7012 Method C)

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	24610356	Report Date:	9/12/2024
Project Name:	Riverbanks Zoo & Garden - Gondola	Test Date(s)	9/10 - 9/12/24
Client Name:	Riverbanks Zoo & Garden		
Client Address:	PO Box 11129, Columbia, SC 29211		

Dimensional Data					
Boring No.	T-4				
Sample Date	N/A				
Sample Id	RS-5				
Depth (ft)	13.4-14.5				
Average Height (in.)	4.13				
Average Diameter (in.)	1.99				
Area (in^2)	3.11				
Length to Diameter Ratio	2.08				
Mass (g)	512.62				
Unit Weight (pcf)	152.0				
Moisture Data					
Moisture (%)	1.5				
Compression Data					
Load (lbs)	3,970				
Comp. Strength (psi)	1,277				
Time / Seconds	36				
Load Rate (psi/sec)	35				
Remarks: Unconfined Compressive Strength of Rock Specimen Before/After					
					

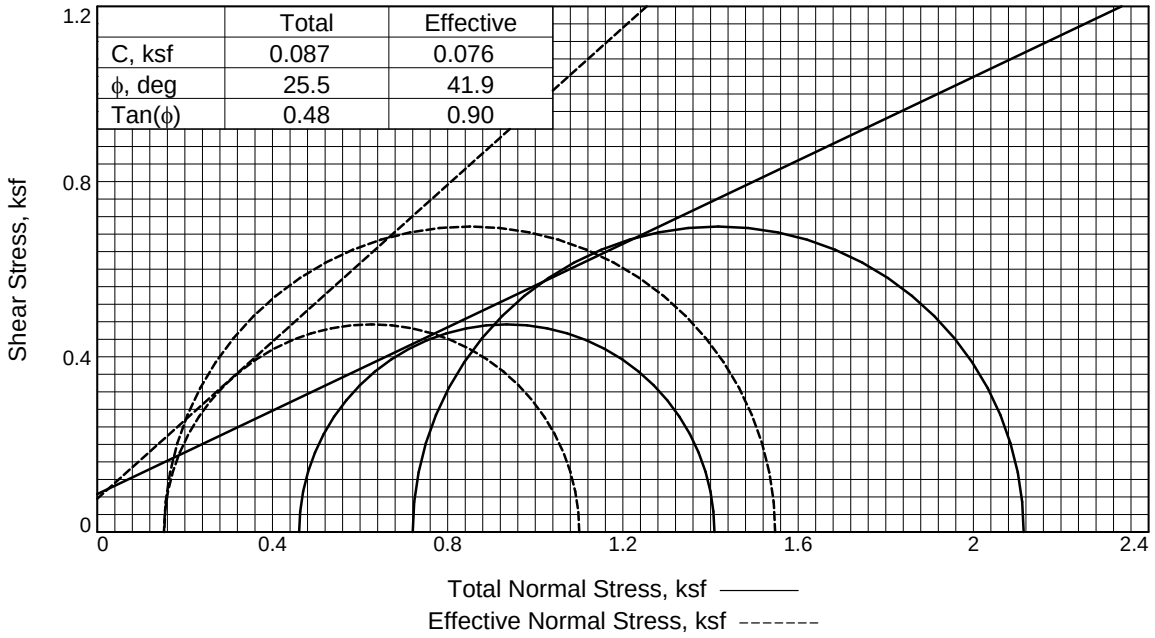
References / Comments / Deviations:

ASTM D4543: Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Toterances.

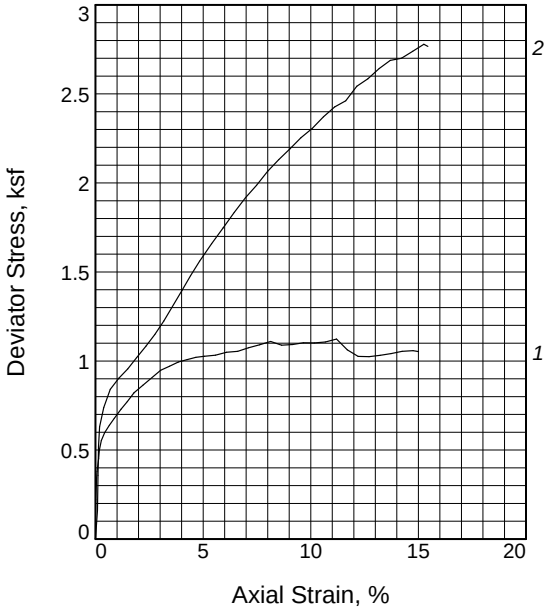
ASTM D2216: Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

Mal Krajan		Laboratory Manager	9/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



	Total	Effective
C, ksf	0.087	0.076
ϕ, deg	25.5	41.9
Tan(ϕ)	0.48	0.90



Specimen No.		1	2
Initial	Water Content, %	14.4	14.4
	Dry Density, pcf	98.8	108.0
	Saturation, %	56.5	71.9
	Void Ratio	0.6750	0.5311
	Diameter, in.	2.851	2.851
	Height, in.	5.623	5.623
At Test	Water Content, %	22.5	16.9
	Dry Density, pcf	103.2	115.4
	Saturation, %	98.8	103.6
	Void Ratio	0.6028	0.4333
	Diameter, in.	2.807	2.801
	Height, in.	5.552	5.455
Strain rate, %/min.		0.23	0.23
Eff. Cell Pressure, ksf		0.461	0.720
Fail. Stress, ksf		0.948	1.395
Total Pore Pr., ksf		10.389	10.647
Strain, %		3.0	4.0
Ult. Stress, ksf		1.053	2.767
Total Pore Pr., ksf		10.314	10.160
Strain, %		15.0	15.4
$\bar{\sigma}_1$ Failure, ksf		1.100	1.548
$\bar{\sigma}_3$ Failure, ksf		0.152	0.153

Type of Test: CU with Pore Pressures

Sample Type: Undisturbed

Description: SILTY CLAYEY SAND WITH GRAVEL (SC-SM)

LL= 20 **PL=** 16 **PI=** 4

Assumed Specific Gravity= 2.65

Remarks: The specimens failed with bulging. Failure selected at peak stress ratio. ASTM D4767.

Figure 1

Client: Riverbanks Zoo & Garden

Project: Riverbanks Zoo - Garden - Gondola

Location: UD-2

Sample Number: W-1 **Depth:** 2 - 4'

Proj. No.: 24610356 **Date Sampled:** 8/27/24

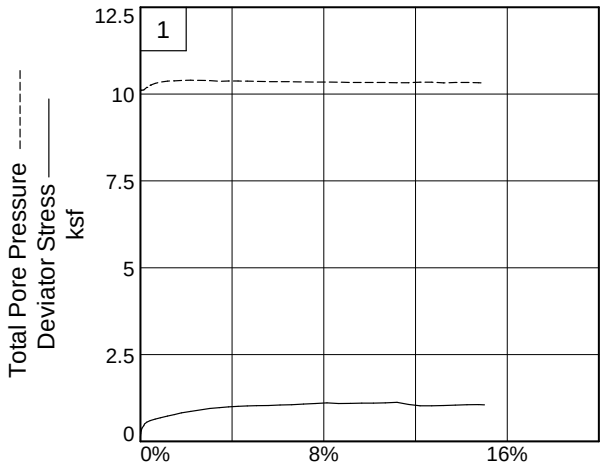
TRIAXIAL SHEAR TEST REPORT

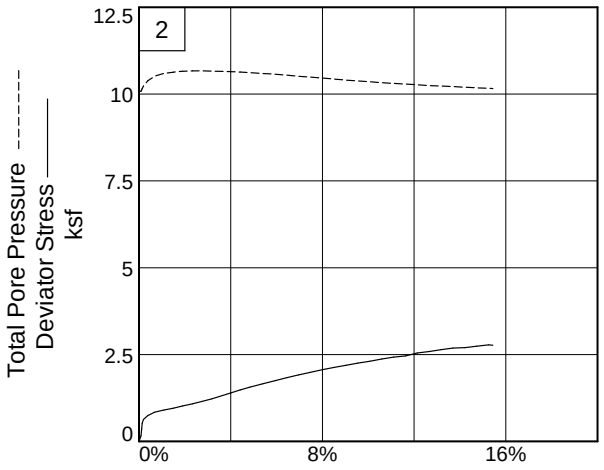
S&ME, Inc.

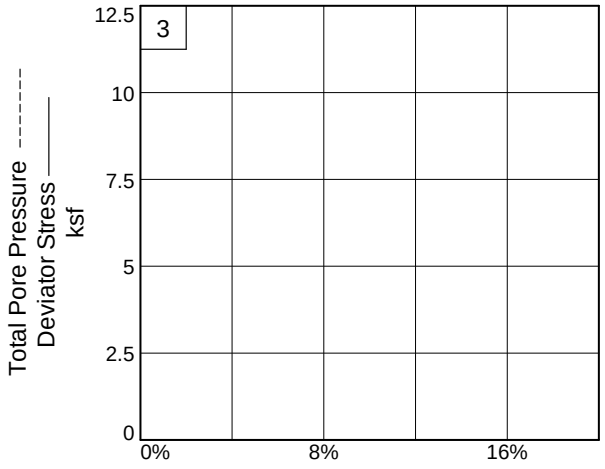
Greenville, SC

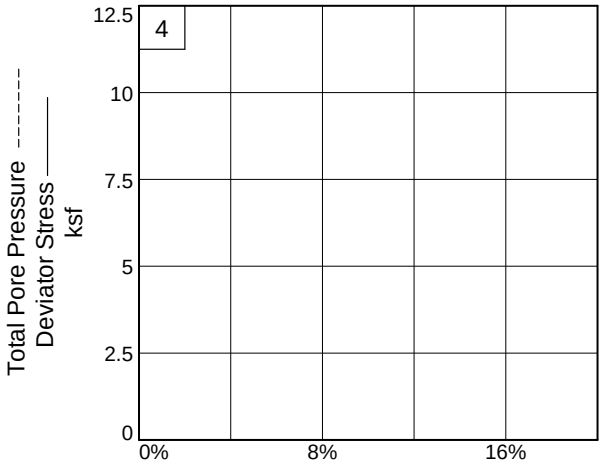
Tested By: Benjamin Kovaleski - 9/19/24 **Checked By:** Robert C. Bruorton, P.E.

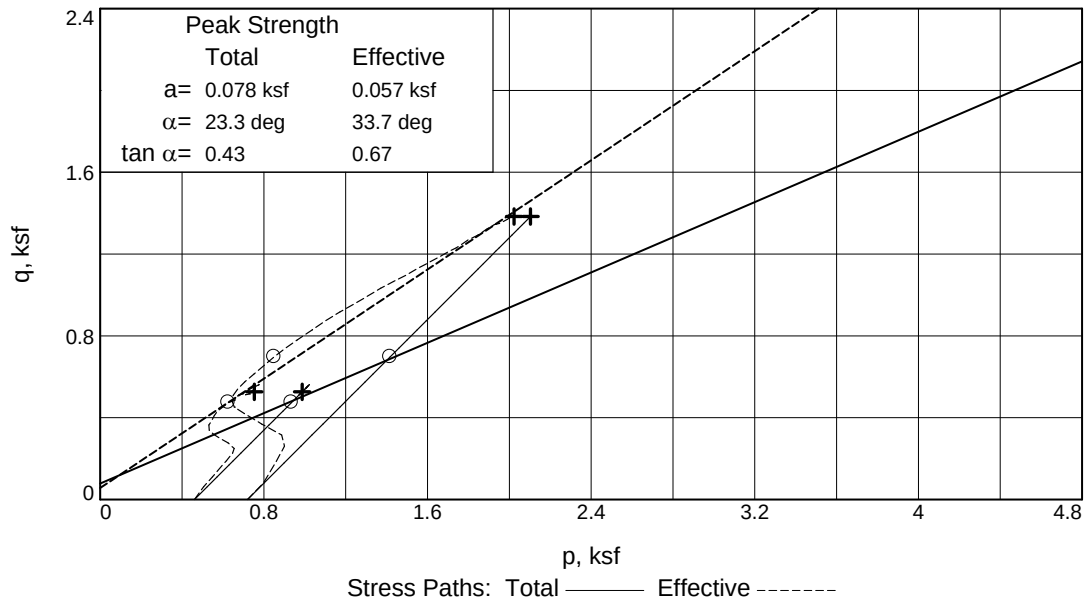
C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.











Client: Riverbanks Zoo & Garden
Project: Riverbanks Zoo - Garden - Gondola
Location: UD-2 **Depth:** 2 - 4' **Sample Number:** W-1
Project No.: 24610356 **Figure** 2

S&ME, Inc.

Tested By: Benjamin Kovaleski - 9/19/24 **Checked By:** Robert C. Bruorton, P.E.

TRIAXIAL COMPRESSION TEST 9/19/2024

CU with Pore Pressures 1:41 PM

Date: 8/27/24
Client: Riverbanks Zoo & Garden
Project: Riverbanks Zoo - Garden - Gondola
Project No.: 24610356
Location: UD-2
Depth: 2 - 4' **Sample Number:** W-1
Description: SILTY CLAYEY SAND WITH GRAVEL (SC-SM)
Remarks: The specimens failed with bulging. Failure selected at peak stress ratio. ASTM D4767.
Type of Sample: Undisturbed
Assumed Specific Gravity=2.65 **LL=**20 **PL=**16 **PI=**4
Test Method: ASTM D 4767 Method A

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	150.250			1139.800
Moisture content: Dry soil+tare, gms.	131.340			930.620
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	14.4	22.9	22.5	22.5
Moist specimen weight, gms.	1064.63			
Diameter, in.	2.851	2.816	2.807	
Area, in.²	6.384	6.230	6.187	
Height, in.	5.623	5.556	5.552	
Net decrease in height, in.		0.067	0.004	
Net decrease in water volume, cc.			4.350	
Wet density, pcf	113.0	125.9	126.4	
Dry density, pcf	98.8	102.4	103.2	
Void ratio	0.6750	0.6151	0.6028	
Saturation, %	56.5	98.8	98.8	

Test Readings for Specimen No. 1

Membrane modulus = 0.14 kN/cm²
Membrane thickness = 0.03 cm
Consolidation cell pressure = 73.200 psi (10.541 ksf)
Consolidation back pressure = 70.000 psi (10.080 ksf)
Consolidation effective confining stress = 0.461 ksf
Strain rate, %/min. = 0.23
Fail. Stress = 0.948 ksf **at reading no.** 15
Ult. Stress = 1.053 ksf **at reading no.** 40

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	0.461	0.461	1.00	70.000	0.461	0.000
1	0.0002	5.358	5.4	0.0	0.125	0.443	0.568	1.28	70.124	0.505	0.062
2	0.0009	9.489	9.5	0.0	0.221	0.438	0.659	1.50	70.156	0.549	0.110
3	0.0026	14.538	14.5	0.0	0.338	0.429	0.767	1.79	70.222	0.598	0.169
4	0.0039	16.312	16.3	0.1	0.379	0.427	0.806	1.89	70.234	0.617	0.190
5	0.0082	19.503	19.5	0.1	0.453	0.420	0.874	2.08	70.282	0.647	0.227
6	0.0098	21.459	21.5	0.2	0.499	0.406	0.904	2.23	70.383	0.655	0.249
7	0.0152	23.845	23.8	0.3	0.553	0.348	0.902	2.59	70.782	0.625	0.277
8	0.0237	25.798	25.8	0.4	0.598	0.287	0.885	3.09	71.209	0.586	0.299
9	0.0357	27.607	27.6	0.6	0.638	0.234	0.872	3.73	71.575	0.553	0.319
10	0.0484	29.355	29.4	0.9	0.677	0.195	0.872	4.48	71.849	0.533	0.339
11	0.0657	31.681	31.7	1.2	0.729	0.167	0.896	5.36	72.041	0.531	0.364
12	0.0822	33.670	33.7	1.5	0.772	0.160	0.932	5.84	72.092	0.546	0.386
13	0.0992	35.917	35.9	1.8	0.821	0.147	0.968	6.58	72.178	0.558	0.411
14	0.1220	37.930	37.9	2.2	0.863	0.142	1.005	7.10	72.217	0.573	0.432
15	0.1680	42.004	42.0	3.0	0.948	0.152	1.100	7.23	72.143	0.626	0.474
16	0.1908	43.170	43.2	3.4	0.970	0.173	1.143	6.61	72.000	0.658	0.485
17	0.2137	44.433	44.4	3.8	0.994	0.163	1.157	7.11	72.070	0.660	0.497
18	0.2366	45.217	45.2	4.3	1.008	0.165	1.172	7.12	72.057	0.668	0.504
19	0.2587	45.978	46.0	4.7	1.020	0.167	1.187	7.11	72.041	0.677	0.510
20	0.2812	46.468	46.5	5.1	1.027	0.173	1.200	6.93	71.998	0.686	0.513
21	0.3094	46.975	47.0	5.6	1.032	0.182	1.214	6.68	71.937	0.698	0.516
22	0.3381	47.986	48.0	6.1	1.049	0.181	1.230	6.79	71.941	0.706	0.524
23	0.3667	48.511	48.5	6.6	1.055	0.184	1.239	6.72	71.919	0.712	0.527
24	0.3951	49.692	49.7	7.1	1.074	0.190	1.265	6.64	71.877	0.728	0.537
25	0.4231	50.752	50.8	7.6	1.091	0.196	1.287	6.57	71.839	0.742	0.546
26	0.4518	51.896	51.9	8.1	1.110	0.195	1.305	6.68	71.843	0.750	0.555
27	0.4800	51.208	51.2	8.6	1.089	0.197	1.286	6.53	71.832	0.741	0.544
28	0.5081	51.676	51.7	9.2	1.093	0.206	1.298	6.31	71.772	0.752	0.546
29	0.5361	52.432	52.4	9.7	1.103	0.206	1.308	6.36	71.772	0.757	0.551
30	0.5642	52.674	52.7	10.2	1.101	0.205	1.306	6.38	71.778	0.755	0.551
31	0.5930	53.229	53.2	10.7	1.107	0.206	1.313	6.37	71.768	0.760	0.553
32	0.6215	54.351	54.4	11.2	1.123	0.215	1.338	6.23	71.708	0.777	0.562
33	0.6494	54.514	54.5	11.7	1.063	0.213	1.276	5.99	71.721	0.744	0.531
34	0.6773	53.124	53.1	12.2	1.026	0.198	1.224	6.18	71.825	0.711	0.513
35	0.7056	53.506	53.5	12.7	1.025	0.198	1.223	6.17	71.825	0.710	0.512
36	0.7340	54.307	54.3	13.2	1.032	0.217	1.249	5.76	71.694	0.733	0.516
37	0.7624	55.249	55.2	13.7	1.042	0.205	1.247	6.08	71.775	0.726	0.521
38	0.7909	56.320	56.3	14.2	1.054	0.205	1.259	6.15	71.777	0.732	0.527
39	0.8191	56.974	57.0	14.8	1.058	0.212	1.270	5.99	71.729	0.741	0.529
40	0.8332	56.946	56.9	15.0	1.053	0.227	1.279	5.64	71.626	0.753	0.526

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	155.720			1190.640
Moisture content: Dry soil+tare, gms.	136.110			1018.160
Moisture content: Tare, gms.	0.000			0.000
Moisture, %	14.4	17.5	16.9	16.9
Moist specimen weight, gms.	1164.77			
Diameter, in.	2.851	2.799	2.801	
Area, in.²	6.384	6.153	6.160	
Height, in.	5.623	5.523	5.455	
Net decrease in height, in.		0.100	0.068	
Net decrease in water volume, cc.			6.200	
Wet density, pcf	123.6	134.2	135.0	
Dry density, pcf	108.0	114.1	115.4	
Void ratio	0.5311	0.4494	0.4333	
Saturation, %	71.9	103.5	103.6	

Test Readings for Specimen No. 2

Membrane modulus = 0.14 kN/cm²
Membrane thickness = 0.03 cm
Consolidation cell pressure = 75.000 psi (10.800 ksf)
Consolidation back pressure = 70.000 psi (10.080 ksf)
Consolidation effective confining stress = 0.720 ksf
Strain rate, %/min. = 0.23
Fail. Stress = 1.395 ksf **at reading no.** 13
Ult. Stress = 2.767 ksf **at reading no.** 36

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	0.720	0.720	1.00	70.000	0.720	0.000
1	0.0048	6.847	6.8	0.1	0.160	0.717	0.877	1.22	70.021	0.797	0.080
2	0.0063	15.331	15.3	0.1	0.358	0.677	1.035	1.53	70.298	0.856	0.179
3	0.0075	22.340	22.3	0.1	0.522	0.640	1.162	1.81	70.555	0.901	0.261
4	0.0105	27.016	27.0	0.2	0.630	0.572	1.202	2.10	71.029	0.887	0.315
5	0.0207	31.701	31.7	0.4	0.738	0.420	1.159	2.76	72.081	0.789	0.369
6	0.0373	36.204	36.2	0.7	0.841	0.284	1.125	3.96	73.026	0.705	0.420
7	0.0591	39.055	39.1	1.1	0.903	0.204	1.107	5.43	73.585	0.655	0.452
8	0.0818	41.502	41.5	1.5	0.956	0.168	1.123	6.70	73.836	0.645	0.478
9	0.1042	44.432	44.4	1.9	1.019	0.141	1.159	8.24	74.023	0.650	0.509
10	0.1276	47.414	47.4	2.3	1.082	0.132	1.214	9.21	74.085	0.673	0.541
11	0.1502	50.540	50.5	2.8	1.149	0.131	1.280	9.78	74.091	0.705	0.574
12	0.1732	54.126	54.1	3.2	1.225	0.138	1.363	9.87	74.041	0.751	0.613
13	0.2188	62.164	62.2	4.0	1.395	0.153	1.548	10.14	73.940	0.850	0.697
14	0.2408	66.198	66.2	4.4	1.479	0.166	1.645	9.93	73.850	0.905	0.740
15	0.2639	70.155	70.2	4.8	1.561	0.183	1.743	9.54	73.731	0.963	0.780
16	0.2944	75.004	75.0	5.4	1.659	0.207	1.865	9.03	73.566	1.036	0.829
17	0.3231	79.449	79.4	5.9	1.747	0.228	1.975	8.68	73.420	1.101	0.874
18	0.3517	83.872	83.9	6.4	1.834	0.255	2.089	8.20	73.232	1.172	0.917
19	0.3800	88.136	88.1	7.0	1.917	0.287	2.204	7.67	73.004	1.246	0.958
20	0.4080	91.840	91.8	7.5	1.986	0.311	2.298	7.38	72.838	1.304	0.993
21	0.4365	96.058	96.1	8.0	2.066	0.339	2.404	7.10	72.649	1.371	1.033
22	0.4644	99.653	99.7	8.5	2.131	0.368	2.499	6.80	72.447	1.433	1.066

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
23	0.4929	103.058	103.1	9.0	2.191	0.398	2.589	6.51	72.238	1.493	1.096
24	0.5207	106.578	106.6	9.5	2.254	0.419	2.673	6.37	72.088	1.546	1.127
25	0.5491	109.684	109.7	10.1	2.306	0.443	2.749	6.21	71.923	1.596	1.153
26	0.5777	113.463	113.5	10.6	2.371	0.471	2.843	6.03	71.728	1.657	1.186
27	0.6060	116.783	116.8	11.1	2.427	0.492	2.919	5.93	71.583	1.705	1.213
28	0.6341	119.129	119.1	11.6	2.461	0.510	2.972	5.82	71.455	1.741	1.231
29	0.6620	123.808	123.8	12.1	2.543	0.531	3.074	5.79	71.313	1.802	1.271
30	0.6903	126.608	126.6	12.7	2.585	0.554	3.139	5.67	71.152	1.847	1.293
31	0.7189	130.197	130.2	13.2	2.642	0.567	3.209	5.66	71.063	1.888	1.321
32	0.7470	133.245	133.2	13.7	2.688	0.583	3.271	5.61	70.953	1.927	1.344
33	0.7755	134.645	134.6	14.2	2.700	0.602	3.302	5.48	70.819	1.952	1.350
34	0.8037	137.432	137.4	14.7	2.739	0.620	3.360	5.42	70.693	1.990	1.370
35	0.8322	140.280	140.3	15.3	2.779	0.632	3.411	5.40	70.612	2.021	1.389
36	0.8421	139.983	140.0	15.4	2.767	0.640	3.407	5.33	70.558	2.023	1.384

Project Name: Riverbanks Zoo – Garden – Gondola

Project #: 24610356

Boring #: W-1

Depth: 2.0′ – 4.0′ (UD-2)

Sample Date: 8/27/24

Test Type: Consolidated Undrained Triaxial Shear (ASTM D4767)

Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F Greenville, SC 29607

Project #:	24610356	Report Date:	9/19/24
Project Name:	Riverbanks Zoo - Garden - Gondola	Test Date:	9/18/24
Client Name:	Riverbanks Zoo & Garden		
Client Address:	PO Box 11129 Columbia, South Carolina 29211		

Boring #:	W-1	Log #:	77g	Sample Date:	8/27/24
Location:	UD-2	Type:	Undisturbed	Depth:	2 - 4'
Sample Description:	SILTY CLAYEY SAND WITH GRAVEL (SC-SM) - red				

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	13942	10/31/2023	Grooving tool	23119	10/15/2023
LL Apparatus	23158	7/18/2023			
Oven	13978	10/1/2023			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	13	14	15				16	17	
A	Tare Weight	26.81	26.67	27.62				26.57	26.64	
B	Wet Soil Weight + A	48.07	45.58	44.52				34.94	36.14	
C	Dry Soil Weight + A	44.60	42.33	41.51				33.83	34.84	
D	Water Weight (B-C)	3.47	3.25	3.01				1.11	1.30	
E	Dry Soil Weight (C-A)	17.79	15.66	13.89				7.26	8.20	
F	% Moisture (D/E)*100	19.5%	20.8%	21.7%				15.3%	15.9%	
N	# OF DROPS	25	20	15				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**15.6%**		

One Point Liquid Limit			
N	**Factor**	**N**	**Factor**
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit	**20**
Plastic Limit	**16**
Plastic Index	**4**
Group Symbol	**CL-ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* 18.1%

Notes / Deviations / References: Group symbol for minus #40 sieve portion only (see Sample Description for classification of entire sample).

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Benjamin J. Kovaleski	9/19/24	Brian Vaughan, P.E.	9/19/24
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No: TR-D1140-3
Revision No. 1
Revision Date: 8/2/17

LABORATORY DETERMINATION OF WATER CONTENT & MATERIAL FINER THAN #200 SIEVE

ASTM D 2216 - ASTM D 1140

S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F Greenville, SC 29607

Project #:	24610356	Report Date:	9/19/24
Project Name:	Riverbanks Zoo - Garden - Gondola	Test Date(s):	9/16 - 9/19/24
Client Name:	Riverbanks Zoo & Garden		
Client Address:	PO Box 11129 Columbia, South Carolina 29211		
		Sample Dates:	8/27/24

Sampling Method: Undisturbed

Method: **A** ☐ **B** ☑ Soaked ☑ Soak Time 2+ hrs.

Sample Identification	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Tare Wt. + Dry Wt. after Wash	Water Wt.	Percent Moisture	% Passing #200
Boring #, Sample #, Depth	grams	grams	grams	grams	grams	%	%
W-1, UD-2, 2-4'	90.41	-	631.62	533.72	-	**-**	**18.1%**

Balance ID.: *13942* *Calibration Date:* *10/31/23* *#200 Sieve:* *23324* *Calibration Date:* *11/02/23*

Notes / Deviations / References: ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um)) Sieve

Method B uses a deflocculating agent such as Sodium Hexametaphosphate while soaking the specimen for at least 2 hours.

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Benjamin Kovaleski		NICET Lab Level III / 117226	9/19/24
Technician Name		*Certification Type/No.*	*Date*
Brian Vaughan, P.E.	Brian Vaughan	QA Supervisor	9/19/24
Technical Responsibility	*Signature*	*Position*	*Date*

Summary of Laboratory Procedures

Recovered disturbed and undisturbed samples and the drillers' field logs were transported to the laboratory where they were examined by the geotechnical engineer. Selected samples representative of certain groups of soils were subjected to simple classification tests by hand or other simple means. Other samples were tested in the laboratory to determine their strength or consolidation properties.

Laboratory Tests of Soil

Examination of Split Spoon Soil Samples

Soil and rock samples and field boring records were reviewed in the laboratory by the geotechnical engineer. Soils were classified in general accordance with the visual-manual method described in ASTM D 2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Method)*. The geotechnical engineer also prepared the final boring records enclosed with this report.

Extrusion and Examination of Group C Undisturbed Samples

Undisturbed samples were stored in the vertical position in the laboratory. Samples were extruded from the thin-walled sampler, using a specially constructed extruder, in the same direction of travel as the sample entered the tube during sampling. In certain cases it was necessary to cut the tube into short sections to facilitate removal of the soil without compressing or disturbing the sample. Specimens were trimmed using a wire saw or steel straightedge. Where removal of pebbles or crumbling resulting from trimming caused voids on the surface of the specimens selected for quantitative laboratory testing, they were filled with remolded soil obtained from the trimmed portion of the sample.

Moisture Content Testing of Soil Samples by Oven Drying

Moisture content was determined in general conformance with the methods outlined in ASTM D2216, "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass." This method is limited in scope to Group B, C, or D samples of earth materials which do not contain appreciable amounts of organic material, soluble solids such as salt or reactive solids such as cement. This method is also limited to samples which do not contain contamination.

A representative portion of the soil was divided from the sample using one of the methods described in Section 9 of ASTM D2216. The split portion was then placed in a drying oven and heated to approximately 110 degrees C overnight or until a constant mass was achieved after repetitive weighing. The moisture content of the soil was then computed as the mass of water removed from the sample by drying, divided by the mass of the sample dry, times 100 percent. No attempt was made to exclude any particular particle size from the portion split from the sample.

Liquid and Plastic Limits Testing

Atterberg limits of the soils was determined generally following the methods described by ASTM D4318, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*. Albert Atterberg originally

defined "limits of consistency" of fine grained soils in terms of their relative ease of deformation at various moisture contents. In current engineering usage, the liquid limit of a soil is defined as the moisture content, in percent, marking the upper limit of viscous flow and the boundary with a semi-liquid state. The plastic limit defines the lower limit of plastic behavior, above which a soil behaves plastically below which it retains its shape upon drying. The plasticity index (PI) is the range of water content over which a soil behaves plastically. Numerically, the PI is the difference between liquid limit and plastic limit values.

Representative portions of fine grained Group A, B, C, or D samples were prepared using the wet method described in Section 10.1 of ASTM D4318. The liquid limit of each sample was determined using the multipoint method (Method A) described in Section 11. The liquid limit is by definition the moisture content where 25 drops of a hand operated liquid limit device are required to close a standard width groove cut in a soil sample placed in the device. After each test, the moisture content of the sample was adjusted and the sample replaced in the device. The test was repeated to provide a minimum of three widely spaced combinations of N versus moisture content. When plotted on semilog paper, the liquid limit moisture content was determined by straight line interpolation between the data points at N equals 25 blows.

The plastic limit was determined using the procedure described in Section 17 of ASTM D4318. A selected portion of the soil used in the liquid limit test was kneaded and rolled by hand until it could no longer be rolled to a 3.2 mm thread on a glass plate. This procedure was repeated until at least 6 grams of material was accumulated, at which point the moisture content was determined using the methods described in ASTM D2216.

Percent Fines Determination of Samples

A selected specimen of soils was washed over a No. 200 sieve after being thoroughly mixed and dried. This test was conducted in general accordance with ASTM D1140, *Standard Test Method for Amount of Material Finer Than the No. 200 Sieve*. Method A, using water to wash the sample through the sieve without soaking the sample for a prescribed period of time, was used and the percentage by weight of material washing through the sieve was deemed the "percent fines" or percent clay and silt fraction.

CU or "R" Triaxial Shear Tests of Undisturbed Samples

Shear tests were performed using the CU or "R" test method described by ASTM D4767, *Standard Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils*. This test is typically applicable to fine-grained soils preserved as Group C samples as defined in ASTM D4220. Samples tested using the R test method are isotropically consolidated and sheared in compression without drainage at a constant rate of axial deformation. The shear characteristics measured under undrained conditions are applicable to field conditions where soils that have been fully consolidated under one set of stresses are subjected to a change in stress without time for further consolidation to take place. Measured pore pressures induced by the change in stress can be used to compute effective stress shear strength, which may be applied to field conditions in which full drainage can occur or to conditions in which pore pressures induced by loading can be estimated.

R tests were performed on samples prepared as generally described in Section 6 of ASTM D4767. Each extruded sample was encased in a rubber membrane and sealed to the specimen base and cap with rubber O-rings to prevent drainage of the specimen. For this test UD samples were tested without trimming except for cutting the end surfaces plane and perpendicular to the longitudinal axis of the specimen. Samples were

saturated by back pressuring the pore water in the specimen to drive the air in the void spaces into solution, after the system was saturated by applying a vacuum to the specimen and dry drainage system as described in section 8.2.

With the drainage valves of the triaxial cell closed, the cell pressure was increased while maintaining back pressure constant to confine the specimen. After the chamber was pressurized to the desired confining pressure the appropriate drainage ports were opened and the sample allowed to fully consolidate to equilibrium before application of axial load. The fully consolidated sample was then loaded axially by compressing the top platen into the sample at a constant rate of approximately one percent strain per minute, with the drainage ports again closed. Deformation of the sample and the applied stress was recorded electronically using LVDT strain gauges and induced pore pressures measured using a stiff electronic pressure transducer.

Failure of the specimens during the tests was defined as the point of maximum effective stress obliquity, the maximum stress difference (deviator stress) attained at any point during the test, or as the deviator stress at 15 percent strain, whichever occurred first. Test output is attached in the Appendix and includes a plot of deviator stress vs. applied strain for various load increments, induced pore pressure vs. applied strain, p'-q' diagram, and Mohr Circle plots at various increments of confining stress.

♦ Laboratory Tests of Rock

Unconfined Compressive Strength Tests of Intact Rock Core

The unconfined compressive strength of intact rock core specimens will be determined generally following the procedures described in ASTM D7012, *Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures*. Selected recovered samples of intact rock core representative of each run will be cut to length and the ends machined flat. Specimens will then be placed in a loading frame and axial load continuously applied until peak load and failure are obtained. Specimens selected for testing will meet shape and L/D proportions outlined in ASTM D4543, *Standard Practice for Preparing Rock Core Specimens and Determining Dimensional and Shape Tolerances*. The specimen minimum dimension should be at least six to ten times the maximum particle or mineral dimension, and the L/D ratio at least 2 to 2.5. Samples will be soaked prior to testing.

Appendix IV – Drilled Shaft Design Parameters

TABLE A-1 - Drilled Shaft Design Parameters

JOB NAME: Riverbanks Zoo & Garden – Gondola
PROJECT NO: 24610356
LOCATION: West Columbia/Columbia, Lexington/Richland Counties, South Carolina
DATE: 9/24/2024

* End bearing resistance value assumes that drilled shafts will be installed to a depth of at least 10 feet below grade.

[t] Ultimate End Bearing Resistance provided does not account for punching failure. Punching shear failure must be evaluated.

[1] **Use of provided Ultimate End Bearing Resistance values should take into account shaft diameter, with the lesser value within 2 diameters beneath the shaft tip used in design.**

** from: FAD 5.1 (FAD Tools) - User's Guide, rev 0, Dec 2015_Tables 1-1/1-3

^ from: FAD 5.1 (FAD Tools) - User's Guide, rev 0, Dec 2015_EQ 1-2/1-3

BORING ID T-1

LAYER ID	Depth (ft)	Description	Approx. Ground Water Depth	SPT Average N-value	Friction Angle (f)	Cohesion (ksf)	Moist Unit Weight (pcf)	Ultimate Side Shear Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Lateral Subgrade Modulus, k (pci)	Soil Strain Parameter (e50)	Deformation Modulus, E_D (ksi)
1	0.0 - 3.5	RESIDUUM - Dense Silty SAND (SM)		32	36	--	125	0.25	--	172	--	1.8
2	3.5 - 6.0	RESIDUUM - Loose Silty SAND (SM)		5	29	--	110	0.22	--	17	--	0.3
3	6.0 - 8.7	PWR - Silty SAND (SM)		100	42	--	130	1.00	--	312	--	5.5
4	8.7 - 13.5	PWR - Silty SAND (SM)	8.7	100	42	--	130	1.23	60	174	--	5.5

LAYER ID	Depth (ft)	Description	Rock Mass Class / Description**	Rock Hardness (Mohs)	Ave. Effective Friction Angle (f')**	Ave. Effective Cohesion (ksf)**	Moist Unit Weight (pcf)	Ultimate Side Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Rock Quality Designation (RQD %)	Ave. Rock Mass Rating (RMR)**	Ave. Deformation Modulus, E^ (ksi)
5	13.5 - 14.5	BEDROCK - Igneous - Granite	III - Fair	6-6.5	37	3.4	163.6	1440	12.48	53	47	1,060
6	14.5 - 23.5	BEDROCK - Igneous - Granite	II - Good	6-6.5	41	4.4	163.6	1440	17.14	87-94	63	3,770

BORING ID T-2

LAYER ID	Depth (ft)	Description	Approx. Ground Water Depth	SPT Average N-value	Friction Angle (f)	Cohesion (ksf)	Moist Unit Weight (pcf)	Ultimate Side Shear Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Lateral Subgrade Modulus, k (pci)	Soil Strain Parameter (e50)	Deformation Modulus, E_D (ksi)
1	0.0 - 3.5	RIVER TERRACE - Very Loose Silty SAND (SM)		4	29	--	110	0.07	--	15	--	0.2
2	3.5 - 6.0	RIVER TERRACE - Medium Dense Silty SAND (SM)		13	31	--	120	0.60	--	71	--	0.7
3	6.0 - 8.5	RESIDUUM - Medium Dense Silty SAND (SM)		14	32	--	120	0.94	--	73	--	0.8
4	8.5 - 13.5	PWR - Silty SAND (SM)		100	42	--	130	1.44	60	312	--	5.5
5	13.5 - 14.8	PWR - Silty SAND (SM)	13.5 (assumed)	100	42	--	130	1.71	60	174	--	5.5

LAYER ID	Depth (ft)	Description	Rock Mass Class / Description**	Rock Hardness (Mohs)	Ave. Effective Friction Angle (f')**	Ave. Effective Cohesion (ksf)**	Moist Unit Weight (pcf)	Ultimate Side Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Rock Quality Designation (RQD %)	Ave. Rock Mass Rating (RMR)**	Ave. Deformation Modulus, E^ (ksi)
6	14.8 - 24.8	BEDROCK - Igneous - Granite	III - Fair	5.5-6.5	37.6	3.7	163.5	1440	12.48	67-69	51	1,244
7	24.8 - 29.8	BEDROCK - Igneous - Granite	II - Good	6-6.5	44.0	6.0	163.5	1440	19.29	100	77	7,830

TABLE A-1 - Drilled Shaft Design Parameters

JOB NAME: Riverbanks Zoo & Garden – Gondola
PROJECT NO: 24610356
LOCATION: West Columbia/Columbia, Lexington/Richland Counties, South Carolina
DATE: 9/24/2024

* End bearing resistance value assumes that drilled shafts will be installed to a depth of at least 10 feet below grade.

[t] Ultimate End Bearing Resistance provided does not account for punching failure. Punching shear failure must be evaluated.

[1] **Use of provided Ultimate End Bearing Resistance values should take into account shaft diameter, with the lesser value within 2 diameters beneath the shaft tip used in design.**

** from: FAD 5.1 (FAD Tools) - User's Guide, rev 0, Dec 2015_Tables 1-1/1-3

^ from: FAD 5.1 (FAD Tools) - User's Guide, rev 0, Dec 2015_EQ 1-2/1-3

BORING ID T-3

LAYER ID	Depth (ft)	Description	Approx. Ground Water Depth	SPT Average N-value	Friction Angle (f)	Cohesion (ksf)	Moist Unit Weight (pcf)	Ultimate Side Shear Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Lateral Subgrade Modulus, k (pci)	Soil Strain Parameter (e50)	Deformation Modulus, E_D (ksi)
1	0.0 - 3.5	ALLUVIUM - Loose Silty SAND (SM)		7	30	--	115	0.12	--	25	--	0.4
2	3.5 - 6.0	WOOD DEBRIS		--	--	--	--	--	--	--	--	--
3	6.0 - 8.5	PWR - Silty SAND (SM)		100	42	--	130	0.96	--	312	--	5.5

LAYER ID	Depth (ft)	Description	Rock Mass Class / Description**	Rock Hardness (Mohs)	Ave. Effective Friction Angle (f')**	Ave. Effective Cohesion (ksf)**	Moist Unit Weight (pcf)	Ultimate Side Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Rock Quality Designation (RQD %)	Ave. Rock Mass Rating (RMR)**	Ave. Deformation Modulus, E^ (ksi)
4	8.5 - 14.9	BOULDER - Igneous - Granite	III - Fair	1.5-7.5	36.5	3.5	164.0	1440	12.14	53-71	47	1,047
5	14.9 - 24.9	BOULDER - Igneous - Granite	IV - Poor	3-6	34.0	2.9	165.1	1440	11.01	20-38	36	631
6	24.9 - 34.9	BEDROCK - Igneous - Granite	III - Fair	5-7.5	39.2	4.0	166.2	1440	13.28	63-77	57	1,548

BORING ID T-4

LAYER ID	Depth (ft)	Description	Approx. Ground Water Depth	SPT Average N-value	Friction Angle (f)	Cohesion (ksf)	Moist Unit Weight (pcf)	Ultimate Side Shear Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Lateral Subgrade Modulus, k (pci)	Soil Strain Parameter (e50)	Deformation Modulus, E_D (ksi)
1	0.0 - 3.5	ALLUVIUM - Very Loose Silty SAND (SM)		4	29	--	110	0.07	--	15	--	0.2
2	3.5 - 6.0	RESIDUUM - Very Stiff Lean CLAY with sand (CL)		18	--	1.8	120	0.99	--	774	0.006	1.4
3	6.0 - 11.6	RESIDUUM - Stiff Sandy Lean CLAY (CL)		13	--	1.3	120	0.69	11	556	0.007	1.0
4	11.6 - 12.8	RESIDUUM - Stiff Sandy Lean CLAY (CL)	11.6	13	--	1.3	120	0.72	11	556	0.007	1.0

LAYER ID	Depth (ft)	Description	Rock Mass Class / Description**	Rock Hardness (Mohs)	Ave. Effective Friction Angle (f')**	Ave. Effective Cohesion (ksf)**	Moist Unit Weight (pcf)	Ultimate Side Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Rock Quality Designation (RQD %)	Ave. Rock Mass Rating (RMR)**	Ave. Deformation Modulus, E^ (ksi)
5	12.8 - 20.1	BOULDER - Igneous - Granite	IV - Poor	1.5-4.5	31.2	2.4	152.0	460	0.03	10-46	26	323

LAYER ID	Depth (ft)	Description	Approx. Ground Water Depth	SPT Average N-value	Friction Angle (f)	Cohesion (ksf)	Moist Unit Weight (pcf)	Ultimate Side Shear Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Lateral Subgrade Modulus, k (pci)	Soil Strain Parameter (e50)	Deformation Modulus, E_D (ksi)
6	20.1 - 28.5	RESIDUUM - Dense Silty SAND (SM)		38	38	--	125	1.83	46	117	--	2.1
7	28.5 - 38.5	RESIDUUM - Very Dense Silty SAND (SM)		78	42	--	130	1.98	60	174	--	4.3
8	43.0 40.0	RESIDUUM - Very Stiff Sandy SILT (ML)		16	32	--	120	2.02	19.2	52	--	0.8

TABLE A-1 - Drilled Shaft Design Parameters

JOB NAME: Riverbanks Zoo & Garden – Gondola
PROJECT NO: 24610356
LOCATION: West Columbia/Columbia, Lexington/Richland Counties, South Carolina
DATE: 9/24/2024

* End bearing resistance value assumes that drilled shafts will be installed to a depth of at least 10 feet below grade.

[t] Ultimate End Bearing Resistance provided does not account for punching failure. Punching shear failure must be evaluated.

[1] **Use of provided Ultimate End Bearing Resistance values should take into account shaft diameter, with the lesser value within 2 diameters beneath the shaft tip used in design.**

** from: FAD 5.1 (FAD Tools) - User's Guide, rev 0, Dec 2015_Tables 1-1/1-3

^ from: FAD 5.1 (FAD Tools) - User's Guide, rev 0, Dec 2015_EQ 1-2/1-3

BORING ID T-5

LAYER ID	Depth (ft)	Description	Approx. Ground Water Depth	SPT Average N-value	Friction Angle (f)	Cohesion (ksf)	Moist Unit Weight (pcf)	Ultimate Side Shear Resistance (ksf)	Ultimate End Bearing Resistance (ksf)*[t1]	Lateral Subgrade Modulus, k (pci)	Soil Strain Parameter (e50)	Deformation Modulus, E_D (ksi)
1	0.0 - 3.5	RESIDUUM - Stiff Lean CLAY with sand (CL)		10	--	1.0	115	0.55	--	395	0.009	0.8
2	3.5 - 6.0	RESIDUUM - Very Stiff Lean CLAY with sand (CL)		21	--	2.1	120	1.16	--	903	0.006	1.6
3	6.0 - 8.5	RESIDUUM - Stiff Lean CLAY with sand (CL)		11	--	1.1	120	0.61	--	444	0.008	0.9
4	8.5 - 28.5	RESIDUUM - Firm Lean CLAY with sand (CL)		7	--	0.7	115	0.40	5	175	0.01	0.6
5	28.5 - 33.5	RESIDUUM - Firm Sand SILT (ML)		8	--	0.8	115	0.44	6	29	0.01	0.5
6	33.5 - 38.5	RESIDUUM - Medium Dense Silty SAND (SM)		21	33	--	120	2.91	25	93	--	1.2
7	38.5 - 40.0	RESIDUUM - Dense Silty SAND (SM)		31	36	--	125	3.02	37.2	166	--	1.7