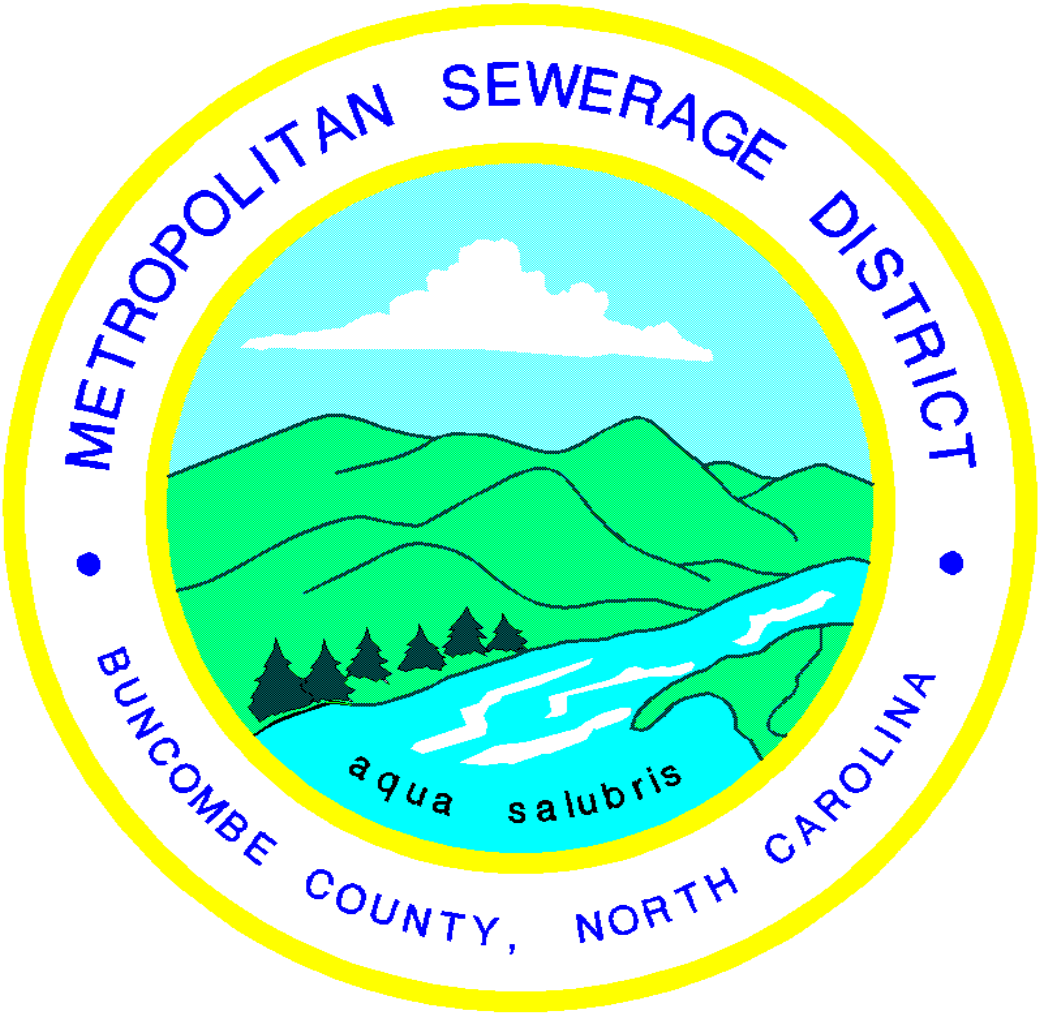
ITT Pump Station Replacement



2026

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METROPOLITAN SEWERAGE DISTRICT
OF
BUNCOMBE COUNTY, NORTH CAROLINA

CONSTRUCTION CONTRACT DOCUMENTS

FOR

ITT Pump Station Replacement

OWNER: **Metropolitan Sewerage District of Buncombe County, NC**
2028 Riverside Drive
Asheville, NC 28804
Phone: (828) 254-9646

DESIGN: **McKim & Creed**
35 N Market Street
Asheville, NC 28801
Phone: (828) 252-8181

CONTRACTOR: _____
_____
_____

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TABLE OF CONTENTS

SECTION	DEFINITION
I	Advertisement for Bids
II	ISO14001 Information Sheet
III	Instructions to Bidders
IV	General Conditions
V	Special Conditions / Permits / Detail Sheets
VI	Technical Specifications (Additional Details on Following Pages)
VII	Minority Business Enterprise
VIII	Non-Collusion Affidavit of Prime Bidder
IX	Bid Schedule
X	Proposal
XI	Bid Bond Form
XII	Notice of Award
XIII	Agreement Form
XIV	Performance and Payment Bonds
XV	Certificate of Insurance
XVI	Notice to Proceed (N.C. OneCall Center)
XVII	Consent to Change Order
XVIII	Application for Payment / Affidavit of Payment of Claims
XIX	State and County Sales/Use Tax Statement
XX	Contractor's Certificate of Completion and Warranty to the Metropolitan Sewerage District of Buncombe County, North Carolina
XXI	Final Certificate and Release
XXII	Affidavit of Payment of Claims
XXIII	Affidavit of Posting on Website
XXIV	Engineer's Certificate

TECHNICAL SPECIFICATIONS

DIVISION 01 – GENERAL REQUIREMENTS

01010 Summary
01026 Measurement and Payment
01050 Field Engineering and Surveying
01100 Special Project Procedures
01210 Allowances
01260 Contract Modification Procedures
01290 Payment Procedures
01300 Project Meetings
01310 Project Management and Coordination
01320 Construction Progress Documentation
01330 Submittal Procedures
01340 Submittals
01400 Quality Requirements
01410 Testing and Testing Laboratory Services
01600 Storage and Handling
01620 Substitutions and Product Options
01650 Delivery, Storage, and Handling
01740 Warranties
01770 Closeout Procedures
01781 Project Record Documents
01782 Operation and Maintenance Data

DIVISION 02 – SITE CONSTRUCTION

02065 Demolition and Removal
02071 Directional Boring
02110 Site Clearing
02140 Dewatering and Drainage
02213 Rock and Boulder Excavation
02221 Excavation, Bedding & Backfill for Pipe and Structures
02223 Stream Crossings
02224 Bank Stabilization
02410 Erosion and Sedimentation Control
02521 Check Valves
02522 Eccentric Plug Valves
02524 Air Release and Air Relief Valves
02605 Manholes
02722 Sanitary Sewers
02723 Force Mains
02830 Precast Modular Block Retaining Walls
02831 Chain Link Fence and Gates
02930 Seeding and Planting

DIVISION 03 – CONCRETE
03100 Concrete Formwork
03200 Concrete Reinforcement
03300 Cast-in-Place Concrete
03410 Precast Concrete Structures
03600 Grouting

DIVISION 09 – FINISHES
09871 Protective Lining for Concrete Exposed to Severe Wastewater Environment

DIVISION 11 – EQUIPMENT
11410 Submersible Wastewater Pumps
11420 Wastewater Grinder
11500 Temporary Wastewater Bypass Pumping Systems

DIVISION 14 – CONVEYING SYSTEMS
14650 Davit Crane

DIVISION 16 – ELECTRICAL
16000 Electrical Basic Requirements
16010 Electrical Power Studies
16060 Grounding and Bonding
16070 Hangers and Supports
16075 Electrical Identification
16080 Electrical Testing
16111 Conduit and Raceway
16120 Conductors and Cables
16130 Enclosures
16230 Engine Generators
16340 Low-Voltage Motor Controllers
16360 Packaged Power Supplies
16410 Enclosed Switches and Circuit Breakers
16415 Automatic Transfer Switches
16416 Manual Transfer Switches
16435 Panelboards

DIVISION 17 – INSTRUMENTATION
17100 Instrumentation and Control, General Requirements
17110 Instrumentation and Control, Control Enclosures
17120 Instrumentation and Control, Devices and Equipment
17120A Instrument Schedule
17130 Instrumentation and Control, Control Hardware
17130A Control System Input/Output Schedule
17140 Instrumentation and Control, Pump Control Panel

APPENDIX

A Special Conditions Attachments
B Geotechnical Exploration Report (April 12, 2024)

ADVERTISEMENT FOR BIDS

Sealed bids will be received by the Metropolitan Sewerage District (DISTRICT) of Buncombe County, North Carolina at the second floor conference room of the MSD W. H. Mull Building, 2028 Riverside Drive in Asheville, North Carolina, until **2:00 PM** (local time), **Tuesday, July 21, 2026,** and shall be immediately opened publicly and read aloud for the project described as follows:

ITT Pump Station Replacement
Project No. 2020061

generally consisting of procurement and installation of a new 10-ft diameter duplex submersible sanitary sewer lift station (expandable to a triplex lift station), wastewater grinder inside a dedicated 5-ft diameter manhole, approximately 20 LF of 24-inch and 2,640 LF of 16-inch HDPE DR 11 force main (approximately 440 LF of which will be encased in a 24-inch HDPE DR 11 to be installed by horizontal directional drill across the French Broad River), approximately 550 LF of 12-inch and 410 LF of 24-inch PVC C900 gravity sewer, and 30 LF of 30-inch DIP gravity sewer, including manholes and all related appurtenances. The project also includes construction of approximately 800 LF of upper access road and an extension of the lower access road from the existing access road.

Complete plans, specifications and contract documents may be **examined** at the following locations:

The DISTRICT website: www.msdbc.org/projects/adsforbids.php

Copies of the complete plans, specifications and contract documents may be **obtained** from:

Attention: Amanda Cutshaw *(must be included when making request by mail)*
Metropolitan Sewerage District of Buncombe County
2028 Riverside Drive
Asheville, N.C. 28804
(828) 225-8352
E-mail address: acutshaw@msdbc.org

The Metropolitan Sewerage District of Buncombe County encourages qualified minority businesses to bid on or participate as a subcontractor in District Contracts. To learn more about the Minority Businesses in the Asheville area, access the *Office of Historically Underutilized Businesses* for the State of North Carolina at www.doa.state.nc.us/hub. Local minority vendors are listed on this site.

The plans, specifications, and contract documents on the DISTRICT'S website are provided as a courtesy to interested parties. **Contractors planning to submit a bid for District projects must purchase an official set of plans and specifications as detailed below**, in order to be a registered plan holder.

A **non-refundable** deposit of **seventy-five dollars ($75.00)** is required. Orders for plans and specifications which are to be delivered by parcel post or other carriers will not be accepted for a period of five (5) days prior to bid date.

All bidders must have current North Carolina licenses for all work for the project.

Each bid shall be accompanied by a deposit with the Metropolitan Sewerage District of Buncombe County of cash, or a cashier's check, or a certified check on some bank or trust company insured by the Federal Deposit Insurance Corporation in an amount equal to not less than five percent (5%) of the bid amount. In lieu of making the cash deposit as above described, a satisfactory Bid Bond in the amount of 5% of the total bid, executed by a corporate surety licensed under the laws of North Carolina to execute such bonds, shall be submitted with each bid, conditioned that the surety will upon demand forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract in accordance with the bid bond. This deposit shall be retained if the successful bidder fails to execute the contract within ten (10) days after the award of bid or fails to give satisfactory surety as required in North Carolina General Statute Section 143-129.

Each Bidder must be appropriately licensed as a Contractor as provided in Chapter 87 of the North Carolina General Statute. Each Bidder must comply with MSD's Guidelines for Recruitment and Selection of Minority Business.

The successful bidder will be required to furnish a Performance Bond and a Payment Bond in the amount of one hundred percent (100%) of the contract amount. Those bonds shall meet the requirements of North Carolina General Statute Section 143-129 and of Article 3 of Chapter 44A of the North Carolina General Statute.

No bid may be withdrawn after bids have been opened, except as provided in North Carolina General Statute Section 143-129.1.

The contract shall be awarded to the lowest responsive, responsible bidder, taking into consideration quality, performance and time of delivery. The DISTRCT reserves the right to reject any and all bids, including, without limitation, the right to reject any or all non-conforming, non-responsive, unbalanced or conditional bids, and to reject the bid of any bidder if the DISTRICT believes that it would not be in the best interest of the DISTRICT to make an award to that bidder. The DISTRICT also reserves the right to waive informalities.

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, NORTH CAROLINA

BY: Thomas E. Hartye, P.E.
GENERAL MANAGER

1. Purpose.

The Metropolitan Sewerage District of Buncombe County, North Carolina (MSD) is committed to environmental quality through ongoing continual improvement with conformance to the ISO14001 standard.

2. Scope.

MSD is committed to environmental awareness with all vendors and contractors who work for or on our behalf. We strive to outreach with our vendors and contractors to promote continual improvement and teambuilding.

3. MSD Environmental Policy

MSD is committed to ensuring environmental quality by:

- *Monitoring our processes and operations for continual improvements.*
- *Setting and reviewing environmental objectives and targets for pollution prevention.*
- *Dedicating our organization to complying with applicable Federal, State and Local regulations.*

4. Vendor / Contractor ISO14001 Environmental Conformance

- *Knowledge of MSD ISO14001 Program and Environmental Policy*
- *Compliance with applicable Federal, State, Local rules and regulations*
- *If applicable, follow MSD standard operating procedures*
- *Promote Pollution Prevention at all times*
- *Recycle waste debris when possible*
- *Be aware of Emergency Response Procedures*

5. Pollution Prevention Strategies

Materials Management

√ Sand, dirt must be contained to prevent entering storm drains.
√ Apply water to control dust
√ Check dumpsters for leaks
√ Label all hazardous materials and hazardous wastes in accordance with local, State and Federal regs.
√ Fuel storage containers must be double walled or have secondary containment
√ Dispose of hazardous waste correctly

Spill Prevention and Control

√ Report hazardous materials spills to owner immediately
√ Keep spill cleanup materials available on-site and contain spills immediately

Equipment Maintenance and Cleaning

√ Inspect vehicles and equipment for leaks and repair promptly
√ Do not clean vehicles at job site

Earthwork

√ Keep all excavated soil on the site where it is least likely to collect in the street.
√ Use erosion control measures to minimize flow of silt off-site

Dewatering Operations

√ Water must be filtered / cleaned prior to entering into storm sewer.
√ In areas of known contamination, testing is required prior to discharge of groundwater. Contaminated groundwater must be taken off site.

Saw Cutting / Concrete Waste Management

√ Cover or barricade storm drains when saw cutting to keep slurry out of storm sewer
√ Collect slurry and dispose in concrete washout area
√ Remove slurry immediately if it enters a catch basin
√ Wash out concrete trucks off site or in pit / designated area. Allow water in pit to evaporate.

Painting

√ Never rinse paint brushes into street gutters or storm sewer
√ Dispose of oil based paints / unusable thinner as hazardous waste

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INDEX

ARTICLE	DESCRIPTION	PAGE
I	Preparation of Bids	2
II	Filing of Proposals	3
III	Opening of Proposals	3
IV	Withdrawal or Revision of Bids	4
V	Addenda and Interpretations	4
VI	Discrepancy in Bids	5
VII	Qualifications of Bidders	5
VIII	Bid Security	5
IX	Responsibilities of Bidders	6
X	Collusive Agreements	6
XI	Taxes	7
XII	Comparison of Bids	7
XIII	Award of Contract	7
XIV	Commencement of Work	8
XV	Damages for Failure to Execute Contract	8
XVI	Equal Employment Opportunity	8
XVII	Wages and Salaries	8

ARTICLE I PREPARATION OF BIDS:

All Bids shall be prepared in accordance with the following requirements:

1. The Bid form furnished by the DISTRICT shall be used and shall not be altered.

2. Entries shall be typed or written in ink; signatures shall be written in ink.

3. The Bidder shall submit a unit or lump sum price for every item in the Bid form unless specific directions in the Invitation for Bids allow for partial Bids. The unit or lump sum bid prices for the various Contract Items shall be typed or written figures in ink, and shall be clearly legible.

4. A Total Bid shall be entered in the Bid form for every item on which a unit price has been submitted. The Total Bid for each item other than lump sum items shall be determined by multiplying each unit price bid by the quantity for that item, and shall be written in figures in the "Total Bid" column in the Bid form. In case of a discrepancy between the unit price bid for a Contract Item and the Total Bid for that item, the unit price bid shall govern. In the case of lump sum items, the price shall be written in figures in the "Total Bid" column in the Bid form.

5. The Total Contract Bid Price shall be written in figures in the proper place in the Bid form. The Total Contract Bid Price shall be determined by adding the Total Bid for each item.

6. Changes in any entry shall be made by marking through the entry in ink and making the correct entry adjacent thereto in ink. The individual signing the Bid shall initial the change in ink.

7. The Bid shall be properly executed. In order to constitute proper execution, the Bid shall be executed in strict compliance with the following. No other forms of execution will be accepted.

   a. If a Bid is by an individual, it shall show the name and address of the individual and shall be signed by the individual.

   b. If the Bid is by a Corporation, it shall be executed in the name of the Corporation by the President or Vice-president. It shall be attested by the Secretary or Assistant Secretary. The seal of the Corporation shall be affixed. The Bid shall show the address of the principal office of the Corporation.

   c. If the Bid is made by a Partnership, it shall be executed in the name of the Partnership by one of the general partners. The address of the Partnership shall also be shown.

   d. If the Bid is a joint venture, it shall be executed by each of the joint venturers with an address for each joint venturer and the address for the joint venture itself.

8. The Bid shall not contain any unauthorized additions, deletions or conditional bids.

9. The Bidder shall not add any provisions reserving the right to accept or reject an award, or to enter into a Contract pursuant to an award.

10. The Bid shall not contain irregularities of any kind which, in the opinion of the DISTRICT, make the Bid incomplete, indefinite, or ambiguous as to its meaning.

11. Alternative Bids will not be considered unless specifically called for. Where numbered

Alternate Bid Items are provided under any Contract, each Bidder must submit a bid price for each numbered Alternate Item.

12. All attachments, certifications or acknowledgements attached to the Bid shall be executed in the same manner as the Bid.

ARTICLE II FILING OF PROPOSALS:

Each Bid shall be made on the forms incorporated in these documents. Clear and legible duplicate copies of the blank bid document forms provided may be used for entry. One (1) copy of each of these bid document forms are to be used to prepare the Contractor's bid proposal. It is not necessary to submit the entire specifications documents on the bid date, only the forms specified below. The Contractor (bidder) is cautioned that all spaces on the Proposal must be fully completed, including all identified or voluntary alternates, if any, and that the Proposal must be properly signed with the name of the company, its authorized representatives, and shall be fully executed in all respects. If this is a Formal Contract, the Bid Security documents shall be fully executed and signed/sealed by the Bidder and the Security Company and shall be witnessed and notarized as required by NC Statutes. This includes the Power of Attorney, attached and properly executed by the Security Company. All documents submitted with the bid shall be original documents and clearly show the original signatures and seals.

Formal Bid Contracts (Bid Bond required):

Bids shall be submitted in a two (2) envelope system. The outer envelope shall bear the project name and project number, and shall be sealed and addressed to the Metropolitan Sewerage District of Buncombe County, North Carolina, 2028 Riverside Drive, Asheville, North Carolina 28804. The **name, address, and license number of the bidder,** as well as the type of contract, if applicable, shall also be shown on the outside (Single-Prime-General, or Separate-Prime-General, Plumbing, HVAC or Electrical). The outer envelope shall contain the following documents, fully executed and signed/sealed as required in these Instructions to Bidders:

1. Proposal Guaranty (Bid Security) and Power of Attorney

2. Certification of receipt of Addenda written on Contractor's letterhead

3. Non-Collusion Affidavit

4. A sealed smaller envelope containing the proposal and Schedule of Estimated Quantities and Bid Prices and marked on the outside "PROPOSAL". This envelope should also contain the project name and the name, address, and license number of the bidder. **Attached to the proposal shall be the appropriate MBE form(s).**

ARTICLE III OPENING OF PROPOSALS:

Bids received prior to the advertised hour of opening will be securely kept, sealed. The officer whose duty it is to open them will decide when the specified time has arrived, and no Bid received thereafter will be considered; except that when a Bid arrives by mail after the time fixed for opening, but before the reading of all other Bids is completed, and it is shown to the satisfaction of the DISTRICT that the non-arrival on time was due solely to delay in the mail for which the bidder was not responsible, such Bid will be received and considered. Mailed Bids will be treated in every respect as though filed in person and will be subject to the same requirements. Bids received subsequent to the advertised hour of opening will be returned to the Bidder unopened.

The Bid opening will be open to all interested parties.

Bid tabulation forms will be prepared by the ENGINEER and will be provided to all interested parties attending the bid opening. Forms will contain the names of prospective bidders and blank spaces for recording the bidder's license number, bid security, base bid and alternates, if any. Spaces for unit prices will not be provided.

Approximately five (5) minutes prior to the designated time for receiving bids the ENGINEER or his representative will announce the "official time" that will be used in declaring the bidding closed.

At the time fixed for the opening of Bids, the ENGINEER will declare the bidding closed. After which, the ENGINEER will determine if at least three (3) bids (sealed envelopes) have been received for the contract. Should there not be at least three, the bids will not be opened. The bids will be returned to the bidders and they will be requested to submit a bid proposal with a re-advertisement.

Since this is a public bid opening, all bids will then be opened and read aloud to the assembled group, beginning with the General Contract bids. The following order will be observed for Formal Bid Contracts:

1. The outer envelopes of all bidders will be opened prior to reading any "Proposals". Prior to opening an outer envelope, the name of the bidder and license number as it appears on the envelope will be announced to the assembled group.

2. With the opening of the bidder's outer envelope, a preliminary determination will be made that bid security and other required certifications are enclosed with the bid.

3. If all of the required material is not with at least three (3) of the bids for a particular contract, the sealed envelopes marked "Proposal" will not be opened.

4. If it is determined that at least three (3) of the outer envelopes appear to be in order, the sealed envelopes containing the bid proposals shall be opened and the bids read aloud. After such determination, all remaining bids may be opened and read aloud without first making a preliminary determination as to the adequacy of bid security.

If this is an informal bid contract, the envelope will be opened and a determination will be made that all the required documents are enclosed and properly executed.

ARTICLE IV WITHDRAWAL OR REVISION OF BIDS:

A Bidder may, without prejudice to himself, withdraw a Bid after it has been delivered to the DISTRICT provided such withdrawal is made in accordance with N.C. General Statute Section 143-129.1.

Only those persons authorized to sign Bids shall be recognized as being qualified to withdraw a Bid.

ARTICLE V ADDENDA AND INTERPRETATIONS:

No interpretations of the meaning of the Plans, Specifications or other portions of the Contract Documents will be made orally.

Every request for interpretation of Plans, Specifications or any portion of the Contract Documents shall be in writing and must be addressed to the office of the DISTRICT, and to be given consideration must be received by the DISTRICT at least five (5) days prior to the date fixed for the opening of Bids. DISTRICT shall determine, in its sole discretion, whether or not a request for clarification or interpretation requires a formal Addendum. Written Addenda, if issued, will be sent by certified or registered mail with return receipt requested, or facsimile with confirmation, or by e-mailed PDF with confirmation, to all holders of Contract Documents at the respective addresses, facsimile numbers, or e-mail addresses furnished for such purposes not later than three (3) days prior to the day fixed for the opening of bids.

Failure of any Bidder to receive any such Addenda shall not relieve said Bidder from any obligation under his Bid as submitted. All Addenda so issued shall become part of the Contract Documents.

Prospective Bidders are cautioned concerning the use of a Post Office Box address as telegraphic Addenda cannot be sent to Post Office Boxes.

ARTICLE VI DISCREPANCY IN BIDS:

In the event there is a discrepancy in any Bid between the unit prices and the extended totals, the unit prices shall govern. Bids which do not contain a price for every numbered item contained in the applicable Bid form will not be accepted, unless otherwise specified.

ARTICLE VII QUALIFICATIONS OF BIDDERS:

The DISTRICT may make such investigation as he deems necessary to determine the qualifications of the Bidder to perform the work and the Bidder shall furnish to the DISTRICT all such information and data for this purpose as the DISTRICT may request. The DISTRICT reserves the right to reject any and all Bids if the evidence submitted by, or investigation of, such Bidder fails to satisfy the DISTRICT that such Bidder is properly qualified to carry out the obligations of the Contract, and to complete the work contemplated therein. Conditional bids will not be accepted.

The Bidder shall submit, with his Bid, a list of Subcontractors, Suppliers, etc., indicating projects recently completed of a similar nature along with names, addresses and phone numbers of their clients for reference of qualifications.

Bidders shall comply with all applicable laws regulating the practice of General Contracting as contained in Chapter 87 of the General Statutes of North Carolina.

All Bidders must be Utility or Unclassified Contractors licensed in the State of North Carolina to perform work of a nature as required by the Contract Documents.

A mandatory pre-bid conference will be held on July 7, 2026 at 9:00 AM at MSD of Buncombe County's office at 2028 Riverside Drive, Woodfin, NC to discuss the requirements of the Contract Documents. An optional site visit to the pump station site will be provided immediately following the pre-bid meeting.

ARTICLE VIII BID SECURITY:

For Formal Bid Contracts, each bid must be accompanied by a Bid Bond, cash, cashiers check or a

certified check of the Bidder made payable to the DISTRICT in an amount not less than five percent (5%) of the amount of the Bid. Bid Bonds shall be issued by a corporate surety licensed under the laws of North Carolina to execute such bonds.

When the Bidder elects to submit a certified check or cashiers check as his Bid Bond, the check shall be drawn on a bank or trust company insured by the Federal Deposit Insurance Corporation.

Where alternate items are included in the Bid, the amount of bid security shall be not less than five percent (5%) of the base bid and all alternates combined.

Please note that while not required, it is helpful to use the Bid Bond form already provided in these contract documents. All language contained within this bond form is acceptable to the District. Non-MSD forms may contain unacceptable language and cause your bid to be rejected. Please also note that the use of "AIA" type bid bonds is not acceptable and will cause your bid to be rejected.

The security of the Bidders will be released upon the earlier to occur of (a) the expiration of five days after the Contract has been signed by the accepted Bidder and the DISTRICT; or (b) the expiration of sixty (60) days after the day the bids are opened, upon demand of any such bidders whose bid has not been accepted prior to such demand.

In the event that all Bids are rejected, the security of all Bidders whose security has not been previously returned will be returned at the time of such rejection.

ARTICLE IX RESPONSIBILITIES OF BIDDERS:

Each bidder shall, by careful examination, satisfy himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work or the cost thereof under the Contract.

The Bidder shall make his own determination as to the nature and extent of the utility facilities, including proposed adjustments, new facilities, or temporary work to be performed by the utility owner or his representative; and as to whether or not any utility work is planned by the DISTRICT in conjunction with the project construction. The Bidder shall consider in his Bid all the permanent and temporary utility facilities in their present or relocation positions, whether or not specifically shown on the Plans or covered in the project Special Conditions. It will be the Bidder's responsibility to anticipate any additional costs to him resulting from such utility work and to reflect these costs in his Bid for the various items in the Contract.

The failure or omission of any Bidder to thoroughly examine and familiarize himself with the Contract Documents or to receive or examine any form, instrument or document or visit the site and acquaint himself with the conditions there existing shall in no way relieve any Bidder from any obligation in respect to his bid.

No verbal agreement or conversation with any officer, agent or employee of the DISTRICT, either before or after the execution of the Contract, shall affect or modify any of the terms or obligations therein.

ARTICLE X COLLUSIVE AGREEMENTS:

Each Bidder submitting a Bid to the DISTRICT for any portion of the work contemplated by the

documents on which bidding is based, shall execute and attach thereto an affidavit substantially in the form herein provided, to the effect that he has not entered into a collusive agreement with any person, firm or corporation in regard to any Bid submitted.

Before executing any Sub-contract, the successful Bidder shall submit the name of any proposed Sub-contractor for prior approval and an affidavit substantially as above.

ARTICLE XI TAXES

The Bidder shall include in his Bid the cost of all sales and use taxes and furnish to the DISTRICT at the end of each month and upon completion of his Contract, a statement setting forth all such taxes paid. This statement shall indicate the amount paid to each firm and be adequate for audit by the State Department of Revenue and must be accompanied by copies of invoices.

ARTICLE XII COMPARISON OF BIDS:

Bids will be compared on the basis of the totals of the approximated quantities comprising all items, at the unit and lump sum prices bid for these items. The resulting total Contract Bid Price will be compared which will include and cover the furnishing of all materials, and the performance of all labor necessary, and completing of all the work called for under the accompanying Contract, and in the manner set forth and described in the Contract Documents.

The lowest Bidder under each Contract will be that Bidder whose Bid totals the lowest number of dollars as determined above.

When numbered Alternate bid items are required, the lowest Bidder is the Bidder whose Base Bid and Bid for the Alternate or combination of Alternates selected by the DISTRICT results in the lowest total amount. The DISTRICT reserves the right to select any Alternate or combinations of Alternates.

Where estimated quantities are included in certain items of the Bid, they are for the purpose of comparing bids. While they are believed to be close approximations, they are not guaranteed, and settlement will be made from such items upon the basis of work as actually executed at the unit prices in the Bid as accepted.

ARTICLE XIII AWARD OF CONTRACT:

The contract shall be awarded to the lowest responsive, responsible bidder, taking into consideration quality, performance and time of delivery. The DISTRICT reserves the right to reject any and all bids, including, without limitation, the right to reject any or all non-conforming, non-responsive, unbalanced or conditional bids, and to reject the bid of any bidder if the DISTRICT believes that it would not be in the best interest of the DISTRICT to make an award to that bidder. The DISTRICT also reserves the right to waive informalities.

When Alternate Bid items are required in the Bid, the Contract will be awarded to that responsible Bidder whose Base Bid and Bid for the Alternate or combination of Alternates selected by the DISTRICT results in the lowest total amount.

These Bids are asked for in good faith, and awards will be made as soon as practicable, provided

satisfactory Bids are received.

The DISTRICT may reject any bid not prepared and submitted in accordance with the provisions of the bid documents.

The right is reserved to waive informalities in bidding, to reject any or all Bids, or to accept a Bid other than the lowest submitted if such action is deemed to be in the best interest of the DISTRICT.

ARTICLE XIV COMMENCEMENT OF WORK:

Upon execution and delivery of the Contract and the delivery of the required performance and payment bonds and insurance certificates and policies, the CONTRACTOR will be notified to proceed with the Work of the Contract. The work of the Contract shall be commenced within ten (10) days following such notification or as otherwise specified in the Notice to Proceed.

The CONTRACTOR shall notify the DISTRICT in writing, of his intention to enter upon the site of the work at least five (5) days in advance of such entrance.

ARTICLE XV DAMAGES FOR FAILURE TO EXECUTE CONTRACT:

If an accepted Bidder shall fail or refuse to sign and deliver this Contract and the required surety bonds and insurance documentation within ten (10) days after he has received Notice of Award of his Bid, the DISTRICT shall retain, as partial damages for such failure or refusal, the Bid security of such defaulting Bidder. In addition to such damages, the DISTRICT reserves the right to pursue any other remedies it may have against such defaulting Bidder.

ARTICLE XVI EQUAL EMPLOYMENT OPPORTUNITY

Attention of Bidders is particularly called to the requirements for insuring that employees and applicants for employment are not discriminated against because of their race, color, religion, sex, or national origin.

ARTICLE XVII WAGES AND SALARIES

The Bidder and his Subcontractors shall be required to pay all employees the minimum prevailing wage and salary rates for the full length of the contract.

TABLE OF CONTENTS

Article Number	Title	Page
0	Index to General Conditions	2
1	Definitions	6
2	Preliminary Matters	9
3	Contract Documents: Intent, Amending and Reuse	11
4	Availability of Lands: Physical Conditions; Reference Points	12
5	Bonds and Insurance	14
6	Contractor's Responsibilities	19
7	Other Work	26
8	District's Responsibilities	27
9	Engineer's Status During Construction	28
10	Changes in The Work	30
11	Change of Contract Price	31
12	Change of Contract Time	35
13	Warranty and Guarantee; Tests and Inspections; Correction, Removal or Acceptance of Defective Work	36
14	Payments to Contractor and Completion	38
15	Suspension of Work and Termination	43
16	Conflict/Appeals Resolution	45
17	Miscellaneous	45

INDEX TO GENERAL CONDITIONS

Acceptance of Insurance.....5.14
Access to the Work..... 13.2
Addenda-definition of (see definition of Specifications).....1
Agreement-definition of.....1
All Risk Insurance.....5.12
Amendment-definition of, Written.....1, 3.4
Appeals Resolution.....16
Application for Payment-definition of.....1
Application for Payment-Final.....14.12
Application for Progress Payment……..14.2
Application for Progress Payment-review of.....14.4-14.8
Authorized Variation in Work.....9.5
Availability of Lands.....4.1
Award, Notice of-defined.....1

Before Starting Construction.....2.6-2.8
Bid-definition of.....1
Bonds and Insurance-in general.....5
Bonds, Delivery of.....2.1, 5.1
Bonds, Performance and Other.....5.1-5.2

Cash Allowances.....11.7
Change Order-definition of.....1
Change Orders-to be executed.....10.4
Changes in the Work.....……10
Claims, Waiver of-on Final Payment.....14.17
Clarifications and Interpretations……9.4
Cleaning.....6.17
Completion.....14
Completion, Substantial.....14.9, 14.10
Conference, Preconstruction.....2.9
Conflict, Error, Discrepancy-Contractor to Report.....2.6, 3.3
Construction Machinery, Equipment, etc.....6.4
Continuing Work.....6.29
Contract Documents-Amending and Supplementing.....3.4-3.5
Contract Documents-definition of.....1
Contract Documents-Intent.....3.1-3.3
Contract Documents-Reuse of.....3.6
Contract Price, Change of.....11
Contract Price-Definition.....1
Contract Time, Change of.....12
Contract Time, Commencement of.....2.4
Contract Time-definition of.....1
Contractor-definition of.....1
Contractor May Stop Work Or Terminate.....15.5
Contractor's Cont. Obligation.....14.16
Contractor's Duty to Report Discrepancy in Documents.....2.6, 3.3
Contractor' Fee-Cost Plus ……..11.4.5.6, 11.5
Contractor's Liability Insurance……..5.8
Contractor's Responsibilities-In General.....6
Contractor's Warranty of Title.....14.3
Contractor's-other work…….....7
Contractual Liability Insurance…….....5.9
Coordinating Contractor - Definition of.....7.4
Coordination.....7.4
Copies of Documents.....2.2, 2.3
Correction or Removal of Defective Work.....13.11
Correction Period, One Year.....13.12
Correction, Removal or Acceptance of Defective Work-In Gen.....13.11-13.14
Cost-net decrease.....11.5.2.4
Cost of Work.....11.4
Costs, Supplemental.....11.4.5

Day-definition of.....1
Defective-definition of.....1
Defective Work,
Acceptance of.....13.13
Correction or Removal of.....13.11
In General.....13, 14.7, 14.12
Rejecting.....9.6
Definitions.....1
Delivery of Bonds.....2.1
Determination for Unit Prices.....9.10
Disputes, Decisions by Engineer.....9.11-9.12
Documents, Copies of.....2.2, 2.3
Documents, Record.....6.19
Documents, Reuse.....3.6
Drawings, definition of.....1

Easements.....4.1
Effective date of Agreement - definition of.....1
Emergencies.....6.22

Engineer-definition of.....1
Engineer's Decisions.....9.10-9.12
Engineer's-Notice Work is
Acceptable.....14.14
Engineer's Recommendation
of Payment.....14.4, 14.12
Engineer's Responsibilities,
Limitations on…….6.6, 9.11, 9.13-9.16
Engineer's Status During Construction -
In General.....9
Equipment, Labor, Materials and……...6.3, 6.5
Equivalent Materials and Equipment…….....6.7
Explorations of Physical Conditions……..…4.2

Fee, Contractor's-Cost Plus.....11.5
Field Order-definition of.....1
Field Order -
Issued by Engineer.....3.5.1, 9.5
Final Application for Payment.....14.13
Final Inspection.....14.12
Final Payment and Acceptance.....14.14
Final Payment -
Recommendation of.....14.14, 14.15

General Provisions.....17.3-17.4
General Requirements -
Definition of.....1
General Requirements -
Principal references to..... 4.4, 6.4,
6.6-6.7, 6.23
Giving Notice.....17.1
Guarantee of Work-by Contractor.....13.1

Indemnification.....6.30-6.32
Inspection, Final.....14.12
Inspection, Tests and.....13.3
Insurance, Bonds and-in general.....5
Insurance, Certificates of.....2.8, 5
Insurance-Completed operations.....5.8
Insurance, Contractor's
Liability……..5.8
Insurance, Contractual Liability.....5.9
Insurance, District's Liability.....5.11
Insurance, Property.....5.12-5.16
Insurance, Waiver of Rights.....5.17
Intent of Contract Documents…….3.3,
9.14
Interpretations and
Clarifications……..…..9.4
Investigations of
physical conditions.....4.2
Labor, Materials & Equipment……..6.3-
6.5

Laws and Regulations-definition of.……..…..1
Laws and Regulations-general.....6.14
Liability Insurance-
Contractor's……...5.8
Liability Insurance-District's.....5.11
Liens-definitions of.....14.2
Limitations on Engineers Respon -
sibilities 6.6, 9.11, 9.13-9.16

Materials and equipment -
furnished by Contractor.....6.3
Materials and equipment -
not incorporated in Work.....14.2
Materials or equipment-
equivalent…….....6.7
Miscellaneous Provisions.....17
Multi-prime contracts.....7

Notice, Giving of.....17.1
Notice of Acceptability
of Project.....14.14
Notice of Award-definition
of.....1
Notice to Proceed-definition
of.....1
Notice to Proceed-giving of.....2.4

"Or-Equal" Items.....6.7
Other Contractors.....7
Other Work.....7
Overtime Work-prohibition of.....6.3
District-definition of 1
District May Correct Defective
Work……...13.14
District May Stop Work.....13.10
District May Suspend Work,
Terminate.....15.1-15.4
District's Duty to Execute
Change Orders.....11.7
District's Liability Insurance.....5.11
District's Representative-Engineer
to serve as.....9.1
District's Responsibilities -
in general.....8
District's Separate Representative
at site.....9.3

Partial Utilization.....14.11
Partial Utilization -
definition of.....1

Partial Utilization - Property Insurance.....5.21
Patent Fees and Royalties.....6.12
Payments, Recommendation of…….....14.4-14.7, 14.14
Payments to Contractor-in general…….....14
When due.....14.4, 14.14
Withholding.....14.7
Performance and other Bonds……...5.1-5.2
Permits.....6.13
Physical Conditions.....4.2
Engineer's Review of.....4.2.4
Existing Structures.....4.2.2
Explorations and Reports.....4.2.1
Possible Document Change.....4.2.5
Price and Time Adjustment.....4.2.6
Report of Differing.....4.2.3
Underground Utilities.....4.3
Preconstruction Conference.....2.9
Preliminary Matters.....2
Premises, Use of.....6.16-6.18
Price, Change of Contract.....11
Price-Contract-definition of.....1
Progress Payment, Applications for.....14.2
Progress Payment-Retainage.....14.2
Progress schedule.....2.7, 2.9, 6.6, 6.29, 15.2.6
Project-definition of.....1
Project Representation - provision for.....9.3
Project Representative, Resident - definition of.....1
Project, Starting the.....2.5
Property Insurance.....5.7, 5.12
Partial Utilization of.....5.21
Receipt and Application of Proceeds.....5.18-5.19
Protection, Safety and.....6.20-6.21
Punch List.....14.12

Recommendation of Payment……14.4, 14.14
Record Documents.....6.19
Reference Points.....4.4
Regular working hours.....1, 6.3
Regulations, Laws and.....6.14
Rejecting Defective Work.....9.6
Related Work at Site.....7.1-7.3
Remedies Not Exclusive.....17.4
Removal or Correction of Defective Work.....13.11
Resident Project Representative - definition of.....1
provision for.....9.3
Responsibilities, Contractor's - in general.....6
Responsibilities, Engineer's - in general.....9

Responsibilities, District's - in general.....8
Retainage.....14.2
Reuse of Documents.....3.6
Rights of Way.....4.1
Royalties, Patent Fees and.....6.12

Safety and Protection.....6.20-6.21
Samples.....6.23-6.28
Schedule of progress - 2.7-2.11, 6.6, 6.29, 15.2.6
Schedule of Shop Drawing Submissions…… 2.7-2.9, 6.23
Schedule of values…….……2.11, 14.1
Schedules, Finalizing.....2.11
Shop Drawings and Samples…….....6.23-6.28
Shop Drawings-definition of.....1
Shop Drawings, use to approve substitutions.....6.7.3
Site, Visits to-by Engineer.....9.2
Special Conditions……..……..….4.2, 7.4
Specifications-definition of.....1
Starting Construction - Before.....2.6-2.8
Starting the Project.....2.5
Stopping Work-by Contractor.....15.5
Stopping Work-by District.....13.10
Subcontractor-definition of.....1
Subcontractors-in general.....6.8-6.11
Subcontracts required provisions.....5.17.1, 6.11, 11.4.3
Substantial Completion - certification of.....14.9
definition of.....1
Substitute or "Or-Equal" Items….....6.7
Subsurface Conditions.....4.2, 4.3
Supplemental costs.....11.4.5
Supplementing Contract Documents.....3.4, 3.5
Supplier-definition of.....1
Supplier-principal

references to.....3.6, 6.5, 6.7-6.11, …6.20 6.24, 9.13, 9.16, 11.7, 13.4, 14.13
Surety-consent to payment……...14.13, 14.15
Surety-Engineer has no duty to.....9.13
Surety-notice to.....10.1, 10.5, 15.2
Surety-qualification of.....5.1-5.2
Suspending Work, by District.....15.1
Suspension of Work and Termination - in general.....15
Superintendent-Contractor's.....6.2
Supervision and Superintendence.....6.1, 6.2

Taxes-Payment by Contractor.....6.15
Termination-by Contractor.....15.5
Termination-by District.....15.2-15.4
Termination, Suspension of Work - in general.....15
Tests and Inspections.....13.3-13.7
Time, Change of Contract.....12
Time, Computation of.....17.2
Time, Contract-definition of.....1

Uncovering Work.....13.8, 13.9
Underground Facilities - definition of.....1
not shown or indicated.....4.3.2
protection of.....4.3, 6.20
shown or indicated.....4.3.1
Unit Price Work-definition of.....1
general.....11.8, 14.1, 14.5
Unit Prices.....11.3.1
Unit Prices, Determinations for……...9.10
Use of Premises.....6.16-6.18
Utility Owners…….....6.13, 6.20, 7.2, 7.3

Values, Schedule of.....2.11, 14.1
Variations in Work - Authorized.....6.25, 6.27, 9.5
Visits to Site-by Engineer.....9.2

Waiver of Claims - on Final Payment.....14.17
Waiver of Rights by insured parties.....5.6, 6.11
Warranty and Guarantee - by Contractor.....13.1
Warranty of Title, Contractor's……..…….14.3
Work, access to.....13.2
Work-by others.....7
Work Continuing During Disputes…….…...6.29
Work, Costs of.....11.4
Work-definition of.....1
Work Directive Change - definition of.....1
principal references to.....3.4.3, 10.1-10.2
Work, Neglected by Contractor…….....13.14
Work, Stopping by Contractor.....15.5
Work, Stopping by District.....15.1-15.4
Written Amendment-definition of.....1
Written Amendment - principal references to…….....3.4.1, 10.1, 11.2, 12.1

ARTICLE 1--DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

Addenda - Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the bidding documents or the Contract Documents.

Agreement - The written agreement between DISTRICT and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

Application for Payment - The form accepted by ENGINEER which is to be used by CONTRACTOR in requesting progress or final payments and which is to include such supporting documentation as is required by the Contract Documents.

Bid - The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

Bonds - Bid, performance and payment bonds and other instruments of security.

Change Order - A document recommended by ENGINEER, which is signed by CONTRACTOR and DISTRICT and authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

Contract Documents - The Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post-Bid documentation submitted prior to the Notice of Award), Bonds, these General Conditions, the Special Conditions, the Specifications and the Plans as the same are more specifically identified in the Agreement, together with all amendments, modifications and supplements issued pursuant to paragraphs 3.4 and 3.5 on or after the Effective Date of the Agreement.

Contract Price - the monies payable by DISTRICT to CONTRACTOR under the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.8.1 in the case of Unit Price Work).

Contract Time - The number of days (computed as provided in paragraph 17.2) or the date stated in the Agreement for the completion of the Work.

Contractor - The person, firm or corporation with whom the DISTRICT has entered into the Agreement.

Day - Consecutive 24 hour period including Saturday or Sunday.

Defective - An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER's recommendation of final payment (unless responsibility for the protection thereof has been assumed by DISTRICT at Substantial Completion in accordance with paragraph 14.8 or 14.10).

District - The Metropolitan Sewerage District of Buncombe County, N.C., with whom the CONTRACTOR has entered into the Agreement and for whom the Work is to be provided.

Effective Date of the Agreement - The date indicated in the Agreement on which it becomes effective, but if not, it means that date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

Engineer - The DISTRICT's representative who is in responsible charge of the Work.

Field Order - A written order issued by ENGINEER which orders minor changes in the Work in accordance with paragraph 9.5; but which does not involve a change in the Contract Price or the Contract Time.

General Requirements - As stated in the Specifications and Requirements of the Agreement.

Inspector - The authorized representative of the ENGINEER assigned to make a detailed inspection of any or all portions of the work and materials.

Laws and Regulations; Laws or Regulations - Statutes of the U.S. Government, the State of North Carolina or other rules, regulations, ordinances or codes adopted by governmental authorities having appropriate jurisdiction.

Notice of Award -The written notice by DISTRICT to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the conditions precedent enumerated therein, within the time specified, DISTRICT will sign and deliver the Agreement.

Notice to Proceed - A written notice given by DISTRICT to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR's obligations under the Contract Documents.

Partial Utilization - Placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work.

Plans - The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents.

Project - The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

Regular Working Hours - Monday through Friday from 8:00 a.m. to 5:00 p.m.

Retainage - The amount of money retained by the DISTRICT until such time as the Work is complete and approved by the DISTRICT.

Shop Drawings - All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for CONTRACTOR to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by CONTRACTOR to illustrate material or equipment for some portion of the Work.

Special Conditions - Part of the Contract Documents which amends or supplements the General Conditions and applies to the Work.

Specifications - Those portions of the Contract Documents consisting of written technical descriptions of

materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

Subcontractor - An individual, firm or corporation having a direct contract with CONTRACTOR or with any other subcontractor for the performance of a part of the Work at the site.

Substantial Completion - The Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER as evidenced by ENGINEER's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if there be no such certificate issued, when final payment is due in accordance with paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to any Work refer to Substantial Completion thereof.

Supplier - A manufacturer, fabricator, supplier, distributor, materialman or vendor.

Unbalanced Bid - A bid which includes any unbalanced bid price.

Underground Facilities - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials; electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

Unit Price Work - Work to be paid for on the basis of unit prices.

Work - The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes performing services, furnishing labor and material and incorporating materials and equipment into the construction, all as required by the Contract Documents.

Work Directive Change - A written directive to CONTRACTOR, issued on or after the Effective Date of the Agreement and signed by the ENGINEER, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the work is to be performed as provided in paragraph 4.2 or 4.3 or to emergencies under paragraph 6.22. A Work Directive Change may not change the Contract Price or the Contract Time, but is evidence that the parties expect that the change directed or documented by a Work Directive change will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Time as provided in paragraph 10.2.

Written Amendment - A written amendment of the Contract Documents, signed by DISTRICT and CONTRACTOR on or after the Effective Date of the Agreement.

ARTICLE 2 --PRELIMINARY MATTERS

Delivery of Bonds:

2.1 When CONTRACTOR delivers the executed Agreements to DISTRICT, CONTRACTOR shall also deliver to DISTRICT such Bonds as CONTRACTOR may be required to furnish in accordance with paragraph 5.1.

Copies of Documents:

2.2 The CONTRACTOR shall be required to post all bonds, acquire any insurance, and offer any warranties required in obtaining the permits demanded by the Work. The CONTRACTOR shall be responsible for all notifications and acceptances required by those permits.

2.3 DISTRICT shall furnish to CONTRACTOR up to five copies of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

Commencement of Contract Time; Notice to Proceed:

2.4 The Contract Time will commence to run on the tenth day after the Effective Date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within ten days after the Effective Date of the Agreement.

Starting the Project:

2.5 CONTRACTOR shall start to perform the Work on the date when the Contract Time commences to run, but no Work shall be done at the site prior to the date on which the Contract Time commences to run.

Before Starting Construction:

2.6 Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, CONTRACTOR shall not be liable to DISTRICT or ENGINEER for failure to report any conflict, error or discrepancy in the Contract Documents, unless CONTRACTOR had actual knowledge thereof or should reasonably have been aware of such discrepancy.

2.7 CONTRACTOR shall, within thirty (30) days after receipt of Notice of Award, prepare and submit to the DISTRICT for approval a practicable construction schedule showing the order in which the CONTRACTOR proposes to carry out the work, the date on which he will start the prominent features and the contemplated dates for completing such prominent features. The schedule may be in any form, at the option of the CONTRACTOR, but shall maintain current with each submittal for progress payment, with at least the following information:

2.7.1 The various classes and area of work broken down into times projected for submittals, approvals and procurement; times for installation and erection; and times for testing and inspection.

2.7.2 Line by line breakdown.

2.7.3 The work completed and the work remaining to complete the project.

2.7.4 Any items of work which will delay the start or completion of other major items of work so as to delay completion of the whole project.

2.7.5 Material suppliers and subcontractors listings – as soon as possible, but in no case more than thirty (30) days after receipt of the Notice of Award, the CONTRACTOR shall supply the names and addresses of all major material suppliers and subcontractors to the DISTRICT.

2.7.6 Shop Drawings and Samples – CONTRACTOR shall submit shop drawings and samples accompanied by his standard transmittal form. Resubmissions, where required, shall be in accordance with the procedures established for the initial submittal.

2.7.7 A preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will sub-divide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work which will be confirmed in writing by CONTRACTOR at the time of submission.

2.8 Before any Work at the site is started, CONTRACTOR shall deliver to DISTRICT, certificates and evidence of insurance requested by the DISTRICT which CONTRACTOR is required to purchase and maintain in accordance with paragraphs 5.3 – 5.10, and DISTRICT shall deliver to CONTRACTOR certificates (and other evidence of insurance requested by CONTRACTOR) which DISTRICT is required to purchase and maintain in accordance with paragraph .5.12.

Pre-construction Conference:

2.9 Within ten days after the Effective Date of the Agreement, but before CONTRACTOR starts the Work at the site, a pre-construction conference attended by CONTRACTOR, ENGINEER and others as appropriate will be held to discuss the schedules referred to in paragraph 2.7, to discuss procedures for handling Shop Drawings and other submittals and for processing Applications for Payment, and to establish a working understanding among the parties as to the Work.

Regular Working Hours:

2.10 All construction activities requiring inspection shall be carried out during regular working hours during normal working days being from 8:00 a.m. - 5:00 p.m., Monday through Friday, except for: New Year's Day, Martin Luther King's Birthday, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and the Friday after, Christmas Day, and December 24 and 26 if they are not on a Saturday or Sunday. When holidays fall on weekends, other days will be observed as the holiday.

2.10.1 No inspections shall take place outside normal times without prior approval of the DISTRICT. Approval shall only be given in emergencies that affect the public health, safety and welfare.

2.10.2 All construction activities conducted outside normal times without prior approval of the DISTRICT shall subject the Work to uncovering for inspection. Said uncovering shall be at the CONTRACTOR'S expense.

Finalizing Schedules:

2.11 At least ten days before submission of the first Application for Payment a conference attended by CONTRACTOR, ENGINEER and others as appropriate will be held to finalize the schedules submitted in accordance with paragraph 2.6. The finalized progress schedule will be acceptable to ENGINEER as providing an orderly progression of the Work to completion within the Contract Time; but such acceptance will neither impose on ENGINEER responsibility for the progress or scheduling of the Work nor relieve CONTRACTOR from full responsibility therefore. The finalized schedule of Shop Drawing submission will be acceptable to ENGINEER as providing a workable arrangement for processing the submissions. The finalized schedule of values will be acceptable to ENGINEER as to form and substance.

ARTICLE 3--CONTRACT DOCUMENTS: INTENT, AMENDING, RE-USE

Intent:

3.1 The Contract Documents comprise the entire Agreement between DISTRICT and CONTRACTOR concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the laws of North Carolina.

3.2 It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not specifically called for. When words which have a generally accepted trade meaning are used to describe Work, materials or equipment, such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority shall mean the latest standard specification, manual, code or Laws or Regulations in effect at the time of Opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of DISTRICT, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor shall it be effective to assign to ENGINEER, or any of ENGINEER's consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.15 or 9.16. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in paragraph 9.5

3.3 If, during the performance of the Work, CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, CONTRACTOR shall so report to ENGINEER in writing at once and before proceeding with the Work affected thereby shall obtain a written interpretation or clarification from ENGINEER. However, CONTRACTOR shall not be liable to DISTRICT or ENGINEER for failure to report any conflict, error or discrepancy in the Contract Documents unless CONTRACTOR had actual knowledge thereof or should reasonably have been aware of such conflict, error or Discrepancy.

Amending and Supplementing Contract Documents:

3.4 The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

3.4.1 A formal Written Amendment;

3.4.2 A Change Order (pursuant to paragraph 10.4); or

3.4.3 A Work Directive Change (pursuant to paragraph 10.1).

As indicated in paragraphs 11.2 and 12.1, Contract Price and Contract Time may only be changed by a Change Order or a Written Amendment.

3.5 In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

3.5.1 A Field Order (pursuant to paragraph 9.5);

3.5.2 ENGINEER's approval of a Shop Drawing or sample (pursuant to paragraphs 6.26 and 6.27); or

3.5.3 ENGINEER's written interpretation or clarification (pursuant to paragraph 9.4).

Re-use of Documents:

3.6 Neither CONTRACTOR nor any subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with DISTRICT shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER; and they shall not re-use any of them on extensions of the Project or any other project without written consent of DISTRICT and ENGINEER.

ARTICLE 4--AVAILABILITY OF LANDS, PHYSICAL CONDITIONS, REFERENCE POINTS

Availability of Lands:

4.1 DISTRICT shall provide access to the lands upon which the Work is to be performed, rights-of-way, easements and access to such other lands which are designated for the use of CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by DISTRICT, unless otherwise provided in the Contract Documents. If CONTRACTOR believes that any delay in DISTRICT's furnishing these lands, rights-of-way or easements entitles CONTRACTOR to an extension of the Contract Time, CONTRACTOR may make a claim therefore as provided in Article 12. CONTRACTOR shall be responsible for all temporary construction facilities and space for storage of materials and equipment.

Physical Conditions:

4.2.1 Explorations and Reports: Reference is made to the Special Conditions for identification of those reports of explorations and tests of sub-surface conditions at the site that have been utilized by ENGINEER in preparation of the Contract Documents. CONTRACTOR may rely upon the accuracy of technical data contained in such reports; but not upon non-technical data, interpretations or opinions contained therein or for the completeness thereof for CONTRACTOR's purposes. Except as indicated in the immediately preceding sentence, CONTRACTOR shall have full responsibility with respect to sub-surface conditions at the site.

4.2.2 Existing Structures: Reference is made to the Special Conditions for identification of those drawings of physical conditions in or relating to existing surface and sub-surface structures (except

Underground Facilities referred to in paragraph 4.3), which are at or contiguous to the site that have been utilized by ENGINEER in preparation of the Contract Documents. CONTRACTOR may rely upon the accuracy of the technical data contained in such drawings; but not for the completeness thereof for CONTRACTOR's purposes. Except as indicated in the immediately preceding sentence and in paragraph 4.2.6, CONTRACTOR shall have full responsibility with respect to physical conditions in or relating to such structures.

4.2.3 Report of Differing Conditions: If CONTRACTOR believes that:

4.2.3.1 Any technical data on which CONTRACTOR is entitled to rely as provided in paragraphs 4.2.1 and 4.2.2 is inaccurate; or

4.2.3.2 Any physical condition uncovered or revealed at the site differs materially from that indicated, reflected or referred to in the Contract Documents.

CONTRACTOR shall promptly, after becoming aware thereof and before performing any Work in connection therewith (except in an emergency as permitted by paragraph 6.22), notify ENGINEER in writing about the inaccuracy or difference.

4.2.4 ENGINEER's Review: ENGINEER will promptly review the pertinent conditions, determine the necessity of obtaining additional explorations or tests with respect thereto, and send a copy to CONTRACTOR, of ENGINEER's findings and conclusions.

4.2.5 Possible Documents Change: If ENGINEER concludes that there is a material error in the Contract Documents or that because of newly discovered conditions a change in the Contract Documents is required, a Work Directive change or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of the inaccuracy or difference.

4.2.6 Possible Price and Time Adjustment: In each such case, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to any such inaccuracy or difference. If DISTRICT and CONTRACTOR are unable to agree as to the amount or length thereof, a claim may be made therefor as provided in Articles 11 and 12.

Physical Conditions -- Underground Facilities:

4.3.1 Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to ENGINEER by the owners of such Underground Facilities or by others.

4.3.1.1 DISTRICT and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

4.3.1.2 CONTRACTOR shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the Contract Documents, for coordination of the Work with the owners of such Underground Facilities during construction, for the safety and protection thereof as provided in paragraph 6.20 and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price.

4.3.2 Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents and which CONTRACTOR could not reasonably have been expected to be aware of, CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work affected thereby (except in an emergency as permitted by paragraph 6.22), identify the owner of such Underground Facility and give written notice thereof to that owner and to ENGINEER. ENGINEER will promptly review the Underground Facility to determine the extent to which it may be necessary to modify the Contract Documents to reflect the existence of the Underground Facility, and the Contract Documents will be amended or supplemented to the extent necessary. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 6.20. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both; to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and which CONTRACTOR could not reasonably have been expected to be aware of. If the parties are unable to agree as to the amount or length thereof, CONTRACTOR may make a claim therefor as provided in Article 11 and 12.

Reference Points:

4.4 DISTRICT shall provide engineering surveys to establish reference points for construction which in ENGINEER's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work (unless otherwise specified in the General Requirements), shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of ENGINEER. CONTRACTOR shall report to ENGINEER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

ARTICLE 5--BONDS AND INSURANCE

Performance and Other Bonds:

5.1 CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, and shall be as prescribed by North Carolina General Statute 44A or by the Contract Documents. All Bonds shall be in the Forms prescribed by North Carolina General Statutes Chapter 44A or by the Contract Documents and be executed by sureties licensed to do business in North Carolina. All Bonds signed by an agent must be accompanied by a copy of the documents authorizing the agent to execute such Bonds.

5.2 If the surety on any bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in North Carolina or it otherwise ceases to meet the requirements of paragraph 5.1, CONTRACTOR shall within five days thereafter substitute another Bond acceptable to DISTRICT.

Insurance:

5.3 The CONTRACTOR shall provide adequate insurance to protect the CONTRACTOR, his Subcontractors, the DISTRICT, and the ENGINEER against damage claims which may arise out of or result from the execution of the work whether such execution be by the CONTRACTOR, by any Subcontractor, by

anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable with coverage and amounts not less than those set forth herewith. All Subcontractors under the CONTRACTOR, of whatever tier, shall provide the same insurance as that required of the CONTRACTOR in addition to that required of the CONTRACTOR.

5.4 The CONTRACTOR shall not commence work on the project until he has obtained all insurance required under this paragraph and such insurance has been accepted by the DISTRICT, nor shall the CONTRACTOR allow any Subcontractor to commence work until the insurance required of the Subcontractor has been obtained and accepted by the DISTRICT.

5.5 All insurance policies shall include a clause requiring that the policy shall not be canceled, modified, nor allowed to expire without 30 days written notice to DISTRICT.

5.6 The CONTRACTOR and Subcontractors shall furnish the DISTRICT a certificate or certificates of insurance issued by an insurance company duly licensed to engage in the business of insurance in North Carolina as evidence that the required insurance policies have been procured and are in force. Actual copies of the insurance policies shall be submitted to the DISTRICT within 10 days after submission of the certificates.

5.7 The CONTRACTOR and Subcontractors shall procure and maintain during the life of the contract the following Insurance:

5.7.1 General Liability and Property Damage Insurance in an amount not less than $1,000,000 for all damages arising out of bodily injury, including death, sustained by any one person in any one accident, and subject to a $2,000,000 aggregate limit, and not less than $1,000,000 for all property damages sustained by any one person in any one occurrence, and subject to the same limit in aggregate. Added to the policy by endorsement shall be (1) Fellow Employee Insurance covering all employees; (2)Broad Form Comprehensive General Liability Insurance; and (3) Explosion (Blasting), Collapse, and Underground Hazard Insurance in the amounts shown above.

5.7.2 Excess General Liability and Property Damage Insurance, Automobile Liability and Employer Liability (Umbrella or Form Following Coverage Equal) in an amount not less than $1,000,000 in aggregate to cover bodily injury, death, and property damage which shall apply as excess insurance over and above the General Liability, Property Damage, Automobile Liability and Employer Liability. Added to the policy by endorsement shall be (1) Fellow Employee Insurance covering all employees; (2) Broad Form Comprehensive General Liability Insurance; and (3) Explosion (Blasting), Collapse, and Underground Hazards Insurance in the amounts shown above.

5.7.3 Motor Vehicle Liability Insurance on all motor vehicles owned, leased, or otherwise used by the CONTRACTOR and all Subcontractors and employers non-ownership coverage for the CONTRACTOR and Subcontractors in an amount not less than $1,000,000 each occurrence to include uninsured and underinsured motorist.

5.7.4 DISTRICT's Protective Liability and Property Damage Insurance to protect the DISTRICT or any of its employees, officers or agents, the ENGINEER, and such other engineer or engineers as may act under the contract, against claims arising from the operations of the CONTRACTOR or his Subcontractors. Such insurance shall be provided by endorsements to the General Liability and Property Damage Insurance, Excess General Liability and Property Damage Insurance, Motor Vehicle Liability Insurance, and Excess Motor Vehicle Liability Insurance policies (including all endorsements) or separate policies shall be provided. Coverage and amounts shall be the same as required of the CONTRACTOR.

5.7.5 Workers' Compensation Insurance as required by applicable Federal, State, or Territorial laws for all employees of the CONTRACTOR and employees of his Subcontractors in the event that the Subcontractors fail to provide such insurance. This insurance shall contain endorsements including (1) Broad Form All States Coverage, (2) United States Longshoremen's and Harbor Workers' Compensation Act, (3) Maritime or Jones Act coverage, when applicable, and (4) Voluntary Compensation Coverage, and shall specifically list the state where the work is performed.

5.7.6 Employers Liability Insurance on all employees of the CONTRACTOR and employees of his Subcontractors in the event that the Subcontractors fail to provide such insurance. This insurance shall provide coverage of at least the statutory minimum requirements.

5.7.7 "Special Form" Type Builders Risk Insurance as will protect the CONTRACTOR and the DISTRICT from loss or damage while the project is under construction and prior to full acceptance thereof by the DISTRICT. The policies shall be payable to the CONTRACTOR and the DISTRICT as their interest in the facility may be determined. This provision shall not release the CONTRACTOR of his obligation to complete, according to the plans and specifications, the project covered by the contract, and the CONTRACTOR and his surety shall be obligated to full performance of the CONTRACTOR's undertaking. The policy coverage shall include all materials and supplies at any location and/or in transit, including theft, at the time an insurable interest begins. The policy shall contain no exclusion pertaining to water damage or any other damage of a building not fully enclosed.

5.7.8 Railroad Protective Liability and Property Damage Liability Insurance if operations performed by the CONTRACTOR require work to be done under, over, or within fifty (50) feet of the center line of any track of any railroad company, unless a written waiver is obtained by the CONTRACTOR from the office of the railroad company's division superintendent having jurisdiction. The CONTRACTOR shall furnish to the railroad company an original insurance policy covering the operations which will be performed by the CONTRACTOR or any Subcontractor, naming the railroad as insured, on the form of Railroad Protective Policy as accepted by the Association of American Railroads and Mutual Insurance Rating Bureau. The amounts and limits of such insurance shall be as required by the division superintendent of the railroad company.

Contractor's Liability Insurance:

5.8 CONTRACTOR shall purchase and maintain in force comprehensive general liability and other insurance as is appropriate for the Work being performed and furnished and will provide protection from claims of injury to persons or property arising out of the Work. In addition, CONTRACTOR shall maintain in force and provide certificates of coverage for:

5.8.1 workers' or workmen's compensation insurance as required by the laws of North Carolina.

5.8.2 liability insurance as required by law for all vehicles and machinery operated by CONTRACTOR in connection with the Work.

The insurance required by this paragraph shall include the specific coverages and be written for not less than the limits of liability and coverages provided below or required by law, whichever is greater. The comprehensive general liability insurance shall include completed operations insurance. All of the policies of insurance so required to be purchased and maintained (or the certificates or other evidence thereof) shall contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days' prior written notice has been given to DISTRICT by certified mail. All such insurance shall remain in effect until final payment and at all times thereafter when CONTRACTOR

may be correcting, removing or replacing **defective** Work in accordance with paragraph 13.11. In addition, CONTRACTOR shall maintain such completed operations insurance for at least two years after final payment and furnish DISTRICT with evidence of continuation of such insurance at final payment and one year thereafter. Further, CONTRACTOR shall be responsible for verifying that any and all Subcontractors furnishing labor and/or materials in connection with the Work be properly insured.

Contractual Liability Insurance:

5.9 In accordance with North Carolina General Statutes Chapter 22B-1, "The CONTRACTOR, to the extent permitted by law, hereby agrees to indemnify and hold harmless the DISTRICT, its independent contractors, agents, and employees against liability for damages resulting from the sole negligence of the CONTRACTOR, its agents or employees. For the purposes of this paragraph, damages shall include the cost and expense of defending a claim, the amount of any judgment recovered, and the amount of damage to property or person.

5.10 The comprehensive general liability insurance required by paragraph 5.8 will include contractual liability insurance applicable to CONTRACTOR's obligations under paragraphs 6.30 and 6.31.

District's Liability Insurance:

5.11 DISTRICT shall be responsible for purchasing and maintaining DISTRICT's own liability insurance and, at DISTRICT's option, may purchase and maintain such insurance as will protect DISTRICT against claims which may arise from operations under the Contract Documents.

Property Insurance:

5.12 CONTRACTOR shall purchase and maintain property insurance upon the Work at the site to the full insurable value thereof (subject to such deductible amounts as may be required by Laws and Regulations). The insurance shall include the interests of DISTRICT, CONTRACTOR, Subcontractors, and ENGINEER in the Work, all of whom shall be listed as insured or additional insured parties, shall insure against the perils of fire and extended coverage and shall include "all risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and shall include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, attorneys and other professionals). If independent consultants are hired, they shall be required to purchase and maintain in force insurance appropriate for the Work. If not covered under the "all risk" insurance CONTRACTOR shall purchase and maintain similar property insurance on portions of the Work stored on and off the site or in transit when such portions of the Work are to be included in an Application for Payment.

5.13 DISTRICT shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by Laws and Regulations which will include the interest of DISTRICT, CONTRACTOR, Subcontractors, ENGINEER and ENGINEER'S consultants in the Work, all of whom shall be listed as insured or additional insured parties.

5.14 All the policies of insurance (or the certificates or other evidence thereof) required to be purchased and maintained by DISTRICT in accordance with paragraphs 5.12 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least thirty days' prior written notice has been given to CONTRACTOR by certified mail and will contain waiver provisions in accordance with paragraph 5.18.1

5.15 DISTRICT shall not be responsible for purchasing and maintaining any property insurance to protect the interest of CONTRACTOR, Subcontractors or others in the Work to the extent of any deductible amounts that are provided. The risk of loss within the deductible amount, will be borne by CONTRACTOR, Subcontractor or others suffering any such loss and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.16 If CONTRACTOR requests in writing that other special insurance be included in the property insurance policy, DISTRICT shall, if possible, include such insurance, and the cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the site, DISTRICT shall in writing advise CONTRACTOR whether or not such other insurance has been procured by DISTRICT.

Waiver of Rights:

5.17.1 DISTRICT and CONTRACTOR waive all right against each other for all losses and damages caused by any of the perils covered by the policies of insurance provided in response to paragraph 5.12 and any other property insurance applicable to the Work, and also waive all such rights against the Subcontractor, ENGINEER, ENGINEER's consultants and all other parties named as insured in such policies for losses and damages so caused. As required by paragraph 6.11, each subcontract between CONTRACTOR and a Subcontractor will contain similar waiver provisions by the Subcontractor in favor of DISTRICT, CONTRACTOR, ENGINEER, ENGINEER's consultants and all other parties named as insured. None of the above waivers shall extend to the rights that any of the insured parties may have to the proceeds of insurance held by DISTRICT as trustee or otherwise payable under any policy so issued.

5.17.2 DISTRICT and CONTRACTOR intend that any policies provided in response to paragraph 5.12 shall protect all of the parties insured and provide primary coverage for all losses and damages caused by the perils covered thereby. Accordingly, all such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurer will have not rights of recovery against any of the parties named as insured or additional insured, and if the insurers require separate waiver forms to be signed by ENGINEER or ENGINEER'S 's consultant DISTRICT will obtain the same, and if such waiver forms are required of any Subcontractor, CONTRACTOR will obtain the same.

Receipt and Application of Proceeds:

5.18 Any insured loss under the policies of insurance required by paragraph 5.12 will be adjusted with DISTRICT and made payable to DISTRICT as trustee for the insured, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.19 . DISTRICT shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached the damaged Work shall be repaired or replaced, the monies so received applied on account thereof and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

5.19 DISTRICT as trustee shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen days after the occurrence of loss to DISTRICT's exercise of this power. If such objection be made, DISTRICT as trustee shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If required in writing by any party in interest, DISTRICT as trustee shall, upon the occurrence of an insured loss, give bond for the proper performance of such duties.

Acceptance of Insurance:

5.20 If DISTRICT has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 5.3 – 5.10 on the basis of its not complying with the Contract Documents, DISTRICT shall notify CONTRACTOR in writing thereof within ten days of the date of delivery of such certificates to DISTRICT in accordance with paragraph 2.8. If CONTRACTOR has any objection to the coverage afforded by or other provisions of the policies of insurance required to be purchased and maintained by DISTRICT on the basis of their not complying with the Contract Documents, CONTRACTOR shall notify DISTRICT in writing thereof within ten days of the date of delivery of such certificates to CONTRACTOR in accordance with paragraph 2.8, DISTRICT and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided by each as the other may reasonably request. Failure by DISTRICT or CONTRACTOR to give any such notice of objection within the time provided shall constitute acceptance of such insurance purchased by the other as complying with the Contract Documents.

Partial Utilization - Property Insurance:

5.21 If DISTRICT finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with paragraph 14.10, provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected the changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or lapse on account of any such partial use or occupancy.

ARTICLE 6--CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence:

6.1 CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction; but CONTRACTOR shall not be responsible for the negligence of others in the design or selection of specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract Documents. CONTRACTOR shall be responsible to see that the finished Work complies with the Contract Documents.

6.2 CONTRACTOR shall keep on the Work site at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to DISTRICT and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications given to the superintendent shall be as binding as if given to CONTRACTOR.

Labor, Materials and Equipment:

6.3 CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours, and CONTRACTOR will not permit

overtime work or the performance of Work on Saturday, Sunday or any legal holiday without DISTRICT'S written consent.

6.4 Unless otherwise specified in the General Requirements, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

6.5 All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleansed and conditioned in accordance with the instructions of the applicable Supplier except as otherwise provided in the Contract Documents; but no provision of any such instructions will be effective to assign to ENGINEER any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.15 or 9.16.

Adjusting Progress Schedule:

6.6 CONTRACTOR shall submit to ENGINEER for acceptance adjustments in the progress schedule to reflect the impact thereon of new developments; these will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

Substitutes or "Or-Equal" Items:

6.7.1 Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item, it is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by ENGINEER if sufficient information is submitted by CONTRACTOR to allow ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named.

6.7.2 The procedure for review by ENGINEER will include the following as supplemented in the General Requirements. Requests for review of substitute items of material and equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will state that the evaluation and acceptance of the proposed substitute will not prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contact with DISTRICT for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of re-design and claims of other contractors affected by the resulting change, all of which shall be

considered by ENGINEER in evaluating the proposed substitute, ENGINEER may require CONTRACTOR to furnish at CONTRACTOR's expense additional data about the proposed substitute.

6.7.3 If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to ENGINEER, if CONTRACTOR submits sufficient information to allow ENGINEER to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in paragraph 6.7.1 as applied by ENGINEER and as may be supplemented in the General Requirements.

6.7.4 ENGINEER will be allowed a reasonable time within which to evaluate each proposed substitute. ENGINEER will be the sole judge of acceptability, and no substitute will be ordered, installed or utilized without ENGINEER's prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing, DISTRICT may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute. ENGINEER will record time required by ENGINEER and ENGINEER's consultants in evaluating substitutions proposed by CONTRACTOR and in making changes in the Contract Documents occasioned thereby. Whether or not ENGINEER accepts a proposed substitute, CONTRACTOR shall reimburse DISTRICT for the charges of ENGINEER and ENGINEER's consultants for evaluating each proposed substitute.

Concerning Subcontractors, Suppliers and Others:

6.8.1 CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization whether initially or as a substitute, against whom ENGINEER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

6.8.2 If the General Conditions require the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials and equipment) to be submitted to DISTRICT in advance of the specified date prior to the Effective Date of the Agreement for acceptance by DISTRICT and if CONTRACTOR has submitted a list thereof in accordance with the General Conditions, ENGINEER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the bidding documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable substitute, the Contract Price will be increased by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by ENGINEER of any such Subcontractor, Supplier or other person or organization shall constitute a wavier of any right of DISTRICT or ENGINEER to reject "defective" Work.

6.9 CONTRACTOR shall be fully responsible to DISTRICT for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create any contractual relationship between DISTRICT and any such Subcontractor, Supplier or other person or organization, nor

shall it create any obligation on the part of DISTRICT to pay or to see to the payment of any monies due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.

6.10 The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

6.11 All Work performed for CONTRACTOR by a Subcontractor will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor which specifically binds the Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of DISTRICT and contains waiver provisions as required by paragraph 5.17. CONTRACTOR shall pay each Subcontractor a just share of any insurance monies received by CONTRACTOR on account of losses under policies issued pursuant to paragraph 5.15.

Patent Fees and Royalties:

6.12 CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by DISTRICT in the Contract Documents. CONTRACTOR shall indemnify and hold harmless DISTRICT and ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorney's fees and court and appeals costs) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

Permits:

6.13 CONTRACTOR shall obtain and pay for all permits and licenses necessary to do the work, which have not been obtained by DISTRICT. DISTRICT shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall post all bonds, provide all insurance, pay all governmental charges, pay all fees, provide all warranties required for the prosecution of the WORK which are applicable at the time of opening Bids, or if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of such utility owners for capital costs related thereto, and CONTRACTOR shall be responsible for all notifications and acceptances required of all permits.

Laws and Regulations:

6.14.1 CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither DISTRICT nor ENGINEER shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

6.14.2 If CONTRACTOR observes that the Specifications or Drawings are at variance with any Laws or Regulations, CONTRACTOR shall give ENGINEER prompt written notice thereof, and any necessary changes will be authorized by one of the methods indicated in paragraph 3.4. If

CONTRACTOR performs any work knowing or having reason to know that it is contrary to such Laws or Regulations, and without such notice to ENGINEER, CONTRACTOR shall bear all costs arising therefrom; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with such Laws and Regulations.

Taxes:

6.15 CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the laws and regulations of the place of the Project which are applicable during the performance of the Work.

Use of Premises:

6.16 CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Project site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by Laws and Regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the Work. Should any claim be made against DISTRICT by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly attempt to settle with such other party by agreement or otherwise resolve the claim. CONTRACTOR shall indemnify and hold DISTRICT and ENGINEER harmless from and against all claims for injury to persons or property including legal fees and other professional fees arising out of the Work.

6.17 During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by DISTRICT. CONTRACTOR shall restore to original condition all property not designated for alteration by the Contract Documents.

6.18 CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

Record Documents:

6.19 CONTRACTOR shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Directive Changes, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.4) in good order and annotated to show all changes made during construction. These record documents together with all approved samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, samples and Shop Drawings will be delivered to ENGINEER.

Safety and Protection:

6.20 CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.20.1 all employees on the Work and other persons and organizations who may be affected thereby;

6.20.2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

6.20.3 other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.20.2 or 6.20.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for those acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of DISTRICT or ENGINEER or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR). CONTRACTOR's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to DISTRICT and CONTRACTOR in accordance with paragraph 14.13 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.21 CONTRACTOR shall designate a responsible representative at the site whose duty shall be the prevention of accidents. This person shall be CONTRACTOR's superintendent unless otherwise designated in writing by CONTRACTOR to DISTRICT.

Emergencies:

6.22 In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from ENGINEER or DISTRICT, is obligated to act to prevent threatened damage, injury or loss, CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If ENGINEER determines that a change in the Contract Documents is required because of the action taken in response to an emergency, a Work Directive Change or Change Order will be issued to document the consequences of the changes or variations.

Shop Drawings and Samples:

6.23 After checking and verifying all field measurements and after complying with applicable procedures specified in the General Requirements, CONTRACTOR shall submit to ENGINEER for review and approval in accordance with the accepted schedule of Shop Drawing submissions (see paragraph 2.11) five copies (unless otherwise specified in the General Requirements) of all Shop Drawings, which will bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's responsibilities under the Contract Documents with respect to the review of the submission. All submissions will be identified as ENGINEER may require. The data shown on the Shop Drawings will be complete with respect to quantities,

dimensions, specified performance and design criteria, materials and similar data to enable ENGINEER to review the information as required.

6.24 CONTRACTOR shall also submit to ENGINEER for review and approval with such promptness as to cause no delay in Work, all samples required by the Contract Documents. All samples will have been checked by and accompanied by a specific written indication that CONTRACTOR has satisfied CONTRACTOR's responsibilities under the Contract Documents with respect to the review of the submission and will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended.

6.25.1 Before submission of each Shop Drawing or sample, CONTRACTOR shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each Shop Drawing or sample with other Shop Drawings and samples and with the requirements of the Work and the Contract Documents.

6.25.2 At the time of each submission, CONTRACTOR shall give ENGINEER specific written notice of each variation that the Shop Drawings or samples may have from the requirements of the Contract Documents, and in addition, shall cause a specific notation to be made on each Shop Drawing submitted to ENGINEER for review and approval of each such variation.

6.26 ENGINEER will review and approve with reasonable promptness Shop Drawings and samples; but ENGINEER's review and approval will be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, techniques, sequences or procedures of construction (except where as specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by ENGINEER, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.27 ENGINEER's review and approval of Shop Drawings or samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of submission as required by paragraph 6.25.2 and ENGINEER has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings or from responsibility for having complied with the provisions of paragraph 6.25.1.

6.28 Where a Shop Drawing or sample is required by the Specifications, any related Work performed prior to ENGINEER's review and approval of the pertinent submission will be the sole expense and responsibility of CONTRACTOR.

Continuing the Work:

6.29 CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with DISTRICT. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.5 or as CONTRACTOR and DISTRICT may otherwise agree in writing.

Indemnification:

6.30 CONTRACTOR shall indemnify and hold harmless DISTRICT and ENGINEER and their consultants, agents and employees from and against all claims, damages, losses and expenses, direct, indirect or consequential (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and appeals costs) arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom and (b) is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified here under or arises by or is imposed by Law and Regulations regardless of the negligence of any such party.

6.31 In any and all claims against DISTRICT or ENGINEER or any of their consultants, agents or employees by any employee of CONTRACTOR, any Subcontractor, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.30 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any such Subcontractor or other person or organization under workers or workmen's compensation acts, disability benefit acts or other employee benefit acts.

6.32 The obligations of CONTRACTOR under paragraph 6.30 shall not extend to the liability of ENGINEER, ENGINEER's consultants, agents or employees arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications.

ARTICLE 7--OTHER WORK

Related Work at Site:

7.1 DISTRICT may perform other work related to the Project at the site by DISTRICT's own forces, have other work performed by utility owners or let other direct contracts therefor which shall contain General Conditions similar to these. If the fact that such other work is to be performed was noted in the Contract Documents, written notice thereof will be given to CONTRACTOR prior to starting any such other work; and if CONTRACTOR believes that such performance will involve additional expense to CONTRACTOR or requires additional time and the parties are unable to agree as to the extent thereof, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

7.2 CONTRACTOR shall afford each utility owner and other contractor who is a party to such a separate contract (or DISTRICT, if DISTRICT is performing the additional work with DISTRICT's employees) proper and safe access to the site for the introduction and storage of materials and equipment and the execution of such work, and shall properly connect and coordinate the Work with theirs. CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility Districts and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said separate contacts between DISTRICT and such utility owners and other contractors.

7.3 If any part of CONTRACTOR's Work depends for proper execution or results upon the work of any such other contractor or utility owner, CONTRACTOR shall inspect and promptly report to ENGINEER in writing any delays, defects or deficiencies in such work that render it unavailable or unsuitable for such proper execution and results. CONTRACTOR's failure to so report will constitute an acceptance of the other work as fit and proper for integration with CONTRACTOR's Work except for latent or non-apparent defects and deficiencies in the other work.

Coordination:

7.4 If DISTRICT contracts with others for the performance of other work on the Project at the site, the person or organization who will have authority and responsibility for coordination of the activities among the various prime Contractors will be identified in the Special Conditions, and the specific matters to be covered by such authority and responsibility will be itemized, and the extent of such authority and responsibilities will be provided in the Special Conditions. Unless otherwise provided in the Special Conditions, neither DISTRICT nor ENGINEER shall have any authority or responsibility in respect of such coordination.

ARTICLE 8--DISTRICT'S RESPONSIBILITIES

8.1 DISTRICT shall issue all communications to CONTRACTOR through ENGINEER.

8.2 In case of termination of the employment of ENGINEER, DISTRICT shall appoint an engineer, against whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.3 DISTRICT shall furnish the data required of DISTRICT under the Contract Documents promptly and shall make payments to CONTRACTOR promptly after they are due as provided in paragraphs 14.4 and 14.13.

8.4 DISTRICT's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to DISTRICT's identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions at the site and in existing structures which have been utilized by ENGINEER in preparing the Plans and Specifications.

8.5 DISTRICT's responsibilities in respect of purchasing and maintaining liability and property insurance are set forth in paragraphs 5.3 through 5.9.

8.6 DISTRICT is obligated to execute Change Orders as indicated in paragraph 10.4.

8.7 DISTRICT's responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4.

8.8 In connection with DISTRICT's right to stop Work or suspend Work, see paragraphs 13.10 and 15.1. Paragraph 15.2 deals with DISTRICT's right to terminate services of CONTRACTOR under certain circumstances.

ARTICLE 9 -- ENGINEER'S STATUS DURING CONSTRUCTION

DISTRICT's Representative:

9.1 ENGINEER will be DISTRICT's representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as DISTRICT's representative during construction are set forth in the Contract Documents and shall not be extended without written consent of DISTRICT and ENGINEER.

Visits to Site:

9.2 ENGINEER will make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for DISTRICT a greater degree of confidence that the completed Work will conform to the Contract Documents. On the basis of such visits and on-site observations as an experienced and qualified design professional, ENGINEER will keep DISTRICT informed of the progress of the Work and will endeavor to guard DISTRICT against defects and deficiencies in the Work.

Project Representation:

9.3 An inspector shall be assigned to the Project by the DISTRICT, to serve as ENGINEER's representative. The inspector shall conduct inspections of the Work, materials, and tests for compliance with the approved Plans and Specifications. Such inspections shall take place during normal times with the CONTRACTOR providing safe access to the work.

9.3.1 The inspector shall attend the preconstruction meeting.

9.3.2 The inspector shall report to the ENGINEER the progress and compliance status of the Work.

9.3.3 Non-compliance issues shall be reported to the CONTRACTOR and ENGINEER.

9.3.4 Failure to obtain compliance by reporting non-compliance issues shall result in a final decision being rendered by the ENGINEER.

9.3.5 Until compliance is obtained based on the final decision of the ENGINEER, no inspections of Work other than the correction work required by the final decision shall take place. All other Work placed during this period shall be rejected.

9.3.6 The CONTRACTOR shall notify the inspector one day in advance prior to covering the Work that requires inspection or testing. Failure to notify the inspector of the need for inspection shall result in rejection of the Work.

9.3.7 Failure of the inspector to inspect when notified does not relieve the CONTRACTOR from compliance with the requirements of the Plans and Specifications.

9.3.8 The inspector is not authorized to revoke, alter or waive any requirements of the Contract Documents. Any advice or recommendation given by the inspector shall not be construed as releasing any party from the requirements of the approved Plans and Specifications.

9.3.9 The CONTRACTOR shall notify the inspector two days in advance to request a final inspection of the Work.

Clarifications and Interpretations:

9.4 ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If CONTRACTOR believes that a written clarification or interpretation justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree to the amount or extent thereof, CONTRACTOR may make a claim therefor as provided in Article 11 or Article 12.

Authorized Variations in Work:

9.5 ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract price or the Contract Time and are consistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order and will be binding on DISTRICT, and also on CONTRACTOR who shall perform the Work involved promptly. If CONTRACTOR believes that a Field Order justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a claim therefore as provided in Article 11 or 12.

Rejecting Defective Work:

9.6 ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be "defective", and will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9, whether or not the work is fabricated, installed or completed.

Shop Drawings, Change Orders and Payments:

9.7 In connection with ENGINEER's responsibility for Shop Drawings and samples, see paragraphs 6.23 through 6.28 inclusive.

9.8 In connection with ENGINEER's responsibilities as to Change Orders, see Articles 10, 11 & 12.

9.9 In connection with ENGINEER's responsibilities in respect of Applications for Payments, etc., see Article 14.

Determinations for Unit Prices:

9.10 ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise), ENGINEER's written decisions thereon will be final and binding upon DISTRICT and CONTRACTOR, unless, within ten days after the date of any such decision, CONTRACTOR delivers to ENGINEER written notice of intention to appeal from such a decision.

Decisions on Disputes:

9.11 ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and claims under Articles 11 and 12 in respect of changes in the Contract Price or Contract Time will be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph, which ENGINEER will render in writing within a reasonable time. Written notice of each such claim, dispute and other matter will be delivered by the claimant to ENGINEER and the other party to the Agreement promptly (but in no event later than thirty days) after the occurrence of the event giving rise thereto, and written supporting data will be submitted to ENGINEER and the other party within sixty days after such occurrence unless ENGINEER allows an additional period of time to a ascertain more accurate data in support of the claim.

9.12 The rendering of a decision by ENGINEER pursuant to paragraphs 9.10 and 9.11 with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.16) will be a condition precedent to any exercise by DISTRICT or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter.

Limitations on ENGINEER's Responsibilities:

9.13 Neither ENGINEER's authority to act under this Article 9 or elsewhere in the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization performing any of the Work, or to any surety for any of them.

9.14 Whenever in the Contract documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper", or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the Work for compliance with the Contract Documents, (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to under take responsibility contrary to the provisions of paragraph 9.15 or 9.16.

9.15 ENGINEER will not be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, and ENGINEER will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.

9.16 ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

ARTICLE 10--CHANGES IN THE WORK

10.1 Without invalidating the Agreement and without notice to any surety, DISTRICT may, at any time or from time to time, order additions, deletions or revisions in the Work; these will be authorized by a Written

Amendment, A Change Order, or a Work Directive Change. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents, except as otherwise specifically provided.

10.2 If DISTRICT and CONTRACTOR are unable to agree as to the extent, if any, of an increase or decrease in the Contract Price or an extension or shortening of the Contract Time that should be allowed as result of a Work Directive change, a claim may be made therefor as provided in Article 11 or Article 12.

10.3 CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraphs 3.4 and 3.5, except in the case of an emergency as provided in paragraph 6.22 and except in the case of uncovering Work as provided in paragraph 13.9.

10.4 DISTRICT and CONTRACTOR shall execute appropriate Change Orders (or Written Amendments) covering:

10.4.1 changes in the Work which are ordered by DISTRICT pursuant to paragraph 10.1, are required because of acceptance of "defective" Work under paragraph 13.13 or correcting "defective" Work under paragraph 13.14, or are agreed to by the parties;

10.4.2 changes in the Contract Price or Contract Time which are agreed to by the parties; and

10.4.3 changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 9.11; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations; but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.29.

10.5 If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Time) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR'S responsibility, and the amount of each applicable Bond will be adjusted accordingly.

ARTICLE 11--CHANGE OF CONTRACT PRICE

11.1 The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at his expense without change in the Contract price.

11.2 The Contract Price may only be changed by a Change Order or by a Written Amendment. Any claim for an increase or decrease in the Contract Price shall be based on written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by claimant's written statement that the amount claimed covers all known amounts (direct, indirect and consequential) to which the claimant is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Price shall be determined by ENGINEER in accordance with

paragraph 9.11. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph.

11.3 The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

11.3.1 Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved (subject to the provisions of paragraphs 11.8.1 through 11.8.3, inclusive).

11.3.2 By mutual acceptance of a lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 11.5.2.1).

11.3.3 On the basis of the Cost of the Work (determined as provided in paragraph 11.4) plus a CONTRACTOR's Fee for overhead and profit (determined as provided in paragraphs 11.5 and 11.6).

Cost of the Work:

11.4 The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by DISTRICT, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items:

11.4.1 Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by DISTRICT and CONTRACTOR. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' or workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Employees shall include superintendents and foremen at the site. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be included in the above to the extent authorized by DISTRICT.

11.4.2 Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless DISTRICT deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to DISTRICT. All trade discounts, rebates and refunds and all returns from sale of surplus materials and equipment shall accrue to DISTRICT, and CONTRACTOR shall make provisions so that they may be obtained.

11.4.3 Payments made by CONTRACTOR to the Subcontractors for Work performed by Subcontractors. If required by DISTRICT, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to CONTRACTOR and shall deliver such bids to DISTRICT who will then determine, with the advice of ENGINEER, which bids will be accepted. If a subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a Fee, the Subcontractor's Cost of the Work shall be determined in the same manner as CONTRACTOR's Cost of the Work. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

11.4.4 Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys and accountants) employed for services specifically related to the Work.

11.4.5 Supplemental costs including the following:

11.4.5.1 The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

11.4.5.2 Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of CONTRACTOR.

11.4.5.3 Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by DISTRICT with the advice of ENGINEER, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof-- all in accordance with terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

11.4.5.4 Sales, consumer, use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.

11.4.5.5 Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

11.4.5.6 Losses and damages (and related expenses), not compensated by insurance or otherwise, to the Work or otherwise sustained by CONTRACTOR in connection with the performance and furnishing of the Work, (except losses and damages within the deductible amounts of property insurance established by DISTRICT in accordance with paragraph 5.9) provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of DISTRICT. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's Fee. If however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in paragraph 11.5.2.

11.4.5.7 The cost of utilities, fuel and sanitary facilities at the site.

11.4.5.8 Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

11.4.5.9 Cost of premiums for additional Bonds and insurance required because of changes in the Work and premiums for property insurance coverage within the limits of the deductible amounts are established by DISTRICT in accordance with paragraph 5.14

Contractor's Fee:

11.5 The CONTRACTOR's Fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

11.5.1 a mutually acceptable fixed fee; or if none can be agreed upon, fee will be determined according to procedure in the following paragraphs;

11.5.2 a fee based on the following percentages of the various portions of the Cost of the Work;

11.5.2.1 for costs incurred under paragraphs 11.4.1 and 11.4.2, the CONTRACTOR's Fee shall be fifteen percent;

11.5.2.2 for costs incurred under paragraph 11.4.3, the CONTRACTOR's Fee shall be five percent; and if a subcontract is on the basis of Cost of the Work Plus a Fee, the maximum allowable to CONTRACTOR on account of overhead and profit of all Subcontractors shall be fifteen percent;

11.5.2.3 no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, and 11.4.5;

11.5.2.4 the amount of credit to be allowed by CONTRACTOR to DISTRICT for any such change which results in a net decrease in cost will be the amount of the actual net decrease plus a deduction in Contractor's Fee by an amount equal to ten percent of the net decrease; and

11.5.2.5 when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's Fee shall be computed on the basis of the net change in accordance with paragraphs 11.5.2.1 through 11.5.2.4, inclusive.

11.6 Whenever the cost of any Work is to be determined pursuant to paragraph 11.4 or 11.5, CONTRACTOR will submit in form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

Cash Allowances:

11.7 It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be done by such Subcontractors or Suppliers and for such sums within the limit of the allowances as may be acceptable to ENGINEER, CONTRACTOR agrees that:

11.7.1 The allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the site, and all applicable taxes; and

11.7.2 CONTRACTOR's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances. No demand for additional payment on account of any thereof will be valid.

Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

Unit Price Work:

11.8.1 Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work in an amount equal to the sum of the established unit prices for each separately identified item of Unit Price work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER in accordance with paragraph 9.10.

11.8.2 Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.

11.8.3 Where the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement and there is no corresponding adjustment with respect to any other item of Work and if CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof, CONTRACTOR may make a claim for an increase in the Contract Price in accordance with Article 11 if the parties are unable to agree as to the amount of any such increase.

ARTICLE 12--CHANGE OF CONTRACT TIME

12.1 The Contract Time may only be changed by a Change Order or a Written Amendment. Any claim for an extension or shortening of the Contract time shall be based on written notice delivered by the party making the claim to the other party promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract time shall be determined by ENGINEER in accordance with paragraph 9.11 No claim for an adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this paragraph..

12.2 The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of CONTRACTOR if a claim is made therefore as provided in paragraph 12.1. Such delays shall include, but not be limited to, acts or neglect by DISTRICT or others performing additional work as contemplated by Article 7, or to fires, floods, labor disputes, epidemics, abnormal weather conditions or acts of God. Abnormal weather conditions will be determined based on daily and monthly data and departures from normal, as published by the National Climatic Data Center, Asheville, NC. Consideration will be given to localized weather events at the job site, and the time required to resume progress on the job.

12.3 All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article 12 shall not exclude recovery for damages (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and appeals costs) for delay by either party.

ARTICLE 13--WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

Warranty and Guarantee:

13.1 CONTRACTOR warrants and guarantees to DISTRICT that all Work will be in accordance with the Contract Documents and will not be "defective". Prompt notice of all defects shall be given to CONTRACTOR. All "defective" Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article 13.

Access to Work:

13.2 ENGINEER and other representatives of DISTRICT, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspection and testing. CONTRACTOR shall provide proper and safe conditions for such access.

Tests and Inspections:

13.3 CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals.

13.4 If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, CONTRACTOR shall assume full responsibility therefor, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval. CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with DISTRICT's acceptance of a Supplier of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. The cost of all inspections, tests and approvals in addition to the above which are required by the Contract Documents shall be paid by DISTRICT (unless otherwise specified).

13.5 All inspections, tests or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to DISTRICT and CONTRACTOR (or by ENGINEER if so specified).

13.6 If any Work (including the work of others) that is to be inspected, tested or approved is covered without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation. Such uncovering shall be at CONTRACTOR's expense unless CONTRACTOR had given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

13.7 Neither observations by ENGINEER nor inspections, tests or approvals by others shall relieve CONTRACTOR from CONTRACTOR's obligations to perform the Work in accordance with the Contract Documents.

Uncovering Work:

13.8 If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at CONTRACTOR's expense.

13.9 If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is "defective", CONTRACTOR shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, (including but not limited to fees and charges of engineers, architects, attorneys and other professionals), and DISTRICT shall be entitled to an appropriate decrease in the Contract Price; and if the parties are unable to agree as to the amount thereof, may make a claim therefor as provided in Article 11. If, however, such Work is not found to be "defective", CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a claim therefor as provided in Article 11 and 12.

DISTRICT May Stop the Work:

13.10 If the Work is "defective", or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, DISTRICT may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of DISTRICT to stop the Work shall not give rise to any duty on the part of DISTRICT to exercise this right for the benefit of CONTRACTOR or any other party.

Correction or Removal of Defective Work:

13.11 If required by ENGINEER, CONTRACTOR shall promptly, as directed, either correct all "defective" Work, whether or not fabricated, installed or completed, or if the Work has been rejected by ENGINEER, remove it from the site and replace it with "non-defective" Work. CONTRACTOR shall bear all direct, indirect and consequential costs of such correction or removal (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby.

One Year Correction Period:

13.12 If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provisions of the Contract Documents, any Work is found to be "defective", CONTRACTOR shall promptly, without cost to DISTRICT and in accordance with DISTRICT's written instructions, either correct such "defective" Work, or, if it has been rejected by DISTRICT, remove it from the site and replace it with "non-defective" Work. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, DISTRICT may have the "defective" Work corrected or the rejected Work removed and replaced, and all direct, indirect and consequential costs of such removal and replacement (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) will be paid by CONTRACTOR. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

Acceptance of Defective Work:

13.13 If, instead of requiring correction or removal and replacement of "defective" Work, DISTRICT (and,

prior to ENGINEER's recommendation of final payment, also ENGINEER) prefers to accept it, DISTRICT may do so. CONTRACTOR shall bear all direct, indirect and consequential costs attributable to DISTRICT's evaluation of and determination to accept such "defective" Work (such costs to be approved by ENGINEER as to reasonableness and to include but not be limited to fees and charges of engineers, architects, attorneys and other professionals). If any such acceptance occurs prior to ENGINEER's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and DISTRICT shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, DISTRICT may make a claim therefor as provided in Article 11. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to DISTRICT.

DISTRICT May Correct Defective Work:

13.14 If CONTRACTOR fails within a reasonable time after written notice of ENGINEER to proceed to correct "defective" Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.11, or if CONTRACTOR fails to perform the Work in accordance with the Contract documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, DISTRICT may, after seven days written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph DISTRICT shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, DISTRICT may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which DISTRICT has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow DISTRICT, DISTRICT's representatives, agents and employees such access to the site as may be necessary to enable DISTRICT to exercise the rights and remedies under this paragraph. All direct, indirect and consequential costs of DISTRICT in exercising such rights and remedies will be charged against CONTRACTOR in an amount approved as to reasonableness by ENGINEER, and a change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and DISTRICT shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, DISTRICT may make a claim therefor as provided in Article 11. Such direct, indirect and consequential costs will include but not be limited to fees and charges of engineers, architects, attorneys and other professionals, all court and appeals costs and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR's "defective" Work. CONTRACTOR shall not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by DISTRICT of DISTRICT's rights and remedies hereunder.

ARTICLE 14--PAYMENTS TO CONTRACTOR AND COMPLETION

Schedule of Values:

14.1 The schedule of values established as provided in paragraph 2.11 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed in accordance with these contract documents.

Application for Progress Payment:

14.2 At least twenty days before each progress payment is scheduled (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and

signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that DISTRICT has received the materials and equipment free and clear of all liens, charges, security interests and encumbrances (which are hereinafter in these General Conditions referred to as "Liens") and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect DISTRICT's interest therein, all of which will be satisfactory to DISTRICT. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

Contractor's Warranty of Title:

14.3 CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to DISTRICT no later than the time of payment, free and clear of all Liens.

Review of Applications for Progress Payment:

14.4 ENGINEER will, within ten days after receipt of each application for Payment, either indicate in writing a recommendation of payment and present the Application to DISTRICT, or return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and re-submit the Application. Ten days after presentation of the Application for Payment with ENGINEER's recommendation, the amount recommended will (subject to the provisions of the last sentence of paragraph 14.7) become due and when due will be paid by DISTRICT to CONTRACTOR.

14.5 ENGINEER'S recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER, based on ENGINEER's on-site observations of the Work in progress as an experienced and qualified design professional and on ENGINEER's review of the application for payment and the accompanying data and schedules that the work has progressed to the point indicated that to the best of ENGINEER's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.10, and to any other qualifications stated in the recommendation); and that CONTRACTOR is entitled to payment of the amount recommended. However, by recommending any such payment ENGINEER will not thereby be deemed to have represented that exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents or that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by DISTRICT or DISTRICT to withhold payment to CONTRACTOR.

14.6 ENGINEER's recommendation of final payment will constitute an additional representation by ENGINEER that the conditions precedent to CONTRACTOR's being entitled to final payment as set forth in paragraph 14.13 have been fulfilled.

14.7 ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER's opinion, it would be incorrect to make such recommendation to DISTRICT. ENGINEER may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent

inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary in ENGINEER's opinion to protect DISTRICT from loss because:

14.7.1 the Work is "defective", or completed Work has been damaged requiring correction or replacement;

14.7.2 the Contract Price has been reduced by Written Amendment or Change Order;

14.7.3 DISTRICT has been required to correct "defective" Work or complete Work in accordance with paragraph 13.14; or

14.7.4 of ENGINEER's actual knowledge of the occurrence of any of the events enumerated in paragraphs 15.2.1 through 15.2.9 inclusive.

14.8 DISTRICT may refuse to make payment of the full amount recommended by ENGINEER because claims have been made against DISTRICT on account of CONTRACTOR's performance or furnishing of the Work or Liens have been filed in connection with the Work or there are other items entitling DISTRICT to a set-off against the amount recommended, but DISTRICT must give CONTRACTOR immediate written notice stating the reasons for such action.

Substantial Completion:

14.9 When CONTRACTOR considers the entire Work ready for its intended use, CONTRACTOR shall notify ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, CONTRACTOR and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. If, after completion of items on tentative list ENGINEER considers the Work substantially complete, ENGINEER will within fourteen days execute and deliver to CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as the ENGINEER believes justified. At the time of delivery of the tentative certificate of Substantial Completion, ENGINEER will deliver to CONTRACTOR a written recommendation as to division of responsibilities pending final payment by DISTRICT to CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities, insurance, warranties, and any other incomplete items of the Work. Unless CONTRACTOR disagrees otherwise in writing and informs ENGINEER prior to ENGINEER'S issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on CONTRACTOR until final payment.

14.10 DISTRICT shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but DISTRICT shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

Partial Utilization:

14.11 Use by DISTRICT of any finished part of the Work, which has specifically been identified in the Contract Documents, or which DISTRICT, ENGINEER and CONTRACTOR agree constitutes a separately

functioning and usable part of the Work that can be used by DISTRICT without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

14.11.1 DISTRICT may at any time request CONTRACTOR in writing to permit DISTRICT to use any such part of the Work which DISTRICT believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees, CONTRACTOR will certify to DISTRICT and ENGINEER that said part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify DISTRICT and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers that part of the Work to be substantially complete, the provisions of paragraphs 14.9 and 14.10 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.11.2 DISTRICT may at any time request CONTRACTOR in writing to permit DISTRICT to take over operation of any such part of the Work although it is not substantially complete, and within a reasonable time thereafter CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If CONTRACTOR does not object in writing to ENGINEER that such part of the Work is not ready for separate operation by DISTRICT, ENGINEER will finalize the list of items to be completed or corrected and will deliver such list to CONTRACTOR together with a written recommendation as to the division of responsibilities pending final payment between DISTRICT and CONTRACTOR with respect to security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that part of the Work which will become binding upon CONTRACTOR at the time when DISTRICT takes over such operation. During such operation and prior to Substantial Completion of such part of the Work, DISTRICT shall allow CONTRACTOR reasonable access to complete or correct items on said list and to complete other related Work.

14.11.3 No occupancy or separate operation of part of the work will be accomplished prior to compliance with the requirements of paragraph 5.12 in respect of property insurance.

Final Inspection:

14.12 Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will make a final inspection with CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or "defective" (punch list). CONTRACTOR shall immediately take such measures as are necessary to remedy such deficiencies.

Final Application for Payment:

14.13 After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, marked-up record documents (as provided in paragraph 6.19) and other documents--all as required by the Contract Documents, and after ENGINEER has indicated that the Work is acceptable (subject to the provisions

of paragraph 14.17), CONTRACTOR may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents, together with complete and legally effective releases or waivers (satisfactory to DISTRICT) of all Liens arising out of or filed in connection with the Work. In lieu thereof and as approved by DISTRICT, CONTRACTOR may furnish receipts or releases in full; an affidavit of CONTRACTOR that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which DISTRICT or DISTRICT's property might in any way be responsible, have been paid or otherwise satisfied; and consent of the surety, if any, to final payment. If any Subcontractor or Supplier fails to furnish a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to DISTRICT to indemnify DISTRICT against any Lien.

Final Payment and Acceptance:

14.14 If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation--all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER's recommendation of payment Thereupon, ENGINEER will give written notice to CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.17. Otherwise, ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and re-submit the Application. Thirty days after presentation to DISTRICT of the Application and accompanying documentation, in appropriate form and substance, and with ENGINEER's recommendation and notice of acceptability, the amount recommended by ENGINEER will become due and will be paid by DISTRICT to CONTRACTOR.

14.15 If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed and if ENGINEER so confirms, DISTRICT shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by DISTRICT for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.1, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

Contractor's Continuing Obligation:

14.16 CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by ENGINEER, nor the issuance of a certificate of Substantial Completion, nor any payment by DISTRICT to CONTRACTOR under the Contract Documents, nor any use or occupancy of the Work or any part thereof by DISTRICT, nor any act of acceptance by DISTRICT, nor any failure to do so, nor any review and approval of a shop Drawing or sample submission, nor the issuance of a notice of acceptability by ENGINEER pursuant to paragraph 14.13, nor any correction of "defective" WORK by DISTRICT will constitute an acceptance of Work not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents (except as provided in paragraph 14.17).

Waiver of Claims:

14.17 The making and acceptance of final payment will constitute:

14.17.1 a waiver of all claims by DISTRICT against CONTRACTOR, except claims arising from unsettled Liens, from "defective" Work appearing after final inspection pursuant to paragraph 14.12 or from failure to comply with the Contract Documents or the terms of any special guarantees specified therein; however, it will not constitute a waiver by DISTRICT of any rights in respect of CONTRACTOR's continuing obligations under the Contract Documents; and

14.17.2 a waiver of all claims by CONTRACTOR against DISTRICT other than those previously made in writing and still unsettled.

ARTICLE 15--SUSPENSION OF WORK AND TERMINATION

DISTRICT May Suspend Work:

15.1 DISTRICT may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if CONTRACTOR makes an approved claim therefor as provided in Articles 11 and 12.

DISTRICT May Terminate:

15.2 Upon the occurrence of any one or more of the following events:

15.2.1 if CONTRACTOR commences a voluntary case under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect, or if CONTRACTOR takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating to the bankruptcy or insolvency;

15.2.2 if a petition is filed against CONTRACTOR under any chapter of the Bankruptcy Code as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against CONTRACTOR under any other federal or state law in effect at the time relating to bankruptcy or insolvency;

15.2.3 if CONTRACTOR makes a general assignment for the benefit of creditors;

15.2.4 if a trustee, receiver, custodian or agent of CONTRACTOR is appointed under applicable law or under contract, whose appointment or authority to take charge of property of CONTRACTOR is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of CONTRACTOR's creditors;

15.2.5 if CONTRACTOR admits in writing an inability to pay its debts generally as they become due;

15.2.6 if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.11

as revised from time to time);

15.2.7 if CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction;

15.2.8 if CONTRACTOR disregards the authority of ENGINEER; or

15.2.9 if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

DISTRICT may, after giving CONTRACTOR (and the surety, if there be one) seven days written notice and to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work, incorporate in the Work all materials and equipment stored at the site or for which DISTRICT has paid CONTRACTOR but which are stored elsewhere, and finish the Work as DISTRICT may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct, indirect and consequential costs of completing the Work (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and appeals costs) such excess will be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to DISTRICT. Such costs incurred by DISTRICT will be approved as to reasonableness by ENGINEER and incorporated in a Change Order, but when exercising any rights or remedies under this paragraph DISTRICT shall not be required to obtain the lowest price for the Work performed.

15.3 Where CONTRACTOR's services have been so terminated by DISTRICT, the termination will not affect any rights or remedies of DISTRICT against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies due CONTRACTOR by DISTRICT will not release CONTRACTOR from liability.

15.4 Upon seven days written notice to CONTRACTOR, DISTRICT may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such case, CONTRACTOR shall be paid for all Work executed and any expense sustained plus reasonable termination expenses, which will include, but not be limited to direct, indirect and consequential costs (including, but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and appeals costs).

CONTRACTOR May Stop Work or Terminate:

15.5 If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety days by DISTRICT or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment, without good cause, within thirty days after it is submitted, or DISTRICT fails for thirty days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days written notice to DISTRICT and ENGINEER, terminate the Agreement and recover from DISTRICT payment for all Work executed and any expense sustained plus reasonable termination expenses. In addition and in lieu of terminating the Agreement, if ENGINEER has failed to act on an Application for Payment or DISTRICT has failed to make any payment as aforesaid, CONTRACTOR may upon seven days written notice to DISTRICT and ENGINEER stop the Work until payment of all amounts then due. The provisions of this paragraph shall not relieve CONTRACTOR of the obligations under paragraph 6.29 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with DISTRICT.

ARTICLE 16 - CONFLICT/APPEALS RESOLUTION

16.1 Claims, disputes and other matters in question between DISTRICT and CONTRACTOR arising out of or relating to the work may be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect, provided that both parties must agree, in writing, to arbitration. No request for arbitration shall be made when a matter has been referred to the ENGINEER pursuant to Paragraph 9.11 until the earlier of - the date on which the ENGINEER renders his opinion or the tenth (10) day after the parties have presented their evidence to the ENGINEER and no written decision has been rendered by that time, or by mutual agreement of the parties.

16.2 Notice of a request for arbitration shall be filed, in writing, signed by both parties with the American Arbitration Association. A copy shall be served on the DISTRICT and CONTRACTOR Said request shall be made within a reasonable time after the claim, dispute or other matter in question has arisen. In no event shall the request for arbitration be made after the date and the applicable statute of limitations would bar institution of legal or equitable proceeding based on such claims, dispute or other matter in question.

16.3 The award rendered by an arbitrator shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction.

16.4 Unless otherwise agreed in writing, the CONTRACTOR shall carry on the work and maintain progress during any arbitration proceedings, and the DISTRICT shall continue to make payments in accordance with the contract documents to the CONTRACTOR. No arbitration arising out of or relating to the work shall include, by consolidation or joinder on any other manner, an additional person not a party to the contract between the DISTRICT and the CONTRACTOR except by written consent of that person containing specific reference to the work and signed by the DISTRICT, the CONTRACTOR and the persons sought to be joined. Consent to arbitration involving an additional person or persons shall not constitute consent to arbitration of a dispute not described or with a person not named therein. This provision shall be specifically enforced by any court of competent jurisdiction.

16.5 Nothing herein shall prevent the DISTRICT or the CONTRACTOR from proceeding with litigation, provided, however, any litigation hereunder shall be brought in the General Court of Justice in the 28th Judicial District of North Carolina.

ARTICLE 17--MISCELLANEOUS

Giving Notice:

17.1 Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

Computation of Time:

17.2.1 When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.2.2 A calendar day of twenty-four hours measured from midnight to the next midnight shall constitute a day.

General:

17.3 Should DISTRICT or CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph 17.3 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

17.4 The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon CONTRACTOR by paragraphs 6.30, 13.1, 13.12, 13.14, 14.3 and 15.2 and all of the rights and remedies available to DISTRICT and ENGINEER thereunder, are in addition, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. All representations, warranties and guarantees made in the Contract Documents will survive final payment and termination or completion of the Agreement.

TABLE OF CONTENTS

ARTICLE NUMBER	DESCRIPTION	PAGE
1	**PROJECT DESCRIPTION**	**2**
2	**PHYSICAL CONDITIONS/CONTRACT PLANS**	**2**
2.1	Physical Conditions	
2.2	Contract Plans	
3	**PROJECT COORDINATION**	**3**
3.1	Intent of Plans and Specifications	
3.2	Interpretation of Estimate	
3.3	Time of Completion	
3.4	Pre-Construction Conference	
3.5	Progress Meetings	
3.6	Utility Owners	
4	**USE OF EASEMENTS AND RIGHT OF WAY**	**7**
4.1	Right of Way Special Provision Detail Sheets and Easements	
4.2	Outstanding Easements	
5	**SPECIAL REQUIREMENTS**	**8**
5.1	Street Cut Permits and Project Access	
5.2	Maintenance of Traffic	
5.3	Miscellaneous Permits	
5.4	Pending Permit	
5.5	Duke Energy	

ARTICLE 1 - PROJECT DESCRIPTION

Scope of Work

1.1 The work to be performed shall consist of the construction of the ITT Pump Station Replacement project for the Metropolitan Sewerage District of Buncombe County, North Carolina. The project shall generally consist of the furnishing of all services, supplies, materials, and equipment, and performing of all labor for the construction of a new generally consisting of the furnishing of all services, supplies, materials, and equipment, and performing of all labor for the construction of a new 10-ft diameter duplex submersible sanitary sewer lift station (expandable to a triplex lift station), wastewater grinder inside a dedicated 5-ft diameter manhole, approximately 20 LF of 24-inch and 2,640 LF of 16-inch HDPE DR 11 force main (approximately 440 LF of which will be encased in a 24-inch HDPE DR 11 to be installed by horizontal directional drill across the French Broad River), approximately 550 LF of 12-inch and 410 LF of 24-inch PVC C900 gravity sewer, and 30 LF of 30-inch DIP gravity sewer, including manholes and all related appurtenances. The project also includes construction of approximately 800 LF of upper access road and an extension of the lower access road from the existing access road.

1.2 The work shall be performed under a single contract based on a lump-sum/unit-price bid schedule that includes specified allowances, and shall consist of furnishing all materials, supplies, and equipment; performing all labor and services incidental to or necessary for the complete construction of the project in accordance with the Plans and Specifications; and maintenance of each completed portion of the work until final acceptance of the entire project by the DISTRICT, unless otherwise approved by the ENGINEER.

ARTICLE 2 - PHYSICAL CONDITIONS/CONTRACT PLANS

2.1 **Physical Conditions.** SM&E conducted a geotechnical exploration of the project area. The associated geotechnical report (attached) was utilized in the preparation of these contract documents.

2.2 **Contract Plans.** The work shall be performed in accordance with these specifications and contract plans, which are incorporated herein as part of the contract and which are identified by the following numbers and titles:

Sheet No.	Description
G00.0	COVER
G01.0	LEGEND AND NOTES
CDE01.1	EXISTING SITE DEMOLITION
CDE04.1	EXISTING FORCE MAIN DEMOLITION
CDE05.1	GRAVITY SEWER DEMOLITION
CU04.1	FORCE MAIN PLAN AND PROFILE STA. 0+00.00 – STA.

	10+00.00
CU04.2	FORCE MAIN PLAN AND PROFILE STA. 10+00.00 – STA. 20+00.00
CU04.3	FORCE MAIN PLAN AND PROFILE STA. 20+00.00 – STA. 26+48
CU05.1	GRAVITY SEWER PLAN AND PROFILE STA. 0+00.00 – STA. 9+31
CS01.1	PROPOSED SITE PLAN
CS02.1	PROPOSED UPPER ACCESS ROAD PLAN
CS02.2	PROPOSED LOWER ACCESS ROAD PLAN 1 OF 2
CS02.3	PROPOSED LOWER ACCESS ROAD PLAN 2 OF 2
CS03.1	GRADING PLAN 1 OF 3
CS03.2	GRADING PLAN 2 OF 3
CS03.3	GRADING PLAN 3 OF 3
CE01.0	GENERAL NOTES AND SCHEDULES
CE01.1	EROSION CONTROL UPPER ACCESS ROAD PLAN
CE01.2	EROSION CONTROL LOWER ACCESS ROAD PLAN 1 OF 2
CE01.3	EROSION CONTROL LOWER ACCESS ROAD PLAN 2 OF 2
CE01.4	EROSION CONTROL FORCE MAIN CROSSING PLAN
CE02.1	EROSION AND SEDIMENTATION CONTROL DETAILS
CE02.2	NCG01 DETAILS
CE02.3	STREAM CROSSING DETAILS
M01.1	PUMP STATION PLAN
M01.2	PUMP STATION SECTION
M01.3	BYPASS CONNECTION DETAIL
M01.4	RECEIVING MANHOLE DETAIL
MD01.1	STANDARD DETAILS 1
MD01.2	STANDARD DETAILS 2
MD01.3	STANDARD DETAILS 3
S00.0	GENERAL NOTES & DESIGN CRITERIA
S01.0	PUMP STATION PUMP CRANE PLAN & SECTION
E00.0	GENERAL NOTES LEGENDS AND ABBREVIATIONS
E00.1	TYPICAL POWER AND CONTROL SYMBOLS
E01.0	PUMP STATION POWER AND CONTROL DIAGRAM
E02.0	PANELBOARD SCHEDULE AND LOAD TABLE
E03.0	TYPICAL INSTALLATION DETAILS
E03.1	EQUIPMENT RACK INSTALLATION DETAIL
E10.0	PUMP STATION POWER AND GROUNDING PLAN
E10.1	CLASSIFICATION PLAN & ELEVATION
I00.0	GENERAL NOTES 1 OF 2
I00.1	GENERAL NOTES 2 OF 2
I01.0	PROCESS AND INSTRUMENTATION DIAGRAM
I03.1	INSTRUMENT MOUNTING DETAIL I

ARTICLE 3 - <u>PROJECT COORDINATION</u>

3.1 Intent of Plans and Specifications

The intent of the Plans and Specifications is to prescribe a complete work that the CONTRACTOR undertakes to do in full compliance with the Contract. The CONTRACTOR shall do all work as provided in the Plans, Special Conditions Detail Sheets, Specifications and other parts of the Contract and shall do such additional, extra, and incidental work as may be considered necessary to complete the work in a satisfactory and acceptable manner. Any work or material not shown on the Plans or described in the Specifications, but which may be fairly implied as included in any item of the Contract, shall be performed and/or furnished by the CONTRACTOR without additional charge therefore. The CONTRACTOR shall furnish all labor, materials, tools, equipment and incidentals necessary to the prosecution of the work.

3.2 Interpretation of Estimate

The quantities of the work and materials shown on the Proposal form or on the Plans are believed to approximately represent the work to be performed and materials to be furnished and are to be used for comparison of bids. Payment to the CONTRACTOR will be made only for the actual quantities of work performed or materials furnished in accordance with the Plans and Specifications and it is understood that the quantities may be increased or decreased as hereinafter provided without in any way invalidating the bid prices.

3.3 Time of Completion

The CONTRACTOR shall commence work to be performed on the project under this agreement on a date to be specified in a written Notice to Proceed from the DISTRICT and shall duly complete all work under this agreement within **600 consecutive calendar days (20 months)** from said date. For each day in excess of the completion time limits specified above, the CONTRACTOR shall pay the DISTRICT the sum of Three Hundred Dollars ($300.00) as liquidated damages reasonably estimated in advance to cover the losses incurred by the DISTRICT by reason of failure of said CONTRACTOR to complete the work within the time specified, such time being in the essence of this Contract and a material consideration thereof.

3.4 Pre-Construction Conference

Prior to starting any construction work on this project, a conference will be held in the Construction Office of the DISTRICT for the purpose of verifying general construction procedures, expediting the handling of shop drawings and schedules, and to establish a working understanding between the parties concerned on the project. Present at the conference shall be a responsible representative of the CONTRACTOR and the CONTRACTOR's job superintendent. The time of the conference shall be as agreed upon by the CONTRACTOR and DISTRICT.

Per the Duke Energy Letter of No Objection (listed and attached below), CONTRACTOR shall inform Craig E. Garrett, Duke Energy Senior Asset Protection Program Manager, of pre-construction conference.

3.5 **Progress Meetings**

The CONTRACTOR and any subcontractors, material suppliers or vendors whose presence is necessary or requested shall attend meetings, referred to as Progress Meetings, when requested by the DISTRICT for the purpose of discussing the execution of the work. Each meeting will be held at the time and place designated by the DISTRICT. A schedule for monthly meetings will be agreed upon at the pre-construction conference. The ENGINEER will call for and schedule additional meetings if necessary. All decisions, instructions and interpretations made at these meetings shall be binding and conclusive on the CONTRACTOR and such decisions, instructions and interpretations shall be confirmed in writing by the DISTRICT.

The proceedings of these meetings will be recorded and the CONTRACTOR will be furnished with a reasonable number of copies for his use and for his distribution to the subcontractors' material suppliers and vendors involved.

3.6 **Utility Owners**

Utility owners within the vicinity of the Project may include, but are not limited to, those listed below. The CONTRACTOR shall contact N.C. OneCall Center for utility locations within public rights of way and easements before digging, as required by NC State Statutes.

Call NC OneCall Center, Inc. (locators for Buncombe County) at "811".

Utility / Agency		**Phone**
Asheville Dispatch City Road Closures		828-252-1122
Asheville		
Public Works Department		828-232-4567
Streets Division		828-259-5852
	Chad Bandy	828-782-0546
	Jerry Yates	828-778-8938
	Rick Gath	828-777-4053
Storm Water		828-259-5973
	Tony Chapman	828-777-5665
	Amy Deyton	828-782-0755

Water Department		828-259-5975
	Travis Mortier	828-778-0191
	Jeremy Godfrey	828-778-0953
	Michele Smith	828-777-3539
Asheville Transit Bus Lines		828-253-5691
AT&T Telephone Co.		877-737-2478
	Chip Lance	828-258-7058
	Jenny Stamey	828-251-8949
Black Mountain		828-669-8610
Public Works Director	Jamie Matthews	828-778-5525
Water Department		828-419-9300 x 1
Buncombe County Board of Education Transportation Department		828-232-4240
Buncombe Co. Emergency Services Fire, Police - NON EMERGENCIES ONLY County Road Closures		828-250-6650
Buncombe County Planning Director		828-250-4830
Charter Spectrum	Don Pullen	828-367-8763
	Karen Allison	864-598-0816
Dominion Gas		877-776-2427
	Richard Walsh	828-273-8446
Duke Energy	Guard House	828-687-5206
	Power Outages	800-827-5118
	Seth McFee	828-271-6271
ERC Fiber	Lewis Lance	828-350-2415 866-372-7110
M.S.D. of Buncombe County		
Construction Director		828-225-8262
Sewer Maintenance Division		828-255-0061
Norfolk Southern RR		
	James Peck	828-808-0366

NCDOT Highway Division	Nick Dorato	828-298-2741
Weaverville Town Hall		828-645-7116
Public Works		828-645-0606 x 400
Woodfin		
Street Department		828-253-4887
Water District		828-253-5551 x 8

ARTICLE 4- USE OF EASEMENTS AND RIGHT OF WAY

4.1 Right of Way Special Provision Detail Sheets and Easements

Easement widths are shown on the Plans and Easement Plats. The Plats (not to scale) are included at the end of the Specifications. If requested, scaled copies of the same will be provided to the CONTRACTOR. Exceptions to the typical details are shown as applicable on the Plans.

The CONTRACTOR shall comply with all provisions of the Special Provision Detail Sheet (SPDS) and easement agreement that may be applicable to his construction process or the general construction of this project.

Unless otherwise specified, all items in these SPDS shall be considered incidental to the construction of the Project. Any compensation to the CONTRACTOR for these items shall be included in the unit and/or lump sum prices bid, unless otherwise specified herein or listed in the Bid Schedule.

Five easements and one Special Provisions Detail Sheets (SPDS) for the following properties have been acquired and are attached at the end of this section.

- Henderson County (Parcel 9642-47-1366)
- UPM Raflatac, Inc. (Parcel 9642-27-5609)
- Wild River Corp (Parcel 9642-29-9794) (SPDS)
- State of North Carolina (French Broad River Subaqueous Crossing)
- Quality Point LLC (Portion of Parcel 9642-36-1779)

Two Right of Entries and two Special Provisions Detail Sheets (SPDS) for the following properties have been acquired and are attached at the end of this section.

- State of North Carolina (Parcel 9642-28-4413) (SPDS)
- Board of Trustees of The Endowment Fund of North Carolina State University at Raleigh (Parcel 9642-38-3057 & Parcel 9642-38-0737) (SPDS) (DRAFT)

4.2 Outstanding Easements

The temporary and permanent easement for a portion of the property owned by Quality Point LLC (Parcel 9642-36-1779) is still in the acquisition process. The DISTRICT anticipates obtaining full access by October 2026. The CONTRACTOR shall refrain from entering this property (and constructing the proposed upper access road) until a final easement is acquired and supplied by the DISTRICT.

ARTICLE 5 - SPECIAL REQUIREMENTS

5.1 Street Cut Permits and Project Access

NCDOT Roads

Per discussion with Troy S. Wilson, NCDOT District Engineer, no encroachment is needed to perform the work under and around Old Fanning Bridge. CONTRACTOR shall notify the office of Troy S. Wilson 72 hours in advance of crews starting work.

Troy S. Wilson, PLS
District Engineer
North Carolina Department of Transportation
District 14: District I – Henderson, Polk & Transylvania Counties
828-891-7911 (office)
D14-D1_Staff@ncdot.gov

City of Asheville Roads

Work performed within City of Asheville streets will require a street-cut permit. It shall be the CONTRACTOR's responsibility to obtain such permits prior to beginning work within said public right of way.

Other Municipalities

Work performed in other municipally-owned public roadways may require a street-cut permit. It shall be the CONTRACTOR's responsibility to obtain such permits prior to beginning work within said public right of way.

All costs associated with NCDOT Encroachments, street-cut permits, and their conditions/requirements shall be included within the various bid items, and no extra or separate payment will be made by the DISTRICT to the CONTRACTOR.

This also includes parking-meter closure fees, where there is an additional charge for existing parking meters on a closed public street.

Where the project work area is not within a Public Street or roadway, the CONTRACTOR shall use existing drives and parking lots as may be reasonable and necessary; however, he shall keep such usage to the minimum required and in

accordance to the terms and conditions of the DISTRICT's Right of Way Policy and the recorded Easement Agreement between the DISTRICT and the Property Owner(s).

The CONTRACTOR shall maintain reasonable access to all properties and drives during construction. Any trench excavations within drive or parking lot that is used for direct access to such property shall be backfilled and provided with an all-weather surface at the end of each day's work. Where the Property Owner SPDS specifies conditions different from the above, the SPDS shall take precedent.

5.2 Maintenance of Traffic

Access to homes and businesses shall be maintained at all times to the properties along and abutting streets disturbed by construction, unless otherwise approved by the ENGINEER. On streets disturbed by construction, a minimum of one lane (with flagmen) shall be maintained at all times and further provided that adequate signing and control is provided as required by the AASHTO MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS and NCDOT Guidelines.

All lane closures and traffic measures shall be coordinated with and meet the minimum requirements of each municipality. Flagmen shall be provided on each end of the closed section or at intermediate points where the closed section is in excess of 250' or where the line of sight is impaired.

5.3 Miscellaneous Permits

5.3.1 NCDEQ Fast Track Permit

A copy of approval and permit dated February 12, 2025, is attached. The CONTRACTOR shall review the permit thoroughly and comply with all conditions therein.

5.3.2 US Army Corps of Engineers Nationwide Permit

A copy of approval and permit dated April 3, 2025, is attached. The CONTRACTOR shall review the permit thoroughly and comply with all conditions therein.

5.3.3 Town of Mills River, NC Non-Residential Zoning Permit

A copy of approval and permit dated May 16, 2025, is attached. The CONTRACTOR shall review the permit thoroughly and comply with all conditions therein.

5.3.4 NCDEQ Erosion and Sedimentation Control Permit

A copy of approval dated June 3, 2026; Certificate of Approval; and accompanying email correspondence is attached. The CONTRACTOR shall review the approval and accompanying documentation thoroughly and comply with all conditions therein.

5.4 **Pending Permit**

5.4.1 Henderson County Electrical Trade Permit

5.5 **Duke Energy**

A copy of Letter of No-Objection (LONO) dated April 22, 2026, is attached. The CONTRACTOR shall review the approval thoroughly and comply with all provisions therein.

TECHNICAL SPECIFICATIONS

ITT PUMP STATION REPLACEMENT

Prepared for

Metropolitan Sewerage District of Buncombe County
2028 Riverside Drive
Asheville, NC 28804

Issued for Bid – Not Released For Construction

June 2026

Prepared by:

McKim & Creed, Inc.
35 N. Market Street, Asheville, NC 28801
NC# F-1222

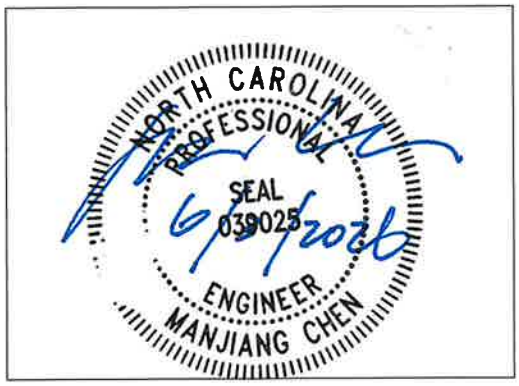
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TECHNICAL SPECIFICATIONS

for

ITT PUMP STATION REPLACEMENT

ISSUED FOR BID – NOT RELEASED FOR CONSTRUCTION



Division 00 – BIDDING REQUIREMENTS/CONTRACT DOCUMENTS

Division 01 – GENERAL REQUIREMENTS

Division 02 – SITE CONSTRUCTION

02065	Demolition and Removal
02071	Directional Boring
02213	Rock and Boulder Excavation
02221	Excavation, Bedding & Backfill for Pipe and Structures
02223	Stream Crossings
02521	Check Valves
02522	Eccentric Plug Valves
02524	Air Release and Air Relief Valves
02605	Manholes
02722	Sanitary Sewers
02723	Force Mains

Division 09 – FINISHES

Division 11 – EQUIPMENT

TECHNICAL SPECIFICATIONS

for

ITT PUMP STATION REPLACEMENT

ISSUED FOR BID – NOT RELEASED FOR CONSTRUCTION



Digitally signed by Patrick N. Hartman
Contact Info: phartman@mckimcreed.com
Date: 2026.06.02 12:13:11-04'00'

Division 02 – SITE CONSTRUCTION

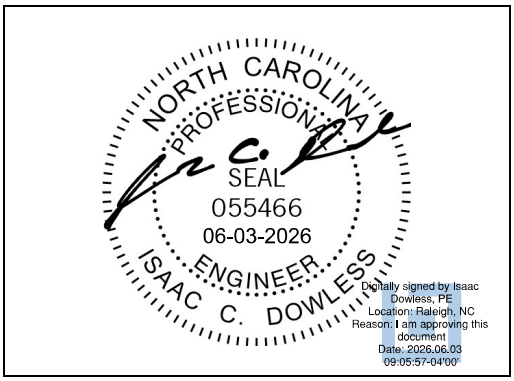
02110	Site Clearing
02140	Dewatering and Drainage
02224	Bank Stabilization
02410	Erosion and Sedimentation Control
02830	Precast Modular Block Retaining Walls
02831	Chain Link Fence and Gates
02930	Seeding and Planting

TECHNICAL SPECIFICATIONS

for

ITT PUMP STATION REPLACEMENT

ISSUED FOR BID – NOT RELEASED FOR CONSTRUCTION



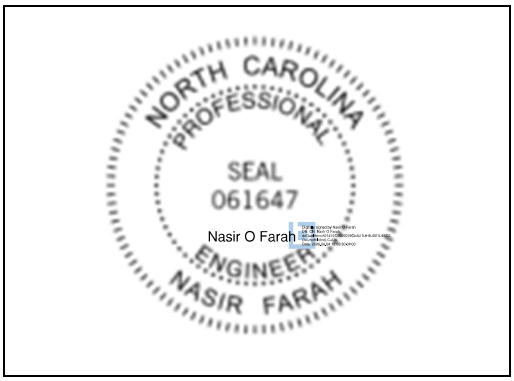
Division 03 – CONCRETE

TECHNICAL SPECIFICATIONS

for

ITT PUMP STATION REPLACEMENT

ISSUED FOR BID – NOT RELEASED FOR CONSTRUCTION



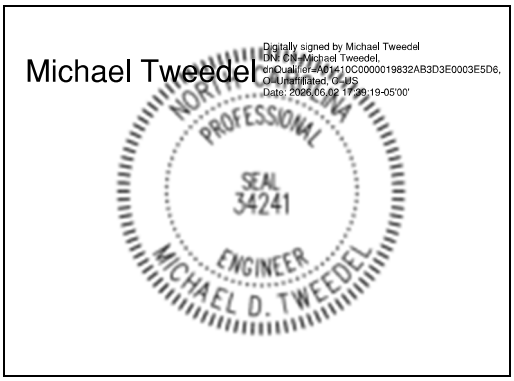
Division 16 – ELECTRICAL

TECHNICAL SPECIFICATIONS

for

ITT PUMP STATION REPLACEMENT

ISSUED FOR BID – NOT RELEASED FOR CONSTRUCTION



Division 17 – INSTRUMENTATION

SECTION 01010 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Project information.

2. Work covered by Contract Documents.

3. Access to site.

4. Coordination with occupants.

5. Work restrictions.

6. Specification and drawing conventions.

1.3 PROJECT INFORMATION

A. Project Identification:

1. Project Name: ITT Pump Station Replacement, MSD Project Number 2020061.

2. Project Location: 470 Broadpointe Drive, Fletcher, NC 28732

3. Owner: Metropolitan Sewerage District of Buncombe County

4. Engineer: McKim & Creed, 35 N Market Street, Asheville, NC 28801

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. The project includes but is not limited to procurement and installation of a new 10-ft diameter duplex submersible sanitary sewer lift station (expandable to a triplex lift station), wastewater grinder inside a dedicated 5-ft diameter manhole, approximately 20 LF of 24-inch and 2,630 LF of 16-inch HDPE DR 11 force main (approximately 440 LF of which will be encased in a 24-inch HDPE DR 11 to be installed by horizontal directional drill across the French Broad River), approximately 550 LF of 12-inch and 410 LF of 24-inch PVC C900 gravity sewer, and 30 LF of 30-inch DIP gravity sewer, including manholes and all related appurtenances. The

project also includes construction of approximately 800 LF of upper access road and an extension of the lower access road from the existing access road.

2. Bypass pumping will be required to ensure that there will be no interruption in the flow of wastewater throughout the duration of work related to piping tie-ins, facility connections, and new pumping station installation.

3. Contractor shall coordinate with Owner to ensure safe and reliable operation of the existing ITT pump station is maintained at all times during construction.

4. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

A. Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work.

B. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

1.6 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Engineer will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.

2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.

3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.

4. Upon occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.7 WORK RESTRICTIONS

A. On-Site Work Hours: Limit work to normal business working hours Monday through Friday as specified in General Conditions Article 2.10.

B. Existing Utility Interruptions, Noise, Vibration, and Odors: Do not interrupt utilities serving facilities occupied by Owner or without coordination with Owner. Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption with Owner. Notify Owner not less than two days in advance and obtain Owner's written permission before proceeding with utility interruptions or disruptive operations.

C. Controlled Substances: Smoking is prohibited on site.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 Precedence

A. In resolving inconsistencies precedence shall be given in the following order: Agreement, Special Conditions, General Conditions, Specifications – Division 01, Specifications – Divisions 02-17, and the construction drawings.

END OF SECTION 01010

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SECTION 01026 – MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This section covers methods of measurement and payment for items of Work under this Contract.

B. The total Bid amount shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction equipment and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the lump sum prices bid. All Work not specifically set forth as a pay item in the Bidding Schedule shall be considered a subsidiary obligation of Contractor, and all costs in connection therewith shall be included in the prices bid.

1.2 DEFINITIONS

A. Unit price is an amount proposed by Bidders, stated on the Bidding Schedule, as a price per unit of measurement for materials and/or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

B. Lump sum is an amount proposed by bidders, stated on the Bidding Schedule, as a price to include all materials, labor, etc. for work furnished and installed, complete and operational.

1.3 PERMITS AND TAXES

A. Refer to General Conditions paragraph 7.09 - Permits for payment of construction and license permits. The Contractor shall include costs of all construction permits and licenses in the bid.

B. Refer to General Conditions paragraph 7.10 - Taxes for payment of taxes. The Contractor shall include costs of state and local sales taxes in the Bid.

1.4 RETAINAGE

A. Refer to the Agreement.

1.5 EXCAVATION AND TRENCHING

A. Except where otherwise specified, the lump sum price bid for each item of Work which involves excavation or trenching shall include all costs for such Work. No direct payment shall be made for excavation or trenching. There shall be no separate payment for excavation and stabilization below grade, or special backfill for such excavation, unless specifically stated in the Measurement and Payment sections.

B. There shall be no separate payment for Rock Excavation associated with the Project.

C. All excavation work required for structures, not otherwise paid for as trenching, shall be considered to be a subsidiary obligation of Contractor; and the cost of such excavation shall be included in the prices bid for the structures.

1.6 MEASUREMENT AND PAYMENT

A. Bid Item 1: Mobilization

1. All work covered by this section will be paid for at the contract lump sum price for “Mobilization.” The lump sum bid price shall not exceed 3% of the total project bid.

2. Partial Payments for the item of “Mobilization” will be made with the first and second partial pay estimates paid on the contract and will be made at the rate of 50% of the lump sum price for “Mobilization” on each of these partial pay estimates.

B. Bid Item 2: 10’ Diameter Pre-Cast Submersible Lift Station w/ Grinder

1. Payment of the lump sum price for the Lift Station shall include, but not be limited to, full compensation for all labor, materials, tools, equipment and incidentals necessary for construction of the lift station complete, as shown inside the proposed pump station boundaries and as specified in the contract documents.

2. The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer’s verification.

C. Bid Item 3: Demolition and Abandonment of Existing Pump Station

1. Payment of the lump sum price for abandonment of the existing pump station shall include, but not be limited to, full compensation for all labor, materials, tools, equipment and incidentals necessary for limited demolition and abandonment of the existing pump station inside the pump station boundary as established by the existing fence including removal of tops of existing structures and filling of structures more than 3-ft below grade with stone, removal of generators, control panels, and pumps and conveyance to the Owner, and abandonment in place of associated gravity and force mains, as shown on the Drawings and as specified.

2. The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer’s verification.

D. Bid Item 4: Manholes

1. Bid Item 4a: Demolish and Remove Existing 4’ Diameter Gravity Sewer Manhole

    a) Payment of the unit price for demolition and removal of 4’ diameter precast concrete manholes not containing valves or other mechanical equipment shall include all work necessary to completely remove the precast concrete manhole as well as to cut and cap the existing downstream 12” gravity sewer main including but not be limited to excavation, compaction, backfill, shoring, dewatering, and disposal as required, in accordance with the contract documents.

    b) Payment shall be per manhole demolished.

2. Bid Item 4b: Demolish and Remove Existing 5’ Diameter Gravity Sewer Manhole

    a) Payment of the unit price for demolition and removal of 5’ diameter precast concrete manholes not containing valves or other mechanical equipment shall include all work necessary to completely remove the precast concrete manhole as well as to cut and cap the existing downstream 24” gravity sewer main including but not be limited to excavation, compaction, backfill, shoring, dewatering, and disposal as required, in accordance with the contract documents.

    b) Payment shall be per manhole removed.

3. Bid Item 4c: Abandon Existing 5’ Diameter Gravity Sewer Manhole

    a) Payment of the unit price for abandonment of 5’ diameter precast concrete manholes not containing valves or other mechanical equipment shall include all work necessary to completely remove the top 3’ of the existing precast concrete manhole and fill the remaining volume with non-compressible material as well as to cut and cap the existing downstream 24” gravity sewer main including but not be limited to excavation, compaction, backfill, shoring, dewatering, and disposal as required, in accordance with the contract documents.

    b) Payment shall be per manhole abandoned.

4. Bid Item 4d: Abandon Existing 4’ Diameter Air Release Valve Manhole

    a) Payment of the unit price for demolition and removal of 4’ diameter precast concrete manholes containing air release valves shall include all work necessary to completely remove the top 3’ of the precast concrete manhole and fill the remaining volume with non-compressible material as well as to cut and cap the existing 6” PVC force main entering and exiting the manhole, including but not be

limited to excavation, compaction, backfill, shoring, dewatering, and disposal as required, in accordance with the contract documents.

b) Payment shall be per manhole abandoned.

5. Bid Item 4e: Modify Existing Sewer Manhole

a) Payment of the unit price for modification of existing sewer manhole (MSD MH 49-481327) shall include, but not be limited to, plugging of existing 24” pipes, installation of new 8” pipe, grout filling and finishing of pipe, and all other necessary materials, work, and equipment required to complete modification to the existing sewer manhole.

b) Payment shall be per manhole modified.

6. Bid Item 4f: Modify Receiving MH 49-23725

a) Payment of the unit price for modification of receiving MH 49-23725 shall include, but not be limited to, core drilling for force main, installation of 24” HDPE force main and flexible manhole sleeve or entrance joint, low shrink hydraulic grout filling, finishing of pipe, installation of proposed bench, installation of concrete backstop, coating of manhole interior, and all other necessary materials, work, and equipment required to complete modification to the existing sewer manhole.

b) Payment shall be per manhole modified.

7. Bid Item 4g: Install 4’ Diameter Gravity Sewer Manhole

a) Payment of the unit price for 4’ diameter precast concrete manholes not containing valves or other mechanical equipment shall include excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

b) Payment shall be per manhole installed.

8. Bid Item 4h: Install 4’ Diameter Gravity Sewer Manhole with Vent Stack

a) Payment of the unit price for 4’ diameter precast concrete manholes with vent stack not containing valves or other mechanical equipment shall include excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

b) Payment shall be per manhole installed.

9. Bid Item 4i: Install 5’ Diameter Gravity Sewer Manhole

a) Payment of the unit price for 5’ diameter precast concrete manholes not containing valves or other mechanical equipment shall include excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

b) Payment shall be per manhole installed.

10. Bid Item 4j: Install 5’ Diameter Manhole with Air Release Valve on 16” HDPE Force Main

a) Payment shall be made for installation of two (2) 2” combination air release valves on 16” HDPE force main complete with valve, 5’ diameter vented manhole, corporation stop and tapping saddle, and all excavation, compaction, backfill, shoring, dewatering, and testing and inspection as required, in accordance with the contract documents.

b) Payment shall be per air release valve installed.

E. Bid Item 5: Gravity Sewer Mains

1. Bid Item 5a: Demolish and Remove Existing 24” DIP Gravity Sewer

a) Payment of the unit price for demolition and removal of 24” DIP gravity sewer main shall include all work necessary to completely remove the existing gravity sewer piping including but not be limited to excavation, compaction, backfill, shoring, dewatering, and disposal as required, in accordance with the contract documents.

b) Payment shall be per linear foot of gravity sewer pipe removed. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline

2. Bid Item 5b: Abandon Existing 24” PVC Gravity Sewer in Place

a) Payment of the lump sum price for abandonment of existing 24” PVC gravity sewer in place shall include, but not be limited to all labor and materials necessary for the abandonment of the existing 24” PVC gravity sewer outside its discharge manhole including excavation, backfill, cutting, capping, and abandonment of existing 24” PVC gravity sewer in place, as shown on the Drawings and as specified in the contract documents.

b) The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer’s verification.

3. Bid Item 5c: Abandon Existing 12” PVC Gravity Sewer in Place

a) Payment of the lump sum price for abandonment of existing 12” PVC gravity sewer in place shall include, but not be limited to all labor and materials necessary for the abandonment of the existing 12” PVC gravity sewer outside its discharge manhole including excavation, backfill, cutting, capping, and abandonment of existing 12” PVC gravity sewer in place, as shown on the Drawings and as specified in the contract documents.

b) The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer’s verification.

4. Bid Item 5d: Install 8” PVC Gravity Sewer

a) Payment of the unit price for 8” PVC gravity sewer installation shall include, but not be limited to, excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

b) Measurement shall be per linear foot of sewer installed. Pipe length shall be measured by actual linear feet in place measured along the

5. Bid Item 5e: Install 12” PVC Gravity Sewer

a) Payment of the unit price for 12” PVC gravity sewer installation shall include, but not be limited to, excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

b) Measurement shall be per linear foot of sewer installed. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline.

6. Bid Item 5f: Install 24” PVC C900 Gravity Sewer

a) Payment of the unit price for 24” PVC C900 Gravity Sewer shall include, but not be limited to, excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

b) Measurement shall be per linear foot of sewer installed. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline.

7. Bid Item 5g: Install 30” DIP Gravity Sewer with Ceramic Epoxy Liner

a) Payment of the unit price for 30” DIP Gravity Sewer with Ceramic Epoxy Liner shall include, but not be limited to, excavation, compaction, backfill, shoring, dewatering, surface repairs, testing,

and inspection as required, in accordance with the contract documents.

b) Measurement shall be per linear foot of sewer installed. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline.

F. Bid Item 6: Force Mains

1. Bid Item 6a: Abandon Existing 6” DIP Force Main on Bridge

a) Payment of the lump sum price for abandonment of existing 6” DIP force main shall include, but not be limited to all labor and materials necessary for the abandonment of the 360 LF of existing 6” DIP force main suspended from the bridge on Old Fanning Bridge Road including cutting, capping, and abandonment of existing 6” PVC force main on both ends of the bridge, as shown on the Drawings and as specified in the contract documents.

b) The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer’s verification.

2. Bid Item 6b: Abandon Existing 6” PVC Force Main at ARV Manholes and Existing Receiving Manhole

a) Payment of the lump sum price for abandonment of existing 6” PVC Force Main at ARV Manholes and Existing Receiving Manhole shall include, but not be limited to all labor and materials necessary for the abandonment of the existing 6” PVC force main outside of the ARV manholes and the existing force main receiving manhole including excavation, backfill, cutting, capping, and abandonment of existing 6” PVC force main, as shown on the Drawings and as specified in the contract documents.

b) The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer’s verification.

3. Bid Item 6c: Install 16” HDPE Force Main by Open Cut

a) Payment shall be made for installation of 16” DR9 HDPE force main with fittings and appurtenances including end connections, stream crossing, excavation, compaction, backfill, pipe bedding, shoring, dewatering, and testing and inspection as required, in accordance with the contract documents.

b) Payment shall be per linear foot of force main installed by open cut. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline.

4. Bid Item 6d: Install 24” HDPE Force Main by Open Cut

a) Payment shall be made for installation of 24” DR9 HDPE force main with fittings and appurtenances including reducer, end connection, excavation, compaction, backfill, pipe bedding, shoring, dewatering, and testing and inspection as required, in accordance with the contract documents.

b) Payment shall be per linear foot of force main installed by open cut. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline.

5. Bid Item 6e: Install 24” HDPE Casing w/ 16” HDPE Carrier Pipe Force Main by Horizontal Directional Drill

a) Payment shall be made for installation of 24” DR9 HDPE casing installed by horizontal directional drill complete with 16” DR9 HDPE carrier pipe. Payment shall include, but not be limited to, excavation, compaction, backfill, shoring, dewatering, insertion of carrier pipe, and testing and inspection as required, in accordance with the contract documents.

b) Payment shall be per linear foot of force main installed by horizontal directional drill. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline.

6. Bid Item 6f: Install Force Main Bypass Connection

a) Payment of the lump sum price for the force main bypass connection shall include all site clearing, grubbing, grading, removal of excess excavated materials from the site and disposal at approved locations, excavation, compaction, and all other necessary materials, work, and equipment required to complete installation in accordance with the contract documents.

b) The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer’s verification.

G. Bid Item 7: Site Development

1. Payment of the lump sum price for pump station site development shall include all site clearing, grubbing, grading, removal of excess excavated materials from the site and disposal at approved locations, excavation, compaction, and all other necessary materials, work, and equipment

required to complete sitework and other general construction items accordance with the contract documents.

2. The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer's verification.

H. Bid Item 8: Access Road

1. Payment of the lump sum price for access road construction shall include all site clearing, grubbing, grading, excavation, compaction, and all other necessary materials, work, and equipment required to complete construction of the access road.

2. The Contractor shall be paid based on percentage completion in accordance with the approved schedule of values, based on the percentage of labor and materials incorporated into the work for each payment item and upon and Owner and Engineer's verification.

I. Bid Item 9: Retaining Wall

1. Payment of the unit price for retaining wall shall include all clearing, grubbing, grading, excavation, compaction, tiebacks, rear wall drainage and all other necessary materials, work, and equipment required to complete construction of the retaining wall.

2. Payment shall be per linear foot of retaining wall installed at the locations shown on the contract drawings. Wall length shall be measured by actual linear feet in place measured along the top of wall.

J. Bid Item 10: Storm Water Installation

1. Bid Item 10a: 18" Concrete Headwall

a) Payment of the unit price for concrete headwall shall include, but not be limited to, wingwalls, apron, rebar, excavation, compaction, testing and all other necessary materials, work, and equipment required to complete installation of the headwall.

b) Payment shall be per headwall installed.

2. Bid Item 10b: 24" Concrete Headwall

a) Payment of the unit price for concrete headwall shall include, but not be limited to, wingwalls, apron, rebar, excavation, compaction, testing and all other necessary materials, work, and equipment required to complete installation of the headwall.

b) Payment shall be per headwall installed.

3. Bid Item 10c: 18” RC Pipe

    a) Payment of the unit price for 18” reinforced concrete pipe installation shall include, but not be limited to, excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

    b) Measurement shall be per linear foot of reinforced concrete pipe installed. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline.

4. Bid Item 10d: 24” RC Pipe

    a) Payment of the unit price for 24” reinforced concrete pipe installation shall include, but not be limited to, excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

    b) Measurement shall be per linear foot of reinforced concrete pipe installed. Pipe length shall be measured by actual linear feet in place measured along the pipe centerline.

5. Bid Item 10e: Concrete Spillway

    a) Payment of the unit price for concrete spillway construction shall include all concrete, rebar, joints, finishing and all other necessary materials, work, and equipment required to complete installation of the spillway.

    b) Payment shall be per concrete spillway installed.

6. Bid Item 10f: 4’ Diameter Storm Water Manhole

    a) Payment of the unit price for 4’ diameter precast concrete storm water manholes shall include excavation, compaction, backfill, shoring, dewatering, surface repairs, testing, and inspection as required, in accordance with the contract documents.

    b) Payment shall be per manhole installed.

7. Bid Item 10g: Modify Existing Storm Water Manhole

    a) Payment of the unit price for modification of existing storm water manhole shall include, but not be limited to, removal of existing pipe, installation of new pipe, grout filling and finishing of pipe, raising ring and cover to proposed elevation and all other necessary materials, work, and equipment required to complete modification to the existing manhole.

b) Payment shall be per manhole modified.

K. Bid Item 11: Electrical Improvements

1. Payment of the lump sum price for electrical improvements shall include all labor, materials, and equipment as necessary to construct the electrical work, as specified by the contract documents. The price shall include, but not be limited to:

a) Location, removal, and relocation of existing wiring, conduits, poles, and equipment as specified and shown on the drawings.

b) Furnishing and installing temporary power and control wiring, conduits, poles, and equipment as required to maintain operation of any and all existing facilities whose power supply may be affected by construction activities.

c) Electrical distribution panels, control panel installations, transformers, wires, conduits, poles, junction boxes, handholes, raceways, duct banks, disconnects, and lighting.

d) Installation and testing of grounding system.

e) Installation and testing of lightning protection system.

f) Testing and acceptance.

g) All other necessary materials, work, and equipment required to complete electrical installation in accordance with the contract documents, but not included as part of another bid item.

L. Bid Item 12: Erosion Control

1. Payment of the lump sum price for erosion control shall include all materials, work, and equipment necessary to furnish, install, and maintain erosion control measures required for the lawful completion of the construction, including but not be limited to silt fencing, stone outlets, inlet protection, rip rap aprons, establishing ground cover, and removal of erosion control measures at the completion of construction, as specified and shown on the drawings.

M. Bid Item 13: Instrumentation & Control Integration Allowance

1. Allowance for Instrumentation & Control Integration by CITI, Inc. for all labor, materials, and equipment as necessary for instrumentation & control integration, as specified by the contract documents. Contractor is responsible for the payment of this item. Any unspent portion of the allowance at the completion of the project will be credited back to the Owner. If the actual instrumentation & control integration cost exceeds the allowance, the Contractor shall provide documentation to support the

additional cost, and the Owner will compensate the Contractor for the difference.

N. Bid Item 14: Henderson County Electrical Trade Permit Fee Allowance

1. Allowance for Henderson County Electrical Trade permit fee required for the execution of the ITT Pump Station Replacement project, as specified in the contract documents. Allowance shall cover all costs associated with obtaining necessary electrical trade permit to perform the work outlined in the Contract. Contractor is responsible for the payment of this fee and for ensuring that required permit is obtained prior to the commencement of relevant work activities. Actual cost of the permit fee will be based on the actual fee assessed by the permitting authority. Any unspent portion of the allowance at the completion of the project will be credited back to the Owner. If the actual permit fee exceeds the allowance, the Contractor shall provide documentation to support the additional cost, and the Owner will compensate the Contractor for the difference.

1.7 ITEMS NOT PAID FOR:

A. **No payment will be made for any item not specifically listed in the Bidding Schedule.** All ancillary items required for a complete, functioning, treatment system installation will be the responsibility of the Contractor to include in the cost of line items listed on the Bidding Schedule. Specific items which will NOT be paid for include, but are not limited to the following:

1. **All excavation is unclassified**. Neither the Owner nor the Engineer assumes responsibility for subsurface conditions, including unyielding material, ground water, and existing utilities not indicated or show on the Drawings.

2. All Clearing, Grubbing, Grading, and Excavation shall be included in the cost of line items listed on the Bidding Schedule and no separate payment shall be made. This shall include storing of topsoil and disposal of debris. No additional payment will be made for any clearing or excavation outside areas indicated on plan sheets which may be required for installation of piping, structures, or equipment.

3. No additional payment for backfill or trench stabilization stone shall be made except where specifically noted above. Contractor shall be required to furnish acceptable bedding, fill, and stabilization materials as part of the total cost of work and no separate payment for these items will be made.

4. Repairing damaged utilities will be at the Contractor’s expense and no compensation therefore will be allowed.

5. Repairing of damaged facility roads will be at the Contractor’s expense and no compensation therefore will be allowed.

6. Shoring, bracing, sheeting, etc., installed where required for trench stabilization and protection of adjacent roads, utilities, and structures shall be included in the Base Bid and no separate payment will be made thereof.

7. No payment will be made for restocking fees incurred by the Contractor due to excess materials. Contractor is advised to include anticipated restocking fees for excess materials, including those due to unforeseen site conditions, in the total cost of work.

END OF SECTION 01026

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SECTION 01050 – FIELD ENGINEERING AND SURVEYING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field surveying services required for the project.

B. The Contractor shall furnish and set all necessary stakes to establish the lines and grades as shown on the Contract Drawings and layout each portion of the Work of the Contract.

1.2 QUALIFICATION OF SURVEYOR AND ENGINEER

A. All construction staking shall be conducted by or under the supervision of a North Carolina Registered Professional Land Surveyor. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the Owner.

1.3 SURVEY REFERENCE POINTS

A. Locate and protect all survey monumentation, property corners and project control points prior to starting work and preserve all permanent reference points during construction. All costs associated with the replacement of all survey monumentation, property corners and project control points shall be borne by the Contractor.

B. Make no changes or relocations without prior written notice to the Owner.

C. Report to Owner when any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

D. Require surveyor to replace project control points which may be lost or destroyed.

E. Establish replacements based on original survey control.

1.4 PROJECT SURVEY REQUIREMENTS

A. The Contractor shall establish temporary benchmarks as needed, referenced to data established by survey control points.

1.5 RECORDS

A. The Contractor shall employ a Professional Land Surveyor registered in the State of North Carolina to verify survey data and properly prepare record drawings per Section 01781 – Project Record Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01050

SECTION 01100 – SPECIAL PROJECT PROCEDURES

PART 1 – GENERAL

1.1 SLEEVES AND OPENINGS

A. The Contractor shall provide all openings, channels, chases, etc., and install anchor bolts and other items to be embedded in concrete, as required to complete the Work under this Contract, together with those required by subcontractors; and shall do all cutting and patching, except cutting and patching of materials of a specified trade

1.2 RELOCATIONS

A. The Contractor shall be responsible for the temporary relocation of structures, including but not limited to light poles, signs, sign poles, fences, piping, conduits, and drains, that interfere with the positioning of the Work as set out on the Drawings. The cost of all such temporary relocations shall be included in the Bid for the Project, and shall not result in any additional cost to the Owner. All such structures shall be returned as nearly as possible to their original location after the work is finished, unless a permanent change in location is identified in the contract documents.

1.3 OBSTRUCTIONS

A. The attention of the Contractor is drawn to the fact that during excavation at the Project site, the possibility exists of the Contractor encountering water, electrical, and/or other lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines so as to avoid damage to the existing lines. Should damage occur to an existing line, the Contractor shall repair the line at no cost to the Owner.

B. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the close proximity of excavation, are temporarily stayed in position while work proceeds in the vicinity of the pole; and that the utility or other companies concerned be given reasonable advance notice of any such excavation by the Contractor.

1.4 PROVISIONS FOR CONTROL OF EROSION

A. Sufficient precautions in accordance with Section 02410 shall be taken during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride, or other polluting materials harmful to humans, fish, or other life, into the supplies and surface waters of the State. Control measures must be adequate to ensure that turbidity in the receiving water will not be increased more than 10 nephelometric turbidity units (NTU), or as otherwise required by the State or other controlling body, in water used for public water supply or fish, unless limits have been established for the particular water. In surface water used for other purposes, the turbidity must not exceed 25 NTU unless otherwise permitted. Special precautions shall be taken in the use of construction equipment to prevent operations which promote erosion.

B. Erosion and sedimentation control shall conform to the requirements of the *North Carolina Erosion and Sediment Control Planning and Design Manual*.

1.5 PROVISIONS FOR THE CONTROL OF DUST

A. Sufficient precautions shall be taken during construction to minimize the amount of dust created. Wetting down the site may be required or as directed by the Engineer to prevent dust as a result of vehicular traffic.

1.6 ONSITE STORAGE

A. The Contractor's attention is invited to special storage requirements and possible charges for noncompliance of onsite storage requirements for materials and equipment as specified in Section 01600.

1.7 CONNECTIONS TO EXISTING SYSTEMS

A. The Contractor shall perform all work necessary to locate, excavate, and prepare for connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Engineer. The cost for this work and for the actual connection of the existing mains shall be included in the Bid for the Project, and shall not result in any additional cost to the Owner.

1.8 EXISTING UTILITY PROTECTION

A. Existing utilities are shown in their approximate locations. It shall be the Contractor's responsibility to locate and protect all utilities whether shown on the Drawings or not.

B. It shall be the Contractor's responsibility to contact utility companies at least 48 hours (two work days) before starting construction so maintenance personnel can locate and protect facilities, if required by the utility company.

1.9 WARRANTIES

A. All equipment supplied under these specifications shall be warranted by the Contractor and the equipment's manufacturers for a period of one year. Warranty period shall commence on the date of Owner acceptance.

B. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the unit and the unit shall be restored to service at no expense to the Owner.

C. The Contractor shall be responsible for obtaining equipment warranties in accordance with Section 01740 from each of the respective suppliers or manufacturers for all the equipment specified under Division 11.

D. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. In the event that the manufacturer is unwilling to provide a one year warranty

commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a two-year warranty starting at the time of delivery to the job site. This two-year warranty shall not relieve the Contractor of the one-year warranty starting at the time of Owner acceptance of the equipment.

1.10 FINAL GUARANTEE

A. All work shall be guaranteed by the Contractor for a period of one year from and after the date of acceptance of the Work by the Owner.

B. If, within the guarantee period, repairs, or changes are required in connection with guaranteed work, which, in the opinion of the Engineer, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall, promptly upon receipt of notice from the Owner and without expense to the Owner, do the following:

1. Place in satisfactory condition in every particular all of such guaranteed work and correct all defects therein.

2. Make good all damage to the building or site, or equipment or contents therefore, which, in the opinion of the Engineer, is the result of the use of materials, equipment, or workmanship which are inferior, defective or not in accordance with the terms of the contract.

3. Make good any work or material, or the equipment and contents of building, structure of site disturbed in fulfilling any such guarantee.

C. If the Contractor, after notice, fails within ten days to proceed to comply with the terms of this guarantee, the Owner may have the defects corrected, and the Contractor and his/her surety shall be liable for all expense incurred, provided; however, that in case of an emergency where, in the opinion of the Owner, delay would cause loss or damage, repairs may be started without notice being given to the Contractor, and the Contractor shall pay the cost thereof.

D. All special guarantees or warranties applicable to specific parts of the Work as may be stipulated in the Contract Specifications or other papers forming a part of this Contract shall be subject to the terms of this paragraph during the first year of life of each such guarantee. All special guarantees and manufacturers' warranties shall be assembled by the Contractor and delivered to the Engineer, along with a summary list thereof, before the acceptance of the work.

1.11 ARCHAEOLOGICAL FINDS

A. Notwithstanding anything to the contrary herein, in the event any archaeological artifacts within the Project are discovered during the course of the work, the Owner shall have and retain all right, title, and interest to such artifacts, and shall have the further right, during the course of the Contract, to examine or cause to have examined the site of the work for any such artifacts, and to perform or have performed archaeological excavations and all other related work to explore for, discover, recover, and remove such artifacts from the site of the work. In the event

the work or archaeological examination and related work delays the Contractor's work, he/she shall be entitled to an extension of time to complete the work equal to the number of days he/she is thus delayed. Such delay shall be considered an excusable delay as defined in the Supplementary Conditions.

1.12 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces as to eliminate direct contact and any resulting electrolysis. The insulating material shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other approved materials.

1.13 DAMAGE ON ACCOUNT OF HIGH WATER

A. The Contractor is informed that sections of this Project are located in or across the floodplain.

B. Contractor shall be responsible for all damage done to the work by heavy rains or floods, and shall take all reasonable precautions to provide against damages by building such temporary dikes, channels, or shoring to carry off stormwater as the nature of the work may require.

C. Contractor shall have at the work site a gasketed plug to insert in the pipe at night, over weekends, and whenever flooding is likely.

1.14 TOOLS

A. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation and maintenance of any equipment shall be furnished with the respective equipment.

1.15 EMERGENCY PHONE NUMBERS AND ACCIDENT REPORTS

A. Emergency phone numbers (fire, medical, police) shall be posted at the Contractor's phone and its location known to all.

B. Accidents shall be reported immediately to the Engineer by messenger or phone.

C. All accidents shall be documented, and a fully detailed written report submitted to the Engineer after each accident.

1.16 MAINTENANCE OF EXISTING UTILITY SERVICE OPERATION

A. The Contractor shall fully cooperate at all times with the Owner in order to maintain plant operation with the least amount of interference and interruption possible. Public health and safety considerations shall exceed all others; and the Contractor's schedule, plan and work shall at all times be subject to alteration and revision if necessary for public health and safety considerations.

B. Contractor shall take whatever precautions are necessary to maintain the flow of water and wastewater, electrical source, etc. where such operation is affected by the Contractor Work. Should a partial shutdown be unavoidable, Contractor shall notify the Owner 72 hours in advance.

C. In no case will the Contractor be permitted to interfere with any existing service until all materials, supplies, equipment, tools, and incidentals necessary to complete the work are on the job site.

D. The Engineer and the Owner reserve the right to require the Contractor to work 24 hours per day in all cases where interferences with existing utility service may result in health hazards, offensive conditions, or serious inconveniences to persons served by the system.

E. Thirty days prior to any interference with existing wastewater lines, the Contractor shall submit to the Engineer his/her proposed method for maintaining service. The submittal shall include text and drawings in sufficient detail to describe the method, a list of equipment to be used, and a schedule for completing the work. No interference with service shall be made until the Engineer approves the Contractor's method and schedule for completing the work.

F. Detailed Construction Sequence:

1. The Contractor shall prepare and submit a detailed construction sequence to maintain continuous treatment to allow the facility to meet the required effluent limitations. This plan shall require approval by the Owner before any of the existing facilities are modified.

2. The Contractor's progress schedule shall reflect the special project procedures described herein. In development of the detailed construction sequence, the Contractor shall give particular consideration to the following:

    a. Startup testing of proposed pump station and force main shall be completed prior to redirection of sanitary sewer flow to proposed pump station.

    b. To minimize bypass pumping, redirection of flow from 24" gravity sewer to proposed pump station after startup is recommended after proposed pump startup but prior to completion of proposed 12" gravity main between proposed manholes #1 and #6.

    c. Generator shall not be relocated from existing to new pump station until all gravity flow has been redirected to new pump station.

3. The following suggested sequence of construction is intended to illustrate the requirements for demolition, construction, and installation of the work as specified in the Contract Documents. This is not intended to be a complete list of all required construction activities but a guideline for the sequencing of work.

a. Construct upper access road, proposed pump station, and proposed 16” force main including necessary site grading while maintaining existing gravity flow through adjacent 24” main. Time limitations from the North Carolina State University Agricultural Extension for planting season apply. These date restrictions will be clarified and codified in the special provisions written during the ROW process.

b. Complete all startup testing of proposed pump station and force main prior to redirection of sanitary sewer flow to proposed pump station.

c. Plug 24” outlet of Manhole #49-479269 and pump all flow from 24” gravity sewer to proposed pump station wet well.

d. Install proposed Manhole #1, 24” gravity sewer connecting Manhole #49-479269 to Manhole #1, and 30” gravity sewer connecting Manhole #1 to grinder manhole. Plug Manhole #1 inlet from Manhole #2.

e. Remove plug and discontinue bypass pumping from Manhole #49-479269. Operation of new pump station shall be maintained hereafter.

f. Pump all flow from 8” gravity sewer from Manhole #49-55979 to Manhole #49-481328. Plug 24” outlet of Manhole #49-481328. Demolish existing 24” gravity sewer from Manhole #49-479269 to Manhole #49-481328.

g. Construct 24” and 12” gravity sewer between proposed Manhole #1 and proposed Manhole #4.

h. Modify Manhole #49-481327, install 8” PVC gravity sewer connection Manhole #49-481327 and Manhole #3. Discontinue bypass pumping from Manhole #49-55979. Demolish existing 24” gravity sewer between Manhole #49-481238 to the existing wetwell.

i. Plug 12” outlet of Manhole #49-481331 and pump all flow from 12” gravity sewer to Manhole #4.

j. Install Manhole #5, Manhole #6 and 12” gravity sewer connecting Manhole #4 to Manhole #6.

k. Demolish 12” gravity sewer between Manhole #6 and the existing wetwell.

l. Remove plug and discontinue bypass pumping from Manhole #49-481331.

m. Relocate generator from existing pump station site to new pump station site. Demolish existing pump station and abandon existing

force main in place.

1.17 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must meet local, state, and federal regulations. Work stoppage by the Owner for excessive noise shall not relieve the Contractor of the other portions of this specification.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.18 VIDEO RECORDING

A. Prior to commencement of any construction activity, the CONTRACTOR shall create and deliver to the Engineer/Owner a video recording in dvd, .avi, or .mp4 format showing the condition of the site prior to construction activity. The video recording shall be made using a hand held video camera of commercial quality and shall be carried over the entire project area. A running audio commentary shall be included pointing out important features such as nearby and impacted utilities, houses, structures, streams, wetlands, etc. Special care shall be taken to video record any structures within 100 feet of the proposed construction area. Video recordings shall take special note of outstanding landscaping, foundations, and any other features that may be impacted by construction.

1.19 RIGHT TO KNOW LAW

A. The Contractor shall submit to the Owner the Material Safety Data Sheets for all substances or mixture of substances used on the Project by him/her or his/her subcontractors prior to commencing any work.

1.20 WEATHER PROTECTION

A. In the event of inclement weather, the Contractor shall protect the Work and materials from damage or injury from the weather. If, in the opinion of the Engineer, any portion of the Work of materials has been damaged by reason of failure on the part of the Contractor to so protect the work, such work and materials shall be removed and replaced with new materials and work to the satisfaction of the Engineer.

1.21 CONSTRUCTION MOBILIZATION AREA

A. Contractor may use the property as a construction mobilization area subject to the time limitations shown in the easement.

B. If used, Contractor, as a part of his project mobilization, shall install and maintain a 6-foot high chain link fence and sediment and erosion control to protect mobilization areas.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01100

SECTION 01210 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.

1.2 RELATED DOCUMENTS

A. General provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract for materials, labor, fees, or appurtenances that have not yet been selected or fully specified. Selection of actual materials, labor, fees, or appurtenances to be postponed to a later date when direction will be provided to Contractor.

1.4 SELECTION AND PURCHASE

A. Contractor shall coordinate procurement and scheduling of allowance items to avoid impacts to the Project schedule. Contractor shall not substitute suppliers or systems without written approval of the Owner and Engineer.

1.5 SUBMITTALS

A. Submit proposals for purchase of products or systems in allowances in the form specified for Change Orders.

B. Submit documentation to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit documentation to show labor time and cost for installation of allowance items only where installation labor is expressly stated to be included in the allowance.

D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

E. Documentation shall be in a level of detail acceptable to the Engineer and Owner for review and verification. Proof of payment may be requested for audit purposes.

1.6 LUMP SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include taxes, freight, and delivery to Project Site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project Site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Engineer under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Installation labor associated with allowance items shall be included in the Contract Sum and shall not be reimbursable from the allowance unless specifically identified in the Schedule of Allowances.

D. No additional compensation for Contractor's overhead or profit shall be applied to allowance expenditures unless expressly stated in the Schedule of Allowances.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. Allowance values are included in the Base Bid and are identified in the Bid Schedule unless otherwise noted.

B. Allowance No. 1: Instrumentation & Control Integration Lump Sum Allowance

1. Included in the Base Bid total, the Owner has established an Instrumentation & Control Integration Allowance for use upon Owner's written instructions.

2. The Instrumentation & Control Integration Allowance shall be used at the sole discretion of the Owner and may not be drawn upon without written approval of the Owner. This allowance is intended to cover the integration of instrumentation & control measures into the Owner's existing control system by CITI System Integrator, the Owner's systems integrator. CITI has provided a quote for this work as shown in the bid schedule.

3. The use of this allowance will be issued with a Work Change Directive. The Work Change Directive must be approved by the Owner.

4. Contractor shall reasonably coordinate with the Owner's designated systems integrator. Contractor shall not be responsible for delays, additional costs, or rework caused solely by the performance, availability, or actions of the Owner's designated systems integrator, provided Contractor has complied with coordination requirements.

5. Contractor shall be entitled to an equitable adjustment in Contract Time for delays directly attributable to the Owner's designated systems integrator.

6. Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due to the Contractor on account of work authorized under the allowance, and the Contract Price shall be properly adjusted.

C. Allowance No. 2: Henderson County Building Permit Fee Lump Sum Allowance

1. Included in the Base Bid total, the Owner has established a Henderson County Building Permit Fee Allowance for use upon Owner's written instructions.

2. The Henderson County Building Permit Fee Allowance shall be used at the sole discretion of the Owner and may not be drawn upon without written approval of the Owner. This allowance is intended to cover the Henderson County Building Permit fee.

3. The use of this allowance will be issued with a Work Change Directive. The Work Change Directive must be approved by the Owner.

4. If the actual permit fee is less than the allowance amount, the unused balance shall be credited to the Owner by Change Order. Permit fees exceeding the allowance shall require prior written authorization from the Owner before payment.

5. Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due to the Contractor on account of work authorized under the allowance, and the Contract Price shall be properly adjusted.

END OF SECTION 01210

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SECTION 01260 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Agreement, General and Supplementary Conditions, and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 REQUIREMENTS INCLUDED

A. Promptly implement change order procedures.

1. Provide full written data required to evaluate changes.

2. Maintain detailed records of work done on a time-and-material/force account basis.

3. Provide full documentation to Engineer on request.

B. Designate in writing the member of Contractor's organization:

1. Who is authorized to accept changes in the Work.

2. Who is responsible for informing others in the Contractor's employ of the authorization of changes in the Work.

C. Owner will designate in writing the person who is authorized to execute Change Orders.

1.4 DEFINITIONS

A. Change Order: Refer to the General and Supplementary Conditions.

B. Construction Change Authorization: A written order to the Contractor, signed by Owner and Engineer, which amends the Contract Documents as described, and authorizes Contractor to proceed with a change which affects the Contract Sum or the Contract Time, for inclusion in a subsequent Change Order.

C. Field Order: A written order to the Contractor, signed by the Engineer and the Contractor, which is issued to interpret/clarify the Contract Documents, order minor changes in the work, or memorialize trade-off agreements. The work described by a Field Order is to be accomplished without change to the Contract Sum, Contract Time, or claims for other costs.

1.5 MINOR CHANGES IN THE WORK

A. Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on applicable MSD forms.

1.6 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Engineer are not instructions either to stop work in progress or to execute the proposed change.

2. Within 20 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute a change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

c. Include costs of labor and supervision directly attributable to the change.

d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use applicable EJCDC forms or other forms acceptable to the Engineer.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Engineer.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Section 01620 – Substitutions and Product Options if the proposed change requires substitution of one product or system for product or system specified.

7. Proposal Request Form: Use applicable EJCDC or other forms acceptable to the Engineer.

1.7 WORK CHANGE DIRECTIVE AUTHORIZATION

A. In lieu of a Request for Proposal (RFP), Engineer may issue a work change directive authorization for Contractor to proceed with a change for subsequent inclusion in a Change Order.

B. Authorization will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change; and will designate a method of determining any change in the Contract Sum and any change in Contract Time.

C. Owner and Engineer will sign and date the Work Change Directive Authorization as authorization for the Contractor to proceed with the changes.

D. Contractor may sign and date the Work Change Directive Authorization to indicate agreement with the terms therein.

1.8 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow Engineer to evaluate the quotation.

B. On request, provide additional data to support time and cost computations.

1. Labor required.

2. Equipment required.

3. Products required.

a. Recommended source of purchase and unit cost.

b. Quantities required.

4. Taxes, insurance, and bonds.

5. Credit for work deleted from Contract similarly documented.

6. Overhead and profit.

7. Justification for any change in Contract Time based upon impact to the approved, current project schedule. The Owner owns all float.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump sum proposal, plus additional information.

1. Name of the Owner's authorized agent who ordered the work, and date of the order.

2. Dates and times work was performed, and by whom.

3. Time record, summary of hours worked, and hourly rates paid.

4. Receipts and invoices for:

a. Equipment used, listing dates and times of use.

b. Products used, listing of quantities.

c. Subcontracts.

1.9 PREPARATION OF CHANGE ORDERS AND FIELD ORDERS

A. Engineer will prepare each Change Order and Field Order.

B. Forms: Engineer will use the applicable forms included in the Contract Documents.

C. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.

D. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

E. Field Order will describe interpretations or clarifications of Contract Documents, order minor changes in the Work, or memorialize trade-off agreements.

F. Field Order work will be accomplished without change in the Contract Sum, Contract Time, or claims for other costs.

1.10 LUMP SUM / FIXED PRICE CHANGE ORDER

A. Content of Change Orders will be based on either:

1. Engineer's Proposal Request and Contractor's responsive Proposal as mutually agreed between Owner and Contractor; or

2. Contractor's Proposal for a change, as recommended by Engineer.

B. Owner and Engineer will sign and date the Change Order as authorization for the Contractor to proceed with the changes.

C. Contractor will sign and date the Change Order to indicate agreement with the terms therein.

1.11 UNIT PRICE CHANGE ORDER

A. Content of Change Orders will be based on either:

1. Engineer's definition of the scope of the required changes;

2. Contractor's Proposal for a change, as recommended by Engineer; or

3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.

2. Those mutually agreed upon between Owner and Contractor.

C. When quantities of each of the items affected by the Change Order can be determined prior to start of the work:

1. Owner and Engineer will sign and date the Change Order as authorization for Contractor to proceed with the changes.

2. Contractor will sign and date the Change Order to indicate agreement with the terms therein.

D. When quantities of the items cannot be determined prior to the start of the work:

1. Owner and Engineer will issue a construction change authorization directing Contractor to proceed with the change on the basis of unit prices and will cite the applicable unit prices.

2. At completion of the change, Engineer will determine the cost of such work based on the unit prices and quantities used.

a. Contractor shall submit documentation to establish the number of units of each item and any claims for a change in Contract Time.

3. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

4. Owner and Contractor will sign and date the Change Order to indicate their agreement with the terms therein.

1.12 TIME AND MATERIAL / FORCE ACCOUNT CHANGE ORDER / WORK CHANGE DIRECTIVE AUTHORIZATION

A. Owner and Engineer will issue a Work Change Directive Authorization directing Contractor to proceed with the changes.

B. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article “Documentation of Proposals and Claims” of this Section.

C. Engineer will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.

D. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

E. Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.

1.13 CORRELATION WITH CONTRACTOR’S SUBMITTALS

A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time.

1. Revise sub-schedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01260

SECTION 01290 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Submit Applications for Payment to the Engineer in accordance with the schedule established by Conditions of the Contract and Agreement between Owner and Contractor.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Agreement, General and Supplementary Conditions, and other Division 01 Specification Sections, apply to this Section.

1.3 SUBMITTALS

A. Submit applications typed on forms provided by the Owner, with itemized data typed on 8-1/2-inch by 11-inch continuation sheets.

B. Provide itemized data on continuation sheets:

1. Format, schedules, line items, and values: Those of the Schedule of Values accepted by the Engineer.

C. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.

2. Schedule of values.

3. Contractor's construction schedule.

4. Schedule of unit prices (if applicable).

5. Submittal schedule.

6. List of Contractor's staff assignments.

7. List of Contractor's principal consultants.

8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

9. Initial progress report.

10. Certificates of insurance and insurance policies.

1.4 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

A. Application Form:

1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.

2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.

3. Execute certificate with signature of a responsible officer of Contract firm.

B. Continuation Sheets:

1. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.

2. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.

    a) Round off values to nearest dollar, or as specified for Schedule of Values.

3. List each Change Order executed prior to date of submission, at the end of the continuation sheets.

    a) List by Change Order Number and description, as for an original component item of work.

4. To receive approval for payment on component material stored onsite, submit copies of the original paid invoices with an application for payment.

1.5 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information, with a cover letter identifying:

1. Project.

2. Application number and date.

3. Detailed list of enclosures.

4. For stored products:

    a) Item number and identification as shown on application.

    b) Invoice with cost.

B. Submit one copy of data and cover letter for each copy of application.

C. As a prerequisite for payment, Contractor shall submit a “Surety Acknowledgment of Payment Request” letter showing amount of progress payment which the Contractor is requesting.

D. The Contractor shall maintain an updated set of drawings to be used as record drawings in accordance with Section 01781 – Project Record Documents. As a prerequisite for monthly progress payments, the Contractor is to exhibit the updated record drawings for review by the Owner and the Engineer.

E. The Contractor shall submit a Tax Statement and Certification with each application for payment on the forms provided.

F. Contractor’s progress schedule shall be up to date and complete as specified as a prerequisite for payment.

G. All Documents dealing with Inclement Weather, shall be submitted with the final payment request.

1.6 SUBSTANTIAL COMPLETION

A. After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for the portion(s) of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

3. Administrative actions and submittals that shall precede or coincide with this application include:

a) Occupancy permits and similar approvals.

b) Warranties (guarantees) and maintenance agreements.

c) Test/adjust/balance records.

d) Maintenance instructions.

e) Startup performance reports.

f) Changeover information related to Owner’s occupancy, use, operation, and maintenance.

g) Final cleaning.

h) Application for reduction of retainage and consent of surety.

i) List of incomplete Work, recognized as exceptions to Engineer's Certificate of Substantial Completion.

1.7 PREPARATION OF FINAL APPLICATION FOR PAYMENT

A. Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, included, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.

2. Completion of items specified for completion after Substantial Completion.

3. Transmittal of required Project Record Documents in accordance with Section 01781 – Project Record Documents.

4. Submittal of all Operation and Maintenance Manuals.

5. Removal of temporary facilities and services.

6. Removal of surplus materials, rubbish, and similar elements.

7. Insurance certificates for products and completed operations where required and proof that taxes, fees and similar obligations were paid.

8. Updated final statement, accounting for final changes to the Contract Sum.

9. Contractor's Affidavit of Payment of Depts and Claims.

10. Contractor's Affidavit of Release of Liens.

11. Consent of Surety to Final Payment.

12. Final liquidated damages settlement statement.

1.8 SUBMITTAL PROCEDURE

A. Submit Applications for Payment to the Engineer at the times stipulated in the Agreement.

B. Number: One electronic copy of each Application transmitted via email.

C. When the Engineer finds that the Application has been properly completed and correct, he/she will transmit a recommendation for payment to the Owner, with one copy to Contractor.

D. Applications for Payment will not be recommended for payment if the Contractor does not have an updated schedule for the basis of payment, and/or if all Record Drawings are not up to date and complete.

1.9 SCHEDULE OF VALUES

A. Coordination: Contractor to coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:

a) Application for Payment forms with continuation sheets.

b) Submittal schedule.

c) Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Engineer at earliest possible date but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values correlated with each element.

B. Format and Content: Use the Bid Form as a guide to establish line items for the schedule of values.

1. Identification: Include the following Project identification on the schedule of values:

a) Project name and location.

b) Name of Engineer.

c) Engineer's project number.

d) Contractor's name and address.

e) Date of submittal.

2. Arrange schedule of values consistent with format of EJCDC Document C-620.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a) Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01290

SECTION 01300 – PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 REQUIREMENTS INCLUDED

A. The Engineer shall schedule and administer preconstruction meeting, monthly progress meetings, and specially called meetings throughout progress of the Work. The Engineer will:

1. Prepare agenda for meetings.

2. Make physical arrangements for meetings.

3. Preside at meetings.

4. Record the minutes, including significant proceedings and decisions.

5. Reproduce and distribute copies of minutes after each meeting.

a) To participants in the meeting.

b) To parties affected by decisions made at the meeting.

B. Representatives of Contractors, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor and his onsite superintendent shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.3 PRE-CONSTRUCTION MEETING

A. The Engineer shall schedule a preconstruction meeting at any time after Notice of Award, but no later than 15 days after date of Notice to Proceed.

B. Location: A central site, convenient for all parties, designated by the Owner.

C. Attendance:

1. Owner’s Representative.

2. Engineer and his/her professional consultants.

3. Contractor’s Project Manager

4. Contractor’s Superintendent.

5. Major Subcontractors.

6. Major suppliers.

7. Utilities.

8. Others as appropriate.

D. Suggested Agenda:

1. Distribution and discussion of:

a) List of major subcontractors and suppliers.

b) Projected Construction Schedules.

2. Critical work sequencing.

3. Major equipment deliveries and priorities.

4. Project Coordination.

a) Designation of responsible personnel.

5. Procedures and processing of:

a) Field decisions.

b) Proposal requests.

c) Submittals.

d) Change Orders.

e) Applications for Payment.

6. Distribution of Contract Documents.

7. Procedures for maintaining Record Documents.

8. Use of premises:

a) Office, work, and storage areas.

b) Owner’s requirements.

9. Construction facilities, controls, and construction aids.

10. Temporary utilities.

11. Housekeeping procedures.

1.4 PROGRESS MEETINGS

A. Schedule regular periodic meetings. The progress meetings will be held approximately every 30 days with the first meeting approximately 30 days after the preconstruction meeting, or approximately 30 days after the date of Notice to Proceed.

B. Hold called meetings as required by progress of the Work.

C. Location of the meetings: Project field office of Contractor, Owner's office, or virtually if agreed upon by the Owner and Contractor.

D. Attendance:

1. Owner's Representative

2. Engineer and his/her professional consultants as needed.

3. General Contractor and onsite superintendent.

4. Subcontractors as appropriate to the agenda.

5. Suppliers as appropriate to the agenda.

6. Others as appropriate.

E. Suggested Agenda:

1. Review and approval of minutes of previous meeting.

2. Review of work progress for the last 30 days using the approved current CPM schedule. The General Contractor shall present a status report of the project with input from the other Prime Contractors seven days prior to the scheduled meeting.

3. Field observations, problems, conflicts.

4. Problems which impede Construction Schedule.

5. Review of offsite fabrication, delivery schedules.

6. Corrective measures and procedures to regain projected schedule.

7. Revisions to Construction Schedule.

8. Progress, schedule, during succeeding work period using the 30-day look-ahead schedule prepared by the General contractor.

9. Coordination of schedules.

10. Review submittal schedules; expedite as required.

11. Maintenance of quality standards.

12. Pending changes and substitutions.

13. Review proposed changes for:

    a) Effect on Construction Schedule and on completion date.

    b) Effect on other contracts of the Project.

14. Safety issues.

15. Critical/long lead items.

16. Other business.

F. The Contractor and his superintendent are to attend progress meetings, and are to study previous meeting minutes and current agenda items in order to be prepared to discuss pertinent topics such as deliveries of materials and progress of the Work, etc.

G. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01330 – Submittal Procedures.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01300

SECTION 01310 - PROJECT MANAGEMENT, PERMITTING AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1 General project coordination and administrative procedures.

2 Permits

3 Key personnel.

4 Requests for Information (RFIs).

5 Project meetings.

B. Related Sections:

1 Division 01 Section "Construction Progress Documentation".

2 Division 01 Section "Closeout Procedures".

1.3 COORDINATION

A. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule, and schedule of values.

2. Delivery and processing of submittals.

3. Progress meetings.

4. Startup and adjustment of systems.

5. Project closeout activities.

B. Permits

1. The Contractor shall obtain and pay for all plan review and approval, construction permits and licenses, including but not limited to all State, County, and local Code Enforcement, building permits, and licenses. The Contractor is also responsible for obtaining and paying for any and all other

permits and licenses required to perform the Work. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay governmental charges and inspection fees necessary for the prosecution of the Work which are applicable on the Effective Date of the Agreement.

1.4 KEY PERSONNEL

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including office, and cellular telephone numbers and email addresses.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI using EJCDC Forms acceptable to the Engineer.

1. Engineer will return RFIs submitted to Engineer by entities other than the Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to prevent delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Date, project name & project number

2. Name of Contractor and Engineer.

3. RFI number, numbered sequentially; and RFI subject.

4. Drawing number and/or Specification Section number, as appropriate.

5. Field dimensions and conditions, as appropriate.

6. Contractor's suggested resolution. ***If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.***

7. Contractor's signature.

8. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. Engineer’s Action: Engineer will review each RFI, determine action required, and respond. Allow fifteen working days for Engineer’s response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals or substitutions.

    b. Requests for information already indicated in the Contract Documents.

    c. Requests for adjustments in the Contract Time or the Contract Sum.

    d. Requests for interpretation of Engineer's actions on submittals.

    e. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.

3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.

D. On receipt of Engineer’s action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within 7 days if Contractor disagrees with response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at monthly progress meetings with the following information:

1. Project name.

2. Name and address of Contractor and Engineer.

3. RFI number including RFIs that were dropped and not submitted.

4. RFI description, date the RFI was submitted and date Engineer’s response was received.

5. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

6. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.6 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Engineer, within 5 days of the meeting.

B. Preconstruction Conference: Owner will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement.

1. Contractor shall have Start-up Construction Schedule distributed before this meeting per section “Construction Progress Documentation.”

C. Project Closeout Conference: Owner will schedule and conduct a Project closeout conference, at a time convenient to Owner and Engineer, but no later than 60 days prior to the scheduled date of Substantial Completion.

D. Progress Meetings: Owner will conduct progress meetings at monthly intervals.

1. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead, or behind schedule, in relation to Contractor's construction schedule. Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the minutes of each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01310

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Start-up construction schedule.

2. Contractor's construction schedule.

3. Upcoming work summary.

B. Related Sections:

1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.

1.3 SUBMITTALS

A. Format for Submittals: PDF electronic file.

B. Start-up construction schedule

C. Contractor's Construction Schedule

D. Upcoming Work Summary

1.4 QUALITY ASSURANCE

A. Provide preliminary schedule at preconstruction conference per Division 01 Section "Project Management and Coordination." Identify any constraints, long-lead items, and procedures for updating the schedule.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from Notice to Proceed to date of final completion.

B. Activities: Comply with the following:

1. Procurement Activities: Include procurement process activities for the long lead items and major items, requiring a cycle of more than 60 days,

as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.

3. Startup and Testing Time: Include not less than 15 days for startup and testing.

4. Milestones: To include, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

2.2 START-UP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit start-up horizontal bar-chart-type construction schedule within 7 days of date established for the Notice to Proceed. Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 30 days of construction

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, construction schedule within 30 days of the Notice to Proceed. Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

2.4 UPCOMING WORK SUMMARY

A. Prepare a brief summary indicating activities scheduled to occur in the next two-weeks, or to commence prior to submittal of next schedule update. At minimum, this shall be submitted electronically via email on a weekly basis to Engineer and Owner.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have occurred. Issue updated schedule concurrently with the report of each such meeting.

2. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

END OF SECTION 01320

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SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY, RELATED DOCUMENTS AND RELATED SECTIONS

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, and other submittals.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

C. Related Sections:

1. General Conditions Section "Payments to Contractor and Completion"

2. Division 01 Section "Submittals"

3. Division 01 Section "Project Record Documents"

4. Division 01 Section "Operation and Maintenance Data"

1.2 SUBMITTAL SCHEDULE

A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. If a start-up construction schedule is not required, delete first subparagraph below or revise to require initial submittal within 14 days of date established for commencement of the Work.

3. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

4. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

5. Format: Arrange the following information in a tabular format:

a. Scheduled date for first submittal.

b. Specification Section number and title.

c. Name of subcontractor.

d. Narrative Description of the Work covered.

e. Scheduled date for Engineer’s final release or approval.

f. Scheduled dates for purchasing and installation.

g. Activity or event number.

1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

4. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer’s receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

2. Resubmittal Review: Allow 7 days for review of each resubmittal.

3. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 14 days for initial review of each submittal.

C. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.

3. Include the following information for processing and recording action taken:

   a. Date and Project name.

   b. Name of Engineer, Construction Manager, Contractor, subcontractor, supplier, and manufacturer.

   c. Revise first subparagraph below to suit Project and office practice.

   d. Submittal number or other unique identifier, including revision identifier. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

   e. Number and title of appropriate Specification Section and/or drawing number.

   f. Location(s) where product is to be installed, as appropriate.

   g. Brief narrative description of item or equipment.

D. Options: Identify options requiring selection by the Engineer.

E. Deviations: Identify deviations from the Contract Documents on submittals.

F. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review received from sources other than Contractor.

1. Transmittal Form: Provide a form that includes date, project name, destination (To), source (from), subject, and signature of transmitter.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal and current revision in label or title block, and clearly indicate extent of revision.

2. Resubmit submittals until they are marked with “no exceptions taken” notation from Engineer’s action stamp.

H. Distribution: Furnish two paper copies of final submittals to Owner. Furnish additional copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Use only final submittals that are marked with “no exceptions taken” notation from Engineer's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections.

1. Submit one electronic copy in .pdf format, of each submittal, unless otherwise indicated.

2. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale, per the requirements of Section 01340 Submittals.

C. Contractor's Construction Schedule per Specification "Construction Progress Documentation."

D. Application for Payment per General Conditions Section "Payments to Contractor and Completion."

E. Schedule of Values per General Conditions Section "Payments to Contractor and Completion."

F. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product and Material Certificates: Submit written statements on manufacturer's letterhead certifying that products and materials complies with requirements in the Contract Documents.

I. Maintenance Data: Submit draft O&M Manuals with initial product submittal.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer. If Contractor stamps submittal indicating it meets the project specifications and the submittal does not meet project specifications, the Engineer will charge the Contractor the cost to review the submittal.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER’S ACTION

A. General: Engineer will **not** review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action required.

C. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

END OF SECTION 01330

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SECTION 01340 – SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL

A. Before any work is started at the job site, the Contractor shall make submittals to the Engineer in accordance with the requirements of this section. The Contractor shall be responsible for preparing a progress or work schedule for the project awarded. The Contractor shall process the shop drawings for all materials required by his work to the Engineer and he shall be responsible for their timely submission in accordance with the shop drawing schedule which is included in the overall progress or work schedule as described in this section.

1.2 SUBMITTALS

A. Submittals are defined as shop drawings, diagrams, illustrations, schedules, performance charts, brochures and other data prepared by each contractor which illustrate how specific portions of the work shall be fabricated and/or installed. Submittals and shop drawings are not part of the Contract Documents but are a supplementary means of communications to assist in understanding what each Contractor proposes to provide and to establish whether or not what he intends to install conforms to the drawing and specifications.

B. In the instance of a substituted item, the Contractor shall verify that it will fit into the space allocated to the originally required item giving due regard to all other trades' requirements. Where modifications to the Plans and Specifications are proposed, the Contractor must indicate such deviation in writing in his submittal.

1.3 SUBMITTAL PROCEDURES

A. Shall be per Section 01330.

1.4 DRAWINGS

A. Only drawings which have been checked or corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter conforms to the Plans and Specifications in all respects. Drawings which are correct shall be marked with the date, checker's name and certification of the Contractor's approval, and then shall be submitted to the Engineer. Any shop drawings submitted without the Contractor's certification will be returned without review.

B. The following information shall be provided with each submittal: A copy of the relevant specification section, with addendum updates included, with each paragraph check-marked (✓) to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right

of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specifications sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Shop drawings shall show the principal dimensions, weight and structural and operating features, performance characteristics and wiring and control diagrams, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. When it is customary to do so, when the dimensions are of particular importance or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct.

D. When so specified or if considered by the Engineer to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted for review in place of shop and working drawings. In such case, the requirements shall be as specified for shop and working drawings, insofar as possible.

E. The Contractor shall be responsible for the prompt submission of all shop and working drawings in accordance with the shop drawing schedule so that there shall be no delay to the work due to the absence of such drawings.

F. No material shall be purchased or fabricated until the required shop and working drawings have been submitted and reviewed. All materials and work involved in the construction shall then be as represented by said drawings.

G. The Engineer's review of shop and working drawings will follow a general check made to ascertain conformance with the design concept and functional result of the project and compliance with the information given in the Plans and Specifications. The Contractor is responsible for details and accuracy, for conforming and correlating all quantities and dimensions at the job site; for information that pertains to the fabrication processes or to techniques of construction; for coordination of the work of all trades; and for timely delivery of all materials so that the project will not be delayed.

1.5 PAYMENT FOR SUBMITTALS

A. Submittals are considered subsidiary to the contract and therefore shall be performed at no extra cost.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01340

SECTION 01400 – QUALITY REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality-control services.

B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Engineer.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified inspections, tests, Sand related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.

3. Requirements for Contractor to provide quality-control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

E. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 01320 – Construction Progress Documentation specifies requirements for development of a schedule of required tests and inspections.

2. Divisions 02 through 17 Sections for specific test and inspection requirements.

1.3 RESPONSIBILITIES

A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.

1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are to be included in the Contract Sum.

2. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will employ and pay an Owner selected qualified independent testing agency to perform those services. The Contractor shall assist the Owner by providing men and equipment for excavation of test pits, excavation for test pads for density tests and moving testing equipment around the project site as required.

B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements. The cost to repair, rework, or replace material or work indicated noncompliance shall be borne by the Contractor.

C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.

2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.

3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.

4. Provide facilities for storage and curing of test samples.

5. Deliver samples to testing laboratories.

6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

7. Provide security and protection of samples and test equipment at the Project Site.

D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Engineer and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Engineer and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

3. The agency shall not perform any duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 SUBMITTALS

A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Engineer. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:

a. Date of issue.

b. Project title and number.

c. Name, address, and telephone number of testing agency.

d. Dates and locations of samples and tests or inspections.

e. Names of individuals making the inspection or test.

f. Designation of the Work and test method.

g. Identification of product and Specification Section.

h. Complete inspection or test data.

i. Test results and an interpretation of test results.

j. Ambient conditions at the time of sample taking and testing.

k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.

l. Name and signature of laboratory inspector.

m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Protect construction exposed by or for quality-control service activities and protect repaired construction.

B. Repair and protection are the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 01400

SECTION 01410 – TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Owner shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or called out in the Specifications. Owner may elect to have materials and equipment tested for conformity with the Contract Documents at any time.

1. Contractor shall cooperate fully with the laboratory to facilitate the execution of its required services.

2. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the work of the Contract.

1.2 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

1.3 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or to Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The Owner may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor and no extra charge to the Owner shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.

2. To obtain and handle samples at the project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed due to insufficient notice, Contractor shall reimburse Owner for testing agency personnel and travel expenses incurred due to Contractor's negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the Owner.

H. If the test results indicate the material or equipment complies with the Contract Documents, the Owner shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01410

SECTION 01600 – DELIVERY, STORAGE, AND HANDLING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the general requirements for the delivery, handling, storage, and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item. Contractor shall be responsible for the safe storage of equipment and materials.

1.2 TRANSPORTATION AND DELIVERY

A. The Contractor and his Suppliers are directed to contact the North Carolina Department of Transportation to verify axle load limits on State maintained roads (and bridges) which are to be used for hauling equipment and materials for this project. The Contractor and his Suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to roads which may be attributed to this project.

B. All materials required to construct this project shall be furnished by the contractor and shall be delivered and distributed at the site by the Contractor or his material supplier.

C. Transport and handle items in accordance with manufacturer's instructions.

D. Schedule delivery to reduce long term onsite storage prior to installation or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.

E. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

F. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, and installing.

G. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors, and will not interfere with the flow of necessary traffic.

H. Provide necessary equipment and personnel to unload all items delivered to the site.

I. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e., Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally and in writing of any problems.

1.3 STORAGE AND PROTECTION

A. Store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer. Instruction shall be carefully followed and a written record of this kept by the Contractor. Arrange storage to permit access for inspection.

B. Store loose granular materials on solid flat surfaces in a well drained area. Prevent mixing with foreign matter.

C. Cement and lime shall be stored under a roof and off the ground, and shall be kept completely dry at all times. All structural, miscellaneous, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease; and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking, and spalling to a minimum.

D. All Mechanical and electrical equipment subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas), shall be stored in a weather-tight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. Building shall be equipped with adequate ventilation to prevent condensation. Temperature and humidity must be maintained in the range recommended by the manufacturer.

1.4 PAYMENT FOR STORED MATERIALS

A. No payment shall be made by Owner to Contractor for any equipment or materials which are improperly stored.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01600

SECTION 01620 – SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. This section covers furnishing of all labor, materials, tools, equipment, and performing all work and services for furnishing, submission, processing, and handling of requests for substitution and any product options. See items as indicated on drawings and as specified. Any substitution or option shall be in accord with provisions of Contract Documents, and completely coordinated with work of other trades.

2. Although such work is not specifically indicated, furnish all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.

3. See appropriate sections for specific items specified. See General Conditions for additional information.

B. Procedure:

1. For equipment and materials which are listed in the proposal, observe procedures outlined in Instructions to Bidders.

2. For products, equipment, and materials which are named in drawings or specifications for which a request for substitution is made, observe procedures outlined in these specifications.

C. Costs:

1. Costs incurred by requester in providing information, catalogs, and samples, including but not limited to labor, materials, freight postage, and transportation, are sole cost of “Requestor” with no cost assessed Owner or Engineer.

D. Although such work is not specifically indicated, furnish all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.

E. Address for submission:

MJ Chen, PE
Senior Project Manager
McKim & Creed, Inc.
mchen@mckimcreed.com
35 N Market Street
Asheville, NC 28801
828-252-8181

1.2 REQUESTS FOR SUBSTITUTION – GENERAL

A. Certain types of equipment and kinds of materials are described in specifications by means of trade names and catalog numbers, and/or manufacturer's names. Where this occurs, it was not intended to exclude from consideration such types of equipment and kinds of material bearing other trade names, catalog numbers, and/or manufacturer's names, capable of accomplishing purpose of types of equipment or kinds of material specifically indicated.

B. Other types of equipment and kinds of material may be acceptable to Owner and Engineer.

C. Types of equipment, kinds of material and methods of construction, if not specifically indicated, must be approved in writing by Engineer and agreed upon by Owner prior to letting of Contract.

D. No substitution permitted after letting of Contract, except as indicated herein.

E. Conditional bids will not be accepted.

1.3 SUBMISSION OF REQUESTS FOR SUBSTITUTION

A. After the Bid Advertisement and prior to Bid Opening, the Engineer will consider requests for substitutions of products, materials, systems, or other items. Requests must be received by Engineer within ten (10) calendar days after the date of Bid Advertisement. All requests for substitution shall be completed as specified below.

B. Substitute items must comply with color and pattern of base specified items unless specifically approved otherwise.

C. Submit request for substitution in writing via email to the contact information listed above. Include in request:

1. Name of product located by Drawing number or Specification number, followed by a detail or line number the particular item(s) for which request for substitution is initiated.

2. Complete data substantiating compliance of proposed substitution with Contract Documents.

3. For products:

a) Product identification by schedule or tag number, including manufacturer's name.

b) Manufacturer's literature, marked to indicate specific model, type, size, and options to be considered.

(1) Product Description.

(2) Performance and test data.

(3) Reference standards.

(4) Difference in power demand.

(5) Dimensional differences for specified unit.

c) Submit samples, full size if so required. Engineer reserves right to impound sample until physical units are installed on project for comparison purposes. All costs of furnishing and return of samples shall be paid by requester. Engineer is not responsible for loss of or damage to samples.

d) Name and address of similar projects on which product was used, date of installation, and field performance data on installation.

4. For construction methods:

a) Detailed description of proposed method.

b) Drawings illustrating methods.

5. Itemized comparison of proposed substitution with product or method specified.

6. A comparison of the impact on the Contractor's schedule between using the proposed substitution item and the specified product.

D. In making request for substitution, or in using an approved substitute item, Contractor/Supplier/Manufacturer represents:

1. He has personally investigated proposed product or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform function for which it is intended.

2. Will provide same or better warranty for substitute item as for product or method specified.

3. Will coordinate installation of accepted substitution into work, to include but not be limited to the following:

a) Building and structure modifications as necessary

b) Additional ancillary equipment to accommodate change

c) Piping, valving, mechanical, electrical, or instrumentation changes

d) All other changes required for work to be complete in all respects to permit incorporation of substitution into project.

4. Waives all claims for additional costs related to substitution which subsequently became apparent.

E. If a proposed product, materials, systems, or other items is deemed adequate by the Engineer, all Bidders of record will be notified by Addendum.

F. Rejection of alternates:

1. Acceptance will require substantial revision of Contract Documents or building spaces.

2. If they are in Engineer's opinion not equal to base product specified, or will not adequately perform function for which intended.

3. If request is not initiated by the Contractor in accordance with this specification section.

1.4 SUBSTITUTION AFTER CONTRACT AWARD

A. Unavailability of specified item due to strikes, lockouts, bankruptcy, discontinuance of production, proven shortage, or similar occurrences are only reasons for substitution after Contract award.

B. Notify Engineer in writing as soon as condition of unavailability becomes apparent. Include substantiating data. Submit request for substitution sufficiently in advance to avoid delays.

C. Submit data as required in section 1.3 above, in addition to the following information:

1. Data relating to changes in construction schedule.

2. Accurate cost data on proposed substitution in comparison with product or method specified.

3. Include with any request a specific statement defining changes in Contract Times or Amount.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01620

SECTION 01650 – DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the general requirements for the delivery, handling, storage, and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item. Contractor shall be responsible for the safe storage of equipment and materials.

1.2 TRANSPORTATION AND DELIVERY

A. The Contractor and his Suppliers are directed to contact the North Carolina Department of Transportation to verify axle load limits on State maintained roads (and bridges) which are to be used for hauling equipment and materials for this project. The Contractor and his Suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to roads which may be attributed to this project.

B. All materials required to construct this project shall be furnished by the contractor and shall be delivered and distributed at the site by the Contractor or his material supplier.

C. Transport and handle items in accordance with manufacturer's instructions.

D. Schedule delivery to reduce long term onsite storage prior to installation or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.

E. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

F. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, and installing.

G. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors, and will not interfere with the flow of necessary traffic.

H. Provide necessary equipment and personnel to unload all items delivered to the site.

I. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e., Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally and in writing of any problems.

1.3 STORAGE AND PROTECTION

A. Store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer. Instruction shall be carefully followed and a written record of this kept by the Contractor. Arrange storage to permit access for inspection.

B. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

C. Cement and lime shall be stored under a roof and off the ground, and shall be kept completely dry at all times. All structural, miscellaneous, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease; and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking, and spalling to a minimum.

D. All mechanical and electrical equipment subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas), shall be stored in a weather-tight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. Building shall be equipped with adequate ventilation to prevent condensation. Temperature and humidity must be maintained in the range recommended by the manufacturer.

1.4 PAYMENT FOR STORED MATERIALS

A. No payment shall be made by Owner to Contractor for any equipment or materials which are improperly stored.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01650

SECTION 01740 – WARRANTIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

B. Refer to the General and Supplementary Conditions for terms of the Contractor's period for correction of the Work.

1.3 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Warranties shall be in accordance with the Agreement, General and Supplementary Conditions, this Section, and Division 02 through 17 Sections for specific requirements for warranties on products and installations specified to be warranted.

B. All mechanical and electrical equipment together with devices of whatever nature and all components which are furnished and/or installed by the Contractor shall be guaranteed.

C. The guarantee shall be against the manufacturing and/or design inadequacies, materials, and workmanship not in conformity, improper assembly, hidden damage, failure of devices and/or components, excessive leakage, or other circumstances which would cause the equipment to fail under normal design and/or specific operating conditions for 1 year or such longer period as may be shown and/or specified from and after the date of Substantial Completion.

D. The Contractor shall replace and install each piece of equipment, device, or component which shall fail within the term specified above of the guarantee with reasonable promptness at no cost to the Owner. If the Contractor fails to provide timely repairs as specified in this Section, the Owner shall issue a claim against the Contractor's Bond. In some instances, if approved by the Owner, the Contractor may be allowed to repair the equipment.

E. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

F. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty and time shall be extended by one (1) year from the date of completion of the acceptable repair or replacement by Contractor.

G. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

H. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

I. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

J. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

K. Disclaimers and Limitations: Manufacturers disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.5 SUBMITTALS

A. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier, or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required

parties. Submit a draft to the Owner, through the Engineer, for approval prior to final execution.

C. Refer to Divisions 02 through 17 Sections for specific content requirements and particular requirements for submitting special warranties.

D. Form of Submittal: At Final Completion compile 3 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer.

E. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

F. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

G. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.

H. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01740

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SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to substantial completion, final completion and warranties.

B. Related Sections:

1. General Conditions

2. Division 01 Section "Project Record Documents"

3. Division 01 Section "Operation and Maintenance Data"

4. Divisions 02 through 17 Sections for specific closeout and requirements.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.

2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

3. Prepare and submit Project Record Documents and operation and maintenance manuals.

4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

5. Complete startup testing and functional testing of all equipment, systems, and instrumentation and controls.

6. Submit test/adjust/balance records.

7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued. Submit a request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION

A. Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to General Conditions Section "Payment Procedures."

2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Instruct Owner's personnel in operation, adjustment, and maintenance of equipment.

Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued. Submit a request for re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Submit list of incomplete items in PDF electronic format, and three paper copes.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents in an orderly sequence based on Project Manual table of contents.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION 01770

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SECTION 01781 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Submit marked-up Record Drawings of the Contract Document Drawings:

B. Related Sections:

1. Section 01050 – Field Engineering and Surveying.

2. Section 01770 – Closeout Procedures for general closeout procedures.

3. Section 01782 – Operation and Maintenance Data for operation and maintenance manual requirements.

4. Divisions 02 through 17 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.

2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal: Submit one PDF electronic file of marked-up record prints. Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal: Submit one paper copy set and one PDF electronic file of marked-up record prints. Print each Drawing, whether or not changes and additional information were recorded.

B. RFI Catalog: Comply with the following:

1. Catalog project RFI's in binder in chronological form.

2. Provide RFI TOC and reference RFI subject.

3. Provide tabs for each RFI item and include all supporting RFI documents and attachments.

   a. Initial Submittal: Submit two binders for review.

   b. Final Submittal: Submit two binders and one PDF electronic file of the same.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of clean, undamaged blue or black line white-prints of Contract Drawings on site for use as record prints. In addition, maintain a PDF electronic file format copy of the Contract Drawings for use as record prints.

   1. Preparation: Mark record prints to show the actual installation where installation varies substantially from that shown originally. Mark which drawing is most capable of showing conditions fully and accurately. Where shop drawings are used, record a cross-reference at the corresponding location on the contract documents. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

      b. Accurately record information in an acceptable drawing technique.

      c. Record data as soon as possible after obtaining it.

      d. Record and check the markup before enclosing concealed installations.

      e. Cross-reference record prints to corresponding archive photographic documentation.

      f. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.

   2. Content: Types of items requiring marking include, but are not limited to, the following:

      a. Dimensional changes in Drawings.

      b. Revisions to details shown on Drawings.

      c. Depths of foundations below first floor.

      d. Locations and depths of underground utilities.

e. Revisions to routing of piping and conduits.

f. Revisions to electrical circuitry.

g. Actual equipment locations.

h. Locations of concealed internal utilities.

i. Changes made by Change Order or Work Change Directive.

j. Changes made following Engineer's written orders.

k. Details not on the original Contract Drawings.

l. Field records for variable and concealed conditions.

m. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets using electronic annotation and drawing markup tools on an electronic copy of the Contract Drawings in PDF electronic file format using Adobe Acrobat or Bluebeam Revu.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Engineer determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

2. Consult Engineer for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Include identification on cover sheets.

2. Format: Annotated PDF electronic file

3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

4. Identification: As follows:

   a. Project name.

   b. Date.

   c. Designation "PROJECT RECORD DRAWINGS."

   d. Name of Engineer.

   e. Name of Contractor.

2.2 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittals in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file of marked up miscellaneous record submittals.

   1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer’s reference during normal working hours.

C. Review: Immediately before submitting each payment application and inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer.

END OF SECTION 01781

SECTION 01782 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation manuals for systems, subsystems, and equipment.

2. Product maintenance manuals.

3. Systems and equipment maintenance manuals.

B. Related Sections:

1. Division 01 Section "Submittal Procedures"

2. Divisions 02 through 17 Sections for specific operation and maintenance manual requirements.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

B. Format: Submit operations and maintenance manuals in PDF Electronic Format and three paper copies.

C. Initial Manual Submittal: Submit draft copy of each O&M manual with the initial equipment submittal.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.

2. Table of contents.

3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.

2. Name and address of Project and Owner.

3. Date of submittal.

4. Name and contact information for Contractor.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification

Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.

5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.

2. Performance and design criteria if Contractor is delegated design responsibility.

3. Operating standards.

4. Operating procedures.

5. Operating logs.

6. Wiring diagrams – showing complete terminal to terminal wiring routing.

7. Control diagrams – showing complete controls logic and sequencing

8. Piped system diagrams.

9. Precautions against improper use.

10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.

2. Manufacturer's name.

3. Equipment identification with serial number of each component.

4. Equipment function.

5. Operating characteristics.

6. Limiting conditions.

7. Performance curves.

8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.

2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.

2. Manufacturer's name.

3. Color, pattern, and texture.

4. Material and chemical composition.

5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.

2. Types of cleaning agents to be used and methods of cleaning.

3. List of cleaning agents and methods of cleaning detrimental to product.

4. Schedule for routine cleaning and maintenance.

5. Repair instructions with complete disassembly, repair, and reassembly instructions and illustrations.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and

source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.

2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

2. Comply with requirements of newly prepared record Drawings in Division 1 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

SECTION 02065 – DEMOLITION AND REMOVAL

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required for demolition, removal, and disposal of pipe, structures, equipment, and appurtenances shown or necessary to be removed for construction of the new work.

B. This section includes removal and disposal, to the extent indicated on the drawings, of the demolition of the existing equipment and structure components at the existing ITT Pump Station.

C. These specifications call attention to certain activities necessary to maintain and facilitate operation during and following construction, but do not purport to cover all of the activities necessary. The Contractor shall exercise due concern for utility system operation, and shall diligently direct all its activities toward maintaining continuous operation of existing facilities and minimizing operation inconvenience.

D. The work includes:

1. Complete removal where shown or necessary of existing pipe, equipment, and miscellaneous items, as shown on the Drawings, which are encountered in the way of the new work.

2. Modification of structures, equipment, appurtenances, and utilities as necessary for continued operation during construction.

3. Removal and offsite disposal of demolished materials.

1.2 CONDITION OF STRUCTURES

A. Information regarding existing conditions is provided for reference only. If conditions materially differ from those indicated, the Contractor shall notify the Engineer and may be entitled to an equitable adjustment.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations may occur prior to the start of demolition work.

C. This provision shall not modify or eliminate the Contractor's rights under the Differing Site Conditions provisions of Division 01 or the General Conditions.

1.3 RULES AND REGULATIONS

A. Comply with all applicable federal, state, and local codes and regulations, including OSHA requirements and governing environmental regulations.

B. No building or structure, or any part thereof, shall be demolished until an application has been filed by the Contractor with the Building Inspector and a

permit issued. The fee for this permit shall be the Contractor's responsibility unless such fees are specifically identified as an allowance in Division 01 or the Bid Schedule].

C. No blasting shall be done onsite unless specifically authorized in writing by the Owner/Engineer. The Contractor shall not store any explosives onsite.

1.4 DISPOSAL OF MATERIAL

A. The Owner will identify materials to be salvaged prior to demolition. Materials designated for salvage shall remain the property of the Owner and shall be carefully removed, protected, and stored as directed..

B. Materials not designated for salvage shall become the property of the Contractor and shall be removed from the site and legally disposed of.

C. The storage or disposal of removed items on the site will not be allowed.

D. All disposal costs shall be included in the Bid prices.

E. Hazardous materials, if encountered, shall be handled and disposed of in accordance with applicable federal, state and local regulations and Division 01 requirements. This Contract does not include hazardous material abatement unless explicitly indicated.

1.5 SUBMITTALS

A. Submit to the Engineer for review two (2) copies of proposed methods and operations of demolition and removal of piping and equipment, and modifications seven days prior to performance of the work. Include the coordination of shut-off, capping, and continuation of utility services as required.

B. Provide a detailed sequence of the demolition and removal work. Indicate disposal locations for materials not designated for salvage.

C. Contractor shall not begin demolition work until the Demolition Plan has been reviewed. Review shall not relieve the Contractor of responsibility for means, methods, or safety.

D. Approved demolition plans may cover phased or multiple removal operations unless otherwise directed by the Engineer.

1.6 TRAFFIC AND ACCESS

A. Conduct demolition, removal, and modification operations to ensure minimum interference with roads and other facilities and utilities.

B. Special attention is directed towards maintaining safe and convenient access to the existing facilities by operating personnel and associated vehicles.

1.7 PROTECTION

A. Conduct operations to preclude damage to adjacent buildings, structures, utilities, roadways, storm drainage, and other facilities that are to remain in service. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished, and adjacent facilities to remain.

1.8 DAMAGE

A. Promptly repair damage caused by demolition operations to other facilities that are to remain in service. Repair as directed by the Engineer and at no additional cost to the Owner.

1.9 UTILITIES

A. Maintain existing utilities and protect against damage during demolition operations.

B. Where maintenance is not practicable, provide temporary services during interruptions to existing utilities acceptable to the Engineer.

C. The Contractor shall cooperate with the Owner regarding utilities serving existing facilities affected by demolition operations.

D. The Contractor shall make all necessary arrangements and perform any necessary work involved in connection with the discontinuance or interruption of utilities.

1.10 POLLUTION CONTROL

A. Clean adjacent structures and improvements of all dust, dirt, and debris caused by demolition operations as directed by the Engineer. Return areas to conditions existing prior to the start of work.

1.11 SAFETY AND MEANS AND METHODS

A. The Contractor shall be solely responsible for demolition means, methods, techniques, sequences, and procedures.

B. The Contractor shall be responsible for the safety of personnel and protection of property during demolition operations.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DEMOLITION AND REMOVAL OF EXISTING STRUCTURES, EQUIPMENT, AND PIPING

A. Subject to the constraints of maintaining the existing utilities in operation, the Contractor shall demolish and/or remove existing structures, equipment, piping, and appurtenances as shown on the drawings, as necessary for construction of the new facilities, and as directed by the Engineer.

B. Utilities temporarily removed or relocated shall be reinstalled with equal or better materials as approved by the Engineer.

C. Ownership of removed materials shall be as specified in PART 1 – Disposal of Material.

3.2 HAULING

A. Hauling of removed materials for storage and disposal shall be performed in a manner meeting all applicable requirements. No mud, soil, or debris shall be deposited on paved roads. Trucks shall be kept clean and all loads covered to preclude loss during transport.

B. This Contract does not include abatement of hazardous materials unless specifically indicated. Encountered hazardous or controlled materials shall be addressed in accordance with Division 01 and applicable regulations.

3.3 RESTORATION

A. All areas where removals take place and all areas disturbed by the work shall be restored to equal or better than the preconstruction condition, as determined by the Engineer.

B. In paved areas, restoration shall be pavement as specified and shown on the Drawings.

C. In grassed or wooded areas, restoration shall comprise finish grading, preparation, liming, fertilizing, seeding and mulching, and creating a healthy cover of grass.

3.4 SCHEDULE AND COORDINATION

A. Coordinate demolition activities with the Project schedule and ongoing facility operations.

B. Sequence work to maintain continuous operation of existing systems.

C. Contractor shall be entitled to an equitable adjustment in Contract Time for delays caused solely by Owner-directed operational constraints not reasonably foreseeable.

END OF SECTION 02065

SECTION 02071 - DIRECTIONAL BORING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, protection of existing underground utilities and environmental protection and restoration.

B. The overall work scope shall include, but not be limited to steerable directional boring equipment, boring pits and equipment, sheeting, location signs as required, miscellaneous appurtenances to complete the entire Work as shown on the Contract Drawings, and restoration, including irrigation system replacement. Directional boring operations shall be performed within the right-of-way and/or easements shown on the Drawings.

C. The equipment used in directional boring shall be of adequate commercial size and satisfactory working condition for safe operation and may be subject to approval by the Owner at the discretion of the Engineer. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Drilling equipment shall be capable of a minimum of 150% of the anticipated drilling forces. The contractor shall be required to have access to a backup drilling rig of equal or greater pulling capacity which can be mobilized to the site in less than 24 hours after the documented failure. Only workmen experienced in directional boring operations shall be used in performing the Work.

D. Provide all structures, safety equipment, and professional services required to provide for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the regulatory agencies having jurisdiction.

E. Take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, and appurtenances from damage due to directional boring work. Responsibility and payment for correction of such damage shall be the sole responsibility of the Contractor.

F. The project schedule shall be established on the basis of working a normal work schedule including five days per week, single shift, and eight hours per day or four days per week, single shift, ten hours per day.

G. The Owner shall be notified 48-hours (minimum) in advance of starting the drilling work after Engineer approval of the Contractor's Installation Plan as required in 1.4 below. The Directional Bore procedure shall not begin until the proper preparations for the operation have been completed.

H. The Directional boring operation is to be operated in a manner to eliminate the discharge of water, drilling mud, and cuttings to the waterways or to the land areas involved during the construction process.

1.2 REFERENCE DOCUMENTS

A. American Society for Testing and Materials (ASTM).

B. American Water Works Associations (AWWA).

1.3 QUALIFICATIONS

A. Directional boring and pipe installation shall be done only by an experienced Contractor specializing in directional boring and whose key personnel have at least 5 years experience in this work, and the installation of similar size pipe.

B. All personnel shall be fully trained in the respective duties as part of the directional drilling crew and in safety. A supervisor thoroughly familiar with the equipment and type of work to be performed shall be in direct charge and control of the operation at all times. The supervisor shall be present at the job site during the actual directional bore operation. The contractor shall have a sufficient number of competent workers on the job at all times to ensure the directional bore procedure shall be made in a timely and satisfactory manner.

1.4 SUBMITTALS

A. INSTALLATION PLAN

1. Submit for review complete construction drawings and/or complete written description identifying details of the proposed method of construction and the sequence of operations to be performed during construction, as required by the method of tunnel excavation approved. The drawings and descriptions shall be sufficiently detailed to demonstrate to the Engineer whether the proposed materials and procedures will meet the requirements of this specification. Contractor shall submit arrangement drawings and technical specifications of the machine and trailing equipment.

    a. Complete details of the equipment, methods and procedures to be used, including but not limited to primary lining installation, timing of installation in relation to the excavation plan and sequence, proposed night work, maintaining access to residential and commercial properties, access for blocked driveways, pipe layout and staging, bulkheads, etc.

    b. Grouting techniques (if required), including equipment, pumping procedures, pressure grout types, mixtures and plug systems.

    c. Method of controlling line and grade of excavation.

    d. Details of muck removal, including equipment type, number, and disposal location.

e. Proposed contingency plans for critical phases and areas of directional drilling.

2. The Contractor shall describes the noise reduction program, contingency plan, solids control plant, pilot hole drilling procedure, use of conductor casing(s) if determined by the Contractor as required, the reaming operation, the pullback procedure, ballasting, use of rollers, sidebooms, side rollers, coating protection, internal cleaning, internal gauging, hydrostatic test, tracer wire testing, sheeting, shoring, dewatering, and gauging. All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.

   a. The contingency plan to be submitted shall describe the Contractor's proposed actions to the following events:

      i. Hydrofracture Plan

      ii. Loss of return or circulation of drilling fluids.

      iii. Pilot bore, reaming or product pullback obstruction.

      iv. Design line and grade deviations.

      v. Loss of drill pipe or product.

      vi. Product collapse.

3. The installation plan shall include a detailed plan and profile of the bores plotted at a scale no smaller than one inch equals 20 feet horizontal and one inch equals 5 feet vertical. The Contractor shall follow the pipeline alignment on the drawings with the exception of deviations proposed on the installation plan or pipeline adjustments during installation that are approved by the Owner and Engineer prior to implementation. The Contractor shall provide anticipated drilling rates for pilot bore, reaming, number of pipe segments and pullback procedures. These drilling rates shall be used to calculate drilling fluid volumes required for pilot hole, each reaming pass and pullback. The contractor shall guarantee pump capacity and that the drilling fluid cleaning system is capable of sustaining the anticipated drilling rates during the pilot bore, reaming and pullback. The Contractor shall have redundant or back-up equipment of at least equivalent size available within 24 hours or less.

4. The installation plan shall consist of drawings showing the proposed layout of equipment and product within the allowable work space and shall also include a listing of major equipment along with the resumes of the supervisory personnel to be used.

5. Quality Control Methods. At least 10 days prior to the start of directional drilling, Contractor shall submit a description of his quality control methods he proposes to use in his operations to the Engineer. The submittal shall describe:

a. Procedures for controlling and checking line and grade

b. Field forms for establishing and checking line and grade

6. The Contractor shall submit a detailed schedule for the HDD installation at least fifteen (15) days prior to HDD equipment mobilization. The detailed schedule shall identify all major construction activities and durations, with beginning and completion dates shown. The detailed schedule shall be updated at least every week or more frequently, as directed by the Engineer, and shall include but not limited to the following items:

   a. Pre-construction walk over and inspection.

   b. Regular Mobilization and set-up.

   c. Installation of conductor casing(s) (if required for successful installation)

   d. Pilot bore

   e. Pre-reaming and reaming.

   f. Layout and thermal butt fusing of pipe.

   g. Pressure testing of pipe prior to pullback.

   h. Final reaming and pullback of product pipe.

   i. Annulus grouting after installation (if required).

   j. Installation of temporary pig launch and receiving locations

   k. Pig test to confirm that deformations of product pipe are within allowable tolerances and to clean the line.

   l. Pressure testing of pipe after pullback.

   m. Cleanup, surface restoration, and demobilization.

7. A Frac-out and Surface Spill Contingency Plan shall be prepared for the installation of pipelines using HDD. This plan shall be submitted to the Engineer prior to construction. The Contractor shall submit a letter of intent signed by an authorized representative of the Contractor, confirming that the plan will be followed. The contingency plan for inadvertent returns/hydrofracture shall address all potential pathways for release of drilling fluid, and shall address containment, cleanup, and mitigation measures as well as reporting procedures and points of contact for the Contractor, Owner, regulatory and permitting agencies. The Plan shall address releases to the ground surface, wetlands, and to waterways as applicable. A list of the stand-by equipment, to be located on-site during the complete boring operation, shall be provided by the Contractor to

recover fluids from the waterway via truck and via boat. Floating turbidity barriers shall be part of the stand-by equipment to minimize dispersion in the event that drilling fluids reach the waterway.

8. Safety. Procedures including, but not limited to, monitoring for gases encountered shall be submitted as part of the Installation Plan.

B. DRILLING LOGS

1. The Contractor shall maintain and update daily an operator logbook. The logbook shall include the drill locator's notes and records of the bore from the steering and tracking system. The logbook should also include pipe diameter, depth, pitch, steering commands, drilling fluid circulation/volume and pressure, drilling fluid composition, ground conditions, date, time on-site, footage obtained during that day, pulling forces, torsional forces and any pertinent notes. The logbook shall be legible, accurate, and shall be submitted to the Owner upon completion of the work and made available throughout the installation process. Electrical drilling data logs shall be maintained as well.

C. MISCELLANEOUS

1. Detailed descriptions, information, and catalog cuts for HDPE pipe, fittings, and transition fittings, and drilling fluids shall be submitted.

2. Hazardous chemical list as well as all MSDS and technical data sheets.

PART 2 - PRODUCTS

2.1 DIRECTIONAL BORING EQUIPMENT

A. The directional boring equipment shall be suitable for installing pipe sizes shown on the Contract Drawings for the soil conditions presented in the geotechnical report.

B. The directional boring equipment shall be steerable by means of an electronic tool directional system with downhole magnetic wireline tracking system and shall provide bentonite clay slurry to completely seal around the installed carrier pipe.

C. Steel casing pipe shall not be required except when a conductor casing is determined as required by the contractor for successful HDD installation.

D. The contractor shall provide and maintain instrumentation necessary to accurately locate the pilot hole (both horizontal and vertical displacements), measure pilot string torsional and axial and measure drilling fluid discharge rate and pressure. The Owner shall have access to instrumentation and readings at all times during operation.

E. The Contractor shall provide all materials for completing the installation and for adequate protection of the work.

F. The casing pipe shall be 24” DR 11 DIPS HDPE with 16” DR 11 HDPE carrier pipe.

2.2 HIGH DENSITY POLYETHYLENE PIPE

A. HDPE Pipe – See Section 02723.

2.3 DRILLING PIPE

A. Drill pipe shall be API steel drill pipe, range 2, premium class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work.

2.4 BENTONITE DRILLING MUD

A. Bentonite technical criteria shall be as described in API Specification 13A, “Specification for Oil Well Drilling Fluids Material for fresh water drilling fluids.

B. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor’s drilling plan presented to the Owner. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.

2.5 PIPE TRACING WIRE

A. All pipe installed by directional boring shall be provided with tracing wire in accordance with Section 02723.

PART 3 - EXECUTION

3.1 GENERAL

A. A geotechnical report is included in Attachment A and boring locations are as indicated. The boring logs indicate the soil and groundwater conditions at the boring location at the time of the geotechnical investigation. Conditions may change away from the actual boring location and may change with time. The geotechnical report is made available to the Contractor for his information to be used at his own risk. The Contractor shall not assume that materials other than those reflected in the geotechnical borings will not be encountered or that the proportions and character of the various materials will not vary from those indicated in the boring logs. The Contractor is responsible for any conclusions to be drawn from the boring including the character of the materials to be encountered and the degree of difficulty to be expected in the performance of the work. The Contractor is encouraged to perform his own subsurface investigation if they deem necessary to understand the full extent of the drilling conditions and requirements.

B. The directional boring equipment shall be operated by individuals trained by the manufacturer as experienced operators.

C. The directional boring equipment shall produce a stable, clay sealed tunnel with a minimum burial depth of 36” for carrier pipe installation.

D. The directional boring equipment shall employ a fluid cutting technique. The soil shall be cut by small diameter, high pressure jets of liquefied clay. The jets shall cut the soil in advance of the boring tool, impregnating and lining the tunnel wall with clay. The clay shall be totally inert and pose no environmental risk. A pilot hole shall be drilled with an appropriately sized drill pipe. The pilot hole will then be increased to the appropriate diameter by a reaming operation. The boring tool will then be connected to the pipe, and the boring tool shall pull the carrier pipe through the clay lined tunnel as it traverses under the surface being crossed. The pulling strength of the boring equipment shall not exceed pipe safety pull strength as per manufacturer's recommendations. Surface excavations shall be limited to small launching and receiving pits. Pits shall be no larger than that required for launching and receiving. Adequate "pit-tail" lengths of service connection piping shall be provided at both the launching and receiving ends to facilitate service connection assembly.

E. The internal fusing beads within the 24" HDPE casing shall be removed prior to pullback to ease installation of 16" HDPE carrier pipe and maximize annular space clearance.

3.2 CONTROL OF THE DRILL LINE AND GRADE

A. Construction Control.

1. The Contractor shall establish and be fully responsible for the accuracy of his own control for the construction of the entire project, including structures, drill line and grade.

2. The Contractor's control points shall be established sufficiently far from the drilling operation not to be affected by construction operations.

3. The Contractor shall maintain daily records of alignment and grade and shall submit three copies of these records to the Engineer. However, the Contractor remains fully responsible for the accuracy of his work and the correction of it, as required.

4. The position of the drill string shall be monitored by the Contractor with the downhole survey instruments. Contractor shall compute the position in the X, Y and Z axis relative to an above ground undisturbed reference from downhole survey data a minimum of once per drill pipe length, 15 feet or 15 minutes whichever is more frequent. Serious deviations between the design positions which may affect the installation of the pipeline shall be documented and immediately brought to the attention of the Owner for discussion and/or approval. The profile and alignment designed on the construction drawings for the bores define the minimum depth and radius of curvature. The Contractor shall furnish a "Directional Bore Log" for each bore completed.

5. Between the entry or exit point the Contractor shall provide and use a steering system employing magnetic steering with wireline tracking such as Trutracker® or equivalent tracking system installed that completely encompasses the area between the entry and exit point including

subaqueous areas. The exit point shall fall within a 3-foot radius of the planned exit point and must be within right-of-way or easement.

6. The Contractor shall provide explanations of this position monitoring and steering equipment. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot bores shall be withheld from the Engineer.

3.3 REAMING

A. Upon approval of the pilot hole location by the Project Representative, the hole opening or enlarging phase of the installation shall begin. The borehole diameter shall be increased to accommodate the pullback operation of the pipe. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the Contractor's discretion. Final ream diameters less than 1.5 times the pipe O.D. must be approved by the Owner prior to initiating pullback. The hole shall be swabbed while recording pull back forces and torque to verify the hole is ready prior to pull back.

3.4 PIPE PULLBACK OPERATION

A. The pipes shall be laid out as shown in the drawings, and assembled in a manner that does not obstruct adjacent roads, public or private activities adjacent to the layout areas except as shown otherwise.

B. The Contractor shall provide adequate support/rollers along the stringing area to support the required length of the carrier pipe for each bore. Such support/rollers shall be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback while preventing overstressing or buckling.

C. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

D. Cuts, gouges or holes that penetrate the pipe wall thickness by more than 10 percent shall not be acceptable and shall be cut out and discarded. Before pipe installation, the Contractor shall be responsible for carefully inspecting the assembled pipeline to ensure that no vandalism or improper acts have occurred to render the new pipeline defective.

E. The maximum pull (axial tension force) exerted on the pipe shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not overstressed.

F. A swivel shall be used to connect the pipe and copper location wire to the drill pipe to prevent torsional stresses from occurring in the pipe.

G. The pipelines shall be adequately supported during installation so as to prevent buckling, kinking or overstressing.

H. The Contractor shall at all times handle the pipe in a manner that does not overstress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the pipe will be installed without damage.

I. During the pullback operation, the Contractor shall monitor roller operation and sidebooms if required to assist movement of the pipe. Surface damage shall be repaired by Contractor before pulling operations resume.

J. The lead end of the pipe shall be closed during the pull back operation.

K. After the carrier pipe is completely pulled through the tunnel, a sufficient relaxation period, as recommended by the specified pipe manufacturer, shall be provided prior to the final pipe tie-in.

L. The Contractor shall install, maintain, and leave in place any sheeting, underpinning, cribbing, and other related items (other than that required for the boring and receiving pits) to support any structure or facility affected by the boring operations. The Project Representative, depending upon existing conditions, may require that additional sheeting for the excavation be left in place.

M. Contractor shall hydrostatically test each line according to the Owner's required test procedures and these Technical Specifications. Pressure and temperature shall be monitored with certified instruments during the test. The requirements for testing shall be met.

3.5 HANDLING DRILLING FLUIDS AND CUTTINGS

A. During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. These fluids must not be discharged into the waterways. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

3.6 WATER

A. The Constructor will furnish water required for use in the HDD operations. The Contractor shall bear the cost of all water used for HDD operations.

3.7 NEARBY UTILITIES

A. The drawings show existing buried utilities that are believed to be near the directional drill alignment. There is no guarantee that these utilities are located as

shown or that other utilities may not be present. It will be the Contractor's responsibility to locate all nearby utilities or other subsurface obstructions that may interfere with the work by excavating windows on the pipeline alignment or other means.

B. The Contractor shall identify locations of existing sewer service laterals, water services, and stormwater underdrains prior to beginning drilling operations and shall avoid damaging the laterals, services and underdrains. Any damage caused by the Contractors work shall be replaced for repaired at the Contractor's expense.

C. The Contractor shall use caution to protect the existing force main during construction as it will remain active during open cut and HDD installation. The contractor shall be responsible for protecting the existing force main by means determined by the Contractor at no additional cost to the Owner.

3.8 RESPONSIBILITY

A. The Contractor shall be fully responsible for the steerable, clay lined directional drilling operation. Any noticeable surface defects resulting from operation of this boring equipment shall be repaired by the Contractor at his expense.

B. Surface settlement or heave of utilities or other feature above the HDD centerlines and within the zone influenced by the HDD construction shall be limited in values that avoid damage. The Contractor shall repair any damage resulting from settlement or heave caused by HDD activities at no additional cost to the Owner.

C. The Contractor shall maintain close observation to detect settlement, displacement, or hydrofracture of surface and adjacent facilities. The Owner shall be notified immediately if settlement, displacement, or hydrofracture is detected. The Contractor shall act to maintain safe conditions and prevent damage.

3.9 SUCCESSFUL COMPLETION

A. The Contractor shall be considered as having completed the requirements of any directional boring when he has successfully completed the work and tested the pipe to the satisfaction of the Owner.

END OF SECTION 02071

SECTION 02110 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of site clearing is shown on Drawings and limited to the depicted limits of disturbance. Contractor shall not disturb areas outside the limits of disturbance. Areas disturbed beyond these limits shall be restored at no additional cost to the Owner.

B. Site clearing work includes, but is not limited to:

1. Protection of existing trees outside of limits of disturbance.

2. Removal of trees and other vegetation.

3. Topsoil stripping.

4. Clearing and grubbing.

5. Removing above-grade improvements.

6. Removing below-grade improvements.

C. Site clearing shall be coordinated with Section 02065 – Demolition and Removal. Demolition of structures and equipment shall comply with Section 02065; clearing and grubbing operations are covered by this Section.

1.3 JOB CONDITIONS:

A. Traffic

Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements

Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect improvements on adjoining properties and on Owner’s property.

2. Restore damaged improvements to equal or better condition, as determined by the Engineer.

C. Protection of Existing Trees and Vegetation

Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark.

1. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to Engineer. Employ licensed arborist to repair damages to trees and shrubs.

2. Replace trees which cannot be repaired and restored to full-growth status, as determined by arborist and approved by the Engineer.

D. Salvable Improvements

1. Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

2. Salvable items shall remain the property of the Owner. Contractor shall be responsible for protection and handling of salvaged items until delivery to the designated storage location.

1.4 MEANS AND METHODS:

A. Contractor shall be solely responsible for means, methods, techniques, sequences, and procedures for site clearing operations.

B. Contractor shall be responsible for safety of personnel and protection of property during clearing operations.

1.5 UTILITIES

A. Verify location of existing utilities prior to clearing operations.

B. Protect utilities to remain in service.

C. Notify the Engineer immediately of conflicts or damage.

1.6 EROSION AND SEDIMENT CONTROL

A. Implement erosion and sediment control measures in accordance with the Contract Documents and applicable permits prior to commencing site clearing operations.

B. Maintain erosion and sediment control measures throughout construction.

1.7 CONTAMINATED OR UNSUITABLE MATERIALS

A. If contaminated or unsuitable materials are encountered, notify the Engineer immediately.

B. Do not proceed with work in affected areas until directed by the Engineer. Removal and disposal will be addressed as a change to the Contract unless otherwise specified.

C. Handling and disposal will be addressed in accordance with the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SITE CLEARING:

A. General

All site vegetation (i.e. trees and underbrush) within the planned construction areas shall be cleared, including their root systems and the surficial silty/organic topsoils. This clearing/stripping work shall be performed within and to a distance up to five (5) feet beyond the perimeter of the planned construction areas unless otherwise indicated on the Drawings or approved by the Engineer.

The perimeter areas may then need to be graded to help direct surface water runoff away from the planned construction areas.

Site clearing operations shall comply with applicable environmental regulations and approved erosion and sedimentation control plans.

B. Topsoil

Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material. Topsoil shall remain the property of the Owner unless determined unsuitable or excess and approved for disposal by the Engineer.

1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

2. Remove heavy growths of grass from areas before stripping.

3. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to the main root system.

4. Stockpile topsoil in storage piles in areas shown, or where directed.

5. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust.

6. Dispose of unsuitable or excess topsoil same as waste material, herein specified.

7. Where reuse of topsoil is indicated on the Drawings, stockpiled topsoil shall be preserved for reuse.

C. Clearing and Grubbing

Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

1. Completely remove all surface vegetation, debris and other deleterious materials including root systems and the surficial silty/organic topsoils.

2. Use only hand methods for grubbing inside the drip line of trees indicated to be left standing.

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

4. Clearing/stripping work shall be performed within the limits indicated, and up to five (5) feet beyond the construction area unless otherwise approved by the Engineer.

D. Removal of Improvements

Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated.

3.2 DISPOSAL OF WASTE MATERIALS:

A. Burning on Owner's Property

Burning is not permitted on Owner's property.

B. Removal from Owner's Property

Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off site in legal manner.

C. Dispose of all materials in accordance with applicable federal, state, and local regulations.

D. Provide documentation of disposal upon request by the Engineer.

END OF SECTION 02110

SECTION 02140 - DEWATERING AND DRAINAGE

PART 1 – GENERAL

1.1 SCOPE

A. Furnish, install, operate, monitor, maintain, and remove temporary dewatering and drainage systems as required to lower and maintain groundwater levels below subgrade of excavations. Prevent surface water runoff from entering or accumulating in excavations.

B. Furnish the services of a licensed professional engineer, registered in the State of North Carolina, to prepare dewatering and drainage system designs and submittals.

C. Collect and properly dispose of all discharge water from dewatering and drainage systems in accordance with State and local requirements and permits.

D. Repair damage caused by dewatering and drainage system operations.

E. Remove temporary dewatering and drainage systems when no longer needed. Restore all disturbed areas.

1.2 SUBMITTALS

A. Dewatering and drainage system designs shall be prepared by a licensed professional engineer, registered in North Carolina, having a minimum of 5 years of professional experience in the design and construction of dewatering and drainage systems.

B. Submit an original and three copies of the licensed professional engineer's certification, on the PE form specified in Section 01300, stating that the dewatering and drainage system designs have been prepared by the professional engineer and that the professional engineer will be responsible for their execution.

C. Do not submit dewatering and drainage system design calculations unless requested in writing.

1.3 DEFINITIONS

A. Where the phrase "in-the-dry" is used in these Specifications, it shall be defined as an excavation subgrade that is stable with no ponded water, mud, or muck and shall be able to support construction equipment without rutting or disturbance and shall be suitable for the placement and compaction of fill material, pipe or concrete foundations. Where requirements in this Section conflict with Section 02221, the more restrictive requirement shall govern.

PART 2 – PRODUCTS

2.1 GENERAL

A. Materials furnished under this Section shall be new, of first quality, and suitable for temporary dewatering and drainage applications. Where standards differ, the more restrictive requirement shall govern.

2.2 MATERIALS

A. Pipe for observation wells, if required, shall consist of a screen, casing, and cap. Casing shall be minimum 1-inch Schedule 80 PVC pipe, with machine-slotted PVC well-points. Maximum well-point slot size shall be 0.020 inch.

B. Observation wells, piping, pumps, and accessories shall be selected and sized by the Contractor's Professional Engineer to achieve required groundwater drawdown and system reliability.

PART 3 – EXECUTION

3.1 GENERAL

A. Control surface water and groundwater such that excavation to final grade is made in-the-dry, and bearing soils are maintained undisturbed. Prevent softening or instability of, or disturbance to, the subgrade due to water seepage.

B. Provide protection against flotation for all work.

C. The impact of anticipated subsurface soil/water conditions shall be considered when selecting methods of excavation and temporary dewatering and drainage systems. Where groundwater levels are above the proposed bottoms of excavations, a pumped dewatering system is expected for pre-drainage of the soils prior to excavation to final grade and for maintenance of the lowered groundwater level until construction has been completed to such an extent that the foundation, structure, pipe, conduit, or fill will not be floated or otherwise damaged.

D. Dewatering system shall maintain groundwater levels three (3) feet, or as required by the geotechnical report, whichever is more restrictive, below the bottom of excavation level at all times.

E. For NCDOT road crossings, pumps of sufficient capacity to handle flow shall be maintained at the site. The Contractor shall monitor groundwater levels throughout tunnel construction and employ additional means and methods if groundwater table is not maintained below the tunnel invert at the face. Pumps in the operation shall be constantly attended on a 24-hour basis until the operation can safely be halted.

3.2 SURFACE WATER CONTROL

A. Control surface water runoff to prevent flow into excavations. Provide temporary measures such as dikes, ditches, and sumps.

3.3 EXCAVATION DEWATERING

A. Provide and maintain adequate equipment and facilities to lower the groundwater table below the excavations; remove promptly and dispose of properly all water entering excavations. Excavations shall be kept in-the-dry, so as to maintain an undisturbed subgrade condition throughout construction below grade, including backfill and fill placement.

B. Collect precipitation or surface runoff in shallow ditches around the perimeter of the excavation, drain to sump, and pump from the excavation to maintain in-the-dry conditions.

C. Pipe and conduit shall not be installed in water or allowed to be submerged prior to backfilling. Pipe and conduit which becomes submerged shall be removed and the excavation dewatered and restored to in-the-dry conditions, and the installation re-performed at no additional cost to the Owner. Dewatering plans shall be coordinated with Section 02221 excavation and backfill requirements.

D. Excavations for foundations and structures shall be maintained in-the-dry for a minimum of 4 days after concrete placement. In no event shall water be allowed to enter an excavation and rise to cause unbalanced pressure on foundations and structures until the concrete or mortar has set at least 24 hours.

E. Dewatering and drainage operations shall, at all times, be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade at the bottom of the excavation and to preserve the integrity of adjacent structures. If the subgrade becomes disturbed for any reason, the unsuitable subgrade material shall be removed and replaced with concrete, compacted granular fill or other approved material to restore the bearing capacity of the subgrade to its original undisturbed condition.

F. Dewatering and drainage operations shall be conducted in a manner which does not cause loss of ground or disturbance to the pipe bedding or soil which supports overlying or adjacent structures.

G. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.

H. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.

I. Take all additional precautions to prevent uplift of any structure during construction.

J. Flotation shall be prevented by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.

K. All pumping equipment shall be electric motor driven or shall have an internal combustion engine with maximum noise of 85dBA at a distance of 10 feet from the

equipment. No internal combustion engines exceeding this noise limit shall be used between the hours of 5:00 p.m. and 8:00 a.m. The Contractor shall provide connections to a commercial power supply for electric motor-driven pumps or shall use generators meeting this noise limit.

L. Remove dewatering equipment after the system is no longer required.

3.4 DISPOSAL OF DRAINAGE

A. Dispose of all water discharged from temporary dewatering and drainage systems in accordance with the sedimentation and control plans as specified in drawings. Do not use existing or new sanitary sewer systems to dispose of drainage unless the written permission of the utility or property owner is obtained.

B. All water removed from the construction site shall be discharged through pipes or open ditches or trenches. Permission to use any storm sewers or drains from water disposal purposes shall be obtained from the authority having jurisdiction. Conform to any requirements and pay all costs for such. Do not cause flooding by overloading or blocking up the flow in drainage facilities. Leave the facilities unrestricted and as clean as originally found. Pay for and repair any damage to facilities to restore them to their original condition.

C. Take all necessary precautions to preclude the accidental discharge of fuel, oil, etc., in order to prevent adverse effects on groundwater quality.

END OF SECTION 02140

SECTION 02213 – ROCK AND BOULDER EXCAVATION

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform excavation and disposal of rock and boulders.

B. Blasting will be permitted only when specifically authorized in writing by the Engineer and all preparation requirements have been fulfilled.

C. Contractor shall secure all local, county, and state permits and licenses prior to commencing any blasting operations. Copies of approved permits and licenses shall be submitted to Engineer.

D. Contractor shall be responsible for damages resulting from blasting operations to the extent caused by Contractor's negligence.

1.2 RELATED WORK

A. Earth excavation and trenching is included in Section 02221.

1.3 DEFINITIONS

A. Rock excavation shall mean the removal of rock which, as determined by the Engineer based on the criteria specified herein, requires its removal drilling and blasting, wedging, sledging, or barring, and which cannot be removed by the following equipment:

1. Trenches – Tracked excavator with a bucket curling force of at least 18,300 pounds.

2. Boulders or masses of rock exceeding ½ cubic yards in volume which, as determined by the Engineer based on the criteria specified herein, require blasting for removal.

B. Rock which can be excavated at a reasonable rate with trench excavation equipment shall be considered as earth.

C. Boulders up to ½ cubic yard in volume which can be removed without resorting to blasting shall be considered as earth.

D. Loose rock, concrete, or other materials that can be removed by means other than drilling and blasting, but which for any reason the Contractor chooses to remove by drilling and blasting shall be considered as earth.

1.4 BLASTING SURVEY

A. Pre-blasting and post-blasting surveys shall be conducted by Contractor and reported for all major structures within the influence range of any blasting operations or within a minimum of **300** feet, whichever is greater from any blast

site. The surveys shall consist of a visual inspection and recording by notes and photographs of structures, to include specifically cracks or other structural damage previously sustained. Pre-blast surveys shall be performed by a third party entity other than the blasting agent, and qualified to perform such surveys. The preconstruction survey will not damage equipment or facilities.

A. The pre-blast survey shall consist of digital color photographs of all observable exterior and interior surfaces. The photographs shall be compiled in an electronic digital format acceptable to the Engineer and indexed, describing the location of each photograph to facilitate easy comparison of a given structures condition. Existing defects in structures shall be photographed and appropriately documented. The Contractor shall furnish a copy of the survey results, including photographs, to the Engineer, prior to beginning blasting operations.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Materials used for replacement, stabilization, or backfill associated with rock excavation shall conform to Section 02221 unless otherwise specified.

B. Structural fill shall be as specified in Section 02221.

C. Stone, aggregate, or granular materials used in connection with rock excavation shall conform to the NCDOT Standard Specifications for Roads and Structures, latest edition.

PART 3 – EXECUTION

3.1 ROCK QUANTITIES

A. Rock excavation shall be measured and paid for under the applicable unit price bid item as established in the Bid Schedule.

B. Rock quantities shall be determined by the Engineer based on auger boring performed by the Contractor and reviewed by the Engineer.

C. Auger borings shall be performed by Contractor using a truck or track mounted auger capable of drilling a four-inch diameter hole.

D. Contractor shall perform auger borings at a maximum of 25-foot intervals along the pipe centerline and at each manhole or structure.

E. Contractor shall record the depth of the rock layer at each boring and the ground elevation at each bore hole based on survey control provided by Engineer and shown on the plans.

F. Contractor shall correlate auger boring data with the excavation capabilities of a backhoe having a bucket curling force of at least 18,300 pounds. If the specified excavator is capable of excavating rock to depths lower than the auger penetration, the rock profile shall be adjusted by the difference in depth.

G. Upon completion of rock profiling, Engineer shall prepare a spreadsheet establishing rock quantities for payment purposes along the pipe centerline. The quantity spreadsheet shall be used as the basis for progress payment estimates for rock excavation as work progresses.

H. Final quantities for payment shall be subject to verification based on actual excavation conditions in accordance with the Contract.

I. Where boulders in excess of 1.0 cubic yards are encountered in the excavation that were not shown in the ledge rock profile, additional compensation shall be provided, based on the actual size of such boulders excavated using the unit prices stated in the Bid.

J. There shall be no adjustment in compensation for excavation of boulders less than 1.0 cubic yards in volume, regardless of the aggregate total volume or quantity of such boulders encountered.

3.2 BLASTING

A. Prior to commencing any blasting operations, the Contractor shall notify the Engineer and the official from the list below (if applicable) and obtain blasting permits as required. The Contractor must furnish certification of insurance specifically covering any and all obligations assumed pursuant to the use of explosives.

BLASTING PERMITS:

City of Asheville	FIRE MARSHAL (828-259-5636)
Biltmore Forest	PUBLIC WORKS DIRECTOR (828-274-3919)
Black Mtn. & Montreat	FIRE DEPT. (828-669-8074)
Town of Weaverville	FIRE MARSHAL (828-645-3500)
Buncombe County	FIRE MARSHAL (828-250-6620)
Town of Woodfin	TOWN MANAGER (828-253-4887)
Town of Mills River	FIRE AND RESCUE (828-891-7959)
Town of Fletcher	FIRE DEPT. (828-684-0864)
Henderson County	FIRE MARSHAL (828-698-6161)

B. Obtain all required permits from authorities having jurisdiction prior to blasting operations.

C. Contractor shall not blast within any rights-of-way maintained by a public agency without approval from the controlling agency and only in accordance with their respective requirements.

D. All blasting operations shall be conducted by qualified persons in full compliance with all laws, regulations, local ordinances, and with all possible care to avoid injury to persons and property. At least 24 hours in advance, notice shall be given in writing to all tenants and residents within 2,000 feet of the work before blasting.

E. Care shall be taken to avoid damage to utilities or other structures above and below ground. Notify authorized representatives of all utilities which might be affected by blasting operations at least 24 hours before any blasting is performed. Unless otherwise permitted, no blasting will be allowed prior to 8:00 AM or after 4:00 PM, local time.

A. In general, blasting for removal of rock along the pipe centerline shall be done prior to any trench excavation. Where the initial blasting fails to fracture rock so that trench excavation can be performed, additional spot drilling and blasting may be authorized. In such cases, all affected areas shall be covered by suitable blasting mats to limit the spread of rock/soil.

F. Storage, handling, and use of explosives shall comply with all applicable regulations and approved safety procedures.

G. If rock below the intended blasting grade is shattered by blasting, caused by holes drilled too deep, or too heavy charges of explosives or any other circumstance due to blasting; and if, in the opinion of the Engineer, the shattered rock is unfit for subgrade, the rock shall be removed and the excavation refilled with structural fill at no additional cost to the Owner.

3.2 BLASTING MONITORING

A. Seismographs shall be set at adjacent structures and other areas designated by the Engineer for monitoring blasting. Blast monitoring shall be conducted by persons trained in the use of seismographs, records shall be analyzed, and results reported by persons familiar with analyzing and reporting the frequency content of a seismograph record. Vibration limits shall not exceed those determined during the pre-blasting survey or applicable regulatory limits, whichever is more stringent. In no case shall peak particle velocity exceed 1.0 inch per second and/or a frequency of 20 Hz unless otherwise approved.

B. All blasting operations conducted within the anticipated zone of influence, but not less than 300 feet of existing structures shall be monitored. In areas where several structures are located adjacent to blasting, a sufficient number of seismic units equipped to provide a printed readout shall be deployed to allow for comprehensive documentation of blasting operations. The resultant seismic data shall be provided to the blasters to allow for blast design changes based on the location of the next blast and the resultant vibration levels for the previous shot. A copy of all resultant seismic data shall be provided to the Engineer, immediately after the shot.

C. The pre-blast survey, vibration and over pressure monitoring shall be conducted by a professional seismic consultant, who is licensed and certified for this work.

D. No separate payment will be made for the pre-blast survey, vibration and over pressure monitoring, the post-blast survey, nor any other work related to the blasting or excavation of rock. This work shall be considered incidental to, and included in, the unit bid prices for sewer pipe, as listed in the bid schedule.

3.3 DISPOSAL AND REUSE OF ROCK

A. Disposal shall comply with all applicable federal, state, and local regulations.

B. Provide documentation of disposal upon request by the Engineer.

C. Excavated rock and boulder material exceeding six inches in the largest cross-sectional dimensions shall not be used for backfilling unless otherwise approved. Rock of six inches and smaller dimensions may be used in the fill material, except that rock shall have a maximum cross-sectional dimension of 1-1/2 inches within 12 inches of a pipeline, and 3-1/2 inches within 12 inches of a road subgrade or a structure. All rock used in backfill shall be mixed with granular backfill materials to achieve the required density.

D. All rock not used for backfilling shall be removed from the site and disposed of by the Contractor at no additional cost to the Owner. No disposal on Owner property or rights-of-way shall be permitted.

E. The Contractor shall advise the Engineer in writing of the disposal location and submit a copy of the agreement with the disposal site property owner.

F. Rock used in backfill shall be free from organic matter, muck, or marl.

END OF SECTION 02213

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SECTION 02221 – EXCAVATION, BEDDING AND BACKFILL FOR PIPE AND STRUCTURES

PART 1 – GENERAL

1.1 SCOPE

A. The work specified in this Section includes requirements for excavation for trenching and support of sending and receiving pits, and temporary excavations. The Contractor shall design, furnish, install, and maintain a system of supports, including all bracing and associated items, to retain excavations in a safe manner and to control ground movements. Upon completion of the required construction the system of supports shall be completely removed unless written approval is received from the Engineer, and the excavation and staging area sites restored as discussed herein.

B. The Contractor shall furnish all labor, materials, equipment and incidentals to perform all excavation work to include: necessary clearing; grubbing; preparation of the site; site grading; fencing and signing; construction staging areas; design and construction of excavation support systems; sheeting, shoring, and protection work; design and construction of thrust blocks; disposal of debris and excavated material, excavation dewatering; surface water control, and ground water control; backfilling; preparation of sub-grades; and site restoration.

C. Earth excavation shall be included in the Base Bid unless otherwise identified. Rock excavation shall be measured and paid for in accordance with Section 02213 – Rock and Boulder Excavation.

D. Clearing and grubbing not directly associated with excavation work are specified in Section 02110. Demolition of existing structures and equipment is specified in Section 02065

E. All excavations and support systems shall conform to applicable OSHA excavation, trenching, and shoring standards which are contained in the U.S. Code of Federal Regulations 29 (C.F.R.) 1926.650-1926.653. In the event of a conflict, comply with the more restrictive applicable requirements.

F. Excavation support at trenchless crossings shall not impede the flow of traffic along the road or railroad being crossed.

G. The Contractor shall be responsible for sizing the excavations and shafts. The size of the shafts shall, however, be adequate for construction of any structures indicated on the Drawings and to provide adequate space to meet the Contractor's work requirements for his/her selected methods of construction. Shaft excavations larger than those shown on the Drawings will be subject to the approval of the Engineer and the Owner, and any modifications to the approved traffic control measures shall be obtained and carried out at no additional cost to the Owner.

H. The Contractor shall examine the site and review available subsurface borings and undertake his own subsurface investigations prior to submitting his bid,

taking into consideration all conditions that may affect his work. The Owner and Engineer make no representation as to the subsurface characteristics at locations other than at boring locations shown and at the time the subsurface investigation was made. This provision shall not eliminate or modify the Contractor's rights under the Differing Site Conditions provisions of the Contract Documents.

I. Prior to construction, the Contractor shall be responsible for taking sufficient measurements, horizontal and vertical, to ensure that all existing facilities, which includes but is not limited to pavement, curbs gutters and drainage facilities are restored to their original lines and grades.

J. Wherever a compaction percent is referred to herein it shall mean at least that percent of maximum density determined in accordance with the test method specified herein (ASTM D698 or AASHTO T-180, as applicable).

K. All of the work herein, except where supplemental unit prices are specifically provided, shall be included in the unit and lump sum pricing of the work.

1.2 SUBMITTALS

A. Shop drawings and submittals for this section shall be for informational review.

B. Shop Drawings for support of temporary excavations and trenches: Submit shop drawings detailing pipe, gaskets, fittings, bedding material, restoration material, equipment, and construction methods to be used for excavation support operations as specified herein and as shown on the Contract Drawings.

C. Shop Drawings for sending and receiving pits: The excavation support systems for sending and receiving pits shown on the contract drawings are the minimum design considered acceptable for this project. The Contractor shall construct the systems as shown on the contract drawings or design and construct an alternate system in accordance with the requirements herein.

1. Submit shop drawings detailing material types, equipment, and construction methods to be used for construction of the excavation support systems as shown on the contract drawings. Shop drawings shall also detail all member connections and tunnel portal openings.

2. Submit design calculations and shop drawings detailing material types, equipment, and construction methods to be used for construction of an alternate excavation support system. Shop drawings shall also detail all member connections and tunnel portal openings.

3. Submit thrust block design calculations and shop drawings for all sending pits.

1.3 DEFINITION

A. Unsuitable materials include soils that are soft, unstable, organic, or otherwise incapable of supporting the Work as determined by the Engineer.

B. Class IV and Class V materials shall not be used for bedding, haunching, or initial backfill under any circumstances.

1.4 EXCAVATION STABILIZATION

A. General

1. All excavations shall be stabilized to protect the safety of workers in the excavations from earth slides and cave-ins, and to protect the integrity of the pipe or structure being constructed.

2. Groundwater control is necessary for creating stable foundations for pipes and structures, and for stabilizing excavation slopes.

3. The contract work may include deep gravity sewer main, force main, and structure excavations, high groundwater tables, and excavation adjacent to and below streams.

4. The type of excavation stabilization systems to be used shall be selected by the Contractor, based upon geotechnical characteristics, excavation depth, groundwater elevation, proximity of existing structures, area available for excavation storage, use of excavation area, etc.

5. All backfill shall be placed and compacted as specified herein.

6. Excavated material shall not be stored outside the designated permanent and temporary rights-of-way or on private properties.

7. Dewatering: Maintain groundwater a minimum of 3 feet below the bottom of excavation or as required by the geotechnical report, whichever is more restrictive.

B. Excavation, Sheeting, and Bracing

1. Furnish, install, maintain, and remove such sheeting and bracing systems as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction; and to protect adjacent structures from undermining, settling, or other damage.

2. For trench sheeting for pipes, no sheeting closer than one pipe diameter or two feet (whichever is greater) from the outside edge of the pipe shall be withdrawn if driven below mid-diameter of any pipe; and no sheeting shall be cut off at a level lower than the top of any pipe unless otherwise approved by the Engineer. Any sheeting beyond these limits which is withdrawn shall be done in a manner in which the sheeting slides smoothly out of position without any disturbance of adjacent bedding. The remaining hole shall immediately be filled by hand with sand. If, during the progress of the work, the Engineer decides that selected sheeting should be left in place, he may direct the Contractor in writing and compensation shall be as provided in the Contract Documents.

Engineer decisions regarding sheeting and bracing shall be based on project safety and protection requirements.

3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger workers, the construction, other structures, utilities, piping, or property. For structures, all sheeting and bracing shall be removed after completion of the substructure. All voids left or caused by withdrawal of sheeting shall be immediately backfilled with sand and compacted.

4. The right of the Engineer to order sheeting and bracing to be left in place shall not be construed as creating any obligation on his part to issue such orders; and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or on the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

5. The Contractor shall construct the cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced in position. Sheeting, bracing, and cofferdams shall be adequate to withstand all pressures to which they will be subjected. Pumping, bracing, and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the new work. Any movement or bulging which may occur shall be corrected by the Contractor so as to provide the necessary clearances and dimensions for the new work.

6. Drawings of the cofferdams, sheeting and bracing, and design computations shall be submitted to the Engineer for information; and construction shall not be started until such drawings are received. The drawings and computations shall be prepared and sealed by a Professional Engineer registered in North Carolina; and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the new work substructures.

7. Sheeting and bracing requirements are further defined in OSHA Standards, Subpart P, Part 1926 of the Code of Federal Regulations.

C. Moveable Earth Retaining Devices

1. The Contractor may, at his option, use moveable earth retaining devices (trench boxes) to stabilize excavations for pipes where these devices can be effectively used. Moveable earth retaining devices shall not be considered as a substitute for sheeting systems specifically called out on the drawings.

2. Trench box interior widths shall be at least four feet wider than the outside diameter of the gravity sewer main pipe and force main to permit space

for exterior jointing and compaction of pipe bedding. The lower edges of trench boxes shall not be deeper than the mid-diameter of the pipe.

3. Trench boxes that are not commercial product provided by a firm regularly engaged in the production of such equipment shall be designed by a Professional Engineer Registered in North Carolina. Design drawings and computations for non-commercial trench boxes shall be submitted to the Engineer for information prior to construction.

1.5 EXCAVATION DEWATERING

A. Structures, casings, and pipes may be constructed below the natural groundwater table and adjacent streams. The Contractor shall construct and place all pipes, concrete structures, structural fill, and crushed stone bedding in-the-dry. The Contractor shall maintain the subsurface water level a minimum of three (3) feet below subgrade at all times unless otherwise specified in the geotechnical report. For purposes of this Contract, “in-the-dry” is defined as no free water inside the excavation. Dewatering operations shall comply with applicable permits and erosion and sedimentation control requirements.

B. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to lower the groundwater table below the excavation, to remove promptly and dispose of properly all ground and rain water entering excavations, and to keep such excavations dry so as to obtain a satisfactory undisturbed sub-grade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations. All excavations shall be diked and ditched so as not to permit the entry of any surface drainage water.

C. Pipes, casings, and structures shall not be installed in water or submerged within 24 hours after being placed. Water shall not flow over new concrete within four (4) days after placement. Pipes not meeting this requirement shall not be paid for, and shall be removed and reinstalled when the excavation is dry and stabilized as directed by the Engineer.

D. In no event shall water rise to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours. The Contractor shall prevent flotation of pipes by promptly placing and compacting backfill to project specifications.

E. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the sub-grade soils at the proposed bottom of the excavation.

F. The Contractor shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems he proposes for handling groundwater and surface water encountered during construction of structures, pipes, and compacted fills.

G. The Contractor shall provide for the disposal of the water removed from the excavation in such a manner as shall not cause erosion, siltation, or turbidity increases in any water course; injury to public health; degradation or damage to private or public property or to any portion of the work completed or in progress, or to roads and streets; or cause any impediment to the reasonable use of the site by others.

H. The Contractor shall be responsible for correcting any disturbance to natural bearing soils or damage to structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.

1.6 RELATED SECTIONS

A. Section V – Special Conditions – Special Provision Detail Sheets for property owner fill requirements (reproduced below for reference).

1. Per Wild River Corp (Parcel 9642-29-9794) Special Provisions Detail Sheet:

a) "MSD Contractor must inform OTCO if any fill dirt will be used so that they can review the source and approve its use. MSD Contractor to go through Adam.wallace@sierranevada.com."

PART 2 – PRODUCTS

2.1 MATERIALS

A. General:

1. Compaction Standards:

a. Structural areas and roadways: 95% Modified Proctor (AASHTO T-180)

b. General trench backfill: 95% Standard Proctor (ASTM D698)

c. Top 6 inches under pavement: 100% Modified Proctor

In case of conflict, the more stringent compaction requirement shall govern.

2. Materials for use as imported fill and backfill shall be as described below. For each material, the Contractor shall notify the Engineer of the source of the material and, if requested, shall submit laboratory analyses or other certification of the material.

3. All timber, structural steel, and steel sheet piling used for the supporting systems, whether new or used, shall be sound and free from defects that may impair their strength.

4. Concrete shall conform to ASTM C33 and ASTM C150 unless otherwise approved.

5. Structural steel shall conform to ASTM A36 or ASTM A252 unless approved otherwise. If steel is used, no members with permanent deformations are to be provided.

6. All timber shall be structural grade with a minimum allowable flexural strength of 1100 psi.

7. Steel sheet piling shall conform to ASTM A328 or ASTM A572 unless approved otherwise.

8. Use soils free of organic matter, refuse, rocks and lumps greater than six inches in diameter, and other deleterious matter.

B. Embedment Materials: For the purpose of this specification, soils to be used as embedment materials are grouped into five classes according to soil properties and characteristics. Where a conflict exists between ASTM D698 and AASHTO T-180, the more restrictive requirement shall govern unless otherwise directed by the Engineer.

1. Class I – Crushed stone bedding shall consist of well graded angular stone material meeting the requirements of ASTM D448 size No. 67.

2. Class II – Coarse sands and gravels with maximum practical size of 44 mm (1-1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class.

3. Class III – Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC are included in this class.

4. Class IV – Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH, and CL are included in this class. These materials are not recommended for bedding, haunching, or initial backfill.

5. Class V – This class includes the organic soils, OL, OH, and PT, as well as soils containing frozen earth, debris, rocks larger than 40 mm (1-1/2 inches) in diameter, and other foreign materials. These materials are not recommended for bedding, haunching, or initial backfill.

C. Topsoil: Natural, friable soil free of subsoil, stumps, rocks larger than 2 inches in diameter, weeds, and other material detrimental to plant growth.

D. Fill Beneath Pavement: Fill material used beneath pavement and for road shoulders shall be Class II or III.

E. General Fill: General fill material not otherwise specified shall be Class II or III.

2.2 STONE AND BRICK

A. Granular Bedding Material:

1. All bedding material shall be angular, clean washed crushed stone graded in accordance with Size #67 in ASTM D-448 for “Standard Sizes of Coarse Aggregate” (NCDOT Standard Size #67).

2. Bedding material will be used only as instructed in the Specifications and/or as specifically directed by the Engineer.

B. Stone Stabilization Material:

1. All stone stabilization material shall be angular, clean washed crushed stone graded in accordance with standard sizes #467 in ASTM D-448 (NCDOT Standard Size #467M).

2. Stabilization material will be used only as instructed in the specifications and/or as specifically directed by the Engineer.

C. Silt Check Dam Material:

1. Shall be coarse angular, clean washed crushed stone, gravel, or rock, well graded, and ranging in sized from 2-inch through 6-inch, (NCDOT stone for erosion control Class A).

D. Rip Rap:

1. All rip rap shall consist of clean field stone or rough unhewn quarry stone, resistant to the action of air and water, varying in weight from 25 to 250 pounds with 60% weighing a minimum of 100 pounds each and no more than 5% weighing less than 50 pounds each, (see details for specific rip rap to be placed). Rip Rap will be placed from a minimum of 4.0 feet below the toe of the bank to top of the bank in areas determined by field conditions. Rip rap thickness shall be 1 ½ times the diameter of the largest stones used, or 2.0 feet, whichever is greater.

E. Brick:

1. Brick shall be clay or shale brick meeting the requirements of ASTM C-62 for Grade SW, except as otherwise provided below.

2. Brick shall be of uniform standard commercial size, with straight and parallel edges and square corners. They shall be burned hard and entirely true, free from injurious cracks and flaws, tough, strong, and shall have a clear ring when struck together. The sides, ends and faces of all brick shall be plane surfaces at right angles and parallel one to the other.

3. Concrete brick may be used in lieu of clay or shale brick for adjustment of water meter vaults and/or water valve vaults. Concrete brick shall meet the requirements of ASTM C-55 for Grade S-II except that the absorption of brick used in minor drainage structures shall not exceed 10 lbs./ft.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Commence excavations only after shop drawings have been reviewed and accepted by the Engineer.

B. Methods of construction for excavations shall be such as to ensure the safety of the Work, Contractor's employees, Engineer and Owner's employees and inspectors, the public, and adjacent property and improvements, whether public or private.

C. Before beginning construction at any location of this project, adequately protect existing structures, utilities, trees, shrubs, and other existing facilities. Design excavation support systems to limit deformations that could damage facilities including utilities and structures. The repair of or compensation for damage to existing facilities shall be at no additional cost to the Owner.

D. As a minimum, place fencing, gates, lights, and signs as necessary around the excavations and staging areas to provide for public safety.

E. Excavations shall provide adequate working space and clearance for the work to be performed therein, and for installation and removal of concrete forms, trench boxes, sheeting, bracing, or shoring. In no case shall excavation faces be undercut for extended footings.

F. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

G. Except where exterior surfaces are specified to be damp-proofed, monolithic concrete manholes and other concrete structures, or parts thereof, which do not have footings and extend beyond the outside face of exterior walls, may be placed directly against excavation faced without the use of outer forms, provided that such faces are stable, and also provided that a layer of 10-Mil polyethylene film is placed between the earth and the concrete.

H. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

I. Conduct all shaft and tunnel construction work, including excavation, shoring, temporary facilities, materials storage, and construction traffic within construction easements established for the project. All work shall be in accordance with the applicable permits.

J. If unstable material is encountered during excavation, all necessary measures shall be taken immediately to contain it in place and prevent ground displacement.

K. A concrete working mat shall be constructed in sending pits as needed.

L. Excavations shall be kept free of water at all times and a stable subgrade shall be maintained. Excavations shall be dewatered in accordance with the project specifications. Where pit dewatering is required, a drainage layer shall be provided under the concrete mat.

M. All welding shall conform to the applicable provisions of ANSI/AWS D1.1.

N. Excavated materials suitable for reuse shall be utilized in the Work where practical, subject to approval by the Engineer.

O. Maximum trench width at pipe springline shall not exceed the limits assumed in pipe design or manufacturer recommendations without approval of the Engineer.

3.2 EXCAVATION AND TRENCHING WORK IN WETLANDS

A. The construction corridor shall be limited to widths shown on the Drawings within or immediately adjacent to any areas identified as wetlands

B. Wetlands shall incur no change in preconstruction contours.

C. The top 6” to 12” of trench shall be backfilled with topsoil.

D. All excess material is removed to upland areas or off-site.

3.3 SITE PREPARATION

A. All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. All stumps shall be grubbed. Subgrades for fills and embankments shall be cleaned and stripped of all surface vegetation, sod, and organic topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of the Contractor.

B. All pipeline rights-of-way shall be cleared of all logs, trees, roots, tree trimmings, and stumps. All such materials shall either be hauled away and disposed of in an approved manner, or ground or chipped onsite; and placed in areas approved by the ENGINEER.

C. Remove sod and grass before stripping topsoil.

D. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

E. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.4 UNAUTHORIZED EXCAVATION

A. Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and

foundations shall be replaced, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

B. Where trenches for pipelines are excavated below the depths shown or required, all such areas shall be backfilled to subgrade using Class I granular materials as specified in Part 2 of this specification.

C. Over-excavation resulting from Contractor means and methods shall be at Contractor's expense. Over-excavation required due to unsuitable subsurface conditions may be eligible for an equitable adjustment.

3.5 DEWATERING

A. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

B. Dewatering for trench excavation shall utilize well-points, sumps and dewatering pumping, or other means selected by Contractor to maintain water in trenches below the subgrade elevations shown on the drawings. Failure to employ effective dewatering methods which result in unstable trench conditions shall not entitle Contractor to any additional compensation to correct this situation and to remove and replace unstable materials with Class I granular materials, or for proper disposal of such unstable materials.

C. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and Maintain groundwater a minimum of 3 feet below the bottom of excavation or as required by the geotechnical report, whichever is more restrictive.

D. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property. The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

E. Direct discharge of groundwater from trenches into surface water courses shall comply with all requirements of the North Carolina Department of Health & Environmental Control and the approved Sediment and Erosion Control Permit.

F. Contractor is responsible for dewatering system performance; however, differing site conditions related to groundwater may be addressed per General Conditions.

3.6 SHEETING AND SHORING

A. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be sheeted, braced, and shored as necessary to prevent caving or sliding.

B. Install steel sheet piling with the minimum embedment depths as shown on the shop drawings.

C. Drive in plumb position with each sheet pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground. Exercise care in driving so that interlocking members can be extracted without damaging adjacent structures or utilities. The methods of driving, cutting, and splicing shall conform to the shop drawings.

D. Use templates or other temporary alignment facilities to maintain piling line.

3.7 INTERNAL BRACING SUPPORT SYSTEM

A. The internal bracing support system shall include wales and struts.

B. Provide wales and struts as needed to enable them to carry maximum design load without distortion or buckling.

C. Include web stiffeners, plates, or angles as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.

D. Install and maintain all bracing support members in tight contact with each other and with the surface being supported.

E. Coordinate excavation work with installation of bracing. Excavation shall extend no more than 2 feet below any brace level prior to installation of the bracing.

F. Use procedures that produce uniform loading of bracing member without eccentricities or overstressing and distortion of members of system.

3.8 STABILIZATION

A. Sub-grades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and sufficiently stable to remain firm and intact under the feet of the workmen.

B. Subgrades for concrete structures or trench bottoms, which are otherwise solid but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than four inches. If the required depth exceeds four inches, the material shall be furnished and installed as specified for granular fills. Not more than ½ inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon.

C. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

3.9 ALIGNMENT, GRADE, AND MINIMUM COVER

A. The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

B. Where pipe grades or elevations are not definitely fixed by the contract drawings and specifications, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 48 inches in other locations. Greater pipe cover depths may be necessary on vertical curves, or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation, except where future surface elevations are indicated on the drawings.

3.10 TRENCH EXCAVATION

A. No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. Unless otherwise shown, one block or 400 feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction.

B. Except where tunneling is indicated on the drawings, is specified, or is permitted by the Engineer, all trench excavation shall be open cut from the surface.

C. Maximum open trench length shall not exceed 400 feet unless otherwise approved by the Engineer.

D. When practical, the banks of the trenches shall be cut in vertical, parallel planes equidistant from the pipe center line. When vertical banks for trench excavation are not practical to construct or create dangerous conditions to workmen, the banks may be sloped, provided that such excavation does not endanger or damage adjacent structures or properties. When trench banks are sloped, the portion of the trench that is below the level of 12 inches above the top of the pipeline shall be cut to vertical planes as specified above. The sides of the remaining portion of the trench shall be graded to a slope which is sufficient to produce a stable embankment or stabilized with mechanical reinforcement. Over-depth excavation shall be backfilled with #67 clean stone.

E. Trench to the lines and grades shown on the drawings. Where elevations are not shown, trench to a depth sufficient to provide at least 48 inches of cover above the top of pipe, unless otherwise specified. Grade trenches to provide a constant slope free of sags and high spots.

F. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. The horizontal distance between such planes, or the overall width of trench, shall not be less than 12 inches on either side of the nominal diameter of the pipe but in no case less than 3 feet, unless shown otherwise on the Plans.

G. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be done only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits.

H. Properly brace, sheet, and support trench walls in strict conformance with all pertinent laws and regulations. Provide adequate bracing and shoring to protect adjacent improvements.

I. Where trench boxes are employed by the Contractor, the width of the trench shall be increased as necessary to provide minimum clearances listed in Section 02221 Paragraph 1.3.C.

J. Pipe barrel OD shall be measured at the midpoint between the ends. Where "profile" pipe is installed, the OD shall be the larger outside dimension.

3.11 STRUCTURAL EXCAVATION

A. Excavation for structures shall be sufficiently large for the proper placing of forms and concrete and for dewatering purposes, but shall not be excessively large in horizontal area. Banks may be sloped at a safe angle provided that such excavation does not endanger or damage existing or proposed structures, pipelines, etc. The bottom of the excavation shall be true to the required shape and elevations shown on the plans. No earth backfilling will be permitted under structures unless specifically shown on the plans. Should the Contractor excavate below the elevations shown or specified, he shall fill the void made with thoroughly compacted Class I pipe embedment materials or with Class B concrete at his own expense.

B. When muck, quicksand, soft clay, organic matter, soils with excessive moisture content or other material unsuitable for foundations are encountered within the limits of the excavation or which extend beyond the limits of the excavation, such materials shall be removed as directed by the Engineer and replaced with thoroughly compacted crushed stone or with Class B concrete as required by the Engineer.

C. In all cases where materials are deposited along open excavation, they shall be placed so that in the event of rain, no damage will result to the work or adjacent property.

3.12 MECHANICAL EXCAVATION

A. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, building, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

B. Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

3.13 CUTTING CONCRETE SURFACES AND PAVEMENT

A. Cuts in concrete and asphalt pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1-1/2 inches deep along each side of the trench, and along the perimeter of cuts for structures.

B. Pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 12 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top, and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.

C. Pavement removed for connections to existing lines or structures shall not be of greater extent than necessary for the installation.

D. Where the trench parallels the length of concrete walks and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts as specified for pavement.

3.14 REMOVAL AND RESTORATION OF PAVEMENT AND ROAD SURFACES

A. All removal and restoration of pavement and road surfaces will be in accordance with the specifications approved by MSD or the North Carolina Department of Transportation, Division of Highways, whichever applies.

B. All restored bituminous and concrete pavements shall be constructed in accordance with the pavement replacement detail in the plans. Restored pavement will in all instances be flush and level with existing pavement at the sawed edges, and at existing gutter lines where applicable unless otherwise approved by the Engineer. When pavement repairs do not meet the above criteria or are not performed in a workmanship manner as determined by the Engineer, MSD, or North Carolina Department of Transportation, whichever applies, the contractor will remove and re-perform the restoration as specified.

C. When cuts are to be made in street rights-of-way, the Contractor shall contact the appropriate owner of the right-of-way or his designated representative before each separate pavement cut is made and secure a permit if not covered under permits obtained by MSD.

D. Pavement will be replaced as follows. In all pavement cuts either the permanent pavement or a temporary pavement consisting of 1"-l 1/2" of black asphaltic concrete (later to be replaced permanently) will be placed immediately upon completion of the subgrade unless otherwise approved by the Engineer.

1. Specifications for Cutting Pavement:

a. Unless otherwise approved or required, concrete pavement shall be removed to the nearest expansion or contraction joint. The Contractor will contact MSD and/or D.O.T.'s District Engineer for a determination of the limits of concrete replacement and location of joints. Where sawed joints are allowed, the depth of the sawed cut shall be at least one (1) inch and shall extend at least 1/5 of the depth of the concrete. More depth may be required if necessary to prevent damage to surrounding pavement.

b. Bituminous pavement shall be cut in a smooth and straight line. Sawing is required on asphaltic concrete. The width of pavement left between the edge of the ditch and the existing edge of the pavement or the front line of the gutter, shall be at least 2 feet. Residual strips of pavement less than 2 feet in width must be removed and replaced. Existing pavement shall be removed on each side of the trench for at least 12 inches beyond top of trench

c. The Contractor shall remove and replace pavement which, in the opinion of the Engineer, has been cracked or displaced by the operation of the Contractor.

2. Specification For Restoring Concrete Pavement: The concrete used to restore pavement shall have a minimum 28 day compressive strength of 3600 P.S.I. The concrete as placed shall conform to the shape, grade, and finish of the existing pavement and will be one (1) inch deeper than the original pavement including base, but in no instance less than six (6) inches.

3. Specification For Restoring Asphalt Pavement:

a. All material above the sub-base level shall be hot-mix bituminous concrete conforming to North Carolina Department of Transportation Standard Specifications for Roads and Structures for both mix design and placement, as shown on the plans.

b. The asphalt pavement as placed shall be in accordance with the pavement replacement detail shown on the plans. The asphalt shall be placed in lifts not greater than 2 inches and shall be hot mix bituminous concrete binder as shown on the plans. Asphalt pavement resurfacing will be placed with paving machines and/or rollers of a size and type currently approved by the North Carolina Department of Transportation for use on resurfacing contracts.

c. If a bituminous surfacing overlays a concrete base, the Contractor, at the option of the Engineer, shall replace the concrete to its original thickness, or to a level 2 inches below the finished surface. The Engineer may direct the Contractor to omit all concrete and to replace the pavement with bituminous materials.

d. Tack coats shall be employed with each lift. Tack coats shall be placed on both horizontal and vertical surfaces (pavement cuts or face of concrete gutters).

e. Under normal conditions, asphalt binder will be placed in pavement cuts at the end of each work day. The surface course shall be replaced weekly or within five days following completion of pipeline construction along a continuous section of pavement. During inclement weather, the Engineer may permit the use of temporary asphalt (cold mix) to seal the trench until permanent asphalt can be placed.

f. Thermoplastic marking shall conform to the NCDOT Standard Specifications for Roads and Structures and the work will be performed in accordance with Div 12 of the standard specifications.

3.14 EXCAVATION BELOW PIPE SUBGRADE

A. Except where otherwise required, pipe trenches shall be excavated per the detail in the plans.

B. Where rock is encountered, it shall be removed to a depth of six (6) inches or more below the outside of the pipe.

C. Where rock is excavated below the minimum depths required, voids shall be backfilled with bedding stone at no additional cost.

3.15 ARTIFICIAL FOUNDATIONS IN TRENCHES

A. Whenever unsuitable or unstable soil conditions are encountered, trenches shall be excavated below grade, and the trench bottom shall be brought to embedment grade with suitable material. Work shall be incidental to construction of pipelines.

B. Pipe foundation material shall be quarry run crushed limestone or granite ranging in size from fines to a maximum size of 3 inches. The material shall be power tamped in 6-inch layers.

C. Unstable conditions resulting from inadequate dewatering practices shall be corrected by the Contractor; and no additional payment, including payment for additional beddings store will be provided.

3.16 BELL HOLES

A. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

B. Bell holes shall be excavated in rock as described above.

3.17 BEDDING, HAUNCHING, AND BACKFILL

A. Tamp subgrade to provide firm, even bedding. Excavate trenches as detailed in the Drawings. Place bedding and haunching material so as to provide full bearing around the bottom of the pipe. Place bedding, haunching, and backfill as specified below.

B. All backfill shall be of a non-plastic nature free from roots, vegetative matter, waste, construction material, or other objectionable material. Rock material up to 6-inches in largest dimension shall be acceptable as trench backfill. Excavated rock material greater than 6-inch, shall be disposed of offsite by the Contractor. Rock shall not exceed 10% of the fill material, and shall not be placed within 2-feet of the pipeline or within 2-feet of finish grade. Backfill material shall be capable of being tamped by mechanical tamps using relatively low velocity and heavy blows. The material shall have no tendency to flow or behave in a plastic manner under the tamping blows. Material deemed by the Engineer as unsuitable for backfill shall be removed from the job site before backfilling operations begin.

C. Replacement of Wet or Unsuitable Material: When the Engineer determines that the material excavated from the trench is unsuitable for backfill because of the material type or because it contains excessive debris, rock, or organics, it shall be removed from the project and replaced with a backfill material approved by the Engineer. When the moisture content of an otherwise suitable material is too high to achieve specified compaction, as determined by moisture content and density test, the Contractor shall replace the material as necessary to fulfill backfill requirements. The wet material may be dried to optimum moisture content and used for backfill in subsequent phases of the project. Should an otherwise suitable material be found too dry to achieve compaction requirements, water may be added to the material to raise the moisture content to optimum. Borrow material placed at the direction of the Engineer shall be clean earth at optimum moisture content, Concord (pit) gravel or ABC stone.

D. Backfilling of Trenches: Trenches shall be backfilled immediately after the pipe is laid. Backfill around pipe and to an elevation of one (1) foot above the pipe bell shall be done only by hand and inlayers not exceeding six (6) inches with every layer thoroughly tamped. Successive layers of backfill shall be compacted in place as specified below.

Should water rise in an unbackfilled ditch after the pipe has been placed, the Engineer may require the Contractor to remove the pipe, muck the trench and relay the pipe using Type II or Type III granular bedding.

1. Backfill of trenches within gravity sewer main and force main rights-of-way: Trenches excavated outside existing roadway and railway right-of-way may be backfilled, above the initial one (1) foot, by mechanical means in layers up to twelve (12) inches thick, unless otherwise approved by the Engineer.

2. Backfill of trenches within road and railway rights-of-way: Trenches excavated within existing road and railway rights-of-way shall be

backfilled in layers not to exceed (6) inches and layer must be thoroughly tamped.

E. Compaction for pipeline and structure excavations shall be attained by the use of mechanical tamps. Each layer of backfill shall be placed loose and thoroughly compacted in place. Heavy rollers, vehicles, or other equipment shall not be used for compacting backfill nor allowed to cross over completed work except at points adjudged capable of adequately protecting the pipeline. Pneumatic tamps, ram type tamps, or vibrating tamps with sheepsfoot rollers will be required to meet the specifications of “Mechanical Tamp.”

1. Where excavation has been made within the limits of easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetative matter, debris, stones, and/or other objectionable materials. Backfill material shall be carefully placed and compacted not less than 85% Standard Proctor.

2. Compaction within road and railway rights-of-way: Trenches excavated within existing road and railway rights-of-way, and all structure excavation regardless of location, shall be backfilled as previously specified and thoroughly tamped:

   a. All material from the bottom of trench to within six (6) inches of subgrade level shall have an in-place density of 95% of the maximum dry density as defined by a standard proctor curve for the material.

   b. All material within six (6) inches of the subgrade level shall have an in place density of 100% of the maximum dry density.

   c. On roadway shoulders, all material shall have an in place density of 95% of maximum dry density.

F. Backfill the remainder of the trench with soils free of organic matter, refuse, rocks and lumps greater than four inches in diameter, and other deleterious matter compacted to a minimum 95% ASTM D698 density. Rock material no larger than 4-inches will be acceptable as trench backfill on pipelines. Rock shall not exceed 10% of the fill material and shall not be placed within 2’ of the pipeline or within 2’ of finish grade. Excavated rock materials greater than four inches within street rights-of-way shall be disposed of offsite by the Contractor.

3.18 PROTECTION OF UTILITIES

A. The Contractor shall locate and protect all utilities which could be affected by the work, including but not limited to overhead cables, poles, buried cables, wastewater pipes, gas pipes, water pipes, and drainage pipes and appurtenances. Before working in any area, the Contractor shall contact the local utility locating service to mark the locations of underground utilities. Any underground utilities which could interfere with the work shall be staked and flagged.

B. Underground pipes and cables which cross the excavations shall be carefully exposed and temporarily supported from overhead beams furnished by the Contractor to the satisfaction of the utility owner. The utility shall be carefully incorporated in the backfill with full support and protection. Should any utilities need to be relocated, the Contractor shall discuss the situation in a meeting with the Engineer and utility owner.

C. Before operating any equipment near a buried Duke Energy Company or other local provider overhead electric cable, the Contractor shall contact Duke Energy Company to arrange for protection of the cable and the Contractor's personnel and equipment. Compliance with Duke Energy Company's or other local provider conditions shall be considered a subsidiary obligation under the contract. The Engineer shall be invited to attend all meetings with Duke Energy Company or other local provider for information only.

D. At least 48 hours prior to operating any equipment near a buried gas pipeline, the Contractor shall contact Enbridge. Compliance with Enbridge's conditions shall be considered a subsidiary obligation under the Contract. The Engineer shall be invited to attend all meetings with Enbridge for information only.

E. Contractor shall comply with local utility locating requirements (e.g., 811 call system).

3.19 TESTS

A. All tests to ensure that embedment, fill, and backfill materials and their placement comply with specified requirements, shall be made by an independent testing laboratory approved by the Owner, as required by the Engineer.

B. Contractor to correct areas that do not meet requirements at no cost to Owner and pay for costs to retest.

3.20 DRAINAGE MAINTENANCE

A. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water shall be constructed on the upstream side of the trafficway to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed, and the original section, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3.21 PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES

A. All surfaces and structures (both public and private) within and adjacent to the construction operations shall be restored to a condition comparable to that existing prior to construction or as specified in the special provisions.

B. All surplus materials shall be disposed of in a manner acceptable to the Engineer, and the construction area shall be left in a neat condition, with special attention called to proper drainage, smoothness of surface, and general clean up. No machinery or equipment shall be left or stored on the job site after the project is completed.

C. Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion using erosion control matting and/or sediment logs. Where the grade of the ditch exceeds 1%, sediment logs shall be installed. Do not use concrete ditch checks.

D. Unless otherwise specified, complete restoration to include fertilizing, seeding, and mulching of any and all areas disturbed during construction shall be completed within 7 days following pipe installation or thirty (30) working days following the initial ground disturbing activity, whichever comes first. Pay application may be held until Contractor complies with this requirement.

1. Water meters, valve boxes, drain pipes, and other structures encountered shall be reset or relaid to match or clear surface grade and/or gravity sewer main and force main pipe grade as applicable.

2. All shoulder areas shall be restored, stabilized, and maintained to their original condition. Concrete, asphalt, gravel, and dirt walks, drives and roadways are to be replaced to their original shape and serviceability.

   The Contractor should note that <u>all</u> existing side streets and drives which are either <u>dirt</u> or <u>gravel</u> will be restored as specified for graveled areas.

3. <u>Refuse Burial</u>: The Contractor shall not bury rock, broken concrete/asphalt, construction material, timber, etc. within the street or gravity sewer main and force main right-of-way.

4. <u>Rip-Rap</u>:

   a. The Contractor shall place stone rip-rap as specified in those areas subject to severe water action where directed by the Engineer.

   b. Placement of rip-rap as shown on the Construction Plans shall be considered a guide only, with final determination made at the time of construction by the Engineer. Either the addition or deletion of quantities may be required.

   c. Stone rip-rap will be placed as indicated on the Standard Details immediately following pipe installation and will be installed no steeper than a 2:1 slope except when specifically approved by the Engineer. Grading will be required as necessary to insure continuous even flow.

d. The rip-rap installation shall include all earthwork necessary to stabilize the creek bank and/or culvert outlets and to provide cover for the water line.

5. Erosion Control Matting: The Contractor shall install jute netting or Erosion Control Matting in areas subject to high runoff velocities, areas subject to concentrated runoff and on steep slopes as shown on the plans and/or as directed by the Engineer.

3.22 DISPOSAL OF EXCESS EXCAVATED MATERIALS

A. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site of the work at a suitable and properly permitted disposal site. Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock, debris encountered in excavation work, and other similar waste materials shall be disposed of away from the site of the work.

B. All excess excavated materials resulting from construction of bedding, haunching, and initial backfill and pipe installation, from construction of manholes or other structures, or from correction of unstable or unsuitable trench conditions, shall be hauled from the site and disposed of by the Contractor at a properly permitted disposal site.

C. Material wasted on sites designated on the plans shall be carefully finished with a drag, blade machine, or other suitable tool to a smooth, uniform surface, without obstructing drainage at any point.

D. All excess material from wetland areas will be removed to upland areas or off-site by the Contractor. No change in preconstruction contours will be accepted. All wetland work shall comply with approved environmental permits.

3.23 REMOVAL OF SUPPORT SYSTEM

A. All shoring and temporary construction elements, including soldier piles, sheet piles, wales, struts, lagging, thrust blocks, and concrete working slabs shall be removed from the excavation prior to restoration. Remove the support system in a manner that will not disturb or harm adjacent construction or facilities. Support members that cannot be removed shall be cut off at least 5 feet below finished grade with the approval of the Engineer. No wood shall remain part of the abandoned portion of the work.

B. All voids created by the removal of the support system shall be immediately filled. The support system removed from the excavation shall remain the property of the Contractor and shall be removed from the site.

3.25 RESTORATION

A. Furnish, place and compact backfill in all excavations. Restore the work area disturbed by construction activities, and repair any damage caused to existing

utilities, to its original, or better condition. Paved areas shall be restored to match existing conditions as approved.

B. Remove and dispose of all temporary utilities, drainage facilities, temporary fencing, waste materials and surplus materials, and other site development facilities provided by the Contractor following backfilling of the excavation.

C. Contractor shall remove all gravel, stones and rocks ½ inch and larger from grassed lawns, rights-of-way, and easement areas.

3.26 TOPSOIL

A. During construction, the top 12 inches of the trench will be backfilled with topsoil excavated from the trench.

B. For landscaped areas, Topsoil shall be placed to a minimum depth of 4” and shall be ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content, free of stones 2 inches or larger in any dimension and other extraneous material harmful to plant growth.

1. Topsoil source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous material harmful to plant growth.

a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches in depth. Do not obtain from agricultural land, bogs, or marshes.

3.27 MAINTENANCE

A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the correction period stipulated in the General Conditions.

B. Settlement tolerance: Contractor shall correct any settlement exceeding 0.10 feet within warranty period.

C. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within ten days after notice from the Engineer or Owner.

D. Contractor shall maintain all project areas during the specified warranty period. Maintenance shall include the following:

1. Immediately filling and reseeding any eroded areas.

2. Reseeding any areas where a full stand of grass does not develop.

3. Removal and replacement of any trees which die or show distress.

4. Refilling and reseeding any backfilled areas which settle and develop depressions.

END OF SECTION 02221

SECTION 02223 – STREAM CROSSINGS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to construct sewers across streams where shown in compliance with these requirements and any US Army Corps of Engineers or other permits which may be issued for the crossings. Where permit requirements are more restrictive than these Specifications, permit requirements shall govern.

1.2 RELATED WORK

A. Excavation, bedding, and backfill for pipe and structures are specified in Section 02221.

B. Cast-in-place concrete and reinforcement are specified in Section 03300.

C. Dewatering system design and operation are specified in Section 02140.

1.3 SUBMITTALS

A. Submit, as specified in Section 01300, the detailed procedure and schedule for installing each respective stream crossing. Include detailed description of sheeting, dewatering, stream diversion, bank and channel stabilization, and pipe and encasement installation.

B. Submit all information as required by the Corps of Engineers permit or other permits for the work.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Rip rap is specified in Section 02224.

B. Geotextile fabric for bank stabilization is specified in Section 02224.

C. Vegetation plantings are specified in Section 02224.

2.2 TEMPORARY COFFERDAMS

A. Temporary cofferdam systems shall be utilized to divert the streams during construction of the stream crossings.

B. Temporary cofferdams shall be inflatable bladders or systems employing a combination of structural steel supports covered by membrane liners (Portadam) or other Engineer-approved systems that comply with permit requirements.

C. Excavated native or imported soils, or stone, shall not be used to create the temporary cofferdams unless specifically approved by the Engineer and permitting agencies.

PART 3 – EXECUTION

3.1 REQUIREMENTS

A. Stream crossings shall comprise construction of sewers across flowing streams where specifically designated on the Drawings.

B. Excavation and dewatering requirements shall be as specified in Section 02221 and Section 02140.

C. At no time during construction of the stream crossing shall the flow capacity of the stream channel be decreased by the work to the extent that flood water levels in the area are increased.

D. Each crossing is covered by a US Army Corps of Engineers permit. The Contractor shall comply with the requirements of the permit in addition to the requirements herein.

E. Any wetlands affected by a stream crossing shall be fully restored in accordance with permit conditions and approved restoration plans using seeds of wetland plant varieties.

3.2 PROCEDURE

A. Stream crossings shall be constructed while maintaining flow in the stream which shall be diverted around or over the sewer pipe excavation until backfill is complete.

B. The Contractor shall design and construct the stream diversion system. The system shall comprise either a temporary re-channeling of the stream around the stream crossing, or conveying the stream flow through one or more HDPE pipes around the stream crossing excavation. Diversions shall be capable of conveying, without damage to the system, stream flows correlating to a minimum one (1) inch of rainfall of any intensity in a 24-hour period in the upstream drainage basin, and shall be designed so that damage is controlled and minimized during high stream flows. This performance requirements represents a minimum diversion capacity and does not limit the Contractor's responsibility to comply with permit-specified design criteria.

C. Diversions shall be performed in stages, as follows:

1. Install temporary cofferdam system to create a temporary stream diversion channel on the opposite side of the stream channel.
2. Dewater, excavate, and install the sewer in a dry trench within the cofferdam.
3. Seal the end of the pipe.

4. Backfill the trench with earth and rip rap.

5. Grade the stream banks and channel.

6. Re-divert the stream back to the opposite side.

7. Install rip rap on the stream banks as shown.

8. Restore all disturbed areas.

D. The restored stream banks shall be stabilized to prevent erosion. Bank stabilization shall be as shown on the Drawings. Stabilized stream banks shall include all bank areas disturbed by the work, a maximum of 20 feet upstream and 20 feet downstream of the sewer crossing.

E. The sewer trench shall be dewatered and dry before placement of any bedding, and shall remain dry until backfill is complete. In the event that this requirement is not fulfilled, work shall stop until dewatering has drawn the groundwater table down to at least 12 inches below the lowest excavation; and all softened subgrade shall be removed and backfilled with pipe bedding material at no additional cost to the Owner. Any installed pipe which is undermined by water or where subgrade is loosened by water shall be removed, and new pipe and bedding installed at no additional cost to the Owner. Any pipe which settles below grade shall be similarly replaced, regardless of cause.

3.3 FLOODING OF TEMPORARY DIVERSIONS

A. Temporary cofferdams shall be designed for over-topping in high water conditions.

B. If the dewatered construction area is flooded, water shall be removed and the cofferdam system repaired.

C. Any pipe installed shall be carefully inspected for proper alignment and grade before pipe laying is resumed. Deviations of line/grade shall be corrected.

3.4 PERMANENT RESTORATION FOR STREAM CROSSINGS

A. All areas disturbed by the work shall be re-graded to leave the area in a smooth condition, sloped for drainage.

B. Stabilize all stream banks with rip rap below the high water mark and high performance turf reinforcement mat and plantings above the high water mark 5 feet upstream and 5 feet downstream of the sewer crossing, as shown on the Drawings, and specified in Section 02224. Stabilize all stream banks disturbed by the work beyond the first 5 feet upstream and downstream of the sewer crossing with high performance turf reinforcement mat and plantings, as shown on the Drawings, and specified in Section 02224. Stabilized stream banks shall include all bank areas disturbed by the work, a maximum of 20 feet upstream and 20 feet downstream of the sewer crossing. Banks shall be restored to their original contours. The stream channel shall be stabilized in accordance with permit requirements in all areas disturbed by the work without geotextile fabric unless otherwise approved.

C. Prepare, topsoil, seed, and mulch all remaining disturbed areas as specified in Section 02930.

END OF SECTION 02223

SECTION 02224 – BANK STABILIZATION

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to stabilize stream banks and other slopes as shown on the Drawings or as specified in Section 02223 or elsewhere.

B. Bank stabilization shall be by the installation of high performance turf reinforcement mat (HPTRM), geotextile fabric, rip rap, and vegetation plantings as specified and shown on the Drawings.

C. Stream bank stabilization work (vegetation) shall be performed by a firm that has successfully installed at least 5 bioengineered channels in the last 5 years or by a firm demonstrating equivalent experience that is acceptable to the Engineer.

D. Stream bank stabilization shall be performed in accordance with MSD Requirements as identified in the Contract Documents and approved plans. Where permit requirements are more restrictive than these Specifications, permit requirements shall govern.

1.2 RELATED WORK

A. Stream crossings of pipe are specified in Section 02223.

1.3 SUBMITTALS

A. Submit shop drawings and materials data as specified in Section 01300 on the HPTRM, geotextile fabric, rip rap, and vegetation plantings.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Rip rap shall be hard, durable, quarry stone, angular in shape and resistant to weathering and erosion. Control of gradation shall be by visible inspection. Rounded stones, soft stone, or relatively thin slabs will not be acceptable. Stone shall be free from overburden, spoil, shale, and organic material. Stone material and placement shall meet all of the requirements for NCDOT's *Standard Specifications for Roads and Structures*, latest edition. Stones shall be so graded that when placed with the larger stones, the entire mass will be compact.

B. Geotextile fabric for placement under rip rap (below the high-water mark) shall be the woven type meeting the following properties:

Property	Test Method	Unit	Minimum Results
Weight	--	Oz/yd^2	5.6
Grab Tensile Strength	ASTM D4632	lb	MD: 370 CD: 250
Grab Tensile Elongation to Break	ASTM D4632	%	MD: 16 CD: 15
Mullen Burst Strength	ASTM D3786	psi	450
Puncture Resistance	ASTM D4833	lb	120
Trapezoidal Tear Strength	ASTM D4533	lb	MD: 100 CD: 60
Water Permittivity	ASTM D44991	sec^{-1}	0.28
Percent Opening Area	CDE 022125-86	%	4-6

The geotextile fabric shall be Mirafi Filterweave 700 or equal.

C. High performance turf reinforcement mat for placement on stream banks outside of areas where rip rap shall be used, above and below the high-water mark, shall be Pyramat 75 by Propex or equal.

D. Vegetation plantings shall be dormant cuttings conforming to MSD requirements as shown on the Contract Drawings.

PART 3 – EXECUTION

3.1 BANK PREPARATION

A. The bank to be stabilized shall be graded and hand compacted to produce a firm subgrade. No mechanical tamping will be allowed. The toe of the bank to be stabilized shall be at least 2 feet below the bottom of the stream bed unless otherwise approved by the Engineer and permitting agencies. A constant slope of 2H:1V shall be prepared for rip rap. Vegetation shall be installed per the Drawings.

B. Mirafi Filterweave 700 geotextile fabric shall be installed on the subgrade prior to placement of rip rap. Protect the fabric from damage by a 2-inch layer of sand or ABC(M) stone on the slope and bottom of gabion benches.

3.2 RIP RAP INSTALLATION

A. Place rip rap to the limits shown or as specified. Rip rap shall be installed, except on stream bottoms at stream crossings, on one layer of geotextile fabric overlapped at least 2 feet of joints.

B. Place rip rap by hand to a depth of 2 feet using the largest pieces on the bottom, and filling the spaces with smaller pieces. Dumping or placement by chutes shall not be permitted. Fill the space between stones with NCDOT No. 5 crushed stone. The finished surface shall have a maximum nominal depth of plus or minus 2 inches. There shall be no openings between the stones such that a ½-inch rod can be inserted to the slope through the rip rap.

C. A 2-foot deep trench shall be constructed at the bottom of the bank (2 feet below stream bottom at streams). Rip rap shall be placed from the bottom of the trench

to 1/3 the distance from the normal water elevation to the top of the bank, or otherwise to the limits specified. The top edge of the rip rap shall form a straight line, and shall blend into the final grade without protrusion.

3.3 HIGH PERFORMANCE TURF REINFORCEMENT MAT (HPTRM) INSTALLATION

A. PREPARATION:

1. Grade and compact areas to be treated with HPTRM. Subgrade shall be uniform and smooth.

2. Remove large rocks, soil clods, vegetation, and other sharp objects so that the installed mat will have direct contact with the soil surface.

3. Prepare seedbed by loosening 50 to 75 mm (2 to 3 in) of soil above final grade. This may be accomplished with a rotary tiller on slopes 3H:1V or flatter.

4. Apply soil amendments and seed, (in an amount equivalent to 50% of the total mixture required to be installed on the soil surface) as shown in the Drawings and in accordance with Section 02930, to scarified surface prior to installation of HPTRM. Do not mulch areas where HPTRM is to be placed.

5. Keep areas moist as necessary to establish vegetation. When watering seeded areas, use fine spray to prevent erosion of seeds or soil. If as a result of rain, prepared seedbed becomes crusted or eroded, or if eroded places, ruts, or depressions exist for any reason, rework soil until smooth and reseed such areas.

6. Excavate a Crest of Slope (COS) trench 12 inches wide by 12 inches deep, a minimum of 3 feet over the crest of each side slope. Excavate a Bottom of Slope (BOS) trench 24 inches wide by 24 inches deep, below the stream bed. Excavate an Initial Channel (IC) and Terminal Channel (TC) trench 12 inches wide by 12 inches deep at the stream bank armoring limits.

B. INSTALLATION:

1. Install HPTRM at locations shown on the Drawings.

2. Beginning at downstream end of stream bank, place initial end of first roll of HPTRM in one of the COS trenches and secure with securing pins at 12 inch intervals.

3. Unroll the HPTRM down the stream bank slope, terminating the HPTRM edge in the IC trench.

4. Secure the HPTRM end in the BOS trench with securing pins at 12 inch intervals.

5. Position adjacent upstream rolls in same manner, overlapping preceding roll minimum 6 inches until the armoring limits are completed and the last HPTRM panel edge terminates in the TC trench.

6. Backfill and compact the trenches with specified soil or as directed by Engineer.

7. Secure HPTRM to stream banks with securing pins at a frequency of 2 pins per square yard. Increased anchoring frequency may be required if site conditions are such that the Engineer determines it necessary.

8. Alternate installation methods must be approved by Engineer prior to execution.

9. Soil fill and seed the HPTRM:

10. Installed HPTRM shall be seeded (or re-seeded) and soil filled as required by the project documents.

11. Do not place excessive soil above material.

12. Broadcast additional seed or mulch (if applicable) above soil-filled mat and irrigate as necessary to establish/maintain vegetation.

13. No heavy and/or tracked equipment or sharp turns are permitted on the installed HPTRM. Avoid ANY traffic over the HPTRM if loose or wet soil conditions exist.

3.4 VEGETATION INSTALLATION

A. Vegetation shall be installed to stabilize stream banks above the high-water mark where required on the Drawings, or as specified.

B. Vegetation plantings shall occur in winter, and vegetation shall be planted at a 45- to 60-degree angle in stream flow direction. Plant vegetation so that buds point upward and approximately 2 inches of wood is above ground level.

C. A diversion ditch shall be constructed 4 feet from the top of the bank to divert water away from the newly planted vegetation.

D. High performance turf reinforcement mat (HPTRM) Pyramat 75 by Propex or equal (seeded) matting shall be used for stabilization.

3.5 RESTORATION

A. After completion of each bank's stabilization, prepare, topsoil, seed and mulch the remaining disturbed areas as specified in Section 02930. No fertilizer or herbicide shall be used as part of the restoration near stabilized banks.

B. Remove from the site all removed vegetation, rock debris, and surplus materials resulting from the work.

END OF SECTION 02224

SECTION 02410 - EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property. This section supplements the approved site plan and permit from the North Carolina Department of Environmental Quality (NCDEQ) Division of Energy, Mineral, and Land Resources – Land Quality Section. Where permit requirements are more restrictive than these Specifications, permit requirements shall govern.

1.2 REGULATORY REQUIREMENTS

A. Contractor shall be responsible for prevention of damage to properties outside the construction limits from siltation due to construction of the project. The Contractor will assume all responsibilities to the affected property owners for correction of damages that may occur. The Contractor shall not allow mud and debris to accumulate in the streets. Should the Contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to discharge of pumped water into any storm drain or stream.

B. In accordance with NPDES Stormwater Discharge Permit associated with Construction Activities NCG010000, the conditions of the permit including but not limited to “material and waste handling, self-inspection and reporting, and ground stabilization”, must be met by the Contractor or Site Representative associated with the Construction Activities.

PART 2 - PRODUCTS

2.1 EROSION CONTROL MATERIALS

A. Silt Fence shall consist of synthetic filter fabric of at least 95% by weight of polyolefins or polyster, which is certified by the manufacturer or supplier as conforming to the requirements in ASTM D6461. The fabric shall also contain ultraviolet ray inhibitors and stabilizers conforming to ASTM D4355. The fabric shall be supported by wire fencing conforming to a minimum 14 gauge and a maximum mesh spacing of 6 inches.

B. Steel posts shall be rated for 1.33 lb/linear foot with a minimum length of 5 feet.

C. Hardware cloth shall be minimum 19 gauge with a maximum mesh opening of 4 inches.

D. Porous baffles shall be 700 grams/square meter coir matting.

E. Excelsior (wood-fiber) Matting shall have a minimum allowable shear or tractive force of 1.65 lbs/ square feet.

F. Excelsior (wood-mat) Wattles shall be minimum 12 inches in diameter.

G. Rip-Rap Erosion Control Stone shall conform to NCDOT Class Specification (Class A, B, I, II, etc.) as indicated on the Construction Drawings.

H. Stone shall conform to NCDOT requirements for the specified type (No. 5, No. 57, etc.) as indicated on the Construction Drawings.

PART 3 - EXECUTION

3.1 STABILIZATION REQUIREMENTS

A. Whenever land disturbing activity is undertaken on a tract, soil stabilization practices must be provided in accordance to the ground stabilization schedule of Section II.B.2 “Ground Stabilization” of the NPDES NCG010000.

B. Suspension of work in any area of operation does not relieve the Contractor of the responsibility for the control of erosion in that area.

3.2 PRACTICES

A. Excavated materials shall not be deposited in rivers, streams, ditches, or impoundments.

B. Avoid equipment crossings of streams, creeks, and ditches unless permitted through applicable regulatory approval (USACE 401/404, NCDEQ DWR, etc.)

C. Temporary and Permanent Erosion Control Measures shall be provided and in sequence as indicated on the Construction Drawings.

D. The Vegetation Plan including temporary seeding, permanent seeding, sod, matting, and mulching shall be followed as indicated on the Construction Drawings and herein this Specification

3.3 STABILIZATION

A. Graded slopes shall not exceed slopes that can be stabilized by vegetation or erosion control devices. Slopes shall not exceed 3H:1V uncles otherwise approved by NCDEQ or shown on drawings. Slopes shall be stabilized in accordance with the ground stabilization criteria schedule below:

Site Area Description	Stabilization Timeframe	Stabilization Timeframe Exceptions
Perimeter dikes, swales, ditches and slopes	7 days	None
High Quality Water (HQW) Zones	7 days	None
Slopes steeper than 3:1	7 days	If slopes are 10’ or less in length and are not steeper than 2:1, 14 days are allowed
Slopes 3:1 or flatter	14 days	7-days for slopes greater than 50 feet in length
All other areas with slopes flatter than 4:1	14 days	None (except for perimeters and HQW Zones)

3.4 VEGETATION SPECIFICATIONS

A. Seed: All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act currently in effect. All seed shall be furnished in scaled standard containers. Seed that has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

B. SCHEDULE OF TEMPORARY SEED MIX

Kind of Seed	Amount / 1000 sqft
Rye Grain	1-2 lbs
Browntop Millet	1-2 lbs

C. SCHEDULE OF PERMANENT SEED MIX

Kind of Seed	Percent of Mix
Bermuda Grass	35%
Centipede Grass	10%
Creeping Red Fescue	30%
Winter Rye (Grain)	25%
Guaranteed Germination	not less than 85%
Guaranteed Purity	not less than 96%

Note: The total percentage by weight of material other than grass seed in the above mixes shall not exceed 5 percent. This material shall include all non-viable seed, chaff, hulls, live matter, and weed seed.

D. FERTILIZER AND LIME

1. Fertilizer shall be 8-8-8 Commercial grade uniform in composition, free-flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled; conforming to the fertilizer laws of the State of North Carolina and bearing the name, trade name, or trade mark and warranty of the producer.

2. Lime shall be ground limestone, not less than 85 percent of total carbonates, and shall be ground that at least 50 percent will pass through a 100 mesh sieve, and at least 90 percent will pass through a 20 mesh sieve.

E. APPLICATION

1. Application of Fertilizer: Fertilizer shall be distributed uniformly at the rate of 4 pounds per 100 square feet over the areas to be seeded, and shall be incorporated into the soil to a depth of at least two (2) inches.

2. Application of lime: Lime shall be distributed uniformly at a rate of 10 pounds per 100 square feet over the areas to be seeded, and incorporate into the soil along with the fertilizer to a depth of two (2) inches.

3. Broadcast Seeding: Seed, if broadcast, shall be distributed by use of mechanical hand-operated sowing equipment at the rate of five (5) pounds of specified seed mix per 1,000 square feet. The seed shall be uniformly distributed over the designated areas. Broadcast seeding shall not be done during windy weather. Seed shall be covered to a depth not to exceed one-eighth (1/8) inch.

F. SOD

1. In order to establish vegetation in critical areas, such as slopes, drainage-ways, and channels, sodding will be required as shown on the Drawings.

2. Sod type shall be Bermuda or Centipede grass unless alternatives are approved by Engineer. The sod shall be of know origin, free of weeds, disease, and insects. The sod should be machine-cut at a uniform depth to a standard size as established by the supplier. Harvest, delivery and installation shall occur within a time period of six (6) hours.

3. Fertilizer and lime shall be furnished and applied as specified herein.

   a. Preparation:

      The surface area established to receive sod shall be cleared of trash, debris, roots, branches and stones. Fill and level low spots to prevent ponding.

      Rake or harrow the sod area to incorporate the fertilizer and lime into the soil and to smooth and level the surface to final grade.

      Final preparation will be to roll or cultipack the surface to firm the soil. However, care must be taken to avoid excessive compaction.

   b. Installation:

      After the sod is unrolled it should be moistened and stored in the shade.

      Moisten the surface area prior to laying out the sod.

      Lay the first layer in a straight line with the longest dimension perpendicular to the slope and/or channel flow.

Install the subsequent rows, parallel to and butted against each other. Stagger the joints in a brick pattern and butt together tightly to prevent voids.

Roll the sod after installation to establish firm contact with the roots and soil.

On slopes 3:1 or greater and channel ways anchor sod with pegs and or wire staples, six (6) to ten (10) inches long.

Irrigate sod until a depth of four (4) inches is wet. Maintain irrigation until the sod takes root.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with asphalt-emulsion tackifier.

2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500 lbs / acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.6 MAINTENANCE

A. Temporary and Permanent Erosion Control devices including but not limited to silt fence, diversion ditches, and sediment basins shall be maintained at a minimum of 50% of the sediment storage depth of the device. Measures must remain in-place unless the construction sequence indicates otherwise.

B. All Temporary and Permanent Erosion Control Measures must be checked for stability and operation within 24 hours of every ½ inch rainfall and at least once a week.

C. All Temporary and Permanent Erosion Control Measures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion (washouts) shall be immediately repaired.

END OF SECTION 02410

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SECTION 02521 – CHECK VALVES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Check valves and appurtenances specified in this Section and shown on the Mechanical Drawings.

1.2 REFERENCES

A. Refer to the following standard references with respect to materials, tests, and physical parameters:

1.	ANSI B16.1	Cast Iron Pipe Flanges and Flange Fittings, Class 125
2.	AWWA C508	Swing-Check Valves for Waterworks Service, 2” through 48”
3.	ASTM A126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
4.	ASTM A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
5.	ASTM A536	Specification for Ductile Iron Castings
6.	ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts

1.3 SUBMITTALS

A. Complete shop drawings and engineering data on all valves and accessories shall be submitted to the Engineer of Record.

1.4 DEFINITIONS

A. References to valve sizes on the Drawings and in the Specifications are intended to be nominal size and shall be interpreted as nominal size.

1.5 QUALITY ASSURANCE

A. All check valves shall be subject to testing in accordance with AWWA C508.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. General: A single manufacturer shall furnish check valves. All check valves shall be swing arm style.

B. Manufacturer:

1. Muller Co. M&H Valve (159-02)

2. APCO (Series 6000)

3. Val-Matic (Heavy Duty/Series 7000)

2.2 CHECK VALVES

A. Check Valves shall be rated at 175 psi water working pressure, 350 psi hydrostatic test for structural soundness (2" through 12"); and 150 psi water working pressure, 300 psi hydrostatic test (sizes 14" through 30"). Valves shall fully conform to AWWA C508.

B. Check valves shall be resilient seated and provide drip tight shut-off up to the full pressure rating of the valve.

C. Materials

1. Body, cover, and disc: Ductile iron

2. Interior Lining and Exterior Coating: NSF/ANSI 61 approved fusion bonded epoxy liner and coating conforming to AWWA C550.

3. Shaft: 304 Stainless Steel

4. Body Seat: 304 or 316 Stainless Steel

5. Resilient Seat: Buna-N

6. All ductile iron shall conform to ASTM A536, Grade 65-45-12.

D. Check valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the line.

E. Check valves shall be equipped with adjustable outside lever & weight to accomplish faster closing and to minimize slamming effect.

F. Minimum Flow Area: One hundred percent (100%) of cross-sectional area of specified pipe size.

G. Minimum Non-shock Working Pressure Rating: 150 psi.

H. Joints

1. Type: Integrally cast flanges

2. Dimension Standard: ANSI B16.1.

I. Accessories

1. Provide limit switches on valves where limit switches are indicated on the Mechanical or Instrumentation Drawings.

PART 3 – EXECUTION

3.1 INSTALLATION

A. As specified by manufacturers, or as shown on drawings.

3.2 HYDROSTATIC TEST

A. Test valves with piping in which valves are installed.

3.3 MANUFACTURER'S REPRESENTATIVE

A. Provide services of valve manufacturers' representative as required to obtain correct installation of valves and accessories, and to provide training to the Owner.

B. Provide assistance of valve manufacturers' representatives at no additional cost to the Owner.

END OF SECTION 02521

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SECTION 02522 – ECCENTRIC PLUG VALVES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Eccentric plug valves and appurtenances specified in this Section and as shown on the drawings.

1.2 RELATED SECTIONS

A. Division 01 - General Requirements

B. Division 02 - Sitework

1.3 REFERENCES

A. ANSI/AWWA Standards

1. ANSI/AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

2. AWWA C517 – Resilient-Seated Cast-Iron Eccentric Plug Valves

B. ASTM Standards

1. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

1.4 SUBMITTALS

A. General: As specified in:

1. General Conditions;

2. Section 01340, Submittals

B. Submit the following:

1. Operator type, size, and orientation.

2. Plug orientation and opening direction.

1.5 QUALITY ASSURANCE

A. All plug valves shall be subject to testing in accordance with AWWA C517.

B. Testing: Test valves as specified in this Section.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. General: A single manufacturer shall furnish eccentric plug valves.

B. Manufacturer:

1. DeZurik
2. M&H Valve
3. Or Equal.

2.2 ECCENTRIC PLUG VALVES

A. All valves shall be of the non-lubricated full-port eccentric type with resilient faced plugs and shall be furnished with flanged joint connections.

B. Port Areas

1. 20” and Smaller Valves: Full port, 100% of full pipe area.

C. Pressure Rating: 175 PSI through 12" and 150 PSI through 72".

D. Shutoff: Drip tight at full valve rating with pressure in either direction.

E. Plugs

1. Type: One-piece
2. Construction
   a. Plugs shall be self supporting
   b. Plugs requiring strengthening member, or members, opposite plug face will not be accepted.
3. Resilient Facing: Neoprene or hypalon as recommended by the manufacturer for the intended service, and per AWWA C517 requirements.
4. Valve Stem: Integral with plug.
5. Valve Stem Bearings
   a. Bearings shall be sleeve type metal bearings, made of sintered, oil impregnated and permanently lubricated type 316 stainless steel.
   b. Non-metallic bearings shall not be acceptable. sleeve type.
   c. Location: At each end of plug.

F. Valve Seat Overlay

1. Welded in overlay of not less than 95% pure nickel content on surfaces contacting the plug face, not less than 1/8” thick.

2. Seat area shall be raised, with raised surface completely covered with nickel to ensure that the plug face contacts only the nickel seat.

3. Valves utilizing resilient seats attached to the body shall not be acceptable.

4. Coated non-metallic materials shall not be acceptable.

G. Valve Shaft Seals

1. Type: Multiple ring; V-type packing, or U-cups.

2. Seal Adjustment and Replacement: Adjustable and replaceable while valve is in service.

H. Materials

1. All materials, including gaskets, in contact with liquid shall be resistant to pH values up to 12.5.

2. Valve Body Material Type: Cast iron.

3. Valve Body Casting Standard: ASTM A126, Class B.

4. Plug Material Type: Ductile Iron

5. Plug Casting Standard: ASTM A536, Grade 65-45-12

6. Exposed Parts, such as nuts, bolts, washers and springs: Stainless steel.

7. Valve Stem Bearings: 316 Stainless Steel.

8. Valve Shaft Seals: Buna-N

I. Joints

1. Joint Type for Exposed Valves: Integrally cast flange joint ends.

2. Exposed Valve Dimension Standard: ANSI B16.1.

J. Interior and Exterior Coating

1. Coating: NSF/ANSI 61 approved fusion bonded epoxy.

2. Dry Mil Thickness: 10 mils, minimum.

3. Interior epoxy coatings shall comply with ANSI/AWWA C550 and shall be free of holidays.

K. Operators and Accessories

1. Valves 6 inches in size and smaller shall be lever operated and valves 8 inches in size and larger shall be wormgear operated. Wormgear operators shall be enclosed of semi-steel construction.

2. Exposed nuts, bolts, and washers on wormgear operators shall be zinc plated. Valves and operators for underground service shall be sealed to prevent moisture entrance to valve and operator parts.

3. Valves installed underground shall be provided with extension stems and cast iron valve boxes.

4. A sufficient number of standard levers and tee wrenches shall be furnished so that valves in each location are provided with at least one lever or tee wrench, as applicable.

5. Nut operators shall have standard 2-inch square AWWA operating nuts.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Valves shall be installed in the direction required to prevent solids from packing into the valve body behind the plug.

B. Certified copies of Proof-of-Design test reports shall be furnished as outlined in AWWA C517 if requested.

3.2 HYDROSTATIC TEST

A. Test valves with piping in which valves are installed. Each valve shall be given a hydrostatic and seat test with test results being certified by the specifications.

3.3 MANUFACTURERS' REPRESENTATIVE

A. Provide services of valve manufacturer's representative as required to obtain correct installation of valves and accessories, and to provide training to the Owner.

B. Provide assistance of valve manufacturer's representatives at no additional cost to the Owner.

END OF SECTION 02522

SECTION 02524 – AIR RELEASE AND AIR RELIEF VALVES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air and vacuum valve assemblies and appurtenances specified in this Section and as shown on the Drawings.

1.2 REFERENCES

A. ANSI Standards

1. ANSI B16.1 – Cast Iron Pipe Flanges and Flange Fittings, Class 125

2. ANSI B16.5 – Pipe Flanges and Flanged Fittings, Class 150

B. ASTM Standards

1. ASTM A48 - Specification for Gray Iron Castings

2. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

3. ASTM A240 - Specification for Heat-Resisting Chromium and Chromium- Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

4. ASTM A276 - Specification for Stainless Steel and Heat-Resisting Steel Bars and Shapes

5. ASTM A582 - Specification for Free-Machining Stainless and Heat Resisting Steel Bars, Hot-Rolled or Cold-Finished

6. ASTM B584 - Specification for Copper Alloy Sand Castings for General Application

7. ANSI B16.1 – Cast Iron Pipe Flanges and Flange Fittings, Class 125

C. AWWA Standards

1. AWWA C207 – Steel Pipe Flanges for Waterworks Service, Class B, Class D, and Class E only

2. AWWA C226 – Stainless Steel Fittings for Waterworks Service, Size 1.2 In. Through 72 In.

3. AWWA C228 – Stainless Steel Pipe Flange Joints for Water Service – Sizes 2 in. Through 72 in.

4. AWWA C512 – Standard for air release, air/vacuum, and combination air valves for water and wastewater service

1.3 DEFINITIONS

A. References to valve sizes on the Drawings and in the Specifications are intended to be nominal size and shall be interpreted as nominal size.

B. Combination Air Release Valves (CARV) are assemblies that contain both an air/vacuum valve and an air release valve.

1.4 SUBMITTALS

A. Complete shop drawings and engineering data on all air release and air relief valves and accessories shall be submitted to the Engineer.

1.5 QUALITY ASSURANCE

A. Testing: Test valves as specified in this Section.

PART 2 - PRODUCTS

2.1 COMBINATION AIR VALVES - WASTEWATER

A. General

1. Each combination air valve shall include an air and vacuum valve and an air release valve.

2. All components of the combination air valve shall be furnished by one (1) manufacturer

3. Combination air valve assemblies shall be single-bodied.

4. Working pressure range: 3-250 psi.

5. A 1½" threaded drainage outlet shall be provided to enable removal of excess fluids.

B. Combination Air Valves

1. Description

a. Combination Air Valves shall include air and vacuum valve, and an air release valve.

b. Combination air valve shall allow large quantities of air to escape out of valve orifice when piping is filled and shall close tight when water enters the valve. Combination air valve shall remain closed tight while water is in the valve.

c. Combination air valve shall permit large quantities of air to enter through valve when piping is drained and shall prevent vacuum from forming in piping.

d. Combination air valve shall consist of a body, cover, baffle, float, seat and throttling device.

e. Combination air valve shall vent accumulated air while piping is pressurized.

f. Combination air valve shall be simple lever type.

g. Combination air valve shall open under pressure when air enters air release valve.

2. Combination Air Valve Inlet and Outlet: NPT.

3. Combination Air Valve Materials

a. Combination Air Valve Body, Cover and Baffle Material

1) Material Type: Stainless Steel 316.

b. Combination Air Valve Float Material

1) Material Type: Stainless steel 316.

c. Combination Air Valve Seat Material: Buna-N rubber.

d. Combination Air Valve Linkage Materials

1) Material Type: Stainless steel 316.

Tapping Saddle

e. Manufacturer and Models for Combination Air Valves, 2” through 8”

1) 2” Combination Air Valve for Wastewater: Hi-Tech Model 986, or preapproved equal.

2) 3” Combination Air Valve for Wastewater: Hi-Tech Model 986, or preapproved equal.

3) 4” Combination Air Valve for Wastewater Hi-Tech Model 986, or preapproved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. As specified by manufacturers, or as shown on drawings.

3.2 HYDROSTATIC TEST

A. Test valves with piping in which valves are installed. Test prior to the connection of the new high service pumps to the discharge piping in which the valves are installed.

3.3 MANUFACTURERS' REPRESENTATIVE

A. Provide services of valve manufacturer's representative as required to obtain correct installation of valves and accessories, and to provide training to Owner.

B. Provide assistance of valve manufacturer's representatives at no additional cost to the Owner.

END OF SECTION 02524

SECTION 02605 - MANHOLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope of Work: The work under this section includes the materials and procedures used in the construction and repair of sanitary sewer manholes as indicated on the Drawings.

1.2 SUBMITTALS

A. The following information shall be submitted to the Engineer for approval in accordance with Section 01340. Fabrication shall not begin until submission has been approved.

B. Drawings and descriptive data on manholes (including wall thicknesses, vertical dimensions, and deflection angles), concrete used in manufacture of manholes and precast inverts, rubber gaskets, joint sealant, flexible manhole sleeves and joints, frames and covers, inverts, and manhole steps shall be submitted to the Engineer for review prior to their manufacture.

1.3 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall coordinate delivery with the manufacturer and shall handle and store the manhole components in accordance with the ASTM C891 and the manufacturer's recommendations using methods that will prevent damage to the components and their joint surfaces.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manholes shall be constructed to the sizes, shapes and dimensions and at the locations shown on the plans. Unless otherwise shown on the Plans, minimum thickness of manholes shall be as follows:

8" to 18" pipe ..... 4' diameter .... 5" thick walls
21" to 36" pipe ..... 5' diameter .... 5" thick walls
39" to 54" pipe ..... 6' diameter .... 6" thick walls
54" and larger ..... 8' diameter .... 8" thick walls

B. The height or depth of each manhole will vary with its location, but it shall be such as will place the top at the finished grade of the pavement or ground surface or to the elevations shown on the Plans and the invert at the elevation shown on the Plans. The number of joints shall be minimized. No more than one riser section for manholes up to six feet tall and no more than one riser for each additional 4 feet in height. One additional section will be allowed for transition manholes.

2.2 MANHOLE CONSTRUCTION

A. Manholes shall be composed of precast reinforced components with tongue and groove joints. Manholes shall conform to the requirements of ASTM Specification C478, except as modified herein.

B. Concrete: Concrete shall conform to ASTM C478 and as follows:

Compressive strength:	5,000 psi minimum at 28 days.
Air Content:	5 - 7 %
Alkalinity:	Adequate to provide a Life Factor, Az = Calcium Carbonate Equivalent times Cover over Reinforcement, no less than 0.35 for bases, risers and cones.
Cementitious Materials:	Minimum of 564 pounds per cubic yard
Coarse Aggregates:	ASTM C33. Sound, crushed, angular granitic stone only. Smooth or rounded stone shall not be used. Free from organic impurities.
Chemical Admixtures (if used):	ASTM C494. Calcium Chloride or admixtures containing calcium chloride shall not be used.
Air Entraining Admixtures (if used):	ASTM C260.

Absorption shall not exceed 6 percent.

C. Reinforcing: Reinforcing steel shall be ASTM A615 grade 60 deformed bar, ASTM A82 wire or ASTM A185 welded wire fabric.

D. Lifting Loops: Lift loops shall be ASTM A416 steel strand. Lifting loops made from deformed bars shall not be used.

E. Wall Thickness: The minimum wall thickness of the manhole riser sections shall be as shown in the table above. Cone sections shall have a minimum wall thickness of 8 inches at their top. The minimum thickness of the bottom shall be 6 inches for manholes 4 feet in diameter and 8 inches for all sizes greater than 4 feet in diameter. Suitable openings for inlet and outlet sewer pipe shall be cast or cored into the base sections and into riser sections for drop connections. These openings shall be circular, accurately made, and located as required for each manhole.

2.3 MANHOLE COMPONENTS

A. Precast Manufacturing: Precast components shall be manufactured in conformance with ASTM C478. Wall and inside slab finishes resulting from

casting against forms standard for the industry shall be acceptable. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal form joint marks, and minor depressions, chips and spalls will be tolerated. Dimensional tolerances shall be those set forth in the appropriate references and specified below.

B. Certification: Precast manufacturer shall manufacture all precast components with one or more of the following testing methods.

1 Plant shall be certified by the National Precast Concrete Association (NPCA) Plant certification program.

2 Plant shall be certified by the Prestressed Concrete Institutes (PCI) Plant certification program.

3 Manufacturing process of components delivered shall have been randomly tested by a DISTRICT-approved outside agency (such as a State Department of Transportation) no less than 5 weeks prior to manufacture. Test results covering no less than one component in 100 and certification from cement manufacturer and aggregate supplier certifying chemical content will be furnished to the DISTRICT upon request. Minimum test shall cover concrete strength and absorption.

4 Components delivered shall be tested by a certified outside testing agency. Test results covering no less than one component in 25 and certification from cement manufacturer and aggregate supplier certifying chemical content will be furnished to the DISTRICT upon request. Minimum test shall cover concrete strength and absorption.

5 Precast concrete manholes shall not be shipped to the job site prior to 15 days after the date of manufacture.

C. Joints: Neither rubber gaskets nor O-Ring seals shall be used. The maximum slope of the vertical surface shall be 2 degrees. The maximum annular space at the base of the joint shall be 0.10 inch. The manhole sections shall be joined as specified herein.

D. Lift Inserts and Holes: If used for handling Precast Components, lift holes and inserts shall be sized for a precision fit with the lift devices, and shall comply with OSHA Standard 1926.704.

E. Step Holes: Step holes shall be cast or drilled in the bases, risers and cones to provide a uniform step spacing of 12 inches or 16 inches. Cast step holes shall be tapered to match the taper of the steps.

F. Precast Base Sections: Base sections shall have the base slab cast monolithically with the walls, or have an approved PVC waterstop cast in the cold joint between the base slab and the walls. Where extended base manholes are required, the width of the base extensions shall be no less than the base slab thickness. The bottom step in the base section shall be a maximum of 16 inches from the top of the invert bench and shall be located directly over the outlet pipe.

G. Precast Riser Sections: The minimum lay length of Precast Riser Sections shall be equal to the step spacing used by that manufacturer.

H. Precast Concentric and Eccentric Cone Sections: Precast Cone Sections shall have an inside diameter at the top of no less than 24 inches and no more than 26 inches. The width of the top ledge shall be no less than 8 inches and no less than the wall thickness required for the cone section. Concentric cones shall be used only for shallow manholes.

I. Precast Transition Cone Sections: Transition Cone Sections shall provide an eccentric transition from 60 inch and larger manholes to 48-inch diameter risers, cones and flat slab top sections. The minimum slope angle for the cone wall shall be 45 degrees. A minimum of 6 feet height is required between the bench and the bottom of the transition cone.

J. Precast Transition Top Sections: Transition Top Section shall provide an eccentric transition from 60 inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be 20 feet. Transition tops shall not be used in areas subject to vehicle traffic. A minimum of 6 feet height is required between the bench and top of transition cone.

K. Precast Flat Slab Top Sections: Standard Flat Slab Top Sections shall have an access opening with an inside diameter at the top of no less than 24 inches and no more than 26 inches and shall be designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces. Flat Slab Top Sections shall not be used without prior authorization from Engineer.

L. Precast Grade Rings and Brick: Precast Grade Rings or Brick shall be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per manhole. Grade Rings shall conform to ASTM C478 and shall be no less than 4 inches in height. All brick used shall be solid and shall be made from Concrete, Clay, or Shale, and shall be of standard building size.

M. Steps: Provide steps in bases, risers, cones, transition cones, and transition top sections aligned vertically on 12-inch or 16-inch centers. All steps shall be aligned vertically over the outlet pipe. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place. The steps shall be a Copolymer Polypropylene Plastic reinforced with a ½ inch diameter grade 60 bar and have serrated tread and tall end lugs. Step pullout strength shall be a minimum of 2000 lbs. when tested according to ASTM C497. The minimum width shall be 12 inches. Rubber or plastic covered steel steps shall be as manufactured by Delta Pipe Products Co., M. A. Industries, Inc., or equal. All manhole steps shall comply with the requirements of OSHA.

N. Lifting Devices: Lifting devices complying with OSHA Standard 1926.704 for handling the Precast Components shall be provided by the Precast

Manufacturer.

O. Coatings: Where shown on the Plans, coating for the interior/exterior of the manhole walls shall be coated per Section 09871. The joints between precast sections shall not be coated. Use butyl rubber rope as specified below to seal the interior horizontal joint surface.

P. Joint Sealing Materials: Joints shall be sealed by TWO Butyl Rubber Seals. Each seal shall be as described below:

1 Butyl Seals shall consist of a plastic or paper-backed butyl rubber rope no less than 1 inch cross section. When manholes are larger than 4 feet diameter or have a larger than normal space between the joints, the length and or diameter of the rope shall be increased as required to achieve a seal. Butyl Rubber Material shall conform to ASTM C990 and as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100 degrees F. Butyl Rubber shall be applied to clean, dry surfaces only. Use of 2 independent wraps of Butyl Rubber qualifies for the requirement of two seals.

2 Internal O-Ring Gaskets and Internal Rubber Gaskets shall not be used.

2.4 GROUTS

A. All grouts used on manhole interiors shall be "non-shrink" grouts, and grout used on manhole exteriors shall be either "non-shrink" or standard cement mortar grouts, as specified in Section 03600 Grouting.

PART 3 - EXECUTION

3.1 DROP MANHOLES

A. Drop manholes shall be similar in construction to the standard manhole except that a drop connection of pipe and fittings of the proper size and material shall be constructed outside the manhole and supported as indicated on the Plans.

3.2 MANHOLE SLEEVES AND ENTRANCE JOINTS

A. Flexible manhole sleeves or flexible manhole entrance joints shall be installed on all pipe entering and leaving precast manholes. Manhole openings shall be accurately core drilled or cast in place. Sleeve and Joint material shall be of high quality synthetic rubber which complies with the requirements of ASTM Specification C 923. Sleeve hardware (clamps, bands, straps, draw bolts, nuts, etc.) shall be stainless steel and make a watertight union. Sleeves shall be Kor-N-Seal I, Kor-N-Seal II, flexible connectors models 72, 73, 74, 107, 117, 126, 127, 128, 1610, or 1612 as manufactured by EPCO, or shall be as manufactured by Lock Joint a subsidiary of Gifford-Hill-American, Inc. or comparable sleeves as manufactured by the Press Seal Gasket Corporation, or equal. Flexible manhole entrance joints may be cast into the wall of the manhole base or may be installed by coring the manhole wall and installing the flexible connector to form a tight waterstop. Joints shall be watertight under a 30 foot head of water. Flexible

manhole entrance joints shall be A-LOK Joints as manufactured by the A-LOK Products Corp., Press Wedge II as manufactured by the Press Seal Gasket Corp., or equal. Flexible manhole sleeves and flexible manhole entrance joints shall be installed in accordance with instructions of their manufacturer. Alternative entrance joint connections must be approved by Engineer prior to construction.

3.3 PLACING MANHOLE SECTIONS

A. The Contractor shall excavate to the required depth and remove materials that are unstable or unsuitable for a good foundation. Prepare a level, compacted foundation extending 6 inches or more beyond the manhole base.

B. The base shall be set plumb and level, aligning manhole invert with pipe invert.

C. Thoroughly clean bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll the Butyl Sealant rope directly against base of spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side - not top to bottom.

D. Risers and cones shall be set so that steps align, taking particular care to clean, prepare and seal joints.

3.4 MANHOLE FINAL FINISHING

A. After placement of manhole frame and vacuum testing, perform the final finishing to the manhole interior by filling all chips or fractures greater than 1/2 inch in length, width or depth (1/8 inch deep in inverts) with non-shrink grout. Grout the interior joints between the precast concrete sections with non-shrink grout. Sharp edges or rough finishes shall be removed providing a smooth surface throughout the manhole. Clean the interior of the manhole, removing all dirt, spills, or other foreign matter.

3.5 CONNECTION TO EXISTING MANHOLES

A. Any connection with 18 inches and smaller pipe at an existing precast or cast-in place manhole will require the Contractor to core the necessary opening through the manhole wall and install a flexible manhole to pipe connector. Connector shall be as specified elsewhere. Connections to existing brick manholes do not require coring and an opening may be carefully hammered or sawed. Connections to existing manholes with pipe larger than 18 inches may be cored or sawed as approved by the Engineer. Connection to an existing manhole may be made without using flexible pipe connectors only if approved by Engineer.

Whenever a connection is made without a flexible pipe connector, a concrete collar shall be poured in accordance with MSD standard details. The existing manhole bench and invert shall be repaired as specified under manhole materials and installation.

3.6 MANHOLE INVERTS

A. Manhole inverts shall be constructed of brick and cement grout or precast concrete and shall have a "U" shaped cross section of the same diameter as the invert of the sewers which they connect. "U" shaped inverts shall be constructed to a minimum depth of 6 inches for 8 inch sewers (unless full depth is required in Specifications or on the Plans) and to full pipe diameter depth of the outlet sewer main for larger mains. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer, whether horizontal or vertical, shall be made with true tangent curve(s) with as large a radius as the size of the manhole will permit. Manhole benches shall slope a minimum of 2 inches to the lip of the "U" shaped invert. Provide a ½ inch radius at the intersection of 2 or more channels. The minimum concrete thickness in the invert of the channel shall be 2 inches, not including the manhole base thickness.

B. When the invert is not constructed at the precast company, the Contractor shall construct the invert using 4000 psi concrete or non shrink grout. Non-shrink grout (minimum 2-inch thickness on invert channel and on bench) may be plastered over layered brick and mortar in lieu of solid non shrink grout invert.

C. Inverts shall meet the following additional requirements:

1 Pipe Openings: Pipe openings shall provide clearance for pipe projecting a minimum of 2 inches inside the manhole. The crown of small I.D. pipe shall be no lower than the crown of the outlet pipe.

2 Trough: The fall across the manhole invert shall be as noted on the plans.

3 Bench: Finish benches to provide a uniform slope from the high point at the manhole wall to the low point at invert trough. Provide a radius (1/8 inch to 1 inch range is acceptable) at the edge of the bench and trough.

4 Gradual smooth sided depressions and high spots may be allowed so long as diameter of invert channel ranges from 1/4 inch less than, or 1/2 inch more than the nominal pipe diameter are maintained. Voids, chips, or fractures over 1/8 inch in diameter or depth shall be filled with a non-shrink grout and finished to a texture reasonably consistent with the bench surface. All work from collar down shall have a steel trowel finish.

3.7 MANHOLE FRAME AND COVER CONSTRUCTION

A. Manhole frames and covers shall be made of cast iron conforming to the minimum requirements of ASTM Specification A48, Class 35B. All castings shall be made accurately to the required dimensions and shall be sound, smooth, clean and free from blisters and other defects. Defective castings which have been plugged or otherwise treated shall be rejected. The contact surfaces between the cover and its corresponding supporting ring in the frame shall be machined so that the cover will rest on the ring for the full perimeter of the contact surfaces.

B. All frames and covers shall comply with AASHTO HS20 loading requirements.

All manhole frames shall be standard height (7" for EJIW's 1045Z frame or 8" for USF 577 frame) unless a reduced height frame is specified in the project plans or specifically approved or required by the Engineer. All manhole frames shall be equipped to accept a cam-lock cover. However, only those frames and covers designated on the plans as "watertight" and/or "lock-down" shall have covers equipped with locks. All manholes designated as "watertight" shall be "lock-down" and those designated "lock-down" shall be "watertight". When "lock-down" manholes are required, covers shall be furnished with two stainless steel, pentagon headed cam-locks, located and constructed as per the MSD details cited below. Frames and covers designated as "watertight" shall have a cover equipped with a one-piece gasket permanently attached in a groove in the bottom of the manhole cover. (See MSD Details 2.11-08.1 and 2.11-08.2). An ORS gasket shall be placed in a dove tailed groove in the bottom of the cover and the cam-lock feature shall provide sufficient pressure to prevent cover movement and subsequent wear of gasket.

C. All covers shall have two 5/8-inch diameter lifting bars set into the cover to allow for lifting by a chain hoist. There shall be no holes or perforations in covers. Manhole covers shall be either standard covers or watertight / lock-down covers and shall meet the additional requirements set forth in paragraphs 6 or 7 below. Watertight /lock-down covers shall be required and used when specified in the project plans; when the diameter of the sewer main equals or exceeds 18 inches in diameter, where the manhole is subject to flooding, or when required by the Engineer. Shop drawings shall be sent to the Engineer for review and acceptance prior to manufacturing and shipping of castings to the job site.

D. Pre-approved Heavy Duty Standard Frames include:

1 USF 577 Ring (with tooling for Bi-Loc Cover) as manufactured by U.S. Foundry & Mfg. Corp.

2 1045Z-1040AGS (with cam-lock ramp) as manufactured by East Jordan Iron Works, Inc.

E. Pre-approved Reduced Height Frames include Model 1046Z1 (with cam-lock ramp) as manufactured by East Jordan Iron Works, Inc.

F. Pre-approved Standard Logo Manhole Covers shall be:

1 USF IB-ORS as manufactured by U.S. Foundry and MFG. Corp as approved by MSD on November 25, 2009 or EJIW NPR 10-508D as manufactured by East Jordan Iron Works and approved by MSD on March 17, 2010, or approved equal.

G. Pre-approved Water-Tight Lock-Down Manhole Covers shall be:

1 USF IB-ORS-LOC manhole cover as manufactured by U.S. Foundry Corp. or EJIW NPR10-508B as manufactured by East Jordan Iron Work, Inc. or approved equal.

H. Manhole Frame Placement

After the manhole has been set in its final position, set the manhole frames to the required elevation using no more than 12 inches of precast concrete grade rings, or bricks sealing all joints between cone, adjusting rings, and manhole frame. When grade rings or bricks are used, grout with cement mortar. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing surrounding pavement. Manhole frames which are placed above final grade will have frames attached to manhole cone section by means of 5/8-inch diameter steel anchors and steel washers. One anchor bolt shall be provided per hole.

3.8 VACUUM TESTING

A. Vacuum testing of manholes shall be required on no less than 10 percent of the manholes installed. In addition, no less than 5 manholes will be tested. The MSD will select which manholes shall be tested after construction. Vacuum testing each manhole prior to backfilling is recommended as most repairs must be made on the manhole exterior. Vacuum testing is not required on manholes with pipe connections in excess of 30 inches diameter. Vacuum testing shall be made at the Contractor's expense. For extensions constructed by Developers and/or projects under the responsible charge and supervision of an Engineer other than DISTRICT's ENGINEER, the Engineer shall certify that the tests were done in accordance with the required testing procedures and that the test reports accurately depict the results of those tests.

B. Vacuum test the assembled manhole after completing pipe connections, sealing and allowing mortar or cement proper curing time. The vacuum test shall be as follows:

1 Plug pipes with suitably sized and rated pneumatic or mechanical pipeline plugs. Place plugs a minimum of 6 inches beyond the manhole wall and brace to prevent displacement of the plugs or pipes during testing.

2 Position the vacuum tester head assembly according to the manufacturer's recommendations.

3 Draw a vacuum of 10 inches of mercury, close the valve on the vacuum line and shut off the vacuum pump.

4 Measure the time for the vacuum to drop to 9 inches of mercury. The manhole shall pass when the time to drop to 9 inches of mercury meets or exceeds the following:

Manhole I.D. (inches)	48	60	72	84	96	120
Time (seconds)	60	75	90	105	120	150

5 If the manhole fails the test, remove the head assembly and coat the manhole interior with a soap and water solution and repeat the vacuum test for approximately 30 seconds. Leaking areas will have soapy bubbles. Make the necessary repairs and repeat the test until the

manhole passes.

END OF SECTION 02605

SECTION 02722 - SANITARY SEWERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work under this section consists of furnishing all plant, labor, materials, and equipment for the installation of sanitary services and appurtenances.

B. Inspection, Testing, and Acceptance - New Pipelines

1. Inspection

a. Upon completion of each section of sewer or at such time as the Engineer may direct, a block or section of sewer shall be cleaned and inspected. All repairs shown necessary by the inspection shall be made. Broken or cracked pipe shall be replaced; defective joints, if any, replaced; all deposits removed; and the sewer left true to line and grade, entirely clean, free from lumps or protruding jointing material, etc., and ready for use. Each section of sewer between manholes shall show, upon examination from either end, a reasonably full circle of light.

b. Manholes shall be precast manhole, and shall have no major defects. Tops shall be properly placed, and castings securely in place. Manholes shall show absolutely no evidence of leakage through the walls or bottom.

2. Deflection Tests

a. After backfilling trenches, all sewer pipes shall be lamped and visually inspected for pipe alignment. Each run of pipe must present a full circle of light when viewed from one of the connected manholes. Any run of pipe which does not present a full circle of light will be removed and reinstalled.

b. After backfilling trenches, all PVC sewer pipe shall be tested for initial diametric deflections by the use of a Go-No-Go type mandrel which is acceptable to the Engineer. The initial diametric deflection shall not exceed five percent of the base inside diameter as defined in ASTM D-3034. Deflection tests will be performed after trench is no longer subject to construction traffic loading and a minimum of 30 days after completion of trench backfill.

Nominal Pipe Size	Pipe I.D. (SDR 35)	Required Mandrel O.D.
8"	7.665"	7.28"
10"	9.563"	9.08"
12"	11.361"	10.79"
15"	13.898"	13.20"

c. The mandrel shall be pulled through each section of pipe from manhole to manhole. The mandrel must slide freely through the pipe with only a nominal hand force applied. No mechanical device shall be used in pulling the mandrel. Any pipe which refuses the mandrel shall be removed and replaced. Such sections shall be re-tested for deflection 30 days after completion of trench backfill.

d. Mandrel testing may be performed by the District at any time prior to the expiration of the one-year warranty. Any pipe which refuses the mandrel shall be replaced by the Contractor as described above.

3. Leakage and Infiltration

a. All pipe and manhole joints shall be watertight. Any leaks into the sewer shall be repaired or corrected as directed by the Engineer. The MSD reserves the right to TV any section of the sewer system to locate point sources of infiltration, either in the pipe or inside manholes. When directed by the Engineer, any desired section shall be isolated and tested separately.

b. No sooner than 10 days following completion of backfill, the Contractor along with the Engineer, will be required to determine the level of the ground water table. If the ground water table is above the top of the pipe, the sewer line shall be tested for infiltration. If ground water table is less than 2 feet above the top of the pipe, the sewer line shall be low pressure air tested. Each test shall be performed as follows:

1) Infiltration

The infiltration into each section of the sewer shall be measured in wet weather by the temporary installation of suitable metal or wooden weirs as authorized by the Engineer. These weirs shall be furnished, installed and removed by the Contractor. Infiltration test limits shall be applied to single reaches of pipe, up to one mile in length, of the same diameter. For pipes 8 inches through 15 inches in diameter, infiltration into the sewer system (including manholes) shall not exceed 50 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours, and in no case shall it exceed 3,000 gallons per mile per 24 hours. For all pipe sizes larger than 15 inches in diameter, infiltration into the sewer system (including manholes) shall not exceed 100 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours, and in no case shall it exceed 3,000 gallons per mile per 24 hours.

2) Air Testing of Gravity Sewers

The Contractor shall conduct low pressure air tests on all completed sections of gravity sewer. Air tests for PVC, and DIP will be performed in accordance with ASTM C828. Air test results will be used to evaluate materials and construction methods on the sewer line sections, and successful air tests shall be mandatory for the acceptance of the sewers 30 inches in diameter and smaller.

a) Air tests will not be required on pipe with diameters exceeding 30 inches. Acceptance of pipes exceeding 30 inches will be based on infiltration tests and/or visual inspection of the joints.

b) The Contractor shall furnish an air compressor of the necessary capacity along with all necessary plugs, valves, pressure gages, air hoses, connections, and other equipment necessary to conduct the air tests. Plugs in sewers 18 inches in size and larger shall be connected by steel cable for thrust reaction.

c) Compressor capacity shall be sufficient to pressurize the sewer main to 4 psig within a time equal to or less than the required test time. The following equation may be used to ensure compliance with this requirement:

$$C = \frac{0.17 \times D^2 \times L}{T} + Q$$

Where: C = Required Compressor Capacity (cfm)
T = Required Test Time (min)
L = Length of Test Section (feet)
D = Pipe Internal Diameter (feet)
Q = Allowable Air Loss Rate (cfm)

d) The following allowable air loss rates will be used for all pipe tests:

Pipe Size	**Q (cfm)**
4"	2.0
6"	2.0
8"	2.0
10"	2.5
12"	3.0
15"	4.0
18"	5.0
21"	5.5
24"	6.0

e) The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 psig. When a stable condition has been reached, the pressure shall be bled back to 3.5 psig. At 3.5 psig, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of 5 readings will be required for each test.

f) If the time for the air pressure to decrease from 3.5 psig to 2.5 psig is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defects. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air test.

g) Schedule 02722-1 shows the required pipe test times.

h) For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

$$Le = \frac{d^2 \times l}{D^2}$$

Where: Le = Effective Pipe Length (added to Total Test Length)
d = Diameter of Service Lateral Pipe(inches)
l = Length of Sewer Lateral (feet)
D=Diameter of Sewer Main Pipe being tested **(inches)**

1.2 SUBMITTALS

A. Shop drawings shall be submitted to the Engineer in accordance with the General Conditions for the following items:

1. Precast manholes

2. Precast valve vaults

3. Metal castings

4. Transition couplings

B. Manufacturer's certifications shall be submitted to the Engineer certifying that the following materials meet all requirements of the specifications:

1. Sewer Main Pipe

2. Sewer Service Pipe

3. Sewer Pipe Fittings

C. Mix designs for concrete and asphalt shall be submitted to the Engineer for approval, if requested by the Engineer.

D. PDF of all submittals are required. None of the above listed equipment or materials shall be used on the project unless the necessary approval for that particular item has been given by the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL

A. All sanitary sewers 15 inches in size and smaller shall be constructed of either ductile iron or PVC sewer pipe as shown on the Plans. All sanitary sewers 18 inches, 21 inches, and 24 inches in size shall be constructed of ductile iron or unless otherwise shown on the Plans. All sanitary sewers larger than 24 inches in size shall be constructed of ductile iron pipe or unless otherwise shown on the Plans.

B. All PVC, and ductile iron sewer pipe and fittings shall be suitably marked at their places of manufacture to show their class, strength, or thickness, as applicable.

C. All materials used in the manufacturer of sewer pipe and fittings used on the District’s systems and projects shall be certified by the manufacturer to meet or exceed ASTM, AWWA, NSF and other nationwide accepted standards for the appropriate type of pipe or fittings. Each joint of pipe delivered to the job site shall be stamped or otherwise marked to indicate the testing laboratory’s acceptance or approval. In addition, if required by the Engineer, all pipe and materials shall be inspected, tested and certified by an accredited commercial testing laboratory, approved by the Engineer, prior to or after delivery of such pipe and/or materials to the job site and shall be certified to meet or exceed the requirements set forth in these specifications. Certified copies of all testing and acceptance reports shall be delivered, in duplicate, to the Engineer prior to the use of such materials on the project. The cost of any inspecting and/or testing shall be borne by the Contractor or pipe manufacturer. Laboratory testing of other materials may be required if deemed necessary by the Engineer.

2.2 DUCTILE IRON PIPE

A. Ductile iron pipe shall conform to the requirements of ANSI Specification A21.51. The pipe class, bedding, and loading shall comply with MSD standard details. When loading conditions are beyond those shown, the Contractor will submit design computations to the Engineer or MSD. The pipe class shall be as shown on the Plans. Bedding shall be as shown on the trench details. Joints shall be "push-on" which conform to the requirements of ANSI Specification A21.11. Ductile iron fittings shall conform to the requirements of ANSI Specification A21.10, Class 350 in sizes 24 inches and smaller and Class 250 in sizes larger than 24 inches, unless otherwise shown on the Plans. All ductile iron pipe shall have a ceramic-filled anime-cured epoxy, Protecto 401 by Induron.

B. All fittings for ductile iron pipe, including but not limited to wyes, tees, saddles, bends, crosses, sleeves, plugs, caps, reducers, and glands, shall be gasketed push-joint pipe or mechanical joint. Fittings shall conform to the requirements of ANSI/AWWA C110/A21.10 (Standard fittings, 3 inches thru 48 inches) or ANSI/AWWA C153/A21.53 (Compact fittings, 3 inches thru 48 inches) with the joints meeting the requirements of ANSI/AWWA C111/A21.11 (Rubber-gasket joints) and shall be pressure rated at the same rating as the mainline sewer pipe but in no case less than 250 psi. Gasketed push-joint type fittings shall meet or exceed the requirements as set forth in ANSI/AWWA C 111/A 21.11 and may be used only in non-pressurized in-line locations and below ground installations. Mechanical joint fittings shall meet or exceed the requirements as set forth in ANSI/AWWA C111/A21.11. All fittings shall be manufactured from ductile iron grade 70-50-05 (min. tensile strength – 70,000 psi; min. yield strength – 50,000 psi, min. elongation – 5%) as specified in AWWA C110 or C153 and ASTM A536. All ductile iron pipe fittings and materials shall conform to paragraph 2.01 (d) of this section of the Technical Specifications. All ductile iron pipe fittings shall have a cement mortar lining of standard thickness conforming to the requirements of ANSI Specification A21.4. Note: Couplings for ductile iron pipe to ductile iron pipe shall be ductile iron mechanical joint sleeves, only.

C. All sanitary sewer cleanout boxes and covers shall be manufactured from gray iron meeting the requirements of ASTM A48 or ductile iron grade meeting the requirements of AWWA C110 and ASTM A536. All sanitary sewer cleanout boxes shall conform to the dimensions and requirements as set forth in MSD's Standard Detail for Cleanout Boxes (MSD-12) and shall be U.S. Foundry Handhole Ring and FC Cover model #7610 or East Jordan Iron Works Heavy Duty Monument Box model #1574 or approved equal. Note: U.S. Foundry Handhole Ring and FC Cover model #7630 may be used where cleanout box is within an asphalt or concrete paved area.

D. For all pipe other than potable and plant water, ductile iron pipe and fittings shall be lined with a ceramic-filled anime-cured epoxy, Protecto 401 by Induron. The lining shall be 40 mils minimum.

2.3 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

A. PVC gravity sewer pipe shall be C900 DR-18 or better conforming to ASTM D3034. Joints shall be integral bell and spigot type with compression type rubber gaskets. Joints shall conform to ASTM Specification D 3212. Couplings for PVC pipe to PVC pipe shall be PVC "Closure" or "Stop" couplings and shall meet ASTM D 3034. Transition Couplings for PVC pipe to ductile iron pipe shall be mechanical joint ductile iron fittings utilizing transition gaskets. No more than one material transition will be allowed in any one reach of pipe.

2.4 TEES, WYES, AND MISCELLANEOUS FITTINGS

A. Wyes and Saddles shall be of the same material and strength as the sewer mains on which they are installed, unless otherwise specified. Saddle type fittings shall not be used on new construction or existing mains for pipes 12 inches in diameter or smaller, unless specifically called for in the Plans and/or Specifications or approved in writing by the Engineer. For ductile iron mains greater than 12 inches in diameter, “CB” Romac tapping saddles as manufactured by Romac Industries Inc. or an approved equal may be used. Unless otherwise specified in the Plans and/or Specifications, house services shall be constructed of 4-inch diameter Schedule 40 PVC pipe or Class 350 psi ductile iron pipe.

B. For taps and services on an existing MSD maintained PVC or VCP sewer main (6 inches in diameter) that are being repaired by trenchless construction methods, flexible saddles as manufactured by NDS/HPI or an approved equal may be utilized. Flexible Saddles shall be affixed to the Main by bands or straps as provided by the manufacturers and by using a two-part epoxy glue uniformly spread over the contact surface of the saddle.

C. A compression coupling by Inserta-Tee or approved equal shall be used to re-connect services to existing 8-inch and larger diameter sewer mains that are being rehabilitated by trenchless construction methods.

D. Wyes shall be placed in sanitary sewers so as to properly serve each existing house and each vacant lot facing or butting on the street or alley in which the sewer is being laid, and at such other locations as may be designated by the Engineer.

E. The Contractor shall measure the distance to the tap or tee from the downstream manhole and the offset distance to each cleanout assembly to obtain the information required for the "As-Built" records. As-built data shall be marked on the Plans and turned over to the Engineer at the end of the project.

F. The location of all wyes, cleanouts, and house sewers installed in the work shall be identified on the Plans and in the field.

2.5 SEWER SERVICE LINES

A. Where existing sewer mains are being rehabilitated, sewer service lines shall be constructed for each property that is occupied by a business or dwelling if it is

currently served by the new construction. For extensions of the existing public system, all buildable lots adjacent to the extension shall have a sewer service line provided.

Additional service lines may be installed by the Contractor as directed and authorized by the Engineer. In general, service lines shall be constructed from the public sewer to a point located at the edge of the public right-of-way or the sewer easement. Service lines shall consist of a 4-inch or 6-inch diameter pipe, as listed in the Bid Schedule and/or shown on the Plans.

B. The Contractor shall be responsible to locate and connect all existing sewer service lines. In the event a service is missed during construction, the Contractor shall return to the site and perform all work necessary to reinstate the connection. The Contractor will be compensated in accordance with the original contract unit pricing; however, re-mobilization to the site will not be paid for.

C. Service lines built for vacant lots/future connections shall have a cleanout assembly constructed, which includes a 1 foot capped stub-out on the service line. The vertical cleanout pipe shall also be capped, and shall be a minimum of 3 feet above the finish grade.

D. Service lines 4 inches or less shall be tapped into the sewer main, not into a manhole. Service connections 6 inches or greater shall only be made into an existing or proposed manhole, unless otherwise approved by the ENGINEER.

E. The MSD-maintained portion of each sewer service line shall have a minimum of 3 feet of cover, unless approved by the Engineer.

F. Sewer service lines and clean-outs shall be Class 350 DIP (with Class 350 appurtenances) if:

1. The service line is installed underneath gravel or paved areas which will have less than 3 feet of cover and will be subjected to traffic loads; or

2. The service line crosses a creek or drainage ditch (whether aerial or subaqueous).

G. The minimum slope on any residential sewer service line shall not be less than 2 percent, unless approved by the Engineer.

H. Sewer service line connections to sewer mains 12 inches and smaller shall be made with a wye of the same material and joint type as the sewer main. Sewer service connections to sewer mains larger than 12 inches may be made with Romac Saddles, style “CB” as manufactured by Romac Industries, Inc., or approved equal.

I. Cleanouts shall be constructed at the edge of the permanent easement or at the edge of the public right of way, whichever applies. In addition, one cleanout shall be constructed for:

1. Every four 45-degree changes located in series (a long sweep is equivalent to two 45-degree bends); and

2. At intervals no greater than 100 feet.

PART 3 - EXECUTION

3.1 LOCATIONS

A. Pipework shall be installed at the locations shown on the Plans and to the position, alignment, and grade shown thereon. Prior to beginning work at any location, the Contractor shall consult with the Engineer and Owner to determine that all rights-of-way, permits, or other legalities are in order. He shall familiarize himself with all conditions and/or limitations of such rights-of-way or permits and shall fully comply with all such requirements. All work shall be confined to rights-of-way or permit limits and any encroachment beyond such limits shall be the Contractor's liability.

3.2 RELATION OF SEWERS TO WATER MAINS

A. Crossing a sewer under a water main: Whenever it is necessary for a sewer to cross under a water main, the sewer shall be laid at such elevation that the top of the sewer is at least 18" below the bottom of the water main, unless local conditions or barriers prevent an 18" 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' on each side of the point of crossing.

B. Crossing a sewer over a water main: Whenever it is necessary for a sewer to cross over a water main, 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' on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

3.3 CLEARING AND GRUBBING

A. Clearing and grubbing, where required, shall be done prior to beginning of pipe installation. It shall be done in accordance with applicable portions of items of General Conditions and the following:

B. The Contractor shall consult with the Owner and Engineer prior to starting clearing and a full understanding is to be reached as to procedure. The Contractor shall then conduct clearing and grubbing operations in strict accordance with these agreements.

C. Clearing of trees and brush along the pipeline shall be carefully done so that no damage will occur outside of the limits of the right-of-way. Trees and brush must be cut by hand and trees felled within the right-of-way limits.

D. Brush, laps, roots, etc., shall be disposed off-site in a manner approved by the Engineer. Burning of trees, brush and debris will not be permitted.

E. Grubbing of stumps that are in the way of construction shall be done in any convenient manner which will not cause damage to remaining trees or adjacent property. Stumps shall be disposed as for brush or laps above.

F. Limits of the pipe-laying operation shall be confined to the right-of-way and easements. The width of clearing shall be held to a minimum and in no case wider than the right-of-way or easement.

G. Site clearing and grubbing shall be limited to 3,000 feet ahead of pipe laying, unless specified or directed otherwise by the Engineer.

3.4 WORK ON HIGHWAY RIGHT-OF-WAY

A. The contractor shall not begin work on any property of the Department of Transportation until necessary permits are in hand. He shall conform to all requirements of the Department of Transportation or its authorized representatives in the prosecution of this portion of the work. It shall be the responsibility of each Bidder to contact the local highway representative and to determine the exact requirements for work to be done. Requirements shall include, but are not limited to the following:

B. Where a pipeline crosses under a highway, it shall be installed either by open cut, in tunnel or in encasement under the highway. Materials and method of crossing shall be as indicated on the plans for each crossing. Where pipe is installed by open cut, at least one full lane for traffic shall be kept open and clear at all times.

C. The Contractor shall provide full-time flagmen, with appropriate red flags, at all times when work is in progress.

D. Necessary warning and descriptive signs shall be provided and placed at each end of the working area while work is in progress along highways. These signs shall be well tended and shall be placed at sufficient distances from the site of the work so that ample warning is given to approaching traffic. Signs shall be adequately lighted at night.

E. The Contractor shall keep all streets open to traffic at all times unless permitted otherwise by the Engineer or Department of Transportation as applicable. The Contractor shall provide, place and maintain temporary traffic control devices as directed by the Engineer or Department of Transportation. The latest edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways* as prepared by the National Joint Committee on Uniform Traffic Control Devices shall be used as a guide in the placement of devices and all devices shall meet the requirements of said manual.

F. Where pipe is installed in open cut across a highway, the cut shall be immediately backfilled and all work of repairing the pavement completed immediately. Any subsequent settlement shall be immediately corrected and repaired.

G. Where pavement is cut and replaced, the Contractor shall cut the edges to a straight and even line before repairing the pavement. No ragged edges will be allowed or accepted.

H. Where asphalt pavement or bituminous surfacing is cut, the entire area to be repaired shall be primed with an asphalt prime coat, acceptable to the Department of Transportation before the pavement is replaced.

I. When required, the Contractor shall furnish to the Department of Transportation a 100% Performance Bond for the amount of paving to be cut and replaced along highways. Bond is required in North Carolina.

J. Unless otherwise indicated, no excavated material shall be placed on the pavement side of the ditch, along State Highways. The least possible amount of trench will be left open when work is not in progress and equipment shall be removed from the pavement and shoulders during shutdown periods.

K. Shoulders of roadways shall be left in good, acceptable condition and all topsoil and grass that is disturbed shall be replaced. Grassing shall include seeding fertilizing, and mulching to conform with the Department of Transportation requirements.

L. The Contractor shall pay the cost of all Department of Transportation inspectors time, if required on the job.

3.5 WORK ON RAILROAD RIGHT-OF-WAY

A. The Contractor shall not begin work on any property of the railroad until he has secured necessary permits. He shall conform to all requirements of the railroad, or its authorized representatives, in the prosecution of this portion of the work, including but not limited to the following:

B. Where a pipeline crosses under a railroad, the work shall be done in accordance with requirements of the Railway Company. Pipe shall be installed by boring and jacking (or open cut as designated). Excavation shall be done ahead of the pipe. The encasement must be kept on accurate line and slightly below grade. A tolerance of 2% will be allowed on short lines in good soil and not over 1% in any case.

C. The Contractor shall furnish the Railway Company the following:

1. Certificate of Worker's Compensation or Employer's Liability Insurance according to the laws of the State.

2. Certificate of the Contractor's Public Liability Insurance to protect the Contractor and Subcontractor for loss of life or injury to persons in an amount not less than $1,000,000 for any one person, not less than $1,000,000 for any one accident; and for property loss or damage in an amount not less than $1,000,000 for any one accident and not less than $1,000,000 aggregate or as required by the Railroad Company.

3. The original policy of Railroad Protective Liability Insurance naming the Railway Company as the insured for loss of life or injury to persons in an amount not less than $1,000,000 for one person, and not less than $1,000,000 for any accident and for property loss or damage in an amount not less than $1,000,000 aggregate. The Railroad Protective Liability Policy should show the location and description of work and name of Owner for whom the work is done.

D. The Contractor shall also pay the cost of flagmen or other expenses of the railroad in protecting traffic. He shall notify the railroad of the time that the work will be done and shall not begin work until authorized by railroad officials.

3.6 PROPERTY OWNER NOTICE AND PROTECTION OF SITE

A. The District will secure rights-of-way or easements where required through private lands. The Contractor shall be responsible for any damage to buildings, walls, fences, utility poles, bridges, utilities, railroad, or other improvements encountered, whether public or private. All such improvements shall be carefully protected from damage and, in case of damage or removal, shall be completely repaired or restored to its original or better condition. All damage to such improvements and all damage to property or persons resulting from damage to such improvements shall be the responsibility of the Contractor. Special care shall be taken in trenching near buildings, roads and railroads, to avoid or minimize all delays, damage, or injury thereto.

B. Prior to any operation, the Contractor shall give advance notice to all property owners and/or tenants within the project.

3.7 USE OF EASEMENTS AND RIGHTS-OF-WAY

A. Prior to disturbing any area, the Contractor shall stake the limits of all easements and/or rights-of-way. The Contractor shall confine all his operations and personnel within limits of all rights-of-way and easements as shown on the Plans. There shall be no disturbance outside the easement or rights-of-way nor shall the workmen be allowed to travel at will through the surrounding private property, except as provided below. The Contractor is responsible to note any areas where limits have been reduced from typical limits. Prior to using any areas outside the rights-of-way and easements provided, the Contractor shall provide written approval of the current property owner and submit to the Engineer for his approval. The Contractor shall abide by all Special Provisions Detail Sheets provided in the Special Conditions section of the Specifications.

3.8 TRENCH EXCAVATION

A. Trench excavation shall be made along the lines designated by the Engineer and to the depth necessary for laying the sewer to the required grade.

B. Sides of trenches shall be kept as nearly vertical as is allowable by the Occupational Safety and Health Administration. They shall be at least 12" and not more than 24" wider at the top of the pipe than the outside diameter of the

pipe plus sheathing where it is necessary. Where pavement is to be cut. It shall be cut in advance of trenching 1' wider than the required width of the trench.

C. Where soil conditions prohibit vertical walls, the trench width at the bottom and to 1' above the top of the pipe shall be as specified above with the remainder being held to the least possible width greater than that specified. Where soil conditions prevent ditch excavation without excessive widths, or where directed by the Engineer, wood or steel sheeting, as hereinafter specified, shall be driven to support the trench walls, or a suitably reinforced steel trench box shall be employed.

D. Trench bottoms shall be hand graded to provide uniform and continuous bearing for the pipe along its entire length, with bell holes being dug for pipe bells. No ridges, sags, or undercutting will be allowed. Excess excavating below grade shall be backfilled at the Contractor's expense with suitable material which shall be thoroughly stamped.

E. If approved by the Engineer and subject to suitable soil conditions, the trench may be excavated a few inches below the established subgrade and backfilled with selected material (from the excavation, if available) well compacted and so shaped as to give the pipes uniform bearing throughout their lengths at the established grade. Bell holes shall be dug to relieve the bells of load and to provide for completing the joints.

F. Where the material at grade is unstable, soft, and incapable of supporting the pipe, the trench shall be excavated below grade, as directed by the Engineer, and refilled to grade with crushed stone or gravel to form a foundation for the pipe.

G. When authorized by the Engineer, the Contractor shall dispose of material excavated from the trench that is unsuitable for backfill material. The Contractor shall provide the place select borrow material to replace unsuitable material for backfilling the trench as directed.

H. Stone shall be compacted and graded to provide stable foundation and a uniform bearing for the pipe. Bell holes shall be provided as in other types of foundations.

I. Should ground water be encountered in the bottom of the trench, causing the trench bottom to be unstable, the material, as directed by the Engineer, shall be excavated below grade sufficiently to allow a bed of crushed rock or gravel to be place in which to bed the pipe. The work shall be done as for unstable foundations. The depth of cut below grade shall be only the minimum amount to accomplish the purpose, and shall be as directed by the Engineer.

J. The Contractor shall furnish all machinery for pumping, bailing, and/or well pointing and shall pump, bail, or otherwise remove any water which may be found or shall accumulate in the trenches, and shall perform all work necessary to keep them clear of water while the pipe is being laid. The disposal of water after removal shall be satisfactory to the Engineer.

K. Whenever necessary, the side of the trench shall be braced and rendered secure and either open or close sheathing used to the satisfaction of the Engineer; such sheathing and bracing to be left in place until the trench is refilled to a safe limit, not less than 2' above the top of the pipe. The top portion may be then cut off, but the lower portion shall remain undisturbed. In lieu of sheeting, suitable trench boxes may be employed. All sheeting, bracing, trench boxes, and trench construction methods shall conform to the latest Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970. No extra payment will be made for sheeting and bracing. Such cost shall be included in the cost of installing the pipe.

L. All existing water, sewer, and gas lines, buried electrical and telephone cable, and other known utilities intersecting the lines of construction, if requested by the Engineer, shall be uncovered by the Contractor at his expense and exposed to the Engineer at least 100' ahead of pipe laying operations of insure the correctness of grades. Existing utilities shown on the Plans are as accurately located as existing records and field surveys allow; however, the Contractor shall verify with the various utility companies before excavating and shall save harmless the Owner from any claims for damages as a result of this work.

M. The Contractor shall at all times take necessary precautions in preventing gutters, catch basins, ditches and other drainage facilities from being clogged that might cause flooding conditions and damage to public or private properties.

N. Rock Removal, Blasting

1. See Section 02213

O. Upon completion of the backfilling and repair operation, all excess earth, broken pavement, rock, shoring and all left over materials and debris resulting from the Contractor's operations shall be removed from the work areas and disposed of by the Contractor. The Contractor shall provide his own disposal site. He shall comply with all State of North Carolina, County and Local regulations, rules and ordinances regarding the disposal of such material. All costs arising from the disposal of the material shall be borne by the Contractor at no additional cost to the Owner. The work areas and adjoining areas used by the Contractor shall be left clean and free of evidence resulting from the Contractor's presence.

3.9 PIPE LAYING

A. Before sewer pipe is placed in position in the trench the bottom and sides of the trench shall be carefully prepared and the necessary bracing and sheeting installed. Each pipe shall be accurately placed to the exact line and grade called for on the Plans.

B. Each piece of pipe and special fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. Pipe shall be straight when placed in the trench. Curved pipe shall not be laid. Trench bottoms found to be at incorrect grade after pipe laying operations has begun shall be corrected and brought to exact line and grade.

Any fill required to bring the trench bottom to grade, shall be pipe foundation material or pipe embedment material as specified herein, as applicable.

C. Bell holes shall be of sufficient size to allow ample room for properly making the pipe joints. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length.

D. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe and so as to avoid sudden offsets or inequalities in the flow lines. The inside of all bells and the outside of all spigots shall be wiped to remove all dirt, water, or other foreign matter. Joint lubricants shall be compatible with the pipe and gasket materials and shall be as recommended by the pipe manufacturer.

E. All jointing of pipe and fittings shall be in accordance with the pipe manufacturer's recommendations.

F. Any leaks or defects discovered at any time shall be repaired immediately. All pipe in place shall be carefully protected from damage until the backfilling operations have been completed. Any pipe which has been disturbed shall be taken up, the joint cleaned and remade, and the pipe re-laid at Contractor's expense.

G. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the joints are completed or before the trench has been backfilled. The Contractor shall not open up at any time more trench than his available pumping facilities are able to dewater.

H. As the work progresses, the interior of all pipe in place shall be thoroughly cleaned. After each line of pipe has been laid it shall be carefully inspected and all dirt, trash, rags, and other foreign matter removed from the interior. When pipe laying is not in progress, the Contractor shall place a watertight plug in the last section of pipe which has been laid. The Contractor shall install temporary watertight plugs in the proposed sewer line at any manhole that is incomplete, at the open end of the pipeline prior to leaving the job site daily and elsewhere as dictated by good engineering and construction practices. All installed pipe shall be backfilled to prevent flotation in the event water enters or rises in the trench. The plugs as installed shall prevent infiltration or the introduction of any foreign material into either the existing or proposed systems. Upon completion of all construction, the Contractor will be responsible for the complete removal of all watertight plugs.

I. Backfilling of trenches shall be started immediately after the pipe is in place and the joints completed.

3.10 DEEP SERVICES AND MAXIMUM SERVICE GRADE

A. When the depth of cut is over 8 feet and the grade of a sanitary sewer is lower than necessary to serve abutting property, and at such other locations as may be designated by the engineer, the Contractor may install the service line with a 22 ½ or 45 degree bend just upstream of the cleanout assembly to bring the service line up to the necessary elevation.

B. Unless required service depth is noted on construction Plans, the Contractor shall contact the Engineer and request confirmation of grade prior to constructing any sewer service line at a depth greater than 8 feet.

3.11 DUST CONTROL

A. The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property. The Contractor will not be directly compensated for any dust control measures necessary, as this work will be considered incidental to the work covered by the various contract items. The Contractor will provide dust control measures as directed by the Engineer.

3.12 CUTTING AND REPLACING PAVEMENT

A. Where pavement is to be cut for installation of pipe or other utilities, the Contractor shall cut it nearly in advance of trenching and shall replace the pavement with base and new pavement.

B. In areas where roadway is to be patched pavement shall be neatly cut to a straight edge in advance of trenching with the method of cutting being subject to approval of the Engineer. Pavement shall be cut 12" wider than the excavated area on each side. Ragged and irregular edges will not be allowed and work completed with ragged edges shall be redone. Concrete pavement shall be sawed with suitable concrete saw cutting equipment.

C. Trench backfilling shall be done in layers not over 6" thick and thoroughly compacted. Compaction shall be such as to prevent future settlement and shall be done by acceptable means, approved by the Engineer. Rolling with rubber-tired vehicles or track-type equipment will not be allowed. Compaction shall be at least 95% of maximum as established by AASHTO Specification T99, Method A.

D. Base for pavement shall be crusher run stone for all non-NCDOT maintained streets, HB binder for all secondary highways, and reinforced concrete for all primary highways. All base shall be placed in accordance with plan and/or encroachment permit details. Base width shall be as shown on the Plans and/or encroachment permits for various types of pavement cuts.

1. Crusher run stone shall be well mixed and compacted by tamping and rolling. Compaction shall be to such degree as to preclude settlement. Crusher run base material shall be placed at the same time that the trench is backfilled. Backfilling to top of ditch, to be cut out and replaced with base material at a later date, will not be allowed.

2. Crusher run base for highway pavement and adjacent drives shall be 8" of stone, stabilized with 5% Portland Cement. It shall be thoroughly mixed prior to compacting.

3. Crusher run base for non-highway pavement and drives shall be 8" of stone without the addition of cement.

4. Binder base for secondary roads shall be a minimum of 6” HB binder conforming to specifications of the Department of Transportation.

5. Concrete base shall consist of 8" of concrete, reinforced with #4 reinforcing steel bars placed at 8" on center in the transverse direction #4 tie bars in the longitudinal direction. Concrete shall be designed to produce a compressive strength of 3000 psi at 28 days. The design of the mix and source of supply shall be subject to approval of the Engineer.

E. Pavement shall be replaced with the same type of pavement that exists prior to cutting and shall consist of either bituminous surface course (double treatment), 2" of hot plant mix asphaltic concrete, or 8" of Portland Cement concrete; all conforming to specifications of the Department of Transportation for each type.

1. Pavement shall be replaced with the same type of pavement that exists prior to cutting and shall consist of either bituminous surface course (double treatment), 2" of hot plant mix asphaltic concrete, or 8" of Portland Cement concrete; all conforming to specifications of the Department of Transportation for each type.

2. For asphalt pavement or bituminous surfacing, the entire area to be resurfaced (including edges of existing pavement) shall be primed with an acceptable asphalt prime coat just prior to placing new pavement.

3.13 TIE-INS TO EXISTING PUBLIC OR PRIVATE COLLECTION SYSTEMS

A. Tie-ins to existing public or private collection systems will be allowed when proper precautions are taken to protect the existing MSD public collection system. Tie-ins to existing inactivated sewer lines not installed under the same contract will not be allowed without written approval from all parties involved (MSD, Contractor, contract holders, etc.).

B. If the proposed sewer does not begin at an existing manhole, a new manhole will be "cut in" at the required location and the existing pipe(s) repaired as specified. For extensions of the system, the new "cut in" manhole or the connection to the existing manhole will not be constructed until all other sewer construction has been completed and tested in compliance with the Specifications.

C. Pipelines or manholes which contain silt, sedimentation, or other foreign material shall not be connected to any portion of the existing public collection system or any private collection system already connected to the MSD’s system. The Contractor shall at his own expense flush, or otherwise cause the line (and manholes) to be cleaned out without any discharge into the existing system.

3.14 ABANDONMENT OF EXISTING SEWERS AND MANHOLES

A. Manholes which are to be abandoned shall first have both influent and effluent lines plugged inside the manhole with watertight masonry or concrete. The

manhole will then be filled with non-compressible material (crushed stone or as approved by Engineer), to a point not less than 3 feet below the finish grade. The remainder of the manhole shall be broken down and removed. Then the excavation shall be backfilled to finish grade as specified under trench backfill.

B. Abandoned mains at active manholes shall be completely disconnected from the manhole by cutting the pipe outside the manhole and then plugging the abandoned main and the manhole wall with watertight masonry. The invert shall then be rebuilt to conform to the standard details.

C. Exposed sections of abandoned mains shall be removed to a point not less than 5 feet from the adjacent banks or surface waters. The remaining ends of the pipe shall be plugged with watertight masonry. Concrete piers or collars in the creek channel shall be removed completely. Concrete piers or collars not located in the creek channel shall be removed to a point 3 feet below the finish grade. Steel piers shall be cut off 3 feet below finish grade.

D. The minimum length of watertight masonry plugs will be the diameter of the abandoned pipe plus 1 foot.

3.15 ABANDONED SEWER GROUTING

A. Existing sewers shall be completely filled with high strength (pressure) grout where indicated on the Plans after the new sewer is placed in service.

B. High strength (pressure) grout shall be composed of cement, flyash, and water proportioned and mixed to produce a plastic pumpable mixture. Cement shall be portland cement conforming to ASTM Specification C150, Type I. Flyash shall be Type C. Water shall be fresh, clean and free from injurious amounts of oil, acid, alkali, and organic matter.

C. The following ingredients shall be selected, proportioned and mixed to produce a pumpable, high strength (pressure) grout:

Wt. of cement per cu. yd.	940 lb.
Wt. of flyash per cu. yd.	1,925 lb.
Vol. of water per cu. yd.	60 gal.
Amount of air entrainment in fresh mix	2 % of volume
Retarder	Max. Allowed / 100 WT

D. Pressure grout shall be pumped into place via a pipe cemented into the sewer line to be grouted full. This pump line shall have vent pipes on each end and the pipe used shall be capable of withstanding the pressure it will be subjected to during the pump process.

3.16 REMOVING AND REPLACING SIDEWALK, OTHER ITEMS

A. Where pipe is to be placed under existing concrete sidewalk, the concrete shall be removed in construction units unless their length is more than 10', in which case the concrete shall be cut as specified in paragraph 3.11.2. of this section. The backfill shall be thoroughly compacted for the entire depth of the trench.

B. The sidewalk shall be replaced with 3000 psi concrete, 4" thick, except for driveways where it shall be 6" thick. The concrete shall be placed monolithic and dressed off with a wooden float, brush and edging tool. Where pipe is to be placed under concrete walk, the Contractor may, with the permission of the Engineer, install the pipe by tunneling instead of removing and replacing the walk. If pipe is to be placed under curb and gutter, it shall be done by tunneling. No additional payment will be made therefor.

C. The Contractor shall be responsible for removing and replacing items such as mail boxes, fences, shrubbery, walls, steps, and any other private ornamental items that are in direct conflict with the sewer line work. No additional payment will be made therefor.

3.17 PIERS AND PROTECTION WORK

A. Concrete piers: Foundation for piers shall be adequate to support the intended load and will be subject to the Engineer's approval prior to pouring concrete. Concrete piers shall have a rubbed finish.

B. Protection concrete shall be poured in such locations as shown on the plans or directed by the Engineer. It shall consist of one part Portland Cement, two parts sand and four parts crushed stone.

3.18 MISCELLANEOUS ITEMS

A. The Contractor shall be responsible for removing and replacing miscellaneous items in conflict with the sewer line work such as mail boxes., signs, fences, walls, shrubbery, private ornamental items, etc. Shrubbery and plantings shall be preserved by proper root protection and watering until replanted. Tree limbs shall be protected where possible. Damaged trees shall be repaired with an approved tree dressing. No additional payment will be made for removing and replacing miscellaneous items.

3.19 REPAIRS TO DAMAGED SERVICES AND UTILITIES

A. Repairs to damaged services and utilities shall be promptly made at the Contractor's expense. The Contractor shall use every effort to avoid damaging or breaking water, sewer, gas, power, telephone or other utility services. Utility lines shall be properly supported across the pipe trench until backfilling is completed. Should damage occur, immediate action shall be initiated to effect satisfactory repairs. All repair work shall be satisfactory to the Engineer and owner of the damaged utility.

3.20 CLEANUP

A. All pipeline rights-of-way and pipework areas shall be cleaned up and left in satisfactory condition.

B. Cleanup of work along highways or roads shall be made immediately upon completion of the backfill operation. Ditching and pipe laying shall be stopped at any time that cleanup work lags and shall not be resumed until cleanup progress is satisfactory to the Engineer. Final cleanup and condition of the work area shall be subject to the approval of the State Highway Representative, the Owner, and the Engineer.

C. Cleanup of work for cross-country locations shall follow immediately upon the completion of any major part of the work or upon instructions by the Engineer. Topsoil shall be replaced on all areas disturbed by the pipeline work throughout the length of the sewer main, and to the full satisfaction of the property owner. Topsoil may be removed from the line of work and stockpiled for future use. It shall be carefully removed, stockpiled, protected, respread, dressed off, and the entire right- of-way left in condition acceptable to the Engineer and property owner. If topsoil is not stockpiled and protected, suitable, approved material from other sources shall be provided. Where the line is located on pasture land, grassed areas, or roadway shoulders, grass shall be replaced.

3.21 BY-PASS PUMPING

A. See Section 11500.

Schedule 02722-1 Minimum Test Times for Pipe

Pipe-Size →	4"	6"	8"	10"	12"	15"	18"	21"	24"
25	0:04	0:10	0:17	0:22	0:26	0:31	0:36	0:44	0:53
50	0:09	0:20	0:35	0:44	0:53	1:02	1:12	1:29	1:47
↑ **75**	0:13	0:30	0:53	1:06	1:20	1:34	1:48	2:14	2:40
100	0:17	0:40	1:11	1:29	1:47	2:05	2:24	2:58	3:33
LENGTH									
125	0:22	0:50	1:29	1:51	2:13	2:36	3:00	3:43	4:27
150	0:26	1:00	1:47	2:13	2:40	3:07	3:36	4:27	5:20
175	0:31	1:10	2:04	2:35	3:07	3:39	4:12	5:12	6:14
200	0:35	1:20	2:22	2:58	3:33	4:10	4:48	5:57	7:07
OF									
225	0:40	1:30	2:40	3:20	4:00	4:41	5:24	6:41	8:00
250	0:44	1:40	2:58	3:42	4:27	5:13	6:00	7:26	8:54
275	0:49	1:50	3:16	4:05	4:53	5:44	6:36	8:10	9:47
300	0:53	2:00	3:33	4:27	5:20	6:15	7:12	8:55	10:41
PIPE									
325	0:58	2:10	3:51	4:49	5:47	6:47	7:48	9:40	11:34
350	1:02	2:20	4:09	4:11	6:14	7:18	8:25	10:24	12:28
375	1:06	2:30	4:27	5:34	6:40	7:49	9:01	11:09	13:21
400	1:11	2:40	4:45	5:56	7:07	8:21	9:37	11:54	14:14
TESTED									
425	1:15	2:50	5:02	6:18	7:34	8:52	10:13	12:38	15:08
450	1:20	3:00	5:20	6:40	8:00	9:23	10:49	13:23	16:01
475	1:24	3:10	5:38	7:03	8:27	9:54	11:25	14:07	16:55
500	1:29	3:20	5:56	7:25	8:54	10:26	12:01	14:52	17:48
525	1:33	3:30	6:14	7:47	9:21	10:57	12:37	15:37	18:42
↓ **550**	1:38	3:40	6:31	8:09	9:47	11:28	13:13	16:21	19:35
575	1:42	3:50	6:49	8:32	10:14	11:60	13:49	17:06	20:28
600	1:47	4:00	7:07	8:54	10:41	12:31	14:25	17:51	21:22

END OF SECTION 02722

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SECTION 02723 – FORCE MAINS

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Work covered under this section of these specifications consists of the construction of force main lines and miscellaneous pipework, including all valves, fittings, and appurtenances. The scope of work shall be as detailed under Project Drawings and Specifications.

1.2 QUALITY ASSURANCE

A. Standards:

1. American Society for Testing and Materials

a) ASTM D2241

b) ASTM D1784

c) ASTM D1598

d) ASTM D1599

e) ASTM D2152

B. The Contractor shall retain the services of a testing laboratory to perform all compaction tests required at the project site. The testing laboratory shall be approved by the Engineer. In areas of fill and backfill, field density tests shall be performed in sufficient numbers to ensure that the specified density is obtained. These tests shall be made and paid for by the Contractor in accordance with the testing allowance, except as follows.

1. Areas in which testing reveals compaction below the specified density shall be reworked, or removed and replaced by the Contractor until specified compaction is obtained. In the event results fail after reworking material, the Contractor shall be liable for retesting.

2. The Contractor shall be responsible for the cost of testing of borrow material which shall include standard density tests (Proctor curves)

1.3 SUBMITTALS

A. Submittals shall be as specified in the General Conditions.

B. Submit the following:

1. Manufacturer's Certificate of Compliance with the applicable specifications and standards.

2. Shop drawings with physical characteristics and dimensions of pipes.

PART 2 – PRODUCTS

2.1 GENERAL

A. All material and appurtenances shall meet the following minimum standard requirements. It shall be each manufacturer's responsibility to check the installation and to furnish material that will be fully capable of performing its intended function.

B. Pipe shall be of the type, size, class and diameter as hereinafter specified and called for by the Drawings.

C. Trench construction shall be in accordance with the MSD's Standard Details.

2.2 DUCTILE IRON PIPE

A. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51 and be centrifugally cast of ductile iron having a minimum tensile strength of 60,000 psi, a minimum yield strength of 42,000 psi, and a minimum elongation of 10% (Grade 60-42-10). All ductile iron pipe shall conform to ANSI/AWWA C150/A21.50 and shall be Pressure Class (PC) 350 for pipes 12-in. and smaller; and shall be PC 250 for pipes 14-in. and larger.

B. Nominal laying lengths shall be 18-ft or 20-ft. A maximum of 20% of the total number of pipes of each size delivered may be provided in lengths that are as much as 24-in. shorter than the nominal lay length; an additional 10% may be provided in lengths that are as much as 6-in. shorter than the nominal lay length.

C. Fittings for flanged ductile iron pipe shall be of ductile iron. Flanged fittings shall conform to the requirements of ANSI/AWWA Specification C110/A21.10 and shall be suitable for a water working pressure of 250 psi. Flanges shall conform to the requirements of ANSI/AWWA Specification C110/A21.10.

D. Underground Sewage Force Main piping, inside the pumping station site, (generally inside the fenced area), shall be ductile iron pipe with gasketed, compression type joints, "slip-joints". Ductile iron pipe with slip joints shall conform to the requirements of ANSI/AWWA Specification C151/A21.51. The pipe shall be Class 350. Slip joints shall conform to the requirements of ANSI/AWWA Specification C111/A21.11. Minimum cover shall be 30 inches.

E. All ductile iron pipe shall have exterior coatings and interior linings as follows:

1. Interior Lining

a. Material: a ceramic-filled anime-cured epoxy, Protecto 401 by Induron or equal.

b. Material Standard: ANSI/AWWA C104/A21.4

c. Lining Thickness: 40 mils nominal dry film thickness.

2. Exterior Coatings (Exposed)

a. Exposed ductile iron pipe and fitting shall have a three part coating system such as Sherwin Williams Exterior Tank System, or approved equal. The surfaces to which the system is to be applied shall be prepared in accordance with the manufacturer's recommendations.

b. The first part or application shall be a rust penetrating epoxy pre-primer (Sherwin Williams Macropoxy 920 Pre-Prime or approved equal). After cure, the intermediate coat or base coat (Sherwin Williams Macropoxy HS high solid epoxy or approved equal) shall be applied.

c. The finish or top coat (High Gloss Sherwin Williams Acrolon 218 HS acrylic polyurethane or approved equal) shall be applied.

d. Color for pump station piping shall be Sherwin Williams Item Number SW4001 Bolt Brown, or approved equal. Colors for applications other than force main piping shall be submitted to the ENGINEER for approval.

F. Weights and Markings:

1. Weights of pipe and fittings shall conform to the requirements of AWWA specifications. The class designations for the various classes of pipe and fittings shall be cast on fittings in raised numerals and cast or stamped on the outside of individual joints of pipe. Weights shall be plainly painted in white on the outside of each joint of pipe after the exterior coating has hardened.

2. The manufacturer's year of production and the letters DI or DUCTILE shall be clear and legible and on, or near, the bell end.

G. Polyethylene Encasement for Buried Ductile Iron Pipe:

1. Polyethylene encasement shall be provided for all buried ductile iron pipe.

2. Material Standard: ANSI/AWWA C105/A21.5

3. Linear low density polyethylene film (8 mil minimum, 3600psi tensile strength) or high density (4 mil minimum, 6300psi tensile strength) cross laminated polyethylene film shall be used.

4. All polyethylene encasement shall be marked showing trademark, year of manufacture, type of resin, specification conformance, and applicable pipe sizes.

5. A 2-in. wide plastic adhesive tape shall be used for sealing seams, cuts, or tears in polyethylene encasement. Duct tape shall not be allowed.

2.3 POLYVINYL CHLORIDE PIPE

A. PVC pipe shall be rigid polyvinyl chloride with integrally formed, factory fabricated for rubber ring type joints. PVC pipe shall be made from clear virgin material and shall conform to all requirements of ANSI/AWWA C900, with cast-iron equivalent outside diameter (CIOD).

B. All PVC force main pipe shall be Pressure Class 200 (DR 21), unless approved otherwise by the MSD.

C. Each length of pipe shall be furnished in standard 20-ft (± 1-in.) laying lengths.

D. PVC material used in the manufacture of PVC pipe shall conform to ASTM D1784 and shall be made from a compound meeting or exceeding the requirements of cell classification 12454.

E. Force mains of PVC pipe shall have gasketed push-on joints. Gaskets shall be manufactured of elastomeric material in accordance with ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”.

F. Identification:

1. All PVC force main pipe shall be green in color and shall be marked “FORCE MAIN” and “NOT FOR POTABLE USE”.

2. Each length of pipe shall be marked with the name of the manufacturer, size, and class. All gaskets shall be marked with the name of the manufacturer, size, and proper insertion directions.

G. Provisions must be made for expansion and contraction at each joint, through the rubber gasket and pipe bell. Laying lengths shall be 20'-1", except random lengths may be furnished for special connections and other special uses.

2.4 PVC FITTINGS

A. PVC fittings shall not be allowed on force mains. All fittings for PVC force main pipe shall be ductile iron fittings, conforming to ANSI/AWWA C110/A21.10 for mechanical joint fittings. All fittings shall be restrained joint type.

2.5 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. Pipes: HDPE force main pipe shall meet the requirements for Type III, Grade P345 Polyethylene Material as defined in ASTM Specification D1248 (PE 4710). The minimum pressure class/SDR rating acceptable shall be Class 200/SDR 11. The pipe shall be DIPS and shall have an interior diameter no less than the piping that it is connected to.

B. Joints: Joints shall be of a heat fusion joining system. Pipe and fittings shall be thermal butt fusion, saddle fusion, or socket fusion in accordance with manufacturer recommended procedures and ASTM D-2161. At the point of fusion, the outside diameter and minimum wall thickness of the fitting shall match the outside diameter and minimum wall thickness specifications of ASTM D-1248 for the same size pipe.

Joining of the pipes and fittings shall be performed in accordance with ASTM D-2774. Depending upon the installation requirements and site location, joining shall be performed within or outside the excavation. Joints of the pipe sections shall be smooth on the inside and internal projection beads shall not be greater than 3/16 inch.

The tensile strength at yield of the butt-fusion joints shall not be less than the pipe. A specimen of the pipe cut across the butt-fusion joints shall be tested in accordance with ASTM D-638.

The manufacturer shall provide fusion training. The Contractor and the onsite joint inspector shall be trained by the manufacturer or manufacturer's authorized representative.

The fusion equipment and operator shall be required to demonstrate successful field experience. Regarding fusion over 36" capability, the fusion unit shall be field tested for a period of five years and the fusion operator shall have pipe size experience of the same size pipe on this project for five years or longer.

C. Fittings: All fitting shall be provided as indicated on the plans. HDPE Fittings shall be of the same material and class as the pipe and shall be manufactured by the manufacturer of the pipe. HDPE Elbows, tees, and wyes shall be manufactured by mitered fabrication. The manufacturer shall have a written specification for all standard mitered fittings, which establishes Quality Control criteria and tolerances. The manufacturer may be required to demonstrate its ability to produce product required by this specification.

Mechanical joint anchor fittings (MJ Adapter or Harvey Adapter) shall be used to transition from ductile iron to HDPE and from HDPE to PVC. The fitting shall be stronger than the pipe in that when it is subjected to tensile stress the pipe will pull apart before the fitting will pull out and the pipe will blow before the fitting will rupture under pressure.

The MJ Adapter shall have a pre-installed stainless steel stiffener, in accordance with Plastic Pipe Institute (PPI) recommendations, to neutralize point-loading, ACQ, creep and loss of gasket seal due to diameter contraction. The stiffener shall be engineered sufficiently thick to avoid redial buckling due to gasket pressure.

The MJ Adapter requires longer bolts and shall be sold with the modified longer bolt kit to avoid construction crew delays or improper installation with too short bolts.

All fittings for force mains or pressure rated fittings shall be rated according to the manufacturer's written specifications, and clearly labeled on the fittings as such.

D. Installation: The installation shall conform to the requirements of the manufacturer, the AWWA Standard, and as indicated on the plans and specified herein.

E. Marking and Certification: Each length of HDPE sanitary sewer shall be clearly marked with the Manufacturer's Name, Tradename or Trademark, Nominal pipe size, Pipe Stiffness, Production Code/Extrusion Code, Material Cell Class Designation and ASTM number.

The pipe manufacturer shall provide certification that the stress regression testing has been performed on the specific product. The said certification shall include a stress live curve per ASTM D-2837. The stress regression testing shall have been performed in accordance with ASTM D-2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis of 1,600 psi as determined by ASTM D-2837. This certification shall also state that the pipe was manufactured from one specific resin in compliance with these specifications. The certificate shall state the specific resin used and its source.

2.6 JOINT MATERIAL

A. Gasket lubricant shall be a potable hydrogenated vegetable oil, insoluble in cold water, non-toxic, and shall not support the growth of bacteria. It shall contain no deleterious ingredients and shall have no deteriorating effects on the gaskets. The lubricant shall be semi-paste, easily applicable, readily adherent to the inside of the bell, and shall remain in a usable state throughout the range of temperature in which pipe is normally installed. Lubricant shall be delivered to the job site in unopened containers bearing the manufacturer's name and trade name or trademark.

2.7 ANCHORAGE / JOINT RESTRAINT

A. Force mains shall be adequately anchored to resist thrusts that may develop at bends, tees, plugs, valves, and at any other location where a change in flow direction occurs.

B. Restrained Joint Pipe and Fittings:

1. Provide restrained joint pipe and fittings where called for on the drawings. Length of restrained pipe shall be as indicated on the Drawings. Restrained joints shall be Flex Ring and Lok-Ring (American), TR Flex (U.S. Pipe), Field Lok (U.S. Pipe), Snap-Lok (Griffin Pipe), or approved equal.

2. Restrained joint pipe and fittings shall be ductile iron manufactured in accordance with ANSI/AWWA C151/A21.51 and C110/A21.10. Restrained joint pipe and fittings shall meet all AWWA standards and other requirements as specified above for standard ductile iron pipe and fittings unless addressed herein.

3. Field made joints are allowable but should be avoided where possible. Careful planning to locate field cuts in standard pipe sections is preferred. For field made joints in restrained piping, use field weldments, an insert

equal to TR Flex Gripper Rings, or gasket-type bolt-less restraint using Field Lok or Fast Grip gaskets or approved equal.

a. Field Lok or Fast Grip gaskets for field made restrained joints shall be Tyton or Fast Tite joint in design with corrosion resistant stainless steel locking teeth vulcanized into the rubber. Gaskets shall meet all applicable requirements of ANSI/AWWA C111/A21.11 and shall be rated for a working pressure of 250 psi, minimum.

b. All gasket-type bolt-less restraints shall be a visible color other than black to ensure immediate identification and correct installation where required. Field Lok gaskets shall be red in color, and Fast Grip gaskets shall be Amarillo Fast Grip gaskets yellow in color for increased visibility, or equal.

c. Gasket-type bolt-less restraints shall only be allowed for joining ductile iron pipe and fittings. Gasket-type bolt-less restrains shall not be used on PVC pipe.

4. Restrained joint fittings shall be provided by the restrained joint pipe supplier. Fittings shall be of the same model / type as the pipe supplied from the pipe manufacturer.

C. Mechanical Joint Restraints:

1. Mechanical joint restraints may be used consisting of a follower gland with restraining device that imparts a wedging action against the pipe. The restraining device shall have twist off nuts to ensure proper contact with the pipe. Glands and restraining devices shall be manufactured of Ductile Iron. The restraining devices shall be heat treated to a hardness of 370BHN. Gland dimensions shall be compatible with the MJ fittings hereinbefore specified. The restrained joint shall be rated for a minimum 250 PSI working pressure with a 2:1 safety factor. Mechanical joint restraints may be through the use of a specially machined ductile iron ring and follower gland that is used with standard mechanical joint gaskets and T-bolts.

a. Restrained mechanical joints shall be Megalug as manufactured by EBAA Iron, Inc., Stargrip as manufactured by Star Pipe Products, or approved equal.

b. Where additional fittings/valves are required for pipes not shown on Drawings, consult with the Engineer for length of restrained joint

pipe necessary each side of fittings/valve prior to installation of pipe/fitting.

c. Contractor shall develop a field layout schedule and drawing for restrained joint pipe installations for the MSD's review prior to installation.

2.8 VALVE BOXES

A. Valve boxes shall be of cast iron, three-piece, screw type with covers and bases. They shall be of suitable size for the valve with which they are used and fully adjustable for depth of setting, extension pieces being furnished where necessary. Drop type covers shall be provided for each box with the proper work designating the valve service cast into its top surface. Oval type bases shall be provided and shall be so designed to fully support the box without weight of the box and/or superimposed load being transmitted to any part of the valve or adjacent pipe on either side.

B. Valve boxes shall be Figure 4905 as manufactured by Opelika Foundry Company, or comparable boxes as manufactured by the Mueller Company, John Bouchard & Sons, Company, or pre-approved equal.

2.9 CONCRETE

A. Concrete for protection and for thrust blocks shall be composed of Portland Cement, sand, coarse aggregate, water and such admixtures as may be allowed, in such proportions as to provide in minimum compressive strength of 3,000 psi. The source of concrete and mix design shall be reviewed and approved by the Engineer prior to use.

2.10 CRUSHED STONE

A. Crushed stone for pipe bedding shall conform to ASTM C33, size no. 67 with a range of ¼" to 1.

2.11 TRACER WIRE

A. All sanitary sewer force mains shall have a solid copper or copper clad steel core tracer wire, specifically manufactured for underground installations, buried on top of the pipe, as per MSD Detail Force Main Tracer Tape and Wire Installation. THHN, TNN or uncoated copper wire shall NOT be allowed.

1. The tracer wire shall have a #12 AWG (minimum) solid copper, 7 strand copper conductor wire or steel core, copper clad wire capable of carrying a low voltage (up to 600 volts) current for low voltage applications for locating buried sewer lines and shall meet or exceed ASTM Specifications, UL Standards, and National Electrical Codes (NEC) requirements.

2. For #12 AWG solid copper tracer wire, the insulation shall be a flame retardant, heat, moisture and chemical resistant polyvinyl chloride (PVC)

material (60 mil minimum thickness) and shall be PRO-LINE Safety Products CU UF Tracer Wire No. 7430405 or approved equal.

3. For #12 AWG 7 stranded copper tracer wire, the insulation shall be a flame retardant, heat, moisture and chemical resistant polyvinyl chloride (PVC) material (60 mil minimum thickness) and shall be PRO-LINE Safety

   Products CU UF Tracer Wire No. 7431005 or approved equal.

4. For #12 AWG steel core, copper clad tracer wire, the insulation shall be a flame retardant, heat, moisture and chemical resistant polyvinyl chloride (PVC) material (60 mil minimum thickness) and shall be Copperhead High Strength CCS Tracer Wire No. CH1230BHS500 or approved equal.

5. The color of the outer cover shall be “green” in accordance with NC811 and AWWA Uniform Color Code for sanitary sewer uses and shall come in a continuous roll of not less than 1000 feet per roll, unless the distance between tracer wire access boxes, for which the wire is to be installed, is less than 1000 feet; in such cases, the minimum length of the wire on the roll shall be not less than the distance between the terminal boxes plus twenty (20’) feet.

6. The tracer wire shall be placed over the sewer pipe or force main pipe after backfilling to 12” to 18” above top of pipe with ABC stone or other acceptable backfill material. After placing tracer wire in pipe trench, the Contractor shall backfill the remainder of the trench as per MSD Backfill Specifications. In no case shall the tracer wire be disturbed by the backfill process or installation.

7. The tracer wire shall be continuous from the beginning point to the ending point. Should it become necessary to splice this wire, a splice kit/connector capable of handling two (2) to four (4) wires per connection and designated to be “waterproof” shall be provided. Such connector / splice kits shall be Scotchlok DBY by 3M, LV 9000 by SNAPLOC or approved equal.

8. The ends of the tracer wire shall terminate at an approved terminal box (or tracer wire access box) specifically made for assisting in the location of underground tracer wire. The ends of the tracer wire shall be tracer wire affixed to the connector points of the tracer wire access boxes as per the tracer box manufacturer’s requirements. Tracer wire access boxes shall be provided at and between each air release valve, air/vacuum valve, combination valve, and the terminal manhole. Tracer wire access boxes shall be those manufactured by VALVCO Inc. or approved equal and capable of supporting and withstanding H20 highway loads.

9. Where the distance between the terminal boxes (tracer wire access boxes) as specified above, exceeds 1000 feet, additional tracer wire access boxes

shall be provided and installed so that the distance between any two adjoining boxes does not exceed 1000 feet.

10. The location of all tracer wire access boxes and air release valves shall be marked with a fiberglass utility marker post of not less than 3.75" (w) x 72" (L) x 0.125" (t). Marker Posts, as manufactured by Rhino Markers or approved equal, shall be embedded not less than 24 inches, nor more than 36 inches into the ground and shall be green in color conforming to NC811 and AWWA color code requirements for sanitary sewers.

11. Fiberglass Utility Marker Posts shall include the following information either printed directly on the face of the post or on a plastic water resistant label affixed with a waterproof glue or adhesive (see MSD Details for layout):

    a. "WARNING" (yellow letters on white background)

    b. "Sanitary Sewer Force Main" (black letters on white background)

    c. "Owner – Metropolitan Sewerage District of Buncombe County, NC" (black letters on white background)

    d. Emergency Phone Number – 828-255-0061 (black letters on white background)

    e. NC811 "Call Before You Dig" logo - (color on white background)

12. A non-detectable 6.0 mil x 6" (w) pigmented polyethylene utility marker tape, green in color with the wording "Caution – Buried Sewer Line Below" or Caution – Buried Sanitary Sewer Below) imprinted thereon shall be installed in the backfill directly above the sewer force main pipe at a depth of 24" to 36" above the top of the pipe but less than 12" below the finish ground surface. This marker tape shall be PRO-LINE 10434 183 3 or 10434 193 3 or approved equal.

B. The Contractor shall be responsible for testing the Tracer Wire System for conductivity after all connections have been made. If the Tracer Wire does not function as intended, the Contractor shall take appropriate and necessary measures to bring the system into compliance.

2.12 COMBINATION AIR/VACUUM AND AIR RELEASE VALVES

A. The route of the force main shall be such that the number of combination air/vacuum release valves (CARV) are minimized to the greatest extent possible.

B. An automatic air release valve shall be provided at all high points to prevent air locking of the force main. An automatic combination air/vacuum release valve (CARV) shall be provided at the ultimate high point and when necessary for surge control where sub-atmospheric pressures or column separation may occur. Automatic air release valves shall be used at all other high points. Air release valves are required when the difference between the low point and high point

exceeds one pipe diameter. These valves shall be of the quick-opening, slow-closing type with a minimum 2-in. diameter screw-threaded inlet and a stainless-steel quarter-turn ball valve between the force main and the air release valve for isolation purposes.

2.13 RESTRAINED FLANGE COUPLING ADAPTERS

A. Manufacturers and Type

1. EBAA Iron Sales, Inc., 2100 MEGAFLANGE

2. Romac Industries, Inc., Style RFCA

3. Smith-Blair Style 911

4. Or equal restrained flange coupling adapters by US manufacturer.

PART 3 – EXECUTION

3.1 LOCATION

A. Pipework shall be installed at the locations shown on the plans and to the position, alignment and grade shown thereon. Prior to beginning work at any location, the Contractor shall consult with the Engineer and the MSD to determine that all rights-of-way, permits, or other legalities are in order. He shall familiarize himself with all conditions and/or limitations of such rights-of-way or permits and shall fully comply with all such requirements. All work shall be confined to rights-of-way or permit limits and any encroachment beyond such limits shall be the Contractor's liability.

B. Force mains shall not be installed closer than 25 feet from a private water supply well or 50 feet from a public water supply well, even if ferrous pipe material with joints equivalent to water main standards is used.

3.2 RELATION OF WATER MAIN TO SEWER

A. Crossing a Force Main under a Water Main: Whenever it is necessary for a force main to cross under a water main, the force main shall be laid at such an elevation that the top of the force main is at least 18" below the bottom of the water main, unless local conditions or barriers prevent an 18" vertical separation, in which case 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' on each side of the point of crossing.

B. Crossing a Force Main over a Water Main: Whenever it is necessary for a force main to cross over a water main, 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' on each side of the point of crossing. A section of force main pipe shall be centered at the point of crossing.

3.3 INSTALLATION OF FORCE MAINS AND APPURTENANCES

A. Force mains shall be installed in accordance with AWWA C600 for ductile iron, AWWA C605 for PVC, and AWWA C906 for HDPE. Continuous and uniform bedding, haunching, and backfill that is appropriate for the soil type and pipe material shall be provided in the force main trench.

B. The Contractor shall haul the pipe and appurtenances to the site of work and distribute them neatly along the trench prior to laying. The pipe shall be carefully handled to prevent damage, mechanical hoists or other approved methods being used in the handling. Depth of cover shall not be less than 3'-0" for pipe up to 8" in diameter or 3'-6" for pipes 10" and larger in diameter, measured to the top of pipe, except where shown differently on a profile or specifically authorized by the Engineer.

1. In the event that the appropriate installation depth cannot be met by the design, the force main shall be constructed of ferrous pipe or provided with a ferrous pipe encasement in accordance with 15A NCAC 2H .0305(g)(4).

C. Pipe and appurtenances shall be kept clean, and open ends securely plugged, when pipe laying is not in progress. The inside of pipe and bell and spigots shall be thoroughly inspected and cleaned prior to lowering into the ditch and care shall be exercised after the pipe is in place to prevent dirt or other extraneous material from getting into the pipe or bells and into the spigot.

D. Spigots shall be fully seated in the bells and the pipe shall be uniformly bedded on the bottom of the trench for its entire length with bells lying in previously dug bell holes sufficiently large to allow proper bedding and jointing. Fittings, valves and other appurtenances shall be located where shown on the plans or directed by the Engineer, with the pipe being cut where necessary. After jointing, a reasonable amount of deflection may be made in the joint. Such deflection shall not exceed the allowable amount specified by the manufacturer for each size of pipe.

E. For mechanical joint pipe, the rubber rings shall be properly lubricated and the spigots and bells cleaned before assembling the joint. Nuts of bolted joints shall be tightened with special torque limiting wrenches set to provide the proper strain on the bolt, and all nuts tightened to that limit.

F. Rubber ring joints, shall be assembled in accordance with the manufacturer's instructions. The bell and spigot shall be absolutely clean prior to seating of the gasket. The gasket shall be wiped clean, flexed and properly inserted into the socket and seated evenly and properly. Care shall be taken to eliminate any bulges which might interfere with the proper entry of the spigot. A thin film of lubricant, shall be applied to the inside surface of the gasket. The spigot shall then be completed by forcing the spigot into the bell until it makes contact with the bottom of the socket. This shall be done by use of pipe jack and assembly, or other methods as approved by the Engineer.

G. Fittings shall be installed where shown on the plans or directed by the MSD. They shall be handled and installed in the same manner as the pipe and all shall be well blocked or restrained as specified herein.

H. Where shown on the plans, or directed by the MSD, concrete supports, walls, or other protective work shall be constructed.

I. Contractor shall take elevation shots every 100 feet on the installed force main pipe along the entire route to ensure positive and uniform grades to each air release valve. The elevations shall be recorded by the Contractor with a record provided to the MSD.

3.4 THRUST BLOCKING

A. Restrained joint pipe and mechanical joint restraints shall be used in lieu of concrete thrust blocking wherever possible. Concrete thrust blocking shall only be used where connections are made to existing pipes or structures, or restrained joint pipe or mechanical joint restraints cannot be used, or at the direction of the MSD.

B. Concrete for blocking and protection shall be poured in accordance with the following requirements: All fittings, bends, dead ends, etc., shall be acceptably blocked with concrete having bearing on undisturbed earth in the side and/or bottom of the trench. Bearing area shall be equal to that shown on the Plans and greater if deemed necessary by the MSD. No concrete shall be poured or splattered on fitting bells, glands, or bolts.

C. Reaction blocking for force mains 10” and larger shall be transit-mixed concrete. Bags of unmixed sacrete or other bagged concrete for blocking and bracing shall not be acceptable. This concrete shall have a 28 day compressive strength of 3000 psi.

D. Material for reaction blocking for force mains less than 10” may be composed of bagged concrete that has been mixed with the correct proportion of water.

3.5 REPAIRS TO DAMAGED SERVICES AND UTILITIES

A. Repairs to damaged services and utilities shall be promptly made at the Contractor's expense. The Contractor shall use every effort to avoid damaging or breaking water, sewer, gas, power, telephone or other utility services. Utility lines shall be properly supported across the pipe trench until backfilling is completed. Should damage occur, immediate action shall be initiated to effect satisfactory repairs. All repair work shall be satisfactory to the Engineer and the Owner of the damaged utility.

3.6 CONNECTIONS TO EXISTING FACILITIES

A. Connections to existing facilities shall be made where shown on the plans or directed by the MSD’s authorized representative. All connections to the MSD’s facilities shall be witnessed by a representative of the MSD, in which case, the main shall be cut and the connections made with fittings. In no case shall the Contractor operate the existing systems without the expressed permission of the MSD.

3.7 TESTING

A. Prior to testing any segment of force main, care should be taken to prevent the pipe from moving while under pressure.

B. Temporary taps and air releases shall be permissible to facilitate testing.

C. Water used for testing force main installations shall either be disposed in a nearby sanitary sewer, as authorized by the MSD or other local sewer authority, or in another location in accordance with state and federal laws and regulations.

D. All testing shall be performed in the presence of the MSD's authorized representative and the Engineer or other authorized representative.

E. The results of all testing shall be submitted to the MSD by the Contractor or Engineer as part of the construction record documentation.

3.8 PRESSURE TESTING

A. A hydrostatic pressure test shall be performed on each segment of installed force main.

B. The test shall be performed after the force main has been backfilled and at least seven days following the pouring of the last thrust block (if applicable).

C. The following procedures shall be followed in performing hydrostatic pressure tests on force mains:

1. The force main segment shall be carefully filled with water at a velocity of approximately one foot per second. Water may be introduced from either the pump station or a temporary connection made in the force main. Appropriate measures necessary to eliminate all air from the force main shall be taken during this process.

2. Once full of water, the force main segment shall be pressurized and allowed to stabilize at a minimum test pressure of 100 psi, or 1.5 times the maximum design pressure of the force main pipe material, whichever is greater.

3. The pressure shall be maintained within 5 psi of the test pressure for at least two (2) consecutive hours.

4. If the stated pressure cannot be maintained, the Contractor shall make all necessary repairs, and repeat the hydrostatic pressure test until the force main segment passes.

D. The pressure test may be performed concurrently or separately with the leakage test.

3.9 LEAKAGE TESTING

A. A leakage test shall be performed on each segment of installed force main at the hydrostatic pressure test stipulated herein, a minimum of 100 psi or 1.5 times the maximum design pressure of the force main pipe material, whichever is greater.

B. Leakage shall be defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure after the pipe has been filled with water and all air has been expelled.

C. Leakage shall be measured with a calibrated test meter and shall not exceed the amount given by the following formula:

$$L = \frac{S * D * \sqrt{P}}{133{,}200}$$

Where:

S = Length of Pipe (feet)

L = Leakage (gph)

D = Nominal Diameter of Pipe Segment Tested (inches)

P = Test Pressure (psi)

All visible leaks shall be repaired regardless of the amount of leakage. If leakage exceeds this rate, the Contractor is responsible for assuring that the cause of test failure is determined, all necessary repairs are made, and repeating the test until the force main segment passes.

D. Water for testing two (2) times the volume of the new line's total volume will be furnished by the Owner at no cost to the Contractor after which normal water usage charges will be made. Contractor shall furnish all necessary pipe or hose extensions or transportation to the point of use and shall exercise care in the use of water.

3.10 PIPE FITTINGS

A. Pipe fittings shall be subject to inspection and testing in accordance with standard manufacturing practice.

3.11 GASKETS

A. Gaskets shall be tested, if required, in accordance with Section 3-4 of ANSI/AWWA C111/A21.11.

3.12 OTHER MATERIAL

A. Other material shall be subject to such testing as the MSD may require, should its acceptability be questioned.

END OF SECTION 02723

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SECTION 02830 – PRECAST MODULAR BLOCK RETAINING WALLS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the design, furnishing and construction of precast concrete modular block (PMB) retaining walls with or without geosynthetic reinforcement. PMB units shall be cast utilizing a wet-cast concrete mix and exhibit a final handling weight in excess of 1,000 pounds (450 kg) per unit and may utilize concrete-reinforcing steel.

B. System shall be consistent with large-block modular gravity and reinforced retaining wall systems such as those manufactured by Redi-Rock International or approved equal.

C. Scope of Work: The work shall consist of furnishing materials, labor, equipment and supervision for the construction of a precast modular block (PMB) retaining wall structure in accordance with the requirements of this section and in acceptable conformity with the lines, grades, design and dimensions shown in the project site plans.

D. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 and Division 02 also apply to this Section.

1.2 REFERENCES

A. Where the specification and reference documents conflict, the Owner's designated representative will make the final determination of the applicable document.

B. Definitions:

1 Precast Modular Block (PMB) Unit – machine-placed, "wet cast" concrete modular block retaining wall facing unit.

2 Geotextile – a geosynthetic fabric manufactured for use as a separation and filtration medium between dissimilar soil materials.

3 Geogrid – a geosynthetic material comprised of a regular network of tensile elements manufactured in a mesh-like configuration of consistent aperture openings. When connected to the PMB facing units and placed in horizontal layers in compacted fill, the geogrid prevents lateral deformation of the retaining wall face and provides effective tensile reinforcement to the contiguous reinforced fill material.

4 Drainage Aggregate – clean, crushed stone placed within and immediately behind the precast modular block units to facilitate drainage and reduce compaction requirements immediately adjacent to and behind the precast modular block units.

5 Unit Core Fill – clean, crushed stone placed within the hollow vertical core of a precast modular block unit. Typically, the same material used for drainage aggregate as defined above.

6 Foundation Zone – soil zone immediately beneath the leveling pad and the reinforced zone.

7 Retained Zone – soil zone immediately behind the drainage aggregate and wall infill for wall sections designed as modular gravity structures. Alternatively, in the case of wall sections designed with geosynthetic soil reinforcement, the retained zone is the soil zone immediately behind the reinforced zone.

8 Reinforced Zone – structural fill zone within which successive horizontal layers of geogrid soil reinforcement have been placed to provide stability for the retaining wall face. The reinforced zone exists only for retaining wall sections that utilize geosynthetic soil reinforcement for stability.

9 Reinforced Fill – structural fill placed within the reinforced zone.

10 Leveling Pad – hard, flat surface upon which the bottom course of precast modular blocks is placed. The leveling pad may be constructed with crushed stone or cast-in-place concrete. A leveling pad is not a structural footing.

11 Wall Infill – the fill material placed and compacted between the drainage aggregate and the excavated soil face in retaining wall sections designed as modular gravity structures.

C. Reference Standards

1 Design

a. Minimum Design Loads for Buildings and Other Structures – ASCE/SEI 7-10.

b. International Building Code, 2018 Edition.

c. FHWA-NHI-10-024 Volume I and GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.

d. FHWA-NHI-10-025 Volume II and GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.

e. National Concrete Masonry Association (NCMA) Design Manual for Segmental Retaining Walls (ASD), 3rd Edition

FHWA GEC-11 shall govern where conflicts exist with NCMA guidance.

2 Precast Modular Block Units

a. ACI 201 – Guide to Durable Concrete

b. ACI 318 – Building Code Requirements for Structural Concrete

c. ASTM A615 – Steel Bars for Concrete Reinforcement

d. ASTM A767 – Galvanized Steel Bars for Concrete Reinforcement

e. ASTM A775 – Epoxy-Coated Steel Reinforcing Bars

f. ASTM C33 – Standard Specification for Concrete Aggregates

g. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

h. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

i. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

j. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.

k. ASTM C150 – Standard Specification for Portland Cement

l. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

m. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

n. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

o. ASTM C595 - Standard Specification for Blended Hydraulic Cements.

p. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

q. ASTM C666 – Standard Test Method for Concrete Resistance to Rapid Freezing and Thawing.

r. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.

s. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.

t. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.

u. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.

v. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.

w. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.

x. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.

y. ASTM C1611 – Standard Test Method for Slump Flow of Self-Consolidating Concrete.

z. ASTM C1776 – Standard Specification for Wet-Cast Precast Modular Retaining Wall Units.

aa. ASTM D6638 – Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks).

bb. ASTM D6916 – Standard Test Method for Determining Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks).

3 Geosynthetics

a. AASHTO M 288 – Geotextile Specification for Highway Applications.

b. ASTM D3786 – Standard Test Method for Bursting Strength of Textile Fabrics Diaphragm Bursting Strength Tester Method.

c. ASTM D4354 – Standard Practice for Sampling of Geosynthetics for Testing.

d. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles

e. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

f. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

g. ASTM D4595 – Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

h. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

i. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.

j. ASTM D4759 – Standard Practice for Determining Specification Conformance of Geosynthetics.

k. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

l. ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

m. ASTM D5262 – Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics.

n. ASTM D5321 – Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.

o. ASTM D5818 – Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics.

p. ASTM D6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.

q. ASTM D6637 – Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.

r. ASTM D6706 – Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil.

s. ASTM D6992 – Standard Test Method for Accelerated Tensile Creep and Creep-Rupture of Geosynthetic Materials Based on Time-Temperature Superposition Using the Stepped Isothermal Method.

4 Soils

a. AASHTO M 145 – AASHTO Soil Classification System.

b. AASHTO T 104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

c. AASHTO T 267 – Standard Method of Test for Determination of Organic Content in Soils by Loss of Ignition.

d. ASTM C33 – Standard Specification for Concrete Aggregates.

e. ASTM D448 – Standard Classification for Sizes of Aggregates for Road and Bridge Construction.

f. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft (2,700 kN-m/m)).

g. ASTM D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base and Surface Courses.

h. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

i. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft (2,700 kN-m/m)).

j. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

k. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

l. ASTM D3080 – Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.

m. ASTM D4254 – Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

n. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

o. ASTM D4767- Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils.

p. ASTM D4972 – Standard Test Method for pH of Soils.

q. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.

r. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Aggregate by Nuclear Methods (Shallow Depth).

s. ASTM G51 – Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing.

t. ASTM G57 – Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method.

5 Drainage Pipe

a. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

b. ASTM F2648 – Standard Specification for 2 to 60 inch Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preconstruction Meeting. As directed by the Owner, the Contractor shall schedule a preconstruction meeting at the project site prior to commencement of retaining wall construction. Participation in the preconstruction meeting shall be required of the Contractor, Retaining Wall Design Engineer (RWDE), Retaining Wall Installation Contractor (RWIC), Grading Contractor, and Inspection Engineer. The Contractor shall provide notification to all parties at least 10 calendar days prior to the meeting.

1. Preconstruction Meeting Agenda:

    a. The RWDE shall explain all aspects of the retaining wall construction drawings.

    b. The RWDE shall explain the required bearing capacity of soil below the retaining wall structure and the shear strength of in-situ soils assumed in the retaining wall design to the Inspection Engineer.

    c. The RWDE shall explain the required shear strength of fill soil in the reinforced, retained and foundation zones of the retaining wall to the Inspection Engineer.

    d. The RWDE shall explain any measures required for coordination of the installation of utilities or other obstructions in the reinforced or retained fill zones of the retaining wall.

    e. The RWIC shall explain all excavation needs, site access and material staging area requirements to the Contractor and Grading Contractor.

1.4 SUBMITTALS

A. Product Data. At least 14 days prior to construction, the Contractor shall submit the retaining wall product submittal package to the Engineer for review and approval. The submittal package shall include technical specifications and product data from the manufacturer for the following:

1. Precast Modular Block System brochure

2. Precast Modular Block concrete test results specified in paragraph 2.01, subparagraph B of this section as follows:

    a. 28-day compressive strength

    b. Air content

    c. Slump or Slump Flow (as applicable)

3. Drainage Pipe

4. Geotextile

5. Geosynthetic Soil Reinforcement (if required by the retaining wall design). The Contractor shall provide certified manufacturer test reports for the geosynthetic soil reinforcement material in the manufactured roll width specified. The test report shall list the individual roll numbers for which the certified material properties are valid.

B. Installer Qualification Data. At least 14 days prior to construction, the Contractor shall submit the qualifications of the business entity responsible for installation of the retaining wall, the RWIC, per paragraph 1.7, subparagraph A of this section.

C. Retaining Wall Design Calculations and Construction Shop Drawings. At least 14 days prior to construction, the Contractor shall furnish electronic versions construction shop drawings and the supporting structural calculations report to the Owner for review and approval. This submittal shall include the following:

1. Block layout and elevations

2. Geogrid elevations and lengths

3. Connection details (positive mechanical connection)

4. Drainage layout and outlet locations

5. Signed, sealed and dated drawings and engineering calculations prepared in accordance with these specifications.

6. Qualifications Statement by the RWDE summarizing their Experience.

7. Certificate of Insurance of the RWDE as specified in paragraph 1.6, subparagraph B of this section.

D. Retaining wall construction/installation shall not proceed until shop drawings are approved by the Engineer of Record.

1.5 CONSTRUCTION SHOP DRAWING PREPARATION

A. The RWDE shall coordinate the retaining wall construction shop drawing preparation with the project Civil Engineer, project Geotechnical Engineer and Engineers. The Contractor shall furnish the RWDE the following project information required to prepare the construction shop drawings. This information shall include, but is not limited to, the following:

1. Current versions of the site, grading, drainage, utility, erosion control, landscape, and irrigation plans;

2. Electronic CAD file of the civil site plans listed in (1);

3. Report of geotechnical investigation and all addenda and any supplemental reports;

4. Recommendations of the project Geotechnical Engineer regarding effective stress shear strength and total stress shear strength (when applicable) parameters for in-situ soils in the vicinity of the proposed retaining wall(s) and for any fill soil that may potentially be used as backfill in retained and/or foundation zones of the retaining wall.

B. The RWDE shall provide the Owner with a certificate of professional liability insurance verifying the minimum coverage limits of $1 million per claim and $1 million aggregate.

C. Design of the precast modular block retaining wall shall satisfy the requirements of this section. Where local, State, or national design or building code requirements exceed these specifications, these requirements shall also be satisfied.

D. The RWDE shall note any exceptions to the requirements of this section by listing them at the bottom right corner of the first page of the construction shop drawings.

E. Approval or rejection of the exceptions taken by the Retaining Wall Design Engineer (RWDE) will be made in writing as directed by the Owner.

F. The RWDE shall determine the appropriate standard(s) to be utilized, and to which the precast modular block design shall be based upon, except as noted herein. Refer to Part 1.2, Paragraph C, Part 1.

G. In the event that a conflict is discovered between these specifications and a reasonable interpretation of the design specifications and methods referenced in paragraph F above, these specifications shall prevail. If a reasonable interpretation is not possible, the conflict shall be resolved per the requirements in paragraph 1.3, subparagraph A of this section.

H. Soil Shear Parameters. The RWDE shall prepare the construction shop drawings based upon soil shear strength parameters from the available project data and the recommendations of the project Geotechnical Engineer. If insufficient data exists to develop the retaining wall design, the RWDE shall communicate the specific deficiency of the project information or data to the Owner in writing.

I. Allowable bearing pressure requirements for each retaining wall shall be clearly shown on the construction drawings.

J. Global Stability. Overall (global) stability shall be evaluated in accordance with the principles of limit equilibrium analysis as set forth in FHWA-NHI-10-024 Volume I and FHWA-NHI-10-025 Volume II GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, or other methods, as determined by the RWDE, as referenced in Section 1.6, Part F. The minimum factors of safety shall be as follows:

Normal Service (Static)	1.5
Seismic	1.2
Rapid Drawdown (if applicable)	1.2

Note: RWDE to select appropriate FOS. Final factors of safety shall be subject to approval by the Engineer and Geotechnical Engineer.

K. Seismic Stability. Seismic loading shall be evaluated in accordance with AASHTO Load and Resistance Factor Design (LRFD) methodology, or NCMA (ASD) methodology as determined by the RWDE as referenced in Section 1.6, Part F.

1.6 QUALITY ASSURANCE

A. RWIC Qualifications. In order to demonstrate basic competence in the construction of precast modular block walls, the RWIC shall possess the following:

1. Experience.

a. Construction experience with a minimum of 3,000 square feet (280 square meters) of the proposed precast modular block retaining wall system.

b. Construction of at least three (3) precast modular block (large block) retaining wall structures within the past three (3) years.

c. Construction of at least 5,000 square feet (465 square meters) of precast modular block (large block) retaining walls within the past five (5) years.

2. RWIC experience documentation for each qualifying project shall include:

a. Project name and location

b. Date (month and year) of construction completion

c. Contact information of Owner or Contractor

d. Type (trade name) of precast modular block system used

e. Maximum height of the wall constructed

f. Face area of the wall constructed

3. In lieu of these specific requirements, the Contractor may submit alternate documentation demonstrating competency in Precast Modular Block retaining wall construction.

B. RWDE Qualifications and Statement of Experience. The RWDE shall submit a written statement affirming that he or she has the following minimum qualifications and experience.

1. The RWDE shall be licensed to practice in the jurisdiction of the project location.

2. The RWDE shall be independently capable of performing all internal and external stability analyses, including those for seismic loading, compound stability, rapid draw-down and deep-seated, global modes of failure.

3. The RWDE shall affirm in writing that he or she has personally supervised the design of the retaining walls for the project, that the design considers all the requirements listed in paragraph 1.6 and that he or she accepts responsibility as the design engineer of record for the retaining walls constructed on the project.

4. The RWDE shall affirm in writing that he or she has designed a minimum of approximately 3,000 face square feet (280 face square meters) of modular block earth retaining walls within the previous five (5) years.

5. In lieu of these specific requirements, the engineer may submit alternate documentation demonstrating competency in Precast Modular Block retaining wall design.

C. The Owner reserves the right to reject the services of any engineer, engineering firm, or Contractor who, in the sole opinion of the Owner, does not possess the requisite experience or qualifications.

1.7 QUALITY CONTROL

A. The Engineer shall review all submittals for materials, design, RWDE qualifications and the RWIC qualifications.

B. The Contractor shall retain the services of an Inspection Engineer who is experienced with the construction of precast modular block retaining wall structures to perform inspection and testing. The cost of inspection shall be the responsibility of the Contractor. Inspection shall be continuous throughout the construction of the retaining walls.

C. The Inspection Engineer shall perform the following duties:

1. Inspect the construction of the precast modular block structure for conformance with construction shop drawings and the requirements of this specification.

2. Verify that soil or aggregate fill placed and compacted in the reinforced, retained and foundation zones of the retaining wall conforms with paragraphs 2.4 and 2.5 of this section and exhibits the shear strength parameters specified by the RWDE.

3. Verify that the shear strength of the in-situ soil assumed by the RWDE is appropriate.

4. Inspect and document soil compaction in accordance with these specifications:

a. Required dry unit weight

b. Actual dry unit weight

c. Allowable moisture content

d. Actual moisture content

e. Pass/fail assessment

f. Test location – wall station number

g. Test elevation

h. Distance of test location behind the wall face

5. Verify that all excavated slopes in the vicinity of the retaining wall are bench-cut as required.

6. Notify the RWIC of any deficiencies in the retaining wall construction and provide the RWIC a reasonable opportunity to correct the deficiency.

7. Notify the Contractor, Owner and RWDE of any construction deficiencies that have not been corrected in a timely manner.

8. Document all inspection results and provide reports to Owner, RWDE, and RWIC.

9. Test compacted density and moisture content of the retained backfill with the following frequency:

a. At least once every 500 square feet (45 square meters) (in plan) per vertical lift, and

b. At least once per every 18 inches (460 mm) of vertical wall construction.

D. The Contractor's engagement of the Inspection Engineer does not relieve the RWIC of responsibility to construct the proposed retaining wall in accordance with the approved construction shop drawings and these specifications.

E. The RWIC shall inspect the on-site grades and excavations prior to construction and notify the RWDE and Contractor if on-site conditions differ from the elevations, assumptions, and grading conditions depicted in the retaining wall construction shop drawings.

F. All warranties shall be in accordance with the General Conditions and provisions of Division 01. Precast modular block units shall be covered by the manufacturer's standard minimum 10-year material warranty

1.8 DELIVERY, STORAGE AND HANDLING

A. The RWIC shall inspect the materials upon delivery to ensure that the proper type, grade and color of materials have been delivered.

B. The RWIC shall store and handle all materials in accordance with the manufacturer's recommendations as specified herein and in a manner that prevents deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, UV exposure or other causes. Damaged materials shall not be incorporated into the work.

C. Geosynthetics

1. All geosynthetic materials shall be handled in accordance with ASTM D4873. The materials should be stored off the ground and protected from precipitation, sunlight, dirt and physical damage.

D. Precast Modular Blocks

1. Precast modular blocks shall be stored in an area with positive drainage away from the blocks. Be careful to protect the block from mud and excessive chipping and breakage. Precast modular blocks shall not be stacked more than three (3) units high in the storage area.

E. Drainage Aggregate and Backfill Stockpiles

1. Drainage aggregate or backfill material shall not be piled over unstable slopes or areas of the project site with buried utilities.

2. Drainage aggregate and/or reinforced fill material shall not be staged where it may become mixed with or contaminated by poor draining fine-grained soils such as clay or silt.

PART 2 – MATERIALS

2.1 PRECAST MODULAR BLOCK RETAINING WALL UNITS

A. All units shall conform to **ASTM C1776** and be wet-cast in a single continuous pour.

B. All units for the project shall be obtained from the same manufacturer. The manufacturer shall be licensed and authorized to produce the retaining wall units by the precast modular block system patent holder/licensor and shall document compliance with the published quality control standards of the proprietary precast modular block system licensor for the previous three (3) years or the total time the manufacturer has been licensed, whichever is less.

C. Concrete used in the production of the precast modular block units shall be first-purpose, fresh concrete. It shall not consist of returned, reconstituted, surplus or waste concrete. It shall be an original production mix meeting the requirements of ASTM C94 and exhibit the properties as shown in the following table:

Concrete Mix Properties

Freeze Thaw Exposure Class[1]	Minimum 28-Day Compressive Strength[2]	Maximum Water Cement Ratio	Nominal Maximum Aggregate Size	Aggregate Class Designation[3]	Air Content[4]
Moderate	4,000 psi (27.6 MPa)	0.45	1 inch (25 mm)	3M	4.5% +/- 1.5%
Severe	4,000 psi (27.6 MPa)	0.45	1 inch (25 mm)	3S	6.0% +/- 1.5%
Very Severe	4,500 psi (30.0 MPa)	0.40	1 inch (25 mm)	4S	6.0% +/- 1.5%
Maximum Water-Soluble Chloride Ion (Cl^-) Content in Concrete, Percent by Weight of Cement[5,6]					0.15
Maximum Chloride as Cl^- Concentration in Mixing Water, Parts Per Million					1000
Maximum Percentage of Total Cementitious Materials By Weight [7,9] (Very Severe Exposure Class Only):					
Fly Ash or Other Pozzolans Conforming to ASTM C618					25
Slag Conforming to ASTM C989					50
Silica Fume Conforming to ASTM C1240					10

Total of Fly Ash or Other Pozzolans, Slag, and Silica Fume[8]	50
Total of Fly Ash or Other Pozzolans and Silica Fume[8]	35
Alkali-Aggregate Reactivity Mitigation per ACI 201	
Slump (Conventional Concrete) per ASTM C143[10]	5 inches +/- 1½ inches (125 mm +/- 40 mm)
Slump Flow (Self-Consolidating Concrete) per ASTM C1611	18 inches – 32 inches (450 mm – 800 mm)

[1]Exposure class is as described in ACI 318. "Moderate" describes concrete that is exposed to freezing and thawing cycles and occasional exposure to moisture. "Severe" describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture. "Very Severe" describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture and exposed to deicing chemicals. Exposure class should be specified by owner/purchaser prior to order placement.

[2]Test method ASTM C39.

[3]Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregates for Concrete*.

[4]Test method ASTM C231.

[5]Test method ASTM C1218 at age between 28 and 42 days.

[6]Where used in high sulfate environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents.)

[7]The total cementitious material also includes ASTM C150, C595, C845, C1157 cement. The maximum percentages shall include:

(a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.

(b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.

(c) Silica fume, ASTM C1240, present in a blended cement.

[8]Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

[9]Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze/thaw durability in a detailed and current testing program.

[10]Slump may be increased by a high-range water-reducing admixture.

D. Concrete reinforcing steel, when required for the specified block, shall conform to ASTM A615 and have a minimum yield strength of 60,000 psi. When required by the Owner to be galvanized or epoxy-coated, reinforcing steel shall conform to ASTM A767 or ASTM A775, respectively, and have a minimum yield strength of 60,000 psi.

E. At least 1 inch of concrete cover shall be maintained over all reinforcing steel bars.

F. Each concrete block shall be cast in a single continuous pour without cold joints. With the exception of half-block units, corner units and other special application units, the

precast modular block units shall conform to the nominal dimensions listed in the table below and be produced to the dimensional tolerances shown.

Block Type	Dimension	Nominal Value	Tolerance
28” (710 mm) Block	Height	18” (457 mm)	+/- 3/16” (5 mm)
	Length	46-1/8” (1172 mm)	+/- 1/2” (13 mm)
	Width*	28” (710 mm)	+/- 1/2” (13 mm)
41” (1030 mm) Block	Height	18” (457 mm)	+/- 3/16” (5 mm)
	Length	46-1/8” (1172 mm)	+/- 1/2” (13 mm)
	Width*	40-1/2” (1030 mm)	+/- 1/2” (13 mm)
60” (1520 mm) Block	Height	18” (457 mm)	+/- 3/16” (5 mm)
	Length	46-1/8” (1172 mm)	+/- 1/2” (13 mm)
	Width*	60” (1520 mm)	+/- 1/2” (13 mm)
52” (1320 mm) XL Block	Height	36” (914 mm)	+/- 3/16” (5 mm)
	Length	46-1/8” (1172 mm)	+/- 1/2” (13 mm)
	Width*	52” (1520 mm)	+/- 1/2” (13 mm)
72” (1830 mm) XL Block	Height	36” (914 mm)	+/- 3/16” (5 mm)
	Length	46-1/8” (1172 mm)	+/- 1/2” (13 mm)
	Width*	72” (1520 mm)	+/- 1/2” (13 mm)
96” (2440 mm) XL Block	Height	36” (914 mm)	+/- 3/16” (5 mm)
	Length	46-1/8” (1172 mm)	+/- 1/2” (13 mm)
	Width*	96” (1520 mm)	+/- 1/2” (13 mm)

1) Block tolerance measurements shall exclude variable face texture.
2) Block dimensions shown are representative; final dimensions shall conform to the approved manufacturer’s production data and shop drawings.

G. With the exception of half-block units, corner units and other special application units, the precast modular block units shall have two (2), circular dome shear knobs that are 10 inches (254 mm), 7.5 inches (190 mm), or 6.75 inches (171 mm) in diameter and 4 inches (102 mm) or 2 inches (51 mm) in height. The shear knobs shall fully index into a continuous semi-cylindrical shear channel in the bottom of the block course above. The peak interlock shear between any two (2) vertically stacked precast modular block units, with 10-inch (254 mm) diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 6,500 lb/ft (95 kN/m) at a minimum normal load of 500 lb/ft (7kN/m). as well as an ultimate peak interface shear capacity in excess of 11,000 lb/ft (160 kN/m). The peak interlock shear between any two (2) vertically stacked precast modular block units, with 7.5-inch (190 mm) or 6.75-inch (171 mm) diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 1,850 lb/ft (27 kN/m) at a minimum normal load of 500 lb/ft (7kN/m) as well as an ultimate peak interface shear capacity in excess of 10,000 lb/ft (146 kN/m).Test specimen blocks tested under ASTM D6916 shall be actual, full-scale production blocks of known compressive strength. The interface shear capacity reported shall be corrected for a 4,000 psi (27.6 MPa) concrete compressive strength. Regardless of precast modular block configuration, interface shear testing shall be completed without the inclusion of unit core infill aggregate.

H. The 28-inch (710 mm) and 41-inch (1030 mm) precast modular block units may be cast with a continuous vertical core slot that will permit the insertion of a 12-inch (305 mm) inch wide strip of geogrid reinforcement to pass completely through the block. When installed in this manner, the geogrid reinforcement shall form a non-normal load dependent, positive connection between the block unit and the reinforcement strip. The

use of steel for the purposes of creating the geogrid-to-block connection is not acceptable.

I. Without field cutting or special modification, the precast modular block units shall be capable of achieving a minimum radius of 14 ft - 6 in (4.42 m).

J. The precast modular block units shall be manufactured with an integrally cast shear knobs that establishes a standard horizontal set-back for subsequent block courses. The precast modular block system shall be available in the standard horizontal set-back facing batter options listed below:

18-inch High Blocks		36-inch High Blocks	
Horizontal Set-Back/Blk. Course	Max. Facing Batter	Horizontal Set-Back/Blk. Course	Max. Facing Batter
3/8” (10 mm)	1.2˚	3-1/4” (83 mm)	5.2˚
1-5/8” (41 mm)	5.2˚		
9-3/8” (238 mm)	27.5˚		
16-5/8” (422 mm)	42.7˚		

The precast modular block units shall be furnished with the required shear knobs that provide the facing batter required in the construction shop drawings.

K. The precast modular block unit face texture shall be selected by the owner from the available range of textures available from the precast modular block manufacturer. Each textured block facing unit shall be a minimum of 5.76 square feet (0.54 square meters) with a unique texture pattern that repeats with a maximum frequency of once in any 15 square feet (1.4 square meters) of wall face.

L. The block color shall be selected by the owner from the available range of colors available from the precast modular block manufacturer.

M. All precast modular block units shall be sound and free of cracks or other defects that would interfere with the proper installation of the unit, impair the strength or performance of the constructed wall. PMB units to be used in exposed wall construction shall not exhibit chips or cracks in the exposed face or faces of the unit that are not otherwise permitted. Chips smaller than 1.5” (38 mm) in its largest dimension and cracks not wider than 0.012” (0.3 mm) and not longer than 25% of the nominal height of the PMB unit shall be permitted. PMB units with bug holes in the exposed architectural face smaller than 0.75” (19 mm) in its largest dimension shall be permitted. Bug holes, water marks, and color variation on non-architectural faces are acceptable. PMB units that exhibit cracks that are continuous through any solid element of the PMB unit shall not be incorporated in the work regardless of the width or length of the crack.

N. Preapproved Manufacturers: Manufacturers of Redi-Rock Retaining Wall Systems as licensed by Redi-Rock International, LLC, 05481 US 31 South, Charlevoix, MI 49720 USA; telephone (866) 222-8400; website www.redi-rock.com.

O. Substitutions. Technical information demonstrating conformance with the requirements of this specification for an alternative precast modular block retaining wall system must be submitted for preapproval at least 14 calendar days prior to the bid date. Acceptable alternative PMB retaining wall systems, otherwise found to be in conformance with this specification, shall be approved in writing by the owner 7 days prior to the bid date. The Engineer reserves the right to provide no response to submissions made out of the time requirements of this section or to submissions of block retaining wall systems that are determined to be unacceptable to the owner.

P. Value Engineering Alternatives. The owner may evaluate and accept systems that meet the requirements of this specification after the bid date that provide a minimum cost savings of 20% to the Owner. Construction expediency will not be considered as a contributing portion of the cost savings total.

2.2 GEOGRID REINFORCEMENT

A. Geogrid reinforcement shall be a woven or knitted PVC coated geogrid manufactured from high-tenacity PET polyester fiber with an average molecular weight greater than 25,000 (M_n > 25,0000) and a carboxyl end group less than 30 (CEG < 30). The geogrid shall be furnished in prefabricated roll widths of certified tensile strength by the manufacturer. The prefabricated roll width of the geogrid shall be 12” (300 mm) +/- 1/2” (13 mm). No cutting of geogrid reinforcement down to the 12” (300 mm) roll width from a larger commercial roll width will be allowed under any circumstances.

B. The ultimate tensile strength (T_{ult}) of the geogrid reinforcement shall be measured in accordance with ASTM D6637.

C. Geogrid – Soil Friction Properties

1 Friction factor, F*, shall be equal to 2/3 Tan ϕ, where ϕ is the effective angle of internal friction of the reinforced fill soil.

2 Linear Scale Correction Factor, α, shall equal 0.8.

D. Long-Term Tensile Strength (T_{al}) of the geogrid reinforcement shall be calculated in accordance with Section 3.5.2 of FHWA-NHI-10-024 and as provided in this specification.

1 The creep reduction factor (RFCR) shall be determined in accordance with Appendix D of FHWA-NHI-10-025 for a minimum 75 year design life.

2 Minimum installation damage reduction factor (RFID) shall be 1.25. The value of RFID shall be based upon documented full-scale tests in a soil that is comparable to the material proposed for use as reinforced backfill in accordance with ASTM D5818.

3 Minimum durability reduction factor (RFD) shall be 1.3 for a soil pH range of 3 to 9.

E. Connection between the PMB retaining wall unit and the geogrid reinforcement shall be determined from short-term testing per the requirements of FHWA NHI-10-025, Appendix B.4 for a minimum 75-year design life.

F. The minimum value of Tal for geogrid used in design of a reinforced precast modular block retaining wall shall be 2,000 lb/ft (29 kN/m) or greater.

G. The minimum length of geogrid reinforcement shall be the greater of the following:

1 0.7 times the wall design height, H.

2 6 feet (1.83 m).

3 The length required by design to meet internal stability requirements, soil bearing pressure requirements and constructability requirements.

H. Constructability Requirements. Geogrid design embedment length shall be measured from the back of the precast modular block facing unit and shall be consistent for the entire height of a given retaining wall section.

I. Geogrid shall be positively connected to every precast modular block unit. Design coverage ratio, Rc, shall not exceed 0.50, calculated in accordance with NCMA Design Manual for Segmental Retaining Walls, 3rd Edition, Chapter 4.

J. Preapproved Geogrid Reinforcement Products.

1 Miragrid XT Geogrids as manufactured by TenCate Geosynthetics of Pendergrass, Georgia USA and distributed by Manufacturers of the Redi-Rock Retaining Wall System.

K. Substitutions. No substitutions of geogrid reinforcement products shall be allowed.

2.3 GEOTEXTILE

A. Nonwoven geotextile fabric shall be placed as indicated on the retaining wall construction shop drawings. Additionally, the nonwoven geotextile fabric shall be placed in the v-shaped joint between adjacent block units on the same course. The nonwoven geotextile fabric shall meet the requirements Class 3 construction survivability in accordance with AASHTO M 288.

B. Preapproved Nonwoven Geotextile Products

1 Mirafi 140N

2 Propex Geotex 451

3 Skaps GT-142

4 Thrace-Linq 140EX

5 Carthage Mills FX-40HS

6 Stratatex ST 142

2.4 DRAINAGE AGGREGATE AND WALL INFILL

A. Drainage aggregate (and wall infill for retaining walls designed as modular gravity structures) shall be a durable crushed stone conforming to No. 57 size per ASTM C33 with the following particle-size distribution requirements per ASTM D6913:

U.S. Standard Sieve Size	% Passing
1-½" (38 mm)	100
1" (25 mm)	95-100
½" (13 mm)	25-60
No. 4 (4.76 mm)	0-10
No. 8 (2.38 mm)	0-5

2.5 REINFORCED FILL

A. Material used as reinforced backfill material in the reinforced zone (if applicable) shall be a granular fill material meeting the requirements of USCS soil type GW, GP, SW or SP per ASTM D2487 or alternatively by AASHTO Group Classification A-1-a or A-3 per AASHTO M 145. The backfill shall exhibit a minimum effective internal angle of friction, ϕ = 34 degrees at a maximum 2% shear strain and meet the following particle-size distribution requirements per ASTM D6913.

U.S. Standard Sieve Size	% Passing
3/4" (19 mm)	100
No. 4 (4.76 mm)	0-100
No. 40 (0.42 mm)	0-60
No. 200 (0.07 mm)	0-15

B. The reinforced backfill material shall be free of sod, peat, roots or other organic or deleterious matter including, but not limited to, ice, snow or frozen soils. Materials passing the No. 40 (0.42 mm) sieve shall have a liquid limit less than 25 and plasticity index less than 6 per ASTM D4318. Organic content in the backfill material shall be less

than 1% per AASHTO T-267 and the pH of the backfill material shall be between 5 and 8.

C. Soundness. The reinforced backfill material shall exhibit a magnesium sulfate soundness loss of less than 30% after four (4) cycles, or sodium sulfate soundness loss of less than 15% after five (5) cycles as measured in accordance with AASHTO T-104.

D. Reinforced backfill shall not be comprised of crushed or recycled concrete, recycled asphalt, bottom ash, shale or any other material that may degrade, creep or experience a loss in shear strength or a change in pH over time.

2.6 LEVELING PAD

A. The precast modular block units shall be placed on a leveling pad constructed from crushed stone or unreinforced concrete. The leveling pad shall be constructed to the dimensions and limits shown on the retaining wall design drawings prepared by the RWDE.

B. Crushed stone used for construction of a granular leveling pad shall meet the requirements of the drainage aggregate and wall infill in section 2.4 or a preapproved alternate material.

C. Concrete used for construction of an unreinforced concrete leveling pad shall satisfy the criteria for AASHTO Class B. The concrete should be cured a minimum of 12 hours prior to placement of the precast modular block wall retaining units and exhibit a minimum 28-day compressive strength of 2,500 psi (17.2 MPa).

2.7 DRAINAGE

A. Drainage Pipe

1 Drainage collection pipe shall be a 4” (100 mm) diameter, 3-hole perforated, HDPE pipe with a minimum pipe stiffness of 22 psi (152 kPa) per ASTM D2412.

2 The drainage pipe shall be manufactured in accordance with ASTM F2648 for HDPE pipe and fittings.

3 Drainage pipe may be AASHTO M252 HDPE if approved by the Engineer.

B. Preapproved Drainage Pipe Products

1 ADS 3000 Triple Wall pipe as manufactured by Advanced Drainage Systems, or Equal.

PART 3 – EXECUTION

3.1 GENERAL

A. All work shall be performed in accordance with OSHA safety standards, state and local building codes and manufacturer’s requirements.

B. The Contractor is responsible for the location and protection of all existing underground utilities. Any new utilities proposed for installation in the vicinity of the retaining wall, shall be installed concurrent with retaining wall construction. The Contractor shall coordinate the work of Subcontractors affected by this requirement.

C. New utilities installed below the retaining wall shall be backfilled and compacted to a minimum of 98% maximum dry density per ASTM D698 standard proctor.

D. The Contractor is responsible to ensure that safe excavations and embankments are maintained throughout the course of the project.

E. All work shall be inspected by the Inspection Engineer as directed by the Owner.

3.2 EXAMINATION

A. Prior to construction, the Contractor, Grading Contractor, RWIC and Inspection Engineer shall examine the areas in which the retaining wall will be constructed to evaluate compliance with the requirements for installation tolerances, worker safety and any site conditions affecting performance of the completed structure. Installation shall proceed only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Fill Soil.

1 The Inspection Engineer shall verify that reinforced backfill placed in the reinforced soil zone satisfies the criteria of this section.

2 The Inspection Engineer shall verify that any fill soil installed in the foundation and retained soil zones of the retaining wall satisfies the specification of the RWDE as shown on the construction drawings.

B. Excavation.

1 The Grading Contractor shall excavate to the lines and grades required for construction of the precast modular block retaining wall as shown on the construction drawings. The Grading Contractor shall minimize over-excavation. Excavation support, if required, shall be the responsibility of the Grading Contractor.

2 Over-excavated soil shall be replaced with compacted fill in conformance with the specifications of the RWDE and Division 02 of these project specifications.

3 Embankment excavations shall be bench cut as directed by the project Geotechnical Engineer and inspected by the Inspection Engineer for compliance.

C. Foundation Preparation.

1 Prior to construction of the precast modular block retaining wall, the leveling pad area and undercut zone (if applicable) shall be cleared and grubbed. All topsoil, brush, frozen soil and organic material shall be removed. Additional foundation

soils found to be unsatisfactory beyond the specified undercut limits shall be undercut and replaced with approved fill as directed by the project Geotechnical Engineer. The Inspection Engineer shall ensure that the undercut limits are consistent with the requirements of the project Geotechnical Engineer and that all soil fill material is properly compacted in accordance with project specifications. The Inspection Engineer shall document the volume of undercut and replacement.

2 Following excavation for the leveling pad and undercut zone (if applicable), the Inspection Engineer shall evaluate the in-situ soil in the foundation and retained soil zones.

a. The Inspection Engineer shall verify that the shear strength of the in-situ soil assumed by the RWDE is appropriate. The Inspection Engineer shall immediately stop work and notify the Owner if the in-situ shear strength is found to be inconsistent with the retaining wall design assumptions.

b. The Inspection Engineer shall verify that the foundation soil exhibits sufficient ultimate bearing capacity to satisfy the requirements indicated on the retaining wall construction shop drawings per paragraph 1.06 I of this section.

D. Leveling Pad.

1 The leveling pad shall be constructed to provide a level, hard surface on which to place the first course of precast modular block units. The leveling pad shall be placed in the dimensions shown on the retaining wall construction drawings and extend to the limits indicated.

2 Crushed Stone Leveling Pad. Crushed stone shall be placed in uniform maximum lifts of 6” (150 mm). The crushed stone shall be compacted by a minimum of 3 passes of a vibratory compactor capable of exerting 2,000 lb (8.9 kN) of centrifugal force and to the satisfaction of the Inspection Engineer.

3 Unreinforced Concrete Leveling Pad. The concrete shall be placed in the same dimensions as those required for the crushed stone leveling pad. The RWIC shall erect proper forms as required to ensure the accurate placement of the concrete leveling pad according to the retaining wall construction drawings.

3.4 PRECAST MODULAR BLOCK WALL SYSTEM INSTALLATION

A. The precast modular block structure shall be constructed in accordance with the construction drawings, these specifications and the recommendations of the retaining wall system component manufacturers. Where conflicts exist between the manufacturer’s recommendations and these specifications, these specifications shall prevail.

B. Drainage components. Pipe, geotextile and drainage aggregate shall be installed as shown on the construction shop drawings.

C. Precast Modular Block Installation

1 The first course of block units shall be placed with the front face edges tightly abutted together on the prepared leveling pad at the locations and elevations shown on the construction drawings. The RWIC shall take special care to ensure that the bottom course of block units are in full contact with the leveling pad, are set level and true and are properly aligned according to the locations shown on the construction drawings.

2 Backfill shall be placed in front of the bottom course of blocks prior to placement of subsequent block courses. Nonwoven geotextile fabric shall be placed in the V-shaped joints between adjacent blocks. Drainage aggregate shall be placed in the V-shaped joints between adjacent blocks to a minimum distance of 12" (300 mm) behind the block unit. If stone infill of hollow core blocks exceeds 45% of the block design volume, drainage aggregate will not be required to extend beyond the back of the blocks, with the approval of the RWDE.

3 Drainage aggregate shall be placed in 9-inch maximum lifts and compacted by a minimum of three (3) passes of a vibratory plate compactor capable exerting a minimum of 2,000 lb (8.9 kN) of centrifugal force.

4 Unit core fill shall be placed in the precast modular block unit vertical core slot. The core fill shall completely fill the slot to the level of the top of the block unit. The top of the block unit shall be broom-cleaned prior to placement of subsequent block courses. No additional courses of precast modular blocks may be stacked before the unit core fill is installed in the blocks on the course below.

5 Base course blocks for gravity wall designs (without geosynthetic soil reinforcement) may be furnished without vertical core slots. If so, disregard item 4 above, for the base course blocks in this application.

6 Nonwoven geotextile fabric shall be placed between the drainage aggregate and the retained soil (gravity wall design) or between the drainage aggregate and the reinforced fill (reinforced wall design) as required on the retaining wall construction drawings.

7 Subsequent courses of block units shall be installed with a running bond (half block horizontal course-to-course offset). With the exception of 90-degree corner units, the shear channel of the upper block shall be fully engaged with the shear knobs of the block course below. The upper block course shall be pushed forward to fully engage the interface shear key between the blocks and to ensure consistent face batter and wall alignment. Geogrid, drainage aggregate, unit core fill, geotextile and properly compacted backfill shall be complete and in-place for each course of block units before the next course of blocks is stacked.

8 The elevation of retained soil fill shall not be less than 1 block course (18 inches (457 mm)) below the elevation of the reinforced backfill throughout the construction of the retaining wall.

9 If included as part of the precast modular block wall design, cap units shall be secured with an adhesive in accordance with the precast modular block manufacturer's recommendation.

D. Geogrid Reinforcement Installation (if required)

1 Geogrid reinforcement shall be installed at the locations and elevations shown on the construction drawings on level fill compacted to the requirements of this specification.

2 Continuous 12” (300 mm) wide strips of geogrid reinforcement shall be passed completely through the vertical core slot of the precast modular block unit and extended to the embedment length shown on the construction plans. The strips shall be staked or anchored as necessary to maintain a taut condition.

3 Reinforcement length (L) of the geogrid reinforcement is measured from the back of the precast modular block unit. The cut length (Lc) is two times the reinforcement length plus additional length through the block facing unit. The cut length is calculated as follows:

L_c = 2*L + 3 ft (2*L + 0.9 m) (28” (710 mm) block unit)

L_c = 2*L + 5 ft (2*L + 1.5 m) (41” (1030 mm) block unit)

4 The geogrid strip shall be continuous throughout its entire length and may not be spliced. The geogrid shall be furnished in nominal, prefabricated roll widths of 12” (300 mm)+/- ½” (13 mm). No field modification of the geogrid roll width shall be permitted.

5 Neither rubber tire nor track vehicles may operate directly on the geogrid. Construction vehicle traffic in the reinforced zone shall be limited to speeds of less than 5 mph (8 km/hr) once a minimum of 9 inches (230 mm) of compacted fill has been placed over the geogrid reinforcement. Sudden braking and turning of construction vehicles in the reinforced zone shall be avoided.

E. Construction Tolerance. Allowable construction tolerance of the retaining wall shall be as follows:

1 Deviation from the design batter and horizontal alignment, when measured along a 10’ (3 m) straight wall section, shall not exceed 3/4” (19 mm).

2 Deviation from the overall design batter shall not exceed 1/2“ (13 mm) per 10’ (3 m) of wall height.

3 The maximum allowable offset (horizontal bulge) of the face in any precast modular block joint shall be 1/2” (13 mm).

4 The base of the precast modular block wall excavation shall be within 2” (50 mm) of the staked elevations, unless otherwise approved by the Inspection Engineer.

5 Differential vertical settlement of the face shall not exceed 1’ (300 mm) along any 200’ (61 m) of wall length.

6 The maximum allowable vertical displacement of the face in any precast modular block joint shall be 1/2“ (13 mm).

7 The wall face shall be placed within 2” (50 mm) of the horizontal location staked.

3.5 WALL INFILL AND REINFORCED BACKFILL PLACEMENT

A. Backfill material placed immediately behind the drainage aggregate shall be compacted as follows:

1 98% of maximum dry density at ± 2% optimum moisture content per ASTM D698 standard proctor or 85% relative density per ASTM D4254.

B. Compactive effort within 3’ (0.9 m) of the back of the precast modular blocks should be accomplished with walk-behind compactors. Compaction in this zone shall be within 95% of maximum dry density as measured in accordance with ASTM D698 standard proctor or 80% relative density per ASTM D 4254. Heavy equipment should not be operated within 3’ (0.9 m) of the back of the precast modular blocks.

C. Backfill material shall be installed in lifts that do not exceed a compacted thickness of 9” (230 mm).

D. At the end of each work day, the RWIC shall grade the surface of the last lift of the granular wall infill to a 3% ± 1% slope away from the precast modular block wall face and compact it.

E. The Contractor shall direct the Grading Contractor to protect the precast modular block wall structure against surface water runoff at all times through the use of berms, diversion ditches, silt fence, temporary drains and/or any other necessary measures to prevent soil staining of the wall face, scour of the retaining wall foundation or erosion of the reinforced backfill or wall infill.

3.6 OBSTRUCTIONS IN THE INFILL AND REINFORCED FILL ZONE

A. The RWIC shall make all required allowances for obstructions behind and through the wall face in accordance with the approved construction shop drawings.

B. Should unplanned obstructions become apparent for which the approved construction shop drawings do not account, the affected portion of the wall shall not be constructed until the RWDE can appropriately address the required procedures for construction of the wall section in question.

3.7 COMPLETION

A. For walls supporting unpaved areas, a minimum of 12” (300 mm) of compacted, low-permeability fill shall be placed over the granular wall infill zone of the precast modular block retaining wall structure. The adjacent retained soil shall be graded to prevent ponding of water behind the completed retaining wall.

B. For retaining walls with crest slopes of 5H:1V or steeper, silt fence shall be installed along the wall crest immediately following construction. The silt fence shall be located 3’ to 4’ (0.9 m to 1.2 m) behind the uppermost precast modular block unit. The crest slope above the wall shall be immediately seeded to establish vegetation. The

Contractor shall ensure that the seeded slope receives adequate irrigation and erosion protection to support germination and growth.

C. The Contractor shall confirm that the as-built precast modular block wall geometries conform to the requirements of this section. The Contractor shall provide sealed As-Built drawings to the Owner, documenting any deviations from the approved installation drawings.

END OF SECTION 02830

SECTION 02831 - CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1. DESCRIPTION

A. Work included: Remove and dispose of existing fence, provide chain link fence system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1 Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.

1.2. SUBMITTALS

A. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1 Materials list of items proposed to be provided under this Section;

2 Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

3 Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades; and

4 Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

PART 2 - PRODUCTS

2.1. DIMENSIONAL DATA

A. General:

1. Pipe sizes indicated are Nominal or outside diameter (O.D.) Pipe Sizes, unless otherwise indicated.

2.2. FABRIC

A. The fabric shall be composed of 6 foot, 9-gauge galvanized steel wire helically wound to form a continuous chain link fabric having a 2-inch mesh. Top and bottom edges shall have a twisted and barbed finish. The fabric shall be manufactured in accordance with ASTM A-392.

B. Fabric shall be hot-dipped galvanized after weaving to produce a zinc coating not less in weight than 2.0 ounces per square foot of uncoated wire surface.

C. Wire in the fabric shall meet minimum breaking strength of 1,290 pounds after galvanizing.

2.3. POSTS, RAILS, AND ASSOCIATED ITEMS

A. End and corner posts shall be standard hot galvanized (2 oz. per square foot) basic open-hearth copper-bearing steel pipe minimum of 3” O.D. weighing 5.79 pounds per foot, for setting a full 3 feet deep in concrete footings, which are crowned at the ground surface to shed water.

B. Line posts shall be minimum of 2” O.D. standard pipe weight 1.76 pounds per foot and hot galvanized (2 ounces per square foot). Posts to be spaced approximately 10 feet on centers and set a full 2 feet in concrete footings, which are crowned at the ground surface to shed water.

C. Gate posts shall be minimum of 4" O.D., Schedule 40, standard pipe weight 9.11 pounds per foot and concrete filled. Posts shall be set a full 3 feet in concrete footings, which are crowned at the ground surface to shed water.

D. Top rails shall be minimum of 1-5/8" O.D. pipe, standard pipe weighing 2.27 pounds per foot and hot galvanized (2 oz. per square foot) and shall be furnished in random lengths averaging not less than 20 feet, jointed with extra long pressed steel sleeves, hot galvanized, making a rigid connection but allowing for expansion and contraction.

E. End and gate post tops shall be galvanized malleable iron, drive fitting outside of post to exclude moisture.

F. Fabric ties for attaching fabric to line posts or top rail shall be aluminum strip or wire used on top rail every 24 inches and on line posts every 14 inches.

G. Barbed Wire: The fabric shall be surmounted with 3 strands of barbed wire. Each strand shall consist of two No. 12-1/2 W&M gauge twisted copper-bearing steel line wires, Class 3, hot galvanized, with No. 14 W&M gauge, 4 point barbs spaced not more than 4 inches apart. The barbed wire shall be manufactured in accordance with ASTM A-121.

H. Barbed Wire Extensions: All intermediate, gate and corner posts shall be equipped with extension arms for supporting barbed wire. The base shall be malleable iron and the extension pressed steel hot galvanized after fabrication. Intermediate arm shall have provision for passing top rail and corner arm casting to have set screw.

I. Brace and tension bands shall be unclimbable beveled edge type with 3/8 inch diameter square shouldered aluminum carriage bolts, non-removable from outside fence.

J. Bracing: All corner, gate and terminal posts shall be braced by means of 1-5/8 O.D. horizontal compression member, securely attached to terminal and to first line posts with malleable iron fittings, beveled edge bands, and truss braced from first line post to bottom of terminal by 1/2 inch rod and turnbuckle. Corner posts to be so braced in each direction.

K. Tension Bars for attaching fabric to terminal posts shall be 3/16 x 3/4 high carbon steel attached to terminal posts by means of beveled edge bands.

2.4. GATES

A. General:

1 Provide manual operated horizontal cantilever slide gate in conformance with ASTM F1184.

2 Fabricate gate perimeter frames with schedule 40 pipe.

3 Provide additional horizontal and vertical members to assure proper operation of the gate, and for attachment of fabric, hardware, and accessories.

4 Space so frame members are not more than 8 feet apart.

5 Fabricate gate frames from a minimum of 2 -3/8”" pipe.

B. Fabrication:

1 Assemble gate frames by welding with special malleable or pressed steel fittings and rivets for rigid connections.

2 Use same fabric as used in the fence.

3 Install fabric with stretcher bars at vertical edges as a minimum.

4 Attach stretchers to gate frame at not more than 15" on centers.

5 Attach hardware with rivets or by other means which will provide security against removal and breakage.

6 Provide diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates where required to provide frame rigidity without sag or twist.

C. Gate hardware:

1 Catch assembly:

a. Provide forked type catcher assembly for gate and post to permit padlock access from the outside of the fence.

b. Provide padlock eye as integral part of catch assembly.

2 Malleable cantilever steel rollers.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install posts at a maximum spacing of 10 feet on centers.

2. Install corner or slope posts where changes in line or grade exceed a 30 degree deflection.

B. Excavating:

1. Drill holes for post footings in firm, undisturbed or compacted soil, strictly adhering to the dimensions and spacing shown.

2. Post hole dimensions:

a. Provide 36" deep by 12" diameter foundations for gate posts.

b. Provide 36" deep by 8" diameter foundations for corner and end posts.

c. Provide 24" deep by 8" diameter foundations for all other posts.

3. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site if so directed.

4. When solid rock is encountered near the surface, drill into rock at least 12" for line posts and at least 18" for end, pull, gate, and corner posts. Drill hole at least 1" greater diameter than the largest dimension of the post to be placed.

5. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed minimum depths specified above.

C. Setting posts:

1. Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.

2. Center and align posts in holes.

3. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation.

4. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

5. Trowel tops of footings, and slope or dome to direct water away from posts.

6. Extend footings for gate posts to the underside of bottom hinge.

7. Set keeps, stops, sleeves, and other accessories into concrete as required.

8. Keep exposed concrete surfaces moist for at least seven days after placement, or cure with membrane curing material or other curing method

approved by the Engineer.

9. Grout-in those posts which are set into sleeved holes, concrete constructions, or rock excavations, using non-shrink portland cement grout or other grouting material approved by the Engineer.

D. Concrete strength:

1. Concrete shall be Class A with a minimum 28-day compressive strength of 4,000 psi.

2. Allow concrete to attain at least 75% of its minimum 28-day strength before rails, tension wires, and/or fabric is installed.

3. Do not, in any case, install such items in less than seven days after placement of concrete.

4. Do not stretch and tension fabric and wire, and do not hang gates, until concrete has attained its full design strength.

E. Rails and bracing:

1. Install fence with a top rail and bottom tension wire.

2. Install top rails continuously through post caps or extension arms, bending to radius for curved runs.

3. Provide expansion couplings as recommended by the fencing manufacturer.

4. Provide bracing to the midpoint of the nearest line post or posts at all end, corner, slope, pull, and gate posts.

5. Install tension wires parallel to the line of fabric by weaving through the fabric, and tying to each post with not less than number 6 gage galvanized wire, or by securing the wire to the fabric.

F. Installing fabric:

1. Leave approximately 2" between finish grade and bottom selvage.

2. Excavate high points in the ground to clear the bottom of the fence.

3. Place and compact fill to within 1" of the bottom of the fabric in depressions.

4. Pull fabric taut and tie to posts, rails, and tension wires.

5. Install fabric on outward side facing side of fence, and anchor to framework so that the fabric remains in tension after pulling force is removed.

6. Install stretcher bars by threading through or clamping to fabric on 4" centers, and secure to posts with metal bands spaced 15" on centers.

G. Installing gates:

1. Install gates plumb, level, and secure for full opening without interference.

2. Install ground-set items in concrete for anchorage in accordance with the fence manufacturer's recommendations as approved by the Engineer.

3. Lubricate and adjust the hardware for smooth operation.

H. Miscellaneous:

1. Use U-shaped tie wires, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.

2. Bend ends of wire to minimize hazards to persons and clothing.

3. Fasteners:

a. Install nuts for tension band and hardware bolts on side of fence opposite fabric side.

4. Repair coatings damaged in the shop or field erection, using a hot-applied repair compound applied in accordance with its manufacturer's recommendations as approved by the Engineer.

END OF SECTION 02831

SECTION 02930 – SEEDING AND PLANTING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Seeding, hydro-seeding, mulching, and fertilizer.

1.2 RELATED SECTIONS

A. Section V – Special Conditions – Special Provision Detail Sheets for property owner seeding requirements (reproduced below for reference).

1. Per Wild River Corp (Parcel 9642-29-9794) Special Provisions Detail Sheet:

a) "MSD Contractor must submit the seed and/or fertilizer product label to Oregon TILTH Organic Certificaiton (OTCO) for review BEFORE any is applied to the field. MSD Contractor to go through Adam.wallace@sierranevada.com. Wild River Corp is responsible for their certification and fees associated with said certification."

B. Section 02221 – Excavation, Bedding and Backfill for Pipe and Structures.

C. Section 02410 – Erosion and Sedimentation Control.

D. Where conflicts occur, Special Provisions and permit requirements shall govern.

1.3 REFERENCES

A. FS O-F-241 – Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass. Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, Brome Grass.

1.5 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.6 REGULATORY REQUIREMENTS

A. Comply with all regulatory agencies for fertilizer and herbicide composition. Where permit requirements are more restrictive than these Specifications, permit requirements shall govern.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site and to prevent damage from wetness and weather conditions.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of Manufacturer.

PART 2 – PRODUCTS

2.1 SEED SUPPLIERS

A. Suppliers which meet seed mixture requirements.

2.2 SEED MIXTURE

A. Seasonal seeding mixtures and rates of application shall be as follows. All rates are in pounds per 1000 square feet and any rates listed below may be cut by 1/2 for temporary erosion control measures only.

B. Contractor shall match existing grass type in landscaped/maintained lawn areas. When restoring Bermuda turf, apply Common Bermuda grass seed at a rate of 3 pounds per 1000 square feet, in place of Kentucky Fescue.

C. The Engineer shall be consulted prior to seeding to confirm appropriate seed mixture based on season, site conditions, and permit requirements.

SEPTEMBER 15 - MARCH 1

Maintained/Established Lawns or road rights-of-way

..... 6# .....Kentucky Fescue No. 31

..... 2# .....Rye Grain

..... 30# .....Fertilizer (10-10-10)

.....100# .....Lime

……. 12#.....…….....Superphosphate

Open-Field (Anything other than an established lawn)

..... 4# .....Kentucky Fescue No. 31

..... 2# .....Rye Grain

..... 20# .....Fertilizer (5-10-10)

.....100# .....Lime

……..……12# .....Superphosphate

Open-Field For Slopes 2:1 or greater or areas subject to erosion

..... 2# .....Kentucky Fescue No. 31

..... 4# .....Sericea Lespedeza (Unscarified)

..... 2# .....Rye Grain

.....30# .....Fertilizer (5-10-10)

.....100# .....Lime

.....12# .....Superphosphate

FEBRUARY 1 - OCTOBER 15

Maintained/Established Lawns or road rights-of-way

……..8# .....Kentucky Fescue No. 31

.....30# .....Fertilizer (10-10-10)

……...100# .....Lime

…….12# ...…….....Superphosphate

Open-Field (Anything other than an established lawn)

…….6# .....Kentucky Fescue No. 31

.....2# .....Sudangrass (May, June, and July only)

.....20# .....Fertilizer (5-10-10)

.....100# .....Lime

…….12# .....Superphosphate

Open-Field For Slopes 2:1 or greater or areas subject to erosion

……..2# .....Kentucky Fescue No. 31

..... 4# .....Sericea Lespedeza (Scarified)

..... 2# .....Sudangrass (May, June, and July only)

..... 20# .....Fertilizer (5-10-10)

.....100# .....Lime

……..12# .....……..Superphosphate

D. The Engineer will be consulted prior to seeding for a determination of appropriate seed mixture. Unless otherwise required by the North Carolina Department of Transportation or the Engineer, seeding within road rights-of-way will be as specified for established lawns.

2.3 SOIL MATERIALS

A. Topsoil: As specified in Section 02221.

2.4 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: FS O-F-241, Type 1, Grade A; recommended for grass, with 50% of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions: Nitrogen 10%, phosphoric acid 10%, soluble potash 10%.

C. Lime shall comply with the rules and regulations of the NC Department of Agriculture. It shall be agricultural grade ground dolomitic limestone containing not less than 85% of combined calcium and magnesium carbonates. It shall be so graded that 100% will pass a No. 10 sieve, and 40% will pass a No. 100 sieve. During handling and storage, lime shall be protected against hardening and caking. Any hardened or caked lime shall be pulverized to its original condition before being used.

D. Water: lean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

E. Erosion Control Matting: Jute, mesh, etc.

F. Biodegradable tackifiers and soil binders may be used as Engineer-approved alternatives to asphalt-based products.

2.5 EROSION CONTROL

A. Seed:

1. All seed shall be labeled to show that it meets the current requirements of the North Carolina Seed Law. Seed shall have been tested within the six (6) months immediately preceding its use.

2. Further specifications for each seed item are given below:

a. Kentucky Fescue #31: Minimum 98% pure live seed; maximum 1% weedseed; minimum 90% germination.

b. Sericea Lespedeza (Scarified and Unscarified): Minimum 98% pure live seed; maximum .50% weed seed; minimum 85% germination. Scarified may include 20% hard seed.

c. Rye Grass (Annual): Minimum 98% pure live seed; maximum .10% weed seed; minimum 85% germination.

d. Sundangrass: Minimum 98% pure live seed; maximum .25% weed seed;

e. Seed containing prohibited noxious weed seed shall not be accepted. Seed shall conform to the state law restrictions for restricted noxious weeds.

B. Fertilizer:

1. All fertilizer for undeveloped areas shall have minimum 5-10-10 analysis or a comparable 1-2-2 ratio. All fertilizer for established lawn areas shall have a minimum 10-10-10 analysis or a comparable 1-1-1 ratio.

2. All fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the job site in the original unopened containers, each bearing the manufacturer's guaranteed analysis.

3. Any fertilizer which becomes caked or otherwise damaged will not be accepted. The quality of all fertilizer and all operations in connection with furnishing same, shall comply with the current requirements.

C. Lime:

1. All lime shall be finely ground limestone (Dolomite) containing not less than 85% total carbonates.

D. Superphosphate:

1. All superphosphates shall be composed of finely ground phosphate rock, as commonly used agricultural purposes, containing not less than 20% available phosphoric acid.

E. Mulch:

1. Temporary straw mulch shall be comprised of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold, or other objectionable material. The straw mulch shall contain at least 50% by weight of material 10 inches or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

2.6 SHRUBS AND TREES

A. Materials to be furnished hereunder shall be approved by ENGINEER prior to delivery of materials. All materials delivered hereafter shall conform to approved

samples. All stored materials on the site shall be protected until installation of materials has been completed.

B. Shrubs and plants shall be inspected for quality, size and variety, either at the place of growth or after delivery at the site of the work; as directed by the ENGINEER. No shrubs or plants rejected at place of growth or at the site of the work shall be used or paid for under the pay item. Certificates of inspection as required by federal, state or other authorities shall accompany each shipment.

C. Plants shall be freshly dug, vigorous, of normal habit of growth, free of disease, insects, insect eggs and larvae. Plants shall be nursery grown under climatic conditions similar to those in the locality of the project. The height of plants and branching shall be measured when branches are in normal positions. The caliper shall be the diameter of trunk measured 1 foot above the surface of ground and shall be the determining measurement on a primary stem which starts from or close to the ground or at a point not higher than 1/4th of the height of the plant. Plants shall conform to measurements of plant list in the Plans, except that oversize plants may be used at no increase in contract price. Plants shall not be pruned prior to delivery except upon special approval. The variety of any shrub or plant shown on the Plans may be changed prior to delivery to another variety of equal cost, at the option of the ENGINEER.

D. Stakes for supporting trees shall be of sound wood of uniform size, capable of standing in ground at least 2 years. They shall be at least 1.5 inches in diameter and not less than 9 feet in length, except that for trees under 6 feet in height stakes shall be not less than 8 feet in length. Ties shall be strips of canvas not less than 3 inches in width and 10 ounces in weight or equal fabric. Wrapping materials shall be of first quality burlap or waterproof crepe paper not less than 6 or more than 10 inches in width and of suitable strength.

E. Scientific and common plant names used on the Plans conform to Standardized Plant Names prepared for the American Joint Committee of Horticulture Nomenclature. Names of varieties not included therein conform generally with names accepted in the nursery trade. Substitutions will not be permitted, except that if proof is submitted that any plant specified is not obtainable a proposal will be considered for use of nearest equivalent size or variety with an equitable adjustment of contract price. The plants to be furnished and planted are shown on the Plans or listed in the Specifications.

PART 3 – EXECUTION

3.1 RESTORATION

A. Established lawns and landscaped areas damaged by construction shall be restored to their former condition by seeding, unless the type and condition of the existing sod warrants it being cut, removed, preserved, and replaced. All areas, regardless of previous condition, damaged by construction shall be fertilized, seeded, and mulched.

3.2 SEED BED PREPARATION

A. Seed Bed Preparation: The seed bed shall be prepared by pulverizing the soil in an approved manner to a depth of three (3) inches for field conditions or slopes that are 3:1 or flatter and to a depth of one (1) to three (3) inches, as determined on site for slopes steeper than 3:1. The soil shall be tilled until a well pulverized, firm, reasonably uniform seed bed is prepared conforming substantially to ground elevations as shown on the Plans and/or as existed prior to construction. The disturbed area shall blend uniformly into adjacent topography. Good surface drainage must be provided, allowances for settlement made and ground elevations adjusted accordingly. Visible ponding will not be allowed. All stones, roots, sticks, rubbish, and other objectionable material shall be removed.

B. Soil Improvements: Soil additives, fertilizer, lime, and superphosphate, shall be incorporated in an approved manner into the top soil at the rates identified in paragraph 2.2 Seed Mixture.

C. Verify that prepared soil base is ready to receive the work of this Section.

3.3 FERTILIZING

A. Apply after smooth raking of topsoil and prior to roller compaction.

B. Do not apply fertilizer or lime at same time or with same machine as will be used to apply seed.

C. Mix thoroughly into upper two inches of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.4 SEEDING

A. Seeding must be done within seven (7) calendar days of pipe installation or within thirty (30) calendar days after the initial ground disturbing activity, whichever comes first. Contractor pay applications will be held until Contractor complies with this requirement.

B. The seed bed must be in good, friable condition and not muddy or hard at the time seeding is performed.

C. Seed shall be applied at the rate specified and raked or tilled into the topsoil with the resulting furroughs running across the natural slope of the ground. Under no circumstances will any tilling activity be allowed parallel with said slope. Slopes steeper than 3:1 shall require the use of hydraulic seeding unless otherwise specifically approved by the Engineer.

D. Apply seed at the rate designated on schedule evenly in two intersecting directions. Rake in lightly.

E. Do not seed areas in excess of that which can be mulched on the same day.

F. Do not sow immediately following rain, when ground is too dry, or during windy periods.

G. Roll seeded area with roller not exceeding 112 pounds.

H. Immediately following seeding and compacting, apply mulch to a thickness of 1/8-inch. Maintain clear of shrubs and trees.

I. Apply water with a fine spray immediately after each area has been mulched. Saturate to four inches of soil.

3.5 HYDRO-SEEDING

A. Apply seeded slurry with a hydraulic seeder at the rate designated on schedule evenly in two intersecting directions.

B. Do not hydro-seed area in excess of that which can be mulched on the same day.

C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

D. Apply water with a fine spray immediately after each area has been mulched. Saturate to four inches of soil.

3.6 RE-FORESTATION AND SEEDING – WETLAND AREAS

A. Restore all contours to preconstruction conditions.

B. Restore all localized drainage channels.

C. Do not fertilize or apply lime in wetland areas.

D. Seeding in areas designated on the drawings as wetlands shall be limited to rye grain at 200 pounds per acre.

E. Existing flooded wetland shall be allowed to re-vegetate naturally with native species.

3.7 SEED PROTECTION

A. Mulching: After fertilizing, seeding and raking, dried straw shall be spread uniformly over the area at a rate of 90 pounds per 1000 square feet. Approximately 1/4 of the ground should remain visible to avoid smothering seedlings. Tack mulch by crimping with crimping attachment. The straw shall be sprayed with liquid asphalt to bond it together and anchor it in place within road right-of-way and areas subject to erosion.

1. Liquid asphalt, thinned with kerosene, shall be used during freezing weather and shall be either rapid or medium curing. It shall be applied at

a rate of 200 gallons per ton of straw or approximately 9 gallons per 1000 square feet.

2. Emulsified asphalt, thinned with water shall be used when temperatures are less severe, shall be rapid curing only, and shall be applied at a rate of 150 gallons per ton of straw or approximately 7 gallons per 1000 square feet.

B. Cover seeded slopes where grade is six inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in six inch deep excavated topsoil trench. Provide 36-inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps as shown on the erosion control matting detail.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum six inches.

3.8 MAINTENANCE:

A. The Contractor shall maintain the seeded areas until there is a uniform growth three (3) inches high. Maintenance shall consist of watering, weed and pest control within established lawns, fertilization, erosion repair, reseeding and all else necessary to establish a vigorous healthy and uniform stand of grass. All areas and spots which do not show a uniform stand of grass, for any reason, shall be treated repeatedly until a uniform stand is attained.

END OF SECTION 02930

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SECTION 03100 – CONCRETE FORMWORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03300 – Cast-in-Place Concrete: Supply of concrete accessories for placement by this Section.

1.3 RELATED SECTIONS

A. Section 03200 – Concrete Reinforcement.

B. Section 03300 – Cast-in-Place Concrete.

1.4 REFERENCES

A. ACI 301 – Structural Concrete for Buildings.

B. ACI 347 – Recommended Practice for Concrete Formwork.

C. PS-1 – Construction and Industrial Plywood.

1.5 DESIGN REQUIREMENTS

A. Design, engineer, and construct formwork, shoring, and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line, and dimension.

B. Safely support all vertical and lateral loads that might be applied during placing or operations until such loads can be supported by the concrete structure.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and 347.

B. Maintain one copy of document onsite.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.8 COORDINATION

A. Coordinate this Section with other Sections of work which require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Owner's Representative before proceeding.

PART 2 – PRODUCTS

2.1 WOOD FORM MATERIALS

A. Plywood: PS 1, B-B Plyform, Class j. Exterior, National Bureau of Standards, Voluntary Products Standard.

2.2 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, one inch back break dimension, free of defects that could leave holes larger than one inch in concrete surface.

B. Form Release Agent: Colorless mineral oil which will not stain concrete or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

3.2 EARTH FORMS

A. Earth forms are not permitted.

3.3 ERECTION – FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301 and ACI 347.

B. Provide bracing to ensure stability of formwork. Shore or strength formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

3.4 APPLICATION – FORM RELEASE AGENT

A. Clean inside surface of all forms.

B. Apply form release agent on formwork in accordance with manufacturer's recommendations.

C. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels; flush with inside face of forms; and neatly fit so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

B. Camber slabs and beams in accordance with ACI 301.

3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

A. Notify Owner's Representative prior to removing formwork.

B. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

C. The minimum time between concrete placement and form removal shall be determined either by field-cured test specimens or in accordance with the time specified for the member involved.

D. No forms or supports shall be loosened or removed until the stripping time in ACI 347 is observed, or tests indicate strength of members as follows:

Item	Strength
Unshored Slab and Beam Forms	.75 f'c
Slab or Beam Shoring	.85 f'c
Wall, Column, and Beam Side Forms	.75 f'c

E. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

F. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION 03100

SECTION 03200 – CONCRETE REINFORCEMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

1.2 RELATED SECTIONS

A. Section 03100 – Concrete Formwork.

B. Section 03300 – Cast-in-Place Concrete.

1.3 REFERENCES

A. ACI 301 – Structural Code for Buildings.

B. ACI 318 – Building Code Requirements for Reinforced Concrete.

C. ACI SP-66 – American Concrete Institute – Detailing Manual.

D. ANSI/ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement.

E. ASTM A615 – Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

F. ASTM A767 – Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.

G. CRSI – Concrete Reinforcing Steel Institute Manual of Practice.

H. CRSI 63 – Recommended Practice for Placing Reinforcing Bars.

I. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications, and Nomenclature.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300. Do not fabricate reinforcing before receipt of approved shop drawings.

B. Shop Drawings: Indicate bar sizes, spacings, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI 63, 65, and Manual of Practice, ACI 301, ACI SP-66, ACI 318.

B. Maintain one copy of each document onsite.

C. Submit certified copies of mill test report of reinforcement materials analysis.

D. Review reinforcing bars in place prior to concrete placement in accordance with "North Carolina Building Code," Chapter 19, Concrete (latest edition).

1.6 COORDINATION

A. Coordinate with placement of formwork, formed openings, and other work.

1.7 WELDING

A. Welding on reinforcing steel during shop fabrication or field work shall not be permitted.

1.8 MARKING AND SHIPPING

A. Ship reinforcing steel to size cut to proper length, tagged with non-rusting metal tags, showing shop drawing numbers, and tied in bundles that can easily be handled.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Bars, when delivered at the site, shall be straight and free from twists, kinks, and irregularities except such as are necessary to conform to reinforcing details. Steel shall be free from dirt, scale, or loose rust or other coatings. Any bars upon which decided rust scales have formed shall be rejected.

B. Store reinforcing bars and wire fabric above ground or under cover to project same from weather, dirt, or grease.

C. Care shall be exercised to prevent any damage during shipment, handling, and storage.

PART 2 – PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain finish.

B. Foundations and Equipment Pads: Plain Finish.

C. Slabs on Grade: Galvanized to ASTM A767 Class I finish.

D. Welded Steel Wire Fabric: ASTM A185 Plain Type; in flat sheets, galvanized to ASTM A767 Class II finish.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support or reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel or stainless steel type, size and shape as required.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.

B. Locate reinforcing splices not indicated on Drawings, at point of minimum stress. Review location of splices with Owner's Representative.

C. Lengths of laps, splices, and embedments shall conform to ACI 318.

PART 3 – EXECUTION

3.1 PLACEMENT

A. Place, support, and secure reinforcement against displacement. Do not deviate from required position.

B. Accommodate placement of formed openings.

C. Maintain concrete cover around reinforcing as follows unless noted otherwise on the drawings:

Item	Coverage
Beams	1-1/2 inch
Floors, walkways, driveways	1-1/2 inch
Supported Slabs and Joists	1 inch
Column Ties	2 inch
Walls (exposed to weather or backfill)	2 inch
Footings and Concrete Formed against Earth	3 inch
Slabs on Grade	3 inch

D. Placing of all reinforcing steel shall conform to ACI 301and ACI 318, , unless otherwise noted herein.

E. Bending or straightening of rebars partially embedded in set concrete shall not be permitted unless specifically approved by the Engineer.

F. Rocks, broken bricks, wood blocks, or concrete fragments shall not be used for support of steel reinforcement.

G. Prior to placing concrete, inspect placement in accordance with Building Code requirements. Inspection by the Owner's construction representative.

END OF SECTION 03200

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SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1. Cast-in-place concrete includes the following:

a. Foundations and footings.

b. Slabs-on-grade.

c. Elevated slabs.

d. Equipment pads and bases.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 01 Specification Sections.

1. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Engineer.

2. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent work.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of each document onsite.

C. Acquire cement and aggregate from same source for all work.

D. Conform to ACI 305R when concreting during hot weather.

E. Conform to ACI 306R when concreting during cold weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. Concrete shall be composed of cement, fine aggregate, coarse aggregate and water proportioned and mixed to produce a plastic, workable mixture. Concrete shall be either Class A or Class B, as indicated on the plans. If the Class is not otherwise indicated, the Contractor shall furnish Class A concrete. In general, Class A concrete shall be reinforced concrete masonry, cast-in-place in forms for foundations, footings, piers, headwalls, tanks, walls, floors, manholes, pits, streets, sidewalks and similar structures; and Class B concrete shall be plain concrete and shall be used for pipe cradles, pipe protection, anchors, collars, massive sections and similar work.

2.2 CONCRETE MATERIALS

A. Cement for Class A and B concrete shall be Portland Cement conforming to ASTM Specification C150, Type I and Section 1000 of the 2024 NCDOT Standard Specifications for Roads and Structures, or latest edition. Type IP and Type IS blended cements, fly ash and/or granulated blast furnace slag may be substituted for a portion of the Portland Cement only upon approval of the Engineer.

B. Additives introduced to effect air entrainment, slump, set; whether to retard or accelerate (high early), water reduction, and other properties may be used only upon consent and approval of the Engineer or when specified in the project Plans and / or Specifications. Additives shall be placed in the cement at the mixer in accordance with recommendations of their manufacturer or as specified in the mix formula.

2.3 AGGREGATES

A. Fine aggregate shall be of a natural siliceous type and consist of hard, durable, and uncoated particles conforming to ASTM Specification C33. It shall have a fineness modulus ranging from 2.40 to 3.00. Fine aggregate shall be of such quality that when made into a mortar and subjected to a mortar strength test (ASTM C87), it shall develop a compressive strength at 7 and 8 days of not less than 90 percent of that developed by a mortar prepared in the same manner with the same cement and graded standard sand having a fineness modulus of 2.40 ± 0.10.

B. Coarse aggregate shall consist of natural washed gravel, crushed stone or crushed blast furnace slag conforming to ASTM Specification C33. It shall be graded to pass square mesh screens of the following limiting sizes:

	Class A Concrete	Class B Concrete
Minimum Screen Size	No. 4	No. 4
Maximum Screen Size	3/4 inch	2 inches

C. Water used in mixing concrete shall be fresh, clean and shall not contain any amounts of oil, acid, alkali, vegetable, sewage and/or organic matter.

2.4 ADMIXTURES

A. General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

1 Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

2 Water-Reducing Admixture: ASTM C 494, Type A or D.

3 High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

2.5 JOINTS

A. Molded rubber water stops for construction joints shall be the flat type, 6 inches in length, with a 3/4-inch bulb at each end. Molded rubber water stops for expansion and contraction joints shall be the flat type, 9 inches in length, with a 1-inch bulb at each end and a 1 1/2 inch hollow bulb in the center. Splices in rubber water stops shall be made by vulcanizing or by the use of a rubber union and rubber cement. Molded rubber water stops shall be as manufactured by A.C. Horn, W. R. Meadows, Inc., Rubber & Plastics Compound Company, or equal.

B. Molded polyvinyl chloride water stops for construction joints shall be the flat type, 6 inches in length and 3/8 inch thick, with a 3/4-inch bulb at each end, as manufactured by A.C. Horn, or the flat type 6 inches in length and 3/8 inch thick with end and intermediate ribs, as manufactured by Vulcan Metal Products, Inc., A-H Products, Viveflex Corporation, or equal. Molded polyvinyl chloride water stops for expansion and contraction joints shall be the flat type, 9 inches in length and 3/8 inch thick, with a 1-inch bulb at each end and a 1 1/2-inch hollow bulb in the center, as manufactured by A.C. Horn, Vulcan Metal Products, Inc., A-H Products, Viveflex Corporation, or equal; or the flat type 9 inches in length and 3/8 inch thick, with intermediate ribs and center hollow bulb as manufactured by Vulcan Metal Products, Inc., A-H Products, Viveflex Corporation, or equal. Splices in polyvinyl chloride water stops shall be made by the heat-softening process in strict accordance with the manufacturer's recommendations.

C. In expansion and contraction joints, pre-molded joint filler and cold applied joint sealing compound shall be applied in the opening on both sides of the molded water stop. Cold applied joint sealing compound shall be applied to the opening at the top of the molded water stop. Pre-molded joint filler shall be Self-Expanding Cork, Code 4324, and cold applied joint sealing compound shall be Vertiseal (light gray), a polysulfide polymer, both as manufactured by A.C. Horn, or shall be comparable products as manufactured by W.A. Meadows, Inc., Rubber & Plastics Compound Co., or equal.

2.6 PROPORTIONING AND DESIGNING MIXES

A. Concrete ingredients shall be selected, proportioned and mixed to produce a workable, homogeneous concrete within the following limiting requirements:

MIXTURE	CONCRETE CLASS A	CONCRETE CLASS B
Min. Compressive Strength (28 days) 5 consecutive specimens (lbs. per square inch)	4000	3000
Any one specimen (lbs. per square inch)	3500	1600
Volume of cement per cubic yard of concrete - minimum (bag)	6	4.5
Volume of cement per cubic yard of concrete - maximum (bag)	7	5.5
Volume of water per cubic yard of cement - maximum (gal)	6	7.5
Amount of air entrained in fresh mix - minimum (% of volume)	4	None
Amount of air entrained in fresh mix - maximum (% of volume)	7	None

B. The exact volumes and proportions of ingredients to be used in each cubic yard of concrete shall be predetermined by the Contractor well in advance of the start of mixing operations in order to assure conformity of the resulting concrete with the above specifications. Such predetermination shall be made by mixing and testing a series of trial mixes of the actual ingredients proposed to be used, the trial mixes to be computed and designed in accordance with the Portland Cement Association Bulletin ST-100, Design of Concrete Mixes. Trial mixes shall be repeated with varying proportions of ingredients until the resulting concrete meets the specified limitations. The results of such trial tests shall be reported to and accepted by the Engineer prior to the start of concrete mixing operations. Said test shall be performed by an independent certified testing laboratory.

C. The amount of moisture carried on the surface of the aggregate particles shall be included in calculating the water content of each mix. In all cases, however, the amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the specific strength and of the desired durability, density and workability. The slump shall be between 3 inches and 4 1/2 inches when determined in accordance with ASTM Test C143. Concrete must be workable at these slumps.

D. The air content of freshly mixed concrete shall be determined by the appropriate ASTM Test C231. Frequency of this test will be at the discretion of the Engineer. Any concrete shown by such measurements to contain more or less air than the specified amount shall be rejected and shall not be used in the work.

E. No admixtures of hardening or curative materials shall be used unless previously authorized in writing by the Engineer.

F. Concrete materials shall be measured by weight. Scales suitably designed and constructed for this purpose shall be provided. Each batch of aggregate and cement shall be weighed separately. Cement in standard packages need not be weighed. Mixing water shall be measured by volume or by weight. All measuring devices shall be checked and accepted by the Engineer prior to use.

G. Concrete shall be mixed in a standard type of batch mixer with a drum speed of 200 to 225 peripheral feet per minute. Mixing time shall be 1 minute for batches of 1 cubic yard or less, and shall be increased 15 seconds for each additional 1/2 cubic yard or fraction thereof. The entire batch shall be discharged before recharging.

H. Central mixed and transit mixed concrete may be used, providing that the quality and kind of material used and the proportioning, mixing and transportation to the forms conform to the requirements of ACI Standard 304.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer all exposed corners and edges, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints. Chamfer edges to be ¾” unless otherwise approved by Engineer.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.2 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Notify the Engineer a minimum of 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed joint fillers and waterstops are not disturbed during concrete placement.

D. Install joint fillers, primer, and sealant in accordance with manufacturer's instructions.

E. Separate slabs on grade from vertical surfaces with ½ inch (12 mm) thick joint filler.

F. Extend joint filler from bottom of slab to within ½ inch (12 mm) of finished slab surface.

G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

H. Place concrete continuously between predetermined expansion, control, and construction joints. Do not interrupt successive placement; do not permit cold joints to occur.

I. Saw cut joints within 24 hours after placing. Using 3/16-inch thick blade, cut into ¼ depth of slab thickness.

J. Screen floors and slabs on grade to slope indicated, maintaining surface flatness of maximum ¼-inch in ten feet (6 mm/3 m), unless noted otherwise on the drawings.

K. Cold Weather – Temperature of concrete delivered to the jobsite shall conform to the following ranges:

Ambient Air Temperature	Concrete Temperature
30° - 45°F	55° - 90°F
0° - 30°F	60° - 90°F
Below 0°F	65° - 90°F

1. All work shall be in accordance with ACI 306, latest edition, "Recommended Practice for Cold Weather Concreting."

2. When outdoor temperature is less than 40°F, temperature of concrete in place shall be maintained at not less than 50°F.

L. Hot Weather – Temperature of the concrete delivered to the jobsite shall not exceed 90°F. All work shall be in accordance with ACI 305, latest edition, "Recommended Practice for Hot Weather Concreting."

M. Protect from rain and rainwater. No concrete shall be placed in rain, sleet, or snow or other adverse weather conditions. Rainwater shall not be allowed to increase the water content of the concrete.

N. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

3.3 CONCRETE CONSTRUCTION

A. Acceptance of Concrete

1. Concrete shall be accepted on the basis of its meeting the requirements listed under the Material Specifications and Detail Specifications Section of this contract. The Inspector will accept no ready mix concrete without the plant dispatch ticket.

2. The Engineer shall make or require any tests as he deems necessary to ensure that the concrete meets specifications. The Engineer may require the test to be performed by an independent testing laboratory at the Contractor's expense.

B. Concrete Placement

1. Before placing concrete, forms shall be clean and thoroughly oiled with a non- staining mineral oil. Concrete shall not be placed until the forms and reinforcement have been checked and accepted by the Engineer. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces, free from water, and never upon soft mud or dry porous earth.

2. Chutes shall be used to place concrete only when specifically authorized by the Engineer. When permitted, metal or metal lined chutes shall have rounded bottoms, with end baffles and shall be sloped to insure continuous flow of concrete without segregation of aggregates. Tremies, bottom dump buckets, or concrete buggies shall be used whenever practical for depositing concrete.

3. Concrete shall be deposited as close as possible to its final position in the forms. The depositing of concrete shall be regulated so that the concrete may be effectively compacted with a minimum of lateral movement into horizontal layers approximately 12 inches in thickness. Concrete shall be worked into all corners and angles and around reinforcement and embedded fixtures in such manner as will fill all voids, prevent honeycombing against the forms, and prevent segregation of coarse aggregate. This operation shall be performed by the use of spades or forks, or by other approved methods. Rakes shall not be used.

4. During placing operations, concrete shall not be allowed to drop freely a distance greater than 5 feet. When concrete is placed a vertical distance greater than 5 feet in narrow wall forms, metal drop chutes with top hoppers (tremies) or other acceptable placing methods shall be used.

5. Concrete shall be compacted with mechanical vibrating equipment supplemented by hand spading and tamping. Vibrators shall not be used to transport concrete inside the forms. Vibrating equipment shall be of the internal type and shall at all times be adequate in number of units and power of each unit to properly consolidate all concrete. Form or surface vibrators shall not be used. Internal vibrators shall maintain a frequency of vibration of not less than 3,600 RPM when submerged in the concrete.

Vibrators shall not be left stationary in any position, but shall be moved continuously from point to point in a slow and steady movement. Vibration shall be held to a minimum to avoid loss of air content after concrete has been placed in the forms.

6. Water accumulated during placement shall be immediately removed. Under no circumstances shall concrete be placed in such accumulations.

7. Before depositing new concrete on or against hardened concrete, the surface of the hardened concrete shall be thoroughly roughened, cleaned, and saturated with water. The surface shall then be coated with grout against which the new concrete shall be placed before the grout has attained its initial set.

8. All top surfaces not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade and struck off by board finish.

9. Freshly placed concrete shall be protected from wash by rain, flowing water, mud deposits and other injurious conditions. Concrete shall not be allowed to dry out from the time it is placed until the expiration of curing period.

10. Concrete will not be accepted if it cannot be placed within ninety (90) minutes of the dispatch time. Time requirements may fluctuate marginally due to temperature. Concrete shall be deposited in such a manner so as to prevent contamination by foreign material and segregation due to rehandling or flowing. Segregated concrete and/or concrete containing foreign material will not be accepted. Depositing will not be permitted when temperature has not exceeded 35° F and rising by 10:00 A.M. Depositing shall cease when the descending air temperature in the shade falls below 40° F. It shall not resume until the ascending air temperature rises to 35° F. All concrete shall be kept from freezing by the Contractor. Frozen concrete shall be replaced at the Contractor's expense. Free fall shall not exceed 3 feet in any case.

C. Testing

1. The following tests will be required by the Engineer to ensure the concrete quality:

   a. Compressive strength in accordance with ASTM C-31 and ASTM C-39. Test cylinders which are formed in the field will be left in the field until compression testing (7 day, 14 day, 28 day) is completed thereby more closely approximating the curing conditions of the field placed concrete.

   b. Slump Test in accordance with ASTM C-143.

   c. Air Content Test in accordance with either ASTM C-173 or ASTM C-231.

3.4 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed with smooth rubbed finish or sack rubbed finish as scheduled in this section. All form marks exposed to view shall be rubbed off with a stone.

B. Concrete Floor and Slab Finishes:

1. Swirl Finish – In areas where indicated on drawings, floor shall have the aggregate well worked down from the surface, and be given a hard, smooth steel trowel finish. After the hard, smooth finish is obtained, the finisher shall make an additional pass over the surface to obtain a nonskid finish, commonly known as a “swirl finish,” which is smoother than “sidewalk finish” but is not a glasslike smoothness. Dusting with sand or cement will not be permitted.

C. The use of any finishing or troweling machine or other apparatus which has a water attachment for wetting the concrete during finishing operations is prohibited.

D. Finish concrete floor surfaces in accordance with ACI 301.

E. Steel trowel surfaces which are scheduled to be exposed.

F. In areas with floor drains, maintain floor elevations at walls; pitch surfaces uniformly to drains as indicated on Drawings.

G. Provide broom or belt finish on concrete slabs on roof membrane.

3.5 CURING AND PROTECTION

A. All concrete shall be cured by the use of wet burlap or by a liquid membrane curing compound. Wet burlap shall be used where concrete is to be painted, topped with grout, and where concrete is to receive tile or a covering which requires an adhesive. Burlap so used shall be kept continuously wet for a period of 7 days, Liquid membrane curing compound shall be Sonneborn-Contech Hydroxide Resin Base Compound with fugitive red tint, Lambert Corporation No. 64-WB Compound with fugitive red tint, or approved equal. Curing compounds shall comply with ASTM Specification C309, Type 1 and AASHO Specification M148, Type 1 and shall be applied to concrete at a rate recommended by the manufacturer.

B. In cold weather concrete shall be mixed and placed only when the temperature is at 40˚F, or above, and rising, unless specifically authorized by the Engineer, in which event all materials shall be heated in a manner acceptable to the Engineer. In freezing weather, suitable means shall be provided for maintaining the concrete at a temperature of at least 50˚F for a period of not less than 72 hours after placing, or until the concrete has thoroughly hardened. Salt, chemicals or other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing. Concrete temperature shall not be allowed to exceed 90˚F during pouring operations or for 72 hours thereafter.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301.

B. Provide free access to Work and cooperate with appointed testing firm.

C. Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of Work.

D. Tests of cement and aggregates shall be performed to ensure conformance with specified requirements.

E. Three concrete test cylinders will be taken for every 75 or less cubic yards of each class of concrete placed each day.

F. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. One slump test will be taken for each set of test cylinders taken.

H. Contractor shall pay for testing.

3.7 PATCHING

A. Allow the Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify the Engineer upon discovery.

C. Patch imperfections in accordance with ACI 301.

3.8 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Engineer.

C. Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of the Engineer for each individual area.

3.9 CONSTRUCTION JOINTS

A. Construction joints and expansion and contraction joints shall be constructed only at locations shown on the Plans, unless otherwise authorized by the Engineer. Concrete at all joints shall have been in place not less than 12 hours before concrete is placed on or adjacent to it. The joints shall be straight and exactly horizontal or vertical as shown on the Plans. When shown on the Plans, molded water stops shall be used in construction joints and expansion and contraction joints. Molded water stops shall be of rubber or polyvinyl chloride composition.

B. Construction joints in general shall be located near the middle of spans of slabs, beams, and girders; unless a beam intersects a girder at this point, in which case

the joints in the girders shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders, and at the top of footings or floor slabs. Beams, girders, brackets, column capitals, haunches and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

C. All reinforcement shall be continued across construction joints. Keys and dowels shall be provided as shown on the Contract Drawings. Vertical joints in walls shall be kept to a minimum. No joints are permitted in footing or foundation work. The Contractor shall make such provisions for bonding walls and footings as shown on the Contract Drawings or as approved by the Owner's Representative.

D. The surface of the hardened concrete at all joints shall be thoroughly cleaned and all laitance removed. The surface shall be prepared to ensure bonding of concrete placed on it.

3.10 EXPANSION JOINTS

A. Expansion joints shall be provided where shown on the Contract Drawings. The joint filler material shall be firmly placed against the face of the completed concrete work before the concrete of the adjoining portion is placed.

B. Reinforcement or other embedded metal items bonded to the concrete shall not be permitted to extend continuously through any expansion joint unless shown otherwise on the Contract Drawings or approved by the Owner's Representative.

3.11 INSERTS

A. All sleeves, anchor bolts, pipe anchors, inserts, and embedded items shall be placed in positions prior to concreting. All such items must be clearly located on the shop drawings, and shall be approved by the Owner's Representative. The Contractor shall coordinate and verify all mechanical, electrical, and architectural drawings for the location of sleeves, pipes, ducts, and all other items. Anchor bolt threads shall be protected with a coat of grease before placing concrete; after which they shall be thoroughly cleaned, re-greased, and wrapped in burlap. All ferrous metal inserts shall be galvanized.

B. Contractor shall hold all embedded items in perfect position and alignment during placement of concrete using supplementary supports, ties, or other approved means. Such supports or hardware which will remain permanently in the concrete shall be evaluated for their effect in shield integrity, and shall be documented by photographs.

C. No items made of aluminum are allowed to be embedded in concrete unless otherwise shown on Contract Drawings. Aluminum surface in contact with concrete shall be given a heavy coat of alkali-resistant bituminous paint before installation. Aluminum surface to be embedded in concrete shall be given one coat of zinc chromate primer conforming to US Military Specification MPL-P735.

3.12 CONCRETE EQUIPMENT PADS AND FLOOR TOPPINGS

A. Prior to placing concrete equipment pads or floor toppings, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required edge strips and reinforcing and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Place concrete equipment pads or floor toppings to required lines and levels.

E. Screed pads or toppings level, maintaining surface flatness of maximum ¼-inch in ten feet (6 mm//3m).

3.13 SCHEDULE – JOINT FILLERS

A. Ground Floor Slab Perimeter and Isolation Joints around Columns: Joint filler set ½-inch below floor slab elevation.

END OF SECTION 03300

SECTION 03410 - PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: The work under this section includes the design, coating, delivery, and erection of precast concrete structures as indicated on the Drawings.

1.2 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall be in accordance with the current editions of the following standards:

1. Standard Building Code.

2. ACI 318, Building Code Requirements for Reinforced Concrete.

3. PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products.

4. ASTM D792-86, ASTM D1238-88, ASTM D1638-83, and ASTM D638-89, testing methods for HDPE cell class properties and Underwriters Laboratory (UL) UL-94 testing method for fire classification.

1.3 SUBMITTALS

A. The following information shall be submitted to the Engineer for approval in accordance with Section 01340. Fabrication shall not begin until submission has been approved.

1. Quality Control: Satisfactory evidence shall be submitted that plant and production methods meet the requirements of PCI MNL 116.

2. Design: Complete calculations including shear, moment, buoyancy, and camber calculations shall be submitted. All computation sheets shall bear the seal of a Professional Engineer registered in the State of North Carolin. Design water table shall be assumed to be at finished grade.

3. Shop Drawings: Complete fabrication and erection drawings shall be submitted. All drawings shall bear the seal of a Professional Engineer registered in the State of North Carolina.

B. Manufacturer's data sheets shall be submitted on the following:

1. Joint mastic and gaskets.

2. Pipe connections.

3. Grout material.

4. Hatches.

1.4 DELIVERY, STORAGE AND HANDLING

A. Transportation and erection shall be done by qualified personnel using proper equipment. Lifting and supporting shall be done only at points indicated on the shop drawings.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

A. Precast Concrete Structures:

1. Design loads shall consist of dead load, live load, impact, soil loads and loads due to water table, as well as other loads which may be imposed upon the structure. Precast concrete structures shall be designed in accordance with ASTM C478.

2. Forms used for precast concrete shall be of metal and sufficiently designed and braced to maintain their alignment under pressures of the concrete during placing. Base and first section of precast structures shall be an integral cast.

3. Aggregates. All aggregates, fine and coarse, other than lightweight aggregate shall conform to ASTM C33. Lightweight aggregates, fine and coarse, shall conform to ASTM C330. Aggregates shall be free of deleterious substances causing reactivity with oxidized hydrogen sulfide.

   Both types of aggregate shall be graded in a manner so as to produce a homogenous concrete mix. All materials are to be accurately weighed at a central batching facility for mixing.

4. Cement shall be Portland cement Type II.

5. Minimum compressive strength of concrete used for precast concrete structures shall be 5,000 psi at 28 days.

6. Placing. All concrete shall be handled from the mixer or transport vehicle to the place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss of ingredients, until the approved unit is completed. Maximum elapsed time from batching to placement shall be 2 hours. Concrete shall be placed in layers not over 2 feet deep. Each layer shall be compacted by mechanical internal or external vibrating equipment. Duration of the vibration cycle shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation.

7. Curing:

   a. For purposes of early reuse of forms, precast concrete may be steam cured after an initial set has taken place. The steam temperature shall not exceed 160°F, and the temperature shall be

raised from normal ambient temperatures at a rate not to exceed 40°F per hour.

b. The steam cured unit shall not be removed from the forms until sufficient strength is obtained for the unit to withstand any structural strain to which it may be subjected during the form stripping operation. After the stripping of forms, further curing by means of water spraying or a membrane curing compound may be used, and shall be of a clear or white type, conforming to ASTM C 309.

8. Reinforcing steel shall be sufficiently tied to withstand any displacement during the pouring operation. All bars shall be Grade 60.

9. Joints shall be tongue and groove pipe ends sealed with round or other flexible type natural rubber joint ring gaskets in conformance with ASTM C 433 or by a flexible preformed bitumastic sealing material equivalent to Ram-Nek as manufactured by R.K. Snyder and Co., Houston, Texas. If rubber joint ring gaskets are used, interior and exterior voids in the pipe joints shall be sealed with flexible sealing material specified above, installed in strict accordance with the manufacturer's printed instructions. If manhole sections are sealed with a flexible preformed bitumastic sealing material, adequate material shall be applied so that "squeeze out" occurs at the interior and exterior of the joint. Rubber joint ring gaskets and flexible preformed bitumastic sealing material shall be provided by the manhole manufacturer.

10. Sealing Compound and Grout: Plastic sealing compound shall comply with Federal Specification SS-S-00210. Mortar shall comply with ASTM C 387, Type S, or use grout complying with Section 03600.

11. Lifting holes through the structures are not permitted. Equally spaced lifting lugs, rings or non-penetrating lift inserts shall be provided.

12. Top slabs for shallow vaults may be precast or cast-in-place. Steel reinforcing shall be as indicated on the Drawings. Concrete for top slabs shall have a compressive strength of 4,000 psi at 28 days. Thickness of concrete for top slabs for vaults shall be as shown on the Drawings.

B. Pipe Connections:

1. Pipe connections for wet wells and manholes shall be resilient, waterproof connections designed in accordance with ASTM C 923 "Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes". Resilient pipe connectors shall either be cast into the manhole wall or installed following casting in a cored section of the manhole wall. Resilient connectors shall either be a gasket type connector equivalent to the A-Lok pipe to manhole seal as manufactured by Atlantic Concrete Products, Inc., or a flexible neoprene boot with stainless steel clamps equivalent to the KOR-N-SEAL System as manufactured by the Dukor Corporation. When the pipe is installed in the resilient manhole connector, the pipe shall be capable of 200 minimum deflection in any direction.

2. Pipe connections for wall penetrations for vaults shall be provided with wall sleeves and link seals.

C. Frames and Covers:

1. Refer to Section 02605 Manholes.

D. Access Hatches

1. Access doors and hatches shall be cast in the structure at the appropriate location as indicated on the plans. They shall be of the sizes shown on the Plans or selected by the pump manufacturer. In no case shall access doors be less than that necessary to service valves and fittings within the pit.
2. Access doors and hatches and their frames shall be double door hatches of all aluminum diamond plate construction reinforced for a 300 psi live load.
3. The frames shall be extruded and have 316 S.S. hinges and 316 S.S. tamper resistant bolts/locknuts.
4. Entrance shall be by a removable key or post/staple for a padlock. A handle on the inside shall permit inside door opening.
5. The frame shall be provided with drainage channel. Provide H20 rated hatches in or near traffic areas or protect structures from traffic by installation of bollards.

E. Coatings:

1. Provide interior and exterior coatings for precast structures in accordance with Section 09871.

F. Pre-Qualification of Lining Material Systems:

1. If the Contractor intends to use a different lining system than that specified, the Contractor shall submit information regarding the substitute materials to the Engineer at least ten (10) days prior to the bid date. The pre-qualification submittal shall include samples, complete performance data, certifications from an independent testing laboratory regarding conformity with the specifications and a list of completed successful installations, with contact names and telephone numbers to enable the accurate evaluation of the proposed lining system. Bidders shall be notified of acceptable and approved substitute lining systems prior to the bid by written addendum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Earthwork:

The Contractor shall prepare an excavation large enough to accommodate the structure and permit sealing of openings, waterproofing, and backfilling operations. Earthwork shall conform to the applicable sections of Division 02.

B. Installation of Precast Concrete Structures:

Precast concrete structures shall be constructed in a workmanlike manner at the locations and dimensions indicated on the Drawings. Precast structures shall be set on a foundation of crushed stone, 12 inches thick. Crushed stone material shall be a well-graded crushed stone or crushed gravel meeting the requirements of ASTM C33, Gradation No. 67 (3/4 inch to No. 4 sieve). The precast structures shall be constructed such that the structure will not transmit dead or live loads to the piping. Care shall be taken to prevent earth and other material from entering precast structures.

C. Sealing and Grouting:

Fill all interior and exterior joints between precast sections with a joint sealant, as recommended by the structure manufacturer.

D. Installing Precast Sections:

1. Set each precast concrete unit plumb on a bed of sealant to make a watertight joint at least 1/2-inch thick with the concrete base or with the preceding unit. Point the inside joint and wipe off the. excess sealant.

2. Assemble units so that the cover conforms to the elevations shown on the Drawings.

3. Pipe connections at precast structures shall be provided at the locations shown on the Drawings. Connections shall be resilient and waterproof

4. All voids in interior and exterior section joints and lift holes for sections shall be filled with a non-shrinking, non-metallic grout. Grout shall be applied and cured in strict accordance with the manufacturer's recommendations. The grout shall be finished smooth and flush with the wall surface of the manhole.

E. Setting Frames and Covers:

1. Unless otherwise indicated on the Drawings, in unpaved areas the tops of vaults shall be set 0.5-feet above finished grade, unless otherwise indicated on the Drawings.

F. Interior Coating:

1. The interior coating system shall be applied following installation of the precast structures and any piping or equipment which will penetrate or attach to the walls. Surface preparation and application of the coating system shall be in strict accordance with the manufacturer's recommendations.

G. Backfill:

1. After the structure and all appurtenances are in place and approved, backfill shall be placed to the original ground line or to the limits designated on the Drawings. Backfill material shall consist of sand or loose earth, free from stones, clods, or other deleterious material. It shall be placed in horizontal layers not exceeding 12 inches in depth, and shall be moistened and thoroughly compacted to a minimum relative density conforming to the requirements of Division 02.

END OF SECTION 03410

SECTION 03600 - GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes grouting of beam and column framing bearing/base plates, equipment bases; and such locations as shown on the Drawings and as specified.

B. The types of grouting include the following:

1. Portland Cement Grout

2. Non-shrink, non-expanding Grout

1.2 DELIVERY AND STORAGE

A. Prevent damage to or contamination of grouting materials during delivery, handling, and storage.

B. Store all grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of the Bid.

1. ASTM C 109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens)

2. ASTM C 531 Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings

3. ASTM C 579 Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings

4. ASTM C 827 Standard Test Method for Early Volume Change of Cementitious Mixtures

1.4 SUBMITTALS

A. Submit the following in accordance with Division 01.

1. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein.

2. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of grout used in the work.

1.5 QUALITY ASSURANCE

A. Field Tests

1. Compression test specimens will be taken during construction from the first placement of grout for each structure and at intervals thereafter as selected by the Engineer to ensure continued compliance with these Specifications. The specimens will be made by the Engineer or its representative.

   a. Compression tests and fabrication of specimens for cement grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days, and any additional time period as appropriate.

2. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Owner's Construction Representative in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.

3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 PREMIXED GROUTS

A. Portland Cement Grout

1. For grout toppings of liquid containment structures and similar items – f'c=3000 psi minimum.

   a. Portland Cement: ASTM C150, Type I

   b. Sand: ASTM C33, Fine Aggregate

   c. Water: Portable

   d. Pea Gravel: ASTM C33. Coarse aggregate, graded so that at least 90% passes 3/8-inch sieve and 90% is retained by a number 4 sieve.

2. Grout Mortar for use as fillets and leveling.

a. Portland Cement: ASTM C150, Type I

b. Sand: ASTM C33, Fine Aggregate (Mason's sand)

c. Water: Potable

d. Mix 1-part Portland cement to 3-parts sand.

B. Pre-Mixed non-shrink, Non-expanding Grout (Nonmetallic)

1. Non-shrink grout as shown on the Drawings shall be a mixture of selected silica sands, Portland cement, water reducing agents, plasticizing and shrinkage compensating agents. Grout shall be nonmetallic non-corrosive, non-staining and comply with CRD C588 and CRD C621.

2. The grout shall be non-shrink in accordance with ASTM C1107, ASTM C827, ASTM C191, and ASTM C109. The water-grout ratio shall be approximately 8 to 10 quarts of water per cubic foot of grout adjustable for varying job conditions.

3. Grout shall not contain calcium chloride or other salt; aluminum or other metals; chemical additives, gypsum, or expansive cements. Grout shall not expand after set.

4. Grout shall be used and applied in accordance with the manufacturer's written instructions.

C. Non-Shrink grouts shall be either Gilco pre-mixed Supreme nonmetallic grout as manufactured by Cormix Construction Chemicals, Dry Pack Grout by A. W. Cook Cement Products, Inc., or equal.

2.2 NON-SHRINK GROUT

A. Non-shrink grout shall conform to the following requirements:

1. Manufactured under rigid quality control specifically for grout used in transferring heavy loads.

2. Contain nonmetallic aggregates specially graded to minimize bleeding.

3. Have an initial setting time of approximately one hour at 70°F.

4. Produce no settlement or drying shrinkage at 3-days or later.

5. Have higher strength at all ages than plain cement grout of the same flowability.

6. Resist attack by oil and water and have lower absorption than plain cement grout of the same flowability.

B. Acceptable range of testing requirements:

Compressive Strength (7 days)….	7,000 to 9,000 psi
Compressive Strength (28 days)....	8,250 to 11,000 psi
% Expansion.....……..	+0.025% to +0.75%

2.3 MIXES

A. For less than 2-inch clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of Portland cement, fine aggregate, and water.

B. For greater than 2-inch clearances where coarse aggregate will not obstruct free passage of the grout, extend grout by adding 50 pounds of pea gravel per 100 pounds grout material.

C. Use minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

D. Portland cement mortar for raked-out edges of non-shrink grout: one part Portland cement, two parts sand and 0.50 parts water by weight.

2.4 MIXING

A. Mix grout in accordance with manufacturer's printed specifications.

B. Mix grouting materials and water in a mechanical mixer for no less than 3-minutes.

C. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

D. After the grout has been mixed, do not add more water for any reason.

PART 3 - EXECUTION

3.1 PROCEDURES

A. Installation methods and procedures shall be approved by Engineer and shall be in accordance with manufacturer's printed specifications before work is begun.

3.2 SURFACE PREPARATION

A. Surface preparation shall be in accordance with manufacturer's printed specifications.

B. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.

C. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout. Cover concrete areas with waterproof membrane until ready to grout. Immediately before grouting remove waterproof membranes and clean any contaminated surfaces.

D. Remove foreign materials from metal surfaces in contact with grout. Align, level, and maintain final positioning of all components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water and leave none standing.

3.3 PLACING

A. Placing shall be in accordance with manufacturer's printed specifications.

B. Place non-shrink grouting material quickly and continuously by the most practical means permissible; pouring, pumping or under gravity pressure.

C. Do not use either pneumatic-pressure or dry packing methods without written permission of the Engineer.

D. Apply grout from one side only to avoid entrapping air.

E. Final installation shall be thoroughly compacted and free from air pockets.

F. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment.

G. Do not remove leveling shims for at least 48 hours after grout has been placed. After shims have been removed, fill voids with plain cement-sand grout.

H. After non-shrink grout has reached initial set, rake out exposed edges approximately 1-inch into the grouted area and paint with Portland cement mortar.

3.4 CURING

A. Cure grout for 3-days after placing by keeping wet and covering with curing paper or by another approved method.

END OF SECTION 03600

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SECTION 09871 - PROTECTIVE LINING FOR CONCRETE EXPOSED TO SEVERE WASTEWATER ENVIRONMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment and incidentals as specified, shown, and required to furnish, install, and place into satisfactory service the protective liner for concrete Work.

2. Where not otherwise shown, Contractor shall install protective lining systems on the following:

   a. All interior surfaces of new concrete wet wells, vaults, and manholes (base sections, invert, risers, and bottom of top slab or cone sections).

3. Cleaning, surface preparation, lining application, and thicknesses shall be as specified herein and shall meet or exceed the lining manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the Manufacturer's minimum recommendations.

B. Coordination:

1. Coordinate surface preparation of substrates to avoid later difficulty or delay in performing the Work of this Section.

2. Review installation procedures under other Sections and coordinate the installation of items that must be installed prior to application of the protective lining.

3. All substrate surface preparation and lining application, including concrete resurfacing, to be completed by manufacturer's approved Applicator.

4. The Contractor shall coordinate with the Engineer regarding the availability of work areas, completion times, safety, access and other factors which can impact plant operations.

C. Related Sections:

1. Division 00

2. Division 01

3. Section 03300 – Cast-in-Place Concrete

4. Section 03410 – Precast Concrete Structures

1.2 REFERENCES

A. This Section contains references to the governing standards and documents listed below. They are a part of this Section as specified and modified; the current version shall apply unless otherwise noted. In case of conflict between the requirements of this section and those of the listed documents, the more stringent of the requirements shall prevail.

1. American Concrete Institute, (ACI)

a. ACI 224.1R – Causes, Evaluation and Repair of Cracks in Concrete Structures

b. ACI 301 – Specifications for Structural Concrete

c. ACI 308R – Guide to Curing Concrete

d. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary

e. ACI 515 – A Guide to the use of Waterproofing, Dampproofing, Protective, and Decorative Barrier Systems for Concrete

f. ACI 546.R – Concrete Repair Guide

g. ACI 546.3R – Guide for the Selection of Materials for the Repair of Concrete

2. ASTM International, (ASTM)

a. ASTM C 868 – Standard Test Method for Chemical Resistance of Protective Linings

b. ASTM C 1583/1583M – Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)

c. ASTM D 2794 – Standard Test Method for Resistance of Organic Linings to the Effects of Rapid Deformation (Impact)

d. ASTM D 4060 – Standard Test Method for Abrasion Resistance of Organic Linings by the Taber Abraser

e. ASTM D 4285 – Standard Test Method for Indicating Water or Oil in Compressed Air

f. ASTM D 4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

g. ASTM D 4414 – Standard Practice for Measurement of Wet Film Thickness by Notch Gages

h. ASTM D 6944 Standard Test Method for Measuring Humidity with a Physchrometer

i. ASTM D 7682 – Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty

j. ASTM F 1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

k. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

l. ASTM F 2414 – Standard Practice for Sealing Sewer Manholes Using Chemical Grouting

3. International Concrete Repair Institute, (ICRI)

a. Guideline No. 310.1R – Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion

b. Guideline No. 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealer, Linings, and Polymer Overlays

4. NACE International, (NACE)

a. NACE Publication 6D-173 – A Manual for Painter Safety

b. NACE SP0188 – Standard Practice for Discontinuity (Holiday) Testing of Protective Linings

c. NACE SP0892 – Standard Practice for Coatings and Linings over Concrete for Chemical Immersion and Containment Service

d. NACE No. 6/SSPC-SP13 – Surface Preparation of Concrete

5. Occupational Safety and health Administration, (OSHA)

a. Safety and health Standards (29 CFR 1910/1926)

6. SSPC: The Society for Protective Linings, (SSPC)

a. SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete

b. SSPC-Guide 12 – Guide for Illumination of Industrial Painting Projects

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of construction of the work. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents, the last version of the document before it was discontinued.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Contractor shall be a qualified Applicator by the corrosion protection lining manufacturer prior to bid date. Submit proof of acceptability of Applicator by manufacturer to the Engineer.

2. Installation equipment shall be acceptable to the protective lining manufacturer.

3. Applicator to establish quality control procedures and practices to monitor phases of surface preparation, storage, mixing, application, and inspection throughout the duration of the project. Contractor to provide a fulltime, on-site person whose dedicated responsibilities will include quality control of the corrosion protection linings.

4. Applicator’s quality control procedures and practices must include the following items:

a. Training of personnel in the proper surface preparation requirements.

b. Training of personnel in the proper storing, mixing, and application and quality control testing of the linings.

B. Pre-Installation Conference:

1. Before installing protective lining systems Contractor, Installer and technical representative of the corrosion protection lining manufacturer shall meet on-site with the Engineer to discuss approved products and workmanship to ensure proper application of the corrosion protection lining components and substrate preparation requirements.

2. Review foreseeable methods and procedures related to the corrosion protection lining of coating Work including but not necessarily limited to the following:

   a. Review Project requirements and the Contract Documents.

   b. Review required submittals, both completed and yet to be completed.

   c. Review status of substrate Work, including approval of surface preparations and similar considerations.

   d. Review requirements of on-Site quality control testing and requirements for preparing Site Quality Control Report as specified herein.

   e. Review availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.

   f. Review required inspection and testing.

   g. Review environmental conditions, other Project conditions, and procedures for coping with unfavorable conditions.

   h. Review regulations concerning code compliance, environmental protection, health, safety, fire and similar considerations.

   i. Review procedures required for the protection of the corrosion protection lining during the remainder of the construction period.

3. Record the discussions of the Pre-Installation Conference and the decisions and agreements or disagreements reached, and furnish a copy of the minutes to each party attending. Record any revision or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

4. Reconvene the conference at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

C. Performance Criteria: The surfaces to receive the protective lining shall be capable of withstanding under constant exposure to raw wastewater, permeation from hydrogen sulfide and other sewer gases, and attack from organic acids generated by microbial sources with no adverse effects. Products must have sufficient field history and accelerated laboratory testing to substantiate product viability for these exposures.

D. Source Quality Control: Provide each component of protective lining produced by a single manufacturer.

E. Reference Standards: Comply with applicable provisions and recommendations of all standards listed in Section 1.2 except as otherwise shown or specified.

1.4 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01200 entitled “Submittals”, the Contractor shall submit all required information as specified herein.

B. Shop Drawings: Submit for approval prior to commencing any Work:

1. Product Data Sheets: Copies of current technical data for each component specified and applied as outlined in this Section.

2. Material Safety Data Sheets: Copies of current MSDS for any materials brought on-site including all clean-up solvents, repair or resurfacing mortars and lining materials.

3. Qualification Data: Approved Installer Training Certificates from manufacturer.

4. Performance Testing Reports: Copies of test data for the entire physical, chemical, and permeation properties listed herein and as outlined within this Section.

5. Installation Instructions: Manufacturer’s written installation instructions for the materials specified in this Section.

6. Construction Details: Copies of manufacturer’s computer generated standard lining details for specified materials, including: leading edge termination, metal embedment in concrete, joint detail, wall-to-slab detail, pipe termination detail, and any other detail at the request of the Engineer.

7. Maintenance Manual: Upon completion of the Work, submit five copies of corrosion protection lining manufacturer’s written instructions for recommended maintenance practices. Include the following information:

a. Product name and number.

b. Name, address, e-mail address and telephone number of manufacturer and local representative.

c. Detailed procedures for routine maintenance and cleaning.

d. Detailed procedures for repairs.

C. Jobsite Reports: Submit at the completion of Work

1. Daily Reports: Include surface preparation, substrate conditions, ambient conditions application procedures, lining materials applied, material quantities, material batch number(s), description of work completed and location thereof.

2. Quality Control Reports: Include all quality control testing and physical specimens.

3. Contractor shall maintain a copy of records until the expiration of the specified warranty period.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Deliver material in manufacturer’s original, unopened and undamaged packages.

2. Clearly identify manufacturer’s, brand name, contents, color, batch number, and any personal safety hazards associated with the use of or exposure to the materials on each package.

3. Packages showing indications of damage that may affect condition of contents are not acceptable.

B. Storage of Materials:

1. Materials shall be stored in accordance with manufacturer's recommendations in enclosed structures and shall be protected from weather and adverse temperature conditions. Flammable materials shall be stored in accordance with state and local codes. Materials exceeding storage life as defined by the manufacturer shall be removed promptly from the site. Store all materials only in area or areas designated by the Engineer solely for this purpose.

2. Store in original packaging under protective cover and protect from damage.

3. Stack containers in accordance with manufacturer’s recommendations.

C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

1.6 JOB CONDITIONS

A. Environmental Requirements:

1. Proceed with corrosion protection lining Work only when temperature and moisture conditions of substrates, air temperature, relative humidity, dew point and other conditions comply with the corrosion protection lining manufacturer’s written recommendations and when no damaging environmental conditions are forecasted for the time when the material will be vulnerable to such environmental damage. Record all such conditions and include in final Site Quality Control Report.

2. Maintain substrate temperature and ambient temperature before, during and after installation above 50°F (10°C) and rising in accordance with protective lining material manufacturer’s instructions.

3. Provide adequate ventilation during instillation and full curing periods of the protective lining.

4. Protective Lining shall not be applied when ambient air temperature is within 5°F (3°C) of the dew point and falling.

5. Protective Lining shall not be applied when relative humidity is outside of material manufacturer’s recommendations. Do not prepare surfaces or apply materials in rain, snow, fog, mist, or otherwise inclement weather as per material manufacturer’s instructions.

B. Dust and Contaminants: Protect work and adjacent areas from excessive dust and airborne contaminates during protective lining application and curing. Schedule Work to avoid excessive dust and airborne contaminants.

1.7 WARRANTY

A. Protective Lining Manufacturer shall warranty its products as free from material defects for a minimum period of three (3) years. Provide associated Warranty Certificate.

B. Contractor shall warranty the installed protective lining system as free from workmanship defects for a minimum period of three (3) years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The interior of manholes, wet wells, valve vaults, and meter vaults shall be lined with one of the following epoxy lining systems for severe wastewater environments:

1. Raven® Lining Systems: Raven® 405 epoxy coating system.

   a. Primer: Raven® 171FS applied at 10 mils wet film thickness. Solvent-free 100% solids, low viscosity penetrating epoxy primer that may be applied to dry or partially damp surfaces. Designed to seal concrete and reduce off-gassing when concrete temperature is above 40°F.

   b. Finish Coat: Raven® 405 applied at 125 mil dry film thickness. 100% solids, ultra-high build, solvent-free epoxy coating. Designed as a corrosion protection and structural enhancement lining system for use in wastewater structures and other corrosive environments.

   c. Apply and test following manufacturer's recommended procedures.

2. Tnemec: Series 218 MortarClad, Series 434 Perma-Shield H2S, Series G435 Perma-Glaze

   a. Epoxy Resurfacer: Tnemec Series 218 MortarClad applied to new or existing concrete to a thickness of ½-inch. Repair or resurface new or existing concrete to fill all bugholes, surface imperfections, and provide a uniform, level substrate for application of the protective lining.

   b. Mortar: Tnemec Series 434 Perma-Shield H2S applied at 125 mil dry film thickness. Trowel-applied, aggregate-reinforced epoxy mortar (basecoat) to provide a chemical, permeation, and abrasion resistant protective lining against physical and chemical attack phenomena typically associated with municipal wastewater headspace conditions.

   c. Finish Coat: Tnemec Series G435 Perma-Glaze applied at 15 to 18 mil dry film thickness. Epoxy glaze coat (topcoat) to provide enhanced chemical, permeation, and abrasion resistance.

      1) Alternate Lining System: Tnemec Series G435 Perma-Glaze may be applied at 125 mil dry film thickness directly

to Tnemec Series 218 MortarClad without use of Tnemec 434 Perma-Shield H2S epoxy mortar.

d. Apply and test following manufacturer's recommended procedures.

B. Contractor shall provide all accessory components such as polysulfide sealants, and curing compounds, as recommended by the manufacturer for maximum protective lining adhesion to substrate, and long-term service performance.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall provide, erect, and maintain all required hoists, scaffolding, staging and planking, and perform all access related hoisting work required to complete the Work of this Section as specified.

B. Contractor shall cover or otherwise protect finish work or other surfaces not being coated within the scope of this Section. Contractor shall erect and maintain protective tarps, enclosures and/or masking to contain debris, including dust or other airborne particles from surface preparation or application activities. This may include the use of dust or debris collection apparatus as required at no additional cost to Owner.

3.2 INSPECTION

A. Contractor shall examine the areas and conditions under which the protective coating Work is to be performed in accordance with NACE SP0892, Table 1 and SSPC-SP13/NACE No. 6, and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work.

B. Contractor shall confirm the presence of a positive side waterproofing on the exterior of the concrete structure.

C. Commencement of the Work of this Section shall indicate that the substrate and other conditions of installation are acceptable to the Contractor and his Applicator, and will produce a finished product meeting the requirements of the Specifications. All defects resulting from accepted conditions shall be corrected by Contractor at his own expense.

3.3 PREPARATION

A. Concrete surfaces to receive protective coating shall be cast with a Smooth Form Finish in accordance with ACI 301. Surfaces shall not be rubbed, sacked, troweled or otherwise finished in any manner that will obscure or cover the parent concrete surface with materials other than materials as specified in this Section.

B. Allow cast-in-place concrete to cure for a minimum of 28 days at 75°F (24°C) and with adequate air movement before installing the corrosion protection lining system.

C. All surface washing, abrasive blasting, water-jetting, grinding, patching, filling and preparation shall be completed by the Applicator in accordance with the Protective Coating Manufacturer's recommendations.

D. Substrate: Concrete surfaces to be coated shall be free of curing compounds and form release agents, laitance and foreign particles that my inhibit bonding. Prior to start of protective coating systems application, pre-clean as required, and inspect the substrate in accordance with SSPC-SP13/NACE No. 6, Severe

Service. Surface preparation procedures shall be in accordance with NACE SP0892, SSPC-SP13/NACE No. 6 and ICRI Guideline No. 310.2. Surface preparation shall expose aggregate and obtain a uniform surface texture resembling the minimum recommended concrete surface ICRI-CSP profile.

E. Level or grind concrete substrates to produce a uniform and smooth surface, including removal of all sharp edges, ridges, form fins, and other concrete protrusions.

F. New Concrete Application: Apply epoxy primer or resurfacer as recommended by the lining system manufacturer.

G. Existing Concrete Application: Existing concrete structures to receive protective coating system must be capable of withstanding imposed loads. All oil, grease, waste and chemical contaminants must be removed from the surface of the concrete prior to preparation in accordance with NACE SP0892 and SSPC-SP13/NACE No. 6. Concrete surfaces must be sound and capable of supporting the Protective Lining system as determined by the Engineer. Surface preparation requirement is to expose a sound, uniform surface texture confirming to the minimum recommended ICRI-CSP. The appropriate cementitious repair mortar or epoxy cementitious resurfacer material shall be applied to the entire, prepared surface to level surface suitable for coating.

H. Metal Application: Remove all visible contaminants per SSPC-SP1. Prepare the surfaces in accordance with SSPC/NACE surface preparation standards per the Manufacturer's instructions.

3.4 APPLICATION

A. Protective coating systems shall be installed when ambient air and surface temperature is above 50°F, or as recommended by the lining system manufacturer. The substrate temperature shall be at least 5°F (3°C) above the dew point. Condition the material between 70-80°F (21-27°C) for 24 hours prior to use. Application when temperatures outside of this range will require written instruction from the Manufacturer and approval of the Engineer.

B. Application in direct sunlight and/or with rising surface temperatures is not allowed, as this may result in blistering of the materials due to expansion of entrapped air or moisture in the concrete. In such cases, it will be necessary to postpone the application until later in the day when the temperature of the substrate is falling. Concrete surfaces that have been in direct sunlight should be shaded for at least 24 hours prior to application. Consult the Manufacturer for application schedule guidelines specific to temperature conditions and possible sealer application recommendations to reduce outgassing.

3.5 FIELD QUALITY CONTROL, INSPECTION AND TESTING

A. Contractor to perform the quality control procedures listed below in conjunction with the requirements of this Section.

B. Inspect all materials upon receipt to ensure that all are supplied by the approved Manufacturer.

C. Surface pH Testing: The pH of the concrete substrate will be measured using pH indicating papers. The pH testing is to be performed once every 50 square feet (5 square meters). Acceptable pH values shall be a minimum 9.0 as measured using color indicating pH paper with readable color calibrations and a scale at whole

numbers (minimum). Use Hydrion Insta-Check Jumbo 1-12, or equal. The paper shall be touched to the surface once using moderate gloved finger pressure. The surface shall not be wiped or moved laterally to disturb the surface during pH testing. Following the one touch, lift the paper vertically to not "wipe" the surface. Compare the color indicated with the scale provided and record the pH. Spot check any questionable areas with a 1% phenolphthalein solution. The phenolphthalein solution shall turn bright pink on concrete.

D. Surface Profile: Inspect and record substrate profile (anchor pattern). Surfaces shall be profiled, at a minimum, equal to the CSP roughness as recommended by the coating manufacturer in accordance with ICRI Guideline 310.2 and SSPC-SP13/NACE No. 6.

1. Perform replication of the concrete surface profile every 500 square feet (46 square meters) using replica putty in accordance with ASTM D7682. Submit replications to the Engineer as part of the Jobsite Reports.

E. Measure and record ambient air temperature once every two hours of each work shift using a thermometer and measure and record substrate temperature once every two hours using an infrared or other surface thermometer.

F. Measure and record relative humidity and dew point temperature every two hours of each work shift using a sling psychrometer in accordance with ASTM E 337.

G. Provide verification of correct mixing of coating materials in accordance with the Manufacturer’s instructions.

H. Inspect and record that the "pot life" of coating materials is not exceeded during installation.

I. Verify curing of the coating materials in accordance with the Manufacturer's instructions.

J. Dry-Film Thickness:

1. Wet-Film Thickness shall be taken every 100 square feet (9 square meters) in accordance with ASTM D 4414 and recorded.

2. The Dry-Film Thickness can be determined using a surface area calculation for material consumption.

K. High-Voltage Holiday (Spark) Testing: Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE SP0188 and the Manufacturer’s printed application guide to verify a pinhole-free surface. Areas which do not pass the spark detection test shall be corrected at no cost to the Owner.

L. Contractor is responsible for keeping MSD and Engineer informed of all progress so that MSD and the Engineer may provide additional quality control at their discretion.

M. Inspection by the Engineer or others does not absolve the Contractor from his responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

3.6 ACCEPTANCE CRITERIA

A. All surfaces shall be prepared, applied, and tested in accordance with the specification and referenced standards herein.

3.7 ADJUSTMENTS AND CLEANING

A. At the completion of the Work, Contractor shall remove all materials and debris associated with the Work of this Section.

B. Clean all surfaces not designated to receive protective coating. Restore all other work in a manner acceptable to the Engineer.

C. All finished protective coating shall be protected from damage until Final Acceptance of the Work. Protective coating damaged in any manner shall be repaired or replaced at the discretion of the Engineer, at no additional cost to Owner.

END OF SECTION 09871

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SECTION 11410 – SUBMERSIBLE WASTEWATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. All pumps furnished under sections referencing this section shall be designed, test and installed in accordance with applicable portions of ANSI/HI 1.1 – 1.6, 2.1 – 2.6, 9.1 – 9.6 and 11.6 and all the requirements of this section. The pumps shall be specifically designed to pump the fluid described in the detailed specification and shall operate without clogging or fouling caused by material in the pumped fluid at any operating condition within the range of service specified.

B. All manufacturers and manufacturing sites for supply of equipment furnished under this section and sections referencing this section shall hold current certification under ISO 9001. Application for certification under ISO 9001 shall not be deemed as an acceptable substitute for current certification. Documentation attesting to current certification shall be signed by an officer of the manufacturer's corporation and shall be notarized. The documentation shall also include the manufacturer's written Quality Assurance/Quality Confirmation (QA/QC) program and the documentation plan necessary for the ISO 9001 certification.

C. Contractor shall furnish and install all necessary piping, valves, pipe supports, electrical and appurtenances needed for a complete and operating pump station to meet all the performance requirements.

1.2 SUBMITTALS

A. Submit shop drawings in accordance with the General Requirements and the following for approval by the engineer:

1. Drawings showing actual dimensions and confirming the size of pumps, motors, drives and specified appurtenances; piping connections; construction details of equipment; wiring diagrams; and weight of equipment. Show impeller diameter and number of vanes. Submit setting drawings. Show anchor bolt layout and anchor bolt dimensions.

2. Submit manufacturer's catalog data and detail drawings showing all pump parts and describe by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Show linings and coatings. Show outline dimensions and weights of pumps, bases, and motors. Identify each pump by tag number to which the catalog data and detail sheets pertain.

3. A copy of this specification section and the referencing section and all other applicable specification sections governing the pump, drive and driver, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor,

each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Submit a compliance statement indicating conformance with this specification. Clearly identify any deviations with accompanying justification. Excessively burdensome formatting or full marked-up specifications are not required.

4. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked “no changes required”. Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

5. Manufacturer shall maintain current ISO 9001 certification. Submit a copy of the valid certificate with shop drawings.as specified under paragraph 1.1. B.

6. Predicted pump performance curves for each condition point specified showing head, power, efficiency, and NPSH required on the ordinate plotted against capacity (in gpm) on the abscissa. Curves for variable speed pumps shall be provided to demonstrate operation at all speeds required to achieve the specified reduced speed operating conditions. All curves shall clearly display the specified operating conditions and the manufacturer’s limits for the POR and AOR, as specified by the ANSI/HI 11.6 and others listed above. Curves for column type pumps shall show bowl efficiency and allowances for inlet, column and discharge head losses separately.

7. NPSH margin calculations performed for each specified operating condition in accordance with paragraph ANSI/HI standards, including certified calculations for motor rotor and frame reed frequencies.

8. Complete description and sketch of proposed test setup for factory test if a factory test has been required under the detailed specification section. Submittal material shall include sample calculations and proposed test log format.

9. Submit manufacturer's reports on hydrostatic tests and performance tests.

    a. All pressure sustaining parts shall be subjected to factory hydrostatic tests. Hydrostatic tests shall conform to the requirements of API 610.

10. Submit manufacturer's sample form for reporting the performance test results. Submit at least two weeks before the tests. The test form shall

contain the data presented in the sample in Section 6 of ASME PTC 8.2 or ANSI/HI 14.6.

11. Submit manufacturer's certified performance curves for review at least two weeks prior to shipping the units from the factory.

1.3 RELATED WORK

A. The following specification sections cover equipment and procedures that may be related to this specification section.

1. Division 00 – Procurement and Contracting Requirements

2. Division 01 – General Requirements

3. Section 01330 – Submittal Procedures

4. Division 11 – Equipment

5. Division 16 – Electrical

6. Division 17 – Instrumentation

1.4 WARRANTY

A. All warranties shall be in accordance with the General Conditions and provisions of Division 01.

B. In addition, the Contractor shall warrant that all pumps, motors, appurtenances, and associated components are free from defects in design, materials, and workmanship, and shall operate without failure under specified operating conditions for a minimum period of one (1) year from the date of Substantial Completion.

C. Warranty shall specifically include, but not be limited to:

1. Mechanical seals

2. Bearings

3. Motor and cable assemblies

4. Leakage and seal integrity

5. Performance meeting specified design conditions

D. Manufacturer warranty limitations shall not relieve the Contractor of responsibility for warranty compliance with the Contract Documents. Repairs or replacements performed under warranty shall include reinstatement of warranty in accordance with Division 01 requirements.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE WASTEWATER PUMPS

A. Preferred Manufacturers:

1. Xylem/Flygt N Series

2. Sulzer type ABS

3. Grundfos/Yeoman-Clow

B. Provide pumps which will operate within the manufacturer's preferred operating region for all the following conditions:

Quantity		EA	2
Duty Design Point	Capacity	GPM	1,390
	Total Dynamic Head	Feet	38.5
	Static Head	Feet	34.1
	Min. Overall Efficiency	%	66%
Maximum Shutoff Head		Feet	81
Minimum Size Solid Sphere Passed		Inches	3
Maximum Motor Horsepower		HP	25
Maximum Speed		RPM	1,750
Motor Voltage / Phase / Hertz		460 V / 3-phase / 60 Hz	
Type of Drive		Constant Speed	
Pump Outlet Diameter		Inches	6
Manufacturer & Model: Flygt NP 3171 MT 3~ 437 (224 mm Impeller) (Basis of Design)			

C. The pumps shall be capable of handling raw unscreened sewage and other similar solids-laden fluids without clogging. The pumps shall be installed in the wet well utilizing dual guide rail systems. Each discharge base and elbow shall be permanently installed in the wet well and connected to the discharge piping. In order to prevent binding or separation of each pump from its guide rail system, the pump shall connect to the guide rail base automatically and firmly, guided by the 316 stainless steel guide rail extending from the top of the station to the discharge connection. Cable guide systems shall not be considered acceptable. Each pump shall be fitted with a 316 stainless cable of adequate strength to permit raising the pump for inspection. The working load of each lifting system shall be 50 percent greater than the pump unit weight. The chain shall be connected to the submersible sewage pump rail using a 316 stainless steel clevis. The length of the chain shall be equivalent to the depth of the wet well plus additional 6 feet. There shall be no need for personnel to enter the wet well to remove or reinstall each pump. Positive sealing of each pump to the discharge elbow shall be accomplished by metal to metal contact between the pump and discharge elbow. No portion of each pump shall bear directly on the floor of the sump. Each pump with its appurtenances and cable shall be capable of operating in a liquid temperature of 104° F and continuous submergence to a depth of 65 feet.

D. The pumps shall be explosion proof according and suitable for use in Class I, Division 1, Group C and Group D hazardous locations.

2.2 PUMP CONSTRUCTION

A. Major pump components, except as described herein, shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. Impeller and insert ring shall be A 532 Alloy III A (25% Chrome). The lifting handle shall be stainless steel. All exposed nuts, bolts and fasteners shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied heavy duty coating system suited for the installation environment.

B. Sealing design for the pump/motor assembly shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where a watertight seal is required shall be machined and fitted with Buna-N rubber O-rings sealed on a beveled edge. Sealing will be the result of controlled compression of a rubber O-ring in two planes and O-ring contact of four sides without requiring a specific torque limit. No secondary sealing compounds, elliptical O-rings, grease, or other devices shall be used.

C. The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.

D. A volute case wear ring shall be provided to minimize impeller wear. The wear ring shall be constructed of a high-grade, wear- and corrosion-resistant metal alloy and secured in accordance with the manufacturer's design. The wear ring shall be easily replaceable using standard field service procedures.

E. Impeller shall be of the multi-vane, enclosed or semi-open solids handling and self-cleaning design. The impeller design shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft and held by an impeller bolt in an arrangement that the impeller shall not require coating. Because most impeller coatings do not remain beyond the very early life of the impeller, efficiency and other performance data submitted shall be based on performance with an uncoated impeller. Attempts to improve efficiency by coating impeller shall not be acceptable. Impellers shall be dynamically balanced. The tolerance values shall be listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames. The tolerance is to be split equally between the two balance planes that are the two impeller shrouds.

RPM	Tolerance
3500	.01 in. – oz./lb. of impeller weight
1750	.02 in. – oz./lb. of impeller weight

1150	.026 in. – oz./lb. of impeller weight
870	.03 in. – oz./lb. of impeller weight

F. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be ASTM/AISI 420 or 431 stainless steel. Shaft sleeves will not be acceptable.

G. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two row angular contact ball bearing. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

H. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting the lower seal on the impeller hub is not acceptable. The pump shall be provided with a double mechanical seal system in which the upper and lower seals operate independently to prevent leakage. Designs in which seal faces rely on a single shared spring mechanism shall not be permitted if they cannot meet the specified leakage protection and service life requirements. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

I. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

J. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

K. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

2.3 MOTORS

A. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The motor exterior shall be protected by a factory applied heavy duty coating system suited for the installation environment. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel. The motors shall include thermal and moisture protection to shut down the motor due to high operational temperatures or infiltration of moisture. The motor shall be automatic restarted once the operational temperature is achieved. The maximum pump motor speed shall be 1,800 rpm unless approved by the DISTRICT and ENGINEER. Motors shall be suitable for 460 volt, 60 Hz, 3-phase operation.

B. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

C. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10% for intermittent running. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

D. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

E. The power cable shall be sized according to the NEC and ICEA standards with P-MSHA approval and shall be of sufficient length to reach the junction box without the need of any splices. The power cable shall be of a shielded design in which an overall tinned copper shield is included, and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. The cable shall be a minimum of 50 feet long. The Contractor shall be responsible to ordering longer cables where required for installation.

2.4 METAL – TO – METAL GUIDE RAIL SYSTEM AND ACCESSORIES

A. General – The Contractor shall furnish guide rail systems and accessories for each pump station. The guide rail system and accessories shall include discharge base elbows, sealing flanges with rail guides, guide rails, upper guide brackets, intermediate guide bar brackets, lifting chains or cables, cable brackets, and access hatches and frames. All bolts, machine screws, lockwashers, and other hardware (except nuts) used in the assembly of discharge elbows, guide rails, pump guides, hoist chains, float cable connectors, and access frames and covers shall be of stainless steel. Nuts shall be brass, installed with anti-seize compound.

B. Discharge Base Elbow

A discharge base elbow, designed to mount directly on the sump floor, shall be supplied for each pump. It shall have a standard 125 pound flange faced and drilled on the outlet side, with a machined mating inlet connection. The design shall be such that the pump to discharge connection is made without the need for any nuts, bolts, or gaskets. The base elbow shall also anchor and align guide rails for each pump. For discharge diameters 4" or larger, the manufacturer supplied submersible sewage pump discharge shall be compatible among all MSD's acceptable manufacturers' submersible sewage pump discharge base elbows.

C. Sealing Flange with Rail Guide

A sealing flange/rail guide bracket shall be mounted on each pump discharge. It shall have a machined mating flange which matches the base elbow discharge connection. Sealing of this discharge connection shall be accomplished by a simple linear downward motion of the pump culminating with the entire weight of the pumping unit supported entirely by the base elbow.

D. Guide Rail

The dual rail guide design shall keep each pump in proper alignment with its stationary discharge piping. These rails shall be 316 stainless steel pipe which shall be securely attached to the base elbow and to the access frame at the top of the wet-well by using an upper guide rail bracket.

E. The submersible sewage pump shall have a sliding bracket for connecting to the dual guide stainless steel rail system. The sliding bracket, either directly or with an adapter, shall allow for the interchangeability of all MSD's acceptable submersible sewage pump manufacturers at alternative locations.

F. Upper Guide Bracket

The upper guide bracket shall align and support the two guide rails for each pump at the top of the wetwell. It shall bolt directly to the hatch frame and incorporate an expandable rubber grommet for secure rail installation. The upper guide rail bracket shall be fabricated from 316 stainless steel.

G. Intermediate Guide Brackets

The intermediate guide brackets shall align and support the pair of guide rails for each pump between the top and bottom of the wetwell. The pump manufacturer shall determine the number of guide brackets required. The intermediate guide brackets shall be supported by the discharge pipe and by bracing connected to the wetwell wall. The intermediate guide bar brackets shall be fabricated from 316 stainless steel.

H. The submersible sewage pump shall include a 316 stainless steel chain capable of supporting the weight of the submersible sewage pump for installation and removal of the submersible sewage pump. The chain shall be connected to the submersible sewage pump bail using a 316 stainless steel clevis. The length of the chain shall be equivalent to the depth of the wet well plus additional 6 feet.

I. Cable Mounting Bracket

A cable bracket shall be provided with strain reliefs that support and hold the float switch cables, power cables, etc. Continuous cables shall run from pumps and level controls to a control panel or junction box. No splices shall be made in the wiring. The bracket shall be fabricated from 316 stainless steel and attached to the access frame with 316 stainless steel fasteners. A dielectric spacer shall be installed when bolting to an aluminum access frame.

PART 3 - EXECUTION

3.1 GENERAL

A. Each item shall be furnished complete and delivered to the site for installation by the contractor. Contractor shall install all equipment in accordance with manufacturer’s recommendations and written instructions.

B. All materials shall be new, undamaged, and conform to the latest standards.

C. Prior to installation, Contractor shall store and protect all equipment from the elements and damage.

3.2 MANUFACTURERS SERVICES

A. The manufacturer's authorized representative shall inspect and check the installation after completion and seven (7) days prior to start-up and shall certify that the completed installation is ready for start-up.

B. The manufacturer's field representative shall check the proper rotation, operating speed, and starting and running electrical characteristics of the operational pumping equipment and certify that they are correct.

C. The manufacturer’s field representative shall provide training to the Owner’s staff on operation and maintenance of the pumps.

D. Certified pump curves shall be submitted by the manufacturer for each pump confirming design operating conditions.

3.3 TESTING

A. Pumps: After all pumps have been completely installed and working under the direction of the manufacturer, conduct in the presence of the Engineer tests necessary to indicate that pump operation conforms to these specifications. Field tests shall include all pumps under this section. Supply all water or wastewater, labor, equipment and incidentals required to complete the field tests.

B. If the pump performance does not meet these specifications, corrective measures shall be taken, or pumps shall be removed and replaced with pumps which satisfy the conditions specified.

C. Motors: The Contractor shall megger test each motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

D. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with the manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

3.4 TOOLS AND SPARE PARTS

A. One set of all special tools for each pump station required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

END OF SECTION 11410

SECTION 11420 – WASTEWATER GRINDER

PART 1 - GENERAL

1.1 DESCRIPTION

A. The unit shall be a TASKMASTER® Titan grinder manufactured by Franklin Miller, Inc. of Livingston, New Jersey and shall meet the following requirements:

1.2 EQUIPMENT

A. Grinder: TASKMASTER® TM14024D or approved equal.

B. Drive Assembly

C. Overflow Bar Screens

D. Concrete Channel (by Contractor)

E. Controller: S260

1.3 MANUFACTURER

A. Manufacturer shall have installations of same design equipment in service for at least 20 years to be considered. Supplier shall provide a list of names and dates of installations for verification by the Engineer or Owner's Representative.

B. Franklin Miller Inc. of Livingston, New Jersey.

1.4 QUALITY ASSURANCE

A. References:

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
AISI	American Iron and Steel Institute
ASTM	American Society for Testing and Materials
HDPE	High Density Polyethylene
UHMWPE	Ultra-High Molecular Weight Polyethylene
AGMA	American Gear Manufacturers Association
NEMA	National Electrical Manufacturer's Association Standards
NEC	National Electric Code
UL	Underwriter's Laboratory
IEC	International Electrotechnical Commission
SSPC	Steel Structures Paint Council

1.5 WARRANTY

A. Provide warranties in accordance with Division 01 – Warranties.

B. In addition, the Contractor shall warrant that the wastewater grinder, drive assembly, motor, controls, and all associated components are free from defects in design, materials, and workmanship and shall operate without failure under specified operating conditions.

C. Warranty period shall be a minimum of one (1) year from the date of Substantial Completion.

D. Warranty shall specifically include, but not be limited to:

1. Cutter cartridges and cutting elements

2. Bearings and seal assemblies

3. Drive reducer and coupling components

4. Motor and submersible cable

5. Control panel components including PLC, relays, and sensors

6. Performance under specified flow and loading conditions

E. The grinder shall be capable of processing wastewater solids without excessive wear, failure, or clogging during the warranty period.

F. Manufacturer warranty limitations or exclusions shall not relieve the Contractor of responsibility for full warranty compliance with the Contract Documents. All warranty repairs or replacements shall be performed at no cost to the Owner and with minimal disruption to operation. Repairs or replacements made under warranty shall include reinstatement of warranty in accordance with Division 01 requirements.

PART 2 - PRODUCTS

2.1 SEWAGE GRINDER

A. General

7. The grinder shall be designed to reduce solids normally found in sewage.

8. The grinder, in combination with the concrete channel (by Contractor) and overflow bar screen, shall be capable of handling the specified flow rate without the use of moving diverter screens:

a. Average Daily Flow: 800,000 gpd

b. Maximum Peak Flow: 5,200,000 gpd

9. Each grinder shall consist of the following main components:

    a. Grinder assembly (Lower Works)

    b. Drive assembly

B. Grinder Housing

1. The main housing components shall be constructed of Ductile Iron.

2. The main housing components shall be independent of and shall not be subject to wear from seal or labyrinth seal system and shall not constitute a seal wear element.

3. The unit shall employ high flow side rails on both sides of the cutters incorporating a series of parallel slots on the sides of the unit housing to optimize the unit flow capability and reduce headloss.

C. Cutting Principle

1. The grinder shall employ one stack of cutter cartridges that intermeshes with a second stack of disks to handle the specified flow rate with an intrinsically open dual shaft design that allows liquid flow to pass through freely without the need for auxiliary screen diverters.

2. The shafts shall counter-rotate with the driven cutter peripheral linear speed operating at approximately two-thirds that of the drive cutter peripheral linear speed.

3. The grinder shall employ a “full-cut” design wherein cutters fill 90% of the cutting chamber. Units with passive style diverter screens or diverter disks shall not be accepted.

4. All cutters shall be constructed of 4140 Heat-treated Alloy Steel, through hardened to a minimum of Rc45-49 and precision ground for uniformity.

5. Cutter Cartridges

    a. The drive shaft shall carry single piece cutter cartridges.

        1) The cutters shall be a monolithic cutter cartridge type consisting of minimum 5/16" (8 mm) thick, toothed cam-shaped cutter elements.

        2) The cartridges shall be designed to eliminate individual cutter and spacer disks for improved strength and transmission of power from the shaft.

        3) Units using multitudes of individual cutters and spacers shall not be accepted.

4) The inside configuration of cutters shall be hexagonal to fit the shafts with a total clearance that shall not exceed 0.015 inch (0.381 mm) across the flats to assure positive drive and minimize wear. Units with keyed cutters shall not be accepted.

5) The spaces defined by the adjacent side surfaces of the cutting edges and outer surface of the connecting spacer areas shall be cylindrically ground for uniformity.

6) Each cutter cartridge shall further have a total accumulated tolerance of plus or minus .0005" (0.127 mm) to eliminate shimming, cutter stack tolerance accumulation and misalignment.

6. Titan Disks

a. Each disk shall incorporate a multi-tooth cutting disk and spacer as one integrated element for high strength.

1) The Titan Disks shall have a minimum of 10" diameter with 14 cutting edges per disk.

2) The Titan Disks shall have a hexagonal bore.

D. Shafts

1. The shafts shall be made of AISI 4140 heat-treated hexagon steel with a nominal tensile strength rating of 180,000 PSI (1241.1 MPa) to incorporate high ductile strength.

2. Each shaft size shall be a minimum of 2 inch (51 mm) hexagon (across the flats).

E. Bearings and Seals

1. The bearings and seals shall be housed in replaceable cartridges that support and align the bearings and seals. The cartridge housings shall be constructed of hardened AISI 17-4 PH Stainless Steel for superior resistance to corrosive and abrasive contaminants.

2. The cutter shaft's radial and axial loads shall be borne by a sealed oversize deep-groove (Conrad type) ball bearing at each end. The bearings shall have a minimum rating of 11,000 lbs (49kN) (dynamic C_E).

3. Units without bearings on both ends shall not be accepted.

4. The bearings shall be protected by a combination of a replaceable and tortuous path device and end face mechanical seals.

5. Face materials shall be tungsten carbide vs. tungsten carbide and shall not require an external flush.

6. The seals shall employ elastomeric members operating as opposing disk springs when compressed and, at the same time, maintain a positive seal face pressure to ensure positive sealing. No metal springs shall be employed.

7. The contact-less labyrinth rings shall be supplied to further protect from coarse and fine granular contaminants.

8. Components subject to wear shall be designed as replaceable elements and shall not be a part of the ductile iron unit main housing.

9. O-rings shall be made of Buna-N elastomers.

F. Painting Specifications

1. All steel or iron structural components shall be prepared and painted in accordance with the following procedures:

   a. The surfaces shall be properly prepared as defined by (SSPC) Steel Structures Paint Council.

   b. The metal surfaces shall be blast cleaned to near-white in preparation for painting to substantially remove mill scale, rust, paint or foreign matter including oil, grease, dirt or oxides.

   c. The cleaned surfaces shall be primed the same day as cleaned.

2. The parts shall be painted with 2 coats of Polyamide Epoxy.

   a. One (1) coat primer

   b. One (1) Top coat

3. The dry film thickness shall be 3 to 5 mil per coat.

4. Color shall be Franklin Miller Blue.

5. Finish shall be Satin.

6. All stainless steel parts, if used, shall not be painted.

G. Reducer

1. The speed reducer shall be a grease-filled cycloidal type reducer with "Heavy-Shock" load classification.

2. Helical gear drives shall not be acceptable.

3. The reduction ratio shall be 29:1.

4. The high-speed shaft of the grinder shall be coupled with the reducer via a coupling.

5. The two-piece, three-lobed coupling shall have jaws that intermesh by at least ¾ inch (19 mm) for dependable torque transmission.

6. The gear reducer shall be fully sealed and capable of operating submerged continuously.

7. A coupling adapter shall be used for accurate alignment and smooth operation. The coupling adapter shall be sealed to prevent water contamination. The adapter shall be firmly connected to the input of the reducer and shall rigidly support the motor weight.

8. The reducer shall have a rigid input shaft supported by heavy bearings capable of handling thrust and radial loads and shock conditions.

H. Motor

1. The motor shall be: Submersible-Explosion Proof design, 5 HP (3.7 kW), 230/460 Volt, 3-phase, 60 Hz.

2. Motor service factor shall be 1.15 with NEMA premium efficiency standards.

3. The unit shall incorporate a submersible explosion-proof motor rated for Division 1, Class 1, Group D and Class 1, Group C&D.

   a. The motor shall be IP68 submersible, continuous in air and while submerged. IP67 motors shall not be accepted.

   b. The motor shall be supplied with 60 ft. (18.29 m) of cable.

   c. The motor shall contain moisture-resistant class F 155EC/311EF insulation.

   d. The motor shall be Squirrel cage induction, NEMA design B for continuous operation.

   e. The motor shall be capable of continuous operation while submerged to 200 feet.

   f. The motor shaft shall be constructed of AISI 416 Stainless Steel.

I. Guide Rail System

1. The grinder shall be supported by two parallel pipes which shall extend vertically from the grinder manhole floor to near the top of the manhole.

2. The guide rails shall secure the grinder in operating position as well as act as a guide for grinder removal or installation.

3. The guide rail system shall be constructed of 316 stainless steel.

4. After concrete channel installation, the grinder shall be lowered into operating position by engaging the guide rails and lowering with the davit crane.

5. It shall not be necessary to bolt or otherwise affix the unit to the structure.

2.2 OVERFLOW BAR SCREENS

A. Overflow bar screens, constructed of 3/8” x 2” welded 304 stainless steel, shall be provided and mounted above the openings of the concrete channel.

2.3 CONCRETE CHANNEL (BY CONTRACTOR)

A. The grinder shall sit in a 36” wide by 35” deep concrete channel (poured by Contractor), at the bottom of the grinder manhole. The concrete channel shall support the grinder unit and provide for convenient installation and removal without entering the confined space area.

B. The concrete channel shall be designed to direct flow from the influent pipe to the grinder.

C. The concrete benches shall be sloped towards the channel for drainage.

2.4 CONTROLLER

A. GENERAL

1. The controller shall completely sequence the operation of the equipment covered by the scope of supply.

2. The enclosure shall be rated NEMA 4X, 316 Stainless Steel and suitable for wall mounting. Hinges and latches shall be corrosion resistant. Enclosure shall house the control devices, relays, terminal blocks, and reversing motor components. A provision shall be made within the enclosure for the connection of a grounding cable.

B. POWER INFEED

1. Terminal blocks only shall be provided for the primary feeder cables entering the controller enclosure.

2. A separate disconnect means with lockout provisions must be provided adjacent to the controller by others.

C. MOTOR STARTER

1. A reversing starter shall be provided for the motor indicated in the job specifications. The size of the starter shall be based on IEC requirements

for the motor horsepower, rated 18A minimum. Motor starter shall be a full voltage reversing type with 120 VAC operating coils. Forward and reverse contactors shall have both mechanical and electric interlocks.

a. A motor protection relay shall be furnished as part of the starting equipment. The motor protector shall be adjustable so that the range selected includes the motor nameplate listed FLA (full load amps) rating and the service factor.

b. Repeated unsuccessful attempts to start the motor or a short circuit shall cause the motor protector to trip.

c. Tripping of the motor protector shall stop the motor and flash the trip light. Resetting the relay shall allow the alarm circuitry to be reset.

d. Output terminals shall be provided for connection of the motor leads exiting the enclosure.

D. CONTROL CIRCUIT

1. The following provisions apply to the control circuit:

a. The control circuit voltage shall nominally be 120V AC.

b. In addition, an adequately sized DC power supply shall be provided where DC is required.

c. The control transformer shall be sized to carry the control-circuit load plus a minimum of 20% spare capacity for future load growth.

d. The transformer primary and secondary side leads shall be fuse protected.

E. OPERATOR CONTROL

1. A three-position “HAND-OFF/RESET- AUTO” selector switch shall be provided for the Grinder. Its function is as follows:

a. Hand: When in this position, the equipment shall run under the control of the PLC until the switch is placed in Off/Reset.

b. Off/Reset: When in this position, the motor shall be prevented from starting (in both the forward and reverse directions); the remote-start signal shall be disabled; and the established Alarm Condition lockout circuitry reset.

c. Auto: In this position, when a remote Run signal is received, the motor shall cycle under the control of the PLC. The cycle shall be terminated if the run signal is interrupted, or the selector switch is

placed in the Off/Reset position or if the equipment experiences an Alarm Condition.

2. Indicators: The following full voltage LED indicators shall be provided:

1. A white “POWER ON” pilot light shall be illuminated when power is available on the secondary side of the control transformer.

2. A green “RUNNING” indicating light shall be illuminated when the selector switch is in the Hand or Auto position with the equipment motor running in the forward or reverse direction; and during motor reversal pauses.

3. A red “TRIP” indicating light shall:

1) Be illuminated steadily when the selector switch is in the Hand or Auto position and the equipment has experienced an Alarm Condition stoppage.

a) It shall remain illuminated until the selector switch is placed in the Off/Reset position, resetting the Alarm Condition Lockout circuit.

2) Flash when the motor protection relay trips.

3) “Double flash” when the motor winding temperature causes the embedded thermostats to open.

4. A red “SEAL FAIL” indicating light shall be illuminated when excessive moisture is detected in the submersible motor.

F. REMOTE I/Os

1. The following inputs and outputs shall be supplied.

a. Run Status: A Form C dry-contact output shall close when the equipment motor is running (and during motor reversal pauses). It shall open when the equipment is stopped, trips on an Alarm Condition, or power to the controller is disconnected.

b. Trip Status: A Form C dry-contact output shall close when the equipment experiences an Alarm Condition stoppage. It shall open when the Alarm Condition lockout circuit has been reset.

1) The contact shall also close and remain closed (no pulsing) when the motor overload relay trips. It shall open when the relay is reset.

c. Motor Thermostats: Provisions shall be made for connection of motor thermostats to indicate Motor Over Temperature failures. Thermostats shall be connected to individual inputs on the PLC.

d. Remote E-stop: Provisions shall be made for connection of a maintained contact pushbutton (by others). Depressing the pushbutton shall disable the system. The terminals shall be jumpered (to be removed if installed).

e. Remote Start: Provision shall be made to accept a remote contact closure input (by others) that shall start the cycle when the selector switch is in the Auto position.

f. All relays shall include an indicator light and manual test switch.

G. PLC

1. A programmable logic controller shall be provided within the controller.

a. PLC shall be manufactured by IDEC.

b. A minimum of 72k programming memory shall be provided with a minimum of 80% of space available for future expansion.

c. PLC shall have an integrated Ethernet port capable of Modbus/TCP communications.

d. Terminal blocks shall be removable to allow for replacement of the PLC without requiring wire removal.

e. The PLC shall have a USB programming port and an SD slot to allow for uploading and downloading of a program without requirement of a PC.

H. INSTRUMENTATION

1. The following items shall be included as part of the controls of the subject equipment.

a. Current Sensor: One phase shall be monitored for a high current condition (for the Grinder) with a current sensor and current relay. If the phase current reaches an adjustable set point, the appropriate motor starter shall be de-energized and after a five second delay [user adjustable], an “Auto-Clear” sequence as described below shall be initiated. When starting the motor the control should delay looking for a signal from the current sensor for 1.5 seconds [user adjustable] to avoid tripping on motor inrush currents.

b. Panel mounted pilot lights shall be full voltage, push-to-test LED 120VAC and visible in sunlight.

1) To meet Sunlight Visible requirement, indicators shall have a minimum luminous intensity of 542 mcd and a minimum luminance of 1482cd/m^2.

c. Moisture Detection: A moisture relay shall be provided within the enclosure. When the probe in the motor detects excessive moisture, the grinder motor is de-energized, the Seal Fail light is illuminated, and an Alarm Condition lockout circuit is established. Terminals shall be provided for sensor leads.

I. OPERATION

1. The Grinder shall be controlled via a reversing motor starter that will normally operate in the forward direction with momentary reversing operation.

2. Normal Cycle: Placing the selector switch in the Hand or (when a remote run signal is received, if in the Auto position), shall energize the Reverse motor starter and the equipment rotates in that direction for two seconds (adjustable) before the reverse starter coil is de-energized.

   a. After a delay of five seconds (adjustable) to allow the equipment to coast to a stop, the equipment shall run continuously in the Forward direction of rotation.

   b. It shall continue to run in this direction until the motor starter is de-energized by interrupting the remote-run signal, or by turning the selector switch to the 'Off' position, or if the equipment experiences a jam condition.

3. Auto Clear Cycle: If the phase current reaches an adjustable set point (factory-set), the motor starter shall be de-energized.

   a. After a delay of five (adjustable) seconds to allow the equipment to coast to a stop, the sequence described above for a normal starting cycle shall be initiated in an attempt to clear the Jam condition.

   b. This automatic auto-clear cycle shall repeat a total of four times.

   c. If at any time the equipment runs for more than 30 seconds continuously in the forward direction during the four attempts, the reversal counter shall be reset.

4. Alarm Condition: If after four tries, however, the Jam condition still exists, the forward starter coil shall be de-energized, and after a two second delay, the reverse starter coil shall be energized for one second then de-energize. An Alarm Condition lockout circuit shall then be established and remain in the alarm state (even if power is lost) until it is reset.

   a. The lockout circuit shall disable the automatic cycle, cause the Trip pilot light to be illuminated, the Trip Status contact to close, the Running pilot light to be extinguished, and the Run Status contact to open. Once the obstruction has been cleared, the Alarm Condition lockout circuit can be reset by moving the selector switch to Off/Reset position.

PART 3 - EXECUTION

3.1 FACTORY TEST

A. Each machine shall be tested to ensure satisfactory operation.

3.2 INSTALLATION

A. All components shall be installed in accordance with the supplier's installation instructions, and in compliance with all OSHA, local, state, and federal codes and regulations.

3.3 OPERATION AND MAINTENANCE MANUALS

A. Supplier shall provide two (2) Operation and Maintenance Manuals. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended lubricants.

B. Operation and Maintenance Manuals shall be provided in hardcover 3-ring binders with the serial number and equipment model information displayed on the front cover.

3.4 SPARE PARTS

A. Spare parts to be furnished by supplier/contractor. Spare parts shall include two sets of wear parts, including cutters and seal cartridges.

END OF SECTION 11420

SECTION 11500 – TEMPORARY WASTEWATER BYPASS PUMPING SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions (if included), and other Division 1 Specifications Sections, apply to this Section.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:

1. It is essential to the operation that there be no interruption in the flow of wastewater throughout the duration of work related to piping tie-ins, facility connections, and pumping station improvements. Provide, maintain and operate all temporary facilities including plugs, pumping equipment (both primary and back up units), pipe, fittings and all necessary power to maintain process flow, and return it to the collection system.

2. Design, install, operate, and maintain the temporary pumping systems and pay all costs including fuel and/or other means of temporary power.

3. Maintain bypass wastewater flow around the Work area in a manner that will not cause surcharging of sewers.

4. Protect water resources, wetlands, and other natural resources. Mitigation of any spills and associated fines and costs shall be the responsibility of the Contractor.

B. Design Requirements

1. Provide all pipeline plugs, temporary bulkheads, pumps of adequate size to handle specified flow and temporary discharge piping and tie-ins, to ensure that the total required flow can be handled throughout the entire period and piping tie-ins, facility connections and pump station improvements are made. The bypass pumping system shall be required to be monitored, operated and maintained by dedicated, full time Contractor staff 24 hours per day, 7 days per week, including holidays.

2. The minimum pumping capacity of the bypass pumps shall handle sewer flows during construction by pumping at peak flows for 1 hour as approved by the Engineer.

a) The estimated required pumping capacity for the 24” gravity main entering the existing pump station from the south is 515 gallons per minute.

b) The estimated required pumping capacity for the 12” gravity main entering the existing pump station from the west is 135 gallons per minute.

c) The estimated required pumping capacity for the 8” gravity service line entering the 24” gravity main at Manhole 49-55979 is 65 gallons per minute.

3. Contractor shall have on-hand a spare standby pump with the minimum pumping capacity described in item 2 above for each bypass pumping operation.

4. Install discharge piping to the downstream point of delivery. Downstream points of delivery shall be adjacent to the bypass location and minimize use of temporary discharge piping. The discharge pipeline shall be of adequate size to convey the required flow for the system’s normal operating pumps.

5. Maintain onsite portable lights for routine maintenance and/or emergency use.

1.3 SUBMITTALS

A. Shop Drawings: Detailed plans and descriptions outlining all provisions and precautions regarding the handling of existing wastewater flows are required for Engineer/Owner review and approval. This plan must be specific and complete including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to ensure proper protection of the facilities. The plan shall include but not be limited to details of the following:

1. Plugging methods and types of plugs.

2. Number, size, material, location and method of installation of suction piping.

3. Number, size, material and method of installation and location of installation of discharge piping.

4. Bypass pump sizes, capacity, and power requirements.

5. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted).

6. Thrust restraint scheme for all pipe fittings.

7. Method of noise control for each pump and/or generator.

8. Any required temporary pipe supports and anchoring.

9. Schedule for installation of and maintenance of bypass pumping lines.

1.4 QUALITY ASSURANCE

A. Employ vendor specializing in design and operation of temporary bypass pumping systems. Provide five references from projects of similar size performed by vendor in the past 5 years.

B. An operator shall be available at all times, 24 hours per day 7 days per week, during the times in which temporary bypass pumps are in operation.

C. Contractor shall be responsible for any spillage of wastewater that results in civil or criminal charges from any local, state or federal agency. Costs for fines and any required mitigation and restoration shall be the Contractor's sole responsibility.

1.5 MAINTAINENCE

A. Maintenance Service: Ensure that the temporary pumping system is properly maintained, and a responsible operator shall be on hand at all times when pumps are operating.

B. Extra Materials: Spare parts for pumps and piping shall be kept onsite as necessary.

C. Spare Pumps: Spare Pumps shall be available as previously specified herein.

D. Stand-by Generator

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. All pumps used shall be fully automatic self priming units that do not require the use of foot-valves or vacuum pumps in the priming system. A primary pump with a backup pump shall be provided. Electric driven or diesel driven pumps are allowed. The Contractor shall make arrangements for and pay all costs to provide temporary electric power or fuel to operate pumps. Pump design shall be such that 3-inch solid may be passed.

B. Pumping equipment shall be fully contained within a lined area so as to capture any wastewater or fuel spills.

C. Contractor is responsible for operating and maintaining the temporary pumping equipment 24 hours a day, 7 days per week, for the duration of the work required to affect the piping tie-ins, facility connections and pumping station improvements.

D. Provide the necessary pump stop/start controls and the following alarm signals for the temporary pumps:

1. High-level alarm beacon and horn locally with automatic dialer, so as to indicate the alarm condition to Contractor and necessary MSD employees.

2. Pump malfunction beacon and horn.

E. Pump design shall be such that 3-inch solid may be passed.

F. All pumps shall be of the capacities specified herein and of sufficient rated head to overcome static and friction head of the pumping system.

G. Incorporate noise prevention measures for any and all equipment being used to ensure minimum noise impact on the surrounding areas. Comply with the Henderson County and/or Town of Mills River/Fletcher noise ordinance.

PART 3 – EXECUTION

3.1 PREPARATION

A. Precautions:

1. Locate bypass pipelines to minimize any disturbances to existing utilities and to maximize utilization of existing process piping systems.

2. Bypass pump during all phases of the Work as required and coordinate all bypass pumping operations with the Owner.

3.2 INSTALLATION

A. Plugging or blocking of wastewater flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of the Work, it is to be removed in a manner that permits the wastewater flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream. Contractor shall provide continuous monitoring of the integrity of plugs and blocks.

B. When working inside manholes, exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.

3.3 FIELD QUALITY CONTROL

A. Test: Perform a hydrostatic pressure test for each section of temporary discharge piping with a maximum pressure equal to 1.5 times the maximum operating pressure of the system. The Owner shall witness the test to ensure that there are no leaks in the discharge piping prior to actual operation.

B. Bypass pumping systems shall be operated continuously for a minimum period of 72 hours to demonstrate their performance and reliability prior to removing existing units from service.

3.4 CLEANING

A. Sewage remaining in the bypass discharge pipeline and/or pumping equipment shall be discharged to a sewer before the bypass pumping system is broken down and demobilized.

B. Disturbed Areas: Upon completion of the bypass pumping operation, clean up all areas disturbed by these operations, restoring same to a condition at least equal to that which existed prior to the start of Work.

3.5 DEMOLITION

A. Upon completion of the temporary bypass pumping, remove pumps, piping, and appurtenances from the site.

END OF SECTION 11500

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SECTION 14650 – DAVIT CRANE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stationary davit crane, electric winch, and all appurtenances.

B. Equipment shall be designed and selected for lifting heavy loads up to 3,000 pounds, and extended reach.

1.2 REFERENCE STANDARDS

A. Equipment shall, as applicable, meet the requirements of ASTM industry standards.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer is single supplier for equipment listed in this section.

2. Manufacturer must have at least five (5) years of substantial experience in the manufacturing of davit cranes in the type of application specified herein.

1.4 SUBMITTALS

A. Submit shop drawings in accordance with the General Requirements and the following for approval by the engineer:

1. Drawings showing actual dimensions and confirming the size of davit crane, hoist, trolley, and specified appurtenances; construction details of equipment; general installation arrangement; wiring diagrams; and weight of equipment. Show anchor bolt layout and anchor bolt dimensions.

2. Product data, including product description text and catalog data.

3. A copy of this specification section and the referencing section and all other applicable specification sections governing the davit crane, hoist, trolley, and specified appurtenances. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any

requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B. Submittals shall contain the following at a minimum:

1. Product Data:

a. Product description text.

b. Catalog data.

2. Shop Drawings

a. General arrangement of installation.

b. Product Configuration.

c. Assembly.

3. Written warranty as specified in Section 01740 – Warranties.

4. Operation and Maintenance (O&M) manual consistent with the requirements of Section 01782 – Operation and Maintenance Data.

a. For all units furnished under this Section, the Contractor shall submit one (1) electronic copy of O&M manual to include the following:

1) General - equipment function, description and normal and limiting operating characteristics.

2) Installation instructions - assembly procedures and alignment and adjustment procedures.

3) Operation instructions - startup procedures, normal operating conditions, emergency, and normal shutdown procedure.

4) Lubrication and maintenance instructions which shall list all points to be greased or oiled; shall recommend type, grade, and temperature range of lubricants; and shall recommend frequency of lubrication.

5) Disassembling instructions.

6) Troubleshooting guide.

7) Parts list and predicted life of parts subject to wear.

8) Drawings - cross sectional view, assembly and wiring diagrams. Drawings shall include detailed parts lists with

part numbers, instructions for ordering spare parts, and complete preventive maintenance instructions required to ensure satisfactory performance and longevity of the equipment.

9) Instructions for adjustment, calibration and testing of selected electronic components or assemblies, normally considered replaceable by the manufacturer, whose performance is not ascertainable by visual inspection.

10) Service instruction for major components not manufactured by the equipment manufacturer, but which are supplied in accordance with these specifications. The incorporation of literature produced by the actual component manufacturer shall be acceptable.

1.5 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 01650 – Delivery, Storage, and Handling.

B. Deliver, handle, and store equipment in manufacturer's original undamaged shipping containers with tags and labels intact and legible.

C. Packaging, Shipping, Handling, and Unloading

1. Pack the crane and winch for transport, using the original packaging materials, if appropriate.

2. Protected from rain, snow, impact, and abrasion while in the possession of the carrier.

D. Acceptance at Site

1. Contractor shall review the contents of the shipment at time of delivery and promptly notify the carrier and supplier of any discrepancies.

E. Storage and Protection

1. Seal the crane and winch in plastic with a desiccant to help protect it from rust, corrosion, and other damage.

2. Equipment to remain in the packaging provided by the supplier until it is installed.

F. Waste Management and Disposal

1. Contractor shall be responsible for discarding all packaging materials in an environmentally friendly manner and in accordance with local regulations.

1.6 WARRANTY

A. Written warranty as specified in Section 01740 – Warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stationary davit crane shall be the Admiral 3000 Model 5PT30, manufactured by Thern, or equal.

2.2 STATIONARY DAVIT CRANE

A. General

1. The davit crane shall be designed for heavy loads up to 3,000 lbs. and extended reach, and shall have a maximum hook height of 153 inches. The hoist shall include an electric winch for raising and lowering of the load. Boom angle shall be adjustable by a screw jack. The davit crane shall have a telescoping boom.

B. Basis of Design:

1. Admiral 3000 Model 5PT30 as manufactured by Thern.

a. Lift Capacity: up to 3,000 pounds

b. Hook Reach: 46 to 112 inches

c. Hook Height: 153 inches maximum

C. Lift Capacity:

1. Davit crane shall have a variable lift capacity based on boom length, to vary up to 3,000 pounds (1,360 kg) lift capacity with the boom in the shortest length when positioned at 50 degrees from horizontal, and 2,400 pounds (1,088 kg) with the boom fully extended and in the horizontal position.
2. At the boom angle and boom extension required to lift the wastewater grinder as shown on the Plans, the crane shall have the capacity to lift 1.5 times the dry weight of the wastewater grinder, or 3,000 pounds, whichever is greater.

D. Hook Reach:

1. Boom shall telescope up to 5 different lengths with a minimum hook reach of 46 inches in the shortest position and a maximum hook reach of 112 inches with the boom fully extended, measured from mast center to hook center.
2. Boom shall be able to install and remove the wastewater grinder without interference from vertical surfaces.

E. Hook Height:

1. Hook height shall be adjustable by moving the boom up or down between horizontal and 50 degrees from horizontal, with a minimum of 87 inches between the lowest position and the highest position with the boom fully

extended.

2. Boom shall be able to install and remove the wastewater grinder without interference from horizontal surfaces.

F. Boom Angle:

1. Boom angle shall be adjustable with a hand operated screw jack acting to raise or lower the boom between horizontal and 50 degrees from horizontal.

G. Boom Sheave:

1. Wire rope shall pass over a sheave at the end of the boom. Sheave shall have a bearing and shall be supported by a machined clevis pin.

H. Rotation:

1. Mast and boom shall rotate 360 degrees on roller and tapered roller bearings, with a rotational handle attached to mast to facilitate rotation.

I. Fastening Pins:

1. Crane components shall be fastened together using 316 stainless steel clevis style pins, secured with lynch pins.

J. Winch Location:

1. Lifting winches shall be located such that the center point of the drive shaft is no more than 18 inches in front of the centerline of the mast.

K. Identification:

1. Davit crane shall be labeled with a non-corrosive metal identification plate labeled or imprinted with the manufacturer's name, model number and serial number.

L. Design Factor:

1. Yield design factor shall be a minimum of 2.0 under static conditions for all crane components including winch and base. Breaking strength safety factor shall be a minimum of 3.0 under static conditions.

2.3 SCOPE OF SUPPLY

A. General

1. Crane: Admiral 3000 Model 5PT30 Series Davit Crane, or equal.

2. Winch: worm gear electric winch, 1.5 HP, 115V, single phase, 60 hz, with 6-ft pendant control. The winch shall have a positive load holding mechanical brake able to stop and hold the load automatically when operation is halted.

3. Material and Finish for Crane and Base: 316 stainless steel meeting ASTM standards. Red enamel finish.

4. Wire Rope: wire rope assembly including swivel hook with latch. Wire rope construction shall be 3/16” diameter 316 stainless steel aircraft cable. Swivel hook with safety latch shall be 316 stainless steel.

5. Fasteners and Assembly Hardware: All fasteners and assembly hardware shall be 316 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Davit crane shall be installed in accordance with the manufacturer(s) installation instructions.

END OF SECTION 14650

SECTION 16000 – ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish all labor, materials, equipment and incidentals required for a complete electrical installation for the Metropolitan Sewerage District ITT Pump Station Replacement as required under this Contract as hereinafter specified and/or shown in the Contract Documents.

B. The purpose of the Division – 16 Specifications and Contract Documents is to provide the Owner with complete and fully functional electrical and control systems that are suitable in every way for the service and design intent. All material and all work which may be reasonably implied as being incidental to the work of the Division – 16 Specifications and Contract Documents shall be furnished by the Contractor at no extra cost to the Owner.

C. Division – 16 Specifications shall supplement and/or compliment the Metropolitan Sewerage District of Buncombe County Construction Standards and if there is a discrepancy between these, the Contractor shall immediately notify the Engineer.

1. Metropolitan Sewerage District Technical Specifications website:

    a. https://www.msdbc.org/techspecssewerextmandev.php

2. Metropolitan Sewerage District Construction Drawings website:

    a. https://www.msdbc.org/constructiondrawings.php

D. Contractor shall read and examine all Contract Documents thoroughly along with evaluating the Project Site to gain a complete understanding of the Electrical Scope Of Work.

E. Electrical Scope Of Work, apparatus and materials which shall be furnished under these Division – 16 Specifications and Contract Documents and shall include all items listed hereinafter and/or shown on the Contract Documents.

F. Electrical Scope Of Work shall include but not limited to the following:

1. Provide and Install temporary Electrical Power Systems and Equipment as required during construction to support all Contractor activities.

2. New Low-Voltage Distribution Equipment along with Low-Voltage feeders and branch circuits to include all required disconnects, pull-boxes, junction-boxes, terminal-boxes, conduit bodies, raceways, conductors, cabling and wires for power, control and data circuitries.

    a. Reference Specification Section(s)

        1) 16060 – GROUNDING AND BONDING

2) 16111 – CONDUIT AND RACEWAY

3) 16115 – UNDERGROUND CONDUIT DUCTS, MAN-HOLES, HAND-HOLES AND PULL-BOXES

4) 16120 – CONDUCTORS AND CABLES

5) 16360 – PACKAGED POWER SUPPLIES

6) 16410 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

7) 16435 – PANELBOARDS

3. Provide and install new equipment rack as shown in the Contract Documents to mount and/or house all power and control enclosures and devices as required.

   a. Contractor shall submit, prior to procurement and/or fabrication for Engineer review plan and elevation dimensional drawings with complete Bill Of Materials (BOM) of the equipment rack to be installed.

4. Install new Standby Emergency Diesel Driven Generator Assembly to include required structural foundations, acceptance testing, fueling/re-fueling, power and control conductors, cabling and wiring to include all ancillary equipment.

   a. Reference Specification Section(s)

      1) 16230 – ENGINE GENERATORS

      2) 16415 – AUTOMATIC TRANSFER SWITCHES

5. Reduced Voltage Solid-State Starters (RVSS) to include required conductors, cabling and wires for power, control, data and grounding.

   a. Reference Specification Section(s)

      1) 16340 – LOW-VOLTAGE MOTOR CONTROLLERS

6. Electrical for Process Controls and Equipment, SCADA, Telemetry, Data and Network Systems to include power and control wiring, raceways and devices components (as provided under Division - 17 for installation) as required to provide complete and fully operable Process Control Systems.

7. New Lighting System to include fixtures, control devices mountings, structural foundations and all required appurtenances.

8. New Concrete foundations and/or structural elements to include but not limited to house-keeping pads, equipment rack anchorage, light-pole bases, etc. to securely mount and install Electrical Equipment and

Systems. These concrete foundation and/or structural element designs shall be prepared by a North Carolina licensed professional engineer for Engineer review prior to installation.

a. Reference Specification Section(s)

1) DIVISION 3 – CONCRETE

9. Preform all Electrical equipment testing and start-up procedures to include but not limited to submitting all testing and corrective action reports for Engineer review.

a. Reference Specification Section(s)

1) 16080 – ELECTRICAL TESTING

G. Provide complete and functioning systems in compliance with manufacturer's instructions, performance requirements specified or shown on the Contract Documents and modifications resulting from reviewed and approved submittals and field coordinated drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division – 16 and those Project Documents referenced herein shall be applied.

B. Related Specification Section(s) include but not limited to

1. DIVISION 0 – BIDDING AND CONTRACTING REQUIREMENTS

2. DIVISION 1 – GENERAL REQUIREMENTS

3. DIVISION 2 – SITEWORK

4. DIVISION 17 – INSTRUMENTATION AND CONTROLS

1.3 REFERENCES

A. All Project applicable codes and standards shall be adhered to complete the Scope Of Work. The following codes and standards, listed below are included but not limited to that for general information.

B. Codes and Standards

1. American National Standards Institute (ANSI)

a. All Project applicable ANSI codes and standards

2. American Society for Testing and Materials (ASTM)

a. All Project applicable ASTM codes and standards

3. Factory Mutual System (FM)

    a. A Guide to Equipment, Materials and Services.

4. Institute of Electrical and Electronics Engineers (IEEE)

    a. All Project applicable IEEE standards and recommendations

    b. 141, Recommended Practice for Electrical Power Distribution for Industrial Plants

    c. 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems

    d. 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

5. National Electrical Contractors Association (NECA)

    a. All Project applicable NECA standards and recommendations

    b. 1, Good Workmanship in Electrical Construction

    c. 200, Recommended Practice for Installing and Maintaining Temporary Electrical Power at Construction Sites

6. National Electrical Installation Standards (NEiS)

    a. Project applicable standards and recommendations

7. National Electrical Manufacturers Association (NEMA)

    a. All Project applicable NEMA standards

    b. 250, Enclosures for Electrical Equipment (1000V Maximum)

    c. ICS 6, Enclosures for Industrial Control and Systems

8. National Fire Protection Association (NFPA)

    a. All Project applicable NFPA codes and standards

    b. 70, National Electrical Code (NEC)

    c. 70E, Standard for Electric Safety in the Workplace

    d. 79, Electrical Standard for Industrial Machinery

    e. 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities

9. Underwriters Laboratories, Inc (UL)

a. All Project applicable UL standards

b. 96A, Installation Requirements for Lightning Protection Systems

c. 508, Industrial Control Equipment

d. 508A, Industrial Control

e. 698, Industrial Control Equipment for Use in Hazardous Locations

C. When a specific code or standard has not been cited, the applicable codes and standards of the following code making authorities and standards organizations shall apply:

1. American Association of State Highway and Transportation Officials (AASHTO).

2. American Iron and Steel Institute (AISI)

3. American National Standard Institute (ANSI)

4. American Society for Testing and Materials (ASTM)

5. ETL Testing Laboratories, Inc (ETL)

6. Insulated Cable Engineers Association (ICEA)

7. Institute of Electrical and Electronic Engineers (IEEE)

8. Illuminating Engineering Society of North America (IES)

9. Instrument Society of America (ISA)

10. Lightning Protection Institute (LPI)

11. National Electrical Manufacturers Association (NEMA)

12. National Fire Protection Association (NFPA)

13. Occupational, Health and Safety Administration (OSHA)

14. Underwriters Laboratories Inc (UL)

D. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, drawings and specifications, or within either document itself, the more stringent condition shall govern.

E. Environmental Conditions

1. Outdoor Areas

a. Locations on the Project site where the equipment is normally

exposed to inclement weather, wind, dust, rain, snow, etc. Outdoor areas include areas protected by a roof or rain/sun shields but not enclosed within a building and/or structure.

b. Outdoor locations may be hazardous, non-hazardous and/or corrosive environments.

1) Hazardous and/or Classified areas are identified on the Contract Documents

2) Corrosive areas are identified on the Contract Documents.

3) All outdoor areas are considered wet and/or damp.

2. Indoor Areas

a. Those locations and/or spaces at the Project site where the equipment is normally protected from inclement weather, wind, dust, rain, snow, etc.

b. Indoor locations may be hazardous, non-hazardous, wet and/or corrosive environments.

1) Hazardous and/or Classified areas are identified on the Contract Documents

2) Corrosive areas ae identified on the Contract Documents.

3) Wet and/or damp indoor areas are identified on the Contract Documents. Those are not identified as such, but provided with heating shall be considered unclassified. Indoor areas not identified as such, but provided without heating shall be considered damp.

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division – 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. All Submittal packages shall include a complete copy of the applicable Specification Sections. Contractor shall review and indicate that all items within the submittal are compliant with the Specifications by indicating with a ‘check mark’ by each paragraph. Any items that do not meet the requirements, Contractor shall indicate by marking the corresponding paragraph with an ‘x’. Those items not in compliance with the Specifications, a written clarification shall be provided by the Contractor describing how the submittal differs from the requirements outlined in the Specification Sections and a detailed explanation why it is not possible to meet those requirements. Any submittal package received without marked-up Specification Sections shall be rejected and returned by the Engineer without review.

C. Shop Drawings:

1. Shop drawings shall be arranged and labeled according to specification section and Contract Drawing.

2. Submit shop drawings prior to purchase or fabrication of equipment. See individual Division – 16 Sections for additional specific requirements.

3. Prior to submittals of shop drawings, coordinate electrical equipment, particularly motor control equipment, control panels, and instrumentation, with all applicable equipment and systems interfacing with that equipment.

4. Submittals shall be made in the following combinations:

   a. Low Voltage Electrical Power Distribution Equipment (≤ 600V)

      1) Panelboards, Load Centers, (lighting panels), Disconnect Switches, Transformers.

   b. Standby Emergency Diesel Driven Generator Assembly and Automatic Transfer Switch

   c. Motor Controllers along with associated control equipment and/or devices

      1) Reduced Voltage Solid-State Starters

   d. Raceway Systems

      1) Conduits, Cable Trays, Duct-Bank details, Manholes, Handholes, Pull-Boxes, Junction Boxes, Conduit Bodies and Fittings.

      2) Conduit layout drawings for major and/or complex routings.

   e. Low-Voltage Wire and Cables (≤ 600V)

      1) Feeder Circuitry power cables and conductors

      2) Branch Circuitry cables and conductors

      3) Control/Signal Circuitry

      4) Low Voltage Systems: Tele/Com, Data, Security, Video

   f. Wiring Devices

      1) Receptacles, Switches

   g. Lighting

      1) Interior/Exterior Lighting Fixtures, Site Lighting Fixtures

h. Supports and Hardware

1) Strut-Channel, Equipment Racks and Stanchions, Fasteners, Concrete Bases, Anchorage, etc.

a) Installation Detail Sketches, Layouts, BOM

i. Electrical Systems Raceway Schedule

1) Provide an Electrical Systems Raceway Schedule for Engineer review, reference:

a) Specification Section 16120 1.4B.2

5. For each product, clearly identify the manufacturer by name. When general data sheets are provided as part of the submittal, specifically identify the products to be used on this Project. Provide manufacturer's technical information on products to be used, including:

a. Product descriptive bulletin.

b. Electrical data pertinent to the Project and necessary to assure compliance with Specifications and Contract Documents.

c. Equipment dimensions, where applicable.

d. Evidence that the products submitted meet the requirements of the standards referenced.

e. Specify part number with explanation of options selected.

6. Ensure that all submittals clearly indicate the equipment is UL or ETL listed.

7. For all equipment, provide manufacturer's installation instructions.

D. When a quality standard has been established by identification of a specific manufacturer or catalog number, submittals for proposed alternates and substitutions shall include:

1. Alternate and substitute equipment cross referenced to the equipment it is replacing. Submittal shall be marked to show how differences will be accommodated.

2. Calculations and other detail data to allow determination of alternate and substitute equipment equivalency to the equipment it is replacing. Data supplied shall allow detailed comparison of all significant characteristics upon which the design equipment is based.

3. Dimensioned drawings, of the same or larger scale as the Contract Documents, for all alternate and substitute equipment, which differs in size, configuration, service accessibility or in any significant way from the equipment it is replacing.

a. Complete system layout, except that portion which is identical to the Contract Documents.

b. Redesign and modifications to all work required by the alternate or substitute equipment.

E. Operation and Maintenance Manuals

F. Project Close-Out Documentation

1.5 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall unload and handle materials using methods, rigging, and equipment that will prevent damage to the materials. Care shall be used to prevent damage to painted and galvanized surfaces.

1. Bare wire rope slings shall not be used for unloading and handling materials and equipment, except with the specific written permission of the Engineer.

B. Equipment and materials, in accordance with the manufacturer's recommendations, shall be stored, supported and protected to prevent damage.

1. Stored materials and equipment shall not be allowed to contact the ground.

2. Equipment and materials which incorporate electrical equipment or which have finished painted surfaces, and other items which would be damaged by outdoor exposure, shall be stored indoors.

a. Provide covering and shielding for all equipment to protect from damage.

b. When such storage would present an unreasonable building space or volume requirement, the equipment or materials may, when acceptable to the Engineer, be stored under weatherproof coverings on shoring or platforms.

3. All small loose items that could be easily lost, stolen, broken, or misused shall not be stored on open platforms or shoring.

4. All storage methods and schedules shall be acceptable to the Engineer.

C. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage either inside or on top of enclosures.

D. Protect nameplates on electrical equipment to prevent defacing.

E. Repair, restore or replace damaged, corroded and rejected items at no additional cost to the Owner.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Reference those applicable Specification Section(s)

1.7 WARRANTY

A. Reference those applicable Specification Section(s)

1.8 IDENTIFICATION

A. Contractor shall reference and provide all identification, tagging and labeling for electrical and control systems as required per Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Refer to related Division 16 Sections. All equipment of a similar type shall be by one manufacturer unless otherwise noted in the Specifications.

B. Subject to compliance with the Contract Documents all electrical equipment and materials shall be acceptable as specified in the Owner's Approved Products List

2.2 MATERIALS

A. Trade names and catalog numbers may be used in the Contract Documents or Specifications to establish quality standards and basics of design.

1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.

2. If no other manufacturer is listed then any manufacturer of equal equipment may be acceptable.

B. Listed: Where UL test procedures have been established for the product type, electrical equipment shall be approved by UL or ETL and shall be provided with the UL or ETL label.

2.3 FABRICATION

A. When equipment is shop fabricated for the Project, the electrical devices and enclosures utilized shall be UL or ETL listed and labeled or shall be UL recognized.

1. Contractor shall submit for Engineer review all fabricated electrical and control equipment assemblies, enclosures including but not limited to: equipment racks or support systems.

B. Shop or Factory Finishes: Interiors of other painted equipment shall be white.

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate with all trades, subcontractors, vendor representatives,

with Engineer, Engineer's Representative and/or Owner.

3.2 INSTALLATION

A. Equipment shall be installed in accordance with the requirements of the NEC.

B. Coordinate the installation of electrical equipment with other trades.

1. Arrange for the building in of equipment during structure construction.

2. Where equipment cannot be built in during construction, arrange for sleeves, box outs, openings, etc., as required to allow installation of equipment after structure construction is complete.

C. Verify that equipment will fit support layouts indicated.

D. Equipment Dimensions and Clearances:

1. Equipment shall fit in the locations shown in the Contract Documents.

2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.

E. Install equipment in accordance with the manufacturer's instructions.

F. Equipment Access

1. Install equipment so it is readily accessible for operation and maintenance.

2. Equipment shall not be blocked or concealed.

3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.

G. Equipment shall be installed plumbed, square and true with the building construction and shall be securely fastened.

H. Outdoor wall mounted equipment and indoor equipment mounted on earth or water bearing walls shall be provided with corrosion resistant spacers to maintain 1/4IN separation between the equipment and the wall.

I. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.

J. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.

K. Provide all necessary anchoring devices and supports.

1. Reference Specification Section 16070 – HANGERS AND SUPPORTS

2. Use supports as detailed in the Contract Documents and as specified.

3. Where not detailed on the Contract Documents or specified, use supports and anchoring devices rated for the equipment load and as recommended by the manufacturer.

L. Contractor shall verify exact rough in locations and dimensions for connection to electrical items to be installed under this Contract.

1. Shop drawings shall be secured from those furnishing the equipment.

2. Proceeding without proper information may require the Contractor to remove and replace work that does not meet the conditions imposed by the equipment supplied.

3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the Engineer.

4. Should any cutting and patching be required on account of failure of the Contractor to coordinate penetrations, such cutting and patching shall be done at the expense of the Contractor.

a. Contractor shall not endanger the stability of any structural member by cutting, digging, chasing, or drilling and shall not, at any time, cut or alter the work without the Engineer's written consent.

1) Provide additional reinforcing if required.

2) Cutting shall be done neatly using proper tools and methods.

b. Subsequent patching to restore walls, ceilings, or floors to their original condition shall be done by workmen skilled in their particular field.

M. Provide concrete foundations or pads required for electrical equipment as indicated or specified.

1. Floor mounted equipment shall be mounted on a 4IN high concrete housekeeping pad. Pad shall be poured on top of the finished floor or slab.

N. Material that may cause rusting or streaking on a building surface shall not be used.

3.3 FIELD QUALITY CONTROL

A. Contractor shall reference and provide all testing procedures, reports and data for Engineer review and approval for electrical systems as required per Specification Section(s)

1. 16080 – ELECTRICAL TESTING

B. Verify all components are operational.

C. Perform ground fault performance testing as required by NEC Article 230 95(c).

D. Test Equipment Interface:

E. Verify systems coordination and operation.

1. Set all adjustable trip protective devices as required for system protection and coordination.

F. Verify all system and equipment ground continuity.

G. Adjust installed equipment for proper operation of all electrical and mechanical components.

H. Replace equipment and systems found inoperative or defective and re test.

1. If equipment or system fails re test, replace it with products that conform to Contract Documents.

2. Continue remedial measures and re tests until satisfactory results are obtained.

3. Remedial measures and re tests will be done at no cost to the Owner.

I. The Engineer shall be notified of tests and Engineer may witness individual tests at their discretion.

J. Required certificates of testing and test reports shall be presented to the Engineer upon completion of the tests.

K. At Completion of Installation:

1. Test to ensure all equipment is free of short circuits and improper grounds.

2. Test to ensure all equipment is operational.

L. After installation, all equipment shall be tested as recommended by the manufacturer.

3.4 STRUCTURAL COORDINATION

A. Contractor shall reference all structural and building requirements prior to installing work and shall not interfere with any structural foundation component such as footings, bearing walls, etc. Contractor shall identify any structural interference and notify the Engineer immediately prior to continuation of work.

B. Do not remove or damage fireproofing materials.

1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.

2. Repair or replace fireproofing removed or damaged.

C. Make all penetrations through roofs prior to installation of roofing.

D. All penetrations required after installation of roofing, shall be completed by an authorized roofer to maintain the roof warranty.

E. Make all penetrations of electrical work through walls water and weather tight.

F. Equipment furnished under this Contract for use on future work and all concealed equipment, including conduits, shall be dimensioned, on the Record Drawings, from visible and permanent building features.

3.5 PROJECT CLOSEOUT

A. Cleaning

1. Clean dirt and debris from all interior and exterior surfaces.

2. Exterior surfaces shall be cleaned with manufacturer approved cleaning agents.

3. Apply touch up paint as required to repair scratches, etc.

4. Replace nameplates or wire and cable markers damaged during installation.

5. Thoroughly vacuum the interior of all enclosures to remove dirt and debris. Do not use pressurized air systems to blow out dirt and debris.

B. Demonstration

1. Demonstrate equipment has been installed and operational in accordance with Contract Requirements and Project Specifications.

C. Close-Out Documentation

1. Contractor shall provide all close-out documentation to include but not limited to as-build drawings, revised panel schedules, conduit and cable schedules, equipment identification schedules, etc. in accordance with Contract Requirements and Project Specifications.

2. Record Drawings

a. Contractor shall maintain a marked up set of Document Drawings showing actual installed circuit numbers, conduit sizes, cable tray routing, number of conductors, conductor sizes (other than 12AWG) and all other deviations from the design drawings.

b. All underground conduit and concealed items shall be dimensioned on the Document Drawings from permanent, visible, building features.

c. Provide actual motor size, starter size, and heater size, along with

all other protective equipment for all motor circuits as part of the one-line record drawings.

d. Revise all wire/cable identification schedules to indicate as installed conditions.

e. Revise all panelboard schedules to indicate as installed conditions.

END OF SECTION 16000

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16010 – ELECTRICAL POWER STUDIES

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish Short-Circuit Coordination Study to include all relay and protective device settings as prepared by the electrical equipment supplier or an approved engineering firm.

B. Contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E - Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E-2024, Annex D.

C. Scope Of Work for the studies shall include all new distribution equipment supplied by the electrical equipment supplier under this Contract as well as all the applicable existing electrical equipment at the Project site.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Documents referenced herein shall be applied.

1.3 REFERENCES

A. Codes and Standards

1. American National Standards Institute (ANSI):

   a. C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis

   b. C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures

   c. C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

   d. C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

   a. 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems

   b. 241 – Recommended Practice for Electric Power Systems in Commercial Buildings

   c. 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

d. 399 – Recommended Practice for Industrial and Commercial Power System Analysis

e. 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

f. 1584 - Guide for Performing Arc-Flash Hazard Calculations

3. National Fire Protection Association (NFPA)

a. 70 - National Electrical Code, latest edition

b. 70E – Standard for Electrical Safety in the Workplace

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01330 – SUBMITTAL PROCEDURES

B. Computer Analysis Software

1. The studies shall be performed using the latest version of SKM® Systems software program or approved equal.

C. Final Submittal For Engineer Review

1. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. No more than five (5) bound hard copies of the complete final report shall be submitted. Electronic copies of the resultant computer analysis software study(ies) shall be included and compatible with the latest version of SKM® Systems software.

2. The report shall include the following section(s)

a. Executive Summary

b. Descriptions, purpose, basis and scope of the study

c. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties

d. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection

e. Fault current calculations including a definition of terms and guide for interpretation of the computer printout

f. Details of the incident energy and flash protection boundary calculations

g. Recommendations for system improvements, where needed

h. One-line diagram(s)

D. Qualifications

1. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer in the State of North Carolina skilled in performing and interpreting the power system studies.

2. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.

3. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

4. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Reference those applicable Specification Section(s)

1.6 OPERATION AND MAINTENANCE MANUALS

A. Reference those applicable Specification Section(s)

1.7 WARRANTY

A. Reference those applicable Specification Section(s)

1.8 IDENTIFICATION

A. Contractor shall reference and provide all identification, tagging and labeling for electrical and control systems as required per Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. NOT USED

2.2 STUDIES

A. Contractor shall furnish short-circuit and protective device coordination studies as prepared by equipment supplier or an approved engineering firm.

B. Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E, Article 130.3 and Annex D.

2.3 DATA COLLECTION

A. Contractor shall furnish all data as required by the power system studies. The engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing, new and proposed loads obtained from the Contract Documents, Engineer or Owner.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.4 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.

B. Transformer design impedances shall be used when test impedances are not available.

C. Provide the following, at a minimum

1. Calculation methods and assumptions

2. Selected base per unit quantities

3. One-line diagram of the system being evaluated

4. Source impedance data, including electric utility system and motor fault contribution characteristics

5. Tabulations of calculated quantities

6. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each

1. Electric utility's supply termination point

2. Incoming switchgear

3. Motor control centers

4. Standby generators

5. Branch circuit panelboards

6. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation

1. Evaluate equipment and protective devices and compare to short circuit ratings

2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses

3. Notify Engineer in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.5 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:

1. Electric utility overcurrent protective device

2. Medium voltage equipment overcurrent relays

3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands

4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands

5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves

6. Conductor damage curves

7. Ground fault protective devices, as applicable

8. Pertinent motor starting characteristics and motor damage points, where applicable

9. Pertinent generator short-circuit decrement curve and generator damage point

10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.6 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E-2024, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. Arc-Flash Hazard Analysis shall include all significant locations in 480V and 208V systems fed from transformers equal to or greater than 125kVA where work could be performed on energized parts.

D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2CAL/CM^2.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into

consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.

2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-Coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2SEC based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2SEC during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.7 REPORT SECTIONS

A. Input data shall include, but not limited to the following

1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).

2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.

3. Reactor data, including voltage rating, and impedance.

4. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance (X”d), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.

5. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.

B. Short-Circuit Output Data shall include, but not be limited to the following reports

1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:

   a. Voltage

   b. Calculated fault current magnitude and angle

   c. Fault point X/R ratio

   d. Equivalent impedance

2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location

   a. Voltage

   b. Calculated symmetrical fault current magnitude and angle

   c. Fault point X/R ratio

   d. Calculated asymmetrical fault currents

      1) Based on fault point X/R ratio

      2) Based on calculated symmetrical value multiplied by 1.6

      3) Based on calculated symmetrical value multiplied by 2.7

   e. Equivalent impedance

3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location

   a. Voltage

   b. Calculated symmetrical fault current magnitude and angle

   c. Fault point X/R ratio

d. No AC Decrement (NACD) Ratio

e. Equivalent impedance

f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis

g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis

C. Recommended Protective Device Setting(s)

1. Phase and Ground Relays

a. Current transformer ratio

b. Current setting

c. Time setting

d. Instantaneous setting

e. Recommendations on improved relaying systems, if applicable.

2. Circuit Breakers

a. Adjustable pickups and time delays (long time, short time, ground)

b. Adjustable time-current characteristic

c. Adjustable instantaneous pickup

d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations

1. Arcing fault magnitude

2. Protective device clearing time

3. Duration of arc

4. Arc flash boundary

5. Working distance

6. Incident energy

7. Hazard Risk Category

8. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractor shall assist and provide support as needed for the electrical equipment supplier or approved engineering firm as necessary to complete the requirements of the Specification.

3.2 FIELD ADJUSTMENT

A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the start-up and commissioning technician of the electrical equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Engineer in writing of any required major equipment modifications.

3.3 ARC FLASH WARNING LABELS

A. The Contractor shall provide and install labels in accordance Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the Engineer for review and after any system changes, upgrades or modifications have been incorporated in the system.

3.4 PROJECT CLOSEOUT

A. Contractor shall provide the final report of that required in Section 1.4D, after incorporating any field adjustments to the equipment that effects the Short-Circuit Coordination Study and Arc Flash Hazard Analysis Study to include a table of the all the relay and protective device settings for project close-out documentation.

END OF SECTION 16010

SECTION 16060 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish and install grounding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered as a minimum requirement for compliance with this Specification Section.

B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100-92, Powering and Grounding of Sensitive Electronic Equipment. Conflicts shall be promptly brought to the attention of the Engineer.

C. In addition to the NEC requirements, building structural steel columns shall be permanently and effectively grounded:

D. Additional requirements for grounding and bonding as shown on the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

1.3 REFERENCES

A. All grounding components and the completed system shall comply with the following codes and standards as well as within the Specifications or as shown in the Contract Documents:

B. Codes and Standards

1. American National Standards Institute (ANSI)

    a. C2 – National Electrical Safety Code (NESC)

2. Institute of Electrical and Electronic Engineers (IEEE)

    a. 81 – Guide for Measuring Earth Resistivity

    b. 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems

3. National Fire Protection Association (NFPA)

    a. NFPA 70, National Electric Code

4. Underwriters Laboratories Inc (UL)

a. 467-13 – Standard for Grounding and Bonding Equipment

b. 588 – Grounding Equipment

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Reports of certified field tests. Each submittal shall be identified by the applicable Specification Section.

3. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.

C. Contractor shall provide drawings and written description(s) of how the Grounding and Bonding system will be installed and in agreement with underground duct-bank systems for Engineer review prior to commencing work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements

1. Grounding and Bonding conductors shall be delivered in continuous lengths on non-returnable reels.

2. Contractor shall not accept any cable reel if the outer protection paper/plastic has been punctured, torn or compromised in any way, or if the reel itself has been significantly damaged.

B. Storage and Handling Requirements:

1. All Grounding and Bonding materials shall be stored in accordance with the manufacturer instructions and recommendations applicable for the Project site conditions. Grounding and Bonding materials shall be stored on a hard surface and not in direct contract with the earth. Grounding and Bonding materials shall be stored in an area where construction equipment, falling or flying objects, chemicals or petroleum products, sources of high heat, etc., will not contact or cause damage to the materials.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Contractor shall reference and provide all Operation and Maintenance Manuals for those applicable Division 16 Sections as required per Specification Section(s)

1. 01782 – OPERATION AND MAINTENANCE DATA

1.7 WARRANTY

A. Manufacturer shall warrant Grounding and Bonding materials to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation or eighteen (18) months from date of purchase.

1.8 IDENTIFICATION

A. Grounding and Bonding conductors and/or connections shall be identified with the tag number(s) as indicated on the Contract Documents and/or the approved shop drawings.

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The equipment covered by this Specification Section shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Documents.

2.2 GROUNDING CONDUCTOR

A. A green, insulated equipment grounding conductor, which shall be separate from the electrical system neutral conductor, shall be furnished and installed for all circuits. Equipment grounding conductors shall be furnished and installed in all conduits. Use of conduits as the NEC required equipment grounding conductor is not acceptable.

B. Where specified or shown a 3IN strap shall be furnished and installed as the grounding conductor.

2.3 EQUIPMENT GROUND CONDUCTOR

A. Equipment ground conductors shall be solid and continuous from a connection at earth to all distribution panelboards. Ground connections at panelboards, outlets, equipment, and apparatus shall be made in an approved and permanent manner.

2.4 BONDING FITTINGS

A. Grounding connections to equipment shall be bolted. Cable end connections may be made by use of the crucible weld process or bolted type connectors. Bolted type connectors for this application shall consist of corrosion resistant copper alloy with silicone bronze bolts, nuts and lock-washers which are designed for this purpose.

2.5 GROUND RODS

A. Ground rods shall be rolled to a commercially round shape from copper clad steel manufactured by the molten welding process or by the electro formed process (molecularly bonded). They shall have an ultimate tensile strength of 75kPSI and an elastic limit of 49kPSI. The rods shall be not less than 3/4IN diameter by 10FT in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.013IN at any point on the rod.

B. The maximum resistance to ground of a driven ground rod shall not exceed 2 5OHM under normally dry conditions. Where the resistance obtained with one (1) ground rod exceeds 25 OHM, additional ground rods shall be coupled, by exothermic welds. Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in non-metallic raceways and neutral conductors of wiring systems shall be grounded.

C. The ground connection shall be made at the main service equipment and shall be extended to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection. If there is not suitable metallic water service to the facility, the ground connection shall be made to the driven ground rods on the exterior of the building.

D. Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

2.6 GROUNDING GRID

A. A grounding grid shall be provided for each structure and interconnected between structures. The grounding grid shall be installed such that the ground resistance does not exceed 5 OHM. The grounding grid shall be interconnected by bare copper conductors sized to the largest service entrance ground, spliced and connected to ground rods by exothermic welds. The grounding conductors shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the grounding grid system and shall enter the buildings and structure from the outside and shall be connected to steel structures, and equipment as described in this Section and as shown in the Contract Documents.

PART 3 - EXECUTION

3.1 COORDINATION

A. If included in the Scope Of Work, Contractor shall coordinate the Grounding and Bonding system(s) with the Lightning Protection system(s).

3.2 INSTALLATION

A. Metal surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.

B. Grounding conductors shall be continuous between points of connection; splices shall not be permitted.

C. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in PVC SCH-80 raceway.

D. Mechanical connections shall be permitted to ground rods in “Ground Test Wells” and shall be exposed to permit maintenance and inspection for continuity and effectiveness of grounding system.

E. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.

F. Conduit

1. Conduit that enters equipment such as motor control centers, switchboards, switchgear, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus, where provided, and as otherwise required by the NEC.

3.3 TESTING

A. All testing shall be performed in accordance with the requirements of Specification Section(s)

1. 16080 – ELECTRICAL TESTING

B. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

C. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment.

D. Field Tests:

1. Ground resistance shall be measured with a three-point, fall of potential instrument.

2. All ground rods shall be tested after being driven and prior to connection to the grounding system. Where test results show resistance-to-ground is greater-than 25 OHM, additional ground rods shall be driven by coupling

with exothermic welds. The compliance shall be demonstrated by retesting ground rod.

3. Upon completion of installation of the grounding and bonding system, the entire system shall be tested at the ground test well(s), as indicated in the Contract Documents. The completed system shall have less-than 5 OHM of ground resistance.

3.4 PROJECT CLOSEOUT

A. Contractor shall provide final documentation to those items listed in Section 1.4C for Project close out requirements to include but not limited to:

1. dimensional data from three (3) locations (existing or new structures)

   a. stop and start locations of straight grounding conductor runs

   b. locations every one-hundred feet (100FT)

   c. grounding conductor connections and/or change of direction

2. burial depth as measured from finished grade to grounding conductor

   a. locations every one-hundred feet (100FT)

END OF SECTION 16060

SECTION 16070 – HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish, install and place in satisfactory condition all conduit, cable-tray, raceway and equipment Hangers and Supports as required for proper installation of those systems per equipment manufacturer installation instructions and applicable codes and standards. All hardware and fasteners required for the installation shall be furnished and installed by the Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

1.3 REFERENCES

A. Codes and Standards

1. American Society for Testing and Materials (ASTM)

   a. A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

   b. A1018 – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

   c. B633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

   d. E84 – Standard Test Method for Surface Burning Characteristics of Building Materials

   e. F1136 – Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners

2. National Electric Manufacturers Association (NEMA)

   a. VE-2 – Cable Tray Installation Guidelines

3. National Fire Protection Agency (NFPA)

   a. 70, National Electrical Code

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. Product data shall be submitted for each Hangers and Supports components and accessories; including clamps, brackets, hanger rods and fittings. The information shall include, but not be limited to, types, materials, finishes, gauge thickness and mounting-hole patterns.

C. Qualifications

1. All Hangers and Supports components shall be listed and labeled by UL, CSA or other NRTL testing and listing agencies that provide third-party certification follow-up services.

2. Contractor will not utilize Hangers and Supports materials from previous project(s) not covered under this Contract.

D. Strut-Channel and fittings shall have a unique identifying number that trace the product back to material test reports. Stainless steel items shall have a part number that contains a material designator or a separate stamp that includes a reference to the type of material used.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements

1. Hangers and Supports shall be delivered in standard lengths as provided by the manufacturer.

2. Contractor shall not accept Hangers and Supports materials if has been damaged during transport.

B. Storage and Handling Requirements:

1. All Hangers and Supports materials shall be stored in accordance with the manufacturer instructions and recommendations applicable for the Project site conditions. Hangers and Supports materials shall be stored on a hard surface and not in direct contract with the earth.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Contractor shall reference and provide all Operation and Maintenance Manuals for those applicable Division 16 Sections as required per Specification Section(s)

1. 01782 – OPERATION AND MAINTENANCE DATA

1.7 WARRANTY

A. Manufacturer shall warrant all Hangers and Supports materials to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation or eighteen (18) months from date of purchase.

1.8 IDENTIFICATION

A. Where applicable, Hangers and Supports shall be identified with the tag number(s) as indicated on the Contract Documents and/or the approved shop drawings.

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents all Hangers and Supports materials shall be provided by one (1) or more of the following:

1. Allied Power-Strut Products
2. B Line Systems
3. Rob-Roy Industries
4. Thomas & Betts
5. Unistrut Building Systems

2.2 COMPONENTS

A. Materials

1. Strut-Channel systems shall be furnished with fittings and accessories designed for use with the manufacturers strut system and made by the same manufacturer.
2. Contractor shall furnish all necessary locknuts, bushings, pipe clamps, ground clamps, supports, pull boxes, mounting bolts, inserts, lugs and any other materials necessary and proper in the execution of the work.
3. All fasteners and hardware materials shall be
    a. Stainless-Steel Type 316 (ASTM A276).
4. Anti-Vibratory type fasteners and hardware shall be utilized on all equipment subject to movement and/or vibration or as indicated on the Contract Documents.

5. Hanger rod materials shall be that as listed in Section 2.2A.3 or as noted in the Contract Documents and 3/8IN minimum diameter for conduit supports and 1/2IN minimum for cable tray supports.

6. Material types other than those listed in Section 2.2A.3, are not acceptable and considered rejected work by the Engineer.

PART 3 - EXECUTION

3.1 COORDINATION

A. Systems Integration

1. Contractor shall coordinate with other trades and craft to ensure electrical, plumbing and HVAC systems utilize common support and hanger systems to minimize individual support systems for each trade.

a. Hanger and support installed for multiple systems shall be designed and installed in accordance with the loading requirements.

b. Multiple individual support and hanger systems installed within common areas and spaces for electrical, plumbing and HVAC systems are not acceptable and considered rejected work by Engineer.

3.2 INSTALLATION

A. Hangers and Supports systems shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown in the Contract Documents.

B. Environmental Conditions

1. All strut, clamps, fittings and fastener materials shall conform to the following unless otherwise noted on the Contract Documents.

a. Outdoor/Wet Areas

1) Stainless Steel Type-304 (ASTM A240)

2) Aluminum 6063-T6

b. Outdoor/Corrosive Areas

1) Stainless Steel Type-316 (ASTM A240)

C. General

1. Boxes, wall brackets, cabinets and hangers shall be secured by means of toggle bolts in hollow masonry and gyp-board, preset inserts or expansion bolts in solid masonry and concrete, machine screws or bolts on metal surfaces and wood or sheet metal screws in wood construction. Brackets

and hangers may also be welded to metal surfaces. Boxes and cabinets shall not be welded to metal surfaces.

2. Electrical cabinets, panelboards, transformers, boxes, disconnect switches, etc., and their supporting hardware, shall be fastened securely to the building structure, bolted strut or fabricated structure.

3. Metal strut shall be installed for surface-mounted cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers and any other electrical devices.

   a. Fiberglass materials where indicated in the Contract Documents

4. In open overhead spaces, cast boxes threaded to raceways need not be supported separately, except where used for fixture support. Sheet metal boxes shall be supported directly from the building structure.

5. Hanger rods shall be fastened to structural steel members with heavy duty beam clamps. Under concrete floors, rods shall be fastened to concrete inserts set flush to the surface. When a hanger is required with no structural steel member directly above, the Contractor shall span between steel members with strut-channel and attach the rod to the strut.

6. Raceway supports shall be selected and installed in accordance with the manufacturer's recommendations. Raceways shall be supported within 1FT of an unsupported box or fitting. Individual horizontal raceways shall be supported with separate conduit hangers. Horizontal conduit racks shall be trapeze-type hangers utilizing strut and all-thread hanger rods. Each conduit on the rack shall be clamped with conduit clamps designed for use with strut. Trapeze hangers shall be used for all RAC, PVC-RAC and PVC conduits. In vertical applications, raceways shall be supported so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the raceway supports, with no load on the raceway fittings. Vertical conduit racks shall utilize strut attached to walls with conduits attached with pipe clamps.

7. Vertical conductor supports and conductors shall be installed simultaneously.

8. Conduits, fittings, enclosures, conduit straps and clamps shall not be welded.

9. Supporting devices and raceways shall be installed plumb, horizontal, or parallel to building lines, finished floors and each other.

10. Cable tray supports shall conform to NEMA Standards Publication VE-2, and the cable tray support detail drawings.

11. All electrical equipment shall not be mounted or supported in any manner to hand-rails, stair-wells, ladder-wells, or safety railing systems unless approved by structural Engineer of record

12. Residential and/or Commercial supports and hanger methods and materials are not acceptable and considered rejected work by Engineer. Example: plumber's perforated strap, "caddy" clips, "push-in" conduit fittings, etc.

3.3 FIELD QUALITY CONTROL

A. Strut-Channel shall not be bent, drilled, cut or otherwise modified to produce fittings, braces or brackets for conduit and equipment supports.

B. Manufactured strut-channel braces, brackets, fittings and post-bases shall be provided and installed with associated hardware and fasteners as a complete system for conduit and equipment supports.

3.4 PROJECT CLOSEOUT

A. All Hangers and Supports systems shall be cleaned and free of dust, grease, oil and debris for project close-out acceptance.

B. All labeling shall be installed in accordance with the following Specification Section(s) to complete project close-out activities and acceptance.

1. 16075 – ELECTRICAL IDENTIFICATION

END OF SECTION 16070

SECTION 16075 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish and install but not limited to the following equipment and warning labels

1. Equipment Identification Nameplates
2. Conduit/Raceway:
    a. Identification Tags
    b. Voltage System Warning Labels
3. Wire/Cable Bundles Identification Tags
4. Wire Markers and Cable Color Coding
5. Electrical Hazards Information
    a. Electrical Signage
    b. Shock Hazard Warning Labels
    c. Arc-Flash Warning Labels
6. Working Space Markings
7. Duct-Bank Systems Warning Tape

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

B. Related Specification Section(s) include but not limited to

1. 16120 – CONDUCTORS AND CABLES

1.3 REFERENCES

A. Codes and Standards

1. American National Standards Institute (ANSI)
    a. Z535.1 Safety Color Codes
    b. Z535.2 Environmental and Facility Safety Signs

c. Z535.3 Criteria for Safety Symbols and Labels

d. Z535.4 Product Safety Signs and Labels

e. Z535.5 Safety Tags and Barricade Tapes (for Temporary Hazards)

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. Contractor shall conform to codes and standards to include but not limited to that listed in Section 1.3A.

C. Contractor shall submit the following

1. Catalog Data: Submit manufacturer's catalog literature for each product.

2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

3. Samples:

a. Submit two (2) samples of each type of printed and stamped identification products applicable to the Project.

b. Submit two (2) nameplates illustrating materials and engraving quality.

4. Submit an Electrical Systems Raceway Schedule for all power, control, signal, process tele/comm/data raceway systems that aligns with the Owner equipment identification and tagging scheme.

5. Electrical Systems Raceway Schedule shall be submitted for Engineer review in an electronic spreadsheet type Excel compatible file format. Electrical Systems Raceway Schedule shall include but not limited to the following data

a. Raceway ID Tag

b. Raceway size, type and quantity

c. Routing

1) duct-bank sections, pull-boxes, hand-holes, marshalling and termination cabinets, etc.

d. Spare Raceway ID Tag

e. Spare Raceway type, size and quantity

f. Contractor additional notes

6. Submit an Electrical Wire Schedule for all power, control, signal, process tele/comm/data, protective circuitry, wiring, conductors, etc. that aligns with the Electrical Systems Raceway Schedule.

7. Electrical Wire Schedule shall be submitted for Engineer review in an electronic spreadsheet type Excel compatible file format. Electrical Wire Schedule shall include but not limited to the following data:

   a. Raceway ID Tag

   b. Cable/Conductor/Wire ID Tag

   c. Cable/Conductor/Wire type, size, quantity and rated voltage

   d. Terminations

      1) terminal block numbers

      2) supply, origin, source, etc.

      3) intermediate terminations and/or splices, e.g. marshalling and termination cabinets

      4) utilization and/or field device, spares, etc.

      5) line, load, lug, terminal block or connection identification

   e. Contractor additional notes

8. Engineer Note: Electrical Systems Raceway Schedule and Electrical Wire Schedule can be combined into one (1) submittal document.

9. Schedules shall be submitted for Engineer review in an electronic spreadsheet type Excel compatible file format. The marker schedule shall incorporate the following alpha-numeric scheme:

   a. Prefix, first letter shall indicate the associated system

A – Analogue	(PLC/DCS variable signals <90V)
C – Control	(Motor/Control signals >90V)
D – Discrete	(PLC/DCS step signals <90V)
E – Data Communications	(Data Systems, EtherNet, WiFi, etc.)
F – Fire Alarm/Annunciation	(Fire Alarm Systems and Devices)
H – PLC/DCS Communications	(ModBus, Profibus, ControlNet, etc.)
P – Power	(Power feeder, branch circuits >115V)
T – Telephone/Voice	(Telephone/Voice Systems copper or fiber)
V – Video	(CCTV/Video Monitoring Systems)
Z – Security	(Security Systems)

b. Prefix, second letter (if applicable or used)

C – Copper Media	(Copper signal conductors)
F – Fiber Optic Media	(Fiber single-mode, multi-mode, etc.)
K – High Voltage	(Power feeder, branch circuits >600V)

c. Prefix, third letter (if applicable or used)

N – Non-Secured/Un-Classified	(Open, non-secured/un-classified systems)
F – Secured/Classified	(Closed, secured/classified systems)

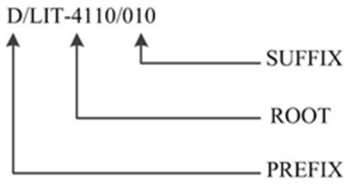
d. Root, alpha-numeric lettering as required and in accordance with the P&ID unique identifiers to reflect the equipment/device; examples:

FIT-20, PLC-1, VFD-4500, FCV-5010

e. Suffix, numeric indexed as required to coincide with the number of cables and/or conductors used; examples:

0100, 0110, 0120…0900

10. Sample Cable/Wire marker format should resemble the following:



1.5 DELIVERY, STORAGE AND HANDLING

A. Reference those applicable Specification Sections

1.6 OPERATION AND MAINTENANCE MANUALS

B. Reference those applicable Specification Sections

1.7 WARRANTY

A. Reference those applicable Specification Sections

1.8 IDENTIFICATION

A. Contractor shall reference the requirements in this Specification Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents all Identification for Electrical Systems products shall be provided by one manufacturer for each product type:

1. Brady
2. Electromark
3. Hazard Communication Systems
4. Hellermann Tyton
5. LEM Products
6. Panduit
7. Seton Name Plate
8. Safety Label Solutions
9. Approved Acceptable as Specified in the Owner's Approved Products List

2.2 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Furnish equipment nameplates as specified and as shown on the Contract Documents to indicate the unique equipment identifiers.

1. UV stabilized phenolic material rated for outdoor applications and 200F.
2. WHITE lettering on BLACK background.
3. 6IN by 1.5IN minimum.

B. Use the following equipment identification nameplate as a basis of design:



2.3 CONDUIT/RACEWAY IDENTIFICATION TAGS

A. Furnish and install conduit/raceway identification tags for all conduit, raceway, wire-way, cable-tray and wire-through, etc. to include but not limited to the following systems:

1. Power Systems
2. PLC/DCS Control Systems
3. Telephone/Voice/Data Systems
4. Fire Alarm and Security Systems
5. Video/CCTV Systems

B. All conduit/raceway identification tags shall conform to the following unless otherwise noted on the Contract Documents.

1. Indoor areas: UV stabilized phenolic
2. Indoor wet/corrosive areas: stainless steel 316L
3. Outdoor areas: aluminum 6063-T6 or stainless steel 304L
4. Outdoor corrosive areas: stainless steel 316L

C. Use the following conduit/raceway identification tags as a basis of design:



D. Reference previous Section 1.4B.4.

2.4 VOLTAGE SYSTEM WARNING LABELS

A. Furnish and install voltage system warning labels for transformers, switchgear, panelboards, starters, motor control centers, safety switches, pull boxes, cabinets, and raceways.

B. Provide flexible pressure sensitive vinyl markers with minimum 1IN by 4IN ORANGE or RED or background with BLACK lettering.

C. Use the following warning label as a basis of design:



D. Provide voltage markers with lettering indicating the highest voltage present:

1. 120V system: 120 VOLTS

2. 208/120V system: 208 VOLTS

3. 120/240V and 240V systems: 240 VOLTS

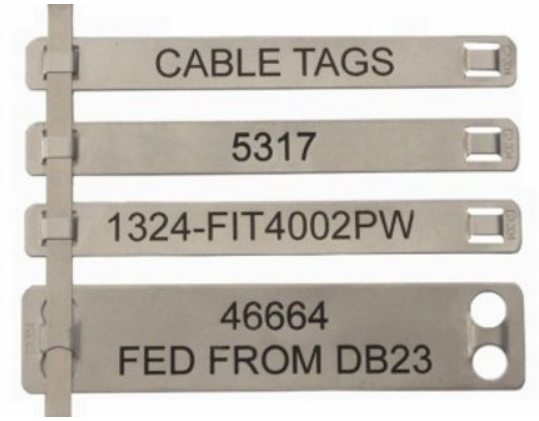
4. 480/277V and 480V systems: 480 VOLTS

5. 4160/2400V systems: 4160 VOLTS

2.5 WIRE/CABLE BUNDLE IDENTIFICATION TAGS

A. Provide and install to each wire/cable bundle routed through man-holes, hand-holes, electrical vaults, etc. laser etched stainless-steel tag with mounting holes to receive black, uv-resistant cable ties with the corresponding information in the approved Electrical Wire Schedule.

B. Use the following wire/cable bundle tags as a basis of design:



C. Reference previous Section 1.4B.5.

2.6 WIRE MARKERS

A. Provide and install wire markers for but not limited to; power, control, instrumentation, fire alarm, tele/comm, video, security and video circuit wires.

B. Furnish polyolefin whole and/or split sleeve, heat-shrinkable wire markers, size as required per wire, conductor, cable, etc.

C. Locate a wire marker on each and every cable, conductor or wire at switchgear, MCC, panelboards, pull boxes, outlet and junction boxes, and at each landed termination.

D. Provide and install typewritten BLACK lettering on WHITE label markers as follows but not limited to:

1. Power and lighting circuits: as-built branch circuit or feeder circuit number.

2. Motor control circuits: as-built control wire number or equipment manufacturer's wiring diagrams.

3. PLC/DCS signals

4. Telephone/Data Communications circuits

5. Fire Alarm and Security circuits

6. Video/CCTV circuits

E. Use the following warning label as a basis of design:



F. Reference previous Section 1.4B.5.

2.7 CABLE COLOR CODING

A. Color Coding

1. Unless otherwise noted on the Contract Documents, conductor insulation shall be color coded as follows:

a. 4160/2400V AC Power:

Phase A – BLACK

Phase B – RED

Phase C – BLUE

Grounding/Earthing conductors – GREEN

b. 480V AC Power:

Phase A - BROWN

Phase B - ORANGE

Phase C - YELLOW

Neutral – GREY

c. 120/208V or 120/240V AC Power:

Phase A - BLACK

Phase B - RED

Phase C - BLUE

Neutral – WHITE

d. 120VAC Control:

Ungrounded conductors – RED

Ungrounded conductors, foreign source - YELLOW.

e. 24VAC Control:

All wiring – ORANGE

f. 24VDC Power:

Positive Lead – RED

Negative Lead – BLACK

g. 24VDC Control:

Ungrounded conductors – BLUE

Grounded conductors – BLUE w/ WHITE stripe

h. Equipment Grounding Conductor:

All wiring – GREEN

2. Conductors #4AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored heat-shrinkable tubing.

2.8 WARNING SIGNS

A. Furnish warning signs for low-voltage and medium-voltage transformers, switchgear, switchboards, panelboards, motor starters, motor control centers, safety switches, pull boxes, and cabinets.

B. Use warning signs that conform to ANSI Z535.4 and OSHA Danger and Caution specifications.

C. Provide minimum 2IN by 4IN warning signs.

D. Provide warning signs with format and lettering as follows:

1. Signal word: DANGER

2. Signal word panel color: RED with safety alert symbol.

3. Word message: HAZARDOUS VOLTAGE SHOCK, BURN OR DEATH

4. Safety symbol: ISO 3864 “lightning bolt” in YELLOW triangle.

E. Materials:

1. For indoor applications use flexible, pressure sensitive, polyester base with polyester overlaminate.

2. For outdoor applications use aluminum signs.

2.9 WORKING SPACE LABELS

A. Provide labels indicating required working clearance at electrical equipment that is likely to require examination, adjustment, servicing, or maintenance while energized and it is impractical mark the NEC-required working space on the floor.

B. Material:

1. Use polyester label stock that is NRTL-recognized to UL969, Marking and Labeling Systems, and has a high adhesion adhesive back.

2. Use printing ribbon recommended by the label stock manufacturer.

3. Use a suitable thermal transfer process label-printing machine to generate labels and enter the application-specific information

4. Outdoor labels shall be suitable for a high-UV environment.

C. Minimum dimensions: 3.5IN by 1.25IN.

D. Use the following warning label design as a basis of design for this scope of work

NOTICE
Keep area in front of this electrical equipment clear for #-#/# feet. OSHA-NEC regulations.

1. Signal word: “NOTICE” in 24-point minimum white italic letters on safety blue panel.

2. Word message: 16-point minimum black or safety blue letters on white background.

a. Word message for 120/240V and 208/120V equipment: “Keep area in front of this electrical equipment clear for 3FT. OSHA-NEC regulations.”

b. Word message for 480V and 480/277V equipment with exposed live parts on one side of the working space and no live parts on the other side of the working space: “Keep area in front of this electrical equipment clear for 3.5FT OSHA-NEC regulations.”

c. Word message for 480V and 480/277V equipment with exposed live parts on both sides of the working space: “Keep area in front of this electrical equipment clear for 4FT OSHA-NEC regulations.”

2.10 DUCT-BANK SYSTEMS WARNING TAPE

A. Provide detectable underground warning tape for underground electrical systems as required and in accordance with the NEC and the Contract Documents.

1. Reference Specification Section: 16115 – UNDERGROUND CONDUIT DUCTS, MAN-HOLES, HAND-HOLES AND PULL-BOXES

B. Material

1. 5-MIL tape thickness with aluminum backing and 2-MIL clear laminated finished over lettering

2. Warning tape shall comply with APWA approved colors

C. Dimensions: 6IN by 1000FT

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, and manufacturer's wiring diagrams, with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Verify electrical equipment designations and unique equipment identifiers with Engineer, Engineer’s Representative and/or Owner.

3.2 INSTALLATION

A. Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

B. Install labels at locations for best convenience of viewing without interference with operation and maintenance of equipment.

1. Coordinate installation of identifying devices with location of access panels and doors.

2. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Install electrical identification products only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

D. Prepare, clean and/or de-grease surfaces where electrical identification product is to be placed.

E. Place electrical identification products centered and parallel to equipment lines.

3.3 EXAMINATION

A. Examine surfaces to receive identification products for compliance with installation tolerances and other conditions affecting performance of the identification products. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.4 EQUIPMENT NAMEPLATES

A. Install equipment nameplates on the front of each piece of new electrical equipment to include but not limited to switchgear, switchboards, motor control centers, control equipment, transformers, panelboards, lighting panelboards, safety switches, enclosed circuit breakers, etc.

B. Position equipment nameplates so they can be read from the front of the enclosure, cabinet, etc.

C. Use manufacturer's recommended adhesive for engraved tags and nameplates.

1. Additionally, equipment nameplates shall be fastened with stainless-steel machine screws; self-tapping fasteners are not acceptable and will be rejected to include re-placement of enclosure.

3.5 CONDUIT/RACEWAYS

A. Identification Tags

1. Install identification tags in accordance with the approved Electrical Systems Raceway Schedule on all but not limited to; power, control, data, fire, tele/comm, video and security system conduit and raceways.

2. Permanently attach laser-etched stainless-steel conduit/raceway tags with stainless steel wire and permanent crimp seal to each exposed terminal end of all conduit runs entering all electrical equipment such as switchgear, switchboards, motor control centers, control panels, pull/junction boxes, utilization equipment, and at each point leaving or entering a structure or building.

3. Position identification tags so they can be read from finished floor/grade visible and vertically or horizontally.

a. Engineer reserves the right during project close-out procedures that Contractor re-position and/or supplement conduit and raceway identification as Engineer and/or Owner requires at no additional cost.

4. Furnish identification tags for all conduit, raceway, wire-way, cable-tray and wire-through, etc. at each enclosure, equipment, junction/pull box, termination cabinet, etc. at terminal ends.

3.6 VOLTAGE SYSTEM WARNING LABELS

A. Install voltage system warning labels to all transformers, switchgear, panelboards, starters, motor control centers, safety switches, pull boxes, cabinets, and conduit/raceway systems.

1. Labels shall indicate the maximum voltage present with enclosures, equipment and conduit/raceway.

B. Electrical Equipment

1. Front and rear of each free-standing switchgear, switchboard and motor-control-center section.

2. Front of each transformer, panelboard, industrial control panel, enclosed circuit breaker, safety switch, and motor controller enclosure, including those furnished with mechanical equipment.

3. Front cover of each pull/junction box containing low-voltage or medium-voltage conductors.

C. Conduit/Raceways

1. Install voltage system warning labels to each exposed terminal end of all conduit runs entering all electrical equipment such as switchgear, switchboards, motor control centers, control panels, pull/junction boxes, utilization equipment, and at each point leaving or entering a structure or building.

a. Labels shall be applied to conduit/raceway systems at intervals no greater than twenty feet (20FT) along entire conduit/raceway run.

b. Position labels so they can be read from finished floor/grade and vertically or horizontally.

3.7 WIRE/CABLE BUNDLES IDENTIFICATION TAGS

A. Install in electrical vaults, man-holes, hand-holes, and underground pull/junction boxes. Vaults only in substitution of stainless-steel conduit/raceway tag identification system.

B. Provide laser-etched stainless-steel tag with uv-resistant cable ties attached to a minimum of one (1) wire/cable bundle associated with each raceway.

C. All wire/cable bundles shall be tagged with its approved tag number per the approved Electrical Wire Schedule immediately after it has been pulled.

3.8 WIRE MARKERS AND CABLE COLOR CODING

A. Install wire markers on all but not limited to; power, control, data, fire, tele/comm, video and security system conductors within all termination, splicing, marshalling, junction-box, devices, cabinets and enclosures.

B. Install wire markers within all switchgear, switchboards, motor control centers, panelboards, lighting panelboards, safety switches, etc.

1. Wire markers shall be installed on all terminated/spliced wire, cable and conductor ends regardless of the number of enclosures that they are routed through.

2. Contractor shall inspect and ensure that all wire markers match on all terminated/spliced ends and correspond with the approved Cable/Wire marker schedule.

3. Engineer reserves the right during project close-out procedures that Contractor re-install wire markers as Engineer and/or Owner requires at no additional cost.

C. Position wire markers so they can be read when opening the enclosure door and without rotating the wire/conductor when landed on terminal strips.

D. Contractor shall re-install wire markers that are blurred, smudged, ill-legible, mis-printed, damaged or soiled at no additional cost.

3.9 WARNING SIGNS

A. Install warning signs at the following locations and position signs so they can be read from floor or ground:

1. Front and rear of each low-voltage switchgear or switchboard section.

2. Front of each low-voltage transformer, switchboard, panelboard, industrial control panel, motor control center, enclosed circuit breaker, safety switch, and motor starter enclosure including those furnished with mechanical equipment.

3.10 WORKING SPACE LABELS

A. Install working space labels at the following locations only in cases where it is impractical to mark the NEC-required working space on the floor (e.g. carpeted areas).

1. Front of each low-voltage switchgear or switchboard section and rear of each freestanding low-voltage switchgear or switchboard section.

2. Front of each meter enclosure, low-voltage transformer, panelboard, industrial control panel, motor control center, enclosed circuit breaker, safety switch, and motor controller enclosure, including those furnished with mechanical equipment.

3. Any other equipment likely to require examination, adjustment, servicing, or maintenance while energized.

B. Position labels so they can be read from floor or ground.

3.11 DUCT-BANK SYSTEMS WARNING TAPE

A. Provide warning tape(s) as follows:

1. Electrical duct-bank systems, trenches and raceways:

a. Legend: “CAUTION CAUTION CAUTION” (1st line), “BURIED ELECTRIC LINE” (2nd line).

b. Letters: 1 1/4IN minimum.

c. Interval: Continuous.

d. Color: BLACK lettering on RED background.

2. Tele-Communication duct-bank systems, trenches and raceways:

a. Legend: “CAUTION CAUTION CAUTION” (1st line), “BURIED TELEPHONE LINE” (2nd line).

b. Letters: 1 1/4IN minimum.

c. Interval: Continuous.

d. Color: BLACK lettering on ORANGE background.

3. SCADA duct-bank systems, trenches and raceways:

a. Legend: “CAUTION CAUTION CAUTION” (1st line), “BURIED COMPUTER LINE” (2nd line).

b. Letters: 1 1/4IN minimum.

c. Interval: Continuous.

d. Color: BLACK lettering on ORANGE background.

3.12 PROJECT CLOSEOUT

Contractor shall replace any Identification device that has been damaged, lost, illegible, etc. during the course of construction and indicate those replacements to the Owner and/or Engineer prior to Project close-out.

END OF SECTION 16075

SECTION 16080 – ELECTRICAL TESTING

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish all labor, materials, equipment and incidentals required to providing standard electrical inspections, testing and commissioning services and required reports required under this Contract as hereinafter specified and/or in the Contract Documents.

B. Requirements include but not limited to:

1. Contractor responsibilities that are a part of, or are related to the testing and commissioning process for the all the electrical systems under the Electrical Scope Of Work and as related in the Contract Documents.

2. Engineer will review and approve, prior to use, all test procedures and forms used and will witness, at their discretion initial checks and testing performed by the Contractor. Engineer will review the completed check and test documentation of the Contractor.

3. It is not the intent under the Division 16 Specifications to duplicate Contractor efforts or to require the Contractor to perform any check or test more than twice. Electrical checks and testing by the Contractor are expected to occur once in the normal sequence of installation, testing and placing equipment into service, if appropriate coordination has occurred allowing the Engineer and/or Owner to witness Contractor efforts.

4. Testing requirements listed under this Specification Section do not release the Contractor from the obligation to perform all other appropriate, industry standard, manufacturer-recommended or code-required checks and tests.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

B. Related Specification Section(s) include

1. Division 2 – SITEWORK

1.3 REFERENCES

A. Codes and Standards

1. Institute of Electrical and Electronic Engineers (IEEE)

a. 43 – Recommended Practice for Testing Insulation Resistance of Rotating Machinery

b. 450 – Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications

c. 519 – Recommended Practices and Requirements for Harmonics Control in Electrical Power Systems

d. C37.233 – Guide for Power System Protection Testing

e. C57.13.1 – Guide for Field Testing of Relaying Current Transformers

f. C57.13.3 – Guide for Grounding of Instrument Transformer Secondary Circuits and Cases

g. C57.104 – Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers

2. International Electrical Testing Association (NETA)

a. ATS – Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems

b. ETT – Standard for Certification of Electrical Testing Technicians

3. North American Electric Reliability Corporation (NERC)

a. PRC-005-2 – Protection System Maintenance

4. National Electrical Manufacturers Association (NEMA)

a. AB4 – Guidelines for Inspection and Preventive Maintenance of Molded-Case Circuit Breakers Used in Commercial and Industrial Applications

b. MG1 – Motors and Generators

5. National Fire Protection Association (NFPA)

a. 70, National Electrical Code

b. 70E, Standard for Electrical Safety in the Workplace

c. 72, National Fire Alarm and Signaling Code

d. 110, Emergency and Standby Power Systems

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. Contractor shall submit written copies of all inspection and test reports to the Engineer for review and acceptance.

C. Sixty days (60DY) before any testing is conducted, submit an overall testing plan and schedule for electrical systems that lists the equipment, modes to be tested, dates of testing and parties conducting the tests. Contractor shall place these tests into the master construction schedule and update as needed.

D. Qualifications

1. Contractor shall provide a listing of testing personnel stating their experience in testing of medium-voltage (5kV though 35kV) equipment and cabling for Engineer approval.

2. Contractor shall provide a listing of testing personnel stating their experience in testing of low-voltage (600V) equipment and cabling for Engineer approval.

3. All personnel involved in testing major electrical equipment, protective relays and meters shall be certified per ANSI/NETA ETT and have a minimum of five years (5YR) experience in testing of this type of equipment; each electrical testing crew leader shall have a current certification of Level III or higher.

4. Contractor shall provide a listing of testing equipment that will be used and provide verification of calibration as applicable within the last year, prior to use and shall have dated calibration labels visible on all test equipment. Test equipment and calibration shall be in accordance with ANSI/NETA ATS Sections 5.2 and 5.3.

E. Test Equipment:

1. Contractor shall provide all test equipment necessary to fulfill the checks and testing requirements. Test equipment shall have been calibrated within one year (1YR) of its use on the Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Reference those applicable Specification Sections

1.6 OPERATION AND MAINTENANCE MANUALS

A. Reference those applicable Specification Sections

1.7 WARRANTY

A. Reference those applicable Specification Sections

1.8 IDENTIFICATION

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate with all trades, subcontractors, vendor representatives, with Engineer, Engineer's Representative and/or Owner prior to executing Testing and Commissioning Plan(s).

3.2 EXAMINATION

A. Engineer reserves the right to inspect the Contractor's work at any time during the contract period. Contractor shall make all work available to the Owner and/or the Engineer, upon request.

B. Contractor shall request Engineer review and approval at least twenty-four-hours (24HR) prior to covering of any concealed work; pulling of wires and cables; or placing covers over outlets, cabinets, panel boards, switchboards, or switchgear.

C. Perform additional tests required under other Specification Sections required under Division 16. Written reports of all test results shall be submitted to Engineer for review.

D. Notify Engineer of any deficiencies that are found during the tests; after deficiencies are corrected, repeat tests until the system is approved. When applicable, electrical work shall not be covered or concealed until satisfactory tests are made and approved.

E. Upon request from the Owner and/or Engineer, place the entire electrical installation or any portion thereof, in operation to demonstrate satisfactory operation.

F. Contractor shall inspect and test all materials and equipment, including all furnished major equipment under this Contract, using the latest edition of the ANSI/NETA ATS – Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems as a guide. The ANSI/NETA ATS specifications apply to testing of all electrical equipment and cabling installed and/or modified under this Project prior to placing into service.

3.3 INSPECTION AND TESTING

A. Inspections and testing procedures shall include but not limited to the following:

1. Transformers, Dry-Type: ANSI/NETA ATS Section 7.2.1.1

2. Cables, Low-Voltage 600V: ANSI/NETA ATS Section 7.3.2

3. Grounding Systems: ANSI/NETA ATS Section 7.13

4. Adjustable Speed Drive Systems: ANSI/NETA ATS Section 7.17

5. Engine Driven Generator: ANSI/NETA ATS Section 7.22.1

B. Test Reports: All testing results, evaluations and operational/functionality reports for all equipment and cabling installed and/or modified under this Contract shall be recorded in a formal report and submitted to the Engineer for review.

3.4 COMMISSIONING

A. The following are Contractor responsibilities applicable to all electrical systems being commissioned and/or placed into service.

1. Document all electrical testing and commissioning forms submitted to and approved by the Engineer prior to placing equipment into service.

2. Notify the Engineer immediately when commissioning activities not yet performed or not yet scheduled will delay construction.

3. Respond to deficiencies identified during the commissioning process, making required corrections or clarifications and returning prompt notification to the Engineer.

4. When completion of a task or other issue has been identified as holding up any commissioning process, particularly functional testing, the Contractor shall, within two days (2DY) notify the Engineer in writing providing an expected date of completion.

5. Develop check and testing procedures with start-up and/or commissioning plan for Engineer review.

6. Review design documents, shop drawings and O&M manuals along with manufacturer recommended installation and testing procedures.

7. Develop test procedures and forms and execute and document testing.

8. Tests of energized equipment shall be conducted when the equipment is operating at its normal capacity. This may require some tests to be conducted after occupancy.

3.5 TRAINING AND ORIENTATION

A. Contractor shall provide orientation and training to facility personnel as required in Division 16 and those Project Specification Sections.

3.6 PROJECT CLOSE-OUT

A. Contractor shall provide all Testing and Commissioning test results and corrective actions complied into one (1) comprehensive report for Project close-out requirements.

END OF SECTION 16080

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SECTION 16111 – CONDUIT AND RACEWAY

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into service all Electrical Raceway Systems to include all conduits, conduit fittings, wireway, supports, etc. as required for a complete electric installation as specified herein and indicated on the Contract Documents.

B. Conduit home runs for lighting, receptacle and other miscellaneous circuits are not necessarily depicted on the Contract Documents; however, the circuit numbers are shown. Conduit shall be furnished and installed for these circuits.

C. Additional raceways from what are not shown on the Contract Documents may be required. Contractor shall coordinate with the requirements in the approved equipment submittals provided under other Divisions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 16 and those Project Documents referenced herein shall be applied.

B. Related Specification Section(s) include but not limited to

1. Division 2 – SITEWORK

2. 16120 – CONDUCTORS AND CABLES

3. 16070 – HANGERS AND SUPPORTS

1.3 REFERENCES

A. Electrical Raceway Systems shall comply with the following applicable codes and standards as well as any others within the specifications and Contract Documents. In the event of any conflict between these codes, regulations, standards, and Contract Documents, the most restrictive shall apply.

B. Codes and Standards

1. American National Standards Institute (ANSI)

a. C80.1, Rigid Steel Conduit Zinc Coated.

b. C80.3, Electrical Metallic Tubing Zinc Coated.

c. C80.4 Fittings for Rigid Metal Conduit and Electrical Metallic Tubing

d. C80.5 Electrical Rigid Aluminum Conduit

e. C80.6 Electrical Intermediate Metal Conduit

2. American Society for Testing and Materials (ASTM)

a. A36, Standard Specification for Structural Steel

b. A153, Zinc Coating (Hot Dip) on Iron and Steel Hardware

c. A307, Carbon Steel Externally Threaded Standard Fasteners

d. A563, Standard Specification for Carbon Steel Nuts

e. A569, Steel Carbon, Hot Rolled Sheet and Strip, Commercial Quality

f. A570, Hot Rolled Sheet and Strip, Structural Quality

g. A575, Merchant Quality Hot Rolled Carbon Steel Bars

h. A635, Standard Specification for Steel, Sheet and Strip, Heavy Thickness Coils, Carbon, Hot Rolled

i. D1248-Specification for Polyethylene Plastic Molding and Extrusion Material

j. D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

k. D1788, Standard Specification for Rigid Acrylonitrile Butadiene Styrene (ABS) Plastics

l. D2239-Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

m. D2412-Test Method for External Loading Properties of Plastic Pipe by Parallel Plate Loading

n. D2447- Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on O.D.

o. D2564, Solvent Cements for (PVC) Plastic Pipe, Tubing, and Fittings

p. D2737-Standard for Polyethylene (PE) Plastic Tubing

q. D3035-Polyethylene (PE) Plastic Pipe Based on Controlled O.D.

r. D3350-Polyethylene Plastic Pipe and Fittings Material

s. D3485-Smooth Wall Coilable (PE) Conduit (Duct) for Preassembled Wire and Cable

t. F512, Standard Specification for Smooth Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

3. ETL Testing Laboratories, Inc (ETL)

4. National Electric Contractors Association (NECA)

   a. NECA 1: Standard Practices for Good Workmanship in Electrical Construction

   b. Project applicable standards and recommendations

5. National Electric Installation Standards (NEiS)

   a. Project applicable standards and recommendations

6. National Electric Manufacturers Association (NEMA)

   a. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

   b. TC 2, Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)

   c. TC 6, PVC and ABS Plastic Utilities Duct for Underground Installation

   d. TC 7, Standard for High Density Polyethylene (HDPE) Raceway Conduit

7. National Fire Protection Association (NFPA)

   a. 70, National Electric Code (NEC)

   b. 79, Electrical Standard for Industrial Machinery

8. Underwriters Laboratories Inc (UL)

   a. 1, Flexible Metal Conduit

   b. 6, Rigid Metal Conduit

   c. 6A, Electrical Rigid Metal Conduit – Aluminum

   d. 209, Cellular Metal Floor Raceways and Fittings

   e. 360, Liquid Tight Flexible Steel Conduit

   f. 467, Grounding and Bonding Equipment

   g. 514, Nonmetallic Outlet Boxes, Flush Device Boxes, and Covers

h. 514B, Conduit, Tubing and Cable Fittings

i. 651, Schedule 40 and 80 Rigid PVC Conduit

j. 797, Electrical Metallic Tubing

k. 870, Wireways, Auxiliary Gutters, and Associated Fittings

l. 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

m. 1242, Intermediate Metal Conduit

n. 1660, Liquid-Tight Flexible Non-Metallic Conduit

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. Construction Drawings

1. Proposed routing of all site conduits including direct buried, concrete encased, and long run above ground conduits.

2. Proposed routing of conduits under floor slabs.

3. Proposed routing and details of construction, including conduit and rebar, of conduits embedded in floor slabs, columns, etc.

1.5 DELIVERY, STORAGE AND HANDLING

A. All raceways, fittings and associated components shall be handled and stored in accordance with manufacturer's instructions and recommendations.

B. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

C. Store in a clean, dry space. an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Contractor shall reference and provide all Operation and Maintenance Manuals for those applicable Division 16 Sections as required per Specification Section(s)

1. 01782 – OPERATION AND MAINTENANCE DATA

1.7 WARRANTY

A. Manufacturer shall warrant Electrical Raceway Systems materials to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. All Electrical Raceway Systems shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents Electrical Raceway Systems shall be provided by one (1) manufacturer for each product type listed in subsequent Sections of this Specification.

2.2 RIGID ALUMINUM CONDUIT (RAC)

A. Product Manufacturers

1. Allied Tube and Conduit Corporation
2. Western Tube and Conduit Corporation
3. Wheatland Tube Company
4. Engineer Approved Equal

B. RAC and associated fittings shall be manufactured from 6063 aluminum alloy in temper designation T-1.

C. RAC shall only be allowed where specified on the Contract Documents.

2.3 PVC COATED RIGID ALUMINUM CONDUIT (PVC-RAC)

A. Acceptable Manufacturers:

1. Thomas & Betts
2. Perma-Cote
3. Rob Roy Ind.

B. PVC-RAC shall have a minimum 40MIL polyvinyl chloride exterior coating. The coating shall be bonded to hot dipped galvanized rigid steel conduit conforming to ANSI C80.1. The bond between the polyvinyl chloride coating and the conduit surface shall be greater than the tensile strength of the coating. PVC-RAC shall have a nominal 2MIL, minimum, urethane interior coating and a urethane coating

on threads. RAC conduit: shall have an epoxy prime coating prior to application of polyvinyl chloride and urethane coatings.

C. Female ends shall have a plastic sleeve extending a minimum of 1 pipe diameter or 2IN, whichever is less beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.

D. Standards:

1. ANSI C80.1

2. NEMA RN 1

2.4 RIGID POLYVINYL CHLORIDE CONDUIT (PVC)

A. Product Manufacturers

1. Allied Tube and Conduit Corporation
2. Carlon
3. Cantex
4. Engineer Approved Equal

B. PVC shall be either Schedule-40 or Schedule-80. The polyvinyl-chloride plastic compound shall meet, as a minimum, ASTM D1784 cell classification PVC 12233-A, B, or C. PVC shall be rated for direct sunlight exposure, 90C wire, and fire retardant with low smoke emission.

C. PVC shall only be allowed where specified on the Contract Documents.

2.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Product Manufacturers

1. Anamet, Inc.
2. Electri-Flex Company
3. International Metal Hose Company
4. Engineer Approved Equal

B. LFMC shall have a core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked, contain an interwoven copper strip suitable as a grounding means, and have an extruded vapor and liquid tight polyvinyl chloride outer jacket positively locked to the steel core.

C. LFMC shall only be allowed where specified on the Contract Documents.

2.6 CONDUIT FITTINGS AND ACCESSORIES

A. Manufacturers

1. Electrical Raceway Systems fittings, conduit bodies, splicing materials, etc. shall be provided by one (1) manufacturer for each product type used as listed below

    a. Appleton

    b. Carlon

    c. Crouse-Hinds

    d. Killark

    e. OZ Gedney Company

    f. Perma-Cote

    g. RACO

    h. Rob-Roy Industries

    i. Steel City

    j. Thomas and Betts

    k. Western Plastics Company

    l. Engineer Approved Equal

B. RAC Fittings

1. Materials: Following minimum requirements unless otherwise noted on the Contract Documents.

    a. Body: Copper-free aluminum with aluminum lacquer or aluminum enamel finish

    b. Covers: Copper-free aluminum and gasketed

    c. Gaskets: Neoprene or PVC

    d. Insulators-phenolic, thermosetting: minimum 105C UL rating.

    e. Grounding saddles tin-plated copper or bronze suitable for use with copper and aluminum conductors.

    f. Bonding jumpers: Tinned copper flexible braid

    g. Locknuts: Malleable iron, zinc plated

2. All fittings: Threaded unless otherwise noted on the Contract Documents.
3. Conduit Hubs shall be cast aluminum with insulated throat
4. Straight couplings shall be same material and finish as the conduit with which they are used.
5. Mogul pulling elbows and tees:

    a. Die cast copper free aluminum

    b. Rain tight

6. Conduit seals:

a. Drain and breather: Stainless steel or brass

b. Fiber and sealing compound: UL listed for use with the sealing fitting

C. PVC-RAC Fittings

1. The same material and construction as those fittings listed under paragraph "Fittings for Use with RAC"; and coated as defined under paragraph "PVC-RAC".

D. PVC Fittings

1. Fittings shall be of the same material, thickness, and construction as the conduits with which they are used.

2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.

a. Shall not be more than one year (1YR) past date of manufacture.

E. LFMC Fittings

1. Fittings shall meet the following minimum requirements unless otherwise noted:

a. Body: Malleable iron, zinc-plated

b. Ferrule: Steel, zinc-plated

c. Locknuts and compression nuts: Malleable iron, zinc-plated

2. Sealing ring: Neoprene

3. Fittings shall be compression type.

2.7 HANGERS AND SUPPORTS

A. Reference Specification Section 16070 – HANGERS AND SUPPORTS

PART 3 - EXECUTION

3.1 GENERAL

A. Electrical Raceway Systems and associated appurtenances shall be designed, constructed and installed in accordance with the best practices of the trade as complete assemblies as intended on the Contract Documents.

3.2 COORDINATION

A. Contractor shall coordinate Electrical Raceway Systems design and installation in accordance with the approved equipment submittals to provide best raceway rough-in locations and final terminations to that equipment.

3.3 INSTALLATION

A. Contractor shall plan the layout of Electrical Raceway Systems so that when the work is complete it will exhibit good workmanship practices in accordance with NECA-1.

1. Exposed raceway groupings three (3) or more shall use a common support/hanger systems with standard radius bends and be arranged such that no cross-overs and saddle bending is required.

2. Exposed raceway groupings twenty (20) or more shall use a common support/hanger systems with concentric radii bends and be arranged such that no cross-overs and saddle bending is required.

3. Exposed raceways and raceway systems that are not organized and grouped in a logical manner are consider rejected work by the Engineer.

B. Exposed Work

1. Wherever practical, Electrical Raceway Systems for power and control circuitry designated for process related equipment shall be installed exposed.

C. Concealed Work

1. All Electrical Raceway Systems for power and control circuitry designated for non-process related equipment shall be installed concealed within structures and/or buildings.

2. All Electrical Raceway Systems for branch, receptacle, lighting and/or ancillary systems shall be installed concealed within structures and/or buildings.

D. Installation of Raceway

1. Raceways embedded in concrete slabs shall be installed in the middle third of the slab thickness with at least 2IN concrete cover. Raceways shall be secured to reinforcing steel to prevent sagging or shifting during concrete placement. Raceways shall be spaced laterally to prevent voids in the concrete. Reference installation details as shown in the Contract Documents.

2. Raceways, where shown in the Contract Documents, indicate the preferred location. Site conditions may affect actual routing. Contractor shall coordinate routing and measurement with other trades and with equipment suppliers.

3. Shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.

4. Wherever possible avoid routing conduits and raceways through areas of high ambient temperature or radiant heat.

E. Size of Raceway

1. The size of raceway are normally shown on the Contract Documents. If a size is not shown on the Contract Documents, or if a minimum size is not stated in the Specifications, then the size of raceway shall be in accordance with the NEC.

2. Raceway shall not be smaller than 1IN for underground installations and 3/4IN elsewhere, unless otherwise shown on the Contract Documents.

F. Types of Raceway

1. Shall be installed as defined in the Contract Documents and as required by NFPA.

2. Flexible Conduit

a. Install as the final conduit to motors, electrically operated valves, primary elements (instrumentation), and electrical equipment that is liable to vibrate.

b. Shall not be used as a conduit run:

c. Maximum length shall not exceed:

1) 60IN to motors.

2) 48IN to all other equipment.

3. PVC-RAC

a. Contractor shall use tools, clamps, dies, equipment, etc. designed specifically for the cutting, bending and threading of PVC-RAC.

b. Contractor shall follow the recommendations and methods of the manufacturer for installing PVC-RAC.

c. Contractor shall repair small (less than 1IN) nicks and cuts to the outer PVC coating per the manufacturer's instructions. If the damaged area is larger (greater than 1IN), the conduit section shall be replaced.

G. Provide openings in walls, floors, and ceilings for all required raceway penetrations.

1. Sleeves and block outs: Set in masonry walls during erection.

2. Sleeves and block outs: Set in concrete during forming.

a. Material: Not harmful to the concrete.

b. Not considered to replace structurally the displaced concrete.

H. Raceway Routing

1. All raceway within a structure shall be installed concealed unless otherwise noted on the Contract Documents.

2. Total of Bends

a. Less than 270-degrees.

b. Provide pull boxes, conduit bodies, condulets, or pulling elbows or tees as needed.

3. Run in straight lines parallel to or at right angles to structural members or building lines.

4. Maintain minimum 2IN separation between all conduits.

5. Maintain minimum 6IN separation between instrumentation and power conduits.

6. Maintain minimum 12IN separation from process, gas, air and water pipes.

7. Raceway and accessories embedded in concrete

a. Shall not be larger in outside diameter than one third the thickness of the slab, column or beam.

b. Place raceway and accessories after reinforcing steel has been laid.

c. Shall not displace the reinforcement steel.

d. Provide a minimum of 1-1/2IN of concrete cover around conduit.

e. Do not run against reinforcing steel.

f. Provide 2IN minimum of spacing between conduits.

g. Install expansion/deflection fittings wherever conduit spans structural or expansion joint.

I. Field Bending

1. Utilize tools, equipment, methods and recommendations by the manufacturer to make all field bends.

2. The internal diameter of raceway shall not be reduced or distorted.

J. Field Cutting and Threading

1. Utilize tools, equipment, methods and recommendations by the manufacturer to field cut and thread raceway.

2. All field cut raceway shall be cut perpendicular, smooth and evenly chamfered on the inside.

3. All field threaded raceway shall be wire-brushed, cleaned and degreased before applying a zinc rich paint.

K. Terminating

1. NEMA 3/3R/3S/13 enclosures:

a. Top: Not allowable on new work and considered rejected work by Engineer.

b. Side: Threaded conduit hubs with insulated throats, threaded grounding conduit hubs with insulated throats or approved cable gland fittings Double sealing locknuts and insulated or grounding bushings.

c. Bottom: Double locknuts and insulated or grounding bushings.

2. NEMA 4/4X enclosures

a. Top: Not allowable on new work and considered rejected work by Engineer.

b. Side: Not allowable on new work and considered rejected work by Engineer.

c. Bottom: Threaded conduit hubs with insulated throats, threaded grounding conduit hubs with insulated throats or approved cable gland fittings.

L. Bodies

1. Raceway bodies shall be installed such that access to covers are maximized and exceed the intent of “Readily Accessible” as described in NEC Article 100. Contractor shall provide and install those raceway body types/models as required to facilitate this requirement in the installation of completed Electrical Raceway Systems.

2. Raceway bodies containing conductors #4/0AWG and larger shall be “Mogul” type with domed covers and integral rollers.

M. Moisture Sealing

1. All exposed enclosures located outdoors with raceway routed underground or from interior to exterior locations shall have

a. Sealant filled within each raceway opening.

1) Polywater P/N FST-205KIT1 or approved equal

N. Coatings

1. The protective coating of metallic raceway, fittings, and accessories shall be maintained.

a. Repair PVC-RAC utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit.

1) The total nominal thickness: 40MIL.

b. Repair surfaces that will be inaccessible after installation prior to installation.

2. All metallic raceways installed in direct contact with concrete, masonry or soils shall be

a. PVC-RAC

b. Installed with heavy-wall heat-shrink polyolefin tubing.

c. Two (2) spiral half-lapped layers of 3M (or approved equal) Type-50 all-weather corrosion protection tape.

d. Installed with 40MIL minimum coating of cured coal-tar bitumastic paint.

3. All metallic raceway transitions through concrete, masonry or soils shall be

a. PVC-RAC

b. Installed with heavy-wall heat-shrink polyolefin tubing extending 6IN minimum on each side of transition.

c. Two (2) spiral half-lapped layers of 3M (or approved equal) Type-50 all-weather corrosion protection tape extending 6IN above finished concrete and below.

d. Installed with 40MIL minimum coating of cured coal-tar bitumastic paint.

O. Feeder Conductor Pulling Preparation

1. The following preparation procedures are required for but not limited to service-entrance, critical systems, emergency power, legally required and process critical equipment raceways larger than 3IN.

a. Pull raceway wire brush sized for raceway and draw within to remove larger debris.

b. Swab raceway by pulling a clean, tight fitting rag through the raceway as many times as required to remove smaller debris, dirt, sand, mud, etc.

c. Pull mandrel with diameter nominally 1/4IN smaller than the internal diameter of the raceway, to ensure circular cross-section and removal of any obstructions.

d. Remove water debris from raceway prior to installation of power cables.

e. Tightly plug ends of conduit with manufactured pipe plugs or plastic conduit inserts until power cables are pulled.

f. Only nylon or polyethylene rope shall be used to pull power cables in rigid nonmetallic conduit systems.

3.4 PROJECT CLOSEOUT

A. All Electrical Raceway Systems shall be cleaned and free of dust, grease, oil and debris for project close-out acceptance.

B. All labeling shall be installed in accordance with the following Specification Section(s) to complete project close-out activities and acceptance.

1. 16075 – ELECTRICAL IDENTIFICATION

END OF SECTION 16111

SECTION 16120 – CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, ready for service, all Low-Voltage Power and Control Conductors as indicated on the Contract Documents and as specified herein or required for proper operation of the installation, with the exception of internal wiring provided by electrical equipment manufacturers. The work of connecting cables to equipment, machinery, and devices shall be considered a part of this Section. All hardware, junction boxes, bolts, clamps, insulators, and fittings required for the installation of cable and wires system shall be furnished and installed by the Contractor

B. Low-Voltage Power and Control Conductors to be furnished and installed for this Project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten years (10YR).

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

B. Related Specification Section(s) include but not limited to:

1. 16075 –ELECTRICAL IDENTIFICATION

2. 16111 – CONDUIT AND RACEWAY

1.3 REFERENCES

A. All Low-Voltage Power and Control Conductors components and/or systems shall be listed and labeled by a nationally recognized testing laboratory (NRTL) such as: UL, ETL, CSA, or FM; shall be labeled and/or listed as part of a UL-labeled assembly, or shall be evaluated by a third party acceptable to the Authority Having Jurisdiction (AHJ) as suitable for the use intended. All labels shall be applied at the manufacturer's factory or facility prior to shipment.

B. Codes and Standards

1. American National Standards Institute (ANSI)

a. P-32-382 – Short Circuit Characteristics of Insulated Cable

b. S-70-547 – Weather-Resistant Polyolefin-Covered Conductors

c. S-81-570 – 600 Volt Cables of Ruggedized Design for Direct Burial Installation as Single Conductors or Assemblies of Single Conductors

d. S-105-692 – 600 Volt Single Layer Thermoset Insulated Utility Underground Distribution Cable

e. T-31-610 – Longitudinal Water Penetration Resistance Tests

2. American Society for Testing and Materials (ASTM)

a. B3 – Standard Specification for Soft or Annealed Copper Wire

b. B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

c. B33 – Standard Specification for Tin-Coated Soft or Annealed Copper Wire

d. D2301 – Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

3. Institute of Electrical and Electronic Engineers (IEEE)

a. 82 – Test Procedure for Impulse Voltage Tests on Insulated Conductors

b. 525 – Design and Installation of Cable Systems in Substations

c. 576 – Recommended practice for installation, termination, and testing of insulated power cable as used in industrial and commercial applications

d. 590 – Cable Plowing Guide

e. 789 – Performance Requirements for Communications and Control Cables for Application in High Voltage Environments

f. 816 – Determining the Smoke Generation of Solid Materials Used for Insulations and Coverings of Electric Wire and Cable

g. 1185 – Cable Installation in Generating Stations and Industrial Facilities

h. 1202 – FT4 Vertical Tray Flame Test (70,000 BTU/hr)

4. Insulated Cable Engineers Association (ICEA)

a. S-58-679 – Control Cable Conductor Identification Method 1

b. S-73-532 – Standard for Control, Thermocouple Extension and Instrumentation Cables

c. S-95-658 – Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

d. T-22-294 – Test Procedures for Extended Time-Testing of Wire and Cable Insulations for Service in Wet Locations

e. T-29-520 – Vertical Tray Flame Tests at 210,000 BTU

5. International Electrical Testing Association (NETA)

a. ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems

6. National Electrical Manufacturers Association (NEMA)

a. PB 1.1 – General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less

b. WC 53 – Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation, and Portable Cables

c. WC 57 – Standard for Control, Thermocouple Extension, and Instrumentation Cables

d. WC 70 – Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

7. National Fire Protection Association (NFPA)

a. 70, National Electrical Code

b. 70E, Standard for Electric Safety in the Workplace

8. Underwriters Laboratories, Inc. (UL)

a. 44 – Thermoset-Insulated Wires and Cables

b. 66 – Fixture Wire Type TFFN

c. 83 – Thermoplastic-Insulated Wires and Cables

d. 486A, B – Wire Connectors and Soldering Lugs for use with Copper Conductors

e. 486C – Splicing Wire Connectors

f. 486D – Sealed Wire Connector Systems

g. 493 – Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables

h. 719 – Nonmetallic-Sheathed Cables

i. 854 – Service-Entrance Cables

j. 1277 – Electrical Power and Control Tray Cables with Optional-Fiber Members

k. 1569 – Metal-Clad Cables

l. 1581 – Reference Standard for Electrical Wires, Cables, and Flexible Cords

m. 3173 – Chemically Cross-linked Polyethylene

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. Contractor shall obtain from the wire and cable manufacturer and submit the following at a minimum:

1. Shop Drawings

a. Drawings shall include, but not limited to, detailed specifications and product data sheets for all cabling required for this Project.

b. Material specifications and product data sheets identifying all materials used and methods of fabrication.

c. Cable and wire identification methods and materials.

d. Reports of Certified Shop and Field Tests

2. Electrical Raceway and Cable Schedule

a. Submit an Electrical Raceway and Cable Schedule that aligns with requirements in Section 16075 – ELECTRICAL IDENTIFICATION for all power, control, signal, process, data and protective circuits. The schedule shall be submitted for Engineer review in an electronic spreadsheet type Excel compatible file format. The schedule shall include but not limited to the following data:

1) Raceway ID Tag

2) From Description and ID Tag

3) To Description and ID Tag

4) Cable/Conductor/Wire type, size and number

5) Raceway type and size

6) Service, e.g. voltage, data, communications

7) Ductbank Call-Outs, if installed and/or routed

8) Contractor additional notes

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements

1. Low-Voltage Power and Control Conductors shall be delivered in continuous lengths on non-returnable reels.

2. Contractor shall not accept any cable reel if the outer protection paper/plastic has been punctured, torn or compromised in any way, or if the reel itself has been significantly damaged.

B. Storage and Handling Requirements

1. Low-Voltage Power and Control Conductors shall be stored in accordance with the manufacturer instructions and recommendations applicable for the Project site conditions. Low-Voltage Power and Control Conductors shall be stored on a hard surface and not in direct contract with the earth. Low-Voltage Power and Control Conductors shall be stored in an area where construction equipment, falling or flying objects, chemicals or petroleum products, sources of high heat, etc., will not contact or cause damage to the materials.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Contractor shall reference and provide all Operation and Maintenance Manuals for those applicable Division 16 Sections as required per Specification Section(s)

1. 01782 – OPERATION AND MAINTENANCE DATA

1.7 WARRANTY

A. Manufacturer shall warrant Low-Voltage Power and Control Conductors to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. Low-Voltage Power and Control Conductors shall be identified with the tag number(s) as indicated on the Contract Documents and/or the approved shop drawings.

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents all Low-Voltage Power and Control Conductors, terminations, fittings, splicing materials, etc. shall be provided by one (1) manufacturer for each product type listed in subsequent Sections of this Specification.

2.2 FEEDER CIRCUIT CONDUCTORS

A. Product Manufacturers

1. Allied Wire & Cable, Inc
2. General Cable Technologies Corporation
3. Houston Wire & Cable Company
4. Southwire Company LLC
5. Engineer Approved Equal

B. All feeder circuit conductors shall be stranded copper per ASTM-B8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise noted on the Contract Documents.

C. All feeder circuit conductors installed in exterior and underground locations shall consist of stranded, copper (individual conductors or multi-conductor cable) with 600V rated insulation type XHHW-2, 90C

D. Those feeder conductors installed within the interior spaces of structures and/or buildings that are not wet, corrosive or underground locations, Contractor may utilize stranded, copper (individual conductors or multi-conductor cable) with 600V rated insulation type, THHN/THWN, 75C.

2.3 BRANCH CIRCUIT CONDUCTORS

A. Product Manufacturers

1. Allied Wire & Cable, Inc.
2. General Cable Technologies Corporation
3. Houston Wire & Cable Company
4. Southwire Company LLC
5. Engineer Approved Equal

B. All branch circuit conductors shall be stranded copper per ASTM-B8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise noted on the Contract Documents. All branch circuit conductors shall not be less than 12AWG

C. Branch circuit conductors for use with overcurrent protection devices rated greater than or equal to 100A shall be consist of stranded, copper conductors with 600V rated insulation, type XHHW-2, 90C.

D. Branch circuit conductors for use with overcurrent protection devices rated less than 100A shall be consist of stranded, copper conductors with 600V rated insulation, rated insulation, type THHN/THWN 75C.

2.4 CONTROL WIRE, GENERAL

A. Product Manufacturers

1. Allied Wire & Cable, Inc

2. General Cable Technologies Corporation

3. Houston Wire & Cable Company

4. Southwire Company LLC

5. Engineer Approved Equal

B. Control wire shall be stranded copper per ASTM B-8, B 33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be 14AWG.

C. All 600V rated control wire shall consist of stranded, copper conductor with insulation type THHN/THWN, 75C.

2.5 CONTROL SIGNAL CABLE (F/UT)

A. Product manufacturer(s) used for basis of design in the Contract Documents:

1. General Cable Specification No.: FREP

2. Southwire Specification No.: 45051

3. Engineer Approved Equal

B. Control cable for discrete signals shall be unshielded twisted individual conductors (F/UT) or twisted multi-paired conductors with an overall foil shield (F/UTP), unless otherwise noted on the Contract Documents. Conductors shall be tin or alloy coated, soft, annealed stranded 14AWG copper with 600V rated insulation for 75C. All twisted pairs shall have an overall foil shield with a 18AWG tinned copper drain wire. Outer jackets shall be lead-free, cross-linked chlorinated polyethylene.

C. Typical notation follows ISO/IEC 11801 designations and as shown on the Contract Documents:

1. 1[9C#14F/UT] denotes one (1) cable of nine (9) twisted 14AWG conductors wrapped within an overall foil shielded outer jacket

D. The individual conductors of the multi-conductor control cable shall be color coded for proper identification. Color coding shall be equal to ICEA S-68-514, Table K-1. Cables shall meet requirements of IEEE-383.

2.6 INSTRUMENTATION SIGNAL CABLE (F/FTP)

A. Product manufacturer(s) used for basis of design in the Contract Documents:

1. Southwire Product Series: 337630

2. Engineer Approved Equal

B. Instrumentation cable for analog signals shall be individually shielded twisted paired conductors (F/FTP) or individually shielded twisted multi-pair conductors within an overall foil shield (F/FTP), unless otherwise shown on the Contract Documents. Conductors shall be tin or alloy coated, soft, annealed stranded 16AWG copper with 600V rated insulation for 75C. All cable assemblies shall have a 18AWG tinned copper drain wire. Outer jackets shall be lead-free, cross-linked chlorinated polyethylene.

C. Typical notation follows ISO/IEC 11801 designations and as shown on the Contract Documents:

1. 2[2C#16F/FTP] denotes two (2) cables of two (2) twisted 16AWG paired conductors within individual foil shield and wrapped with an overall foil shielded outer jacket

2.7 INDUSTRIAL ETHERNET TCP/IP CABLE (F/UTP)

A. Product manufacturer(s) used for basis of design in the Contract Documents:

1. Belden Product Series: 7953A

2. General Cable Catalog No.: GCR1452

3. Engineer Approved Equal

B. All industrial EtherNet data cables shall be TIA/EIA-568-B.2-1 Category 6 compliant, non-plenum rated with black PVC outer jacket rated for 600V. The industrial EtherNet data cable shall be eight (8) individually twisted, bonded paired conductors with splined center member and wrapped within an overall foil shield (F/UTP). Signal conductors shall be soft, annealed solid #23AWG copper with a #24AWG tinned copper drain wire.

C. Typical notation follows ISO/IEC 11801 designations and as shown on the Contract Documents:

1. 1[8C#23F/UTP] denotes one (1) cable of eight (8) twisted #23AWG paired conductors within a PVC inner jacket and wrapped within an overall foil shielded outer jacket.

2.8 CABLE FITTINGS AND CONNECTORS

A. Where shown in the Contract Documents, Contractor shall provide and install all required cable glands, fittings and connectors with those manufacturer approvals, UL listing and/or NEMA rating to match enclosures and/or devices to which the cable is terminated.

B. Where cables are subject to vibration and/or tension, Contractor shall provide and install cable glands, fittings and connectors with strain-relief assembly to include supplemental cable strain-reliefs were required.

PART 3 - EXECUTION

3.1 GENERAL

A. Power Feeder and Branch Circuitries

1. All power feeder and branch circuit cables, wires and/or conductors shall be terminated in accordance with the applicable Specification Sections throughout all power distribution equipment to include all utilization equipment and/or devices.

    a. Splices within pull-boxes and junction boxes for all feeder circuits rated 100A or more are not acceptable unless approved by Engineer.

B. Control, Signal and Data Circuitries

1. All control, signal and data cables, wires and/or conductors shall be terminated in accordance with the applicable Project Specification Sections throughout all terminal, marshalling cabinets to include all control and/or utilization devices.

    a. Splices within pull-boxes and junction boxes are not acceptable unless approved by Engineer

2. All control and data cabling routed to Programmable Logic Controllers (PLC) and/or SCADA equipment shall be identified and neatly bound in coils, secured with white nylon cable ties

    a. Sufficient cable and/or wire slack shall be provided such that no splicing is required within PLC and SCADA cabinets.

C. Contractor shall ensure all power, control, signal and data cables, wires and/or conductors are terminated correctly throughout the entire circuit and shall provide labor and materials as required to make all corrections necessary without any additional cost to Owner.

D. Engineer and/or Owner Representative reserves the right to witness and inspect all power, control, signal and data terminations.

3.2 POWER AND CONTROL CONDUCTOR INSTALLATION

A. Cable and wires shall be installed as specified herein and shown on the Contract Documents.

B. Cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox-E as manufactured by Burndy Electrical, or approved equal.

D. Splices are normally not permitted in the underground duct, manhole and handhole systems. If splices are required, Contractor shall obtain approval in writing from the Engineer prior to splicing.

1. Splicing material shall be a two-part insulating and encapsulating resin.

E. Sizing

1. Sizes of cable and wire shall be as shown in the Contract Documents, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be shall be coordinated with and approved by the Engineer.

2. Minimum wire size within control panels, motor control centers, switchboards and similar equipment shall be 12AWG for power and 14AWG for control.

F. Quantity

1. The number of wires indicated in the Contract Documents for the various control, indication, and metering circuits were determined for general schemes of control and for particular indication and metering systems.

2. The actual number of wires installed for each circuit shall, in no case, be less than the number required; however, the Contractor shall add as many wires as may be required for control and indication of the actual equipment selected for installation at no additional cost to the Owner. The addition of conductors shall be coordinated with and approved by the Engineer.

G. Identification

1. Provide and install cable, conductor and wiring identification in accordance with the procedures and requirements Specification Section(s)

a. 16075 – ELECTRICAL IDENTIFICATION

H. Training

1. Furnish all labor and material required to train wire, conductors and cables in all electrical and control enclosures to include but not limited to cable vaults within buildings, manholes, hand-holes and pull-boxes.

   a. Sufficient length of cable shall be provided in each cable vault, manhole, handhole or underground pull-box such that the wire, conductors or cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any wire, conductors or cable shall be not less than the manufacturer's recommendation. The training shall be done in such a manner as to minimize chaffing.

   b. Slack coils of wire, conductors or cables shall be provided in all pull-boxes, junction boxes, etc. and secured with approved UV resistant cable ties.

   c. Power and control wire, conductors or cables shall be neatly routed, trained and secured with approved UV resistant cable ties within all electrical enclosures to include but not limited to switchboards, transformers, transfer switches, power panels, lighting panels, disconnects, control cabinets such as PLCs.

I. Terminations and Connections

1. Where stranded wires are terminated at panels, and/or devices, connections shall be made by solderless lug, crimp type ferrule or solder dipped.

2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make seven-strand, 12AWG, wire terminations impractical, the Contractor shall terminate external circuits in an adjacent junction box of proper size and shall install 14AWG stranded wires from the device to the junction box in a conduit. The 12 AWG field wiring shall also be terminated in the same junction box to complete the circuit.

J. Temperature

1. Cable shall not be flexed or pulled when the temperature of the insulation or of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature within a three-day period prior to pulling of 40F or lower, cable reels shall be stored during the three-day period prior to pulling in a protected storage area with an ambient temperature not lower than 55F and pulling shall be completed during the work day for which the cable is removed from the protected storage.

K. Color Coding

1. Unless otherwise noted in the Contract Documents, conductor insulation shall be color coded as follows:

    a. 480V AC Power:

        1) Phase A - BROWN

        2) Phase B - ORANGE

        3) Phase C - YELLOW

        4) Neutral – GREY

    b. 120/208V or 120/240V AC Power:

        1) Phase A - BLACK

        2) Phase B - RED

        3) Phase C - BLUE

        4) Neutral – WHITE

    c. 120VAC Control:

        1) Ungrounded conductors – RED

        2) Ungrounded conductors, foreign source - YELLOW.

    d. 24VAC Control:

        1) All wiring – ORANGE

    e. 24VDC Power:

        1) Positive Lead – RED

        2) Negative Lead – BLACK

    f. 24VDC Control:

        1) Ungrounded conductors – BLUE

        2) Grounded conductors – BLUE w/ WHITE stripe

    g. Equipment Grounding Conductor:

        1) All wiring – GREEN

2. Conductors 4AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently

throughout the system. Larger cables shall be coded by the use of colored tape.

3.3 INSTRUMENTATION / TELEPHONE / DATA CABLE INSTALLATION

A. Grounding of cable shield shall be accomplished at one end point only.

B. Raceways exceeding 5FT and containing instrumentation / telephone / data cable shall be installed to provide the following clearances:

1. Raceway installed parallel to raceway conductors energized at 480 through 208V shall be 18IN and 208/120V shall be 12IN.

2. Raceway installed at right angles to conductors energized at 480V or 120/208V shall be 6IN.

C. Where practical, raceways containing instrumentation / telephone / data cable shall cross raceway containing conductors of other systems at right angles.

D. Where instrumentation / telephone / data cables are installed in panels, etc., the Contractor shall arrange wiring to provide maximum clearance between cables and other conductors. Instrumentation / telephone / data cables shall not be installed in same bundle with conductors of other circuits.

E. Additional pull-boxes shall be furnished and installed for ease of cable pulling and the cable manufacturer's recommended conduit fill factor shall be followed.

F. All cable, insulation and jacket shall have adequate strength to allow for it to be pulled through the conduit systems. Sufficient conductors shall be installed to provide space and serve future equipment where shown and specified. All conductors shall be color coded and all wires shall be suitably tagged with permanent markers at each end.

3.4 TESTING

A. All wire and cable testing shall be performed in accordance with the requirements of Specification Section(s)

1. 16080 – ELECTRICAL TESTING

B. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

C. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment.

3.5 PROJECT CLOSEOUT

A. Provide all cable testing and corrective action reports for record.

END OF SECTION 16120

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SECTION 16130 - ENCLOSURES

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Section Includes:

Section includes requirements for boxes, cabinets and enclosures used in electrical systems. Types of boxes, cabinets and enclosures specified in this section include the following:

1. Junction Boxes and Pull Boxes
2. Device Boxes
3. Flush Mounted Floor Boxes
4. Cabinets and Enclosures
5. Hazardous Locations

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Documents referenced herein shall be applied.

1. Section 01330 – SUBMITTAL PROCEDURES
2. Section 16060 – GROUNDING & BONDING
3. Section 16070 – HANGERS AND SUPPORTS
4. Section 16075 – ELECTRICAL IDENTIFICATION
5. Section 16110 – CONDUIT AND RACEWAY
6. Section 16120 – CONDUCTORS AND CABLES

1.3 REFERENCES

A. Abbreviations and Acronyms:

1. American Society of Testing and Materials (ASTM)
2. National Electrical Manufacturers Association (NEMA)
3. National Fire Protection Agency (NFPA)
4. Polyvinyl Chloride (PVC)
5. Underwriters Laboratories, Inc. (UL)

B. Definitions:

1. Cabinet – An enclosure designed for surface mounting or flush mounting with a frame, mat or trim in which a swinging door or doors may be hung.

2. Contractor – The Company that has a contract with the Owner to perform the work.

3. Device Box – A box designed to house a unit that carries or controls electric energy as its principal function; such as a receptacle or light switch.

4. Enclosure – A case or housing for electrical wiring and/or components which is utilized to either prevent personnel from accidently contacting energized parts or to protect the equipment from physical damage.

5. Floor Box – A device box designed to be installed in a poured concrete floor.

6. Installer – The Contractor or Subcontractor physically installing the electrical equipment or system specified.

7. Junction Box – An enclosure with a screw-fastened cover utilized for splicing or terminating wires.

8. Pull Box – An enclosure with a screw-fastened cover utilized in facilitating the pulling of cable.

9. Subcontractor – The Company that has a contract with the Contractor to perform certain portions of the work.

C. Reference Standards:

1. ASTM A167 – Standard Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

2. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

3. NEMA ICS6 – Enclosures for Industrial Controls and Systems

4. NEMA OS 1 – Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

5. NEMA OS 2 – Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports

6. NFPA 70 – National Electrical Code

7. UL 50 & 50E – Enclosures for Electrical Equipment

8. UL 508A – Industrial Control Panels

9. UL 514A – Metallic Outlet Boxes

10. UL 514B – Conduit, Tubing, and Cable Fittings

11. UL 514C – Nonmetallic Outlet Boxes, Flush Device Boxes and Covers

12. UL 886 – Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

13. UL 1203 – Explosion Proof and Dust Ignition Proof Electrical Equipment for Use in Hazardous (Classified) Locations

14. UL 1773 – Termination Boxes

15. NFPA 496 – Purged and Pressurized Enclosures for Electrical Equipment

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01330 – SUBMITTAL PROCEDURES

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Each box, cabinet and enclosure shall be listed and labeled by UL, ETL or other recognized testing agency that provides third-party certification follow-up services.

2. Each metallic box, cabinet and enclosure shall have a unique identifying number that traces the product back to material mill test reports. Stainless steel items shall have a part number that contains a material designator or a separate stamp that includes a reference to the type of material used.

PART 2 - PRODUCTS

2.1 BOXES, CABINETS AND ENCLOSURES

Boxes, cabinets and enclosures shall be of the NEMA Class and of the types and sizes shown on the raceway plans, sections and details. Sizes not indicated in the project documents or electrical drawings shall be sized and applied in accordance with the requirements of NFPA 70 (National Electrical Code). Unless specified in the project documents or shown on the raceway plans, sections and details, minimum classifications shall be either NEMA 1 or NEMA 12 for dry indoor applications and either NEMA 3R, NEMA 4 or NEMA 4X for outdoor locations, depending on the surrounding environment. Unless indicated otherwise, metallic boxes, cabinets and

enclosures shall be cast-aluminum. Corrosion-resistant screws and hardware, including cadmium and zinc plated items, shall be utilized for dry indoor locations. Stainless-steel screws and hardware shall be utilized for exterior or wet locations. Boxes, cabinets and enclosures shall be complete with covers, gaskets and any other accessories required for the intended use. Fittings for boxes, cabinets and enclosures shall conform to UL 514B. Malleable iron or zinc plated steel shall be used for conduit hubs, bushings and box connectors.

2.2 PRODUCT TYPES

A. Performance Criteria:

1. Junction Boxes and Pull Boxes:

   Junction boxes and pull boxes shall be manufactured and applied in accordance with UL 50. Boxes shall have bolted-on, screwed or hinged covers manufactured from the same material as the boxes. Covers shall be of the size and shape to suit the application.

2. Device Boxes:

   Device Boxes shall be complete with features and accessories suitable for each location; including mounting brackets, cable clamps, closure plugs, exterior rings and threaded screw holes for devices and covers.

   a. Metallic:

      Metallic device boxes shall be manufactured from sheet-steel in accordance with NEMA OS 1 and UL 514A. Metallic boxes shall be galvanized, enameled or otherwise corrosion resistant.

   b. Nonmetallic:

      Nonmetallic device boxes shall be manufactured and applied in accordance with NEMA OS 2 and UL 514C.

3. Flush Mounted Floor Boxes:

   Flush mounted floor boxes shall be manufactured and applied in accordance with UL 514C. Boxes shall be concrete tight and fully adjustable vertically and angularly before and after concrete is poured. Metallic boxes utilized for power wiring shall have a grounding terminal consisting of a washer-in-head machine screw, not smaller than No. 10-32, screwed into a tapped hole in the box. Boxes requiring multiple sections shall have hinged section covers with provisions under a common floor plate for a duplex receptacle, telephone or data device as required. Floor boxes shall have a flange, cover, carpet trim plate, extension collar, gaskets, brass floor plates and other various service fittings as needed to form a complete unit for the required application.

4. Cabinets and Enclosures:

Cabinets and enclosures shall be selected, manufactured and applied in accordance with UL 50. Cabinets and enclosures shall consist of a one-piece frame box and front with hinged door or doors. Cabinets and enclosures greater than 36 inches wide shall have double doors. Door(s) shall be constructed to close against a rabbet placed around the inside edge of the frame, with a uniformly close fit between door and frame. Solid neoprene gaskets shall be utilized if required for the application. Door hinges may be flush or concealed and shall be bolted and installed less than 24 inches apart and less than 6 inches from either the top or the bottom of the door.

Flush mounted cabinets and enclosures shall have a front that is 3/4-inch larger than the box all around. Surface mounted cabinets and enclosures shall have a front that is the same height and width as the box.

Cabinets and enclosures not installed in dedicated wiring closets or mechanical/electrical rooms shall have key locks. Cabinets and enclosures for the same system shall be keyed alike and have spare keys. Locks shall allow doors to latch closed without locking.

If required, cabinets and enclosures shall have adequate ventilation, filtration, fans and ducting to compensate for internal heat generation. Cabinets and enclosures shall also have a mounting panel constructed of the same material.

5. Hazardous Locations:

Boxes, cabinets and enclosures installed in hazardous locations shall be listed and labeled for use according to NFPA 70 (National Electrical Code) for the specific class and division of the location. Conduit entrances shall be threaded and suitable for the installation of conduit seals.

B. Materials:

1. Sheet Steel:

Sheet steel boxes, cabinets and enclosures shall be constructed of flat-rolled, code-gauge, galvanized steel with stamped knockouts for raceway entries.

2. Hot-Dipped Galvanized Steel:

Hot-dipped galvanized steel junction boxes and pull boxes shall be constructed of sheet steel with welded seams. Internal stiffeners shall be provided when necessary to ensure a rigid assembly. Boxes shall be hot-dip galvanized after fabrication.

3. Stainless-Steel:

Stainless-steel junction boxes, pull boxes, cabinets and enclosures shall be fabricated of stainless steel conforming to Type 302 of ASTM A167. Internal stiffeners shall be provided when necessary to ensure a rigid and structurally sound assembly.

4. Cast-Aluminum:

Cast-aluminum boxes, cabinets and enclosures shall be molded of copper-free aluminum with integral threaded raceway entries.

5. Cast-Iron:

Cast-iron boxes shall be waterproof and molded of an iron alloy with integral threaded raceway entries.

6. Nonmetallic (PVC):

Nonmetallic boxes, cabinets and enclosures shall be molded from gray, nonconductive, glass fiber-reinforced, ultra-violet stabilized, high impact-resistance strength polyvinyl chloride (PVC) with integral mounting flanges and raceway entries.

C. Finishes:

Metallic boxes, cabinets and enclosures shall have an exterior finish of gray baked enamel and an interior finish of white baked enamel. Mounting panels shall be primed and painted white.

PART 3 - EXECUTION

3.1 INSTALLATION

Installation of boxes, cabinets and enclosures shall be in accordance with the electrical plans and details and Article 314 of NFPA 70 (National Electrical Code). Boxes, cabinets and enclosures shall be installed such that the box is supported independently of raceways and cable trays and does not interfere with any other equipment or equipment access. Caps and plugs shall be installed in any raceway entry not utilized. Knockouts on boxes, cabinets and enclosures shall only be removed it required for raceway installation. All burs and sharp edges shall be removed from knockouts prior to the connection of raceways. Isolation barriers shall be installed between adjacent devices or cables of dissimilar voltage. Boxes, cabinets and enclosures installed in concrete walls shall be deep enough to avoid interference with reinforcing steel, with a maximum depth of six inches.

A. Systems Integration:

1. Junction Boxes and Pull Boxes:

Junction boxes shall be installed as required to terminate or tap multiple circuits. Pull boxes or conduit bodies shall be installed on any field routed conduit installation that exceeds 360 degrees of bending and as required to eliminate jamming, excessive sidewall pressures and excessive pulling tensions during cable installation. Requirements for additional pull boxes shall be based on the calculations performed in Section 16120 - CONDUCTORS AND CABLES

2. Device Boxes:

Unless shown otherwise on the lighting and power plans, device boxes shall be installed at the following heights (inches):

Outdoor Receptacle 24

Indoor Receptacle 18

Mechanical Room Receptacle 24

Light Switch 48

Outdoor Telephone Device 48

Indoor Telephone Device 18

Computer/Data Devices 18

Fire Alarm Pull Switches 48

Welding Receptacles 48

Device boxes for light switches and receptacles shall be installed with the long axis of the box in the vertical position. Device boxes for light switches shall be installed at doors on the side opposite the hinges.

Through wall boxes shall not be installed. Device boxes installed back-to-back on common walls shall be installed on opposite sides of a stud to minimize sound transmission. Device boxes installed on columns or pilasters shall be located such that the centers are clear for the future installation of partitions.

Device boxes installed in fire-rated walls or partitions shall have a maximum of 16 square inches of surface area exposed through the wall at one location, unless additional fireproofing material is added. Metallic device boxes installed in fire-rated walls or partitions shall have a minimum of 24 inches of separation.

Device boxes for fixtures installed in finished areas with concealed wiring shall be a minimum of 4 inches square by 1-1/2 inches deep.

Extension rings installed on existing device boxes shall have mounting holes drilled to align the extension ring with the existing device box.

3. Flush Mounted Floor Boxes:

Floor boxes shall be installed in concrete slabs such that the box is completely flush with the concrete surface. Boxes installed prior to the placement of concrete shall be secured to prevent movement during the concrete pour. Floor boxes utilized for power receptacles shall be listed specifically for this application.

4. Cabinets and Enclosures:

Unless otherwise shown on the electrical details, cabinets and enclosures shall be installed such that the tops of the boxes are 78 inches above the finished floor. Cabinets and enclosures installed in finished locations shall be plumb and flush with the finished wall. Pad mounted cabinets and enclosures shall be mounted on concrete surfaces as indicated on either the electrical details or foundation plans. As a minimum, clearances around cabinets and enclosures shall be in accordance with Article 110 of NFPA 70 (National Electrical Code).

5. Hazardous Locations:

Boxes, cabinets and enclosures located in hazardous locations shall utilize expanded fill sealed fittings as required and shall be installed in accordance with NFPA 70 (National Electrical Code). If the Installer encounters a box, cabinet or enclosure that is to be installed outside the limits of the area classification drawings, or if the Installer believes the location may be located within a hazardous area not shown on the area classifications drawings, then the Installer shall immediately stop work and advise the Contractor so that a check and/or inspection may be made. Conduits, fittings and couplings connecting to boxes, cabinets and enclosures shall have at least five full threads engaged.

3.2 GROUNDING AND BONDING

Metallic boxes, cabinets and enclosures shall be electrically grounded in accordance with Article 250 of NFPA 70 (National Electrical Code) and Section 16060 – GROUNDING AND BONDING.

3.3 CLEANING

Upon completion of installation, interiors of boxes, cabinets and enclosures shall be inspected, all blockages cleared, and burrs, dirt and construction debris removed. Damaged finishes, including chips, scratches and abrasions, shall be repaired. Damaged galvanized finishes shall be repaired with zinc-rich paint recommended by the manufacturer. Precautions shall be taken to prevent the future entrance of plaster, dirt and debris.

END OF SECTION 16130

SECTION 16230 – ENGINE GENERATORS

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish and install a completed and fully functional standby electrical power system sourced by an Engine Driven Generator that has been tested during design verification, production and at the Project site. All finished equipment shall be of the latest industrial design and will be complete with all of the necessary accessories for complete installation as shown in the Contract Documents and Specifications herein. Engine Driven Generator and associated equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All Engine Driven Generator equipment shall be new and of current production of a national firm that manufactures generator sets and controls, switchgear, paralleling switchgear and assembles these as a complete and coordinated systems. There will be one (1) source responsibility for warranty, parts, and service through a local representative with factory-trained service personnel.

B. Section consists of providing a complete packaged electrical system and associated controls with all required accessories as specified and shown in the Contract Documents. The equipment supplier must be the authorized distributor for each component of the products specified herein. The Work includes the furnishing of all labor, materials, equipment, test, and training to provide a complete and workable power system, including the generator set and generator set controls, transfer switch controls, fuel tank system, and installation as shown in the Contract Documents and Specifications herein. It is the intent of this Specification to have a single source responsibility for the Engine Driven Generator.

C. Any and all exceptions to the published Specifications shall be subject to the approval of the Engineer.

D. Engine Driven Generator and associated standby power system shall be finished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown in the Contract Documents and Specifications herein.

E. Equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least twenty-five years (25YR) and who maintains a service organization available twenty-four hours (24HR) a day throughout the year.

F. Specifications contained herein represent minimum requirements. Actual sizing of the generator shall be coordinated with the loads of the equipment supplied.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

B. Related Specification Section(s) include but not limited to

1. 16415 – AUTOMATIC TRANSFER SWITCHES

1.3 REFERENCES

A. Engine Driven Generator system shall conform to the requirements of the following codes, standards and regulations.

B. Codes and Standards

1. US Environmental Protection Agency

a) Clean Air Act (CAA)

b) National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines (RICE NESHAP)

c) New Source Performance Standards (NSPS)

2. CSA C22.2, No. 14 – M91 Industrial Control Equipment.

3. EN 50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.

4. EN 55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

5. IEC 8528 part 4. Control Systems for Generator Sets

6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.

7. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

8. Mil Std 461D –1993. Military Standard, Electromagnetic Interference Characteristics.

9. Mil Std 462D - 1993. Military Standard, Measurement of Electromagnetic Interference Characteristics.

10. NFPA 70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.

11. NFPA 99 – Essential Electrical Systems for Health Care Facilities

12. NFPA 110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

13. UL 2200 The generator set shall be listed to UL 2200 or submit to an independent 3rd party certification process to verify compliance as installed

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for Division 16 as required per Specification Section(s)

1. 01330 – SUBMITTAL PROCEDURES

B. Submittals without the information indicated below will be returned rejected and will not be reviewed.

C. Submittals shall include but not limited to the following

1. Prototype test certification

2. Specification sheets showing all standard and optional accessories to be supplied.

3. Schematic wiring diagrams and interconnection diagrams identifying by terminal number, each required interconnection between the generator set, the transfer switch, and the remote monitoring/control devices if included elsewhere in the Contract Documents.

4. Sizing calculations for Engine Driven Generator with respect to the new and/or existing connected loads as required as part of this Contract.

5. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

6. Include thermal damage curve for Engine Driven Generator.

7. Include time-current characteristic curves for Engine Driven Generator protective device(s).

8. Include fuel consumption in gallons per hour (GAL/HR) at 0.8PF measured at 0.5-, 0.75-, and 1.0-times alternator capacity.

9. Include Engine Driven Generator efficiency at 0.8PF measured at 0.5-, 0.75-, and 1.0-times alternator capacity.

10. Include airflow requirements for cooling and combustion air in cubic feet per minute (CU-FT/MIN) at 0.8PF and reference air-supply temperature. Provide scaled drawings indicating requirements and limitations for location of air intake and exhausts.

11. Include Engine Driven Generator characteristics, including but not limited to: kilowatt rating, efficiency, reactances, and short-circuit current capability.

12. Dimensional drawings in AutoCAD drawing format to include but not limited to

a) Drawing Index

b) Front, Side and Rear elevation views

c) Plan view of the assembly

d) Completed Assembly weight

e) Assembly Center of Gravity (COG)

f) Lifting points and anchorage

g) Conduit space locations within the assembly

h) Fuel, exhaust, coolant connections

i) Radiator ducting

13. Contact information for the twenty-four-hour (24HR) parts and service organization.

14. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

15. Vibration isolation base details:

a) Detail fabrication, including anchorages and attachments to structure and supported equipment; include base weights.

D. Qualifications

1. Equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production, installation, and service of their complete product line

1.5 DELIVERY, STORAGE AND HANDLING

A. Engine Driven Generator and all components shipped loose shall be handled and stored (if required) in accordance with manufacturer's instructions and recommendations as outlined in applicable Installation and Maintenance Manuals. Three (3) copies of these instructions shall be included with the equipment at time of shipment.

B. Inspect and report concealed damage to carrier within their required time period. Owner shall not be held responsible for damages incurred during shipping, handling and storage.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Engine Driven Generator Operation and Maintenance manuals shall be provided and shall include additional instruction leaflets and instruction bulletins for the complete assembly and each major component.

B. Operation and Maintenance manuals, drawings etc. to be provided within the assemblies shall be water-proof and fire-resistant utilizing tear-resistant paper.

1.7 WARRANTY

A. Manufacturer shall warrant Engine Driven Generator to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. Engine Driven Generator shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplate(s) shall be securely affixed in a conspicuous place(s). Nameplates shall be furnished and installed as required Specification Section(s):

1. 16075 – ELECTRICAL IDENTIFICATION

1.9 MAINTAINENCE

A. Engine Driven Generator manufacturer and its distributor shall maintain a twenty-four-hour (24HR) parts and service organization within one-hundred miles (100MILE) of the Project site. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment provided.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Engine Driven Generator and associated equipment shall be provided by one of the manufacturers listed:

1. Blue Star Power Systems

2. Cummins Power Systems

3. MTU Onsite Energy

4. Approved Equal

B. Listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting the Specifications in their entirety.

2.2 RATINGS

A. Engine Driven Generator Assembly shall be defined for the purpose of this Project as Stationary Emergency Standby Power Diesel Driven Generator.

B. Engine Driven Generator shall have those electrical ratings as shown on the Contract Documents and rated for operation in an ambient condition of 40C at 150M above sea level (minimum).

C. Engine Driven Generator shall be rated for continuous standby duty usage.

2.3 DIESEL ENGINE

A. Turbocharged and accept No.2 diesel fuel (2-D)

B. Operate at a governed speed of 1800RPM

C. Liquid-Cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the Diesel Engine with up to 0.5IN H20 static pressure on the fan in an ambient temperature up to 50C.

D. EPA Tier-II factory certified

E. Shall be equipped with the following:

1. Electronic isochronous governor capable of +0.25% steady-state frequency regulation.

2. 24V positive engagement solenoid shift-starting motor.

3. Automatic battery charging alternator with solid-state voltage regulation.

4. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.

5. Dry-type replaceable air cleaner elements for heavy-duty applications.

6. Engine-Driven or electric fuel transfer pump capable of lifting fuel 300.0mm, fuel filters, and electric solenoid fuel shut-off valve.

F. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

2.4 ALTERNATOR

A. Permanent Magnet brushless design.

B. Salient-Pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-33.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. The excitation system shall be of brushless construction controlled by a solid- state

voltage regulator capable of maintaining voltage within +/- 2% at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating.

C. The generator set shall meet the transient performance requirements of ISO 8528-5, level G-3.

D. The alternator excitation shall be of a permanent magnet exciter design.

E. Engine Driven Generator shall be inherently capable of sustaining at least 250% of rated current for at least 10SEC under a three-phase symmetrical short circuit without the addition of separate current support devices.

F. Alternator having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

2.5 CONTROLS

A. Engine Driven Generator shall be controlled and monitored by a fully solid-state, microprocessor based electronic controller and shall be designed, tested and built by the engine manufacturer. Controller shall provide all operating, monitoring, and control functions for the generator set. Controller shall provide real time digital communications to all engine and regulator controls via SAE J1939.

B. Controller and its enclosure shall be tested and certified to the following environmental conditions:

1. –40C to +70C Operating Range

2. 100% condensing humidity, 30C to 60C

3. IP22 protection for rear of controller; IP55 when installed in controller enclosure

4. 5% salt spray, 48HR, +38C, 36.8V system voltage

5. Sinusoidal Vibration: 4.3G RMS, 24-1000Hz

6. Shock Withstand: 15G

7. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)

C. Controller shall have but not limited to the following functional requirements

1. Standard ISO labels

2. Display: 33 x 132 pixel, 24mm x 95mm, positive image, transflective LCD display with minimum three-line data display for text-based alarm/event descriptions

3. Audible horn for alarm and shutdown with horn silence switch

4. Remote start/stop control

5. Local AUTO/OFF/RUN control integral to system microprocessor

6. Cooldown timer

7. Speed Adjustment

8. Push-To-Test Lamps

9. Emergency E-STOP mushroom push-button

10. Voltage Adjustment

11. Voltage regulator V/Hz slope - adjustable

12. Password protected system programming

D. Controller shall provide the following digital readouts for the engine and alternator. All readings shall be indicated in either SI or Imperial units

1. Engine

a) oil pressure

b) oil temperature

c) coolant temperature

d) RPM

e) battery volts

f) run-hours

g) crank attempt counter

h) successful start counter

i) maintenance interval(s)

j) real-time clock

k) exhaust stack temperature

l) main bearing temperature

2. Alternator

a) AC voltage (line-to-line, line-to-neutral and average)

b) AC current (average and per phase)

c) AC frequency

d) kW (total and per phase)

e) kVA (total and per phase)

f) kVAR (total and per phase)

g) power factor (average and per phase)

h) total kW-Hr

i) total kVAR-Hr

j) % kW

k) % kVA

l) % kVAR

m) bearing temperature

n) stator winding temperature

3. Voltage Regulator

a) excitation voltage

b) excitation current

E. Controller shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored in memory for first and last occurrence

1. Engine Alarm/Shutdown

a) low oil pressure alarm/shutdown

b) high coolant temperature alarm/shutdown

c) loss of coolant shutdown

d) overspeed shutdown

e) over-crank shutdown

f) emergency stop shutdown

g) low coolant temperature alarm

h) low battery voltage alarm

i) high battery voltage alarm

j) not in AUTO alarm

k) battery charger failure alarm

2. Alternator Alarm/Shutdown

a) phase sequence

b) over voltage

c) under voltage

d) over frequency

e) under frequency

f) reverse power (real and reactive)

g) overcurrent

3. Voltage Regulator Alarm/Shutdown

a) loss of excitation alarm/shutdown

b) instantaneous over excitation alarm/shutdown

c) time over excitation alarm/shutdown

d) rotating diode failure

F. Controller I/O

1. Programmable Digital Inputs: Controller shall include the ability to accept programmable digital input signals. Signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.

2. Programmable Relay Outputs: Controller shall include the ability to operate programmable relay output signals, integral to the controller. Output relays shall be rated for 2A @ 30VDC and consist of six (6) Form A (Normally Open) contacts and two (2) Form C (Normally Open & Normally Closed) contacts.

3. Programmable Discrete Outputs: Controller shall include the ability to operate two (2) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.

G. Maintenance

1. All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the Controller.

(1) engine running hours display

(2) service maintenance interval (running hours or calendar days)

(3) engine crank attempt counter

(4) engine successful starts counter

(5) forty (40) events are stored in memory

2. Programmable cycle timer that starts and runs the Engine Driven Generator for a predetermined time. Timer shall use seven (7) user-programmable sequences that are repeated in a seven-day (7DY) cycle. Each sequence shall have the following programmable set points:

a) day of week

b) time of day to start

c) duration of cycle

H. Local Annunciator

1. Shall be provided and installed in the same enclosure with the along with Engine Driven Generator controller to meet the requirements of CSA 282, NFPA 99 and NFPA 110, Level 1.

2. Include a lamp test pushbutton, alarm horn and alarm acknowledge pushbutton

3. Provide but not limited to the following individual LED light indications for protection and diagnostics

a) over-crank

b) low coolant temperature

c) high coolant temperature warning

d) high coolant temperature shutdown

e) low oil pressure warning

f) low oil pressure shutdown

g) overspeed

h) low coolant level

i) not in AUTO

j) high battery voltage

k) low battery voltage

l) battery charger AC failure

m) emergency stop

2.6 FUEL SYSTEM

A. The fuel system shall be integral with the engine. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted. Flexible fuel lines shall be minimally rated for 300F and 100psi.

B. Fuel Sub Base Tank: Provide a double wall sub-base tank constructed to meet all local codes and requirements to include UL 142. A fuel tank base with a minimum of twenty-four hour (24HR) capacity shall be provided as an integral part of the enclosure. It shall be contained in a rupture basin with 110% capacity. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, normal and emergency vent extensions to 12FT and fuel tank rupture alarm contact shall be provided.

1. Provide five-gallon (5GAL) Fuel Fill spill containment with OFPV (without exception)

2. Steps and Platforms on both sides of the weather/sound enclosure as required for re-fueling operations

2.7 STARTING SYSTEM

A. Starting Motor(s) shall be direct-current type with positive engagement and as recommended by the engine manufacturer.

B. Engine block and water jacket heater shall be thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1 in accordance with the ambient conditions of the site.

C. Batteries shall be 12V lead-antimony capable of delivering the manufacturer's recommended minimum cold-cranking amps required at -20C, per SAE Standard J-537.

D. Battery Charging System shall be automatic float and equalize with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40C to +60C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Battery Charging System shall be mounted within the inside weather/sound enclosure.

2.8 COOLING SYSTEM

A. Engine Driven Generator shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. Cooling system shall be sized to operate at full load conditions and 110F ambient air entering the weather/sound enclosure. Engine Driven Generator supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

2.9 EXHAUST SYSTEM

A. Muffler / Silencer shall be a super critical grade silencer, companion flanges, and flexible stainless-steel exhaust fitting properly sized shall be furnished and installed inside weather/sound enclosure. Muffler / Silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer.

2.10 WEATHER / SOUND ENCLOSURE

A. Weather/Sound enclosure with sub-base fuel tank shall include the following features:

1. Enclosure shall be constructed of aluminum (min. 2.5MM thickness), cleaned and painted inside and out with rust inhibiting primer and exterior coat of the manufacturer's standard color.

2. Enclosure shall be braced for wind loading of 160MILES per hour (71.5 meters per second) in accordance with the Project Site Conditions and/or as outlined in the Contract Documents.

3. Enclosures must be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker must meet the requirements of the National Electric Code. Doors must be hinged with stainless steel hinges and hardware and be removable. Doors must be equipped with lockable latches. Locks must be keyed alike.

4. Enclosure roof must be pitched to prevent accumulation of water

5. A duct between the radiator and air outlet must be provided to prevent re-circulation of hot air.

6. A radiator duct flange to provide a convenient connection to duct work for the radiator discharge air.

7. Generator heater to prevent the accumulation of moisture for dampness in the generator windings.

8. Engine exhaust silencer shall be stainless steel and be temperature and rust resistance, rated for residential application. The silencer will reduce total engine exhaust noise by 25-35 dB(A).

9. Gas-proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT connection.

10. Generator rodent guards.

11. Generator skid end caps.

2.11 ACCESSORIES

A. Battery rack, and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.

B. Two flexible fuel lines rated at a minimum of 125C and 690kPA ending in pipe thread.

C. Air cleaner restriction indicator to indicate the need for maintenance of the air cleaners.

2.12 TOOLS, SUPPLIES, AND SPARE PARTS

A. Tools, supplies, and spare parts shall be provided per manufacturer requirements and as specified for each equipment item. In addition, the following items shall be provided.

B. Provide one set of tools required for preventative maintenance of the Engine Driven Generator system. Package tools in an industrial grade metal tool box with minimum of 30% spare space.

C. Two (2) of each type of fuel, oil, and air filters

D. Two (2) of each type of accessories belt(s)

E. One (1) can of touch up paint

PART 3 – EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate the Engine Driven Generator Assembly installation in accordance with the approved equipment submittals and manufacturer(s) installation instructions to include Engineer recommendations or directives.

B. Engine Driven Generator Assembly Switchboards shall be installed in accordance with the Electrical Raceway Systems design and best practices of the trade as complete assemblies as intended on the Contract Documents.

3.2 EXAMINATION

A. Examine concrete flooring and/or concrete equipment pad(s) to receive the Engine Driven Generator Assembly for compliance with installation tolerances and other conditions affecting performance of the product as required by the manufacturers installation instructions and recommendations to include Engineer installation details. Do not proceed with installation until unsatisfactory conditions have been met or corrective action has been taken.

3.3 INSTALLATION

A. Contractor shall install Engine Driven Generator Assembly per the manufacturer's recommendations and the Contract Documents.

B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

C. Engine Driven Generator Assembly shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:

1. Checking to ensure that concrete flooring and/or concrete equipment pad(s) are level to within 0.125IN per 3FT feet of distance in any direction; reference Section 2.3B.

2. Checking to ensure that all bus bars are torqued to the manufacturer's recommendations

3. Assembling all shipping sections, removing all shipping braces and connecting all shipping split mechanical and electrical connections

4. Securing Engine Driven Generator Assembly to concrete flooring and/or concrete equipment pad(s).

5. Inspecting and installing all circuit breakers in their proper compartments

3.4 FIELD QUALITY CONTROL

A. Clean, inspect, test, and energize Engine Driven Generator Assembly in accordance with applicable NECA / NEiS standards and recommendations.

B. Verify circuit breakers are in the proper locations and that setting of trip units, devices and current sensor taps match values scheduled on the approved submittals.

C. Exercise each circuit breaker three (3) times to verify smooth mechanical operation.

D. Verify proper torque of accessible cable terminations, bus connections and mechanical fasteners after installing Engine Driven Generator Assembly.

E. Field testing shall be done in accordance with the requirements specified in Specification Sections:

1. Division 2 – SITE CONTRUCTION

2. 16080 – ELECTRICAL TESTING

3. Coordinate inspections and tests as required

F. After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.

G. Provide the services of a qualified factory-trained manufacturer's representative to provide start-up of the equipment specified under this Section for a period of three (3) working days.

H. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.5 TESTING

A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

B. Design Prototype Tests: Components of the stand-by emergency system such as the Engine Driven Generator, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests.

1. Maximum power (kW).

2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.

3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.40.

4. Governor speed regulation under steady-state and transient conditions.

5. Voltage regulation and generator transient response.

6. Harmonic Analysis, voltage waveform deviation, and telephone influence factor.

7. Three-Phase short circuit tests.

8. Alternator cooling air flow.

9. Torsional analysis to verify that the generator set is free of harmful torsional stresses.

10. Endurance testing.

C. Production Tests: Each Engine Driven Generator shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

1. Single-Step loading pickup

2. Transient and steady—state governing

3. Safety shutdown device testing

4. Voltage regulation

5. Rated Power @ 0.8 PF

6. Maximum Power

7. Upon Owner or Engineer request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

D. Site Tests: An installation check, start-up, and load bank test shall be performed by the manufacturer's local representative. Contractor shall notify Owner and Engineer at least two weeks (2WK) prior of the time and date of the site test. The tests shall include but not limited to the following:

1. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, alternator strip heaters, remote annunciator, etc.

3. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency, and phase rotation.

4. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timing shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge

level along with Engine Driven Generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient load is unavailable to load the generator set to the nameplate kW rating.

5. Contractor shall provide all fuel, lubricants, and engine fluids required and consumed for start-up, testing or commissioning at no additional cost to Owner.

6. Contractor shall replenish fuel to maximum filled level after successful completion of testing at no additional cost to Owner.

END OF SECTION 16230

SECTION 16340 – LOW - VOLTAGE MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall provide and install Motor Controller(s) for use with those motors as shown in the Contract Documents and specified herein to include the approved submittal information.

B. Contractor shall provide and install the Motor Controllers and all associated appurtenances for the equipment as referenced in the Contract Documents.

C. Stand-Alone Motor Controllers shall fit in those new and/or existing locations and spaces as shown in the Contract Documents.

D. All power and control wiring shall enter the bottom of the Motor Controllers unless otherwise noted in the Contract Documents.

1. Motor Controllers shall be provided with the connections, terminals or lugs to terminate the motor feeder circuit conductors as shown on the Contract Documents.

E. Any exceptions/deviations to this Specification Section shall be indicated in writing to the Engineer and submitted with the quotation.

F. Motor Controllers shall operate auxiliary equipment such as seal water valves, motor space heaters, and include safety and equipment protection interlocks as shown in the Contract Documents.

G. Motor Controller manufacturer shall be responsible for providing all equipment specified under this section, and furnishing the equipment to the Contractor for installation.

H. Motor Controller manufacturer shall furnish, factory test, field test, adjust and certify all installed Motor Controllers for satisfactory operation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

1.3 REFERENCES

A. Motor Controllers referenced herein shall be designed and manufactured in accordance with the applicable codes, standards and regulations.

B. Codes and Standards

1. American Society of Civil Engineers (ASCE)

a. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures

2. American Society for Testing and Materials (ASTM)

a. C84.1 - Electric Power Systems and Equipment - Voltage Ratings

3. Canadian Standards Association (CSA)

b. C22.1 - Canadian Electrical Code, Part I (CEC)

c. C22.2 No. 274 - Adjustable Speed Drives

4. Institute of Electrical and Electronics Engineers (IEEE)

a. 519 - Recommended Practices and Requirements for Harmonic Control in Electric Power Systems

5. International Code Council (ICC)

a. AC156 - Acceptance criteria for Seismic Certification by Shake Table Testing of Nonstructural Components

b. IBC - International Building Code

c. UBC - Uniform Building Code

6. International Electrotechnical Commission (IEC)

a. 106 - Guide for Specifying Environmental Conditions for Equipment Performance Rating

b. 529 - Degrees of protection provided by enclosure

c. 1000 - Electromagnetic Compatibility

d. 1800 - Adjustable speed Electrical power drive systems

e. 60068 - Basis Environmental Testing Procedures Part 2-3

f. 60146 - Semiconductor converters - General requirements and line commutated converters Part 1-1

g. 60204 - Safety of machinery - Electrical equipment of machines - Part 1

h. 60255-8 - Overload Relays

i. 60364 - Low-Voltage Electrical Installations - Part 1

j. 60447 - Basic and safety principles for man-machine interface, marking and identification - Actuating principles

k. 60664-1 - Insulation Coordination for Equipment Within Low-Voltage Systems

l. 60721-3-3 - Classification of Environmental Conditions

m. 60801-2, -3, -4, -5 - Immunity Tests

n. 60947-2 - Low-voltage Switchgear and Control gear - Part 2

o. 61000 - Electromagnetic Compatibility

p. 61439-1 - Low-Voltage Switchgear and Control gear Assemblies

q. 61800 - Adjustable speed electrical power drive systems - Part 5-1

7. International Organization for Standardization (ISO):

a. 9001 - Quality Management Systems – Requirements

b. 14001 - Environmental management systems -- Requirements with guidance for use

8. National Electrical Manufacture Association (NEMA)

a. 250 - Enclosures for Electrical Equipment

b. ICS Part 4 - Overload Relays

c. ICS7 - Industrial Control and Systems Adjustable Speed Drives

d. ICS 7.1 - Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Speed Drives

9. National Fire Protection Association

a. 70, National Electrical Code (NEC)

b. 79, Electrical Standard for Industrial Machinery

c. 5000, Building Construction and Safety Code

10. Occupational Health and Safety Administration (OHSA)

a. 1910.95 - AC Drive Controller Acoustical Noise

11. Underwriters Laboratories, Inc. (UL)

a. 50 - Enclosures for Electrical Equipment

b. 98 - Disconnect Switches

c. 507 - Electric Fans

d. 508 - Industrial Control Equipment

e. 508A - Standard for Industrial Control Panels

f. 508C, 61800-5-1 - Standard for Safety Power Conversion Equipment

g. 991 - Safety Tests for Safety Related Controls Employing Solid State Devices

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 26 Sections as required per Specification Section(s)

1. 01330 – SUBMITTAL PROCEDURES

B. Shop drawings shall be furnished for Engineer review prior to factory assembly of the Motor Controllers. These drawings shall consist of elementary power and control wiring diagrams and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations and nameplate legend details.

C. Standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different horsepower rated Motor Controllers provided.

D. Qualifications

1. Manufacturer of the Motor Controllers shall be a certified ISO 9001 facility.

2. Motor Controllers and all associated optional equipment shall be UL Listed and labeled. A UL label shall be attached inside each enclosure as verification.

3. Motor Controllers shall be designed constructed and tested in accordance with NEMA, NEC, VDE, IEC standards.

4. Motor Controllers door mounted pilot devices shall be tested to verify successful operation. Documentation shall be furnished upon written request of the Engineer.

5. Motor Controllers shall undergo factory QA test procedures and be submitted to a hi-pot test with all enclosed devices mounted and wired, prior to shipment.

1.5 DELIVERY, STORAGE AND HANDLING

A. Motor Controllers and all components shipped loose shall be handled and stored in accordance with manufacturer's instructions and recommendations as outlined in applicable Installation and Maintenance Manuals. Three (3) copies of these instructions shall be included with the equipment at time of shipment.

B. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Motor Controllers operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

1.7 WARRANTY

A. Manufacturer shall warrant Motor Controllers to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. Motor Controllers shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Motor Controllers shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown in the Contract Documents.

B. Subject to compliance with the Contract Documents all Motor Controllers shall be of the same manufacturer and provided by

1. ABB
2. Eaton Power and Industrial
3. General Electric Company
4. Siemens Power USA
5. Square D / Schneider Electric USA
6. Approved Equal

2.2 SWITCH OPERATORS AND PILOT LIGHTS

A. E-Stop / Disable Mushroom Push Button

1. Provide and install a maintained mushroom style push button, mounted on the exterior of the enclosure door that when pushed, will disable the Motor Controller and immediately remove the power supply from the motor load and stop all internal and external control operations.

a. Where indicated in the Contract Documents, provide dynamic braking components sized per the connected motor load.

B. Hand/Off/Auto Mode Selector Switch

1. Provide a HAND-OFF-AUTO selector switch, mounted on the exterior of the enclosure door.

b. In the HAND position, the Motor Controller shall start and operate the motor.

c. In the OFF position, the Motor Controller shall immediately remove the power supply from the motor load and disable all internal and external control signals.

d. In the AUTO position, the Motor Controller shall be started and stopped remotely from external and isolated control signals and contacts.

1. Pilot Lights

1. Provide LED pilot lights, mounted on the enclosure door, for indication of the following status:

a. Power ON / Controller READY pilot light, LED, AMBER

b. RUNNING pilot light, LED, RED, push-to-test

c. STOPPED pilot light, LED, GREEN, push-to-test.

d. HAND / AUTO pilot lights, LED, AMBER, push-to-test

e. FAULT(S) pilot light, LED, AMBER, push-to-test

f. Additional pilot lights shall be installed as required in accordance with the Contract Documents.

2. All operators and pilot lights shall be (30mm), NEMA Type 4/13, mounted on the enclosure door.

2.3 CONTROL POWER

A. External and/or auxiliary control power sources are not acceptable unless otherwise stated in the Contract Documents.

B. Motor Controllers shall be supplied with an internal Control Power Transformer(s) with sufficient capacity to source all those internal and/or external control devices as required in the Contract Documents.

C. Control Power Transformer (CPT) shall have fused primary and secondary circuit protection on all line-to-line connections.

D. CPT secondary shall be 120VAC with grounded neutral unless otherwise stated on the Contract Documents.

2.4 REDUCED VOLTAGE SOLID STATE (RVSS) MOTOR STARTER

A. RVSS shall be a combination integral disconnect/motor starter. The input circuit breaker shall provide NEC required branch motor circuit protection. Branch circuit protection shall have an external operator. Conductive parts on the line side of the disconnect shall be isolated to prevent accidental contact.

B. RVSS interior shall be white for better interior visibility.

C. RVSS disconnects shall be lever handle operators.

D. RVSS enclosures shall include, but shall not limited to, a door-mounted digital keypad for adjusting the RVSS parameters and viewing the motor, RVSS, and fault status without opening the enclosure door.

E. A shorting contactor shall be supplied in each RVSS to reduce temperature rise within the enclosure. Shorting contactor shall be rated to carry the motor full load current during steady state after full voltage has been applied to the motor by the RVSS.

F. Electrical Ratings

1. Designed to operate from an input voltage between -10% and +10% of nominal voltage rating.

2. Operate from an input voltage frequency range of ±5%.

3. Capable of supplying 350% of rated full load current for 20SEC at the maximum ambient temperature.

4. Power and control devices shall be rated for severe duty capable of six (6) evenly spaced starts per hour at 350% of full rated current for 24SEC per start without tripping.

5. Silicon-Controlled Rectifiers (SCRs) shall have a minimum peak inverse voltage (PIV) rating of 1.8kVAC. SCRs with protection by metal oxide varistors (MOVs) are not acceptable.

G. Protection

1. A microprocessor-based thermal protection system shall be included that shall continuously calculate the temperature rise of the motor and RVSS and shall provide the following:

   a. Motor overload pre-alarm that shall indicate by relay contact or logic output that the motor windings have exceeded 110% of their rated temperature rise; this function shall be for alarm only.

   b. Motor overload fault shall stop the motor if the windings have exceeded 125% of their rated temperature rise.

   c. An electronic circuit with a time-constant adjustable to the motor's thermal cooling time-constant that shall ensure memorization of the thermal state even if power is removed from the RVSS.

2. RVSS controller unit shall provide line and motor phase loss, phase reversal, underload, stall, and jam protection.

3. RVSS controller unit shall include, but not be limited to, a shorting contactor which shall close after full voltage has been applied to the motor by the RVSS to reduce the current carrying duty on the SCRs. The integral protective features shall be active even when the shorting contactor is used to bypass the SCRs during steady state operation.

4. Units and options shall be constructed with protection provisions to pass UL 845 short circuit testing criteria at a minimum of 100kA short circuit current.

5. Diagnostic faults and soft start status shall be displayed on the door-mounted keypad after a fault condition.

6. The motor shall be automatically protected from solid state component failure by one of the following means:

   a. Shunt trip coil to trip disconnect in the event of a RVSS fault condition, including, but not limited to, a shorted SCR.

   b. Isolation contactor that shall open when the motor is stopped or when the controller detects a fault condition, including, but not limited to, a shorted SCR.

H. Adjustments and Configurations

1. Programming/configuration devices, display units, and field control wiring terminals shall be accessible on the front of the control module. Exposure to control circuit boards or electrical power devices during routine adjustments is prohibited.

2. Digital indication shall provide, as a minimum, the following conditions:

a. RVSS status; ready, starting/stopping, run.

b. Motor status; current, torque, thermal state, power factor, operating time, power in kW.

c. Fault status; motor thermal overload, RVSS thermal fault, loss of line or motor phase, line frequency fault, low line voltage fault, locked rotor fault, motor underload, maximum start time exceeded, external fault, serial communication fault, line phase reversal fault, motor overcurrent fault.

d. RVSS controller shall have internal slot for a Modbus TCP network interface card. The card shall provide dual RJ45 ports and support both Modbus TCP and Ethernet/IP protocols.

3. RVSS controller unit shall be preset to the following for operation without adjustment in most applications:

a. Linear (torque-controlled) acceleration ramp of 10SEC.

b. Current limitation to 350% of the motor full load current rating.

c. Class-10 overload protection.

d. Motor current preset per NEC Table 430.150 for standard horsepower motors.

4. A digital keypad shall be used to configure the following operating parameters as required:

a. Motor full load amperes adjustable from 40 to 100% of the RVSS controller unit rating.

b. Current limitation on starting adjustable from 200 to 700% of the motor current rating, not to exceed 350% of the RVSS controller unit rating.

c. Voltage ramp adjustable from 1 to 60SEC.

d. Initial voltage adjustable from 10 to 50% of nominal motor torque.

e. Maximum start time adjustable from 1 to 250SEC.

f. Voltage boost duration adjustable from 0.1 to 1SEC.

g. Selection of freewheel or soft stop.

h. Linear (torque-controlled) deceleration ramp time adjustable from 1 to 60SEC.

i. Threshold to change to freewheel following a soft stop from 0 to 10% of the nominal motor torque.

j. Selection of Class-10, Class-20, or Class-30 motor thermal overload protection.

5. Digital keypad shall be used configure the following controller parameters as required

a. Assignment of RVSS inputs and outputs.

b. Activation of phase reversal protection.

c. Reset of motor thermal state.

d. Return to factory parameter settings.

e. Activation of self-test mode.

f. Indication of elapsed time in hours of starting, running, and stopping.

6. Output relays shall provide the following status indications

a. Two (2) Form A (normally open) minimum for indication of trip.

b. Two (2) Form A (normally open) for indication that RVSS controller is running.

7. Additional inputs and outputs shall be available to provide the following status indications

a. Two (2) assignable control inputs for the following functions: external fault input, disable serial link control, second set of parameters, or general fault reset.

8. Relay and I/O functions listed above shall be isolated with respect to common.

I. Controls

1. RVSS controller unit control circuit shall be fed from a fused line supply and shall be completely independent of the power circuit and separate from relay control logic.

2. The peripheral RVSS controller unit control circuitry shall be operated from a control power transformer included within the enclosure.

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate all Motor Controllers installation in accordance with the approved equipment submittals to provide best locations.

B. Motor Controllers shall be installed in accordance with the Electrical Raceway Systems design and best practices of the trade as complete assemblies as intended on the Contract Documents.

3.2 INSTALLATION

A. Contractor shall install Motor Controllers per the manufacturer's recommendations and the Contract Documents.

B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

C. Motor Controllers shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to the following

1. Checking to ensure that all bus bars are torqued to the manufacturer's recommendations

2. Assembling all shipping sections, removing all shipping braces and connecting all shipping split mechanical and electrical connections

3. Inspecting and installing all circuit breakers in their proper compartments

3.3 FIELD QUALITY CONTROL

A. Clean, inspect, test, and energize Motor Controllers in accordance with applicable NECA / NEiS standards and recommendations.

B. Field testing shall be done in accordance with the requirements specified in Specification Sections:

1. Division 2 – SITE CONSTRUCTION

2. 16080 – ELECTRICAL TESTING

3. Coordinate inspections and tests as required

C. After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.

D. Provide the services of a qualified factory-trained manufacturer's representative to provide start-up of the equipment specified under this Section for a period of one working day (1DY).

E. Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.4 EXAMINATION

A. Contractor shall examine Motor Controller exterior and interior prior to installation. Contractor shall immediately report any damage to the Owner and shall not install any equipment that is damaged in any manner.

B. Examine structure and equipment to receive Motor Controllers compliance with installation tolerances and other conditions affecting performance of the product as required by the manufacturers installation instructions and recommendations to include Engineer installation details. Do not proceed with installation until unsatisfactory conditions have been met or corrective action has been taken.

C. Verification of Conditions

1. Examine areas and conditions under which the work is to be installed, and notify the Owner and Engineer in writing, of any conditions detrimental to the proper and timely completion of the work.

2. Contractor shall not proceed with the work until all unsatisfactory conditions have been corrected and accepted by the Owner and Engineer.

3.5 FACTORY ACCEPTANCE TESTING

A. Motor Controller shall go through a non-witnessed, Factory Acceptance Test (FAT) prior to shipment. FAT shall include, but not limited to, the following

1. Physical Inspection of the following

a. Structure

b. Electrical conductors, including, but not limited to, the following:

1) Power and Control wiring

2. Electrical Tests

a. General electrical tests shall include, but shall not be limited to, the following:

1) Power circuit phasing

2) Control circuit wiring

3) Device electrical operation

4) Forced faults

b. AC dielectric tests shall be performed on the power circuits.

3. Markings/labels include, but shall not be limited to, the following

a. Instructional type

b. UL/CSA

c. Inspector's stamps

4. Each device shall be configured and addressed to correspond with software setting.

5. A read/write test shall be performed prior to shipment on network devices.

6. Testing shall be designed to verify system operation and shall include, but shall not be limited to, these verifications as a minimum

    a. Drawings and bill of materials

    b. I/O addressing, hard-wired and digital

    c. Correct device operation by I/O address

    d. Host communications

    e. Control network interface

C. Manufacturer shall use integral quality control checks throughout the manufacturing process to ensure that Motor Controller meet operating Specifications.

D. A certified test report of all standard FAT procedures, tests, results and corrective actions shall be shipped Motor Controller.

E. Manufacturer shall notify Engineer two weeks (2WK) prior to the date the tests are to be performed.

3.6 TRAINING

A. Contractor shall provide a training session for up to five (5) Owner's representatives for one normal workday (1DY) at a job site location determined by the Owner.

B. Training sessions shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, and major components within the assembly.

END OF SECTION 16340

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SECTION 16360 – PACKAGED POWER SUPPLIES

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish and install Packaged Power Supplies of voltage and current ratings as shown in the Contract Documents. Packaged Power Supplies shall be furnished with transformer ratings, circuit breaker ratings, number of circuit breakers, number of poles and locations conforming to the Contract Documents.

B. Reference Section 16000 – ELECTRICAL BASIC REQUIREMENTS.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

B. Related Specification Section(s) include but not limited to

1. 16120 – CONDUCTORS AND CABLES

2. 16111 – CONDUIT AND RACEWAYS

1.3 REFERENCES

A. Packaged Power Supplies shall conform to all applicable Federal, UL, and NEMA standards. Materials and components shall be new and conform to grades, qualities and standards as specified herein and shown on the Contract Documents.

B. Codes and Standards

1. American National Standards Institute (ANSI)

a) C57.1, C57.2, C57.3 – ANSI Standards for Transformers, Regulators and Reactors

2. International Organization for Standardization (ISO)

a) 9001, Quality Management Systems - Requirements

3. National Electrical Manufacturers Association (NEMA)

a) AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

b) PB 2 - Deadfront Distribution Switchboards, File E8681

c) TP 1 – Guide for Determining Energy Efficiency for Distribution Transformers,

d) TP 2 – Standard Test Method for Measuring the Energy

Consumption of Distribution Transformers

e) TP 3 – Standard for the Labeling of Distribution Transformer Efficiency

f) ST 20 2014 – Dry Type Transformers For General Applications

4. National Fire Protection Agency (NFPA)

a) 70, National Electrical Code (NEC)

5. Underwriters Laboratories, Inc. (UL)

a) 50 - Cabinets and Boxes

b) 67 – Panelboards

c) 98 - Enclosed and Dead Front Switches

d) 489 - Molded Case Circuit Breakers

e) 1561 - Dry-Type General Purpose and Power Transformers

6. USA Federal Regulations, Policies and Acts

a) Energy Act of 2020

b) 10 CFR Part 429 – Certification, Compliance And Enforcement For Consumer Products and Commercial and Industrial Equipment

c) 10 CFR Part 431 – Energy Efficiency Program For Certain Commercial And Industrial Equipment

d) W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.

C. Packaged Power Supplies shall be UL listed and labeled as service equipment.

D. Quality Assurance

1. Manufacturer of the assembly shall be the manufacturer of the secondary distribution equipment.

2. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

3. Manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five years (5YR).

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Sections:

1. 01340 – SUBMITTALS

B. Shop drawings shall be furnished for Engineer review prior to factory assembly of the Packaged Power Supplies. These drawings shall include but not limited to:

1. Material specifications and product data sheets identifying all materials used and methods of fabrication.

2. Complete assembly, layout, and installation drawings with clearly marked dimensions for each packaged power supply.

3. Complete panelboard schedules indicating circuit designations and connected loads as shown on the Contract Documents for each packaged power supply.

C. In accordance with the procedures and requirements set forth in the General Conditions and Section 01340, SUBMITTALS, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Reports of Certified Shop Tests

3. Spare Parts List

4. Operation and Maintenance Manuals

D. Each submittal shall be identified by the applicable specification section.

E. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

F. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

G. Shop drawings shall include but not be limited to:

1. Material specifications and product data sheets identifying all materials used and methods of fabrication.

2. Complete assembly, layout, and installation drawings with clearly marked dimensions for each packaged power supply.

3. Complete panelboard schedules indicating circuit designations and connected loads as shown on the Contract Documents for each packaged power supply.

H. The submittal information shall reflect the specific equipment identification as indicated on the Contract Documents.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in unopened cartons or bundles as appropriate, clearly identified with manufacturer's name, Underwriter's or other approved label, grade or identifying number.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to equipment and material from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component

1.7 WARRANTY

A. Manufacturer shall warrant Packaged Power Supplies to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. Packaged Power Supplies shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

A. All Packaged Power Supplies shall be identified with the identification tag number as indicated on the Contract Documents and the accepted shop drawings. A nameplate shall be securely affixed in a conspicuous place on each packaged power supply.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Documents.

B. Subject to compliance with these specifications all Packaged Power Supplies shall be of the same manufacturer and provided by:

1. Eaton Power and Industrial

2. General Electric Company

3. Siemens Power USA

4. Square D / Schneider Electric USA

5. Engineer Approved Equal

2.2 FEATURES

A. General

1. Packaged Power Supplies panelboards and transformers shall be constructed with separate enclosures capable of being assembled or disassembled as independent units.

2. Panelboard shall be furnished with Surge Protective Device(s) (SPD) integral to the packaged unit provided by the package unit manufacturer.

3. Packaged Power Supplies enclosures shall be NEMA rated and as shown on the Contract Documents.

4. Packaged Power Supplies shall be UL listed and labeled for use as service equipment where indicated on the Contract Documents.

B. Panelboard

1. General:

a) Panelboard shall be dead-front type with automatic trip-free, non-adjustable, thermal-overload, branch circuit breakers. Panelboard shall be of the configuration and rating as specified herein and indicated on the Contract Drawings.

b) Panelboard shall be equipped with a main breaker or main lugs complete with branch circuit breakers, as shown on the Contract Documents.

c) Panelboard shall be fully rated and shall have a short circuit rating of 35kA symmetrical, minimum.

2. Circuit Breakers:

a) All circuit breakers shall be bolt-on, molded-case type conforming to NEMA Standard AB 1. Trip elements of circuit breakers shall be 20A unless otherwise shown on the Contract Drawings. Circuit breakers shall have an interrupting rating of 22kA symmetrical at

240VAC, minimum. All breakers shall have quick-make, quick-break, toggle-mechanism for manual as well as automatic operation. Tandem or half-size breakers are not acceptable.

3. Bus Work

a) All bus shall be plated copper.

b) Branch bus work shall be rated to match the maximum branch circuit breaker which may be installed in the standard space.

c) Solid neutral bus bars are required. Ratings shall be in accordance with applicable standards.

d) A separate ground bus shall be provided with lugs for termination of equipment grounding conductors.

4. Directory

a) An approved panelboard directory with typewritten designations of each branch circuit shall be furnished and installed for each packaged power supply panelboard.

C. Transformer

1. All transformers shall have copper windings.

2. Transformers shall have a minimum of (2-5%) full capacity primary taps below normal and shall be rated 115DEG C temperature rise above 40DEG C maximum ambient.

3. All insulating materials are to be in accordance with current ANSI C89.2 and NEMA ST20 standards for an 185DEG C UL component recognized insulation system.

4. All transformers shall be encapsulated using a sand-epoxy resin mixture

5. All three-phase transformers shall be 480VAC primary and 208/120VAC secondary.

D. Enclosure

1. Packaged Power Supplies enclosure rating shall be NEMA-12 or as shown on the Contract Documents.

2.3 TOOLS, SUPPLIES AND SPARE PARTS

A. Contractor shall furnish to the Owner all spare parts as recommended by the equipment manufacturer including two (2) molded case circuit breakers of each type, size, and rating used.

B. Spare parts lists, included with the shop drawing submittal, shall indicate specific

sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

C. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

2.4 PAINTING

A. Factory: Surfaces shall be thoroughly cleaned, phosphatized and electrostatically power coated.

B. Field: After delivery and installation, but before packaged power supplies are placed in service, all factory-painted surfaces shall be carefully cleaned and all abrasions shall be repaired.

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate the Packaged Power Supplies installation in accordance with the approved equipment submittals to provide best locations and that all NEC required clearances are met.

B. Examine wall structures, equipment racks and/or structural elements to receive Packaged Power Supplies for compliance with installation tolerances and other conditions affecting performance of the product as required by the manufacturers installation instructions and recommendations to include Engineer installation details. Do not proceed with installation until unsatisfactory conditions have been met or corrective action has been taken.

C. Packaged Power Supplies shall be installed in accordance with the Electrical Raceway Systems design and best practices of the trade as complete assemblies as intended on the Contract Documents.

3.2 INSTALLATION

A. Contractor shall install Packaged Power Supplies per the manufacturer’s recommendations and the Contract Documents.

B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

C. Packaged Power Supplies shall be set true and plumb in all locations as shown on the Contract Documents. The main breaker and/or disconnect of Packaged Power Supplies shall not exceed 6FT above finished floor elevation.

D. Packaged Power Supplies shall not be fastened to concrete or masonry surfaces with wooden plugs, conical plastic anchors. Contractor shall use approved cadmium plated, galvanized steel or stainless-steel bolts with expansion shields or

other metallic type concrete insert for mounting on concrete or solid masonry walls. Approved cadmium plated, galvanized steel or stainless-steel toggle bolts shall be used for mounting on concrete block or other hollow masonry walls. Bolt diameter shall be as required considering the size and weight of the packaged power supply to provide adequate structural support.

3.3 FIELD QUALITY CONTROL

A. Clean, inspect, test, and energize Packaged Power Supplies in accordance with applicable NECA / NEiS standards and recommendations.

B. Field testing shall be done in accordance with the requirements specified in Specification Section(s)

1. 16080 – ELECTRICAL TESTING

2. Coordinate inspections and tests as required

C. After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.

END OF SECTION 16360

SECTION 16410 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall provide and install all Disconnect Switches of voltage and current ratings as shown in the Contract Documents of the type approved and as indicated herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

B. Related Specification Sections include but not limited to:

1. 16120 – CONDUCTORS AND CABLES

2. 16111 – CONDUIT AND RACEWAYS

1.3 REFERENCES

A. Disconnect Switches shall conform to all applicable Federal, UL, and NEMA standards. Materials and components shall be new and conform to grades, qualities and standards as specified herein and shown in the Contract Documents.

B. Codes and Standards

1. American National Standards Institute (ANSI)

2. International Organization for Standardization (ISO)

   a. 9001, Quality Management Systems - Requirements

3. National Electrical Manufacturers Association (NEMA)

   a. 250 - Enclosures for Electrical Equipment

   b. KS 1 - Enclosed Switches

4. National Fire Protection Agency (NFPA)

   a. 70, National Electrical Code (NEC)

5. Underwriters Laboratories, Inc. (UL)

   a. UL Listing/ Approval

   b. UL 98 - Enclosed and Dead Front Switches

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Sections:

1. 01330 – SUBMITTAL PROCEDURES

B. Shop Drawings

1. Submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

2. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

3. Shop drawings shall include but not be limited to:

a. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.

b. Complete layout drawing(s) with clearly marked dimensions for each type/size/rating of Disconnect Switch.

c. Double-Throw Disconnect Switches identified for use as Service-Entrance (SE) equipment are to be labeled for this application.

d. Assembled weight of each unit.

4. Shop drawing information shall be complete and organized in such a way that Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items that the Contractor intends to provide are acceptable and shall be submitted.

C. Qualifications

1. For approval, manufacturer shall have specialized in the manufacturing and assembly of Disconnect Switches for at least fifty (50) years.

2. Furnish products listed by Underwriters Laboratories Incorporated and in accordance with standards listed in Section 1.3.

3. Manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

1.5 DELIVERY, STORAGE AND HANDLING

A. Disconnect Switches and all components shipped loose shall be handled and stored in accordance with manufacturer’s instructions and recommendations.

B. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

C. Store in a clean, dry space.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Disconnect Switches operation and maintenance manuals shall be provided with each lot shipped, and shall include instruction leaflets and instruction bulletins for the assembly.

1.7 WARRANTY

A. Manufacturer shall warrant Disconnect Switches to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation or eighteen (18) months from date of purchase.

1.8 IDENTIFICATION

A. Disconnect Switches shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s):

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The equipment covered by this Section is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown in the Contract Documents.

B. Subject to compliance with the Contract Documents all Disconnect Switches shall be of the same manufacturer and provided by:

1. Square D / Schneider Electric USA

2. Acceptable as Specified in the Owner's Approved Products List

2.2 GENERAL-DUTY SAFETY DISCONNECT SWITCHES

A. Provide Disconnect Switches as shown in the Contract Documents with the following ratings:

1. 30A to 600A

2. 240VAC maximum

3. 2- and 3-pole plus Solid Neutral (S/N)

4. Fusible and Non-Fusible

5. Mechanical lugs suitable for aluminum or copper conductors

B. Construction:

1. Switch blades and jaws shall be visible and plated copper

2. Disconnect Switches shall have a black handle through 100A (except on plug-fuse type) that is easily pad-lockable with two 3/8IN shank locks in the OFF position. Higher rating shall have a RED handle that is easily pad-lockable with three 3/8IN shank locks in the OFF position

3. Disconnect Switches shall have non-defeatable door interlock that prevent the door from opening when the handle is in the ON position

   a. Switch assembly and operating handle shall be an integral part of the enclosure

   b. Disconnect Switches rated 200A to 600A shall have reinforced fuse clips

   c. Switch blades shall be readily visible in the “ON” and “OFF” position

4. Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type (except 30A plug-fuse type and compact design general-duty double-throw)

5. Fusible Disconnect Switches shall be suitable for service entrance equipment and be equipped with factory installed neutrals, as noted on drawings

6. All Disconnect Switches (except 30A plug-fuse type) shall have hinged doors. Door padlocking capability shall be provided

7. Disconnect Switches shall be suitable for systems capable of 100kA with Class R Fuses (except 30A plug-fuse type)

8. Double-Make, Double-Break switch blade feature shall be provided (except 30A plug-fuse type and compact design general-duty double throw)

9. 30A to 100A shall have Class R fuse rejection capability (not applicable to plug-fuse type)

10. Viewing Window, lower contacts

11. Voltage Indicators, line-side and load-side

C. Enclosures

1. All enclosures shall be NEMA-1 general purpose unless otherwise noted.

2. Paint color shall be ANSI 61 gray

3. Other types, where noted in the Contract Documents shall be:

   a. NEMA-1G plug fuse indoor:

      1) 30A to 60A NEMA 1 enclosures shall have tangential knockouts on the top, bottom and sides of the enclosure.

   b. NEMA-3R rainproof:

      1) Enclosures shall have tangential knockouts on the bottom and sides. (Not applicable to NEMA-1 plug-fuse type).

2.3 HEAVY-DUTY SAFETY DISONNECT SWITCHES

A. Provide Disconnect Switches as shown in the Contract Documents with the following ratings:

1. 30A to 1200A

2. 250VAC/DC, 600VAC (30A to 200A 600VDC)

3. 2, 3, 4 and 6 poles (2, 3 and 4 poles on 800A; 2 and 3 poles on 1200A)

4. Fusible and Non-Fusible

5. Mechanical lugs suitable for aluminum or copper conductors.

B. Construction:

1. Switch blades and jaws shall be visible and plated copper

2. Disconnect Switches shall have a RED handle that is easily pad-lockable with three 3/8IN shank locks in the OFF position

3. Disconnect Switches shall have non-defeatable door interlock that prevent the door from opening when the handle is in the ON position (except for double-throw switches). Defeater mechanism shall be front accessible.

4. Switches shall have deionizing arc chutes.

5. Disconnect Switch assembly and operating handle shall be an integral part of the enclosure base.

6. Disconnect Switches rated 30A to 600A shall have reinforced fuse clips

7. Switch blades shall be readily visible in the “ON” and “OFF” position

8. Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type. Bail type mechanisms are not acceptable

9. Fusible Disconnect Switches shall be suitable for service entrance equipment (except for 4-pole switches and 1200A when used on 480/277 or 600/347 grounded WYE systems)

10. Switches shall have line terminal shields (except for non-fusible double throw switches)

11. Disconnect Switches shall be suitable for systems capable of 200kA at 480V with Class J, L, R, or T fusing as applicable for single-throw switches; 100kA at 600V for double- throw switches

12. Engraved ON-OFF indication label shall be provided

13. Double-Make, Double-Break switch blade feature shall be provided

14. Fuse pullers shall be provided on all NEMA-4X and NEMA-12 Disconnect Switches through 200A

15. Shunt-trippable mechanism for switches 30A thru 800A switches, NEMA-12/3R, 4, and 4X/SS

    a. Coil voltage rating 24, 48, 120, 240, 480 VAC and 24, 48 and 125VDC

    b. Minimum operating voltage 55% of nominal rating for AC coils rated for Class 1 ground fault interruption

    c. 3-cycle maximum response time

16. Viewing Window, lower contacts

17. Voltage Indicators, line-side and load-side

C. Enclosures:

1. All enclosures shall be NEMA-12 general purpose unless otherwise shown in the Contract Documents.

2. Other types, where noted, shall be:

    a. NEMA-3R rainproof

    b. NEMA-4X watertight corrosion-resistant:

        1) 30A to 200A – 304 stainless steel

        2) 400A to 1200A – 304 stainless steel

c. NEMA-12 dust-tight and oil-tight special industry (dual NEMA-12/3R rating through 800A).

d. Paint color shall be ANSI 61 gray

3. 30A to 100A NEMA-4X and 12 enclosures shall be provided with draw-pull latches.

2.4 HEAVY-DUTY DOUBLE-THROW GENERATOR SAFETY DISCONNECT SWITCHES

A. Provide Heavy-Duty Double-Throw Generator Disconnect Switches as shown in the Contract Documents, with the following ratings:

1. 100A – 800A

2. 250VAC/DC; 600VAC (30A - 200A 600VDC)

3. 2, 3 or4 poles

4. Upper utility switch shall be: Fusible

5. Lower generator switch shall be: Fusible

6. Mechanical lugs suitable for aluminum or copper conductors

B. Construction:

1. Switch blades and jaws and bus bars shall be visible and plated copper

2. Disconnect Switches shall have a RED handle that is easily pad-lockable with three 3/8IN shank locks in the OFF position

3. Switch shall be of double throw design such that both switches may not be closed simultaneously. Handle operation shall have an “OFF” position between the two on positions.

4. Disconnect Switch shall be equipped with a separate interlocked receptacle compartment containing receptacles for quick-connection and disconnection of portable cord-connected equipment.

5. Interlock shall prevent the lower generator switch from being closed while cable compartment door is open, and shall prevent the door from being opened while the switch is closed.

6. Compartment shall be equipped with a spring-assisted door to allow portable cords to exit the compartment while in use, but shall close when not in use to effectively seal the compartment to prevent insects and small animals from entry.

7. Compartment shall be equipped with receptacles for sufficient cable connection for the ampacity of the switch.

8. Receptacles for switches 200A and greater shall be of the single cable per phase design – utilizing quarter turn cam type connections.

    a. Receptacles shall be: Cam-Lok type.

    b. 600A and 800A switches shall employ parallel receptacles.

9. Switch shall have deionizing arc chutes.

10. Disconnect Switches shall have factory-installed ground lug kit.

11. Switch assembly and operating handle shall be an integral part of the enclosure base

12. Switch blades shall be readily visible in the “ON” and “OFF” position.

13. Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type. Bail type mechanisms are not acceptable.

14. Fusible Disconnect Switches shall be suitable for Service-Entrance equipment.

15. Disconnect Switches shall have a solid or switched neutral as shown in the Contract Documents.

16. Disconnect Switches shall have line terminal shields (except for non-fusible double throw switches).

17. Switch shall be suitable for systems capable of 100kA at 600V with embossed or engraved ON-OFF indication shall be provided

18. Double-make, double-break switch blade feature shall be provided.

19. Viewing Window, lower contacts

20. Voltage Indicators, line-side and load-side

C. Enclosures:

1. All enclosures shall be NEMA-3R heavy-duty unless otherwise shown in the Contract Documents.

2. Other types, where noted, shall be:

    a. NEMA-4X watertight corrosion-resistant

        1) 100A to 800A – 304 stainless steel

    b. NEMA-12 dust-tight and oil-tight special industry (dual NEMA-12/3R rating through 800A).

        1) Paint color shall be ANSI 61 gray

3. 600A and 800A Switches shall be equipped with lifting eyes.

4. The following factory modifications are to be included:

   a. Factory installed UL listed switching neutral bonding kit for 3 or 4 pole double throw switches requiring a switching neutral

PART 3 - EXECUTION

3.1 INSTALLATION

A. Disconnect Switches to be mounted 60IN to top of enclosure above the finished floor, finished concrete or finished grade at the equipment height where appropriate, or as shown in the Contract Documents.

B. Disconnect Switches shall not be mounted to any hand-rail, safety rail stair-well, ladder-well or like structure that is designed for life-safety use. A minimum of 4IN shall be maintained from all life-safety structures and any edge of Disconnect Switches.

C. Contractor shall provide and install supports and/or support structures such as equipment racks to mount all Disconnect Switches.

D. Contractor shall furnish and install fuses or circuit breakers as required or shown in the Contract Documents.

3.2 PROJECT CLOSE OUT

A. All exterior and interior surfaces of the Disconnect Switches shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same paint coating as approved by the manufacturer for touch-up work.

B. Interiors of Disconnect Switches shall be free of debris to include cleaning of wire/cable pulling compounds. The use of compressed air systems is not acceptable.

END OF SECTION 16410

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SECTION 16415 – AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Owner shall furnish and Contractor shall install complete and fully functional Automatic Transfer Switches that have been tested during design verification, production to include performance testing at the Project site. All finished equipment shall be of the latest industrial design and will be complete with all of the necessary accessories for complete installation as shown in the Contract Documents and Specifications herein. Automatic Transfer Switches and associated equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All Automatic Transfer Switches and ancillary equipment shall be new and of current production of a national firm that manufactures Automatic Transfer Switches, switchgear, paralleling switchgear, generator controls and assembles these as complete and coordinated systems. There will be one (1) source responsibility for warranty, parts, and service through a local representative with factory-trained service personnel.

B. Scope of work shall include furnishing all labor, materials, equipment, testing, and training to provide a complete and fully functional standby back-up power system, including but not limited to the generator set, generator set controls, Automatic Transfer Switch(es), switching controls and installations as shown on the Contract Documents. It is the intent of this Specification to have a single source responsibility for the generator set, and automatic transfer switch.

C. Automatic Transfer Switches shall be produced by a manufacturer who has produced this type of equipment for a period of at least twenty-five years (25YR) and who maintains a service organization available twenty-four hours (24HR) a day throughout the year.

D. Automatic Transfer Switches shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production, installation, and service of their complete product line.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

B. Related Specification Section(s) include but not limited to

1. Section 16230 – ENGINE GENERATORS

1.3 REFERENCES

A. Automatic Transfer Switches shall conform to all applicable Federal, UL and NEMA standards. Materials shall be new and conform to grades, qualities and standards as specified herein and shown in the Contract Documents.

B. Codes and Standards

1. EN 50082-2 Generic immunity standard

2. EN 50140 Radiated Electro-Magnetic field immunity

3. EN 55011 Emission standard - Group 1, Class A

4. EN 61000-4-2 Electrostatic discharge (ESD) immunity

5. EN 61000-4-4 Fast Transient Immunity Severity Level 4

6. EN 61000-4-5 Surge Immunity Class 4 (voltage sensing and programmable inputs only)

7. IEC Specifications for EMI/EMC Immunity as follows

   a) CISPR 1 Radiated Emissions

   b) IEC 947-6-1, Low-Voltage Switchgear and Controlgear; Multifunction equipment; Automatic Transfer Switching Equipment

   c) IEC 1000-4-2, Electrostatic Discharge

   d) IEC 1000-4-3, Radiated Electromagnetic Fields

   e) IEC 1000-4-4, Electrical Fast Transient (Bursts)

   f) IEC 1000-4-5, Surge Voltage

   g) IEC 1000-4-6, Conducted RF Disturbances

   h) IEC 1000-4-8, Magnetic Fields

   i) IEC 1000-4-11, Voltage Variations and Interruptions

8. IEEE Standard 241--Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book)

9. IEEE Standard 446--Recommended Practice for Emergency and Standby Power Systems (Orange Book)

10. IEEE472 (ANSI C37.90A) Ring Wave Test

11. NEMA Standard IC10 (formerly ICS 2-447) Automatic Transfer Switches.

12. NFPA 70--National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700

13. NFPA 99--Essential Electrical Systems for Health Care Facilities

14. NFPA 110--Standard for Emergency and Standby Power Systems

15. UL 508 – Standard for industrial Control Equipment

16. UL 1008--Standard for Automatic Transfer Switches

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. Shop Drawings

1. Submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

2. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

3. Shop drawings shall include but not be limited to

a) Equipment specifications and product data sheets identifying all materials used and methods of fabrication.

b) Complete layout drawing(s) utilizing AutoCAD® or similar software to provide clear and accurate dimensional drawing sheets for each type/size/rating of each Automatic Transfer Switch utilized in the Project scope of work.

c) Automatic Transfer Switches identified for use as Service-Entrance (SE) equipment are to be labeled for this application.

d) Assembled weight of each unit.

4. Shop drawing information shall be complete and organized into one (1) PDF file format with Table Of Contents for ease of navigation.

5. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" I not acceptable and shall be rejected.

C. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set and the Automatic Transfer Switch if it is included elsewhere in these Specifications.

D. Qualifications

1. For approval, manufacturer shall have specialized in the manufacturing and assembly of Automatic Transfer Switches for at least twenty-five years (25YR).

2. Furnish products listed by Underwriters Laboratories Incorporated and in accordance with standards listed in Section 1.3.

3. Manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

1.5 DELIVERY, STORAGE AND HANDLING

A. Automatic Transfer Switches and all components shipped loose shall be handled and stored in accordance with manufacturer's instructions and recommendations.

1. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

2. Store in a clean, dry space.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Automatic Transfer Switches operation and maintenance manuals shall be provided with each lot shipped, and shall include instruction leaflets and instruction bulletins for the assembly.

1.7 WARRANTY

A. A one-year (1YR) service agreement and warranty shall be provided and shall include complete corrective and preventative maintenance for one year from the date of substantial completion. The service agreement shall include adjustment to the Automatic Transfer Switch, generator set and switchgear controls as required, and certification in the Owner's maintenance log of repairs made and proper functioning of all systems. All required materials and labor shall be provided.

B. Automatic Transfer Switch manufacturer and its distributor shall maintain a 24-hour (24HR) parts and service organization within one-hundred miles (100MILE) of the project site. The organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment provided.

1.8 IDENTIFICATION

A. Automatic Transfer Switches shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Automatic Transfer Switches and associated equipment shall be provided by one of the manufacturers listed:

1. ASCO Power technologies
2. Eaton Power and Industrial
3. General Electric Company
4. Russelectric / Siemens
5. Square D / Schneider Electric USA
6. Engineer Approved Equal

B. Listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting the Specifications in their entirety.

2.2 RATINGS

A. Switch assembly shall be rated for power system operating voltage as shown on the Contract Documents

B. Switch enclosure shall be NEMA rated with those enclosure ratings as shown on the Contract Documents

C. Switch shall be a 600V class equipment

2.3 ELECTRICAL REQUIREMENTS

A. Automatic Transfer Switches not intended for continuous duty or repetitive load transfer switching are not acceptable.

B. Automatic Transfer Switches shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load.

C. Automatic Transfer Switches rated less than or equal to 400A shall be suitable for 100% tungsten-filament lamp load.

D. Automatic Transfer Switches rated greater than or equal to 600A shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

E. Automatic Transfer Switches rated greater than 800A shall have front removable

and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

F. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.

G. Automatic Transfer Switches shall be rated to withstand the RMS symmetrical short circuit current 35kA minimum at the switch terminals, with the type of overcurrent protection shown on the Contract Documents.

2.4 MECHANICAL REQUIREMENTS

A. All main contacts shall be of silver composition.

B. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the Automatic Transfer Switch without major disassembly or disconnection of power conductors.

C. Contact transfer time shall not exceed (0.150SEC)

D. All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.

E. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the Automatic Transfer Switch without major disassembly or disconnection of power conductors.

F. The neutral conductor shall be solidly connected or as otherwise shown on the Contract Documents. A neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.

2.5 CONTROL SYSTEM

A. A control module shall direct the operation and status of the switch. The sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. Control module shall have a keyed disconnect plug to enable the control module to be disconnected from the switch mechanism for routine maintenance.

B. Control module shall be mounted separately from the switch mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.

C. Control module shall be capable of storing the following records in memory for access either locally (at the control module) or remotely (at a computer):

1. Number of hours transfer switch is in the emergency position (total and since record reset)

2. Number of hours the emergency is available (total and since record reset)

3. Total days that control has been energized (total and since record reset)

4. Total transfers in either direction (total and since record reset)

5. Date of record reset

6. Date of last exercise period

7. Date, time, and description of the last four source failures

8. Elapsed time during the most recent source outage

2.6 OPERATION

A. Source Voltages

1. The voltage of each phase of the normal source and a single phase of the emergency source shall be monitored with pickup adjustable from 75% to 100% and dropout adjustable from 70% to 95% of nominal. Adjustment must be digital.

2. An automatic minimum differential of 2% shall be maintained between pickup and dropout settings.

3. Repetitive accuracy of the setting shall be ±2% or better over an operating temperature range of -20°F to 150°F (-29°C to 65.5°C).

4. Settings shall be fully field-adjustable by keypad or keyboard (local or remote) in increments of 1V without opening the enclosure door and without the use of special tools or separate meters.

5. Factory settings shall be pickup at 95% and dropout at 85%.

6. A light-emitting diode shall indicate that normal and/or emergency voltage is within the set point parameter. The indication shall be viewable when the enclosure door is closed.

B. Time Delays

1. Control module shall include four-time delays that are fully field-adjustable by keypad or keyboard in increments of 1SEC over the entire range.

2. Adjustments and viewing of the time delay values shall be accessible when the enclosure door is closed.

3. Light emitting diodes shall indicate when the timing feature is running and when the time delay has ended.

4. Required Time Delays

a) Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6SEC. Factory set at 5SEC.

b) Time delay for transfer to standby power: Range 0-5MIN. Factory set at 10SEC.

c) Time delay for transfer back to normal power: Range 0-30MIN. Factory set at 5MIN.

d) Time delay for engine cooldown: Range 0-60MIN. Factory set at 10MIN.

5. Input values outside the allowable parameters shall cause a "range error" message to be displayed.

C. User shall have the ability to manually program an engine start and run for a period of up to twenty-four hours (24HR) in the loaded or unloaded mode of operation. The time delay transfer to standby and/or normal power may be bypassed during the run period. A numeric indication shall be displayed of the run time remaining in hours and minutes. The run period may be stopped at any time with a single keystroke. After the run period has stopped, the engine shall run unloaded for the cooldown time.

D. User terminals shall be available to connect a normally closed contact that, when opened, signals the control module to start and transfer load to the engine-generator. Closing these contacts shall initiate a re-transfer and engine cooldown sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.

E. The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field by installing an insulated program jumper provided by the vendor as standard.

1. Factory installed anti-single phasing protection shall detect regenerative voltage as a failed source condition.

2. In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal.

3. Manual operation override shall function to bypass any manual switch accessories if the source to which the transfer switch is positioned fails. This program jumper shall be factory installed.

4. Plant Exerciser: Programmable seven-day, fourteen-day or calendar exerciser. Each exerciser mode shall be capable of performing up to two exercise runs in up to five exercise event periods. The exerciser period shall be programmed with the enclosure door closed. The exercise time may be reset at any time with a single keystroke. The engine shall be allowed to run when the exercise period is terminated.

F. Status Indicators

1. Light-emitting diodes shall indicate the status of the following:

2. Contactor Position

3. System Status

a) Switch Position Sensing Fault

b) Switch Fail to Transfer

c) Internal Control Module Fault

d) Manual Transfer Operation

e) External Fault Condition (two inputs)

f) Not In Automatic

g) Programming Switch Not In Off

h) System status messages shall also be shown on the alphanumeric display.

4. Accessory Active

a) Plant Exerciser

b) In-Phase Monitor

c) Load Shed

d) Area Protection

5. A lamp test push button shall light all light-emitting diodes.

G. Control module shall have a three-position, key-operated, programming control switch. The key shall be removable in any position. The positions shall be:

1. OFF - Allows all enabled accessories to be monitored only. Settings cannot be changed while in this position.

2. LOCAL - Allows all enabled accessory settings to be changed by local keypad entry.

3. REMOTE - Allows all enabled accessories to be altered via the remote communications port.

H. A momentary-type test switch shall be provided to simulate a normal source failure.

I. Automatic Transfer Switch (ATS) shall be able to control up to twelve (12) isolated

Form-C auxiliary contacts. Signals to be monitored include the following

1. ATS connected to utility.

2. ATS connected to standby power.

3. ATS connected to standby power for pump control panel interlock.

4. ATS failure.

J. A set of gold-flashed contacts rated 10A/28VDC shall be provided for a low-voltage engine start signal when the normal source fails.

PART 3 – EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate the Automatic Transfer Switch(es) installation in accordance with the approved equipment submittals to provide best locations and that all NEC required clearances are met.

B. Examine wall structures, equipment racks and/or structural elements to receive Automatic Transfer Switch(es) for compliance with installation tolerances and other conditions affecting performance of the product as required by the manufacturers installation instructions and recommendations to include Engineer installation details. Do not proceed with installation until unsatisfactory conditions have been met or corrective action has been taken.

C. Automatic Transfer Switch(es) shall be installed in accordance with the Electrical Raceway Systems design and best practices of the trade as complete assemblies as intended on the Contract Documents.

3.2 INSTALLATION

A. Contractor shall install Automatic Transfer Switch(es) per the manufacturer's recommendations and the Contract Documents.

B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.3 FIELD QUALITY CONTROL

A. Clean, inspect, test, and energize Automatic Transfer Switch(es) in accordance with applicable NECA / NEiS standards and recommendations.

B. Field testing shall be done in accordance with the requirements specified in Specification Section(s)

1. 16080 – ELECTRICAL TESTING

2. Coordinate inspections and tests as required

C. After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.

D. Provide the services of a qualified factory-trained manufacturer's representative to provide start-up of the equipment specified under this Section for a period of one (1) working days.

E. Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.4 TRAINING

A. Contractor shall provide a training session for up to five (5) Owner's representatives for one (1) normal workday at a job site location determined by the Owner.

B. Training sessions shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, and major components within the assembly.

3.5 PROJECT CLOSE OUT

A. All exterior and interior surfaces of the Automatic Transfer Switch(es) shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same paint coating as approved by the manufacturer for touch-up work.

B. Interiors of Automatic Transfer Switch(es) shall be free of debris to include cleaning of wire/cable pulling compounds. The use of compressed air systems is not acceptable.

C. Contractor shall provide one (1) complete set of operating instructions (laminated tear-resistant paper) within the enclosure.

END OF SECTION 16415

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SECTION 16416 – MANUAL TRANSFER SWITCHES

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall Furnish and install Manual Transfer Switches (MTS) and Non-Automatic Transfer Switches (NATS) having the ratings, features/accessories and enclosures as specified herein and as shown on the contract drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

B. Related Specification Section(s) include but not limited to

1. 16120 –CONDUCTORS AND CABLES

2. 16111 – CONDUIT AND RACEWAY

1.3 REFERENCES

A. The transfer switches and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of UL and NEMA as follows:

1. UL 1008 – Transfer Switches
2. UL 991
3. NFPA 70 – National Electrical Code
4. NFPA 99 – Essential Electrical Systems of Health Care Facilities
5. NFPA 110 – Emergency and Standby Power Systems
6. NEMA ICS 10 – AC Transfer Switch Equipment
7. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems
8. IEC 801-2, 3, 4, and 5
9. CISPR 11
10. Compliant with FCC Part 15, Subpart B, Class A.

1.4 SUBMITTALS

A. The following information shall be submitted to the Engineer:

1. Master drawing index
2. Front view and plan view of the assembly
3. Schematic diagram
4. Nameplate schedule
5. Component list
6. Conduit space locations within the assembly.
7. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current rating.
8. Major component ratings including:
    a. Voltage
    b. Continuous current rating
    c. Interrupting ratings.
9. Cable terminal sizes
10. Product Data Sheets.

B. Where applicable, the following additional information shall be submitted to the Engineer:

1. Busway connection
2. Connection details between close-coupled assemblies
3. Composite front view and plan view of close-coupled assemblies
4. Key interlock schematic drawing and sequence of operations
5. Mimic bus.

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in section 1.4
2. Wiring diagrams

3. Certified production test reports

4. Installation information

5. Seismic certification as specified

B. The final (as-built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

1.6 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.7 REGULATORY REQUIREMENTS

A. Provide a certificate of compliance with UL 1008 for the transfer switches furnished under this section.

1.8 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.9 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton

B. Schneider Electric

C. Engineer approved equal

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the engineer ten (10) days prior to bid date.

2.2 RATINGS

A. The transfer switch shall have equal 3-second withstand; closing and interrupting ratings of ·35,000 amperes at ·480 volts.

B. The transfer switch shall be 100% equipment rated for continuous duty.

C. The transfer switch shall be 100% equipment rated for continuous duty as shown on the drawings and shall conform to the applicable requirements of UL 1008 for emergency system total load.

D. The manual transfer switches shall be fully rated for all types of loads, inductive and resistive, without over-sizing, either open or enclosed.

2.3 CONSTRUCTION

D. Main contacts shall be designed to withstand multiple fault currents and shall meet UL 489 and/or UL 1087 requirements.

E. The transfer switch shall be mechanically interlocked to prevent cross connection of sources when operated.

F. Transfer switches shall be capable of being operated manually under full rated load conditions. Removable manual operating handles are not acceptable. Manual operators requiring source or load disconnection prior to manual operation are not acceptable.

G. On transfer switches requiring a fourth pole for switching the neutral, the neutral shall be fully rated with equal withstand, closing and interrupting ratings to the power poles. Switched neutral poles which are add-on or overlap, or that are not capable of breaking full rated load current are not acceptable.

2.4 WIRING/TERMINATIONS

A. Terminal blocks shall conform to NEMA ICS 4. Terminal facilities shall be arranged for entrance of external conductors from the top or bottom of the enclosure. The main transfer switch terminals shall be suitable for the termination of conductors shown on the plans.

2.5 ENCLOSURE

A. Each transfer switch shall be provided in a NEMA 4X enclosure suitable for use in environments indicated in the drawings.

2.6 FINISH

A. NEMA 1, 12 or 3R enclosures shall be painted with the manufacturer's standard light gray ANSI 61 paint. NEMA 4 or 4X shall be stainless steel, non-painted.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

1. Insulation check to ensure the integrity of insulation and continuity of the entire system

2. Visual inspection to ensure that the switch matches the specification requirements and to verify that the fit and finish meet quality standards

3. Mechanical tests to verify that the switch's power sections are free of mechanical hindrances

4. Electrical tests to verify the complete electrical operation of the switch and to set up time delays and voltage sensing settings of the logic.

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.3 FIELD QUALITY CONTROL

A. Provide the services of a qualified factory-trained manufacturer's representative to assist the contractor in installation and start-up of the equipment specified under this section for a period of three working days. The manufacturer's representative shall provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

B. The contractor shall provide three (3) copies of the manufacturer's field start-up.

3.4 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

3.5 TRAINING

A. The contractor shall provide a training session for up to five (5) owner's representatives for two (2) normal workdays at a jobsite location determined by the owner.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers and major components within the assembly.

3.6 INSTALLATION

A. The contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. All necessary hardware to secure the assembly in place shall be provided by the contractor.

C. The equipment shall be installed and checked in accordance with the manufacturer's recommendations.

3.7 FIELD SERVICE

A. The manufacturer of the MTS shall also have a national service organization that is available throughout the contiguous United States and is available on call 24 hours a day, 365 days a year.

END OF SECTION 16416

SECTION 16435 – PANELBOARDS

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish and install panelboards of voltage and current ratings as shown in the Contract Documents. Panelboards shall be furnished with circuit breaker ratings, number of breakers, number of poles and locations conforming to the panelboard schedules in the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section, the requirements of Division 16 and those Project Specification Sections referenced therein shall be applied.

1.3 REFERENCES

A. Panelboards shall conform to all applicable Federal, UL, and NEMA standards. Materials and components shall be new and conform to grades, qualities and standards as specified herein and shown in the Contract Documents.

B. Codes and Standards

1. American National Standards Institute (ANSI)

2. International Organization for Standardization (ISO)

    a. 9001, Quality Management Systems - Requirements

3. National Electrical Manufacturers Association (NEMA)

    a. AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

    b. PB 2 - Deadfront Distribution Switchboards, File E8681

4. National Fire Protection Agency (NFPA)

    a. 70, National Electrical Code (NEC)

5. Underwriters Laboratories, Inc. (UL)

    a. 50 - Cabinets and Boxes

    b. 67 – Panelboards

    c. 98 - Enclosed and Dead Front Switches

    d. 489 - Molded Case Circuit Breakers

6. USA Federal Regulations, Policies and Acts

a. W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 16 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. Qualifications

1. For approval, manufacturer shall have specialized in the manufacturing and assembly of Panelboards for at least fifty years (50YR).

2. Furnish products listed by Underwriters Laboratories Incorporated and in accordance with standards listed in Section 1.3.

3. Manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

4. Equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

5. Panelboards shall bear UL label.

1.5 DELIVERY, STORAGE AND HANDLING

A. Panelboards and all components shipped loose shall be handled and stored in accordance with manufacturer's instructions and recommendations as outlined in applicable Installation and Maintenance Manuals. Three (3) copies of these instructions shall be included with the equipment at time of shipment.

B. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Panelboards operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

1.7 WARRANTY

A. Manufacturer shall warrant Panelboards to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. Panelboards shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Panelboards shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown in the Contract Documents.

B. Subject to compliance with the Contract Documents all Panelboards shall be of the same manufacturer and provided by:

1. Eaton Power and Industrial
2. General Electric Company
3. Siemens Power USA
4. Square D / Schneider Electric USA
5. Engineer Approved Equal

2.2 MAIN BUS AND BRANCH CONNECTORS

A. All main bus shall be copper sized in accordance with UL standards to limit the temperature rise on any current carrying part to a maximum of 50C above a maximum ambient temperature of 40C.

2.3 PANELBOARDS - POWER DISTRIBUTION

A. General

1. Power Distribution Panelboards, as defined by NEC or noted in Contract Documents, shall be of the configuration and rated as shown in the Contract Documents. Panelboards shall be dead front type with automatic trip-free, non-adjustable, thermal overload branch circuit breakers. Circuit breakers shall be bolt-on molded case type conforming to NEMA Standard AB1. Trip elements of the circuit breakers shall be rated 20A unless otherwise shown in the Contract Documents. Bus ratings shall be as

shown in the Contract Documents. Panelboards shall be listed and labeled by Underwriter's Laboratories, Inc.

2. Power distribution panelboards shall be fully rated and shall have a short circuit rating of 35kA symmetrical, minimum. In the event the results of the Contractor's short circuit fault analysis, as accepted by the Engineer, indicate that a higher short circuit rating of the panelboards is required, furnish complete panelboards with that higher rating.

3. Power Distribution Panelboards shall be furnished with Surge Protective Device(s) (SPD) integral to the Panelboard provided by the Panelboard Manufacturer.

B. Enclosures

1. Power Distribution Panelboard enclosure rating shall be as indicated in the Contract Documents. The door shall be fastened to the enclosure with concealed brass hinges and shall be equipped with flush-type catches and locks; all locks shall be keyed alike. Enclosures shall have wiring gutters on sides and shall be at least 20IN wide and 5-3/4IN deep. Contractor shall provide an engraved nameplate for the panelboard in accordance with Section 1.8

2. All metal surfaces of the enclosures shall be thoroughly cleaned and given one prime of zinc chromate primer. All interior surfaces shall then be given one shop finishing coat of a lacquer of the nitro cellulose enamel variety. All exterior surfaces shall be given three coats of the same lacquer. The color of finishing coats shall be light gray ANSI #61.

3. An Underwriter's Laboratories, Inc. inspection label shall appear on the interior of the cabinet.

C. Bus Work

1. Main bus bars shall be of ample size so that a current density of not more than 1kA per square inch of cross section will be attained. This current density shall be based on the application of the full load connected to the panel plus approximately 25% of the full load for spare capacity. The main bus shall be full capacity as based on the preceding for the entire length of the panel so as to provide full flexibility of circuit arrangement.

2. Solid neutral bus bars, where required, shall be provided. Ratings shall be in accordance with applicable standards.

3. A separate ground bus shall be provided with lugs for termination of equipment grounding conductors.

4. Branch bus work shall be rated to match the maximum branch circuit breaker which may be installed in the standard space.

5. All bus shall be plated copper.

D. Circuit Breakers

1. Circuit breakers shall be bolt-on, molded-case type conforming to NEMA Standard AB 1. Trip elements of circuit breakers shall be 20A unless otherwise shown in the Contract Documents. Minimum branch circuit breaker shall be 100A frame for 30A and above except where shown otherwise in the Contract Documents or where a larger frame size is standard for the continuous current rating required. Breakers shall have an interrupting rating of 25kA symmetrical at 480VAC, minimum. All breakers shall have quick-make, quick-break, toggle mechanism for manual as well as automatic operation. Tandem or half-size breakers are not acceptable.

E. Directories

1. Approved directories with glass or noncombustible plastic cover, and with typewritten designations of each branch circuit, shall be provided in each panel. Contractor shall maintain in each panel, during the duration of the Contract, a handwritten directory clearly indicating the circuit breakers in service. This directory shall be updated as work progresses, and final, typewritten directories, as specified above, shall be installed at the end of the project and required for project close-out. Designations and circuit locations shall conform to the Panelboard schedules in the Contract Documents, except as otherwise authorized by the Engineer.

2. Contractor shall provide directories identifying Panelboards and indicating the size of the feeder (cable and conduit) serving the panel, circuit numbers, and a description of associated branch circuits including branch circuit trip and connected load for each circuit.

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate the Panelboard installation in accordance with the approved equipment submittals to provide best locations and that all NEC required clearances are met.

B. Examine wall structures, equipment racks and/or structural elements to receive Panelboards for compliance with installation tolerances and other conditions affecting performance of the product as required by the manufacturers installation instructions and recommendations to include Engineer installation details. Do not proceed with installation until unsatisfactory conditions have been met or corrective action has been taken.

C. Panelboards shall be installed in accordance with the Electrical Raceway Systems design and best practices of the trade as complete assemblies as intended on the Contract Documents.

3.2 INSTALLATION

A. Panelboards shall be furnished and installed as shown in the Contract Documents and as recommended by the equipment manufacturer.

B. Panelboards shall be set true and plumb in all locations as shown in the Contract Documents. Top of Panelboard enclosure shall not exceed 6FT above finished floor elevation.

C. Panelboards installed outdoors shall not be mounted to hand-rail or safety rail.

D. Panelboard enclosures shall not be fastened to concrete or masonry surfaces with wooden plugs, conical plastic anchors. Appropriate cadmium plated or galvanized steel bolts shall be used with expansion shields or other metallic type concrete insert for mounting on concrete or solid masonry walls. Cadmium plated or galvanized steel toggle bolts shall be used for mounting on concrete block or other hollow masonry walls. Bolt diameter shall be as required considering the size and weight of the completed panelboard and enclosure to provide adequate structural support.

E. Contractor shall not use factory furnished knockouts with surface back boxes. The Contractor shall punch or drill required openings during installation and shall equip flush back boxes with manufacturer's standard pattern of knockouts. The Contractor shall equip enclosure doors exceeding 40IN height with vertical bolt three-point locking mechanism.

F. Contractor shall install cabinets (and other enclosure products) in plumb with the building construction. Flush enclosures shall be installed so that the trim will rest against the surrounding surface material and around the entire perimeter of the enclosure.

3.3 FIELD QUALITY CONTROL

A. Contractor shall comply with those requirements and procedures per Specification Section(s)

1. 16080 – ELECTRICAL TESTING

3.4 PROJECT CLOSE OUT

A. All exterior and interior surfaces of the Panelboards shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same paint coating as approved by the manufacturer for touch-up work.

B. Interiors of Panelboards shall be free of debris to include cleaning of wire/cable pulling compounds. The use of compressed air systems is not acceptable.

END OF SECTION 16435

SECTION 17100 – INSTRUMENTATION AND CONTROL, GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. The Contractor shall provide, through the services of a single Control Systems Integrator (CSI), all components, system installation services, as well as all required and specified ancillary services, in connection with the Instrumentation and Control System (ICS).

B. ICS shall include all materials, labor, tools, fees, and documentation required to furnish, install, test, and place into operation, a complete and operable as shown and/or specified within this section, related ICS specification sections, and subsections within equipment specifications.

C. ICS shall include all measuring elements, signal converters, transmitters, specialty cables, control panels, digital hardware and software, remote telemetry units (RTU), signal and data transmission systems, interconnecting wiring and such accessories as shown, specified, and/or required to provide the functions indicated, whether specifically mentioned or not.

D. Where references are made to the SCADA System Programmer (SSP), it shall be understood that all application software services will be provided by the CSI as part of this Contract.

E. The Contractor shall be ultimately responsible for installation of the ICS. However, the CSI will include installation within the scope of his subcontract to provide for installation of the complete system as specified. CSI shall also coordinate this work with the Contractor to ensure that the proper type, size, and number of wires with their conduits are provided and installed. This coordination will also ensure that proper electrical power circuits are provided for all components and systems.

F. The Contractor responsibilities, as distinct from the CSI responsibilities, shall be to provide all additional materials and work necessary to supplement the materials and work provided by the CSI; thereby satisfying all requirements that are within ICS specification sections.

G. The Contractor shall coordinate structural work, penetrations, painting, etc., as required for installation of a complete ICS. In-line or integrally mounted items (such as flow elements, level sensors, etc.) shall be installed under the supervision of the CSI.

H. The Contractor shall be responsible for coordinating interfaces between ICS equipment provided under the ICS specification sections and the equipment provided under other sections of the specifications. Contractor shall verify and coordinate space requirements, process equipment power supply and voltage, process equipment control power supply and voltage, compatibility of control signals, details of equipment installation and interconnection. Coordination shall include distribution of approved shop drawings to all vendors, subcontractors, etc., involved in the control interface. Likewise, Contractor shall ensure that

instrumentation and control devices provided under other sections of the specifications are compatible and of the same quality and characteristics as similar devices specified under the ICS specification sections.

I. Scope Of Work (SOW) items listed within this Section pertain to major items of supply. Reference all the Contract Documents for additional Project requirements.

J. Project SOW will include updates to the existing SCADA System by the SSP for the equipment and instruments provided under this contract as shown on the Contract Documents and/or specified herein.

K. SOW will provide for the following components, systems or subsystems

1. Furnish various local process monitoring instrumentation complete with surge protection and signal transmission as specified.

2. Furnish Remote Telemetry Unit (RTU) complete with integrated PLC, OIT, and cellular communications as shown on the Contract Documents.

3. Furnish a local Pump Control Panel (PCP) for local operation of the pumps and capable of interfacing with the RTU to provide automatic and/or backup pump control operation.

4. Furnish an Intrinsically Safe panel for termination of wet well continuous level and float switch signals to intrinsically safe devices before continuation to the RTU and PCP.

5. Furnish antenna, communications hardware, and pole as shown on the Contract Documents and/or as required.

6. Furnish SPD devices for instrumentation and control panels as specified.

7. Furnish spare parts as described herein.

8. Provide implementation and testing of the complete system.

9. Furnish training of Owner personnel.

10. Provide Operations and Maintenance Manuals.

L. The CSI shall provide RTU and control panels complete with wiring, relay logic, pilot devices, backup power systems, power and signal line surge protection, communications equipment and appropriate interfaces to all station equipment.

M. The SSP shall provide PLC programming of control logic functions. This includes all applications for the monitoring and control of the process equipment.

N. The Contractor, working in conjunction with the CSI, shall be responsible to provide a complete and operational system in full compliance with the Project Specifications and Contract Drawings. CSI shall be responsible for the detailed design, field verification, installation, technical oversight, testing, quality assurance and documentation of all technical details involving instrumentation and control for

this project. CSI shall furnish trained personnel on site during any activities requiring installation, calibration, testing or startup of any controls or communications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Division 16 – Electrical

1. Where electrical subcomponents are to be provided as part of ICS equipment, but for which there is no specification, provide in accordance with Division 16 - Electrical. These subcomponents shall be compatible and of the same quality and characteristics as similar devices specified under Division 16 - Electrical. If possible, the same make and/or model supplied under Division 16 shall be provided.

2. The following work shall be provided under Division 16 – Electrical:

a. Conduit, raceways, and installation of wire and cable for all instrumentation and control system signal wiring, grounding systems, special cables and network cables except as noted.

b. Instrumentation and control system signal field wire.

c. Grounding systems for all ICS equipment.

d. Mounting of ICS electrical enclosures (i.e., control panels, SPD boxes, electronic instrumentation, etc.) with exclusion of final measuring elements of instrumentation (i.e., flow tubes, sensors in process piping, etc.) which shall be as coordinated by the Contractor.

B. Division 17 – Instrumentation and Control Specifications shall supplement and/or compliment the Metropolitan Sewerage District of Buncombe County Construction Standards and if there is a discrepancy between these, the Contractor shall immediately notify the Engineer.

1. Metropolitan Sewerage District Technical Specifications website:

a. https://www.msdbc.org/techspecssewerextmandev.php

2. The requirements explicit or implied within the Division 17 Specifications shall be applied to all of the Project Specification Sections to include but not limited to the following

a. 17110 – INSTRUMENTATION AND CONTROL, CONTROLS ENCLOSURES

b. 17120 – INSTRUMENTATION AND CONTROL, DEVICES AND EQUIPMENT

c. 17130 – INSTRUMENTATION AND CONTROL, SCADA

HARDWARE

d. 17140 – INSTRUMENTATION AND CONTROL, PUMP CONTROL PANEL

1.3 REFERENCES

A. ICS shall comply with the National Electric Code, National Electric Safety Code, OSHA, and with all applicable federal, state, county, municipal, and electrical utility codes and regulations, as well as the Contract Documents. In the event of any conflict between these codes, regulations, and Contract Documents, the most restrictive shall apply.

B. Codes and Standards

1. Applicable state, county, and municipal code requirements.

2. Applicable standards of the National Fire Protection Association (NFPA)

a. National Electrical Code (NEC).

3. Applicable standards of the Underwriter's Laboratories, Inc. (U.L.)

a. UL 508 Industrial Control Equipment

b. UL 508A Industrial Control Panels

4. Applicable standards of the Institute of Electrical and Electronics Engineers (IEEE)

5. Applicable standards of the National Electrical Manufacturers Association (NEMA)

a. NEMA 250 Enclosures for Electrical Equipment (1000 V Maximum)

b. NEMA ICS 1 Industrial Control and Systems: General Requirements

c. NEMA ICS 6 Enclosures for Industrial Control and Systems

6. Applicable standards of the International Society of Automation (ISA)

a. S5.1 Instrumentation Symbols and Identification

b. S5.4 Instrument Loop Diagrams

c. S20 Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves

d. TR20.00.01 Specification Forms for Process Measurement and Control Instruments

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division – 17 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. All Submittal packages shall include a complete copy of the applicable Specification Sections. Contractor shall review and indicate that all items within the submittal are compliant with the Specifications by indicating with a ‘check mark’ by each paragraph. Any items that do not meet the requirements, Contractor shall indicate by marking the corresponding paragraph with an ‘x’. Those items not in compliance with the Specifications, a written clarification shall be provided by the Contractor describing how the submittal differs from the requirements outlined in the Specification Sections and a detailed explanation why it is not possible to meet those requirements. Any submittal package received without marked-up Specification Sections shall be rejected and returned by the Engineer without review.

C. After all changes or corrections resulting from the review of the system supplier's drawings have been made, panels may be built and instrumentation devices may be supplied in accordance with the approved drawings. One set of "as shipped" prints shall be included in the panels when shipped from the system supplier's wiring and assembly shop.

D. The following major list of submittals shall be provided as a minimum. Major submittals are generally listed in the order they are to be provided. Refer to related ICS Specification Sections and equipment subsections for additional submittals and submittal requirements.

1. Preliminary Design Review/Project Execution Plan Submittal

2. Process Instrumentation Submittal

3. SCADA System Hardware and Control Panel Submittal

4. Training Submittal

5. Testing Submittal

6. Tools, Supplies, and Spare Parts Lists Submittal

7. Preliminary and Final Operation and Maintenance Manuals

E. Preliminary Design Review/Project Execution Plan Submittal

1. The Project Execution Plan (PEP) shall provide an overview of the proposed system including system architecture diagrams, the approach to work, the proposed work schedule indicating milestones and potential meetings, project personnel and organization, details of factory testing and field testing, details of training programs, and a paragraph-by-paragraph

review of the specifications indicating any proposed deviations. The schedule shall illustrate all major project milestones including the following:

a. Schedule for all subsequent project submittals.

b. Tentative dates for all project design review meetings.

c. Schedule of manufacture and staging of all instrumentation and control system equipment.

d. Schedule for all testing.

e. Schedule for shipment of all instrumentation and control system equipment and peripheral devices.

f. Schedule for equipment start up.

g. Schedule for all training.

2. No other submittals will be allowed prior to acceptance of the Project Plan.

F. Process Instrumentation Submittal

1. This submittal shall provide complete documentation of all field devices and other instrument and control equipment not specified to be submitted elsewhere.

a. Provide data sheets for each component listing all model numbers, optional, and ancillary devices that are being provided. The data sheets shall be provided with an index and proper identification and cross referencing. They shall include but not be limited to the following information.

1) Plant Equipment Number and ISA tag number per the Loop Diagrams.

2) Product (item) name used herein and on the Contract Drawings.

3) Manufacturers complete model number.

4) Location of the device.

5) Input - output characteristics.

6) Range, size, and graduations.

7) Physical size with dimensions, enclosure NEMA classification and mounting details.

8) Materials of construction of all components.

9) Instrument or control device sizing calculations where applicable.

10) Certified calibration data on all flow metering devices.

b. Provide equipment specification sheets which shall fully describe the device, the intended function, how it operates and its physical environmental and performance characteristics. Each data sheet shall have appropriate cross references to loop or equipment identification tags. As a minimum the specification sheets shall include the following:

1) Dimension, rigid-clearances.

2) Mounting or installation details.

3) Connection.

4) Electrical power or air requirements.

5) Materials of construction.

6) Environmental characteristics.

7) Performance characteristics.

c. The submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards, and equipment layouts in order to enable the Contractor to proceed with the detailed site preparation for all equipment.

G. SCADA System Hardware and Control Panel Submittal

1. Provide detailed drawings covering control panels, consoles and/or enclosures which shall include:

a. Cabinet assembly and layout drawings to scale. These shall include both front and interior layouts.

b. Material, fabrication and painting specifications.

c. Color selection samples for selection by the Engineer.

d. Where graphic display panels are required, submit detailed layout to scale, including symbols and line widths as well as color selection samples and details of fabrication. Half-scale layout will be acceptable.

e. Heat calculations for control panels that include a PLC control system.

f. Power supply device sizing calculations which include UPS systems (where applicable).

g. Panel wiring diagrams showing all power connections to equipment within and on the panel, combined panel power draw requirements (volts, amps), breaker sizes, fuse sizes, and grounding. This wiring diagram shall be in ladder logic format and shall reference the appropriate loop drawing for continuations or details where required. Show all wire numbers and terminal block designations

2. Provide detailed loop diagrams on a single 11IN x 17IN sheet for each monitoring or control loop. The loop diagram shall show all components of the loop both analog, digital, and discrete including all relays, switches, dropping resistors, etc. which are being provided for proper operation. Loop numbers used shall correspond to the loop numbers indicated in the Contract Documents. The format shall be the International Society of Automation, Standard for Instrument Loop Diagrams, ISA-S5.4 plus the following requirements:

   a. On each diagram, present a tabular summary of (1) the output capability of the transmitting instrument, (2) the input impedance of each receiving instrument, (3) an estimate of the loop wiring impedance based on wire sizes and approximate length used, (4) the total loop impedance, (5) reserve output capacity.

   b. Show all interconnecting wiring between equipment, panels, terminal junction boxes and field mounted components. The diagrams shall show all components and panel terminal board identification numbers and all wire numbers. This diagram shall include all intermediate terminations between field elements and panels (e.g., terminal junction boxes). The diagrams shall be coordinated with the electrical contractor and shall bear his mark showing this has been done.

   c. Show location of all devices.

   d. Show instrument description including type, manufacturer, model number, range, set points, and operation (e.g., fail open, open on energize, normally closed, etc.) as applicable.

   e. Show all instrument loop power or instrument air requirements back to termination on terminal block or bulkhead, fuse block (including fuse size), etc., as applicable.

3. This submittal shall provide complete documentation of the proposed hardware (PLC, communications equipment, peripherals, etc.) including:

   a. A system block diagram(s) showing in schematic form, the interconnections between major hardware components such as: control centers, panels, consoles, computer and peripheral devices, telemetry equipment, local digital processors and like equipment.

The block diagram shall reflect the total integration of all digital devices in the system and shall reflect any man/machine interface locations. All components shall be clearly identified with appropriate cross references to the location of each. The diagram shall reference all interconnecting cabling requirements for digital components of the system including any data communication links.

b. Data sheet for each hardware component, listing all model numbers, optional, auxiliary, and ancillary devices that are being provided. The data sheets shall be provided with an index and proper identification and cross referencing. They shall include but not be limited to the following information.

1) Equipment Number and ISA tag number per the Loop Diagrams (as applicable).

2) Product (item) name used herein and on the Contract Drawings.

3) Manufacturers complete model number.

4) Location of the device.

5) Input - output characteristics.

6) Range, size, and graduations.

7) Physical size with dimensions, enclosure NEMA classification and mounting details.

8) Materials of construction of all components.

9) Power supply device sizing calculations where applicable.

c. Equipment specification sheets which shall fully describe the device, the intended function, how it operates and its physical environmental and performance characteristics. Each data sheet shall have appropriate cross references to loop or equipment identification tags. As a minimum the specification sheets shall include the following:

1) Dimensions and working clearances.

2) Mounting or installation details.

3) Connection diagrams.

4) Electrical power requirements (volts, amps).

5) Materials of construction.

6) Environmental characteristics.

7) Performance characteristics.

d. The submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards, and equipment layouts in order to enable the Contractor to proceed with the detailed site preparation for all equipment.

4. This submittal shall contain a complete system Input/Output (I/O) and termination list for the local control PLC panel. The list shall be sorted first by ISA tag name and second by I/O type (i.e., AI, AO, D1, DO, PI, PO. etc.). The list shall contain as a minimum the following for each active point and spare point:

a. Full ISA instrument tag (or "SPARE").

b. Input / Output (I/O)

1) Type: DI, DO, AI or AO

2) Terminal point, strip, number, physical location

3) Panel name, rack, slot, point, etc.

4) Point address and name

H. Training Submittals

1. Training Plan Submittal: The training plan shall include:

a. Definitions of each course.

b. Specific course attendance.

c. Schedule of training courses including dates, duration, and locations of each class.

d. Resumes of the instructors who will actually conduct the training.

I. Testing Submittals

1. The test plan shall be submitted after all equipment submittals have been approved by the Owner and/or Engineer.

2. The test plan shall demonstrate that the CSI has designed and configured a system that meets the design specifications. The documents for the test plan shall be structured so that it is easily understood what the inputs are, what the predicted outputs should be, and what the actual outputs are. The test plan should have sign-off and date block for the CSI, the Contractor, and the Owner.

3. The complete test plan should include but not be limited to the following:

a. Test assumptions and methods

b. Test Equipment List

c. Test Personnel Staffing and Qualifications

d. Test Schedule with time allotted for each task

e. System hardware and software summary

f. Communications test to the various PLC for Discrete and Analog I/O data transfer

g. 100% I/O point test including all spare points based upon the previously submitted system I/O list

4. Test Procedures: Submit the procedures proposed to be followed during the test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests. Testing may not be started until all Testing Submittals have been approved.

5. Test Documentation: Submit a copy of the signed off test procedures upon completion of each required test.

J. Tools, Supplies and Spare Parts Lists Submittal

1. This submittal shall include a list of all required and recommended spares. The following information shall be provided in table format:

a. Specification Section

b. Tagname

c. Description

d. Quantity

e. Manufacturer

f. Model, part, order number

g. Local distributor and manufacturer contact information. Contact information shall include address, phone number, and website.

K. Operational and Maintenance Manuals

1. Prior to installation of any equipment onsite, preliminary O&M manuals shall have been submitted and approved. No installation of equipment shall be permitted without the Contractor maintaining an updated version of these preliminary O&M manuals onsite for the Owner's and Engineer's use.

2. After all field changes or corrections made during installation and field check out have been completed, then all system supplier documentation, including drawings, shall be revised to reflect the “as installed, corrected and accepted" condition of the system and final record copies of O&M manuals for the system shall be provided to the Owner and Engineer for approval.

3. Final system documentation shall be provided in three-hole type binders of archival quality (e.g., slant D or elliptical binding, vinyl with metal hinge or extra heavy weight vinyl, etc.) with a binding no larger than three (3) inches. Materials shall be printed on 8.5IN x 11IN and/or 11IN x 17IN tear resistant paper or ring reinforced paper where tear resistant is not available. Drawings shall be either folded to fit within an 8.5IN x 11IN binder or in an 11IN x 17IN three-hole binder. Each binder shall include fifteen percent (15%) spare space for the addition of future material. Tear resistant paper shall be Xerox Never Tear or equal.

4. Final documentation shall also be provided in an electronic format. Electronic documentation shall be organized and provided on CD which shall include all CAD drawings, manuals and word processing documents. Electronic documentation format shall be primarily Adobe .pdf with additional documents provided in AutoCAD, Microsoft Office, HTML or as approved by the Engineer or Owner. Organization of the electronic documentation shall be such as to allow point and click navigation from a table of contents to the particular documents with the ability to return to the table of contents from any location with one mouse click.

5. AutoCAD drawings files shall include all supporting files, symbol libraries and print configurations needed to support future modifications and properly print additional drawing copies.

6. All electronic media (i.e., software, electronic documentation, configuration files/reports, device backups, etc.) shall be provided with two (2) backup copies, each organized into a separate binder. Media storage binders shall include but not be limited to the following:

    a. Table of contents

    b. Archival media holders (e.g., CD, DVD, floppy, tape disk, etc.)

    c. Support contacts (i.e., company, phone, internet link, etc.)

    d. Software system requirements and installation instructions

7. Laminated or water/tear resistant copies of all applicable instrumentation and control system drawings shall be supplied in drawing pocket of each control enclosure after “as installed, corrected, and accepted" revisions have been made to the enclosure.

8. Operation and Maintenance manuals shall include but not be limited to the following:

a. Manufacturer standard O&M manuals for all equipment and software furnished.

b. Custom O&M information describing the specific configuration of equipment and software, and the operation and maintenance requirements for this particular project.

c. The manuals shall contain all illustrations, detailed drawings, wiring diagrams and instructions necessary for installing, operating and maintaining the equipment.

d. All modifications to manufacturer standard equipment and/or components shall be clearly identified and shown on the drawings and schematics. All information contained therein shall apply specifically to the furnished equipment and shall only include instructions that are applicable.

e. A functional description of the entire system, with references to drawings and instructions.

f. A complete "as built" set of all approved shop drawings, which shall reflect all work required to achieve final system acceptance.

g. A complete list of the equipment supplied, including serial numbers, ranges, configuration parameters and other pertinent data.

h. Full specifications on each item.

i. Detailed service, maintenance and operation instructions for each item supplied.

j. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

k. Complete parts lists with stock numbers and name, address and telephone number of the local supplier.

l. References to manufacturers' standard literature where applicable.

m. Warning notes shall be located throughout the manual where such notes are required to prevent accidents or inadvertent misuse of equipment.

n. The operating instructions shall clearly describe the step by step procedures that must be followed to implement all phases of all operating modes. The instructions shall be in terms understandable and usable by operating personnel and maintenance crews and shall be useful in the training of such personnel.

o. The maintenance instructions shall describe the detailed preventive and corrective procedures required, including environmental

requirements during equipment storage and system operation, to keep the System in good operating condition. All hardware maintenance documentation shall make reference to appropriate diagnostics, where applicable, and all necessary wiring diagrams, component drawings and PCB schematic drawings shall be included.

L. Quality Assurance

1. The listing of specific products in this Specification in no way relieves the Contractor of furnishing equipment which shall meet the performance and quality criteria specified herein.

2. All equipment and materials shall be new and the products of reputable recognized suppliers having adequate experience in the manufacture of these particular items.

3. For uniformity, only one (1) manufacturer will be accepted for each type of product.

4. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses that may occur during fabrication, transportation, and erection as well as during continuous or intermittent operation. They shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.

5. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, which shall be of sturdy and durable construction and be suitable for long, trouble free service.

6. Electronic equipment shall be suitable for the specified environmental conditions.

   a. Optional or substituted equipment or both requiring changes in details or dimensions required to maintain all structural, mechanical, electrical, control, operating, maintenance or design features incorporated in these specifications and drawings, shall be made at no additional cost to Owner. In the event that the changes are necessary, calculations and drawings showing the proposed revisions shall be submitted for approval. Contractor shall coordinate all changes with other affected trades and contracts and pay all additional charges incurred.

1.5 CONTROL SYSTEM INTEGRATOR

A. Control System Integrator (CSI) shall be regularly engaged in the detailed design, fabrication, installation and startup of instrumentation and control systems for water and wastewater treatment facilities in North Carolina or surrounding states.

B. The Owner has determined that the implementation of the ISC shall be performed through a contractual allowance negotiated with the awarded contractor using the Owner specified integrator. The Control System Integrator shall be:

1. CITI, Inc.: 4030 Yancey Rd, Charlotte, NC 28217, 704-969-2484; www.citi-inc.com

C. Owner shall have the right of access to the CSI facilities and the facilities of their equipment suppliers to inspect materials and parts, witness inspections, tests and work in progress, and examine applicable design documents, records and certifications during any stage of design, fabrication and tests. CSI and their equipment suppliers shall furnish office space, supplies and services required for these inspection activities.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All materials, equipment, and devices shall, as a minimum, meet the requirements of UL, where UL Standards are established for those items, and the requirements of NFPA-70. All control panels shall comply with the requirements of UL 508A for Industrial Control Panels. All items shall be new and unused unless specified or indicated otherwise.

B. Properly store, adequately protect, and carefully handle equipment and materials to prevent damage before and during installation. Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations. Replace damaged or defective items.

C. All equipment shall be the latest and proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering into design of the instrumentation system. The completed system shall be compatible with functions required and the equipment furnished by the Contractor.

D. All electrical components of the system shall operate on 120VAC 60Hz power source, except as otherwise noted in the Specifications. Drawings and specifications indicate the energy sources that will be provided. Any other devices necessary to obtain proper operation of the instrumentation and control system from these energy sources shall be furnished with the system.

E. All necessary fuses or switches required by the instrumentation manufacturer for equipment shall be provided with the equipment. All instruments requiring internal power supply shall have internal on-off switches.

F. The mechanical, process, and electrical drawings indicate the approximate locations of field instruments, control panels, systems and equipment as well as field mounted equipment provided by others. The instrumentation subcontractor shall examine the mechanical, process and electrical drawings to determine actual size and locations of process connections and wiring requirements for instrumentation and controls furnished under this Contract. The CSI shall inspect all equipment, panels, instrumentation, controls and appurtenances either existing

or furnished under other Divisions of the Specifications to determine all requirements to interface same with the ICS. The Contractor shall coordinate the completion of any required modifications with the associated supplier of the item furnished.

G. Instrumentation equipment and enclosures shall be suitable for ambient conditions specified. All system elements shall operate properly in the presence of telephone lines, power lines, and electrical equipment.

H. Inside control rooms and climate-controlled electrical rooms, the temperature will normally be 20C to 25C; relative humidity 40% to 80% without condensation and the air will be essentially free of corrosive contaminants and moisture. Appropriate air filtering shall be provided to meet environmental conditions (i.e., for dust).

I. Other indoor areas may not be air conditioned/heated; temperatures may range between 0C and 40C with relative humidity between 40% and 95%.

J. Field equipment, including instrumentation and panels, may be subjected to wind, rain, lightning, and corrosives in the environment, with ambient temperatures from -20C to 40C and relative humidity from 10% to 100%. All supports, brackets and interconnecting hardware shall be aluminum, 316 stainless-steel, or as shown on the Contract Documents.

2.2 SIGNAL TRANSMISSION

A. Contractor shall be responsible for providing a signal transmission system free from electrical interference that would be detrimental to the proper functioning of the ICS equipment.

B. Contractor shall be responsible for coordinating signal types and transmission requirements between the various parties providing equipment under this Contract. This shall include, but not be limited to, distribution of appropriate shop drawings among the equipment suppliers and subcontractors.

C. CSI shall provide 24VDC power supplies for signals and instruments where applicable and as required inside panels, controls, etc. Where two-wire instruments transmit directly to the instrumentation and control system, the CSI shall provide power supplies at the PLC-equipped control panels for those instruments. Where four-wire instruments with on-board loop power supplies transmit directly to the instrumentation and control system, the CSI shall provide necessary signal isolators or shall otherwise isolate the input from the ICS loop power supply. Similar provisions shall be made when a third element such as a recorder, indicator or single loop controller with integral loop power supply is included in the loop.

D. Analog signal transmission between electric or electronic instruments, controllers, and all equipment and control devices shall be individually isolated, linear 4-20mA and shall operate at 24VDC. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by changes in load resistance within the unit's rating. All cable shields shall be grounded at one end only, at the control panel, with terminals bonded to the panel ground bus. Analog signal

isolation and/or conversion shall be provided where necessary to interface with instrumentation, equipment controls, panels and appurtenances.

E. Non-standard analog transmission systems such as pulse duration, pulse rate, and voltage regulated shall not be permitted except where specifically noted in the Contract Documents. Where transmitters with nonstandard outputs do occur, their outputs shall be converted to an isolated, linear, 4-20mA signal.

F. All discrete inputs to equipment and PLC, from field devices, starters, panels, etc., shall be dry contacts in the field device or equipment, powered from the PLC, unless specified otherwise. Sensing power (wetting voltage) supplied by the PLC shall be 24VDC.

G. All discrete outputs from local control panels and Control and Information System PLC, to field devices, starters, panels, etc., shall be 120VAC / 28VDC 5A dry contacts. Output contacts may be powered from the field equipment, or powered from 24VDC / 120VAC sourced from PLC cabinet power system, as required to interface with field equipment. Outputs to solenoid valves, horns, and strobe lights shall be 120VAC, powered from the PLC or control panel unless specified or shown otherwise.

H. Discrete signals between starters, panels, etc. where 120VAC is utilized shall be clearly identified in the starter, panel, etc. as being powered from a different power supply, than other starter/panel components. Where applicable, warning signs shall be affixed inside the starter, panel, etc., stating that the panel is energized from multiple sources. Output contacts in the starter, panel, etc. which are powered from other locations shall be provided with special tags and/or color coding. Disconnecting terminal strips shall be provided for such contacts. The above requirements shall apply to all starters and panels, regardless of supplier.

2.3 IDENTIFICATION

A. All Instrumentation and Control System (ICS) equipment to include but not limited to; panels, cabinets, enclosures, control devices and equipment listed in the instrument schedule shall be identified with the equipment tag number indicated on the Contract Documents and tat align with the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

2.4 TOOLS, SUPPLIES, AND SPARE PARTS

A. Provide special tools, other than those normally found in an electronic technician's tool box, required to test, diagnose, calibrate, install, wire, connect, disconnect, assemble and disassemble any digital equipment, instrument, panel, rack, cabinet or console mounted equipment for service and maintenance (i.e., connector pin insertion and removal tools, wire crimping tool, special wrenches, special instrument calibrators, indicator lamp insertion and removal tools, etc.).

B. Provide tools and test equipment together with items such as instruction manuals, carrying/storage cases, unit battery charger where applicable, special tools,

calibration fixtures, cord extenders, patch cords and test leads, which are not specified but are necessary for checking field operation of equipment supplied under this Section.

C. CSI shall provide supplies as needed or as required by the Owner during the specified warranty period. All fuses consumed during installation, testing, start-up, the system availability demonstration, and the warranty period shall be replaced by the Contractor.

D. Provide spare parts for items of ICS equipment as recommended by the manufacturer and in accordance with the Contract Documents.

E. Furnish all spares in moisture-proof boxes designed to provide ample protection for their contents. Label all boxes to clearly identify contents and purpose.

F. Refer to individual product specifications for additional requirements specific to those devices.

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractor shall be required to give the Owner and their representatives, at least a two-week (2WK) notice prior to any scheduled meetings. The notice may be shortened by consent.

B. Preliminary Site Testing Meeting: A preliminary site testing meeting shall be conducted by the Contractor for the Owner and Engineer, to ensure site readiness, testing strategies and proper coordination between parties related or involved in testing the ICS. Contractor shall be responsible for arranging the on-site meeting after the Site Testing Plan has been approved and no earlier than three weeks (3WK) prior to testing. Engineer must be satisfied that the site is ready and that the testing will be performed to their satisfaction prior to any documented ICS testing being performed. Contractor shall arrange for detailed meeting minutes to be recorded, approved, and distributed to meeting attendees. Additional meetings may be required at the discretion of the Owner and Engineer to resolve specific action items not addressed in the preliminary site testing meeting. Two weeks (2WK) prior to the meeting the Contractor shall submit the following for approval.

1. A proposed list of meeting attendees including organization and phone number.
2. A proposed meeting agenda.
3. A list of personnel to be involved in the testing including their responsibilities, qualifications, and phone numbers.
4. A list of tasks requiring Owner, Engineer or outside party involvement in testing.
5. A testing schedule that coordinates the ICS testing with the operability of the specific equipment being tested.

C. Additional meetings may be required at the discretion of the Owner and Engineer,

to resolve specific action items not addressed in the preliminary design review or preliminary site testing meeting.

3.2 INSTALLATION

A. CSI shall provide the Contractor a periodic written report detailing progress of start-up. This report shall include specific tabulations of devices on which start-up has been completed.

B. Equipment shall be located so that it is accessible for operation and maintenance. CSI shall examine the Contract Documents and Shop Drawings for various items of equipment in order to determine the best arrangement for the work as a whole, and shall supervise the installation of ICS equipment.

C. Instrumentation and Control System equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field, all information relevant to the placing of process control work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

D. CSI shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, CSI shall be required to ship his material in sections sized to permit passing through restricted areas in the building. CSI shall also investigate, and make any field modifications to the allocated space for each cabinet, enclosure and panel, to assure proper space and access (front, rear, side).

E. Two (2) complete sets of approved shop drawings shall be kept at the job site during all on-site construction. Both sets shall be identically marked up to reflect any modifications made during field installation or start-up. All markings shall be verified and initialed by the Engineer or his designated representative. Following completion of installation and the operational readiness test, one set of the marked up drawings shall be provided to the Engineer, the other retained by the CSI for incorporation of the mark-ups into final as-built documentation.

F. All work shall be in strict accordance with codes and local rulings, should any work be performed contrary to said rulings, ordinances and regulations, the Contractor shall bear full responsibility for such violations and assume all costs arising there from.

G. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment. Reference Specification Section(s)

1. 16070 – HANGERS AND SUPPORTS

H. Contractor shall take steps to keep electrical and control enclosures clean and free of contaminants throughout installation. Cleaning after installation is not

acceptable. Under no circumstances are electrical and control enclosures to be cleaned using compressed air to blow out dust, causing contaminants to be forced into sensitive electronics.

I. Provisions shall be made to completely capture filings (metal, etc.) when drilling into enclosures, to prevent contamination of electrical equipment.

J. Upon completion of the instrumentation and control work, Contractor shall thoroughly clean all soiled surfaces of installed equipment and materials and remove all surplus materials, rubbish, and debris that has accumulated during the construction work. The entire area shall be left neat, clean, and acceptable to the Owner.

3.3 WIRING AND GROUNDING

A. The following wiring practice guidelines shall be used in order to minimize ground loops, to minimize electromagnetic interference/radio frequency interference (EMI/RFI) to this equipment, and to provide maximum practical immunity from damage resulting from lightning-induced transients.

B. Common wires or conductors shall not be utilized (either within panels or external to panels or for grounding of field devices) for both signal shield or signal grounding and for safety grounds.

C. Exposed wire lengths extending from within shielded signal cables shall be minimized to reduce pick-up of EMI/RFI by signal circuits. Exposed lengths of less than one inch are preferred, and a maximum exposed length of two inches may be permitted where necessary. No splicing of signal wires is permitted.

D. All signal wiring shall be shielded, both within panels and external to panels. Unless otherwise specified, all signal wiring shall be No. 16 AWG stranded tinned two-conductor twisted pair, with 100 percent coverage aluminized Mylar or aluminized polyester shield and tinned copper drain wire.

E. Signal wiring within outdoor or indoor field device enclosures shall conform to the same requirements as panel wiring.

F. The shield on each process instrumentation cable shall be continuous from source to destination, and grounded at one end only. In general, grounding of signal cable shields shall be done at the control panel end. The signal cable for no signal shall share a common cable shield grounding wire with the signal cable shield for any other signal, and shall not share a common grounding wire with any other circuit. The length of no signal cable shield grounding wire shall not exceed two inches, with less than one-inch maximum length preferred.

G. All outdoor instruments and all outdoor enclosures shall be grounded using the practice defined in Section 800.40 of the National Electric Code.

3.4 TESTING, GENERAL REQUIREMENTS

A. The CSI shall test all equipment hardware and software at the factory prior to

shipment. As a minimum, testing shall include the following:

1. Unwitnessed Factory Testing (UFT)

2. Factory Acceptance Testing (FAT)

3. Operational Readiness Testing (ORT)

4. System Acceptance Testing (SAT)

B. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.

C. All tests shall be conducted in accordance with prior Engineer approved procedures, forms, and check lists. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party after its satisfactory completion.

D. Copies of these sign off test procedures, forms, and check lists will constitute the required test documentation.

E. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data; provide suitable means of simulation. Define these simulation techniques in the test procedures.

F. Contractor shall require the CSI to coordinate all of his testing with him, all affected Subcontractors, and the Owner Representative.

G. Owner Representative reserves the right to test or retest all specified functions whether or not explicitly stated in the prior approved test procedures.

H. Owner Representative's decision shall be final regarding the acceptability and completeness of all testing.

I. CSI shall furnish the services of technicians, all special calibration, and test equipment, and labor to perform the field tests.

3.5 UNWITNESSED FACTORY TESTING (UFT)

A. Prior to the performance of a Witnessed Factory Acceptance Test, the CSI shall perform an Unwitnessed Factory Test.

B. The purpose of this test is to inspect and test the system to ensure it is operational and ready for the Factory Acceptance Test.

C. This test will include all of the components of the Witnessed Testing and the CSI shall provide documentation of the completion of this testing as part of the request to performed the Witnessed Testing.

3.6 FACTORY ACCEPTANCE TESTING (FAT)

A. The entire system except for primary elements, final control elements, and field mounted transmitters shall be interconnected and tested to ensure the system will operate as specified. All analog and discrete input/output points not interconnected at this time shall be simulated to ensure proper operation of all alarms, monitoring devices/functions and control devices/functions by installing a test PLC program, provided by the CSI, which test all I/O. The CSI shall make provisions to view and manipulate this I/O, by all participants, during the factory testing.

B. All panels and assemblies shall be inspected and tested to verify that they are in conformance with related submittals, specifications, and Contract Drawings.

C. Factory acceptance testing shall take place over a contiguous time period after all factory fabrication has been completed.

D. The test shall verify the functionality, performance, and stability of the hardware. All deficiencies identified during testing shall be corrected and retested.

E. Successful completion of this test, as determined by the Owner and Contractor, shall be the basis for approval of the system to be shipped to the site. No equipment shall be shipped until the Owner and Contractor has reviewed all test results and approved the system as ready for shipment.

F. The Owner and Contractor reserve the right to attend the factory acceptance testing in its entirety. Two (2) weeks' notice shall be given prior to the start of testing.

3.7 OPERATIONAL READINESS TESTING (ORT)

A. The entire system shall be certified (inspected, calibrated, tested, and documented) that it is ready for operation. Each specified function shall be verified on a paragraph-by-paragraph, loop-by-loop and site-by-site basis.

B. Owner and/or Engineer reserves the right to witness any test, inspection, calibration, or start-up activity. Acceptance by Engineer of any plan, report, or documentation relating to any testing or commissioning activity specified herein, shall not relieve the Contractor of responsibility for meeting all specified requirements.

C. CSI shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of Engineer, at no cost to Owner. Contractor shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.

D. Each instrument shall be calibrated at 0, 25, 50, 75 and 100 percent of span using test instruments to simulate inputs and read outputs. Test instruments shall be

rated to an accuracy of at least five (5) times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracies as set forth by the National Institute for Standards and Technology (NIST).

E. CSI shall provide a written calibration sheet to Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. Contractor shall submit proposed calibration sheets for various types of instruments for Engineer approval prior to the start of calibration. This sheet shall include but not be limited to date, instrument tag numbers, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required and corrections made.

F. If doubt exists as to the correct method for calibrating or checking the calibration of an instrument, the manufacturer's printed recommendations shall be used as an acceptable standard, subject to the approval of Engineer.

G. Upon completion of calibration, devices calibrated hereunder shall not be subjected to sudden movements, accelerations, or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt, and excessive temperature variations. Caution shall be exercised to prevent such devices from being subjected to over-voltage, incorrect voltages, overpressure or incorrect air. Damaged equipment shall be replaced and recalibrated at no cost to Owner.

H. After completion of instrumentation installation and calibration, CSI shall perform a loop check. Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all representatives involved for each loop test.

I. Loop/Component Inspections and Tests: The entire system shall be checked for proper installation, calibrated, and adjusted on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and the Contract Documents.

1. Loop/Component Inspections and Tests shall be implemented using Engineer approved forms and check lists.

2. Contractor shall require the CSI to maintain the Loop Status Reports and Components Calibration sheets at the job-site and make them available to Engineer/Owner at any time.

3. These inspections and tests do not require witnessing. However, Engineer will review and initial all Loop Status Sheets and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational Readiness Tests. Any deficiencies found shall be corrected.

3.8 SYSTEM ACCEPTANCE TEST (SAT)

A. Successful completion of the operational readiness test, as determined by Owner

and/or Engineer, shall be the basis for starting the witnessed system acceptance test. Engineer shall approve the ORT test results and Engineer and Owner shall be given two weeks notice prior to the start of the System Acceptance Test.

B. The system acceptance test shall repeat loop and functional testing done during the operational readiness test in order to demonstrate to the Owner and Engineer that the system has been started up, is operating, and is in compliance with these Specifications. Each specified function shall be demonstrated on a paragraph-by-paragraph, loop-by-loop and site-by-site basis.

C. The following documentation shall be made available to the Engineer during the test:

1. All Contract Drawings and Specifications, addenda, and change orders.

2. Master copy of the test procedure.

3. One copy of all O&M Manuals shall be made available to the Engineer at the job-site both before and during testing.

D. Any malfunction during the tests shall be analyzed, and corrections made by CSI. At any time during the tests, Owner and/or Engineer reserve the right to halt the test if there are an excessive number of malfunctions until all signals are corrected by CSI. Owner and/or Engineer will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

E. After all functions have been tested and all corrections made, the system shall operate continuously for fifteen days (15DY) without failure before this test will be considered successful.

F. The total availability of the system shall be greater than 99.5% during this test period. Availability shall be defined as "Avail. = (Total Time-Down Time,) / (Total Time) x 100%". Down times due to power outages or other factors outside the normal protection devices or back-up power supplies provided, shall not contribute to the availability test times above.

3.9 TRAINING

A. CSI shall provide project specific classroom training at Owner site or designated location. Training shall be provided for the operation and maintenance of all equipment provided, as well as site specific installation configuration training for the system as a whole.

B. Each attendee shall be provided with training materials. All training materials shall be provided in hardcopy as well as digital, with all materials in Microsoft Office or Adobe pdf file format. All digital materials shall be updated with final configuration information and resubmitted for approval. Final digital media shall be archival quality.

C. Owner reserves the right to video tape any and all training sessions for the purposes of future or refresher training.

D. To facilitate the Owner operations staff scheduling, training shall be conducted in two (2) four-hour (4HR) sessions, a morning session and an afternoon session. Morning and afternoon sessions will cover the same material on a given day. The training shall consist of four days (4DY) minimum with two (2) sessions per day.

E. Maintenance training shall be provided to designated maintenance personnel, so that each component may be maintained without the assistance of outside organizations. Training shall be extensive so that after training, personnel shall be able to identify component malfunctions and repair components to the board/module replacement level. Training shall cover the entire system including controls and field equipment.

F. Maintenance training shall be conducted in one (1) session, with a minimum of eight hours (8HR) of instruction.

G. Under the scope of this project, the System Integrator will not be responsible for providing PLC and HMI control programming and logic. Specific training should therefore include, but not be limited to: system architecture and interconnection, wiring, field instrumentation and PLC hardware including maintenance and trouble-shooting.

H. Refer to related Specification Sections for additional training requirements.

I. Training sessions shall be carried out to the satisfaction of the Owner before final acceptance will be provided.

J. Training schedules shall be coordinated with the Owner and conducted at his convenience.

3.10 WARRANTY

A. The warranty period for the ICS shall be for one-year (1YR) and shall begin upon acceptance of the complete system by the Owner. During this warranty period, the CSI shall provide, at no additional cost to the Owner, the services of a trained, competent, field service engineer who shall arrive on site within thirty-six hours (36HR) of notification by Owner or Engineer, to repair and/or replace any faulty device or equipment supplied by the system supplier as part of this Instrumentation and Control System. All preventive and corrective activities shall be documented with service reports, which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed, and list materials used. A copy of all service reports shall be delivered to the Owner on or before the next business day.

B. CSI shall be capable of providing, after the warranty period for this system expires, a one-year (1YR) renewable service contract whereby a trained, competent field service engineer shall arrive on site within thirty-six hours (36HR) of notification by Owner. Information relative to charges for such service and availability of such service shall be submitted to Owner and Engineer.

C. Components shall be furnished to the manufacturer's standard for service intended, unless otherwise indicated in the Specifications or on the Contract

Documents.

END OF SECTION 17100

SECTION 17110 – INSTRUMENTATION AND CONTROL, CONTROL ENCLOSURES

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish, modify, test, install and place into satisfactory operation all Instrumentation and Control System (ICS) Control Enclosures (i.e., field panels, control panels, cabinets, consoles, boxes, etc.) as specified herein and as shown on the Contract Documents, even if each needed item is not specifically specified or shown.

B. Contractor shall also be responsible to provide modifications to existing control panels as described herein or as indicated in the PLC Input/Output Schedule Attachment. Modifications to existing control panels shall also conform to the requirements of these specifications.

C. New ICS Control Enclosures and/or subpanels shall be assembled, wired and tested in the CSI facilities, unless specified otherwise.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section and the requirements of Division 17 to include those Project Documents referenced herein shall be applied.

B. Instrumentation and Controls Schedules. Reference Instrumentation Schedule and PLC Input/Output Schedule Attachment(s) for a listing of major equipment, enclosure construction and signal monitoring requirements

C. Related Specification Section(s) include but not limited to:

1. 17100 – INSTRUMENTATION AND CONTROL, GENERAL REQUIREMENTS

2. 17120 – INSTRUMENTATION AND CONTROL, DEVICES AND EQUIPMENT

3. 17130 – INSTRUMENTATION AND CONTROL, SCADA HARDWARE

4. 17140 – INSTRUMENTATION AND CONTROL, PUMP CONTROL PANEL

1.3 REFERENCES

A. ICS Control Enclosures assembly and installation shall comply with the National Electric Code, National Electric Safety Code, OSHA, and with all applicable federal, state, county, municipal, and electrical utility codes and regulations, as well as the Contract Documents. In the event of any conflict between these codes, regulations, and Contract Documents, the most restrictive shall apply.

B. Codes and Standards

1. All applicable state, county, and municipal code requirements.

2. All applicable standards of the National Fire Protection Association (NFPA)

    a. National Electrical Code (NEC)

3. All applicable standards of the Underwriter's Laboratories, Inc. (U.L.) to include but not limited to

    a. UL 508 Industrial Control Equipment

    b. UL 508A Industrial Control Panels

    c. UL 698 Industrial Control Equipment for Use in Hazardous Locations

4. All applicable standards of the Institute of Electrical and Electronics Engineers (IEEE)

5. All applicable standards of the National Electrical Manufacturers Association (NEMA) to include but not limited to

    a. NEMA 250 Enclosures for Electrical Equipment (1000 V Maximum)

    b. NEMA ICS 1 Industrial Control and Systems: General Requirements

    c. NEMA ICS 6 Enclosures for Industrial Control and Systems

6. All applicable standards of the International Society of Automation (ISA)

7. All Owner related construction and installation specifications and details

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 17 Sections as required per Specification Section(s)

    1. 01340 – SUBMITTALS

B. ICS Control Enclosures sizing in relation to heat dissipation and cooling/heating system sizing calculations shall be submitted for all cabinets containing PLC, UPS, VFD, SCR or at the request of the Engineer, for all enclosures containing sensitive electronic equipment or chemicals.

1.5 DELIVERY, STORAGE AND HANDLING

A. ICS Control Enclosures shall be handled and stored in accordance with manufacturer’s instructions and recommendations as outlined in applicable Installation and Maintenance Manuals.

B. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.6 OPERATION AND MAINTENANCE MANUALS

A. ICS Control Enclosures operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

1.7 WARRANTY

A. Manufacturer shall warrant ICS Control Enclosures to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. ICS Control Enclosures shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All ICS Control Enclosures shall fit within the allocated space shown on the Contract Documents. Contractor shall examine plans and/or field inspect new and existing structures as required to determine installation requirements and shall coordinate the installation of all enclosures with Owner and all affected contractors. Contractor shall be responsible for all costs associated with installation of enclosures, including repair of damage to structures (incidental, accidental or unavoidable).

B. A minimum estimated size is shown on the Contract Drawings. Contractor shall furnish ICS Control Enclosures of the size and quantity as required to house the equipment supplied and all other electrical components installed within the enclosure. In addition, provide useful space and power supply capacity as spare for future expandability to a minimum of one (1) item per item type installed or twenty percent (20%) of quantity of each type item installed, whichever yields the greater spare space.

2.2 MATERIALS AND CONSTRUCTION

A. ICS Control Enclosures shall be formed or welded construction, reinforced with Unistrut, Powerstrut or equal to facilitate mounting of internal components or equipment. Sufficient access plates and doors shall be provided to facilitate maintenance and testing of the supplier's equipment. Doors shall be removable. Enclosures with any dimension thirty-six inches (36IN) or greater shall be provided with removable lifting lugs designed to facilitate safe moving and lifting of the panel during installation. No screws or bolts shall protrude through from the interior enclosure.

B. ICS Control Enclosures with any dimension twenty-four inches (24IN) or larger shall be provided with drawing pockets for as-built panel drawings. One (1) laminated copy of the appropriate panel as-built drawings shall be furnished and left in the pocket of each panel.

C. All steel ICS Control Enclosures shall be free from dirt, grease and burrs, and shall be treated with a phosphatizing metal conditioner (phosphate conversion coating) before painting. All surfaces shall be filled, sanded, and finish coated by spraying a 1-2MIL epoxy prime coat and smooth, level, high grade textured finish between flat and semi-gloss shine. The colors shall be selected by Owner from a minimum of six (6) color samples provided. All stainless-steel enclosures shall be polished to a No. 4 finish

D. ICS Control Enclosures shall be prefabricated cabinets assemblies and equal to

1. Hoffman Enclosures

2. Saginaw Enclosures

3. Hammond Manufacturing

4. Contractor may optionally provide enclosures custom fabricated by a reputable panel fabrication shop acceptable to Engineer.

E. ICS Control Enclosures shall incorporate a removable back panel on which control components shall be mounted. Back panels shall be secured to the enclosures with collar studs. All components shall be of the highest industrial quality and securely mounted to the removable back panels with screw and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.

F. ICS Control Enclosures shall be protected from internal corrosion-inhibiting vapor capsules equal to

1. Northern Instruments Model Zerust VC

2. Hoffman Engineering Model A-HCL

3. Engineer Approved Equal

G. All metallic ICS Control Enclosures with door mounted equipment shall have the door grounded by means of flexible ground strap.

H. ICS Control Enclosures interior and exterior devices and/or equipment shall be identified with nameplates. The equipment shall be mounted such that service can occur without removal of other equipment. Panel mounted equipment shall be flush or semi-flush mounted with flat black escutcheons. All equipment shall be accessible such that adjustments can be made while the equipment is in service and operating. All enclosures shall fit within the allocated space as shown on the Contract Documents.

I. ICS Control Enclosures shall provide mounting for UPS, power supplies, control equipment, input / output subsystems, panel mounted equipment and appurtenances. Ample space shall be provided between equipment to facilitate servicing and cooling. ICS Control Enclosures shall be sized to adequately dissipate heat generated by equipment mounted inside the panel. Louvered openings fitted with dust filters near the bottom and top of the cabinet shall be provided for NEMA 12 enclosures. If required, ICS Control Enclosures shall be provided with filtered fans, heat exchangers or air conditioners. Only closed loop cooling systems shall be provided for NEMA 4X cabinets. Cooling systems shall be by the cabinet fabricator or equal to

1. McLean Midwest

2. Noren Products

3. Engineer Approved

A. ICS Control Enclosures shall be provided with 120VAC, 20A GFCI receptacles, for service equipment and convenience receptacles for programming. Simplex receptacles shall be provided for enclosures with an uninterruptable power supply (UPS). Main breaker and branch breaker sizes shall be coordinated such that an overload in a branch circuit will trip only the branch breaker but not the main breaker. Circuit breakers shall be provided for the following internal branch circuits distributed within the panel

1. receptacles and power strips

2. lighting

3. UPS

4. cooling and ventilation equipment

B. ICS Control Enclosures shall be provided with 120VAC LED service lights. Loads not requiring transient voltage surge suppression (i.e., receptacles, lighting, HVAC, branch circuits to remote equipment, etc.) shall be connected ahead of the enclosure SPD device.

C. Locate equipment, devices, hardware, power supplies, instrumentation and controls, electrical equipment and wiring to be installed inside the enclosures and/or as facial features on the enclosures, so that connections can be easily made and so that there is ample room for servicing each item. Every component in and on the enclosures shall be able to be removed individually without affecting

the other components and without the need to move other components. Support and restrain all internally, as well as panel mounted components to prevent any movement.

D. ICS Control Enclosures shall be NEMA rated for the environment in which it is to be installed and as noted in the Contract Documents.

E. ICS Control Enclosures shall be provided with a security door switch mounted at the top of the enclosure. The door switch shall be general duty, reed-type switch operation with a straight plunger. Maximum voltage rating shall be 240VAC and 125/VDC with single-pole, double throw, one position momentary signal switch unit. Door switch shall be equal to

1. Square D, XA7506E

F. ICS Control Enclosures shall be built in accordance with UL508A Industrial Control Panels and NEC Article 409 Industrial Control Panels. Control panels for areas classified as Hazardous shall be built in accordance with UL698 Industrial Control Equipment for Use in Hazardous Locations. Control panels shall be UL508A and/or UL698 labeled and marked as defined in NEC 409.110 with the following

1. Manufacturer’s name and contact information (i.e., address, phone, website, email, etc.).

2. Supply voltage, phase, frequency, and full-load current.

3. Short-circuit current rating of the industrial panel based on one of the following:

   a. Short-circuit current rating of a listed and labeled assembly

   b. Short-circuit current rating established utilizing an approved method

   c. Electrical wiring diagram numbers or the index sheet to the electrical wiring diagrams.

   d. Enclosure type number (i.e., NEMA 1A, 3R, 12, 4X, 7, 9, etc.)

4. If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.

G. All work shall be performed in a professional manner and in consideration of allowing ease of future troubleshooting and maintenance. All equipment should be mounted so as to minimize crowding within the panel. All devices shall be mounted and wired in a neat and workmanlike manner. Each component shall be prominently identified with the use of permanent engraved legend plates.

H. Grounding: All suppressors shall be grounded per the suppressor manufacturer's recommendations. Furnish control panels with an integral copper grounding bus for connection of suppressors and other required instrumentation. Provide single-point connection of all grounds to grounding bus using the shortest possible

path. Each grounded object shall have a separate connection to the ground bus. Do not connect cable shields to suppressor ground terminal or daisy-chain ground connections. Provide 1IN wide by 1/8IN thick copper ground bus as a minimum.

2.3 OUTDOOR ENCLOSURES

A. All outdoor enclosures shall be rated NEMA 4X, constructed of 316 stainless-steel with a white powder coated finish unless specified otherwise. Outdoor enclosures shall have a hinged and gasketed door. Door latches shall be all stainless steel, fast operating clamp assemblies (quick release), which do not require bolts or screws to secure. Gaskets shall be polyurethane.

B. Outdoor panels shall be fitted with pad-lockable latch kits.

C. Outdoor enclosures with internal digital electronics, exterior indicators, or exterior indicator lights shall have external sun shields or sunshades, constructed of the same materials as the associated enclosure, unless otherwise specified.

D. Outdoor enclosures shall be designed for ambient conditions of -15C to 50C and twenty to ninety-five percent (20% - 95%) relative humidity, unless otherwise specified. Outdoor enclosures shall be provided with thermostatically controlled space heaters to provide condensation protection.

2.4 INDOOR ENCLOSURES

A. Indoor enclosures located in the same area (i.e., room, etc.) as open process tanks, open process channels, closed process piping or process equipment containing wet liquids or possible airborne powders, shall be rated NEMA 4X, constructed of 316 stainless steel, fiberglass, fiberglass reinforced polyester, or polycarbonate, unless specified otherwise. Enclosures shall have a hinged and gasketed door. Door latches shall be all stainless steel, fast operating clamp assemblies (quick release) which do not require bolts or screws to secure. Gaskets shall be polyurethane.

B. Indoor enclosures located in a dry or environmentally controlled area (i.e., electrical room, etc.) shall be NEMA 12 steel, unless specified otherwise. Enclosures shall have a hinged and gasketed door. Door latches shall be three-point door latch with handle for all enclosures with a dimension of twenty-four inches (24IN) or larger, or otherwise shall be fast operating clamp assemblies which do not require bolts or screws to secure. Gaskets shall be polyurethane.

C. Indoor enclosures in a non-air-conditioned space shall be designed for ambient conditions of 0C to 40C and twenty to ninety-five percent (20% - 95%) relative humidity, unless otherwise specified. Indoor enclosures in an air-conditioned space shall be designed for ambient conditions of 20C to 30C and twenty to eighty-five percent (20% - 85%) relative humidity, unless otherwise specified.

2.5 TERMINAL BLOCKS

A. Terminal blocks shall be assembled on non-current carrying galvanized steel DIN mounting rails, securely bolted to the cabinet sub-panel. Terminals shall be screw

down pressure plate with captive cage type. Power terminal blocks shall be single level with a minimum rating of 600V, 30A. Signal terminal blocks shall be double-level with a minimum rating of 600V, 20A.

B. Fused terminal blocks or miniature thermal circuit breaker terminal blocks shall be supplied for protection and isolation of enclosed equipment, or as specified in the Contract documents. Blown fuse indicators shall be provided and/or tripped breaker status shall be clearly visible. Fused or miniature thermal circuit breaker terminal blocks shall be provided for, but not limited to each of the following

1. Each PLC module requiring external power

2. Each piece of equipment provided with a power supply (integral, internal or external) with the exception of devices with internal fusing plugged into a receptacle.

3. Terminals shall be marked with a black waterproof, permanent, continuous marking strip. One side of each terminal shall be reserved exclusively for field incoming conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal.

C. Terminal blocks shall be equal to

1. Phoenix Contact

2. Square-D

3. Wieland

4. Engineer Approved

2.6 WIRING

A. All wiring shall be bundled and run open or enclosed in vented plastic wireway, as required. All conductors run open shall be bundled and bound with nylon cable ties, at regular intervals, with intervals not to exceed twelve inches (12IN). Adequately support and restrain all wiring runs to prevent sagging or other movement. Care shall be taken to separate communication, network, electronic signal, AC discrete signal, DC discrete signal and power wiring. Wiring to equipment mounted on doors or where movement of the equipment will take place, shall be installed in nylon spiral wrapping sheaths.

B. Wires shall be color coded as follows

1. Equipment Ground – GREEN

2. 120 VAC Power Distribution – BLACK

3. 120 VAC Power Neutral – WHITE

4. 120 VAC Control (Internally Powered) – RED

5. 120 VAC Control (Externally Powered) – YELLOW

6. 24 VAC Control – ORANGE

7. DC Power (+) – BLUE

8. DC Power (-) – GREY

9. DC Control – BLUE

10. Analog Signal (+) – RED

11. Analog Signal (-) – BLACK

C. All wiring shall comply with accepted standard instrumentation and electrical practices. Field wiring for power, control and signal wires shall comply with Division 16 of the Specifications. For each pair of parallel terminal blocks, the field wiring shall be between the blocks.

D. Internal panel wiring shall be as follows

1. AC power wiring: 14AWG minimum, stranded copper conductors, THHN/THHW wire rated for 600V and 90C. For wiring carrying more than 15A, use sizes required by NEC.

2. AC control and dc power and control wiring: 16AWG minimum, stranded copper conductors, THHN/THHW wire rated for 600V and 90C.

3. Instrument signal wiring: 18AWG stranded conductors, tinned copper, twisted pair or triad, overall, one hundred percent (100%) aluminum foil shield with 20AWG stranded drain wire, plenum rated 300V 60C FEP insulated wire with FEP jacket, equal to Belden 8760.

4. All stranded wire shall have a minimum of sixteen (16) strands, except for drain wires.

2.7 CONTROL OPERATORS AND PILOT LIGHTS

A. Control operators such as pushbuttons (PB), selector switches (SS), and pilot lights (PL) shall be 30.5mm, round, heavy-duty, oil tight NEMA 4X corrosion resistant. Control operators and pilot lights shall be equal to

1. Eaton, Type HT800

2. Square D, Type SK

3. Allen Bradley 800T

B. Pushbuttons and selector switches shall be non-illuminated, spring release type. Pushbuttons shall include a full guard. Panic stop/alarm pushbuttons shall be red mushroom type with manual-pull release. Pilot lights shall be of the proper control voltage, push-to-test LED type (indoor) and lamp type (outdoor).

C. Control operators shall have legend plates as specified herein, indicated on the Contract Documents, or otherwise directed by Engineer. Legend plates shall be plastic, white field (background) with black lettering. Engraved nameplates shall be securely fastened above each control operator. If adequate space is not available, the nameplate shall be mounted below the operator.

D. Control operators for all equipment shall be as specified herein and of the same type and manufacturer unless otherwise specified or indicated on the Contract Documents. Modifications to existing panels using control operators and indicators of the same type and manufacturer shall be allowed with Engineer approval.

2.8 CONTROL DEVICES

A. Where required to interface between motor control centers, equipment controls, and control panels, interposing relays and associated control wiring circuitry shall be furnished and installed to provide the monitoring and/or control functions specified herein. Interposing relays shall be miniature type with DPDT contacts rated a minimum 10A @ 120VAC, push-to-test button, and status indicator. Relay coils shall be 120/240VAC or 24VDC as required. Relays shall be equal to

1. Eaton
2. Idec
3. Square D
4. Omron
5. Engineer Approved

B. Digital Indicators shall be provided to indicate rates and readings in digital format and true engineering units. Indicators shall accept a 4-20mA input signal and shall be programmable through the front panel to provide scaling, calibration, options and accessories. Units shall be four-digit minimum with red LED indication, 120VAC power. Digital Indicators shall be equal to

1. Precision Digital
2. Red Lion
3. Engineer Approved

C. Signal isolators/boosters/converters shall be solid state electronic type with RFI protection. Signal isolators/boosters/converters shall accept a current, voltage, frequency, temperature, or resistance and provide current or voltage dual outputs as shown on the Contract Documents and specified herein. Signal isolators/boosters/converters shall have complete isolation between input circuitry, output circuitry, and power supply, and with provisions for DIN rail mount inside the control panel enclosure. Signal isolators/boosters/converters shall be equal to

1. Acromag

2. Phoenix Contact

3. Engineer Approved

2.9 POWER SUPPLIES

A. Each control panel shall be provided with a minimum of one (1) 24VDC power supply. Power supplies shall be enclosed, DIN rail mounted and sized per the guidelines of UL508 and UL508A. Redundant power supplies with redundancy modules shall be provided in locations as specified and shown on the Contract Documents. Power supplies shall be equal to

1. Allen Bradley 1606

2. Equal by PULS

3. Equal by Sola

4. Engineer Approved Equal

B. External PLC power supplies provided for loop and/or PLC power shall be redundant and alarm to the PLC upon failure.

2.10 UNINTERRUPTABLE POWER SUPPLIES (UPS)

A. UPS shall be online interactive units provided for new RTU panels and as shown on the Contract Documents.

B. UPS shall be sized for a minimum of twenty-minute (20MIN) backup for all connected equipment. UPS shall consist of a UPS module and battery modules as required to meet backup run time requirements.

C. A manually operated maintenance bypass switch shall be provided for each UPS installation to allow hardware to be powered while the UPS is removed for maintenance. The bypass switch shall be a make-before-break type to ensure continuous power.

D. UPS units shall provide dry contact outputs to transmit utility power failure and low battery conditions.

E. UPS shall meet the following requirements:

1. Input voltage shall be 120VAC, single phase, 60HZ.

2. Operating temperature range shall be 0C to 40C.

3. Voltage regulation shall be plus or minus five percent (+/-5%) for line and load changes.

4. Output frequency shall be phase-locked to the input AC line on AC operation and shall be 60HZ (+/-0.5%) when on battery operation.

5. Batteries shall be of the sealed, lead acid or lead calcium gelled electrolyte type, suitable for high temperatures.

6. Sound absorbing enclosure.

7. EMI/RF noise filtering.

8. SPD shall be provided on the AC input circuit, which shall have a UL clamping voltage rating of 400V with a <5nSEC response time.

9. Adjustment allowed to prevent UPS from going offline when on a standby generator supplied power source.

10. DIN-Rail Mounted

F. UPS shall equal to

1. Allen Bradley

2. Phoenix Contact

3. Sola

4. Engineer Approved Equal

2.11 SURGE PROTECTIVE DEVICES (SPD)

A. Surge Protective Devices (SPD) and/or voltage surge suppressors shall be provided at the following minimum locations

1. Connections between AC power and electrical and electronic equipment, including panels, assemblies and field mounted instruments.

2. Analog signal circuits (both terminal ends) that have any portion of the circuit extending outside of a protecting building.

3. Discrete signal circuits that have any portion of the circuit extending outside of a protecting building.

4. All copper-based communications cables that extend outside of a building or enclosed structure.

5. All specified spare analog inputs and outputs

B. SPD shall be external to and installed in addition to any protective devices built into the equipment. SPD shall be mounted and wired per manufacturer recommendations including local grounding for surge energy dissipation. Power and signal protection shall be installed either in a NEMA 4X enclosure or in the enclosure that houses the equipment to be protected.

C. Lightning Arrestors (LA) shall use 8AWG stranded CU cable for ground connection or install suppressor directly on ground bus using bolted connections. Provide 1IN

wide by 1/8IN thick copper ground bus as a minimum.

D. Panel-mounted power circuit protectors shall be provided in all enclosures powered by 120VAC. SPD shall be a three-stage hybrid, solid-state power line protector with noise filtering, common mode and normal mode suppression and nanosecond reaction time. The unit shall include a replaceable fuse to remove the load (protected equipment) from the line if the unit is either overloaded or the internal protection fails. SPD shall be equal to

1. DEHN 952 201

2. Engineer Approved Equal

E. Panel-mounted signal circuit protectors shall be made for mounting on a terminal block rail. SPD shall include a moveable grounding link to allow each signal cable shield to be individually grounded to the panel via the mounting rail through the surge protective devices for that cable without the use of any additional grounding wire or to be isolated from ground at the surge protective device. Each mounting rail shall be grounded to the panel by the use of rail mounting screws at approximately one-foot intervals. Protection shall be from line to line and from each line to ground. Protection shall also be from shield to ground where the shield is not grounded at the protector. SPD shall have the ability to protect against surge currents greater than 10kA. SPD shall add no more than 22 OHM per signal wire to the total signal loop resistance of the analog signal loop in which it is installed. SPD shall not introduce error-producing ground loop currents into the instrumentation signal circuits. SPD shall be equal to

1. Dehn Blitzductor

    a. Base: BXT BAS

    b. Module: BXTM2 BDHC 5A 24

2. Engineer Approved Equal

F. Signal circuit SPD for two-wire field instruments shall be a conduit connected/pipe nipple type and shall have characteristics equal to the panel mounted devices. Units shall be mounted to a transmitter conduit entry point where available. When not available or practical, then these devices shall be mounted in NEMA 4X enclosures located at the field devices. SPD devices shall be equal to

1. Dehn Blitzductor

    a. Base: BXT BAS

    b. Module: BXTM2 BDHC 5A 24

2. Engineer Approved Equal

G. Signal circuit SPD for four-wire field instruments shall be a separate enclosure unit capable of providing protection on both the power and signal side. The unit shall

contain the characteristics of the line power protector and signal circuit protectors discussed above. Units shall be enclosed in a manufacturer assembled NEMA 4X stainless-steel enclosure. SPD shall be equal to:

1. ASCO/Schneider, P/N EDCO SLAC-12036

2. Phoenix Contact

3. Engineer Approved Equal

H. SPD devices antenna cable signal protection shall be an in-line panel mount type unit rated for 50 OHM and with dc blocking. Unit shall be rated for the appropriate frequency range and have an insertion loss of 0.1dB. SPD shall be equal to

1. ASCO/Schneider, EDCO

2. Polyphaser

3. Engineer Approved Equal

I. SPD specifications and ratings for signal or communications types not defined herein shall be as specified elsewhere or of a type recommended by the manufacturer of the device being protected. SPD shall be equal to

1. ASCO/Schneider

2. Phoenix Contact

3. Engineer Approved Equal

2.12 TOOLS, SUPPLIES, AND SPARE PARTS

A. Tools, supplies, and spare parts shall be provided as specified in Division 17 and as specified for each equipment item. In addition, the following items shall be provided

1. One (1) of each type of panel mounted equipment (i.e., indicators, signal converters, etc.) provided under this Contract.

2. One (1) 24VDC power supply and redundancy module provided under this contract.

3. Three (3) of each type of interposing relay provided under this Contract.

4. One (1) of each type of power SPD device used

5. Six (6) of each type of signal SPD device used

6. Two (2) of each type of communication SPD device used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor mounted enclosures shall be installed on 1/4IN thick rubber type pads. These pads shall completely cover the area of the base that is against the floor.

B. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation, including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures. Careful attention must be paid to provide installations which are both functional and esthetically acceptable.

C. All conduits used in conjunction with control panels or instrumentation of any kind shall be sealed using a suitable duct-sealing compound to minimize the possible damage caused by vapors or wetness. It shall be the responsibility of the CSI to verify that this is accomplished early in the project, so that corrosion damage does not occur during the time of construction.

D. Contractor shall provide Engineer a periodic written report detailing construction progress. This report shall include specific tabulations of equipment on which construction/installation has been completed.

E. Equipment shall be located so that it is accessible for operation and maintenance. CSI shall examine the Contract Documents and Shop Drawings for various items of equipment in order to determine the best arrangement for the work as a whole and shall supervise the installation of all equipment.

3.2 WIRING AND GROUNDING

A. The following wiring practice guidelines shall be used in order to minimize ground loops, minimize the effects of electromagnetic interference/radio frequency interference (EMI/RFI) and to provide maximum practical immunity from damage resulting from lightning-induced transients.

B. Common wires or conductors shall not be utilized (either within panels or external to panels, or for grounding of field devices) for signal shielding, signal grounding, or safety grounds.

C. Exposed wire lengths extending from within shielded signal cables shall be minimized to reduce pick-up of EMI/RFI by signal circuits. Exposed lengths of less than one inch is preferred with a maximum exposed length of two-inches (2IN) only permitted where necessary. No splicing of signal wires shall be permitted.

D. All signal wiring shall be shielded, both within panels and external to panels. Unless otherwise specified, all signal wiring shall be 16AWG stranded tinned two-conductor twisted pair with 100% coverage of aluminized Mylar or aluminized polyester shield and tinned copper drain wire.

E. The shield on each process instrumentation cable shall be continuous from source to destination, and grounded at one end only. In general, grounding of signal cable shields shall be done at the control panel end. No signal cable shall share a common cable shield grounding wire with any other signal cable or other circuit.

The exposed length of cable shield grounding wires shall not exceed two-inches (2IN) prior to termination with less than one-inch (1IN) maximum length preferred.

F. All outdoor instruments and all outdoor enclosures shall be grounded using the practice defined in Section 800.40 of the National Electric Code.

END OF SECTION 17110

SECTION 17120 - INSTRUMENTATION AND CONTROL, DEVICES AND EQUIPMENT

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. Contractor shall furnish, test, install and place in satisfactory operation all equipment required to provide a complete and operable Instrumentation and Control System (ICS) as specified herein and as shown on the Contract Documents, even if each needed item is not specifically specified or shown.

B. Control System Integrator (CSI) shall provide full onsite supervision of all equipment provided under this section, where installation is provided by others.

C. ICS devices and equipment (i.e., primary elements, measuring devices, transmitters, field controllers, chart recorders, indicators, and other instrumentation and accessories) shall be provided with all components necessary for a fully functional device whether specifically mentioned in these specifications or not. This shall include, as applicable or recommended by the manufacturer: sample conditioning, sensors, sensor holder and mounting brackets, transmitter, all required cables, calibration equipment, chemicals, reagents and spare parts.

D. Specialty cables between sensors/probes and their electronics/transmitters shall be furnished with each instrument. Cables shall be coordinated with the conduit installation and be of sufficient length to not require any splicing. Specialty cables include any type of cable not specified in Division 16.

E. Panels will be designed with consideration given to routing of cables and piping, maintenance, and calibration. The panel designs will be submitted with the field measurement equipment for approval.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this Section and the requirements of Division 17 to include those Project Documents referenced herein shall be applied.

B. Instrumentation and Controls Schedules. Reference Instrumentation Schedule and PLC Input/Output Schedule Attachments for a listing of major equipment, enclosure construction and signal monitoring requirements

C. Related Specification Section(s) include but not limited to

1. 17000 – INSTRUMENTATION AND CONTROL, GENERAL REQUIREMENTS

1.3 REFERENCES

A. ICS devices and equipment installations shall comply with the National Electric Code, National Electric Safety Code, OSHA, and with all applicable federal, state, county, municipal, and electrical utility codes and regulations, as well as

the Contract Documents. In the event of any conflict between these codes, regulations, and Contract Documents, the most restrictive shall apply.

B. Codes and Standards

1. All applicable state, county, and municipal code requirements

2. All applicable standards of the National Fire Protection Association (NFPA)

a. National Electrical Code (NEC)

3. All applicable standards of the Underwriter's Laboratories, Inc. (U.L.)

4. All applicable standards of the Institute of Electrical and Electronics Engineers (IEEE)

5. All applicable standards of the National Electrical Manufacturers Association (NEMA)

6. All applicable standards of the International Society of Automation (ISA) to inlcude but not limited to

a. S5.1 Instrumentation Symbols and Identification

b. S5.4 Instrument Loop Diagrams

c. S20 Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves

d. TR20.00.01 Specification Forms for Process Measurement and Control Instruments

7. All Owner related construction and installation specifications and details

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 17 Sections as required per Specification Section(s)

1. 01340 – SUBMITTALS

B. In addition to the requirements in Division 17, the following specific submittals items shall be provided

1. An ISA specification sheet for each instrument furnished and/or calibrated shall be submitted with the field equipment submittals. The ISA data sheet shall be in accordance with ISA Standards ISA S20 “Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves” and ISA TR20.00.01 “Specification Forms for Process Measurement and Control Instruments”.

2. CSI and ICS devices and equipment manufacturer(s) shall review the proposed installation and configuration of all field equipment, prior to submittal for approval, and shall identify any condition which shall require corrective measures. The following as a minimum shall be reviewed for the installation configuration of each instrument:

   a. Listed features

   b. Material of construction

   c. Consideration of process fluid

   d. Environmental conditions

   e. Installation location

   f. Process connections

   g. Ability to perform maintenance

3. Submit in writing in the field equipment submittal, that each piece of equipment is suitable for the proposed installation. Any proposed deviations shall be reviewed by the Engineer prior to execution.

1.5 DELIVERY, STORAGE AND HANDLING

A. ICS devices and equipment and all components shipped loose shall be handled and stored in accordance with manufacturer's instructions and recommendations as outlined in applicable Installation and Maintenance Manuals.

B. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.6 OPERATION AND MAINTENANCE MANUALS

A. ICS devices and equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

1.7 WARRANTY

A. Manufacturer shall warrant ICS devices and equipment to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. ICS devices and equipment shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. ICS devices and equipment shall be provided within enclosures to suit the specified environmental conditions or as indicated on the Contract Documents. Field-mounted devices shall be rated for hard-usage and securely mounted on walls, equipment racks, or pipe stanchions. Where the field equipment integral enclosure for a specified instrument is not available with the specified environmental rating, the field equipment shall be provided in a control enclosure. Reference Specification Section(s)

1. 17110 – INSTRUMENTATION AND CONTROL, CONTROL ENCLOSURES

B. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted or shown on the Contract Documents, installed adjacent or near to the sensor, in a readily accessible location. Special cables that are required for interconnection between sensors or probes and transmitters shall be furnished with the instrumentation devices by the associated equipment manufacturer. Special cables shall be of the required length for the equipment locations and conduit routing paths shown on the Contract Documents. No splicing of cables will be accepted.

C. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture and fungus. Ambient conditions shall be -15C to 50C and twenty to ninety-five percent (20% - 95%) relative humidity, unless otherwise specified. Field mounted equipment and system components shall be designed for installation in dusty, humid and corrosive service conditions.

D. All non-loop-powered instruments and equipment shall be designed to operate on a 60Hz alternating current power source at a nominal 120VAC, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

E. All analog transmitter and controller outputs shall be isolated, 4-20mA into a load of 0-750 OHM minimum, unless specifically noted otherwise.

F. Process taps for primary sensors shall be sized to suit each individual installation and the requirements of the instrument served. Contractor is responsible to ensure that the location, supports, orientation and dimensions of the connections and taps for instrumentation furnished under this Division are such as to provide the proper

bracing, the required accuracy of measurement, protection of the sensor from accidental damage, and accessibility for maintenance while the plant is in operation. Isolation valves shall be provided at all process taps.

G. All instrumentation exposed to sunlight shall be provided with sunshields constructed from 316 stainless steel. Sunshields shall be designed to withstand regional wind and ice loads. Sunshield design shall be submitted for approval.

H. All outdoor external sample/process piping, including valves and appurtenances, shall be insulated with weather-proof insulation, and heat-taped to prevent freezing. Heat taping shall be thermostatically controlled, self-regulating and shall adjust its heat output to the temperature of the lines.

I. Each instrument shall include a stainless-steel tag, with tag number and calibration data from the Contract Documents, attached to the instrument. Where not physically connected to the instrument, the tag shall be attached with stainless-steel wire.

2.2 LEVEL SWITCH, SUSPENDED FLOAT TYPE

A. Float switches shall be of the non-mercury displacement type, encapsulated in polyurethane or vinyl floats.

B. Units shall be waterproof, shockproof, explosion-proof and equipped with sufficient submersible cable to extend to the control panel or junction box without splicing.

C. Any required weights shall be provided. Switches shall be suspended on a suitable rack or rail of stainless-steel construction.

D. Suspended type float switches shall be equal to

1. Flygt ENM-10
2. Anchor Scientific Eco-Float
3. Dwyer Series CFS2
4. Engineer Approved Equal

2.3 LEVELTRANSMITTER, RADAR TYPE

A. Radar level transmitters shall be provided for measurement of tank, wet well, and pond levels. Equipment shall be provided with features and accessories as described herein and suitable for the application.

B. Ultrasonic level transmitters shall meet the following specifications as a minimum:

1. 24 VDC loop powered
2. 80 GHz nominal frequency
3. Output signal: isolated 4-20 mA DC with HART communications

4. Programmable over a Bluetooth connection
5. Operating range: 0-50 feet
6. Accuracy: +/- 2mm
7. Enclosure: PDVF, rated hazardous environment C1, DII
8. Process connection: 1-1/2 inch NPT
9. Cable connection: 1-inch NPT. The cable provided with the transducer shall be ordered with sufficient length to provide installation without splicing the cable at any point.
10. Siemens SITRANS LR110 transmitter with SITRANS mobile IQ application

C. The transmitter shall provide a 4-20 mA DC signal to a display and pump controller. The display unit shall retransmit the 4-20 mA DC level signal to the RTU through the pump control panel.

D. The display unit/pump controller shall be used to control the pump station when the pump control panel selector switch is set to Level mode. The control shall utilize the pump wet well level control scheme and control relays for operation of the pumps in an alternating lead/lag configuration.

E. The CSI shall provide all mounting hardware and coordinate the details of the installation and control so that the instruments are installed in keeping with the best standard and recommended practices of the manufacturer and conforming to the requirements set forth by the Engineer.

F. Level display unit/pump controller shall be fully programmable and configurable using a computer and keypad. The final 'As-Built' documentation shall be provided with a tabulation of the Programming Parameters used in the level transmitter so that the initial calibration can be reproduced if a spare transmitter is installed.

G. Level transmitters shall be provided with optional integral analog signal isolators, as part of the transmitter assembly. All conduit connections shall be sealed to prevent damage or corrosion due to vapors or wetness.

H. Ultrasonic Level/Flow Transmitters shall be Siemens SITRANS LT500.

I. The CSI shall provide mounting hardware components and appropriate mounting assistance to install and secure the transducers in a manner in keeping with the recommendations of the manufacturer of the equipment and in keeping with the general details provided in the drawings. All hardware shall be fabricated from corrosion resistant materials and shall utilize stainless steel hardware. The mounting system shall be secure and permanent and shall allow easy access to the sensor for servicing. All cables shall be installed in suitable rigid conduit with only short lengths of flexible conduit allowed to complete the installation.

J. Spare parts: Provide one (1) spare radar level transmitter of each type used, supplied with the longest cable utilized in the project.

2.4 FLOW TRANSMITTER, MAGNETIC

A. Magnetic flow meters shall consist of a flow tube with remote-mounted signal converter/transmitter that is capable of converting and transmitting a signal from the flow tube. The flow tube shall utilize the characterized principle of electromagnetic induction and shall produce DC signals directly proportional to the flow rate

B. The flow meter accuracy shall be ≤ ±0.5% of reading from 2% to 100% meter capacity.

C. The flow meter shall include but not be limited to the following:

1. NEMA 6P / IP68 submersion enclosure

2. Meter body shall be powder coated aluminum or carbon steel with an epoxy finish

3. Electrical Housing shall be epoxy painted aluminum

4. ANSI Class 150 flanges (minimum)

5. EPDM, polyurethane or hard rubber liner to suit process requirements

6. Flush type or bullet type (slurry applications) electrodes compatible with process fluid

7. Empty pipe detection

8. SST bolts/nuts, centering device, Teflon gaskets

9. Grounding rings when installed in non-metallic piping. Grounding rings shall be chemically resistant to process, 316 SST minimum.

10. The cables for interconnecting the flow tube to the transmitter shall be furnished by the manufacturer and of sufficient length as to not require splicing.

D. The transmitter shall include but not be limited to the following

1. NEMA 6P enclosure / IP68 submersion enclosure

2. 120VAC, 60Hz input power

3. Process display with keypad for menu driven configuration

4. One (1) 4-20mA output, minimum

5. HART protocol

6. One (1) alarm relay output

7. Empty pipe detection

8. Lo-flow cutoff

9. Damping

10. Flow Totalizer

11. Non-volatile memory

E. Magnetic flowmeter, transmitter, electrical/control connections, and appurtenances shall be rated for continuous submergence of up to 10 mH_2O.

F. Magnetic Flowmeters shall be equal to

1. Siemens

a) Sitrans F M Mag 5100W flow tube

b) Sitrans F M Mag 6000 signal converter/transmitter

2. Engineer Approved Equal

2.5 TOOLS, SUPPLIES AND SPARE PARTS

A. Tools, supplies and spare parts shall be provided as required in Division 17 and as specified for each equipment item. In addition, the following items shall be provided:

2.6 ACCESSORIES

A. Instrument tubing shall be 1/4IN x 0.065IN seamless, annealed, ASTM A-269 Type 316L stainless-steel with Type 316 - 37 stainless-steel flared fittings, or equal to Swagelok or Parker-CPI flareless fittings.

B. Diaphragm seals shall be provided to systems as shown on the Contract Documents, as specified herein and/or for isolation of pressure gauges, switches and transmitters attached to systems containing chemical solutions or corrosive fluids. As a minimum, seals shall be of all 316 stainless-steel. Diaphragms shall be 316L stainless steel for operating pressures at or above 15PSI, and elastomers for operating pressures below 15PSI. Diaphragm material shall be non-reactive with the process fluid. Refer to the Instrument Schedules for specific materials requirements. Seal shall have fill connection, 1/4IN NPT valve flush port and capable of disassembly without loss of filler fluid. Where specified, diaphragm seals shall comply with the above requirements, and shall be provided with 316 stainless-steel factory filled capillaries. Seals shall be equal to Helicoid Type 100 HA, Mansfield & Green, Ashcroft or approved equal.

C. Isolating ring seals shall be provided for sensing elements measuring pressure in solids bearing fluids. For heavy solids/slurry applications, wherever the associated pressure instrument is used for control purposes, or as shown on the Contract Documents, the sensor body shall be full line size wafer design, with 316 stainless-steel housing and assembly flanges, and Buna N flexible cylinder lining for in-line

mounting. The wafer shall have through bolt holes or centerline gauge for positive alignment with the associated flanged piping. The captive liquid chamber and associated instrument(s) shall be furnished with threaded drain tap and plug. Isolating ring seals shall be equal to RED Valve Series 40, Ronningen-Petter Iso-Ring, Moyno RKL Series W or approved equal.

D. For all other solids bearing fluids, pressure shall be sensed via a 1/2IN diameter spool-type isolating ring seal, mounted on a 1/2IN pipe nipple at ninety-degrees from the process piping. An isolation ball valve shall be provided between the process piping and the ring seal, and a cleanout ball valve shall be provided between the ring seal and the atmosphere. The pressure instrument shall be back or side mounted to the ring seal such that the gauge or readout may be viewed normally. Isolating ring seals for normal solids service shall be equal to Red Valve Series 42, Ronningen-Petter Iso-Spool, or equal.

E. Isolation valves shall be 1/2IN diameter ball valves with 316 stainless-steel body, 316 stainless-steel ball.

PART 1 - EXECUTION

3.1 INSTALLATION

A. In addition to the requirements specified in this Section, reference Specification Section(s)

1. 17000 – INSTRUMENTATION AND CONTROL, GENERAL REQUIREMENTS

END OF SECTION 17120

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Magnetic Flow Meters				
Tag Number	**Description**	**State/Span**	**Dwg. #**	**Additional Requirements**
FE/FIT-100	Pump Station Discharge Flow	0-1000 gpm	E01.0	16-inch Flow Tube; Field SPD for 120 VAC and 4-20mA; Sunshield for FIT
Submersible Pressure Transmitters				
Tag Number	**Description**	**State/Span**	**Dwg. #**	**Additional Requirements**
LE/LT/LIT-100	Pump Station Wetwell Level	0-25 feet	E01.0	Sensor rated for Class 1, Div 1.; Field SPD for 120 VAC and 4-20mA, Sunshield for LIT
Pressure Gauge				
Tag Number	**Description**	**State/Span**	**Dwg. #**	**Additional Requirements**
PI-101, PI-102	Pump No. 1, No. 2 Discharge Pressure Gauge	0-60 psi	E01.0	60 PSIG Dial, 1/2" NPT with diaphragm seal; Manufacturer Assembled
Float Level Switches				
Tag Number	**Description**	**State/Span**	**Dwg. #**	**Additional Requirements**
LSLL-100	Pump Station Wetwell Low Level Float	Elev. XXX.XX	E01.0	Sensor rated for Class 1, Div 1.
LSHH-100	Pump Station Wetwell High Level Float	Elev. XXX.XX	E01.0	Sensor rated for Class 1, Div 1.
LSHH-101	Pump Station Meter Vault High Level Float	Elev. XXX.XX	E01.0	Sensor rated for Class 1, Div 1.

END OF SECTION 17120A

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SECTION 17130 – INSTRUMENTATION AND CONTROL, CONTROL HARDWARE

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. The Contractor shall furnish, test, install and place in satisfactory operation all equipment required to provide a complete and operable Supervisory Control and Data Acquisition (SCADA) system, as specified herein and as shown on the Contract Drawings, even if each needed item is not specifically specified or shown.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of specification Section 40 60 00 – Process Control Systems, General Requirements and the sections referenced therein shall be applied.

B. An Input/Output (I/O) list for the PLC(s) is included in these specifications. For bidding purposes, the I/O list is intended to provide information to the Contractor which includes a description of the supplied control system I/O provided under this contract.

1.3 SUBMITTALS

A. All submittals shall be in accordance with Specification DIVISION 1 – Shop Drawings, Project Data and Samples and as specified in Section 40 60 00 – Process Control Systems, General Requirements. In addition, the following specific submittals items shall be provided.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The SCADA hardware configuration as specified herein, as specified in related sections and as shown on the Contract Drawings depicts overall system configuration requirements. Unless otherwise specified, designs which vary from this concept will be rejected.

B. All discrete and analog data acquisition, pre-processing, storage and process control functions shall be performed at the PLC level.

C. PLC-to-PLC communication protocols shall be Ethernet based.

D. The Controls System Integrator shall provide all software, operating systems, network interface, special drivers and network integrations required and shall perform all configuration, commissioning, troubleshooting and diagnostics required for a complete and functional system.

E. The equipment specifications included herein define a level of performance based

on current technology to establish a basis of bid. However, it is recognized that technology changes rapidly and that this technology level, while leading edge today, will be surpassed by the time the equipment will be purchased. It is therefore expected that a comparable leading edge value in technology will be provided at the time of purchase.

F. The intent of this section is to provide the components to implement a fully functional SCADA monitoring and control system with an Ethernet-based network, linking all of the control equipment and providing for complete monitoring, control and data analysis for the station operations and process control.

G. Cable systems shall be provided for various requirements, including but not limited to data network, fiber optic, printer, power cables, and others as required. Cables shall be routed in suitable conduits, cable ducts, channels and wire ducts to provide a clean, safe, non-obtrusive and workmanlike installation.

H. Station communications to the remote SCADA system shall occur over cellular communications. The CSI shall be responsible to provide the cellular modem and coordinate service with the Owner and the service provider (T-Mobile). The CSI shall provide the SIM card for the modem and provide all configuration needed to provide connection to the Owner SCADA system.

I. All software licenses and support contracts shall be registered to the Owner. The particular contact person and address shall be coordinated with the Owner prior to purchasing of any equipment or software. The CSI shall provide documentation within the submittals which states that all software and services provided and purchased under this contract will be registered in the Owner's name and that this coordination has been done. Proof of this ownership shall be provided prior to granting of Substantial Completion.

2.2 TOOLS, SUPPLIES, AND SPARE PARTS

A. Tools, supplies and spare parts shall be provided as specified in Section 17100 - Instrumentation and Control, General Requirements, and as specified for each equipment item. In addition, the following items shall be provided.

1. One (1) of each type of CPU module for PLC equipment furnished under this Contract.

2. Two (2) of each type of input/output module for PLC equipment furnished under this Contract.

3. Two (2) of each type and size of PLC and equipment power supply furnished under this Contract.

4. One (1) of each type of control panel mounted network switch and/or media converter furnished under this Contract.

5. One (1) of each type of Operator Interface Terminal (OIT) furnished under this contract.

2.3 SURGE PROTECTIVE DEVICES (SPDs)

A. Refer to specification Section 17100 – Instrumentation and Control - Control Enclosures for surge protection device requirements.

2.4 UNINTERRUPTABLE POWER SUPPLIES (UPS), CONTROL PANEL

A. UPS units shall be online, line interactive units provided for new PLC control panels as specified herein or shown elsewhere within the Contract Documents.

B. UPS units for locations without Automatic Transfer Switch (ATS) and generators shall be sized to provide a minimum of two (2) hours backup time for all connected equipment. At sites with ATS and generators, UPS units shall be sized for a minimum of twenty (20) minute backup for all connected equipment. Each UPS shall consist of a UPS module and battery modules as required to meet backup run time requirements.

C. UPS units provided for PLC cabinets shall be provided with a dry contact output to alarm on UPS trouble or failure. This fail output shall be wired into the PLC I/O to represent UPS status.

D. Where located in a control or PLC enclosure, the UPS shall be located at the bottom of the enclosure but mounted on a raised shelf or platform or mounted on DIN rail attached to the control panel back panel.

E. Provide network interface for network management support and power management. Provide relay output card for connection to PLC discrete inputs.

F. Each UPS shall be sized to match the maximum power requirements of the associated digital equipment, control panel power supplies and accessories plus twenty (20) percent spare capacity. Upon loss of the AC supply, the inverter shall continue to supply normal power to the device, drawing DC from the batteries.

G. Each UPS shall meet the following requirements:

1. Input voltage shall be 120 VAC, single phase, 60 Hz.

2. Operating temperature range shall be 0 to 40 degree C.

3. Voltage regulation shall be plus or minus five percent (+/-5%) for line and load changes.

4. The output frequency shall be phase-locked to the input AC line on AC operation and shall be 60 hertz (+/-0.5%) when on battery operation.

5. The batteries shall be of the sealed, lead acid or lead calcium gelled electrolyte type, suitable for high temperatures.

6. Sound absorbing enclosure.

7. EMI/RF noise filtering.

8. Surge protection shall be provided on the AC input circuit, which shall have a UL TVSS clamping voltage rating of 400 V with a <5 ns response time.

9. Adjustment allowed to prevent UPS from going offline when on a standby generator supplied power source.

10. Two separate relay output contacts indicating UPS on battery and UPS low battery.

H. UPS systems shall be Allen Bradley 1606 or equal by PULS, Sola or approved equal.

2.5 PROGRAMMABLE LOGIC CONTROLLERS (PLC), GENERAL

A. The CSI shall furnish programmable controllers (PLCs) as specified herein and as shown on the Drawings. PLCs shall be provided complete with rack, power supply, Input/Output (I/O) modules, special function cards, instructions, memory, input/output capacity and appurtenances to provide all features and functions as described herein. PLC I/O cards may be supplied by third party vendors if approved by the PLC manufacturer and the Owner. No substitutions will be permitted.

B. All components of the PLC system shall be of the same manufacturer; who shall have fully tested units similar to those being furnished, in an industrial environment with associated electrical noise. The PLC system shall have been tested to meet the requirements of NEMA Standard ICS 2-230 (Arc Test) and IEEE C37.90.1 (SWC). The processing unit shall perform the operations functionally described herein, based on the program stored in memory and the status of the inputs and outputs.

C. The programmable controller shall be designed to operate in an industrial environment. The PLC shall operate in an ambient temperature range of 0°-60°C and a relative humidity of five to ninety-five percent (5% - 95%), non-condensing. The PLC shall operate on supply voltages of 90-132 VAC at 47-63 Hz, or 24 VDC if provided with a battery backup system. Overcurrent and undervoltage protection shall be provided on the power supply.

D. System configuration shall be as shown on the Contract Drawings. PLC types shall be designated on the system block diagram and correspond to the specifications herein. Only a single type of processor shall be supplied for all PLCs of a designated type. The minimum PLC backplane size shall be 8 slots, not including power supply slots. Memory, processor and PLC type shall be adequate for all control functions specified. Memory backup shall be provided during loss of power for the configuration, logic program and current operating parameters/addresses.

E. The processor and its associated memory shall be enclosed in a modular enclosure. A multiple-position selector switch or equivalent shall be used to select

processor operating mode. LED-type indicating lights shall be provided to indicate processor, memory and battery status. Errors in memory shall be recognized and shall activate the memory error indicating lights. Memory shall consist of battery or capacitor-backed RAM or EEPROM, which shall retain the control program for at least one (1) year, in the event of power loss. Visual indication shall be provided if battery charge is insufficient to maintain the program in RAM memory for at least two (2) weeks.

F. All PLC processors shall be provided with the latest manufactured firmware revision level installed.

2.6 PLC COMPONENTS

A. PLC power supply shall be compatible with the Modicon x80 Process Automation Controller. Input shall be 120 VAC and shall supply power to the PLC, Communication and I/O Modules; BMXCPS3500.

B. PLC processors shall be Modicon 340 CPU, 4MB, 1024 discrete and 256 analog I/O, 11 slots (x80); with Unity Pro software compatibility; BMXP342020.

C. Backplane for Modicon M340 CPUs with 8 bus X slots; BMXXBP0800

D. Backplane for Modicon M340 CPUs with 12 bus X slots; BMXXBP1200

E. Peripheral BMXXBE2005 Expansion Rack Kit with Daisy Chain Cord set BMXXBC015K 1.5m Cable, or BMXXBC050 5m Cable.

F. Communication module for Modicon M340 CPUs with Modbus TCP Scanner and Messaging and Ethernet/IP Scanner and Messaging; BMXNOE0110H.

2.7 PLC INPUT/OUTPUTS

A. Each PLC within an enclosure shall handle the required number of process inputs and outputs, plus a minimum of ten percent (10%) pre-wired spares for each I/O type furnished except discrete inputs which shall have a minimum of twenty percent (20%) pre-wired spares, plus a minimum of twenty percent (20%) spare I/O rack expansion space for the addition of future circuit cards or modules.

B. PLC input/output systems and processing modules shall be of the same model series. No third party manufacturer models will be accepted.

C. Discrete inputs (DI) shall be 16-point module, 120 VAC positive (sink), for Modicon X80;BMXDAI1604H.

D. Discrete outputs (DO) shall be 16-point, 240 VAC / 125 VDC 3A relay contact modules, for the PLC. Output contacts may be powered from the field equipment or powered from 24 VDC / 120 VAC sourced from PLC control panel's power system, as required to interface with field equipment. Outputs to solenoid valves shall be 120 VAC, powered from the control panel unless specified or shown otherwise. Provide interposing relays as specified in Section 17110 as required to

meet dry contact rating. Modicon X80; BMXDRA1605H.

E. Analog input (AI) circuits shall be isolated, 12-bit (minimum) resolution type. Analog input hardware shall be provided as required for all types of analog inputs being transmitted to the PLC. In general, analog input modules shall be capable of receiving 4-20 mA signals. Each input circuit shall have optical isolation to protect the equipment against high voltage transients. Modicon X80; BMXAMI0810.

F. Analog outputs (AO) shall be isolated 24 VDC, 4-20mA outputs powered from the PLC. Each output circuit shall have optical isolation to protect the equipment against high voltage transients. Modicon X80; BMXAMO0410.

G. Input/output modules shall be configured for ease of wiring and maintenance. The modules shall be connected to wiring arms which can be disconnected to permit removal of a module without disturbing field wiring. Covers shall be provided to prevent operator personnel from inadvertently touching the terminals. The process interface modules shall be provided with screw-type terminal blocks with barriers between adjacent terminals for connection of field inputs. Terminals shall be suitable for accepting up to and including No. #22-#12 AWG (0.2-4 mm2) wire.

H. Output failure mode shall be selectable so that upon station or communication system failure, all outputs shall be placed in the non-conducting mode or remain as they were prior to failure. Light-emitting diodes shall be provided for status indication for each input and output point.

I. Signal and control circuitry to individual input/output boards shall be arranged such that board failure shall not disable more than one half (½) of the control loops within any group of controlled equipment (e.g., one pump out of a group of three pumps, two pumps out of four, etc.). Where possible, individual control loops and equipment shall be assigned to individual boards such that failure of the board will disable only one (1) loop or piece of equipment.

J. Control circuits and signals entering hazardous areas shall be provided with intrinsically safe barriers meeting the requirements of the NEC and UL698.

2.8 OPERATOR INTERFACE TERMINAL (OIT)

A. Operator Interface Terminals (OIT) shall be provided as specified herein and shown on the contract drawings. The OIT shall include all graphics and control features for its respective PLC unless otherwise noted.

B. The NEMA rating of the OIT enclosure shall be the same as the NEMA rating of its respective PLC enclosure. Outdoor locations shall be protected from sun and UV exposure with a cover and /or sun shields.

C. The OIT display shall have a flat-panel color TFTH LCD touchscreen display, with 800 x 600 pixel resolution and 64 K colors, SVGA with LED backlight.

D. The unit shall have three (3) serial ports, one (1) Ethernet communication port, two

(2) USB ports, and SD card slot for storage. Input power for OIT is 24-24 VDC, with a temperature range of 0-50 degrees C.

E. OIT shall be manufactured by Automation Direct, C-more CM5-T10W Color Touch Screen Graphics Terminal. Unless noted otherwise, the unit shall have a 10.4-inch display size.

F. For outdoor installation, the OIT shall be provided with a lockable and collapsible protective unit. OIT Shade Aide cover shall be stainless steel and manufactured by Smith & Loveless Inc. or approved equal.The OIT configuration software shall be the manufacturer's latest version. The software package shall consist of programing, configuration, and documentation software needed for developing graphic displays. The software shall allow off-line program development and documentation.

2.9 LOCAL AREA NETWORK (LAN)

A. An IEEE 802.3 Ethernet local area network shall be used for communications between plant devices. Network protocol shall be Modbus TCP and all devices shall support the use of the protocol.

B. Network wiring shall be unshielded, twisted-pair copper cables for connections within buildings. Fiber optic media shall be used for all inter-device communication links extended outside of a building, unless specifically noted. Cables shall be as shown in the design drawings and as specified herein.

C. The Contractor shall supply all hardware, cables, connectors, adapters, modules, and software to implement a network as specified herein and shown on Drawings.

2.10 INDUSTRIAL ETHERNET NETWORK SWITCHES

A. Managed industrial Ethernet network switches shall be provided for each device connected to the process control system network. The switches shall create Ethernet networks that conform to the IEEE 802.3 and 802.3u standards using copper wires or optical fibers in a bus, tree or ring network topology as shown on the Drawings.

B. The network switches shall be supplied by the same manufacturer for all types furnished under this contract to ensure compatibility and the functionality of the specified networks.

C. On-line signal monitoring shall be provided to detect and locate impending faults. Network switches shall be replaceable on-line without disrupting the network. Switches shall support the non-proprietary Media Redundancy Protocol (MRP) and Rapid Spanning Tree Protocol (RSTP) in addition to the switch manufacturer's standard redundant ring network protocol, all of which shall provide for communication recovery.

D. The network configuration shall be separated into three (3) groupings – device level, PLC level and SCADA level. Switches and other communication devices will provide a physical or logical separation between the network groups.

E. The switch shall provide a minimum of eight (8) Ethernet 10/100/1000 Base T(X) RJ-45 network ports and Four (4) Gigabit SFP fiber optic ports.

F. The switch shall include automatic port detection for speed (10/100/1000 Mbps), duplex (full/half) and connection (mdi/mdix).

G. Input voltage shall be 13-30 VDC with a max current of 8 mA.

H. Management: Simple Network Management Protocol (SNMP) (v1/v2/v3) IGMP filtering and snooping

I. Operating Temperature: -40 to 75 degrees C

J. Relative Humidity: 5 - 95% non-condensing

K. Managed industrial network switches shall be MoxaEDS-G512E-4GSFP-T.

L. The CSI shall coordinate addressing, configuration and programming of the network switch with the Owner to ensure compatibility and compliance with the Owner's SCADA and network practices. This is including but not limited to NAT configurations, VLAN configurations and Layer 3 routing where required.

2.11 UNSHIELDED TWISTED PAIR CABLE

A. Network communications cable shall be provided as indicated on the design drawings and as needed to complete network communications links.

B. Cable shall be certified for operation in an industrial environment and compliant with Enhanced Category 6 specifications and indicate compliance with the specifications for Modbus TCP communications.

C. Unshielded twisted pair cable shall consist of 4 pair of 24 AWG copper conductors in a flame-retardant jacket. Cable shall be plenum rated (UL 910) and meet EIA/TIA-568 Category 6 specifications.

D. Cable shall be terminated using RJ-45 type connectors.

E. All cables shall be installed and tested in compliance with the requirements of Division 16.

F. Unshielded twisted pair cable shall be Hyper Grade Extended Distance cable as manufactured by Berk-Tek, Belden equivalent, or approved equal.

2.12 CELLULAR GATEWAY REMOTE (TYPE-1)

A. Cellular Gateway shall meet the following requirements:

1. Minimum LTE band and provide up to five (5) concurrent VPN tunnels using IPsec, GRE and OpenVPN.

2. The gateway shall support T-Mobile as a cellular carrier.

3. The housing shall be constructed of aluminum die cast and rated at a minimum of IP-54.

4. Interfaces shall be 1000 Mbs Ethernet, RS-232 and USB 2.0.

5. Input Voltage 7 – 36 VDC

6. Mobile FIPS compliant

7. The gateway shall be a Semtech/Sierra Wireless Airlink RV55X or approved equal.

2.13 ANTENNAS

A. Cellular Gateway Antenna: Panel mounted antennas shall be provided as shown or specified.

1. The panel mounted antenna shall come with a seal that resides between the panel surface and the antenna.

2. Cellular antenna shall be as provided by Parsec Technologies, model no. PTA5BC2L2WG15B.

3. One (1) Antenna shall be provided for each cellular antenna connector, minimum of two (2).

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. In addition to the requirements specified in this section, refer to Section 17100 – Process Control Systems, General Requirements.

END OF SECTION 17130

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Tag Number	Description	I/O Type	State/Span	Remarks
METROPOLITAN SEWERAGE DISTRICT ITT PUMP STATION				
YI-100	Inline Grinder Running	DI	0 - Stopped, 1 - Running	
XA-100	Inline Grinder Fault	DI	0 - Normal, 1 - Fault	
RL-101	Wastewater Pump No. 1 Running	DI	0 - Stopped, 1 - Running	
YI-101	Wastewater Pump No. 1 In Auto	DI	0 - Not In Auto, 1 - In Auto	
YI-101	Wastewater Pump No. 1 In Hand	DI	0 - Not In Hand, 1 - In Hand	
XA-101	Wastewater Pump No. 1 Overload	DI	0 - Normal, 1 - Overload	
TAH-101	Wastewater Pump No. 1 Overtemp	DI	0 - Normal, 1 - Overtemp	
UAH-101	Wastewater Pump No. 1 Seal Fail	DI	0 - Normal, 1 - Seal Fail	
HS-101	Wastewater Pump No. 1 Start/Stop Command	DO	0 - Stop Command, 1 - Run Command	
II-101	Wastewater Pump No. 1 Current	AI	0-XX Amps	
RL-102	Wastewater Pump No. 2 Running	DI	0 - Stopped, 1 - Running	
YI-102	Wastewater Pump No. 2 In Auto	DI	0 - Not In Auto, 1 - In Auto	
YI-102	Wastewater Pump No. 2 In Hand	DI	0 - Not In Hand, 1 - In Hand	
XA-102	Wastewater Pump No. 2 Overload	DI	0 - Normal, 1 - Overload	
TAH-102	Wastewater Pump No. 2 Overtemp	DI	0 - Normal, 1 - Overtemp	
UAH-102	Wastewater Pump No. 2 Seal Fail	DI	0 - Normal, 1 - Seal Fail	
HS-102	Wastewater Pump No. 2 Start/Stop Command	DO	0 - Stop Command, 1 - Run Command	
II-102	Wastewater Pump No. 2 Current	AI	0-XX Amps	
HS-104	Control Mode Selection	DI	0 - Level Mode, 1 - PLC Mode	
LSHH-100	Wetwell High Level Float	DI	0 - Normal, 1 - High Level	
LSLL-100	Wetwell Low Level Float	DI	0 - Low Level, 1 - Normal	
LE/LIT-100	Wetwell Level	AI	0-25 feet	
FE/FIT-100	Wastewater Pump Station Discharge Flow	AI	0-1000 gpm	
LSHH-101	Meter Vault High Level Float	DI	0 - Normal, 1 - High Level	
RL-120	Generator Running	DI	0 - Stopped, 1 - Running	
YCI-120	Generator In Auto	DI	0 - Not In Auto, 1 - In Auto	
XA-120	Generator Alarm	DI	0 - Normal, 1 - Alarm	
LAH-120	Generator Low Fuel	DI	0 - Normal, 1 - Low Fuel	
YCI-130A	MTS On Utility	DI	0 - Not on Utility, 1 - On Utility	
YCI-130B	MTS On Generator	DI	1 - Not on Generator, 1 - On Generator	
XA-130	MTS Alarm	DI	0 - Normal, 1 - Alarm	
YCI-140A	ATS On Utility	DI	0 - Not on Utility, 1 - On Utility	
YCI-140B	ATS On Generator	DI	1 - Not on Generator, 1 - On Generator	
XA-140	ATS Alarm	DI	0 - Normal, 1 - Alarm	
JA-140	Station Phase Fail	DI	0 - Normal, 1 - Alarm	
JA-150	Control Panel Power Fail	DI	0 - Power Fail, 1 - Normal	
ZSC-150	Control Panel Intrusion Switch	DI	0 - Normal, 1 - Intrusion	
UAH-150	Control Panel 24VDC Power Supply Status	DI	0 - Power Supply Fail, 1 - Normal	
JA-150A	UPS On Battery	DI	0 - Not On Battery, 1 - On Battery	
JA-1510B	UPS Battery Warning	DI	0 - UPS Normal, 1 - UPS Warning	
JA-150C	UPS Battery Alarm	DI	0 - Normal, 1 - Battery Alarm	
TSH-150	Control Panel Temperature High	DI	0- Normal, 1- High	
HS-150	Alarm Horn Silence	DI	0- Normal, 1- Silence	
YA-150	Alarm Light/Horn	DO	0- Normal, 1- Alarm	
TI-150	Outside Temperature	AI	0-120 degrees	

NOTES:
Input / Output types are as follows:
DI - Discrete Input
DO - Discrete Output
AI - Analog Input
AO - Analog Output

END OF SECTION 17130A

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SECTION 17140 – INSTRUMENTATION AND CONTROL, PUMP CONTROL PANEL

PART 1 - GENERAL

1.1 REQUIREMENT SUMMARY

A. The Control Systems Integrator (CSI) shall furnish, modify, test, install and place into satisfactory operation the Pump Station Control Panel (PCP), Remote Telemetry Unit (RTU) and instrumentation required to provide a complete and operable Instrumentation and Control System (ICS) as specified herein and as shown on the Contract Documents, even if each needed item is not specifically specified or shown.

B. All control panels and/or subpanels shall be assembled, wired and tested in at the CSI facility, unless specified otherwise.

C. All components and all necessary accessories (e.g., mounting hardware, air-conditioning equipment, surge protective devices, fuses, circuit breakers, terminals, ground bars, relays, contactors, starters, indicators, control operators, power supplies, signal conditioning, connectors, digital hardware, etc.) that may be required to complete the system shall be provided.

D. The SCADA System Programmer (SSP) shall make all modifications to the existing SCADA system to incorporate the pump station. The CSI shall program and configure all Programmable Logic Controllers and shall fully coordinate with the Owner as required by the Contract Documents and Project Scope of Work (SOW).

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of Division 17 and those Project Documents referenced herein shall be applied.

B. Instrumentation and Controls Schedules. Reference Instrumentation Schedule and PLC Input/Output Schedule Attachment(s) for a listing of major equipment, enclosure construction and signal monitoring requirements

C. Related Specification Section(s) include but not limited to

1. 17000 - INSTRUMENTATION AND CONTROL, GENERAL REQUIREMENTS

1.3 REFERENCES

A. Control panel assembly and installation shall comply with the National Electric Code, National Electric Safety Code, OSHA, and with all applicable federal, state, county, municipal, and electrical utility codes and regulations, as well as the Contract Documents. In the event of any conflict between these codes, regulations, and Contract Documents, the most restrictive shall apply.

B. Codes and Standards

1. All applicable state, county, and municipal code requirements.

2. All applicable standards of the National Fire Protection Association (NFPA)

    a. National Electrical Code (NEC)

3. All applicable standards of the Underwriter's Laboratories, Inc. (U.L.) to include but not limited to

    a. UL 508 Industrial Control Equipment

    b. UL 508A Industrial Control Panels

    c. UL 698 Industrial Control Equipment for Use in Hazardous Locations

4. All applicable standards of the Institute of Electrical and Electronics Engineers (IEEE)

5. All applicable standards of the National Electrical Manufacturers Association (NEMA)

6. All applicable standards of the International Society of Automation (ISA)

7. All Owner related construction and installation specifications and details

1.4 SUBMITTALS

A. Contractor shall reference and provide all documentation for all Division 17 Sections as required per Specification Section(s)

    1. 01340 – SUBMITTALS

B. All Submittal packages shall include a complete copy of the applicable Specification Sections. Contractor shall review and indicate that all items within the submittal are compliant with the Specifications by indicating with a ‘check mark’ by each paragraph. Any items that do not meet the requirements, Contractor shall indicate by marking the corresponding paragraph with an ‘x’. Those items not in compliance with the Specifications, a written clarification shall be provided by the Contractor describing how the submittal differs from the requirements outlined in the Specification Sections and a detailed explanation why it is not possible to meet those requirements. Any submittal package received without marked-up Specification Sections shall be rejected and returned by the Engineer without review.

C. Shop Drawings

    1. Control panel assembly and layout drawings to scale no smaller than 1/4IN equal 1FT. These shall include but not be limited to

        a. Front and Interior elevations and layouts

b. Complete Bill Of Material (BOM)

i) Fabrication and painting specifications

c. Heat calculations for Control Panels

d. Power supply device sizing calculations

2. Control panel wiring diagrams showing all power connections to equipment within and on the panel, combined panel power draw requirements (volts, amps), breaker sizes, fuse sizes, and grounding. This wiring diagram shall be in ladder logic format and show all wire numbers and terminal block designations

3. Provide detailed wiring connection diagrams covering all internal wiring and external connections

4. Submittal shall provide complete documentation of the proposed Control Panel functionality to include descriptive sequence of operations.

D. Qualifications

1. Manufacturer shall be a UL listing facility and control panel shall carry a UL certification.

E. Cellular Communications Submittal

1. The cellular communications submittal shall provide complete documentation of the proposed hardware and software including:

a. A network diagram(s), showing in schematic form, the interconnections, between major hardware components such as the PLC and/or master station and field equipment The diagram shall provide details on type of communications (Modbus RTU Serial or TCP/IP, Ethernet I/P, etc.) and reference all interconnecting cabling requirements and/or wireless equipment for the data communication links between the PLC and/or master station and field equipment. All components shall be clearly identified with appropriate cross references to the location of each.

b. Data sheet for each hardware and software component, listing all model numbers, optional, auxiliary, and ancillary devices that are being provided.

c. The data sheets shall be provided with an index and proper identification and cross referencing. They shall include but not be limited to the following information:

1) Equipment number and ISA tag number per the loop diagrams, where applicable.

2) Product (item) name used herein and on the Contract Drawings.

3) Manufacturers complete model number.

4) Location of the device.

5) Input-output characteristics.

6) Range, size, and graduations.

7) Physical size with dimensions, enclosure NEMA classification, and mounting details.

8) Material of construction of all components.

9) Power supply device sizing calculations where applicable.

d. Equipment specification sheets which shall fully describe the device, the intended function, how it operates and its physical environmental and performance characteristics. Each data sheet shall have appropriate cross references to loop or equipment identification tags. As a minimum the specification sheets shall include the following:

1) Dimensions and working clearances.

2) Mounting or installation details.

3) Connection diagrams.

4) Electrical power requirements (volts, amps).

5) Materials of construction.

6) Environmental characteristics.

e. Submit information on the following control network software where applicable:

1) Information on the operator interface software provided by the manufacturer to interface with the control network system.

2) Software configuration and parameters to set up and operate the control network system.

2. Cellular Path Field Survey Report

a. The Control System Integrator shall conduct a path field survey for the cellular connections prior to installation of equipment, using field RF measurements at each site, to determine path viability, signal strength to available cellular access points, antenna type, location, bearing, and height to achieve maximum signal strength. Antenna types, cable types, and lengths shall be established to provide minimum specified performance requirements. In addition, the report shall provide the following:

b. Survey methods used and assumptions taken.

c. List of equipment and software used in the study.

1) Topographical maps of all communication paths, with elevation profiles.

2) Signal strengths using approved test equipment and a listing of equipment at each site required to achieve the results.

The final installed equipment configuration shall be taken into account to include losses due to lightning protection and additional connectors, cables, etc.

3) Signal quality radio values.

4) Access point location utilized for testing.

5) Mounting instructions for antennas at each site (coordinates, elevation, bearing, cable length, etc.)

6) Path reports giving a summary of results

d. Cellular Communications “As Installed” Report & Testing: Upon completion of the installation of the cellular communications system, the CSI shall perform system testing to confirm the operating efficiency of each site. Testing shall confirm the operation of the system to the requirement as specified herein. The results of this testing, including signal strength and signal quality values shall be submitted as a benchmark of the system operation. All stations not conforming to the included system performance requirements shall be corrected and retested. Refer to Testing submittals for the required test plan documentation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Control panels and all components shipped loose shall be handled and stored in accordance with manufacturer’s instructions and recommendations as outlined in applicable Installation and Maintenance Manuals.

B. Inspect and report concealed damage to carrier within their required time period. Owner is not responsible for damages incurred during shipping, handling and storage.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Control panel operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

1.7 WARRANTY

A. Manufacturer shall warrant control panels to be free from defects in materials and workmanship for the lesser of one year (1YR) from date of installation or eighteen months (18MTH) from date of purchase.

1.8 IDENTIFICATION

A. Control panel shall be identified with the equipment tag number indicated on the Contract Documents and the accepted shop drawings. Nameplates shall be furnished and installed as required Specification Section(s)

1. 16075 – ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Control panels shall be provided with an enclosure to suit the specified environmental conditions or as indicated on the Contract Documents. Reference Specification Section(s)

1. 17110 – INSTRUMENTATION AND CONTROL, CONTROL ENCLOSURES

2.2 EQUIPMENT

2.3 TOOLS, SUPPLIES, AND SPARE PARTS

A. The following shall be provided at a minimum

1. One (1) of each type of panel mounted equipment (i.e., indicators, signal converters, etc.) provided under this Contract.

2. One (1) 24VDC power supply and redundancy module.

3. Three (3) of each type of interposing relay provided under this Contract.

4. One (1) of each type of power surge protection device used

5. Six (6) of each type of signal surge protection device used

6. Two (2) of each type of communication surge protection device used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. CSI and SSP shall provide Contractor a periodic written report detailing progress of startup. This report shall include specific tabulations of devices on which startup has been completed.

B. Equipment shall be located so that it is accessible for operation and maintenance. CSI shall examine the Contract Documents and approved shop drawings for various items of equipment in order to determine the best arrangement for the work as a whole and shall supervise the installation of ICS equipment.

C. Instrumentation and Control System equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Contract Documents are approximate

only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field, all information relevant to the placing of process control work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

D. Two (2) complete sets of approved shop drawings shall be kept at the job site during all on site construction. Both sets shall be identically marked up to reflect any modifications made during field installation or startup. All markings shall be verified and initialed by the Engineer or his designated representative. Following completion of installation and the operational readiness test, one (1) set of the marked-up drawings shall be provided to the Engineer, the other retained by the CSI for incorporation of the mark ups into final as built documentation.

E. All work shall be in strict accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the CSI and SSP shall bear full responsibility for such violations and assume all costs arising there from.

F. Brackets and hangers required for mounting of equipment shall be provided by the Contractor. They shall be installed in a workmanlike manner and not interfere with any other equipment.

G. Contractor shall take steps to keep electrical and control enclosures clean and free of contaminants throughout installation. Cleaning after installation only is not acceptable. Under no circumstances are electrical and control enclosures to be cleaned using compressed air to blow out dust, causing contaminants to be forced into sensitive electronics.

H. Provisions shall be made to completely capture filings (metal, etc.) when drilling into enclosures, to prevent contamination of electrical equipment. Any damage incurred from metal filings, debris, etc. entering modules, components, etc., shall be replaced with new at no cost to the Owner.

I. Upon completion of the instrumentation and control work, Contractor shall thoroughly clean all soiled surfaces of installed equipment and materials and remove all surplus materials, rubbish, and debris that has accumulated during the construction work. The entire area shall be left neat, clean, and acceptable to the Owner.

3.2 WIRING AND GROUNDING

A. The following wiring practice guidelines shall be used in order to minimize ground loops, to minimize electromagnetic interference/radio frequency interference (EMI/RFI) to this equipment, and to provide maximum practical immunity from damage resulting from lightning-induced transients.

B. Common wires or conductors shall not be utilized (either within panels or external to panels or for grounding of field devices) for signal shield or signal grounding and for safety grounds.

C. Exposed wire lengths extending from within shielded signal cables shall be minimized to reduce pick-up of EMI/RFI by signal circuits. Exposed lengths of less than one inch are preferred, and a maximum exposed length of two inches (2IN) may be permitted where necessary. No splicing of signal wires is permitted.

D. All signal wiring shall be shielded, both within panels and external to panels. Unless otherwise specified, all signal wiring shall be #16AWG stranded tinned two-conductor twisted pair, with one-hundred percent (100%) coverage aluminized Mylar or aluminized polyester shield and tinned copper drain wire.

E. Signal wiring within outdoor or indoor field device enclosures shall conform to the same requirements as panel wiring.

F. The shield on each process instrumentation cable shall be continuous from source to destination and grounded at one end only. In general, grounding of signal cable shields shall be done at the control panel end. The signal cable for no signal shall share a common cable shield grounding wire with the signal cable shield for any other signal, and shall not share a common grounding wire with any other circuit. The length of no signal cable shield grounding wire shall not exceed two inches (2IN), with less than one inch (1IN) maximum length preferred.

G. All outdoor instruments and all outdoor enclosures shall be grounded using the practice defined in Section 800.40 of the National Electric Code.

3.3 TESTING

A. CSI and SSP shall fully coordinate to completely all testing, start-up and commissioning of all equipment hardware and software to include those requirements related in Specification Section(s)

1. 17000 – INSTRUMENTATION AND CONTROL, GENERAL REQUIREMENTS

3.4 TRAINING

A. CSI and SSP shall provide Project specific on-site training for the Owner personnel. Training shall be provided per those requirements related in Specification Section(s)

1. 17000 – INSTRUMENTATION AND CONTROL, GENERAL REQUIREMENTS

END OF SECTION 17140

Appendix A:

Special Conditions Attachments

Right of Way Special Provision Detail Sheets and Easements

Henderson County (Parcel 9642-47-1366)

BK 4335 PG 637 - 642 (6) DOC# 1001036744
This Document eRecorded: 09/09/2025 09:06:23 AM
Fee: $26.00
Henderson County, North Carolina Tax: $0.00
William Lee King, Register of Deeds

PREPARED BY AND RETURN AFTER RECORDING TO:
KATHRYN MAULTSBY MADISON of
ROBERTS & STEVENS, P. A.

STATE OF NORTH CAROLINA

COUNTY OF HENDERSON EASEMENT AGREEMENT

THIS EASEMENT AGREEMENT, made this 2nd day of September, 2025, by and between **HENDERSON COUNTY, a body politic and corporate,** hereinafter referred to as Grantor, and **METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, NORTH CAROLINA**, a public body and body politic and corporate, created and established by the North Carolina State Stream Sanitation Committee by Resolution adopted on January 19, 1962, under the provisions of the North Carolina Metropolitan Sewerage Districts Act, now codified as Chapter 162A, Article 5, of the General Statutes of North Carolina, hereinafter referred to as Grantee (the designations Grantor and Grantee as used herein shall include said parties, their heirs, successors and assigns and shall include singular, plural, masculine, feminine and neuter as required by context).

W I T N E S S E T H:

THAT WHEREAS, the Grantor is the owner of certain property more particularly described in a deed recorded in Book 944 at Page 605, Henderson County Registry (hereinafter sometimes referred to as "Property"); and

WHEREAS, the Property's access is by a private road, as described in that instrument recorded in Book 944 at Page 605 and as shown on the plat recorded in Cabinet 1996 at Slide 2295, Henderson County Registry (the "Road"); and

WHEREAS, the Grantee has requested that the Grantor grant and convey to the Grantee a permanent and temporary construction easement over, upon, across, under and through a portion the Property of the Grantor and the Road for purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sewer lines and accessories and the Grantor has agreed to do so.

NOW, THEREFORE, the Grantor, for and in consideration of the sum of One Dollar ($1.00), and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, has given, granted and conveyed, and by these presents does give, grant, and convey unto the Grantee, its successors and assigns, the permanent and temporary right, privilege and easement to construct, operate, maintain, repair, inspect, reconstruct and replace, if necessary, sanitary sewer lines and accessories over, upon, across, under and through the Property of the Grantor and the Road, said permanent easement and temporary construction easement being described as follows:

PERMANENT EASEMENT: A non-exclusive permanent easement for the purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sanitary sewer lines, including such pipes, manholes, fittings, fixtures and other accessories as from time to time may be required. The easement shall include the right to perform appropriate tests within said permanent easement, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee

RS #3674433v1
Submitted electronically by "Roberts & Stevens PA"
in compliance with North Carolina statutes governing recordable documents
and the terms of the submitter agreement with the Henderson County Register of Deeds.

PREPARED BY AND RETURN AFTER RECORDING TO:
KATHRYN MAULTSBY MADISON of
ROBERTS & STEVENS, P. A.

STATE OF NORTH CAROLINA

COUNTY OF HENDERSON **EASEMENT AGREEMENT**

THIS EASEMENT AGREEMENT, made this 2nd day of September, 2025, by and between **HENDERSON COUNTY, a body politic and corporate,** hereinafter referred to as Grantor, and **METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, NORTH CAROLINA**, a public body and body politic and corporate, created and established by the North Carolina State Stream Sanitation Committee by Resolution adopted on January 19, 1962, under the provisions of the North Carolina Metropolitan Sewerage Districts Act, now codified as Chapter 162A, Article 5, of the General Statutes of North Carolina, hereinafter referred to as Grantee (the designations Grantor and Grantee as used herein shall include said parties, their heirs, successors and assigns and shall include singular, plural, masculine, feminine and neuter as required by context).

W I T N E S S E T H:

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WHEREAS, the Property's access is by a private road, as described in that instrument recorded in Book 944 at Page 605 and as shown on the plat recorded in Cabinet 1996 at Slide 2295, Henderson County Registry (the "Road"); and

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NOW, THEREFORE, the Grantor, for and in consideration of the sum of One Dollar ($1.00), and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, has given, granted and conveyed, and by these presents does give, grant, and convey unto the Grantee, its successors and assigns, the permanent and temporary right, privilege and easement to construct, operate, maintain, repair, inspect, reconstruct and replace, if necessary, sanitary sewer lines and accessories over, upon, across, under and through the Property of the Grantor and the Road, said permanent easement and temporary construction easement being described as follows:

PERMANENT EASEMENT: A non-exclusive permanent easement for the purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sanitary sewer lines, including such pipes, manholes, fittings, fixtures and other accessories as from time to time may be required. The easement shall include the right to perform appropriate tests within said permanent easement, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee

reasonable, practical, and necessary access to and egress from said permanent easement to effectuate the purposes outlined herein, said permanent easement being more particularly described as follows:

BEGINNING at a computed point found in the northern boundary of the property, said point being with located South 26° 04' 05" East 516.01 feet from CAPPED REBAR with published NC Grid Coordinates: N: 628,081.70' and E: 943,012.28' and being with NC Grid Coordinates N: 627,618.28' and E: 943,238.98' (83/2011), and from said Beginning Point thus established, running North 76° 22' 03" East 29.48 feet to a computed point; thence running South 34° 06' 02" East 14.26 feet to a computed point; thence running North 55° 53' 58" East 10.93 feet to a computed point; thence running South 07° 38' 34" East 5.81 feet to a computed point; thence running South 58° 16' 53" West 30.45 feet to a computed point; thence running North 45° 05' 51" West 29.04 feet to the Beginning Point.

Said Permanent Easement consisting of 625 square feet (0.01 acres), more or less.

TEMPORARY CONSTRUCTION EASEMENT: A temporary construction easement for the purposes of excavation, digging ditches, storing dirt, supplies and materials, moving and using equipment and generally carrying out the completion of the installation of said sanitary sewer lines and accessories, and for the purposes of inspecting and performing appropriate tests within said temporary construction easement, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said temporary construction easement to effectuate the purposes outlined herein. This right of use as set out in this paragraph shall terminate upon the final completion of the entire project, said temporary construction easement being more particularly described as follows:

BEGINNING at a Computed Point found within the boundary of the Property, said point being the terminus of the fourth course and distance for the Permanent Easement described above, and from said Beginning Point thus established, North 55° 53' 58" East 9.07 feet to a computed point; thence running North 34° 06' 02" West 6.80 feet to a computed point; thence running North 76° 22' 03" East 6.84 feet to a computed point; thence running South 20° 23' 55" East 117.72 feet to a computed point; thence running North 45° 05' 51" West 128.48 feet to a computed point; thence running North 58° 16' 53" East 30.45 feet to a computed point; thence running North 07^0 38' 34" West 5.81 feet to the Beginning Point.

Said Temporary Construction Easement consisting of 2,536 square feet (0.06 acres), more or less.

Said permanent easement and temporary construction easement being shown on the plat entitled "ITT Pump Station Replacement Easement Across the Property of Owner: Henderson County", prepared by McKim & Creed, dated May 5, 2025, Project No. 09596-0001 attached hereto as Exhibit A and made a part hereof.

IT IS UNDERSTOOD AND AGREED BETWEEN THE GRANTOR AND THE GRANTEE:

1. That the Grantee shall have the right to clear the permanent easement and temporary construction easement described above and the right but not the obligation to keep the permanent easement clear at all times, and the right to remove from the permanent easement and temporary construction easement all brush, trees and other obstructions, and to go upon said easements whenever necessary for the purpose of clearing the same and removing therefrom all brush, trees and other obstructions of any kind.

2. That the Grantor shall at all times, other than while the sewer lines are under actual construction, have the right to use said permanent easement and said temporary construction easement, in the same manner as has been heretofore done; provided such use shall in no manner interfere with or be inconsistent with the use thereof by Grantee as provided herein. Prohibited uses of the permanent easement by the Grantor include, but are not limited to, the following: the erection of a shed, building, structure or other obstruction within the permanent easement by the Grantor shall not be allowed; the planting of trees within the permanent easement by the Grantor shall not be allowed; additional fill cannot be placed within the permanent easement except after

prior written consent from the Grantee; and other utility lines, including but not limited to, electric, gas, telephone, cable, or water lines, cannot be constructed within the permanent easement except after prior written approval by the Grantee.

3. That the Grantee agrees to restore the topography of said easement areas, and access areas, if any, after installation or repairs of the sewer lines and accessories to approximately the same condition as existed before said installation or repairs.

4. That the Grantor shall have the right to pass over and upon said permanent easement with appropriate roadways for the full use of the Property and Road, provided, however, that the construction, maintenance and use of said roadways shall in no way interfere with the sewer lines and accessories constructed within said permanent easements. As to paved roads, the Grantee, in future repairs or maintenance of said sewer lines and accessories, shall only be responsible for regraveling, tamping and patching the portion of said paved roads disturbed by such work. As to non-paved roads, the Grantee shall only be responsible for regraveling and tamping in connection with any repairs or maintenance.

5. If the Grantor has a sewer service line ("service line") that presently leads from the Grantor's residence or building on the Grantor's Property to the existing main sewer line which may be abandoned by the Grantee, the Grantee agrees that it will connect the service line to the new or rehabilitated sewer line that will be located within the permanent easements described above. The Grantor hereby agrees to cooperate with and authorizes the Grantee to enter upon the Grantor's Property and the Road and to excavate on the Grantor's Property outside of the permanent and temporary construction easement described herein as reasonably practical and necessary for the purpose of locating and connecting said service line. The Grantee shall perform such excavation in a good and workmanlike manner and shall obtain prior approval from the Grantor as to specific areas of Grantor's Property to be excavated. The Grantee shall also restore the topography of the Grantor's Property after location and connection of said service line to approximately the same condition as existed before said work.

6. Other conditions and provisions:

TO HAVE AND TO HOLD said permanent easement and temporary construction easement unto said Grantee, its successors and assigns, upon the terms and for the time periods set forth above.

The Grantor covenants to and with the Grantee, its successors and assigns, that the Grantor is lawfully seized in fee simple of the Property and has full right and power to convey these easements to the Grantee, and that Property is free from any and all liens and encumbrances, and that they will and their successors and assigns shall forever warrant and defend the title to said easements unto the Grantee, its successors and assigns, against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the Grantor has hereunto executed this document, as of the day and year first above written.

HENDERSON COUNTY (SEAL)

By: _____
Print Name: WILLIAM G. LAPSLEY
Title: CHAIRMAN
BOARD OF COUNTY COMMISSIONERS

By: _____
Print Name: Denisa A Lauffer
Title: County Clerk

* * * * * * * * * * * *

STATE OF NC

COUNTY OF Henderson

I, a Notary Public of the County and State aforesaid, certify that Denisa Lauffer, appeared before me and being personally known to me (or proved to me on the basis of satisfactory evidence) to be the County Clerk of Henderson County, a municipal corporation, and that by authority duly given and as the act of the corporation the foregoing instrument was signed in its name by its Chairman and attested to by himself/herself as its County Clerk.

Witness my hand and official stamp or seal, this 3 day of September, 2025.

_____
NOTARY PUBLIC

My Commission Expires:
5-17-2028

[NOTARIAL SEAL]

ALMA B. CREASMAN NOTARY PUBLIC HENDERSON COUNTY, NC

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f.)(11.)(d.).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

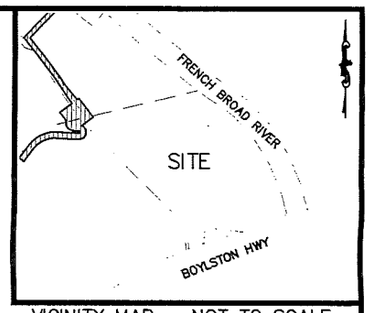
CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

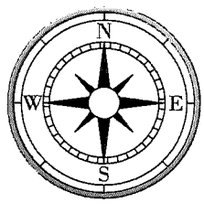
THIS 13th DAY OF May, 2025.

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN



VICINITY MAP - NOT TO SCALE



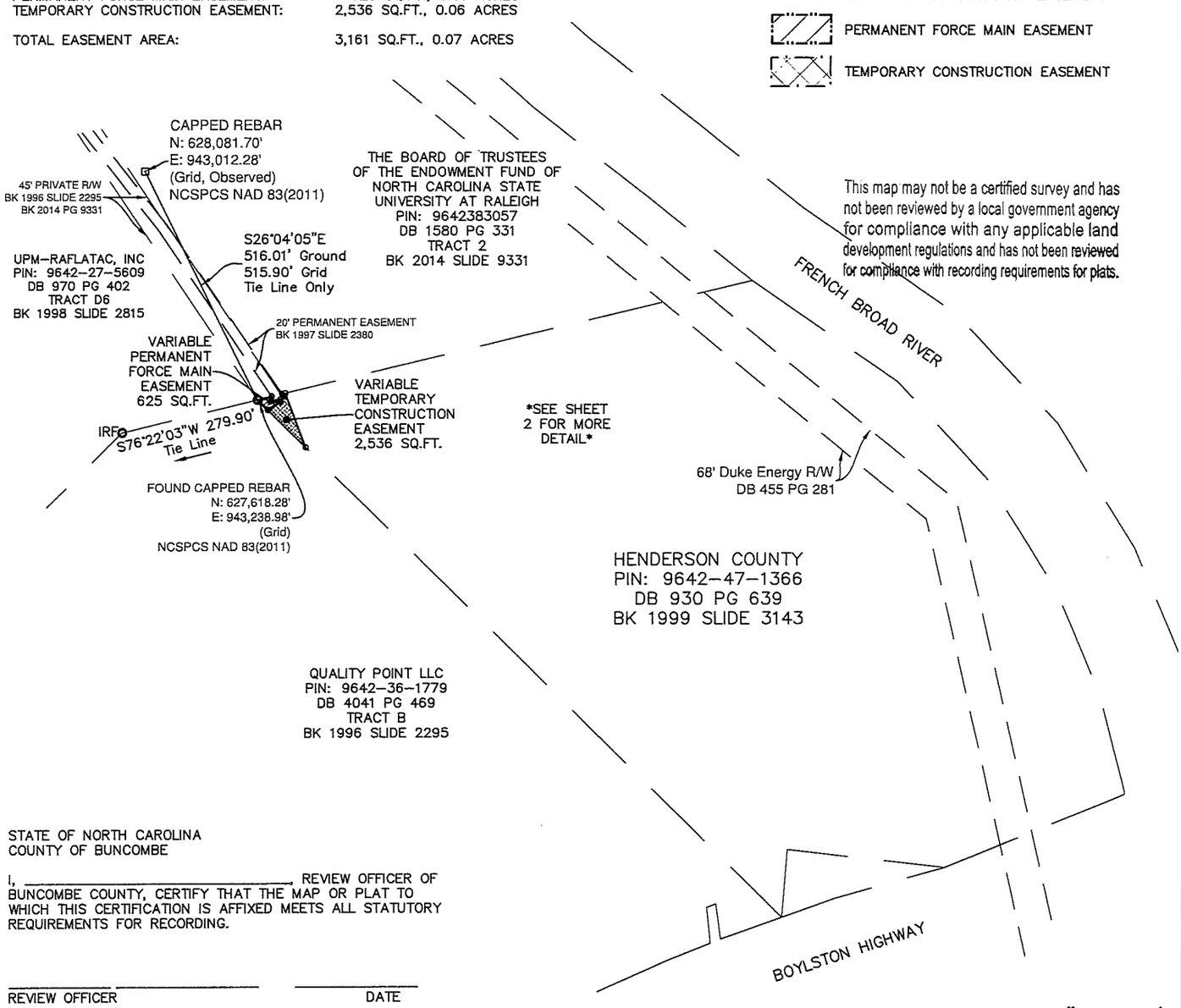
NC GRID NAD83/2011

LEGEND

- O COMPUTED POINT
- PARCEL LINE
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT

AREA TABLE

PERMANENT FORCE MAIN EASEMENT:	625 SQ.FT., 0.01 ACRES
TEMPORARY CONSTRUCTION EASEMENT:	2,536 SQ.FT., 0.06 ACRES
TOTAL EASEMENT AREA:	3,161 SQ.FT., 0.07 ACRES



This map may not be a certified survey and has not been reviewed by a local government agency for compliance with any applicable land development regulations and has not been reviewed for compliance with recording requirements for plats.

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____, REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____ _____
REVIEW OFFICER DATE

SCALE: 1" = 300'

0 150 300

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 930 PAGE 639, AND PLAT BOOK 1999 SLIDE 3143 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

DATE	REVISION	BY
5/13/25	ADD HATCHING TO EASEMENT AREAS	TB

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: HENDERSON COUNTY
PARCEL 9642-47-1366
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PROJ. SVYR :	TAB
DRAWN BY :	GHL
SCALE :	1" = 300'
DATE :	05/05/2025
SHEET # :	1 of 2

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567

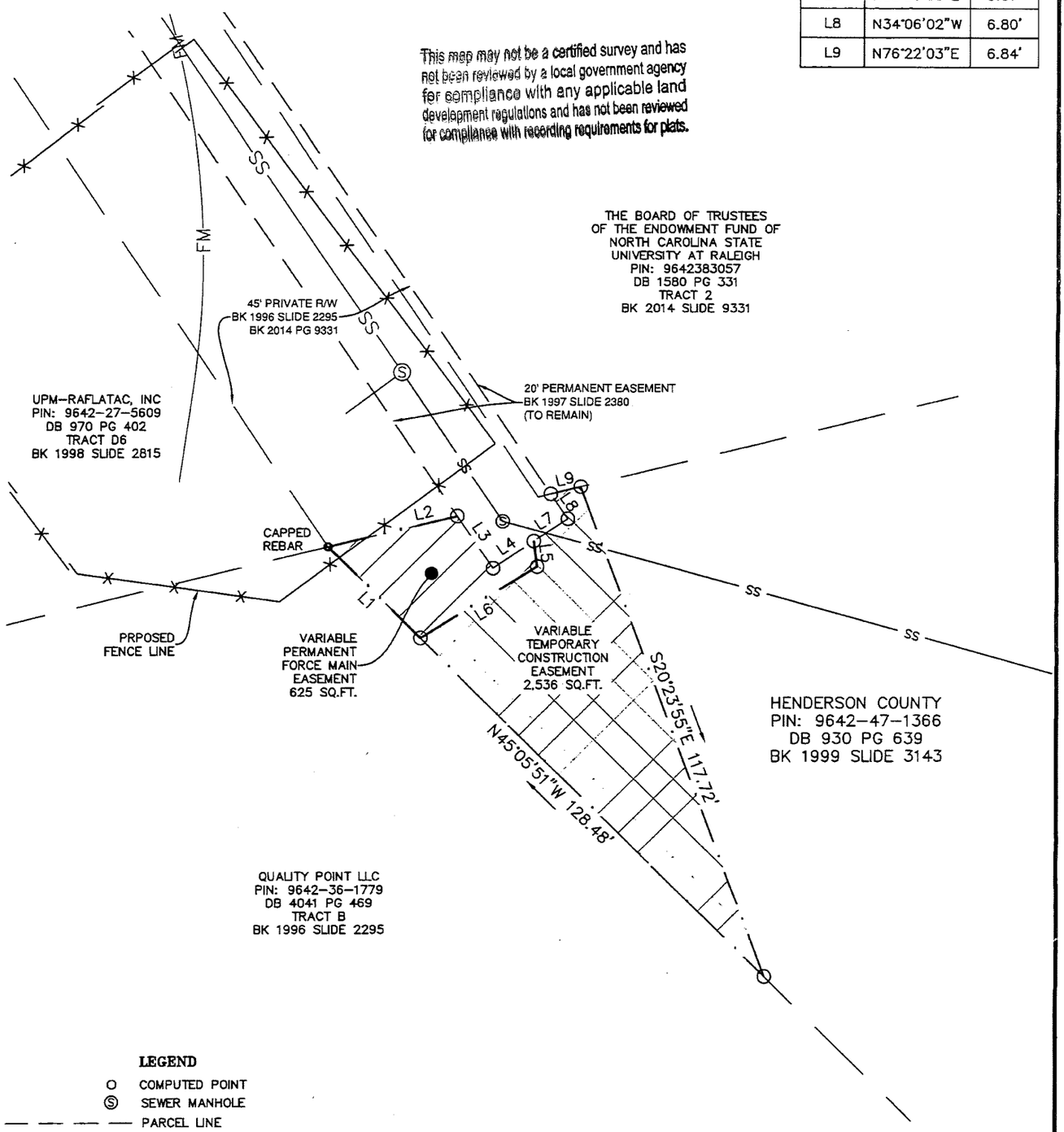
NC License# F-1222
Internet Site: http://www.mckimcreed.com

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

LINE TABLE		
LINE #	BEARING	LENGTH
L1	N45°05'51"W	29.04'
L2	N76°22'03"E	29.48'
L3	S34°06'02"E	14.26'
L4	N55°53'58"E	10.93'
L5	S07°38'34"E	5.81'
L6	S58°16'53"W	30.45'
L7	N55°53'58"E	9.07'
L8	N34°06'02"W	6.80'
L9	N76°22'03"E	6.84'

This map may not be a certified survey and has not been reviewed by a local government agency for compliance with any applicable land development regulations and has not been reviewed for compliance with recording requirements for plats.



LEGEND

- O COMPUTED POINT
- Ⓢ SEWER MANHOLE
- PARCEL LINE
- SS SEWER LINE
- FM PROPOSED NEW FORCE MAIN
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT

SCALE: 1" = 30'

0 15 30

N E S W

NC GRID NAD83/2011

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: HENDERSON COUNTY
PARCEL 9642-47-1366
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PROJ. SVYR :	TAB
DRAWN BY :	GHL
SCALE :	1" = 30'
DATE :	05/05/2025
SHEET # :	2 of 2

McKIM & CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567

NC License# F-1222
Internet Site: http://www.mckimcreed.com

Right of Way Special Provision Detail Sheets and Easements

UPM Raflatac, Inc. (Parcel 9642-27-5609)

BK 4346 PG 280 - 283 (4) DOC# 1001037996
This Document eRecorded: 10/02/2025 10:49:38 AM
Fee: $26.00
Henderson County, North Carolina Tax: $0.00
William Lee King, Register of Deeds

PREPARED BY AND RETURN AFTER RECORDING TO:
KATHRYN MAULTSBY MADISON of
ROBERTS & STEVENS, P. A.

STATE OF NORTH CAROLINA

COUNTY OF HENDERSON **EASEMENT AGREEMENT**

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W I T N E S S E T H:

THAT WHEREAS, the Grantor is the owner of certain property more particularly described in a deed recorded in Book 970 at Page 402, Henderson County Registry (hereinafter sometimes referred to as "Property"); and

WHEREAS, the Grantee has requested that the Grantor grant and convey to the Grantee a permanent and three (3) temporary construction easements over, upon, across, under and through a portion the Property of the Grantor for purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sewer lines and accessories and the Grantor has agreed to do so.

NOW, THEREFORE, the Grantor, for and in consideration of the sum of One Dollar ($1.00), and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, has given, granted and conveyed, and by these presents does give, grant, and convey unto the Grantee, its successors and assigns, the permanent and temporary right, privilege and easement to construct, operate, maintain, repair, inspect, reconstruct and replace, if necessary, sanitary sewer lines and accessories over, upon, across, under and through the Property of the Grantor, said permanent easement and temporary construction easement being described as follows:

PERMANENT EASEMENT: A non-exclusive permanent easement for the purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sanitary sewer lines, including such pipes, manholes, fittings, fixtures and other accessories as from time to time may be required. The easement shall include the right to perform appropriate tests within said permanent easement, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said permanent easement to effectuate the purposes outlined herein, said permanent easement being more particularly described as follows:

Submitted electronically by "Roberts & Stevens PA"
in compliance with North Carolina statutes governing recordable documents
and the terms of the submitter agreement with the Henderson County Register of Deeds.

PREPARED BY AND RETURN AFTER RECORDING TO:
KATHRYN MAULTSBY MADISON of
ROBERTS & STEVENS, P. A.

STATE OF NORTH CAROLINA

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NOW, THEREFORE, the Grantor, for and in consideration of the sum of One Dollar ($1.00), and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, has given, granted and conveyed, and by these presents does give, grant, and convey unto the Grantee, its successors and assigns, the permanent and temporary right, privilege and easement to construct, operate, maintain, repair, inspect, reconstruct and replace, if necessary, sanitary sewer lines and accessories over, upon, across, under and through the Property of the Grantor, said permanent easement and temporary construction easement being described as follows:

PERMANENT EASEMENT: A non-exclusive permanent easement for the purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sanitary sewer lines, including such pipes, manholes, fittings, fixtures and other accessories as from time to time may be required. The easement shall include the right to perform appropriate tests within said permanent easement, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said permanent easement to effectuate the purposes outlined herein, said permanent easement being more particularly described as follows:

Being that area shown as Variable Permanent Force Main Easement on the survey entitled "ITT Pump Station Replacement MSD Project #2020061 Sewer Easement Across the Property of: UPM-RAFLATAC, INC." prepared by McKim & Creed, dated May 5, 2025 (Project No. 09596-0001) and recorded in Plat Book 2025 at Page 16599, Henderson County Registry (hereinafter the "Plat"), reference to which is hereby made and incorporated for a more particular description.

Said Variable Permanent Force Main Easement being listed as Permanent Force Main Easement on the Area Table consisting of 5,784 square feet (0.13 acres), more or less.

TEMPORARY CONSTRUCTION EASEMENTS: Three (3) temporary construction easements for the purposes of excavation, digging ditches, storing dirt, supplies and materials, moving and using equipment and generally carrying out the completion of the installation of said sanitary sewer lines and accessories, and for the purposes of inspecting and performing appropriate tests within said temporary construction easements, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said temporary construction easements to effectuate the purposes outlined herein. This right of use as set out in this paragraph shall terminate upon the final completion of the entire project, said temporary construction easements being more particularly described as follows:

Being that area shown as Variable Temporary Construction Easement 1, Variable Temporary Construction Easement 2, and Variable Temporary Construction Easement 3 on the Plat, reference to which is hereby made and incorporated for a more particular description.

Said Variable Temporary Construction Easement 1 being listed Temporary Construction Easement 1 on the Area Table consisting of 554 square feet (0.01 acres), more or less; said Variable temporary Construction Easement 2 being listed Temporary Construction Easement 2 on the Area Table consisting of 2,946 square feet (0.07 acres), more or less; and said Variable Temporary Construction Easement 3 being listed Temporary Construction Easement 3 on the Area Table consisting of 7,312 square feet (0.17 acres), more or less.

Said Permanent Easement and Temporary Construction Easements being shown on the Sewer Line Location Drawing for Project # 2020061, Sewer Easement Across the Property of UPM-RAFLATAC, INC., prepared by McKim & Creed, dated May 5, 2025, Project No. 09596-0001.

IT IS UNDERSTOOD AND AGREED BETWEEN THE GRANTOR AND THE GRANTEE:

1. That the Grantee shall have the right to clear the permanent easement and temporary construction easements described above and the right but not the obligation to keep the permanent easement clear at all times, and the right to remove from the permanent easement and temporary construction easements all brush, trees and other obstructions, and to go upon said easements whenever necessary for the purpose of clearing the same and removing therefrom all brush, trees and other obstructions of any kind.

2. That the Grantor shall at all times, other than while the sewer lines are under actual construction, have the right to use said permanent easement and said temporary construction easements, in the same manner as has been heretofore done; provided such use shall in no manner interfere with or be inconsistent with the use thereof by Grantee as provided herein. Prohibited uses of the permanent easement by the Grantor include, but are not limited to, the following: the erection of a shed, building, structure or other obstruction within the permanent easement by the Grantor shall not be allowed; the planting of trees within the permanent easement by the Grantor shall not be allowed; additional fill cannot be placed within the permanent easement except after prior written consent from the Grantee; and other utility lines, including but not limited to, electric,

gas, telephone, cable, or water lines, cannot be constructed within the permanent easement except after prior written approval by the Grantee.

3. That the Grantee agrees to restore the topography of said easement areas, and access areas, if any, after installation or repairs of the sewer lines and accessories to approximately the same condition as existed before said installation or repairs.

4. That the Grantor shall have the right to pass over and upon said permanent easement with appropriate roadways for the full use of the Property, provided, however, that the construction, maintenance and use of said roadways shall in no way interfere with the sewer lines and accessories constructed within said permanent easements. As to paved roads, the Grantee, in future repairs or maintenance of said sewer lines and accessories, shall only be responsible for regraveling, tamping and patching the portion of said paved roads disturbed by such work. As to non-paved roads, the Grantee shall only be responsible for regraveling and tamping in connection with any repairs or maintenance.

5. If the Grantor has a sewer service line ("service line") that presently leads from the Grantor's residence or building on the Grantor's Property to the existing main sewer line which may be abandoned by the Grantee, the Grantee agrees that it will connect the service line to the new or rehabilitated sewer line that will be located within the permanent easements described above. The Grantor hereby agrees to cooperate with and authorizes the Grantee to enter upon the Grantor's Property and to excavate on the Grantor's Property outside of the permanent and temporary construction easement described herein as reasonably practical and necessary for the purpose of locating and connecting said service line. The Grantee shall perform such excavation in a good and workmanlike manner and shall obtain prior approval from the Grantor as to specific areas of Grantor's Property to be excavated. The Grantee shall also restore the topography of the Grantor's Property after location and connection of said service line to approximately the same condition as existed before said work.

6. Other conditions and provisions:

TO HAVE AND TO HOLD said permanent easement and temporary construction easements unto said Grantee, its successors and assigns, upon the terms and for the time periods set forth above.

The Grantor covenants to and with the Grantee, its successors and assigns, that the Grantor is lawfully seized in fee simple of the Property and has full right and power to convey these easements to the Grantee, and that Property is free from any and all liens and encumbrances, and that they will and their successors and assigns shall forever warrant and defend the title to said easements unto the Grantee, its successors and assigns, against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the Grantor has hereunto executed this document, as of the day and year first above written.

UPM-RAFLATAC, INC., a North Carolina Corporation (SEAL)

By: _____

Print Name: Brinder Gill

Title: SVP, Americas

* * * * * * * * * * * *

STATE OF NC

COUNTY OF Buncombe

I, a Notary Public of the County and State aforesaid, certify that Brinder Gill, appeared before me and being personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity, and that by his/her/their signature(s) on the instrument the person(s), or entity upon behalf of which the person(s) acted, executed the instrument.

Witness my hand and official stamp or seal, this 9th day of September, 2025

_____
NOTARY PUBLIC

My Commission Expires:
4/14/29

[NOTARIAL SEAL]

CYNTHIA M GIBSON
NOTARY PUBLIC
BUNCOMBE COUNTY
North Carolina
Commission Expires: 4/14/29

PB2025-16599 Henderson County

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f)(11)(d).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 5th DAY OF May, 2025.

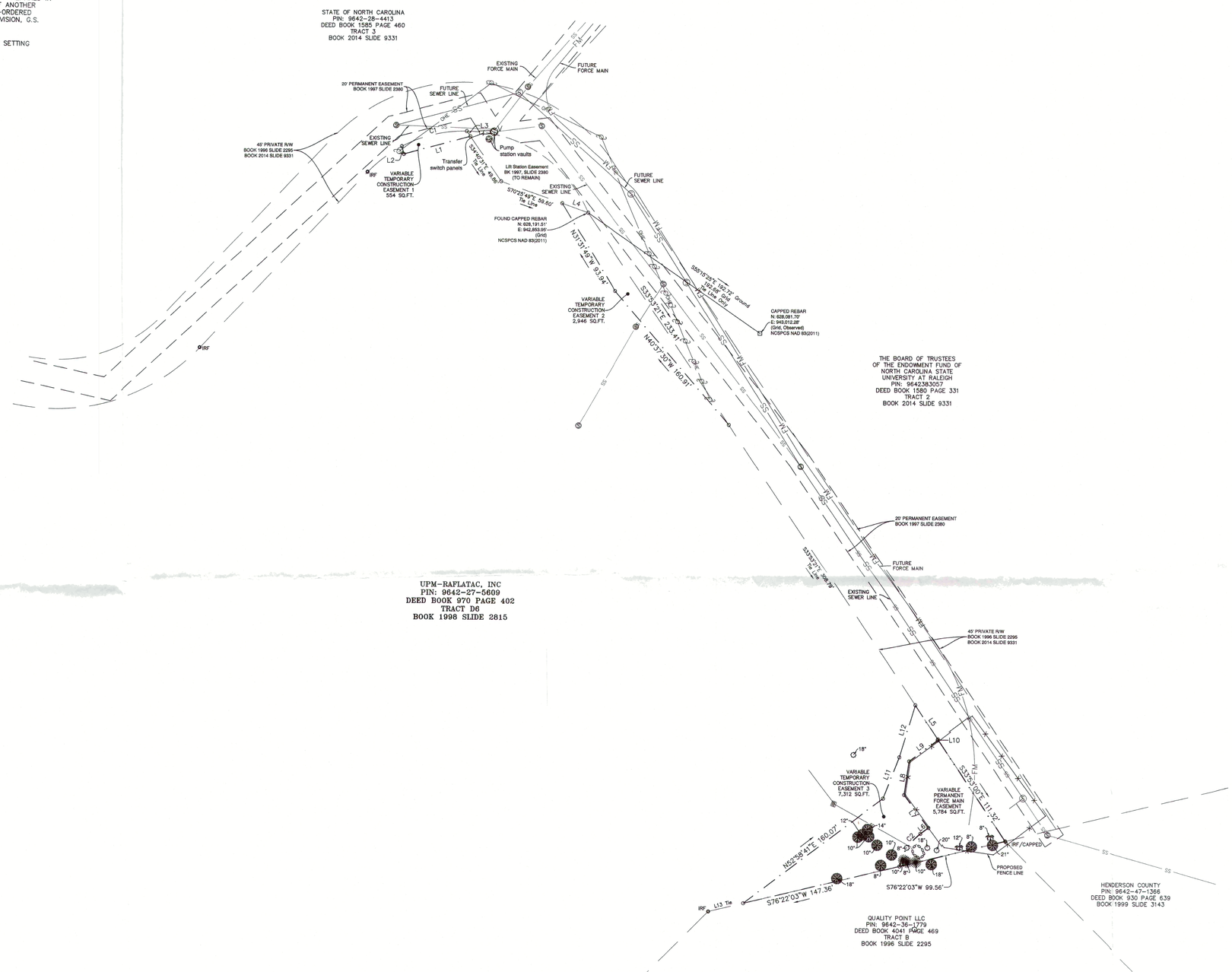
TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

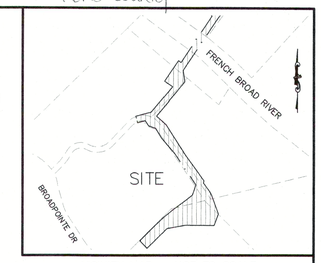
I, _____ REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____
REVIEW OFFICER DATE





NC GRID NAD83/2011



VICINITY MAP – NOT TO SCALE

CURVE TABLE				
CURVE	RADIUS	LENGTH	BEARING	CHORD
C1	121.05'	61.79'	N76°40'49"E	61.12'
C2	50.00'	36.12'	N32°35'25"E	35.34'

LINE TABLE		
LINE #	BEARING	LENGTH
L1	S74°57'33"W	63.04'
L2	N15°02'27"W	7.28'
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L4	S70°25'49"E	25.21'
L5	S33°54'24"E	37.17'
L6	N53°17'10"E	9.11'
L7	N36°42'50"W	37.25'
L8	N08°17'10"E	30.82'
L9	N53°17'07"E	32.49'
L10	N09°12'29"E	0.88'
L11	N21°36'13"E	40.39'
L12	N16°57'10"E	49.69'
L13	S76°22'03"W	32.98'

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 970 PAGE 402, PLAT BOOK 1997 SLIDE 2380, AND PLAT BOOK 1998 SLIDE 2815 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

AREA TABLE

PERMANENT FORCE MAIN EASEMENT:	5,784 SQ.FT., 0.13 ACRES
TEMPORARY CONSTRUCTION EASEMENT 1:	554 SQ.FT., 0.01 ACRES
TEMPORARY CONSTRUCTION EASEMENT 2:	2,946 SQ.FT., 0.07 ACRES
TEMPORARY CONSTRUCTION EASEMENT 3:	7,312 SQ.FT., 0.17 ACRES
TOTAL EASEMENT AREA:	16,596 SQ.FT., 0.38 ACRES

LEGEND

- COMPUTED POINT
- EXISTING SEWER MANHOLE
- VENT PIPE
- CURB INLET
- UTILITY POLE
- POPLAR
- OAK
- WILLOW
- PINE
- PARCEL LINE
- SEWER LINE
- FORCE MAIN
- TREE LINE
- OVERHEAD ELECTRIC
- RIP RAP
- STORM DRAIN PIPE
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT

SCALE: 1" = 50'
0 25' 50' 100' 150'

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: UPM-RAFLATAC, INC.
PARCEL 9642-27-5609
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # : 09596-0001
PLS : TAB
DRAWN BY : GHL
SCALE : 1" = 50'
DATE : MAY 5, 2025
SHEET # : 1 OF 1
DWG. # : ESMT-Parcel4

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

DATE	REVISION	BY
--	--	--

Docusign Envelope ID: 97D754DA-C9F4-4885-B5AB-FE882386CF6D

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF A PROPOSED EASEMENT FOR A PUBLIC UTILITY AS DEFINED IN G.S. 62-3.
G.S. 47-30 (f)(11)(c).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NCS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 26TH DAY OF SEPTEMBER, 2025.

Signed by: Timothy A. Brown
SIGNATURE

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

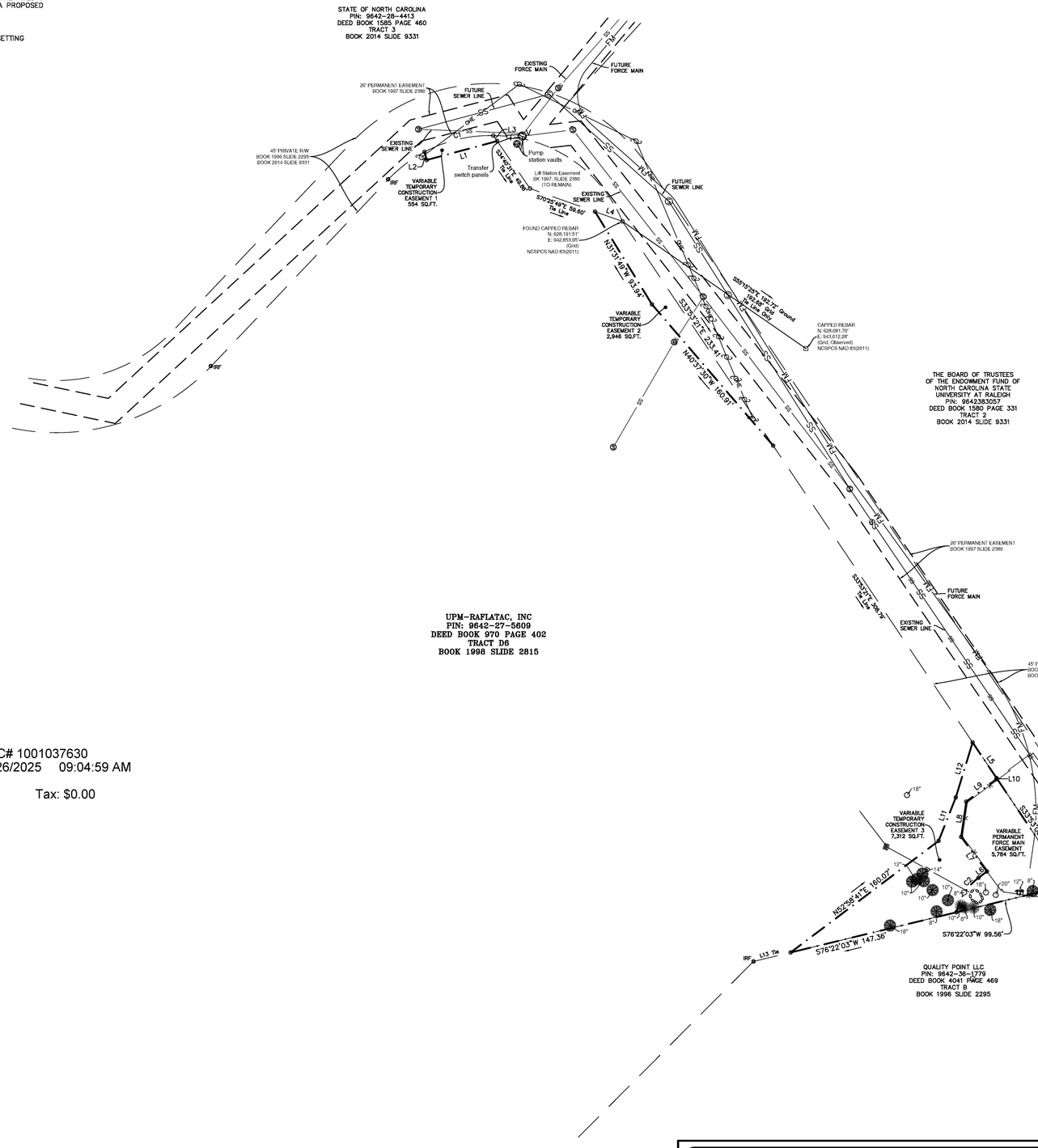
NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

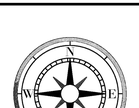
STATE OF NORTH CAROLINA
COUNTY OF HENDERSON

I, Austin L. Parks, REVIEW OFFICER OF HENDERSON COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

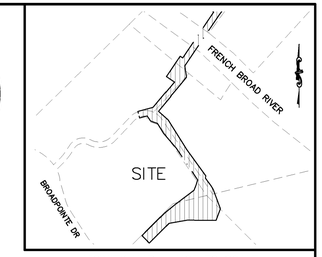
DocuSigned by: Austin L. Parks
SIGNATURE
REVIEW OFFICER

9/26/2025
DATE





NC GRID NAD83/2011



VICINITY MAP – NOT TO SCALE

CURVE TABLE				
CURVE	RADIUS	LENGTH	BEARING	CHORD
C1	121.05'	61.79'	N76°40'49"E	61.12'
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L12	N16°57'10"E	49.69'
L13	S76°22'03"W	32.98'

BK 2025 PG 16599 - 16599 (1) DOC# 1001037630
This Document eRecorded: 09/26/2025 09:04:59 AM
Fee: $21.00
Henderson County, North Carolina Tax: $0.00
William Lee King, Register of Deeds

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 970 PAGE 402, PLAT BOOK 1997 SLIDE 2380, AND PLAT BOOK 1998 SLIDE 2815 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
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9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

AREA TABLE

PERMANENT FORCE MAIN EASEMENT:	5,784 SQ.FT., 0.13 ACRES
TEMPORARY CONSTRUCTION EASEMENT 1:	554 SQ.FT., 0.01 ACRES
TEMPORARY CONSTRUCTION EASEMENT 2:	2,946 SQ.FT., 0.07 ACRES
TEMPORARY CONSTRUCTION EASEMENT 3:	7,312 SQ.FT., 0.17 ACRES
TOTAL EASEMENT AREA:	16,596 SQ.FT., 0.38 ACRES

LEGEND

- COMPUTED POINT
- EXISTING SEWER MANHOLE
- VENT PIPE
- CURB INLET
- UTILITY POLE
- POPLAR
- OAK
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- PINE
- PARCEL LINE
- SEWER LINE
- FORCE MAIN
- TREE LINE
- OVERHEAD ELECTRIC
- RIP RAP
- STORM DRAIN PIPE
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT

Submitted electronically by "McKim & Creed, Inc."
in compliance with North Carolina statutes governing recordable documents
and the terms of the submitter agreement with the Henderson County Register of Deeds.

SCALE: 1" = 50'
0 25' 50' 100' 150'

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: UPM-RAFLATAC, INC.
PARCEL 9642-27-5609
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PLS :	TAB
DRAWN BY :	GHL
SCALE :	1" = 50'
DATE :	9/24/2025
SHEET # :	1 OF 1
DWG. # :	ESMT-Parcel4

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

DATE	REVISION	BY
09/24/2025	REVISE CERTIFICATION BLOCK PER COUNTY COMMENTS	TB

Right of Way Special Provision Detail Sheets and Easements

Wild River Corp (Parcel 9642-29-9794) (SPDS)

BK 4349 PG 300 - 303 (4) DOC# 1001038423
This Document eRecorded: 10/10/2025 10:39:28 AM
Fee: $26.00
Henderson County, North Carolina Tax: $41.00
William Lee King, Register of Deeds

PREPARED BY AND RETURN AFTER RECORDING TO:
KATHRYN MAULTSBY MADISON of
ROBERTS & STEVENS, P. A.

STATE OF NORTH CAROLINA

Rev. Stamps: $41

COUNTY OF HENDERSON **EASEMENT AGREEMENT**

THIS EASEMENT AGREEMENT, made this 30 day of September, 2025, by and between **WILD RIVER CORP., a North Carolina corporation,** hereinafter referred to as Grantor, and **METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, NORTH CAROLINA**, a public body and body politic and corporate, created and established by the North Carolina State Stream Sanitation Committee by Resolution adopted on January 19, 1962, under the provisions of the North Carolina Metropolitan Sewerage Districts Act, now codified as Chapter 162A, Article 5, of the General Statutes of North Carolina, hereinafter referred to as Grantee (the designations Grantor and Grantee as used herein shall include said parties, their heirs, successors and assigns and shall include singular, plural, masculine, feminine and neuter as required by context).

W I T N E S S E T H:

THAT WHEREAS, the Grantor is the owner of certain property more particularly described in a deed recorded in Book 1580 at Page 323, Henderson County Registry (hereinafter sometimes referred to as "Property"); and

WHEREAS, the Grantee has requested that the Grantor grant and convey to the Grantee a permanent and two (2) temporary construction easements over, upon, across, under and through a portion the Property of the Grantor for purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sewer lines and accessories and the Grantor has agreed to do so.

NOW, THEREFORE, the Grantor, for and in consideration of the sum of One Dollar ($1.00), and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, has given, granted and conveyed, and by these presents does give, grant, and convey unto the Grantee, its successors and assigns, the permanent and temporary right, privilege and easement to construct, operate, maintain, repair, inspect, reconstruct and replace, if necessary, sanitary sewer lines and accessories over, upon, across, under and through the Property of the Grantor, said permanent easement and temporary construction easements being described as follows:

PERMANENT EASEMENT: A non-exclusive permanent easement for the purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sanitary sewer lines, including such pipes, manholes, fittings, fixtures and other accessories as from time to time may be required. The easement shall include the right to perform appropriate tests within said permanent easement, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said permanent easement to effectuate the purposes outlined herein, said permanent easement being more particularly described as follows:

Submitted electronically by "Roberts & Stevens PA"
in compliance with North Carolina statutes governing recordable documents
and the terms of the submitter agreement with the Henderson County Register of Deeds.
RS #

PREPARED BY AND RETURN AFTER RECORDING TO:
KATHRYN MAULTSBY MADISON of
ROBERTS & STEVENS, P. A.

STATE OF NORTH CAROLINA

COUNTY OF HENDERSON Rev. Stamps: $41 **EASEMENT AGREEMENT**

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W I T N E S S E T H:

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WHEREAS, the Grantee has requested that the Grantor grant and convey to the Grantee a permanent and two (2) temporary construction easements over, upon, across, under and through a portion the Property of the Grantor for purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sewer lines and accessories and the Grantor has agreed to do so.

NOW, THEREFORE, the Grantor, for and in consideration of the sum of One Dollar ($1.00), and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, has given, granted and conveyed, and by these presents does give, grant, and convey unto the Grantee, its successors and assigns, the permanent and temporary right, privilege and easement to construct, operate, maintain, repair, inspect, reconstruct and replace, if necessary, sanitary sewer lines and accessories over, upon, across, under and through the Property of the Grantor, said permanent easement and temporary construction easements being described as follows:

PERMANENT EASEMENT: A non-exclusive permanent easement for the purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sanitary sewer lines, including such pipes, manholes, fittings, fixtures and other accessories as from time to time may be required. The easement shall include the right to perform appropriate tests within said permanent easement, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said permanent easement to effectuate the purposes outlined herein, said permanent easement being more particularly described as follows:

Being that area shown as 20' Permanent Force Main Easement on the survey entitled "ITT Pump Station Replacement MSD Project #2020061 Sewer Easement Across the Property of: Wild River Corporation" prepared by McKim & Creed, dated May 5, 2025 (Project No. 09596-0001) and recorded in Plat Book 2025 at Page 16613, Henderson County Registry (hereinafter the "Plat"), reference to which is hereby made and incorporated for a more particular description.

Said 20' Permanent Force Main Easement being listed as Permanent Force Main Easement on the Area Table consisting of 20,795 square feet (0.48 acres), more or less.

TEMPORARY CONSTRUCTION EASEMENTS: Two (2) temporary construction easements for the purposes of excavation, digging ditches, storing dirt, supplies and materials, moving and using equipment and generally carrying out the completion of the installation of said sanitary sewer lines and accessories, and for the purposes of inspecting and performing appropriate tests within said temporary construction easements, including but not limited to, archaeological and environmental studies. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said temporary construction easements to effectuate the purposes outlined herein. This right of use as set out in this paragraph shall terminate upon the final completion of the entire project, said temporary construction easements being more particularly described as follows:

Being that area shown as Variable Temporary Construction Easement 1 and Variable Temporary Construction Easement 2 on the Plat, reference to which is hereby made and incorporated for a more particular description.

Said Variable Temporary Construction Easement 1 being listed as Temporary Construction Easement 1 on the Area Table consisting of 24,464 square feet (0.56 acres), more or less; and said Variable Temporary Construction Easement 2 being listed as Temporary Construction Easement 2 consisting of 14,757 square feet (0.34 acres), more or less.

Said Permanent Easement and Temporary Construction Easements being shown on the Sewer Line Location Drawing for Project # 2020061, Sewer Easement Across the Property of Wild River Corporation, prepared by McKim & Creed, dated May 5, 2025, Project No. 09596-0001.

IT IS UNDERSTOOD AND AGREED BETWEEN THE GRANTOR AND THE GRANTEE:

1. That the Grantee shall have the right to clear the permanent easement and temporary construction easements described above and the right but not the obligation to keep the permanent easement clear at all times, and the right to remove from the permanent easement and temporary construction easements all brush, trees and other obstructions, and to go upon said easements whenever necessary for the purpose of clearing the same and removing therefrom all brush, trees and other obstructions of any kind.

2. That the Grantor shall at all times, other than while the sewer lines are under actual construction, have the right to use said permanent easement and said temporary construction easements, in the same manner as has been heretofore done; provided such use shall in no manner interfere with or be inconsistent with the use thereof by Grantee as provided herein. Prohibited uses of the permanent easement by the Grantor include, but are not limited to, the following: the erection of a shed, building, structure or other obstruction within the permanent easement by the Grantor shall not be allowed; the planting of trees within the permanent easement by the Grantor shall not be allowed; additional fill cannot be placed within the permanent easement except after prior written consent from the Grantee; and other utility lines, including but not limited to, electric, gas, telephone, cable, or water lines, cannot be constructed within the permanent easement except after prior written approval by the Grantee.

3. That the Grantee agrees to restore the topography of said easement areas, and access areas, if any, after installation or repairs of the sewer lines and accessories to approximately the same condition as existed before said installation or repairs.

4. That the Grantor shall have the right to pass over and upon said permanent easement with appropriate roadways for the full use of the Property, provided, however, that the construction, maintenance and use of said roadways shall in no way interfere with the sewer lines and accessories constructed within said permanent easements. As to paved roads, the Grantee, in future repairs or maintenance of said sewer lines and accessories, shall only be responsible for regraveling, tamping and patching the portion of said paved roads disturbed by such work. As to non-paved roads, the Grantee shall only be responsible for regraveling and tamping in connection with any repairs or maintenance.

5. If the Grantor has a sewer service line ("service line") that presently leads from the Grantor's residence or building on the Grantor's Property to the existing main sewer line which may be abandoned by the Grantee, the Grantee agrees that it will connect the service line to the new or rehabilitated sewer line that will be located within the permanent easements described above. The Grantor hereby agrees to cooperate with and authorizes the Grantee to enter upon the Grantor's Property and to excavate on the Grantor's Property outside of the permanent and temporary construction easement described herein as reasonably practical and necessary for the purpose of locating and connecting said service line. The Grantee shall perform such excavation in a good and workmanlike manner and shall obtain prior approval from the Grantor as to specific areas of Grantor's Property to be excavated. The Grantee shall also restore the topography of the Grantor's Property after location and connection of said service line to approximately the same condition as existed before said work.

6. Other conditions and provisions:

TO HAVE AND TO HOLD said permanent easement and temporary construction easements unto said Grantee, its successors and assigns, upon the terms and for the time periods set forth above.

The Grantor covenants to and with the Grantee, its successors and assigns, that the Grantor is lawfully seized in fee simple of the Property and has full right and power to convey these easements to the Grantee, and that Property is free from any and all liens and encumbrances, and that they will and their successors and assigns shall forever warrant and defend the title to said easements unto the Grantee, its successors and assigns, against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the Grantor has hereunto executed this document, as of the day and year first above written.

WILD RIVER CORP., a North Carolina Corporation (SEAL)

By: _____

Print Name: Brian Grossman

Title: Secretary, Wild River Corp.

* * * * * * * * * * * *

STATE OF North Carolina

COUNTY OF Henderson

I, a Notary Public of the County and State aforesaid, certify that Brian Grossman, appeared before me and being personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity, and that by his/her/their signature(s) on the instrument the person(s), or entity upon behalf of which the person(s) acted, executed the instrument.

Witness my hand and official stamp or seal, this 30th day of September, 2025.

Heidi Lacy
NOTARY PUBLIC

My Commission Expires:
April 6, 2030

[NOTARIAL SEAL]

HEIDI LACY
NOTARY PUBLIC
Henderson County
North Carolina
My Commission Expires April 06, 2030

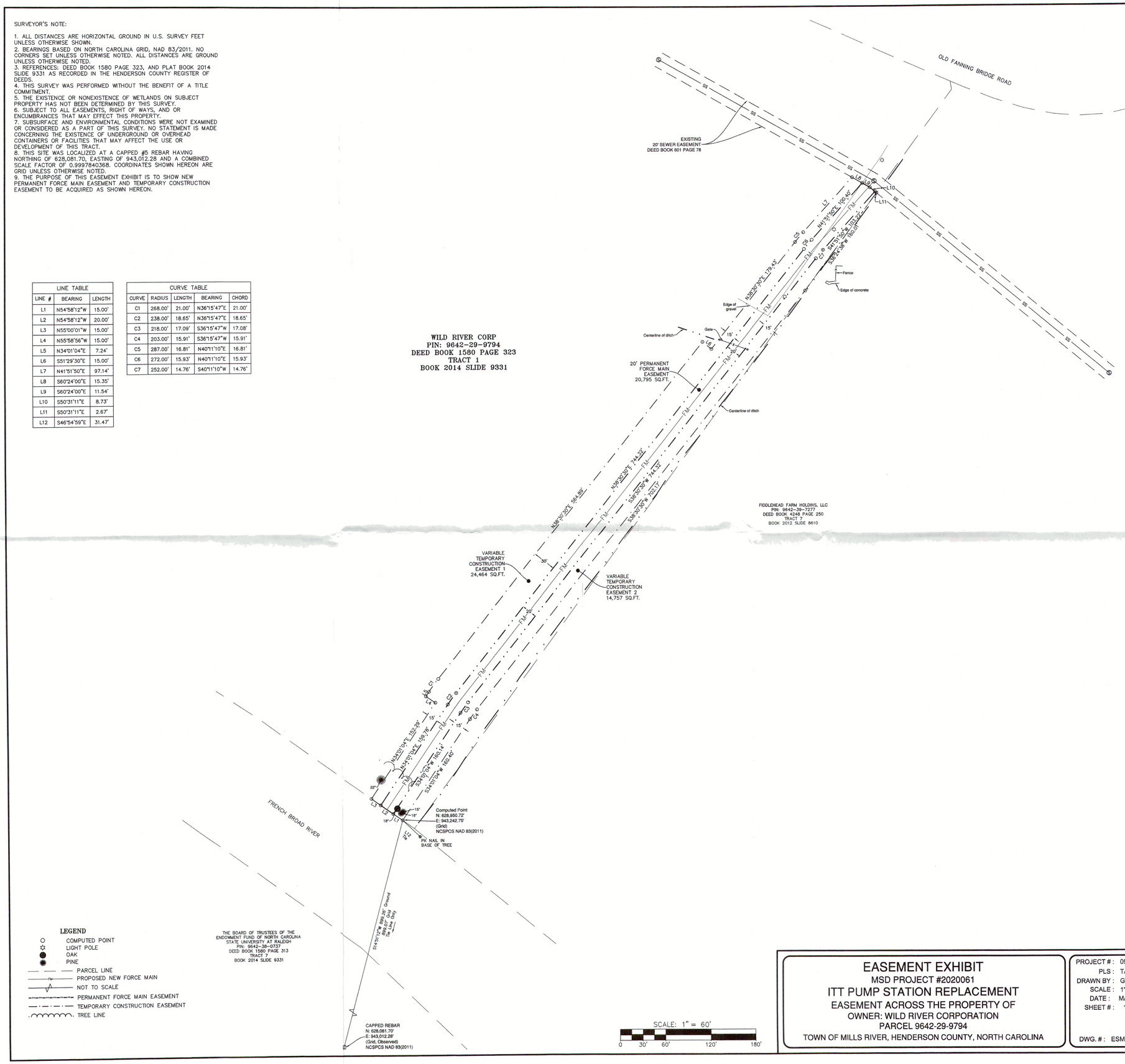
PB2025-166613 Hend Co.

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 1580 PAGE 323, AND PLAT BOOK 2014 SLIDE 9331 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

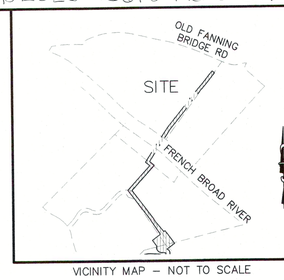
LINE TABLE		
LINE #	BEARING	LENGTH
L1	N54°58'12"W	15.00'
L2	N54°58'12"W	20.00'
L3	N55°00'01"W	15.00'
L4	N55°58'56"W	15.00'
L5	N34°01'04"E	7.24'
L6	S51°29'30"E	15.00'
L7	N41°51'50"E	97.14'
L8	S60°24'00"E	15.35'
L9	S60°24'00"E	11.54'
L10	S50°31'11"E	8.73'
L11	S50°31'11"E	2.67'
L12	S46°54'59"E	31.47'

CURVE TABLE				
CURVE	RADIUS	LENGTH	BEARING	CHORD
C1	268.00'	21.00'	N36°15'47"E	21.00'
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C6	272.00'	15.93'	N40°11'10"E	15.93'
C7	252.00'	14.76'	S40°11'10"W	14.76'





NC GRID NAD83/2011



VICINITY MAP – NOT TO SCALE

AREA TABLE

PERMANENT FORCE MAIN EASEMENT:	20,795 SQ.FT., 0.48 ACRES
TEMPORARY CONSTRUCTION EASEMENT 1:	24,464 SQ.FT., 0.56 ACRES
TEMPORARY CONSTRUCTION EASEMENT 2:	14,757 SQ.FT., 0.34 ACRES
TOTAL EASEMENT AREA:	60,016 SQ.FT., 1.38 ACRES

LEGEND
- COMPUTED POINT
- LIGHT POLE
- OAK
- PINE
- PARCEL LINE
- PROPOSED NEW FORCE MAIN
- NOT TO SCALE
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- TREE LINE

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____ REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____ _____
REVIEW OFFICER DATE

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f)(11)(d).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 5th DAY OF May 2025.

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: WILD RIVER CORPORATION
PARCEL 9642-29-9794
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PLS :	TAB
DRAWN BY :	GHL
SCALE :	1" = 60'
DATE :	MAY 5, 2025
SHEET # :	1 OF 1
DWG. # :	ESMT-Parcel1

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

DATE	REVISION
"	"

SPECIAL PROVISIONS DETAIL SHEET

April 13, 2026

Project:	I.T.T. Pump Station Replacement MSD of Buncombe County Project #2020061
Parcel Numbers:	9642299794
Owner:	Wild River Corp
Phone:	(828) 808-4643
Email:	Adam.wallace@sierranevada.com
Address:	741 Old Fanning Bridge Road, Mills River NC 28759
Mailing Address:	1075 E 20th St. Chico CA. 95928
Engineer Approval:	

1. The MSD Inspector shall contact the property owners at the number listed above at least two weeks prior to any work being performed on the property (except for emergencies) to give owner notice of when work will begin.

2. The MSD Contractor must ensure equipment is clean when it arrives at the project site for this parcel due to the Organic Certifications held on this parcel. MSD Contractor equipment must not have any caked-on dirt on treads or buckets before entering subject parcel and be clean of foreign material.

3. MSD Contractor must submit the seed and/or fertilizer product label to Oregon TILTH Organic Certification (OTCO) for review BEFORE any is applied to the field. MSD Contractor to go through Adam.wallace@sierranevada.com. Wild River Corp is responsible for their certification and fees associated with said certification.

4. MSD Contractor must inform OTCO if any fill dirt will be used so that they can review the source and approve its use. MSD Contractor to go through Adam.wallace@sierranevada.com

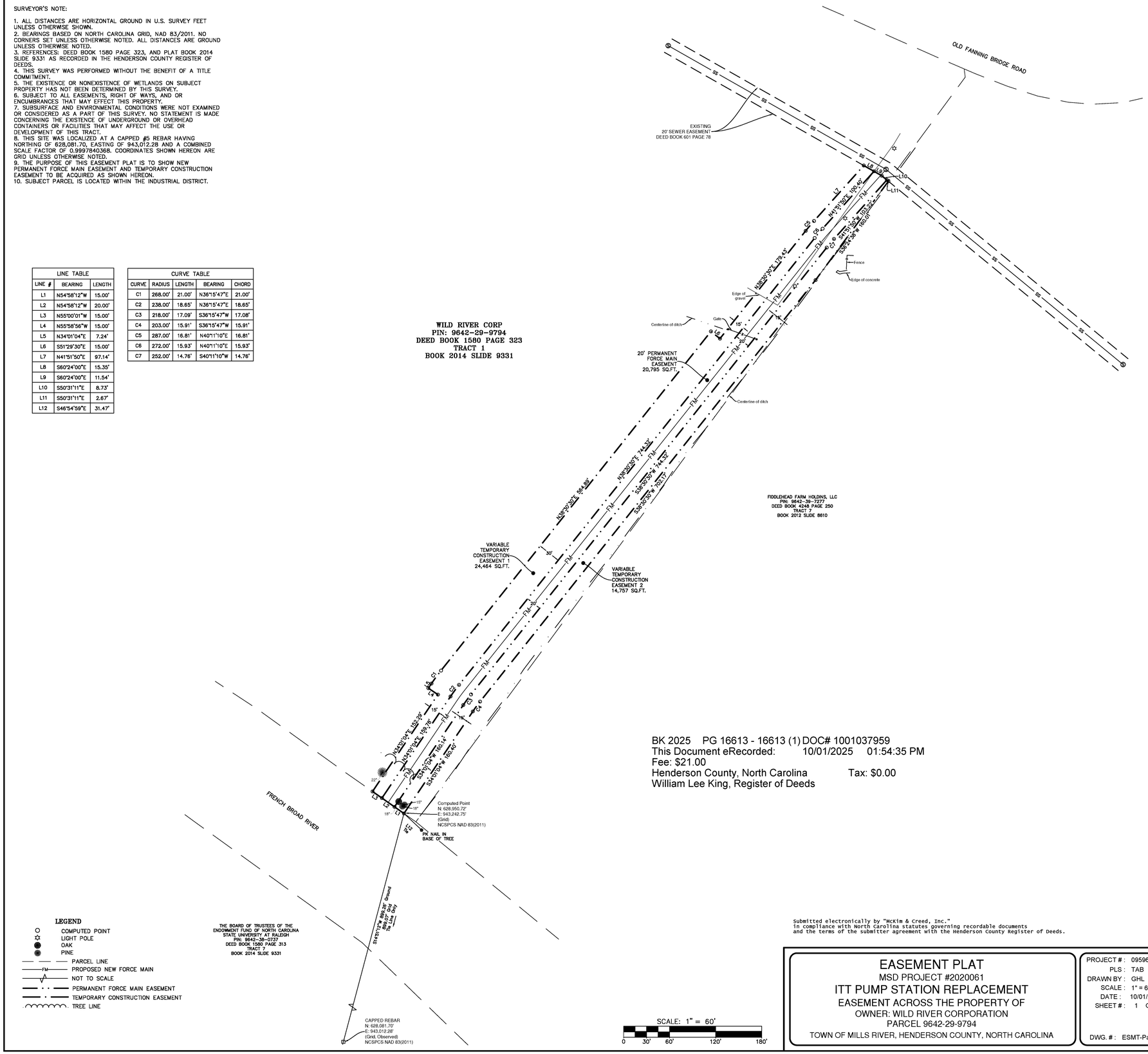
Docusign Envelope ID: A9653E32-F160-46EA-88B9-9990130B9CE3

SURVEYOR'S NOTE:

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4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
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9. THE PURPOSE OF THIS EASEMENT PLAT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.
10. SUBJECT PARCEL IS LOCATED WITHIN THE INDUSTRIAL DISTRICT.

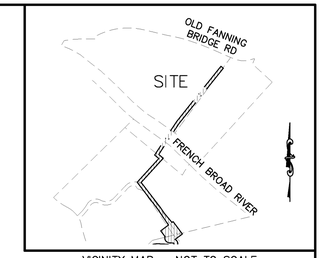
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NC GRID NAD83/2011



VICINITY MAP – NOT TO SCALE

AREA TABLE

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TOTAL EASEMENT AREA:	60,016 SQ.FT., 1.38 ACRES

LEGEND

- COMPUTED POINT
- LIGHT POLE
- OAK
- PINE
- PARCEL LINE
- PROPOSED NEW FORCE MAIN
- NOT TO SCALE
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- TREE LINE

SCALE: 1" = 60'

0 30' 60' 120' 180'

STATE OF NORTH CAROLINA
COUNTY OF HENDERSON

I, Carlos Martinez, REVIEW OFFICER OF HENDERSON COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

DocuSigned by: Carlos Martinez 10/1/2025

REVIEW OFFICER DATE

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF A PROPOSED EASEMENT FOR A PUBLIC UTILITY AS DEFINED IN G.S. 62-3. G.S. 47-30 (f)(11)(c).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 1ST DAY OF OCTOBER, 2025.

Signed by: Timothy A. Brown

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

BK 2025 PG 16613 - 16613 (1) DOC# 1001037959
This Document eRecorded: 10/01/2025 01:54:35 PM
Fee: $21.00
Henderson County, North Carolina Tax: $0.00
William Lee King, Register of Deeds

Submitted electronically by "McKim & Creed, Inc."
in compliance with North Carolina statutes governing recordable documents
and the terms of the submitter agreement with the Henderson County Register of Deeds.

EASEMENT PLAT

MSD PROJECT #2020061

ITT PUMP STATION REPLACEMENT

EASEMENT ACROSS THE PROPERTY OF
OWNER: WILD RIVER CORPORATION
PARCEL 9642-29-9794
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # : 09596-0001
PLS : TAB
DRAWN BY : GHL
SCALE : 1" = 60'
DATE : 10/01/2025
SHEET # : 1 OF 1

DWG. # : ESMT-Parcel1

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567

NC License# F-1222

Internet Site: http://www.mckimcreed.com

DATE	REVISION	BY
10/1/25	ADD ZONING NOTE PER COUNTY COMMENT	TB

Right of Way Special Provision Detail Sheets and Easements

State of North Carolina (French Broad River Subaqueous Crossing)

BK 4331 PG 262 - 268 (7) DOC# 1001036201
This Document eRecorded: 08/27/2025 03:16:08 PM
Fee: $26.00
Henderson County, North Carolina Tax: $0.00
William Lee King, Register of Deeds

Prepared By: Attorney General's Office / Property Control Section
P.O. Box 629, Raleigh, North Carolina 27602
SPO File No.: 45-LD-45 / DOJ File No. PC)-25-108477

Return To: Roberts & Stevens, P.A.
P.O. Box 7647, Asheville, NC 28802

After Recording Return to: _____

STATE OF NORTH CAROLINA

EASEMENT

COUNTY OF HENDERSON

THIS EASEMENT ("**Easement**"), made and entered into as of the date set forth in the notary acknowledgment below, by and between the **STATE OF NORTH CAROLINA**, a body politic and corporate, hereinafter referred to as ("**Grantor**"), and **METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY**, a body politic and corporate, created and established by the North Carolina State Stream Sanitation Committee by Resolution adopted on January 19, 1962, under the provisions of the North Carolina Metropolitan Sewerage Districts Act, now codified as Chapter 162A, Article 5, of the General Statutes of North Carolina, hereinafter referred to as ("**Grantee**");

WITNESSETH:

THAT, WHEREAS, the North Carolina Department of Administration, has authorized and approved the execution of this instrument for the purposes herein expressed; and,

WHEREAS, the execution of this instrument for and on behalf of the State of North Carolina has been duly approved by the Council of State by resolution adopted at a meeting held in the City of Raleigh, North Carolina, on the 6th day of May 2025. A copy of said resolution is attached hereto as "Exhibit B".

WHEREAS, it is the intent of the Grantee to install a sixteen-inch (16") subaqueous sewer force main inside a twenty-four inch (24") casing pipe under the French Broad River in Henderson County to transport wastewater to a downstream manhole owned by Metropolitan Sewerage District (MSD) of Buncombe County.

Submitted electronically by "Roberts & Stevens PA"
in compliance with North Carolina statutes governing recordable documents
and the terms of the submitter agreement with the Henderson County Register of Deeds.

Prepared By: **Attorney General's Office / Property Control Section**
P.O. Box 629, Raleigh, North Carolina 27602
SPO File No.: 45-LD-45 / DOJ File No. PC)-25-108477

Return To: Roberts & Stevens, P.A.
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STATE OF NORTH CAROLINA

EASEMENT

COUNTY OF HENDERSON

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W I T N E S S E T H:

THAT, **WHEREAS**, the North Carolina Department of Administration, has authorized and approved the execution of this instrument for the purposes herein expressed; and,

WHEREAS, the execution of this instrument for and on behalf of the State of North Carolina has been duly approved by the Council of State by resolution adopted at a meeting held in the City of Raleigh, North Carolina, on the 6th day of May 2025. A copy of said resolution is attached hereto as "Exhibit B".

WHEREAS, it is the intent of the Grantee to install a sixteen-inch (16") subaqueous sewer force main inside a twenty-four inch (24") casing pipe under the French Broad River in Henderson County to transport wastewater to a downstream manhole owned by Metropolitan Sewerage District (MSD) of Buncombe County.

NOW, THEREFORE, the Grantor, for and in consideration of the sum of TWO-HUNDRED FIFTY and No/100 DOLLARS ($250.00), and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, has given, granted and conveyed, and by these presents does give, grant, and convey unto the Grantee, its successors and assigns, the permanent right, privilege and easement to construct, operate, maintain, repair, inspect, reconstruct and replace, if necessary, a subaqueous sewer force main with accessories and appurtenances necessary in connection therewith (hereafter referred to as the "Facilities"), over, upon, across, under and through the French Broad River, situated in the Town of Mills River, Henderson County, North Carolina, and more particularly described as follows:

A permanent easement for the purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, the Facilities, and other accessories as from time to time may be required. The easement shall include the right to perform appropriate tests within said permanent easement. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said permanent easement to effectuate the purposes outlined herein, said permanent easements being more particularly described as follows:

Being a permanent easement containing 3,363 square feet, 0.077 acre, more or less, as shown on a survey prepared by McKim & Creed (Project No. 09596-0001), dated February 4, 2025, captioned "RIVER CROSSING EASEMENT EXHIBIT MSD PROJECT #2020061 ITT PUMP STATION REPLACEMENT EASEMENT ACROSS THE FRENCH BROAD RIVER FOR THE STATE OF NORTH CAROLINA TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA" and attached hereto and incorporated herein as **Exhibit A**, reference to which survey being hereby made for a more particular description (hereinafter referred to as the **"Easement Area").**

Commencing at a 5/8" capped rebar set, having NC NAD83 Grid coordinates of N: 628,081.70' and E: 943,012.28', and a combined scale factor of 0.9997840368; N 10° 34' 45" E, a distance of 742.17 feet to a calculated point in the northeastern line of The Board of Trustees of the Endowment Fund of North Carolina State University at Raleigh, Deed Book 1580 Page 313. Said parcel shown as Tract 7 on Plat Book 2014, Slide 9331.

Thence, along said northeastern line, N 54° 10' 47" W, a distance of 15.01 feet to a calculated point, also being the Point of Beginning.

Thence, with said Beginning Point, the following (4) calls:

(1) Continuing with said line, N 54° 10' 47" W, a distance of 20.01 feet to a calculated point;

(2) N 34° 01 ' 04" E, a distance of 168.01 feet to a calculated point in the southwestern line of Wild River Corp. Deed Book 1580 Page 323. Parcel shown as Tract 1 on Plat Book 2014, Slide 9331;

(3) With said line, S 54° 58' 12" E, a distance of 20.00 feet to a calculated point;

(4) S34°01'04" W, for a distance of 168.28 feet to the point and place of beginning,

and containing 3,363 Sq. Ft., 0.08 acres, more or less.

Subject to any rights-of-way and or easements not listed herein.

IT IS UNDERSTOOD AND AGREED BETWEEN THE GRANTOR AND GRANTEE:

1. This Easement is granted subject to all existing rights of way and easements within the Easement Area.

2. Grantor reserves the right to utilize the area within the Easement Area for all purposes not inconsistent with the easement rights herein conveyed.

3. The Facilities constructed and installed hereunder shall remain the property of Grantee. Grantee shall have the right to inspect, rebuild, remove, repair, improve and relocate its Facilities within the Easement Area, and make such changes, alterations, substitutions, additions to or extensions of its Facilities as Grantee may from time to time deem advisable.

4. Grantee shall repair any damage and, to the extent practical, restore to its original condition, the Easement Area, or any other land that is disturbed by the construction, installation and maintenance of the Facilities.

5. If the Facilities are not operated within the Easement Area for a continuous period of twelve (12) months, this Easement shall be deemed abandoned. Notwithstanding the foregoing, non-operation of the Facilities resulting from an Act of God shall not be deemed abandonment.

6. It is further understood and agreed that this conveyance is made subject to the condition that Grantee shall properly obtain all necessary permits required by State and Federal law. Failure to obtain such permits in a timely manner shall be deemed an abandonment of this Easement.

7. Grantee shall maintain access at all times to and from Grantor Facilities on the subject property.

TO HAVE AND TO HOLD the aforesaid rights, privileges and easements unto Grantee, its successors and assigns, for so long as Grantee maintains the Facilities and no longer.

IN TESTIMONY WHEREOF, the **STATE OF NORTH CAROLINA** has caused this instrument to be executed in its name by **JOSH STEIN**, Governor, attested by **ELAINE F. MARSHALL**, Secretary of State, and the Great Seal of the State of North Carolina to be hereto affixed by virtue of the power and authority aforesaid.

STATE OF NORTH CAROLINA

By: _____
Governor

ATTEST:

_____
Secretary of State

APPROVED AS TO FORM:
JEFF JACKSON, Attorney General

By: _____
Special Deputy Attorney General

STATE OF NORTH CAROLINA
COUNTY OF WAKE

I, Jennell Baughman, a Notary Public for Johnston County, North Carolina, do hereby certify that **ELAINE F. MARSHALL**, Secretary of State of North Carolina, personally came before me this day and acknowledged that she is Secretary of State of North Carolina, and that by authority duly given and as the act of the State, the foregoing instrument was signed in its name by **JOSH STEIN**, Governor of the State of North Carolina, sealed with the Great Seal of the State of North Carolina, and attested by herself as Secretary of State of North Carolina.

IN WITNESS WHEREOF, I have hereunto set my hand and Notarial Seal, this the 31st day of July, 2025.

JENNELL BAUGHMAN
Notary Public
Johnston County
State of North Carolina
My Commission Expires 11-21-2026

_____
Notary Public
Print Name: Jennell Baughman

My Commission Expires: 11-21-2026

EXHIBIT A

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f.)(11.)(d.).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

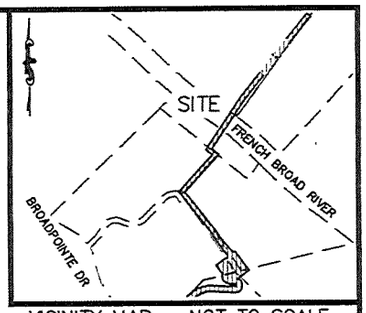
CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "TANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 4th DAY OF February 2025

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN



VICINITY MAP - NOT TO SCALE

SCALE: 1" = 30'

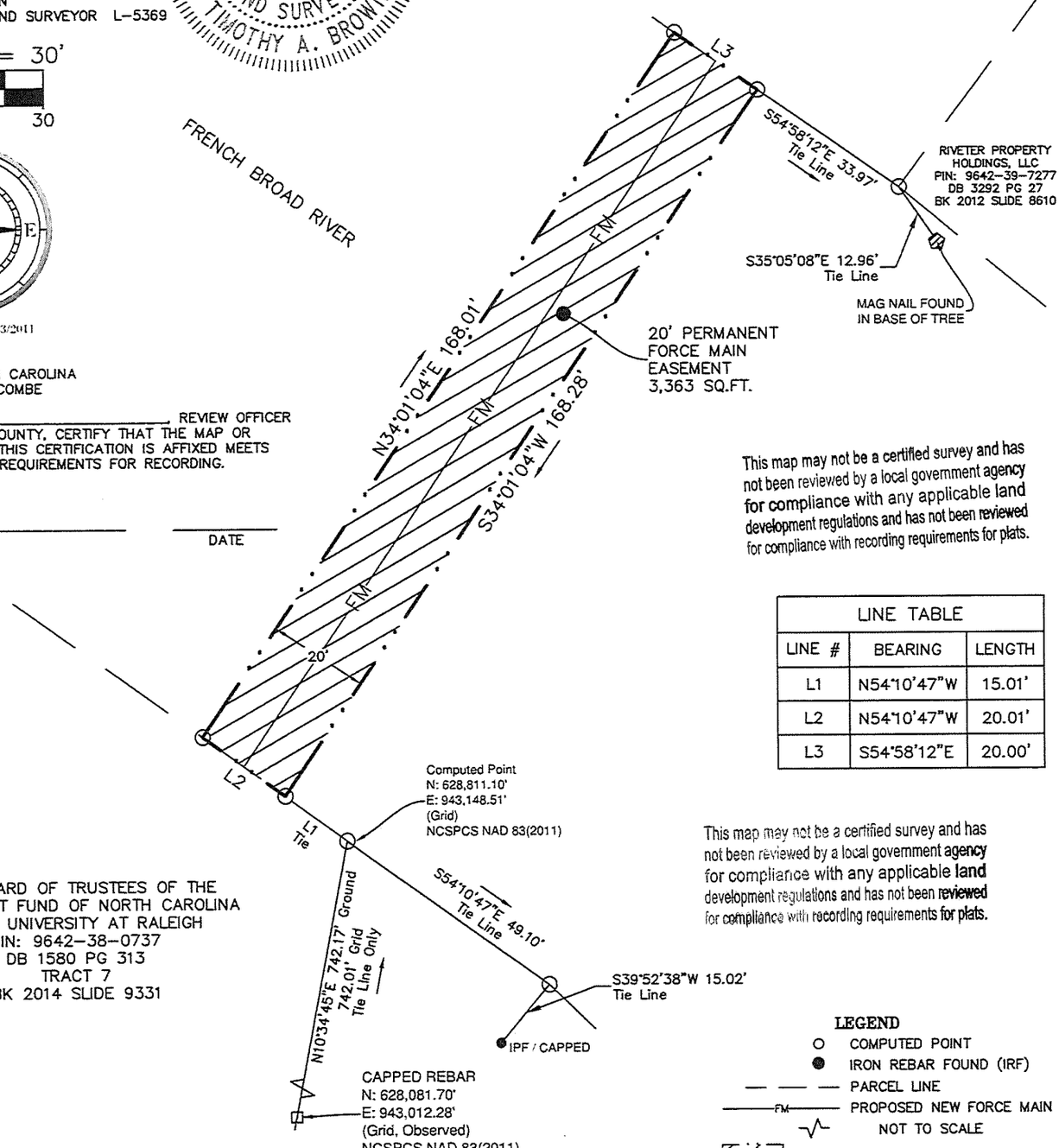
0 15 30

NC GRID NAD83/2011

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____, REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

REVIEW OFFICER _____ DATE _____



This map may not be a certified survey and has not been reviewed by a local government agency for compliance with any applicable land development regulations and has not been reviewed for compliance with recording requirements for plats.

LINE TABLE		
LINE #	BEARING	LENGTH
L1	N54°10'47"W	15.01'
L2	N54°10'47"W	20.01'
L3	S54°58'12"E	20.00'

This map may not be a certified survey and has not been reviewed by a local government agency for compliance with any applicable land development regulations and has not been reviewed for compliance with recording requirements for plats.

LEGEND

- COMPUTED POINT
- IRON REBAR FOUND (IRF)
- PARCEL LINE
- FM PROPOSED NEW FORCE MAIN
- NOT TO SCALE
- PERMANENT FORCE MAIN EASEMENT

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: PLAT BOOK 2014 SLIDE 9331 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. TOTAL AREA: PERMANENT FORCE MAIN EASEMENT: 3,363 SQ.FT., 0.08 ACRES
10. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT CROSSING THE FRENCH BROAD RIVER AS SHOWN HEREON.

DATE	REVISION	BY

RIVER CROSSING EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE FRENCH BROAD RIVER
FOR THE STATE OF NORTH CAROLINA
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PROJ. SVYR :	TAB
DRAWN BY :	GHL
SCALE :	1" = 30'
DATE :	02/04/2025
SHEET # :	1 of 1

McKIM & CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588. Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

NC DOA
Department of Administration

Exhibit B

State Property Office
Tim Walton | Director

Josh Stein | Governor
Gabriel J. Esparza | Secretary

May 6, 2025

Shaun Armistead
2028 Riverside Drive
Asheville, NC 28804

Re: Council of State Approval
File No. 45-LD-45

Dear Jesse:

This is to advise you that the Council of State, at its meeting held on the above date, approved the attached item.

This matter will be referred to the Attorney General's Office at the appropriate time for preparation of documents. In the meantime, if you have any questions regarding this transaction, please contact Dannielle Sampson of this office.

Sincerely,

Tim Walton
Director

DRS:tm

Attachment

C: Mark Teague, AG's Office
Manjiang Chen, McKim Creed

Mailing
1321 Mail Service Center
Raleigh, NC 27699-1321

doa.nc.gov

Location
325 N Salisbury St. | Raleigh, NC 27603
984-236-0270 T

Exhibit B

DISPOSITION BY EASEMENT

ITEM 2
GRANTOR: State of North Carolina, Department of Administration

GRANTEE: Metropolitan Sewerage District of Buncombe County

LOCATION: French Broad River, near Old Fanning Bridge Road, Town of Mills River, Henderson County

EASEMENT AREA: ±3,363 sq. ft. (±0.077 acre)

CONSIDERATION: $250

COMMENTS: Subaqueous Easement. Proposed easement is needed for the installation of a sewer force main to transport wastewater to a downstream manhole.

Right of Way Special Provision Detail Sheets and Easements

Quality Point LLC (Portion of Parcel 9642-36-1779)

PREPARED BY AND RETURN AFTER RECORDING TO:
KATHRYN MAULTSBY MADISON of
ROBERTS & STEVENS, P. A.

STATE OF NORTH CAROLINA

COUNTY OF HENDERSON **EASEMENT AGREEMENT**

THIS EASEMENT AGREEMENT, made this 1 day of May, 2026, by and between **QUALITY POINT, LLC, a Delaware limited liability company,** hereinafter referred to as Grantor, and **METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, NORTH CAROLINA**, a public body and body politic and corporate, created and established by the North Carolina State Stream Sanitation Committee by Resolution adopted on January 19, 1962, under the provisions of the North Carolina Metropolitan Sewerage Districts Act, now codified as Chapter 162A, Article 5, of the General Statutes of North Carolina, hereinafter referred to as Grantee (the designations Grantor and Grantee as used herein shall include said parties, their heirs, successors and assigns and shall include singular, plural, masculine, feminine and neuter as required by context).

W I T N E S S E T H:

THAT WHEREAS, the Grantor is the owner of certain property more particularly described in a deed recorded in Book 4041 at Page 469, Henderson County Registry (hereinafter sometimes referred to as "Property"); and

WHEREAS, the Grantee has requested that the Grantor grant and convey to the Grantee a permanent and two (2) temporary construction easements over, upon, across, under and through a portion the Property of the Grantor for purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sewer lines and accessories and the Grantor has agreed to do so.

NOW, THEREFORE, the Grantor, for and in consideration of the sum of One Dollar ($1.00), and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, has given, granted and conveyed, and by these presents does give, grant, and convey unto the Grantee, its successors and assigns, the permanent and temporary right, privilege and easement to construct, operate, maintain, repair, inspect, reconstruct and replace, if necessary, sanitary sewer lines and accessories over, upon, across, under and through the Property of the Grantor, said permanent easement and temporary construction easements being described as follows:

PERMANENT EASEMENT: A non-exclusive permanent easement for the purposes of constructing, operating, maintaining, repairing, inspecting, reconstructing and replacing, if necessary, sanitary sewer lines, including such pipes, manholes, fittings, fixtures and other accessories as from time to time may be required. The easement shall include the right to perform appropriate tests within said permanent easement, including but not limited to, archaeological and environmental studies; provided, however, that Grantee shall not conduct any invasive testing within the permanent easement without the prior written consent of Grantor, which consent may not be unreasonably withheld or delayed. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said permanent easement to effectuate the purposes outlined herein, said permanent easement being more particularly described as follows:

Being that area shown as Variable Permanent Access Easement on the survey entitled "ITT Pump Station Replacement MSD Project #2020061 Sewer Easement Across the Property of: Quality Point, LLC " prepared by McKim & Creed, dated May 5, 2025, last updated May 27, 2026 (Project No. 09596-0001) and recorded in Plat Book 2026 at Page 17083, Henderson County Registry (hereinafter the "Plat"), reference to which is hereby made and incorporated for a more particular description.

Said Variable Permanent Access Easement consisting of 9,791 square feet (0.22 acres), more or less.

TEMPORARY CONSTRUCTION EASEMENTS: Two (2) temporary construction easements for the purposes of excavation, digging ditches, storing dirt, supplies and materials, moving and using equipment and generally carrying out the completion of the installation of said sanitary sewer lines and accessories, and for the purposes of inspecting and performing appropriate tests within said temporary construction easements, including but not limited to, archaeological and environmental studies; provided, however, that Grantee shall not conduct any invasive testing within the temporary construction easements without the prior written consent of Grantor, which consent may not be unreasonably withheld or delayed. The Grantor agrees to cooperate with the Grantee and to allow the Grantee reasonable, practical, and necessary access to and egress from said temporary construction easements to effectuate the purposes outlined herein. This right of use as set out in this paragraph shall terminate upon the final completion of the entire project, said temporary construction easements being more particularly described as follows:

Being that area shown as Temporary Construction Easement 1 and Temporary Construction Easement 2 on the Plat, reference to which is hereby made and incorporated for a more particular description.

Said Temporary Construction Easement 1 being listed as Temporary Construction Easement 1 on the Area Table consisting of 8,807 square feet (0.20 acres), more or less, and said Temporary Construction Easement 2 being listed as Temporary Construction Easement 2 on the Area Table consisting of 15,851 square feet (0.36 acres), more or less.

Said Permanent Easement and Temporary Construction Easements being shown on the Sewer Line Location Drawing for Project # 2020061, Sewer Easement Across the Property of Quality Point, LLC, prepared by McKim & Creed, dated May 5, 2025, last updated on May 27, 2026, Project No. 09596-0001.

IT IS UNDERSTOOD AND AGREED BETWEEN THE GRANTOR AND THE GRANTEE:

1. That the Grantee shall have the right to clear the permanent easement and temporary construction easements described above and the right but not the obligation to keep the permanent easement clear at all times, and the right to remove from the permanent easement and temporary construction easements all brush, trees and other obstructions, and to go upon said easements whenever necessary for the purpose of clearing the same and removing therefrom all brush, trees and other obstructions of any kind.

2. That the Grantor shall at all times, other than while the sewer lines are under actual construction, have the right to use said permanent easement and said temporary construction easements, in the same manner as has been heretofore done; provided such use shall in no manner interfere with or be inconsistent with the use thereof by Grantee as provided herein. Prohibited uses of the permanent easement by the Grantor include, but are not limited to, the following: the erection of a shed, building, structure or other obstruction within the permanent easement by the Grantor shall not be allowed; the planting of trees within the permanent easement by the Grantor shall not be allowed; additional fill cannot be placed within the permanent easement except after prior written consent from the Grantee; and other utility lines, including but not limited to, electric, gas, telephone, cable, or water lines, cannot be constructed within the permanent easement except after prior written approval by the Grantee.

3. That the Grantee agrees to restore the topography of said easement areas, and access areas, if any, after installation or repairs of the sewer lines, pump station and accessories to the topography in accordance with the engineering plans entitled "ITT Pump Station Replacement" by McKim & Creed dated April 22, 2026, and as needed in the advancement towards completion of ITT Pump Station Replacement MSD Project #2020061. Such restoration shall be completed within sixty (60) days following the final completion of the applicable work. In the event the Grantee fails to complete such restoration within said sixty (60) day period, the Grantor shall have the right, after ten (10) days' prior written notice to Grantee, to perform or cause to be performed such restoration at the sole cost and expense of Grantee, and Grantee shall reimburse Grantor for all reasonable costs and expenses incurred in connection therewith within thirty (30) days of written demand.

4. That the Grantor shall have the right to pass over and upon said permanent easement with appropriate roadways for the full use of the Property, provided, however, that the construction, maintenance and use of said roadways shall in no way interfere with the sewer lines and accessories constructed within said permanent easements. As to paved roads, the Grantee, in future repairs or maintenance of said sewer lines and accessories, shall only be responsible for regraveling, tamping and patching the portion of said paved roads disturbed by such work. As to non-paved roads, the Grantee shall only be responsible for regraveling and tamping in connection with any repairs or maintenance.

5. If the Grantor has a sewer service line ("service line") that presently leads from the Grantor's residence or building on the Grantor's Property to the existing main sewer line which may be abandoned by the Grantee, the Grantee agrees that it will connect the service line to the new or rehabilitated sewer line that will be located within the permanent easements described above. The Grantor hereby agrees to cooperate with and authorizes the Grantee to enter upon the Grantor's Property and to excavate on the Grantor's Property outside of the permanent and temporary construction easements described herein as reasonably practical and necessary for the purpose of locating and connecting said service line. The Grantee shall perform such excavation in a good and workmanlike manner and shall obtain prior written approval, which shall not be unreasonably withheld, from the Grantor as to the specific areas of Grantor's Property to be excavated, and such written approval shall identify with particularity the location and scope of the proposed excavation. The Grantee shall restore the topography of the Grantor's Property after location and connection of said service line to the topography in accordance with the engineering plans entitled "ITT Pump Station Replacement" by McKim & Creed dated April 22, 2026, and as needed in the advancement towards completion of ITT Pump Station Replacement MSD Project #2020061 and such restoration shall be completed within sixty (60) days following the completion of the service line connection work.

6. That all notices, consents, approvals, requests, demands, and other communications required or permitted under this Agreement shall be in writing and shall be deemed duly given: (i) upon delivery, if delivered personally; (ii) one (1) business day after deposit with a nationally recognized overnight courier service; or (iii) three (3) business days after being sent by United States certified mail, return receipt requested, postage prepaid, addressed as follows: if to Grantor, at the address of the Property as reflected in the Henderson County tax records; and if to Grantee, at its principal office. Either party may designate a different address for notices by providing written notice to the other party in accordance with this paragraph.

7. That, to the extent allowed by law, the Grantee shall indemnify, defend, and hold harmless the Grantor and its members, managers, officers, employees, agents, successors, and assigns (collectively, "Grantor Indemnitees") from and against any and all claims, actions, damages, losses, costs, and expenses, including reasonable attorneys' fees, arising out of or resulting from Grantee's exercise of any rights granted under this Agreement, including but not limited to: (i) any personal injury, death, or property damage occurring on or about the Temporary and Permanent Easement Areas during Grantee's operations; (ii) any environmental contamination, soil disturbance, or hazardous materials release caused by Grantee's activities; and (iii) any liens or claims asserted against the Property by Grantee's contractors, subcontractors, or suppliers.

8. That this Agreement shall be governed by and construed in accordance with the laws of the State of North Carolina.

TO HAVE AND TO HOLD said permanent easement and temporary construction easements unto said Grantee, its successors and assigns, upon the terms and for the time periods set forth above.

The Grantor covenants to and with the Grantee, its successors and assigns, that the Grantor is lawfully seized in fee simple of the Property and has full right and power to convey these easements to the Grantee, and that Property is free from any and all liens and encumbrances, and that they will and their successors and assigns shall forever warrant and defend the title to said easements unto the Grantee, its successors and assigns, against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the Grantor has hereunto executed this document, as of the day and year first above written.

QUALITY POINT, LLC, a Delaware limited Liability company (SEAL)

By: _____

Print Name: Scott Clark

Title: Manager

* * * * * * * * * * * *

STATE OF _

COUNTY OF

I, a Notary Public of the County and State aforesaid, certify that Scott David Clark, appeared before me and being personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity, and that by his/her/their signature(s) on the instrument the person(s), or entity upon behalf of which the person(s) acted, executed the instrument.

Witness my hand and official stamp or seal, this 7 day of May, 2026

_____
NOTARY PUBLIC

My Commission Expires:
6-8-26

[NOTARIAL SEAL]

CHASITY JUSTICE
NOTARY PUBLIC
BUNCOMBE COUNTY, N.C.
MY COMMISSION EXPIRES 06/08/2026
20211920096

Docusign Envelope ID: 8B190934-3068-8B74-8015-9F6335041BAC

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f)(11)(d).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 27th DAY OF MAY, 2026.

Signed by:
Timothy Brown
SIGNATURE

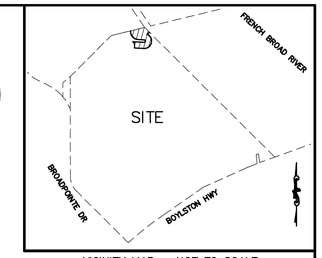
TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

LINE TABLE		
LINE #	BEARING	LENGTH
L1	S45°05'51"E	29.04'
L2	S20°23'55"E	16.43'
L3	N00°42'43"W	52.87'
L4	N00°42'43"W	20.04'
L5	S87°02'50"E	77.00'
L6	S87°02'50"E	49.08'

CURVE TABLE				
CURVE	RADIUS	LENGTH	BEARING	CHORD
C1	45.00'	141.37'	S02°57'10"W	90.00'
C2	25.00'	78.54'	N02°57'10"E	50.00'
C3	50.00'	86.34'	N37°34'35"W	76.01'

NC GRID NAD83/2011



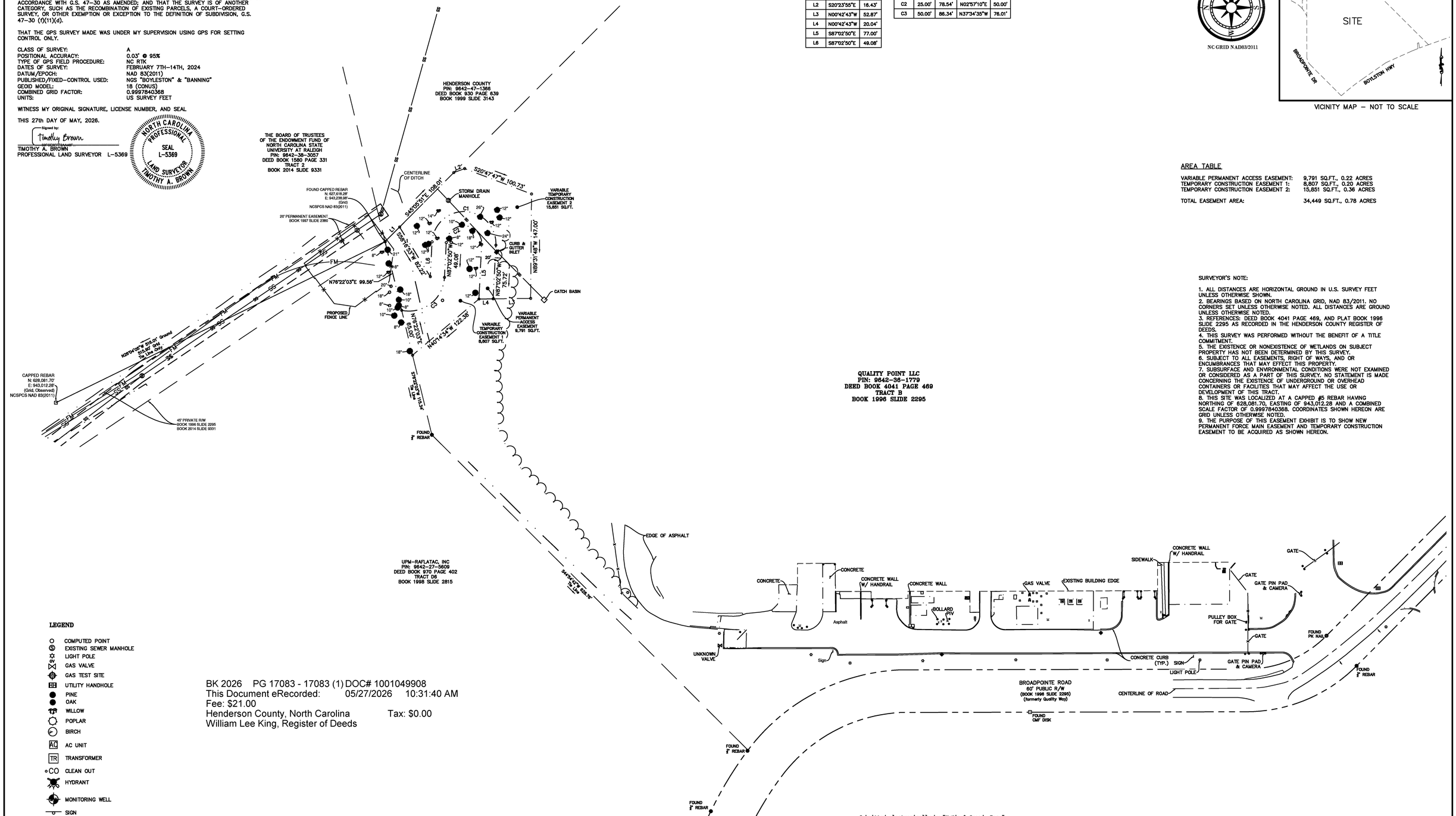
VICINITY MAP – NOT TO SCALE

AREA TABLE

VARIABLE PERMANENT ACCESS EASEMENT:	9,791 SQ.FT., 0.22 ACRES
TEMPORARY CONSTRUCTION EASEMENT 1:	8,807 SQ.FT., 0.20 ACRES
TEMPORARY CONSTRUCTION EASEMENT 2:	15,851 SQ.FT., 0.36 ACRES
TOTAL EASEMENT AREA:	34,449 SQ.FT., 0.78 ACRES

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 4041 PAGE 469, AND PLAT BOOK 1996 SLIDE 2295 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.



LEGEND

- COMPUTED POINT
- EXISTING SEWER MANHOLE
- LIGHT POLE
- GAS VALVE
- GAS TEST SITE
- UTILITY HANDHOLE
- PINE
- OAK
- WILLOW
- POPLAR
- BIRCH
- AC UNIT
- TRANSFORMER
- CLEAN OUT
- HYDRANT
- MONITORING WELL
- SIGN
- (TL) TOTAL DISTANCE
- PARCEL LINE
- RIGHT OF WAY LINE
- STORM LINE
- SEWER LINE
- FORCE MAIN
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- CENTERLINE DITCH
- TREE LINE

BK 2026 PG 17083 - 17083 (1) DOC# 1001049908
This Document eRecorded: 05/27/2026 10:31:40 AM
Fee: $21.00
Henderson County, North Carolina Tax: $0.00
William Lee King, Register of Deeds

STATE OF NORTH CAROLINA
COUNTY OF HENDERSON

I, Carlos Martinez, REVIEW OFFICER OF HENDERSON COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

DocuSigned by:
Carlos Martinez
REVIEW OFFICER — 5/27/2026 DATE

SCALE: 1" = 60'
0 30' 60' 120' 180'

Submitted electronically by "McKim & Creed, Inc."
in compliance with North Carolina statutes governing recordable documents
and the terms of the submitter agreement with the Henderson County Register of Deeds.

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: QUALITY POINT, LLC
PARCEL 9642-36-1779
TOWN OF FLETCHER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PLS :	TAB
DRAWN BY :	GHL
SCALE :	1" = 60'
DATE :	MAY 5, 2025
SHEET # :	1 OF 1
DWG. # :	ESMT-Parcel5

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

DATE	REVISION	BY
07/01/2025	UPDATE AREA TABLE DESIGNATION	TB
08/21/2025	REVISE TCE & PERM. ACCESS EASEMENTS	TB
02/16/2026	REVISE TCE & PERM. ACCESS EASEMENTS	GL
05/27/2026	CORRECT TOWN NAME	TB

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f)(11)(d).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 21ST DAY OF AUGUST, 2025.

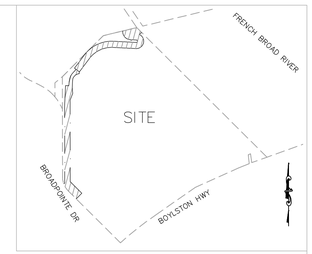
_____
TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

LINE TABLE		
LINE #	BEARING	LENGTH
L1	S45°05'51"E	29.04'
L2	S87°02'50"E	49.08'
L3	S02°12'12"W	47.38'
L4	S01°52'00"E	20.27'
L5	S18°55'43"W	62.40'
L6	N45°05'56"W	20.00'
L7	N18°55'43"E	62.07'
L8	S01°41'05"W	31.29'
L9	N02°12'12"E	48.09'
L10	N87°02'50"W	49.08'
L11	S20°23'55"E	16.43'
L12	N43°48'01"W	24.43'
L13	N43°48'01"W	39.91'
L14	N52°58'41"E	33.89'
L15	S76°22'03"W	32.98'

CURVE TABLE				
CURVE	RADIUS	LENGTH	BEARING	CHORD
C1	45.00'	141.37'	S02°57'10"W	90.00'
C2	240.00'	234.83'	S64°55'19"W	225.58'
C3	120.00'	72.65'	S19°32'49"W	71.55'
C4	159.23'	17.43'	N42°01'31"W	17.42'
C5	140.00'	84.76'	N19°32'49"E	83.47'
C6	260.00'	254.40'	N64°55'19"E	244.37'
C7	25.00'	78.54'	N02°57'10"E	50.00'
C8	50.00'	86.34'	N37°34'35"W	76.01'







VICINITY MAP – NOT TO SCALE

QUALITY POINT LLC
PIN: 9642-36-1779
DEED BOOK 4041 PAGE 469
TRACT B
BOOK 1996 SLIDE 2295

AREA TABLE

VARIABLE PERMANENT ACCESS EASEMENT:	39,642 SQ.FT., 0.91 ACRES
TEMPORARY CONSTRUCTION EASEMENT 1:	29,440 SQ.FT., 0.68 ACRES
TEMPORARY CONSTRUCTION EASEMENT 2:	39,296 SQ.FT., 0.90 ACRES
TOTAL EASEMENT AREA:	108,378 SQ.FT., 2.49 ACRES

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 4041 PAGE 469, AND PLAT BOOK 1996 SLIDE 2295 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

LEGEND

- COMPUTED POINT
- EXISTING SEWER MANHOLE
- LIGHT POLE
- GAS VALVE
- GAS TEST SITE
- UTILITY HANDHOLE
- PINE
- OAK
- WILLOW
- POPLAR
- BIRCH
- AC UNIT
- TRANSFORMER
- CLEAN OUT
- HYDRANT
- MONITORING WELL
- SIGN
- (TL) TOTAL DISTANCE
- PARCEL LINE
- RIGHT OF WAY LINE
- SD STORM LINE
- SS SEWER LINE
- FM FORCE MAIN
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- CENTERLINE DITCH
- TREE LINE
- VARIABLE PERMANENT ACCESS EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT

STATE OF NORTH CAROLINA
COUNTY OF HENDERSON

I, _____ REVIEW OFFICER OF HENDERSON COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____
REVIEW OFFICER DATE

SCALE: 1" = 60'
0 30' 60' 120' 180'

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: QUALITY POINT, LLC
PARCEL 9642-36-1779
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PLS :	TAB
DRAWN BY :	GHL
SCALE :	1" = 60'
DATE :	MAY 5, 2025
SHEET # :	1 OF 1
DWG. # :	ESMT-Parcel5

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

DATE	REVISION	BY
07/01/2025	UPDATE AREA TABLE DESIGNATION	TB
08/21/2025	REVISE TCE & PERM. ACCESS EASEMENTS	TB

Right of Way Special Provision Detail Sheets and Easements

State of North Carolina (Portion of Parcel 9642-28-4413) (SPDS)

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f)(11)(d).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 5th DAY OF May, 2025.

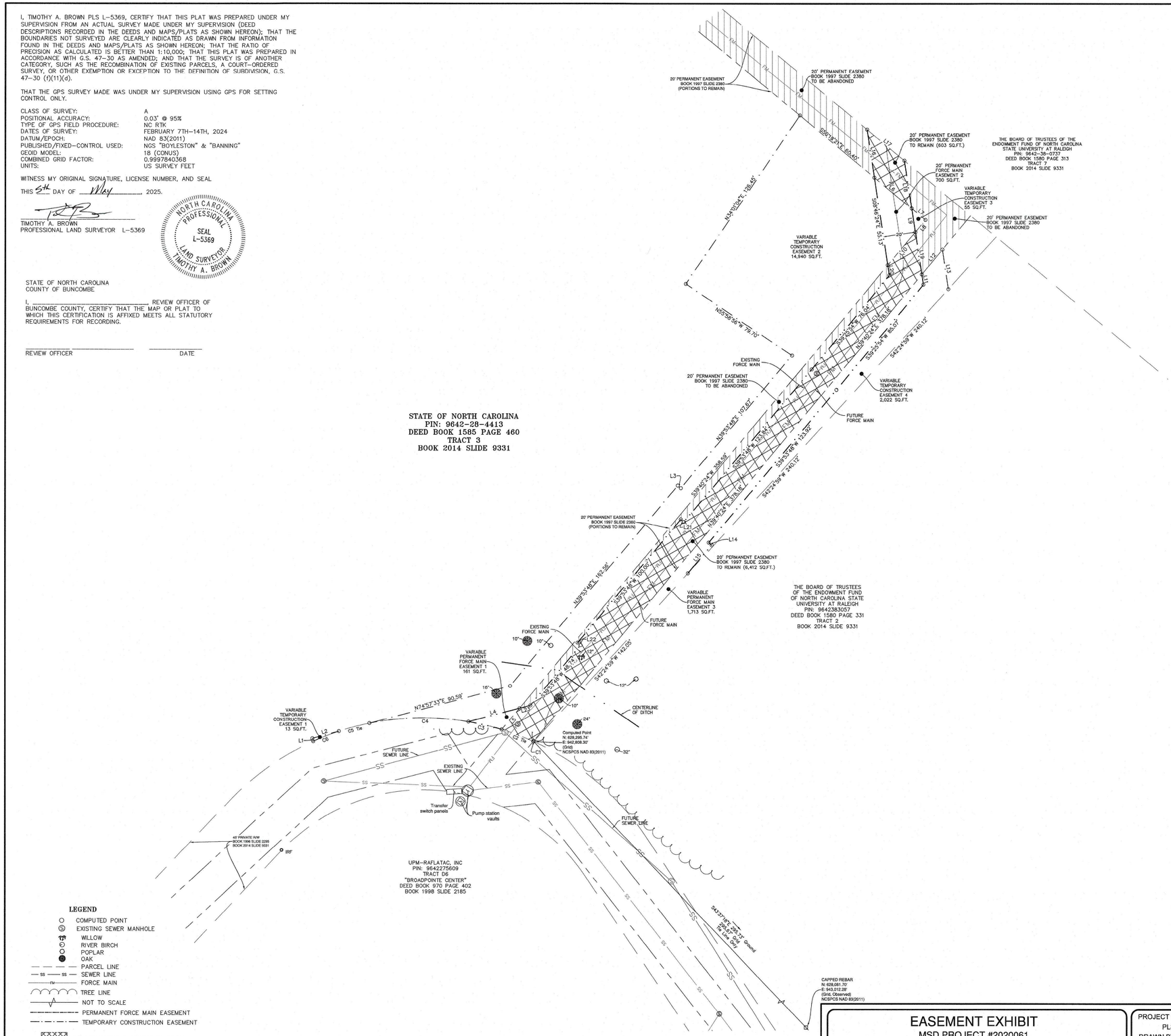
TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____, REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____
REVIEW OFFICER DATE



STATE OF NORTH CAROLINA
PIN: 9642-28-4413
DEED BOOK 1585 PAGE 460
TRACT 3
BOOK 2014 SLIDE 9331

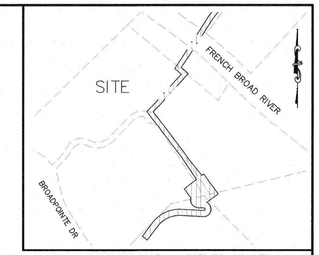
LEGEND

- COMPUTED POINT
- EXISTING SEWER MANHOLE
- WILLOW
- RIVER BIRCH
- POPLAR
- OAK
- PARCEL LINE
- SS SEWER LINE
- FM FORCE MAIN
- TREE LINE
- NOT TO SCALE
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- 20' PERMANENT EASEMENT TO REMAIN
- 20' PERMANENT EASEMENT TO BE ABANDONED

SCALE: 1" = 30'
0 15' 30' 60' 90'



NC GRID NAD83/2011



VICINITY MAP – NOT TO SCALE

LINE TABLE			LINE TABLE		
LINE #	BEARING	LENGTH	LINE #	BEARING	LENGTH
L1	N15°02'27"W	1.91'	L13	S08°46'24"E	24.76'
L2	N74°57'33"E	17.14'	L14	S50°06'12"E	2.50'
L3	S50°06'12"E	2.50'	L15	S39°53'48"W	23.01'
L4	N74°57'33"E	32.88'	L16	N08°46'24"W	30.15'
L5	N39°40'24"E	17.46'	L17	S50°19'21"E	30.15'
L6	S50°19'21"E	30.15'	L18	S08°46'24"E	30.15'
L7	S50°19'21"E	11.10'	L19	S08°46'24"E	26.73'
L8	S39°40'24"W	9.84'	L20	S08°46'24"E	6.40'
L9	S08°46'24"E	14.84'	L21	N50°06'12"W	2.50'
L10	S39°40'24"W	26.73'	L22	S50°06'12"E	2.50'
L11	S08°46'24"E	6.35'	L23	S74°57'33"W	7.01'
L12	N39°40'24"E	20.04'			

CURVE TABLE				
CURVE	RADIUS	LENGTH	BEARING	CHORD
C1	166.05'	0.25'	N65°35'58"W	0.25'
C2	166.05'	21.16'	N69°17'38"W	21.15'
C3	166.05'	21.20'	N76°36'08"W	21.18'
C4	166.05'	61.99'	S89°02'42"W	61.63'
C5	166.05'	19.65'	S74°57'33"W	19.64'
C6	166.05'	17.26'	S68°35'30"W	17.25'

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 1585 PAGE 460, AND PLAT BOOK 2014 SLIDE 9331 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
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9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

AREA TABLE

PERMANENT FORCE MAIN EASEMENT 1:	161 SQ.FT., 0.00 ACRES
PERMANENT FORCE MAIN EASEMENT 2:	700 SQ.FT., 0.02 ACRES
PERMANENT FORCE MAIN EASEMENT 3:	1,713 SQ.FT., 0.04 ACRES
TEMPORARY CONSTRUCTION EASEMENT 1:	13 SQ.FT., 0.00 ACRES
TEMPORARY CONSTRUCTION EASEMENT 2:	14,940 SQ.FT., 0.34 ACRES
TEMPORARY CONSTRUCTION EASEMENT 3:	55 SQ.FT., 0.00 ACRES
TEMPORARY CONSTRUCTION EASEMENT 4:	2,022 SQ.FT., 0.05 ACRES
TOTAL EASEMENT AREA:	19,604 SQ.FT., 0.45 ACRES

EASEMENT EXHIBIT

MSD PROJECT #2020061

ITT PUMP STATION REPLACEMENT

EASEMENT ACROSS THE PROPERTY OF
OWNER: STATE OF NORTH CAROLINA
PARCEL 9642-28-4413
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # : 09596-0001
PLS : TAB
DRAWN BY : GHL
SCALE : 1" = 30'
DATE : MAY 5, 2025
SHEET # : 1 OF 1

DWG. # : ESMT-Parcel3

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567

NC License# F-1222

Internet Site: http://www.mckimcreed.com

DATE	REVISION	BY
"	"	"

SPECIAL PROVISIONS DETAIL SHEET

April 10, 2026

Project:	I.T.T. Pump Station Replacement MSD of Buncombe County Project #2020061
Agent:	Wesley G. Banner
Parcel Number:	9642-28-4413
Owner:	State of North Carolina
Phone:	(828) 808-5185 (Tom Hoyt) Mountain Horticulture Crops & Research Center
Owner Email:	Tom_Hoyt@ncsu.edu
Site Address:	00000 Fanning Bridge Road, Fletcher, NC 28732
Mailing Address:	325 N. Salisbury Street, 6th Floor Raleigh, NC 28759
Engineer Approval:	Shawn K Smith

1. The MSD Inspector shall contact Tom Hoyt with Mountain Horticulture Crops Research & Extension Center (Mailing Address: 455 Research Drive, Mills River, NC 28759) at (828) 808-5185 least two weeks prior to any work being performed on the property (excepting emergencies) to give owner advance notice of when work will begin. The same notice requirements shall be made to Janice Veilleux, Real Property Agent State of North Carolina Department of Administration at (984) 236-0275. Additionally periodic updates shall be provided to both contacts above throughout the project until final restoration is completed.

2. MSD's Contractor shall not be working on or accessing the subject parcel between April 15 to October 15 since this is their planting & harvest season. The contactor should plan on their work occurring between November 1-March 31 on this parcel.

NC DOA
Department of Administration

State Property Office
Tim Walton | Director

Josh Stein | Governor
Gabriel J. Esparza | Secretary

March 11, 2026

Metropolitan Sewerage District of Buncombe County, North Carolina
Wesley G. Banner
Right of Way Manager
2028 Riverside Drive
Asheville, NC 28804

Re: Right of Entry; 74 Research Drive, Mills River, NC 28759 SPO File 45-004.007
Henderson County

Dear Mr. Banner,

Please consider this letter as formal authorization for the Metropolitan Sewerage District of Buncombe County, North Carolina (MSDBC) to enter State land allocated to NC State University identified as Henderson County PIN #9642284413, for the purpose of constructing, operating, and maintaining a perpetual sanitary sewer line at the Mountain Horticultural Crops Research Station.

By acceptance of this right of entry, evidenced by the performance of work on the property, MSDBC agrees to indemnify and hold harmless the State of North Carolina for any injury, loss, or damage arising out of the actions of MSDBC, its employees, agents, or contractors performing work on the premises, to the extent permitted by North Carolina law and provided such injury, loss, or damage does not proximately result from the negligence, gross negligence, or intentional acts of the State of North Carolina, the Federal Government, its agencies, contractors, or subcontractors.

It is our understanding that this right of entry has been requested in the interest of time. The issuance of the easement remains subject to the approval of the Council of State. This right of entry is further conditioned upon obtaining all necessary Federal, State, and local permits or approvals required for the proposed project.

If we can assist you further, please advise.

Sincerely,

Eric W. Moore
General Real Estate Manager

Mailing
1321 Mail Service Center
Raleigh, NC 27699-1321

ncadmin.nc.gov

Location
325 N. Salisbury St. | Raleigh, NC 27603
984-236-0270 T

Right of Way Special Provision Detail Sheets and Easements

Board of Trustees of The Endowment Fund of North Carolina State University at Raleigh (Parcel 9642-38-3057 & Parcel 9642-38-0737) (SPDS) (DRAFT)

Docusign Envelope ID: 9161DAE1-63C2-83F5-8258-A307464E7E14

NC STATE UNIVERSITY

The Board of Trustees
of the Endowment Fund

Campus Box 7472
Raleigh, NC 27695-7472

May 4, 2026

Wesley G. Banner
Right of Way Manager
Metropolitan Sewerage District of Buncombe County
2028 Riverside Drive
Asheville, NC 28804
WesleyB@msdbc.org
(828) 254-9646

SUBJECT: Right of Entry – Board of Trustees of the Endowment Fund of North Carolina State University

Mr. Banner,

As per the attached letter dated May 4, 2026 from the Metropolitan Sewerage District of Buncombe County (the "MSD"), a Right of Entry has been requested for MSD and their contractors (the "Contractors") on property owned by the Board of Trustees of the Endowment Fund of North Carolina State University (the "BOTEF") located at the Mountain Horticultural Crops Research Station (the "MHCRS") in Henderson County, North Carolina, as shown on the attached maps (the "Exhibits"). The BOTEF will agree to provide the Right of Entry to MSD and Contractors, conditioned on the following terms:

i. The scope of work to be performed shall be expressly limited to clearing, grading, and installation of common utility infrastructure in the area identified as "Permanent Force Main Easement" and "Temporary Construction Easement" on the attached Exhibits.
ii. MSD and Contractors shall be responsible for all costs associated with any work performed by or on behalf of MSD and Contractors on the MHCRS and/or pursuant to the Right of Entry, as well as all costs associated with the items specified below.
iii. Upon completion of its work, MSD shall provide an as-built survey for all MSD facilities and equipment located in the "Permanent Force Main Easement" area included in the Exhibits.
iv. All work to be completed pursuant to the Right of Entry shall be completed on or before May 31, 2027. The rights granted to MSD and Contractors by this Right of Entry shall cease as of 5:00 pm on May 31, 2027.
v. MSD and Contractors shall use commercially reasonable efforts to ensure that its activities on the MHCRS do not unreasonably interfere with the normal business operations of NC State University (the "University") on and adjacent to the MHCRS and shall endeavor to provide prior notice and coordinate with the MHCRS Superintendent, Tom Hoyt (Tom_Hoyt@ncsu.edu), if any material interference or disruption to the MHCRS's operations is anticipated.
vi. To the extent permitted by North Carolina Law and provided such damage or injury does not proximately result from the negligence, gross negligence or intentional acts of the State of North Carolina, the Federal Government, or any of their respective agencies, contractors, and subcontractors, MSD and the Contractors shall indemnify and hold harmless the BOTEF and the University for injury, loss or damage arising out of the actions of MSD, the Contractors, or any of their respective agents or subcontractors performing work at the MHCRS pursuant to the Right of Entry.

Docusign Envelope ID: 9161DAE1-63C2-83F5-8258-A307464E7E14

Please evidence your agreement with the terms outlined above by signing in the space provided below. Return a signed copy of this letter by email to saeverh2@ncsu.edu.
Thank you,

Signed by:
Alicia Knight
2AAB57A78A57475...
Alicia Knight
Authorized Signatory, Board of Trustees of the Endowment Fund of North Carolina State University

cc: Jessie Askew, Director, Real Estate & Development

ACCEPTED AND AGREED:

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

By: _____
Print Name: _____
Title: _____
Date: _____

Docusign Envelope ID: 9161DAE1-63C2-83F5-8258-A307464E7E14

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f.)(11.)(d.).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

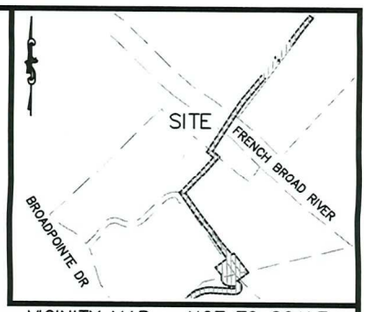
CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 5th DAY OF May, 2025.

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN



VICINITY MAP - NOT TO SCALE



NC GRID NAD83/2011

MINKLES BROADPOINTE II, LLC
PIN: 9642-29-2434
DEED BOOK 3749 PAGE 453
BOOK 2015 SLIDE 9773

THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NORTH CAROLINA STATE UNIVERSITY AT RALEIGH
PIN: 9642-38-0737
DEED BOOK 1580 PAGE 313
TRACT 7
BOOK 2014 SLIDE 9331

LEGEND

- O COMPUTED POINT
- PARCEL LINE
- NOT TO SCALE
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT

MINKLES BROADPOINTE II, LLC
PIN: 9642-19-9283
DEED BOOK 3749 PAGE 453
TRACT A
BOOK 2023 SLIDE 14905

FRENCH BROAD RIVER

20' PERMANENT EASEMENT
BOOK 1997 SLIDE 2380

SEE SHEET 2 FOR MORE DETAIL

VARIABLE PERMANENT FORCE MAIN EASEMENT 3,796 SQ.FT.

Computed Point
N: 628,811.10'
E: 943,148.51'
(Grid)
NCSPCS NAD 83(2011)

VARIABLE TEMPORARY CONSTRUCTION EASEMENT 4,163 SQ.FT.

VARIABLE TEMPORARY CONSTRUCTION EASEMENT 2,929 SQ.FT.

STATE OF NORTH CAROLINA
PIN: 9642-28-4413
DEED BOOK 1585 PAGE 460
TRACT 3
BOOK 2014 SLIDE 9331

68' Duke Energy R/W
DEED BOOK 455 PAGE 281

20' PERMANENT EASEMENT
BOOK 1997 SLIDE 2380

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____, REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____ _____
REVIEW OFFICER DATE

S10°34'45"W 742.17' Ground
742.01' Grid
Tie Line Only

THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NORTH CAROLINA STATE UNIVERSITY AT RALEIGH
PIN: 9642383057
DEED BOOK 1580 PAGE 331
TRACT 2
BOOK 2014 SLIDE 9331

IRF/CAPPED

45' PRIVATE R/W
BOOK 1996 SLIDE 2295
BOOK 2014 SLIDE 9331

IRF

IRF/CAPPED

CAPPED REBAR
N: 628,081.70'
E: 943,012.28'
(Grid, Observed)
NCSPCS NAD 83(2011)

SCALE: 1" = 150'

0 75 150

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 1580 PAGE 313, AND PLAT BOOK 2014 SLIDE 9331 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. TOTAL AREA: PERMANENT FORCE MAIN EASEMENT: 3,796 SQ.FT., 0.09 ACRES (1,412 SQ.FT. IN 68' DUKE ENERGY R/W)
   TEMPORARY CONSTRUCTION EASEMENT: 7,092 SQ.FT., 0.16 ACRES (3,516 SQ.FT. IN 68' DUKE ENERGY R/W)
10. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

DATE	REVISION	BY

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NC STATE UNIVERSITY AT RALEIGH
PARCEL 9642-38-0737
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PROJ. SVYR :	TAB
DRAWN BY :	GHL
SCALE :	1" = 150'
DATE :	05/05/2025
SHEET # :	1 of 2

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567

NC License# F-1222
Internet Site: http://www.mckimcreed.com

Docusign Envelope ID: 9161DAE1-63C2-83F5-8258-A307464E7E14

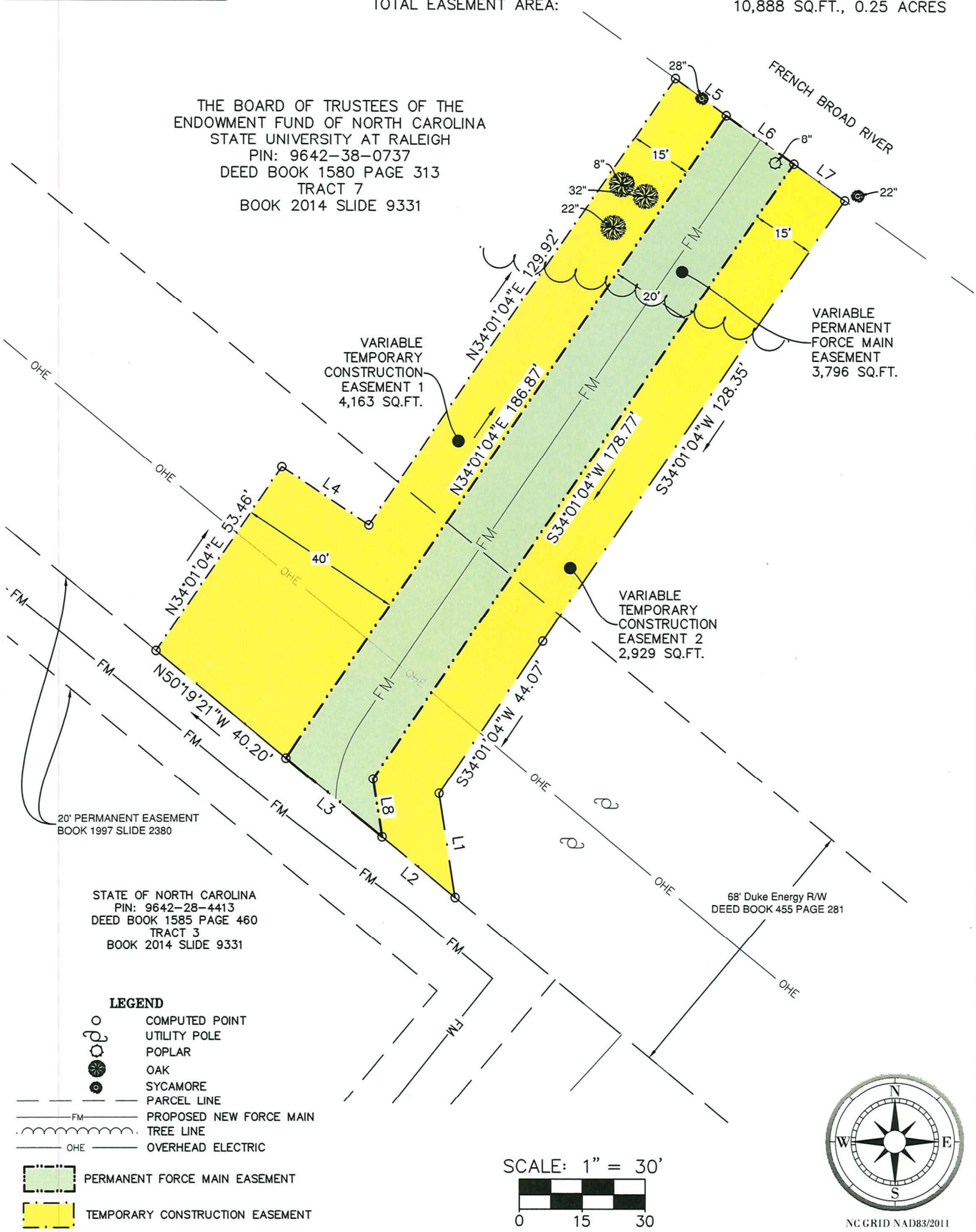
LINE TABLE		
LINE #	BEARING	LENGTH
L1	S08°46'24"E	25.23'
L2	N50°19'21"W	30.52'
L3	N50°19'21"W	29.78'
L4	S55°58'56"E	25.00'
L5	S54°10'47"E	15.01'
L6	S54°10'47"E	20.01'
L7	S54°10'47"E	15.01'
L8	S08°46'24"E	14.18'

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

AREA TABLE

PERMANENT FORCE MAIN EASEMENT 1:	3,796 SQ.FT., 0.09 ACRES
TEMPORARY CONSTRUCTION EASEMENT 1:	4,163 SQ.FT., 0.10 ACRES
TEMPORARY CONSTRUCTION EASEMENT 2:	2,929 SQ.FT., 0.06 ACRES
TOTAL EASEMENT AREA:	10,888 SQ.FT., 0.25 ACRES



LEGEND

- COMPUTED POINT
- UTILITY POLE
- POPLAR
- OAK
- SYCAMORE
- PARCEL LINE
- PROPOSED NEW FORCE MAIN
- TREE LINE
- OVERHEAD ELECTRIC
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT

SCALE: 1" = 30'

0 15 30

N
W E
S

NC GRID NAD83/2011

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NC STATE UNIVERSITY AT RALEIGH
PARCEL 9642-38-0737
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PROJ. SVYR :	TAB
DRAWN BY :	GHL
SCALE :	1" = 30'
DATE :	05/05/2025
SHEET # :	2 of 2

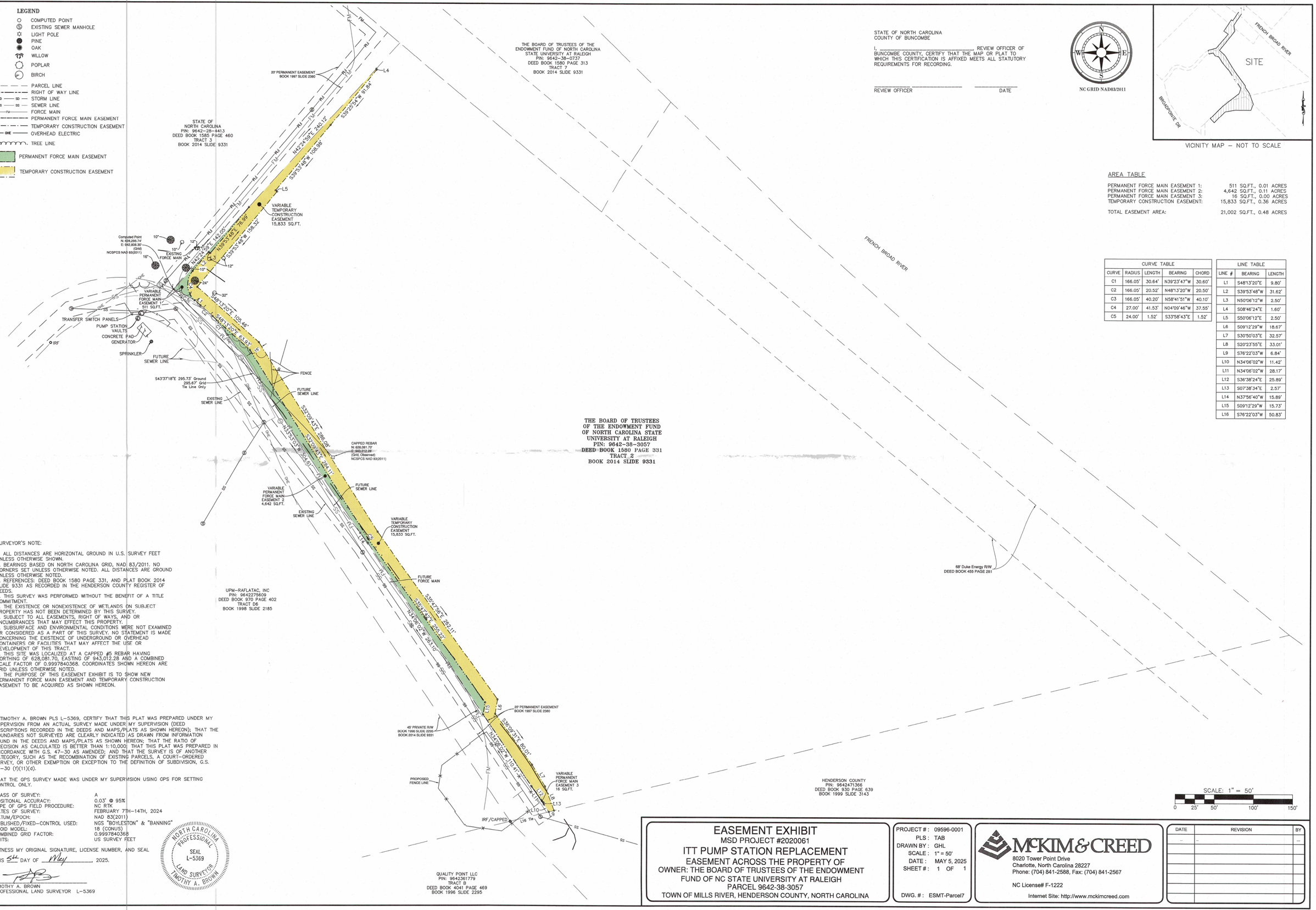
McKIM & CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567

NC License# F-1222
Internet Site: http://www.mckimcreed.com

Docusign Envelope ID: 9161DAE1-63C2-83F5-8258-A307464E7E14

LEGEND

- COMPUTED POINT
- EXISTING SEWER MANHOLE
- LIGHT POLE
- PINE
- OAK
- WILLOW
- POPLAR
- BIRCH
- PARCEL LINE
- RIGHT OF WAY LINE
- STORM LINE
- SEWER LINE
- FORCE MAIN
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- OVERHEAD ELECTRIC
- TREE LINE
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT



SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 1580 PAGE 331, AND PLAT BOOK 2014 SLIDE 9331 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f)(11)(d).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 5th DAY OF May, 2025.

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____, REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____
REVIEW OFFICER DATE

NC GRID NAD83/2011

VICINITY MAP – NOT TO SCALE

AREA TABLE

PERMANENT FORCE MAIN EASEMENT 1:	511 SQ.FT., 0.01 ACRES
PERMANENT FORCE MAIN EASEMENT 2:	4,642 SQ.FT., 0.11 ACRES
PERMANENT FORCE MAIN EASEMENT 3:	16 SQ.FT., 0.00 ACRES
TEMPORARY CONSTRUCTION EASEMENT:	15,833 SQ.FT., 0.36 ACRES
TOTAL EASEMENT AREA:	21,002 SQ.FT., 0.48 ACRES

CURVE TABLE				
CURVE	RADIUS	LENGTH	BEARING	CHORD
C1	166.05'	30.64'	N39°23'47"W	30.60'
C2	166.05'	20.52'	N48°13'20"W	20.50'
C3	166.05'	40.20'	N58°41'51"W	40.10'
C4	27.00'	41.53'	N04°09'46"W	37.55'
C5	24.00'	1.52'	S33°58'43"E	1.52'

LINE TABLE		
LINE #	BEARING	LENGTH
L1	S48°13'20"E	9.80'
L2	S39°53'48"W	31.62'
L3	N50°06'12"W	2.50'
L4	S08°46'24"E	1.60'
L5	S50°06'12"E	2.50'
L6	S09°12'29"W	18.67'
L7	S30°50'03"E	32.57'
L8	S20°23'55"E	33.01'
L9	S76°22'03"W	6.84'
L10	N34°06'02"W	11.42'
L11	N34°06'02"W	28.17'
L12	S36°38'24"E	25.89'
L13	S07°38'34"E	2.57'
L14	N37°56'40"W	15.89'
L15	S09°12'29"W	15.73'
L16	S76°22'03"W	50.83'

SCALE: 1" = 50'
0 25' 50' 100' 150'

EASEMENT EXHIBIT

MSD PROJECT #2020061

ITT PUMP STATION REPLACEMENT

EASEMENT ACROSS THE PROPERTY OF
OWNER: THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NC STATE UNIVERSITY AT RALEIGH
PARCEL 9642-38-3057
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PLS :	TAB
DRAWN BY :	GHL
SCALE :	1" = 50'
DATE :	MAY 5, 2025
SHEET # :	1 OF 1
DWG. # :	ESMT-Parcel7

McKIM & CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

DATE	REVISION	BY
..	..	..

LEGEND

- COMPUTED POINT
- EXISTING SEWER MANHOLE
- LIGHT POLE
- PINE
- OAK
- WILLOW
- POPLAR
- BIRCH
- PARCEL LINE
- RIGHT OF WAY LINE
- STORM LINE
- SEWER LINE
- FORCE MAIN
- PERMANENT FORCE MAIN EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- OVERHEAD ELECTRIC
- TREE LINE

STATE OF NORTH CAROLINA
PIN: 9642-25-4413
DEED BOOK 1585 PAGE 460
TRACT 3
BOOK 2014 SLIDE 9331

THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NORTH CAROLINA STATE UNIVERSITY AT RALEIGH
PIN: 9642-38-0737
DEED BOOK 1580 PAGE 313
TRACT 7
BOOK 2014 SLIDE 9331

20' PERMANENT EASEMENT
BOOK 1997 SLIDE 2580

VARIABLE TEMPORARY CONSTRUCTION EASEMENT 15,833 SQ.FT.

Computed Point
N: 628,295.74'
E: 942,808.39'
(Grid)
NCSPCS NAD 83(2011)

EXISTING FORCE MAIN

VARIABLE PERMANENT FORCE MAIN EASEMENT 1
511 SQ.FT.

TRANSFER SWITCH PANELS
PUMP STATION VAULTS
CONCRETE PAD
GENERATOR
IRF
SPRINKLER
FUTURE SEWER LINE
EXISTING SEWER LINE
FENCE

S43°37'18"E 295.73' Ground
295.67' Grid
Tie Line Only

CAPPED REBAR
N: 628,081.70'
E: 943,012.28'
(Grid, Observed)
NCSPCS NAD 83(2011)

VARIABLE PERMANENT FORCE MAIN EASEMENT 2
4,642 SQ.FT.

VARIABLE TEMPORARY CONSTRUCTION EASEMENT
15,833 SQ.FT.

FUTURE FORCE MAIN

UPM-RAFLATAC, INC
PIN: 9642275609
DEED BOOK 970 PAGE 402
TRACT D6
BOOK 1998 SLIDE 2185

45' PRIVATE R/W
BOOK 1996 SLIDE 2295
BOOK 2014 SLIDE 9331

29' PERMANENT EASEMENT
BOOK 1997 SLIDE 2580

PROPOSED FENCE LINE

VARIABLE PERMANENT FORCE MAIN EASEMENT 3
16 SQ.FT.

IRF/CAPPED

QUALITY POINT LLC
PIN: 9642361779
TRACT B
DEED BOOK 4041 PAGE 469
BOOK 1996 SLIDE 2295

THE BOARD OF TRUSTEES
OF THE ENDOWMENT FUND
OF NORTH CAROLINA STATE
UNIVERSITY AT RALEIGH
PIN: 9642-38-3057
DEED BOOK 1580 PAGE 331
TRACT 2
BOOK 2014 SLIDE 9331

FRENCH BROAD RIVER

68' Duke Energy R/W
DEED BOOK 455 PAGE 281

HENDERSON COUNTY
PIN: 9642471366
DEED BOOK 930 PAGE 639
BOOK 1999 SLIDE 3143

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
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6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
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9. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f)(11)(d).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 5th DAY OF May, 2025.

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

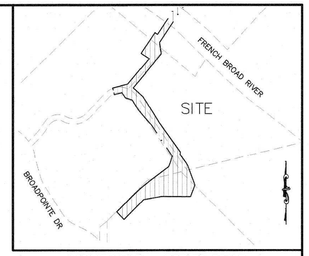
TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____ REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____
REVIEW OFFICER DATE

NC GRID NAD83/2011



VICINITY MAP – NOT TO SCALE

AREA TABLE

PERMANENT FORCE MAIN EASEMENT 1:	511 SQ.FT., 0.01 ACRES
PERMANENT FORCE MAIN EASEMENT 2:	4,642 SQ.FT., 0.11 ACRES
PERMANENT FORCE MAIN EASEMENT 3:	16 SQ.FT., 0.00 ACRES
TEMPORARY CONSTRUCTION EASEMENT:	15,833 SQ.FT., 0.36 ACRES
TOTAL EASEMENT AREA:	21,002 SQ.FT., 0.48 ACRES

CURVE TABLE				
CURVE	RADIUS	LENGTH	BEARING	CHORD
C1	166.05'	30.64'	N39°23'47"W	30.60'
C2	166.05'	20.52'	N48°13'20"W	20.50'
C3	166.05'	40.20'	N58°41'51"W	40.10'
C4	27.00'	41.53'	N04°09'46"W	37.55'
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LINE TABLE		
LINE #	BEARING	LENGTH
L1	S48°13'20"E	9.80'
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L6	S09°12'29"W	18.67'
L7	S30°50'03"E	32.57'
L8	S20°23'55"E	33.01'
L9	S76°22'03"W	6.84'
L10	N34°06'02"W	11.42'
L11	N34°06'02"W	28.17'
L12	S36°38'24"E	25.89'
L13	S07°38'34"E	2.57'
L14	N37°56'40"W	15.89'
L15	S09°12'29"W	15.73'
L16	S76°22'03"W	50.83'

SCALE: 1" = 50'
0 25' 50' 100' 150'

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NC STATE UNIVERSITY AT RALEIGH
PARCEL 9642-38-3057
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PLS :	TAB
DRAWN BY :	GHL
SCALE :	1" = 50'
DATE :	MAY 5, 2025
SHEET # :	1 OF 1
DWG. # :	ESMT-Parcel7

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

DATE	REVISION	BY
--	--	---

I, TIMOTHY A. BROWN PLS L-5369, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTIONS RECORDED IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON); THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN THE DEEDS AND MAPS/PLATS AS SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS BETTER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED; AND THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXEMPTION OR EXCEPTION TO THE DEFINITION OF SUBDIVISION, G.S. 47-30 (f.)(11.)(d.).

THAT THE GPS SURVEY MADE WAS UNDER MY SUPERVISION USING GPS FOR SETTING CONTROL ONLY.

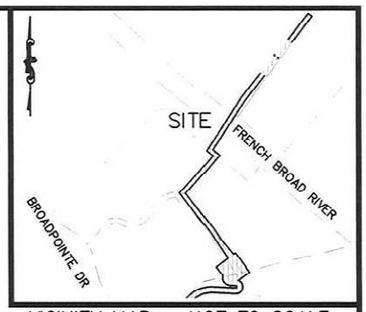
CLASS OF SURVEY:	A
POSITIONAL ACCURACY:	0.03' @ 95%
TYPE OF GPS FIELD PROCEDURE:	NC RTK
DATES OF SURVEY:	FEBRUARY 7TH-14TH, 2024
DATUM/EPOCH:	NAD 83(2011)
PUBLISHED/FIXED-CONTROL USED:	NGS "BOYLESTON" & "BANNING"
GEOID MODEL:	18 (CONUS)
COMBINED GRID FACTOR:	0.9997840368
UNITS:	US SURVEY FEET

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL

THIS 5th DAY OF May, 2025.

TIMOTHY A. BROWN
PROFESSIONAL LAND SURVEYOR L-5369

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

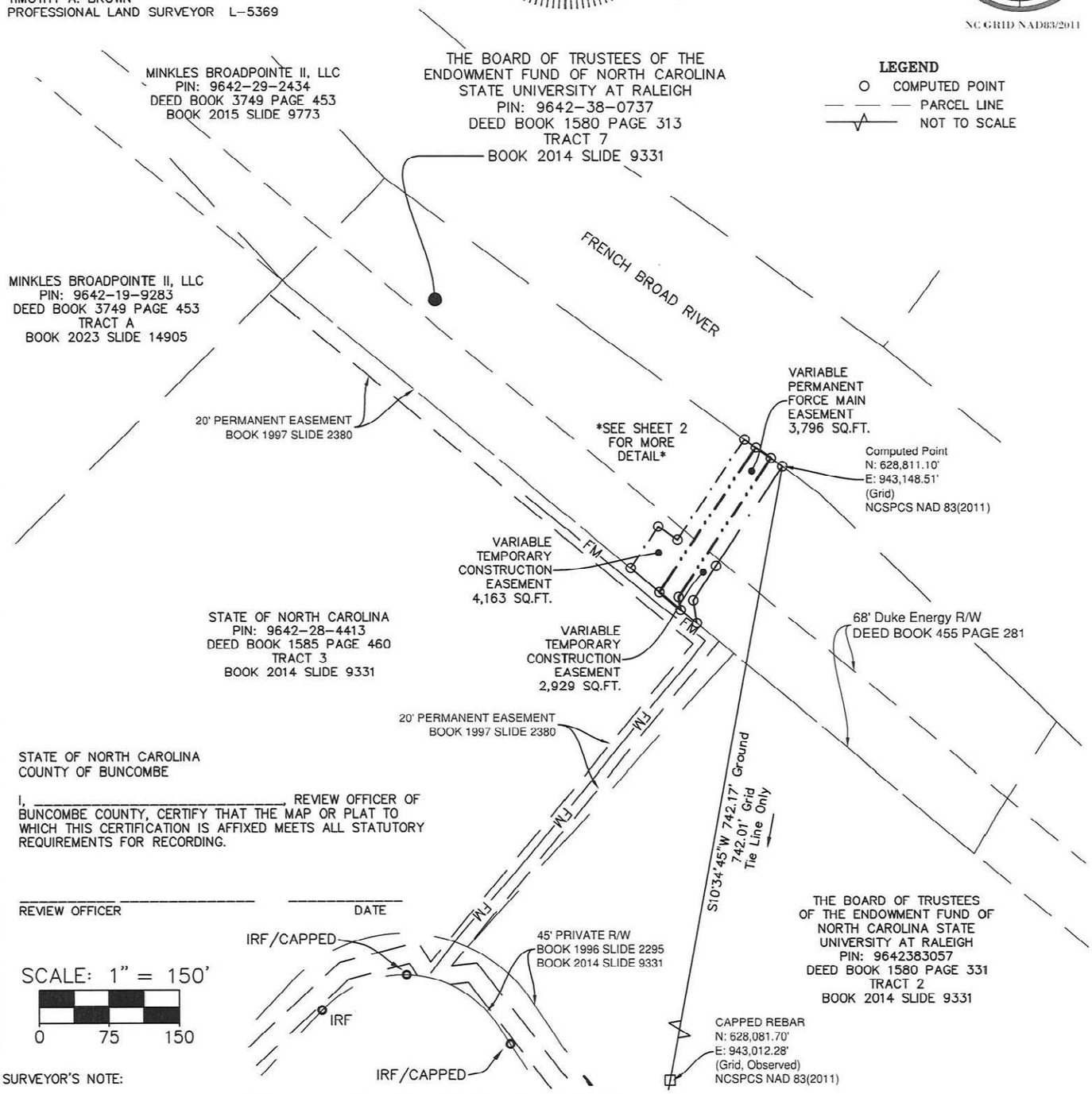


VICINITY MAP - NOT TO SCALE



NC GRID NAD83/2011

LEGEND
O COMPUTED POINT
PARCEL LINE
NOT TO SCALE



STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____, REVIEW OFFICER OF BUNCOMBE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

_____ _____
REVIEW OFFICER DATE

SCALE: 1" = 150'
0 75 150

SURVEYOR'S NOTE:

1. ALL DISTANCES ARE HORIZONTAL GROUND IN U.S. SURVEY FEET UNLESS OTHERWISE SHOWN.
2. BEARINGS BASED ON NORTH CAROLINA GRID, NAD 83/2011. NO CORNERS SET UNLESS OTHERWISE NOTED. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
3. REFERENCES: DEED BOOK 1580 PAGE 313, AND PLAT BOOK 2014 SLIDE 9331 AS RECORDED IN THE HENDERSON COUNTY REGISTER OF DEEDS.
4. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
5. THE EXISTENCE OR NONEXISTENCE OF WETLANDS ON SUBJECT PROPERTY HAS NOT BEEN DETERMINED BY THIS SURVEY.
6. SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS, AND OR ENCUMBRANCES THAT MAY EFFECT THIS PROPERTY.
7. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT.
8. THIS SITE WAS LOCALIZED AT A CAPPED #5 REBAR HAVING NORTHING OF 628,081.70, EASTING OF 943,012.28 AND A COMBINED SCALE FACTOR OF 0.9997840368. COORDINATES SHOWN HEREON ARE GRID UNLESS OTHERWISE NOTED.
9. TOTAL AREA: PERMANENT FORCE MAIN EASEMENT: 3,796 SQ.FT., 0.09 ACRES (1,412 SQ.FT. IN 68' DUKE ENERGY R/W)
TEMPORARY CONSTRUCTION EASEMENT: 7,092 SQ.FT., 0.16 ACRES (3,516 SQ.FT. IN 68' DUKE ENERGY R/W)
10. THE PURPOSE OF THIS EASEMENT EXHIBIT IS TO SHOW NEW PERMANENT FORCE MAIN EASEMENT AND TEMPORARY CONSTRUCTION EASEMENT TO BE ACQUIRED AS SHOWN HEREON.

DATE	REVISION	BY

EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NC STATE UNIVERSITY AT RALEIGH
PARCEL 9642-38-0737
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PROJ. SVYR :	TAB
DRAWN BY :	GHL
SCALE :	1" = 150'
DATE :	05/05/2025
SHEET # :	1 of 2

McKIM&CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

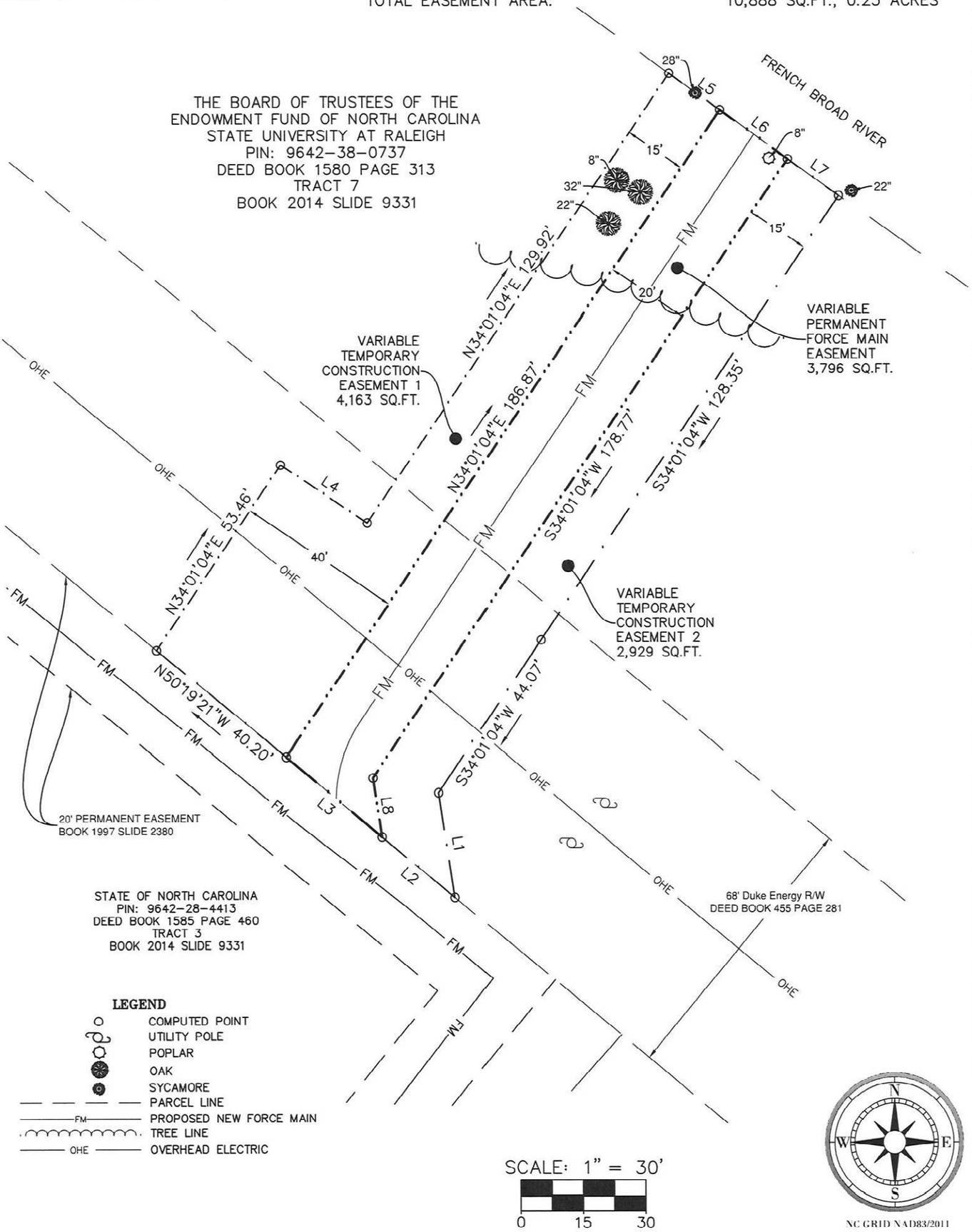
LINE TABLE		
LINE #	BEARING	LENGTH
L1	S08°46'24"E	25.23'
L2	N50°19'21"W	30.52'
L3	N50°19'21"W	29.78'
L4	S55°58'56"E	25.00'
L5	S54°10'47"E	15.01'
L6	S54°10'47"E	20.01'
L7	S54°10'47"E	15.01'
L8	S08°46'24"E	14.18'

NORTH CAROLINA PROFESSIONAL SEAL L-5369 LAND SURVEYOR TIMOTHY A. BROWN

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PROFESSIONAL LAND SURVEYOR L-5369

AREA TABLE

PERMANENT FORCE MAIN EASEMENT:	3,796 SQ.FT., 0.09 ACRES
TEMPORARY CONSTRUCTION EASEMENT 1:	4,163 SQ.FT., 0.10 ACRES
TEMPORARY CONSTRUCTION EASEMENT 2:	2,929 SQ.FT., 0.06 ACRES
TOTAL EASEMENT AREA:	10,888 SQ.FT., 0.25 ACRES



EASEMENT EXHIBIT
MSD PROJECT #2020061
ITT PUMP STATION REPLACEMENT
EASEMENT ACROSS THE PROPERTY OF
OWNER: THE BOARD OF TRUSTEES OF THE ENDOWMENT FUND OF NC STATE UNIVERSITY AT RALEIGH
PARCEL 9642-38-0737
TOWN OF MILLS RIVER, HENDERSON COUNTY, NORTH CAROLINA

PROJECT # :	09596-0001
PROJ. SVYR :	TAB
DRAWN BY :	GHL
SCALE :	1" = 30'
DATE :	05/05/2025
SHEET # :	2 of 2

McKIM & CREED
8020 Tower Point Drive
Charlotte, North Carolina 28227
Phone: (704) 841-2588, Fax: (704) 841-2567
NC License# F-1222
Internet Site: http://www.mckimcreed.com

SPECIAL PROVISIONS DETAIL SHEET

April 10, 2026

Project:	I.T.T. Pump Station Replacement MSD of Buncombe County Project #2020061
Agent:	Wesley G. Banner
Parcel Number:	9642-38-3057 & 9642-38-0737
Owner:	Board of Trustees of The Endowment Fund of North Carolina State University at Raleigh
Phone:	(828) 808-5185 (Tom Hoyt) Mountain Horticulture Crops & Research Center
Owner Email:	Tom_Hoyt@ncsu.edu
Site Address:	00000 Fanning Bridge Road, Fletcher, NC 28732
Mailing Address:	Campus Box 7501, Raleigh, NC 27695
Engineer Approval:	

1. The MSD Inspector shall contact Tom Hoyt with Mountain Horticulture Crops Research & Extension Center (Mailing Address: 455 Research Drive, Mills River, NC 28759) at (828) 808-5185 least two weeks prior to any work being performed on the property (excepting emergencies) to give owner advance notice of when work will begin. The same notice requirements shall be made to Sierra Everhart with NCSU Real Estate Services (E-Mail Address: saeverh2@ncsu.edu) or at (919) 513-0470. Additionally periodic updates shall be provided to both contacts above throughout the project until final restoration is completed.

2. MSD's Contractor shall not be working on or accessing the subject parcel between April 15 to October 15 since this is their planting & harvest season. The contactor should plan on their work occurring between November 1-March 31 on this parcel.

Miscellaneous Permits

NCDEQ Fast Track Permit

Docusign Envelope ID: 17826726-1947-4C66-B0B4-95CF2E1CFF63

JOSH STEIN
Governor
D. REID WILSON
Secretary
RICHARD E. ROGERS, JR.
Director

NORTH CAROLINA
Environmental Quality

SENT VIA ELECTRONIC MAIL ONLY: NO HARD COPY WILL BE MAILED.

February 12, 2025

Thomas Hartye, General Manager
Metropolitan Sewerage District of Buncombe County
E-mail: thartye@msdbc.org

Subject: Permit No. WQ0046149
Metropolitan Sewerage District of Buncombe County
ITT Pump Station Replacement
Wastewater Collection System Extension Permit
Buncombe County

Dear Mr. Hartye:

In accordance with your application received February 4, 2025, and additional information received on February 12, 2025, we are forwarding herewith Permit No. WQ0046149 dated February 12, 2025, to the Metropolitan Sewerage District of Buncombe County (Permittee) for the construction and operation upon certification of the subject wastewater collection system extension. This permit shall be effective from the date of issuance until rescinded and shall be subject to the conditions and limitations as specified therein. This cover letter shall be considered a part of this permit and is therefore incorporated therein by reference.

Please pay particular attention to the following conditions contained within this permit:

Condition II.1: This permit shall not be automatically transferable; a request must be made and approved.

Condition II.4: Requires that the wastewater collection facilities be properly operated and maintained in accordance with 15A NCAC 02T .0403 or any individual system-wide collection system permit issued to the Permittee.

Condition II.7: Upon completion of construction and prior to operation of these permitted facilities, the completed Engineering Certification form with checklist attached to this permit shall be submitted with the required supporting documents to the address provided on the form. **Permit modifications are required for any changes resulting in non-compliance with this permit, regulations, or the Minimum Design Criteria.** [15A NCAC 02T.0116]

It shall be responsibility of the Permittee to ensure that the as-constructed project meets the appropriate design criteria and rules. Failure to comply may result in penalties in accordance with North Carolina

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General Statute §143-215.6A through §143-215.6C, construction of additional or replacement wastewater collection facilities, and/or referral of the North Carolina-licensed Professional Engineer to the licensing board.

If any parts, requirements, or limitations contained in this permit are unacceptable, you have the right to request an adjudicatory hearing upon written request within 30 days following receipt of this permit. This request must be in the form of a written petition, conforming to Chapter 150B of North Carolina General Statutes, and filed with the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, NC 27699-6714. Unless such demands are made, this permit shall be final and binding.

If you need additional information concerning this matter, please contact Mikal Willmer at (828) 296-4686 or via e-mail at mikal.willmer@deq.nc.gov.

Sincerely,

DocuSigned by:
Dan Boss
E397192DABFB4FF...

Daniel Boss, Asst. Regional Supervisor
Water Quality Regional Operations Section
Asheville Regional Office
Division of Water Resources, NCDEQ

Ec: Manjiang Chen, Mckim & Creed (mchen@mckimcreed.com)
Samuel Gettleman, MSDBC (Sgettleman@msdbc.org)
Hunter Carson, MSDBC (hcarson@msdbc.org)
LF

Docusign Envelope ID: 17826726-1947-4C66-B0B4-95CF2E1CFF63

NORTH CAROLINA
Environmental Quality

WASTEWATER COLLECTION SYSTEM EXTENSION PERMIT

In accordance with the provisions of Article 21 of Chapter 143, General Statutes of North Carolina as amended, and other applicable Laws, Rules, and Regulations, permission is hereby granted to the

Metropolitan Sewerage District of Buncombe County
Buncombe County

for the construction and operation of a 1,390–gallon per minute pump station with duplex pumps, on-site audible and visual high water alarms, telemetry, and a permanent generator with automatic transfer switch; as well as approximately 2,750 linear feet of 16-inch force main to serve as upgrades as part of the ITT Pump Station Replacement project, and the discharge of zero additional gallons per day of collected domestic, commercial, industrial wastewater into the Metropolitan Sewerage District of Buncombe County's existing sewerage system, pursuant to the application received February 4, 2025, and additional information received on February 12, 2025 and in conformity with 15A NCAC 02T; the Division's Gravity Sewer Minimum Design Criteria adopted February 12, 1996 as applicable; the Division's Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains adopted June 1, 2000 as applicable; and other supporting data subsequently filed and approved by the Department of Environmental Quality and considered a part of this permit.

This permit shall be effective from the date of issuance until rescinded and shall be subject to the specified conditions and limitations contained therein.

DocuSigned by:
Dan Boss
E397192DABFB4FF...

Daniel Boss, Asst. Regional Supervisor
Water Quality Regional Operations Section
Asheville Regional Office
By Authority of The Environmental Management Commission

Permit Number: **WQ0046149**
Permit Issued: **February 12, 2025**

Docusign Envelope ID: 17826726-1947-4C66-B0B4-95CF2E1CFF63

SUPPLEMENT TO PERMIT COVER SHEET

Metropolitan Sewerage District of Buncombe County is hereby authorized to:

Construct, and then operate upon certification the aforementioned wastewater collection extension. The sewage and wastewater collected by this system shall be treated in the Metropolitan Sewerage District of Buncombe County's Wastewater Treatment Facility in accordance with Permit Number NC0024911

Permitting of this project does not constitute an acceptance of any part of the project that does not meet 15A NCAC 02T; the Division's Gravity Sewer Minimum Design Criteria adopted February 12, 1996 as applicable; and the Division's Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains adopted June 1, 2000 as applicable, unless specifically mentioned herein. Division approval is based on acceptance of the certification provided by a North Carolina-licensed Professional Engineer in the application. It shall be the Permittee's responsibility to ensure that the as-constructed project meets the appropriate design criteria and rules.

Construction and operation is contingent upon compliance with the Standard Conditions and any Special Conditions identified below.

I. SPECIAL CONDITIONS

1. No flow in excess of the quantity permitted herein, zero GPD, shall be made tributary to the subject sewer system until an application for permit modification for an increase in flow has been submitted to and approved by the Division. [15A NCAC 02T.0304(b)]

2. Each pump station shall be clearly and conspicuously posted using a weatherproof sign with a pump station identifying name/number, 24-Hour Emergency telephone number, and name of the owner/operator of the sewer system/pump station and instructions to call the number in the event of alarm activation or other emergency. Simplex pump stations or vacuum sewer pits serving a single-family residence may have a placard or sticker on the control panel in lieu of a sign. [15A NCAC 02T .0305(h)(2)]

II. STANDARD CONDITIONS

1. This permit shall not be transferable. In the event there is a desire for the wastewater collection facilities to change ownership, or there is a name change of the Permittee, a formal permit request shall be submitted to the Division accompanied by documentation from the parties involved, and other supporting materials as may be appropriate. The approval of this request shall be considered on its merits and may or may not be approved. [15A NCAC 02T.0116; G.S 143-215.1(d3)]

2. This permit shall become voidable unless the wastewater collection facilities are constructed in accordance with the conditions of this permit; 15A NCAC 02T; the Division's Gravity Sewer Minimum Design Criteria adopted February 12, 1996 as applicable; the Division's Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains adopted June 1, 2000 as applicable; and other supporting materials unless specifically mentioned herein. [15A NCAC 02T.0110]

3. This permit shall be effective only with respect to the nature and volume of wastes described in the application and other supporting data. [15A NCAC 02T .0110]

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4. The wastewater collection facilities shall be properly maintained and operated at all times. The Permittee shall maintain compliance with an individual system-wide collection system permit for the operation and maintenance of these facilities as required by 15A NCAC 02T .0403. If an individual permit is not required, the following performance criteria shall be met:

    a. The sewer system shall be effectively maintained and operated at all times to prevent discharge to land or surface waters, and to prevent any contravention of groundwater standards or surface water standards.

    b. A map of the sewer system shall be developed and shall be actively maintained.

    c. An operation and maintenance plan including pump station inspection frequency, preventative maintenance schedule, spare parts inventory and overflow response has been developed and implemented.

    d. Pump stations that are not connected to a telemetry system shall be inspected every day (i.e. 365 days per year). Pump stations that are connected to a telemetry system shall be inspected at least once per week.

    e. High-priority sewer lines shall be inspected at least once per every six-months and inspections are documented.

    f. A general observation of the entire sewer system shall be conducted at least once per year.

    g. Overflows and bypasses shall be reported to the appropriate Division regional office in accordance with 15A NCAC 2B .0506(a), and public notice shall be provided as required by North Carolina General Statute §143-215.1C.

    h. A Grease Control Program is in place as follows:

        1. For public owned collection systems, the Grease Control Program shall include at least biannual distribution of educational materials for both commercial and residential users and the legal means to require grease interceptors at existing establishments. The plan shall also include legal means for inspections of the grease interceptors, enforcement for violators and the legal means to control grease entering the system from other public and private satellite sewer systems.

        2. For privately owned collection systems, the Grease Control Program shall include at least bi-annual distribution of grease education materials to users of the collection system by the permittee or its representative.

        3. Grease education materials shall be distributed more often than required in Parts (1) and (2) of this Subparagraph if necessary to prevent grease-related sanitary sewer overflows.

    i. Right-of-ways and easements shall be maintained in the full easement width for personnel and equipment accessibility.

    j. Documentation shall be kept for Subparagraphs (a) through (i) of this Rule for a minimum of three years with exception of the map, which shall be maintained for the life of the system.

5. The Permittee shall report by telephone to a water resources staff member at the Asheville Regional Office, telephone number (828) 296-4500, as soon as possible, but in no case more than 24 hours, following the occurrence or first knowledge of the occurrence of either of the following:

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a. Any process unit failure, due to known or unknown reasons, that renders the facility incapable of adequate wastewater transport, such as mechanical or electrical failures of pumps, line blockage or breakage, etc.; or
b. Any SSO and/or spill over 1,000 gallons; or
c. Any SSO and/or spill, regardless of volume, that reaches surface water

Voice mail messages or faxed information is permissible, but this shall not be considered as the initial verbal report. Overflows and spills occurring outside normal business hours may also be reported to the Division of Emergency Management at telephone number (800) 858-0368 or (919) 733-3300. Persons reporting any of the above occurrences shall file a spill report by completing and submitting Part I of Form CS-SSO (or the most current Division approved form) within five days following first knowledge of the occurrence. This report must outline the actions taken or proposed to be taken to ensure that the problem does not recur. Part II of Form CS-SSO (or the most current Division approved form) can also be completed to show that the SSO was beyond control. [G.S. 143-215.1C(a1)]

6. Construction of the gravity sewers, pump stations, and force mains shall be scheduled so as not to interrupt service by the existing utilities nor result in an overflow or bypass discharge of wastewater to the surface waters of the State. [15A NCAC 02T.0108(b)]

7. Upon completion of construction and prior to operation of these permitted facilities, the completed Engineering Certification form with checklist attached to this permit shall be submitted with the required supporting documents to the address provided on the form. A complete certification is one where the form is fully executed and the supporting documents are provided as applicable. Any wastewater flow made tributary to the wastewater collection system extension prior to completion of this Engineer's Certification shall be considered a violation of the permit and shall subject the Permittee to appropriate enforcement actions.

If the permit is issued to a private entity with an Operational Agreement, then a copy of the Articles of Incorporation, Declarations/Covenants/Restrictions, and Bylaws that have been appropriately filed with the applicable County's Register of Deeds office shall be submitted with the certification.

A complete certification is one where the form is fully executed and the supporting documents are provided as applicable. Supporting documentation shall include the following:

a. One copy of the project construction record drawings (plan & profile views of sewer lines & force mains) of the wastewater collection system extension. Final record drawings should be clear on the plans and are defined as the design drawings that are marked up or annotated with after construction information and show required buffers, separation distances, material changes, etc.

b. One copy of the supporting applicable design calculations including pipe and pump sizing, velocity, pump cycle times, and level control settings, pump station buoyancy, wet well storage, surge protection, detention time in the wet well, and force main, ability to flush low points in force mains with a pump cycle, and downstream sewer capacity analysis. If a portable power source or pump is dedicated to multiple stations, an evaluation of all the pump stations' storage capacities and the rotation schedule of the portable power source or pump, include travel timeframes, shall be provided.

c. Changes to the project that do not result in non-compliance with this permit, regulations, or the Minimum Design Criteria should be clearly identified on the record drawings, on the certification in the space provided, or in written summary form.

Docusign Envelope ID: 17826726-1947-4C66-B0B4-95CF2E1CFF63

Prior to Certification (Final or Partial): Permit modifications are required for any changes resulting in non-compliance with this permit (including but not limited to pipe length changes of 10% or greater, increased flow, pump station design capacity design increases of 5% or greater, and increases in the number/type of connections), regulations, or the Minimum Design Criteria. Requested modifications or variances to the Minimum Design Criteria will be reviewed on a case-by-case basis and each on its own merit. Please note that variances to the Minimum Design Criteria should be requested and approved during the permitting process prior to construction. After-construction requests are discouraged by the Division and may not be approved, thus requiring replacement or repair prior to certification & activation. [15A NCAC 02T .0116]

8. Gravity sewers installed greater than ten percent below the minimum required slope per the Division's Gravity Sewer Minimum Design Criteria shall not be acceptable and shall not be certified until corrected. If there is an unforeseen obstacle in the field where all viable solutions have been examined, a slope variance can be requested from the Division with firm supporting documentation. This shall be done through a permit modification with fee. Such variance requests will be evaluated on a case-by-case basis. Resolution of such request shall be evident prior to completing and submitting the construction certification. [15A NCAC 02T.0105(n)]

9. A copy of the individual permit and construction record drawings shall be maintained on file by the Permittee for the life of the wastewater collection facilities. [15A NCAC 02T .0116]

10. Failure to abide by the conditions and limitations contained in this permit; 15A NCAC 02T; the Division's Gravity Sewer Design Criteria adopted February 12, 1996 as applicable; the Division's Minimum Design Criteria for the Fast-Track Permitting of Pump Station and Force Mains adopted June 1, 2000 as applicable; and other supporting materials may subject the Permittee to an enforcement action by the Division, in accordance with North Carolina General Statutes §143-215.6A through §143-215.6C, construction of additional or replacement wastewater collection facilities, and/or referral of the North Carolina-licensed Professional Engineer to the licensing board. [15A NCAC 02T .0108(b-c)]

11. In the event that the wastewater collection facilities fail to perform satisfactorily, including the creation of nuisance conditions, the Permittee shall take immediate corrective action, including those as may be required by this Division, such as the construction of additional or replacement facilities. [15A NCAC 02T .0110; 15A NCAC 02T .0108(b)]

12. The issuance of this permit shall not exempt the Permittee from complying with any and all statutes, rules, regulations, or ordinances that may be imposed by the Division any other Federal, State, or Local government agencies which have jurisdiction or obtaining other permits which maybe required by the Division or any other Federal, State, of Local government agencies. [G.S. 143-215.1(b)]

Docusign Envelope ID: 17826726-1947-4C66-B0B4-95CF2E1CFF63

CERTIFICATION CHECKLIST

To be completed by the certifying engineer prior to operation of the permitted sewers, per 15A NCAC 02T.0116.

Certifying Engineer: _____

Certification Review Date: _____

Project Name: _____

WQ00_____ Project County: _____

1) Has permittee information changed since the permit was issued (or last modified): change of mailing address, change of ownership, transfer from developer to HOA/POA, etc. ☐ Yes ☐ No

   - If yes, please provide either a change of ownership form or new contact information. Note that transfer of permits from the developer to the HOA/POA must occur with the first certification.

2) Have the as-built drawings have been signed, sealed, and dated by an N.C. PE? ☐ Yes ☐ No

3) Final Engineering certification? ☐ Yes ☐ No

   - **If Partial Engineering certification, provide detailed narrative including what is being certified in the current phase, what was previously certified (if applicable), and what is left to be certified.**

4) Adequate information related to sewer lines: ☐ Yes ☐ No ☐ N/A

   - Three feet minimum cover has been provided for all sewers unless ferrous pipe was installed.
   - Minimum diameters for gravity sewers are 8-inches for public lines and 6-inches for private lines.
   - Manholes have been installed: At the end of each line, at all changes in grade, size, or alignment, at all intersections, and at distances not greater than 425 feet; minimum diameter shall be 4 feet (48-inches).

5) Adequate information related to pump stations: ☐ Yes ☐ No ☐ N/A

   - Ensure power reliability option was selected per 15A NCAC 02T.0305(h).

6) Was project construction completed in accordance with all of the following: ☐ Yes ☐ No ☐ N/A

   - 15A NCAC 02T, Minimum Design Criteria (MDC) for the permitting of Gravity Sewers (latest version), and MDC for the Permitting of Pump Stations and Force Mains (latest version)?

If not, a variance approval is required in accordance with 15A NCAC 02T.0105(b), **prior to certification and operation.**

   - Contact the Central Office to discuss the variance to determine a course of action.
   - Applicant must submit two copies of the variance request form, plans, specifications, calculations, and any other pertinent information to the Central Office (one hard copy, one digital copy).
   - The central office will review the variance request, and if approvable, specific language regarding the variance will be incorporated into the permit, either via a special condition or a supplementary letter. A copy of the reissued permit with variance language or the variance letter must be maintained with the original documents.

7) Does the project contains high priority lines (15A NCAC 02T .0402(2))? ☐ Yes ☐ No

   - If yes, ensure that the permit already contains the necessary condition related to high priority lines 15A NCAC 02T.0403 (a)(5). If the permit does not include this language, the Fast Track reviewer will reissue the permit with the appropriate language.

8) Are Permit modifications are required for any changes resulting in non-compliance with this permit (including but not limited to pipe length changes of 10% or greater, change in flow, pump station design capacity design change of 5% or greater, and/or change in the number/type of connections)? ☐ Yes ☐ No

   - If yes, a permit modification request must be submitted to the appropriate Regional Office, and **a modified permit with revised certification must be issued prior to certification and operation**.

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FAST TRACK SEWER ENGINEERING CERTIFICATION

PERMITTEE: Metropolitan Sewerage District of Buncombe County
PERMIT #: WQ0046149
PROJECT: ITT Pump Station Replacement
ISSUE DATE: February 12, 2025

This project shall not be considered complete nor allowed to operate in accordance with Condition 7 of this permit until the Division has received this Certification and all required supporting documentation. It should be submitted in a manner that documents the Division's receipt. Send the required documentation the Regional Supervisor, Water Quality Regional Operations Section at the address at the bottom.

Any wastewater flow made tributary to the wastewater collection system extension prior to completion of this Certification shall be considered a violation of the permit and shall subject the Permittee to appropriate enforcement actions. The Permittee is responsible for tracking all partial certifications up until a final certification is received. A Final Certification shall be a complete set of record drawings and design calculations regardless of whether partials have been submitted.

PERMITTEE'S CERTIFICATION

I, the undersigned agent for the Permittee, hereby state that this project has been constructed pursuant to the applicable standards & requirements, the Professional Engineer below has provided applicable design/construction information to the Permittee, and the Permittee is prepared to operate & maintain the wastewater collection system permitted herein or portions thereof.

_____ _____ _____
Printed Name, Title Signature Date

ENGINEER'S CERTIFICATION

I, _____, as a duly registered Professional Engineer in the State of North Carolina, having been authorized to observe (☐ periodically, ☐ weekly, ☐ full time) the construction of the project name and location as referenced above for the above Permittee hereby state that, to the best of my abilities, due care and diligence was used in the observation of the following construction:

1,390–gallon per minute pump station with duplex pumps, on-site audible and visual high water alarms, telemetry, and a permanent generator with automatic transfer switch; as well as approximately 2,750 linear feet of 16-inch force main to serve as upgrades as part of the ITT Pump Station Replacement project, and the discharge of zero additional gallons per day of collected domestic, commercial, industrial wastewater into the Metropolitan Sewerage District of Buncombe County's existing sewerage system

; such that the construction was observed to be built within substantial compliance of this permit; 15A NCAC 02T; the Division of Water Resources' (Division) Gravity Sewer Minimum Design Criteria adopted February 12, 1996 as applicable; the Division's Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains adopted June 1, 2000 as applicable; and other supporting materials.

North Carolina Professional Engineer's Seal w/signature & date:

☐ **Final** ☐ **Partial (include description)**

Certification Comments/Qualifiers (attach if necessary):

Miscellaneous Permits

US Army Corps of Engineers Nationwide Permit

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ASHEVILLE DISTRICT
ASHEVILLE REGULATORY FIELD OFFICE
151 PATTON AVENUE SUITE 208
ASHEVILLE NC 28801

April 3, 2025

Regulatory Division
SAW-2023-01929

Sent Via email: ShaunA@msdbc.org

Shaun Armistead
Metropolitan Sewerage District of Buncombe County
2028 Riverside Drive
Asheville, NC 28804

Dear Mr./Ms. Armistead:

This letter is in response to the Pre-Construction Notification (PCN) you submitted to the Asheville District, Asheville Regulatory Field Office on January 15, 2025, for a Department of the Army Nationwide permit (NWP) verification. This project has been assigned the file number SAW-2023-01929 and is known as MSD ITT Pump Station Replacement. This file number should be referenced in all correspondence concerning this project.

A review of the information provided indicates that the proposed work would include the installation of a new sewer line and pump station, including 0.009 acres of wetland fill, 22 linear feet of temporary open cut trenching in McDowell Creek, and a directional bore below the French Broad River. The project area for this determination includes a 4 acre(s) area which is illustrated on the enclosed site plans/maps. The project/review area is located in McDowell Creek and adjacent wetlands and below the French Broad River; at Broadpointe Drive, at Latitude 35.424780 and Longitude -82.548410; in Mills River, Henderson County, North Carolina.

We have determined that the proposed work is authorized by **Nationwide Permit 58—Utility Line Activities for Water and Other Substances** pursuant to authorities under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. § 403) and Section 404 of the Clean Water Act (33 U.S.C § 1344). The proposed work must be accomplished in strict accordance with the general permit conditions, any regional conditions, the special conditions listed in this letter, the application materials, and the enclosed plans. If the extent of the project area and/or nature of the authorized impacts to waters are modified, a revised PCN must be submitted to this office for written approval before work is initiated. Any violation of permit conditions or deviation from your submitted plans may subject the permittee to enforcement action.

This verification is valid until **March 14, 2026**, unless prior to this date the subject NWP(s) is suspended, revoked, or is modified such that the activity no longer complies with the terms and conditions of this NWP. If you commence or are under contract to commence this activity before the date that the relevant NWP is modified or revoked, you will have 12 months from the date of the modification or revocation of the NWP to complete the activity under the present terms and conditions of this NWP.

Project Specific Special Conditions:

1. Hydraulic Fracturing (Fracking): When directional boring or horizontal directional drilling (HDD) under waters of the United States, including wetlands, the Permittee shall closely monitor the project for hydraulic fracturing or "fracking" and material from the drilling operation leaching to the surface and into jurisdictional areas. Any discharge from fracking or leaching into waters of the United States, including wetlands, shall be reported to U.S. Army Corps of Engineers, Wilmington District, Asheville Regulatory Field Office, Attn: Joey Winston at 828-271-7980 ext. 4233, or joseph.b.winston@usace.army.mil within 48 hours. Restoration and/or mitigation may be required as a result of any unintended discharges.

2. Navigable Rivers and Streams without Maintained Channel: Pipelines placed beneath navigable rivers and streams that do not have a maintained channel shall be placed 10 feet below the thalweg depth of the river or stream. Pipelines shall be placed at the greatest depth which meets the above requirements over the entire channel bottom width plus a distance 12.5 feet on each side of the stream channel measured from the ordinary high water mark (OHWM) of the stream or river.

Activities subject to Section 404 (as indicated above) may also require an individual Section 401 Water Quality Certification. You should contact the NC Division of Water Resources (telephone 828-296-4500) to determine Section 401 requirements.

This NWP verification does not preclude the necessity to obtain any other Federal, State, or local permits, licenses, and/or certifications, which may be required.

If you have any questions related to this verification or have issues accessing documents referenced in this letter, please contact Joey Winston, Regulatory Specialist of the Asheville Regulatory Field Office at (828)271-7980 x4233, by mail at the above address, or by email at joseph.b.winston@usace.army.mil. Please take a moment to complete our customer satisfaction survey located at https://regulatory.ops.usace.army.mil/customer-service-survey/.

Sincerely,



Joey Winston
Regulatory Specialist

Enclosures

Cc (w/enclosures)
Emily Tarsa, ClearWater Environmental Consultants, Inc. (via etarsa@enviroscienceinc.com)

U.S. Army Corps of Engineers (USACE)

CERTIFICATION OF COMPLIANCE WITH DEPARTMENT OF THE ARMY PERMIT

For use of this form, see Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act of 1899, and Section 103 of the Marine Protection, Research, and Sanctuaries Act; the proponent agency is CECW-COR.

Form Approved - OMB No. 0710-0003 Expires 2027-10-31

The Agency Disclosure Notice (ADN)

The Public reporting burden for this collection of information, 0710-0003, is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PURPOSE: This form is used by recipients of U.S. Army Corps of Engineer Regulatory permits to certify compliance with the permit terms and conditions.

Your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification, or revocation.

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the U.S. Army Corps of Engineers, Asheville District, Regulatory Office.

The certification can be submitted by email at joseph.b.winston @usace.army.mil or by mail at the below address:

U.S. Army Corps of Engineers
Asheville Regulatory Field Office
Street Address: 151 Patton Avenue
City: Asheville State: North Carolina Zip Code: 28801

COMPLETED BY THE CORPS

Corps Action Number: SAW-2023-01929

Permit Type: General Permit

General Permit Number and Name (*if applicable*):

Name of Permittee: Shaun Armistead

Project Name: MSD ITT Pump Station Replacement

Project Location (*physical address*): Broadpointe Drive
Mills River, North Carolina

PERMITTEE'S CERTIFICATION

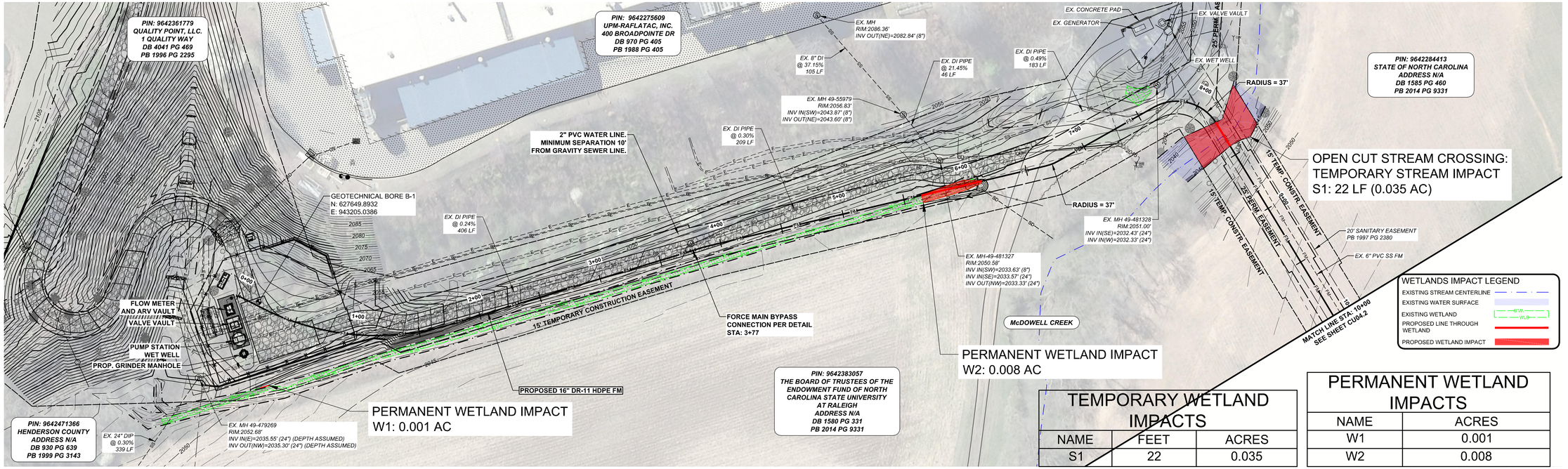
Date Work Started: _____

Date Work Completed: _____

Enclose photographs showing the completed project (*if available*).

I _____ hereby certify that the work authorized by the above referenced permit has been completed in accordance with all of the permit terms and conditions, and that any required compensatory mitigation has been completed in accordance with the permit conditions.

Name	Date	Signature



PLAN VIEW

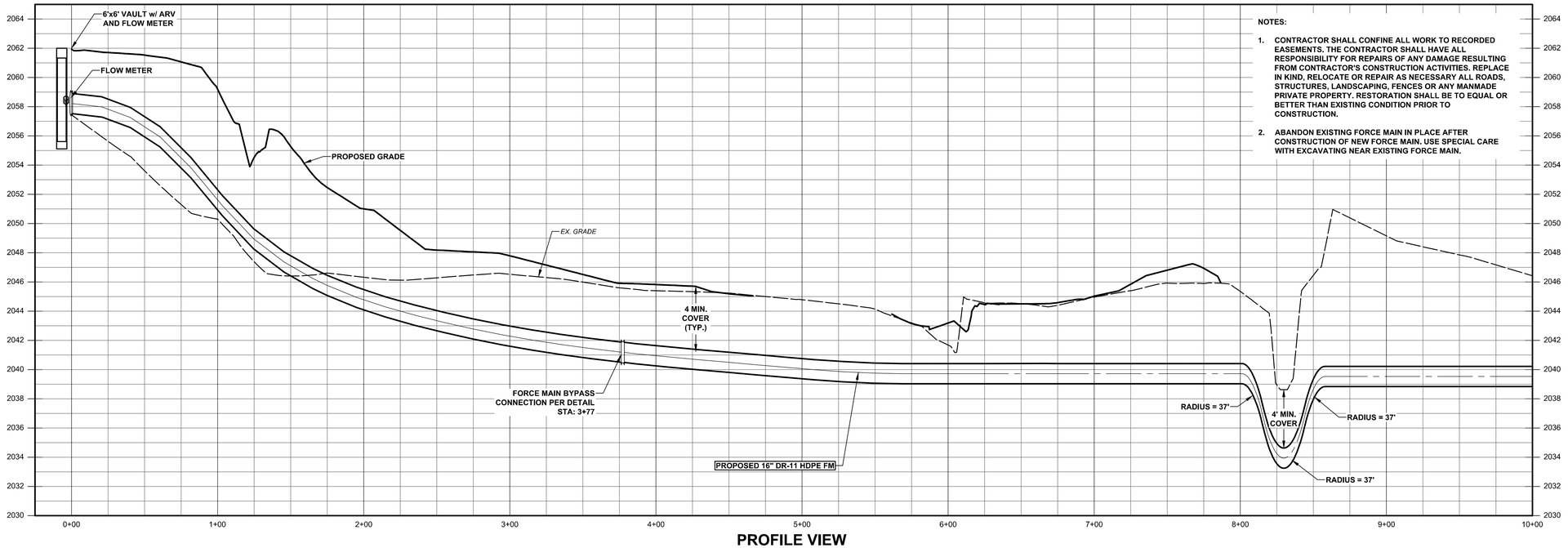
HORIZ. SCALE: 1"=40'

TEMPORARY WETLAND IMPACTS

NAME	FEET	ACRES
S1	22	0.035

PERMANENT WETLAND IMPACTS

NAME	ACRES
W1	0.001
W2	0.008



NOTES:

1. CONTRACTOR SHALL CONFINE ALL WORK TO RECORDED EASEMENTS. THE CONTRACTOR SHALL HAVE ALL RESPONSIBILITY FOR REPAIRS OF ANY DAMAGE RESULTING FROM CONTRACTOR'S CONSTRUCTION ACTIVITIES. REPLACE IN KIND, RELOCATE OR REPAIR AS NECESSARY ALL ROADS, STRUCTURES, LANDSCAPING, FENCES OR ANY MANMADE PRIVATE PROPERTY. RESTORATION SHALL BE TO EQUAL OR BETTER THAN EXISTING CONDITION PRIOR TO CONSTRUCTION.
2. ABANDON EXISTING FORCE MAIN IN PLACE AFTER CONSTRUCTION OF NEW FORCE MAIN. USE SPECIAL CARE WITH EXCAVATING NEAR EXISTING FORCE MAIN.

PROFILE VIEW

HORIZ. SCALE: 1"=40'
VERT. SCALE: 1"=4'

4' 0' 4' 8'
SCALE: 1"=4' (Vert.)

REV.NO.	DESCRIPTION	DATE
B	60% DESIGN - NOT FOR CONSTRUCTION	22 JULY 2024
A	30% DESIGN - NOT FOR CONSTRUCTION	6 MAY 2024

REVISIONS

McKIM&CREED
51 Thompson Street, Suite D
Asheville, North Carolina 28803
Phone: (828) 252-8181, Fax: (828) 252-8857
NC License# F-1222
www.mckimcreed.com

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

ITT PUMP STATION REPLACEMENT

CIVIL

FORCE MAIN PLAN AND PROFILE
STA. 0+00 - STA. 10+00

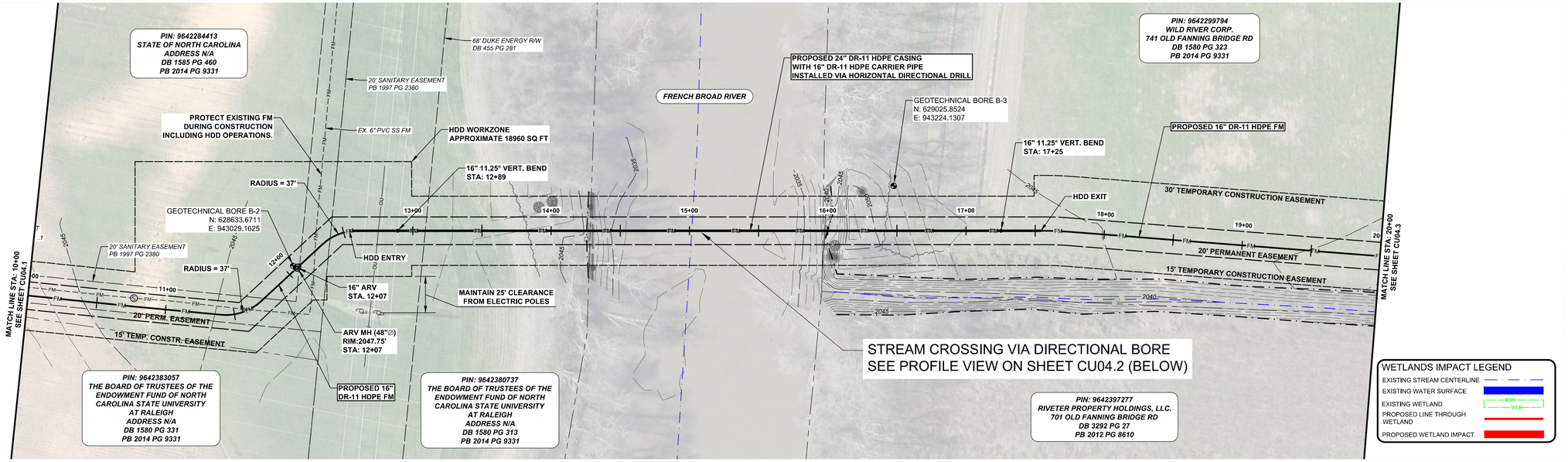
PROJ. START DATE:	2024 MAR
MDE PROJ. #	09596-0001
MSD PROJ. #	2020061
DRAWN	MN
DESIGNED	MW
CHECKED	MW
PROJ. MGR.	MC

SCALE
HORIZONTAL: 1"=40'
VERTICAL: 1"=4'

CU04.1
DRAWING NUMBER
C
REVISION

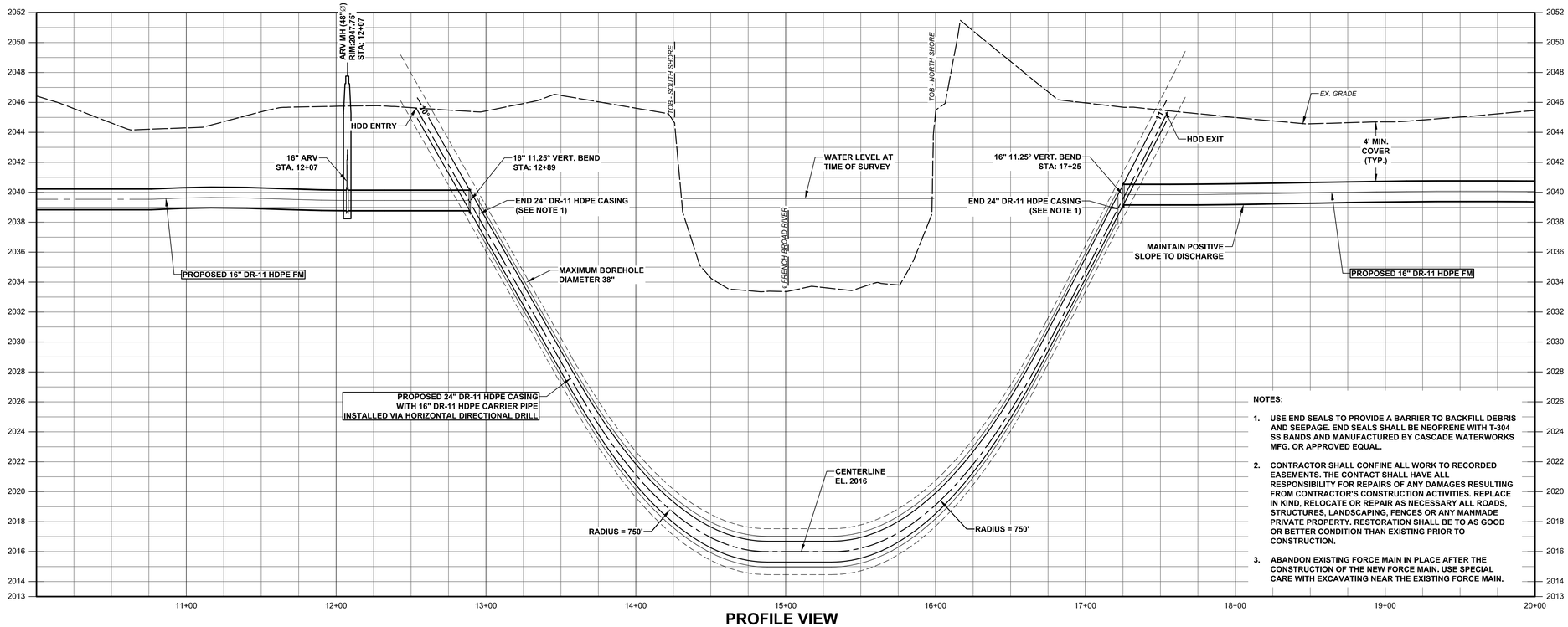
STATUS: 90% DESIGN
NOT FOR CONSTRUCTION

I:\09596\0001\ENG\80-DRAWINGS\CIVIL\CU04-095960001-FORCE MAIN.DWG 11/19/2024 10:05:30 MICHAEL WHITTENBURG



PLAN VIEW

HORIZ. SCALE: 1"=40'



PROFILE VIEW

HORIZ. SCALE: 1"=40'
VERT. SCALE: 1"=4'

NOTES:

1. USE END SEALS TO PROVIDE A BARRIER TO BACKFILL DEBRIS AND SEEPAGE. END SEALS SHALL BE NEOPRENE WITH T-304 SS BANDS AND MANUFACTURED BY CASCADE WATERWORKS MFG. OR APPROVED EQUAL.
2. CONTRACTOR SHALL CONFINE ALL WORK TO RECORDED EASEMENTS. THE CONTACT SHALL HAVE ALL RESPONSIBILITY FOR REPAIRS OF ANY DAMAGES RESULTING FROM CONTRACTOR'S CONSTRUCTION ACTIVITIES. REPLACE IN KIND, RELOCATE OR REPAIR AS NECESSARY ALL ROADS, STRUCTURES, LANDSCAPING, FENCES OR ANY MANMADE PRIVATE PROPERTY. RESTORATION SHALL BE TO AS GOOD OR BETTER CONDITION THAN EXISTING PRIOR TO CONSTRUCTION.
3. ABANDON EXISTING FORCE MAIN IN PLACE AFTER THE CONSTRUCTION OF THE NEW FORCE MAIN. USE SPECIAL CARE WITH EXCAVATING NEAR THE EXISTING FORCE MAIN.

4' 0' 4' 8'
SCALE: 1"=4' (Vert.)

REV.NO.	DESCRIPTION	DATE
B	60% DESIGN - NOT FOR CONSTRUCTION	22 JULY 2024
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www.mckimcreed.com

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

ITT PUMP STATION REPLACEMENT

CIVIL

FORCE MAIN PLAN AND PROFILE STA. 10+00 - 20+00

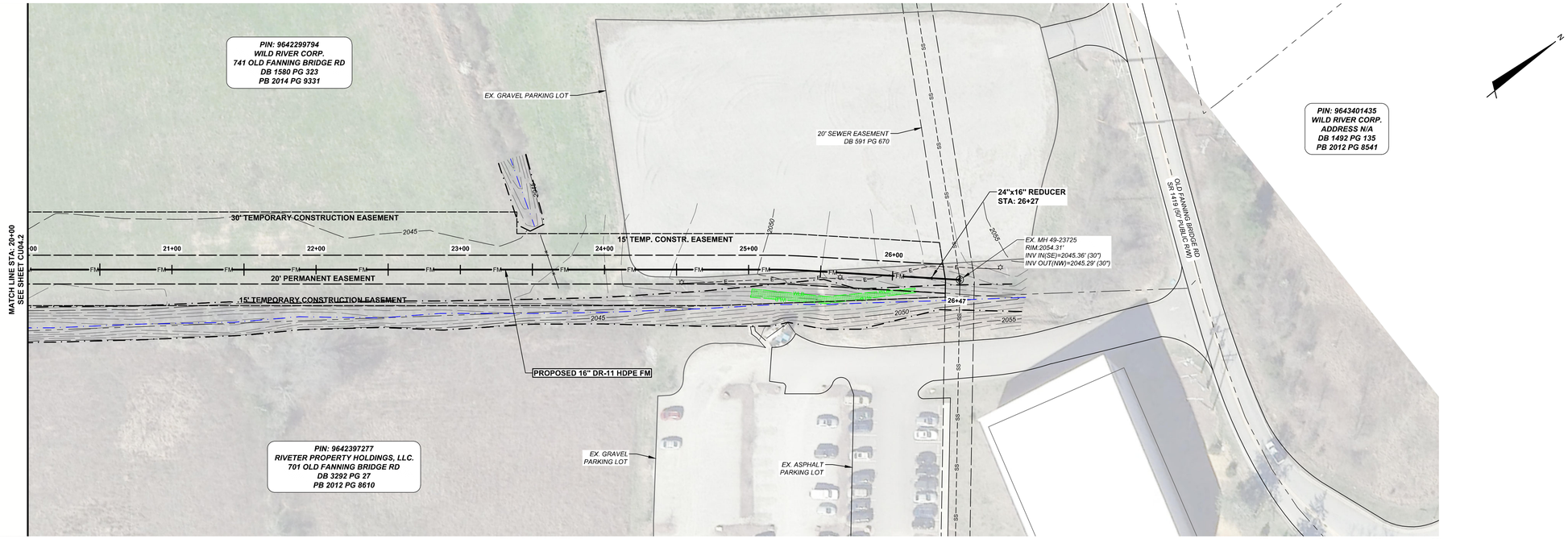
PROJ. START DATE:	2024 MAR
MCE PROJ. #	095960001
MSD PROJ. #	2020061
DRAWN	MN
DESIGNED	MW
CHECKED	MW
PROJ. MGR.	MC

SCALE
HORIZONTAL: 1"=40'
VERTICAL: 1"=4'

CU04.2
DRAWING NUMBER
C
REVISION

STATUS: 90% DESIGN NOT FOR CONSTRUCTION

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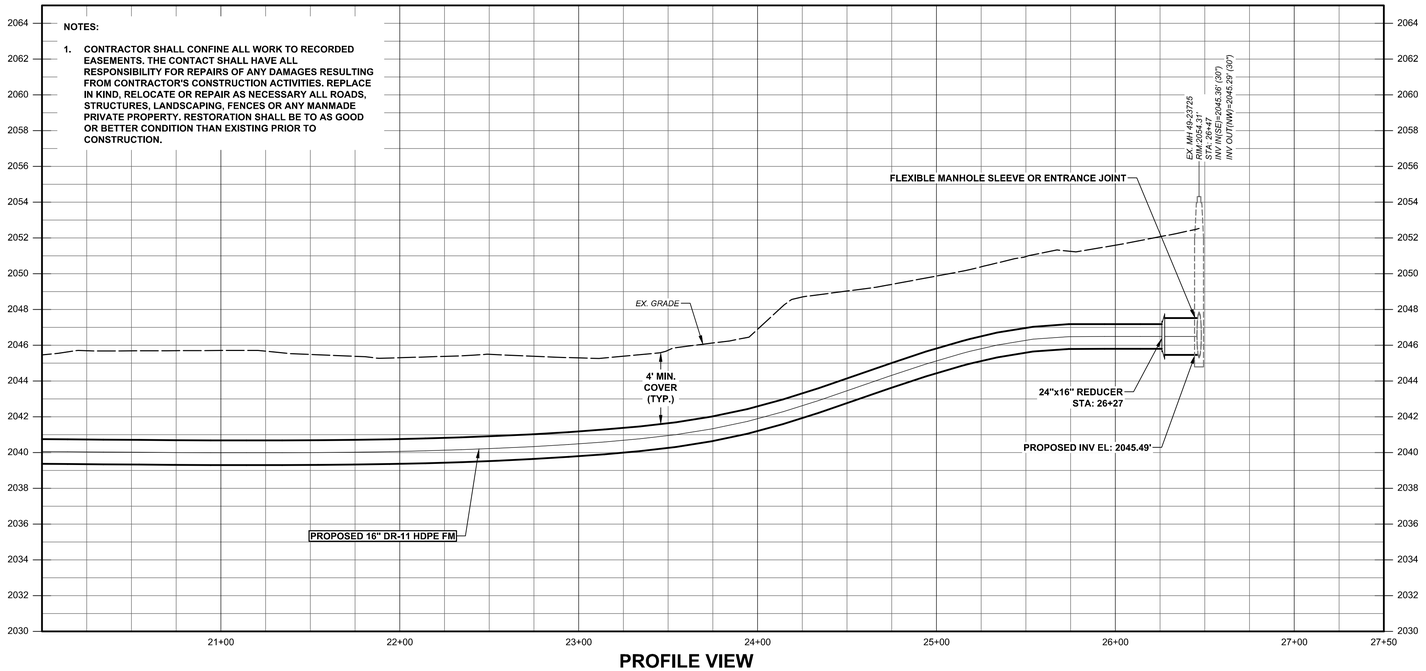


PLAN VIEW

HORIZ. SCALE: 1"=40'

WETLANDS IMPACT LEGEND

- EXISTING STREAM CENTERLINE
- EXISTING WATER SURFACE
- EXISTING WETLAND (WLB)
- PROPOSED LINE THROUGH WETLAND
- PROPOSED WETLAND IMPACT



PROFILE VIEW

HORIZ. SCALE: 1"=40'
VERT. SCALE: 1"=4'

REV.NO.	DESCRIPTION	DATE
B	60% DESIGN - NOT FOR CONSTRUCTION	22 JULY 2024
A	30% DESIGN - NOT FOR CONSTRUCTION	6 MAY 2024

REVISIONS

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www.mckimcreed.com

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

ITT PUMP STATION REPLACEMENT

CIVIL

FORCE MAIN PLAN AND PROFILE STA. 20+00 - STA. 26+48

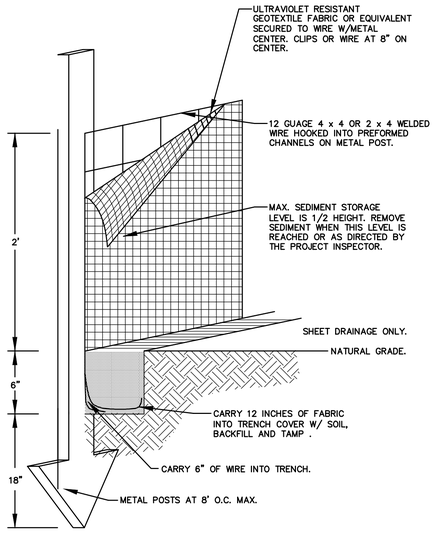
PROJ. START DATE:	2024 MAR
MDE PROJ. #	09596-0001
MSD PROJ. #	2020061
DRAWN	MN
DESIGNED	MW
CHECKED	MW
PROJ. MGR.	MC

SCALE
HORIZONTAL: 1"=40'
VERTICAL: 1"=4'

CU04.3
DRAWING NUMBER
C
REVISION

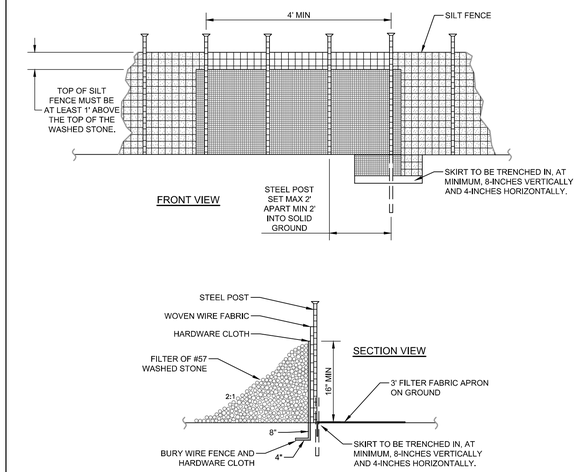
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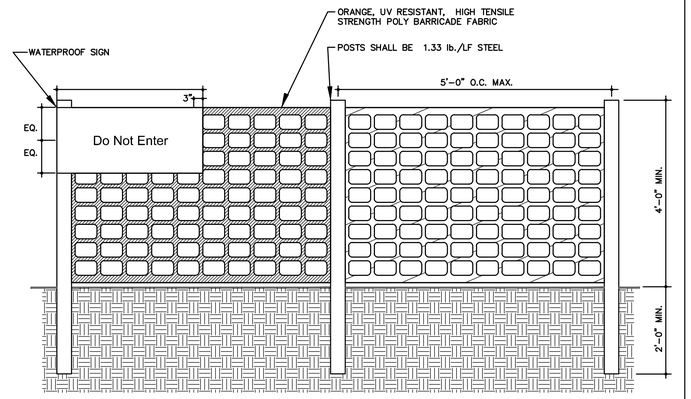
SILT FENCES SHOULD NOT BE USED AT PIPE OUTLETS OR IN AREAS OF CONCENTRATED FLOWS (CREEKS, DITCHLINES, SWALES ETC.).

EC-01 SILT FENCE DETAIL N.T.S.



MAINTENANCE:
1. REMOVE SEDIMENT WHEN HALF OF STONE OUTLET IS COVERED.
2. REPLACE STONE AS NEEDED TO ENSURE DEWATERING.

EC-02 SILT FENCE OUTLET N.T.S.

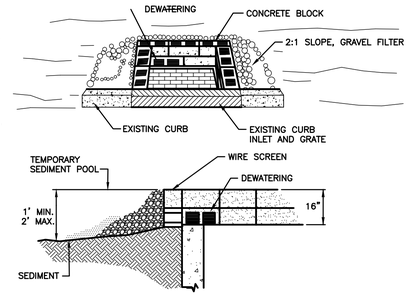


NOTES
–WARNING SIGNS TO BE MADE OF DURABLE, WEATHERPROOF MATERIAL
–LETTERS TO BE 3" HT. MIN., CLEARLY LEGIBLE AND SPACED AS DETAILED.
–ATTACH SIGNS SECURELY TO FENCE POSTS AND FABRIC.

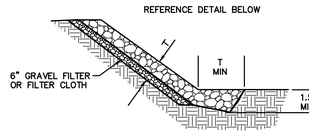
EC-03 TREE PROTECTION FENCE DETAIL N.T.S.

CONSTRUCTION SPECIFICATIONS

1. LAY ONE BLOCK ON EACH SIDE OF THE STRUCTURE ON ITS SIDE ON THE BOTTOM ROW TO ALLOW POOL DRAINAGE. THE FOUNDATION SHOULD BE EXCAVATED AT LEAST 2 INCH BELOW THE CREST OF THE STORM DRAIN. PLACE THE BOTTOM ROW OF THE BLOCK AGAINST THE EDGE OF THE STORM DRAIN FOR LATERAL SUPPORT AND TO AVOID WASHOUTS WHEN OVERFLOW OCCURS. IF NEEDED, GIVE LATERAL SUPPORT TO SUBSEQUENT ROWS BY PLACING 2x4 WOOD STUDS THROUGH BLOCK OPENINGS.
2. CAREFULLY FIT HARDWARE CLOTH OR COMPARABLE WIRE MESH WITH 1/2–INCH OPENING OVER ALL BLOCK OPENING TO HOLD GRAVEL IN PLACE.
3. USE CLEAN GRAVEL, 3/4–TO 1/2–INCH IN DIAMETER, PLACED 2 INCHES BELOW THE TOP OF THE BLOCK ON A 2:1 SLOPE OR FLATTER AND SMOOTH IT TO AN EVEN GRADE. DOT #57 WASHED STONE IS RECOMMENDED



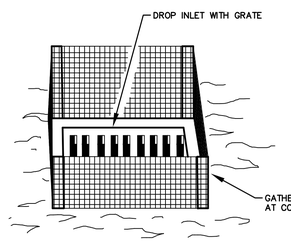
EC-06 GRAVEL FILTER INLET PROTECTION N.T.S.

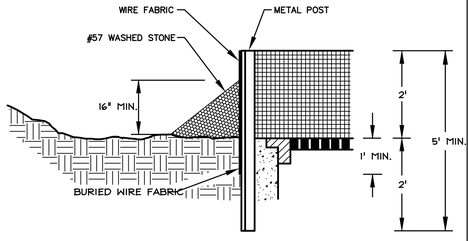


THE DIAMETER OF THE LARGEST STONE SHALL NOT EXCEED 1.5 TIMES THE SIZE OF THE RIP–RAP. (EX. 12" FOR 8") MINIMUM THICKNESS (T) SHOULD BE 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT IN NO CASE LESS THAN 6".

1. EACH RIP RAP PLACEMENT SHALL BE BEDDED IN EITHER A 6 INCH LAYER OF STABILIZATION STONE OR A TYPE II NON–BIODEGRADABLE FILTER FABRIC. PLACEMENT OF RIP–RAP SHALL IMMEDIATELY FOLLOW THE PLACEMENT OF THIS LAYER. KEEP VOIDS TO A MINIMUM AND FORM A DENSE WELL GRADED MASS OF STONE. DO NOT DISLODGE THE UNDERLYING BASE OF FILTER WHEN PLACING STONE. COST OF THE STONE BASE OR FILTER SHALL BE INCLUDED IN THE COST OF THE PLACING OF RIP–RAP.
2. MAXIMUM STONE SIZE WHEN USING 8 INCH D50 WILL BE 12 INCHES AND THE MINIMUM THICKNESS OF THE RIP–RAP LAYER SHALL BE 18 INCHES.
3. MAXIMUM SLOPE OF THE CHANNEL BANK SHALL NOT EXCEED 2.0 HORIZONTAL TO 1.0 VERTICAL. FINISHED GRADE OF THE RIP–RAP IS TO BLEND WITH THE SURROUNDING AREA.
4. INSPECT RIP–RAP PERIODICALLY FOR SCOUR OR DISLODGED STONES (ESPECIALLY AFTER SEVERE STORMS) AND WEED BRUSH GROWTH.

EC-08 RIP RAP PLACEMENT DETAIL N.T.S.

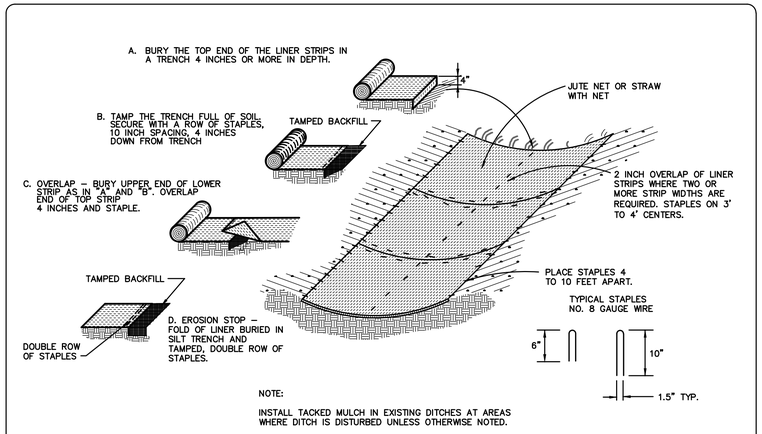




CONSTRUCTION SPECIFICATIONS

1. UNIFORMLY GRADE A SHALLOW DEPRESSION APPROACHING THE INLET.
2. DRIVE 5–FOOT STEEL POSTS 2 FEET INTO THE GROUND SURROUNDING THE INLET. SPACE POSTS EVENLY AROUND THE PERIMETER OF THE INLET, A MAXIMUM OF 4 FEET APART.
3. SURROUND THE POSTS WITH WIRE MESH HARDWARE CLOTH. SECURE THE WIRE MESH TO THE STEEL POSTS AT THE TOP, MIDDLE, AND BOTTOM. PLACING A 2–FOOT FLAP OF THE WIRE MESH UNDER THE GRAVEL FOR ANCHORING IS RECOMMENDED.
4. PLACE CLEAN GRAVEL (NC DOT #5 OR #57 STONE) ON A 2:1 SLOPE WITH A HEIGHT OF 16 INCHES AROUND THE WIRE, AND SMOOTH TO AN EVEN GRADE.
5. ONCE THE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED, REMOVE ACCUMULATED SEDIMENT, AND ESTABLISH FINAL GRADING ELEVATIONS.
6. COMPACT THE AREA PROPERLY AND STABILIZED IT WITH GROUNDCOVER.

EC-04 INLET PROTECTION (STAGE ONE) N.T.S.



NOTE:

INSTALL TACKED MULCH IN EXISTING DITCHES AT AREAS WHERE DITCH IS DISTURBED UNLESS OTHERWISE NOTED.

EC-07 MATTING DETAIL N.T.S.

SEEDING SCHEDULE FOR STABILIZATION GRASS

SHOULDERS, SIDE DITCHES, SLOPES (MAX. 3:1)

DATE	TYPE	PLANTING RATE
AUG. 15 - NOV. 1	TALL FESCUE	300 LBS/ACRE
NOV. 1 - MAR. 1	TALL FESCUE	300 LBS/ACRE
	& ABRUZZI RYE	25 LBS/ACRE
MAR. 1 - APR. 15	TALL FESCUE	300 LBS/ACRE
APR. 15 - JUN. 30	HULLED COMMON BERMUDAGRASS	25 LBS/ACRE
JUL. 1 - AUG. 15	TALL FESCUE AND	120 LBS/ACRE
	*** BROWNTOP MILLET	35 LBS/ACRE
	*** OR SORGHUM - SUDAN HYBRIDS	30 LBS/ACRE

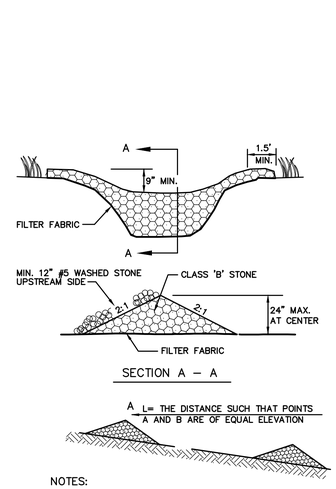
SHOULDERS, SIDE DITCHES, SLOPES (3:1 TO 2:1)

MAR. 1 - JUN. 1	SERICEA LESPEDEZA (SCARIFIED)	50 LBS/ACRE
	&	
(MAR. 1 - APR. 15)	ADD TALL FESCUE	120 LBS/ACRE
(MAR. 1 - JUN. 30)	OR ADD WEEPING LOVERGRASS	10 LBS/ACRE
(MAR. 1 - JUN. 30)	OR ADD HULLED COMMON BERMUDAGRASS	25 LBS/ACRE
JUN. 1 - SEP. 1	*** TALL FESCUE AND	120 LBS/ACRE
	*** BROWNTOP MILLET	35 LBS/ACRE
	*** OR SORGHUM - SUDAN HYBRIDS	30 LBS/ACRE
SEP. 1 - MAR. 1	SERICEA LESPEDEZA (UNHULLED - UNSCARIFIED)	70 LBS/ACRE
	AND TALL FESCUE	120 LBS/ACRE
NOV. 1 - MAR. 1	ADD ABRUZZI RYE	25 LBS/ACRE

CONSULT CONSERVATION ENGINEER OR SOIL CONSERVATION SERVICE FOR ADDITIONAL IN-FORMATION CONCERNING OTHER ALTERNATIVES FOR VEGETATION OF DENUDED AREAS. THE ABOVE VEGETATION RATES ARE THOSE WHICH DO WELL UNDER LOCAL CONDITIONS. OTHER SEEDING RATE COMBINATIONS ARE POSSIBLE.

*** TEMPORARY -- RESEED ACCORDING TO OPTIMUM SEASON FOR DESIRED PERMANENT VEGETATION. DO NOT ALLOW TEMPORARY COVER TO GROW OVER 12" IN HEIGHT BEFORE MOWING,OTHERWISE FESCUE MAY BE SHADED OUT.

EC-10 SEEDING SCHEDULE (GRASS) N.T.S.



SECTION A – A

NOTES:

(1) STONE SHOULD BE PLACED OVER THE CHANNEL BANKS TO KEEP WATER FROM CUTTING AROUND THE DAM.

(2) STONE CHECK DAMS SHOULD BE SPACED IN A CHANNEL SO THAT THE CREST OF THE DOWNSTREAM DAM IS AT THE SAME ELEVATION OF THE TOE OF UPSTREAM DAM.

EC-05 INLET PROTECTION N.T.S.

SEEDBED PREPARATION

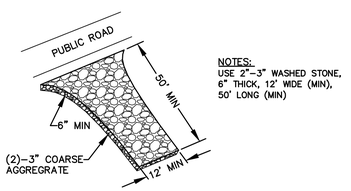
1. CHISEL COMPACTED AREAS AND SPREAD TOPSOIL 3 INCHES DEEP OVER ADVERSE SOIL CONDITIONS, IF AVAILABLE.
2. RIP THE ENTIRE AREA TO 6 INCHES DEPTH.
3. REMOVE ALL LOOSE ROCK, ROOTS, AND OTHER OBSTRUCTIONS LEAVING SURFACE REASONABLY SMOOTH AND UNIFORM.
4. APPLY AGRICULTURAL LIME, FERTILIZER, AND SUPERPHOSPHATE UNIFORMLY AND MIX WITH SOIL (SEE BELOW*).
5. CONTINUE TILLAGE UNTIL A WELL – PULVERIZED, FIRM, REASONABLY UNIFORM SEEDBED IS PREPARED 4 TO 6 INCHES DEEP.
6. SEED ON A FRESHLY PREPARED SEEDBED AND COVER SEED LIGHTLY WITH SEEDING EQUIPMENT OR CULTIPACK AFTER SEEDING.
7. MULCH IMMEDIATELY AFTER SEEDING AND ANCHOR MULCH.
8. INSPECT ALL SEEDED AREAS AND MAKE NECESSARY REPAIRS OR RESEEDINGS WITHIN THE PLANTING SEASON, IF POSSIBLE. IF STAND SHOULD BE OVER 60% DAMAGED REESTABLISHED FOLLOWING ORIGINAL LIME, FERTILIZER AND SEEDING RATES.
9. CONSULT CONSERVATION INSPECTOR ON MAINTENANCE TREATMENT AND FERTILIZATION AFTER PERMANENT COVER IS ESTABLISHED. * APPLY: AGRICULTURAL LIMESTONE – 2 TONS/ACRE OR 3 TONS/ACRE IN CLAY SOILS FERTILIZER – 1000 LBS/ACRE (10–10–10) SUPERPHOSPHATE – 500 LBS/ACRE (20%) MULCH – 2 TONS/ACRE (SMALL GRAIN STRAW) ANCHOR – ASPHALT EMULSION AT 450 GAL./ACRE

EC-11 SEEDBED PREPARATION N.T.S.

CONSTRUCTION SEQUENCE

1. INSTALL TEMPORARY SILT FENCING, CHECK DAMS, OR OTHER MEASURES AS SHOWN ON THE APPROVED PLANS.
2. INSTALL TEMPORARY GRAVEL CONSTRUCTION ENTRANCE WHERE REQUIRED TO ACCESS WORK AREA.
3. PROTECT INLETS WITH SILT FENCING, SEDIMENT TRAPS OR OTHER APPROVED MEASURES AS SHOWN ON THE PLANS.
4. CALL FOR ONSITE INSPECTION BY ENVIRONMENTAL INSPECTOR AND OBTAIN CERTIFICATION OF COMPLIANCE, PRIOR TO CONSTRUCTION IN EACH AREA.
5. OPEN TRENCH, INSTALL PIPELINE, AND BACKFILL TRENCH.
6. STABILIZE SITE AS TRENCH IS RESTORED TO ORIGINAL GRADE WITH VEGETATION, PAVING, DITCH LININGS, ETC.
7. WHEN VEGETATION HAS BECOME ESTABLISHED, CALL FOR FINAL SITE INSPECTION BY ENVIRONMENTAL INSPECTOR.
8. REMOVE SILT FENCING & CHECK DAMS AFTER FINAL APPROVAL FROM ENVIRONMENTAL INSPECTOR.

EC-12 CONSTRUCTION SEQUENCE N.T.S.



NOTES:
USE 2"–3" WASHED STONE, 6" THICK, 12' WIDE (MIN), 50' LONG (MIN)

EC-09 GRAVEL CONSTRUCTION ENTRANCE N.T.S.

REV.NO.	DESCRIPTION	DATE
C	90% DESIGN - NOT FOR CONSTRUCTION	4 NOV 2024
B	60% DESIGN - NOT FOR CONSTRUCTION	22 JULY 2024
A	30% DESIGN - NOT FOR CONSTRUCTION	6 MAY 2024

REVISIONS

McKIM&CREED
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www.mckimcreed.com

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

ITT PUMP STATION REPLACEMENT

CIVIL

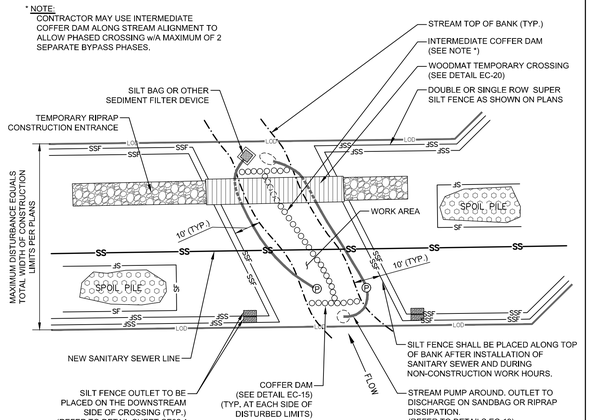
EROSION AND SEDIMENTATION CONTROL DETAILS

PROJ. START DATE:	2024 MAR
MCE PROJ. #	09596-0001
MSD PROJ. #	2020001
DRAWN	AWB
DESIGNED	MJW
CHECKED	MJW
PROJ. MGR.	MC

SCALE
HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

CE02.1
DRAWING NUMBER
C
REVISION

STATUS: 90% DESIGN NOT FOR CONSTRUCTION



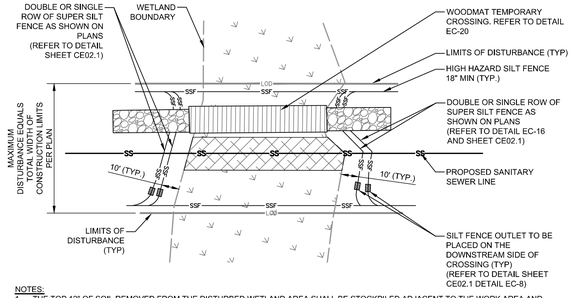
CONSTRUCTION SPECIFICATIONS:
1. KEEP CLEARING AND EXCAVATION OF THE STREAM BANKS AND BED AND APPROACH SECTIONS TO A MINIMUM.
2. DIVERT ALL SURFACE WATER FROM THE CONSTRUCTION SITE ONTO UNDISTURBED AREAS ADJOINING THE STREAM.
3. KEEP STREAM CROSSING AT RIGHT ANGLES TO THE STREAM FLOW.
4. ALIGN ROAD APPROACHES WITH THE CENTER LINE OF THE CROSSING FOR A MINIMUM DISTANCE OF 30 FEET. RAISE BRIDGE ABUTMENTS AND CULVERT FILLS A MINIMUM OF 1 FOOT ABOVE THE ADJOINING APPROACH SECTIONS TO PREVENT EROSION FROM SURFACE RUNOFF AND TO ALLOW FLOOD FLOWS TO PASS AROUND THE STRUCTURE.
5. STABILIZE ALL DISTURBED AREAS SUBJECT TO FLOWING WATER, INCLUDING PLANNED OVERFLOW AREAS, WITH RIPRAP OR OTHER SUITABLE MEANS IF DESIGN VELOCITY EXCEEDS THE ALLOWABLE FOR THE IN-PLACE SOIL.
6. ENSURE THAT BYPASS CHANNELS NECESSARY TO DEWATER THE CROSSING SITE ARE STABLE BEFORE DIVERTING THE STREAM. UPON COMPLETION OF THE CROSSING, FILL, COMPACT, AND STABILIZE THE BYPASS CHANNEL APPROPRIATELY.
7. REMOVE TEMPORARY STREAM CROSSINGS IMMEDIATELY WHEN THEY ARE NO LONGER NEEDED. RESTORE THE STREAM CHANNEL TO ITS ORIGINAL CROSS-SECTION, AND SMOOTH AND APPROPRIATELY STABILIZE ALL DISTURBED AREAS.
8. ANY IN-STREAM SEDIMENT CONTROL MEASURES MUST BE REMOVED UPON STABILIZATION OF THE AREA.

MAINTENANCE:
1. INSPECT TEMPORARY STREAM CROSSINGS AFTER RUNOFF-PRODUCING RAINS TO CHECK FOR BLOCKAGE IN CHANNEL, EROSION OF ABUTMENTS, CHANNEL SCOUR, RIPRAP DISPLACEMENT, OR PIPING. MAKE ALL REPAIRS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO THE INSTALLATION.

IMPLEMENTATION SEQUENCE:
SEDIMENT CONTROL MEASURES, PUMP-AROUND PRACTICES FOR STREAM CROSSINGS, AND ASSOCIATED CONSTRUCTION SHALL BE COMPLETED IN THE FOLLOWING SEQUENCE (REFER TO DETAIL).

1. THE INTENT OF THIS CONSTRUCTION SEQUENCE IS TO PROVIDE THE CONTRACTOR WITH A GENERAL GUIDE FOR CONSTRUCTION PURPOSES. THIS SEQUENCE IS NOT INTENDED TO OUTLINE ALL CONSTRUCTION ACTIVITIES ON THIS PROJECT.
2. CONTRACTOR TO INSTALL SUPER SILT FENCE AND SILT FENCE OUTLETS PER THE PLANS.
3. PUMP AROUND DEVICES SHALL BE INSTALLED PER THE IMPLEMENTATION SEQUENCE SHOWN ON DETAIL EC-19.
4. WOODMATS SHALL BE INSTALLED PER DETAIL EC-0.
5. ONCE THE TEMPORARY PUMP AROUND HAS BEEN INSTALLED, THE CONTRACTOR SHALL INSTALL THE SEWER LINE AS SHOWN IN THESE PLANS.
6. CONTRACTOR TO MAINTAIN THE PUMP AROUND AT EACH STREAM CROSSING TO PREVENT ANY SEDIMENT FROM LEAVING THE WORK AREA.
7. ONCE THE INSTALLATION OF THE SEWER LINE HAS BEEN INSTALLED AT A STREAM CROSSING, THE CONTRACTOR IS TO RESTORE THE STREAM AND BANKS TO PRE-CONSTRUCTION GROUND ELEVATIONS.
8. THE CONTRACTOR IS TO STABILIZE THE SLOPES PER DETAIL EC-23 AND THE PROJECT SPECIFICATIONS. CONTRACTOR SHALL ESTABLISH STABILIZED GROUNDCOVER WITHIN 7 DAYS WITHIN RIPARIAN BUFFER ZONES.

EC-16 TEMPORARY STREAM CROSSING N.T.S.



NOTES:
1. THE TOP 12" OF SOIL REMOVED FROM THE DISTURBED WETLAND AREA SHALL BE STOCKPILED ADJACENT TO THE WORK AREA AND REUSED FOR FINAL BACKFILL AT THE RESTORED GROUND SURFACE.
2. THE CONTRACTOR SHALL USE MATTING OR OTHER MEASURES NECESSARY FOR CROSSING WETLAND AREAS DURING EXCAVATION, INSTALLATION AND BACKFILL OF THE SANITARY SEWER.
3. WETLAND AREAS SHALL BE RESTORED TO THE PRE-CONSTRUCTION GROUND ELEVATIONS AND REPLANTED IN ACCORDANCE WITH THE WETLAND SEEDING SCHEDULE, TECHNICAL SPECIFICATIONS AND THE APPROVED SECTION 404/401 NATIONWIDE PERMIT.

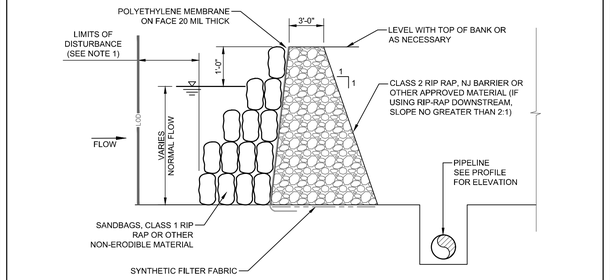
CONSTRUCTION SPECIFICATIONS:
1. KEEP CLEARING AND EXCAVATION OF THE WETLAND BED AND APPROACH SECTIONS TO A MINIMUM.
2. DIVERT ALL SURFACE WATER FROM THE CONSTRUCTION SITE ONTO UNDISTURBED AREAS ADJOINING THE WETLANDS.
3. KEEP WETLAND CROSSING AS PERPENDICULAR AS POSSIBLE TO THE FLOW.
4. STABILIZE ALL DISTURBED AREAS SUBJECT TO FLOWING WATER, INCLUDING PLANNED OVERFLOW AREAS, WITH RIPRAP OR OTHER SUITABLE MEANS IF DESIGN VELOCITY EXCEEDS THE ALLOWABLE FOR THE IN-PLACE SOIL.
5. REMOVE TEMPORARY WETLAND CROSSINGS IMMEDIATELY WHEN THEY ARE NO LONGER NEEDED. RESTORE THE WETLAND BED TO ITS ORIGINAL CROSS-SECTION, AND SMOOTH AND APPROPRIATELY STABILIZE ALL DISTURBED AREAS.
6. ANY IN-WETLAND SEDIMENT CONTROL MEASURES MUST BE REMOVED UPON STABILIZATION OF THE AREA.

MAINTENANCE:
1. INSPECT TEMPORARY WETLAND CROSSINGS AFTER RUNOFF-PRODUCING RAINS TO CHECK FOR BLOCKAGE IN CHANNEL, EROSION OF ABUTMENTS, CHANNEL SCOUR, RIPRAP DISPLACEMENT, OR PIPING. MAKE ALL REPAIRS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO THE INSTALLATION.

IMPLEMENTATION SEQUENCE:
SEDIMENT CONTROL MEASURES, PUMP-AROUND PRACTICES FOR WETLAND CROSSINGS, AND ASSOCIATED CONSTRUCTION SHALL BE COMPLETED IN THE FOLLOWING SEQUENCE (REFER TO DETAIL).

1. THE INTENT OF THIS CONSTRUCTION SEQUENCE IS TO PROVIDE THE CONTRACTOR WITH A GENERAL GUIDE FOR CONSTRUCTION PURPOSES. THIS SEQUENCE IS NOT INTENDED TO OUTLINE ALL CONSTRUCTION ACTIVITIES ON THIS PROJECT.
2. CONTRACTOR TO INSTALL HIGH HAZARD SILT FENCE AND SILT FENCE OUTLETS PER THE PLANS AND DETAILS.
3. CONTRACTOR IS TO MINIMIZE THE CLEARING AND EXCAVATION OF THE WETLAND BED, BANKS AND APPROACH SECTIONS TO A MINIMUM.
4. ONCE THE INSTALLATION OF THE SEWER LINE HAS BEEN INSTALLED AT A WETLAND CROSSING, THE CONTRACTOR IS TO RESTORE THE WETLAND BED TO ITS ORIGINAL CROSS-SECTION, AND SMOOTH AND APPROPRIATELY STABILIZE ALL DISTURBED AREAS.
5. THE CONTRACTOR IS TO SEED THE WETLAND IN ACCORDANCE WITH THE DETAILS SHOWN IN THESE PLANS OR THE PROJECT SPECIFICATIONS.

EC-17 TEMPORARY WETLAND CROSSING N.T.S.

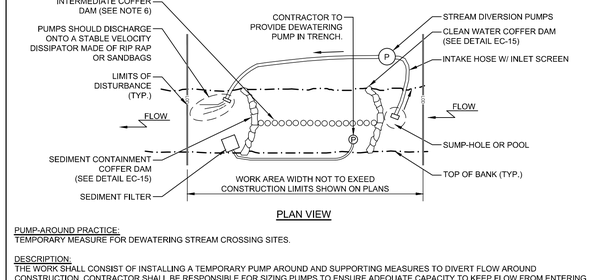


NOTES:
1. CONTRACTOR SHALL INSTALL COFFER DAMS WITH ENOUGH SEPARATION FROM THE PROJECT CONSTRUCTION LIMITS OF DISTURBANCE TO PLACE PUMP INTAKE AND DISCHARGE HOSES, DISSIPATORS AND SEDIMENT FILTER STRUCTURES.
2. TEMPORARY PRE-FABRICATED COFFER DAMS SUCH AS PORT-A-DAM AND OTHERS MAY BE USED IN SUBSTITUTION TO THE SANDBAG/RIP-RAP DAM WITH PRIOR APPROVAL BY THE OWNER AND ENGINEER.
3. TEMPORARY COFFER DAMS BY PORTADAM OR EQUAL SYSTEM ARE ACCEPTABLE. CONTRACTOR SHALL SUBMIT TO ENGINEER PROPOSED TEMPORARY COFFER DAM SYSTEM IN ACCORDANCE WITH THE CONTRACT DOCUMENTS FOR REVIEW AND ACCEPTANCE PRIOR TO CONSTRUCTION.

CONSTRUCTION SPECIFICATIONS:
1. MOBILIZATION AREAS FOR PLACEMENT OR CONSTRUCTION SHOULD BE KEPT AS SMALL AS POSSIBLE TO FACILITATE EROSION AND SEDIMENT CONTROL AND SHOULD BE PROTECTED WITH DOWNGRADIENT SEDIMENT BARRIERS.
2. PLACEMENT ACTIVITIES SHOULD MINIMIZE VEGETATION REMOVAL AND DISTURBANCE OF ADJACENT AREAS TO THE MAXIMUM EXTENT PRACTICABLE.
3. WHERE POSSIBLE, USE BARRIER CONTROLS CONSTRUCTED WITHOUT EARTH FILL. ACCEPTABLE COFFER DAM MATERIALS INCLUDE SAND BAGS, SAND TOTES, JERSEY WALL SECTIONS, COLLAPSIBLE FABRIC MEMBRANE DAMS, WATER FILLED BAGS/TUBES OR OTHER SUITABLE MATERIALS.
4. EARTH FILL BARRIERS REQUIRE STABILIZATION TO PREVENT EROSION AS BARE SOILS COME INTO CONTACT WITH FLOWING WATER. STABILIZATION CAN OFTEN BE ACHIEVED BY COVERING BARE AREAS WITH WEEL-SECURED PLASTIC SHEETING.
5. ENSURE THE BARRIER STRUCTURES ARE OF SUFFICIENT HEIGHT TO PREVENT WAVES OR OVERFLOWS FROM FLOODING THE ENCLOSED WORK AREA.
6. FOR DEWATERING A STREAM REACH, INSTALL BARRIERS AT UPSTREAM AND DOWNSTREAM LOCATIONS. IF USED, STABILIZE THE BYPASS TRENCH/CHANNEL WITH PLASTIC SHEETING, ROCK, OR OTHER LINER MATERAIL TO PREVENT TURBIDITY DOWNSTREAM.
7. DEWATERING OF THE ENCLOSURE TYPICALLY REQUIRES SEDIMENT REMOVAL TO ENSURE THAT TURBID WATER IS NOT DISCHARGED INTO NEARBY WATERBODIES.
8. IF STORED ONSITE, MATERIAL EXCAVATED FROM THE MOBILIZATION SITE, THE ENCLOSURE, OR REMOVED FROM THE DISCHARGE WATER SHOULD BE PLACED IN STOCKPILES PROTECTED WITH EROSION AND SEDIMENT CONTROL MEASURES, SUCH AS PLASTIC SHEETING OR TARPAULIN COVERS, DOWNGRADIENT SEDIMENT BARRIERS, TEMPORARY MULCH AND SEED, OR OTHER MEASURES.
9. UPON COMPLETION OF WORK IN THE BARRIER AREA, DEMOBILIZATION AND BACKFILLING SHOULD OCCUR WITH MINIMAL ADDITIONAL SOIL DISTURBANCE AND IN A MANNER THAT MINIMIZES TURBIDITY IN THE NEARBY WATERBODY. BACKFILLING WITH HYDRAULIC DREDGE OR VIA SLURRY APPLICATION SHOULD BE AVOIDED IF POSSIBLE.

MAINTENANCE:
1. WATERS ADJACENT TO THE BARRIER STRUCTURES SHOULD BE INSPECTED FOR TURBIDITY ON A CONTINUOUS BASIS. FIND AND ELIMINATE SOURCES OF TURBIDITY, OR USE FLOATING SILT CURTAINS TO PREVENT TURBID WATERS FROM MIGRATING AWAY FROM THE IMMEDIATE CONSTRUCTION AREA.
2. CLEAR SEDIMENT AND DEBRIS FROM DEWATERING PUMP INTAKE SCREENS AND FILTERS AS NEEDED. CLEAN DISCHARGE AREA FILTERS (E.G., FILTER FABRIC, SILT FENCING, ETC.) AND REMOVE ACCUMULATED SEDIMENT BEFORE IT RESTRICTS OR CONSUMES HALF OF THE EFFECTIVE TREATMENT VOLUME OR STORAGE CAPACITY.
3. REPLACE OR CLEAN FILTER BAGS AS NEEDED.

EC-15 COFFER DAM N.T.S.



PLAN VIEW

PUMP-AROUND PRACTICE:
TEMPORARY MEASURE FOR DEWATERING STREAM CROSSING SITES.

DESCRIPTION:
THE WORK SHALL CONSIST OF INSTALLING A TEMPORARY PUMP AROUND AND SUPPORTING MEASURES TO DIVERT FLOW AROUND CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING PUMPS TO ENSURE ADEQUATE CAPACITY TO KEEP FLOW FROM ENTERING WORK AREA.

IMPLEMENTATION SEQUENCE:
SEDIMENT CONTROL MEASURES, PUMP-AROUND PRACTICES, AND ASSOCIATED CONSTRUCTION SHALL BE COMPLETED IN THE FOLLOWING SEQUENCE (REFER TO DETAIL).

1. COFFER DAMS SHALL BE SITUATED AT THE ENDS OF THE WORK AREA AS SHOWN ON THE PLANS (REFER TO DETAIL EC-12), AND WATER ON THE UPSIDE OF THE DAM AREA SHALL BE PUMPED AROUND THE WORK AREA.
2. THE DIVERSION PUMPS SHALL DISCHARGE ONTO A STABLE VELOCITY DISSIPATER MADE OF RIP-RAP OR SANDBAGS.
3. WATER FROM THE WORK AREA SHALL BE PUMPED TO A SEDIMENT FILTERING MEASURE SUCH AS A TEMPORARY WOOD CHIP DEWATERING BASIN, SILT BAG OR OTHER APPROVED SEDIMENT FILTERING MEASURE (REFER TO DETAIL EC-16).
4. AFTER THE SANITARY SEWER IS INSTALLED AND THE SLOPES HAVE BEEN STABILIZED, THE PUMP INTAKE HOSES, DISSIPATOR PADS AND FILTER MEASURES SHALL BE REMOVED AND THEN THE COFFER DAMS SHALL BE REMOVED.
5. A PUMP AROUND MUST BE INSTALLED ON ANY TRIBUTARY OR STORM DRAIN OUTFALL WHICH CONTRIBUTES BASEFLOW TO THE WORK AREA. THIS SHALL BE ACCOMPLISHED BY LOCATING A COFFER DAM AT THE DOWNSTREAM END OF THE TRIBUTARY OR STORM DRAIN OUTFALL AND PUMPING THE STREAM FLOW AROUND THE WORK AREA. THIS WATER SHALL DISCHARGE ONTO THE SAME VELOCITY DISSIPATER USED FOR THE MAIN STREAM PUMP AROUND.
6. CONTRACTOR MAY USE INTERMEDIATE COFFER DAM ALONG STREAM ALIGNMENT TO ALLOW PHASED CROSSING W/A MAXIMUM OF 2 SEPARATE BYPASS PHASES.

EC-19 TEMPORARY PUMP AROUND N.T.S.

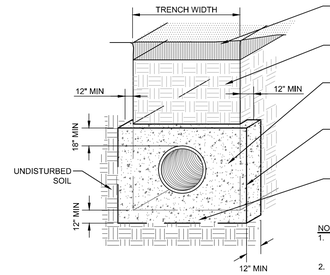
ISOMETRIC PROFILE

MAINTENANCE:
1. IN GENERAL, ONCE A RIPRAP INSTALLATION HAS BEEN PROPERLY DESIGNED AND INSTALLED IT REQUIRES VERY LITTLE MAINTENANCE. RIPRAP SHOULD BE INSPECTED PERIODICALLY FOR SCOUR OR DISLODGED STONES, CONTROL OF WEED AND BRUSH GROWTH MAY BE NEEDED IN SOME LOCATIONS.

NOTES:
1. EACH RIP RAP REPLACEMENT SHALL BE BEDDED ON A 6 INCH LAYER OF STABILIZATION STONE AND A NON-BIODEGRADABLE FILTER FABRIC. PLACEMENT OF RIP RAP SHALL IMMEDIATELY FOLLOW THE PLACEMENT OF THIS LAYER. KEEP VOIDS TO A MINIMUM AND FORM A DENSE WELL GRADED MASS OF STONE. DO NOT DISLODGE THE UNDERLYING BASE OF FILTER WHEN PLACING STONE. COST OF THE STONE BASE OR FILTER SHALL BE INCLUDED IN THE COST OF PLACING OF RIP RAP.
2. MAXIMUM STONE SIZE WHEN USING 8-INCH D50 WILL BE 12-INCHES AND THE MINIMUM THICKNESS OF THE RIP-RAP LAYER SHALL BE 18-INCHES.
3. MAXIMUM SLOPE OF THE CHANNEL BANK SHALL NOT EXCEED 2.0' HORIZONTAL TO 1.0' VERTICAL.
4. FINISHED GRADE OF THE RIP RAP IS TO BLEND WITH THE SURROUNDING AREAS SUCH THAT THE RIP RAP SURFACE ELEVATIONS MATCH THE EXISTING STREAM BANK AND BOTTOM SURFACE ELEVATIONS WHERE THE RIP RAP MEETS THESE POINTS.
5. INSPECT RIP RAP PERIODICALLY FOR SCOUR OR DISLODGED STONES (ESPECIALLY AFTER SEVERE STORMS) AND WEED BRUSH GROWTH.

CONSTRUCTION SPECIFICATIONS:
1. SUBGRADE PREPARATION - PREPARE THE SUBGRADE FOR RIPRAP AND FILTER TO THE REQUIRED LINES AND GRADES SHOWN ON THE PLANS. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY APPROXIMATING THAT OF THE SURROUNDING UNDISTURBED MATERIAL OR OVERFILL DEPRESSIONS WITH RIPRAP. REMOVE BRUSH, TREES, STUMPS, AND OTHER OBJECTIONABLE MATERIAL. CUT THE SUBGRADE SUFFICIENTLY DEEP THAT THE FINISHED GRADE OF THE RIPRAP WILL BE AT THE ELEVATION OF THE SURROUNDING AREA. CHANNELS SHOULD BE EXCAVATED SUFFICIENTLY TO ALLOW PLACEMENT OF THE RIPRAP IN A MANNER SUCH THAT THE FINISHED INSIDE DIMENSIONS AND GRADE OF THE RIPRAP MEET DESIGN SPECIFICATIONS.
2. SAND AND GRAVEL FILTER BLANKET - PLACE THE FILTER BLANKET IMMEDIATELY AFTER THE GROUND FOUNDATION IS PREPARED. FOR GRAVEL, SPREAD FILTER STONE IN A UNIFORM LAYER TO THE SPECIFIED DEPTH, WHERE MORE THAN ONE LAYER OF FILTER MATERIAL IS USED, SPREAD THE LAYERS WITH MINIMAL MIXING.
3. SYNTHETIC FILTER FABRIC - PLACE THE CLOTH FILTER DIRECTLY ON THE PREPARED FOUNDATION, OVERLAP THE EDGES BY AT LEAST 12 INCHES, AND SPACE ANCHOR PINS EVERY 3 FEET ALONG THE OVERLAP, BURY THE UPSTREAM END OF THE CLOTH A MINIMUM OF 12 INCHES BELOW GROUND AND WHERE NECESSARY, BURY THE LOWE END OF THE CLOTH OR OVER LAP WITH THE NEXT SECTION AS REQUIRED. TAKE CARE NOT TO DAMAGE THE CLOTH WHEN PLACING RIPRAP. IF DAMAGE OCCURS REMOVE THE RIPRAP, AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FILTER MATERIAL WITH A MINIMUM OVERLAP OF 12 INCHES AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.
WHERE LARGE STONES ARE USED OR MACHINE PLACEMENT IS DIFFICULT, A 4-INCH LAYER OF FINE GRAVEL OR SAND MAY BE NEEDED TO PROTECT THE FILTER CLOTH.
4. STONE PLACEMENT - PLACEMENT OF RIPRAP SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER. PLACE RIPRAP SO THAT IS FORMS A DENSE, WELL-GRADED MASS OF STONE WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF STONES THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY, AND CONTROLLED DUMPING DURING FINAL PLACEMENT. PLACE RIPRAP TO ITS FULL THICKNESS IN ONE OPERATION. DO NOT PLACE RIPRAP BY DUMPING THROUGH CHUTES OR OTHER METHODS THAT CAUSE SEGREGATION OF STONE SIZES. TAKE CARE NOT TO DISLODGE THE UNDERLYING BASE OR FILTER WHEN PLACING STONES.
THE TOE OF THE RIPRAP SLOPE SHOULD BE KEYED TO A STABLE FOUNDATION AT ITS BASE AS SHOWN IN FIGURE 6.15B. THE TOE SHOULD BE EXCAVATED TO A DEPTH ABOUT 1.5 TIMES THE DESIGN THICKNESS OF THE RIPRAP, AND SHOULD EXTEND HORIZONTALLY FROM THE SLOPE. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL STONE OR CLUSTERS OF LARGE STONE. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF STONE SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE RIPRAP SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF RIPRAP SHOULD BE APPARENT.

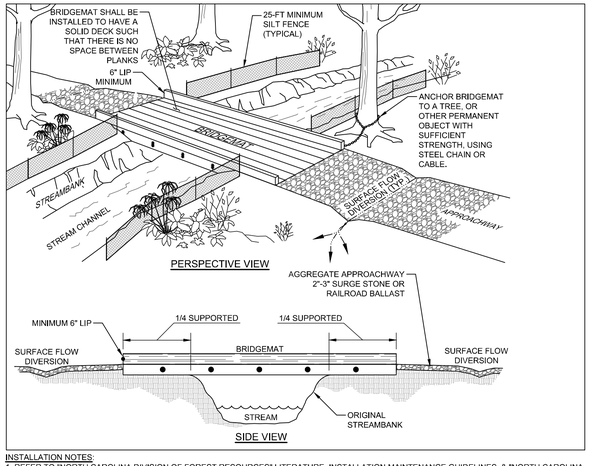
EC-23 STREAM BANK RIP-RAP RESTORATION N.T.S.



NOTES:
1. EXISTING TOPSOIL SHALL BE REMOVE STOCKPILED AND PROTECTED FROM CONTAMINATION AND SHALL BE REPLACED AS TOPSOIL AFTER UTILITY INSTALLATION.
2. ANTI-SEEP COLLAR SHALL BE PLACED AT THE DOWNSTREAM WETLAND BOUNDARY AND A MIN. SPACING OF 150' UP THE GRADIENT UNTIL THE UTILITY EXITS THE WETLAND BOUNDARY UNLESS INDICATED OTHERWISE ON THE DRAWINGS.
3. ANTI-SEEP COLLARS MAY BE CONSTRUCTED WITH COMPACTED CLAY, CLASS B CONCRETE, PVC OR METAL COLLARS. WETLAND CROSSINGS THAT ARE DIRECTIONALLY DRILLED AND PERPENDICULAR WETLAND CROSSINGS THAT ARE OPEN CUT AND LESS THAN 150' IN LENGTH DO NOT REQUIRE ANTI-SEEP COLLARS.
4. CONTRACTOR SHALL PROVIDE SUITABLE FORMING (TO BE REMOVED) TO CONTAIN CONCRETE FOR PROPER SHAPE AND DIMENSIONS.
5. 5. ANTI-SEEP COLLAR MATERIAL AND INSTALLATION SHALL BE APPROVED BY THE PROJECT COORDINATOR PRIOR TO PLACING AND BACKFILLING
6. CONSTRUCTION AND SEEDING IN WETLAND AREAS SHALL BE IN ACCORDANCE WITH STATE AND FEDERAL REGULATIONS AND THE OWNER'S PERMIT REQUIREMENTS.

CLASS B CONCRETE SPECIFICATIONS	
A) MINIMUM CEMENT CONTENT, SACKS PER CUBIC YARD WITH ROUNDED COURSE AGGREGATE	5.0
B) MINIMUM CEMENT CONTENT, SACKS PER CUBIC YARD WITH ANGULAR COURSE AGGREGATE	5.5
C) MAXIMUM WATER-CEMENT RATIO GALLONS PER SACK	6.8
D) SLUMP RANGE	2" TO 4"
E) MINIMUM STRENGTH - 28 DAY PSI	2,500

EC-22 ANTI-SEEP COLLAR N.T.S.

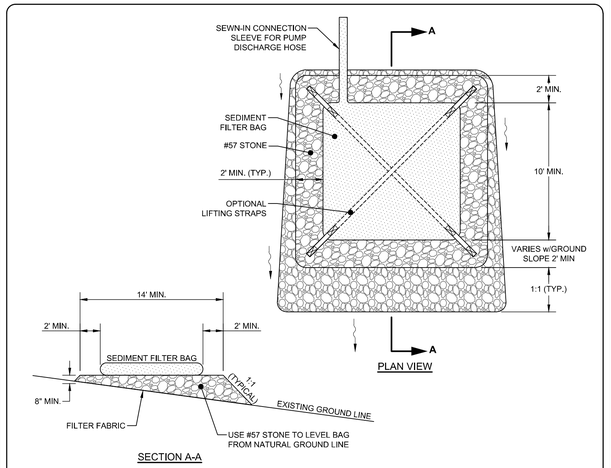


INSTALLATION NOTES:
1. REFER TO "NORTH CAROLINA DIVISION OF FOREST RESOURCES" LITERATURE, INSTALLATION MAINTENANCE GUIDELINES, & "NORTH CAROLINA FORESTRY BMP MANUAL-2006".
2. INSTALL WATER DIVERSION DEVICES (WATER BARS, TURNOUTS, BROAD-BASED DIPS, ETC.) ON BOTH SIDES OF THE MATS.
3. STABILIZE EXPOSED MINERAL SOIL WITH TREE TOPS OR BRUSH DURING MAT INSTALLATION, AND SEEDING/MULCH AFTER MAT REMOVAL.
4. INSTALL MATS TO CREATE A MINIMUM TEN FOOT BRIDGE WIDTH.
5. INCLUDE COARSE AGGREGATE ON THE APPROACHWAY FOR A MINIMUM OF 25 FEET AND SILT FENCE ALONG STREAMBANKS ADJACENT TO CROSSING FOR A MINIMUM OF 25 FEET.

MAINTENANCE NOTES:
1. KEEP MATS' SURFACE FREE OF MINERAL SOIL AND DEBRIS THAT COULD ENTER STREAM.
2. PERIODICALLY CHECK MAT HARDWARE; RETIGHTEN NUTS & CABLE CLAMPS AS NECESSARY TO MAINTAIN BRIDGE STRENGTH AND INTEGRITY.
3. IMMEDIATELY REMOVE ANY DEBRIS WHICH ENTERS THE STREAM AT THE CROSSING LOCATION.

REMOVAL NOTES:
1. CLEAN OFF BRIDGE SURFACE.
2. REMOVE MATS BY USING MAT CABLE LOOP OR SKIDDER GRAPPLE.
3. PERMANENTLY STABILIZE DISTURBED PORTIONS OF STREAMBANK AND APPROACH ROADS WITH PERENNIAL GRASSES/MULCH (OR WETLAND MIX WHEN APPLICABLE).
4. LEAVE APPROPRIATE WATER DIVERSION STRUCTURES IN PLACE ON BOTH SIDES OF STREAM.
5. RESTORE THE STREAM CHANNEL TO ITS ORIGINAL CROSS-SECTION, AND SMOOTH AND APPROPRIATELY STABILIZE ALL DISTURBED AREAS.

EC-20 WOODMAT TEMPORARY CROSSING N.T.S.



SECTION A-A

SEDIMENT FILTER BAG GENERAL NOTES:
1. CONTRACTOR SHALL EXERCISE CAUTION NOT TO BURST OR DAMAGE THE SEDIMENT FILTER BAG WHEN PUMPING.
2. THE LENGTH AND WIDTH OF THE TEMPORARY SEDIMENT BAG SHOWN ON THIS DRAWING MAY VARY PER VENDOR SPECIFICATIONS. THE MINIMUM "FOOTPRINT" OF THE BAG SHALL BE 10 x 15 FEET.
3. SEDIMENT FILTER BAGS SHALL BE EQUIPPED WITH A SEWN-IN SLEEVE OF SUFFICIENT SIZE TO ACCEPT A MINIMUM 4 INCH DIAMETER PUMP DISCHARGE HOSE. THE DISCHARGE HOSE SHOULD BE EXTENDED INTO THIS SLEEVE A MINIMUM OF 6 INCHES AND BE TIGHTLY SECURED WITH A HOSE CLAMP OR OTHER SUITABLE MEANS TO PREVENT LEAKAGE. HOSE CONNECTION THROUGH A SLIT IN THE BAG WILL NOT BE ACCEPTABLE.
4. THE PUMP DISCHARGE HOSE CONNECTION SLEEVE SHALL BE SECURELY TIED OFF DURING DISPOSAL OF THE SEDIMENT FILTER BAG IN ORDER TO PREVENT LEAKAGE OF COLLECTED SEDIMENTS.
5. SEDIMENT FILTER BAG SHALL BE MAINTAINED AND REPLACED WHEN ONE HALF FULL OF SEDIMENT OR IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

CONSTRUCTION SPECIFICATIONS:
1. FILTER BAG IS TO BE PLACED ON A LEVEL BED OF AGGREGATE.

Nationwide Permit 58
Utility Line Activities for Water and Other Substances

Effective Date: March 15, 2021 / Expiration Date: March 15, 2026

Authorities: Sections 10 and 404

Activities required for the construction, maintenance, repair, and removal of utility lines for water and other substances, excluding oil, natural gas, products derived from oil or natural gas, and electricity. Oil or natural gas pipeline activities or electric utility line and telecommunications activities may be authorized by NWPs 12 or 57, respectively. This NWP also authorizes associated utility line facilities in waters of the United States, provided the activity does not result in the loss of greater than 1/2-acre of waters of the United States for each single and complete project.

Utility lines: This NWP authorizes discharges of dredged or fill material into waters of the United States and structures or work in navigable waters for crossings of those waters associated with the construction, maintenance, or repair of utility lines for water and other substances, including outfall and intake structures. There must be no change in pre-construction contours of waters of the United States. A "utility line" is defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose that is not oil, natural gas, or petrochemicals. Examples of activities authorized by this NWP include utility lines that convey water, sewage, stormwater, wastewater, brine, irrigation water, and industrial products that are not petrochemicals. The term "utility line" does not include activities that drain a water of the United States, such as drainage tile or french drains, but it does apply to pipes conveying drainage from another area.

Material resulting from trench excavation may be temporarily sidecast into waters of the United States for no more than three months, provided the material is not placed in such a manner that it is dispersed by currents or other forces. The district engineer may extend the period of temporary side casting for no more than a total of 180 days, where appropriate. In wetlands, the top 6 to 12 inches of the trench should normally be backfilled with topsoil from the trench. The trench cannot be constructed or backfilled in such a manner as to drain waters of the United States (e.g., backfilling with extensive gravel layers, creating a french drain effect). Any exposed slopes and stream banks must be stabilized immediately upon completion of the utility line crossing of each waterbody.

Utility line substations: This NWP authorizes the construction, maintenance, or expansion of substation facilities associated with a utility line in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not result in the loss of greater than 1/2-acre of waters of the United States. This NWP does not authorize discharges of dredged or fill material into non-tidal wetlands adjacent to tidal waters of the United States to construct, maintain, or expand substation facilities.

Foundations for above-ground utility lines: This NWP authorizes the construction or maintenance of foundations for above-ground utility lines in all waters of the United States, provided the foundations are the minimum size necessary.

Access roads: This NWP authorizes the construction of access roads for the construction and maintenance of utility lines, including utility line substations, in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not cause the loss of greater than 1/2-acre of non-tidal waters of the United States. This NWP does not authorize discharges of dredged or fill material into non-tidal wetlands adjacent to tidal waters for access roads. Access roads must be the minimum width necessary (see Note 2, below). Access roads must be constructed so that the length of the road minimizes any adverse effects on waters of the United States and must be as near as possible to pre-construction contours and elevations (e.g., at grade corduroy roads or geotextile/gravel roads). Access roads constructed above pre-construction contours and elevations in waters of the United States must be properly bridged or culverted to maintain surface flows.

This NWP may authorize utility lines in or affecting navigable waters of the United States even if there is no associated discharge of dredged or fill material (see 33 CFR part 322). Overhead utility lines constructed over section 10 waters and utility lines that are routed in or under section 10 waters without a discharge of dredged or fill material require a section 10 permit.

This NWP authorizes, to the extent that Department of the Army authorization is required, temporary structures, fills, and work necessary for the remediation of inadvertent returns of drilling fluids to waters of the United States through sub-soil fissures or fractures that might occur during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines. These remediation activities must be done as soon as practicable, to restore the affected waterbody. District engineers may add special conditions to this NWP to require a remediation plan for addressing inadvertent returns of drilling fluids to waters of the United States during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines.

This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the utility line activity. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges of dredged or fill material, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. After construction, temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if: (1) a section 10 permit is required; or (2) the discharge will result in the loss of greater than 1/10-acre of waters of the United States. (See general condition 32.) (Authorities: Sections 10 and 404)

Note 1: Where the utility line is constructed, installed, or maintained in navigable waters of the United States (i.e., section 10 waters) within the coastal United States, the Great Lakes, and United States territories, a copy of the NWP verification will be sent by the Corps to the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), for charting the utility line to protect navigation.

Note 2: For utility line activities crossing a single waterbody more than one time at separate and distant locations, or multiple waterbodies at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. Utility line activities must comply with 33 CFR 330.6(d).

Note 3: Access roads used for both construction and maintenance may be authorized, provided they meet the terms and conditions of this NWP. Access roads used solely for construction of the utility line must be removed upon completion of the work, in accordance with the requirements for temporary fills.

Note 4: Pipes or pipelines used to transport gaseous, liquid, liquescent, or slurry substances over navigable waters of the United States are considered to be bridges, not utility lines, and may require a permit from the U.S. Coast Guard pursuant to the General Bridge Act of 1946. However, any discharges of dredged or fill material into waters of the United States associated with such pipelines will require a section 404 permit (see NWP 15).

Note 5: This NWP authorizes utility line maintenance and repair activities that do not qualify for the Clean Water Act section 404(f) exemption for maintenance of currently serviceable fills or fill structures.

Note 6: For activities that require pre-construction notification, the PCN must include any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings that require Department of the Army authorization but do not require pre-construction notification (see paragraph (b)(4) of general condition 32). The district engineer will evaluate the PCN in accordance with Section D, "District Engineer's Decision." The district engineer may require mitigation to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see general condition 23).

GENERAL CONDITIONS

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific

conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. **Navigation.** (a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his or her authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. **Aquatic Life Movements.** No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. **Spawning Areas.** Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. **Migratory Bird Breeding Areas.** Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. **Shellfish Beds.** No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. **Suitable Material.** No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. **Water Supply Intakes.** No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. **Adverse Effects From Impoundments.** If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. **Management of Water Flows.** To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. **Fills Within 100-Year Floodplains.** The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. **Equipment.** Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. **Soil Erosion and Sediment Controls.** Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. **Removal of Temporary Structures and Fills.** Temporary structures must be removed, to the maximum extent practicable, after their use has been discontinued. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. **Proper Maintenance.** Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. **Single and Complete Project.** The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. **Wild and Scenic Rivers.** (a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.

(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. Permittees shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.

(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

17. **Tribal Rights.** No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

18. **Endangered Species.** (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify designated critical habitat or critical habitat proposed for such designation. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless ESA section 7 consultation addressing the consequences of the proposed activity on listed species or critical habitat has been completed. See 50 CFR 402.02 for the definition of "effects of the action" for the purposes of ESA section 7 consultation, as well as 50 CFR 402.17, which provides further explanation under ESA

section 7 regarding "activities that are reasonably certain to occur" and "consequences caused by the proposed action."

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA (see 33 CFR 330.4(f)(1)). If pre-construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed such designation) might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat or critical habitat proposed for such designation, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation), the pre-construction notification must include the name(s) of the endangered or threatened species (or species proposed for listing) that might be affected by the proposed activity or that utilize the designated critical habitat (or critical habitat proposed for such designation) that might be affected by the proposed activity. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. For activities where the non-Federal applicant has identified listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have "no effect" on listed species (or species proposed for listing or designated critical habitat (or critical habitat proposed for such designation), or until ESA section 7 consultation or conference has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation or conference with the FWS or NMFS the district engineer may add species-specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where

"take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word “harm” in the definition of “take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.

(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.nmfs.noaa.gov/pr/species/esa/ respectively.

19. **Migratory Birds and Bald and Golden Eagles.** The permittee is responsible for ensuring that an action authorized by an NWP complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting the appropriate local office of the U.S. Fish and Wildlife Service to determine what measures, if any, are necessary or appropriate to reduce adverse effects to migratory birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. **Historic Properties.** (a) No activity is authorized under any NWP which may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)(1)). If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate

documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts commensurate with potential impacts, which may include background research, consultation, oral history interviews, sample field investigation, and/or field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect.

(d) Where the non-Federal applicant has identified historic properties on which the proposed NWP activity might have the potential to cause effects and has so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed. For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. **Discovery of Previously Unknown Remains and Artifacts.** Permittees that discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by an NWP, they must immediately notify the district engineer of what they have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. **Designated Critical Resource Waters.** Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, 52, 57 and 58 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed by permittees in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after she or he determines that the impacts to the critical resource waters will be no more than minimal.

23. **Mitigation.** The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.

(d) Compensatory mitigation at a minimum one-for-one ratio will be required for all losses of stream bed that exceed 3/100-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. This compensatory mitigation requirement may be satisfied through the restoration or enhancement of riparian areas next to streams in accordance with paragraph (e) of this general condition. For losses of stream bed of 3/100-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult-to-replace resources (see 33 CFR 332.3(e)(3)).

(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. If restoring riparian areas involves planting vegetation, only native species should be planted. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address

documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f).)

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)). If permittee-responsible mitigation is the proposed option, and the proposed compensatory mitigation site is located on land in which another federal agency holds an easement, the district engineer will coordinate with that federal agency to determine if proposed compensatory mitigation project is compatible with the terms of the easement.

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan needs to address only the baseline conditions at the impact site and the number of credits to be provided (see 33 CFR 332.4(c)(1)(ii)).

(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.

(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. **Safety of Impoundment Structures.** To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state or federal, dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. **Water Quality.** (a) Where the certifying authority (state, authorized tribe, or EPA, as appropriate) has not previously certified compliance of an NWP with CWA section 401,

a CWA section 401 water quality certification for the proposed discharge must be obtained or waived (see 33 CFR 330.4(c)). If the permittee cannot comply with all of the conditions of a water quality certification previously issued by certifying authority for the issuance of the NWP, then the permittee must obtain a water quality certification or waiver for the proposed discharge in order for the activity to be authorized by an NWP.

(b) If the NWP activity requires pre-construction notification and the certifying authority has not previously certified compliance of an NWP with CWA section 401, the proposed discharge is not authorized by an NWP until water quality certification is obtained or waived. If the certifying authority issues a water quality certification for the proposed discharge, the permittee must submit a copy of the certification to the district engineer. The discharge is not authorized by an NWP until the district engineer has notified the permittee that the water quality certification requirement has been satisfied by the issuance of a water quality certification or a waiver.

(c) The district engineer or certifying authority may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. **Coastal Zone Management.** In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). If the permittee cannot comply with all of the conditions of a coastal zone management consistency concurrence previously issued by the state, then the permittee must obtain an individual coastal zone management consistency concurrence or presumption of concurrence in order for the activity to be authorized by an NWP. The district engineer or a state may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. **Regional and Case-By-Case Conditions.** The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its CWA section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. **Use of Multiple Nationwide Permits.** The use of more than one NWP for a single and complete project is authorized, subject to the following restrictions:

(a) If only one of the NWPs used to authorize the single and complete project has a specified acreage limit, the acreage loss of waters of the United States cannot exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

(b) If one or more of the NWPs used to authorize the single and complete project has specified acreage limits, the acreage loss of waters of the United States authorized by those NWPs cannot exceed their respective specified acreage limits. For example, if a commercial development is constructed under NWP 39, and the single and complete project includes the filling of an upland ditch authorized by NWP 46, the maximum acreage loss of waters of the United States for the commercial development under NWP 39 cannot exceed 1/2-acre, and the total acreage loss of waters of United States due to the NWP 39 and 46 activities cannot exceed 1 acre.

29. **Transfer of Nationwide Permit Verifications.** If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

_____
(Transferee)

_____
(Date)

30. **Compliance Certification.** Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the

certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the activity and mitigation.

The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. **Activities Affecting Structures or Works Built by the United States.** If an NWP activity also requires review by, or permission from, the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission and/or review is not authorized by an NWP until the appropriate Corps office issues the section 408 permission or completes its review to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. **Pre-Construction Notification.** (a) *Timing*. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33

CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) *Contents of Pre-Construction Notification*: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

(4) (i) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures.

(ii) For linear projects where one or more single and complete crossings require pre-construction notification, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters (including those single and complete crossings authorized by an NWP but do not require PCNs). This information will be used by the district engineer to evaluate the cumulative adverse environmental effects of the proposed linear project, and does not change those non-PCN NWP activities into NWP PCNs.

(iii) Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided

results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial and intermittent streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45-day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands or 3/100-acre of stream bed and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-federal permittees, if any listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat (or critical habitat proposed for such designation), the PCN must include the name(s) of those endangered or threatened species (or species proposed for listing) that might be affected by the proposed activity or utilize the designated critical habitat (or critical habitat proposed for such designation) that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act;

(8) For non-federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the “study river” (see general condition 16); and

(10) For an NWP activity that requires permission from, or review by, the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from, or review by, the Corps office having jurisdiction over that USACE project.

(c) *Form of Pre-Construction Notification*: The nationwide permit pre-construction notification form (Form ENG 6082) should be used for NWP PCNs. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) *Agency Coordination*: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iii) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or e-mail that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure that the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will

consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

District Engineer's Decision

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. If a project proponent requests authorization by a specific NWP, the district engineer should issue the NWP verification for that activity if it meets the terms and conditions of that NWP, unless he or she determines, after considering mitigation, that the proposed activity will result in more than minimal individual and cumulative adverse effects on the aquatic environment and other aspects of the public interest and exercises discretionary authority to require an individual permit for the proposed activity. For a linear project, this determination will include an evaluation of the single and complete crossings of waters of the United States that require PCNs to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings of waters of the United States authorized by an NWP. If an applicant requests a waiver of an applicable limit, as provided for in NWPs 13, 36, or 54, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in only minimal individual and cumulative adverse environmental effects.

2. When making minimal adverse environmental effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. He or she will also consider the cumulative adverse environmental effects caused by activities authorized by an NWP and whether those cumulative adverse environmental effects are no more than minimal. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional or condition assessment method is available and practicable to use, that assessment method may be used by the district

engineer to assist in the minimal adverse environmental effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

3. If the proposed activity requires a PCN and will result in a loss of greater than 1/10-acre of wetlands or 3/100-acre of stream bed, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for NWP activities with smaller impacts, or for impacts to other types of waters. The district engineer will consider any proposed compensatory mitigation or other mitigation measures the applicant has included in the proposal in determining whether the net adverse environmental effects of the proposed activity are no more than minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are no more than minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure that the NWP activity results in no more than minimal adverse environmental effects. If the net adverse environmental effects of the NWP activity (after consideration of the mitigation proposal) are determined by the district engineer to be no more than minimal, the district engineer will provide a timely written response to the applicant. The response will state that the NWP activity can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

4. If the district engineer determines that the adverse environmental effects of the proposed activity are more than minimal, then the district engineer will notify the applicant either: (a) that the activity does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the activity is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal; or (c) that the activity is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse environmental effects, the activity will be authorized within the 45-day PCN period (unless additional time is required to comply with general conditions 18, 20, and/or 31), with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation plan or a requirement that the applicant

submit a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal. When compensatory mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

Further Information

1. District engineers have authority to determine if an activity complies with the terms and conditions of an NWP.

2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.

3. NWPs do not grant any property rights or exclusive privileges.

4. NWPs do not authorize any injury to the property or rights of others.

5. NWPs do not authorize interference with any existing or proposed Federal project (see general condition 31).

Definitions

Best management practices (BMPs): Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

Compensatory mitigation: The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Currently serviceable: Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

Direct effects: Effects that are caused by the activity and occur at the same time and place.

Discharge: The term “discharge” means any discharge of dredged or fill material into waters of the United States.

Ecological reference: A model used to plan and design an aquatic habitat and riparian area restoration, enhancement, or establishment activity under NWP 27. An ecological reference may be based on the structure, functions, and dynamics of an aquatic habitat

type or a riparian area type that currently exists in the region where the proposed NWP 27 activity is located. Alternatively, an ecological reference may be based on a conceptual model for the aquatic habitat type or riparian area type to be restored, enhanced, or established as a result of the proposed NWP 27 activity. An ecological reference takes into account the range of variation of the aquatic habitat type or riparian area type in the region.

Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area.

High Tide Line: The line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

Historic Property: Any prehistoric or historic district, site (including archaeological site), building, structure, or other object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).

Independent utility: A test to determine what constitutes a single and complete non-linear project in the Corps Regulatory Program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Indirect effects: Effects that are caused by the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.

Loss of waters of the United States: Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. The loss of stream bed includes the acres of stream bed that are permanently adversely affected by filling or excavation because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters or wetlands for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities that do not require Department of the Army authorization, such as activities eligible for exemptions under section 404(f) of the Clean Water Act, are not considered when calculating the loss of waters of the United States.

Navigable waters: Waters subject to section 10 of the Rivers and Harbors Act of 1899. These waters are defined at 33 CFR part 329.

Non-tidal wetland: A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

Open water: For purposes of the NWPs, an open water is any area that in a year with normal patterns of precipitation has water flowing or standing above ground to the extent that an ordinary high water mark can be determined. Aquatic vegetation within the area of flowing or standing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. Examples of “open waters” include rivers, streams, lakes, and ponds.

Ordinary High Water Mark: The term ordinary high water mark means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Perennial stream: A perennial stream has surface water flowing continuously year-round during a typical year.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Pre-construction notification: A request submitted by the project proponent to the Corps for confirmation that a particular activity is authorized by nationwide permit. The request

may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Pre-construction notification may be required by the terms and conditions of a nationwide permit, or by regional conditions. A pre-construction notification may be voluntarily submitted in cases where pre-construction notification is not required and the project proponent wants confirmation that the activity is authorized by nationwide permit.

Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.

Riffle and pool complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Riparian areas: Riparian areas are lands next to streams, lakes, and estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects riverine, lacustrine, estuarine, and marine waters with their adjacent wetlands, non-wetland waters, or uplands. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality. (See general condition 23.)

Shellfish seeding: The placement of shellfish seed and/or suitable substrate to increase shellfish production. Shellfish seed consists of immature individual shellfish or individual shellfish attached to shells or shell fragments (i.e., spat on shell). Suitable substrate

may consist of shellfish shells, shell fragments, or other appropriate materials placed into waters for shellfish habitat.

Single and complete linear project: A linear project is a project constructed for the purpose of getting people, goods, or services from a point of origin to a terminal point, which often involves multiple crossings of one or more waterbodies at separate and distant locations. The term "single and complete project" is defined as that portion of the total linear project proposed or accomplished by one owner/developer or partnership or other association of owners/developers that includes all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

Single and complete non-linear project: For non-linear projects, the term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete non-linear project must have independent utility (see definition of "independent utility"). Single and complete non-linear projects may not be "piecemealed" to avoid the limits in an NWP authorization.

Stormwater management: Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

Stormwater management facilities: Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and best management practices, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

Stream bed: The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

Stream channelization: The manipulation of a stream's course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized jurisdictional stream remains a water of the United States.

Structure: An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef,

permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.

Tidal wetland: A tidal wetland is a jurisdictional wetland that is inundated by tidal waters. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line.

Tribal lands: Any lands title to which is either: 1) held in trust by the United States for the benefit of any Indian tribe or individual; or 2) held by any Indian tribe or individual subject to restrictions by the United States against alienation.

Tribal rights: Those rights legally accruing to a tribe or tribes by virtue of inherent sovereign authority, unextinguished aboriginal title, treaty, statute, judicial decisions, executive order or agreement, and that give rise to legally enforceable remedies.

Vegetated shallows: Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

Waterbody: For purposes of the NWPs, a waterbody is a "water of the United States." If a wetland is adjacent to a waterbody determined to be a water of the United States, that waterbody and any adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)).

REGIONAL CONDITIONS:

The following Regional Conditions have been approved by the Wilmington District for the Nationwide Permits (NWPs) published in the January 13, 2021, *Federal Register* (86 FR 2744) announcing the reissuance of 12 existing (NWPs) and four new NWPs, as well as the reissuance of NWP general conditions and definitions with some modifications.

A. EXCLUDED WATERS AND/OR AREAS

The Corps has identified waters that will be excluded from the use of all NWP's during certain timeframes. These waters are:

1. **Anadromous Fish Spawning Areas.** Work in waters of the U.S. designated by either the North Carolina Division of Marine Fisheries (NCDMF) or the North Carolina Wildlife Resources Commission (NCWRC) as anadromous fish spawning areas are prohibited from February 15th through June 30th, without prior written approval from the Corps and the appropriate wildlife agencies (NCDMF, NCWRC and/or the National

Marine Fisheries Service (NMFS)). Work in waters of the U.S. designated by NCWRC as primary nursery areas in inland waters are prohibited from February 15th through September 30th, without prior written approval from the Corps and the appropriate wildlife agencies. Work in waters of the U.S. designated by NCDMF as primary nursery areas shall be coordinated with NCDMF prior to being authorized by this NWP. Coordination with NCDMF may result in a required construction moratorium during periods of significant biological productivity or critical life stages.

2. **Trout Waters Moratorium.** Work in waters of the U.S. in the designated trout watersheds of North Carolina are prohibited from October 15th through April 15th without prior written approval from the NCWRC, or from the Eastern Band of Cherokee Indians (EBCI) Fisheries and Wildlife Management (FWM) office if the project is located on EBCI trust land. (See Section C.3. above for information on the designated trout watersheds).

3. **Sturgeon Spawning Areas.** No in-water work shall be conducted in waters of the U.S. designated by the National Marine Fisheries Service as Atlantic sturgeon critical habitat from February 1st through June 30th. No in-water work shall be conducted in waters of the U.S. in the Roanoke River designated as Atlantic sturgeon critical habitat from February 1st through June 30th, and August 1st through October 31st, without prior written approval from NMFS.

4. **Submerged Aquatic Vegetation.** Impacts to Submerged Aquatic Vegetation (SAV) are not authorized by any NWP, except NWP 48, NWP 55 and NWP 56, unless Essential Fish Habitat (EFH) consultation has been completed pursuant to the Magnuson-Stevens Fisheries Conservation and Management Act (Magnuson-Stevens Act). Permittees shall submit a PCN (See NWP General Condition 32) to the District Engineer prior to commencing the activity if the project would affect SAV. The permittee may not begin work until notified by the Corps that the requirements of the Magnuson-Stevens Act have been satisfied and that the activity is verified.

B. REGIONAL CONDITIONS APPLICABLE TO ALL NWP's

1. **Critical Habitat in Western NC.** For proposed activities within waters of the U.S. that require a Pre-Construction Notification (PCN) and are located in the thirteen counties listed below, permittees must provide a copy of the PCN to the U.S. Fish and Wildlife Service (USFWS), 160 Zillicoa Street, Asheville, North Carolina 28801 and the Corps Asheville Regulatory Field Office. Please see General Condition 18 for specific PCN requirements related to the Endangered Species Act and the below website for information on the location of designated critical habitat.

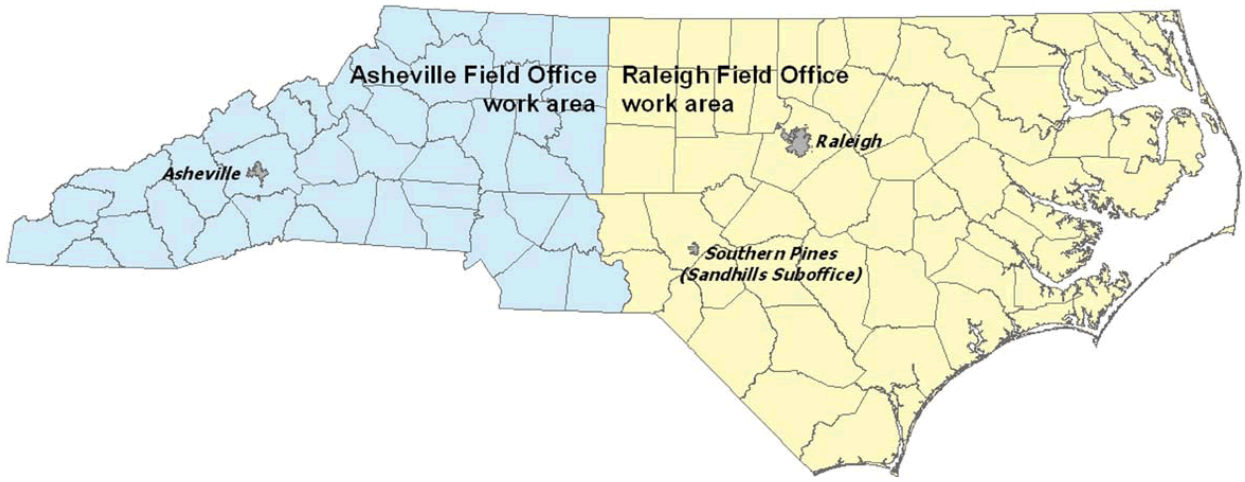
Counties with tributaries that drain to designated critical habitat that require notification to the Asheville U.S. Fish and Wildlife Service: Avery, Cherokee, Graham, Haywood, Henderson, Jackson, Macon, Mecklenburg, Mitchell, Swain, Transylvania, Union and Yancey.

Website and office addresses for Endangered Species Act Information:

The Wilmington District has developed the following website for permittees which provides guidelines on how to review linked websites and maps in order to fulfill NWP General Condition 18 (Endangered Species) requirements: http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram/AgencyCoordination/ESA.aspx.

Permittees who do not have internet access may contact the appropriate U.S. Fish and Wildlife Service offices listed below or Corps at (910) 251-4850.

Below is a map of the USFWS Field Office Boundaries:



Asheville U.S. Fish and Wildlife Service Office counties: All counties west of and including Anson, Stanly, Davidson, Forsythe and Stokes Counties.

U.S. Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801
Telephone: (828) 258-3939

Raleigh U.S. Fish and Wildlife Service Office counties: All counties east of and including Richmond, Montgomery, Randolph, Guilford, and Rockingham Counties.

U.S. Fish and Wildlife Service
Raleigh Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Telephone: (919) 856-4520

2. **Special Designation Waters.** Prior to the use of any NWP that involves a discharge of dredged or fill material in any of the following identified waters and/or adjacent wetlands in North Carolina, permittees shall submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32). The North Carolina waters and wetlands that require additional PCN requirements are:

"Primary Nursery Areas" (PNA), including inland PNA, as designated by the North Carolina Marine Fisheries Commission and/or the North Carolina Wildlife Resources Commission. The definition of and designated PNA waters can be found in the North Carolina State Administrative Code at Title 15A, Subchapters 3R and 10C (15A NCAC 03R .0103; 15A NCAC 10C .0502; and 15A NCAC 10C .0503) and at the following web pages:

- http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environmental%20quality/chapter%2003%20-%20marine%20fisheries/subchapter%20r/15a%20ncac%2003r%20.0103.pdf

- http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environmental%20quality/chapter%2010%20-%20wildlife%20resources%20and%20water%20safety/subchapter%20c/15a%20ncac%2010c%20.0502.pdf

- http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environmental%20quality/chapter%2010%20-%20wildlife%20resources%20and%20water%20safety/subchapter%20c/15a%20ncac%2010c%20.0503.pdf

3. **Trout Waters.** Prior to any discharge of dredge or fill material into streams, waterbodies or wetlands within the 294 designated trout watersheds of North Carolina, the permittee shall submit a PCN (see General Condition 32) to the District Engineer prior to commencing the activity. The permittee shall also provide a copy of the PCN to the appropriate NCWRC office, or to the EBCI FWM Office (if the project is located on EBCI trust land), to facilitate the determination of any potential impacts to designated Trout Waters.

NCWRC and NC Trout Watersheds:

NCWRC Contact**	**Counties that are entirely within Trout Watersheds***		**Counties that are partially within Trout Watersheds***	
Mountain Coordinator 645 Fish Hatchery Rd., Building B Marion, NC 28752 828-803-6054 For NCDOT Projects: NCDOT Coordinator 12275 Swift Rd. Oakboro, NC 28129 704-984-1070	Alleghany Ashe Avery Graham Haywood	Jackson Macon Swain Transylvania Watauga	Burke Buncombe Caldwell Cherokee Clay Henderson Madison	McDowell Mitchell Polk Rutherford Surry Wilkes Yancey
EBCI Contact**	**Counties that are within Trout Watersheds***			
Office of Natural Resources P.O. Box 1747, Cherokee, NC 28719 (828) 359-6113	Qualla Boundary and non-contiguous tracts of trust land located in portions of Swain, Jackson, Haywood, Graham and Cherokee Counties.			

*NOTE: To determine PCN requirements, contact the Corps Asheville Regulatory Field Office at (828) 271-7980 or view maps showing trout watersheds in each County at the following webpage: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/Trout/.

**If a project is located on EBCI trust land, submit the PCN in accordance with Regional Condition C.16. Contact the Corps Asheville Regulatory Field Office at (828) 271-7980 with questions.

4. **Western NC Waters and Corridors.** The permittee shall submit a PCN (see General Condition 32) to the District Engineer prior to commencing the activity in waters of the U.S. if the activity will occur within any of the following identified waters in western North Carolina, within 0.5 mile on either side of these waters, or within 0.75 mile of the Little Tennessee River, as measured from the top of the bank of the respective water (i.e., river, stream, or creek):

Brasstown Creek
Burningtown Creek
Cane River
Caney Fork
Cartoogechaye Creek
Chattooga River
Cheoah River
Cowee Creek
Cullasaja River
Deep Creek
Ellijay Creek
French Broad River
Garden Creek
Hiwassee River
Hominy Creek
Iotla Creek
Little Tennessee River (within the river or within 0.75 mile on either side of this river)
Nantahala River
Nolichucky River
North Fork French Broad River
North Toe River
Nottley River
Oconaluftee River (portion not located on trust/EBCI land)
Peachtree Creek
Shooting Creek
Snowbird Creek
South Toe River
Stecoah Creek
Swannanoa River
Sweetwater Creek
Tuckasegee River (also spelled Tuckaseegee or Tuckaseigee)
Valley River
Watauga Creek
Watauga River
Wayah Creek

West Fork French Broad River

To determine PCN requirements, contact the Corps Asheville Regulatory Field Office at (828) 271-7980 or view maps for all corridors at the following webpage: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/Designated-Special-Waters.aspx .

5. **Limitation of Loss of Stream Bed.** NWPs may not be used for activities that may result in the loss of more than 0.05 acres of stream bed, except for NWP 32.

6. **Pre-Construction Notification for Loss of Stream Bed Exceeding 0.02 acres.** The permittee shall submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32) prior to the use of any NWP for any activity that results in the loss of more than 0.02 acres of stream bed. This applies to NWPs that do not have PCN requirements as well as those NWPs that require a PCN.

7. **Mitigation for Loss of Stream Bed.** For any NWP that results in a loss of more than 0.02 acres of stream bed, the permittee shall provide a mitigation proposal to compensate for more than minimal individual and cumulative adverse impacts to the aquatic environment, unless the District Engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal. For stream bed losses of 0.02 acres or less that require a PCN, the District Engineer may determine, on a case-by-case basis, that compensatory mitigation is required to ensure that the activity results in minimal adverse effect on the aquatic environment.

8. **Riprap.** For all NWPs that allow for the use of riprap material for bank stabilization, the following conditions shall be applied:

a. Filter cloth must be placed underneath the riprap as an additional requirement of its use in North Carolina waters. The placement of filter fabric is not required if the riprap will be pushed or “keyed” into the bank of the waterbody. A waiver from the specifications in this Regional Condition must be requested in writing.

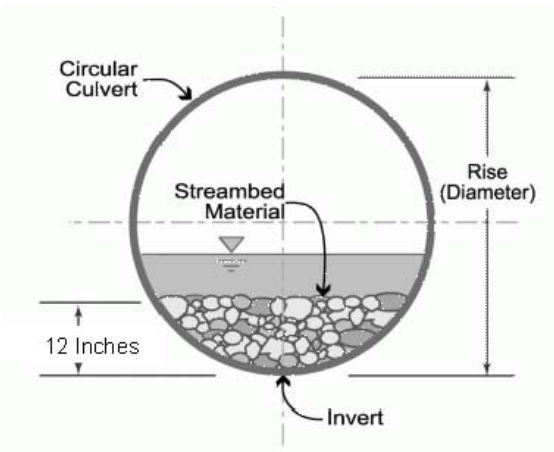
b. Riprap shall be placed only on the stream banks, or, if it is necessary to be placed in the stream bed, the finished top elevation of the riprap should not exceed that of the original stream bed.

9. **Culvert Placement.** For all NWPs that allow for culvert placement, the following conditions shall be applied:

a. For all NWPs that involve the construction/installation of culverts, measures shall be included in the construction/installation that will promote the safe passage of fish and other aquatic organisms

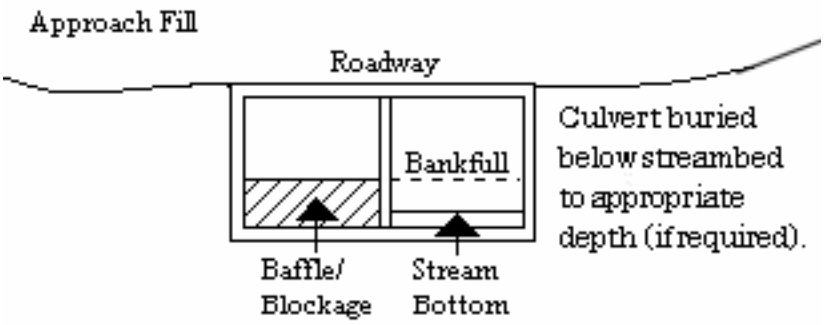
Placement of culverts and other structures in streams shall be below the elevation of the streambed by one foot for all culverts with a diameter greater than 48 inches, and 20% of the culvert diameter for culverts having a diameter less than or equal to 48 inches. If the culvert outlet is submerged within a pool or scour hole and designed to provide for aquatic passage, then culvert burial into the streambed is not required.
Culvert burial is not required for structures less than 72 inch diameter/width, where the slope of the culvert will be greater than 2.5%, provided that all alternative options for flattening the slope have been investigated and aquatic life movement/connectivity has been provided when possible (e.g., rock ladders, cross vanes, sills, baffles etc.). Culvert burial is not required when bedrock is present in culvert locations.

Installation of culverts in wetlands shall ensure continuity of water movement and be designed to adequately accommodate high water or flood conditions. When roadways, causeways, or other fill projects are constructed across FEMA-designated floodways or wetlands, openings such as culverts or bridges shall be provided to maintain the natural hydrology of the system as well as prevent constriction of the floodway that may result in destabilization of streams or wetlands.



A waiver from the depth specifications in this condition may be requested, in writing, by the permittee and issued by the Corp. This waiver request must be specific as to the reasons(s) for the request. The waiver will be issued if it can be demonstrated that the proposed design would result in less impacts to the aquatic environment. Culverts placed across wetland fills purely for the purposes of equalizing surface water do not have to be buried, but the culverts must be of adequate size and/or number to ensure unrestricted transmission of water.

b. Bank-full flows (or less) shall be accommodated through maintenance of the existing bank-full channel cross sectional area. Additional culverts or culvert barrels at such crossings shall be allowed only to receive bank-full flows.



c. Culverts shall be designed and installed in such a manner that the original stream profiles are not altered and allow for aquatic life movement during low flows. The dimension, pattern, and profile of the stream above and below a pipe or culvert shall not be modified by widening the stream channel or by reducing the depth of the stream in connection with the construction activity. The width, height, and gradient of a proposed culvert shall be such as to pass the average historical low flow and spring flow without adversely altering flow velocity. If the width of the culvert is wider than the stream channel, the culvert shall include multiple boxes/pipes, baffles, benches and/or sills to maintain the natural width of the stream channel. If multiple culverts/pipes/barrels are used, low flows shall be accommodated in one culvert/pipe and additional culverts/pipes shall be installed such that they receive only flows above bankfull.

10. **Utility Lines.** For all NWPs that allow for the construction and installation of utility lines, the following conditions shall be applied:

a. Utility lines consisting of aerial electric power transmission lines crossing navigable waters of the U.S. (which are defined at 33 CFR part 329) must comply with the applicable minimum clearances specified in 33 CFR 322.5(i).

b. The work area authorized by this permit, including temporary and/or permanent fills, will be minimized to the greatest extent practicable. Justification for work corridors exceeding forty (40) feet in width is required and will be based on pipeline diameter and length, size of equipment required to construct the utility line, and other construction information deemed necessary to support the request. The permittee is required to provide this information to the Corps with the initial PCN package.

c. A plan to restore and re-vegetate wetland areas cleared for construction must be submitted with the required PCN. Cleared wetland areas shall be re-vegetated, as appropriate, with species of canopy, shrub, and herbaceous species. The permittee shall not use fescue grass or any other species identified as invasive or exotic species by the NC Native Plant Society (NCNPS): https://ncwildflower.org/invasive-exotic-species-list/.

d. Any permanently maintained corridor along the utility right of way within forested wetlands shall be considered a loss of aquatic function. A compensatory mitigation plan will be required for all such impacts associated with the requested activity if the activity requires a PCN and the cumulative total of permanent conversion of forested wetlands

exceeds 0.1 acres, unless the District Engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal.

Where permanently maintained corridor within forested wetlands is 0.1 acres or less, the District Engineer may determine, on a case-by-case basis, that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment.

e. When directional boring or horizontal directional drilling (HDD) under waters of the U.S., including wetlands, permittees shall closely monitor the project for hydraulic fracturing or "fracking." Any discharge from hydraulic fracturing or "fracking" into waters of the U.S., including wetlands, shall be reported to the appropriate Corps Regulatory Field Office within 48 hours. Restoration and/or compensatory mitigation may be required as a result of any unintended discharges.

11. **Temporary Access Fills.** The permittee shall submit a PCN to the District Engineer prior to commencing the activity if the activity will involve the discharge of dredged or fill material into more than 0.1 acres of wetlands or 0.02 acres of stream channel for the construction of temporary access fills and/or temporary road crossings. The PCN must include a restoration plan that thoroughly describes how all temporary fills will be removed, how pre-project conditions will be restored, and include a timetable for all restoration activities.

12. **Federal Navigation Channel Setbacks.** Authorized structures and fills located in or adjacent to Federally authorized waterways must be constructed in accordance with the latest setback criteria established by the Wilmington District Engineer. You may review the setback policy at http://www.saw.usace.army.mil/Missions/Navigation/Setbacks.aspx. This general permit does not authorize the construction of hardened or permanently fixed structures within the Federally Authorized Channel Setback, unless the activity is approved by the Corps. The permittee shall submit a PCN (see General Condition 32) to the District Engineer to obtain a written verification prior to the construction of any structures or fills within the Federally Authorized Channel Setback.

13. **Northern Long-eared Bat – Endangered Species Act Compliance**

The Wilmington District, U.S. Army Corps of Engineers has consulted with the United States Fish and Wildlife Service (USFWS) in regard to the threatened Northern long-eared bat (NLEB) (*Myotis septentrionalis*) and Standard Local Operating Procedures for Endangered Species (SLOPES) have been approved by the Corps and the USFWS. This condition concerns effects to the NLEB only and does not address effects to other federally listed species and/or federally designated critical habitat.

A. Procedures when the Corps is the lead federal* agency for a project:

The permittee must comply with (1) and (2) below when:

• the project is located in the western 41 counties of North Carolina, to include non-federal aid North Carolina Department of Transportation (NCDOT) projects, OR;
• the project is located in the 59 eastern counties of North Carolina and is a non-NCDOT project.

*Generally, if a project is located on private property or on non-federal land, and the project is not being funded by a federal entity, the Corps will be the lead federal agency due to the requirement to obtain Department of the Army authorization to impact waters of the U.S. If the project is located on federal land, contact the Corps to determine the lead federal agency.

(1) A permittee using an NWP must check to see if their project is located in the range of the NLEB by using the following website: http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf. If the project is within the range of the NLEB, or if the project includes percussive activities (e.g., blasting, pile driving, etc.), the permittee is then required to check the appropriate website in the paragraph below to discover if their project:

• is located in a 12-digit Hydrologic Unit Code area ("red HUC" - shown as red areas on the map), AND/OR;
• involves percussive activities within 0.25 mile of a red HUC.

Red HUC maps - for the western 41 counties in NC (covered by the Asheville Ecological Services Field Office), check the project location against the electronic maps found at: http://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html. For the eastern 59 counties in NC (covered by the Raleigh Ecological Services Field Office), check the project location against the electronic maps found at: https://www.fws.gov/raleigh/NLEB_RFO.html.

(2) A permittee must submit a PCN to the District Engineer, and receive written verification from the District Engineer, prior to commencing the activity, if the activity will involve any of the following:

• tree clearing/removal and/or, construction/installation of wind turbines in a red HUC, AND/OR;
• bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, (applies anywhere in the range of the NLEB), AND/OR:
• percussive activities in a red HUC, or within 0.25 mile of a red HUC.

The permittee may proceed with the activity without submitting a PCN to either the Corps or the USFWS, provided the activity complies with all applicable NWP terms and

general and regional conditions, if the permittee's review under A.(1) and A.(2) above shows that the project is:

- located outside of a red HUC (and there are no percussive activities), and the activity will NOT include bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, OR;
- located outside of a red HUC and there are percussive activities, but the percussive activities will not occur within 0.25-mile of a red HUC boundary, and the activity will NOT include bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, OR;
- located in a red HUC, but the activity will NOT include tree clearing/removal; construction/installation of wind turbines; bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, and/or; any percussive activities.

B. Procedures when the USACE is not the lead federal agency:

For projects where another federal agency is the lead federal agency - if that other federal agency has completed project-specific ESA Section 7(a)(2) consultation for the NLEB, and has (1) determined that the project would not cause prohibited incidental take of the NLEB, and (2) completed coordination/consultation that is required by the USFWS (per the directions on the respective USFWS office's website), that project may proceed without PCN to either the USACE or the USFWS, provided all General and Regional Permit Conditions are met.

The NLEB SLOPES can be viewed on the USACE website at: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/ESA/. Permittees who do not have internet access may contact the USACE at (910) 251- 4633.

14. **West Indian Manatee Protection.** In order to protect the endangered West Indian manatee (*Trichechus manatus*) the Permittee shall implement the USFWS' Manatee Guidelines, and strictly adhere to all requirements therein. The guidelines can be found at https://www.fws.gov/raleigh/pdfs/ManateeGuidelines2017.pdf.

15. **ESA Programmatic Biological Opinions.** The Wilmington District, USFWS, NCDOT, and the FHWA have conducted programmatic Section 7(a)(2) consultation for a number of federally listed species and designated critical habitat (DCH), and programmatic consultation concerning other federally listed species and/or DCH may occur in the future. The result of completed programmatic consultation is a Programmatic Biological Opinion (PBO) issued by the USFWS. These PBOs contain mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" of whichever species or critical habitat is covered by a specific PBO. Authorization under NWPs is conditional upon the permittee's compliance with all the mandatory terms and conditions associated with incidental take of the applicable PBO (or PBOs), which are incorporated by reference in

the NWPs. Failure to comply with the terms and conditions associated with incidental take of an applicable PBO, where a take of the federally listed species occurs, would constitute an unauthorized take by the permittee, and would also constitute permittee non-compliance with the authorization under the NWPs. If the terms and conditions of a specific PBO (or PBOs) apply to a project, the Corps will include this/these requirements in any NWP verification that may be issued for a project. For an activity/project that does not require a PCN, the terms and conditions of the applicable PBO(s) also apply to that non-notifying activity/project. The USFWS is the appropriate authority to determine compliance with the terms and conditions of its PBO and the ESA. All PBOs can be found on our website at: https://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/ESA/.

16. **Work on Eastern Band of Cherokee Land.**

Notifying NWPs - All PCNs submitted for activities in waters of the U.S. on Eastern Band of Cherokee Indians (EBCI) trust land (i.e., Qualla Boundary and non-contiguous tracts of trust land located in portions of Swain, Jackson, Haywood, Graham and Cherokee Counties), must comply with the requirements of the latest MOU between the Wilmington District and the EBCI.

Non-notifying NWPs - Prior to the use of any non-notifying NWP for activities in waters of the U.S. on EBCI trust land (i.e., Qualla Boundary and non-contiguous tracts of trust land located in portions of Swain, Jackson, Haywood, Graham and Cherokee Counties), all prospective permittees must comply with the requirements of the latest MOU between the Wilmington District and the EBCI; this includes coordinating the proposed project with the EBCI Natural Resources Program and obtaining a Tribal Approval Letter from the Tribe.

The EBCI MOU can be found at the following URL: http://saw-reg.usace.army.mil/FO/Final-MOU-EBCI-USACE.pdf

17. **Sedimentation and Erosion Control Structures and Measures**
All PCNs will identify and describe sedimentation and erosion control structures and measures proposed for placement in waters of the U.S. The structures and measures should be depicted on maps, surveys or drawings showing location and impacts to jurisdictional wetlands and streams.

C. SECTION 401 WATER QUALITY CERTIFICATION (WQC) AND/OR COASTAL ZONE MANAGEMENT ACT (CZMA) CONSISTENCY DETERMINATION SUMMARY AND APPLICABLE CONDITIONS

The CZMA Consistency Determination and all Water Quality Certifications for the NWPs can be found at: https://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Permits/2017-Nationwide-Permits/

Patrick Cusack

From: Emily Tarsa <etarsa@enviroscienceinc.com>
Sent: Friday, April 4, 2025 8:17 AM
To: Manjiang Chen
Subject: FW: SAW-2023-01929, MSD ITT Pump Station Replacement, Nationwide Permit 58
Attachments: SAW-2023-01929_MSDITTPumpStationReplacement_Verification20250403.pdf; 2021 NWP58.pdf

Hi MJ,

Attached is the approved permit application needed for wetland and stream impacts on the ITT pump station project. See below for the two special permit conditions. Interestingly, there is not permit condition for restrictions on tree clearing in here, so you are good to clear trees at any time of year.

Let me know if you have any questions!

Thanks,
Emily

Emily Tarsa, Ph.D.
Wetland Ecologist

EnviroScience, Inc.
O. 800.940.4025 | C. 518.572.5322

From: Winston, Joseph B CIV USARMY CESAW (USA) <Joseph.B.Winston@usace.army.mil>
Sent: Thursday, April 3, 2025 2:31 PM
To: shauna@msdbc.org
Cc: Emily Tarsa <etarsa@enviroscienceinc.com>; Hickman, Tyler N <tyler.hickman@deq.nc.gov>; Leslie, Andrea J <andrea.leslie@ncwildlife.gov>
Subject: SAW-2023-01929, MSD ITT Pump Station Replacement, Nationwide Permit 58

Hello,

Please find the Nationwide Permit and permit verification letter attached for the above-referenced project. Please note the two special conditions, included below.

1. Hydraulic Fracturing (Fracking): When directional boring or horizontal directional drilling (HDD) under waters of the United States, including wetlands, the Permittee shall closely monitor the project for hydraulic fracturing or "fracking" and material from the drilling operation leaching to the surface and into jurisdictional areas. Any discharge from fracking or leaching into waters of the United States, including wetlands, shall be reported to U.S. Army Corps of Engineers, Wilmington District, Asheville Regulatory Field Office, Attn: Joey Winston at 828-271-7980 ext. 4233, or joseph.b.winston@usace.army.mil within 48 hours. Restoration and/or mitigation may be required as a result of any unintended discharges.

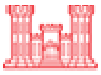
2. Navigable Rivers and Streams without Maintained Channel: Pipelines placed beneath navigable rivers and streams that do not have a maintained channel shall be placed 10 feet below the thalweg depth of the river or stream. Pipelines shall be placed at the greatest depth which meets the above requirements over the

entire channel bottom width plus a distance 12.5 feet on each side of the stream channel measured from the ordinary high water mark (OHWM) of the stream or river.

Please let me know if you have any questions.

Thanks,
Joey

Joey Winston
Regulatory Specialist, Asheville Regulatory Field Office
US Army Corps of Engineers, Wilmington District
151 Patton Avenue, Room 208
Asheville, NC 28801-5006
Office: 828-271-7980, ext. 4233
Cell: 828-782-0795
Email: joseph.b.winston@usace.army.mil



Miscellaneous Permits

Town of Mills River, NC Non-Residential Zoning Permit

TOWN OF MILLS RIVER, NC

NON-RESIDENTIAL ZONING PERMIT (COMMERCIAL / INDUSTRIAL) PERMIT

124 TOWN CENTER DRIVE
MILLS RIVER, NC 28759 (828) 890-2901
http://www.millsriver.gov planning@millsriver.gov

PERMIT NUMBER: **Z-25-89**
ISSUED DATE: 05/16/2025
EXPIRATION DATE: **11/16/2026**

400 BROADPOINTE DR
MILLS RIVER, NC 28759

PARCEL NUMBER: 9642275609 LOT NUMBER: 5609
Legal Description: D6 BROADPOINTE CTR PL:SLD-2815

PROJECT: INSTALLATION OF NEW MSD SEWER PUMP STATION AND ASSOCIATED INFRASTRUCTURE

	NAME	ADDRESS	PHONE/EMAIL
APPLICANT:	Hartman, Patrick	51 THOMPSON ST., SUITE F ASHEVILLE, NC 28803	8503591280 PHARTMAN@MCKIMCREED.COM
OWNER:	UPM RAFLATAC INC	400 BROADPOINTE DR MILLS RIVER, NC 28759	

FEE SUMMARY:

Non-Residential Zoning Permit (Commercial / Industrial)	$250.00
TOTAL FEES PAID:	**$250.00**

CONDITIONS

1. Notes:
   - Removal of existing pump station will occur after completion of new sewer pump station.
   - Per Ordinance 2025-02 (An ordinance establishing a moratorium on non-residential development in special flood hazard areas within the Town of Mills River), development related to public infrastructure or utilities, where required for the health, safety, and welfare of the community are exempt from the moratorium.

SIGNATURE OF OWNER OR AGENT: Patrick Hartman DATE: May 13, 2026

PRINTED NAME: Patrick Hartman

TOWN OF MILLS RIVER
APPROVED DATE: 5/16/25
ZONING ADMINISTRATOR: Kevin Webb

*Six month extension granted on 11/14/25
*Six month extension granted on 5/13/26

KW 5/13/26

ITT PUMP STATION REPLACEMENT

TOWN OF MILLS RIVER
APPROVED DATE: 05/13/2025
ZONING ADMINISTRATOR: Kerin Webb

MSD PROJECT NO. 2020061
M&C PROJECT NO. 09596-0001
APRIL 16, 2025
90% DESIGN - NOT FOR CONSTRUCTION



VICINITY MAP NOT TO SCALE

PROJECT NAME ITT PUMP STATION REPLACEMENT

OWNER
METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY
2028 RIVERSIDE DR
ASHEVILLE, NC 28804

PROJECT LOCATION
470 BROADPOINTE DR
FLETCHER, NC 28732

McKIM&CREED
51 Thompson Street, Suite D
Asheville, North Carolina 28803
Phone: (828) 252-8181, Fax: (828) 252-8857
NC Licensed F-1275
www.mckimcreed.com

PROJECT INFORMATION



SITE MAP SCALE: 1" = 200'

SHEET INDEX

SHEET NO.	SHEET TITLE
GENERAL	
G00 0	COVER
G01 0	LEGEND AND NOTES
CIVIL	
CX01 1	EXISTING SITE
CX01 1	EXISTING FORCE MAIN PLAN
CDE01 1	EXISTING SITE DEMOLITION
CDEM 1	EXISTING FORCE MAIN DEMOLITION
CU04 1	FORCE MAIN PLAN AND PROFILE STA 0+00 - STA 10+00
CU04 2	FORCE MAIN PLAN AND PROFILE STA 10+00 - STA 20+00
CU04 3	FORCE MAIN PLAN AND PROFILE STA 20+00 - STA 26+48
CU05 1	GRAVITY SEWER PLAN AND PROFILE STA 0+00 - STA 9+31
CS01 1	PROPOSED SITE PLAN
CSR2 1	PROPOSED UPPER ACCESS ROAD PLAN
CSR2 2	PROPOSED LOWER ACCESS ROAD PLAN 1 OF 2
CSR2 3	PROPOSED LOWER ACCESS ROAD PLAN 2 OF 2
CE1 1	GRADING PLAN 1 OF 3
CE1 2	GRADING PLAN 2 OF 3
CE1 3	GRADING PLAN 3 OF 3
CE01 0	GENERAL NOTES AND SCHEDULES
CE01 1	EROSION CONTROL UPPER ACCESS ROAD PLAN
CE01 2	EROSION CONTROL LOWER ACCESS ROAD PLAN 1 OF 2
CE01 3	EROSION CONTROL LOWER ACCESS ROAD PLAN 2 OF 2
CE01 4	EROSION CONTROL FORCE MAIN CROSSING PLAN
CE12 1	EROSION AND SEDIMENTATION CONTROL DETAILS
CE12 2	NCDOT DETAILS
MECHANICAL	
M01 1	PUMP STATION PLAN
M01 2	PUMP STATION SECTION
M01 3	BYPASS CONNECTION DETAIL
M01 1	STANDARD DETAILS 1
M01 2	STANDARD DETAILS 2
M01 3	STANDARD DETAILS 3
ELECTRICAL	
E00 0	GENERAL NOTES LEGENDS AND ABBREVIATIONS
E01 1	TYPICAL POWER AND CONTROL SYMBOLS
E01 0	PUMP STATION POWER AND CONTROL DIAGRAM
E02 0	PANELBOARD SCHEDULE AND LOAD TABLE
E03 0	TYPICAL INSTALLATION DETAILS
L01 1	EQUIPMENT RACK INSTALLATION DETAIL
E10 0	PUMP STATION POWER AND GROUNDING PLAN

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 057953 PATRICK N HARTMAN

Digitally signed by Patrick N Hartman
Contact Info: phartman@mckimcreed.com
Date: 2025.04.16 14:50:44-04'00'

811 Know what's below. Call before you dig.

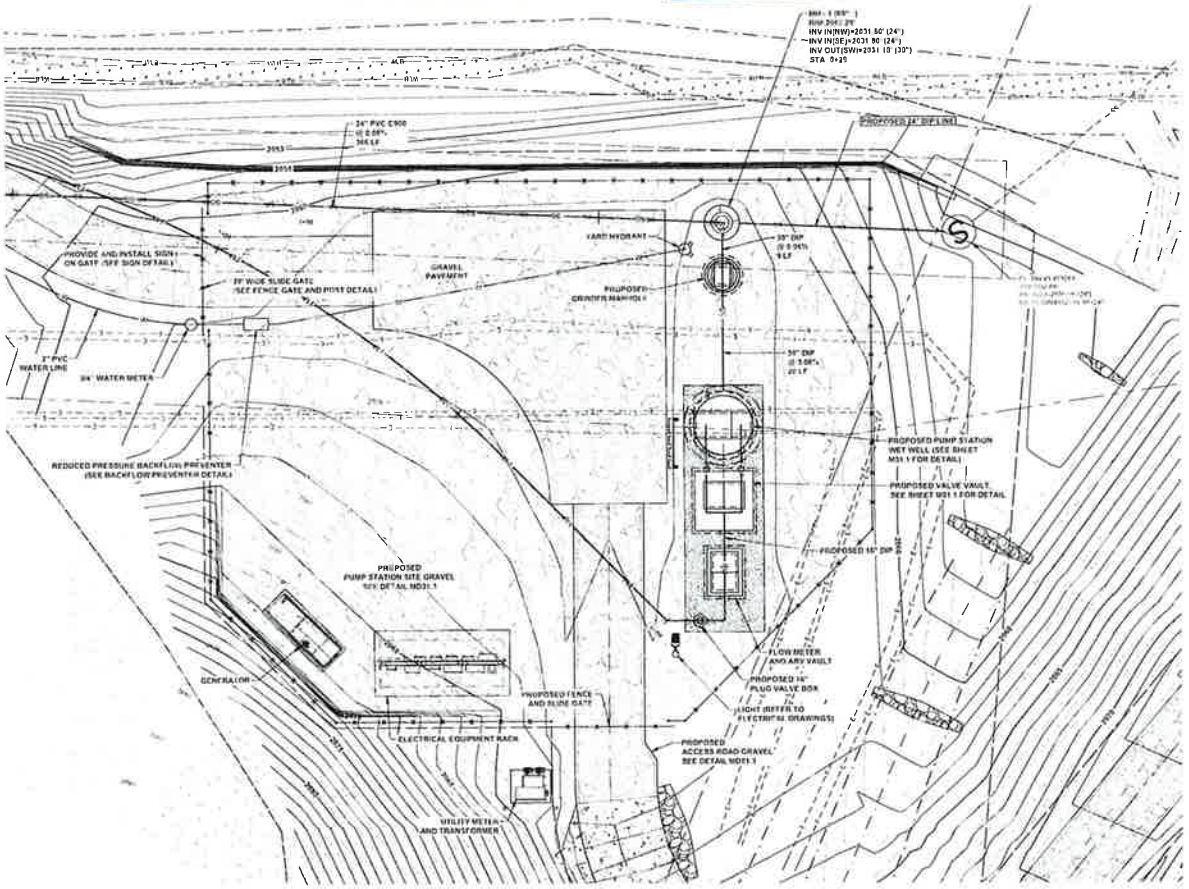
SHEET INDEX

MSD PROJECT NO. 2020061 M&C PROJECT NO. 09596-0001 ITT PUMP STATION REPLACEMENT
SUBMITTAL DATE: APRIL 16, 2025

TOWN OF MILLS RIVER

APPROVED DATE: 05/13/2025

ZONING ADMINISTRATOR: Kerin Webb



SITE PLAN

HORIZ SCALE: 1" = 10'

C	WILKESBORO WATER DISTRIBUTION		
B	WILKESBORO WATER DISTRIBUTION		
A	WILKESBORO WATER DISTRIBUTION		

REVISIONS

McKIM&CREED

31 Thompson Street Suite D
Asheville, North Carolina 28801
Phone: (828) 252-8181, Fax: (828) 252-1957

NC Licensed: C-0782
www.mckimcreed.com

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

ITT PUMP STATION REPLACEMENT

CIVIL

PROPOSED SITE PLAN

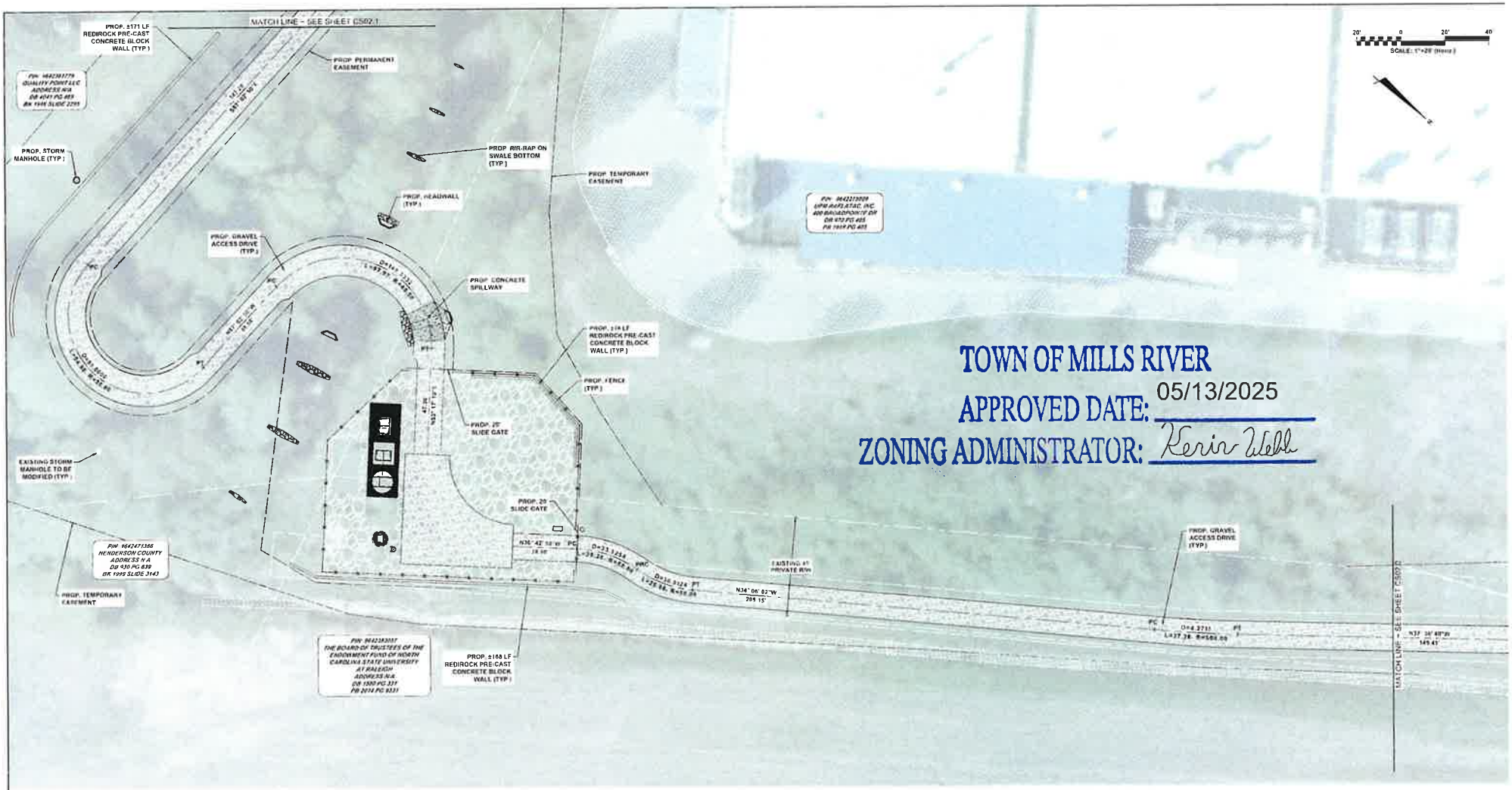
PROJ START DATE	2024 MAR
DRAWN	AWR
DESIGNED	NJW
CHECKED	NJW
DWG MOD	MC

SCALE: 1"=5" (HORIZ) / N/A (VERTICAL)

CS01.1

C

90% DESIGN
NOT FOR CONSTRUCTION



TOWN OF MILLS RIVER

APPROVED DATE: 05/13/2025

ZONING ADMINISTRATOR: Kerin Webb

McKIM&CREED

61 Biltmore Street Suite D
Asheville, North Carolina 28803
Phone: (828) 252-8181 Fax: (828) 252-1857

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

ITT PUMP STATION REPLACEMENT

CIVIL

PROPOSED LOWER ACCESS ROAD PLAN
1 OF 2

PROJ START DATE	2024 MAR
DESIGN	PHR
DRAWN	PHR
DESIGNED	PHR
CHECKED	PHR
PROJ MGR	MC

SCALE
HORIZONTAL 1"=10'
VERTICAL 1"=4'

CS02.2

C

STATUS: 90% DESIGN NOT FOR CONSTRUCTION

Z-25-89_V2_signed

Final Audit Report 2026-05-13

Created:	2026-05-13
By:	Kevin Webb (Kevin.Webb@millsriver.gov)
Status:	Signed
Transaction ID:	CBJCHBCAABAA-q6X-72EpRpfr5HborbJKZFtFNxWu7Cv

"Z-25-89_V2_signed" History

Document created by Kevin Webb (Kevin.Webb@millsriver.gov)
2026-05-13 - 4:48:50 PM GMT

Document emailed to phartman@mckimcreed.com for signature
2026-05-13 - 4:49:04 PM GMT

Email viewed by phartman@mckimcreed.com
2026-05-13 - 4:56:48 PM GMT

Signer phartman@mckimcreed.com entered name at signing as Patrick Hartman
2026-05-13 - 6:19:09 PM GMT

Document e-signed by Patrick Hartman (phartman@mckimcreed.com)
Signature Date: 2026-05-13 - 6:19:11 PM GMT - Time Source: server - Signature Appearance Selected: IMAGE

Agreement completed.
2026-05-13 - 6:19:11 PM GMT

Miscellaneous Permits

NCDEQ Erosion and Sedimentation Control Permit

JOSH STEIN
Governor
D. REID WILSON
Secretary
WILLIAM E. TOBY VINSON, JR
Director

NORTH CAROLINA
Environmental Quality

June 3, 2026

LETTER OF APPROVAL WITH MODIFICATIONS

Metropolitan Sewerage District of Buncombe County
2028 Riverside Drive
Woodfin, NC 28804

RE: Project Name: MSD ITT Pump Station
Permit Number: HENDE-2026-0136
Acres Approved: 4.9
County: Henderson
City: Mills River
Address: Broadpointe Dr
River Basin: French Broad
Stream Classification: C
Plan Type: Utility

Dear Metropolitan Sewerage District of Buncombe County,

This office has reviewed the subject erosion and sedimentation control plan. We hereby issue this Letter of Approval with Modifications. Any modifications required for approval are listed in the body of the email that accompanied this attached letter. The enclosed Certificate of Approval must be posted at the job site. This plan approval shall expire three (3) years following the date of approval, if no land-disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0129.

As of April 1, 2019, all new construction activities are required to complete and submit an electronic Notice of Intent (eNOI) form requesting a COC under the NCG010000 Construction Stormwater General Permit. You must apply for coverage by submitting a "Construction Stormwater – NCG01 (Subject to the SPCA) in the AccessDEQ Portal. Once your application is complete, you will receive an invoice for the $120 annual permit fee and can submit payment through the AccessDEQ Portal. Once the fee is processed and the application approved, you will receive the COC via email. As the Financially Responsible Party shown on the FRO form submitted for this project, you MUST obtain the COC prior to commencement of any land disturbing activity. Please direct questions about the eNOI form to the Stormwater Program staff in the Raleigh central office. If the owner/operator of this project changes in the future, the new responsible party must obtain a new COC.

Title 15A NCAC 4B .0118(a) and the NCG01 permit require that the following documentation be kept on file at the job site:

1. The approved E&SC plan as well as any approved deviation.
2. The NCG01 permit and the COC, once it is received.
3. Records of inspections made during the previous 12 months.

Also, this letter gives the notice required by G.S. 113A-61.1(a) of our right of periodic inspection to ensure compliance with the approved plan.

North Carolina's Sedimentation Pollution Control Act is performance-oriented, requiring protection of existing natural resources and adjoining properties. If, following the commencement of this project, the erosion and sedimentation control plan is inadequate to meet the requirements of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statute 113A-51 through 66), this office may require revisions to the plan and implementation of the revisions to ensure compliance with the Act.

Acceptance and approval of this plan is conditioned upon your compliance with Federal and State water quality laws, regulations, and rules. In addition, local city or county ordinances or rules may also apply to this land-disturbing activity. This approval does not supersede any other permit or approval.

Please note that this approval is based in part on the accuracy of the information provided in the Financial Responsibility Form and on the plan, which you provided. You are requested to file an amended form if there is any change in the information included on the form.

Your cooperation is appreciated.

Sincerely,

Fred Walker

Fred Walker, PE
Land Quality Section
NCDEQ - DEMLR

CERTIFICATE OF PLAN APPROVAL

The posting of this certificate certifies that an erosion and sedimentation control plan has been approved for this project by the North Carolina Department of Environmental Quality in accordance with North Carolina General Statute 113A – 57 (4) and 113A – 54 (d) (4) and North Carolina Administrative Code, Title 15A, Chapter 4B.0107 (c). This certificate must be posted at the primary entrance of the job site before construction begins and until establishment of permanent groundcover as required by North Carolina Administrative Code, Title 15A, Chapter 4B.0127 (b).

MSD ITT Pump Station
Broadpointe Dr Mills River, NC 28759

06/03/2026	HENDE-2026-0136
Date of Plan Approval	**Project Identifier**

Certificate of Coverage Number: _____

Patrick Cusack

From: Patrick Hartman
Sent: Wednesday, June 3, 2026 6:28 PM
To: Manjiang Chen; Patrick Cusack
Subject: Fw: NCDEMLR - Erosion and Sedimentation Control - Letter of Plan Approval with Modifications Needed CRM:0138194
Attachments: Application Report - Wednesday, June 3, 2026 329 PM.pdf; Certificate of Approval - Wednesday, June 3, 2026 329 PM.pdf; LOAwM HENDE-2026-0136 2026-06-03.docx

Sent from my T-Mobile 5G Device
Get Outlook for Android

From: SVC_DoNotReply-DEQPermits <DoNotReply-DEQPermits@deq.nc.gov>
Sent: Wednesday, June 3, 2026 6:26:09 PM
To: Metropolitan Sewerage District of Buncombe County <ShaunA@msdbc.org>; Patrick Hartman <PHartman@mckimcreed.com>
Cc: Wilson, Josh E <josh.e.wilson@deq.nc.gov>
Subject: NCDEMLR - Erosion and Sedimentation Control - Letter of Plan Approval with Modifications Needed CRM:0138194

LETTER OF PLAN APPROVAL WITH MODIFICATIONS 06-03-2026:

Project Name: MSD ITT Pump Station
Permit Number: HENDE-2026-0136
Permit Application ID: PA-060242
County: Henderson
Acres Approved: 4.9
River Basin: French Broad
Stream Classification: C
Plan Type: Utility - Revision
Date Complete Plan Received by LQS: June 1, 2026

Dear Metropolitan Sewerage District of Buncombe County,

This office has reviewed the subject erosion and sedimentation control plan. We find the plan to be acceptable with modifications and hereby issue this Letter of Approval with Modifications. The Modifications Required for Approval are listed in the attached Letter and below. The Certificate of Approval must be posted at the job site. Please also see the attached Application Report (FRO form), Letter of Approval (LOA) and the Certificate of Approval (COA). The Certificate of Approval must be posted at the job site in addition to a copy of the Certificate of Coverage (COC), a hard copy of the final approved plan, self-inspection records and the rain gauge.

The attached, signed, digital copy of the letter may be used to submit with your electronic Notice of Intent (eNOI) in order to receive your Certificate of Coverage (COC). You must apply for coverage by submitting a

"Construction Stormwater – NCG01 (Subject to the SPCA)" application in the AccessDEQ Portal.

This plan approval shall expire three (3) years following the date of approval, if no land-disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0129.

The following modifications to the erosion and sediment control plan must be made prior to the beginning of land disturbance. Provide an updated plan set to this office once modifications have been addressed.

Modifications Required for Approval:

1. Provide temporary and or permanent slope breaks i.e. wattles, benches, etc., for proposed slopes that are over 30 ft. in slope length. {15A NCAC 04B .0106(a)(4)}

Per the construction sequence, contact this office in advance of the activity start date to schedule the preconstruction meeting.
Additional measures may be required, you are responsible for the control of sediment on-site. If the approved erosion and sedimentation control measures prove insufficient, additional steps may be necessary to stop sediment from leaving this site.
Any off-site borrow and waste required for this project must come from a site with an approved erosion control plan, a site regulated under the Mining Act of 1971, or a landfill regulated by the Division of Solid Waste Management. Trash/debris from demolition activities or generated by any activities on site must be disposed of at a facility regulated by the Division of Solid Waste Management or per Division of Solid Waste Management or Division of Water Resources rules and regulations.

Your cooperation is appreciated.

Sincerely,

Fred Walker

Fred Walker, PE
North Carolina Department of Environmental Quality
Division of Energy, Mineral & Land Resources, Land Quality Section
Asheville Regional Office | 2090 U.S. 70 Highway | Swannanoa NC, 28778-8211
828-296-4500

Email correspondence to and from this address may be subject to the North Carolina Public Records Law and may be disclosed to third parties by an authorized state official.

Duke Energy

Letter of No-Objection

Duke Energy
37 Old Charlotte Hwy.
Asheville, NC 28803
828.258.5018
craig.garrett@duke-energy.com

4/22/2026

Re: Duke Energy Transmission ("**DET**") Line Easement Plan Review Conditional Approval
Project: MSD at Broad Pointe Commercial Park
Lines: 1H304 Str. 68.0 – 115kV

Manjiang Chen
McKim & Creed
35 N Market St.
Asheville, NC 28801
828.252.818

Manjiang Chen,

- This office has reviewed the proposed: MSD AT BROADPIONT COMMERCIAL PARK located in HENDERSON COUNTY, NC. site plans (as attached via email) and referred to herein as Attachment "A". We find the plans as shown on the referenced drawings to be acceptable and in compliance with the attached Use Guidelines for Encroachments involving Transmission Easements. Therefore, Duke Energy Transmission ("DET") approves the referenced plans, insofar as its transmission easement rights are concerned, subject to the conditions detailed below. If this project construction has not commenced by a period of 12 months from the date of this letter, this approval by DET shall expire, and an additional plan review will be required by DET at that time.

In summary, the following details Duke Energy comments:

- Contractors operating any and all equipment should be instructed not to operate within 25' of the poles, towers, or other electrical structures including guy anchors. All slopes shall be 4:1 or less except where Duke Energy has agreed to a variance. No spoil dirt is to be placed within the easement limits unless previously approved by DET.
- High visibility construction fencing required at a 9' offset around DET's transmission tower legs.
- No Impressed current cathodic protection system on UG pipe
- Any proposed easements must not cross closer than 25' to DET's electrical structures including, but not limited to poles, towers, and guy anchors.
- All underground facilities, such as, but not limited to, storm water pipes and domestic water line pipes, must be capable of a heavy equipment load bearing weight of 80,000 lbs. DET will not be responsible for damages to these installed facilities.
- All plats, plans, renderings and representations of lots, parcels, designated spaces and/or designated areas having and including area within a DET easement cannot represent, with setbacks or other means, buildable areas(s) within a DET easement.
- Underground Utilities with cathodic protection will require a study of anodic interference on existing DET structures. The developer / owner is responsible for any required remediation as determined by DET. This study shall be provided at no cost to DET for their review and acceptance before a Final Approval shall be issued by DET**.** This study must be submitted to DET prior to the commissioning of the Underground Utilities.
- Any damage to the transmission line or its associated structures, related to this project, and/or claims due to the damage, is the responsibility of the developer/owner.

- Any vegetation within or outside of the transmission easement that will pose a grow-in, fall-in, or blowing together threat (typical maximum mature height greater than 15' within the transmission easement depending up voltage), limit or block access, limit the safe and reliable operation, emergency restoration, or maintenance of the transmission facilities, or limit the full use of the easement for its intended purposes, is incompatible with the high voltage transmission power lines and therefore could be subject to removal by DET.
- This approval by DET is subject to the paramount right of DET at all times to make use of its entire easement area for the construction, maintenance, reconstruction, and operation of electric lines.
- This letter only addresses issues related to the DET's transmission line easement. Additional easements, approvals, or permits from the underlying property owner(s) or other applicable agencies may be required in order for you to proceed with this project.

DET also offers these additional comments to ensure that other potential conflicts are not created during or after construction: We have not reviewed, and therefore have not approved, any plans other than Attachment "A".

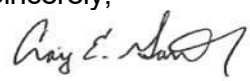
- If there are design changes to any drawings that involve the transmission easements, DET must review the changes for compliance with the Use Guidelines for Encroachments involving Transmission Easements.
- Proper clearances must be maintained at all times. If any transmission line modification by DET is required to maintain proper clearances, the cost will be the responsibility of the developer/owner. Any such line modifications must be approved and scheduled, through DET well in advance of the project start date.
- All current and future property owners are required to adhere to the most current version of the DET transmission right-of-way guidelines and restrictions. (Attached herein via email)
- DET heavy equipment access must not be restricted during this project due to grading or other activity.
- Please contact me prior to the start of this project to attend any pre-construction meetings.

In not objecting to the use of the transmission easement for use as shown on the drawings, DET is not relinquishing the right to control and maintain the transmission easement as specified in the recorded agreements. Any damages to the transmission lines or its associated structures, and claims caused by the damage, is the responsibility of the developer/contractor. It is the responsibility of the contractors/owners to ensure that all work performed in the proximity of the transmission lines complies with all applicable laws and regulations, including but not limited to the National Electric Safety Code ("**NESC**"), the Overhead High-Voltage Line Safety Act ("**OHVLSA**"), and the Occupational Safety and Health Act ("**OSHA**"), and that all persons working near the electric power lines are made aware of the inherent safety hazards associated with these lines.

Please note that this approval is based in part on the accuracy of the information you have supplied on the plans (Attachment "A"). You are responsible for indicating the correct location of the DET easement and its associated electrical structures along with the correct width of the DET easement limits.

Thank you for your cooperation. If you have any questions, please feel free to contact me at 828-258-5018

Sincerely,



Craig E. Garrett
Senior Asset Protection Program Manager
Transmission Asset Protection
Craig.garrett@duke-energy.com

Attachments: Attachment "A", Referenced Site Plans, Duke Energy Use Guidelines for Encroachments involving Transmission Easements, and the Duke Energy "Look Up & Live" Brochure.

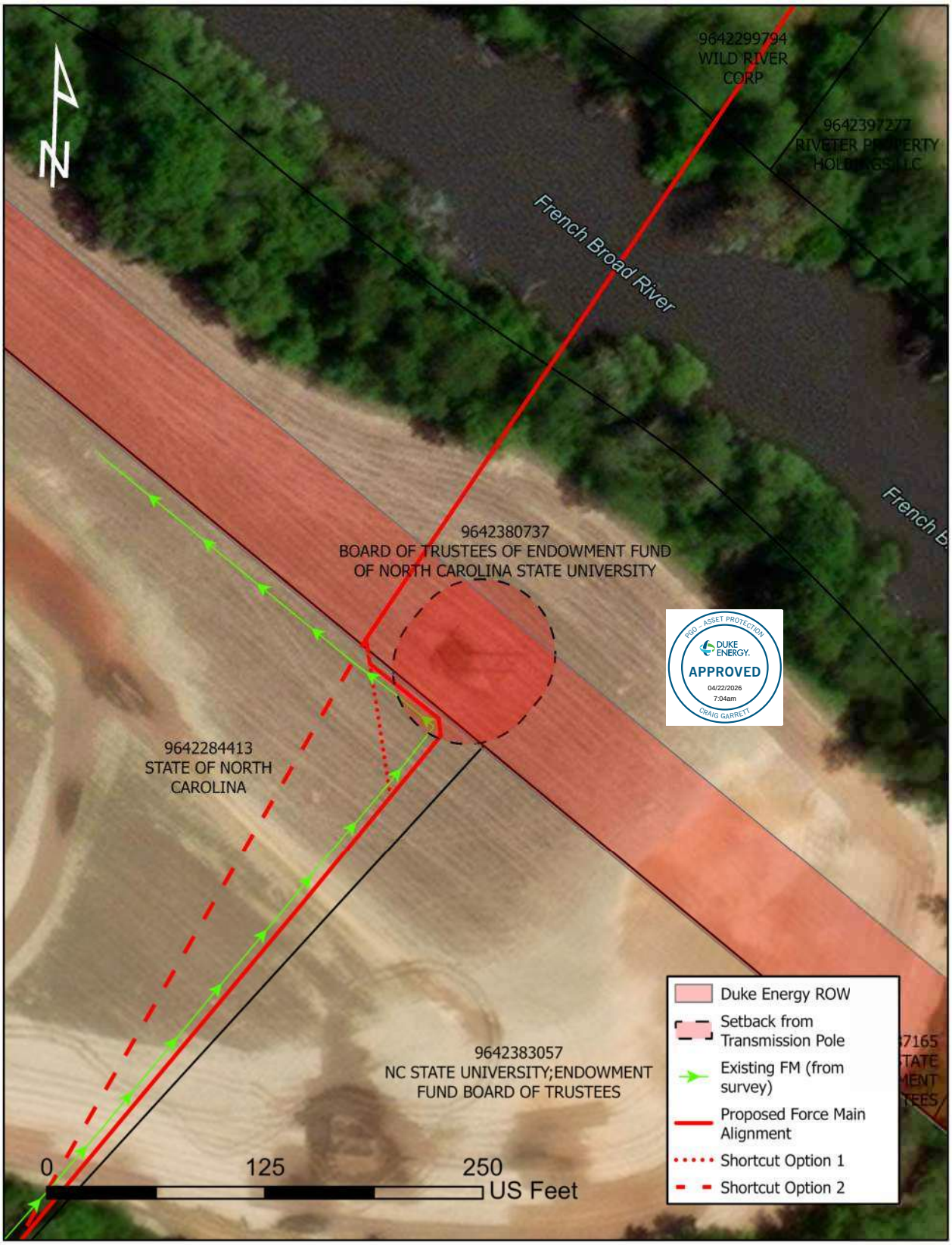
Attachment “A”:

9642284413 State of NC- Board of trustees of Endowment Fund of NCSU

1-In not objecting to the use of the transmission easement for use as shown on the drawings, DET is not relinquishing any of its vegetation management rights as afforded it within its recorded easement documents

-2. Provide the below attached Duke Energy “Look Up and Live” Brochure to all those working in proximity to the high voltage transmission power lines.

-3. During site construction a cement barrier is required as a “Jersey” type barrier to protect any Duke Energy Progress transmission power poles, guy wires and guy anchors which will be within 10’ of any construction traffic.


9642299794
WILD RIVER
CORP
9642397277
RIVETER PROPERTY
HOLDINGS LLC
French Broad River
French B
9642380737
BOARD OF TRUSTEES OF ENDOWMENT FUND
OF NORTH CAROLINA STATE UNIVERSITY
9642284413
STATE OF NORTH
CAROLINA
9642383057
NC STATE UNIVERSITY;ENDOWMENT
FUND BOARD OF TRUSTEES
ROD – ASSET PROTECTION
DUKE ENERGY.
APPROVED
04/22/2026
7:04am
CRAIG GARRETT
Duke Energy ROW
Setback from Transmission Pole
Existing FM (from survey)
Proposed Force Main Alignment
Shortcut Option 1
Shortcut Option 2
0
125
250
US Feet

USE GUIDELINES FOR ENCROACHMENTS INVOLVING TRANSMISSION EASEMENTS

Duke Energy has a property interest called an easement (or sometimes a right-of-way) in land that you own or are considering purchasing. This easement grants Duke Energy the right to use the easement area for purposes described in the easement document that is filed and recorded in the county's recorder office. This property interest stays with the land when it is bought and sold and generally is perpetual in duration. A series of easements often form a corridor in which the transmission facilities are located and access up and down the corridor is part of the reason Duke Energy obtains these rights.

Broadly stated, easements allow Duke Energy to use another person's property to construct, operate, maintain, repair, and replace electrical facilities for the transmission of high voltage power. The landowner may continue to use the easement area so long as the use is not inconsistent with the easement document or Duke Energy's use of the easement. Any incompatible use by the landowner is called an encroachment. Where an encroachment is under construction, Duke Energy will request that it be stopped and removed; where an encroachment is already installed, Duke Energy will request that it be removed. Where a landowner fails to cooperate, Duke Energy will seek legal recourse to remove the encroachment.

Electricity is a public service and subject to state and federal regulations with which Duke Energy must comply. Any use by the landowner that does or could create regulatory issues is an encroachment. Power lines in the transmission easement are uninsulated and electricity is a dangerous instrumentality. Any landowner use that increases the danger to the landowner, the public or Duke Energy in its use of the easement is also an encroachment.

Over years of designing, constructing, operating, repairing, upgrading and maintaining electric facilities in transmission easements, Duke Energy has developed an understanding of the types of uses by landowners that do, or potentially can, interfere with the easement's purposes and Duke Energy's ability to provide safe and reliable service. This guidance, which supersedes all prior versions, provides a brief overview of types of things that do, or can, interfere with Duke Energy's easement rights and thereby create encroachments.

This overview cannot address all possible situations and is intended to provide general guidance. Please contact the Asset Protection Specialist if you have additional questions or concerns about the use of the easements. Please discuss any proposed activity in the transmission easements with Duke Energy to avoid creating an encroachment or interference. The Asset Protection Specialist can assist and help avoid a subsequent need by the landowner to revise plans or remove obstructions from the easements. Engineering plans may be required by Duke Energy to fully understand any proposed use by the landowner.

By providing these guidelines, Duke Energy does not waive any rights it has in its easements or under the law. Duke Energy's concurrence that a proposed use does not constitute an interference with its easement rights does not mean that requirements of local, county, state or federal governments or other agencies with governing authority have been met.

The following are not permitted in Duke Energy's transmission easements as they interfere with Duke Energy's use of the easements for transmission of electricity by, among other things, interfering with full use the easement, interfering with existing facilities, interfering with access to the facilities, interfering with future expansion in the easement, increasing the danger to the public or those who may be required to work in the easement, creating regulatory violations and generally, making the transmission of electricity more dangerous, costly and/or unreliable: Examples include but are not limited to:

- Permanent or temporary structures and buildings, including for example, permanent or manufactured/mobile homes (and home additions and extensions), garages, sheds, satellite systems, intersections, cul-de-sacs, entrances, streets, swimming pools (any associated equipment and decking), playground equipment, graves, billboards, dumpsters, signs, wells, deer stands, retaining walls, septic systems or tanks (whether above or below ground).

- Mounding or stockpiling any material, such as spoils, dirt, logs, construction or building material, wrecked or disabled vehicles, (e.g. may create clearance and access issues and/or increases dangers in using the easement).

- Transformers, telephone/cable pedestals and associated equipment (unless specifically addressed in a joint use agreement), fire hydrants, manholes, water valves, water meters, backflow preventers & irrigation heads, (e.g. may increase the likelihood of safety hazards & access issues).

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- Attachments to Duke Energy structures in the easement; (unless specifically addressed in a joint use agreement).

- Streets, roads, driveways, sewer/water lines, other utility lines or any underground facilities that run in parallel to the centerline in the easement or cross in one contiguous segment from outside edge of easement to opposing outside edge of easement, at any angle that is less than 30 degrees or greater than 90 degrees as measured from the centerline. No portion of such facility shall be located within 25 feet of Duke Energy's facilities (unless specifically addressed in a joint use agreement.)

- Fences or utilities that cross the easement in multiple segments in a non-continuous alignment from outside edge of easement to opposing outside edge of easement at any angle of less than 30 degrees or greater than 90 degrees as measured from the centerline. This generally creates an interference as the ability to access and utilize the full easement and reach facilities in the easement is substantially impaired. If a fence crosses the easement at an angle greater than or equal to 30 degrees and less than or equal to 90 degrees with the centerline, a gate (16 feet wide at each crossing) shall be installed by the landowner, per Duke Energy's specifications. Duke Energy will supply a lock. The landowner is required to install the Duke Energy lock on the gate to ensure access. The lock can be interlocked with the landowner's lock. Fences and gates that exceed 10 feet in height are prohibited because they create a clearance issue and are an interference. Fences that inhibit Duke Energy's access because they lack a gate that is at least 16 feet wide, interfere with Duke Energy's easement use.

- Grading (cuts or fill) in the easement that is closer than 25 feet to transmission facilities i.e. poles, towers, guys and anchors and/or slopes greater than 4:1 no matter where located or that otherwise change clearances or topography.

- Parking or lighting facilities which affect clearances, access or Duke Energy's ability to make full use of its easement.

- Placement of combustible materials and/or the purposeful burning of anything within the easement are inconsistent with electric facilities, the transmission of power and create safety hazards and system reliability issues.

- Any water feature in the easement, such as a detention and retention pond, stream or lake. Where a structure outside the easement causes erosion or directs storm water toward the easement or the electric facilities or access to or around the electric facilities, such structure will interfere with Duke Energy's use and must be altered to eliminate that effect.

- Incompatible vegetation above ground transmission lines - Vegetation within or outside of the transmission easement that will mature to a height or size that will pose a grow-in, fall-in, or blowing-together threat to the transmission conductor (typical maximum mature height greater than 15 feet within the transmission easement depending on location and voltage).

- Incompatible vegetation underground transmission lines - Vegetation within or outside of the transmission easement that is capable of posing a threat (e.g., root systems, etc.) to the underground transmission conductor by **a)** causing damage to the underground pipes / cables or **b)** reducing the moisture in the soil, thus altering the thermal properties of the surrounding soil / backfill and thereby negatively impacting the cable ampacity rating (typical maximum mature height within the easement - greater than 3 feet depending on location and voltage).

- Incompatible vegetation for safe and reliable operation and access on all transmission lines - Vegetation that will limit or block access, limit the safe and reliable operation, emergency restoration, or maintenance of the transmission facilities, limit the full use of the transmission easement for its intended purposes or vegetation which is typically within a horizontal distance of 25 feet of any Duke Energy facilities (towers, poles, guy wires, guy anchors, manholes, dip-poles, substation equipment, etc.).

As discussed, these guidelines are not exhaustive and there may be other interferences on a case-by-case basis depending on individual circumstances. Certain conditions such as line voltage, line criticality, frequency of required access and structure type may require heightened restrictions in the easements to provide safe and reliable service.

If you have additional questions or plan any activity not mentioned above, please contact customer service and ask for your local Transmission Asset Protection Specialist.

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Duke Energy Carolina West and Carolina East
Power Grid Operations - Asset Protection Zones



Zone 1 – Craig Garrett 828.258.5018
craig.garrett@duke-energy.com

Zone 2 – Matthew Odom 864.624.6153
matthew.odom@duke-energy.com

Zone 3 – Stephen Lord 704.812.2316
stephen.lord@duke-energy.com

Zone 4 –

Currently vacant - email
john.hanes@duke-energy.com for assignment

Zone 5 – River Norton 843.679.2516
river.norton@duke-energy.com

Zone 6 – Bill Wilder 910.772.4903
bill.wilder@duke-energy.com

Zone 7 – Bruce Pait 919.431.4831
bruce.pait@duke-energy.com

Zone 8 – Chip Wilkins 864.948.5416
waverly.wilkins@duke-energy.com

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BUILDING A **SMARTER** ENERGY FUTURE®

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Your safety is our priority

We have a goal at Duke Energy – to eliminate injury and death from needless power line contacts. We want to provide you with the information you need to stay safe at work.

Important OSHA minimum approach regulation

The following table is from OSHA 1910.333 and applies to nonqualified persons working in proximity to energized power lines. The minimum approach distance is to be maintained for nonqualified workers. When using equipment classified as a crane or derrick, OSHA 29 CFR 1926.1407-1411 must be followed.

OSHA - 1910.333 Applies to NonQualified Persons Minimum Approach Distance	
Up to 50 kV	10 Feet
50 kV up to 200 kV	15 Feet
200 kV up to 350	20 Feet
350 to 500 kV	25 Feet
500 kV to 750 kV	35 Feet

Important OSHA crane regulation

Cranes and derricks near transmission power lines – OSHA 29 CFR 1926.1407-1411

This regulation applies to power-operated equipment used in construction that can hoist, lower and horizontally move a suspended load. Such equipment includes, but is not limited to:

If any part of equipment, load line or load could get closer than 20 feet to less than 350 kV power lines or 50 feet for greater than 350 kV power lines, you must speak with a Duke Energy representative before beginning work.

Such equipment includes, but is not limited to:

- Articulating cranes (such as knuckle boom cranes)
- Floating cranes
- Locomotive cranes
- Multipurpose machines when configured to hoist and lower (by means of a winch or hook) and horizontally move a suspended load
- Industrial cranes (such as carry deck cranes)
- Pedestal cranes
- Straddle cranes
- Derricks
- Overhead bridge and gantry cranes NOT permanently installed
- Crawler cranes
- Cranes on barges
- Side boom tractors
- Base-mounted drum hoists only when used with derricks
- Tower cranes
- Portal cranes
- Service/mechanic trucks with a hoisting device
- Dedicated pile drivers
- Mobile cranes (such as wheel-mounted, rough-terrain, all-terrain, commercial truck-mounted and boom truck cranes)
- Variations of these types of equipment



Contact us

For more information, please visit duke-energy.com/safety or call:

Duke Energy Carolinas
800.777.9898 or 800.POWERON

Duke Energy Indiana
800.521.2232

Duke Energy Kentucky or Ohio
800.544.6900

Duke Energy Progress
800.452.2777

Duke Energy Florida
800.700.8744

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Charlotte, NC 28202

www.duke-energy.com

Look up and live.

Working around high-voltage transmission lines



Know how to protect yourself, your crew and the public when working around transmission lines.

Duke Energy cares about your safety. This brochure contains important information for:

- Anyone working around power lines
- Grading contractors
- Forklift operators
- Crane operators
- Developers (residential, commercial, industrial)
- Architects and engineers
- Dump truck operators

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Know your voltage, know your clearance

Federal law requires that all contractors maintain at least a 10-foot clearance from overhead power lines up to 50 kV. Greater clearance is required for higher-voltage power lines and cranes and derricks in construction.

Contact Duke Energy at least three working days before you start working near overhead power lines and equipment so that safety recommendations can be made.

Treat all transmission lines, regardless of their operating voltage, with caution:

- 44 kV and 100 kV lines look similar.
- Never assume a voltage based on the illustration.
- Minimum clearance includes maximum sag, which must be calculated for each instance.
- Injury or death can occur without touching power lines.
- Assume all overhead power lines are energized.
- Contact Duke Energy if you are in doubt about safe operating distances.

Fact 1.

Power lines that serve your homes and businesses are not insulated like home appliance cords.

Fact 2.

Power lines carry 4,000 to 500,000 volts of electricity that can seriously injure or kill on contact.

Fact 3.

The simplest way to stay safe is to know where your power lines are located and stay away.

A planned project is a safe project

Check the job site for hazards and know the location of all overhead power lines and electric equipment, including poles and guy wires.

Consider all overhead lines as energized. Mark the work site boundaries to keep workers, vehicles, tools and equipment a safe distance from electric lines and equipment.

Hold a pre-work safety meeting, pointing out areas where overhead lines and electric equipment are located.

We can help you:

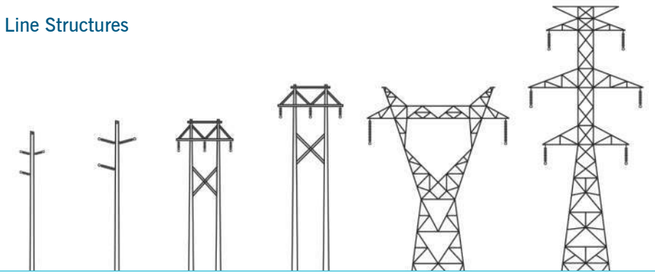
- Confirm voltage
- Confirm clearance
- Confirm wire height under peak conditions
- Provide safety guidance around power lines
- Review and approve drawings for:
  - Compliance with right-of-way restrictions
  - Compliance to National Electric Safety Code
- Identify the best, safe solution

Emergency situations

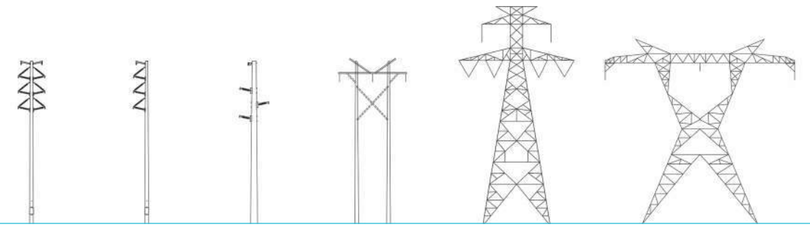
If your equipment makes contact with an overhead power line, notify Duke Energy immediately and take these precautions:

- Have someone call 911.
- Do not attempt to turn off engines or generators.
- Move equipment away from the line only if it is safe to do so.
- Remain on equipment until utility workers arrive and de-energize the line.
- Warn others to stay away. Those on the ground can be injured or killed if they make contact with the equipment.
- If you must leave the equipment because of fire or other dangers, jump off with your feet together. Never touch the ground and equipment at the same time. Keeping your feet together, shuffle or hop away until you are clear of the area.

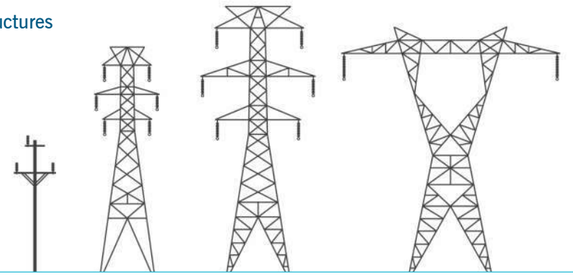
Duke Energy Midwest Transmission Line Structures



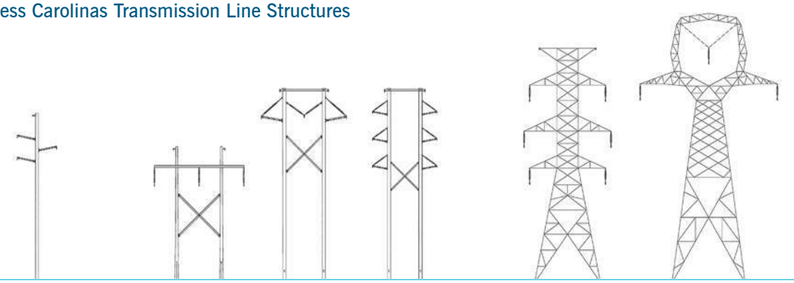
Duke Energy Florida Transmission Line Structures



Duke Energy Carolinas Transmission Line Structures



Duke Energy Progress Carolinas Transmission Line Structures



For more information, visit duke-energy.com/safety.

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Appendix B:

Geotechnical Exploration Report (April 12, 2024)

Geotechnical Exploration Report
ITT Pump Station Replacement
Mills River, North Carolina
S&ME Project No. 23410064

PREPARED FOR:

McKim and Creed
51 Thompson Street, Suite D
Asheville, North Carolina 28803

PREPARED BY:

S&ME, Inc.
44 Buck Shoals Road, Suite 603
Arden, North Carolina 28704

April 12, 2024

April 12, 2024

McKim and Creed
51 Thompson Street, Suite D
Asheville, North Carolina 28803

Attention: Ms. Manjiang Chen

Reference: **Geotechnical Exploration Report**
ITT Pump Station Replacement
Mills River, North Carolina
S&ME Project No. 23410064
NC PE Firm License No. F-0176

Dear Ms. Chen:

S&ME, Inc. (S&ME) is pleased to submit this Geotechnical Report for the above-referenced. Geotechnical services were provided in general accordance with our Proposal No. 23410064, dated November 9, 2023 and authorized via Subcontract Services Work Order dated January 11, 2024. The purpose of this geotechnical exploration was to help determine site subsurface conditions and to evaluate these conditions relative to site preparation and foundation design and construction for the proposed new pump station as well as to provide geotechnical data related to the Horizontal Direction Drilling (HDD) of a new forced sewer main beneath the French Broad River. This report presents a brief confirmation of our understanding of the project, the exploration results, and our geotechnical conclusions and recommendations.

S&ME appreciates the opportunity to assist you during this phase of the project. If you have questions concerning this report, please contact us.

Sincerely,

S&ME, Inc.

Christopher Fujita-Mentch, PE
Associate Project Manager

NORTH CAROLINA PROFESSIONAL SEAL 049942 ENGINEER CHRISTOPHER S. MENTCH

Matthew H. McCurdy, PE
Principal Engineer

HDD Section Reviewed by Chad Bruorton

Table of Contents

1.0 Project Information 1

2.0 Field Exploration and Testing 1

2.1 Field Exploration 1

2.2 Laboratory Classification and Testing 2

3.0 Site Conditions 2

3.1 Surface Conditions 2

3.2 Area Geology 3

3.3 General Subsurface Conditions 4

3.3.1 Surface Materials 4

3.3.2 Previously Cultivated Soils 4

3.3.3 Existing Fill Soils 4

3.3.4 Alluvium 4

3.3.5 Residuum 5

3.3.6 Partially Weathered Rock 5

3.3.7 Auger Refusal Materials and Coring 5

3.3.8 Subsurface Water 5

4.0 Horizontal Directional Drilling Conclusions and Recommendations 6

4.1 HDD Subsurface Conditions 6

4.2 HDD Natural Geologic Hazards 7

4.3 Recommended Soil Parameters 7

5.0 New Pump Station Conclusions and Recommendations 8

5.1 General Discussion 8

5.2 Excavation Considerations 9

5.2.1 Dense Soil, Partially Weathered Rock, and Rock 9

5.2.2 Subsurface Water 9

5.2.3 General 9

5.3 Earthwork Recommendations 10

5.3.1 Site Preparation, Existing Fill, Subgrade Evaluation, and Stabilization 10
5.3.2 Fill Placement and Compaction 10
5.3.3 In-Place Density Testing 11
5.4 Lateral Earth Pressures 11
5.5 Foundation Recommendations 12
5.5.1 Shallow Foundation Recommendations 12
5.6 Seismic Site Classification 13

6.0 Limitations of Report 14

List of Tables

Table 2-1: Boring Summary 1
Table 3-1: Water Levels 5
Table 4-1: HDD Strata Interpretation 6
Table 4-2: HDD Design Soil Parameters 8
Table 5-1: Retaining Structure Design Parameters (Drained Strength) 11

Appendices

Appendix I – HDD Natural Geologic Hazard Table
Appendix II – Boring Location Plan and Generalized Subsurface Profile for HDD Section
Appendix III – Boring Logs and Rock Core Photos
Appendix IV – Laboratory Test Results
Appendix V – Important Information

1.0 Project Information

Our understanding of this project is based on the following:

- A Request for Qualifications prepared by the Metropolitan Sewer District.
- An AutoCAD drawing (Alt Location 2 Site Plan for Survey.dwg) showing the location of the proposed pump station.
- A Google Earth file (Force Main Alignment 20231101.kmz) showing the approximate alignment of the proposed new force main including where it crosses the French Broad River approximately north of the proposed pump station.
- A Topographic Survey for Metropolitan Sewer District prepared by McKim and Creed and dated February 27, 2024.

The existing ITT pump station located near the Broadpointe Business Park in Mills River, North Carolina is planned to be replaced with a new pump station and a new force main. The existing pump station was constructed in 1997 and services the northern portion of the Mills River township in Henderson County, North Carolina. The proposed new pump station is in the early design stage, but Ms. Manjiang Chen with McKim and Creed indicated that the station footprint will be on the order of up to 150 feet by 150 feet and will extend to a depth of approximately 30 to 40 feet. The new force main is planned to be installed using open cut techniques except for where it crosses the French Broad River, where horizontal direction drilling (HDD) is being planned.

2.0 Field Exploration and Testing

2.1 Field Exploration

The field exploration included a site reconnaissance by a Geotechnical Professional and the drilling of three (3) soil test borings (labeled B-1 through B-3). The approximate boring locations are shown on Figure 1 – Boring Location Plan in Appendix I. The boring number, corresponding project area and depth extended below the existing ground surface are summarized below in Table 2-1.

Table 2-1: Boring Summary

Boring ID	Adjacent Structures	Depth (ft.)
B-1	Proposed Pump Station	48.1
B-2	HDD Alignment, South of French Broad River	63.8
B-3	HDD Alignment, North of French Broad River	62.7

The boring locations were established in the field by our personnel using our hand-held GPS system and the provided coordinates. The borings were drilled with a track-mounted Diedrich D-50 drill rig (with an automatic hammer) using hollow-stem augers to advance the boreholes. Split-spoon samples and Standard Penetration Test (SPT) values (N-values) were generally obtained at 2.5-foot intervals in the upper 10 feet, and at 5-foot intervals thereafter. Boring B-2 was advanced below its auger refusal depth using rock coring techniques. One (1) relatively

undisturbed Shelby tube (UD) sample was attempted to provide additional information to aid in determining soil strength and design properties. After completion of drilling and attempting initial subsurface water depth measurements, borings B-2 and B-3 were kept open overnight to allow water levels to stabilize for delayed water level measurement. Following subsurface water measurements, boring B-1 was backfilled with soil cuttings and a mechanical hole plug was installed to help reduce borehole settlement. Borings B-2 and B-3 were backfilled with grout up to within a few feet of the surface, and the upper few feet were backfilled with soil cuttings.

2.2 Laboratory Classification and Testing

A Geotechnical Professional visually and manually classified the soils in general accordance with the guidelines of the Unified Soil Classification System (USCS). The results of the classifications as well as the field test results are presented on the individual Boring Logs in Appendix III. Ground surface elevations shown on the Boring Logs were interpolated from the topographic data provided on the provided survey and should be considered approximate. The rock core samples were also examined in the laboratory. Descriptions of the core samples, the calculated core Recovery (REC) values, and Rock Quality Designation (RQD) values were added to the boring logs for the two rock core borings. Core recovery (REC) is a measure of the length of rock sample recovered relative to the total length of sample cored, expressed as a percentage. In some cases, this percentage is an indication of the relative continuity of the rock. Another means by which the relative quality of bedrock is measured is termed the Rock Quality Designation (RQD). RQD is a measure of the amount of rock recovered, considering only intact segments of core 4 inches or longer, relative to the total length of sample cored. Higher values generally indicate less weathering and fracturing, and higher quality rock.

Select UD, split-spoon, and rock core samples obtained during the field exploration program were tested in the laboratory. Representative samples were subjected to following laboratory testing:

- Natural moisture content
- Grain size analysis with No. 200 sieve wash
- Atterberg limits
- Rock unconfined compressive strength

Additionally, a Consolidated Undrained (CU) Triaxial test was attempted, but was not successful. The testing was performed in general accordance with ASTM specifications. A Summary of Laboratory Test Data and individual testing data sheets are included in Appendix IV.

3.0 Site Conditions

3.1 Surface Conditions

The proposed pump station is located between an industrial facility located at 400 Broadpointe Drive to the southwest and an existing agricultural field managed by North Carolina State University (NCSU) to the north and northeast. The proposed force main extends generally to the north, extending through the NCSU managed agricultural field and crossing McDowell Creek and the French Broad River. North of the river, the force main extends through private property. The gates to access the agricultural fields and the private property to the north

were closed and locked during our site visits. The French Broad River is located approximately 800 feet northeast and McDowell Creek is located approximately 800 feet northwest of the proposed pump station. A small ditch extends along the area between the agricultural field towards McDowell Creek. A relatively tall slope extends upward from the proposed pump station to the industrial facility. Based on the provided survey data, the slope (apparently a fill embankment) is approximately 35 feet tall and at an inclination of approximately 1.8 horizontal to 1 vertical. The area has relatively thick brush and required clearing to access the location of boring B-1. The slope area is covered in large bushes and small trees.

3.2 Area Geology

The project site is in the Blue Ridge Physiographic Province of North Carolina in the apparent historic floodplain of the French Broad River. The Blue Ridge is generally underlain by ancient igneous and metamorphic rocks. The soils encountered in this area are the residual product of in-place physical and chemical weathering of the rock presently underlying the site. In areas not altered by erosion or disturbed by the activities of man, the residual soil profile typically consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands. The boundary between soil and rock is not sharply defined. This transitional zone, termed "partially weathered rock," is normally found overlying parent bedrock. Partially weathered rock is defined, for engineering purposes, as residual material with standard penetration resistance values of at least 50 blows per 6 inches (denoted as 50/6" on the Boring Logs). Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, the profile of the partially weathered rock (as well as hard rock) is quite irregular and erratic, even over relatively short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level.

The natural geological profile of portions of the site appears to have been modified/disturbed by past site activities including the development of the adjacent Broadpointe Business Park that have resulted in the placement of some fill soils. Please keep in mind that fill soils can vary in composition and consistency, and the engineering characteristics of these soils can be difficult to predict. We are not aware of any construction records that document the site preparation/grading activities, including placement and compaction of the fill. Although there is no specific correlation between the degree of compaction of existing fill and the results of standard penetration testing, a qualitative assessment of existing fill can often be made based on visual observation of the fill materials sampled in the borings and the general magnitude of the standard penetration test values.

Alluvial soils (alluvium) consist of soil sediments which have been eroded, deposited, and reshaped by flowing water in some form. Alluvial soils are typically found in geologic floodplains, near rivers and streams, and often in "draws". Alluvium typically has a very low consistency and is usually unconsolidated. The alluvial soils typically consist of a variety of materials, including fine particles of silt and clay and larger particles of sand, gravel, cobbles, and boulders along with organic matter.

The typical upper Blue Ridge soil profile can also be altered through activities such as agricultural farming and cultivation, which leaches out most of the upper clay content and creates a disturbed soil layer. These "cultivated" or "disturbed" soils often exist in a loose sandier condition (than the underlying clay or silt soils), can vary in composition and consistency, and can be highly sensitive to moisture content changes. It is denoted as "Cultivated Zone" on the boring logs. Previously cultivated soils may also contain a higher concentration of roots

and organic material, and are typically wetter than the underlying undisturbed soils. The presence of cultivated soil at this site corroborates the historic aerial photograph review, indicating that portions of the site were used for agricultural farmland in the past.

3.3 General Subsurface Conditions

The following is a brief and general description of subsurface conditions encountered at the site. More detailed information is provided on the individual Boring Logs included in Appendix III. Similar soils were grouped into strata on the logs. The strata contact lines represent approximate boundaries between soil types; the actual transition between soil types in the field could be gradual or abrupt in both the horizontal and vertical directions. Generalized boring profiles are included in Appendix II, based on the provided topographic survey. These are approximate, provided for illustration purposes only, and should not be used for quantity estimated and/or pricing.

3.3.1 Surface Materials

Each of the borings initially encountered a surface layer of organic-laden topsoil about 3 inches (B-1) or 12 inches (B-2 and B-3) thick. Please note that surface materials will vary in type and thickness throughout the site and could possibly be thicker in unexplored areas.

3.3.2 Previously Cultivated Soils

Beneath the topsoil, previously disturbed soils (apparently due to cultivation, labeled "Cultivated Zone" on the boring logs) were encountered in borings B-2 and B-3 to depths approximately 3 feet below the existing ground surface. The previously cultivated soils consist of silty sand (USCS classification symbol of SM) and was mixed with topsoil and the sample from B-2 contained a trace of roots. The N-values recorded in the previously cultivated soils ranged from 2 to 3 blows per foot (bpf), indicating a very loose relative density.

Previously cultivated soils should be expected across the site and will vary in thickness. Please note that soils cultivated by historical land use are typically wetter than the underlying natural soils because rainwater runoff tends to infiltrate these soils and "perch" above the more consistent alluvial and residual soils. The moisture content and stability of these cultivated soils is highly dependent on prevailing weather conditions.

3.3.3 Existing Fill Soils

Beneath the topsoil, existing fill soils were encountered in boring B-1 to a depth of 5.5 feet. The fill encountered was difficult to differentiate from alluvial soils (described below) and as such was labeled as "possible alluvium." The sampled fill soils consisted primarily of silty sand (SM) and contained a trace of topsoil. N-values obtained in the fill soils ranged from 4 to 8 bpf, indicating a very loose to loose relative density. Please note that the depth and composition of fill in unexplored areas will vary and could be deeper and/or erratically compacted.

3.3.4 Alluvium

Beneath the existing fill soils in B-1 and the previously cultivated soils in B-2 and B-3, alluvial soils consisting of elastic silt with sand (MH), sandy silt and silt with sand (ML), and silty sand and silty sand with gravel (SM) were

encountered in each of the borings to depths of 19 feet (B-1), 13 feet (B-2), and 17 feet (B-3). N-values ranged from the sampler being driven 18 inches by the weight of the hammer (weight of hammer, WOH) to 10 bpf, indicating a very soft to firm consistency in the silts and a very loose to loose relative density in the sands. Most of the samples were described as very moist to wet.

3.3.5 Residuum

Beneath the alluvium in each of the borings, residual soils consisting of silty sand (SM) and sandy silt (ML) were encountered to depths of 42 feet (B-1), 27 feet (B-2) and 52 feet (B-3). N-values ranged from 4 to 40 bpf, indicating a very loose to dense relative density in the sands and a stiff consistency in the silts. Some of the samples were described as moist to wet.

3.3.6 Partially Weathered Rock

Beneath the residuum in each of the borings, partially weathered rock (PWR) consisting of silty sand (SM) and sandy silt (ML) were encountered to depths of 48.1 feet (B-1), 32.7 feet (B-2) and 62.7 feet (B-3). N-values ranged from 50 blows for 5 inches of penetration (50/5") to 50/1". Each of the borings encountered refusal in the PWR, and borings B-1 and B-3 were terminated at their refusal depths in the PWR as requested by Ms. Chen with McKim & Creed.

3.3.7 Auger Refusal Materials and Coring

Auger refusal was encountered in each of the borings at depths of 48.1 feet (B-1), 32.7 feet (B-2) and 62.7 feet (B-3). Ms. Chen requested that we core the refusal material in boring B-2 to approximately the same depth as refusal was encountered in boring B-3. NQ rock coring was performed and extended approximately 31.1 feet below refusal in B-2. The rock core samples were interpreted to be biotite gneiss interlayered with mica schist. The rock core samples ranged from friable to hard. The recovery (REC) ranged from 9% to 100% and the rock quality designation (RQD) ranged from 0% to 98%. The RQD values ranged from very poor to excellent quality.

3.3.8 Subsurface Water

Subsurface water was encountered in each of the borings at depths indicated in Table 3-1 below. Also shown for reference is the water elevation in the adjacent French Broad River based on the provided survey. The elevations shown are interpolated from the provided survey and should be considered approximate.

Table 3-1: Water Levels

Location	TOB Water Level (ft)	Approx. TOB Water Elevation (ft)	After Drilling Water Level (ft)	Approx. After Drilling Water Elevation (ft)
B-1	19.3	2036.7±	-	-
B-2	13.2	2031.8±	9.7	2035.3±
B-3	22.8	2025.2±	9.8	2038.2±
French Broad River at time of survey (elevation shown on provided survey will vary)				2039.6

It should be noted water levels tend to fluctuate with seasonal and climatic variations, changes in nearby river and stream levels, and construction activity. Therefore, subsurface water may be encountered during construction at different depths than observed during drilling. Seasonal high groundwater levels would need to be determined by the installation of a temporary piezometer and monitored over time or by evaluation by a licensed soil scientist.

4.0 Horizontal Directional Drilling Conclusions and Recommendations

4.1 HDD Subsurface Conditions

Generalized subsurface conditions encountered are presented below. The site rock types are not typically problematic for HDD; however, the rock quality and joint spacing (width and filling) could be prone to release of HDD drilling fluid. The strata contact lines will vary between the borings due to widely spaced data and should be considered approximate. These strata are shown on the attached Subsurface Profile in Appendix II.

Table 4-1: HDD Strata Interpretation

Strata	Description	Percent of Material			USCS	SPT resistance (blows/foot)
		Gravel	Sand	Silt/ Clay		
I	**Previously Cultivated Soils:** Silty Sands	< 10	> 60	< 40	SM	2 - 3
II	**Alluvial Silts:** Sandy Silts, Silts with Sand	< 10	20 - 40	60 - 80	ML	1 - 3
III	**Alluvial Sands:** Silty Sands, Silty Sands with Gravel	0 - 50	40 - 80	10 - 30	SM	0 (WOH) - 10
IV	**Loose Residual Soils:** Silty Sands	< 10	65 - 80	20 - 35	SM	5 - 10
V	**Medium Dense to Dense Residual Soils:** Silty Sands	< 10	70 - 80	20 - 35	SM	17 - 40
VI	**Partially Weathered Rock:** Silty Sands	<10	70 - 80	20 - 35	SM	50/5" – 50/1"
Strata	**Description**	**Recovery (%)**	**RQD (%)**	**Moh's Hardness**	**Joint Spacing (ft)**	**Unconfined Compressive Strength (psi)**
VII	**Rock:** Metavolcanic Rock	9 - 100	0 - 98	2 - 8	see below	3,489 - 17,312

Notes and Abbreviations:

1. USCS = Unified Soil Classification System, visual classification.

2. SPT = Standard Penetration Test "N" value.
3. W-O-H = a measurement where only the weight of the hammer on the drilling rods causes the spoon to advance the full one-foot increment.
4. The range of Percentage of Materials was estimated based on lab data where available.
5. The information presented above is a generalization of predominant subsurface conditions encountered. The material descriptions, percentages of materials, USCS, and SPT values presented are estimated based on review of visual classification, laboratory testing and field testing by others, and experience.

Natural joint spacing observed in the retrieve rock core, and shown on the attached rock core photographic logs, that may result in mud loss pending the drilling fluid pressures exerted within these depths, was as follows:

- from 6 to 10 inches from roughly 37.6 to 38.8 feet below the existing ground surface,
- from 12 to 24 inches from roughly 38.8 to 40.8 feet below the existing ground surface,
- from 2 to 4 inches from roughly 41.3 to 42.2 feet below the existing ground surface,
- from 4 to 8 inches from roughly 41.8 to 43.3 feet below the existing ground surface,
- from 8 to 12 inches from roughly 49.9 to 50.9 feet below the existing round surface,
- from 2 to 8 inches from roughly 52.2 to 52.7 feet below the existing ground surface
- from 4 to 8 inches from roughly 57.0 to 58.0 feet below the existing ground surface
- from 6 to 10 inches from roughly 62.8 to 63.8 feet below the existing ground surface.

4.2 HDD Natural Geologic Hazards

Based on our experience with the area geology and the exploration results, Table A-1 in the Appendix summarizes our comments relative to HDD natural geologic hazards associated with the subject site.

4.3 Recommended Soil Parameters

Subsurface conditions along the planned HDD crossings were characterized based on subsurface conditions encountered in the borings and geologic setting. Soils and rock with similar HDD drilling characteristics were grouped into strata. The strata contact lines will vary between the borings due to widely spaced data and should be considered approximate.

Maximum soil drilling fluid pressures are calculated using the Delft Equation. The Delft Equation is based on cavity expansion theory and applies to soils (not rock). Cavity expansion theory assumes significant strain before fracture occurs releasing drilling fluid to the surface. Since the shear modulus varies with strain, we assumed 1% strain at failure when determining the shear modulus.

The friction angle and cohesion of the soils encountered were determined based on empirical correlations with the SPT N-value (uncorrected field value or N_{60} value) and soil type. Soils have been categorized as "sand-like" or "clay-like" based on their expected porewater pressure response during HDD construction. Soils that are permeable enough to drain excess porewater pressure and form a load carrying matrix of soil particles are considered "sand-like". Sand-like soils have 35% or less fines and a PI<7.[1] Soils that are low permeable and do

not drain excess porewater pressure are considered "clay-like". Clay-like soils have more than 35% fines and a PI of more than 7.[1]

Material properties are provided in tables based on correlations with subsurface conditions encountered. Based on the data obtained during our field and laboratory testing, we recommend the following soil strength parameters for use in HDD design:

Table 4-2: HDD Design Soil Parameters

Strata	Description	Soil Behavior Type[2]	Effective Friction Angle (degrees)	Total Cohesion (psf)	Unit Weight (pcf)		Shear Modulus (ksf) at 1% Strain[1]
					Total	Buoyant	
I	Cultivated Soils	sand-like	29	---	110	---	50
II	Alluvial Silts	clay-like	---	220	110	---	40
III	Alluvial Sands	sand-like	29	---	112	49	70
IV	Loose Residual Soils	sand-like	30	---	114	52	130
V	Medium Dense to Dense Residual Soils	sand-like	35	---	123	60	350
VI	Partially Weathered Rock	sand-like	45	---	130	68	750

[1] Above parameters are for use in determining maximum fluid pressures using the Delft Equation and may not be suitable for other uses.

[2] Sand-like and clay-like soil type behavior is addressed in Section 4.4

5.0 New Pump Station Conclusions and Recommendations

5.1 General Discussion

Based on the boring near the proposed pump station (B-1), the site contains fill and alluvial materials to depths of about 19 feet below the existing ground surface. Blue Ridge residual soils (and some PWR with depth) were encountered below the alluvium. PWR was encountered at a depth of 42 feet and auger refusal (probably near the top of competent rock) was encountered at a depth of 48.1 feet below the surface. Based on the provided preliminary information, planned excavation could extend to depths near where PWR was encountered (up to 40 feet planned, PWR was encountered at 42 feet). Also, subsurface water was encountered at the time of drilling at 19.3 feet below the surface; therefore, significant dewatering will be required during construction.

The results of the exploration indicate the main geotechnical concerns for the proposed pump station will likely be the following:

[1] Idriss, I.M., and Boulanger, R.W., 2008. Soil Liquefaction During Earthquakes, EERI Monograph

- Potential unstable excavation sidewalls requiring sloping back to less steep inclinations or shoring (excavation bracing).
- Excavation below the subsurface water table (dewatering and subgrade stabilization).
- The on-site alluvial soils, and possibly the existing fill, will not be suitable for reuse as compacted backfill.
- Difficult excavation due to PWR and rock.

5.2 Excavation Considerations

5.2.1 Dense Soil, Partially Weathered Rock, and Rock

Excavation is primarily expected to extend through low to moderate consistency fill, alluvium, and residual soils, but harder consistency PWR or even rock could be encountered. PWR was encountered at 42 feet and auger refusal (likely rock) was encountered at 48.1 feet. Planned excavations are not anticipated to extend to rock (planned excavations are expected to be on the order of up to 40 feet deep); however, it should be noted that depth to rock and PWR can vary erratically over relatively short distances in this region, and PWR or rock could be encountered shallower in areas intermediate of the borings or in unexplored areas and require excavation by blasting or the use of pneumatic tools.

PWR can cause greater difficulty, requiring heavier equipment, greater effort, and in some cases light blasting or the use of pneumatic tools (such as a backhoe-mounted hammer) will be required to excavate. Rock excavation will typically require blasting or the use of pneumatic tools. Additionally, PWR and rock are often more difficult to remove in confined excavations such as trenches.

5.2.2 Subsurface Water

Subsurface water will be encountered during construction of the pump station. The existing ground surface, and especially any excavations within about 3 feet of the water table, will probably be wet and unstable. There are a number of methods available. We advise letting the contractor select the dewatering method based on the final grades and construction implications, with the stipulation that the subsurface water level be maintained at least 2 feet below excavation bottoms.

Water encountered in utility trenches can typically be controlled by pumping from sump pits. In wet trenches, the trench bottoms will typically need to be stabilized with 6 to 12 inches of NCDOT No. 57 crushed stone bedding. The No. 57 stone may need to be placed as trench backfill up to the water level. The open-graded crushed stone should be separated from surrounding soils by wrapping it in a non-woven filter fabric to reduce migration of soil into the open-graded crushed stone. The fabric should overlap the crushed stone layer at the top a minimum of 12 inches.

5.2.3 General

Excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. Also, excavating below the subsurface water level will cause the slopes to be unstable at steep inclinations. The contractor is solely responsible for site safety. This

information is provided only as a service and under no circumstances should we be assumed to be responsible for construction site safety.

5.3 Earthwork Recommendations

5.3.1 Site Preparation, Existing Fill, Subgrade Evaluation, and Stabilization

To prepare the site for construction, in areas to receive fill or new construction, all surface vegetation, topsoil, roots and any other unsuitable surface materials should be stripped to at least 5 feet beyond the construction limits.

After stripping, the exposed subgrades should be evaluated by a representative of the geotechnical engineer. During this evaluation, where practical, the exposed subgrade should be methodically proofrolled with a tandem-axle dump truck or similar piece of rubber-tired equipment loaded at the engineer's discretion. Areas that deflect excessively during proofrolling should be undercut or stabilized in place as recommended by the geotechnical engineer. The evaluation by the geotechnical engineer or his representative could also include random probings with a ½-inch diameter steel T-handle probe rod, observation of backhoe-excavated test pits, and/or hand auger borings coupled with portable dynamic cone penetrometer (DCP) tests. Based on the low consistency/strength of the fill and alluvial soils, some undercutting/stabilization should be expected and budgeted.

Proofrolling will not be practical inside the excavation for the pump station. In these and other inaccessible areas, the subgrades should be evaluated by the geotechnical engineer's representative by probing and auger borings.

5.3.2 Fill Placement and Compaction

The majority of the alluvial soils sampled during this exploration appear to be challenging to reuse as structural fill/backfill, primarily due to moisture contents. The alluvial soils could also contain potentially organics or large rock pieces, cobbles, and boulders. The underlying residual soils will be too wet to compact unless they are thoroughly dried prior to compaction. For these reasons, unless the deleterious materials are removed and the soils are dried, we expect all excavated materials will require being hauled off-site or wasted in non-structural areas.

We expect the contractor will need to import much of the fill and trench backfill soils. Any soils proposed for fill should be evaluated by a geotechnical engineer prior to hauling to the site. The imported fill soils should have a maximum dry density of at least 100 pcf and a plasticity index (PI) of less than 20. Suitable soils include sands, silty sands, low-plasticity clays, and gravels (USCS Group Symbols SP, SW, SM, CL, GW, and GP).

For this project, we recommend all fill/backfill should be spread in thin (6- to 8-inch thick) loose lifts and uniformly compacted to at least 95 percent of the soil's maximum dry density, as determined by the standard Proctor compaction test (ASTM D-698). The moisture content of the soil should be maintained between +/- 3 percent of the standard Proctor optimum moisture content. All structural fill should be free of organic matter and other deleterious materials and have maximum particle size of 4 inches or less.

5.3.3 *In-Place Density Testing*

A qualified materials technician working under the direction of the geotechnical engineer should observe fill and trench backfill placement. The technician should perform a sufficient number of in-place field density tests during grading and backfilling of utility trenches to assess whether the recommended compaction criteria have been achieved. Field check plugs should be performed to determine appropriate standard Proctor comparisons.

5.4 Lateral Earth Pressures

We anticipate the pump station will be constructed with cast-in-place concrete. The following are our recommended parameters for use in design of concrete walls and substructures. Cast-in-place (CIP) concrete retaining walls must be capable of resisting lateral earth pressures that will be imposed on them. Lateral earth pressures to be resisted by the walls will be partially dependent upon the method of construction. Assuming the walls are relatively rigid and structurally braced against rotation, design for a condition approaching the "at-rest" lateral pressure should be assumed. However, in the event the walls are free to deflect (about 1/2 to 1 inch for a 10-foot high wall) during backfilling, as for any exterior walls that are not restrained or rigidly braced, the "active" pressure conditions will be applicable for design.

The following lateral earth pressure parameters are recommended for design, based on our experience, and assuming a level backfill, a frictionless wall and no hydrostatic pressure.

Table 5-1: Retaining Structure Design Parameters (Drained Strength)

Soil Strata	At-Rest Condition		Active Condition		Passive Coefficient (K_P)	Moist Unit Weight (γ_m), (psf)	Friction Factor
	Coefficient (K_O)	Equivalent Fluid Pressure (psf)	Coefficient (K_A)	Equivalent Fluid Pressure (psf)			
Alluvium/Existing Fill	0.58	67	0.41	47	2.5	115	0.30
Residuum	0.53	64	0.36	43	2.8	120	0.35
PWR/Rock	0.36	50	0.22	30	4.6	140	0.40
New Structural Fill/Backfill[1]	0.53	64	0.36	43	2.8	120	0.35
No. 57 Stone Backfill	0.41	43	0.26	27	3.9	105	N/A

[1]Fat/Lean Clay (CH/CL) and Elastic Silt/Silt (MH/ML) materials should not be used as wall structural backfill. Suitable backfill material consists of sands (SM, SP, SW, SC) and gravel.

For short term conditions, ML and MH soils may not drain sufficiently for fully drained conditions to govern shear strength. So, we suggest analyzing earth pressures using an undrained shear strength (S_u) value of 600 psf, with

zero angle of internal friction (ϕ_u). Long term, the ML soils will drain and strength will be controlled by effective stresses. Drained parameters presented in Table 5-1 are applicable for short and long term conditions for SM soils.

The above-recommended lateral earth pressure coefficients/parameters do not consider the development of hydrostatic pressure behind the earth retaining wall structures. As such, if positive wall drainage is not provided for earth retaining structures, full hydrostatic pressure should be added to the earth pressures. Wall drainage systems can be constructed of open-graded washed stone isolated from the soil backfill with a geosynthetic filter fabric and drained by perforated pipe or weepholes. As an alternative, several wall drainage products are produced specifically for this application. In addition to the water and soil pressures, lateral earth pressures arising from surcharge loading should be added to the above pressures to determine the total lateral pressure. Also, if the backfill will be sloping upward, the coefficients (K_o and K_A) will be significantly increased.

The soil backfill placed behind retaining walls and for fill placed in the passive zone should be placed and compacted in accordance with Section 5.3.2. However, as stated in the note below Table 5-1, sands and gravels are recommended for wall backfills; clays and silts should not be used. We caution that operating compaction equipment directly behind the retaining structures can create lateral earth pressures far in excess of those recommended for design. Therefore, bracing of the walls will be needed during backfilling operations. The backfill zone should be wide enough to facilitate compaction of soil backfill with compaction equipment. This will be difficult for deep excavations. For this reason, it may be more practical for at least the lower parts of the backfill to consist of No. 57 crushed stone. The minimum backfill zone behind retaining walls should include 3-foot laterally at the bottom of wall and increasing to the surface at an inclination of approximately 60 degrees.

5.5 Foundation Recommendations

5.5.1 Shallow Foundation Recommendations

We anticipate the pump station will be supported on footings or a mat/slab about 30 to 40 feet below the surface, and also anticipate there may be isolated and very lightly loaded footings for appurtenances that will be constructed only a few feet below the existing ground surface.

Following site preparation as described above, the pump station structure may be supported by conventional shallow spread footings bearing in residual soils, partially weathered rock, or new, compacted crushed stone after being evaluated and approved by the geotechnical engineer. If any alluvium remains after excavating the pump station to planned subgrade elevation, it should be undercut to residual soil/PWR and replaced with No. 57 crushed stone densified in up to one foot lifts (non-woven filter fabric should be used to separate surrounding soils from the crushed stone). We recommend a net maximum allowable bearing pressure of 3,000 psf be used in design of the pump station foundations. Other foundations constructed nearer the existing ground surface (in the alluvial soils) should be designed with a reduced bearing pressure of 1,000 psf. Based on our experience and the boring data, we estimate maximum total structural settlement to be up to 1 inch. Maximum differential settlement between foundations is estimated to be about ½ inch.

Continuous wall footings should be at least 18 inches wide and column footings should be at least 24 inches wide. This recommendation is to help prevent localized or "punching" shear failure which can occur with very narrow

footings. Foundations should bear at least 24 inches below finished exterior grades to provide adequate embedment against frost penetration.

The geotechnical engineer or their representative must observe the foundation bearing conditions at the footing excavations prior to placement of reinforcing steel and concrete. This evaluation should include the performance of shallow hand auger borings with dynamic cone penetrometer testing. Undercutting some of the footings could be required to penetrate lower-consistency soils, or if they have softened due to exposure to the elements, utility installation, etc. We expect this for the stairs or any other lightly loaded footings that are constructed near the existing ground surface. This undercutting should typically extend to a depth at least equal to the width of the footing. Any undercut areas should be backfilled with compacted No. 57 crushed stone separated from the soils by a non-woven filter fabric. Some crushed stone and filter fabric will also likely be needed to protect the foundation subgrades for the pump station, due to subsurface water, between the time of excavation and concrete placement.

Exposure to the environment will cause the bearing soils to rapidly deteriorate. If surface water runoff collects in any excavation, it should be removed promptly by pumping to help prevent softening of foundation supporting soils. To further reduce the potential for deterioration of bearing soils, we recommend that foundation excavation, evaluation, and placement of concrete be conducted on the same day, if practical. If an excavation is to remain open overnight, or if rain is imminent, consideration could be given to lowering the footing subgrade and placing a 3- to 4-inch mud mat of lean (2,000 psi) concrete in the bottom of the excavation, or lowering and placing about 12 inches of crushed stone, to protect the bearing soils. This will help limit the potential for additional excavation of wet, softened soils which often results in footings exposed to inclement weather.

If a mat foundation is selected, the pump station mat foundation can be supported on residual soils, partially weathered rock, or new, compacted crushed stone after being evaluated and approved by the geotechnical engineer. We recommend using a minimum 6-inch thick layer of crushed stone (No. 57) over a non-woven filter fabric to separate the floor slab from the subgrade soils. A thicker layer of crushed stone may be required in at least parts of the pump station areas, if not entirely, due to water-softened residual soils (resulting from the subsurface water). In this case, a geotechnical engineer should evaluate the subgrade. We expect a maximum of 2 feet of crushed stone should be satisfactory to stabilize a soft and wet subgrade. Also, if alluvium is encountered at the bottom of the excavation, it should be undercut and replaced as described in the section above.

We expect a modulus of subgrade reaction (k) of 25 pci to be available for design of a mat over the compacted stone.

5.6 Seismic Site Classification

The proposed structure should be designed to resist possible earthquake effects as determined in accordance with Section 1613 of the North Carolina Building Code (NCBC) 2018 Edition (2015 International Building Code with North Carolina Amendments). The NCBC assigns a Seismic Site Class based on the type and thickness of overburden soil materials. Site Class values range from Class A for hard bedrock to Class F for deep deposits of soft bearing strata. Based on the N-values obtained in the exploration and allowances in the North Carolina Building Code, a Seismic Site Class D should be used in design.

There are no active earthquake fault zones within close proximity to the general area and thus the site vicinity is not known to be subject to concerns of any major geologic hazards such as significant ground shaking, liquefaction, seismically induced slope failures, etc.

6.0 Limitations 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, 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 observation and monitoring of earthwork and foundation construction activities by a qualified geotechnical engineer.

Appendices

Appendix I – HDD Natural Geologic Hazard Table

Table A-1 – HDD Natural Geologic Hazards

SOIL CONDITIONS AND HDD DIFFICULTY				POTENTIAL SITE SOIL CONDITIONS AND HDD DIFFICULTY[3]		
Soil Condition	Generally Suitable[4]	Difficulties May Occur	Substantial Problems	Consistent with Geology	Encountered by Borings	Comments
Very soft to soft clays, silts, and organic deposits[1]		X		Yes	B-2, B-3	Encountered as Stratum II
Medium to Very stiff Clays and Silts[1]	X			No	No	Not consistent with geology or encountered in borings
Hard Clays and highly weathered shales[1]	X			No	No	Not consistent with geology or encountered in borings
Very loose to loose sands above and below the water table (not more than 30% gravel by weight)[1,2]		X		Yes	B-2, B-3	Encountered in Strata III and IV
Medium to dense sands above or below the water table (not more than 30% gravel by weight)[1,2]	X			Yes	B-3	Encountered as Strata V
Very loose to dense gravelly sand, (30% to 50% gravel by weight)[1,2]		X		Yes	B-3	Encountered in Stratum III
Very loose to dense gravelly sand (50% to 85% gravel by weight)[1,2]			X	No	No	Not consistent with geology or encountered in borings
Very loose to very dense gravel[1,2]			X	No	No	Not consistent with geology or encountered in borings
Soils with significant cobbles, boulders, and obstructions[1]			X	No	No	Not consistent with geology or encountered in borings
Weathered rocks, marls, chalks, and firmly cemented sands[1]	X			Yes	B-2, B-3	Encountered as Stratum VI
Slightly weathered to un-weathered rocks[1]		X		Yes	B-2	Encountered as Stratum VII
Material with sufficient potential swell upon exposure to water to reduce borehole diameter		X		No	No	Not consistent with geology or encountered in borings
Karst geology or preferential seepage paths potentially resulting in loss of drilling fluid circulation			X	Yes	B-2	Soil seems encountered in Stratum VII
Artesian groundwater conditions		X		No	No	Not consistent with geology or encountered in borings
Rock Fill or fill containing rock			X	No	No	Not consistent with geology or encountered in borings
General HDD Issues (Historically derived)				ITT Pump Station Replacement – Mills River, North Carolina		

[1] Adapted from ASTM F1962, Table 1-"Soil Conditions and Suitability of Horizontal Directional Drilling". Soil Conditions with a Superscript of [1] are directly from this reference.
[2] The inside diameter of Spilt Spoon Samplers (ASTM D1586) is 1-3/8 inches. Gravel larger than 1-3/8 inches in diameter cannot be recovered from split spoon samplers used for this exploration which may result in the percent gravel and maximum gravel size being underestimated.
[3] "Potential Site Soil Conditions and HDD Difficulty" is a professional opinion based on experience with the site geology; subsurface conditions encountered by borings performed for this exploration; and subsurface soil conditions known to be difficult for HDD.
[4] "Generally Suitable" presumes a knowledgeable, experienced contractor and personnel using appropriate equipment.
[5] BGS = below existing ground surface.

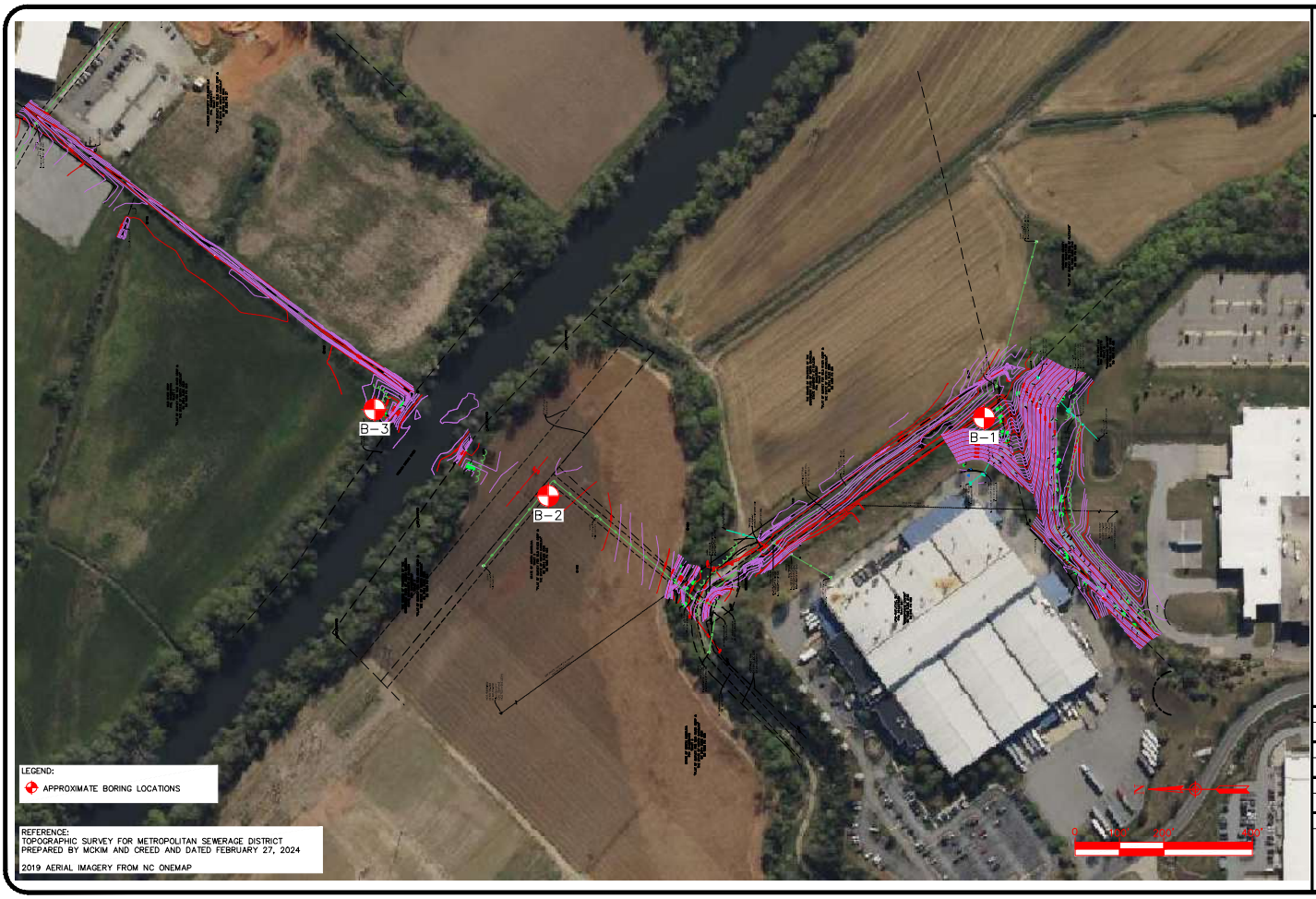
Table A-2 – Summary of Laboratory Test Data – HDD Section

Sample Location				Sample Type	USCS Classification Soil Type	Atterberg Limits			Natural Moisture Content %	Diameter (millimeters)				% Silt and Clay	% Sand			% Gravel	Rock Core Compressive Strength (psi)
Boring	Sample	Depth (ft)	Strata			LL	PL	PI		D_{100}	D_{60}	D_{30}	D_{10}		Fine	Medium	Coarse		
B-2	SS-2	3.5-5	II	SS	ML	37	25	9	34.9	2.0	-	-	-	69.4	29.2	1.3	0.0	0.0	-
	SS-5	13.5-15	IV	SS	SM	-	-	-	23.6	4.75	0.52	0.11	-	20.5	31.5	42.4	5.4	0.2	-
	SS-7	23.5-25	IV	SS	SM	38	31	7	35.1	2.0	0.13	-	-	33.7	52.9	12.9	0.5	0.0	-
	Run 2	34.0-35.2	VII	RC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,121
	Run 4	47.6-48.4	VII	RC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17,312
	Run 6	58.1-58.8	VII	RC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,489
B-3	SS-3	6-7.5	II	SS	ML	35	25	10	37.3	2.0	-	-	-	75.6	23.0	1.3	0.1	0.0	-
	SS-5	13.5-15	III	SS	SM	-	-	-	16.7	25.0	5.1	0.11	-	18.9	22.8	8.8	7.8	41.7	-
	SS-7	23.5-25	IV	SS	SM	-	-	-	31.5	4.75	0.21	0.072	-	29.2	59.3	11.2	0.1	0.1	-
	SS-11	43.5-45	V	SS	SM	-	-	-	24.8	2.0	0.21	0.078	-	29.1	56.9	14.0	0.0	0.0	-
	SS-13	53.5-55	VI	SS	SM	-	-	-	18.5	2.0	0.21	-	-	31.9	44.7	23.1	0.2	0.0	-

Legend
LL – Liquid Limit
PL – Plastic Limit
PI – Plasticity Index
NP – Non-Plastic
SS – Split Spoon Soil Sample
RC – Rock Core Sample

Notes
[1] - USCS classification determined by visual-manual identification
* - Fines visually/ manually classified

Appendix II – Boring Location Plan and Generalized Subsurface Profile for HDD Section



LEGEND:
APPROXIMATE BORING LOCATIONS

REFERENCE:
TOPOGRAPHIC SURVEY FOR METROPOLITAN SEWERAGE DISTRICT
PREPARED BY MCKIM AND CREED AND DATED FEBRUARY 27, 2024

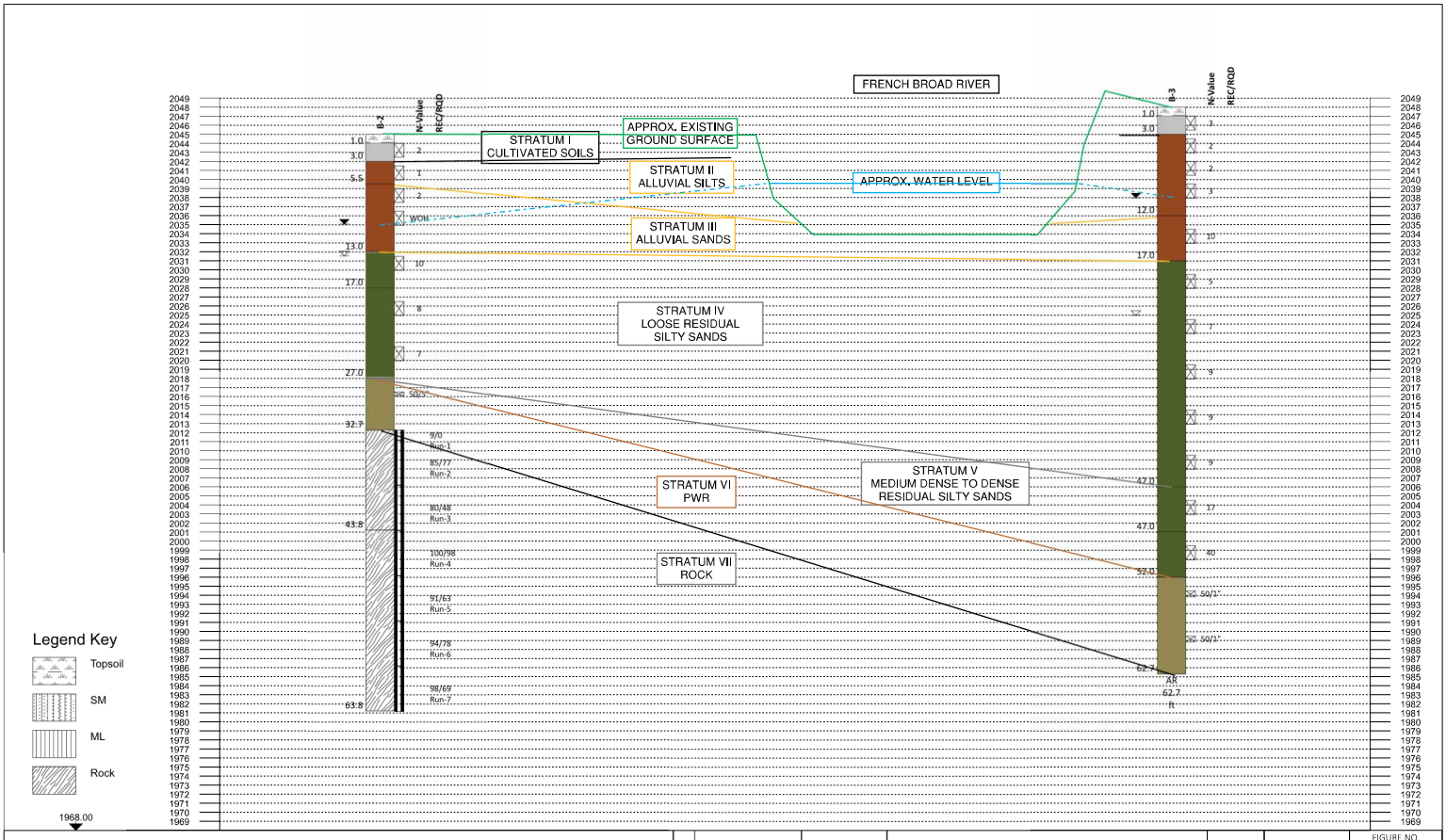
2019 AERIAL IMAGERY FROM NC ONEMAP

BORING LOCATION PLAN

ITT PUMP STATION
BROADPOINTE DRIVE
MILLS RIVER, NORTH CAROLINA

SCALE:	1"=200'
DATE:	MARCH 2024
PROJECT NUMBER	23410064
FIGURE NO.	1

Drawing path: T:\Active\B-1410\Projects\2023\23410064_McKim & Creed_ITT Pump Station Replacement - Teaming_Mills River NC\GEO\CAD\ITT Pump Station BLP.dwg



The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface conditions will vary between boring locations.

▽	AT TIME OF DRILLING
▼	END OF DRILLING
▼	AFTER DRILLING

Generalized Subsurface Profile - FBR HDD Section

ITT Pump Station
Mills River, North Carolina

SCALE:	1:600
DATE:	Mar 11, 2024
PROJECT NUMBER:	23410064

FIGURE NO. 2

Appendix III – Boring Logs and Rock Core Photos

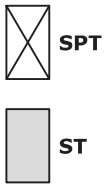
SOIL LOG LEGEND

SOIL PROPERTY SYMBOLS

N - Standard Penetration, bpf
LL - Liquid Limit, %
PPV - Pocket Penetrometer Value, tsf
NMC - Natural Moisture Content, %
PL - Plastic Limit, %
Qu - Unconfined Compressive Strength
F - Fines Content, %
PI - Plasticity Index, %
γd - Dry Unit Weight, pcf

The STANDARD PENETRATION TEST (SPT) as defined by ASTM D1586 (or AASHTO T206) is a method to obtain a disturbed soil sample for examination and testing and to obtain relative density and consistency information. A standard 1.4-inch I.D./2-inch O.D. split-barrel sampler is driven three 6-inch increments with a 140 lb. hammer freely falling 30 inches. The hammer can either be of a trip, free-fall design, or actuated by a rope and cathead. The SPT N Value is determined by adding the number of blows from the 2nd and 3rd 6-inch increments. A normalized blowcount (N_{60}) may be determined by the following equation: N_{60} = [Rig Energy Ratio (%) / 60] * N.

SHELBY TUBE (ST) samples are obtained by hydraulically pushing a thin-walled tube (typically 3-inches in diameter) to obtain a relatively undisturbed sample for testing of fine-grained soils to determine engineering properties such as strength, compressibility, permeability, and density. Shelby tubes are sampled in general accordance with ASTM D1587 (AASHTO T207).



Descriptive Order of Soil Strata: Geologic Disposition (i.e., Fill, Colluvium, Alluvium, etc.), ASTM Group Name (ASTM Group Symbol), quantified/qualified soil constituents, misc. constituents, consistency/density, color, organic description, moisture. ASTM group classifications is determined per ASTM D2487 where lab testing has been performed and ASTM D2488 where lab testing has not been performed.

ASTM GROUP NAME (SYMBOL) AND GRAPHIC

- WELL GRADED GRAVEL (GW)
- POORLY GRADED GRAVEL (GP)
- WELL GRADED GRAVEL WITH SILT (GW-GM)
- WELL GRADED GRAVEL WITH CLAY (GW-GC)
- POORLY GRADED GRAVEL WITH SILT (GP-GM)
- POORLY GRADED GRAVEL WITH CLAY (GP-GC)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- CLAYEY GRAVEL WITH SILT (GC-GM)
- WELL GRADED SAND (SW)
- POORLY GRADED SAND (SP)
- WELL GRADED SAND WITH SILT (SW-SM)
- WELL GRADED SAND WITH CLAY (SW-SC)
- POORLY GRADED SAND WITH SILT (SP-SM)
- POORLY GRADED SAND WITH CLAY (SP-SC)
- SILTY SAND (SM)
- CLAYEY SAND (SC)
- CLAYEY SAND WITH SILT (SC-SM)
- LEAN CLAY (CL)
- SILTY CLAY (CL-ML)
- SILT (ML)
- FAT CLAY (CH)
- ELASTIC SILT (MH)
- ORGANIC LOW PLASTICITY SILT OR CLAY (OL)
- ORGANIC HIGH PLASTICITY SILT OR CLAY (OH)
- PEAT (PT)
- TOPSOIL
- ASPHALT
- BASE - CEMENT MODIFIED
- BASE - CEMENT STABILIZED AGGREGATE
- BASE - GRAVEL
- CONCRETE
- VOID / NO RECOVERY
- IGM / PWR

FINE-GRAINED SOIL (Relative Consistency)

	N	PPV
Very Soft	< 2 bpf	< 0.25 tsf
Soft	2 - 4 bpf	> 0.25 - 0.5 tsf
Firm	5 - 8 bpf	> 0.5 - 1.0 tsf
Stiff	9 - 15 bpf	> 1.0 - 2.0 tsf
Very Stiff	16 - 30 bpf	> 2.0 - 4.0 tsf
Hard	> 30 bpf	> 4.0 tsf

COARSE-GRAINED SOIL (Relative Density)

	N
Very Loose	< 5 bpf
Loose	5 - 10 bpf
Medium Dense	11 - 30 bpf
Dense	31 - 50 bpf
Very Dense	> 50 bpf

MINOR CONSTITUENTS (% By Weight)

	Percentage
Trace	0% - 10%
Little	11% - 20%
Some	21% - 35%
"And"	≥ 36%

ORGANIC CONTENT OF SOIL (Determined by ASTM D2974 or AASHTO T267)

Classification	Percentage
With Organic Matter	4% - 15%
Organic Soil	16% - 30%
Peat	> 30%

MOISTURE CONDITION

Dry	Absense of moisture, dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

At Time of Drilling (ATD) — Groundwater observation made anytime during the drilling process. Depending on time of reading and drilling methodologies, this value may be influenced by the drilling process.

End of Drilling — Groundwater measurement soon after the drilling processes are complete, and the borehole is at final depth. Drilling fluids, if introduced during drilling, may influence this measurement.

After Drilling — Groundwater measurements made in a borehole hours to days after drilling is complete. Depending on subsurface conditions, elapsed time, drilling process, etc. this observation may reflect a stabilized level.

REFERENCES:

FHWA NHI-16-072, Geotechnical Engineering Circular No. 5 "Geotechnical Site Characterization"
ASTM Specifications D2487 and D2488
DOT Specifications & Design Manuals from NC, SC, OH, MI, IN, PA, VA.

ROCK CORE LOG LEGEND

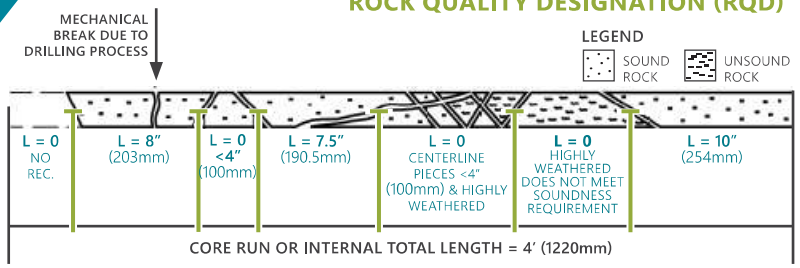
ROCK CORE RECOVERY

Core Diameter (I.D.)	Inches
BQ	1-7/16
NQ	1-7/8
HQ	2-1/2

Rock Core Sample

$$\text{REC (Recovery)} = \frac{\text{Length of Rock Core Recovered}}{\text{Length of Core Run}} \times 100$$

ROCK QUALITY DESIGNATION (RQD)



$$\text{RQD (Equation)} = \left(\frac{\sum \text{Sound Core with Length (L)} \geq 4\text{" (100mm)}}{\text{Core Run or Interval Total Length}}\right) \times 100$$

$$\text{RQD (Example)} = \left(\frac{8\text{"} + 7.5\text{"} + 10\text{"}}{48\text{"}}\right) \times 100 = 53\% \text{ (FAIR)}$$

ROCK QUALITY

Percent	Quality
>90–100	Excellent
>75–90	Good
>50–75	Fair
>25–50	Poor
0–25	Very Poor

(ASTM D6032)

GRAIN SIZE

Very Fine-Grained	<0.003 in. (<0.075 mm)
Fine-Grained	0.003 – 0.02 in. (0.075 – 0.425 mm)
Medium-Grained	0.02 – 0.8 in. (0.425 – 2 mm)
Coarse-Grained	0.8 – 2 in. (2 – 4.75 mm)
Very Coarse-Grained	>2 in. (>4.75 mm)

BEDDING

Very Thickly Bedded	>3 ft.
Thickly Bedded	3 ft. – 18 in.
Thinly Bedded	18 in. – 2 in.
Very Thinly Bedded	2 in. – 0.4 in.
Laminated	0.4 in. – 0.1 in.
Thinly Laminated	<0.1 in.

FRACTURE RATE / SPACING

Unfractured	>10 ft.
Intact	10 ft. – 3 ft.
Slightly Fractured	3 ft. – 1 ft.
Moderately Fractured	12 in. – 4 in.
Fractured	4 in. – 2 in.
Highly Fractured	< 2 in.

SURFACE ROUGHNESS

Very Rough	Near vertical steps and ridges occur on the discontinuity surface.
Slightly Rough	Asperities on the discontinuity surface are distinguishable and can be felt.
Smooth	Surface appears smooth and feels so to the touch.
Slickensided	Surface has a smooth, glassy finish with visual evidence of striation.

WEATHERING

Fresh	No visible sign of rock material weathering; slight discoloration on major discontinuity surfaces is possible.
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All rock material may be discolored by weathering and the external surface may be somewhat weaker than in its fresh condition.
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones. A minimum 2 in. diameter sample cannot be broken readily by hand.
Highly Weathered	More than half the rock is decomposed or disintegrated to soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones. A minimum 2 in. diameter sample can be broken readily by hand across the rock fabric.
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is largely still intact. Material can by granulated by hand.
Residual Soil	All rock material is converted to soil. Material can be easily broken apart by hand.

STRENGTH

		APPROX. UNCONFINED COMPRESSIVE STRENGTH (PSI)
Extremely Strong Rock	Specimen can only be chipped with firm blows from the hammer end of a geological hammer.	> 36,250
Very Strong Rock	Specimen requires many firm blows from the hammer end of a geological hammer to fracture.	36,250 – 14,500
Strong Rock	Specimen requires more than one firm blow of the point of a geological hammer to fracture.	14,500 – 7,250
Medium Strong Rock	Specimen cannot be scraped or cut with a pocket knife. Specimen can be fractured with a single firm blow with a geological hammer point.	7,250 – 3,500
Weak Rock	Shallow cuts or scrapes can be made in a specimen with a pocket knife. A firm blow with a geological hammer creates shallow indents.	3,500 – 725
Very Weak Rock	Specimen crumbles under sharp blow with point of geological hammer and can be peeled with a pocket knife.	725 – 150
Extremely Weak Rock	Specimen can be indented by thumbnail.	150 – 35

HARDNESS

Very Hard	Cannot be scratched with a pocket knife; leaves knife steel marks on surface.
Hard	Can be scratched by a pocket knife with difficulty; scratch produces little powder and is only faintly visible; trace of knife's steel may be visible.
Moderately Hard	Can be readily scratched by a pocket knife; scratch leaves a heavy trace of dust and scratch is readily visible after the powder has been blown away.
Low Hardness	Can be gouged deeply or carved with a pocket knife.
Friable	Easily crumbled by hand, pulverized or reduced to powder sand is too soft to be cut by a pocket knife.
Soft	Very weak plastic material.

REFERENCES:

FHWA NHI-16-072, GEOTECHNICAL ENGINEERING CIRCULAR NO. 5 "GEOTECHNICAL SITE CHARACTERIZATION"
DOT SPECIFICATIONS & DESIGN MANUALS FROM NC, SC, OH, MI, IN, PA.

PROJECT:	ITT Pump Station Mills River, North Carolina S&ME Project No. 23410064	BORING LOG: B-1 *Sheet 1 of 2*
DATE DRILLED: 02/20/2024	**ELEVATION:** 2056 ft	**NOTES:** 2 Shelby Tube samples were attempted. The first (8'-10') was successful, and the second (18'-20') only returned about 0.8 feet of soil.
DRILL RIG: Diedrich D-50 Track	**DATUM:** NAVD 1988	
DRILLER: S&ME - B. Blizzard	**BORING DEPTH:** 48.1 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings with Hole Closure Device	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christopher Fujita-Mentch	**LATITUDE:** 35.422683 **LONGITUDE:** -82.548043
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL–LL; 20 40 60 80 100)	ELEVATION
0					TOPSOIL, 3 inches			2056
	0.3	Fill		SS-1	SILTY SAND (SM), very loose to loose, tan orange red, fine grained, moist, trace topsoil, possible alluvium	2-1-3 N = 4	●	
				SS-2		3-4-4 N = 8	●	
5								2051
	5.5	Alluvium		SS-3	ELASTIC SILT WITH SAND (MH), firm, red tan, fine grained, moist	3-4-3 N = 7	● ⊢ △	
	8.0			SS-4	SILTY SAND (SM), loose, red tan, fine grained, moist	2-3-2 N = 5	● ○ △	
10								2046
	11.0			SS-5	SANDY SILT (ML), firm, gray tan, fine grained, moist, trace rounded gravel, trace mica, trace roots in SS-3, very moist	3-3-2 N = 5	● ⊢○ △	
15								2041
	19.0 ▽			SS-6	SILTY SAND (SM), very loose, gray white tan, fine grained, seam of micaceous coarse sand near 19 ft, very moist	3-2-2 N = 4	●	
20								2036
	22.0	Residuum		SS-7	SILTY SAND (SM), very loose, tan white gray, fine to medium grained, wet	3-2-2 N = 4	● ⊘	
25								2031
	27.0			SS-8	SANDY SILT (ML), stiff, tan white gray, fine grained, micaceous, moist	4-5-5 N = 10	●	
30								2026

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	02/20/2024	19.3	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from client provided topo map, Horizontal Accuracy: Handheld GPS

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	ITT Pump Station Mills River, North Carolina S&ME Project No. 23410064	BORING LOG: B-1 *Sheet 2 of 2*
DATE DRILLED: 02/20/2024	**ELEVATION:** 2056 ft	**NOTES:** 2 Shelby Tube samples were attempted. The first (8'-10') was successful, and the second (18'-20') only returned about 0.8 feet of soil.
DRILL RIG: Diedrich D-50 Track	**DATUM:** NAVD 1988	
DRILLER: S&ME - B. Blizzard	**BORING DEPTH:** 48.1 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings with Hole Closure Device	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christopher Fujita-Mentch	**LATITUDE:** 35.422683 **LONGITUDE:** -82.548043
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

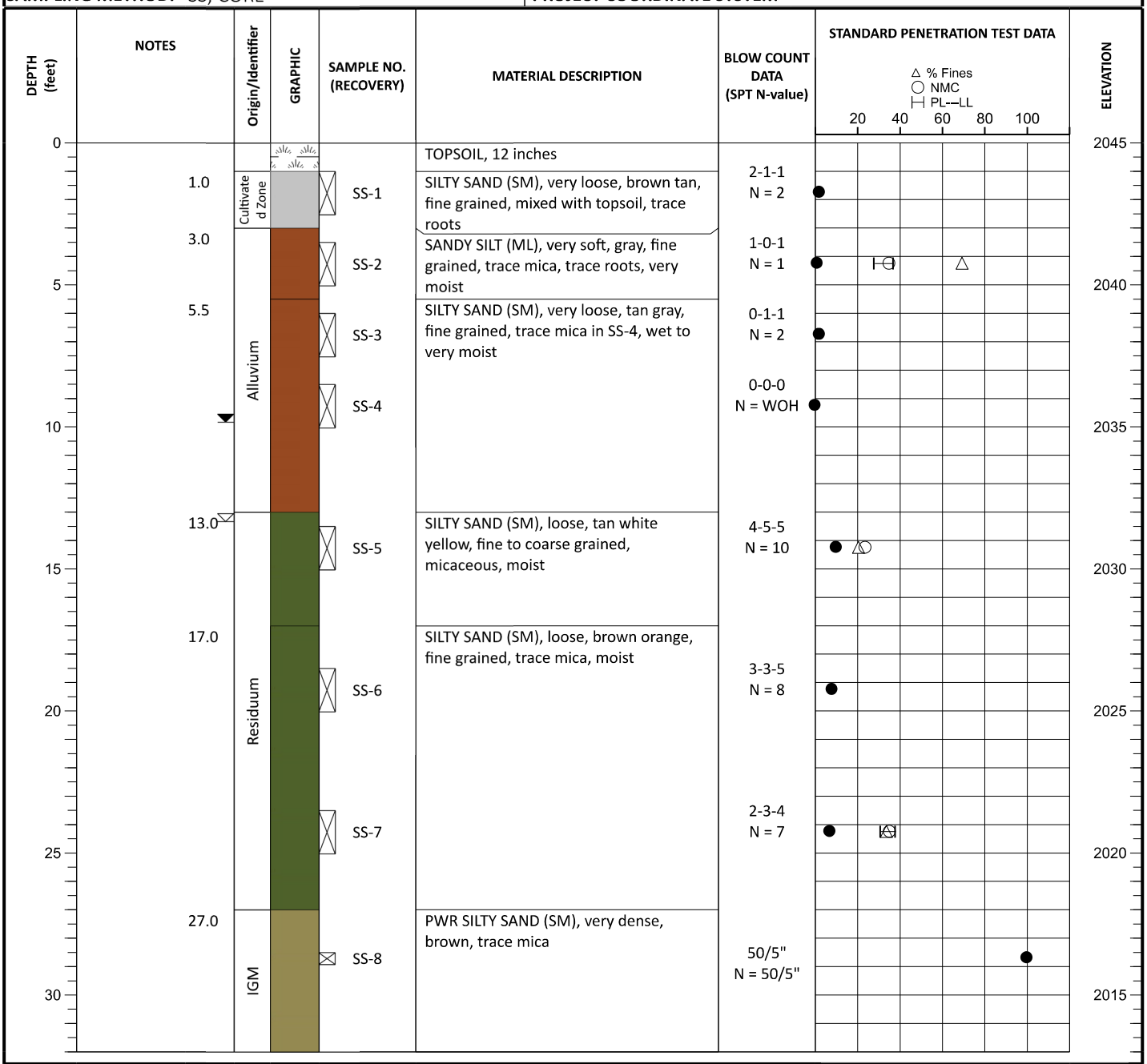
DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL—LL; 20 40 60 80 100)	ELEVATION
35	32.0	Residuum		SS-9	SILTY SAND (SM), medium dense, gray orange tan, fine grained, trace mica, moist	7-10-8 N = 18		2021
40				SS-10		6-11-12 N = 23		2016
45	42.0	IGM		SS-11	PWR SANDY SILT (ML), hard, gray tan, fine grained, trace mica	20-50/4" N = 50/4"		2011
50	Auger refusal at 48.1 feet 48.1				Borehole terminated at 48.1 feet			2006
55								2001
60								1996

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	02/20/2024	19.3	
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from client provided topo map, Horizontal Accuracy: Handheld GPS

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	ITT Pump Station Mills River, North Carolina S&ME Project No. 23410064	BORING LOG: B-2 *Sheet 1 of 2*
DATE DRILLED: 02/20/2024	**ELEVATION:** 2045 ft	**NOTES:** Borehole was braced overnight using a slotted PVC standpipe to allow delayed water level measurement.
DRILL RIG: Diedrich D-50 Track	**DATUM:** NAVD 1988	
DRILLER: S&ME - B. Blizzard	**BORING DEPTH:** 63.8 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: 3-1/4" HSA, NQ Core	**LOGGED BY:** Christopher Fujita-Mentch	**LATITUDE:** 35.425367 **LONGITUDE:** -82.548751
SAMPLING METHOD: SS, CORE	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	02/20/2024	13.2	
END OF DRILLING	▼			
AFTER DRILLING	▼	02/21/2024	9.7	
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from client provided topo map, Horizontal Accuracy: Handheld GPS

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	ITT Pump Station Mills River, North Carolina S&ME Project No. 23410064	BORING LOG: B-2 *Sheet 2 of 2*
DATE DRILLED: 02/20/2024	**ELEVATION:** 2045 ft	**NOTES:** Borehole was braced overnight using a slotted PVC standpipe to allow delayed water level measurement.
DRILL RIG: Diedrich D-50 Track	**DATUM:** NAVD 1988	
DRILLER: S&ME - B. Blizzard	**BORING DEPTH:** 63.8 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: 3-1/4" HSA, NQ Core	**LOGGED BY:** Christopher Fujita-Mentch	**LATITUDE:** 35.425367 **LONGITUDE:** -82.548751
SAMPLING METHOD: SS, CORE	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

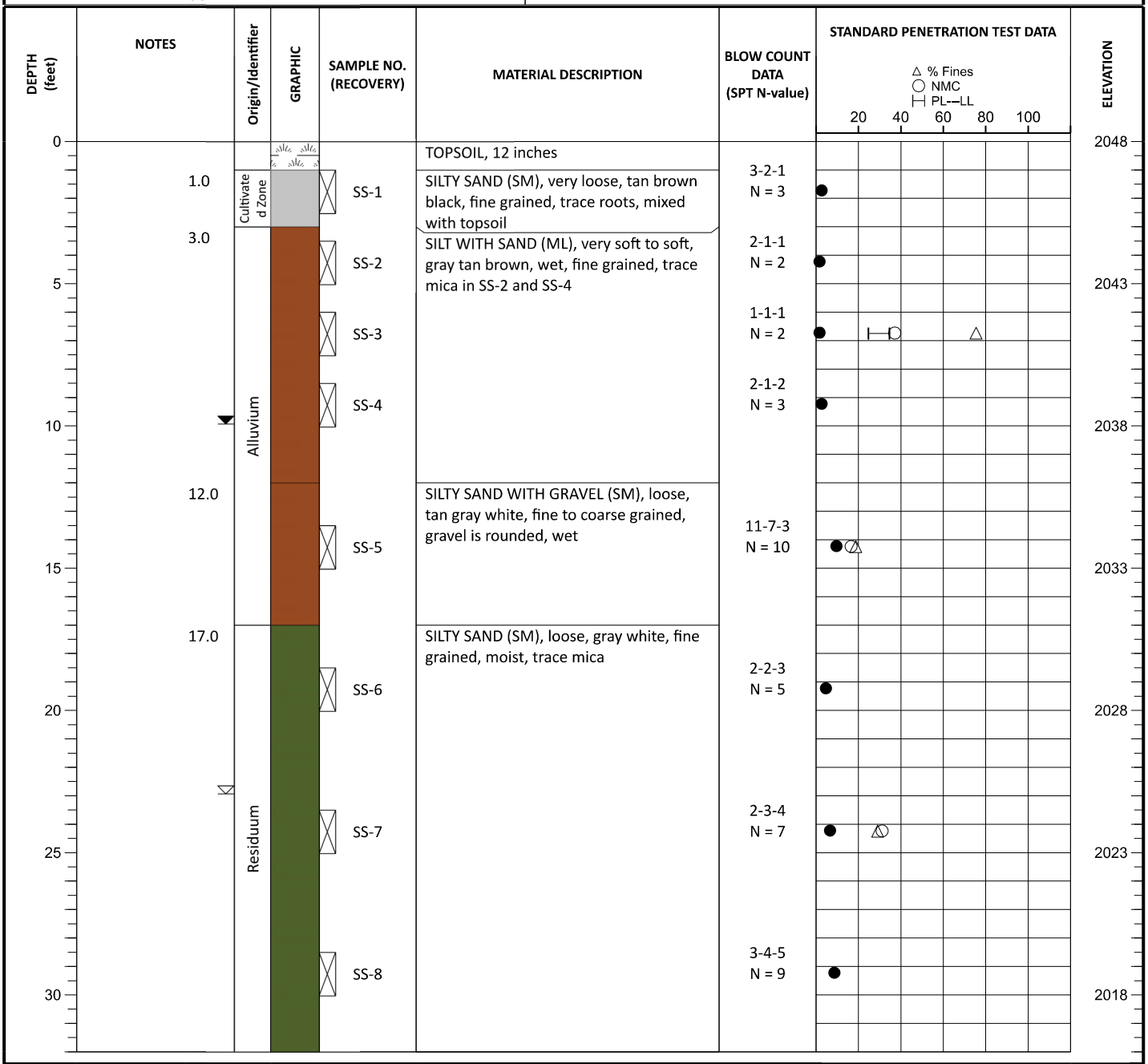
DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL—LL; 20 40 60 80 100)	ELEVATION
35	Auger refusal at 32.7 feet	IGM		Run-1 REC-9% RQD-0%	PWR SILTY SAND (SM), very dense, brown, trace mica			2010
40	32.7	Rock		Run-2 REC-85% RQD-77%	SCHIST, gray white, good quality to very poor quality, slightly weathered to highly weathered, moderately hard to friable, mica, moderately fractured, Moh's hardness 2 to 5 (run 1 and 2) and 2 to 7 (run 3)			2005
45	43.8			Run-3 REC-80% RQD-48%	BIOTITE GNEISS interlayered with some MICA SCHIST, gray white, excellent quality to fair quality, fresh to slightly weathered, hard, slightly fractured to fractured, Moh's hardness 4 to 8 (run 4), 2 to 3 (run 5), and 4 to 5 (run 6 and 7)			2000
50				Run-4 REC-100% RQD-98%				1995
55				Run-5 REC-91% RQD-63%				1990
60				Run-6 REC-94% RQD-78%				1985
				Run-7 REC-98% RQD-69%	Borehole terminated at 63.8 feet			

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	02/20/2024	13.2	
END OF DRILLING	▼			
AFTER DRILLING	▼	02/21/2024	9.7	
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from client provided topo map, Horizontal Accuracy: Handheld GPS

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	ITT Pump Station Mills River, North Carolina S&ME Project No. 23410064	BORING LOG: B-3 *Sheet 1 of 2*
DATE DRILLED: 02/19/2024	**ELEVATION:** 2048 ft	**NOTES:** Borehole was braced overnight using hollow stem augers to allow delayed water level measurement.
DRILL RIG: Diedrich D-50 Track	**DATUM:** NAVD 1988	
DRILLER: S&ME - B. Blizzard	**BORING DEPTH:** 62.7 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christopher Fujita-Mentch	**LATITUDE:** 35.426463 **LONGITUDE:** -82.548144
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	02/19/2024	22.8	
END OF DRILLING	▼			
AFTER DRILLING	▼	02/20/2024	9.8	
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from client provided topo map, Horizontal Accuracy: Handheld GPS

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

PROJECT:	ITT Pump Station Mills River, North Carolina S&ME Project No. 23410064	BORING LOG: B-3 *Sheet 2 of 2*
DATE DRILLED: 02/19/2024	**ELEVATION:** 2048 ft	**NOTES:** Borehole was braced overnight using hollow stem augers to allow delayed water level measurement.
DRILL RIG: Diedrich D-50 Track	**DATUM:** NAVD 1988	
DRILLER: S&ME - B. Blizzard	**BORING DEPTH:** 62.7 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christopher Fujita-Mentch	**LATITUDE:** 35.426463 **LONGITUDE:** -82.548144
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane North Carolina FIPS 3200 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL—LL; 20 40 60 80 100)	ELEVATION
35		Residuum		SS-9	SILTY SAND (SM), loose, gray white, fine grained, moist, trace mica	3-4-5 N = 9		2013
40				SS-10		3-3-6 N = 9		2008
42.0								
45				SS-11	SILTY SAND (SM), medium dense, white gray tan, fine grained, moist, trace mica	6-7-10 N = 17		2003
47.0								
50				SS-12	SILTY SAND (SM), dense, gray white, fine grained, moist, trace mica	11-12-28 N = 40		1998
52.0		IGM						
55				SS-13	PWR SILTY SAND (SM), very dense, gray white orange, fine grained, trace mica	42-50/1" N = 50/1"		1993
60	Auger refusal at 62.7 feet			SS-14		48-50/1" N = 50/1"		1988
62.7					Borehole terminated at 62.7 feet			

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	02/19/2024	22.8	
END OF DRILLING	▼			
AFTER DRILLING	▼	02/20/2024	9.8	
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from client provided topo map, Horizontal Accuracy: Handheld GPS

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal, IGM = Intermediate Geomaterial

Field Testing Procedures

Soil Test Borings

All borings and sampling were conducted in accordance with ASTM D-1586 test method. Initially, the borings were advanced by either mechanically augering or wash boring through the overburden soils. When necessary, a heavy drilling fluid is used below the water table to stabilize the sides and bottom of the borehole. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel or split-spoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated as the "Standard Penetration Resistance" or N-value. The penetration resistance, when properly evaluated, can be correlated to consistency, relative density, strength and compressibility of the sampled soils.

Water Level Readings

Water level readings are normally taken in conjunction with borings and are recorded on the Boring Logs following termination of drilling (designated by ▽) and at a period of 24 hours following termination of drilling (designated by ▼). These readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. The groundwater table may be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should also be expected with variations in surface run-off, evaporation, construction activity and other factors.

Occasionally the boreholes sides will cave, preventing the water level readings from being obtained or trapping drilling water above the cave-in zone. In these instances, the hole cave-in depth (designated by HC) is measured and recorded on the Boring Logs. Water level readings taken during the field operations do not provide information on the long-term fluctuations of the water table. When this information is required, piezometers are installed to prevent the boreholes from caving.

Rock Coring

Diamond-bit core drilling procedures were used to determine the character and continuity of the refusal materials. The core drilling procedures were carried out in general accordance with ASTM Specification D-2113. Initially, casing was set through the overburden soils to prevent the borehole from collapsing. Rock core samples of the materials penetrated were protected and retained in a swivel-mounted inner tube of the cored barrel. Upon completion of the drill run, the core barrel was brought to the surface and samples removed and placed in standard boxes. The samples were returned to the laboratory for classification by a Geologist and/or Geotechnical Engineer. During the classification, the "recovery" and "Rock Quality Designation" of the recovered cores were determined.

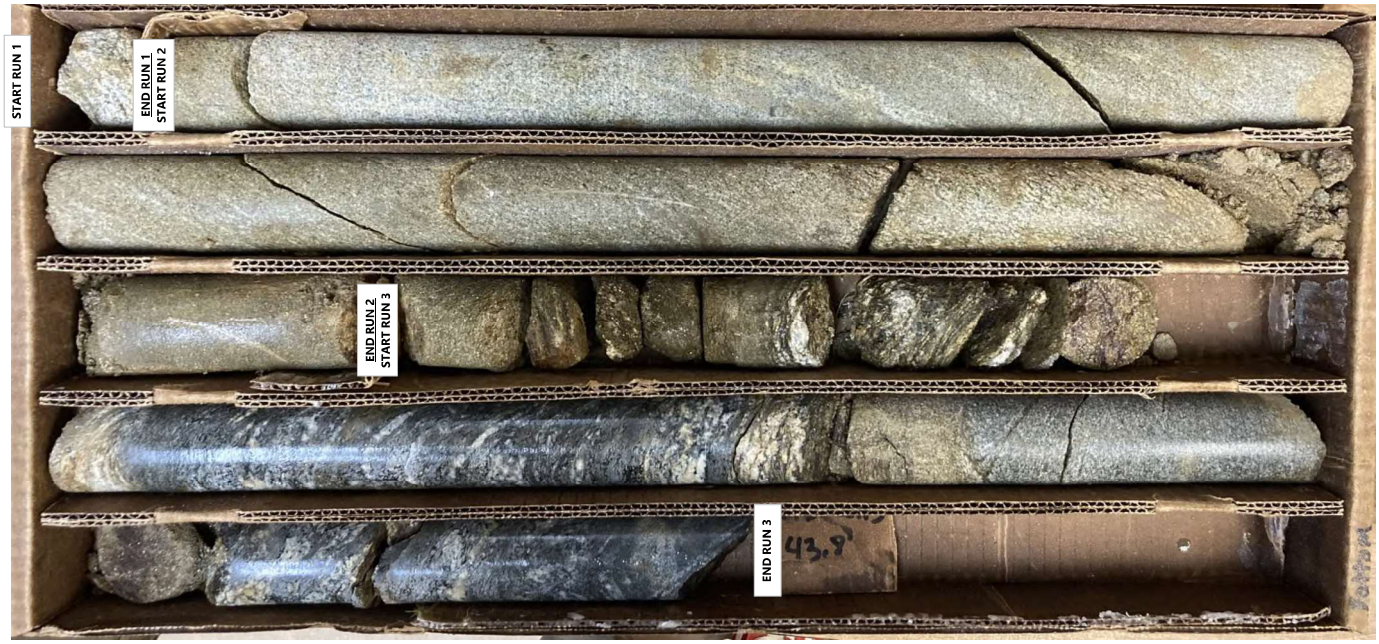
The "recovery" is the ratio of the sample length obtained to the length drilled, expressed as a percent. The "Rock Quality Designation" (RQD) is the percent of the recovered rock samples in lengths of four or more inches, compared to the total length of the core run. The percent recovery and RQD are related to rock soundness and continuity. Generalized rock descriptions, percent recovery, and RQD values are shown on the appropriate Soil Boring Records.

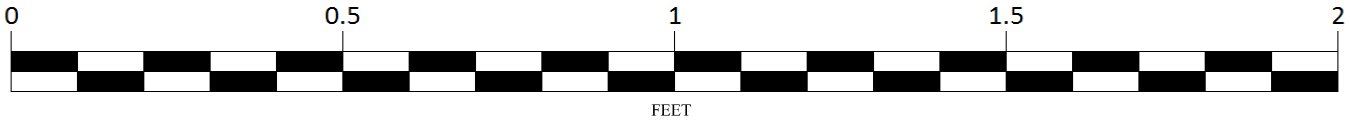
44 Buck Shoals Road, Suite C-3
Arden, North Carolina 28704
828-687-9080

Rock Core Photograph
Core Location: B-2
ITT Pump Station
Mills River, North Carolina
S&ME Project No. 23410064

Core Run Listing Corresponding to Boring Log
(feet below ground surface)

Run 1:	32.7 ft. - 33.8 ft.	Run 2:	33.8 ft. - 38.8 ft.	Run 3:	38.8 ft. - 43.8 ft.
REC:	0.1 ft / 9%	REC:	4.3 ft. / 85%	REC:	4.0 ft. / 80%
RQD:	0 ft. / 0%	RQD:	3.8 ft. / 77%	RQD:	2.4 ft. / 48%





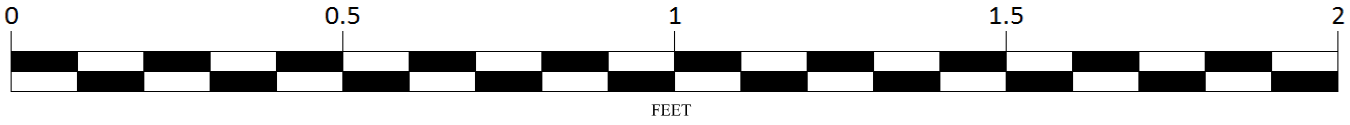
44 Buck Shoals Road, Suite C-3
Arden, North Carolina 28704
828-687-9080

Rock Core Photograph
Core Location: B-2
ITT Pump Station
Mills River, North Carolina
S&ME Project No. 23410064

Core Run Listing Corresponding to Boring Log
(feet below ground surface)

Run 4:	43.8 ft. - 48.8 ft.	Run 5:	48.8 ft. - 53.8 ft.
REC:	5 ft. / 100%	REC:	4.5 ft. / 91%
RQD:	4.9 ft. / 98%	RQD:	3.1 ft. / 63%





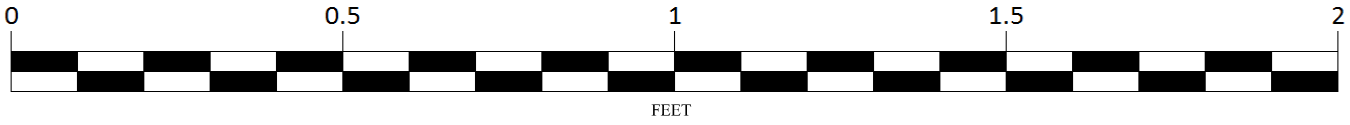
44 Buck Shoals Road, Suite C-3
Arden, North Carolina 28704
828-687-9080

Rock Core Photograph
Core Location: B-2
ITT Pump Station
Mills River, North Carolina
S&ME Project No. 23410064

Core Run Listing Corresponding to Boring Log
(feet below ground surface)

Run 6:	53.8 ft. - 58.8 ft.	Run 7:	58.8 ft. - 63.8 ft.
REC:	4.7 ft. / 94%	REC:	4.9 ft. / 98%
RQD:	3.9 ft. / 78%	RQD:	3.5 ft. / 69%





Appendix IV – Laboratory Test Results

SUMMARY OF SOIL LABORATORY TEST DATA

ITT Pump Station
Mills River, North Carolina
S&ME Project No. 23410064

Boring	Sample Depth (feet)	Sample Type	USCS Classification	Finer Than #200 Sieve (%)	Atterberg Limits			Natural Moisture Content (%)	Shear Strength		
					LL	PL	PI		Effective Cohesion (psf)	Effective Friction Angle (degrees)	Test Method
B-1	6-7.5	SS	MH	70.1	55	33	22	32.3	-	-	-
B-1	8-10	ST	SM	29.9	NP	NP	NP	22.4	0	38.1	TX CU
B-1	13.5-15	SS	ML	63.4	32	27	5	36.6	-	-	-
B-1	23.5-25	SS	SM	35.4	-	-	-	34.3	-	-	-
B-2	3.5-5	SS	ML	69.4	37	28	9	34.9	-	-	-
B-2	13.5-15	SS	SM	20.5	-	-	-	23.6	-	-	-
B-2	23.5-25	SS	SM	33.7	38	31	7	35.1	-	-	-
B-3	6-7.5	SS	ML	75.6	35	25	10	37.3	-	-	-
B-3	13.5-15	SS	SM	18.9	-	-	-	16.7	-	-	-
B-3	23.5-25	SS	SM	29.2	-	-	-	31.5	-	-	-
B-3	43.5-45	SS	SM	29.1	-	-	-	24.8	-	-	-
B-3	53.5-55	SS	SM	31.9	-	-	-	18.5	-	-	-

SS - Split Spoon
ST - Shelby Tube
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
NP - Non-plastic
TX CU - CU Triaxial

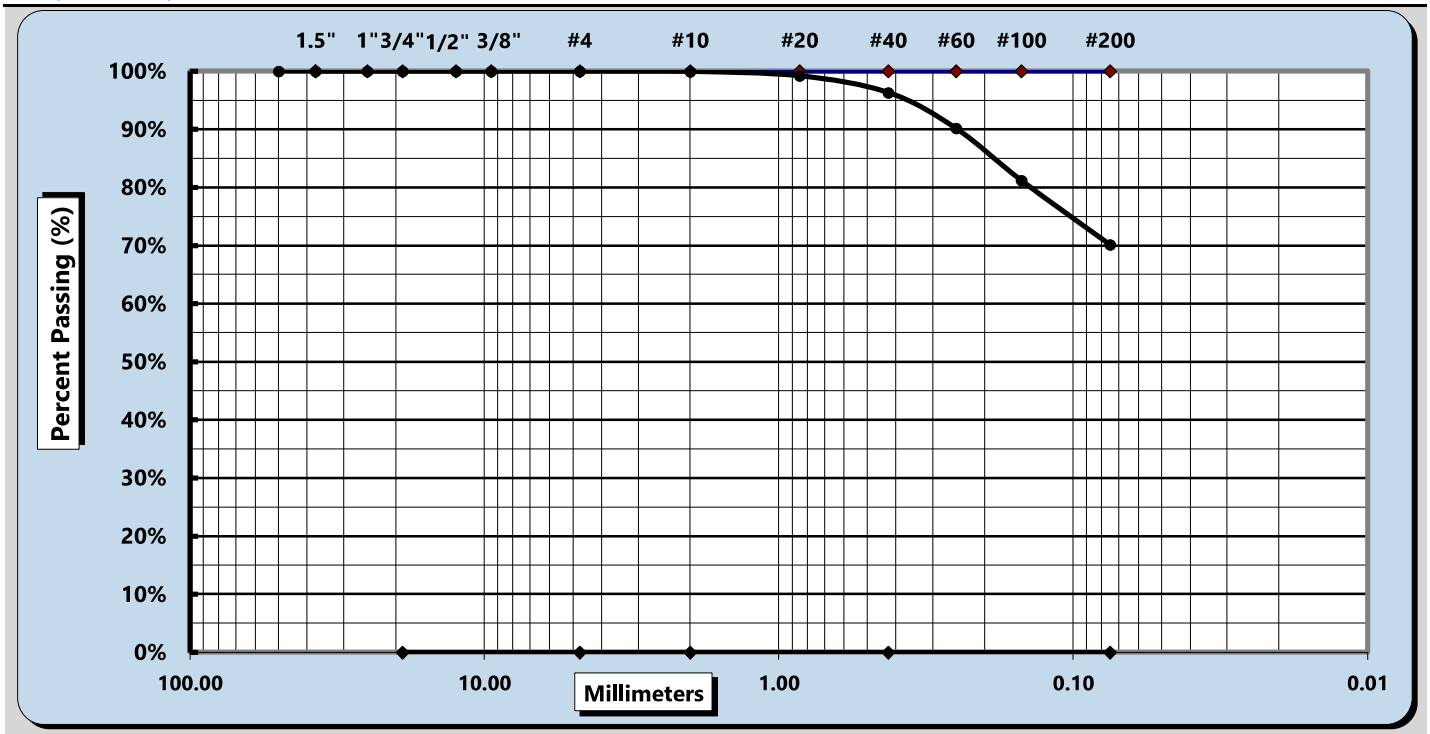
Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/8/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-1	Log #: 30	Sample Date: 2/20/24
Location:	SS-3	Type: Split-spoon	Depth: 6 - 7.5'
Sample Description:	ELASTIC SILT WITH SAND (MH) - red tan brown, fine		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	2.00 mm	Coarse Sand	0.1%	Fine Sand	26.2%
Gravel	0.0%	Medium Sand	3.6%	Silt & Clay	70.1%
Liquid Limit	55	Plastic Limit	33	Plastic Index	22
				Moisture Content	32.3%

Coarse Sand	0.1%	Medium Sand	3.6%	Fine Sand	26.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

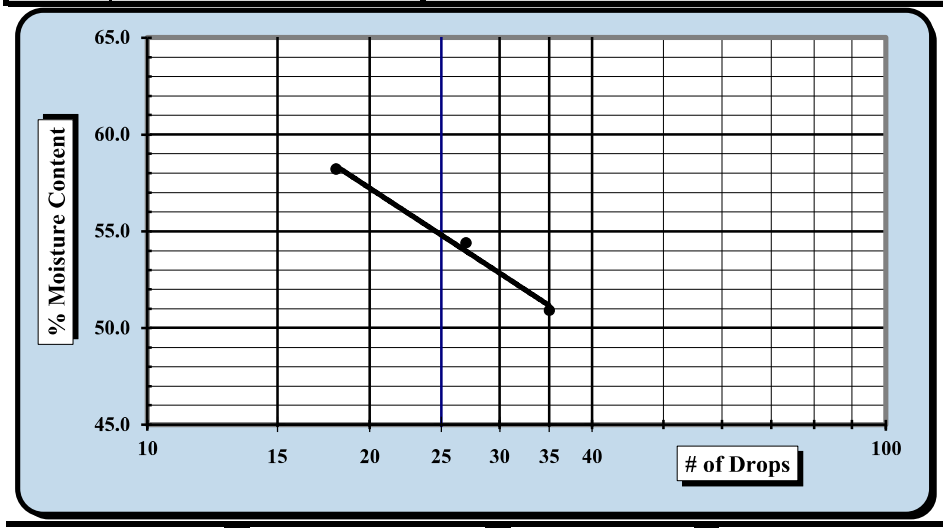
ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date:	3/13/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-1	Log #: 30	Sample Date: 2/20/24
Location:	SS-3	Type: Split-spoon	Depth: 6 - 7.5'
Sample Description:	ELASTIC SILT WITH SAND (MH) - red tan brown, fine		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	7537	1/29/2024	Grooving tool	14185	9/29/2023
LL Apparatus	13859	6/16/2023			
Oven	7313	7/28/2023			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	P-1	P-2	P-3				1	2	
A	Tare Weight	16.29	15.18	16.51				12.11	12.16	
B	Wet Soil Weight + A	33.36	33.61	34.17				19.61	19.49	
C	Dry Soil Weight + A	27.60	27.12	27.67				17.77	17.68	
D	Water Weight (B-C)	5.76	6.49	6.50				1.84	1.81	
E	Dry Soil Weight (C-A)	11.31	11.94	11.16				5.66	5.52	
F	% Moisture (D/E)*100	50.9%	54.4%	58.2%				32.5%	32.8%	
N	# OF DROPS	35	27	18				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							32.7%		



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	**55**
Plastic Limit	**33**
Plastic Index	**22**
Group Symbol	**MH**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* 70.1%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs	3/14/24	Brian Vaughan, P.E.	3/14/24
Technician Name	*Date*	*Technical Responsibility*	*Date*

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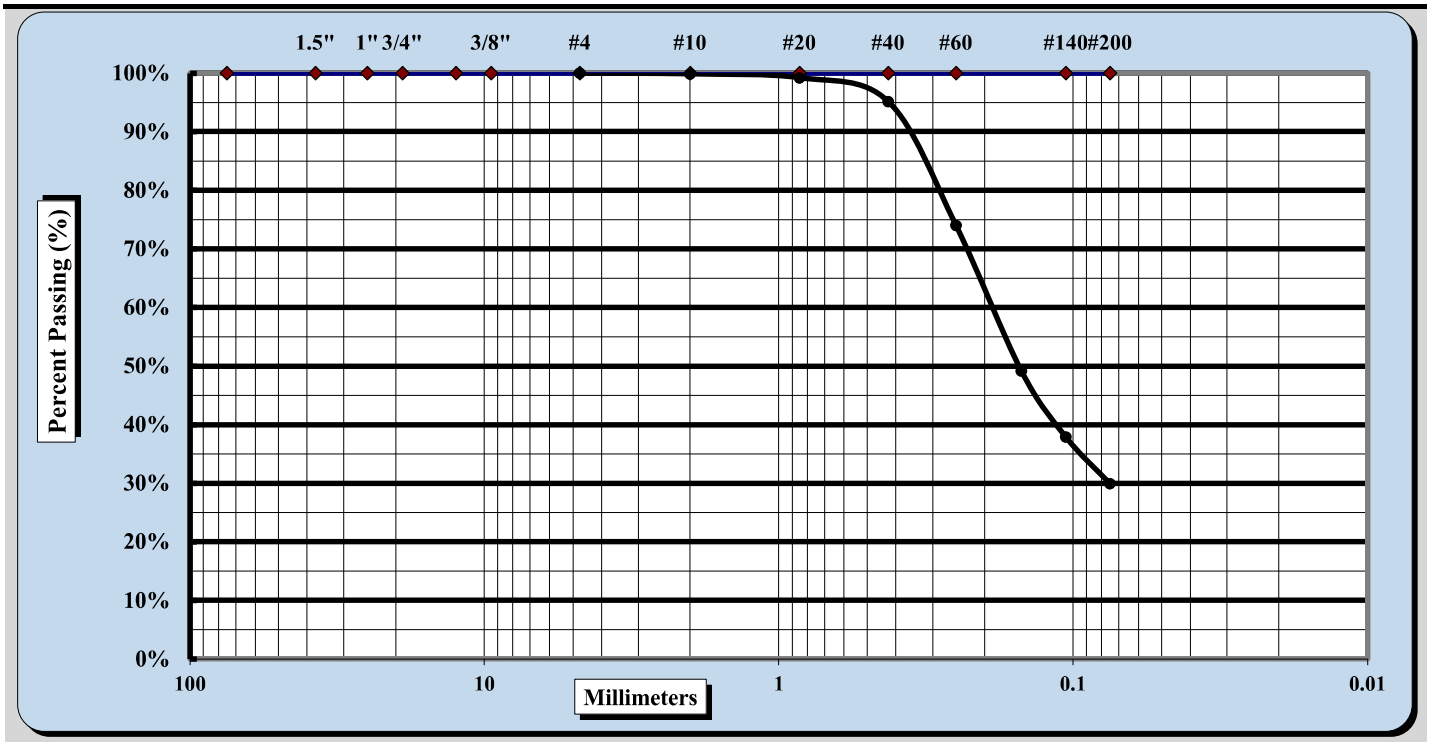
Form No: TR-2310LEX-D422D6
Revision No. 0
Revision Date: 09/02/20

SIEVE ANALYSIS OF SOILS

ASTM D6913 METHOD B

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	23410064	Report Date:	03/28/24
Project Name:	ITT Pump Staion	Test Date(s):	3/18 - 03/22/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D, Asheville, NC 28803		
Boring #:	B-1 Log #: S3015	Sample Date:	2/19 - 2/21/24
Location:	UD-1 Type: Shelby Tube	Depth:	8' - 9'
Sample Description:	SILTY SAND (SM) - red, fine, micaceous		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size:	#20	Coarse Sand:	0.1%	Fine Sand:	65.3%
Gravel:	0.0%	Medium Sand:	4.7%	Silt & Clay:	29.9%
Liquid Limit:	NP	Plastic Limit:	NP	Plastic Index:	NP
				Moisture Content:	22.4%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References: Moisture content 22.4%

"ND" = not determined. "NP" = not plastic.

Jacob Folsom	Jacob Folsom	Laboratory Service Manager	3/29/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D4318-T89-90
Revision No. 1 LEXb
Revision Date: 05/16/22

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

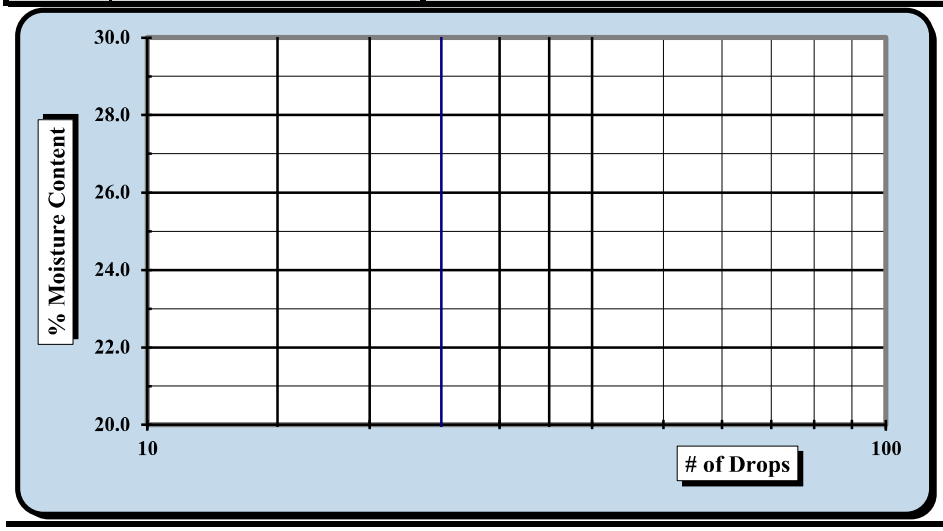
ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	23410064	Report Date:	03/28/24
Project Name:	ITT Pump Station	Test Date(s)	03/22/24
Client Name:	McKim and Creed		
Client Address:	51 Tompson Street, Suite D, Asheville, NC 28803		
Boring #:	B-1	Log #: S3015	Sample Date: 2/19-2/21/24
Location:	UD-1	Type: Shelby Tube	Depth (ft): 8.0 - 9.0
Sample Description:	SILTY SAND (SM) - red, fine, micaceous		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)		01/24/24			
Oven (brown)	24438	02/09/24			

		Liquid Limit						Plastic Limit		
A	Tare Weight									
B	Wet Soil Weight + A									
C	Dry Soil Weight + A									
D	Water Weight (B-C)									
E	Dry Soil Weight (C-A)									
F	% Moisture (D/E)*100									
N	# OF DROPS							*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*	#DIV/0!								



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	**NP**
Plastic Limit	**NP**
Plastic Index	**NP**
Group Symbol	**ML***

Multipoint Method ☒
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☒ Air Dried ☒ *Est. the % retained on the #40 Sieve:* #DIV/0!

Notes / Deviations / References: *Classification listed here applies only to portion passing No. 40 sieve.

J. LaMothe	3/22/2024	Jacob Folsom	3/29/2024
Technician Name	*Date*	*Technical Responsibility*	*Date*

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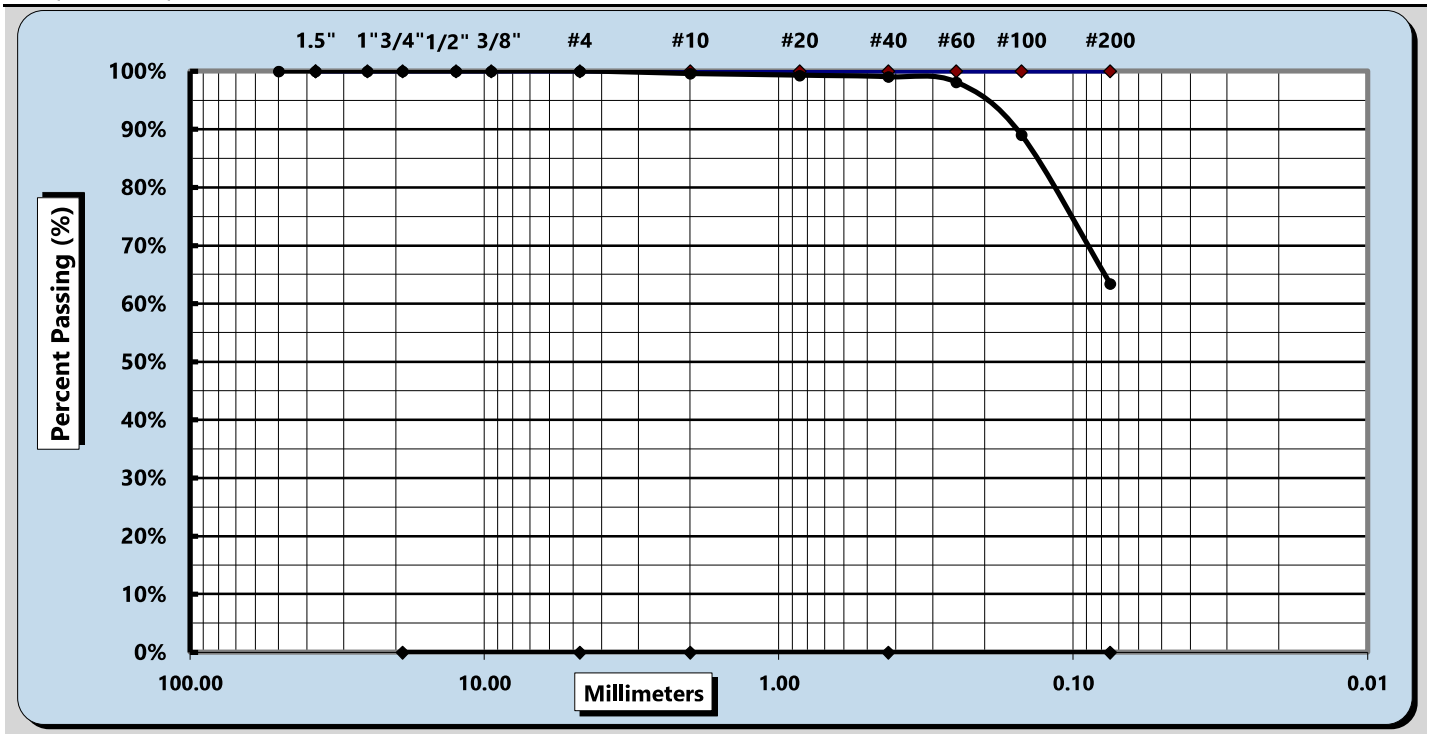
Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/8/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #: B-1	Log #: 30	Sample Date:	2/20/24
Location: SS-5	Type: Split-spoon	Depth:	13.5 - 15'
Sample Description:	SANDY SILT (ML) - gray tan, fine		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	2.00 mm	Coarse Sand	0.4%	Fine Sand	35.6%
Gravel	0.0%	Medium Sand	0.5%	Silt & Clay	63.4%
Liquid Limit	32	Plastic Limit	27	Plastic Index	5
				Moisture Content	36.6%

Coarse Sand	0.4%	Medium Sand	0.5%	Fine Sand	35.6%

Description of Sand & Gravel Particles: **Rounded** ☒ Angular ☐
Hard & Durable ☐ **Soft** ☒ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E.		QA Supervisor	3/14/24
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

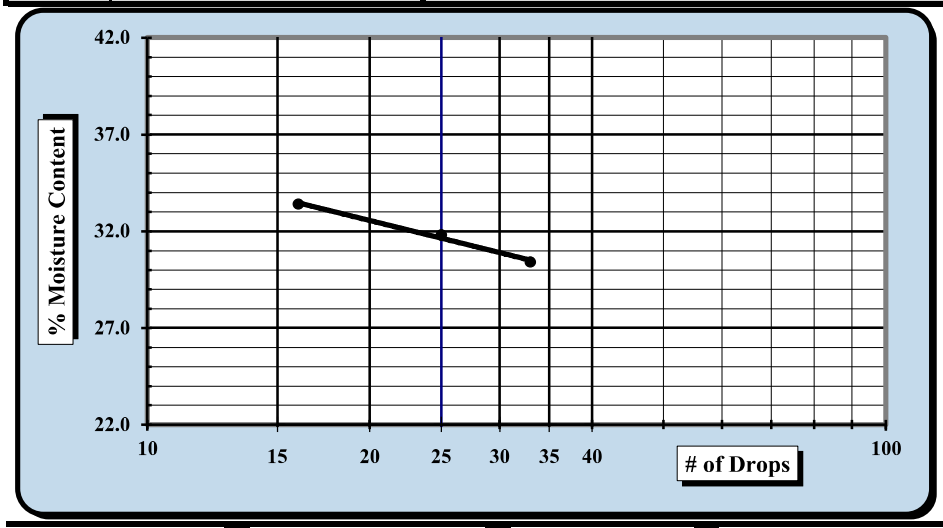
ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date:	3/13/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-1	Log #: 30	Sample Date: 2/20/24
Location:	SS-5	Type: Split-spoon	Depth: 13.5 - 15'
Sample Description:	SANDY SILT (ML) - gray tan, fine		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	7537	1/29/2024	Grooving tool	14185	9/29/2023
LL Apparatus	13859	6/16/2023			
Oven	7313	7/28/2023			

	Pan #	Liquid Limit						Plastic Limit		
	Tare #:	Q-1	Q-2	Q-3				3	4	
A	Tare Weight	16.62	16.56	15.71				11.60	12.26	
B	Wet Soil Weight + A	36.23	36.78	35.62				18.63	19.09	
C	Dry Soil Weight + A	31.66	31.90	30.64				17.13	17.65	
D	Water Weight (B-C)	4.57	4.88	4.98				1.50	1.44	
E	Dry Soil Weight (C-A)	15.04	15.34	14.93				5.53	5.39	
F	% Moisture (D/E)*100	30.4%	31.8%	33.4%				27.1%	26.7%	
N	# OF DROPS	33	25	16				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							26.9%		



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	**32**
Plastic Limit	**27**
Plastic Index	**5**
Group Symbol	**ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* 63.4%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs	3/14/24	Brian Vaughan, P.E.	3/14/24
Technician Name	*Date*	*Technical Responsibility*	*Date*

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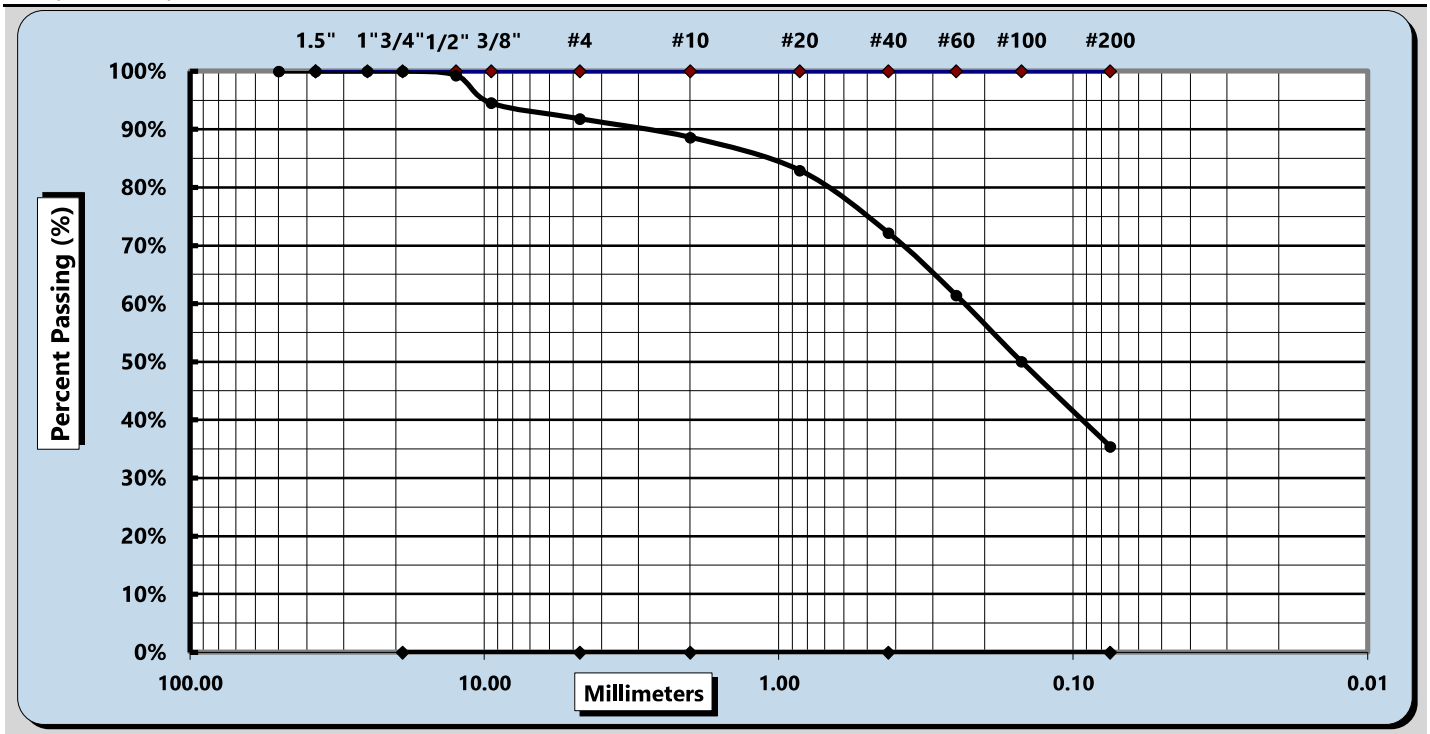
Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/8/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-1	Log #: 30	Sample Date: 2/20/24
Location:	SS-7	Type: Split-spoon	Depth: 23.5 - 25'
Sample Description:	SILTY SAND (SM) - tan white gray, medium to fine		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	12.50 mm	Coarse Sand	3.2%	Fine Sand	36.8%
Gravel	8.2%	Medium Sand	16.4%	Silt & Clay	35.4%
Liquid Limit	-	Plastic Limit	-	Plastic Index	-
				Moisture Content	34.3%

Coarse Sand	3.2%	Medium Sand	16.4%	Fine Sand	36.8%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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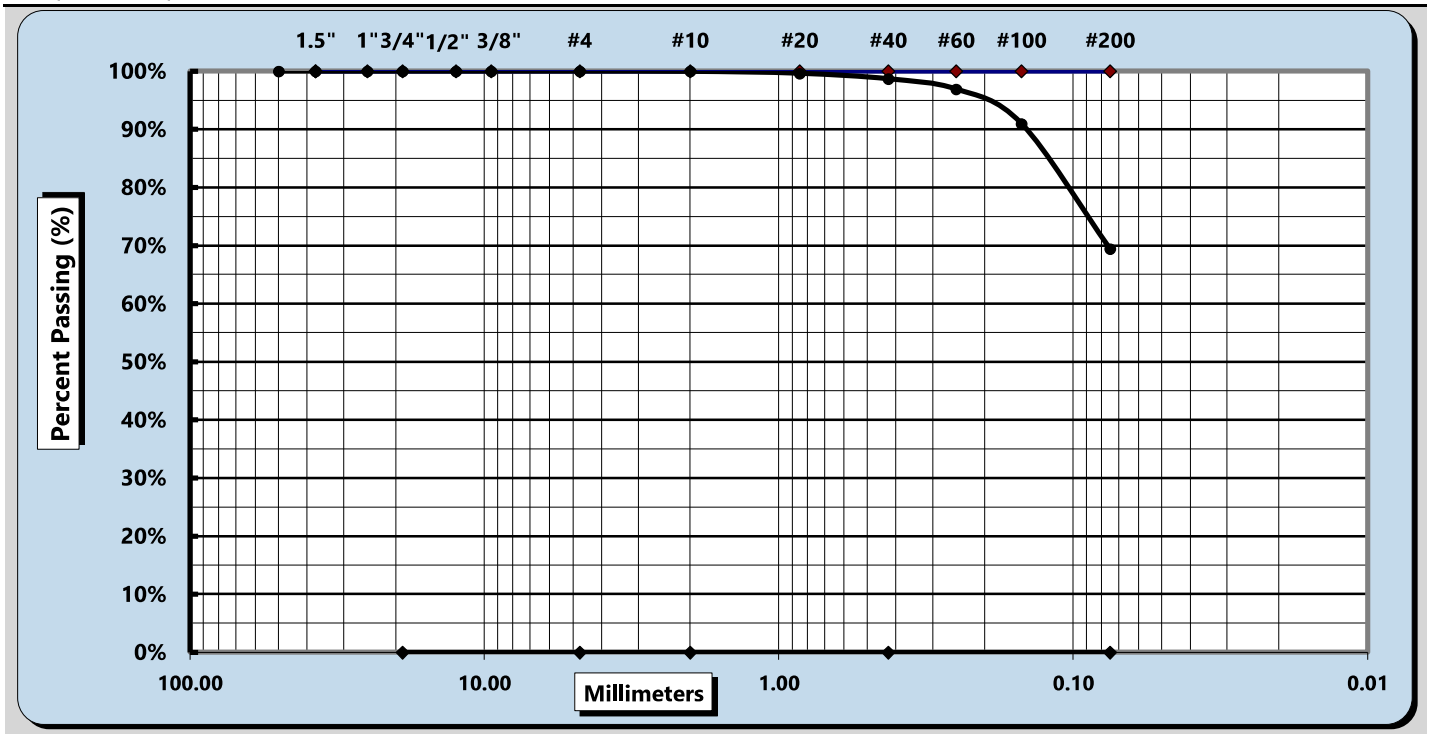
Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/12/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-2	Log #: 30	Sample Date: 2/20/24
Location:	SS-2	Type: Split-spoon	Depth: 3.5 - 5'
Sample Description:	SANDY SILT (ML) - gray brown, fine		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	2.00 mm	Coarse Sand	0.0%	Fine Sand	29.2%
Gravel	0.0%	Medium Sand	1.3%	Silt & Clay	69.4%
Liquid Limit	37	Plastic Limit	28	Plastic Index	9
				Moisture Content	34.9%

Coarse Sand	0.0%	Medium Sand	1.3%	Fine Sand	29.2%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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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* ☐

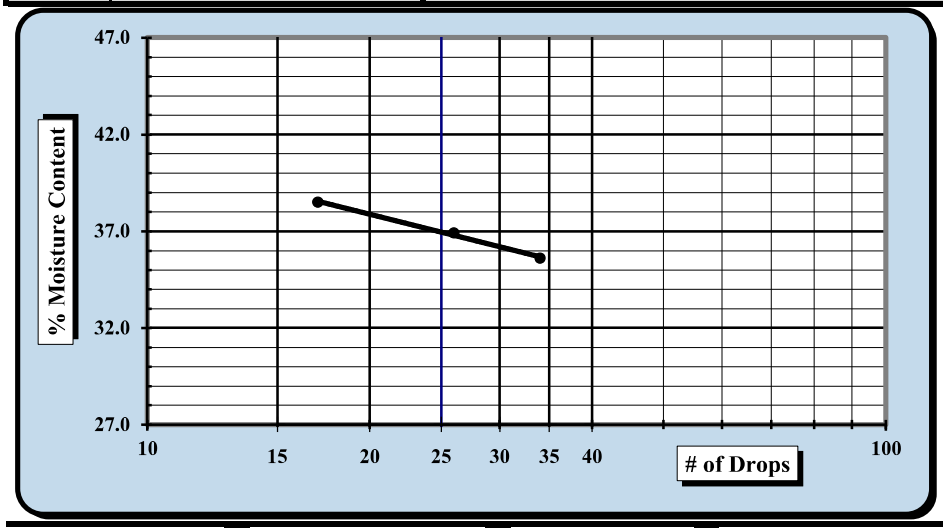
S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date:	3/13/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		

Boring #:	B-2	Log #:	30	Sample Date:	2/20/24
Location:	SS-2	Type:	Split-spoon	Depth:	3.5 - 5'
Sample Description:	SANDY SILT (ML) - gray brown, fine				

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	7537	1/29/2024	Grooving tool	14185	9/29/2023
LL Apparatus	13859	6/16/2023			
Oven	7313	7/28/2023			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	Y-1	Y-2	Y-3				5	6	
A	Tare Weight	16.37	16.40	16.98				12.10	12.29	
B	Wet Soil Weight + A	35.16	34.37	35.49				18.29	18.61	
C	Dry Soil Weight + A	30.23	29.53	30.34				16.93	17.23	
D	Water Weight (B-C)	4.93	4.84	5.15				1.36	1.38	
E	Dry Soil Weight (C-A)	13.86	13.13	13.36				4.83	4.94	
F	% Moisture (D/E)*100	35.6%	36.9%	38.5%				28.2%	27.9%	
N	# OF DROPS	34	26	17				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							28.1%		



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	**37**
Plastic Limit	**28**
Plastic Index	**9**
Group Symbol	**ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* 69.4%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs	3/14/24	Brian Vaughan, P.E.	3/14/24
Technician Name	*Date*	*Technical Responsibility*	*Date*

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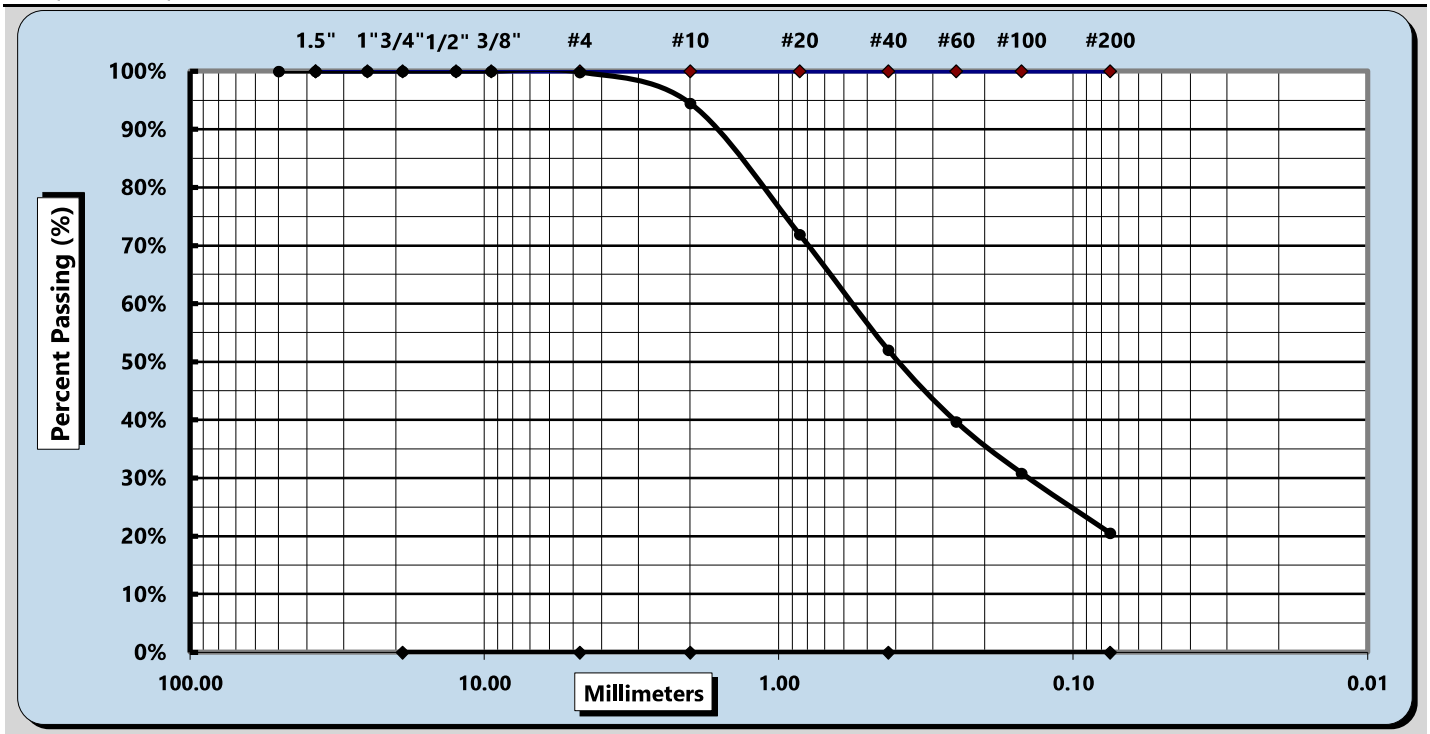
Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/12/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-2	Log #: 30	Sample Date: 2/20/24
Location:	SS-5	Type: Split-spoon	Depth: 13.5 - 15'
Sample Description:	SILTY SAND (SM) - tan white yellow, fine to medium, micaceous		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	4.75 mm	Coarse Sand	5.4%	Fine Sand	31.5%
Gravel	0.2%	Medium Sand	42.4%	Silt & Clay	20.5%
Liquid Limit	-	Plastic Limit	-	Plastic Index	-
				Moisture Content	23.6%

Coarse Sand	5.4%	Medium Sand	42.4%	Fine Sand	31.5%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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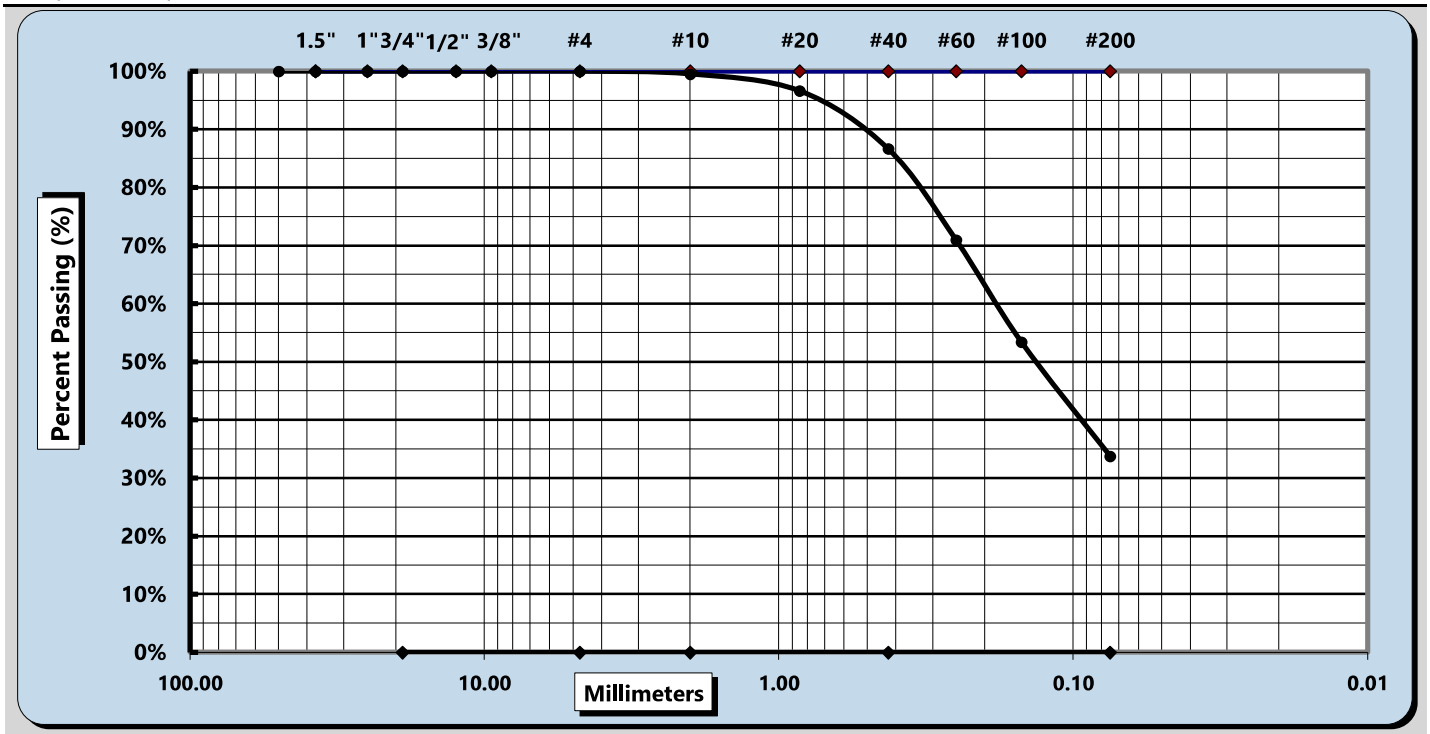
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Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/12/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-2	Log #: 30	Sample Date: 2/20/24
Location:	SS-7	Type: Split-spoon	Depth: 23.5 - 25'
Sample Description:	SILTY SAND (SM) - brown orange, medium to fine, micaceous		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	2.00 mm	Coarse Sand	0.5%	Fine Sand	52.9%
Gravel	0.0%	Medium Sand	12.9%	Silt & Clay	33.7%
Liquid Limit	38	Plastic Limit	31	Plastic Index	7
				Moisture Content	35.1%

Coarse Sand	0.5%	Medium Sand	12.9%	Fine Sand	52.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

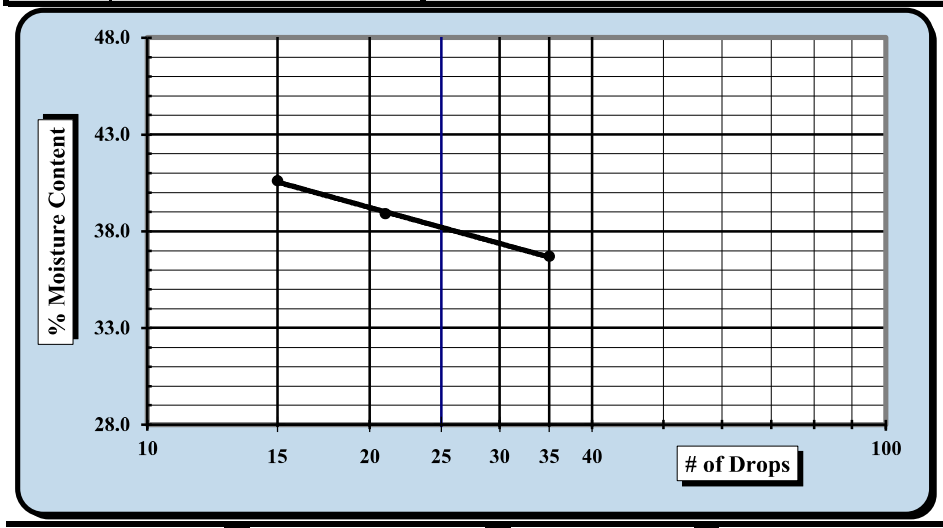
ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date:	3/13/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-2	Log #: 30	Sample Date: 2/20/24
Location:	SS-7	Type: Split-spoon	Depth: 23.5 - 25'
Sample Description:	SILTY SAND (SM) - brown orange, medium to fine, micaceous		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	7537	1/29/2024	Grooving tool	14185	9/29/2023
LL Apparatus	13859	6/16/2023			
Oven	7313	7/28/2023			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	Z-1	Z-2	Z-3				7	9	
A	Tare Weight	15.87	16.55	16.76				12.00	12.23	
B	Wet Soil Weight + A	35.34	34.81	35.90				19.48	19.62	
C	Dry Soil Weight + A	30.11	29.70	30.37				17.71	17.89	
D	Water Weight (B-C)	5.23	5.11	5.53				1.77	1.73	
E	Dry Soil Weight (C-A)	14.24	13.15	13.61				5.71	5.66	
F	% Moisture (D/E)*100	36.7%	38.9%	40.6%				31.0%	30.6%	
N	# OF DROPS	35	21	15				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							30.8%		



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	**38**
Plastic Limit	**31**
Plastic Index	**7**
Group Symbol	**SM**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* 33.7%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs	3/14/24	Brian Vaughan, P.E.	3/14/24
Technician Name	*Date*	*Technical Responsibility*	*Date*

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Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

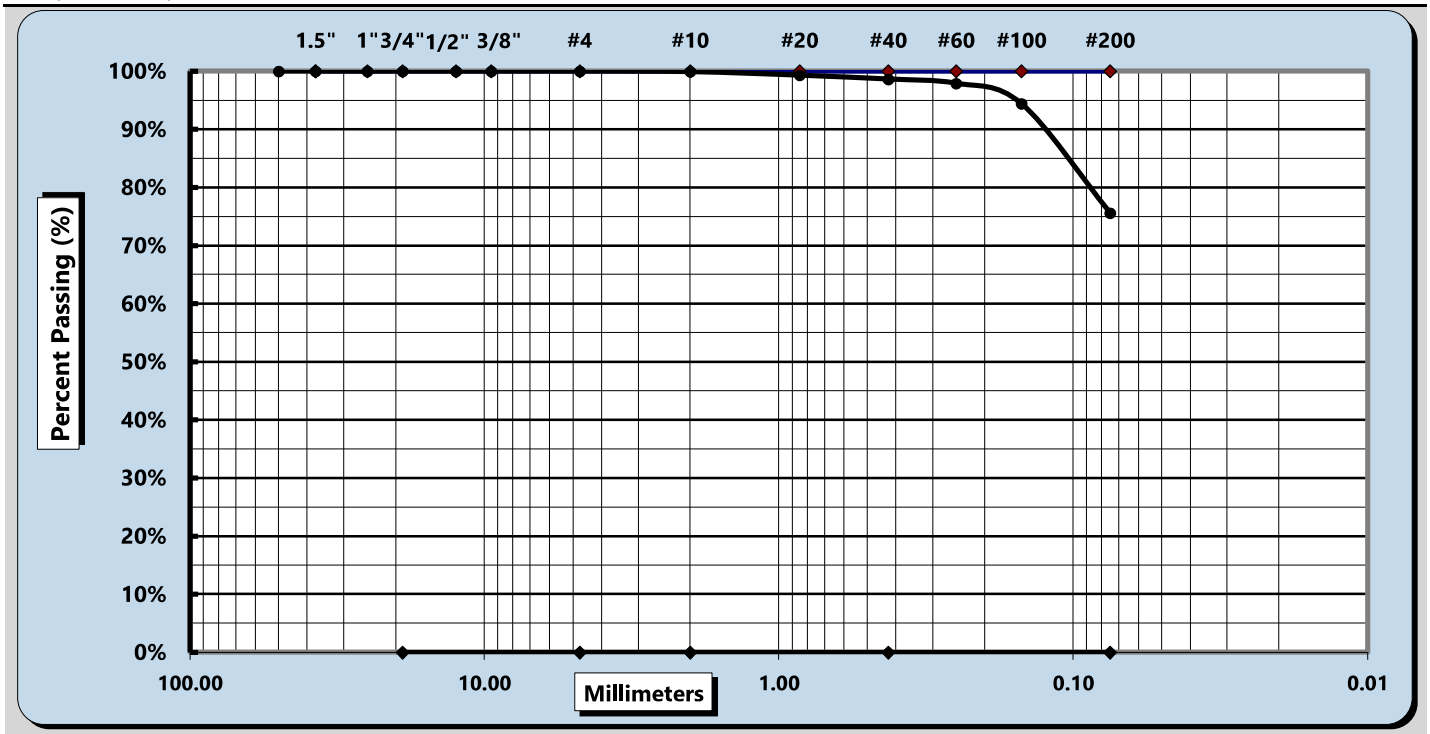
SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/13/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #: B-3	Log #: 30	Sample Date:	2/19/24
Location: SS-3	Type: Split-spoon	Depth:	6 - 7.5'

Sample Description: SILT WITH SAND (ML) - tan brown, fine



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	2.00 mm	Coarse Sand	0.1%	Fine Sand	23.0%
Gravel	0.0%	Medium Sand	1.3%	Silt & Clay	75.6%
Liquid Limit	35	Plastic Limit	25	Plastic Index	10
				Moisture Content	37.3%

Coarse Sand	0.1%	Medium Sand	1.3%	Fine Sand	23.0%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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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. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

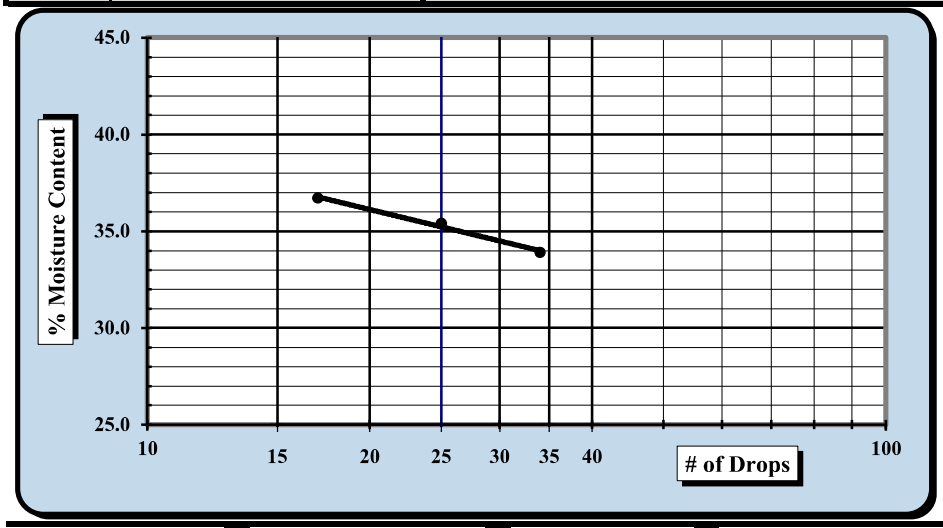
Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date:	3/13/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		

Boring #:	B-3	Log #:	30	Sample Date:	2/19/24
Location:	SS-3	Type:	Split-spoon	Depth:	6 - 7.5'

Sample Description: SILT WITH SAND (ML) - tan brown, fine

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	7537	1/29/2024	Grooving tool	14185	9/29/2023
LL Apparatus	13859	6/16/2023			
Oven	7313	7/28/2023			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	P-4	P-5	P-6				12	13	
A	Tare Weight	16.58	16.55	15.96				11.16	12.10	
B	Wet Soil Weight + A	35.83	34.71	34.22				17.83	18.98	
C	Dry Soil Weight + A	30.96	29.96	29.32				16.48	17.59	
D	Water Weight (B-C)	4.87	4.75	4.90				1.35	1.39	
E	Dry Soil Weight (C-A)	14.38	13.41	13.36				5.32	5.49	
F	% Moisture (D/E)*100	33.9%	35.4%	36.7%				25.4%	25.3%	
N	# OF DROPS	34	25	17				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							25.4%		



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	**35**
Plastic Limit	**25**
Plastic Index	**10**
Group Symbol	**ML**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* 75.6%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs	3/14/24	Brian Vaughan, P.E.	3/14/24
Technician Name	*Date*	*Technical Responsibility*	*Date*

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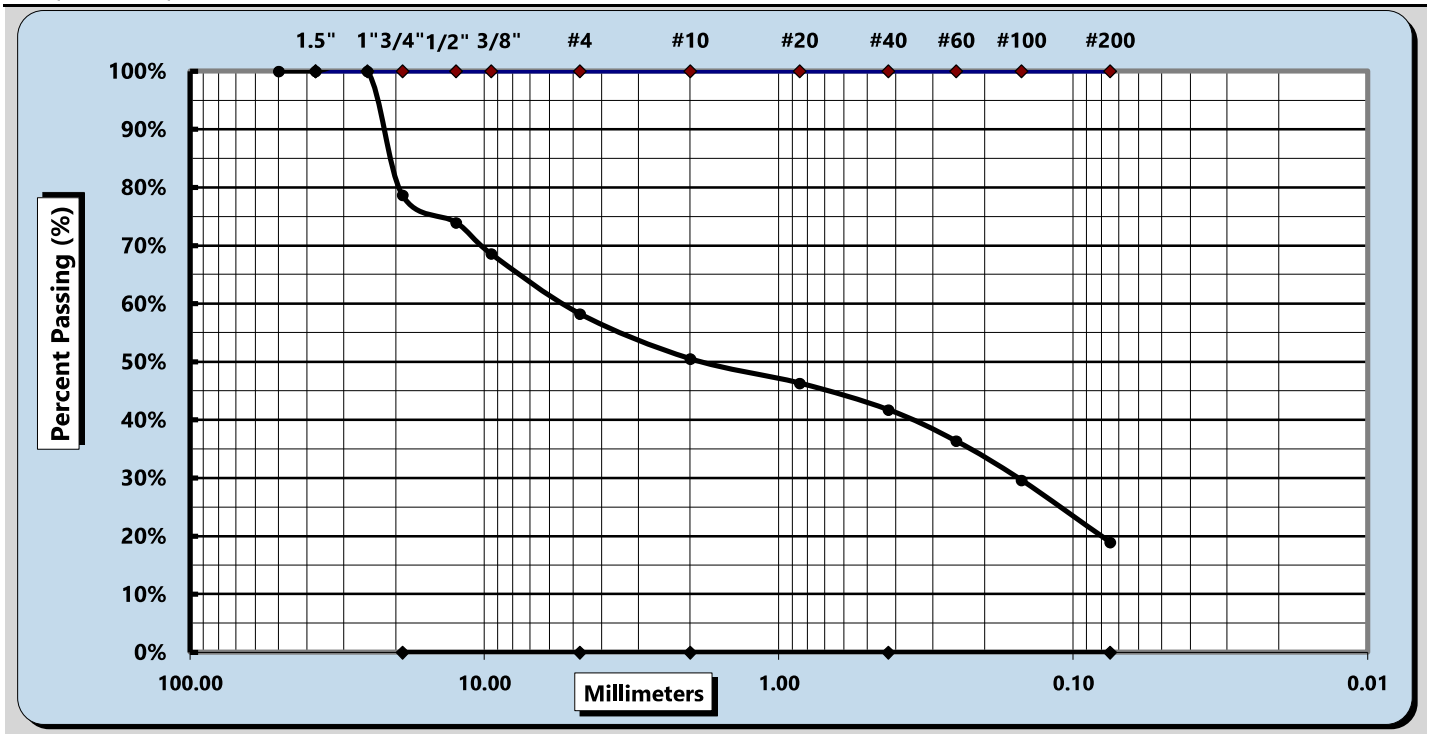
Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/13/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #: B-3	Log #: 30	Sample Date:	2/19/24
Location: SS-5	Type: Split-spoon	Depth:	13.5 - 15'
Sample Description:	SILTY SAND WITH GRAVEL (SM) - tan brown gray, fine with few medium and coarse		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	25.00 mm	Coarse Sand	7.8%	Fine Sand	22.8%
Gravel	41.7%	Medium Sand	8.8%	Silt & Clay	18.9%
Liquid Limit	-	Plastic Limit	-	Plastic Index	-
				Moisture Content	16.7%

Coarse Sand	7.8%	Medium Sand	8.8%	Fine Sand	22.8%

Description of Sand & Gravel Particles: **Rounded** ☒ **Angular** ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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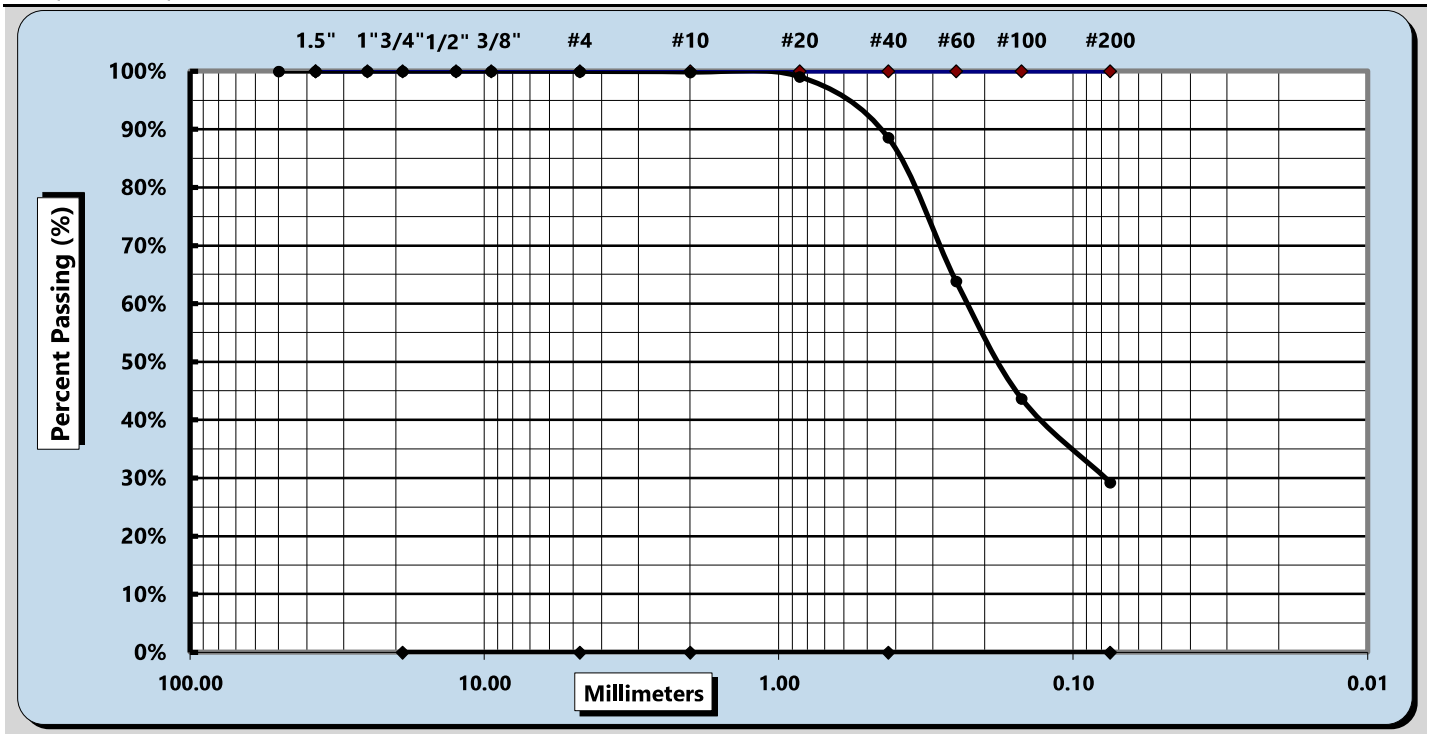
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Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/14/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-3	Log #: 30	Sample Date: 2/19/24
Location:	SS-7	Type: Split-spoon	Depth: 23.5 - 25'
Sample Description:	SILTY SAND (SM) - gray, medium to fine, trace mica		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	4.75 mm	Coarse Sand	0.1%	Fine Sand	59.3%
Gravel	0.1%	Medium Sand	11.2%	Silt & Clay	29.2%
Liquid Limit	-	Plastic Limit	-	Plastic Index	-
				Moisture Content	31.5%

Coarse Sand	0.1%	Medium Sand	11.2%	Fine Sand	59.3%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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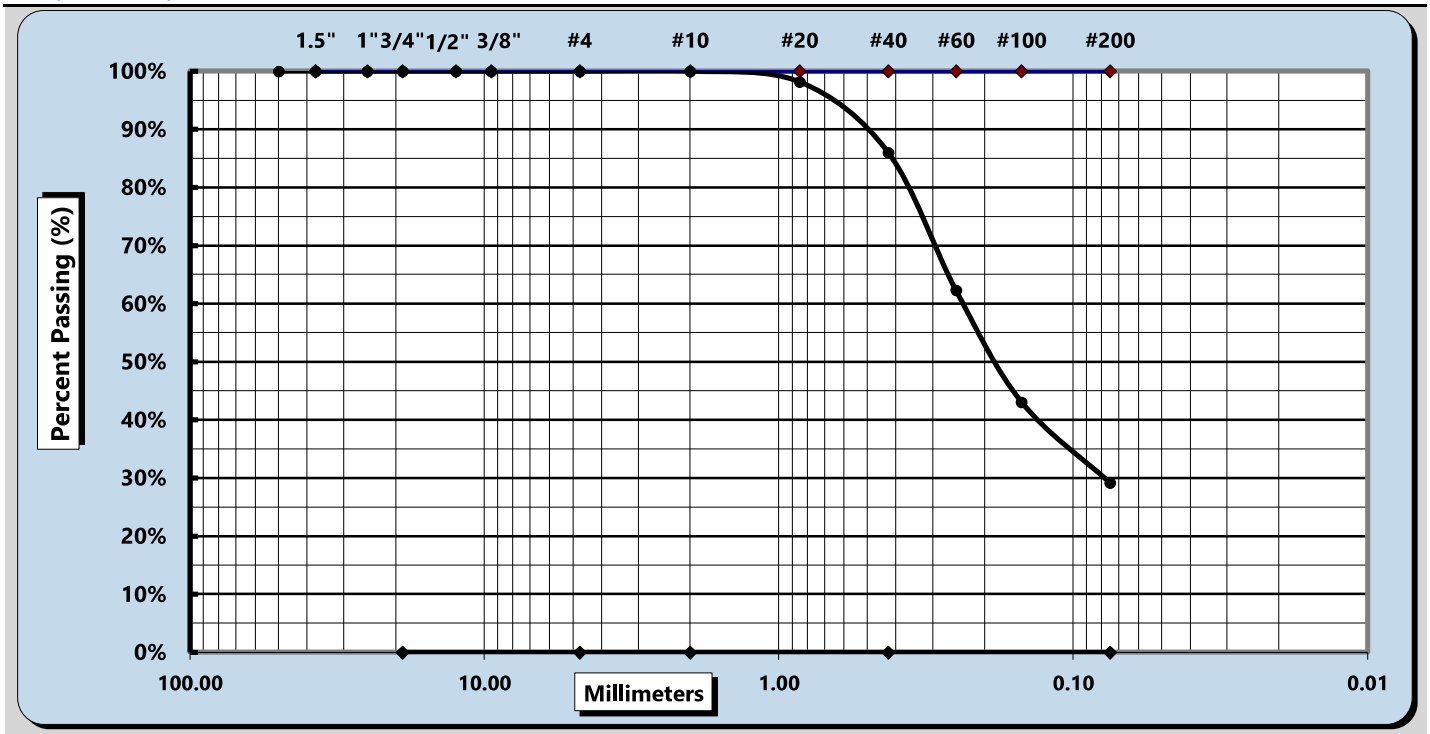
Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/14/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-3	Log #: 30	Sample Date: 2/19/24
Location:	SS-11	Type: Split-spoon	Depth: 43.5 - 45'
Sample Description:	SILTY SAND (SM) - gray tan, medium to fine, trace mica		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	2.00 mm	Coarse Sand	0.0%	Fine Sand	56.9%
Gravel	0.0%	Medium Sand	14.0%	Silt & Clay	29.1%
Liquid Limit	-	Plastic Limit	-	Plastic Index	-
				Moisture Content	24.8%

Coarse Sand	0.0%	Medium Sand	14.0%	Fine Sand	56.9%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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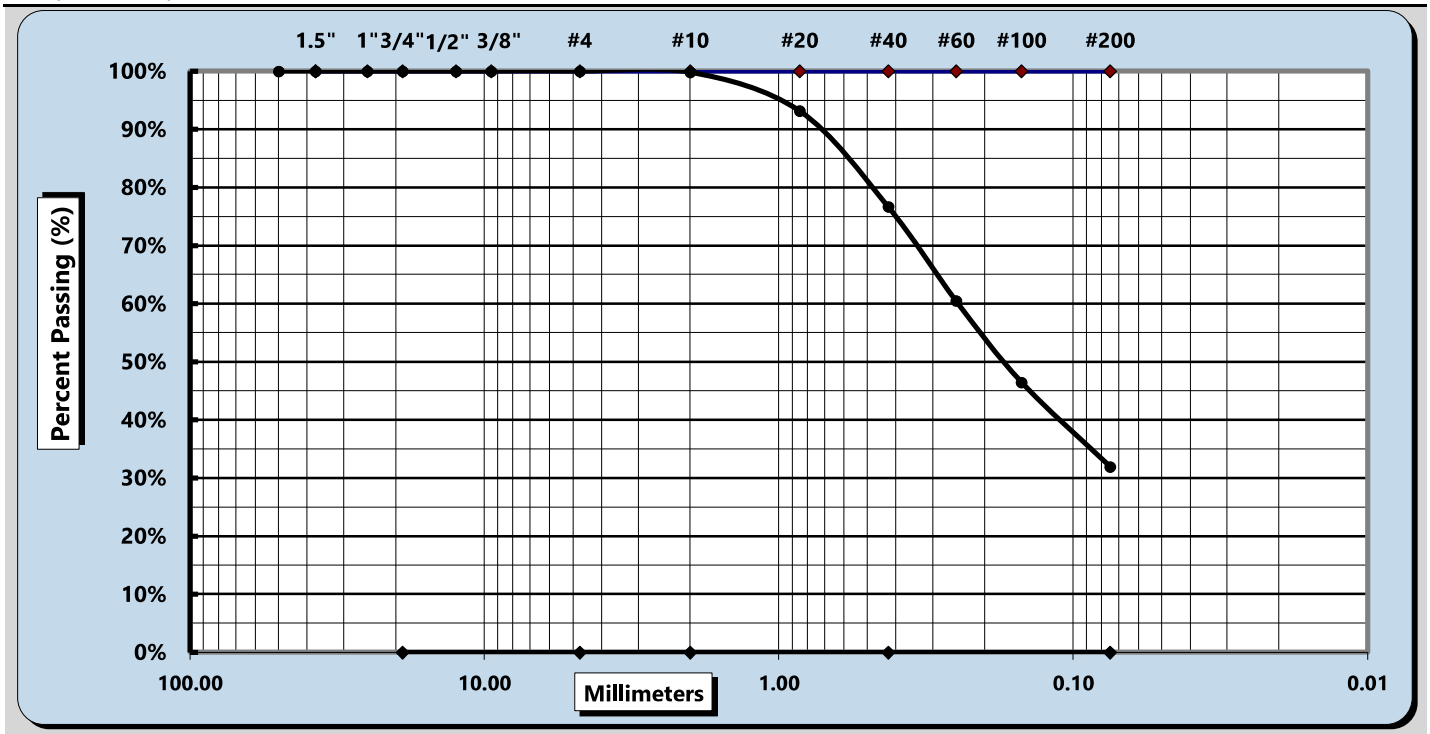
Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	23410064	Report Date:	3/14/24
Project Name:	ITT Pump Station	Test Date(s):	3/5 - 3/14/24
Client Name:	McKim and Creed		
Client Address:	51 Thompson Street, Suite D Asheville, North Carolina 28803		
Boring #:	B-3	Log #: 30	Sample Date: 2/19/24
Location:	SS-13	Type: Split-spoon	Depth: 53.5 - 55'
Sample Description:	SILTY SAND (SM) - gray white orange, medium to fine, micaceous		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	2.00 mm	Coarse Sand	0.2%	Fine Sand	44.7%
Gravel	0.0%	Medium Sand	23.1%	Silt & Clay	31.9%
Liquid Limit	-	Plastic Limit	-	Plastic Index	-
				Moisture Content	18.5%

Coarse Sand	0.2%	Medium Sand	23.1%	Fine Sand	44.7%

Description of Sand & Gravel Particles: Rounded ☐ Angular ☒
Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Notes / Deviations / References:

Brian Vaughan, P.E. — *Technical Responsibility*
Signature
QA Supervisor — *Position*
3/14/24 — *Date*

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Form No. TR-43-D7012C-02
Revision No. : 0
Revision Date: 08/22/18

UNCONFINED COMPRESSION
(ASTM D7012 Method C)

S&ME, Inc. - Knoxville 1413 Topside Road, Louisville, TN 37777

Project Name: ITT Pump Station
Project Number: 23410064

Report Date: March 15, 2024
Reviewed By: Tyler Copeman

Boring No.	Sample No.	Depth (ft)	Dimensions, in.		Shape (See Key)	Area (in^2)	Unit Weight (lbs/ft^3)	Loading Rate (psi/sec)	Maximum Load (lbs)	Strength (psi)	Moisture (%)
			Length	Diameter							
B-2	Run-2	34.0 - 34.4	4.40	1.98	A	3.08	164.3	70	21,934	7,121	0.3
B-2	Run-4	47.7 - 48.1	4.58	1.98	A	3.08	163.9	90	53,322	17,312	0.1
B-2	Run-6	58.3 - 58.7	4.40	1.98	A	3.08	173.8	48	10,746	3,489	0.2

NOTES: Effective (as received) unit weight as determined by RTH 109-93.
Loading rates were selected to target reaching failure between 2 and 15 minutes.
Test results for specimens not meeting the requirements of ASTM D4543-19 may differ from a test specimen that meets the requirements of ASTM D4543.

SHAPE KEY

ASTM D4543-19 Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content and chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial and error that this is not possible, prepare the rock specimen to the closest tolerances practicable and consider this to be the best effort and report it as such and if allowable or necessary for the intended test, capping the ends of the specimen as discussed in this practice is permitted."

A Test specimen measurements met the desired shape tolerances of ASTM D4543-19 (side straightness, end flatness & parallelism, and end perpendicularity to axis)

B Test specimen measurements met the desired shape tolerances of ASTM D4543-19 for end flatness & parallelism, and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness. Specimen prepared to closest tolerances practicable.

C Test specimen measurements met the desired shape tolerances of ASTM D4543-19 for end flatness & parallelism. Specimen did not meet the desired tolerances for side straightness and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

D Test specimen measurements met the desired shape tolerances of ASTM D4543-19 for end flatness. Specimen did not meet the desired tolerances for side straightness, parallelism and end perpendicularity to axis. Specimen prepared to closest tolerances practicable.

E Test specimen measurements met the desired shape tolerances of ASTM D4543-19 for end flatness and end perpendicularity to axis. Specimen did not meet the desired tolerance for side straightness and parallelism. Specimen prepared to closest tolerances practicable.

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PREPARING ROCK CORE AS CYLINDRICAL TEST SPECIMENS AND VERIFYING CONFORMANCE TO DIMENSIONAL AND SHAPE TOLERANCES (ASTM D4543)

1413 Topside Road, Louisville, TN 37777

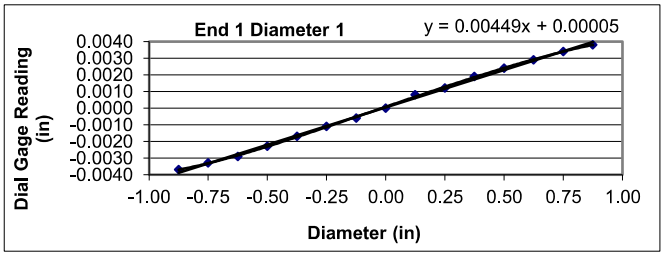
Project:	ITT Pump Station	**Diameter (in):**	1.98	**Date:**	3/15/2024
Project No.:	23410064	**Length (in):**	4.4	**Tested by:**	Ryan Skinner
Boring Id:	B-2	**Unit Weight (pcf):**	164.3	**Reviewed by:**	Tyler Copeman
Sample No.:	Run-2	**Moisture Content (%):**	0.3		
Depth (ft):	34.0 - 34.4				

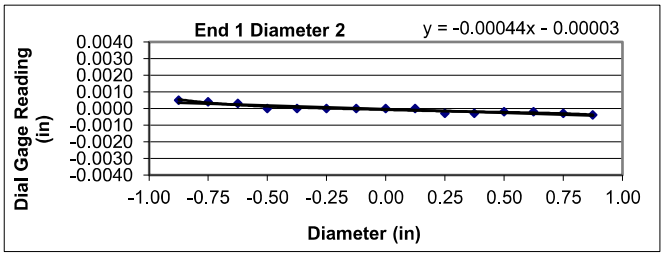
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **YES** Straightness Tolerance Met? **YES**

End Flatness and Parallelism Readings (Procedure FP1)

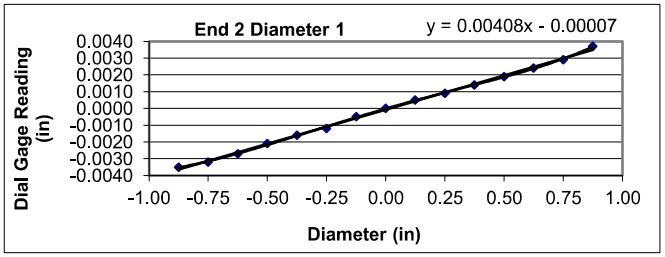
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0037	0.0005	-0.0035	0.0024
- 6/8	-0.0033	0.0004	-0.0032	0.0020
- 5/8	-0.0029	0.0003	-0.0027	0.0016
- 4/8	-0.0023	0.0000	-0.0021	0.0012
- 3/8	-0.0017	0.0000	-0.0016	0.0008
- 2/8	-0.0011	0.0000	-0.0012	0.0003
- 1/8	-0.0006	0.0000	-0.0005	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0008	0.0000	0.0005	-0.0001
2/8	0.0012	-0.0003	0.0009	-0.0006
3/8	0.0019	-0.0003	0.0014	-0.0010
4/8	0.0024	-0.0002	0.0019	-0.0013
5/8	0.0029	-0.0002	0.0024	-0.0017
6/8	0.0034	-0.0003	0.0029	-0.0021
7/8	0.0038	-0.0004	0.0037	-0.0023

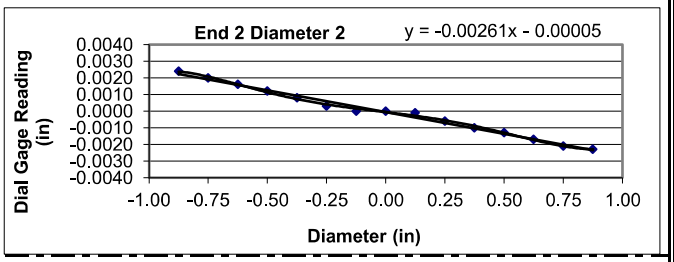




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00449
	Angle of Best Fit Line:	0.25750
End 2:	Slope of Best Fit Line:	0.00408
	Angle of Best Fit Line:	0.23360
	Max Angular Difference:	**0.02**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00044
	Angle of Best Fit Line:	-0.02505
End 2:	Slope of Best Fit Line:	-0.00261
	Angle of Best Fit Line:	-0.14946
	Max Angular Difference:	**0.12**

Parallelism Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0075	0.0038	**YES**
End 1 Diam 2	0.0009	0.0005	**YES**
End 2 Diam 1	0.0072	0.0036	**YES**
End 2 Diam 2	0.0047	0.0024	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORE AS CYLINDRICAL TEST SPECIMENS AND VERIFYING CONFORMANCE TO DIMENSIONAL AND SHAPE TOLERANCES (ASTM D4543)

1413 Topside Road, Louisville, TN 37777

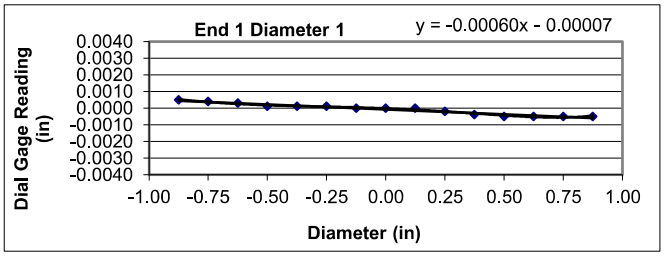
Project:	ITT Pump Station	**Diameter (in):**	1.98	**Date:**	3/15/2024
Project No.:	23410064	**Length (in):**	4.58	**Tested by:**	Ryan Skinner
Boring Id:	B-2	**Unit Weight (pcf):**	163.9	**Reviewed by:**	Tyler Copeman
Sample No.:	Run-4	**Moisture Content (%):**	0.1		
Depth (ft):	47.7 - 48.1				

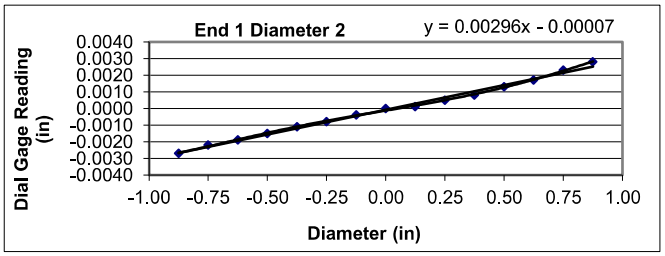
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **YES** Straightness Tolerance Met? **YES**

End Flatness and Parallelism Readings (Procedure FP1)

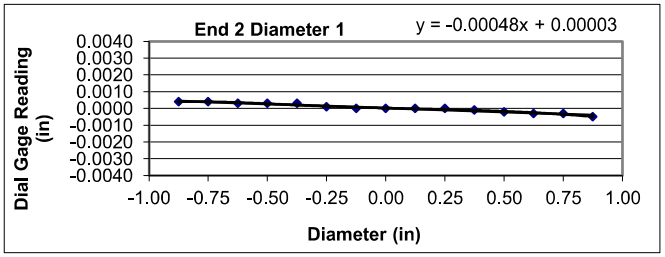
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	0.0005	-0.0027	0.0004	-0.0024
- 6/8	0.0004	-0.0022	0.0004	-0.0017
- 5/8	0.0003	-0.0019	0.0003	-0.0014
- 4/8	0.0001	-0.0015	0.0003	-0.0011
- 3/8	0.0001	-0.0011	0.0003	-0.0008
- 2/8	0.0001	-0.0008	0.0001	-0.0004
- 1/8	0.0000	-0.0004	0.0000	0.0000
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0000	0.0001	0.0000	0.0004
2/8	-0.0002	0.0005	0.0000	0.0010
3/8	-0.0004	0.0008	-0.0001	0.0015
4/8	-0.0005	0.0013	-0.0002	0.0018
5/8	-0.0005	0.0017	-0.0003	0.0020
6/8	-0.0005	0.0023	-0.0003	0.0022
7/8	-0.0005	0.0028	-0.0005	0.0026

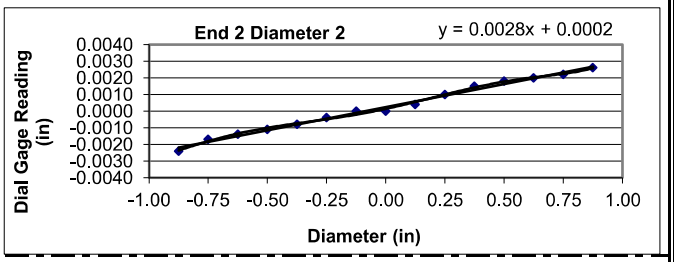




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	-0.00060
	Angle of Best Fit Line:	-0.03421
End 2:	Slope of Best Fit Line:	-0.00048
	Angle of Best Fit Line:	-0.02767
	Max Angular Difference:	**-0.01**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	0.00296
	Angle of Best Fit Line:	0.16943
End 2:	Slope of Best Fit Line:	0.00277
	Angle of Best Fit Line:	0.15895
	Max Angular Difference:	**0.01**

Parallelism Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0010	0.0005	**YES**
End 1 Diam 2	0.0055	0.0028	**YES**
End 2 Diam 1	0.0009	0.0005	**YES**
End 2 Diam 2	0.0050	0.0025	**YES**

Perpendicularity Tolerance Met? **YES**

PREPARING ROCK CORE AS CYLINDRICAL TEST SPECIMENS AND VERIFYING CONFORMANCE TO DIMENSIONAL AND SHAPE TOLERANCES (ASTM D4543)

1413 Topside Road, Louisville, TN 37777

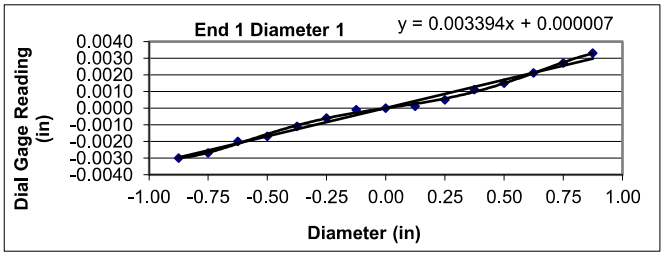
Project:	ITT Pump Station	**Diameter (in):**	1.98	**Date:**	3/15/2024
Project No.:	23410064	**Length (in):**	4.4	**Tested by:**	Ryan Skinner
Boring Id:	B-2	**Unit Weight (pcf):**	173.8	**Reviewed by:**	Tyler Copeman
Sample No.:	Run-06	**Moisture Content (%):**	0.2		
Depth (ft):	58.3 - 58.7				

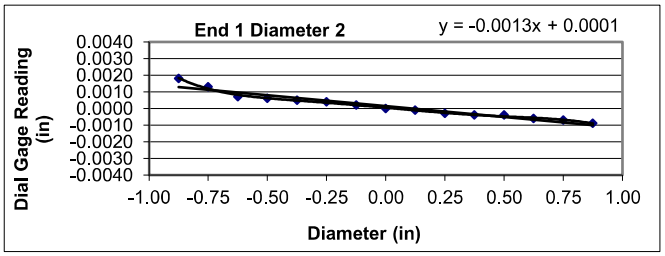
Deviation From Straightness (Procedure S1)

Is the maximum gap ≤ 0.02 in.? **YES** Straightness Tolerance Met? **YES**

End Flatness and Parallelism Readings (Procedure FP1)

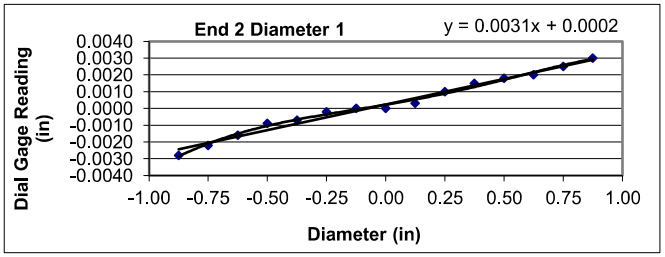
Position	End 1	End 1(90)	End 2	End 2(90)
- 7/8	-0.0030	0.0018	-0.0028	0.0030
- 6/8	-0.0027	0.0013	-0.0022	0.0027
- 5/8	-0.0020	0.0007	-0.0016	0.0022
- 4/8	-0.0017	0.0006	-0.0009	0.0019
- 3/8	-0.0011	0.0005	-0.0007	0.0012
- 2/8	-0.0006	0.0004	-0.0002	0.0009
- 1/8	-0.0001	0.0002	0.0000	0.0004
0	0.0000	0.0000	0.0000	0.0000
1/8	0.0001	-0.0001	0.0003	0.0000
2/8	0.0005	-0.0003	0.0010	-0.0007
3/8	0.0011	-0.0004	0.0015	-0.0009
4/8	0.0015	-0.0004	0.0018	-0.0014
5/8	0.0021	-0.0006	0.0020	-0.0020
6/8	0.0027	-0.0007	0.0025	-0.0025
7/8	0.0033	-0.0009	0.0030	-0.0031

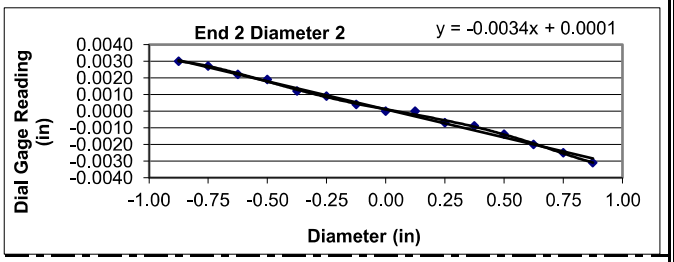




Flatness is met when the difference at any point between a smooth curve drawn through points and a visual best fit line is ≤ 0.001 in.

Flatness Tolerance Met? **YES**





Parallelism is met when the angular difference between best fit lines on opposing ends is ≤ 0.25°.

Parrallelism Diameter 1

End 1:	Slope of Best Fit Line:	0.00339
	Angle of Best Fit Line:	0.19448
End 2:	Slope of Best Fit Line:	0.00305
	Angle of Best Fit Line:	0.17500
	Max Angular Difference:	**0.02**

Parrallelism Diameter 2

End 1:	Slope of Best Fit Line:	-0.00131
	Angle of Best Fit Line:	-0.07498
End 2:	Slope of Best Fit Line:	-0.00337
	Angle of Best Fit Line:	-0.19317
	Max Angular Difference:	**0.12**

Parallelism Tolerance Met? **YES**

Perpendicularity (Procedure P1) is met when the difference between max and min readings along each line divided by the diameter is ≤ 0.0043.

	Difference b/w max & min	Divide by Diameter	Meets Tolerance
End 1 Diam 1	0.0063	0.0032	**YES**
End 1 Diam 2	0.0027	0.0014	**YES**
End 2 Diam 1	0.0058	0.0029	**YES**
End 2 Diam 2	0.0061	0.0031	**YES**

Perpendicularity Tolerance Met? **YES**



Date: 03/15/2024

Photographer: Ryan Skinner

1	**Location / Orientation**	B-2, Run-2 (34.0' – 34.4')
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)



Date: 03/15/2024

Photographer: Ryan Skinner

2	**Location / Orientation**	B-2, Run-4 (47.7' – 48.1')
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)





Date: 03/15/2024

Photographer: Ryan Skinner

3	**Location / Orientation**	B-2, Run-6 (58.3' – 58.7')
	Remarks	Unconfined Compressive Strength of Rock Core Specimen Before/After (ASTM D7012 Method C)

Appendix V – Important Information

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.

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TABLE OF CONTENTS

ARTICLE NUMBER	DESCRIPTION	PAGE
I	Application	2
II	Minority Business Enterprise Goals	2
III	Subcontractor Payment Requirements	3
IV	Program Compliance Requirements	3
V	Checklist for Review of Good Faith Efforts	4
VI	MBE Utilization Commitment (Form 1)	5
VII	Contractor Certification Regarding Subcontracting Practices (Form 2)	6
VIII	MBE Letter of Intent (Form 3)	7
IX	Guidelines for Recruitment and Selection of MBE	8

ARTICLE I: APPLICATION

The requirements of the Metropolitan Sewerage District (DISTRICT) Guidelines for Recruitment and Selection of Minority Businesses for Participation in Sewage Construction Contracts are hereby made a part of these contract documents. These requirements shall apply to all contractors regardless of ownership. A copy of the Metropolitan Sewerage District Guidelines for Recruitment and Selection of Minority Businesses for Participation in Sewage Construction Contracts is attached:

ARTICLE II: MINORITY BUSINESS ENTERPRISE GOALS

The goal for Minority Business Enterprise (MBE) participation on DISTRICT projects has been set at **Twelve (12)** percent.

The Bidder shall provide, with the bid, documented proof in the form of MBE Form 1, MBE UTILIZATION COMMITMENT, that these goals have been met or exceeded;

OR

If minority participation is less than Twelve (12) percent, provide with the bid, 1) the Checklist for Review of Good Faith Efforts, and 2) MBE Form 1 (MBE UTILIZATION COMMITMENT) identifying the amount of MBE participation.

NOTE: If the Bidder awards ALL subcontracts to MBE's, the Checklist for Review of Good Faith Efforts listed above will not be required; however, this shall be noted on MBE Form 1.

OR

If there is no minority participation, provide with the bid, MBE Form 2, CERTIFICATION REGARDING SUBCONTRACTING PRACTICES, and upon request, information sufficient for the DISTRICT to determine that the Bidder does not customarily subcontract work on this type of project.

Failure to provide this evidence may result in rejection of the bid and award to another responsible, responsive bidder.

NOTE REGARDING MBE FORM 3:

Bidders employing MBE's shall provide with the bid, or within 72 hours from the receipt of bids, a Letter of Intent **(MBE Form 3)**, complete with a description of the scope of services and dollar value for each MBE firm proposed for use in this contract. Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to another responsible, responsive bidder. The DISTRICT reserves the right to waive any irregularities in MBE documentation if they can be resolved prior to award of the contract, and the DISTRICT finds it to be in its best interest to do so and award the contract.

ARTICLE III: SUBCONTRACTOR PAYMENT REQUIREMENTS

North Carolina General Statute 143-134.1 states that the percentage of retainage on payments made by the prime contractor to the subcontractor shall not exceed the percentage of retainage on payments made by the DISTRICT to the prime CONTRACTOR. Failure to comply with this provision shall be considered a breach of the contract, and the contract may be terminated in accordance with the termination provisions of the contract.

The CONTRACTOR shall provide an itemized statement of payments to each MBE subcontractor with each request for payment or before final payment is processed.

ARTICLE IV: PROGRAM COMPLIANCE REQUIREMENTS

All written statements, certifications or intentions made by the Bidder shall become a part of the agreement between the CONTRACTOR and DISTRICT for performance of this contract. Failure to comply with any of these statements, certifications or intentions, or with the MBE Guidelines shall constitute a breach of the contract. A determination by the DISTRICT that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the DISTRICT whether to terminate the contract for breach.

In determining whether a CONTRACTOR has made good faith efforts to include minority participation, DISTRICT will evaluate all efforts made by the CONTRACTOR and will determine compliance. DISTRICT may take into account any or all of the following:

1. Whether the Bidder attended any pre-bid meetings scheduled by the DISTRICT;

2. Whether the Bidder advertised in general circulation, trade association, and minority-focused media concerning the subcontracting opportunities;

3. Whether the Bidder provided written notice to a minimum of three MBE's for each portion of the work subcontracted, that their interest in the contract was being solicited in sufficient time to allow the MBE's to participate effectively;

4. Whether the Bidder followed up initial solicitations of interest by contacting MBE's to determine with certainty whether the MBE's were interested;

5. Whether the Bidder selected portions of the work to be performed by MBE's in order to increase the likelihood of meeting MBE goals (including, where appropriate, breaking down contracts into economically feasible units to facilitate MBE participation);

6. Whether the Bidder provided interested MBE's with adequate information about the Plans, Specifications and requirements of the contract;

7. Whether the Bidder negotiated in good faith with interested MBE's and not rejecting MBE's as unqualified without sound reasons based upon a thorough investigation of their capabilities.

ARTICLE V - CHECKLIST FOR REVIEW OF GOOD FAITH EFFORTS

(Must be submitted with Bid under certain conditions – See Article II)

1. Have you attended any of the pre-bid conferences scheduled?
( ) Yes ( ) No ( ) None Scheduled

2. Have you advertised for at least three (3) consecutive days in general circulation, trade association, construction and minority focused media regarding subcontracting opportunities with your firm at least fifteen (15) days prior to bid opening on formal projects?
( ) Yes ( ) No (Show how and attach proof)

3. Have you utilized the services of state and/or federal minority business assistance, minority contractors' group, available minority community organizations, , and other organizations that provide assistance in the recruitment and placement of minorities and women? ( ) Yes ( ) No (Show how and attach proof)

4. Have you provided interested MBE's with adequate and equal access to information about the plans, specifications and requirements of the contract and insurance or licenses?
( ) Yes ( ) No

5. Did you provide written notice to all appropriate certified MBE's within the identified subcontracting / supplier / service categories that their interest in the contract was being solicited and in sufficient time to allow the MBE'S to participate? Additionally, did the solicitation contain a description and location of the project, the work for which the subcontractors' bids are being solicited, date, time and location where the subcontractors' bids are to be submitted, locations where bidding documents could be reviewed?
( ) Yes ( ) No

6. Have you selected portions of the work to be performed by MBE's in order to increase the likelihood of meeting MBE's goals including breaking it into economically feasible units where appropriate?
( ) Yes ( ) No

7. Have you designated someone in your firm to be the single contact for MBE's that may have questions, etc.? ( ) Yes ( ) No (Please indicate name of person and title)
_____.

8. Did you follow up initial solicitations of interest by contacting MBE's to determine with certainty whether they are interested in bidding? ( ) Yes ( ) No

9. Did you negotiate in good faith with interested MBE's, not rejecting MBE's as unqualified without sound reasons based on a thorough investigation of their capabilities?
( ) Yes ( ) No (Show how)

COMPANY NAME OF BIDDER: _____ Signature

_____ _____ Title

ARTICLE VI: MBE FORM 1

(Must be submitted with Bid if any subcontractors are used.)

MBE UTILIZATION COMMITMENT

We, _____, do certify that on the

ITT Pump Station Replacement

that we will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. MBE's will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. If the Bidder intends to subcontract, this form must be completed regardless of the amount or lack of participation attained.

Name and Phone Number of Firm	Indicate MBE	Description of Work	% of Contract

The undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the **Metropolitan Sewerage District**. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the Bidder to the commitment herein set forth.

(Name of Bidder)

Date: _____

By: _____

Title: _____

ARTICLE VII: MBE FORM 2

(Must be completed with Bid if MBE Form 1 is not submitted)

CERTIFICATION REGARDING SUBCONTRACTING PRACTICES

We, _____, hereby certify that it is our intent to perform
(Name of Bidder)

100% of the work required for **ITT Pump Station Replacement**

In making this certification, the Bidder states the following:

1. That the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this Project with his/her own current work forces; and

2. That, if requested, the Bidder agrees to submit the following information after bid and before the award of the contract:

   * List of the scope of services involved in this project.
   * List of previous projects of this type that Bidder has performed with his/her forces.
   * Payrolls from the above-mentioned jobs which illustrate Bidder's employee's job classifications needed to perform the elements of the work on the Project or a breakdown of Bidder's entire work force which illustrates the number of employees in each job classification.
   * Name and phone number of the Field Supervisors for these jobs.
   * List of equipment Bidder owns that has been used on previous projects.
   * Copies of lease agreements for equipment that was leased.

The Bidder agrees to provide any additional information requested for the statement contained in Paragraph Number 1 above.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____

(Name of Bidder)

By: _____
Title: _____

ARTICLE VIII: MBE FORM 3

LETTER OF INTENT TO PERFORM AS A SUBCONTRACTOR OR PROVIDE MATERIALS OR SERVICES

SUBJECT: ITT Pump Station Replacement

TO:_____
(Name of Prime Bidder)

The undersigned intends to perform work in connection with the above project as a Minority Business Enterprise.

The MBE status of the undersigned **is / is not** (circle one) certified by the Office of Historically Underutilized Businesses for the State of North Carolina. The DISTRICT encourages all qualified MBE's to become certified by this office.

The undersigned is prepared to perform the following described work or provide materials or services in connection with the above project (specify in detail particular work items, materials or services to be performed or provided):

at the following price: _____.

You have projected the following commencement date for such work, and the undersigned is projecting completion of such work as follows:

Items	Projected Commencement Date	Projected Completion Date

Subcontracting at any tier must be reported and is subject to all MBE compliance requirements. This form shall be used for MBE subcontracting at any level.

Date: _____

Name of Minority Contractor

_____

By: _____

Title: _____

ARTICLE IX: THE METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, NORTH CAROLINA GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN SEWAGE CONSTRUCTION CONTRACTS

These guidelines establish goals for minority participation in single-prime and separate-prime sewage construction contracts. Legislation provides that public bodies shall have a verifiable percentage goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These guidelines are published to accomplish that end.

SECTION 1: INTENT AND APPLICATION OF GUIDELINES

It is the intent of these guidelines that The Metropolitan Sewerage District of Buncombe County, North Carolina, (DISTRICT) as awarding authority for sewage construction projects, and the contracts and subcontractors performing the construction contracts awarded, shall make a good faith effort to attain a verifiable goal of 12% participation by minority businesses in each construction project. Nothing contained in these guidelines shall be construed to require DISTRICT to award contracts to or to make purchases of materials or equipment from minority-business contractors who do not submit the lowest responsible responsive bid or bids.

These guidelines shall apply to all contracts for the erection, construction, alteration, or repair of any buildings or other construction projects when the entire cost of such work shall exceed $100,000.00.

SECTION 2: DEFINITIONS

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:

    a. Black, that is, a person having origins in any of the black racial groups in Africa;

    b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;

    c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia, and Asia, the Indian subcontinent, the Pacific Islands;

    d. American Indian or Alaskan Native, that is, a person having origins in any of the original peoples of North America; or

    e. Female.

2. Minority Business - Means a business:

a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one (51%) of the stock is owned by one or more minority persons; and

b. Of which the management and daily business operations are controlled by one or more of the minority persons who owns it.

3. District - The Metropolitan Sewerage District of Buncombe County, North Carolina.

4. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

5. Contract - A mutually binding legal relationship or any modification thereof obligating the Contractor to furnish labor, equipment, materials, or services for the erection, construction, alteration, or repair of any buildings or other construction projects and obligating the DISTRICT to pay for them.

6. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the DISTRICT to perform a Contract to which these guidelines apply.

7. Subcontractor - Any person, firm, partnership, corporation, association, or joint venture under contract with a CONTRACTOR for supplying materials or labor, equipment, materials or services. The subcontractor may or may not provide materials in his subcontract. Work subcontracted in an emergency and which could not have been anticipated is excluded as part of this program.

8. Verifiable goal - means:

a. For purposes of separate-prime contract system, that the DISTRICT has adopted written guidelines specifying the actions that will be taken to ensure a good faith effort in the recruitment and solicitation of minority businesses for participation in contracts awarded; and

b. For purposes of separate-prime contract system, that the DISTRICT has adopted written guidelines specifying the actions that the prime CONTRACTOR must take to ensure a good faith effort in the recruitment and solicitation of minority businesses for participation in contracts awarded; the required actions must be documented in writing by the CONTRACTOR to the DISTRICT.

SECTION 3: RESPONSIBILITIES

1. The State of North Carolina has an established program in which it lists certified minority and women businesses persons who may qualify as Minority or Woman-owned Business Enterprises (MBE/WBE). The State of North Carolina accepts certification through the ***Office for Historically Underutilized Businesses*** (www.doa.state.nc.us/hub). Current information on the program, certification and searching for minority vendors can be found at this website.

2. DISTRICT/The Metropolitan Sewerage District of Buncombe County, North Carolina.

   Under the single-prime contract system and the separate-prime contract system, the DISTRICT shall:

   a. Fully explain the bidder's responsibilities and this program at the pre-bid conference, if scheduled, conducted by the representative of the DISTRICT. Said conference will be open to all known and anticipated prime contractors, subcontractors, material suppliers, and other bidders.

   b. Be responsible for reviewing the apparent low bidder's compliance with the items listed in the proposal that must be complied with, if the bid is to be considered responsive and responsible. The DISTRICT reserves the right to reject any and all bids and to waive informalities.

   c. Identify or determine the work areas of a contract where MBE's may have an interest in performing contract work.

3. Prime Contractor(s)

   Under the single-prime contract system and the separate-prime contract system, the prime contractor(s) shall:

   a. Attend the scheduled pre-bid conference.

   b. Identify or determine those work areas of a subcontract where MBEs may have an interest in performing subcontract work.

   c. Notify certified MBE's of potential subcontracting opportunities listed in the proposal at least ten (10) days prior to the scheduled day of bid opening. The notification will include the following:

      (1) A description of the work for which the sub-bid is being solicited.

      (2) The date, time and location where sub-bids are to be submitted.

      (3) The name of the individual within the company who will be available to answer questions about the project.

      (4) Where bid documents may be reviewed.

(5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

If there are more than three (3) certified MBE's in the area of the project, the CONTRACTOR(s) shall notify three (3), but may contact more, if the CONTRACTOR(s) so desires.

d. During the bidding process, comply with the DISTRICT's requirements listed in the contract documents for minority participation.

e. Submit with the bid a description of that portion of the work to be executed by MBE's expressed as a percentage of the total contract price.

f. Upon being named the apparent low bidder, provide the necessary documentation as listed in the contract documents provided by the DISTRICT. Failure to comply with procedural requirements as defined in contract documents may render the bid as non-responsive and may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

g. During the construction of a project, if it becomes necessary to replace an MBE subcontractor, advise the DISTRICT.

h. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit bids from MBE's.

4. MBE Responsibilities

While MBE's are not required to become certified in order to participate in this program, it is recommended that they become certified in the State of North Carolina by the N.C. Office for Historically Underutilized Businesses and should take advantage of the appropriate technical assistance that is made available. In addition, MBE's who are contacted by the DISTRICT or bidders should respond promptly whether or not they wish to submit a bid.

SECTION 4: DISPUTE PROCEDURES

It is the policy of the Metropolitan Sewerage District of Buncombe County, North Carolina, that disputes with another person that involve a person's rights, duties or privileges, should be settled through informal procedures. To that end, MBE disputes arising under these guidelines should be resolved, if possible, by informal proceedings arranged by the General Manager or his designee.

SECTION 5: EFFECTIVE DATE

These guidelines became effective on July 17, 2002. Copies of these guidelines may be obtained from the MSD Construction Office, 2028 Riverside Drive, Asheville, North Carolina, 28804; telephone number (828) 254-9646.

SECTION 6: GUIDELINES AND COMPLIANCE DOCUMENTATION TO BE PART OF CONTRACT DOCUMENTS

These guidelines will be included in the contract to each construction bid package and provisions for documenting contractual compliance in providing for MBE participation in the construction program will be included in each construction bid package.

State of North Carolina
County of Buncombe

_____, being first duly sworn, deposes and says that:

1) He/She is President of _____(Company/Corporation), that has submitted the attached bid for _____.

2) He/She is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

3) Such Bid is genuine and is not a collusive or sham bid;

4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees, or parties in interest, including this affiant, has in any way colluded, conspired, connived, or agreed, directly or indirectly with any other Bidder, firm, or person to submit a collusive or sham Bid in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm, or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit, or cost element of the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Metropolitan Sewerage District of Buncombe County or any person interested in the proposed Contract; and

5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

Signed: _____

Title: _____

Subscribed and sworn before me this the _____ day of _____, 20____.

_____ (Seal)
Notary Public

My Commission Expires: _____

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BID SCHEDULE

Schedule of Estimated Quantities and Bid Prices

Item No.	Description	Qty.	Units	Bid	Total
1	Mobilization (3%)	3%	LS		
2	10' Diameter Pre-Cast Submersible Lift Station w/ Grinder (Expandable to Triplex Lift Station)	1	LS		
3	Demolition and Abandonment of Existing Pump Station	1	LS		
4	Manholes				
4a	Demolish and Remove Existing 4' Diameter Gravity Sewer Manhole	1	EA		
4b	Demolish and Remove Existing 5' Diameter Gravity Sewer Manhole	1	EA		
4c	Abandon Existing 5' Diameter Gravity Sewer Manhole	1	EA		
4d	Abandon Existing 4' Diameter Air Release Valve Manhole	6	EA		
4e	Modify Existing Sewer Manhole	1	EA		
4f	Modify Receiving MH 49-23725	1	EA		
4g	Install 4' Diameter Gravity Sewer Manhole	4	EA		
4h	Install 4' Diameter Gravity Sewer Manhole w/ Vent Stack	1	EA		
4i	Install 5' Diameter Gravity Sewer Manhole	1	EA		
4j	Install 5' Diameter Manhole w/ Air Release Valve on 16" HDPE Force Main	2	EA		
5	Gravity Sewer Mains				
5a	Demolish and Remove Existing 24" DIP Gravity Sewer	620	LF		
5b	Abandon Existing 24" PVC Gravity Sewer In Place	230	LF		
5c	Abandon Existing 12" PVC Gravity Sewer In Place	90	LF		
5d	Install 8" PVC Gravity Sewer	30	LF		
5e	Install 12" PVC Gravity Sewer	550	LF		
5f	Install 24" PVC C900 Gravity Sewer	410	LF		
5g	Install 30" DIP Gravity Sewer with Ceramic Epoxy Liner	30	LF		
6	Force Mains				
6a	Abandon Existing 6" DIP Force Main on Bridge	1	LS		
6b	Abandon Existing 6" PVC Force Main at ARV Manholes and Existing Receiving Manhole	1	LS		
6c	Install 16" HDPE Force Main by Open Cut	2,200	LF		
6d	Install 24" HDPE Force Main by Open Cut	20	LF		
6e	Install 24" HDPE Casing w/ 16" HDPE Carrier Pipe Force Main by Horizontal Directional Drill	440	LF		
6f	Install Force Main Bypass Connection	1	LS		
7	Site Development	1	LS		
8	Access Road	1	LS		
9	Retaining Wall	420	LF		

Item No.	Description	Qty.	Units	Bid	Total
10	Storm Water Installation				
10a	18" Concrete Headwall	1	EA		
10b	24" Concrete Headwall	2	EA		
10c	18" RC Pipe	125	LF		
10d	24" RC Pipe	55	LF		
10e	Concrete Spillway	1	EA		
10f	4' Diameter Storm Water Manhole	1	EA		
10g	Modify Existing Storm Water Manhole	1	EA		
11	Electrical Improvements	1	LS		
12	Erosion Control	1	LS		
13	Instrumentation & Control Integration Allowance	1	AL		$272,815.00
14	Henderson County Electrical Trade Permit Fee Allowance	1	AL		$3,500.00
				Total Bid Amount (Items 1 – 14)	

Total Written Bid Price (Items 1 – 14):

_____

_____**and**_____**/100 Dollars**

END OF BID SCHEDULE

LIST OF SUBCONTRACTORS:

The Bidder shall list below the name and the location of the place of business of each subcontractor who will perform work or labor or render service to the prime contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State who, under subcontract to the prime contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the Contract Documents, in an amount in excess of one-half of 1 percent of the prime contractor's total bid. The Bidder shall also list below the portion of the work, which will be done by each subcontractor under this Contract. The prime contractor shall list only one subcontractor for each portion as is defined by the prime contractor in its bid.

Work to be Performed	Subcontractor License Number	Percent of Total Contract	Subcontractor's Name & Address
1.			
2.			
3.			
4.			
5.			
6.			

Note: Attach additional sheets if required.

NAMED EQUIPMENT/MATERIAL SUPPLIER LIST:

The Contract Documents are based upon the equipment or products available from the suppliers listed below. Provisions are made in the Contract Documents for alternate suppliers in certain instances whose equipment or products may be deemed equivalent in quality. However, the Bidder must indicate in its Bid which named supplier the Bidder intends to use (in the event an alternate is not accepted) for each item of equipment / material item listed on this form by circling one of the listed Suppliers below for each type of equipment / material noted. Should a Bidder fail to circle a named supplier in any category it hereby agrees to furnish the first supplier listed (denoted by the letter A). Should a Bidder circle more than one named supplier in any category it hereby agrees to furnish the first supplier circled.

Where "or equal" is specified in the technical specifications, the Bidder may write in the proposed "or equal" Supplier name in the "OR EQUAL" SUPPLIER/MATERIAL SUPPLIER LIST (page Bid Schedule -5), but it must nevertheless also circle one of the listed Suppliers below.

If the proposed "or equal" Supplier is not accepted by the Engineer, the Bidder must furnish the circled Supplier as noted above.

Equipment/Material Item	Supplier
HDPE Pipe	
Ductile Iron Pipe	
PVC Pipe	
Manholes	
Pumps	
Grinder	
Sewage Combination Air & Vacuum Valves	
Davit Crane	
Generator	

"OR EQUAL" SUPPLIER/MATERIAL SUPPLIER LIST

The Bidder proposes the following "or equal" Suppliers for the equipment or material categories so identified:

Equipment or Material Item	Alternate Supplier (list one only per item)
1.	
2.	
3.	
4.	
5.	

The acceptance of equipment or materials by the proposed "or equal" Suppliers shall be at the sole discretion of the Owner based on the SUBSTITUTES OR "OR EQUAL" ITEMS requirements of the General Conditions. Note that only one "or equal" Supplier may be proposed per Equipment or Material Item. In the event that the single proposed "or equal" item is not ultimately accepted by the Owner, the Contractor shall furnish the named equipment / material item per the NAMED EQUIPMENT/MATERIAL SUPPLIER LIST.

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4030 Yancey Road, Charlotte, NC 28217
P.O. Box 33758, Charlotte, NC 28233
PHONE 704.969.2484 FAX 704.969.2480

CITI SCOPE PROPOSAL 000058

Date: May 29, 2026

To: Bidding Contractors

Project: Metropolitan Sewerage District of Buncombe County
ITT Pump Station Replacement

Reference: Process Control System - System Integrator Scope

CITI Inc, an equipment supplier, offers to furnish the following described materials and services as our scope as the System Integrator, in accordance with the provisions that are referenced herein and subject to and governed by solely (i) the Master Terms and Conditions of Sale available at www.citi-inc.com/Master-TCs, and (ii) the Supplemental T&Cs available at www.citi-inc.com/Supplemental-Seller-TCs (collectively, the "CITI Inc. Conditions of Sale").

CITI Scope Summary

Materials

Qty		Description
1		ITT Pump Station PLC Panel – ITT-RTU: new PLC panel with NEMA 4X wall/rack mount enclosure (316SS, 60"H x 36"W x 12"D max.) and hardware including unmanaged Ethernet switch, cellular modem with panel mounted antenna, 10-inch operator interface, Schneider M340 CPU and IO modules as required for new IO listed in contract drawing I01.0
1		ITT Pump Control Panel – PCP-100: New control panel with NEMA 4X wall/rack mount enclosure (316SS, 60"H x 36"W x 12"D max.) and hardware including door mounted selector switches and pilot lights, interposing relays, alarm horn and beacon
2		Intrinsically Safe Barrier Panel with NEMA 4X wall mount enclosure for the following applications: Service Description: ISB Signals Wetwell Level: LSHH-100, LSLL-100, LT-100 and LT-200 Flow Meter Vault: LSHH-101
1		Magnetic flow meter each including flanged end flow tube, grounding rings, remote rack/wall mount transmitter, and interconnect cable for the following applications: Tag No. / Service Description / Flange Size/Type / Cable FE/FIT-100 / Pump Station Discharge Flow / 16-inch/ASME, Cl 150 / 33 feet
2		Radar level meter, each including level sensor with a flange mounting connection, interconnect cable, and a remote wall/rack mount transmitter for the following applications: Tag No. / Service Description / Sensor Mount / Sensor / Cable Length LT/LIT-100 / Pump Station Wetwell Level A / 6-in flange / C1, D2 / 33 feet LT/LIT-200 / Pump Station Wetwell Level B / 6-in flange / C1, D2 / 33 feet

Materials

<table>
<tr><th>Qty</th><th></th><th>Description</th></tr>
<tr><td>3</td><td></td><td>Float type level switches for use with intrinsically safe circuits, each with 40 ft of integral cable and OEM cable support for the following applications:
<table>
<tr><th>Tag No.</th><th>Service Description</th><th>Mounting Hardware</th></tr>
<tr><td>LSHH-100</td><td>Pump Station Wetwell – Level High High</td><td>[1]Weighted suspension cable and [2]Cable clip</td></tr>
<tr><td>LSLL-100</td><td>Pump Station Wetwell – Level Low Low</td><td>[1]Weighted suspension cable and [2]Cable clip</td></tr>
<tr><td>LSHH-101</td><td>Pump Station Flow Meter Vault – Flood Alarm</td><td>[3]Pole clip</td></tr>
</table>
[1]A weighted cable assembly is proposed where it is not readily possible to enter the tank or wetwell to adjust a float's setpoint. The assembly will include wall mountable suspension bracket, 1/8-inch by x ft long 316SS suspension wire, and bottom suspended mushroom anchor weight.
[2]Cable clip will be used to tether the float cable to the suspension cable at the setpoint.
[3]Pole clip will be used to tether the float cable to a nominal 1-inch support pipe. Support pipe and wall mountable brackets are not included in this scope</td></tr>
<tr><td>2</td><td></td><td>Pressure gauge and switch assembly, each including a pressure gauge, pressure switch, a 1-inch threaded isolation annular seal and 1-inch inlet isolation and bleed-off ball valves for the following applications:
<table>
<tr><th>Tag</th><th>Service Description</th></tr>
<tr><td>PI/PSH-101</td><td>Pump Station Pump 1 Discharge Pressure</td></tr>
<tr><td>PI/PSH-102</td><td>Pump Station Pump 2 Discharge Pressure</td></tr>
</table></td></tr>
<tr><td>1</td><td></td><td>Pressure assembly, each including pressure gauge level transmitter, a 1-inch threaded isolation annular seal and 1-inch inlet isolation and bleed-off ball valves for the following applications:
<table>
<tr><th>Tag</th><th>Service Description</th></tr>
<tr><td>PIT-100</td><td>Pump Station Discharge Pressure</td></tr>
</table></td></tr>
<tr><td>Lot</td><td></td><td>Spare parts including:
<table>
<tr><th>Qty</th><th>Description</th></tr>
<tr><td>1</td><td>PLC Processor</td></tr>
<tr><td>1</td><td>PLC Backplane</td></tr>
<tr><td>1</td><td>PLC IO module of each type</td></tr>
<tr><td>1</td><td>PLC Power supply</td></tr>
<tr><td>1</td><td>Ethernet switch</td></tr>
<tr><td>1</td><td>IS barrier of each type</td></tr>
<tr><td>1</td><td>Magnetic flow meter transmitter (FIT)</td></tr>
<tr><td>1</td><td>Radar level meter sensor (LT)</td></tr>
</table></td></tr>
<tr><td>1</td><td></td><td>Lot of stainless-steel nameplates for instruments in this scope</td></tr>
<tr><td>1</td><td></td><td>Lot of field instrument surge protection for instruments in this scope</td></tr>
<tr><td>1</td><td></td><td>O&M Manuals in digital form for equipment in this scope</td></tr>
</table>

Services		
Qty		**Description**
1		Process control system coordination meetings attendance
1		Submittal for control panels, field instrumentation, network hardware, and communications equipment in this scope
1		Control panel interconnect wiring details for all panels in this scope
1		Control system testing submittal
1		Control system training submittal
1		PLC, OIT and SCADA application software programming
1		Factory acceptance testing for panels in this scope
1		Network configuration and communications testing
1		Field instrumentation setup and testing for all devices in this scope
1		External connection/loop checkout for I/O to all panels in this scope
1		Control strategy startup and demonstration testing
1		Startup and testing assistance for instrumentation and panels in this scope
1		Operator training – 1 session

CITI Pricing Summary

Pricing for CITI scope of materials and services	*Materials Subtotal =*	*$140,480*
	Services Subtotal =	*$132,335*
	Total =	*$272,815*

TAXES ARE EXCLUDED

CITI Clarifications:

1. The scope of this proposal excludes all of the following regardless of the specification responsibility statements:
   - RVSS, LCS and LCP panels unless specifically listed in CITI Inc's materials scope;
   - Field instruments not listed in CITI Inc's materials scope;
   - Copper Ethernet cable;
   - Software licenses or upgrades to existing licenses;
   - Equipment mounting racks and stands, sensor support brackets, instrument and panel sunshades, support anchors and hardware, flange fitting accessory kits, pipe taps, isolation valves, sample pumps, sample piping, impulse piping, grounding wire and rods, stilling wells, etc. as may be required or shown on the contract drawings, unless specifically listed in CITI Inc's materials scope;
   - Field instrument and panel sunshades for outdoor mounted applications;
   - Field wiring materials, power disconnect switches, conduits, junction boxes, and pull boxes;
   - Surge protection for field components and instruments supplied by others;
   - Nametags for field components and instruments supplied by others;
   - Materials not specifically listed in CITI Inc's scope;
   - Review of the size and routing of all instrumentation and control cable and conduit systems furnished by the electrical subcontractor;
   - Building or work permits;
   - Demolition or relocation of existing instrumentation and controls equipment (we will recalibrate equipment after it is physically relocated by others);
   - Onsite supervision of equipment installation;
   - Installation of panels and field process components/instruments, field wiring and network cabling;
   - Field wiring terminations of power and control wiring at panels, field instruments, and process components;
   - Field terminations communications network cabling;
   - Power system studies;

- Confined space planning, permits, reports, labor, supervision and equipment;
- PLC programming and OIT programming of panels supplied by others;
- Power monitor configuration;
- Configuration of the Verizon Wireless Private Network (VWPN). We will coordinate with MSD to add the new cellular modem to their existing VWPN;
- Video recording of training sessions;
- Component inspections and startup for field process components/instruments and panels supplied by others;
- Services not specifically listed in CITI Inc's scope.

2. Network equipment will be configured in accordance with the current telemetry system; no additional network appliances will be provided under this scope of work but may be added at additional cost if required by the Owner.
3. All instruments and panels furnished under the scope of this proposal will be provided with the manufacturers' standard finish.
4. CITI Inc will provide our control panel drawing with field wiring interconnect details for all I/O points. ISA loop drawing will not be provided.
5. Unless otherwise noted in our proposal, CITI Inc will be providing all manufacturer's services under this scope.
6. Materials will be released for manufacture and shipment to the job site upon receipt of the approved submittal and your authorization. After your authorization to release, you must accept deliveries when equipment is available. You must assume custody upon delivery and provide suitable facilities in accordance with the specifications for on-site storage until materials are installed and powered. CITI Inc's hardware submittals will be available within 12-14 weeks after receipt of an executed order. Materials should be fully deliverable within 18-20 weeks after approved submittals and in accordance with an agreed upon schedule that will be based on product availability and supply chain constraints. Delivery schedules are non-binding, and CITI Inc maintains the right to partial deliveries as materials become available. If the delivery of materials is delayed as a result of manufacturer supply chain issues or other factors beyond our control, CITI Inc shall not be liable for any additional costs or damages associated with such delays.
7. After your completion of equipment installation and field wiring terminations, CITI Inc will begin the field services for commissioning our panels and field instruments. You will need to have qualified staff present during this testing to assist in verifying that each external connection to the equipment is correctly wired and to operate the interconnected field process equipment and panels furnished by others.
8. All materials are warranted for 18 months after delivery, 12 months after completion of their respective acceptance testing, or 12 months after the original project completion date, whichever occurs first. We will be responsible for shipping and repair costs for non-conforming or defective items during the warranty period. You will be responsible for removal, return shipment, receipt, and re-installation of any equipment items which you originally installed.
9. CITI Inc's insurance coverage is: general liability - $1,000,000/$2,000,000; auto liability - $1,000,000; excess liability - $1,000,000; and workers compensation - $1,000,000. If any additional coverage or endorsements are required, the charges for additions to CITI Inc's policy will be charged to you as an extra expense at actual cost times a multiplier of 1.15.
10. CITI Inc will retain all rights to Intellectual Property developed under this project and will grant the end user non-transferable rights to its use and modification. A copy of CITI Inc's privacy statement is available at www.CITI-INC.com.
11. This proposal is valid for 60 days. However, due to potential cost increases resulting from newly imposed import tariffs affecting our vendor suppliers, CITI Inc. reserves the right to adjust selling prices accordingly before receiving an executed purchase order and authorization for the release of materials for manufacturing and delivery. Shipping terms are FOB factory, with freight costs allowed. Unless otherwise specified in this proposal, all shipments will be directed to the designated project site.
12. Payment terms for this project are **net 30 days**, contingent upon approved credit, after the date of each invoice. Payment to CITI Inc shall not be dependent on your receipt of payment from any third parties. Materials that are delivered or approved for storage in CITI Inc's facility will be billed

complete at the time of delivery/storage in accordance with a pre-submitted schedule of values. Services will be billed based on the percentage completed against this schedule of values.

13. CITI Inc will accept retainage being withheld from progress payments due to CITI if the Owner is applying retainage against the prime contract. Five percent retainage may be withheld until CITI Inc's work is 50% complete by approved billings, after which 0% may be withheld. Partial and full retainage releases must be made within the earlier of: seven days of Owner's payment of retainage to you; or 60 days from the completion of CITI Inc's scope of work.
14. CITI Inc will not provide any materials or services for this project prior to receipt of an executed purchase order.
15. CITI Inc will accept a purchase order for this scope of supply subject to these clarifications and the CITI Inc. Conditions of Sale. In the event of a conflict between this proposal and the CITI Inc. Conditions of Sale the terms specified in this proposal take precedence. A subcontract will not be accepted. The order will need to incorporate this proposal or specifically include within its body the listing of materials, services, and clarifications from this proposal so as to define CITI Inc's scope of supply and terms. Flow-down clauses will not be accepted. All terms of CITI Inc's agreement must be specifically listed in the order. Assignment of order is subject to CITI Inc's written consent.
16. CITI Inc will apply taxes to all invoices for labor and materials as applicable. If a tax exemption is being claimed, all relevant exemption forms must be provided to CITI at the time the purchase order is issued. A completed NCDOR E-589CI Affidavit of Capital Improvement is needed if the work is to be taxed as a real property contract with respect to a capital improvement to real property.

If you have any questions about this scope of supply, please call us. Thank you for your consideration.

CITI Inc.



Camilo Castaño
Chief Estimator

Date: _____

To: Metropolitan Sewerage District
Buncombe County, North Carolina
Asheville, North Carolina

_____
Individual or Firm Name of Bidder

Ladies and/or Gentlemen:

In response to your request the undersigned Bidder submits the following proposal for constructing the proposed project described and specified in the attached documents titled:

ITT Pump Station Replacement

1. Bidder proposes and agrees, in event this proposal is accepted, to enter into a contract with the Metropolitan Sewerage District of Buncombe County, North Carolina (herein designated and referred to as the DISTRICT, in the form herein specified, to furnish all materials, equipment, machinery, tools, means of transportation, power and fuel and to perform all labor necessary for or incidental to the construction of the aforementioned improvements, all in complete accordance with the requirements of the attached contract documents and plans, to the entire satisfaction of the DISTRICT, at the unit and/or lump sum prices we have inserted opposite each item of work listed in the accompanying "Schedule of Estimated Quantities and Bid Prices" and/or bid sheet, which is an integral part of this proposal.

2. In submitting this proposal the Bidder understands and agrees that a contract may be awarded for the work as may appear to the interest of the DISTRICT; that the quantities as stated are approximate only and that no claim shall be made against the DISTRICT on account of any excess or deficiency, either absolute or relative, therein; that the estimated quantities will be used as a basis for canvassing and evaluating proposals and for determining the estimated amount of the contract, and that, within the limits of available funds, the DISTRICT reserves the right to increase or decrease the estimated quantities, stated above by such amounts as may be necessary to complete the work, provided, however, that the stated unit prices shall remain firm and unchanged.

3. Bidder hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into, that this proposal is made without connection with any other person, company or parties making a proposal, and that this proposal is in all respects fair and made in good faith without collusion or fraud.

4. Bidder further declares that he has examined the site of the work and the building and labor conditions and has informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the plans and specifications for the work and the other contract documents relating thereto and has read all Special Conditions furnished prior to the opening of bids; and that he has satisfied himself relative to the work to be performed.

5. Bidder further proposes and agrees, that, if awarded a contract for this project, he will commence work immediately on the date stated in a written notice from the DISTRICT to commence work; that he will furnish all materials, and perform all labor for the completion of the contract and will complete same, including all accepted alternates thereto, within the time stated below, and that on his failure to complete the work within such time he will pay to the DISTRICT for each calendar day that the work, or any part thereof remains uncompleted beyond such specified time, the amount specified, this payment to be made as liquidated damages.

Substantial completion is to be completed within 540 **calendar days** (18 **months**). All WORK of the Agreement is to be completed within 600 **calendar days (**20 **months)** and the amount of liquidated damages shall be $ 300.00 each calendar day until complete.

6. And the Bidder further declares that accompanying this proposal is a certified check or satisfactory bid bond in the sum of five percent (5%) of this proposal, and it is hereby agreed that in case of the withdrawal of this proposal without the consent of the DISTRICT within sixty (60) days after the bid opening, or that in case of failure on the part of the undersigned to execute the contract as aforesaid and to deliver same and the required security for the faithful performance of the contract, (executed in the form annexed hereto) to said DISTRICT within ten days from the date a notice of acceptance of this proposal is given to the undersigned personally, or by mail to the address as herein stated, then the undersigned Bidder will be deemed to have abandoned the contract, and thereupon the amount of such check or bond shall be absolutely due and payable thereunder to the DISTRICT.

7. The Bidder understands that the DISTRICT shall withhold a Five Percent (5%) retainage from progress payments until the Project is fifty percent (50%) complete. In accordance with NCGS 143-134.1 the DISTRICT will then retain this constant amount, while retaining no further retainage, until the project is one hundred percent (100%) complete. If the DISTRICT becomes dissatisfied with performance of the CONTRACTOR after reducing or holding the Five Percent (5%) retainage, the DISTRICT may reinstitute such retainage until the Project has been completed, or may withhold up to two and one-half (2.5) times the value of any incomplete Work.

Nothing in this section shall be deemed to preclude the DISTRICT from withholding full or partial payment for defective Work or Work that has not been fully completed in accordance with the Project Specifications and the Contract Documents, to the satisfaction of the ENGINEER.

_____

Individual or Firm Name of Bidder

By:_____

Title: _____

State License No. _____ Type: _____ Limit: _____ Expir. Date: _____

Bidder's Address:_____

Note: If the Bidder is a corporation give the following information:

State in which it is incorporated _____

Address of Principal Office _____

The Bidder acknowledges receipt of the following addenda:

No.	Date
_____	_____
_____	_____

BID BOND
(FORM)

Date of Execution of this Bond: _____

Name and Address of Principal (Bidder): _____

_____

Name and Address of Surety: _____

_____

Name and Address of Obligee: Metropolitan Sewerage District of Buncombe County, NC

2028 Riverside Drive - Asheville, NC 28804

Amount of Bond: Five Percent (5%) of attached bid dollars

Bid and Proposal Dated: _____ for the _____

KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL above named and SURETY above names who is duly licensed to act as SURETY in the State of North Carolina, are held and firmly bound unto the METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, a body politic and corporate of the State of North Carolina, as Obligee, in the penal sum of FIVE PERCENT (5%) of the amount bid in the bid and proposal above described in lawful money of the United States of America, for the payment of which, well and truly to be made we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such, that if the Principal shall be awarded the contract for which the bid and proposal above described is submitted and shall execute the contract, give bond for the faithful performance of the contract, and give bond for the payment to all persons supplying labor and material in the prosecution of the work provided for in said contract, within ten (10) days after the award of the same to the Principal above named, then this obligation shall be null and void; but if the Principal above names fails to so execute such contract and give performance bond and payment bond as required by Section 129 of Chapter 143 of the General Statutes of North Carolina, as amended, and Article 3 of Chapter 44-A of the General Statutes of North Carolina, as amended, the Surety shall, upon demand, forthwith pay to the OBLIGEE the amount of this bond set forth above.

IN WITNESS WHEREOF, the Principal above names and the Surety above names have executed this instrument under their several seals on the date set forth above.

_____
Principal (name of individual, individual and trade name, partnership, corporation or joint venture)

WITNESS:

_____
(Proprietorship or Partnership)

BY:_____

TITLE:_____
(owner, partner, office held in corporation, joint venture)

ATTEST: (Corporation)

(Corporate Seal)

BY:_____

TITLE: _____
(Corporate Secretary or Assistant Secretary only)

_____
Surety (name of Surety Company)

WITNESS:

_____

BY:_____
TITLE: Attorney-in-Fact
(Corporate Seal of Surety)

_____
Address of Attorney-in-Fact)

NOTICE OF AWARD

TO:

PROJECT: ITT Pump Station Replacement

The DISTRICT has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bid dated _____ and Instruction to Bidders.

You are hereby notified that your BID has been accepted for items in the amount of ( ) $_____.

You are required by the Instruction to Bidders to execute the Agreement and furnish the required CONTRACTOR's Performance Bond, Payment Bond and Certificates of Insurance within ten (10) calendar days from the date of receipt of this Notice by you.

If you fail to execute said agreement and to furnish said BONDS within ten (10) days from the date of your receipt of this NOTICE, said DISTRICT will be entitled to consider all your rights arising out of the BONDS. The DISTRICT will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the DISTRICT.

Dated this _____day of _____, 20____.

Metropolitan Sewerage District
of Buncombe County, North Carolina

By:_____
W. Hunter Carson, P.E.
Title: **Director of Engineering**

ACCEPTANCE OF NOTICE

Receipt of the above **NOTICE OF AWARD** is hereby acknowledged by _____ this the _____ day of _____, 20___.

By: _____

Title:_____

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Section XIII - Agreement Form

THIS AGREEMENT, made and entered into this the _____ day of _____, 20___, by and between **THE METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, NORTH CAROLINA**, hereinafter referred to as the DISTRICT and _____hereinafter referred to as the CONTRACTOR.

WITNESSETH:

That the parties hereto do mutually agree as follows:

1. The CONTRACTOR will furnish all materials, equipment, supplies, tools, power, fuel and services and perform all labor necessary for construction of the pump station replacement**,** and will construct same in strict conformity with the terms and conditions set forth in the following named documents which are hereto attached and made a part of this contract:

ITT Pump Station Replacement

Notice to Contractors, Instructions to Bidders, Minority Business Enterprises, Non-Collusive Affidavit, Bid Proposal, Bid Bond, General Conditions, Special Conditions, Performance Bond, Labor and Materials Bond, Technical Specifications, Details and Contract Plans as enumerated and identified in the specifications.

2. The DISTRICT will pay to the CONTRACTOR, on faithful performance of his undertakings hereunder, in lawful money of the United States, the respective unit and/or lump sum prices set forth in the aforementioned bid proposal for each unit of work performed or installed by the CONTRACTOR, the estimated sum total of all payments hereunder being:

_____ (PUT AMOUNT HERE)

3. The DISTRICT will make payments to the CONTRACTOR as specified in Paragraph 14.2 of the General Conditions. In accordance with NCGS 143-134.1 retainage shall be Five Percent (5%) until the project has been satisfactorily Fifty Percent (50%) completed and deemed to be on schedule for completion by the agreed completion date. The DISTRICT will then retain this constant amount, while retaining no <u>further</u> retainage, until the project is one-hundred percent (100%) complete.

Nothing in this section shall be deemed to preclude the DISTRICT from withholding full or partial payment for defective Work or Work that has not been fully completed in accordance with the Project Specifications and the Contract Documents, to the satisfaction of the ENGINEER. The DISTRICT may withhold up to two and one-half (2.5) times the value of any incomplete Work, in accordance with NCGS 143-134.1.

4. Within a period of 30 days after completion of the work and acceptance by the DISTRICT, the DISTRICT will make a final and complete payment in full to the CONTRACTOR on account of this contract; provided that, during said 30 day period, the CONTRACTOR has submitted to the DISTRICT satisfactory written evidence that all payrolls and other costs incurred by the CONTRACTOR in connection with the work have been paid in full and executed "Certificate of Completion" with all submittals; otherwise final payment will be made only after such evidence has been submitted.

5. The CONTRACTOR will commence the work on or as of the date set in a notice from the DISTRICT to proceed with the work, will prosecute same diligently and continuously until completed, and will complete same in conformity with the stated requirements within <u>600</u> **consecutive calendar days (**<u>20</u> **months)**. Should the work or any separate part thereof be not completed by such time or date, then the CONTRACTOR will pay to the DISTRICT as fixed, agreed and liquidated damages the sum stipulated in the Proposal.

6. The CONTRACTOR shall be solely and completely responsible for safety at the job site in accordance with Paragraph 6.20 of the General Conditions.

7. As a condition of this contract, CONTRACTOR agrees and warrants and represents that it will comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes. If CONTRACTOR utilizes a subcontractor to perform any part of the work included in the Contract, CONTRACTOR shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes.

IN WITNESS WHEREOF, the parties have executed this contract on the day and date first above written in three (3) original counterparts.

WITNESS: **M.S.D. OF BUNCOMBE COUNTY, N.C.**

(SEAL)

_____ By_____

Thomas E. Hartye, P.E.
GENERAL MANAGER

WITNESS: **CONTRACTOR'S NAME HERE**

_____ By_____

(Proprietorship or Partnership)

Title _____

CERTIFICATE OF SECRETARY
OF CORPORATION:

I, _____ certify that I am the Secretary of the Corporation named as Contractor herein; that _____, who signed this contract on behalf of the Contractor, was then _____ of said Corporation; that said contract was duly signed for and on behalf of said Corporation by authority of its governing body and is within the scope of its corporate powers.

_____

SECRETARY

(Corporate Seal)

_____

W. Scott Powell, MSD Director of Finance

"This instrument has been pre-audited in the manner required by the Local Government Budget and Fiscal Control Act"

PERFORMANCE BOND
(Form)

Date of Execution of this Bond: _____

Name and Address of Principal (Contractor): _____

_____

Name and Address of Surety: _____

_____

Name and Address of Contracting Body: **The Metropolitan Sewerage District of Buncombe County, North Carolina**
2028 Riverside Drive
Asheville, North Carolina 28804

Amount of Bond: _____

Contract: That certain contract by and between the Principal and the Contracting Body above named dated _____ for the _____

KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain contract with the Contracting Body, as identified and shown above and hereto attached:

NOW, THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the Contracting Body, with or without notice to the Surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modification of the contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

THIS PERFORMANCE BOND is made and given pursuant to the requirements and provisions of Section 129 of Chapter 143 of the General Statutes of North Carolina and pursuant to Article 3 of Chapter 44-A of the General Statutes of North Carolina, and each and every provision set forth and contained in Article 3 of Chapter 44-A of the General Statutes of North Carolina is incorporated herein, made a part hereof, and deemed to be conclusively written into this Bond.

IN WITNESS WHEREOF, the principal and surety parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____
Principal (name of individual, individual and trade name, partnership, corporation or joint venture)

WITNESS:

_____ BY:_____
(SEAL)

(Proprietorship or Partnership)

TITLE:_____
(owner, partner, office held in corporation, joint venture)

ATTEST: (Corporation) (Corporate Seal)

BY:_____

TITLE:_____
(Corporate Secretary or Assistant Secretary only)

_____
Surety (name of Surety Company)

WITNESS:

_____ BY:_____
TITLE: Attorney-in-Fact
(Corporate Seal of Surety)

_____
(Address of Attorney-in-Fact)

PAYMENT BOND
(Form)

Date of Execution of this Bond: _____

Name and Address of Principal (Contractor): _____

_____

Name and Address of Surety: _____

_____

Name and Address of Contracting Body: **The Metropolitan Sewerage District of Buncombe County, North Carolina**
2028 Riverside Drive
Asheville, North Carolina 28804

Amount of Bonds: _____

Contract: That certain contract by and between the Principal and the Contracting Body above named dated _____ for the _____

KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain contract with the Contracting Body, as identified and shown above and hereto attached:

NOW THEREFORE, if the Principal shall promptly make payment to all persons supplying labor and material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications and extensions of time of said contract that may hereafter be made, notice of which modifications and extensions of time to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

THIS PAYMENT BOND is made and given pursuant to the requirements and provisions of Section 129

of Chapter 143 of the General Statutes of North Carolina and pursuant to Article 3 of Chapter 44-A of the General Statutes of North Carolina, and each and every provision set forth and contained in Article 3 of Chapter 44-A of the General Statutes of North Carolina is incorporated herein, made a part hereof, and deemed to be conclusively written into this Bond.

IN WITNESS WHEREOF, the principal and surety parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____
Principal (name of individual, individual and trade name, partnership, corporation or joint venture)

WITNESS:

_____ BY:

(SEAL)

(Proprietorship or Partnership)

TITLE:_____
(owner, partner, office held in corporation, joint venture)

ATTEST: (Corporation) (Corporate Seal)

BY:_____

TITLE:_____
(Corporate Secretary or Assistant Secretary only)

_____
Surety (name of Surety Company)

WITNESS:

_____ BY:_____

TITLE: Attorney-in-Fact
(Corporate Seal of Surety)

_____
(Address of Attorney-in-Fact)

Section XV - Certificate of Insurance

DATE OF ISSUANCE

To the Metropolitan Sewerage District of Buncombe County, North Carolina. The subscribing insurance company certifies that insurance of the kinds and types and for limits of liability covering the work herein designated has been procured by and furnished on behalf of the insured contractor/vendor listed below:

NAME AND ADDRESS OF PRODUCER:	**CERTIFICATE HOLDER:** METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY, NORTH CAROLINA 2028 RIVERSIDE DRIVE ASHEVILLE, NORTH CAROLINA 28804 TELEPHONE NO. (828) 254-9646
NAME AND ADDRESS OF INSURED:	**COMPANIES AFFORDING COVERAGE**
	COMPANY LETTER "A":
	COMPANY LETTER "B":
	COMPANY LETTER "C":
	COMPANY LETTER "D":
	COMPANY LETTER "E":

Description of Work & Location _____

CO. LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS (IN THOUSANDS)
	GENERAL LIABILITY _ Commercial General Liability _ Claims Usage _ Occurrence _ Owner & Contractor Protective _ _____ _ _____				General Aggregate $ 2,000 Products-Comp/Ops Aggregate $ 1,000 Personal & Advertising Injury $ 1,000 Each Occurrence $ 1,000 Fire Damage (any one fire) $ 50 Medical Expense (any one person) $ 5
	AUTOMOBILE LIABILITY _ Any Auto _ All owned Autos _ Scheduled Autos _ Hired Autos _ Non-Owned Autos _ Garage Liability _ _____				Combine Single Limit $ 1,000 Bodily Injury (per person) $ Bodily Injury (per accident) $ Property Damage $
	EXCESS LIABILITY _ Umbrella Form _ Other Than Umbrella Form				Each Occurrence $ 1,000 Aggregate $ 1,000
	WORKERS' COMPENSATION AND EMPLOYERS' LIABILITY				STATUTORY (North Carolina) (Each Accident) $ 100 (Disease-Policy Limit) $ 500 (Disease-Each Employee) $ 100
	OTHER				

UNDER GENERAL LIABILITY POLICY OR POLICIES: Y N

1. Does property damage liability insurance shown include coverage for XC and U hazards? _____ _____
2. Is occurrence basis coverage provided under property damage liability? _____ _____
3. Does Personal Injury Liability Insurance include coverage for personal injury sustained by any person as a result of an offense directly or indirectly related to the employment of such person by the insured? _____ _____
4. Is coverage provided for Contractual Liability (including indemnification provision) assumed by insured? _____ _____
5. The Metropolitan Sewerage District of Buncombe County, North Carolina is named as additionally insured? _____ _____
6. Is Broad Form Property Damage Coverage provided for this project? _____ _____

CANCELLATION / EXPIRATION: The subscribing company hereby agrees that thirty (30) days written notice shall be given to the Metropolitan Sewerage District of Buncombe County, North Carolina before any policy referred to herein is changed or canceled. In addition, immediate notice shall be given by the subscribing company to the Metropolitan Sewerage District of Buncombe County, North Carolina if any policy is not renewed by the insured.

Name of Insurance Company Authorized to do Business in North Carolina_____ Address_____

Signature of Authorized Representative_____ Date of Signature_____

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NOTICE TO PROCEED

TO: DATE:_____

FOR: **ITT Pump Station Replacement**

You are hereby notified to commence WORK in accordance with the Agreement dated _____, on or before _____, and you are to complete the WORK within 600 **calendar days (**20 **months)** thereafter.

The date of completion of ALL WORK is therefore _____.

METROPOLITAN SEWERAGE DISTRICT
OF BUNCOMBE COUNTY, NORTH CAROLINA

BY:_____
W. Hunter Carson, P.E.
TITLE: **Director of Engineering**

ACCEPTANCE OF NOTICE

Receipt of the above **NOTICE TO PROCEED** is hereby acknowledged by _____, this the _____ day of _____, _____.

BY:_____

TITLE:_____

THE N.C. OneCall CENTER

THE N.C. OneCall CENTER is a corporation formed and funded by participating utility companies and municipalities in the interest of community and job safety and improved service through damage reduction to the utilities.

A ONE-CALL TOLL-FREE TELEPHONE NUMBER, 811 PROVIDES AN AVENUE TO ALL OF THE PARTICIPATING MEMBERS FROM ANY POINT WITHIN THE STATE OF NORTH CAROLINA.

Anyone proposing to excavate, dig, bore, tunnel, blast or disturb the earth in any manner in which buried utilities may be damaged is requested to call the toll-free number between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday, seventy-two (72) hours before starting the proposed work.

Within minutes of your telephone call, the participating members will be made aware of your plans and will be given pertinent information that has been provided by you about your planned work. You will be told the names of the participating members from whom you can expect a response -- if there are buried facilities in the path of your activity, the route of the utilities will be staked and/or marked at no expense to you. If there are not facilities in the area of the planned work, you will be called or notified by a representative of the participating company accordingly.

Should a non-participating utility operator be serving your area, we recommend that you call them on an individual basis. All utility operators, whether company or municipality, will be provided an opportunity to become a member of THE NORTH CAROLINA ONE CALL CENTER.

Naturally, knowing the route of the utilities, the excavator is expected to exercise caution and to avoid damage as the project progresses.

Damage prevention doesn't just happen -- It is a planned and orderly process through which each of us can participate -- **YES, WE CAN AND WE WILL DRAMATICALLY REDUCE DAMAGES TO THE UTILITIES IN THE STATE OF NORTH CAROLINA!! THANKS FOR YOUR HELP.**

BEFORE YOU DIG

IN THE INTEREST OF COMMUNITY AND JOB SAFETY AND IMPROVED SERVICE

CALL N.C. OneCall

811

Section XVII - Consent to Change Order

The undersigned contractor,_____

and its surety, _____, indicated on the Performance and Payment Bonds for the project identified as ITT Pump Station Replacement do hereby consent on behalf of themselves, their successors and assigns, to an increase in the amount of $_____ to the original (revised) contract price in the amount of $_____, as set forth in the Change Order Number _____ to said contract.

IN WITNESS WHEREOF, each party has caused this agreement to be executed by its duly authorized official as of the _____ day of _____, 20____.

ATTEST:

_____ By:_____

_____
(Address)

ATTEST:

_____ _____
(Surety)

_____
(Address)

_____
(Attorney-in-Fact)

_____
(Address)

STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

I, _____, a Notary Public of the County and State aforesaid certify that _____, personally came before me this day and acknowledged that (he/she) is the Secretary of _____, a corporation, and that by authority duly given as the act of the corporation the foregoing instrument was signed in its name by its President and attested by (himself/herself) and its Secretary.

Witness my hand and notarial seal this the _____ day of _____, 20____.

_____ _____
My Commission Expires Notary Public

THE METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

_____

Purchase Order No. _____

APPLICATION NO.: _____
DATE NOTICE TO PROCEED: _____
COMPLETION DATE: _____
DAYS REMAINING IN CONTRACT: _____
PERCENT COMPLETE: _____

CONTRACTOR: _____

ADDRESS: _____

PROJECT: _____

ORIGINAL CONTRACT AMOUNT:	**$_____**
APPROVED CHANGE ORDER AMOUNT:	**$_____**
REVISED CONTRACT AMOUNT:	**$_____**
TOTAL WORK COMPLETED TO DATE:	**$_____**
TOTAL MATERIALS STORED ON SITE:	**$_____**
TOTAL EARNED THIS APPLICATION:	**$_____**
LESS RETAINAGE (%):	**$_____**
SUBTOTAL	**$_____**
LESS PREVIOUS PAYMENTS:	**$_____**
CURRENT PAYMENT DUE:	**$_____**

_____ _____ _____
CONTRACTOR'S REPRESENTATIVE TITLE DATE

****

MSD APPROVAL:

_____ _____
INSPECTOR DATE

_____ _____
CONSTRUCTION DIRECTOR DATE

_____ _____
PROJECT ENGINEER DATE

AFFIDAVIT OF PAYMENT OF CLAIMS

BY: _____

_____

_____

This day _____, personally appeared before, _____a Notary Public in and for the County of _____, State of _____ and being by me first duly sworn, states that all subcontractors and suppliers of labor and materials have been paid all sums due them as of _____(date), for work performed or materials furnished in the performance of the contract between Metropolitan Sewerage District and _____, Contractor, dated _____, for the construction of the _____ or arrangements have been made by the Contractor satisfactory to such subcontractors and suppliers with respect to the payments of such sums as may be due them by the Contractor.

(CONTRACTOR)

By:_____

Title: _____

SWORN TO AND SUBSCRIBED before me this the _____ day of _____, 20____.

_____ _____

My Commission Expires Notary Public

(SEAL)

STATE AND COUNTY SALES/USE TAX CERTIFICATION

I, _____, of _____

hereby certify that the companies cited have been paid the North Carolina Sales Tax and the Buncombe County Tax, as shown on the materials purchased by us, and that these materials became a part of the ____ _____for North Carolina, through_____(date).

Please see attached...

Name of Firm:_____

Signature:_____

Title:_____

SWORN TO AND SUBSCRIBED before me, this the _____ day of _____, 20____.

_____ _____

My Commission Expires Notary Public

(Seal)

CONTRACTOR NAME_____

PROJECT NAME AND NO. _ITT Pump Station Replacement_____

INVOICE NO.	INVOICE DATE	VENDOR NAME	SUBTOTAL AMOUNT OF INVOICE	SALES TAX STATE	SALES TAX COUNTY	TOTAL TAX	TOTAL INVOICE
			TOTALS MUST BE SHOWN				

(PAID INVOICES ATTACHED IN ORDER)

Section XX - Contractor's Certificate of Completion and Warranty to the Metropolitan Sewerage District of Buncombe County, North Carolina

ITT Pump Station Replacement

I, the undersigned, do hereby certify:

1. That _____hereinafter referred to as CONTRACTOR, is a licensed Utility or Unclassified Contractor in the State of North Carolina.

2. That the sewer rehabilitation, replacement, improvements, and/ or extensions relative to the above referenced project have been installed and tested in strict accordance with the approved plans and specifications for the project under the supervision of the ENGINEER and DISTRICT'S representative.

3. That we guarantee the materials and installation of the sewer rehabilitation, replacement, improvements, and/ or extensions, including all appurtenances and the restoration of any disturbed areas for a period of (1) year and shall make repairs deemed necessary by DISTRICT, during the one year warranty period. Any repairs for defective work will be made at The CONTRACTOR's expense for all labor, materials, equipment, and supplies necessary for a complete and acceptable repair. Should any additional work, not performed under the original contract and not as a result of defective work or materials, be required, the DISTRICT will pay CONTRACTOR at the original contract unit prices without mobilization.

4. That we have submitted the record documents to the DISTRICT.

5. That we will reimburse DISTRICT for costs for emergency repairs made by its own forces during the one year warranty period. These costs will include, but not be limited to, materials, labor, equipment, damages and reimbursement collection costs.

_____ _____
Name of Firm (Corporation/Company) *Signature of Authorized Representative*

_____ _____
License Number *(Title)*

_____ _____
Substantial Completion Date *Date signed*

_____
Warranty Period Ends (Date)

Corporation or Company Seal

State of _____
County of _____

Subscribed and sworn to before me this the _____ day of _____, 20____.

_____ _____
My Commission Expires Notary Public (Seal)

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STATE OF NORTH CAROLINA
COUNTY OF BUNCOMBE

FROM: _____

TO: **Metropolitan Sewerage District of Buncombe County, N.C.**

REFERENCE: Contract entered into the ____day of _____, 20____, between the Metropolitan Sewerage District, hereinafter called the DISTRICT and _____, hereinafter called the CONTRACTOR, for the ____ITT Pump Station Replacement__

KNOW ALL MEN BY THESE PRESENTS:

1. The CONTRACTOR hereby certifies that there is due and payable under the contract and all change orders and modifications thereof the sum of $-0- as final payment.

2. The CONTRACTOR further certifies that there are no outstanding or unsettled claims or items in addition to the amount set forth in paragraph one hereof which it claims are just and due and owing by the DISTRICT to the CONTRACTOR.

3. The CONTRACTOR further certifies that all work required under this contract, including work required under all change orders and modifications, has been performed in accordance with the terms thereof, and that there are no claims of laborers, materialmen, mechanics or subcontractors for unpaid monies or wages arising out of the performance of this contract.

4. The CONTRACTOR realizes that this final certificate and release is submitted for the purpose of inducing the DISTRICT to make final payment to CONTRACTOR under circumstances such that there are no outstanding or unsettled claims or items owed or asserted other than or in addition to the amount set forth in paragraph one above and under circumstances such that all work required under the contract identified above, including all change orders and modifications thereof, have been performed in accordance with the terms thereof and such that there are no claims of laborers, materialmen, mechanics, or subcontractors for unpaid monies or wages arising out of the performance of said contract, and CONTRACTOR does hereby agree to indemnify and hold the DISTRICT harmless of and from any and all loss, costs, damage claims, and expense of every kind, including attorney's fees, which DISTRICT shall or may suffer or incur or for which the DISTRICT or its property may become liable in connection with any such claims or items as may arise or may have arisen out of the performance of or failure to perform said contract. This obligation shall not be construed to negate, abridge or otherwise reduce any other right of the DISTRICT or obligation of the CONTRACTOR as would otherwise exist but shall be in addition thereto.

5. Except for the amount stated in paragraph one above, the CONTRACTOR has received from the DISTRICT all sums of money payable to CONTRACTOR under or pursuant to the aforementioned contract and change orders and

modifications thereof.

6. That in consideration of the payment of the amount stated in paragraph one hereof, the CONTRACTOR does hereby release the DISTRICT from any and all claims, demands, rights, claims of lien, damages, suits or causes of action, both legal and equitable, which the CONTRACTOR has, might now have, or that subsequently may accrue to it, arising under, growing out of, or in any wise connected with the Contract above referred to and all change orders and modifications thereof.

IN WITNESS WHEREOF, the CONTRACTOR has caused this Final Certificate and Release to be executed by its duly authorized officers and its seal to be hereunto affixed, all by authority duly given, this _____ day of _____, 20____.

_____(SEAL)
Contractor Name

By: _____

Title: _____

ATTEST:

_____
Secretary

STATE OF _____

COUNTY OF _____

I, a Notary Public of the State of _____, County of _____, do hereby certify that _____ personally appeared before me this day and, being first duly sworn on oath, deposed and said that he/she is _____ of _____ and that he/she has read the foregoing Final Certificate and Release and that the matters and things stated therein are, to the best of his knowledge and belief, true, and that by the authority duly given and as the act of the corporation the foregoing instrument was signed in its name by him as its _____, sealed with its corporate seal, and attested by its Secretary.

WITNESS my hand and Notarial Seal, this _____ day of _____, 20____.

My Commission Expires:

_____ _____
Notary Public

AFFIDAVIT OF PAYMENT OF CLAIMS

BY: _____

_____

_____

This day _____, personally appeared before _____a Notary Public in and for the County of _____, State of _____ and being by me first duly sworn, states that all subcontractors and suppliers of labor and materials have been paid all sums due them as of _____(date), for work performed or materials furnished in the performance of the contract between _____(Owner) and _____(Contractor) dated _____, for the construction of the _____ or arrangements have been made by the Contractor satisfactory to such subcontractors and suppliers with respect to the payments of such sums as may be due them by the Contractor.

By:_____

Title: _____

SWORN TO AND SUBSCRIBED before me this the _____ day of _____, 20___.

_____ _____

My Commission Expires Notary Public

(SEAL)

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Metropolitan Sewerage District of Buncombe County, N.C.

AFFIDAVIT

State of North Carolina
County of Buncombe

Before the undersigned, a Notary Public of said County and State, duly commissioned, qualified and authorized by law to administer oaths, personally appeared Dean Allen who being first duly sworn, deposes and says that he is employed with the Metropolitan Sewerage District (MSD) of Buncombe County, N.C. That he is authorized to make this affidavit and sworn statement; that the Advertisement of Bid for the **ITT Pump Station Replacement, Project No. 2020061,** a copy of which is attached hereto, was posted on the Internet at MSD's Website address www.msdbc.org on the 7th day of June, 2026, and said posting will run until July 21, 2026, the day of the bid opening.

Signed this _____ day of _____, 20___

_____
Dean Allen
IT Department
MSD of Buncombe County, NC

Sworn to and subscribed before me this the ____ day of _____, 2026.

_____
Notary Public

My Commission Expires: _____

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Metropolitan Sewerage District of Buncombe County, N.C.

Permit Number: _____

Date of Approval: _____

Project Name and Number: ITT Pump Station Replacement, Project No. 2020061

Project Location: _____,
(*location)*
_____Fletcher_____, Henderson County, N.C.
(*Town or city)*

General Project Information and Description:

MSD Manhole Number at point of tie-in: _____
Line Size: _____ inches (diameter)
Pipe Material: _____ (VCP, PVC, DIP, CIP, other)
Approximate Length of Line: _____ Feet
Classification of Line: _____(local - residential or industrial, collector, outfall, interceptor)
Predominate type of flow: _____(residential, commercial, industrial)

Engineer's Certification

_____Partial _____Final

I _____, as a duly registered Professional Engineer in the State of North Carolina, having been authorized to periodically observe the construction of the above referenced project for the Metropolitan Sewerage District of Buncombe County, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction of the project and that to the best of my knowledge and belief the project was constructed within substantial compliance to the Permit, the certificate of coverage, the North Carolina Gravity Sewer Minimum Design Manual, and other supporting materials.

_____ Registration Number _____
Signature

Certified and Sealed, this the _____ day of _____, 20____.

(SEAL)

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