CITY OF LANCaster
STANDARD DETAILS AND SPECIFICATIONS

1309 LYNWOOD DRIVE
LANCASTER, SOUTH CAROLINA 29721
APRIL 2008
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CITY OF LANCASTER
SPECIFICATION REVISIONS/ADDITIONS

Lancaster/70540/07
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City of Lancaster

Water and Sewer Submittal Application

1. Date Submitted: _____________ Submittal Number: _____________

2. Project Name of Project: ________________________________________________

3. Project Address/Location: ______________________________________________

4. Owners Name: __________________________________________________________
   Address: ______________________________________________________________
   ______________________________________________________________
   Contact Number: _________________________________________________________
   Fax Number: ___________________________________________________________
   Contact Person/Number: _________________________________________________

5. Engineering Firm: _______________________________________________________
   Contact Person/Number: ________________________________________________

Note: Plans will not be accepted without a completed Submittal Application Form

Conditions of Submittal:

1. Developer/Owner maintains ownership of the proposed water and sewer utilities of the referenced project until project is completed to the satisfaction of the City of Lancaster. At that time ownership may be switched to the City.

2. Developer/Owner agrees to ensure, with the assistance of a Professional Engineer Registered in the State of South Carolina, that the utilities shall be designed and constructed in accordance with the City of Lancaster Standard Specifications and Details or has written approval for any deviations.

3. Developer/Owner agrees that the City of Lancaster and their Engineer shall not be held liable for any cost or liabilities associated with this project unless otherwise agreed upon in writing.

4. Developer/Owner agrees to not begin construction of water or sewer utilities until all necessary permits, SCDHEC, SC DOT, or otherwise, have been obtained by the Developer/Owner.

Signed: ___________________________ Date: ___________________________
Printed Name: _____________________ Company: _____________________
Title: ______________________________

City of Lancaster
City of Lancaster
Water and Sewer Submittal Requirements

Preliminary Submittal Meeting

1. Project layout with streets and property lines.
2. Topographic map delineating drainage basin where project is located and the proposed project including all phases (current and future).
3. Location of connection points to existing water and sanitary sewer utilities.

Submittal Requirements

1. City of Lancaster Application for plan approval.
2. Design calculations, signed and sealed by Registered Professional Engineer, including population served flow rates, pump station design, etc.
3. Topographic map clearly delineating drainage basin where project is located and the proposed project including all phases (current and future).
4. Three (3) sets of plans, specifications and permits for review purposes.
5. Completed and signed submittal checklist.

Construction Requirements

1. Under NO circumstances will water or sewer utility construction start without appropriate SC DHEC permits and City of Lancaster approvals!
2. Written notification 48 hours before construction is to begin with the appropriate items completed Construction and Closeout Checklist items completed.
3. Preliminary construction schedule highlighting approximate dates of key work items: system interconnections, testing, etc.
4. Notification 48 hours in advance of actual interconnection and testing.
5. City of Lancaster personnel or designated representative must be present for all interconnections to the existing system and testing.

Closeout Requirements

1. As-built Drawings – Three (3) sets and digital file on CD (AutoCad 14)
2. Certification By Engineer of Record
3. Certification of Completion to SC DHEC
4. Transfer Deeds of Easements to City of Lancaster
5. Final Inspection with Public Works Department Representative
6. Transfer Ownership of utility extensions to City of Lancaster
7. Completed and signed Water and Sewer Construction and Closeout Checklist
City of Lancaster
Water and Sewer Plan Checklist

A. General

1. City of Lancaster Application For Approval
2. Topographic map identifying drainage basin and project site
3. Design Calculations
4. Permits
5. Three (3) sets of Specifications – Signed and Sealed by Registered PE
6. Three (3) sets of Plans Size: 24” x 36” - Signed and Sealed by Registered PE
7. Recommended Scale Plan: 1” = 50’
   Profile: 1” = 5’ (Vertical)
   1” = 50’ (Horizontal)
8. Cover Sheet
   Name of Project and Phase
   Name of Developer
   Address
   Telephone/Fax Number
   Name of Engineer
   Address
   Telephone/Fax Number
   Date of Drawing Revisions
9. Title Blocks
   Sheet Title and Stationing
   Name of Project
   Developers Name and Address
   Engineers Name and Address
   Plan/Profile Scale
   Date of Drawing and Revisions
10. North Arrow – All Sheets
11. Signature and Seal of Professional Engineer
12. Street Layout With Names and R/W Widths
13. Lot Layout
14. Utility (Water and Sewer) Maintenance Easements - With Widths
15. Pavement Width including Curb
16. Lot Numbers
17. Existing and Proposed Ground Elevations in Profile
18. Match Lines
City of Lancaster
Water and Sewer Plan Checklist

B. Water Plans Plan View

- 1. Water Line Location with distance from back of curb or edge of pavement
- 2. Size of Water line
- 3. Water Line material
- 4. All Fittings and Appurtenances
- 5. Length of main between Fittings
- 6. Horizontal Separation between sewer and other utilities

Profile View

- 1. Water Line Location with minimum 3’ cover unless DIP used
- 2. Size of Water line
- 3. Depth of Water Line
- 4. Label all Utility Crossings with Minimum Clearances

C. Sewer Plans

Plan View

- 1. Manhole with Manhole number and Station
- 2. Sewer Line Location
- 3. Size of sewer line
- 4. Sewer line material
- 5. Grade of sewer line
- 6. Length and bearing of sewer line between manholes
- 7. Horizontal separation between sewer & other utilities
- 8. Force Main size, location, material, and length. Reference location to benchmarks and/or stationary objects as necessary.
- 9. Pump Station location

Profile View

- 1. Manhole with Manhole number and Station
- 2. Sewer Line Location
- 3. Size of sewer line
- 4. Sewer line material
- 5. Grade of sewer line
- 6. Length of sewer line between manholes
- 7. Inverts (In and Out of Manhole) of sewer line
- 8. Rim elevations
- 9. Minimum bury depth shown
- 10. Utility Crossings with separation distances
- 11. Force main size, material, length, and depth
- 12. 100 year flood elevation
- 13. Elevation of vent for sealed and vented manholes
- 14. Label outside drop manholes
## City of Lancaster
### Water and Sewer Construction and Closeout Checklist

Transmit to the City of Lancaster minimum 48 hours prior to starting construction and 48 hours prior to any system interconnections and testing. Send to:

City of Lancaster  
1309 Lynnwood Drive  
Lancaster, SC 29721  
Telephone Number (803) 285-9431  
Fax Number (803) 289-3026

Project Name: ________________________________

Date

1. Plans reviewed and approved by City of Lancaster

2. Plans Approved by SCDHEC – Approval letters/Permits attached

3. Construction Start date – Preliminary schedule attached

4. Contractor/Contact Name ________________________________
   
   Address: 
   
   Telephone Number: 
   
   Fax Number: 

5. Hydrostatic Test – Results Attached
   
   Water
   Witnessed by City of Lancaster PW Rep. ________________________________

   Sewer
   Witnessed by City of Lancaster PW Rep. ________________________________

6. Mandrel Test – Results Attached
   Witnessed by City of Lancaster PW Rep. ________________________________

7. Disinfection Test – Results Attached
   Witnessed by City of Lancaster PW Rep. ________________________________

8. Field Inspection – Report Attached
   Witnessed by City of Lancaster PW Rep. ________________________________
City of Lancaster
Water and Sewer Construction and Closeout Checklist

9. As-built Drawings three (3) sets and on CD (AutoCad 2008)

10. Certification by Engineer - Attached
    Engineer of Record: ____________________________

    Address: ______________________________________
              ______________________________________

    Telephone Number: ____________________________
    Fax Number: __________________________________

11. Certification of Completion By SCDHEC - Attached

12. Deeds to the City of Lancaster

13. Final Inspection

14. Transfer of Ownership to the City of Lancaster

15. Project Close Date

This project is deemed complete as signified by the following signatures:

CITY OF LANCASTER

Name: ____________________________
Title: ____________________________
Date: ____________________________

DEVELOPER: ____________________________

Name: ____________________________
Title: ____________________________
Date: ____________________________
# CITY OF LANCASTER
## STANDARD SPECIFICATIONS

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SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes.
   1. Submittal procedures.
   2. Product data.
   3. Shop drawings.
   4. Samples.
   5. Design data.
   6. Test reports.
   7. Certificates.
   8. Manufacturer's instructions.
   9. Manufacturer's field reports.
  10. Construction progress schedules.
  11. Proposed products list.
  13. Construction photographs.

1.2 SUBMITTAL PROCEDURES

A. Submit number of copies Contractor requires, plus two copies Engineer will retain.

B. Deliver to Engineer at business address.

C. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

D. Transmit each submittal with Engineer accepted form.

E. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

F. Identify Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification Section number appropriate to submittal.

G. Apply Contractor's stamp signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

H. Schedule submittals to expedite Project. Coordinate submission of related items.

I. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

J. Allow space on submittals for Contractor and Engineer review stamps.

K. When revised for resubmission, identify changes made since previous submission.

L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

M. Submittals not requested will not be recognized or processed.
1.3 PRODUCT DATA
A. Product Data: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers’ standard data to provide information specific to this Project.
C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.4 SHOP DRAWINGS
A. Shop Drawings: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.
D. Submit number of copies described in SUBMITTAL PROCEDURES article.

1.5 SAMPLES
A. Samples: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
B. Submit number of samples specified in individual specification sections; Engineer will retain one sample.
C. Samples For Selection as Specified in Product Sections:
   1. Submit to Engineer for aesthetic, color, or finish selection.
   2. Submit samples of finishes from full range of manufacturers' standard colors, in custom colors selected, textures, and patterns for Engineer selection.
D. Submit samples to illustrate functional and aesthetic characteristics of Products with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
E. Include identification on each sample with full Project information.
F. Reviewed samples which may be used in the Work are indicated in individual specification sections.
G. Samples will not be used for testing purposes unless specifically stated in specification section.

H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 70 00 - Execution and Closeout Requirements.

1.6 DESIGN DATA
A. Submit for Engineer's knowledge as contract administrator or for Owner.
B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.7 TEST REPORTS
A. Submit for Engineer's knowledge as contract administrator or for Owner.
B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.8 CERTIFICATES
A. When specified in individual specification Sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Engineer.
B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
C. Certificates may be recent or previous test results on material or Product but must be acceptable to Engineer.

1.9 MANUFACTURER'S INSTRUCTIONS
A. When specified in individual specification Sections, submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing to Engineer for delivery to Owner.
B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.10 MANUFACTURER'S FIELD REPORTS
A. Submit reports for Engineer's knowledge as contract administrator or for Owner.
B. Submit report within 72 hours of observation to Engineer for information.
C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.11 CONSTRUCTION PROGRESS SCHEDULES
A. Submit initial schedules within 15 days after date established in Notice to Proceed. After review, resubmit required revised data within 10 days.
B. Submit revised Progress Schedules with each Progress Meeting or Application for Payment, but not less than monthly.

C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

E. Submit computer generated Gantt chart with separate line for each major portion of Work or operation, identifying first work day of each week.

F. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

G. Indicate estimated percentage of completion for each item of Work at each submission.

H. Submit separate schedule of submittal dates for shop drawings, product data, and samples. Indicate dates reviewed submittals will be required from Engineer. Indicate decision dates for selection of finishes.

I. Indicate delivery dates for Owner furnished products and products identified under Allowances if required.

J. Revisions To Schedules:
   1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
   2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
   3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect, including effect of changes on schedules of separate contractors.

1.12 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.13 ERECTION DRAWINGS

A. Submit drawings for Engineer's knowledge as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

1.14 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Engineer.
B. Submit photographs monthly or to show milestones of Work.

C. Photographs: Two prints; color, glossy; 8 x 10 inch size; mounted on 8-1/2 x 11 inch soft card stock, with left edge binding margin for three-hole punch.

D. Take three photographs from differing directions for each section of work indicating relative progress of the Work, three days maximum prior to submitting.

E. Take photographs as evidence of existing project conditions.

F. Identify each print on front. Identify name of Project, contract number, phase orientation of view, date and time of view, name and address of photographer, and photographer's numbered identification of exposure.

G. Deliver negatives to Owner with project record documents. Catalog and index negatives in chronological sequence; include typed table of contents.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quality control and control of installation.
   2. Tolerances.
   3. References.
   4. Testing and inspection services.
   5. Manufacturers' field services.
   7. Mock-up requirements.
   8. Examination.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or Work specified by association, trades, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
B. Conform to reference standard by date of issue current on date for receiving Bids, (date of Owner-Contractor Agreement when there are no Bids), except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. Contractual relationships, duties, and responsibilities of parties in Contract and those of Engineer shall not be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 TESTING AND INSPECTION SERVICES

A. Employ and pay for services of an independent firm acceptable to Owner to perform specified testing and inspection.
   1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer, specialists and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

B. Independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Engineer.
   1. Laboratory: Authorized to operate in State of Project location.
   2. Laboratory Staff: Maintain full time registered Engineer and necessary specialists on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing and inspections may occur on or off project site. Perform off-site testing as required by Engineer or Owner.

D. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor’s use.

E. Testing and employment of independent firm does not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

F. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Engineer.
   1. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
   2. Submit final report indicating correction of Work previously reported as non-compliant.

G. Independent Firm Responsibilities:
   1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertained compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests required by Engineer.
7. Attend preconstruction meetings and progress meetings.

H. Independent Firm Reports: After each test, promptly submit one copy of report to Engineer and Owner; and two copies to Contractor, and authority having jurisdiction. When requested by Engineer, provide interpretation of test results. Include the following:
1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.

I. Limits On Independent Firm:
1. May not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. May not approve or accept any portion of the Work.
3. May not assume duties of Contractor.
4. Has no authority to stop the Work.

1.6 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to:
1. Observe site conditions.
2. Observe conditions of surfaces.
4. Review start-up of equipment.
5. Review testing, adjusting and balancing of equipment.
6. Initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

1.7 LABELING

A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
1. Model number.
2. Serial number.
3. Performance characteristics.
1.8 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be comparison standard for remaining Work.

D. Where mock-up has been accepted by Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Engineer.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION
SECTION 01 43 13
REFERENCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance.

B. Schedule of references.

1.2 RELATED SECTIONS


1.3 QUALITY ASSURANCE

A. For products or workmanship specified by association, trades, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

1. Applicable Codes:

   b. The National Electrical Code, NFPA 70.

B. Obtain copies of standards when required by product specification sections.

C. Maintain copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

D. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.4 SCHEDULE OF REFERENCES

AA

   Aluminum Association
   818 Connecticut Avenue, N.W.
   Washington, DC  20006

AABC

   Associated Air Balance Council
   1000 Vermont Avenue, N.W.
   Washington, DC  20005

AASHTO

   American Association of State Highway and Transportation Officials
   444 North Capitol Street, N.W.
   Washington, DC  20001

ACI

   American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219

ADC
Air Diffusion Council
230 North Michigan Avenue
Chicago, IL 60601

AGC
Associated General Contractors of America
1957 E Street, N.W.
Washington, DC 20006

AI
Asphalt Institute
Asphalt Institute Building
College Park, MD 20740

AIA
American Institute of Architects
1735 New York Avenue, N.W.
Washington, DC 20006

AISC
American Institute of Steel Construction
400 North Michigan Avenue
Eighth Floor
Chicago, IL 60611

AISI
American Iron and Steel Institute
1000 16th Street, N.W.
Washington, DC 20036

AITC
American Institute of Timber Construction
333 W. Hampden Avenue
Englewood, CO 80110

AMCA
Air Movement and Control Association
30 West University Drive
Arlington Heights, IL 60004

ANSI
American National Standards Institute
1430 Broadway
New York, NY 10018

APA
American Plywood Association
Box 11700
Tacoma, WA 98411

ARI
Air-Conditioning and Refrigeration Institute
1501 Wilson Boulevard
Arlington, VA 22209

ASHRAE
American Society of Heating, Refrigerating and
Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, GA 30329
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Name</th>
<th>Address</th>
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<tbody>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
<td>1801 Alexander Bell Drive, Reston, VA 20191</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
<td>345 East 47th Street, New York, NY 10017</td>
</tr>
<tr>
<td>ASPA</td>
<td>American Sod Producers Association</td>
<td>4415 West Harrison Street, Hillside, IL 60162</td>
</tr>
<tr>
<td>ASTE</td>
<td>The American Society of Test Engineers</td>
<td>P.O. Box 389, Nutting Lake, MA 01865-0389</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
<td>1916 Race Street, Philadelphia, PA 19103</td>
</tr>
<tr>
<td>AWI</td>
<td>Architectural Woodwork Institute</td>
<td>2310 South Walter Reed Drive, Arlington, VA 22206</td>
</tr>
<tr>
<td>AWPA</td>
<td>American Wood-Preservers' Association</td>
<td>7735 Old Georgetown Road, Bethesda, MD 20014</td>
</tr>
<tr>
<td>AWS</td>
<td>American Welding Society</td>
<td>550 LeJeune Road, N.W., Miami, FL 33135</td>
</tr>
<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
<td>6666 West Quincy Avenue, Denver, CO 80235</td>
</tr>
<tr>
<td>BHMA</td>
<td>Builders Hardware Manufacturers Association, Inc.</td>
<td></td>
</tr>
<tr>
<td>BIA</td>
<td>Brick Institute of America</td>
<td>11490 Commerce Park Drive, Reston, VA 22091</td>
</tr>
<tr>
<td>CDA</td>
<td>Copper Development Association</td>
<td>57th Floor, Chrysler Building, 405 Lexington Avenue, New York, NY 10174</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
<td></td>
</tr>
<tr>
<td>Association</td>
<td>Address</td>
<td></td>
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<tr>
<td>-------------</td>
<td>----------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| ICBO        | International Conference of Building Officials  
5360 S. Workman Mill Road  
Whittier, CA  90601 |
| IEEE        | Institute of Electrical and Electronics Engineers  
345 East 47th Street  
New York, NY  10017 |
| IMIAC       | International Masonry Industry All-Weather Council  
International Masonry Institute  
815 15th Street, N.W.  
Washington, DC  20005 |
| ISA         | Instrument Society of American  
67 Alexander Drive  
P.O. Box 12277  
Research Triangle Park  
North Carolina  27709 |
| ISO         | International Organization for Standardization  
1, Rue de Varembe  
Case Postale 56  
CH-1211 Geneve 20  
Switzerland |
| MSS         | Manufacturers Standardization Society of the Valves and Fittings Industry, Inc.  
127 Park Street  
N. E., Vienna, VA 22180 |
| MBMA        | Metal Building Manufacturer's Association  
1230 Keith Building  
Cleveland, OH  44115 |
| MCAA        | Mechanical Contractors Association of America  
1385 Piccard Drive  
Rockville, MD  20850 |
| MFMA        | Maple Flooring Manufacturers Association  
60 Rivere Drive  
Northbrook, IL  60062 |
| MIL         | Military Specification  
Naval Publications and Forms Center  
5801 Tabor Avenue  
Philadelphia, PA  19120 |
| ML/SFA      | Metal Lath/Steel Framing Association  
221 North LaSalle Street  
Chicago, IL  60601 |
| NAAMM       | National Association of Architectural Metal Manufacturers |
221 North LaSalle Street  
Chicago, IL  60601

NCMA  
National Concrete Masonry Association  
P.O. Box 781  
Herndon, VA  22070

NEBB  
National Environmental Balancing Bureau  
8224 Old Courthouse Road  
Vienna, VA  22180

NEMA  
National Electrical Manufacturers' Association  
2101 'L' Street, N.W.  
Washington, DC  20037

NFPA  
National Fire Protection Association  
Battery March Park  
Quincy, MA  02269

NFPA  
National Forest Products Association  
1619 Massachusetts Avenue, N.W.  
Washington, DC  20036

NSWMA  
National Solid Wastes Management Association  
4301 Connecticut Ave NW, #300  
Washington, DC  20008

NTMA  
National Terrazzo and Mosaic Association  
3166 Des Plaines Avenue  
Des Plaines, IL  60018

NWMA  
National Woodwork Manufacturers Association  
205 W. Touhy Avenue  
Park Ridge, IL  60068

OSHA  
Occupational Safety & Health Administration  
200 Constitution Avenue, NW  
Washington, DC  20210

PCA  
Portland Cement Association  
5420 Old Orchard Road  
Skokie, IL  60077

PCI  
Prestressed Concrete Institute  
201 North Wells Street  
Chicago, IL  60606

PS  
Product Standard  
U. S. Department of Commerce  
Washington, DC  20203

RIS  
Redwood Inspection Service  
One Lombard Street
San Francisco, CA 94111

REA/RUS
Rural Utilities Service, Dept. of Agriculture
Rm. 4051-S, Fourteenth Street and Independence Avenue SW
Washington, DC 20250-0320

RCSHSB
Red Cedar Shingle and Handsplit Shake Bureau
515 116th Avenue
Bellevue, WA 98004

SDI
Steel Deck Institute
P.O. Box 9506
Canton, OH 44711

SDI
Steel Door Institute
712 Lakewood Center North
14600 Detroit Avenue
Cleveland, OH 44107

SIGMA
Sealed Insulating Glass Manufacturers Association
111 East Wacker Drive
Chicago, IL 60601

SJI
Steel Joist Institute
1205 48th Avenue North
Suite A
Myrtle Beach, SC 29577

SMACNA
Sheet Metal and Air Conditioning Contractors’ National Association
8224 Old Court House Road
Vienna, VA 22180

SPFA
Steel Plate Fabricators Association
11305 Reed Hartman Highway, Suite 202
Cincinnati, Ohio 45241

SSPC
Steel Structures Painting Council
4400 Fifth Avenue
Pittsburgh, PA 15213

TCA
Tile Council of America, Inc.
Box 326
Princeton, NJ 08540

UL
Underwriters’ Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

WCLIB
West Coast Lumber Inspection Bureau
6980 S.W. Varns Road
Box 23145
Portland, OR 97223
PART 2   PRODUCTS  Not Used.

PART 3   EXECUTION  Not Used.

END OF SECTION
SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.
B. Final cleaning.
C. Starting of systems.
D. Demonstration and instructions.
E. Protecting installed construction.
F. Project record documents.
G. Operation and maintenance data.
H. Manual for equipment and systems.
I. Spare parts and maintenance products.
J. Product warranties and product bonds.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.
B. Provide submittals to Engineer required by authorities having jurisdiction.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
D. Replace filters of operating equipment.
E. Clean debris from roofs, gutters, downspouts, and drainage systems.
F. Clean site; sweep paved areas, rake clean landscaped surfaces.
G. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS
A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer and Owner seven days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01 33 00 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of substantial completion.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time at equipment location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

F. Required instruction time for each item of equipment and system is specified in individual Sections.

1.6 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

G. Submit documents to Engineer.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring capacity expansion binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:

1. Part 1: Directory listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions arranged by system or process flow and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
   a. Significant design criteria.
   b. List of equipment.
   c. Parts list for each component.
   d. Operating instructions.
   e. Maintenance instructions for equipment and systems.
   f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Originals and Photocopies of warranties and bonds.

1.9 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed or by label machine.

G. Include color coded wiring diagrams as installed.

H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
J. Include servicing and lubrication schedule, and list of lubricants required.

K. Include manufacturer's printed operation and maintenance instructions.

L. Include sequence of operation by controls manufacturer.

M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

N. Include control diagrams by controls manufacturer as installed.

O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.

P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

R. Include test and balancing reports as specified in Section 01 40 00 - Quality Requirements.

S. Additional Requirements: As specified in individual product Specification Sections.

T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.

B. Deliver to project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.11 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:
1. For equipment or component parts of equipment put into service during construction with Owner’s permission, submit documents within ten days after acceptance.
2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond date of substantial completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION
SECTION 03 30 00  
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Formwork and accessories.
   2. Shoring, bracing, and anchorage.
   3. Reinforcing bars.
   5. Inserts and accessories.

B. Related Sections:
   1. Section 31 23 16 - Excavation and Backfill: Excavation for Work of this Section.
   2. Section 32 13 13 – Concrete Paving
   3. Section 32 31 13 – Chain Link Fences and Gates
   4. Section 33 11 00 – Water Utility Distribution Piping
   5. Section 33 31 00 – Sanitary Utility Sewerage Piping
   6. Section 33 34 00 – Sanitary Utility Sewerage Force Mains
   7. Section 33 41 00 – Storm Utility Drainage Piping
   8. Section 33 42 13 – Pipe Culverts

1.2 REFERENCES

A. American Concrete Institute:
   2. ACI 301 - Specifications for Structural Concrete.
   3. ACI 305 - Hot Weather Concreting.
   5. ACI 308.1 - Standard Specification for Curing Concrete.
   6. ACI 318 - Building Code Requirements for Structural Concrete.
   7. ACI 530.1 - Specifications for Masonry Structures.

B. American Forest and Paper Association:
   1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:

D. ASTM International:
   2. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
   3. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
7. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
15. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
16. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
19. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
20. ASTM C685 - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
25. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
31. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
32. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

E. American Welding Society:
1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

F. Concrete Reinforcing Steel Institute:
2. CRSI - Placing Reinforcing Bars.

G. West Coast Lumber Inspection Bureau:
1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.3 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum 0.3 perm when tested in accordance with ASTM E96, Procedure A.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on joint devices, attachment accessories, and admixtures.

C. Shop Drawings: Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

D. Certificates: Submit AWS qualification certificate for welders employed on the Work.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1. Submit certified copies of mill test report of reinforcement materials analysis.

F. Concrete Design Data:

1. Submit a concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
   a. Hot and cold weather concrete work.
   b. Air entrained concrete work.

2. Identify mix ingredients and proportions, including admixtures.

3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

G. Manufacturer’s Installation Instructions: Submit installation procedures and interface required with adjacent Work.

H. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Prepare shop drawings in accordance with ACI SP-66.

D. Conform to ACI 305 when concreting during hot weather.

E. Conform to ACI 306.1 when concreting during cold weather.

F. Acquire cement and aggregate from one source for Work.

1.6 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.7 ENVIRONMENTAL REQUIREMENTS
A. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

B. Maintain high early strength concrete temperature after installation at minimum 50 degrees F for minimum 3 days.

1.8 COORDINATION

A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Products storage and handling requirements.

B. Deliver void forms and installation instructions in manufacturer’s packaging. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Softwood Plywood: APA/EWA PS 1, C Grade, Group 2.

B. Lumber Forms:
   1. Application: Use for edge forms and unexposed finish concrete.
   2. Boards: 6 inches or 8 inches in width, ship lapped or tongue and groove, “Standard” Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.

C. Plywood Forms:
   2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
   4. Plywood where “Smooth Finish” is required, as indicated on Drawings: APA/EWA “HD Overlay Plyform Structural I Exterior” grade, minimum of 3/4-inch thick.

2.2 PREFABRICATED FORMS

A. Manufacturers:
   2. Economy Forms Corp.
   3. Molded Fiber Glass Concrete Forms Co.
   4. Perma Tubes.
   5. Sonoco Products Co.
   6. Symons Corp. Product Western Forms, Inc.
   7. Product Substitutions: Equal per Section 01600 - Product Requirements.

B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Pan Type: Steel or glass fiber of size and profile required.

E. Tubular Column Type: Round, spirally wound laminated fiber material; surface treated with release agent, non-reusable, sizes as indicated on Drawings.

F. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 4 inches thick.

G. Steel Forms: Sheet steel, suitably reinforced and designed for particular use indicated on Drawings.

H. Form Liners: Smooth, durable, grainless, and non-staining hardboard, unless otherwise indicated on Drawings.

I. Framing, Studding, and Bracing: Stud or No. 3 structural light framing grade.

2.3 ARCHITECTURAL FORM LINERS

A. Architectural Form Liners: As indicated on Drawings.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Removable type, adjustable length, with waterproofing washer, free of defects capable of leaving holes larger than 1 inch in concrete surface, and leaving no metal within 1 inch of exposed surface.

B. Spreaders: Standard non-corrosive metal form clamp assembly of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Anchors and Hangers:
   1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
   2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
   3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.
   1. Manufacturers:
      a. Arcal Chemical Corporation, Arcal-80.
      b. Industrial Synthetics Company, Synthex.
      c. Nox-Crete Company, Nox-Crete Form Coating.
      d. Substitutions: Section 01600 - Product Requirements.

E. Corners exposed to view: Fillet and Chamfer; rigid plastic or wood strip type; 3/4 x 3/4 inch size; maximum possible lengths.

F. Vapor Retarder: Where indicated on Drawings, 6 mil thick polyethylene sheet.

H. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.

I. Water Stops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, width as shown on Drawings, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

2.5 REINFORCEMENT

A. Deformed Reinforcement: ASTM A615; 60 ksi yield strength, steel bars, unfinished or epoxy coated finish as indicated on Drawings.

B. Deformed Bar Mats: ASTM A184; fabricated from ASTM A615 60 ksi yield strength, steel bars, unfinished or epoxy coated finish as indicted on Drawings.

C. Welded Plain Wire Fabric: ASTM A185; in flat sheets or coiled rolls; unfinished or epoxy coated finish as indicated on Drawings.

2.6 REINFORCEMENT ACCESSORIES

A. Tie Wire: Minimum 16 gage annealed type, epoxy coated.

B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel type; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Exothermic welding type or mechanical threaded type; full tension and compression; sized to fit joined reinforcing.

E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.7 REINFORCEMENT FABRICATION

A. Fabricate concrete reinforcement in accordance with ACI 318.

B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks; and seismic hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8-inch diameter continuous deformed bar or wire.

F. Form ties and stirrups from the following:
   1. For bars No. 10 and Smaller: No. 3 deformed bars.
   2. For bars No. 11 and Larger: No. 4 deformed bars.

G. Weld reinforcement in accordance with AWS D1.4.
H. Epoxy-Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI.

I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Engineer.

2.8 SHOP FINISHING

A. Epoxy Coated Finish for Steel Bars: ASTM A775; ASTM A934 if coating is applied after fabrication.

B. Epoxy Coated Finish for Steel Wire: ASTM A884, Class A using ASTM A775; ASTM A934 if coating is applied after fabrication.

2.9 SOURCE QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing, inspection, and analysis requirements.

B. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents. Specified shop tests are not required for Work performed by approved fabricator.

2.10 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I – Normal, Type IA - Air Entraining, Type II – Moderate, Type IIA - Air Entraining, or Type V - Sulfate Resistant Portland type.

B. High Early Strength Cement: ASTM C150, Type III or Type III – Air Entraining only when indicated on Drawings.

C. Normal Weight Aggregates: ASTM C33.
   1. Coarse Aggregate Maximum Size: In accordance with ACI 318.

D. Water: ACI 318; potable, without deleterious amounts of chloride ions.

2.11 CONCRETE ADMIXTURES

A. Manufacturers:
   1. Degussa Admixtures, Inc. (Master Builders).
   2. Euclid Chemical Co.
   3. Fritzpak Concrete Admixtures Co.
   5. Larsen Products Corp.
   7. Sika Chemical Co.
   8. W. R. Meadows Inc.

B. Air Entrainment: ASTM C260.

C. Chemical: ASTM C494:
   1. Type A - Water Reducing.
   2. Type B – Retarding.
   3. Type C – Accelerating.
   4. Type D - Water Reducing and Retarding.
5. Type E - Water Reducing and Accelerating.
6. Type F - Water Reducing, High Range.

D. Fly Ash: ASTM C618, Class F or C.
E. Plasticizing: ASTM C1017, Type I - Plasticizing or Type II - Plasticizing and retarding.

2.12 CONCRETE ACCESSORIES

A. Bonding Agent:
   1. Not exposed to water after placement: Polyvinyl Acetate.
   2. Exposed to water after placement: Latex emulsion or epoxy adhesive.

B. Vapor Retarder: ASTM E1745 Class A; 6 mil thick clear polyethylene film; type recommended for below grade application. Furnish joint tape recommended by manufacturer.

C. Non-Shrink Grout: ASTM C1107, Grade A or B; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 3 days and 7,000 psi in 28 days.

2.13 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: ASTM D1751 or ASTM D994; Preformed asphalt impregnated fiberboard or felt, thickness as indicated on Drawings; tongue and groove profile.

B. Sealant: ASTM D6690, Type III.

2.14 CONCRETE MIX

A. Select proportions for normal weight concrete in accordance with ACI 301 Method 1 or Method 2.

B. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Engineer.
   1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
   2. Do not use calcium chloride or admixtures containing calcium chloride.
   3. Use set retarding admixtures during hot weather.
   4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing or deicing chemicals.
   5. For concrete exposed to deicing chemicals, limit fly ash to less than 25 percent of the combined weight of cement and fly ash.

C. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94.

D. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

2.15 CURING COMPOUNDS

A. Membrane Curing Compound: ASTM C309 Type 1, Class B.
   1. Manufacturers:
      b. Euclid Chemical Co., Kurez W VOX.
PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with epoxy.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

E. Earth Forms:
   1. Trench earth forms neatly, accurately, and at least 2 inches wider than footing widths indicated on Drawings.
   2. Trim sides and bottom of earth forms.
   3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
   4. Form sides of footings where earth sloughs.
   5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

F. Formwork - General:
   1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
   2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
   3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
   4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
   5. Complete wedging and bracing before placing concrete.

G. Forms for Smooth Finish Concrete:
   1. Use steel, plywood or lined board forms.
   2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

H. Architectural Form Liners:
1. Erect architectural side of formwork first.
2. Attach form liner to forms before installing form ties.
3. Install form liners square and straight, with joints and pattern aligned.
4. Seal form liner joints to prevent grout leaks.
5. Dress joints and edges to match form liner pattern and texture.

I. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

J. Framing, Studding and Bracing:
1. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
2. Distribute bracing loads over base area on which bracing is erected.
3. When placed on ground, protect against undermining, settlement, or accidental impact.

K. Erect formwork, shoring, and bracing to achieve design requirements in accordance with requirements of ACI 318.

L. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

M. Obtain Engineer’s approval before framing openings in structural members not indicated on Drawings.

N. Install fillet and chamfer strips on external corners of exposed corners.

O. Install void forms in accordance with manufacturer’s recommendations.

P. Do not reuse wood formwork with damaged faces or edges for concrete surfaces to be exposed to view. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat
forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.

F. 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.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
   1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
   2. Place ties at least 1 inch away from finished surface of concrete.
   3. Leave inner rods in concrete when forms are stripped.
   4. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless otherwise shown on Drawings.
   5. Set with waterstops.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
   1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
   2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
   3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
   4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
   1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   2. Do not embed wood or uncoated aluminum in concrete.
   3. Obtain installation and setting information for embedded items furnished under other Specification sections.
   4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
   5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad, or base type screed supports which will not puncture membrane.
2. Staking through membrane is not permitted.

O. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING
A. Clean forms as erection proceeds to remove foreign matter within forms.
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. Do not use water to clean out forms unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL
A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads or removal has been approved by Engineer.
B. Leave forms in place for minimum number of days as specified in ACI 347.
C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
D. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
E. Twist ties off, point and patch holes with non-shrink grout within 48 hours of form removal.

3.7 ERECTION TOLERANCES
A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

B. Camber slabs and beams in accordance with ACI 318.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. 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.

C. Notify Engineer after placement of reinforcing steel in forms but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

3.9 PLACEMENT

A. Place, support, and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
   1. Do not weld crossing reinforcement bars for assembly except as permitted by Engineer.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318.

E. Maintain concrete cover around reinforcement as indicated in Drawings with a minimum cover as follows:

<table>
<thead>
<tr>
<th>Reinforcement Location</th>
<th>Minimum Concrete Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footings and concrete formed against earth</td>
<td>3 inches</td>
</tr>
<tr>
<td>Concrete exposed to earth or weather</td>
<td></td>
</tr>
<tr>
<td>No. 6 bars and larger</td>
<td>2 inches</td>
</tr>
<tr>
<td>No. 5 bars and smaller</td>
<td>1-1/2 inches</td>
</tr>
<tr>
<td>Supported slabs, walls, and joists</td>
<td></td>
</tr>
<tr>
<td>No. 14 bars and larger</td>
<td>1-1/2 inches</td>
</tr>
<tr>
<td>No. 11 bars and smaller</td>
<td>3/4-inch</td>
</tr>
<tr>
<td>Beams and columns</td>
<td>1-1/2 inches</td>
</tr>
<tr>
<td>Shell and folded plate members</td>
<td></td>
</tr>
<tr>
<td>No. 6 bars and larger</td>
<td>3/4-inch</td>
</tr>
<tr>
<td>No. 5 bars and smaller</td>
<td>1/2-inch</td>
</tr>
</tbody>
</table>

F. Splice reinforcing only where indicated on Drawings or approved by Engineer. Splice in accordance with splicing device manufacturer’s instructions.

G. Bond and ground reinforcement in accordance with requirements of Section 33 79 00.

3.10 ERECTION TOLERANCES
A. Section 01400 - Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

<table>
<thead>
<tr>
<th>Reinforcement Depth</th>
<th>Depth Tolerance</th>
<th>Concrete Cover Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 8 inches</td>
<td>Plus or minus 3/8-inch</td>
<td>Minus 3/8-inch</td>
</tr>
<tr>
<td>Less than 8 inches</td>
<td>Plus or minus 1/2-inch</td>
<td>Minus 1/2-inch</td>
</tr>
</tbody>
</table>

C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.11 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify testing laboratory and Engineer minimum 48 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion, and contraction joints are not disturbed during concrete placement.

D. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight by taping edges and ends.

E. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

F. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.

G. Place joint filler in slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

H. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface.

I. Install construction joint devices in coordination with slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

J. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

K. Install joint covers in longest practical length, when adjacent construction activity is complete.

L. Deposit concrete at final position. Prevent segregation of mix.

M. Place concrete in continuous operation for each panel or section determined by predetermined joints.

N. Consolidate concrete.

O. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken. Keep records on site in Contractor’s office or file with Engineer.
P. Place concrete continuously between predetermined expansion, control, and construction joints.

Q. Do not interrupt successive placement; do not permit cold joints to occur.

R. Place floor slabs in pattern indicated.

S. Saw cut joints prior to concrete set. Thickness and depth as indicated on Drawings.

T. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 feet.

3.12 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing and other items to be cast in.

C. Apply bonding agent to substrate.

D. Place concrete floor toppings to required lines and levels.

E. Screed toppings level, maintaining surface flatness of maximum 1/8 inch in 10 feet.

3.13 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed smooth rubbed, sand float, or sack rubbed finish as indicated on Drawings.

B. Finish concrete floor surfaces in accordance with ACI 318.

C. Steel trowel surfaces which are indicated to be exposed.

D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8 inch per foot nominal or as indicated on Drawings.

3.14 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
   1. Protect concrete footings from freezing for minimum five days.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure concrete in accordance with ACI 308.1 using method approved by Engineer.

D. Maintain 100 percent coverage over floor slab areas continuously for seven days.

3.15 FIELD QUALITY CONTROL

A. Section 00 14 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform field inspection and testing in accordance with ACI 318.
C. Provide free access to Work and cooperate with appointed firm.

D. Reinforcement Inspection:
1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
2. Welding: Inspect welds in accordance with AWS D1.1.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
5. Periodic Weld Inspection: Other welded connections.

E. Concrete Inspections:
1. Continuous Placement Inspection: Inspect for proper installation procedures.
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

F. Strength Test Samples:
2. Cylinder Molding and Curing Procedures: ASTM C31, cylinder specimens, standard cured or field cured.
3. Sample concrete and make one set of 4 cylinders for every 50 cubic yards or less of each class of concrete placed each day and for every 5,000 square feet of surface area for slabs and walls.
4. When volume of concrete for any class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches or from every batch when less than five batches are used.

G. Field Testing:
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

H. Cylinder Compressive Strength Testing:
2. Test Acceptance: In accordance with ACI 318.
3. Test one cylinder at 7 days.
4. Test one cylinder at 14 days.
5. Test one cylinder at 28 days.
6. Retain one cylinder for testing when requested by Engineer.
7. Dispose remaining cylinders when testing is not required.

I. Core Compressive Strength Testing:
2. Test Acceptance: In accordance with ACI 318.
3. Drill three cores for each failed strength test from concrete represented by failed strength test.

J. Water Soluble Chloride Ion Concentration Test Method: ASTM C1218; tested at 28 days.
1. Maximum Concentration: As permitted by applicable code.
K. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.16 PATCHING
A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.
B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
C. Patch imperfections as directed by Engineer in accordance with ACI 318.

3.17 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 Engineer.
C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.18 SCHEDULE - CONCRETE TYPES AND FINISHES
A. Foundation Walls: 3,000 psi 28 day concrete, form finish with honeycomb filled surface.
B. Underside of Supported Floors and Structure Exposed to View: 4,000 psi, 28-day concrete, sack rubbed finish.
C. Exposed Portico Structure: 4,000 psi 28 day concrete, air entrained, smooth stone rubbed finish.

3.19 SCHEDULE – REINFORCEMENT
A. Reinforcement for Superstructure Framing Members: Deformed bars, unfinished.
B. Reinforcement for Foundation Wall Framing Members and Slab-on-Grade: Deformed bars and wire fabric, epoxy coated finish.
C. Reinforcement for Parking Structure Framing Members: Deformed bars, epoxy-coated finish.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes concrete masonry units; firebrick, reinforcement, anchorage, and accessories; and [parged masonry surfaces].

B. Related Sections:

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
5. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
6. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
17. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
19. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
20. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
22. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
27. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.

C. National Fire Protection Association:

D. Underwriters Laboratories Inc.:

1.3 PERFORMANCE REQUIREMENTS
A. Clay Masonry Compressive Strength (f'm) 3,000 psi; determined by unit strength test method.
   1. Clay Masonry Units: 3,000 psi minimum net area compressive strength.
B. Concrete Masonry Compressive Strength (f'm) 3,000 psi; determined by unit strength test method.
   1. Concrete Masonry Units: 3,000 psi minimum net area compressive strength.

1.4 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Submittal requirements.
B. Product Data:
   1. Submit data for giant brick masonry units and fabricated wire reinforcement, wall ties, anchors, and other accessories.
   2. Indicate initial rate of absorption for clay and shale brick.
C. Samples: Submit four samples of decorative block, units to illustrate color, texture and extremes of color range.
D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE
A. Perform Work in accordance with ACI 530 and ACI 530.1.
B. Fire Rated Construction: Rating as indicated on Drawings.
   1. Tested Rating: Determined in accordance with ASTM E119.
   2. Prescriptive Rating: determined in accordance with applicable code.

C. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with NFPA 255.

D. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation insert.

E. Perform Work in accordance with State of South Carolina Highways standard.

F. Maintain one copy of each document on site.

1.6 QUALIFICATIONS
A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 MOCKUP
A. Section 01 40 00 - Quality Requirements: Mock-up requirements.
B. Locate where directed by Engineer.
C. Remove mockup when directed by Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
B. Accept masonry units on site. Inspect for damage.

1.9 ENVIRONMENTAL REQUIREMENTS
A. Section 01 60 00 - Product Requirements.
B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

1.10 COORDINATION
A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
B. Coordinate masonry work with installation of window and door anchors.

1.11 EXTRA MATERIALS
A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
PART 2 PRODUCTS

2.1 REINFORCED UNIT MASONRY ASSEMBLIES

A. Manufacturers:
   1. Acme Brick Co.
   2. The Belden Brick Co.
   3. Canada Brick
   4. Elgin Butler Brick Co.
   5. Endicott Clay Products Co.
   6. General Shale Brick
   7. Southern Brick
   8. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

In the following paragraphs, Grades MW, SW, and NW identify durability of brick units under various weather and moisture conditions. Grade SW is the default if no other grade is specified. Types FBS, FBX, and FBA identify recommended end use applications. Type FBS is the default if no other grade is specified.

A. Facing Brick: ASTM C216, Type FBS, Grade SW; color as selected.

B. Building Brick: ASTM C62, Grade SW; solid units.

C. Hollow Brick: ASTM C652, Grade [SW] [MW] [NW], Type [HBS] [HBX] [HBA] [HBB]; [________] color [as selected].

D. Calcium Silicate Face Brick: ASTM C73, Grade [SW.]

E. Ceramic Glazed Facing Brick: ASTM C126, Grade [S -Select] [SS - Select Sized], Type [I - Single] [II - Two Faced] units.

F. Firebrick: [ASTM C27] [ASTM C1261].

Following paragraphs are applicable to one or several of the above paragraphs. Indicate coursing dimension, brick and joint size, in PART 3.

G. Brick Size and Shape: Nominal size of [____x____x____] inches. Furnish special units for [90] [________] degree corners, [lintels] [bullnosed corners] [and] [_______].

H. [Special Brick Shape: Shaped to [profile indicated] [_______]; surface texture on [________] sides [and ends].]
Grade LBX is for general purpose use including moderate exposure to exterior. Grade LB is for locations not exposed to freeze/thaw cycling.

I. Structural Clay Load-Bearing Wall Tile: ASTM C34, Grade [LBX] [LB], [________] color [as selected], [________] texture, [________] finish.

J. Structural Clay Nonload-Bearing Wall Tile: ASTM C56, Grade NB, [________] color [as selected], [________] texture, and [________] pattern.

Grades SE, ME, and NE vary in moisture absorption capabilities and relative durability. Type STX has higher degree of mechanical perfection and minimum size variation than Type STA.

K. Structural Nonload-Bearing Screen Tile: ASTM C530, Grade [SE] [ME] [NE], Type [STX] [STA], [________] color [as selected], [________] texture, and [________] pattern.

Type FTX and FTS identify application and exposure capabilities.

L. Structural Clay Facing Tile: ASTM C212, Type [FTX] [FTS], [Standard] [Special Duty] Class; [smooth] [rough] surface finish, [single face] [two faces].

Describe special shaped, perforated, or decorative units in supplementary statements to the paragraphs below. Indicate coursing dimension, brick and joint size, in PART 3.

M. Clay Tile Units: Nominal modular size of [____x____x____] inches. Furnish special units for [90] [________] degree corners, tee intersections, [lintels] [bond beams] [bullnosed corners] [and] [________].

N. Special Clay Tile Shape: Shaped to [profile indicated] [________]; surface texture on [________] sides [and ends].

O. Clay Flue Lining: ASTM C315, [rectangular [non-modular] [modular]] [round] [oval] shape, [____x____x____] inches with wall thickness of [________] inches.

Select appropriate concrete masonry units (CMU) from the following paragraphs. Edit decorative and acoustic perforated units into one of the following paragraphs. Surface texture of units varies between manufacturers and may not be suitable as base for some paint or high-build glazed finishes.

P. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90; [normal] [medium] [light] weight.

Q. Solid Load-Bearing Concrete Masonry Units (CMU): ASTM C90; [normal] [medium] [light] weight.
Non-load bearing units are intended to be used for interior partitions and may not be suitable for use in exterior exposure, fire rated, or below grade applications.

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R.  [Hollow] [Solid] Non-Load Bearing Concrete Masonry Units (CMU):  ASTM C129; [normal] [medium] [light] weight.

S.  Decorative Concrete Masonry Units:  ASTM C90; [normal] [medium] [light] weight; [________] color [as selected] to the following design:
    1.  [Single scored horizontally] [Single scored vertically] [Double scored vertically]
        [Triple scored vertically] to [V] [square] [half round] cut.
        ****** [OR] ******
    2.  [Ribbed] [Ribbed and split] face with [three] [four] vertical ribs.
        ****** [OR] ******
    3.  Split face with [________] vertical splits.
        ****** [OR] ******
    4.  [Ground face] [________].

T.  Pre-faced Concrete Masonry Units:  ASTM C744 with resinous surfacing on [ASTM C55; Grade [N] [S]]; [normal] [medium] [light]
    weight; [________] color [as selected].
    1.  Furnish [single] [double] faced units.
    2.  Furnish coved base units at first courser above finished floor.
```

Grade N units are recommended for above and below grade exterior wall applications and where high strength and resistance to moisture penetration and severe frost action is anticipated; Grade S is recommended for above grade work where moderate strength and resistance to moisture penetration and frost action is anticipated.

Exercise care when specifying Grade N and S units for same Project.  Grades are impossible to visually differentiate; destructively test to determine one from the other.  Cost difference between grades is negligible.

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U.  Concrete Brick Units:  ASTM C55, [Grade [N] [S]; [normal] [light] weight] [same weight as block units].
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The following paragraph is applicable to one or several of the above paragraphs.  Indicate coursing dimension, block or brick and joint size, in PART 3.

```
V.  Concrete Masonry Unit Size and Shape:  Nominal modular size of [____x____x____] inches.  Furnish special units for 90 degree corners, bond beams, lintels, [coved base,] [and] [bullnosed corners].

2.3 ACCESSORIES

A.  Single Wythe Joint Reinforcement:  ASTM A951; truss type; steel; 0.148 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.

B.  Multiple Wythe Joint Reinforcement:  ASTM A951; truss type; steel; with moisture drip; adjustable type; 0.188 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.
```
C. Reinforcing Steel: ASTM A615/A615M, 75 ksi yield grade, plain billet bars, galvanized uncoated finish.

D. Strap Anchors: bent steel shape; ASTM A153/A153M hot dip galvanized.

E. Wall Ties: Corrugated formed sheet metal; ASTM A153/A153M hot dip galvanized.

F. Wall Ties: ASTM A82; steel wire, adjustable or eye and pintle type; ASTM A153/A153M hot dip galvanized.

G. Dovetail Anchors: Bent steel strap; ASTM A153/A153M hot dip galvanized.

H. Anchor Rods: ASTM A307; Grade C; J-shaped or L-shaped; complete with washers and heavy hex nuts; sized for minimum 15 inch embedment; galvanized finish.
   1. Hot-Dipped Galvanizing: ASTM A153/A153M.
   2. Mechanical Galvanizing: ASTM B695; Class 55.

I. Mortar and Grout: As specified in Section 04 05 03.

J. Plastic Flashings: Sheet polyethylene; 20 mil thick.

K. Copper: ASTM B370, cold rolled; 20 oz/sq ft thick; natural finish.

L. Coping Flashing: Stainless steel, soft temper; 0.015 inch thick; Copper, cold rolled; 16 oz/sq ft; smooth finish; formed with ribs 3 inches on center for integral mortar bond.
   1. Cheney Flashing Company.
   3. Substitutions: Section 01 60 00 - Product Requirements.

M. Preformed Control Joints: Rubber material. Furnish with corner and tee accessories, [heat] [cement] fused joints.

N. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self expanding.

O. Masonry Core Insulation: Molded expanded polystyrene, ASTM C578, Type 1; Insulation specially molded to fit into block cores at the block plant prior to shipment.
   1. Shelter Enterprises, Inc.
   2. Concrete Block Insulation Systems
   3. Substitutions: Section 01 60 00 - Product Requirements.

P. Cavity Drain Material: Open polyethylene mesh thickness required to fill cavity space, and shaped to ensure moisture drainage to cavity weeps.
   1. Advanced Building Products, Inc.
   2. CavClear/Archovations Inc.
   3. Mortar Net USA, Ltd.
   5. Substitutions: Section 01 60 00 - Product Requirements.


R. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

S. Weeps: Preformed plastic tubes, cotton wick filled.

T. Cavity Vents: Aluminum; insect resistant.
U. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
V. Precast Concrete Lintels: size, as indicated on Drawings, 4,000 psi strength at 28 days.
W. Steel Lintels: size as indicated on Drawings, hot-dip galvanized.

2.4 SOURCE QUALITY CONTROL
A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.
B. Test brick efflorescence in accordance with ASTM C67. Brick rated greater than “slightly effloresced” is not acceptable.

PART 3 EXECUTION
3.1 EXAMINATION
A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
B. Verify field conditions are acceptable and are ready to receive work.
C. Verify items provided by other sections of work are properly sized and located.
D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION
A. Direct and coordinate placement of metal anchors supplied to other Sections.
B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.
C. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION
A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Coursing of Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.

D. Coursing of Brick Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.

E. Coursing of Prefinished Units:
   1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.

F. Placing And Bonding:
1. Lay solid masonry units in full bed of mortar, with full head joints.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Remove excess mortar as Work progresses.
5. Interlock intersections and external corners.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, or bitumen dampproofing is applied.
9. Isolate masonry from vertical structural framing members with movement joint [as indicated on Drawings].
10. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.

G. Weeps and Vents: Furnish weeps and vents in outer wythe at 24 inches oc horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

H. Cavity Wall: Do not permit mortar to drop or accumulated into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor retarder adhesive.
1. Install cavity drain material continuously at bottom of each cavity above through wall flashing.

I. Joint Reinforcement And Anchorage - Single Wythe Masonry:
1. Install horizontal joint reinforcement 16 inches Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
2. Place joint reinforcement continuous in first and second joint below top of walls.
3. Lap joint reinforcement ends minimum 6 inches.
4. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches oc.

J. Joint Reinforcement And Anchorage - Masonry Veneer:
1. Install horizontal joint reinforcement 16 inches oc.
2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first and second joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.
5. Embed wall ties in masonry backing to bond veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb of wall openings.
6. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb of wall openings.
7. Place wall ties at maximum 8 inches on center horizontally within 8 inches of head and sill of wall openings.
8. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches oc.
K. Joint Reinforcement And Anchorages - Cavity Wall Masonry:
1. Install horizontal joint reinforcement 16 inches oc.
2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first and second joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.
5. Embed anchors in concrete. Attach to structural steel members. Embed anchorages in every second block joint.
6. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches oc.

L. Reinforcement And Anchorages - Multiple Wythe Unit Masonry:
1. Install horizontal joint reinforcement 16 inches oc.
2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first and second joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.
5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
6. Embed anchors embedded in concrete attached to structural steel members.
7. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches oc.

M. Masonry Flashings:
1. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls, and turn down on outside face to form drip.
2. Turn flashing up minimum 8 inches and bed into mortar joint of masonry seal to concrete seal to sheathing over wood backing.
3. Lap end joints minimum 6 inches and seal watertight.
4. Turn flashing, fold, and seal at corners, bends, and interruptions.

N. Lintels:
1. Install precast concrete lintels over openings.
2. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
3. Openings Up To 42 inches Wide: Place two No. 3 (M9) reinforcing bars 1 inch from bottom web.
4. Openings From 42 inches Up To 78 inches Wide: Place two, No. 5 (M16) reinforcing bars 1 inch from bottom web.
5. Openings Over 78 inches: Reinforce openings as indicated on Drawings.
6. Do not splice reinforcing bars.
7. Support and secure reinforcing bars from displacement.
8. Place and consolidate grout fill without displacing reinforcing.
9. Allow masonry lintels to attain specified strength before removing temporary supports.
10. Maintain minimum 4 inch bearing on each side of opening.

O. Grouted Components:
1. Reinforce bond beam with 2, No. 3 bars, 1 inch from bottom web.
2. Reinforce pilaster with 2, No. 3 bars, placed 1 inch from bottom.
3. Lap splices bar diameters required by code.
4. Support and secure reinforcing bars from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.

P. Reinforced Masonry:
1. Lay masonry units with cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
2. Place reinforcing, reinforcement bars, and grout as indicated on Drawings.
3. Splice reinforcement in accordance with Section 03 20 00.
4. Support and secure reinforcement from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. Place grout in accordance with ACI 530.1 Specification for Masonry Structures.

Q. Control And Expansion Joints:
1. Install control [and expansion] joints at the following maximum spacings, unless otherwise indicated on Drawings:
   a. Exterior Walls: 20 feet on center and within 24 inches on one side of each interior and exterior corner.
   b. Interior Walls: 30 feet on center.
   c. At changes in wall height.
2. Do not continue horizontal joint reinforcement through control and expansion joints.
3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
4. Size control joint in accordance with Section 07 90 00 for sealant performance.
5. Form expansion joint by omitting mortar and cutting unit to form open space.

R. Built-In Work:
1. As work progresses, install built-in metal door and glazed frames fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Do not build in materials subject to deterioration.

S. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain Architect/Engineer’s approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

T. Parging:
1. Dampen masonry walls prior to parging.
2. Scarify each parging coat to ensure full bond to subsequent coat.
3. Parge masonry walls in two uniform coats of mortar to total thickness of 3/4 inch.
4. Steel trowel surface smooth and flat with maximum surface variation of 1/8 inch per foot.
5. Strike top edge of parging at 45 degrees.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.
B. Maximum Variation From Alignment of Columns: 1/4 inch.
C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.

G. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

I. Maximum Variation for Steel Reinforcement:
   1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.
   2. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
   3. Plus or minus 1 inch when distance is between 8 and 24 inches.
   4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.
   5. Plus or minus 2 inches from location along face of wall.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Brick Units: Test each type in accordance with ASTM C67, 5 random units for each 50,000 units installed.

C. Concrete Masonry Units: Test each type in accordance with ASTM C140.

3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect exposed external corners subject to damage.

C. Protect base of walls from mud and mortar splatter.
D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

END OF SECTION
SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing surface debris.
   2. Removing designated paving, curbs, and slabs.
   3. Removing designated trees, shrubs, and other plant life.
   4. Removing abandoned utilities and structures where indicated.
   5. Plugging abandoned utilities and filling abandoned structures where indicated.
   6. Protecting plant life and structures designated to remain.

B. Related Sections:
   1. Section 02 65 00 - Underground Storage Tank Removal.
   2. Section 31 23 16 - Excavation and Fill: Topsoil and subsoil removal, proofrolling.
   4. Section 32 93 00 - Plants: Tree and root pruning.

1.2 REFERENCES

A. SCDOT Standard Specifications:

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with Section 201 of the SCDOT Standard Specifications.

B. Maintain one copy of document on site.

C. Conform to applicable code for environmental requirements and disposal of debris.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify waste area or salvage area for placing removed materials when materials are indicated to remain on site.

3.2 PREPARATION

A. Call local utility line information service indicated on Drawings not less than three working days before performing Work.
1. Request underground utilities to be located and marked within and surrounding construction areas.

3.3 PROTECTION
   A. Locate, identify, and protect from damage utilities indicated to remain.
   B. Protect trees, plant growth, and features designated to remain as final landscaping.
   C. Protect bench marks and survey control points from damage or displacement.

3.4 CLEARING
   A. Remove trees and shrubs within areas indicated on Drawings.
   B. Remove stumps, main root ball, root system, surface rock, and pavements to depth of 12 inches below proposed Subgrade elevation.
   C. Clear undergrowth and deadwood without disturbing subsoil.

3.5 REMOVAL
   A. Remove debris, rock, and extracted plant life from site.
   B. Remove paving, curbs, and site slabs.
   C. Where indicated on Drawings partially remove paving, curbs, and slabs. Neatly saw cut edges at right angle to surface.
   D. Remove abandoned utilities. Indicate removal termination point for underground utilities on Record Documents.
   E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
   F. Do not burn or bury materials on site unless authorized in writing by authority having jurisdiction.
   G. Leave site in clean condition.

3.6 SCHEDULES – Not used

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating topsoil.
2. Excavating subsoil for buildings, pavements, and landscape.
3. Backfilling building perimeter to subgrade elevations.
4. Backfilling site structures to subgrade elevations.
5. Filling under pavements or slabs-on-grade.
6. Undercutting and filling over-excavation.
7. Disposal of excess material.

B. Related Sections:
1. Section 02 41 16 - Structure Demolition: Demolition of buildings prior to excavation.
2. Section 31 10 00 - Site Clearing: Clearing site prior to excavation.
3. Section 31 25 13 - Erosion Controls: Controlling sediment and erosion from Work of this section.
5. Section 31 23 18 - Rock Removal.

1.2 REFERENCES

A. SCDOT Standard Specifications:

B. American Association of State Highway and Transportation Officials:

C. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

1.3 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Dewatering Plan: Describe dewatering methods to be used to keep excavations dry if required.

D. Samples: Submit, in air-tight containers, 10-pound sample of each type of fill to testing laboratory.

E. Materials Source DOT Approval: Submit certification that aggregate and soil material suppliers are approved by the State Department of Transportation.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Division 200 - Earthwork of the SCDOT Standard Specifications.

B. Maintain one copy of document on site.

C. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Project location.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Original surface soil typical of the area which is capable of supporting native plant growth. It shall be free of large stones, roots, waste, debris, contamination, or other unsuitable material which might hinder plant growth.

B. Subsoil: Clean natural soil with a plasticity index of 15 or less that is free of clay, rock, or gravel lumps larger than 2 inches in any dimension, debris, waste, frozen material, and any other deleterious material that might cause settlement. Suitable material excavated from the site may be used as subsoil fill under optimum moisture conditions.

C. Granular Fill: Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SW, SP, SP-SM, or SP-SC.

D. Structural Fill: Clean course aggregate Gradation No. 57 conforming to Sections 801 of the SCDOT Standard Specifications.

E. Borrow Material: Conform to subsoil requirements.
2.2 ACCESSORIES

A. Geotextile Fabric: Non-woven, non-biodegradable, conforming to Section 804 of the SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

D. Verify underground structures are anchored to their own foundations to avoid flotation after backfilling.

E. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION FOR EXCAVATION

A. Call Local Utility Line Information service as indicated on Drawings not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site and protect from erosion.

D. Remove from site excess topsoil not intended for reuse.

3.4 SUBSOIL EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.
B. Excavate subsoil to accommodate building foundations, structures, slabs-on-grade, paving, landscaping, and construction operations.

C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity.

D. Slope banks with machine to angle of repose or less until shored.

E. Do not interfere with 45-degree bearing splay of foundations.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation.

G. Trim excavation. Remove loose matter.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume. Remove larger material as specified in Section 31 23 18.

I. Notify Engineer and testing agency of unexpected subsurface conditions.

J. Correct areas over excavated with granular fill and compact as required for fill areas.

K. Remove excess and unsuitable material from site.

L. Repair or replace items indicated to remain damaged by excavation.

M. Excavate subsoil from areas to be further excavated, re-landscaped, or regraded.

N. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

O. Remove from site excess subsoil not intended for reuse.

P. Benching Slopes: Horizontally bench existing slopes greater than 3:1 to key placed fill material into slope to provide firm bearing.

Q. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support excavations more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished subgrade, or design sheeting and shoring to be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water, or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.
3.6 SURFACE WATER CONTROL

A. Control and remove unanticipated water seepage into excavation.

B. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 31 25 13.

C. Divert surface water and seepage water within excavation areas into sumps or settling basins prior to pumping water into drainage channels and storm drains.

3.7 DEWATERING

A. Design and provide dewatering system to permit Work to be completed on dry and stable subgrade.

B. Operate dewatering system continuously until backfill is minimum 2 feet above normal ground water table elevation.

C. When dewatering system cannot control water within excavation, notify Engineer and stop excavation work.
   1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
   2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

D. Modify dewatering systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

E. Discharge ground water and seepage water within excavation areas into sumps or settling basins prior to pumping water into drainage channels and storm drains.

F. Remove dewatering and surface water control systems after dewatering operations are discontinued.

3.8 PROOF ROLLING

A. Proof roll areas to receive fill, pavement and building slabs to identify areas of soft yielding soils.
   1. Use loaded tandem-axle pneumatic tired dump truck or large smooth drum roller.
   2. Load equipment to maximum 50 tons gross weight and make a minimum of four passes with two passes perpendicular to the others.

B. Undercut such areas to firm soil, backfill with granular fill, and compact to density equal to or greater than requirements for subsequent fill material.

C. Do not proof roll or undercut until soil has been dewatered.

3.9 BACKFILLING

A. Scarify subgrade surface to depth of 4 inches.

B. Compact subgrade to density requirements for subsequent backfill materials.

C. Backfill areas to contours and elevations with unfrozen materials.
D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

E. Place fill material in continuous layers and compact in accordance with Schedule at end of this Section.

F. Employ placement method that does not disturb or damage other work.

G. Maintain optimum moisture content of backfill materials to attain required compaction density.

H. Support foundation walls and structures prior to backfilling.

I. Backfill simultaneously on each side of unsupported foundation walls and structures until supports are in place.

J. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise.

K. Make gradual grade changes. Blend slope into level areas.

L. Remove surplus backfill materials from site.

3.10 BRIDGING DEGRADED SOILS – Not Used

3.11 TOLERANCES
A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Within Building and Paved Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of Backfilling Within Landscape Areas: Plus or minus 2 inches from required elevations.

3.12 PROTECTION
A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

D. Repair or replace items indicated to remain damaged by excavation or filling.

3.13 FIELD QUALITY CONTROL
A. Section 01 40 00 - Quality Requirements: Independent laboratory, field inspecting, testing, adjusting, and balancing.

B. Request visual inspection of bearing surfaces by Engineer and inspection agency before installing subsequent work.

C. Laboratory Material Tests: In accordance with ASTM D1557 or AASHTO T180.
D. In-Place Compaction Tests: In accordance with the following:

E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

F. Frequency of Tests:
   1. Building and Pavement Areas: Twice per lift for every 5,000 square feet.
   2. Landscape Areas: Twice per lift for every 10,000 square feet.

3.14 SCHEDULES

A. Under Pavement and Slabs:
   1. Maximum 8-inch compacted depth.
   2. Compact material to a minimum of 95 percent of maximum density, except the top 12 inches.
   3. Compact top 12 inches to a minimum of 98 percent of maximum density.

B. Under Landscape Areas:
   1. Maximum 8-inch compacted depth.
   2. Compact to minimum 90 percent of maximum density.

C. Footing Foundation Fill:
   1. Structural fill to maximum 12-inch compacted depth.
   2. Compact to 98 percent of maximum density.

END OF SECTION
SECTION 31 23 17
TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating trenches for utilities and utility structures.
2. Bedding.
3. Backfilling and compacting to subgrade elevations.
4. Sheetin g and Shoring.
5. Dewatering.
6. Compacting backfill material.

B. Related Sections:
1. Section 33 23 13 - Erosion Controls: Diversion of water from excavations.
2. Section 31 23 16 - Excavation and Fill: Topsoil and subsoil removal from site surface.
4. Section 31 25 13 – Erosion Controls: Controlling sediment and erosion from Work of this section.
5. Section 33 11 16 - Water Utility Distribution Piping: Water piping and appurtenances.
6. Section 33 31 00 - Sanitary Utility Sewerage Piping: Sanitary sewer piping and bedding.
7. Section 33 41 00 - Storm Utility Drainage Piping: Storm sewer piping and bedding.
8. Section 33 46 00 - Subdrainage: Building perimeter drainage, filter aggregate, filter fabric, and granular cover.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

C. SCDOT Standard Specifications:

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Utility Structures: Manholes, catch basins, inlets, valve vaults, hand holes, and other utility access structures as indicated on Drawings.

C. Trench Terminology:
   1. Foundation: Area under bottom of trench supporting bedding.
   2. Bedding: Fill placed under utility pipe.
   3. Haunching: Fill placed from bedding to center line of pipe.
   4. Initial Backfill: Fill place from center line to 6 to 12 inches above top of pipe.
   5. Final Backfill: Fill placed from initial backfill to subgrade.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of South Carolina.

C. Dewatering Plan if required: Describe methods of dewatering and disposal of water.


E. Samples: Submit to testing laboratory, in air-tight containers, 10-pound sample of each type of fill.

F. Materials Source: Submit name of imported fill material suppliers.

G. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Division 200 of SCDOT Standard Specifications.

B. Maintain one copy of document on site.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.
PART 2 PRODUCTS

2.1 BACKFILL MATERIALS

A. Subsoil Fill: Clean natural soil with a plasticity index of 15 or less that is free of clay, rock, or gravel lumps larger than 2 inches in any dimension; debris; waste; frozen material; and any other deleterious material that might cause settlement. Suitable material excavated from the site may be used as subsoil fill under optimum moisture conditions.

B. Granular Fill: Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SW, SP, SP-SM or SP-SC.

C. Foundation Stone: Clean course aggregate Gradation No. 57 conforming to Sections 801 of the SCDOT Standard Specifications.

D. Bedding and Haunching Material:
   1. Rigid Pipe: Granular Fill.


F. Initial Backfill to 6 inches Minimum Above Utility:
   1. Rigid Pipe: Subsoil Fill.

G. Final Backfill to Subgrade:
   1. Under Pavement: Granular Fill.
   2. Under Landscape: Subsoil Fill.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-woven, non-biodegradable conforming to Section 804 of the SCDOT Standard Specifications.

B. Concrete: Concrete conforming to Section 701 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
   4. Maximum slump of 3.5 inches for vibrated concrete and 4 inches for non-vibrated concrete.
   5. Minimum cement content of 564 lbs per cubic yard for vibrated and 602 lbs. per cubic yard for non-vibrated concrete.

PART 3 EXECUTION

3.1 PREPARATION

A. Call local utility line information service indicated on Drawings not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.
C. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.2 LINES AND GRADERS

A. Excavate to lines and grades indicated on Drawings.
   1. Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.3 TRENCHING

A. Excavate subsoil required for utilities.

B. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard, measured by volume. Remove larger material as specified in Section 31 23 18.

C. Perform excavation within 48 inches of existing utility service in accordance with utility’s requirements.

D. Do not advance open trench more than 200 feet ahead of installed pipe.

E. Remove water or materials that interfere with Work.

F. Trench Width: Excavate bottom of trenches maximum 16 inches wider than outside diameter of pipe or as indicated on Drawings.

G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.

H. Maintain vertical faces to an elevation equal to 12 inches above top of pipe.
   1. When Project conditions permit, side walls may be sloped or benched above this elevation.
   2. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this Section.

I. Support Utilities and Structures:
   1. Keep trench width at top of trench to practical minimum to protect adjacent or crossing utility lines
   2. Support utilities crossing trench by means acceptable to utility company.
   3. Do not interfere with 45-degree bearing splay of foundations.
   4. Provide temporary support for structures above and below ground.

J. When subsurface materials at bottom of trench are loose or soft, excavate to firm subgrade or to depth directed by Engineer.
   1. Cut out soft areas of subgrade not capable of compaction in place.
2. Backfill with foundation stone and compact to density equal to or greater than requirements for subsequent backfill material.

K. Trim Excavation: Hand trim for bell and spigot pipe joints where required. Remove loose matter.

L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

M. Place geotextile fabric over trench foundation stone prior to placing subsequent bedding materials.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work unless approved by Engineer.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water, or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 SURFACE WATER CONTROL

A. Control and remove unanticipated water seepage into excavation.

B. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 31 25 13.

C. Divert surface water and seepage water within excavation areas into sumps or settling basins prior to pumping water into drainage channels and storm drains.

3.6 DEWATERING

A. Design and provide dewatering system to permit Work to be completed on dry and stable subgrade.

B. Operate dewatering system continuously until backfill is minimum 2 feet above normal ground water table elevation.

C. When dewatering system cannot control water within excavation, notify Engineer and stop excavation work.
   1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
   2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.
D. Modify dewatering systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

E. Discharge ground water and seepage water within excavation areas through filter bags or into settling basins prior to pumping water into drainage channels and storm drains.

F. Remove dewatering and surface water control systems after dewatering operations are discontinued.

3.7 BEDDING, HAUNCHING, AND INITIAL BACKFILL

A. Place bedding full width of trench to the depth indicated on Drawings and compact to 95 percent maximum density. Excavate for pipe bells.

B. Install utility pipe and conduit in accordance with the respective utility section.

C. Support pipe uniformly along entire length of pipe.

D. Carefully place haunching material to center of pipe, rod and tamp material to fill voids and provide uniform support of pipe haunches. Compact to 90 percent maximum density.

E. Carefully place initial backfill to 6 inches above top of pipe or to depth indicated on Drawings. Compact to 95 percent maximum density.

3.8 FINAL BACKFILLING TO SUBGRADE

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place fill material in continuous layers and compact in accordance with schedule at end of this Section.

D. Employ placement method that does not disturb or damage utilities in trench or foundation perimeter drainage.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Do not leave more than 50 feet of trench open at end of working day.

G. Protect open trench to prevent danger to the public.

3.9 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess material offsite and legally.

B. Furnish Engineer with certificate of disposal site or agreement from private property owner.

3.10 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.
3.11 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557 or AASHTO T180.

C. Perform in place compaction tests in accordance with the following:

D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

E. Frequency of Tests: Two tests per lift for every 1000 feet of trench.

3.12 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.13 SCHEDULE OF COMPACTION

A. Under Pavement and Slabs:
   1. Granular Fill in maximum 8-inch loose lifts.
   2. Compact to minimum 95 percent maximum density except the top 12 inches.
   3. Compact top 12 inches to minimum 98 percent maximum density.

B. Under Landscape Areas:
   1. Subsoil Fill in maximum 8-inch loose lifts.
   2. Compact to minimum 90 percent maximum density.

C. In Unstable or Unsuitable Trench Foundation Areas:
   1. Foundation Stone in maximum 12-inch loose lifts.
   2. Compact to 98 percent maximum density.

END OF SECTION
SECTION 31 23 18
ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing identified and discovered rock during excavation.
   2. Expansive tools to assist rock removal.
   3. Explosive tools to assist rock removal.

B. Related Sections:
   1. Section 31 22 16 - Excavation and Fill: Excavating and filling for road or site work.
   2. Section 31 23 17 - Trenching: Excavating and backfilling for utilities.

1.2 REFERENCES

A. National Fire Protection Association:

1.3 DEFINITIONS

A. Rock: Solid mineral material with volume in excess of 1/3 cubic yard or solid material that cannot be removed with 3/4 cubic yard capacity excavator without drilling or blasting.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate proposed method of blasting, delay pattern, explosive types, and type of blasting mat or cover. Indicate intended rock removal method.


1.5 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 495.

B. Seismic Survey Firm: Licensed company specializing in seismic surveys with five years documented experience.

C. Explosives Firm: Company specializing in explosives for disintegration of rock with five years documented experience.

1.6 PROJECT CONDITIONS FOR USE OF EXPLOSIVES

A. Conduct survey and document conditions of buildings near locations of rock removal prior to blasting; photograph existing conditions identifying existing irregularities.

B. Advise owners of adjacent buildings or structures, in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations.
C. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

1.7 SCHEDULING

A. Schedule Work to avoid disruption to occupied buildings nearby and conform to local laws and regulations pertaining to blasting times.

PART 2 PRODUCTS

2.1 MATERIALS

A. Conform to NFPA 495.

B. Explosives, Delay Devices, and Blast Mat Materials: Type recommended by explosive firm following seismic survey and required by authorities having jurisdiction.

C. Mechanical Disintegration Compound: Grout mix of materials that expand on curing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify site conditions and note subsurface irregularities affecting Work of this Section.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method.
   1. Drill holes and use expansive tools, wedges, and mechanical disintegration compound to fracture rock.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove shaled layers to provide sound and unshattered base for footings and foundations.

D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 16 inches wider than pipe diameter.

E. Remove excavated materials from site.

F. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 23 16.

3.4 ROCK REMOVAL BY EXPLOSIVE METHODS
A. When rock is uncovered requiring explosives method for rock disintegration, notify Architect/Engineer prior to executing as follows.
1. Provide seismographic monitoring during progress of blasting operations.
2. Drill blasting holes within 12 feet of finished slope.
3. Disintegrate rock and remove from excavation.
4. Remove rock at excavation bottom to form level bearing.
5. Remove shaled layers to provide sound and unshattered base for footings and foundations.
6. In utility trenches, excavate to 6 inches below invert elevation of pipe and 16 inches wider than pipe diameter.
7. Remove excavated material from site.
8. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 23 16.

B. Notify affected parties 72 hours in advance of using explosives including.
10. Schools
11. Fire department.
12. Rescue.
13. Emergency management.
14. Local Law Enforcement department.
15. NC Department of Transportation.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Request visual inspection of foundation bearing surfaces by Architect/Engineer and inspection agency before installing subsequent work.

END OF SECTION
SECTION 31 25 13
EROSION CONTROLS

PART 1 GENERAL
1.1 SUMMARY
A. Section Includes installing, maintaining and removing:
   1. Silt Fence.
   2. Temporary Construction Entrances.
   3. Diversion Channels.
   4. Sediment Traps.
   5. Rip Rap.
   7. Inlet Protection.
   8. Site Stabilization.
B. Related Sections:
   1. Section 31 10 00 - Site Clearing.
   2. Section 31 23 16 - Excavation and Fill.
   3. Section 31 37 00 - Riprap.
   4. Section 32 91 19 - Landscape Grading.
   5. Section 32 92 19 - Seeding and Soil Supplements.

1.2 REFERENCES
A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils
      Using a 4.54-kg (10-pound) rammer and a 457-mm (18-inch) drop.
B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics
      of Soil Using Standard Effort (12,400 ft-lbf/ft\(^3\) (600 kN-m/m\(^3\)).
   2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics
      of Soil Using Modified Effort (6,000 ft-lbf/ft\(^3\) (2,700 kN-m/m\(^3\)).
   3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in
      Place by Nuclear Methods (Shallow Depth).
   4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in
      Place by Nuclear Methods (Shallow Depth).
C. SCDOT Standard Specifications:
      Carolina Department of Transportation.

1.3 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit data on geotextile, posts, woven wire, concrete mix design, and
   pipe.
C. Manufacturer's Certificate: Certify products and aggregates meet or exceed specified
   requirements.
D. Closeout Submittals: Section 01 70 00 - Execution and Closeout Requirements:
Requirements for submittals.

1.4 QUALITY ASSURANCE
B. Maintain one copy of document on site.

1.5 PRE-INSTALLATION MEETINGS
A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this Section.

PART 2 PRODUCTS

2.1 GEOTEXTILE MATERIALS
A. Engineering Fabric Materials: Non-biodegradable conforming to Section 815.02 of SCDOT Standard Specifications:
   1. Silt Fence: Type 3, Class A or B Engineering Fabric.
   2. Under Rip Rap or Construction Entrances: Type 2 Engineering Fabric.

2.2 STONE, AGGREGATE, AND SOIL MATERIALS
A. Stone for Sediment Trap and Check Dam: Class B erosion control stone conforming to Division 800 of the SCDOT Standard Specifications. Minimum size 5 inches, midrange size 8 inches, and maximum size 12 inches equally distributed.
B. Stone for Rip Rap: Class 1 erosion control stone conforming to Division 800 of the SCDOT Standard Specifications. Minimum size 5 inches, midrange size 10 inches, and maximum size 17 inches equally distributed.
C. Washed Stone: Coarse aggregate, Gradation No. 57 conforming to Division 800 of the SCDOT Standard Specifications.
D. Aggregate for Construction Entrance: Coarse aggregate, Gradation No. 4 or larger with maximum size of 3 inch, conforming to Division 800 of the SCDOT Specifications.
E. Soil Fill: Clean natural soil with a plasticity index of 15 or less that is free of clay, rock, or gravel lumps larger than 2 inches in any dimension; debris; waste; frozen material; and any other deleterious material that might cause settlement. Suitable material excavated from the site may be used as soil fill under optimum moisture conditions.

2.3 PLANTING MATERIALS
A. General: Conform to South Carolina rules and regulations as specified in Section 810 of the SCDOT Standard Specifications for seed, agricultural ground limestone, fertilizers, and mulch.
B. Temporary Seed Mixture:
   1. Late winter and early spring: Rye and Annual Lespedeza (Kobe)
2. Summer: German Millet.
3. Fall: Rye.

C. Fertilizer: Commercial grade; recommended for grass.

D. Lime: ASTM C602, Class O agricultural ground limestone containing a minimum 80 percent calcium carbonate equivalent.

E. Mulch: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

2.4 CONCRETE

A. Concrete: Class B concrete conforming to Section 701 of the SCDOT Standard Specifications.
   1. Compressive strength of 2,500 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.567 with angular aggregate.
   4. Maximum slump of 2.5 inches for vibrated concrete and 4 inches for non-vibrated concrete.
   5. Minimum cement content of 508 lbs per cubic yard for vibrated and 545 lbs per cubic yard for non-vibrated concrete.

2.5 PIPE MATERIALS

A. Pipe: Corrugated steel pipe and fittings conforming to Section 715.2.3 of SCDOT Standard Specifications.

2.6 ACCESSORIES

A. Posts for Silt Fence and Inlet Protection: Steel posts 5 feet long, 1-3/8 inches wide, minimum weight 1.25 lbs/ft. conforming to Section 815.4.6 of the SCDOT Standard Specifications.

B. Woven Wire Fence for Silt Fence: Minimum 32 inches high, minimum 5 horizontal wires, vertical wires spaced 12 inches apart, minimum 10 gage top and bottom wires, and minimum 12-1/2 gage; all other wires conforming to Section 815 of the SCDOT Standard Specifications.

C. Attachment Devices for Silt Fence: No. 9 staple, minimum 1-1/2 inches long, or other approved attachment devices.

D. Hardware Cloth for Inlet Protection: 24 gage, 1/4-inch mesh opening hardware cloth.

E. Trash Rack for Pipe Riser: Cone shaped with #4 bars welded at each intersection of bars and sized to fit pipe riser. Conform to Division 800 of the SCDOT Standard Specifications.

2.7 SOURCE QUALITY CONTROL (AND TESTS)

A. Section 01 40 00 - Quality Requirements: Testing, inspection, and analysis requirements.

B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.
C. Make rock available for inspection at producer’s quarry prior to shipment. Notify Architect/Engineer at least seven days before inspection is allowed.

D. Allow witnessing of inspections and tests at manufacturer’s test facility. Notify Architect/Engineer at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of base or foundation for other work are correct.

3.2 SILT FENCE

A. Install in accordance with Section 815 of the SCDOT Standard Specifications at locations shown on Drawings.

B. Use wire fence with Class A fabric.

C. Class B fabric may be used without woven wire backing subject to the following:
   1. Fabric is approved by Architect/Engineer.
   2. Maximum post spacing is 6 feet.
   3. Posts are inclined toward runoff source not more than 20 degrees from vertical.

3.3 TEMPORARY CONSTRUCTION ENTRANCES

A. Excavate and compact subgrade as specified in Section 31 23 16.

B. Install construction entrances to the dimensions and locations as shown on Drawings. Minimum thickness is 6 inches.

C. Mound aggregate near intersection with public road to prevent site runoff entering road.

D. Periodically dress entrances with 2-inch thick course aggregate when aggregate becomes clogged with soil.

3.4 DIVERSION CHANNELS

A. Excavate channel as specified in Section 31 23 16.

B. Windrow excavated material on low side of channel.

C. Compact to 95 percent maximum density.

D. On entire channel area, apply soil supplements and sow seed as specified in Section 32 92 19.

E. Mulch seeded areas with hay as specified in Section 32 92 19.
3.5 SEDIMENT TRAPS
A. Clear site as specified in Section 31 00 00.
B. Construct trap by excavating and forming embankments as specified in Section 31 23 16.
C. Place coarse aggregate or rock at outlet as indicated on Drawings.
D. Place geotextile fabric as specified for rock lining.
E. On entire sediment trap area, apply soil supplements and sow seed as specified in Section 32 92 19.
F. Mulch seeded areas with hay as specified in Section 32 92 19.
G. Clean trap of accumulated sediment when directed but no less than when trap is half full of sediment.

3.6 ROCK LINING (RIP RAP)
A. Excavate to depth of rock lining as indicated on Drawings or nominal placement thickness as follows. Remove loose, unsuitable material below bottom of rock lining and replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.
B. Lay and overlay geotextile fabric over substrate. Lay fabric parallel to flow from upstream to downstream. Overlap edges upstream over downstream and upslope over downslope. Provide a minimum overlap of 3 feet. Offset adjacent roll ends a minimum of 5 feet when lapped. Cover fabric as soon as possible and in no case leave fabric exposed more than 4 weeks.
C. Carefully place rock on geotextile fabric to produce an even distribution of pieces with minimum of voids and without tearing geotextile.
D. Unless indicated otherwise, place full course thickness in one operation to prevent segregation and avoid displacement of underlying material. Arrange individual rocks for uniform distribution.

3.7 STONE CHECK DAM
A. Determine length required for ditch or depression slope and excavate, backfill, and compact foundation area to firm, even surface.
B. Place Class B erosion control stone in an even distribution of rock pieces with minimum voids to the indicated shape, height, and slope.
C. Construct washed stone filter blanket against upstream face of stone heck dam to the thickness indicated on Drawings.

3.8 INLET PROTECTION
A. Install four posts around drainage structure and attach hardware cloth as indicated on Drawings.
B. Place Class B erosion control stone at base of fabric and mound at approximately 2:1.
C. Place washed stone filter blanket on upstream side(s).

3.9 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize, and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2:1 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
   1. During non-germinating periods, apply mulch at recommended rates.
   2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 32 92 19 at 75 percent of permanent application rate with no topsoil.
   3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 32 92 19 permanent seeding specifications.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.10 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

C. Perform laboratory material tests in accordance with ASTM D1557 or AASHTO T180.

D. Perform in place compaction tests in accordance with the following:

E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

F. Frequency of Tests: Twice per lift for every 10,000 square feet.

3.11 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. When sediment accumulation in sedimentation structures has reached a point one-half depth of sediment structure or device, remove and dispose of sediment.

C. Do not damage structure or device during cleaning operations.

D. Do not permit sediment to erode into construction or site areas or natural waterways.
E. Clean channels when depth of sediment reaches approximately one-half channel depth.

3.12 SCHEDULES

A. Erosion Control Schedule:

<table>
<thead>
<tr>
<th>Erosion Control Element</th>
<th>Location</th>
<th>Size</th>
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<tbody>
<tr>
<td>Silt Fence</td>
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<tr>
<td>Temporary Construction Entrance</td>
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<td>Diversion Channel</td>
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<tr>
<td>Sediment Trap</td>
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<tr>
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<td>Stone Check Dams</td>
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<td>Inlet Protection</td>
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<tr>
<td>Sediment Pond</td>
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</tbody>
</table>

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate base course on a prepared subgrade.

B. Related Sections:
   1. Section 31 23 16 - Excavation and Fill: Preparing subgrade under base course.
   2. Section 32 12 16 - Asphalt Paving: Binder and finish asphalt courses.
   3. Section 32 13 13 - Concrete Paving: Finish concrete surface course.
   4. Section 32 17 13 - Parking Bumpers.
   5. Section 33 05 13 - Manholes and Structures: Frames and lids penetrating aggregate base course.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-pound) rammer and a 457-mm (18-inch) drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
   2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
   3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
   4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

C. SCDOT Standard Specifications:

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit to testing laboratory 10-pound sample of each type of aggregate in airtight containers.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE
A. Perform Work in accordance with Divisions 300 and 800 of the SCDOT Standard Specifications.

B. Maintain one copy of document on site.

C. Furnish each aggregate material from single source throughout the Work.

D. Use sources approved by SCDOT.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base Course: Coarse aggregate Type A or B with a gradation of ABC conforming to Section 801 of SCDOT Standard Specifications.

B. Fine Aggregate: Sand gradation 1S or 2S conforming to Section 801 of SCDOT standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verify existing conditions before starting work.

B. Verify substrate has been inspected and gradients and elevations are correct and dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and recompacting as specified in Section 31 23 16.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Place aggregate in minimum 4-inch and maximum 10-inch layers and roller compact to specified density. When total thickness is 10 inches or less, place in one layer. When total thickness is greater than 10 inches, place in two equal layers.

B. Have each layer of material compacted and approved prior to placing succeeding layers.

C. Level and contour surfaces to elevations and gradients indicated on Drawings.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Use mechanical tamping equipment in areas inaccessible to roller compaction equipment.

3.4 TOLERANCES
A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Thickness: 1/2 inch.

C. Maximum Variation from Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Independent laboratory, field inspecting, testing, adjusting, and balancing.

B. Laboratory Material Tests: Conform to Modified Proctor ASTM D1557 or AASHTO T180.

C. In-place Compaction Tests: Conform to:

D. Compaction:
   1. 100 percent of maximum when measured in-place by standard methods.
   2. 98 percent of maximum when measured in-place by nuclear methods.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

F. Frequency of Compaction Tests: Two tests per layer for every 5,000 tons of aggregate base course.

END OF SECTION
SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Asphaltic Concrete Paving: Surface, binder, and base courses.
   2. Prime Coat and Tack Coat.
   3. Surface Sealer.

B. Related Sections:
   1. Section 31 23 16 - Excavation and Fill: Compacted subbase for paving.
   2. Section 32 11 23 - Aggregate Base Courses: Compacted base for paving.
   3. Section 32 13 13 - Concrete Paving: Concrete curbs.
   4. Section 32 17 23 - Pavement Markings.
   5. Section 33 05 13 - Manholes and Structures: Frames and lids in pavement.

1.2 REFERENCES

A. SCDOT Standard Specifications:

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit product information and mix design.
C. Manufacturer’s Certification: Certify products are produced at a plant approved by SCDOT and that products meet or exceed specified requirements.
D. Installer Certification: Certify installer is on list of SCDOT approved contractors with an approved Quality Control Plan.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Division 400 of SCDOT Standard Specifications.
B. Maintain on site one copy of each document.
C. Obtain materials from same source throughout.
D. Installer Qualification: Company specializing in performing work of this Section with minimum 5 years experience.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt base course or intermediate course when ambient air or road surface temperature is less than 35 degrees F. or surface is wet or frozen.
B. Do not place asphalt surface course when ambient air or road surface temperature is less than 50 degrees F. or wet.
C. Place bitumen mixture when temperature is not more than 15 degrees F. below temperature at when initially mixed and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 MATERIALS
A. Asphalt Plant Mix Materials: Conform to Division 400 of SCDOT Standard Specifications.
B. Prime Coat and Tack Coat: Conform to Division 400 of SCDOT Standard Specifications.
C. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling or full depth removal of existing asphalt concrete pavements. Conform to Division 400 of SCDOT Standard Specifications.
D. Sand: Fine aggregate, gradation S1 or S2 conforming to Divisions 300 and 400 of SCDOT Standard Specifications.

2.2 ASPHALT PAVING MIX
A. General: Use Superpave mix design conforming to Division 400 of SCDOT Standard Specifications.
B. Wedging or Leveling Mix: Conform to intermediate course.
C. Reclaimed Asphalt Pavement (RAP) Content: Use maximum 50 percent for base and intermediate courses, maximum 15 percent for surface course.

2.3 SOURCE QUALITY CONTROL AND TESTS
A. Section 00 14 00 - Quality Requirements: Testing, inspection, and analysis requirements.
B. Submit proposed mix design of each class of mix for review prior to beginning Work.
C. Obtain materials from plant approved by SCDOT.
D. Test plant samples in accordance with Division 400 of SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify compacted subgrade and aggregate base is dry and ready to support paving and imposed loads.
B. Verify gradients and elevations of base are correct.
C. Verify utility structure frames and lids are installed in correct position and elevation.

3.2 PRIME COAT
A. Apply primer on aggregate base course at uniform rate of 0.2 to 0.5 gal/sq. yd. in accordance with Division 400 of SCDOT Standard Specifications.

B. Apply primer to contact surfaces of curbs and gutters.

C. Use clean sand to blot excess primer.

3.3 TACK COAT

A. Apply tack coat on asphalt or concrete surfaces at uniform rate of 0.04 to 0.08 gallons/square yard in accordance with Division 400 of SCDOT Standard Specifications.

B. Apply tack coat to contact surfaces of curbs and gutters.

C. Coat surfaces of utility structures with oil to prevent bond with asphalt pavement. Do not tack-coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT

A. Install Work in accordance with Division 400 of SCDOT Standard Specifications.

B. Place asphalt within 24 hours of applying prime coat or tack coat.

C. Place asphalt in courses to the thicknesses and dimensions shown on the Drawings.

D. Place binder and intermediate courses.

E. Place surface course within 2 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

F. Place surface course to thicknesses and dimensions shown on the Drawings.

G. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

H. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.5 JOINTS

A. Traverse Joints:
   1. When Work is suspended long enough to allow mixture to chill, construct transverse joint.
   2. Use butt joint when traffic will not pass over pavement.
   3. Use sloped wedge ahead of the end of pavement when traffic will pass over pavement. Place paper parting strip to removal of wedge.
   4. Tack coat edge of pavement prior to placing adjoining pavement.

B. Longitudinal Joints:
   1. Tack the edge of longitudinal joints prior to placing adjoining pavement.
   2. Pinch joint by rolling immediately behind the paver.
   3. Offset longitudinal joints in each layer by approximately 6 inches.

3.6 TOLERANCES
A. Density Compaction: Minimum of 92 percent of Maximum Specific Gravity ($G_{mm}$).

B. Flatness: Maximum variation of 1/8-inch measured with 10-foot straight edge.

C. Compacted Thickness: Within 1/4-inch.

D. Variation From Indicated Elevation: Within 1/2-inch.

3.7 FIELD QUALITY CONTROL

A. Section 00 14 00 - Quality Requirements: Independent testing firm, field testing, and inspecting.

B. Perform Contractor Quality Control Program in accordance with Division 400 of SCDOT Standard Specifications.

C. Take compaction tests every 2,000 linear feet or fraction thereof per day on pavement placed at the paver lay down width.

D. Take 6-inch diameter full depth pavement cores every 2,000 linear feet or fraction thereof per day on pavement placed at the paver lay down width.

E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Immediately after placement, protect pavement from mechanical injury for seven days or until surface temperature is less than 140 degrees F.

END OF SECTION
SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete sidewalks.
   2. Concrete integral curbs and gutters.
   3. Concrete median barriers.
   4. Concrete base and surface for parking areas and roads.
   5. Small miscellaneous slabs.

B. Related Sections:
   1. Section 31 23 23 - Excavation and Fill: Compacted subgrade for paving.
   2. Section 32 11 23 - Aggregate Base Courses: Compacted base for paving.
   4. Section 32 17 23 - Pavement Markings.
   5. Section 33 05 13 - Manholes and Structures: Frames and lids in paving.

1.2 REFERENCES

A. American Association of State Highway Transportation Officials (AASHTO)
   1. AASHTO M 31 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
   2. AASHTO M 32 - Steel Wire, Plain for Concrete Reinforcement.
   3. AASHTO M 282 - Joint Sealants, Hot Poured, Elastomeric-Type, for Portland Cement Concrete Pavements.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:
   3. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. SCDOT Standard Specifications:

1.3 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Concrete Mix Design: Submit concrete mix design 30 days prior to use of concrete.

C. Product Data: Submit data on joint materials, admixtures, and curing compounds.

D. Manufacturer's Certification: Certify products are produced at a plant approved by SCDOT and that products meet or exceed specified requirements.

E. Installer Certification: Certify installer is on list of SCDOT prequalified contractors with an approved Quality Control Plan.

F. Process Control Plan: Submit process control plan for delivering and placing concrete.

G. Samples: Submit two sample panels, 2 inch x 12 inch in size, illustrating exposed aggregate finish.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with section 501 of SCDOT Standard Specifications, except as modified herein.

B. Maintain one copy of document on site.

C. Obtain cementitious materials from same source throughout.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section and prequalified by SCDOT.

B. Installer: Company specializing in performing Work of this Section and prequalified by SCDOT.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not place concrete when base surface temperature or air temperature in the shade is 40 degrees F and falling or surface is wet or frozen.

C. Do not place concrete when air temperature in the shade is 95 degrees F and rising or when concrete temperature is greater than 95 degrees F.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Slip Form Methods: Use slip form methods wherever possible.

B. Fixed Form Materials: Metal conforming to Section 501 of SCDOT Standard Specifications.
2.2 JOINT MATERIALS

A. General: Conform to Section 501 of SCDOT Standard Specifications.

B. Joint Filler: Sponge rubber or cork type conforming to ASTM D1751 (AASHTO M213) or bituminous, non-extruding, resilient type conforming to ASTM D1752 (AASHTO M153), Type 1; thickness as indicated on Drawings.

C. Silicone Sealant: Low modulus, cold applied, single component, chemically curing silicone material.
   1. Type NS: Non-sag silicone, toolable.
   2. Type SL: Self-leveling silicone, tooling not required.

D. Rubber Asphalt Sealant: Hot poured rubber asphalt joint sealer conforming to AASHTO M282 (ASTM D3406).

E. Bond Breaker:
   1. General: Product that does not stain or adhere to the sealant and is chemically inert and resistant to oils, gasoline, solvents, and primer.
   2. For On-Grade Pavements: Circular backer rod, diameter 25 percent larger than joint width.
      a. Type L, For Cold Pour Sealants Only: Closed cell expanded polyethylene foam. Use with Type NS silicone only.
      b. Type M, For Cold or Hot Pour Sealants: Closed cell polyolefin with closed skin over an open cell core.
   3. For Bridge Decks Only: Bond breaking tape, extruded polyethylene with pressure sensitive adhesive on one side, minimum 0.005 inches thick.

2.3 REINFORCEMENT

A. General: Conform to Section 501 of SCDOT Standard Specifications.

B. Reinforcing Steel: ASTM A615 (AASHTO M 31); 60 ksi yield grade; deformed billet steel bars; epoxy coated finish.

C. Dowels and Tie Bars: ASTM A615 (AASHTO M 31); 60 ksi yield grade, plain steel, epoxy coated finish.

D. Welded Wire Fabric Steel: Deformed type, ASTM A497; unfinished.

2.4 CONCRETE MATERIALS

A. Concrete Materials: Provide fine aggregate, coarse aggregate, Portland Cement, fly ash, ground granulated blast furnace slag, water, air entraining agent, and chemical admixtures in accordance with Section 501 of SCDOT Standard Specifications.

2.5 ACCESSORIES

A. Curing Compound: ASTM C309 (AASHTO M-148), Type 1 clear or translucent or Type 2 white pigmented.

2.6 CONCRETE MIX

A. Mix and deliver concrete in accordance with Section 501 of SCDOT Standard Specifications.
B. Roadway and Area Pavement concrete: Air entrained conforming to the following criteria:
1. Flexural Strength: 650 psi at 28 days.
2. Slump: 1.5 inch maximum for slip form method, 3 inches maximum for fixed form hand methods.
5. Air Entrainment: Between 4.5 and 5.5 percent.

C. Class A Concrete for sidewalk, curb, curb and gutter, and other incidental site concrete: Air entrained, vibrated conforming to the following criteria:
1. Compressive Strength: 3,000 psi at 28 days.
2. Maximum Slump Vibrated: 3.5 inches.
5. Maximum Water/Cement Ratio for Rounded Aggregate: 0.488.
6. Air Entrainment: 6.0 percent plus or minus 1.5 percent.

D. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.

E. Use calcium chloride only when approved by the Engineer in writing.

F. Use set retarding admixtures during hot weather only when approved by the Engineer in writing.

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services.

B. Submit proposed mix design of each class of concrete to independent firm for review prior to commencement of Work.

C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

D. Test samples in accordance with ACI 301 for compressive strength (cylinders) and flexural strength (beams.)

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted base course is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify utility structure frames and lids are installed in correct position and elevation.
3.2 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.
B. Coat surfaces of manhole, catch basin, and other utility structure frames with oil to prevent bond with concrete pavement.
C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.
B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.4 REINFORCEMENT

A. Place reinforcement as indicated on Drawings.
B. Interrupt reinforcement at contraction and expansion joints.
C. Place dowels to achieve pavement and curb alignment as detailed.
D. Provide doweled joints 18 inches on center at transverse joints with one end of dowel set in capped sleeve to allow longitudinal movement.

3.5 PLACING CONCRETE

A. Place concrete in accordance with Section 501 of SCDOT Standard Specifications.
B. Place concrete using the slip form technique wherever possible.
C. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
E. Place concrete to pattern indicated on Drawings.

3.6 PAVEMENT JOINTS

A. Provide expansion, contraction, and construction joints as indicated on Drawings.
B. Place expansion joints at 60 foot maximum intervals. Place contraction joins at 20-foot maximum intervals. Align pavement joints with curb, gutter, and sidewalk joints.
C. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/2 inch for backer rod and sealant placement.
D. Saw cut contraction joints 3/16 inch wide or as indicated at an optimum time after finishing. Cut 1/3 into depth of slab.

3.7 SIDEWALK, CURB, AND CURB AND GUTTER JOINTS
A. Provide sawn joints at 5-foot intervals. Provide 3/4 inch expansion joint at 30 feet maximum and between sidewalks and curbs and structures.
B. Align sidewalk, curb and gutter joints with pavement joints.

3.8 FINISHING
A. Area Paving: Heavy broom.
B. Sidewalk Paving: Light broom. [Brush to 6 inch radius with smooth trowel joint edges.]
C. Median Barrier: Light broom and trowel joint edges.
D. Curbs and Gutters: Light broom.
E. Inclined Vehicular Ramps: V-grooves with mechanical equipment and spring tines, perpendicular to slope.

3.9 EXPOSED AGGREGATE
A. Apply surface retarder where exposed aggregate finish is indicated.
B. Wash exposed aggregate surface with clean water and scrub with stiff bristle brush exposing aggregate to match sample panel.
C. Sand blast concrete surfaces to achieve aggregate exposure surface to match sample panel.

3.10 CURING
A. Place curing compound on concrete surfaces immediately after finishing.
B. Cover with burlap or polyethylene film to protect from cold weather and rain.

3.11 JOINT SEALING
A. Separate pavement from vertical surfaces with 1/2 inch thick joint filler.
B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
C. Extend joint filler from bottom of pavement to within 1/2 inch of finished surface.

3.12 TOLERANCES
A. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
B. Maximum Variation From True Position: 1/2 inch.
C. Maximum Variation in thickness: 1/2 inch.
3.13 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Prepare three concrete test beams for every 1,333 or less square yards of pavement for each class of concrete placed each day.

C. Prepare one additional test beam during cold weather and cured on site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

F. Take one 4-inch diameter core for every 1,333 square yards or less of pavement for each class of concrete placed each day.

3.14 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

3.15 SCHEDULES

A. Concrete Sidewalks: Class A Concrete, compressive strength of 3,000 psi at 28 days, 4 inches thick, buff color Portland cement, light broom finish.

B. Roadway Pavement Concrete: Non-reinforced, flexural strength of 650 psi at 28 days, 8 inches thick, wood float finish.

C. Propane Tank Slab: Class AA Concrete, 4,500 psi 28 day concrete, 6 inches thick, 6/6-6 x 6 inch mesh reinforcement, light broom finish.

END OF SECTION
SECTION 32 17 13
PARKING BUMPERS

PART 1 GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Precast concrete parking bumpers.
   2. Parking bumper anchors.
B. Related Sections:
   1. Section 32 12 16 - Asphalt Paving.
   2. Section 32 13 13 - Concrete Paving.

1.2 REFERENCES
A. ASTM International:
   1. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for
      Concrete Reinforcement.

1.3 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit unit configuration, dimensions.

1.4 COORDINATION
A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
B. Coordinate the Work with pavement placement and parking striping.

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers:
   1. Gage Brothers Concrete Products.
   2. Southern Cast Stone Co., Inc.
   3. Parking Bumper Co.
   4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

2.2 CONCRETE BUMPERS
A. Precast Reinforced Concrete Mix: Minimum compressive strength of 5,000 psi at
   28 days, air entrained to 5 to 7 percent.
B. Use rigid molds constructed to maintain precast units uniform in shape, size, and finish.
   Maintain consistent quality during manufacture.
C. Embed reinforcing steel and drill or sleeve for two dowels.
D. Cure units to develop concrete quality and to minimize appearance blemishes including non-uniformity, staining, or surface cracking.
E. Minor patching in plant is acceptable providing appearance of units is not impaired.

2.3 CONFIGURATION
A. Nominal Size: 6 inches high, 8 inches wide, 6 feet long.
B. Profile: Manufacturer's standard cross section with sloped vertical faces, square ends, and drainage slots.

2.4 ACCESSORIES
A. Dowels: Steel, unfinished, 1/2 inch diameter, 24 inches long, pointed tip conforming to ASTM A615.

PART 3 EXECUTION

3.1 INSTALLATION
A. Install units without damage to shape or finish. Replace or repair damaged units.
B. Install units in alignment with adjacent work.
C. Fasten units in place with two dowels for each unit bumper.
D. Core drill concrete pavement 1/8 inch larger than dowel. Seal annular space around hole with grout or sealant.

END OF SECTION
SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Traffic lines, legends and markings on asphalt and concrete surfaces.
   2. Waterborne Traffic Paint.
   3. Thermoplastic Pavement Markings.
   4. Glass beads.

B. Related Sections:
   1. Section 32 12 16 - Asphalt Paving.
   2. Section 32 13 13 - Concrete Paving.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

B. SCDOT Standard Specifications:

1.3 PERFORMANCE REQUIREMENTS

A. Paint Adhesion: Adhere to road surface forming smooth continuous film one minute after application.

B. Paint Drying: Tack free by touch so as not to require coning or other traffic control devices to prevent transfer by vehicle tires within 10 minutes after application.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit paint formulation for each type of paint and glass beads if required.

C. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.

D. Manufacturer’s Installation Instructions: Submit instructions for application temperatures, eradication requirements, application rate, line thickness, and application of glass beads if required.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Division 600 of SCDOT Standard Specifications.

B. Maintain one copy of document on site.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum 5 years experience.

B. Applicator: Company specializing in performing work of this section with minimum 5 years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Invert containers several days prior to use when paint has been stored more than two months. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.

C. Where glass beads are required, store glass beads in cool, dry place. Protect from contamination by foreign substances.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer or:
   1. Waterborne Paint: Apply when ambient air temperature and surface temperature is minimum 40 degrees F and rising and a maximum of 160 degrees F.
   2. Thermoplastic: Do not apply until ambient air temperature and temperature of the pavement is 50 degrees F or higher.

C. Do not apply materials during rain or snow when relative humidity is outside humidity ranges or moisture content of surfaces exceed those required by paint product manufacturer.

D. Volatile Organic Content (VOC). Do not exceed State or Environmental Protection Agency maximum VOC on traffic paint.

PART 2 PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

A. Manufactures:
   2. Franklin Paint Company (franklinpaint.com).
   3. EZ-Liner Industries (ezliner.com).
   4. TAPCO, Inc. (tapconet.com).
   5. Pervo Paint Company (pervo.com).
   6. Substitutions: Equal per Section 01 60 00 – Product Requirements.

B. Furnish materials in accordance with Division 600 of SCDOT Standard Specifications.

C. Waterborne Paint: Ready mixed, fast dry waterborne traffic paints, lead-free, non-toxic, suitable for roadway or parking lots.

D. Thermoplastic: Alkyd based ready mixed, fast dry, lead free, non toxic, for roadways.
E. Glass Beads: AASHTO M247, Type 1, coated to enhance embedment and adherence with paint.

2.2 EQUIPMENT

A. Roadway Application for Continuous Longitudinal Lines: Use equipment with following capabilities.
   1. Dual nozzle paint gun to simultaneously apply parallel lines of indicated width in solid or broken patterns or various combinations of those patterns.
   2. Pressurized bead-gun to automatically dispense glass beads onto painted surface, at required application rate.
   3. Measuring device to automatically and continuously measure length of each line placed, to nearest foot.
   4. Device to heat paint to manufacturer’s temperature recommendation for fast dry and thermoplastic applications.

B. Machine Calibration: Calibrate machines to meet specified tolerances.

C. Other Equipment: For application of crosswalks, intersections, stop lines, legends and other miscellaneous items by walk behind stripers, hand spray or stencil trucks, apply with equipment meeting requirements of this section. Do not use hand brushes or rollers. Optionally apply glass beads by hand.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Do not apply paint to concrete surfaces until concrete has cured for 28 days.

3.2 PREPARATION

A. Maintenance and Protection of Traffic:
   1. Provide short term traffic control in accordance with Section 01 50 00 - Temporary Facilities and Controls.
   2. Prevent traffic from interrupting or driving on newly applied markings before markings dry.
   3. Maintain roadway travel lanes between 7:00 a.m. to 9:00 a.m. and between 4:00 p.m. and 6:00 p.m.
   4. Maintain access to existing businesses and other properties requiring access.

B. Surface Preparation.
   1. Clean and dry paved surface prior to painting.
   2. Blow or sweep surface free of dirt, debris, oil, grease, or gasoline.
   3. Spot location of final pavement markings as specified and as indicated on Drawings by applying pavement spots 25 feet on center.
   4. Notify Engineer after placing pavement spots and minimum three days prior to applying traffic lines.

3.3 EXISTING WORK
A. Remove existing markings in an acceptable manner. Do not remove existing pavement markings by painting over with black paint. Remove by methods that will cause least damage to pavement structure or pavement surface. Satisfactorily repair any pavement or surface damage caused by removal methods.

B. Clean and repair existing or remaining lines and legends.

3.4 APPLICATION

A. Agitate paint for 1-15 minutes prior to application to ensure even distribution of paint pigment.

B. Dispense paint at temperature recommended by manufacturer to wet-film thickness of 15 mils.

C. Dispense thermoplastic at temperature recommended by manufacture to thickness of:
   1. 120 mils for center lines, skip lines, transverse markings, and legends.
   2. 90 mils for edge lines diagonals and arrow symbols.

D. Apply glass beads at rate of 1 to 3 pounds per gallon of paint.

E. Apply markings to indicated dimensions at indicated locations.

F. Prevent splattering and over spray when applying markings.

G. Unless material is track free at end of paint application convoy, use traffic cones to protect markings from traffic until track free.

H. When vehicle crosses a marking and tracks it or when splattering or overspray occurs, eradicate affected marking and resultant tracking and apply new markings.

I. Collect and legally dispose of residues from painting operations.

3.5 APPLICATION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Wet Film Thickness: 1 mil.

C. Maximum Variation from Wet Paint Line Width: Plus or minus 1/8 inch.

D. Maintain cycle length for skip lines at tolerance of plus or minus 6 inches per 40 feet and line length or plus or minus 3 inches per 10 feet.

E. Maximum Variation from Specified Application Temperature: Plus or minus 5 degrees F.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

C. Repair lines and markings which after application and curing do not meet following criteria:
1. Incorrect Location: Remove and replace incorrectly placed patterns.
2. Insufficient Thickness, Line Width, Paint Coverage, Retention or Glass Bead Coverage (where required): Prepare defective material by acceptably grinding or blast cleaning to remove substantial amount of beads and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot beyond affected area. Apply new markings on cleaned surface in accordance with this Section.

D. Replace failed or defective markings in entire section of defective markings within 30 days after notification when any of the following exists:
   1. Marking is discolored or exhibits pigment loss and is determined to be unacceptable by visual comparison with beaded color plates.
   2. If glass beads are used, the average retro-reflectivity is less than 375 mcd/m²/1x for white pavement markings and 250 mcd/m²/1x for yellow pavement markings.

E. When eradication of existing paint lines is necessary, eradicate by shot blast or water blast method. Do not gouge or groove pavement more than 1/16 inch during removal. Limit area of removal to area of marking plus 1 inch on all sides. Prevent damage to transverse and longitudinal joint sealers, and repair any damage according to requirements in Section 32 12 16 or Section 32 13 13.

F. Maintain daily log showing work complete, results of inspections or tests, pavement and air temperatures, relative humidity, presence of any moisture on pavement, and any material or equipment problems. Make legible entries in log in ink, sign, and submit by end of each work day. Enter environmental data into log prior to starting work each day and at two additional times during day.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer’s recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than two minutes dry time.

3.8 SCHEDULES

A. Pavement Markings:

<table>
<thead>
<tr>
<th>Items</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 inch white paint</td>
<td>Parking lot lines</td>
</tr>
<tr>
<td>4 inch yellow paint</td>
<td>Parking lot lane lines</td>
</tr>
<tr>
<td>24 inch white thermoplastic</td>
<td>Stop line</td>
</tr>
<tr>
<td>4 inch yellow thermoplastic</td>
<td>Roadway center lines</td>
</tr>
<tr>
<td>4 inch white thermoplastic</td>
<td>Roadway edge lines</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fence framework, fabric, and accessories.
   2. Excavation for post bases.
   3. Concrete foundation for posts and center drop for gates.
   5. Barbed wire, 3 strand on fence top.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A121 - Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

B. Chain Link Fence Manufacturers Institute:
   1. CLFMI - Product Manual.

C. SCDOT Standard Specifications:

1.3 SYSTEM DESCRIPTION

A. Fence Height: As indicated on Drawings.
B. Line Post Spacing: As indicated on Drawings, 12 feet maximum.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.
D. Manufacturer's Installation Instructions: Submit installation requirements including post foundation anchor bolt templates if required.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.
C. Operation and Maintenance Data: Procedures for submittals.

1.6 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.
B. Comply with Section 806 of SCDOT Standard Specifications except as modified herein. Maintain one copy of document on site.
C. Perform installation in accordance with ASTM F567.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years experience.
B. Installer: Company specializing in performing work of this section with minimum 5 years experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.
B. Identify each package with manufacturer’s name.
C. Store fence fabric and accessories in secure and dry place.
PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Pipe Framing: ASTM F1083 Schedule 40 galvanized steel pipe, welded construction; coating conforming to ASTM F1043 Type A on pipe exterior and interior.

B. Hot Rolled Steel Framing: ASTM A1011 hot rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum Grade 50; coating conforming to ASTM F1043 Type B on pipe exterior and interior.


E. Aluminum Alloy Fence Fabric: ASTM F1183

F. Barbed Wire: ASTM A121 galvanized steel or ASTM A585 aluminum coated steel; 12 gage thick wire, 2 strands, and 4 points at 3 inch on center.

G. Concrete: Class A concrete in accordance with Section 701 of SCDOT Standard Specifications with 3000 psi compressive strength at 28 days.

2.2 COMPONENTS

A. Nominal fence height less than 6 feet:
   1. Line Posts: 1.9 inch diameter.
   2. Corner and Terminal Posts: 2.88 inch.
   3. Gate Posts: 3.5 inch diameter.
   4. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
   5. Gate Frame: 1.66 inch diameter for welded fabrication.

B. Nominal Fence height 6 feet or more:
   1. Line Posts: 2.38 inch diameter.
   2. Corner and Terminal Posts: 3.5 inch.
   3. Gate Posts: 4.5 inch diameter.
   4. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
   5. Gate Frame: 1.66 inch diameter for welded fabrication.

C. Fabric: 2 inch diamond mesh interwoven wire, 11 gage thick steel, 9 gage thick aluminum, top selvage knuckle end closed, bottom selvage knuckle end closed.

D. Tension Wire: 7 gage thick steel, single strand.

E. Tension Band: 3/16 inch thick by 3/4 inch wide steel.

F. Tie Wire: Aluminum steel wire, 9-gage or 6-gage as indicated.

2.3 ACCESSORIES

A. Caps: Cast steel galvanized, galvanized pressed steel, malleable iron galvanized, or aluminum alloy; sized to post diameter, set screw retainer.
B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Extension Arms: Cast steel galvanized or galvanized pressed steel to accommodate 3 strands of barbed wire, single arm, for placing vertical or sloped to 45 degrees as indicated on Drawings.

D. Gate Hardware: Fork latch with gravity drop, center gate stop and drop rod; two 180 degree gate hinges for each leaf and hardware for padlock keyed to match hardware as directed by Architect/Engineer.

2.4 GATES

A. General:
   1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
   2. Design gates for operation by one person.
   3. Deliver gates factory assembled.
   4. Finish is to be galvanized, aluminum coated, or PVC coated to match fence.

B. Swing Gates:
   1. Fabricate gates to permit 180 degree swing.
   2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

2.5 FINISHES

A. Galvanized Components and Fabric: Galvanized to ASTM A123/A123M for components; ASTM A153/A153M for hardware; ASTM A392 for fabric; 2.0 oz/sq. ft. coating.

B. Aluminum Coated Components and Fabric: Aluminum coating to ASTM A792/A792M for components and ASTM A491 for fabric; 0.40 oz/sq. ft.

C. Vinyl Coated Components and Fabric: Vinyl coating, 10 mil thick, over metallic coated wire, medium green, dark green or black color in accordance with ASTM F934 as indicated on Drawings.

D. Hardware: Galvanized to ASTM A153/A153M, 2.0 oz/sq. ft. coating.

E. Accessories: Same finish as framing.

2.6 CONCRETE

A. Concrete for foundations: Class A Concrete conforming to Section 701 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
   4. Maximum slump of 3.5 inch for non-vibrated concrete and 4 inch for vibrated concrete.
   5. Minimum cement content of 564 lbs per cubic yard for non-vibrated and 602 lbs per cubic yard for vibrated concrete.
PART 3 EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories, and gates in accordance with ASTM F567.

B. Set intermediate, terminal, gate, and corner posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

C. Footing Depth from Finished Grade:
   1. Line Posts for Nominal Fence Height Less Than 6 Feet: 2.25 feet.
   2. Line Posts for Nominal Fence Height 6 Feet or More: 2.5 feet.
   3. Corner, Gate, Pull, and Terminal Posts: 3 feet.

D. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

E. Install top rail through line post tops and splice with 6 inch long rail sleeves.

F. Install center and bottom brace rail on corner gate leaves.

G. Place fabric on outside of posts and rails.

H. Do not stretch fabric until concrete foundation has cured 28 days.

I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

J. Position bottom of fabric 2 inches above finished grade.

K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

M. Install bottom tension wire stretched taut between terminal posts.

N. Install support arms sloped inward, outward, or vertical as indicated and attach barbed wire, tension, and secure.

O. Support gates from gate posts. Do not attach hinged side of gate from building wall.

P. Install gate with fabric and barbed wire overhang to match fence. Install three hinges on each gate leaf. Install latch, catches, and drop bolt.

Q. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

R. Connect to existing fence at an existing terminal post, new terminal post, or an existing line post converted to terminal post by installation of brace rails and brace rods.

S. Install posts with 6 inches maximum clear opening from end posts to buildings, fences, and other structures.
T. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.

U. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

V. Extend concrete footings 1 inch above grade and trowel, forming crown to shed water.

W. Allow footings to cure minimum 7 days before installing fabric and other materials attached to posts.

3.2 ERECTION TOLERANCE

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 1/4 inch.

C. Maximum Offset from Indicated Position: 1 inch.

D. Minimum distance from property line: 6 inches.

END OF SECTION
SECTION 32 91 19
LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Final grade topsoil for finish landscaping.
   2. Testing Topsoil.
   5. Placing and lightly compacting topsoil.
   6. Removing excess topsoil from site.
B. Related Sections:
   1. Section 31 23 16 - Excavation and Fill: Cutting and filling to site subgrade.
   2. Section 31 23 17 - Trenching: Backfilling trenches to subgrade.
   3. Section 32 92 19 - Seeding.
   4. Section 32 92 23 - Sodding.
   5. Section 32 93 00 - Plants: Topsoil fill for trees, plants and ground cover.

1.2 REFERENCES
A. SCDOT Standard Specifications:

1.3 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
B. Test Results: Submit results of topsoil tests to determine soil amendments required.
C. Samples: Submit to testing laboratory for independent test, in air-tight containers, 10 pound sample of topsoil.
D. Materials Source: Submit name and location of imported materials source.

1.4 QUALITY ASSURANCE
A. Furnish each topsoil material from single source throughout the Work.
B. Perform Work in accordance with applicable portions of Division 800 of SCDOT Standard Specifications.
C. Maintain one copy on site.

PART 2 PRODUCTS

2.1 MATERIAL
A. Topsoil: Original surface soil typical of the area, which is capable of supporting native plant growth; free of large stones, roots, waste, debris, contamination, or other unsuitable material, which may be detrimental to plant growth; pH value of 5.4 to 7.0.

B. Suitable material excavated from site, amended per requirements of tests is acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify building and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 6 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding, and planting is required to thickness as scheduled. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material, buildings, and pavement to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.
B. Top of Topsoil: Plus or minus 1/2 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Prohibit construction traffic over topsoil. Scarify and regrade disturbed areas.

3.7 SCHEDULES

A. Compacted topsoil thicknesses:
   1. Seeded Areas: 6 inches.
   2. Sodded Areas: 4 inches.
   4. Flower Beds: 12 inches.
   5. Planter Boxes: To within 3 inches of box rim.
   6. Trees: As indicated on Drawings.

END OF SECTION
SECTION 32 92 19
SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fertilizing.
   2. Seeding.
   3. Hydroseeding.
   4. Mulching.
   5. Maintenance.

B. Related Sections:
   1. Section 32 84 00 - Planting Irrigation: Irrigation system for seeded areas.
   2. Section 32 91 19 - Landscape Grading: Preparation and placement of topsoil in preparation for the Work of this Section.
   3. Section 32 92 23 - Sodding.
   4. Section 32 93 00 - Plants.

1.2 REFERENCES

A. ASTM International:

B. SCDOT Standard Specifications:

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

C. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Invoices or proof of purchase to verify quantities specified.

F. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; and, types, application frequency, and recommended coverage of fertilizer.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Section 810 of SCDOT Standard Specifications.
B. Maintain copy of document on site.

1.6 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing products specified in this Section with minimum 3 years documented experience.

B. Installer: Company specializing in performing work of this Section with minimum 5 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers showing percentage of seed mix, germination, inert matter and weeds; year of production; net weight; date of packaging; and location of packaging. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.8 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition for minimum of three cuttings.

PART 2 PRODUCTS

2.1 TOPSOIL MATERIALS

A. Conform to Section 32 91 19. Topsoil: Original surface soil typical of the area, which is capable of supporting native plant growth; free of large stones, roots, waste, debris, contamination, or other unsuitable material, which may be detrimental to plant growth; pH value of 5.4 to 7.0.

2.2 SEED MIXTURE

A. Furnish materials in accordance with South Carolina Board of Agriculture rules and regulations as specified in Section 810 of SCDOT Standard Specifications.

1. Piedmont Region:

<table>
<thead>
<tr>
<th>Seed Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall fescue</td>
<td>80 lbs/acre</td>
</tr>
<tr>
<td>Sericea lespedeza</td>
<td>20 lbs/acre</td>
</tr>
<tr>
<td>Kobe lespedeza</td>
<td>10 lbs/acre</td>
</tr>
</tbody>
</table>

2.3 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: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis. When test is not available, use 10-10-10 mixture of Nitrogen, phosphoric acid, and soluble potash.
C. Lime: ASTM C602, Class T or Class O agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

E. Erosion Fabric: Jute matting, open weave.

F. Herbicide: As required to combat type of weeds encountered.

G. Stakes: Softwood lumber, chisel pointed.

H. String: Inorganic fiber.

PART 3 EXECUTION

3.1 EXAMINATION

A. Administrative Requirements: Verification of existing conditions before starting Work.

B. Verify prepared soil base and topsoil are ready to receive the Work of this Section.

3.2 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.

B. Apply fertilizer at application rate recommended by soil analysis.

C. Apply after smooth raking of topsoil and prior to roller compaction.

D. Do not apply fertilizer at same time or with same machine used to apply seed.

E. Mix fertilizer thoroughly into upper 2 inches of topsoil.

F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Apply seed evenly in two intersecting directions at the rates shown above. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Planting Season:
   1. Piedmont Region:
      a. Fall: August 15 – September 15.
      b. Late Winter: February 15 – March 21.

D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

E. Roll seeded area with roller not exceeding 112 lbs/linear foot.
F. Immediately following seeding and rolling, apply mulch to thickness of 1/8 inch. Maintain clear of shrubs and trees.

G. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.4 HYDROSEEDING

A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at rate of 6 lbs per 1,000 square feet evenly in one pass.

B. Apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.5 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery. Set string height to 12 inches. Space stakes at 5 feet on center.

B. Cover seeded slopes where grade is greater than 3 H:1 V with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36 inch intervals with stakes.

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 6 inches.

3.6 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas showing bare spots.

H. Repair washouts or gullies.
I. Protect seeded areas with warning signs during maintenance period.

3.7 SCHEDULE

A. Lawn Area: Mix Type 1, 4-inch top soil.

B. Pond Slopes: Mix type 2, 4-inch top soil.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fertilizing.
   2. Sod installation.

B. Related Sections:
   1. Section 32 92 19 - Seeding.
   2. Section 32 93 00 - Plants.

1.2 REFERENCES

A. ASTM International:

B. SCDOT Standard Specifications:

C. Turfgrass Producers International:
   1. TPI - Guideline Specifications to Turfgrass Sodding.

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for sod grass species, fertilizer, mulch, and other accessories.

C. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Invoices or proof of purchase to verify quantities specified.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE
A. Sod: Root development capable of supporting its own weight without tearing, when suspended vertically by holding upper two corners.
B. Perform Work in accordance with Section 813 of SCDOT Standard Specifications.
C. Maintain one copy of document on site.

1.7 QUALIFICATIONS

A. Sod Producer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.
B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
B. Deliver sod on pallets. Protect exposed roots from dehydration.
C. Do not deliver more sod than can be laid within 24 hours.

1.9 MAINTENANCE SERVICE

A. Maintain sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition for three cuttings.

PART 2 PRODUCTS

2.1 GENERAL

A. Furnish materials in accordance with South Carolina Board of Agriculture rules and regulations as specified in Section 813 of SCDOT Standard Specifications.

2.2 TOPSOIL MATERIALS

A. Conform to Section 32 91 19. Topsoil: Original surface soil typical of the area, which is capable of supporting native plant growth; free of large stones, roots, waste, debris, contamination, or other unsuitable material, which may be detrimental to plant growth; pH value of 5.4 to 7.0.

2.3 SOD

A. Sod: TPI defined Field grown; cultivated grass sod; type indicated below; with strong fibrous root system, free of stones, burned or bare spots; containing no more than five weeds per 1,000 square feet.

<table>
<thead>
<tr>
<th>Cool Season Grasses</th>
<th>Varieties</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky Bluegrass Blend</td>
<td>Adventure, Brookston,</td>
<td>Mountain</td>
</tr>
<tr>
<td>Tall Fescue Blend</td>
<td>Falcon, Finelawn, Galway,</td>
<td>Mountain and Piedmont</td>
</tr>
<tr>
<td>Warm Season Grasses</td>
<td>Varieties</td>
<td>Region</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Hybrid Bermuda Grass</td>
<td>Vamont, Tifway, Tifway II, Tifgreen</td>
<td>Piedmont and Coastal Plain</td>
</tr>
<tr>
<td>Zoysia Grass</td>
<td>Emerald, Meyer</td>
<td>Piedmont and Coastal Plain</td>
</tr>
<tr>
<td>Centipede Grass</td>
<td></td>
<td>Piedmont and Coastal Plain</td>
</tr>
<tr>
<td>St. Augustine Grass</td>
<td>Raleigh</td>
<td>Piedmont and Coastal Plain</td>
</tr>
</tbody>
</table>

2.4 ACCESSORIES

A. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis. When test is not available, use 10-10-10 mixture of Nitrogen, phosphoric acid, and soluble potash.

B. Lime: ASTM C602, Class T or Class O agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

C. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.

D. Herbicide: As required to combat type of weeds encountered.

E. String: Inorganic fiber.

F. Wood Pegs: Softwood, sufficient size and length to anchor sod on slope.

G. Surface Mesh: Interwoven hexagonal plastic mesh of 2 inch size.

2.5 HARVESTING SOD

A. Machine cut sod and load on pallets in accordance with TPI guidelines.

B. Cut sod in area not exceeding 1 sq yd, with minimum 1/2 inch and maximum 1 inch topsoil base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base and topsoil are ready to receive the Work of this Section.

3.2 FERTILIZING
A. Apply lime at the application rate recommended by topsoil analysis or 2 tons per acre (100 pounds per 1000 square feet). Work lime into top 6 inches of soil.

B. Apply fertilizer at application rate recommended by soil analysis or 1,000 lbs per acre (25 pounds per 1,000 square feet) of 10-10-10 fertilizer in fall or 5-10-10 fertilizer in spring.

C. Apply after smooth raking of topsoil and prior to roller compaction.

D. Do not apply fertilizer at same time sod is applied.

E. Mix fertilizer thoroughly into upper 2 inches of topsoil.

F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod within 48 hours of being cut and within 24 hours after topsoil is prepared and fertilized.

C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.

D. Lay smooth. Align with adjoining grass areas.

E. Place top elevation of sod 1/2 inch below adjoining paving.

F. On slopes 6 inches per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. When using "big roll", lay sod parallel to slope. Drive pegs flush with soil portion of sod.

G. Do not place sod when temperature is lower than 32 degrees F.

H. Prior to placing sod, on slopes exceeding 8 inches per foot or where indicated, place surface mesh over topsoil. Securely anchor mesh in place with wood pegs sunk firmly into ground.

I. Water sodded areas immediately after installation. Saturate soil to 4 inches.

J. After sod and soil have dried, roll sodded areas to bond sod to soil and to remove minor depressions and irregularities. Roll sodded areas with roller not exceeding 112 pounds.

K. Roll before first watering.

3.4 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.
C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas showing bare spots.

H. Repair washouts or gullies.

I. Protect sodded areas with warning signs during maintenance period.

3.5 SCHEDULE

A. Lawn Area: Sod Type 1, 4-inch top soil.

B. Pond Slopes: Sod Type 2, 4-inch top soil.

END OF SECTION
SECTION 32 93 00
PLANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Trees, plants, and ground cover.
   2. Mulch.
   3. Fertilizer.
   4. Pruning.
   5. Maintenance.

B. Related Sections:
   1. Section 32 91 19 - Landscape Grading: Preparation and placement of topsoil in preparation for the Work of this Section.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices.
   2. ANSI Z60.1 - Nursery Stock.

B. National Arborist Association:
   1. NAA - Certification documentation for tree pruning Qualifications.

C. SCDOT Standard Specifications:

1.3 DEFINITIONS


B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit list of plant material sources, data for fertilizer and other accessories.

C. Submit minimum 10 ounce sample of mulch.

D. Planting Schedule: Indicate dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from Date of Substantial Completion.
E. Operation and Maintenance Data: Include maintenance instructions recommending procedures to be established by Owner for maintenance of landscape work during one full year.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include pruning objectives, types and methods; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Tree Pruning: ANSI A300 Pruning Standards for Woody Plants.

B. Perform Work in accordance with Section 811 of SCDOT Standard Specifications.

C. Maintain one copy of document on site.

1.7 QUALIFICATIONS

A. Nursery: Company specializing in growing and cultivating plants with 3 years documented experience.

B. Installer: Company specializing in installing and planting plants 5 years documented experience.

C. Tree Pruner: Company specializing in performing work of this Section with person certified by National Arborist Association.

D. Maintenance Services: Performed by installer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Protect and maintain plant life until planted.

D. Deliver plant life materials immediately prior to placement. Keep plants moist.

E. Plant material damaged as a result of delivery, storage or handling will be rejected.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

C. Do not install plant life when wind velocity exceeds 30 mph.
1.10 COORDINATION
A. Administrative Requirements: Requirements for coordination.

1.11 WARRANTY
A. Furnish one year warranty for trees, plants and ground cover.

B. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.12 MAINTENANCE SERVICE
A. Maintain plant life immediately after placement until plants are well established and exhibit vigorous growing condition.

PART 2 PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER
A. Planting Stock:
1. Species: In accordance with Standardized Plant Names, official code of American Joint Committee on Horticulture Nomenclature.
2. Identification: Label individual plants or each bundle of plants when tied in bundles.
3. Plants: No. 1 Grade conforming to “American Standard for Nursery Stock” of American Association of Nurserymen (AAN); well-branched, vigorous and balanced root and top growth; free from disease, injurious insects, mechanical wounds, broken branches, decay and other defects.
4. Trees: Furnish with reasonably straight trunks, well balanced tops, and single leader.
5. Deciduous Plants: Furnish in dormant state, except those specified as container grown.

B. Trees, Plants, and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SOIL MATERIALS
A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0; organic matter to exceed 1.5%, magnesium to exceed 100 units; phosphorus to exceed 150 units; potassium to exceed 120 units; soluble salts/conductivity not to exceed 900 ppm/0.9 mmhos/cm in soil.

B. Plant Soil Mix: Uniform mixture of 1 part peat and 3 parts topsoil by volume.

2.3 SOIL AMENDMENT MATERIALS
A. When soil tests indicate soil amendment, apply soil conditioners or fertilizers to amend soil to specified conditions.
1. Tree Fertilizer: Containing 50 percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis or as shown on Drawings.
B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.

D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

E. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of plants.

2.4 MULCH MATERIALS

A. Mulching Material: Composted, shredded hardwood bark, dark brown in color.

2.5 ACCESSORIES

A. Wrapping Materials: Burlap.

B. Stakes: Softwood lumber, pointed end. Mild steel angle, galvanized, pointed end.

C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared subsoil and planters are ready to receive work.

C. Saturate soil with water to test drainage.

3.2 PREPARATION OF SUBSOIL AND TOPSOIL

A. Conform to Section 32 19 91.

3.3 PLANTING

A. Place plants for best appearance.

B. Set plants vertical.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared plant mix, at minimum depth as indicated on Drawings under each plant. Loosen and remove burlap, ropes, and wires, from top half of root ball.

F. Saturate soil with water when pit or bed is half full of topsoil and again when full.

3.4 PLANT RELOCATION AND RE-PLANTING
A. Relocate plants as indicated on Drawings or directed by Engineer.
B. Ball or pot removed plants when temporary relocation is required.
C. Replant plants in pits or beds, as described for new plants above.

3.5 PLANT SUPPORT
A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

<table>
<thead>
<tr>
<th>Tree Caliper</th>
<th>Tree Support Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>1 stake with one tie</td>
</tr>
<tr>
<td>1 – 2 inches</td>
<td>2 stakes with two ties</td>
</tr>
<tr>
<td>2 – 4 inches</td>
<td>3 guy wires with eye bolts and turn buckles</td>
</tr>
<tr>
<td>Over 4 inches</td>
<td>4 guy wires with eye bolts and turn buckles</td>
</tr>
</tbody>
</table>

3.6 TREE PRUNING
A. When pruning trees is required, lightly prune trees in accordance with ANSI A300 Maintenance Pruning Type: Crown Cleaning.

3.7 FIELD QUALITY CONTROL
A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
B. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.8 SCHEDULE
A. Plant Schedule:

<table>
<thead>
<tr>
<th>Key</th>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Size Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-1</td>
<td>Betula Papyrifera</td>
<td>Paper Birch</td>
<td>Height: 4 - 5 feet</td>
<td>Balled and Burlapped</td>
</tr>
<tr>
<td>T-2</td>
<td>Citrus Aurantium</td>
<td>Sour Orange</td>
<td>Caliper: 3/8 - 1/2 inch</td>
<td></td>
</tr>
<tr>
<td>S-1</td>
<td>Juniperus Chinensis</td>
<td>Pfitzer's Juniper</td>
<td>Spread: 24 - 30 inches</td>
<td>Balled and Burlapped</td>
</tr>
<tr>
<td></td>
<td>&quot;Pfitzeriana&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-2</td>
<td>Juniperus Sabina</td>
<td>Tamarix Juniper</td>
<td>Spread: 18 - 24 inches</td>
<td>Balled and Burlapped</td>
</tr>
<tr>
<td></td>
<td>Tamariscifolia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-1</td>
<td>Euonymus Fortunii</td>
<td>Winter Creeper</td>
<td>Pot: 2-1/4 inch minimum</td>
<td>Minimum Runner Length - 8 inches</td>
</tr>
<tr>
<td></td>
<td>Cultivars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G-2</td>
<td>Pachysandra Terminalis</td>
<td>Japanese Spirge</td>
<td>3 stems</td>
<td></td>
</tr>
</tbody>
</table>
END OF SECTION
SECTION 33 01 32
SEWER AND MANHOLE TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gravity Sewer Testing:
      a. Low-pressure Air Test.
      b. Exfiltration Test.
      c. Infiltration Test.
   3. Manhole Testing:
      a. Vacuum Test.
      b. Exfiltration Test.

B. Related Sections:
   1. Section 33 05 14 - Utility Manholes and Structures.
   2. Section 33 31 00 - Sanitary Utility Sewerage Piping.
   3. Section 33 41 00 - Storm Utility Drainage Piping.

1.2 REFERENCES

A. ASTM International:
   2. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
   3. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit the following prior to start of testing:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   5. Certification of test gauge calibration.
   6. Deflection mandrel drawings and calculations.

C. Test Reports: Indicate results of manhole and piping tests.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that manholes and piping are ready for testing.

B. Verify trenches are backfilled.

C. Verify pressure piping concrete reaction support blocking or mechanical restraint system is installed.

3.2 PIPING PREPARATION

A. Flush and clean piping.

B. Assist Engineer in lamping gravity piping.
   1. Engineer will perform lamping operation by shining light at one end of each pipe section between manholes; observe light at other end; reject pipe not installed with uniform line and grade
   2. Remove and reinstall rejected pipe sections; re-clean and assist engineer with re-lamping.

C. Plug outlets, wye-branches, and laterals; brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Notify Engineer 72 hours in advance of tests and have witness tests.

3.4 TESTING GRAVITY SEWER PIPING

A. Low-pressure Air Test:
   1. Perform test in accordance with applicable portions of ASTM 828 and ASTM 924.
   2. Test each section of gravity sewer piping between manholes.
   3. Introduce air pressure slowly to approximately 4 psig.
   4. Determine groundwater elevation above spring line of pipe. For every foot of groundwater above spring line of pipe, increase starting air test pressure by 0.43 psig; do not increase pressure above 10 psig.
   5. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or increased test pressure as determined above when groundwater is present. Start test.
   6. Determine test duration for sewer section with single pipe size from the following table. Do not make allowance for laterals.

<table>
<thead>
<tr>
<th>Nominal Pipe Size (inches)</th>
<th>Minimum Test Time (min/100 feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.2</td>
</tr>
<tr>
<td>4</td>
<td>0.3</td>
</tr>
<tr>
<td>6</td>
<td>0.7</td>
</tr>
<tr>
<td>8</td>
<td>1.2</td>
</tr>
<tr>
<td>10</td>
<td>1.5</td>
</tr>
<tr>
<td>12</td>
<td>1.8</td>
</tr>
<tr>
<td>15</td>
<td>2.1</td>
</tr>
<tr>
<td>18</td>
<td>2.4</td>
</tr>
<tr>
<td>21</td>
<td>3.0</td>
</tr>
<tr>
<td>24</td>
<td>3.6</td>
</tr>
<tr>
<td>27</td>
<td>4.2</td>
</tr>
</tbody>
</table>
7. Record drop in pressure during test period; when air pressure has dropped more than 1.0 psig during test period, piping has failed; when 1.0 psig air pressure drop has not occurred during test period, discontinue test and piping is accepted.

8. When piping fails, determine source of air leakage, make corrections and retest; test section in incremental stages until leaks are isolated; after leaks are repaired, retest entire section between manholes.

B. Exfiltration Test:
1. Test pipe larger than 36 inch diameter with exfiltration test not exceeding 100 gallons for each inch of pipe diameter for each mile per day for each section under test. Perform test with minimum positive head of 2 feet.

C. Infiltration Test:
1. Use only when gravity piping is submerged in groundwater minimum of 4 feet above crown of pipe for entire length being tested.
2. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter for each mile per day for section under test; include allowances for leakage from manholes. Perform test with minimum positive head of 2 feet.

3.5 DEFLECTION TESTING OF PLASTIC PIPING
A. Perform vertical ring deflection testing on PVC and ABS sewer piping after backfilling has been in place for at least 30 days but not longer than 12 months.

B. Allowable maximum deflection for installed plastic sewer pipe is limited to 5 percent of original vertical internal diameter.

C. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe as determined by ASTM standard to which pipe is manufactured. Measure pipe in compliance with ASTM D2122.

D. Perform deflection testing using properly sized rigid ball or ‘Go, No-Go’ mandrel.

E. Perform test without mechanical pulling devices.

F. Locate, excavate, replace, and retest pipe exceeding allowable deflection.

3.6 TESTING MANHOLES
A. General: Test using air whenever possible prior to backfilling to assist in locating leaks. Make joint repairs on both outside and inside of joint to ensure permanent seal. Test manholes with manhole frame set in place.

B. Vacuum test in accordance with ASTM C1244 and as follows:
1. Plug pipe openings; securely brace plugs and pipe.
2. Inflate compression band to affect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.
3. Determine test duration for manhole from the following table:

<table>
<thead>
<tr>
<th>Manhole Diameter</th>
<th>Test Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>4.8</td>
</tr>
<tr>
<td>33</td>
<td>5.4</td>
</tr>
<tr>
<td>36</td>
<td>6.0</td>
</tr>
</tbody>
</table>
4. Record vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.

5. When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.

C. Exfiltration Test:
1. Plug pipes in manhole; remove water in manhole; observe plugs over period of not less than 2 hours to ensure there is no leakage into manhole.
2. Determine groundwater level outside manhole.
3. Fill manhole with water to within 4 inches of top of cover frame. Prior to test, allow manhole to soak from minimum of 4 hours to maximum of 72 hours; after soak period, adjust water level inside manhole to within 4 inches of top of cover frame.
4. Measure water level from top of manhole frame; at end of 4 hour test period, again measure water level from top of manhole frame; compute drop in water level during test period.
5. Manhole exfiltration test is considered satisfactory when drop in water level is less than values listed in table below:

<table>
<thead>
<tr>
<th>Manhole Depth (feet)</th>
<th>Allowable Leakage (Inches for Manhole Diameter)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 feet</td>
</tr>
<tr>
<td>4</td>
<td>0.11</td>
</tr>
<tr>
<td>6</td>
<td>0.17</td>
</tr>
<tr>
<td>8</td>
<td>0.23</td>
</tr>
<tr>
<td>10</td>
<td>0.28</td>
</tr>
<tr>
<td>12</td>
<td>0.34</td>
</tr>
<tr>
<td>14</td>
<td>0.40</td>
</tr>
<tr>
<td>16</td>
<td>0.45</td>
</tr>
<tr>
<td>18</td>
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6. When unsatisfactory test results are achieved, repair manhole and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipeline flushing and cleaning.
2. TV inspection of sewer pipelines.
3. Audio-video taping of pipeline interior.

B. Related Sections:
1. Section 33 31 00 - Sanitary Utility Sewerage Piping.

1.2 REFERENCES

A. Electronics Industries Association (EIA).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit completed tape cassettes, identified by tape number, project name, street name, right-of-way property name, and manhole numbers.

C. Tapes become property of Owner.

D. Submit cleaning and television inspection logs for each section of sewer line to be rehabilitated and three copies of color videotapes for work performed. Include the following as minimum information: stationing and location of lateral services, wyes or tees, clock references, pipe joints, infiltration/inflow defects, cracks, leaks, offset joints, and other information required to assess condition of sewer.

E. Submit a specific, detailed description of proposed bypass pumping system to include written description of plan and addressing quantity, capacity, and location of pumping equipment. Submit spill plan to address any spills that might occur.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with local agency having jurisdiction.

B. Use cameras with video output capable of producing minimum of 600 lines of horizontal resolution at center; optimum imagery with minimum illumination; and meet requirements of EIA Standard Video Signal.

1.5 QUALIFICATIONS

A. Applicator: Company specializing in performing work of this Section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 DVD
A. Audio track containing simultaneously recorded narrative commentary and evaluations of operator describing in detail condition of pipeline interior.

PART 3 EXECUTION

3.1 PREPARATION

A. Flush and clean pipeline interiors to remove sludge, dirt, sand, stone, grease, and other materials from pipe to ensure clear view of interior conditions.

B. Intercept flushed debris at next downstream manhole by use of weir or screening device; remove and dispose of debris off site.

C. Furnish materials, labor, equipment, power, and maintenance to implement a temporary bypass pumping system around work area for time required to complete TV inspection.

3.2 APPLICATION

A. Closed-Circuit TV Camera System:
   1. Utilize cameras specifically designed and constructed for closed-circuit sewer line inspection. Utilize camera equipment with pan and tilt capability to view each lateral connection at multiple angles.
   2. Utilize camera capable of moving upstream and downstream; minimum 1,000 feet horizontal distance with one setup; direct reading cable position meter.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Pipeline Inspection:
   1. Audio-video sections of sewer pipeline between manholes designated.
   2. Identify and record locations of flat grades, dips, deflected joints, open joints, broken pipe, protrusions into pipeline, and points of infiltration.
   3. Locate and record service connections.
   4. Record locations of pipeline defects and connection horizontal distance, in feet, and direction from manholes.
   5. Video with pipe section plugged as to view 100 percent of inside pipe diameter; use flow control methods as specified for bypass pumping system to eliminate surcharging and reduce flow.

END OF SECTION
SECTION 33 05 14
UTILITY MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Precast reinforced concrete manholes and structures with tongue-and-groove joints with masonry transition to frames, lids, grates, anchorage, and accessories.
   2. Masonry manhole and structure sections with masonry transition to frames, lids, grates, anchorage, and accessories.
   3. Cast-in-place concrete manholes and structures with masonry transition to frames, lids, grates, covers, anchorage, and accessories.
   4. Structure connections to existing public utility lines.
   5. Bedding and backfill materials.

B. Related Sections:
   2. Section 33 01 32 - Sewer and Manhole Testing.
   5. Section 33 41 13 - Storm Utility Drainage Piping: Connections to inlets, catch basins, manholes, and structures.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

B. ASTM International:
   2. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Solid Masonry Units Made From Clay or Shale).
   7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
   9. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures.

C. National Precast Concrete Association:
1. NPCA Quality Control Manual for Precast Plants.
2. NPCA Plant Certification Program.

D. SCDOT Standard Specifications:

1.3 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Shop Drawings:
   1. Standard Fabrication: Indicate structure locations, elevations, sections, equipment support, piping sizes, and elevations of penetrations.
   2. Custom Fabrication: Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings for each custom type, size and configuration.
C. Product Data: Submit manhole frames and lids, accessories, component construction, features, configuration, dimensions, and joint data.
D. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.
E. Project Record Documents: Record actual locations of manholes and structures with rim and invert elevations.
F. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 QUALITY ASSURANCE
A. Obtain precast concrete utility structures from single source.
B. Perform Work in accordance with Section 719 of SCDOT Standard Specifications.
C. Maintain one copy of document on site.

1.5 QUALIFICATIONS
A. Manufacturer: Certified by NPCA Plant Certification Program prior to and during Work of this section.
B. Installer: Company specializing in performing work of this Section with minimum five years experience.
C. Design custom utility structures under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Project location.

1.6 DELIVERY, STORAGE AND HANDLING
A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer’s instructions and ASTM C913 for unloading, storing and moving precast manholes and drainage structures.

C. Store precast concrete manholes and drainage structures to prevent damage to Owner’s property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer and identifying symbols, and numbers shown on Drawings to indicate its intended use.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Masonry Work: Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Cold Weather Requirements: ACI 530/530.1.

PART 2 PRODUCTS

2.1 PRECAST REINFORCED MANHOLES AND STRUCTURES

A. Precast Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478.


2. Joints for Precast Manholes and Structures for Other Utility uses: Butyl rubber gaskets in accordance with ASTM C990.

2.2 MASONRY CONSTRUCTION

A. Concrete Brick: ASTM C55, Grade S, Type II - Non-moisture controlled; except that the absorption of brick shall not exceed 10 lbs / cubic foot.

B. Clay or Shale Brick: ASTM C32, Grade SW, solid units.

C. Mortar: Conform to Division 700 of SCDOT Standard Specifications proportioned as described below. Do not add more water than is necessary to make a workable mixture.

1. Mix No. 1: 1 part Portland cement, 1/4 part hydrated lime, 3-3/4 parts mortar sand (maximum).

2. Mix No. 2: 1 part Portland cement, 1 part masonry cement, 6 parts mortar sand (maximum).

D. Grout: Non-shrink, non-metallic in accordance with Division 700 of SCDOT Standard Specifications with a compressive strength of at least 5,000 psi at 3 days.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete: Class A Concrete conforming to Division 700 of the SCDOT Standard Specifications.

1. Compressive strength of 3,000 psi at 28 days.
2. Air entrained.
3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

2.4 FRAMES AND COVERS

A. Product Description: Grey cast iron ASTM A48, Class 30B; size and shape as indicated on Drawings. Live load rating of HS 20 in paved areas.

2.5 CONFIGURATION

A. Provide size and shape as indicated on Drawings.

B. Foundation Slab: Cast-in-place or precast reinforced concrete integral with bottom section, level top surface.

2.6 ACCESSORIES

A. Steps: Conform to ASTM C-478 and current OSHA Regulations, minimum 12 inches wide spaced vertically 16 inches on center, made of copolymer polypropylene plastic encapsulating ½” grade 60 steel reinforcement. Vertical load resistance of 400 lbs and minimum pull-out resistance of 1000 lbs.

B. Strap Anchors: Stainless steel capable of supporting pipe or accessories indicated on Drawings, minimum 1 inch wide x 1/8 inch thick.

C. Geotextile Filter Fabric: Type 1 Engineering fabric in accordance with Section 804 of SCDOT Standard Specifications; non-woven, needle punched, non-biodegradable, and rot-proof.

D. Bituminous Interior Manhole Coating:
   1. Manufacturers:
      a. Bitumastic.
      b. Beazer East, Inc.
      c. Substitutions: Equal per Section 01 60 00 - Product Requirements.

E. Watertight Polyethylene Manhole Insert:
   1. Manufacturers:
      a. Parsons.
      b. Substitutions: Equal per Section 01 60 00 - Product Requirements.

2.7 BEDDING AND BACKFILL MATERIALS

A. Bedding: Clean course aggregate Gradation No. 57 conforming to Division 700 and 800 of the SCDOT Standard Specifications.

B. Backfill around Structures: As specified in Section 31 23 17 -Trenching.

PART 3 EXECUTION
3.1 EXAMINATION
A. Verify items provided by other Sections of Work are properly sized and located.
B. Verify built-in items are in proper location and ready for roughing into Work.
C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION
A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.
B. Do not install manholes and structures where site conditions induce loads exceeding structural capacity of manholes or structures.
C. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify manholes and structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION – GENERAL
A. Excavation and Backfill:
   1. Excavate and backfill for manholes and structures in accordance with Section 31 23 17 in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations, backfill, and placement of geotextile filter fabric if required.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.
   3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.
B. Place foundation slab, trowel top surface level.
C. Place precast manhole sections plumb and level, trim to correct elevations, anchor to foundation slab.
D. As Work progresses, install steps and other fabricated metal items.
E. Install cast-in-place manholes and structures supported at proper grade and alignment as shown on Drawings.
F. Cut pipe to connect to structure as indicated on Drawings.
G. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.
H. Set cover frames and covers level without tipping, to correct elevations.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION
A. Install underground precast utility structures in accordance with ASTM C891.
B. Lift precast manholes and structures at lifting points designated by manufacturer.
C. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

D. Set precast manholes and structures bearing firmly and fully on stone bedding, 8-inch minimum thickness, compacted to 95 percent maximum density per Section 31 23 17 or on other support system shown on Drawings.

E. Assemble multi-section manholes and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer’s recommendations. Lower, set level, and firmly position base section before placing additional sections.

F. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

G. Joint sealing materials may be installed on site or at manufacturer’s plant.

H. Verify manholes and structures installed satisfy required alignment and grade.

I. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with non-shrink grout.

3.5 MASONRY MANHOLE AND STRUCTURE INSTALLATION

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Lay masonry units in running bond. Course one unit and one mortar joint to equal 8 inches.

C. Form flush mortar joints.

D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other Work.

E. Install joint reinforcement 16 inches on center.

F. Place joint reinforcement in first and second horizontal joints above base pad and below cover frame opening.

3.6 CAST-IN-PLACE CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Prepare crushed stone bedding or other support system shown on Drawings to receive foundation slab as specified for precast manholes and structures.

B. Erect and brace forms against movement in accordance with Section 719 of SCDOT Standard Specifications.

C. Install reinforcing steel as indicated on Drawings and in accordance with Section 719 of SCDOT Standard Specifications.

D. Place and cure concrete in accordance with Section 719 of SCDOT Standard Specifications.
3.7 CONNECTION TO EXISTING SEWER WITH MANHOLE

A. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.

B. Carefully excavate around existing sewer line to adequate depth for foundation slab installation. Protect existing pipe from damage. Cut out soft spots and replace with granular fill compacted to 95 percent maximum dry density per Section 31 23 17.

C. Prepare crushed stone bedding or other support system shown on Drawings, to receive foundation slab as specified for precast manholes and structures.

D. Install manhole or structure around existing pipe in accordance with the appropriate paragraphs specified herein.

E. Block upstream flow at existing manhole or structure with expandable plug.

F. If flow is excessive, pump flow around new manhole to existing downstream manhole.

G. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up the outside diameter on each side of the pipe. Bottom half of pipe shall remain as manhole flow channel. Saw cut to have a smooth finish with top half of pipe flush with interior of manhole or structure.

3.8 SANITARY MANHOLE DROP CONNECTIONS

A. Construct drop connections into sanitary manholes in accordance with Drawings.

B. Concrete encase pipe drop connection to minimum of 2 feet outside of manhole.

C. Form channel from pipe drop to sweep into main channel at maximum angle of 45 degrees.

3.9 CASTINGS INSTALLATION

A. Set frames using mortar and masonry as indicated on Drawings. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Do not install more than 3 courses of brick or more than 12 inches of masonry.

3.10 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform soil compaction tests in accordance with Section 31 23 17.

C. Perform hydrostatic tests in accordance with Section 33 01 32.
   1. Notify Engineer 72 hours in advance of test and have witness test.

D. Test cast-in-place concrete in accordance with ASTM C39.

E. Test concrete manhole and structure sections in accordance with ASTM C497.
F. Vertical Adjustment of Existing Manholes and Structures:
   1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
   2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
   3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on Drawings.

END OF SECTION
SECTION 33 05 17
PRECAST CONCRETE VALVE VAULTS AND METER BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Precast concrete valve vaults.
   2. Precast concrete meter boxes.

B. Related Sections:
   1. Section 31 23 17 – Trenching: Excavating and backfilling for vaults and meter boxes.
   2. Section 33 11 13 - Water Utility Distribution Piping: Connections to valve and meter vaults.

1.2 REFERENCES

A. ASTM International:
   4. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
   5. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

B. SCDOT Standard Specifications:

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawing: Indicate plan, location and inverts of connecting piping.

C. Product Data: Submit data on valve vaults and meter boxes.

D. Manufacturer’s Certificates: Submit Statement of Compliance and supporting data from materials suppliers attesting that precast concrete valve vaults and meter boxes provided meet or exceed ASTM Standards and specification requirements.

E. Manufacturer’s Installation Instructions: Submit special procedures for precast concrete valve vaults and meter boxes installation.

1.4 CLOSEOUT SUBMITTALS
A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations and inverts of buried pipe, components and connections.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Division 700 of SCDOT Standard Specifications.

B. Maintain one copy of document on site.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Transport and handle precast concrete units with equipment designed to protect units from damage.

C. Do not place concrete units in position to cause overstress, warp or twist.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE VALVES AND METER BOXES

A. Precast Sections: Reinforced precast concrete in accordance with ASTM C478.
   2. Joints: Butyl rubber gaskets in accordance with ASTM C990.

2.2 FRAMES AND COVERS

A. Product Description: Grey cast iron ASTM A48/A48M, Class 30B; size and shape as indicated on Drawings. Live load rating of HS 20 in paved areas.

2.3 CONFIGURATION

A. Provide size and shape as indicated on Drawings.

B. Foundation Slab: Cast-in-place or precast reinforced concrete integral with bottom section, level top surface.

2.4 ACCESSORIES

A. Steps: Conform to local agency requirements, minimum 12 inches wide spaced vertically 16 inches on center.

B. Strap Anchors: Stainless steel capable of supporting pipe or accessories indicated on Drawings, minimum 1 inch wide x 1/8 inch thick.

C. Geotextile Filter Fabric: Type 1 Engineering fabric in accordance with Division 800 of SCDOT Standard Specifications; non-woven, needle punched, non-biodegradable, and rot-proof.

2.5 BEDDING AND BACKFILL MATERIALS
A. Bedding: Clean course aggregate Gradation No. 57 conforming to Division 700 and 800 of the SCDOT Standard Specifications.

B. Backfill around Structures: As specified in Section 31 23 17 - Trenching.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other Sections of Work are properly sized and located.

B. Verify built-in items are in proper location and ready for roughing into Work.

C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe.

B. Do not install vaults and structures where site conditions induce loads exceeding structural capacity of vaults.

C. Inspect precast concrete vaults immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

A. Excavation and Backfill:
   1. Excavate and backfill for vaults and meter boxes in accordance with Section 31 23 17 in location and to depth shown. Provide clearance around sidewalls of structure for construction operations, backfill, and placement of geotextile filter fabric if required.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place structures in dry trench.
   3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.

B. Place bedding and foundation slab; trowel top surface level if cast-in-place.

C. Install underground precast utility structures in accordance with ASTM C891.

D. Lift precast vaults and structures at lifting points designated by manufacturer.

E. When lowering vaults and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

F. Set precast vaults and structures bearing firmly and fully on stone bedding, 8-inch minimum thickness, compacted to 95 percent maximum density per Section 31 23 17 or on other support system shown on Drawings.

G. Assemble multi-section vaults and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer’s recommendations. Lower, set level, and firmly position base section before placing additional sections.
H. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

I. Joint sealing materials may be installed on site or at manufacturer’s plant.

J. Verify vaults and structures installed satisfy required alignment and grade.

K. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with non-shrink grout.

3.4 CASTINGS INSTALLATION

A. Set frames using mortar and masonry as indicated on Drawings. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Do not install more than 3 courses of brick or more than 12 inches of masonry.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform soil compaction tests in accordance with Section 31 23 17.

C. Perform hydrostatic tests in accordance with Section 33 01 32.
   1. Notify Engineer 72 hours in advance of test and have witness test.

D. Test concrete manhole and structure sections in accordance with ASTM C497.

E. Vertical Adjustment of Existing Structures:
   1. Where required, adjust top elevation of existing vaults and structures to finished grades shown on Drawings.
   2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
   3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on Drawings.

END OF SECTION
SECTION 33 05 19
PRESSURE PIPING TIED JOINT RESTRAINT SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Tied joint restraint system.

B. Related Sections:
   1. Section 31 23 17 – Trenching: Excavation and backfill for Work of this Section.
   2. Section 33 11 16 - Water Utility Distribution Piping: Pipe to be restrained.
   3. Section 33 34 00 - Sanitary Utility Sewerage force Mains: Pipe to be restrained.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI B1.1 - Unified Inch Screw Threads.

B. ASTM International (ASTM):
   3. ASTM A143 - Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
   5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   8. ASTM A588 - Specification for High Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick.

1.3 DESIGN REQUIREMENTS

A. Provide pressure pipeline with restrained joints at bends, tees, and changes in direction.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate restrained joint details and materials being utilized. Submit layout drawings showing piece numbers and locations. Also, indicate restrained joint locations.

C. Product Data: Submit catalog data for restrained joint details and installation instructions.

D. Design Data: Submit design calculations showing determination of restrained lengths and submit joint restraint details. Use joint restraint devices specifically designed for applications described in manufacturer’s data.
E. Manufacturer's Installation Instructions: Submit installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Project Record Documents: Record actual locations of joint restraints.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years experience.

B. Installer: Company specializing in performing work of this Section with minimum 3 years documented experience.

PART 2 PRODUCTS

2.1 TIED JOINT RESTRAINT SYSTEM

A. Manufacturers:
   1. Dresser Piping Specialties.
   2. Ebaa Iron Sales, Inc.
   3. Star Pipe Products, Inc.
   4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Steel Types:
   1. High Strength Low-Alloy Steel, ASTM A588, heat-treated.
   2. High Strength Low-Alloy Steel, ASTM A588.
   3. Carbon Steel ASTM A36.

2.3 COMPONENTS

A. Tie Bolts:
   1. 5/8 inch for 2 inch and 3 inch mechanical joints, ¾ inch for 4 inch to 12 inch mechanical joints and flanged joints, ASTM A588, Grade B; ASTM A325, Type 3, except increase tensile strength of full-body threaded section to 40,000 pounds minimum for 5/8 inch and 60,000 pounds minimum for ¾ inch by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.
   2. ¾ inch for 14 inch to 24 inch mechanical joints, ASTM A588, Grade B; ASTM A325, Type 3.
   3. 1 inch for 30 inches and larger mechanical joints and flanged joints, ASTM A588, Grade B; ASTM A325, Type 3; except increase tensile strength of full-body thread section to 100,000 pounds minimum by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

B. Tie Nut: Hex nut for each tie bolt and tie rods; ASTM A563, Grade C3; plain, zinc plated, or galvanized.

C. Tiepin: ¾ inch round bar stock for use on bends and hydrants, 6-inch hairpin shape, ASTM A588; ANSI B1.1; plain, zinc plated, or galvanized.

D. Tie Coupling: Used to extend continuous threaded rods and provided with center stop to aid installation; ASTM A588; plain, zinc plated, or galvanized.
E. Tie Clamp: Retainer clamp for ductile iron, asbestos cement and polyvinyl chloride, push-on pipe in front of bell; ASTM A36; ASTM A307; ASTM A563, Grade A; plain, zinc plated, or galvanized.

F. Tie Rod: Continuous threaded rod for cutting to desired lengths; ASTM A588, Grade B; ASTM A325, Type 3; ANSI B1.1; plain zinc plated, or galvanized.

G. Tie Bar: Steel bar used to restrain push-in plugs; ASTM A36; plain, zinc plated, or galvanized.

H. Tie Washer: Round flat washers; ASTM A588, ASTM F436, Type 3; plain, zinc plated, or galvanized.

2.4 FACTORY APPLIED FINISHES – STEEL

A. Items to be zinc plated or galvanized to meet the following requirements:
   1. ASTM B633 for electrodeposited coating of zinc on steel.
   2. ASTM A153 for galvanizing iron and steel hardware.
   3. Galvanizing for rolled, pressed, and forged steel shapes: ASTM A123; minimum 2.0 ounces per square foot coating thickness; galvanize after fabrication.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify pipe and fittings are ready to receive work.

B. Field measure and verify conditions.

C. Clean surfaces of pipe and fittings to receive tied joint restraint system.

3.2 INSTALLATION

A. Excavate and Backfill in accordance with Section 31 23 17.

B. Install pipe and fittings in accordance with [Section 33 11 16.] [and] [Section 33 34 00].

C. Install joint restraint system so joints are mechanically locked together to prevent joint separation.

3.3 ERECTION TOLERANCES

A. Torque nuts on mating threaded fasteners to 45-foot pounds to 60-foot pounds for 5/8 inch nut.

B. Torque nuts on mating threaded fasteners to 75-foot pounds to 90-foot pounds for 3/4 inch nut.

C. Torque 1 inch nuts to 100-foot pounds to 120-foot pounds.

END OF SECTION
SECTION 33 05 23
TRENCHLESS UTILITY INSTALLATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation and backfill for approach trenches and pits.
   2. Excavation for Casing pipe.
   3. Carrier pipe.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 31 23 17 - Trenching: Excavating and backfilling access pits.
   3. Section 33 01 32 - Sewer and Manhole Testing.
   5. Section 33 13 00 - Disinfecting of Water Utility Distribution.
   6. Section 33 31 00 - Sanitary Utility Sewerage Piping.
   7. Section 33 34 00 - Sanitary Utility Sewerage Force Mains.
   8. Section 33 41 00 - Storm Utility Drainage Piping.
   9. Section 33 42 13 - Pipe Culverts.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

B. American Railway Engineering and Maintenance-of-Way Association:

C. ASTM International:

D. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

E. National Utility Contractors Association:
   1. NUCA - Pipe Jacking & Microtunneling Design Guide.

F. SCDOT Standard Specifications:

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Prepare scaled shop Drawings to supplement Drawings, signed and sealed by Professional Engineer.
1. Include details of casing, jacking head, sheeting, and other falsework for trenches and pits and support for adjacent facilities, field sketches, and other details to complete the Work.
2. Show relation of proposed installation to adjacent facilities and natural features over installation, angle of installation, right-of-way lines, and general layout of built facilities.
3. Show cross-section or sections from field survey showing installation in relation to actual profile of ground.

C. Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.

D. Installation Plan: Submit description of proposed construction plan, dewatering plan, and plan to establish and maintain vertical and horizontal alignment.

E. Submit emergency response procedures to handle situations when conduit is compromised and jeopardizes integrity of installation or safety.

F. Submit written report results of visual check prior to installation of carrier pipe of entire length of casing or liner, to verify there are no voids or defective joints.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of casing or tunnel liner, carrier pipe, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE


B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum five years documented experience.
1. Work Experience: Include projects of similar magnitude and conditions.
2. Furnish list of references upon request.
1.7 PRE-INSTALLATION MEETINGS
   A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
   B. Convene minimum one week prior to commencing work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING
   A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
   B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
   C. Protect piping and jacking systems from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.
   D. Accept system components on site in manufacturer’s original containers or configuration. Inspect for damage.
   E. Use wooden shipping braces between layers of stacked pipe. Stack piping lengths no more than three layers high.
   F. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60 to 85 degrees F.
   G. Support casing and carrier pipes with nylon slings during handling.

1.9 ENVIRONMENTAL REQUIREMENTS
   A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
   B. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.10 FIELD MEASUREMENTS
   A. Verify invert elevations of existing work prior to excavation and installation of casing or tunnel.

PART 2 PRODUCTS

2.1 CASING AND JACKING PIPE MATERIALS
   A. Steel Casing Pipe: ASTM A53 or ASTM A139, 35,000 psi minimum yield strength, full circumference welded joints in accordance with AWS D1.1 to withstand excavation forces, minimum wall thickness and diameter as shown on the plans or otherwise shown below:
<table>
<thead>
<tr>
<th>CARRIER PIPE</th>
<th>Casing Pipe</th>
<th>Thickness</th>
<th>Recommended Min. Tunnel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>D.O.T.</td>
<td>R.R.</td>
</tr>
<tr>
<td>6-Inch Ductile Iron</td>
<td>14&quot;</td>
<td>.250&quot;</td>
<td>.281&quot;</td>
</tr>
<tr>
<td>8-Inch Ductile Iron</td>
<td>18&quot;</td>
<td>.250&quot;</td>
<td>.281&quot;</td>
</tr>
<tr>
<td>10-Inch Ductile Iron</td>
<td>20&quot;</td>
<td>.250&quot;</td>
<td>.344&quot;</td>
</tr>
<tr>
<td>12-Inch Ductile Iron</td>
<td>22&quot;</td>
<td>.250&quot;</td>
<td>.375&quot;</td>
</tr>
<tr>
<td>16-Inch Ductile Iron</td>
<td>28&quot;</td>
<td>.312&quot;</td>
<td>.469&quot;</td>
</tr>
<tr>
<td>18-Inch Ductile Iron</td>
<td>30&quot;</td>
<td>.312&quot;</td>
<td>.469&quot;</td>
</tr>
<tr>
<td>20-Inch Ductile Iron</td>
<td>32&quot;</td>
<td>.375&quot;</td>
<td>.501&quot;</td>
</tr>
<tr>
<td>24-Inch Ductile Iron</td>
<td>36&quot;</td>
<td>.375&quot;</td>
<td>.532&quot;</td>
</tr>
</tbody>
</table>

2.2 CARRIER PIPE MATERIALS

A. Water Distribution System Piping: As specified in Section 33 11 00.
B. Sanitary Sewage System Piping: As specified in Section 33 31 00.
C. Sanitary Sewage Force Mains Piping: As specified in Section 33 34 00.
D. Storm Drainage Piping: As specified in Section 33 41 00.
E. Pipe Culverts: As specified in Section 33 42 13.

2.3 GROUT AND COVER MATERIALS

A. Soil Backfill for Trench Approaches and Pits to Finish Grade: As specified in Section 33 23 17.
B. Fill and Seal Grout at Pipe Ends: Mortar conforming to Division 700 of SCDOT Standard Specifications proportioned as described below. Do not add more water than is necessary to make a workable mixture.
   1. Mix No. 1: 1 part Portland cement, 1/4 part hydrated lime, 3-3/4 parts mortar sand (maximum).
   2. Mix No. 2: 1 part Portland cement, 1 part masonry cement, 6 parts mortar sand (maximum).
C. Pressure Grout Mix: One part Portland cement and six parts mortar sand mixed with water to consistency applicable for pressure grouting.

2.4 ACCESSORIES

A. Supports and Insulators:
1. Steel and Plastic: 14 gage stainless steel band, 5/16 inch stainless steel flange bolts, heavy duty PVC liner, polyethylene or phenolic skids.

B. Steel Strapping: ASTM A36.

C. Concrete: Class A Concrete conforming to Division 500 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
   4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
   5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify connection to existing piping system size, location, and invert elevations are in accordance with Drawings.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities indicated to remain from damage.

C. Notify utility company to remove and relocate utilities.

D. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Establish minimum separation of from other utility piping in accordance with local code.

3.3 EXCAVATION AND BACKFILL

A. Excavate and backfill in accordance with Section 31 23 17.

3.4 DEWATERING

A. Intercept and divert surface drainage precipitation and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps, or other means.

B. Develop substantially dry subgrade for prosecution of subsequent operations.

C. Comply with State of South Carolina requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.
3.5 EXISTING WORK
A. Maintain access to existing facilities and other remaining active installations requiring access. Modify installation as necessary to maintain access.

3.6 PITS OR APPROACH TRENCHES
A. Excavate approach trenches or pits in accordance with shop drawings and as site conditions require.
B. Ensure casing entrance face as near perpendicular to alignment as conditions permit.
C. Establish vertical entrance face at least 1 foot above top of casing.
D. Install dewatering measures and excavation supports as specified in Section 31 23 17.

3.7 CASING PIPE INSTALLATION
A. Boring:
   1. Push pipe into ground with boring auger rotating within pipe to remove spoil. Do not advance cutting head ahead of casing pipe except for distance necessary to permit cutting teeth to cut clearance for pipe. Arrange machine bore and cutting head to be removable from within pipe. Arrange face of cutting head to provide barrier to free flow of soft material.
   2. When unstable soil is encountered during boring retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.
   3. When voids develop greater than outside diameter of pipe by approximately one inch, grout to fill voids.
   4. When boring is obstructed, abandon boring, relocate jack or tunnel as directed by Engineer.
B. Jacking
   1. Construct adequate thrust wall normal to proposed line of thrust.
   2. Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.
C. Drilling and Jacking
   1. Use oil field type rock roller bit or plate bit made up of individual roller cutter units solidly welded to pipe which is turned and pushed for its entire length by drilling machine to give bit necessary cutting action.
   2. Inject high density slurry (oil field drilling mud) to head as cutter lubricant. Inject slurry at rear of cutter units to prevent jetting action ahead of pipe.
D. Mining and Jacking: Utilize manual handmining excavation from within casing pipe as casing is advanced with jacks, allowing minimum ground standup time ahead of casing pipe.

3.8 PRESSURE GROUTING
A. Pressure grout annular space between casing pipe and surrounding earth.

3.9 CARRIER PIPE INSTALLATION
A. Clean, inspect, and handle pipe in accordance with applicable Section for carrier pipe.
B. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.

C. Support pipeline within casing so no external loads are transmitted to carrier pipe. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.
   1. Use minimum 2 supports per joint of carrier pipe.

D. Grout ends of casing to seal.

3.10 TOLERANCES

A. Do not over cut excavation by more than 1 inch greater than outside diameter of casing pipe.

B. Install casing pipe to vertical and horizontal alignment on Drawings within plus or minus 3 inches prior to installation of carrier pipe.

C. Install pipe bells with minimum 1/2 inch clearance to casing.

3.11 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting and testing.

B. Compaction Testing: As specified in Section 31 23 17.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.12 REMOVAL OF FACILITIES AND CONTROLS

A. Remove temporary facilities for casing installation and jacking operations in accordance with Section 01 50 00 - Temporary Facilities and Controls.

END OF SECTION
SECTION 33 05 24
UTILITY HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation and backfill for approach trenches and pits.
   2. Horizontal directional drilling.
   3. Pipe and accessories.
   4. Testing of Pipe

B. Related Sections:
   1. Section 03 30 10 - Cast-In-Place Concrete.
   2. Section 31 23 15 - Excavation and Fill.
   3. Section 31 23 17 - Trenching: Excavating and backfilling access pits.
   4. Section 33 01 32 - Sewer and Manhole Testing.
   6. Section 33 13 00 - Disinfecting of Water Utility Distribution.
   7. Section 33 31 00 - Sanitary Utility Sewerage Piping.
   8. Section 33 34 00 - Sanitary Utility Sewerage Force Mains.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in.
      for Water Service.

B. ASTM International:
      Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River
      Crossings.

C. National Utility Contractors Association:
   1. NUCA - HDD Installation Guidelines.

1.3 DESIGN REQUIREMENTS

A. Design Criteria:
   1. Drilling Steering System: Remote with continuous electronic monitoring of boring
      depth and location.
   2. Directional Change Capability: 90 degree with 35 foot radius curve.
   3. Minimum distance for single bores and between boring pits:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Boring Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 1-1/2 inches</td>
<td>400 feet</td>
</tr>
<tr>
<td>2 to 2-1/2 inches</td>
<td>350 feet</td>
</tr>
<tr>
<td>3 to 6 inches</td>
<td>300 feet</td>
</tr>
</tbody>
</table>

   4. Ratio of Reaming Diameter to Pipe Outside Diameter:
      a. Nominal Pipe Diameter of 6 Inches and Smaller: 1.5 maximum.
      b. Nominal pipe diameter larger than 6 Inches: Submit recommended ratio
         and reaming procedures for review.
1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Submit technical data for equipment, method of installation, and proposed sequence of construction.
   2. Include information pertaining to pits, dewatering, method of spoils removal, equipment size and capacity, equipment capabilities including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade and detection of surface movement, name plate data for drilling equipment, and mobile spoils removal unit.

C. Product Data:
   1. Identify source of water used for drilling.
   2. Submit copy of approvals and permits for use of water source.

D. Installer Qualifications: Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of pipe and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

D. Record actual depth of pipe at 25 feet intervals.

E. Record actual horizontal location of installed pipe.

F. Show depth and location of abandoned bores.

G. Record depth and location of drill bits and drill stems not removed from bore.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with the following:
   1. NUCA HDD Installation Guidelines.
   2. ASTM F1962.

B. Maintain one copy of documents on site.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing work of this Section with minimum 5 years documented experience.

   1. Work Experience: Include projects of similar scope and conditions.
   2. Furnish list of references upon request.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Provide temporary end caps and closures on piping and fittings until pipe is installed.

C. Protect pipe from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.

D. Accept products on site in manufacturer’s original containers or configuration. Inspect for damage.

E. Use shipping braces between layers of stacked pipe. Stack piping lengths no more than three layers high.

F. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60 to 85 degrees F.

G. Support pipes with nylon slings during handling.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 PRODUCTS

2.1 DRILLING FLUID

A. Drilling Fluid: Liquid bentonite clay slurry; totally inert with no environmental risk.

2.2 PIPE

A. Polyethylene Pipe: AWWA C901 for 160 psig pressure rating:
   1. Fittings: AWWA C901 molded or fabricated.
   2. Joints: Butt fusion.

2.3 FILL MATERIALS

A. Backfill: Excavated subsoil or granular fill per Section 31 23 17.

2.4 WATER SOURCE

A. Water: Potable.

2.5 UNDERGROUND PIPE MARKERS

A. Trace Wire: Electronic detection materials for non-conductive piping products.
   1. Unshielded 10 gage copper wire.
   2. Conductive tape.
2.6 GROUT

A. Fill and Seal Grout at Pipe Ends: Mortar conforming to Division 700 of SCDOT Standard Specifications proportioned as described below. Do not add more water than is necessary to make a workable mixture.
   1. Mix No. 1: 1 part Portland cement, 1/4 part hydrated lime, 3-3/4 parts mortar sand (maximum).
   2. Mix No. 2: 1 part Portland cement, 1 part masonry cement, 6 parts mortar sand (maximum).

B. Pressure Grout Mix: One part Portland cement, and six parts mortar sand mixed with water to consistency applicable for pressure grouting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify connection to existing piping system size, location, and invert elevations are in accordance with Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at number shown on Drawings not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Locate, identify, and protect utilities indicated to remain from damage.

C. Notify utility company to remove and relocate utilities.

D. Identify required lines, levels, contours, and datum locations.

E. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

G. Establish minimum separation between utilities in accordance with applicable code.

H. Establish pipe elevations with not less than 3 feet of cover.

3.3 DEWATERING

A. Intercept and divert surface drainage, precipitation, and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps or other means.

B. Develop and maintain substantially dry subgrade during drilling and pipe installation.

C. Comply with State and Municipal requirements for discharging water to watercourse, preventing stream degradation, and erosion and sediment control.
3.4 EXISTING WORK
A. Maintain access to existing facilities and services indicated to remain. Modify pipe installation to maintain access to existing facilities.

3.5 EXCAVATION
A. Excavate subsoil as specified in Section 31 23 17 – Trenching.
B. Excavate approach trenches and pits in accordance with shop drawings and as site conditions require. Minimize number of access pits.
C. Provide sump areas to contain drilling fluids.
D. Install excavation supports as specified in Section 31 23 17.
E. Restore areas after completion of drilling and carrier pipe installation.

3.6 DRILLING
A. Drill pilot bore with vertical and horizontal alignment as indicated on shop drawings.
B. Guide drill remotely from ground surface to maintain alignment by monitoring signals transmitted from drill bit.
   1. Monitor depth, pitch, and position.
   2. Adjust drill head orientation to maintain correct alignment.
C. Inject drilling fluid into bore to stabilize hole, remove cuttings, and lubricate drill bit and pipe.
D. Continuously monitor drilling fluid pumping rate, pressure, viscosity, and density while drilling pilot bore, back reaming, and installing pipe to ensure adequate removal of soil cuttings and stabilization of bore.
   1. Provide relief holes when required to relieve excess pressure.
E. Calibrate and verify electronic monitor accuracy during first 50 feet of bore in presence of Engineer before proceeding with other drilling. Excavate minimum of four test pits spaced along first 50 feet bore to verify required accuracy. When required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.
F. After completing pilot bore, remove drill bit.

3.7 DRILLING OBSTRUCTIONS
A. When obstructions are encountered during drilling, notify Engineer immediately. Do not proceed around obstruction without Engineer’s approval.
B. For conditions requiring more than 3-foot deviation in horizontal alignment, submit new shop drawings to Engineer for approval before resuming work.
C. Maintain adjusted bore alignment within easement or right-of-way.

3.8 PIPE INSTALLATION
A. After completing pilot bore, remove drill bit. Install reamer and pipe pulling head.
   1. Select reamer with minimum bore diameter required for pipe installation.
B. Attach pipe to pipe pulling head. Pull reamer and pipe to entry pit along pilot bore.
C. Inject drilling fluid through reamer to stabilize bore and lubricate pipe.
D. Install piping with horizontal and vertical alignment as shown on Drawings.
E. Protect and support pipe being pulled into bore so pipe moves freely and is not damaged during installation.
F. Do not exceed pipe manufacturer’s recommended pullback forces.
G. Install trace wire continuous with each bore. Splice trace wire only at intermediate bore pits. Tape or insulate trace wire to prevent corrosion and maintain integrity of pipe detection.
   1. Terminate trace wire for each pipe run at structures along pipe system.
   2. Provide extra length of trace wire at each structure, so trace wire can be pulled 3 feet out top of structure for connection to detection equipment.
   3. Test trace wire for continuity for each bore before acceptance.
H. Provide sufficient length of pipe to extend past termination point to allow connection to other pipe sections.
I. Allow minimum of 24 hours for stabilization after installing pipe before making connections to pipe.
J. Mark location and depth of bore with spray paint on paved surfaces, and wooden stakes on non-paved surfaces at 25-foot intervals.

3.9 SLURRY REMOVAL AND DISPOSAL
A. Contain excess drilling fluids at entry and exit points until recycled or removed from site. Provide recovery system to remove drilling spoils from access pits.
B. Remove, transport and legally dispose of drilling spoils off site.
   1. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.
   2. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.
C. When drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.
D. Complete cleanup of drilling fluid at end of each work day.

3.10 BACKFILL
A. Install backfill and compact as specified in Section 31 23 17.
B. Backfill approach trenches and pits with subsoil fill to contours and elevations indicated on Drawings or of surrounding existing grade.

3.11 ERECTION TOLERANCES
A. Maximum Variation From Horizontal Position: 12 inches.

B. Maximum Variation From Vertical Elevation: 2 inches.

C. Minimum Horizontal and Vertical Clearance from Other Utilities: 12 inches.

D. When pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, re-bore, and reinstall pipe in correct alignment.

E. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

3.12 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Leakage Testing: Upon completion of pipe installation, test pipe in accordance with the following:
   1. Sanitary Sewer force Mains Testing: 33 34 00.
   2. Water Distribution Pipe Testing: Section 33 11 00.

C. Disinfection of Water piping: As specified in Section 33 13 00.

D. Compaction Testing: As specified in Section 31 23 17.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.13 CLEANING

A. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits. Clean up excess slurry from ground.

B. Restore approach trenches and pits to original condition.

C. Remove temporary facilities for drilling operations in accordance with Section 01 50 00 - Temporary Facilities and Controls.

END OF SECTION
SECTION 33 11 00
WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for potable water line and fire water line.
   2. Valves and Valve Boxes
   3. Fire Hydrants.
   4. Tapping Sleeves and Valves.
   5. Air Release valves.
   7. Thrust Blocking.
   8. Pressure Testing

B. Related Sections:
   1. Section 31 23 17 - Trenching: Excavation and backfill requirements.
   2. Section 33 05 14 - Utility Manholes and Structures: Valve vaults.
   3. Section 33 05 19 - Pressure Piping Tied Joint Restraint Systems.
   4. Section 33 05 23 - Trenchless Utility Installation: Waterline installation under roadways and other obstructions.
   5. Section 33 12 13 - Water Service Connections: Tapping and Backflow prevention at water main.
   6. Section 33 13 00 - Disinfecting of Water Utility Distribution: Disinfection of water piping.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

B. American Water Works Association:
   2. AWWA C105 - Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
   3. AWWA C110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm), for Water.
   6. AWWA C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
   8. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
   9. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
   10. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
   11. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
   12. AWWA C502 - Dry-Barrel Fire Hydrants.
   13. AWWA C504 - Rubber-Sealed Butterfly Valves.
   14. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
   15. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
16. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
17. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.
18. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution.
19. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in. for Water Service.
20. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.

C. ASTM International:
2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

D. Manufacturer’s Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

E. National Sanitation Foundation:
1. NSF 61 - Drinking Water System Components - Health Effects

F. National Fire Protection Association:

G. SCDOT Standard Specifications:

1.3 DEFINITIONS
A. Utility Company: City of Lancaster

1.4 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Shop Drawings: Indicate piping layout, including piping specialties.
C. Product Data: Submit data on pipe materials, pipe fittings, valves, hydrants, and accessories.
D. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.
E. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

F. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SCDOT Standard Specifications except as modified herein.

B. Perform work in accordance with utility company standards.

C. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver and store valves in shipping containers with manufacturer's name and pressure rating labeling in place.

C. Block individual and stockpiled pipe lengths to prevent moving.

D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

E. Store polyethylene materials out of sunlight.

PART 2 PRODUCTS

2.1 WATER PIPING

   1. Pipe Thickness Class: 50.
   2. Pressure Rating: 350 psi. for 3” through 12”.
      b. Coating: Bituminous Coating, AWWA C110.
      c. Lining: Cement Mortar Lining, AWWA C104
   4. Joints:
      a. Mechanical Joints: AWWA C111.
      c. Flanged Joints: AWWA C115.
      e. Tied Restrained Joints: Per Section 33 05 19.

B. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, marked with NSF 61 designation for potable water use.
   1. Pipe Class: DR 18, 150 psi. and DR 14, 200 psi.
   2. Fittings:
a. PVC, AWWA C900 and AWWA C905.
b. Ductile Iron, Mechanical Joint, AWWA C110.

3. **Joints:**
   a. PVC, ASTM D3139 with ASTM F477 flexible elastomeric seals.
   b. Ductile Iron, Mechanical Joint, AWWA C111.

### 2.2 TAPPING SLEEVES AND VALVES

A. **Manufacturers:**
   1. American Flow Control.
   2. Clow Valve Company.
   4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. **Tapping Sleeves:**
   1. Ductile iron or cast-iron dual compression type.
   2. Outlet Flange Dimensions and Drilling: MSS SP-60.

C. **Tapping Valves:**
   1. AWWA C500, double disc with non-rising stem. Inlet flanges shall conform to ANSI B16.1, Class 125 and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111.

### 2.3 DOUBLE-DISC GATE VALVES

A. **Manufacturers:**
   1. Mueller Company.
   2. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Furnish materials in accordance with utility company or governing agency requirements.

C. **Double-Disc Gate Valves:** AWWA C500, NSF 61; iron body, bronze trim.
   1. Gate: Double disc parallel seat gate.
   2. Stem: Non-rising stem.
   4. Operating Nut: 2” square; open counterclockwise unless otherwise indicated.
   5. Ends: Flanged, mechanical joint or bell end connections.
   7. Provide valves 16 inch diameter and larger with bypass valves and gear operators.
   8. Sizes 4-Inch Diameter and Larger: 175 psig working, 300 psig test.
   9. Valves 16-Inch Diameter and larger shall be installed with a bypass valve unless otherwise indicated. The bypass valve shall conform to the most recent AWWA C-500.
   10. Sizes 3-Inch Diameter and Smaller: AWWA approved, bronze and non-rising stem, square operating nut, O-ring seals, test pressure not less than 250 psig, Wolverine #467, Jenkins 4370 or approved equal.

### 2.4 RESILIENT WEDGE GATE VALVES

A. **Manufacturers:**
   1. Mueller Company.
   3. Clow Valve Company.
4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Furnish materials in accordance with utility company or governing agency requirements.

C. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron.
   1. Resilient seats.
   2. Stem: Non-rising bronze stem.
   3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
   4. Ends: Flanged, mechanical joint or bell end connections.
   7. Sizes 16-Inch Diameter and Larger: 150 psig.

2.5 BUTTERFLY VALVES

A. Manufacturers:
   1. Mueller Company.
   3. Clow Valve Company.
   4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Size 12 Inch to 24 Inch: AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten infinite position lever handle.

C. Furnish materials in accordance with utility company or governing agency requirements.

2.6 VALVE BOXES

A. Valves 12-Inch Diameter and Smaller: Cast iron, two-piece, Mueller #H-10364 or approved equal.

B. Valves Larger Than 12-Inch Diameter: Cast iron, three-piece, screw type; round base.

C. Cast iron lid marked "WATER".

2.7 FIRE HYDRANTS

A. Manufacturers:
   1. Mueller.
   2. Waterous.
   3. Trend.
   4. Pacer.
   5. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Furnish materials in accordance with utility company or governing agency requirements.

C. Dry-barrel Break-away Type: AWWA C502; cast-iron body, compression type valve.
   1. Bury Depth: As indicated on the Drawings.
   2. Inlet Connection: 6 inches.
   3. Valve Opening: 5-1/4 inch diameter.
   4. Ends: Mechanical Joint or Bell End.
   5. Bolts and Nuts: Corrosion resistant.
   7. Direction of Opening: Counterclockwise unless otherwise indicated.

D. One pumper, two hose nozzles.
1. Obtain thread type and size from local fire department.
2. Attach nozzle caps by separate chains.

E. Finish: Primer and two coats of enamel, color in accordance with utility company, fire department, or NFPA 281 requirements.

2.8 AIR RELEASE VALVES

A. Manufacturers:
1. Apco Valve and Primer Co.
2. Crispin Valve Co.
3. Valmatic Valve and Manufacturing Corp.
4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Furnish materials in accordance with utility company or governing agency requirements.

2.9 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon and Trace Wire Tape: Brightly colored blue continuously printed with "WATER SERVICE" in large letters, minimum 6 inch wide by 4 mils thick, with magnetic detectable conductor manufactured for direct burial service.

2.10 PRECAST CONCRETE VALVE VAULTS AND METER BOXES

A. Conform to Section 33 05 14 – Utility Manholes and Structures.

B. Provide size and type as indicated on Drawings.

2.11 CONCRETE FOR THRUST RESTRAINT, ENCASEMENT AND CRADLES

A. Concrete: Class A Concrete conforming to Division 500 of the SCDOT Standard Specifications.
1. Compressive strength of 3,000 psi at 28 days.
2. Air entrained.
3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

2.12 BEDDING AND COVER MATERIALS

A. Bedding for Rigid Pipe (DIP, PVC C900, PVC C905, and PCCP): Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SP, SP-SM or SP-SC.

B. Backfill Around Pipe and Above Pipe: As specified in Section 31 23 17 -Trenching.

2.13 ACCESSORIES

A. Polyethylene Jackets: AWWA C105 polyethylene jacket. Single layer, lapped over pipe joint, and secured with 10 mil polyethylene tape.

B. Steel rods, bolt, lugs and brackets: ASTM A36 or ASTM A307 carbon steel.
PART 3 EXECUTION

3.1 PREPARATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing utility water main size, location, and inverts are as indicated on Drawings.

3.2 EXCAVATION

A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.

B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

C. Provide sheeting and shoring as required.

D. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches in compacted depth; compact to 95 percent.

3.3 INSTALLATION – PIPE

A. Install ductile iron pipe and fittings in accordance with AWWA C600 and manufactures' instructions.

B. Install PVC pipe in accordance with AWWA C605 and manufactures' instructions.

C. Handle and assemble pipe in accordance with manufacturer’s instructions and as indicated on Drawings.

D. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

E. Maintain minimum 10-foot horizontal separation and 18-inch vertical separation of water main from sewer piping or as required by local code.

F. Install pipe to indicated elevation to within tolerance of 1/2 inch.

G. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

H. Remove scale and dirt on inside and outside before assembly.

I. Flanged Joints: Not to be used in underground installations except within structures.

J. Route pipe in straight line. Relay pipe that is out of alignment or grade.

K. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Architect/Engineer.

L. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
M. Prevent foreign material from entering pipe during placement.

N. Install pipe to allow for expansion and contraction without stressing pipe or joints.

O. Close pipe openings with watertight plugs during work stoppages.

P. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

Q. Install underground marking tape continuously 12 inches above pipe line.

R. Establish elevations of buried piping with not less than 3 feet of cover. Measure depth of cover from final surface grade to top of pipe barrel.

3.4 INSTALLATION – FIRE HYDRANTS

A. Install fire hydrants; provide support blocking and drainage gravel; do not block drain hole.

B. Set hydrants plumb with pumper nozzle facing roadway; set hydrants with centerline of pumper nozzle 18 inches above finished grade and safety flange not more than 6 inches or less than 2 inches above grade.

C. Paint hydrants in accordance with local color scheme.

D. After hydrostatic testing, flush hydrants and check for proper drainage.

3.5 INSTALLATION - VALVES

A. Install valves in conjunction with pipe installation; set valves plumb.

B. Provide buried valves with valve boxes installed flush with finished grade.

3.6 INSTALLATION - TAPPING SLEEVES AND VALVES

A. Install tapping sleeves and valves in accordance with utility company requirements, as indicated on Drawings, and in accordance with manufacturer’s instructions.

B. Have Engineer witness tap.

3.7 POLYETHYLENE ENCASEMENT

A. Encase Ductile Iron piping in polyethylene where indicated on Drawings to prevent contact with surrounding backfill material.

B. Install in accordance with AWWA C105.

C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

3.8 CONCRETE THRUST RESTRAINT

A. Provide valves, tees, bends, caps, plugs, and dead ends with concrete thrust blocks as indicated on Drawings.
B. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.

C. Do not encase fitting joints and flanges.

3.9 TIED JOINT RESTRAINT

A. Install tied joint restraint systems in accordance with Section 33 05 19.

3.10 SERVICE CONNECTIONS

A. Install service connections in accordance with Section 33 12 13.

3.11 BACKFILLING

A. Backfill and compact around sides and to top of pipe in accordance with Section 31 23 17.

B. Maintain optimum moisture content of material to attain required compaction density.

3.12 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.13 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Compaction Testing: Perform soil compaction tests in accordance with Section 31 23 17.

C. Pressure Tests: Perform pressure test on potable water distribution system in accordance with AWWA C600.

D. Notification: Notify Engineer and Owner 72 hours in advance of test and have witness test.

E. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.

F. Pressure Test Procedure:
   1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct concurrent pressure and leakage tests.
   2. Provide equipment required to perform leakage and pressure tests.
   3. Conduct tests for at least two-hour duration.
   4. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of hydrostatic pressure test.
   5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks removed and plug resulting piping openings.
   6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
7. Examine exposed piping, fittings, valves, hydrants, and joints carefully during pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.

8. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

\[
L = \frac{(SD \sqrt{P})}{133,200}
\]

- \( L \) = allowable, in gallons per hour
- \( S \) = length of pipe tested, in inches
- \( D \) = nominal diameter of pipe, in inches
- \( P \) = average test pressure during leakage test, in pounds per square inch (gauge)

9. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.
SECTION 33 12 13
WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe and fittings for domestic water service connections to buildings.
2. Corporation stop assembly.
3. Curb stop assembly.
4. Water meters and meter setting equipment.
5. Backflow preventers.
7. Bedding and cover materials.

B. Related Sections:
1. Section 31 23 17 - Trenching: Excavating backfilling and compacting for Work of this section.
2. Section 33 05 13 - Utility Manholes and Structures.
3. Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes
4. Section 33 13 00 - Disinfecting of Water Utility Distribution

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

B. American Society of Sanitary Engineering:
1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

C. ASTM International:
2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
5. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

D. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

E. American Water Works Association:
1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
3. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
4. AWWA C702 - Cold-Water Meters - Compound Type.
5. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
6. AWWA C800 - Underground Service Line Valves and Fittings.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in. for Water Service.

F. SCDOT Standard Specifications:

1.3 DEFINITIONS

A. Utility Company: City of Lancaster

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Shop Drawings: Provide shop drawings for precast concrete vaults to include detail drawings showing the vault and accessories.
C. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventor, and accessories.
D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.
C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with utility company standards and the SCDOT Standard Specifications.
B. Maintain one copy of document on site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.
C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Copper Tubing: ASTM B88, Type K, annealed:
   2. Joints: Compression connection or AWS A5.8, BCuP silver braze.

2.2 CORPORATION STOP ASSEMBLY

A. Manufacturers:
   1. Ford Meter Box Company.
   3. McDonald Company.
   4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Corporation Stops:
   1. Brass or red brass alloy body conforming to ASTM B62.
   2. Inlet end threaded for tapping according to AWWA C800.
   3. Outlet end suitable for service pipe specified.

C. Service Saddles: Double strap type, designed to hold pressures in excess pipe working pressure. Manufacturers:
   1. Rockwell.
   2. McDonald Company.
   3. Substitutions: Equal per Section 01 60 00 - Product Requirements.

2.3 CURB STOP ASSEMBLY

A. Manufacturers:
   1. Ford Meter Box Company.
   3. McDonald Company.
   4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Curb Stops:
   1. Brass or red brass alloy body conforming to ASTM B62.
   2. Plug type valve.
   3. Positive pressure sealing.

C. Curb Boxes and Covers:
   1. Cast iron body, Extension Type or Buffalo Type.
   2. Minneapolis or Arch Pattern Base.
   3. Lid with inscription WATER, with Pentagon Plug.

2.4 METER SETTING EQUIPMENT

A. Manufacturers:
   1. Ford Meter Box Company.
3. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Outside Meter Setting:
1. Meter Yokes: Copper or iron, riser type assembly with bronze inlet inverted key angle valve expansion type outlet connection and Ell fitting; flared copper tubing connections both ends.
2. Meter Yokes: Copper or iron, inlet and outlet horizontal or vertical setting with matching couplings, fittings, and stops.

2.5 WATER METERS

A. Residential Manufacturers:
1. Rockwell/Sensus with leak detector. SSRIIBBBWPIIMEF or SRII mtr ECR-WP IM USG.
2. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Commercial Manufacturers:
2. Substitutions: Equal per Section 01 60 00 - Product Requirements.

C. AWWA C700, positive displacement disc type suitable for fluid with bronze case and cast iron frost-proof, breakaway bottom cap, hermetically sealed register, remote reading to AWWA C706.

2.6 BACKFLOW PREVENTERS

A. Manufacturers:
1. Watts Industries
2. Febco
3. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
1. Comply with ASSE 1013.
2. Bronze body, with bronze internal parts and stainless steel springs.
3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

C. Double Check Valve Assemblies: Comply with ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.7 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon and Trace Wire Tape: Brightly colored blue continuously printed with "WATER SERVICE" in large letters, minimum 6 inches wide by 4 mils thick, with magnetic detectable conductor manufactured for direct burial service.

2.8 PRECAST CONCRETE VAULT

A. Product Description: Precast vault designed in accordance with ASTM C858, comprising modular, interlocking sections complete with accessories.
B. Conform to Section 33 05 17 – Precast Concrete Vaults and Meter Boxes.

C. Shape and Size: As indicated on Drawings.

D. Frames and Covers: ASTM A48; Class 30B gray cast iron, machine finished with flat bearing surfaces. Furnish cover marked WATER SERVICE.

E. Steps: Polypropylene plastic step with 1/2 inch steel reinforcement. Cast steps at 16 inches on center vertically.

2.9 CONCRETE

A. Concrete: Class A Concrete conforming to Division 500 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
   4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
   5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

2.10 BEDDING AND COVER MATERIALS

A. Backfill around pipe and above pipe: As specified in Section 31 23 17 - Trenching.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.2 INSTALLATION - CORPORATION STOP ASSEMBLY

A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Engineer.

B. Provide service clamps for mains other than of cast iron or ductile iron mains.

C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.

D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2-inch width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.
E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Engineer.

3.3 EXCAVATION, BEDDING AND BACKFILL

A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section.

B. Place bedding material at trench bottom, level in one continuous layer not exceeding 6-inch loose thickness; compact to 95 percent in accordance with Section 31 23 17.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact to 95 percent in accordance with Section 31 23 17.

D. Maintain optimum moisture content of fill material to attain required compaction density.

3.4 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sewer piping in accordance with local code or a minimum of 10 feet horizontal and 18 inches vertical distance.

B. Group piping with other site piping work whenever practical.

C. Install pipe to indicated elevation to within tolerance of 5/8 inch.

D. Route pipe in straight line.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

G. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

H. Establish elevations of buried piping with not less than 3 feet of cover.

I. Install plastic ribbon with trace wire continuous over top of pipe buried 6 inches below subgrade above pipe line; coordinate with Section 31 23 17.

J. Backfill trench in accordance with Section 31 23 17.

3.5 INSTALLATION - CURB STOP ASSEMBLY

A. Set curb stops on solid bearing of compacted soil.

B. Center and plumb curb box over curb stops. Set box cover flush with finished grade.

3.6 INSTALLATION - BACKFLOW PREVENTERS WATER METERS

A. Install positive displacement meters in accordance with AWWA M6, as indicated on Drawings, and in accordance with manufacture’s instructions.

B. Install backflow preventer where indicated on Drawings and in accordance with manufacturer’s instructions.
C. Comply with local water company requirements and plumbing codes regarding testing and installation requirements.

3.7 SERVICE CONNECTIONS

A. Install water service to 5 feet of building and plug.

3.8 PRECAST CONCRETE VAULT

A. Construct valve vaults of precast concrete.
B. Install in accordance with Section 33 05 17.
C. Seal vault joints watertight with preformed plastic joint sealant compound. Apply asphalt waterproofing to exterior walls.
D. Seal annular space between pipe and wall sleeves as indicated on Drawings.
E. Install vault covers and frames; adjust to finished grade elevation.

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.10 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
B. Compaction testing for bedding and backfill: Conform to Section 31 23 17.
C. Pressure testing: Perform pressure test on water service connections in accordance with AWWA C600.
D. Notification: Notify Engineer and Owner 72 hours in advance of test and have them witness test.
E. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
F. Procedure:
   1. After completion of pipeline installation, but prior to backfill and final connection to existing system, conduct concurrent pressure and leakage tests in accordance with AWWA C600.
   2. Provide equipment required to perform leakage and pressure tests.
   3. Conduct tests for at least two-hour duration.
   4. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of pressure test.
   5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks and plug resulting piping openings.
   6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
7. Examine exposed piping, fittings, valves, and joints carefully during pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.

8. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

\[ L = \frac{(SD^2 - P)}{C} \]

- \( L \) = allowable, in gallons per hour
- \( S \) = length of pipe tested, in feet
- \( D \) = nominal diameter of pipe, in inches
- \( P \) = average test pressure during leakage test, in pounds per square inch gauge
- \( C = 133,200 \)

9. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

END OF SECTION
SECTION 33 13 00
DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.

B. Related Sections:
   1. Section 33 11 00 - Water Utility Distribution Piping: Piping Product and Execution requirements for installation, testing, of water distribution piping.
   2. Section 33 12 13 - Water Service connections.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA B300 - Hypochlorites.
   2. AWWA B301 - Liquid Chlorine.
   3. AWWA B302 - Ammonium Sulfate.
   4. AWWA B303 - Sodium Chlorite.
   5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   6. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

C. Test Reports: Indicate results comparative to specified requirements.

D. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Initial and 24 hour disinfectant residuals in treated water in ppm for each outlet tested.
   6. Date and time of flushing start and completion.
   7. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological Report:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certify water conforms, or fails to conform, to bacterial standards of authority having jurisdiction.

D. Water Quality Certificate: Certify water conforms to quality standards of authority having jurisdiction, suitable for human consumption.

1.5 QUALITY ASSURANCE
A. Perform Work in accordance with AWWA C651; maintain one copy of document on site.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS
A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION
A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
B. Verify piping system has been cleaned, inspected, and pressure tested.
C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.

3.2 INSTALLATION
A. Provide and attach required equipment to perform the Work of this Section.
B. Perform disinfection of water distribution system.
C. Introduce treatment into piping system.
D. Maintain disinfectant in system for 24 hours minimum.
E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water. The new system must be thoroughly flushed until no trace of dirt or foreign matter is visible. The sterilizing agent used must produce a solution of water and chlorine of not less than 50 parts per million available chlorine throughout the entire new piping system. Prior to flushing, the chlorine residual shall be measured. If it is less than 25 ppm, the system shall be redisinfected using 50 ppm available chlorine in accordance with AWWA standards. After the chlorine solution has remained in the new piping system for at least 24 hours, the lines shall be thoroughly flushed until the normal residual chlorine in the system is measured.
F. Replace permanent system devices removed for disinfection.
3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Disinfection, Flushing, and Sampling:
1. Notify Engineer, Owner and testing agency 72 hours in advance of test and have witness test.
2. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted.
3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
4. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
5. After final flushing and before pipeline is connected to existing system or placed in service, employ an approved independent testing laboratory to sample, test, and certify water quality suitable for human consumption. A minimum of two samples shall be collected from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction but must include all dead end lines, be representative of the water in the newly constructed mains, and shall be collected a minimum of every 1,200 linear feet. These samples must be collected at least 24 hours apart and must show the water line to be absent of total coliform bacteria.
6. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported.
7. The chlorine residual must also be measured and reported.
8. If the non-coliform growth is greater than 80 colonies per 100 milliliters, the sample result is invalid and must be repeated.
9. All samples must be analyzed by a State certified laboratory.
10. Results of the bacterial examination shall be forwarded to the South Carolina Department of Health and Environmental Control with the engineer’s letter of certification. Upon receipt of acceptable results of the test and receipt of the final certification letter from the engineer, a representative from DHEC will conduct a final inspection of the project at which time the representative will obtain additional samples for bacterial examination. No taps into the new piping system shall be made before a written “approval to place into operation” is received from DHEC.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sanitary sewer pipe and fittings.
   2. Underground pipe markers.
   3. Connection to existing manholes.
   4. Wye branches and tees.
   5. Sanitary Laterals.

B. Related Sections:
   1. Section 31 23 17 - Trenching: Excavation, bedding and backfill requirements for trenching required by this section.
   2. Section 33 01 32 - Sewer and Manhole Testing: Pressure, infiltration, and deflection tests.
   3. Section 33 05 14 – Utility Manholes and Structures: Concrete manholes, frames and lids for sanitary sewer.

1.2 REFERENCES

A. ASTM International:
   8. ASTM C1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.
B. American Water Works Association:
   1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. Through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
   4. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

C. SCDOT Standard Specifications:

1.3 SUBMITTALS
   A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
   B. Permits: Submit copies of construction permits obtained for this Work.
   C. Product Data: Submit catalog cuts and other pertinent data indicating proposed materials, accessories, details, and construction information.
   D. Submit reports indicating field tests made and results obtained.
   E. Manufacturer's Installation Instructions:
      1. Indicate special procedures required to install Products specified.
      2. Submit detailed description of procedures for connecting new sewer to existing sewer line and directional drilling, or pipe jacking installation.
   F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS
   A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
   B. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.
   C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE
   A. Perform Work in accordance with SCDOT Standard Specifications.
   B. Maintain one copy of document on site.

1.6 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
   B. Installer: Company specializing in performing Work of this section with minimum 3 years documented experience.
1.7 DELIVERY, STORAGE, AND HANDLING
A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
B. Deliver and store valves in shipping containers with labeling in place.
C. Block individual and stockpiled pipe lengths to prevent moving.
D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
E. Do not place pipe flat on ground. Cradle to prevent point stress.
F. Store UV sensitive materials out of direct sunlight.

1.8 FIELD MEASUREMENTS
A. Verify field measurements and elevations are as indicated.

1.9 COORDINATION
A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
B. Coordinate Work with local sewerage authority. Convene pre-installation meeting minimum of one week prior to starting Work of this Section.
C. Notify affected utility companies minimum of 72 hours prior to construction.

PART 2 PRODUCTS
2.1 SANITARY SEWER PIPE AND FITTINGS
A. PVC Flexible Joint Plastic Pipe: ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; bell and spigot style rubber ring sealed gasket joint.
   1. Pipe Class: SDR 35.
   2. Fittings: PVC conforming to pipe specifications.
   1. Pipe Class: 8" through 12" pressure class 350 psi., 14" and larger pressure class 250 psi.
   3. Joints: Rubber gaskets per AWWA C111.

2.2 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES
A. Furnish materials in accordance with authority having jurisdiction.
B. Flexible Pipe Boot: ASTM C923, ethylene propylene rubber (EPDM), Series 300 stainless steel clamp and stainless steel hardware.

2.3 UNDERGROUND PIPE MARKERS
A. Plastic Ribbon Tape: Brightly colored green continuously printed with "SANITARY SEWER" in large letters, minimum 6 inches wide by 4 mils thick.

2.4 MANHOLES

A. Manholes: As specified in Section 33 05 14 and indicated on Drawings; cover inscribed with "SANITARY SEWER".

2.5 CONCRETE AND GROUT

A. Concrete: Class A Concrete conforming to Division 500 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
   4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
   5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

B. Grout: Non-shrink, non-metallic in accordance with Divisions 500 and 700 of SCDOT Standard Specifications with a compressive strength of at least 5,000 psi at 3 days.

2.6 BEDDING AND COVER MATERIALS

A. General: Conform to Section 31 23 17 for bedding and backfill around and on top of pipe.

B. Bedding for Rigid Pipe (DIP and RCP): Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SP, SP-SM or SP-SC.

C. Bedding for Flexible Pipe (PVC, ABS): Clean course aggregate Gradation No. 57 conforming to Division 700 of the SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing sanitary sewer utility main size, location, and inverts are as indicated on Drawings.

3.2 EXCAVATION AND BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17.

B. Excavate to lines and grades shown on Drawings or required to accommodate installation of encasement.

C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
D. Provide sheeting and shoring in accordance with Section 31 23 17.

E. Place bedding material at trench bottom, level continuous layer not exceeding 8-inch compacted depth; compact to 95 percent per Section 31 23 17.

3.3 INSTALLATION – PIPE

A. Install in accordance with manufactures instructions and as indicated on Drawings.

B. Install plastic pipe, fittings, and accessories in accordance with ASTM D2321.

C. Install VCP, fittings, and accessories in accordance with ASTM C12.

D. Install RCP, fittings, and accessories in accordance with ASTM C1479.

E. Install CIP and DIP, fittings, and accessories in accordance with applicable portions of AWWA C600.

F. Seal joints watertight.

G. Lay pipe to slope gradients indicated on Drawings with maximum variation from indicated slope of 1/8 inch in 10 feet. Begin at downstream end and progress upstream.

H. Ensure entire pipe is supported by bedding.

I. Assemble and handle pipe in accordance with manufacturer's instructions except as modified on the Drawings or by Engineer.

J. Keep pipe and fittings clean until work is completed and accepted by Engineer. Cap open ends during periods of work stoppage.

K. Lay bell and spigot pipe with bells upstream.

L. Connect pipe to existing sewer system as indicated on Drawings at existing manhole or using doghouse manhole connection per Section 33 05 14.

M. Place haunching material, rod, and tamp per Section 31 23 17 to eliminate voids.

N. Install underground marking tape continuously 18 inches above pipe line.

3.4 CONNECTION TO EXISTING MANHOLE

A. Core drill existing manhole to clean opening. Using pneumatic hammers, chipping guns, and sledge hammers is not permitted.

B. Install watertight neoprene gasket and seal with non-shrink concrete grout.

C. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint. Use epoxy binder between new and existing concrete.

D. Prevent construction debris from entering existing sewer line when making connection.

3.5 MANHOLE INSTALLATION

A. Install manholes in accordance with Section 33 05 14.
3.6 INSTALLATION - WYE BRANCHES AND TEES

A. Install wye branches or pipe tees at locations indicated on Drawings concurrent with pipe laying operations. Use standard fittings of same material and joint type as sewer main.

B. Maintain minimum 5 feet separation distance between wye connection and manhole.

C. Use saddle wye or tee with stainless steel clamps for taps into existing piping. Mount saddles with solvent cement or gasket and secure with metal bands. Layout holes with template and cut holes with mechanical cutter.

3.7 INSTALLATION - SANITARY LATERALS

A. Construct laterals from wye branch to terminal point at right-of-way or as indicated on Drawings.

B. Where depth of main pipeline warrants, construct riser type laterals from wye branch.

C. Maintain 3-foot minimum depth of cover over pipe.

D. Maintain minimum 5-foot separation distance between laterals.

E. Install watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral. Install temporary marker stake extending from end of lateral to 24 inches above finished grade. Paint top 6 inches of stake with fluorescent orange paint.

3.8 BACKFILLING

A. Backfill around sides and to top of pipe in accordance with Section 31 23 17.

B. Maintain optimum moisture content of backfill material to attain required compaction density.

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Request inspection prior to and immediately after placing bedding.

C. Perform test on sanitary sewage system in accordance with Section 33 01 34 and local code. Perform the following tests:
   1. Gravity Sewer Testing:
      a. Low pressure air test.
      b. Infiltration test.
   4. Notify Engineer and Owner 72 hours in advance of test and have witness test.

D. Compaction Testing: In accordance with Section 31 23 17.

E. When tests indicate Work does not meet specified requirements, remove work, replace, and retest.

3.10 PROTECTION OF FINISHED WORK
A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish all labor, materials, equipment and supplies and shall perform all work necessary for the complete construction of submersible pumping station as shown on the plans and specified herein.

B. Section Includes:
   1. Submersible public wastewater pumping station.
   2. Initial operation of packaged public pumping station.

C. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 31 23 16 – Excavation and Fill.
   4. Section 32 31 13 - Chain Link Fences and Gates.
   5. Section 33 05 14 - Utility Manholes and Structures.
   6. Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes.
   7. Section 33 11 00 - Public Water Utility Distribution Piping.
   8. Section 33 12 13 - Water Service Connections.
   9. Section 33 31 00 - Sanitary Utility Sewerage Piping.
   10. Section 33 34 00 - Sanitary Utility Sewerage Force Mains.
   11. Division 26 – Electrical Section

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

B. ASTM International:
   5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   6. ASTM A709/A709M - Standard Specification for Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy.
   7. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   8. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).

C. United States Department of Defense:
1. US DoD W-C-375/1A NOT 1 - Circuit Breakers, Molded Case, Branch Circuit and Service, Type I, Series Trip, Single Pole (10 Through 70 Amperes).

1.3 SYSTEM DESCRIPTION
A. Pumping Station: Duplex; field assembled; with precast concrete basin; submersible non-clog [________] pumps; multiple automatic control for in ground [________] installation.

1.4 DESIGN REQUIREMENTS
A. Design influent conditions to pumping station are as follows:
   2. Minimum: [________] gpm
   3. Average: [________] gpm
   4. Maximum: [________] gpm

1.5 PERFORMANCE REQUIREMENTS
A. Pumping Station: The pumps shall be duplex pumps supplied by constant speed drives having the necessary characteristics and properly selected to perform under the following operating characteristics:
   1. Number of Pumps [__]
   2. Pump Capacity @ maximum speed (60 Hz) [__] gpm @ [__] feet TDH
      [__] gpm @ [__] feet TDH
   3. Pump Capacity @ minimum speed [__] gpm @ [__] feet TDH
   4. Static Head [__] feet
   5. Minimum Shut-off Head [__] feet
   6. Discharge Size (Nominal) [__] inches
   7. Minimum Solids Handling Size [__] inches
   8. Pump Horse Power [__] Hp (Non-Overloading)
   9. Minimum Efficiency [__]%
   10. Maximum Motor Speed [__] rpm
   11. Electrical Service [__] volt[/__] phase/60 Hz
   12. Power Cable Required Continuous to panel w/o splices
   13. Float Switch Cord Required per Float Continuous to panel w/o splices

B. Basin Wall: Sufficient to withstand water-saturated sand load of 120 pcf.

C. Basin Cover: Support live load of 150 psf
1. Locate four mercury switch floats consisting of "pump off", "start lead", "start lag", and "high level" in basin. Start one pump automatically when "start lead" float is activated. Start second pump automatically when "start lag" float is activated. Signal alarm condition automatically when "high level" float is activated. Stop both pumps automatically when "common stop" float is activated. Set float elevations in accordance with Drawings. Set pumps to automatically switch operation from one pump to another after shut off of each pumping cycle.

D. Sound, Vibration, and Thermal Control: Dampen or suppress noise, absorb vibration, accommodate thermal expansion and stresses, and adjust or correct for misalignment in piping systems.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Outline drawings showing equipment and shipping dimensions and weights, location of accessories, and clearances required.

C. Product Data: Submit for each type of pumping station.
   1. Include catalog data for basin, cover, hinged door, slide rail assembly, lifting assembly, discharge piping, valves, junction box, level controls, and control panel.
   2. Include pump catalog data, performance curve, breakaway fittings data, and access frame data.
   3. Include control panel data and panel wiring schematic.
   4. Include recommended spare parts list.

D. Test Reports:
   1. Submit written report showing factory pump inspections and tests have been successfully performed.

E. Manufacturer's Installation Instructions: Submit manufacturer’s published instructions for basin, pump, and panel systems procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Manufacturer's Field Reports:
   1. Submit report of each visit of manufacturer’s representative to provide technical assistance during installation.
   2. Submit start-up report before final acceptance of [pump] [pumps] to document pumping station operation meets performance requirements.

1.7 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Record actual locations of pumping stations including basins and control panel.

C. Submit two copies of executed certification of pumping stations after performance testing to the owner.
D. Submit two copies of spare parts list and rebuild kits to the owner.

E. Provide two copies of the Operations and Maintenance Manual containing operating and maintenance requirements for pumping station and schedule of recommended maintenance to the owner.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum 5 years experience.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping [system pieces] [systems] from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.

D. Accept system components on site in manufacturer’s original containers or configuration. Inspect for damage.

E. Store sensitive materials for field assembly in dry area in original shipping containers.

F. Support basin with nylon slings to structural lift points during handling.

G. Repair damage to basin according to manufacturer’s instructions.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install concrete basin base when bedding is wet or frozen. Dewater excavation to keep excavation dry.

1.12 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.
1.13 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Bedding, Ballast, and Backfill.
   1. Bedding: Aggregate Type as specified in Drawings.

2.2 WETWELL SYSTEM

A. Concrete Basin:
   2. Minimum wall thickness: 6 inches
   3. Diameter: 96 inches
   4. Joints: Made to receive rubber gasket, butyl mastic rope sealer, or a non-shrink type grout especially made for this purpose.
   5. Base: Integrally cast with extended base conforming to ASTM C-478 or to minimum dimensions shown on the drawings.

B. Concrete Cover: Reinforced concrete in accordance with Section 03 30 00

C. Concrete Mortar: 3000 psi

D. Access Hatch:
   1. 1/4 inches aluminum with diamond pattern capable of withstanding 300 pounds per square foot, stainless steel hinges, anchor flange, drainage coupling, and snap lock.
   2. Hardware and hinges: Stainless steel with tamper-proof fasteners.
   3. Doors: Open 90 degrees and capable of locking in this position with a stainless steel positive locking arm and aluminum release handle.

E. Junction Box: NEMA 250 Type 6 with cable grips for incoming direct burial cable.

F. Electrical:
   1. Provide cable grips for direct burial cable for field installation.
   2. Provide explosion proof equipment, supplies and fittings.

G. Level Controls: Four mechanical float type or mercury type pilot duty liquid level controls with AWG 18-2 SJOW-A cable in polypropylene housing for mounting to cable bracket.

2.3 VALVE VAULT SYSTEM

A. Concrete Vault:
   2. Minimum wall thickness: 6 inches
3. Dimensions: [__] feet wide by [__] feet long.
4. Joints: Made to receive rubber gasket, butyl mastic rope sealer, or a non-shrink type grout especially made for this purpose.
5. Base: Integrally cast conforming to ASTM C-478 or to minimum dimensions shown on the drawings.

B. Concrete Cover: Reinforced concrete in accordance with Section 03 30 00

C. Concrete Mortar: 3000 psi

D. Access Hatch:
   1. 1/4 inches aluminum with diamond pattern capable of withstanding 300 pounds per square foot, stainless steel hinges, anchor flange, drainage coupling, and snap lock.
   2. Hardware and hinges: Stainless steel with tamper-proof fasteners.
   3. Doors: Open 90 degrees and capable of locking in this position with a stainless steel positive locking arm and aluminum release handle.

E. Valves General: To be the type, size, and class shown on the plans. Valves shall have a heavy cast iron body with standard flanged ends, Class 125 with operating devices as specified or shown. Valves shall be at least the same class as the pipe on which they are used. All exposed valves shall be shop primed. Insofar as possible, all valves shall be by the same manufacturer.

F. Plug Valves:
   1. Eccentric of the non-lubricated type with resilient faced plugs.
   2. Valve bodies: Conform to ASTM A-126 Class B cast iron according to AWWA C504
   3. Plugs: Resilient faced cast iron, ASTM A126 Class B
   4. Metal bearings: Sleeved and sintered, oil impregnated, and permanently lubricated stainless steel conforming to Type 316, ASTM A743, Grade CF-8M or AISI Type 317. Non-metallic bearings are not acceptable.
   5. Valve shaft seals: Conform to AWWA 504 and AWWA C507. Utilize a multiple v-ring that is externally adjustable and repackable under pressure.
   6. Valve actuators: Lever type for all valves 6 inches and smaller.

G. Swing Check Valves: Shall be bronze mounted with rubber faced bronze clapper disc seated by a bronze clapper arm against a bronze seat ring. The clapper shall have a lever and spring to assist closure. The spring tension shall be adjustable to set the speed of closure of the valve to the operating conditions in field. The clapper shall be secured to a stainless steel shaft set in bronze bushings. Bushings shall be secured to the valve body with cap screws and sealed with O-rings.

H. Pressure Gauge: Supply two (2) glycerin-filled pressure gauges for installation by the Contractor on each discharge pipe from the pump station inside the valve vault. Pressure gauge casing shall be black fiberglass reinforced thermoplastic, wetted parts shall be 316 stainless steel, and the dial indicator must be a minimum of 4" inches in diameter dial as manufactured by WIKA or an approved equal. Rated accuracy shall be 1% of full scale reading. Mounting of the gauge shall be 1/2" NPT. Range of the pressure gauge shall be zero to 100 psi or shall have a rated over range maximum pressure capacity greater than the rated capacity of the pumps. A diaphragm protector shall be supplied with each gauge to include a teflon O-ring seal at the gauge, liquid filled upper housing, flexible diaphragm, and a 1/2" process connection. Gauge installation shall be complete with all hoses and
fittings, including a 1/2” NPT brass cock valve for the gauge line at the point of connection to the discharge pipe.

2.4 PUMPS

A. Manufacturers:
   1. ABS
   2. Substitutions: Section 01 60 00 - Product Requirements

B. Product Description:
   1. Pumps: Submersible non-clog constant speed with horizontal discharge, fittings, piping, and pump brackets.
   2. Discharge Size: [_______] inches.

C. Volute: ASTM A48, Class 40, cast iron, non-concentric design. Discharge shall have an ANSI bolt pattern for attachment of discharge bracket.

D. Motor Housing: ASTM A48, Class 25, cast iron.

E. Seal Plate: ASTM A48, Class 25, cast iron.

F. Impeller:
   1. Design: single vane, enclosed, and non-clogging and have pump out vanes to prevent grit and other materials from collecting in the seal area. Capable of passing a minimum 3 inch solid and coated to improve efficiency. Dynamically balanced and slip fit to a tapered shaft and key driven. Impeller fastened to the shaft with a 300 series stainless steel washer and bolt. Impeller shall be constructed of cast iron ASTM-A48, Class 40. Provide a volute case wear ring constructed of 316 stainless steel and an impeller wear ring constructed of 304 stainless steel.

G. Shaft
   1. Pump shaft and motor shaft shall be an integral unit. Each shaft shall be a one piece design constructed of 420 stainless steel.

H. O Rings: Buna-N, rubber.

I. Hardware: 300 Series stainless steel.

J. Paint: All metal surfaces coming into contact with the pumped media (Other than stainless steel) shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a high solids two part epoxy paint finish on the exterior of the pump.

K. Seal:
   1. Each pump shall have a tandem mechanical shaft seal system consisting of two totally independent mechanical seal assemblies. The upper set of the tandem seals shall operate in an oil chamber located below the moisture sensing chamber. The set shall contain one stationary silicon-carbide ring and one positively driven rotating silicon-carbide ring functioning as an independent secondary barrier between the pumped liquid and the stator housing. The lower tandem set shall function as the primary barrier between
the pumped liquid and the stator housing. This set shall consist of a stationary ring and a positively driven rotating ring both being silicon-carbide.

2. Each seal interface shall be held in contact by its own spring system. The seals shall not require maintenance or adjustment but shall be easily replaceable.

3. The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.

4. There shall be an electric probe or seal failure sensor installed in the moisture detection chamber. If the seal fails, contaminants which enter the seal chamber shall be detected by the sensor and send a signal to operate the specified warning device.

5. Units equipped with opposed mechanical seals shall not be acceptable.

L. Cable Entry: 30 feet cord. Pressure grommet for sealing and strain relief.

M. Speed: [____] rpm, constant.

N. Shaft: 420 stainless steel designed with a sufficient diameter with a minimum overhang to reduce shaft deflection and bearing wear.

O. Upper Bearing:
   1. Design: cylindrical, roller bearing.
   2. Lubrication: grease.
   3. Load: radial.
   4. Bearing Life: 100,000 hours

P. Lower Bearing:
   1. Design: angular contact
   2. Lubrication: grease.
   3. Bearing Life: 100,000 hours.

Q. Motor:
   1. Design: U/L listed, hermetically sealed, submersible type. Provided with thermal overload protection and moisture detection system. Designed for continuous duty, capable of sustaining a minimum of 10 starts per hour.
   2. Data: [____] hp, [____] rpm, for operation at [____] volt, [____] phase, [____] hertz.
   3. Motor must be inverter duty rated.

R. Rail Assembly: Pumps mounted on rail assembly for removal without entering the wetwell. Pumps connected to the stationary discharge elbow by use of a hydraulic sealing flange with no metal-to-metal contact. All assembly, brackets, support, and accessories, Schedule 40, 304 stainless steel.

2.5 CONTROL PANEL

A. Power Supply:
   1. [____] volt, [____] phase, [____] wire, [____] hertz.
   2. For operation of [____][____] horsepower pumps.

B. Enclosure
1. The controls will be housed in a free-standing, three door, NEMA 4X stainless steel enclosure. The enclosure shall be completely gasketed, hinged, and equipped with a padlockable latch. The stainless steel enclosure will be 304 type with 3-point latching.

2. All installations requiring penetration of the control panel shall be made in such a manner and with approved devices that will maintain the panels’ NEMA 4X rating.

C. Inner Door
   1. Provide a removable inner swing door for each door of the enclosure. Inner swing door must be 5052 brushed marine grade aluminum having a minimum thickness of .090 inches. The door shall have .5 inch flanges on three sides for increased strength. The door shall be adequately sized to enclose all panel-mounted components while having a vertical swing of a minimum 90 degrees. Inner doors shall be held closed with a durable 1/4-turn latch. The doors shall have a brushed high gloss luster. All inner door mounted components will be labeled with phenolic engraved nameplates.

D. Sub-panel
   1. Control sub-panel shall be 12-gauge steel with white enamel finish. Sub-panel shall have flanges on at least two sides. All mounting holes shall be drilled and tapped at least 8/32” and parts mounted with stainless steel machine screws. Self-tapping screws will not be accepted.

E. Wiring and Labeling
   1. Power wiring shall be properly sized MTW rated 90 degrees C. Control wiring shall be red #14 AWG, MTW, rated 90 degrees C. All panel wiring shall have polyester or vinyl-cloth numerically identified labels on each end to indicate wire number. Labels will be manufactured by Brady. Wire will be neatly routed in the panel through polyester wire duct except from the backplate to the inner door, which shall be wrapped in a separate bundled harness for control.

   2. A laminated “As-Built” wiring schematic shall be posted on the inside of the inner door. A data tag with panel and manufacturer information shall be provided on inside of enclosure door.

   3. All panel mounted components including control and power terminal strips will be clearly labeled according to provided wiring diagram.

   4. All UL labels shall be posted where required by 698 standards.

F. Panel Components
   1. Main disconnect
      a. Main disconnecting means shall be installed in the control panel. The main disconnect shall consist of a 200 amp KAL type breaker with operator mechanism, both manufactured by Square D Company.

      b. The disconnect operator shall be interlocked with the inner door to prohibit the door from being opened with the circuit breaker on. A concealed override mechanism shall allow qualified personnel to bypass the interlock allowing entrance without turning the circuit breaker off. The operator shall be lockable in both the on and off positions. It shall not be possible to open the door with the circuit breaker locked in any position.

   2. Pump Circuit Breakers
      a. Circuit breakers shall be provided for each pump. Each pump breaker shall be 100 amp FAL type manufactured by Square D Company.
b. The pump disconnect operators shall be interlocked with the inner door to prohibit the door from being opened with the circuit breakers on. Concealed override mechanisms shall allow qualified personnel to bypass the interlock allowing entrance without turning the circuit breakers off. The operators shall be lockable in both the on and off positions. It shall not be possible to open the door with the circuit breakers locked in any position.

3. Transient Voltage Surge Suppressor (TVSS) with a minimum surge current rating of 160,000A shall be provided. The TVSS shall have an LED indicator light and be mounted in a NEMA 4X enclosure.

4. A three phase voltage monitor shall be provided to protect against over-voltage, under-voltage, phase loss, phase sequence reversal, and load cycling. The monitor shall be plug-in type as manufactured by Diversified Corporation.

5. Climate Control
   a. A properly sized climate control system to maintain a temperature between 50 and 90 degrees inside the control panel under any sequence of operation should be provided.
   b. It shall be mounted in a manner that retains the 4X rating of enclosure.

6. Control Transformer
   a. A 5 KVA stainless steel enclosed transformer manufactured by shall be provided for the control circuit and other auxiliary devices. It shall be mounted on the side of the control panel and shall maintain the 4x rating of the enclosure.
   b. A 15 amp 2 pole FAL type circuit breaker shall be provided to protect the primary of the transformer.
   c. A 40 amp 2 pole FAL type circuit breaker shall be provided to protect the secondary of the transformer.
   d. Transformer and breakers shall be manufactured by Square D Company.

7. Protected Equipment
   a. One 20 amp ground fault circuit interrupter (GFCI) type duplex receptacle shall be provided on the side of the control panel for operation of 115VAC devices. The GFCI shall be protected by a 20 amp QOU type circuit breaker.
   b. Three spare 20 amp QOU type circuit breakers shall be provided for connection to future equipment.
   c. All breakers shall be manufactured by Square D Company.

8. Pump Protection
   a. Over-temperature protection shall be provided in the control panel to operate in conjunction with the over-temperature switch in each pump motor. The control shall provide pump lockout of operation upon occurrence of high temperature.
   b. Pump seal failure protection shall be provided in the control panel to operate in conjunction with the moisture sensor or seal failure switch in each pump motor. Seal leaks shall be detected for in the motor housing and seal chamber. The circuitry shall include a red failure indicating light on the inner panel for each pump as an alarm indication. The pumps shall be allowed to continue to run.

9. A Square D premium M340 Programmable Logic Controller (PLC) or pre-approved equal in the control panel shall control the operation of the pumps based on wet well level.
10. Intrinsically safe relays shall be provided in the panel. They will be connected to two float type switches installed in the wet well as high and low alarm devices and backup pump control.

11. An interior panel light shall be provided and interlocked with enclosure door so that it illuminates when the door is open.

G. Indication and Operator Interface (mounted on panel inner doors)

1. A three-position ‘P1-P2-Alternate’ switch shall be provided to select lead pump.
2. Each pump will have a three-position switch to select ‘Manual-Off-Automatic’ position.
3. Each pump will have a two-position switch to choose ‘Automatic-Manual Speed’
4. A 5-10K ohm potentiometer shall be provided to determine speed of each pump.

Green Pump Running lights shall be provided for each pump.

5. Red fault lights for each pump shall be provided for the following conditions:
   a. Pump Over-Temperature
   b. Pump Seal Failure

6. Amber indication lights shall be provided for the following conditions:
   a. Backup Float Low Level
   b. Backup Float High Level

7. Provide LED push-to-test transformer type indicator lights for all pilot lights.

8. All lights and switches shall be SKS type manufactured by Square D Company.

9. Each pump shall have elapsed time meter mounted on the inner door. Meters shall be wired to each starter, six digit, non-resettable, to indicate total run time in hours and tenths.

10. A Square D color touch screen operator interface or pre-approved equal shall be provided for visual display of tank level and adjustment of level setpoints and timer values.

11. Ultrasonic Liquid Level equipment shall operate on 120 VAC power and be fully compatible with Pump Control Centers specified below.
   a. Ultrasonic control equipment shall consist of one (1) complete Hydro-Ranger 200 panel mount unit as manufactured by Milltronics; rack mount models are not acceptable.
   b. The system shall include a separate hand-held, 20 key programmer and graphics LCD indicator screen.
   c. The system shall also include one (1) non-contacting wet well mounted ultrasonic transducer, Echomax Model XPS-15, providing a one (1) foot to fifty (50) feet operating range with thirty (30) feet long cable. The transducer shall be contained within a chemical resistant polypropylene compound IP65 NEMA 4X NEMA 4X enclosure measuring 7.7 x 7.1 x 3.0 inches as manufactured by Milltronics.

14. A Magnetic flowmeter shall be furnished consisting of a panel mounted transmitter and flow tube properly sized for the installation. The transmitter shall be Siemens MAG 5000 with a 5100 W flow tube or pre-approved equal.

15. The flowmeter and level controller shall be supplied by the control manufacturer to assure system compatibility.

H. Alarm System

1. A flashing alarm light with a minimum 40 watt light bulb shall be installed at the panel and located as to be readily visible from the main road. Alarm light
shall be approved for vapor tight side installation and shall have a red lexan globe.

2. A weatherproof alarm horn with back box shall be mounted below the alarm light on the side of the enclosure. Horn shall have a minimum 87 DBA output. The silencer shall be mounted on the front enclosure door and be labeled with a phenolic engraved name tag.

3. SCADA connections shall be provided for all run, alarm, and analog signals.

I. Experience and Rating

1. The pump control panel manufacturer shall have at least 20 years of experience and have at least 3000 similar installations.

2. The control panel shall be UL listed and labeled as an industrial control panel under UL 698 procedures.

3. The pump control panels shall be CPDPSV Series as manufactured by Control Interface, Inc.; Cincinnati, OH, or pre-approved equal.

J. Lightning Arrestor:

1. Manufacturers:
   a. Delta Lightning Arrestors, Inc.
   b. Substitutions: Section 01 60 00 - Product Requirements

K. Auxiliary Power Supply: Emergency standby electric generating system suitable to meet pump station power handling.

1. Manufacturers:
   a. Kohler
   b. Cummins-Atlantic
   c. Detroit Diesel
   d. Caterpillar
   e. Substitutions: Section 01 60 00 - Product Requirements

2.6 PUMP HOIST

A. Design: Stainless steel boom and winch assembly with a telescoping adjustable boom and winch with enclosed gears at a 4:1 ratio, removable from a mounting base permanently attached to the wetwell, containing 30 feet of stainless steel cable and safety hook.

B. Capacity: 500 pounds or two times the weight of specified pump and motor, whichever is greater.

2.7 ACCESSORIES

A. Sealant: Industrial silicon sealant for pipe penetrations in basin.

B. Anchor Bolts, Nuts, and Washers: ASTM A709/A709M, Grade 36, bent anchor bolts; ASTM A307, Grade A, nuts; ASTM A126, gray iron washers. Galvanize bolts, nuts and washers in accordance with ASTM A153/A153M.

C. Exterior Lighting: As indicated on Drawings and as specified in Section 26 56 00

D. Fresh Water Supply: As indicated on Drawings.
2.8 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Perform the following field inspections and tests:
   1. Motor voltage and frequency check as shown on name plate.
   2. Motor and cable insulation test for moisture content or insulation defects in accordance with UL criteria.
   3. Submerged pump run test to determine pump meets hydraulic performance requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Verify inlet and discharge piping connection are size, location, and elevation on Drawings.

3.2 BASIN INSTALLATION

A. Place, compact and level aggregate bedding to minimum 8 inches.

B. Install basin at proper grade and to alignment on Drawings on aggregate base.

C. Set cover frames and covers level without tipping, to correct elevations.

D. Assemble basin components including inlet hub/fitting, discharge hub, cover, pump support rail system, level controls, and junction box.

E. Connect to inlet and discharge piping with flexible connector.

F. Seal joints water tight between inlet and discharge pipes and sump wall.

G. Install fresh water supply system.

3.3 PUMP INSTALLATION

A. Install pump including fittings, brackets, discharge piping, check valve to basin rail assembly, lifting device, and discharge. Wire pump to junction box.

3.4 CONTROL PANEL INSTALLATION

A. Mount and wire control panel for pumping station operation including duplex motor controls, circuit breaker, starter, control transformer, fuse box, terminal block, alternator, alarm and running lights, and auxiliary power supply generator.

B. Wire in accordance with requirements of National Electrical Code.

C. Number each conductor.
D. Tin ends of wires with 60/40 lead tin alloy solder.

E. Locate and connect direct burial cable from control panel to basin junction box.

3.5 STATION STARTUP, INITIAL TESTING AND OPERATION

A. Notify Engineer and Owner, 3 days prior to flow rate testing.

B. Provide startup and initial testing of system. Coordinate and operate pumps in conjunction with other construction.

C. Correct failures during test by repairing or replacing malfunctioning parts or equipment or faulty workmanship, regardless of cause, within 72 hours after notification from Engineer.

D. After correcting failures caused by defective equipment, material, or faulty workmanship, retest until failures are eliminated.

E. Confirm general sequencing of pump and float operations at basin and control panel are in accordance with performance requirements.

F. Document and certify startup results in start up report.

3.6 MANUFACTURER'S FIELD SERVICE

A. Section 01 40 00 - Quality Requirements: Requirements for manufacturer's field services.

B. Furnish factory trained representative and field technical assistance during the following periods of pumping station installation:
   1. Unloading of station materials and components.
   2. Start-up, testing, and demonstration of station systems-basin, pump, and control panel.

3.7 ADJUSTING

A. Adjust basin, pump, and control panel systems so station operates to performance requirements and in accordance with specifications.

3.8 DEMONSTRATION

A. Demonstrate operation of pumping station - basin components, pump system, and control panel.

END OF SECTION
SECTION 33 34 00
SANITARY UTILITY SEWERAGE FORCE MAINS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Force mains.
2. Bedding materials.

B. Related Sections:
1. Section 31 23 17 - Trenching: Excavation and backfill requirements.
2. Section 33 05 14 - Utility Manholes and Structures: Manholes vaults.
3. Section 33 05 19 - Pressure Piping Tied Joint Restraint Systems.
4. Section 33 05 23 - Trenchless Utility Installation: Pipe installation under roadways and other obstructions.
5. Section 33 01 32 - Sewer and Manhole Testing.

1.2 REFERENCES

A. ASTM International:

B. American Water Works Association:
3. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1,219 mm), for Water.
5. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
7. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
8. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.
9. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm through 300 mm), for Water Distribution.
10. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.

C. SCDOT Standard Specifications:
1.3 SUBMITTALS
   A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
   B. Shop Drawings: Indicate piping layout, including piping specialties.
   C. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories.
   D. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS
   A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
   B. Project Record Documents: Record location of pipe runs, connections, and invert elevations.
   C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE
   A. Perform Work in accordance with SCDOT Standard Specifications except as modified herein.
   B. Perform work in accordance with utility company standards.
   C. Maintain one copy of each document on site.

1.6 PRE-INSTALLATION MEETINGS
   A. Convene minimum one week prior to commencing work of this Section.

1.7 FIELD MEASUREMENTS
   A. Verify field measurements and elevations are as indicated on Drawings.

1.8 DELIVERY, STORAGE, AND HANDLING
   A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
   B. Do not place materials on private property without written permission of property owner.
   C. During loading, transporting and unloading, exercise care to prevent damage to materials.
   D. Do not drop pipe or fittings.
   E. Avoid shock or damage to pipe.
   F. Take measures to prevent damage to exterior surface or internal lining of pipe.
   G. Do not stack pipe higher than recommended by pipe manufacturer.
H. Store gaskets for mechanical and push-on joints in cool, dry location out of direct sunlight and not in contact with petroleum products.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with connection to existing municipal sewer utility service and trenching.

PART 2 PRODUCTS

2.1 FORCE MAIN PIPING

   1. Pipe Thickness Class: 50
   2. Pipe Pressure Rating: 350 psi minimum for 8” through 12”, 250 psi minimum for 14” and larger.
   3. Fittings: Ductile iron, standard size, AWWA C110; compact size, AWWA C153.
      b. Lining: Cement Mortar Lining, AWWA C104
   4. Joints:
      a. Mechanical Joints: AWWA C111.
      c. Flanged Joints inside structures: AWWA C115.
      e. Tied Restrained Joints: Per Section 33 05 19.

   1. Pipe Class: DR 18, 150 psi.
   2. Fittings:
   3. Joints:
      a. Ductile Iron, Mechanical Joint, AWWA C111.

2.2 AIR RELEASE VALVES

A. Manufacturers:
   2. Apco Valve and Primer Co.
   3. Crispin Valve Co.
   4. Valmatic Valve and Manufacturing Corp.
   5. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Furnish materials in accordance with utility company or governing agency requirements.

2.3 UNDERGROUND PIPE MARKERS
A. Plastic Ribbon and Trace Wire Tape: Brightly colored green continuously printed with "SEWER FORCE MAIN" in large letters, minimum 6 inches wide by 4 mils thick, with magnetic detectable conductor manufactured for direct burial service.

2.4 DOUBLE-DISC GATE VALVES

A. Manufacturers:
1. American Flow Control.
2. Clow Valve Company.
4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Furnish materials in accordance with utility company or governing agency requirements.

C. Double-Disc Gate Valves: AWWA C500, NSF 61; iron body, bronze trim.
1. Gate: Double disc parallel seat gate.
2. Stem: Non-rising stem.
4. Operating Nut: Square; open counterclockwise unless otherwise indicated.
5. Ends: Flanged, mechanical joint or bell end connections.
7. Provide valves 16 inch diameter and larger with bypass valves and gear operators.

2.5 RESILIENT WEDGE GATE VALVES

A. Manufacturers:
1. American Flow Control.
2. Clow Valve Company.
4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Furnish materials in accordance with utility company or governing agency requirements.

C. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron.
1. Resilient seats.
2. Stem: Non-rising bronze stem.
3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
4. Ends: Flanged, mechanical joint or bell end connections.
7. Sizes 16-Inch Diameter and Larger: 150 psig.

2.6 BUTTERFLY VALVES

A. Manufacturers:
1. American Flow Control.
2. Clow Valve Company.
4. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Size 12 Inch to 24 Inch: AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten infinite position lever handle.
C. Furnish materials in accordance with utility company or governing agency requirements.

2.7 VALVE BOXES
A. Valves 12-Inch Diameter and Smaller: Cast iron, two-piece, screw type.
B. Valves Larger Than 12-Inch Diameter: Cast iron, three-piece, screw type; round base.
C. Cast iron lid marked "SEWER".

2.8 PRECAST CONCRETE VALVE VAULTS
A. Conform to Section 33 05 14 - Utility Manholes and Structures.
B. Provide size and type as indicated on Drawings.

2.9 CONCRETE FOR THRUST RESTRAINT AND COLLARS
A. Concrete: Class A Concrete conforming to Divisions 500 and 700 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
   4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
   5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

2.10 BEDDING AND COVER MATERIALS
A. Bedding for Rigid Pipe (DIP, PVC C900, and PVC C905): Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SP, SP-SM or SP-SC.
B. Backfill around Pipe and Above Pipe: As specified in Section 31 23 17 - Trenching.

2.11 ACCESSORIES
A. Polyethylene Jackets: AWWA C105 polyethylene jacket. Single layer, lapped over pipe joint 1 foot minimum, and secured with 10-mil polyethylene tape.
B. Steel Rods, Bolt, Lugs, and Brackets: ASTM A36/A36M or ASTM A307 carbon steel.

PART 3 EXECUTION
3.1 PREPARATION
A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
B. Verify existing sewer connection, size, location, and inverts are as indicated on Drawings.

3.2 EXCAVATION
A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.

B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

C. Provide sheeting and shoring as required.

D. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches in compacted depth; compact to 95 percent.

3.3 INSTALLATION – PIPE

A. Install ductile iron pipe and fittings in accordance with AWWA C600 and manufactures’ instructions.

B. Install PVC pipe in accordance with AWWA C605 and manufactures’ instructions.

C. Handle and assemble pipe in accordance with manufacturer’s instructions and as indicated on Drawings.

D. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

E. Maintain minimum 10-foot horizontal separation and 18-inch vertical separation of water main from sewer piping or as required by local code.

F. Install pipe to indicated elevation to within tolerance of 1/2 inch.

G. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

H. Remove scale and dirt on inside and outside before assembly.

I. Route pipe in straight line. Relay pipe that is out of alignment or grade.

J. Install pipe with no high points unless indicated on Drawings. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Architect/Engineer.

K. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.

L. Prevent foreign material from entering pipe during placement.

M. Install pipe to allow for expansion and contraction without stressing pipe or joints.

N. Close pipe openings with watertight plugs during work stoppages.

O. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

P. Install underground marking tape continuously 18 to 24 inches below finished grade.
Q. Establish elevations of buried piping with not less than 3 feet of cover. Measure depth of cover from final surface grade to top of pipe barrel.

3.4 POLYETHYLENE ENCASEMENT
A. Encase Ductile Iron piping in polyethylene where indicated on Drawings to prevent contact with surrounding backfill material.
B. Install in accordance with AWWA C105, Method A.
C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

3.5 CONCRETE THRUST RESTRAINT
A. Provide valves, tees, bends, caps, plugs, and dead ends with concrete thrust blocks as indicated on Drawings.
B. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.
C. Do not encase fitting joints and flanges.

3.6 TIED JOINT RESTRAINT
A. Install tied joint restraint systems in accordance with Section 33 05 19.

3.7 BACKFILLING
A. Backfill and compact around sides and to top of pipe in accordance with Section 31 23 17.
B. Maintain optimum moisture content of material to attain required compaction density.

3.8 FIELD QUALITY CONTROL
A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
B. Perform soil compaction tests in accordance with Section 31 23 17.
C. Perform pressure test on sanitary sewer force mains in accordance with AWWA C600.
   1. Notify Engineer and Owner 72 hours in advance of test and have witness test.
   2. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.
   3. Provide equipment required to perform leakage and hydrostatic pressure tests.
   4. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
   5. Conduct hydrostatic test for at least a two-hour duration.
   6. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of hydrostatic pressure test.
   7. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure.
pressure. At conclusion of tests, remove corporation cocks removed and plug resulting piping openings.

8. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.

9. Examine exposed piping, fittings, valves, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, or joints discovered, following pressure test.

10. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

\[
L = \frac{SD\sqrt{P}}{133,200}
\]

- \( L \) = allowable, in gallons per hour
- \( S \) = length of pipe tested, in inches
- \( D \) = nominal diameter of pipe, in inches
- \( P \) = average test pressure during leakage test, in pounds per square inch (gauge)

11. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Storm drainage piping.
   2. Accessories.
   3. Concrete Collars.

B. Related Sections:
   1. Section 31 23 17 - Trenching: Excavation, bedding, and backfill requirements for trenching required by this Section.
   2. Section 33 01 32 - Sewer and Manhole Testing: Pressure, infiltration, and deflection tests.
   3. Section 33 05 14 - Utility Manholes and Structures: Concrete and masonry manholes, catch basins, inlets, junction boxes, and frames and grates for storm drains.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials
   1. AASHTO M36 – Corrugated Steel Pipe, Metallic Coated, for Sewers and Drains.
   2. AASHTO M190 – Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.
   3. AASHTO M196 – Corrugated Aluminum Pipe for Sewers and Drains.
   4. AASHTO M294 – Corrugated Polyethylene Pipe

B. ASTM International:
   1. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
   4. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
   5. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

C. SCDOT Standard Specifications:

1.3 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit data for pipe and pipe accessories.
C. Manufacturer's Installation Instructions: Submit special procedures required to install products specified.
D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS
A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
B. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE
A. Perform Work in accordance with SCDOT Standard Specifications.
B. Maintain one copy of document on site.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 5 years documented experience.
B. Installer: Company specializing in performing Work of this section with minimum 5 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
B. Block individual and stockpiled pipe lengths to prevent moving.
C. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
D. Do not place pipe flat on ground. Cradle to prevent point stress.
E. Store UV sensitive materials out of direct sunlight.

1.8 COORDINATION
A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
B. Coordinate Work with local storm drain authority.
C. Notify affected utility companies minimum of 72 hours prior to construction.
PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Reinforced Concrete Pipe (RCP): ASTM C76, bell and spigot or tongue and groove ends.
   1. Pipe Class: Class III with Wall Type B, or as otherwise specified on Drawings.
   2. Fittings: Reinforced concrete.

B. HDPE Corrugated Polyethylene Pipe: AASHTO M294, Type S or Type D.
   1. Fittings: PVC conforming to pipe specifications.

C. Corrugated Metal Pipe (CMP):
   3. Fittings: Corrugated Steel or Aluminum to match pipe.
   4. Joints: Corrugated coupling bands, galvanized steel or aluminum to match pipe, minimum 10 inches wide; connected with two neoprene "O" ring gaskets per and two galvanized steel bolts.

D. Bituminous Coated CMP: AASHTO M 190, Coated inside and out with 0.050 inch thick bituminous coating.

2.2 MANHOLES AND STRUCTURES

A. Manholes: As specified in Section 33 05 14 and indicated on Drawings; covers inscribed with “STORM SEWER.”

B. Catch Basins, Inlets and Junction Boxes: Conform to Section 33 05 14 and as indicated on Drawings.

2.3 CONCRETE AND GROUT

A. Concrete: Class A Concrete conforming to Divisions 500 and 700 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
   4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
   5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

B. Grout: Non-shrink, non-metallic in accordance with Divisions 500 and 700 of SCDOT Standard Specifications with a compressive strength of at least 5,000 psi at 3 days.

2.4 BEDDING AND COVER MATERIALS

A. General: Conform to Section 31 23 17 for bedding and backfill around and on top of pipe.

B. Bedding for Rigid Pipe (RCP): Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SP, SP-SM or SP-SC.
C. Bedding for Flexible Pipe (HDPE and CMP): Clean course aggregate Gradation No. 57 conforming to Division 700 of the SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Excavate pipe trench in accordance with Section 31 23 17.

B. Excavate to lines and grades shown on Drawings or required to accommodate installation of encasement.

C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

D. Provide sheeting and shoring in accordance with Section 31 23 17.

E. Place bedding material at trench bottom, level continuous layer not exceeding 8-inch compacted depth; compact to 95 percent per Section 31 23 17.

F. Maintain optimum moisture content of bedding material to attain required compaction density.

3.3 INSTALLATION – PIPE

A. Install in accordance with manufactures instructions and as indicated on Drawings.

B. Install plastic pipe, fittings, and accessories in accordance with ASTM D2321.

C. Seal joints watertight.

D. Lay pipe to slope gradients indicated on Drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet. Begin at downstream end and progress upstream.

E. Assemble and handle pipe in accordance with manufacturer’s instructions except as modified on the Drawings or by Engineer.

F. Keep pipe and fittings clean until work is completed and accepted by Engineer. Cap open ends during periods of work stoppage.

G. Lay bell and spigot pipe with bells upstream.

H. Connect pipe to existing sewer system as indicated on Drawings at existing manhole or using doghouse manhole connection per Section 33 05 14.

I. Install underground marking tape continuously 12 inches above pipe line.
J. Connect to subdrainage tile system piping. Refer to Section 33 46 00.

K. Install site storm drainage system piping to 5 feet of building and plug.

3.4 INSTALLATION - CONNECTION TO EXISTING STRUCTURES

A. Core drill existing manhole to clean opening. Do not use pneumatic hammers, chipping guns, and sledge hammers.

B. Install watertight neoprene gasket and seal with non-shrink concrete grout.

C. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint. Use epoxy binder between new and existing concrete.

D. Prevent construction debris from entering existing sewer line when making connection.

3.5 INSTALLATION – MANHOLES, CATCH BASINS AND CLEANOUTS

A. Install manholes in accordance with Section 33 05 14.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Form and place cast-in-place concrete base pad or pre-cast concrete base with provision for storm sewer pipe end sections.

D. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

E. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

F. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Request inspection prior to and immediately after placing bedding.

C. Perform tests on storm drain system in accordance with Section 33 01 34 and local code. Perform the following tests:

   1. Gravity Sewer Testing:
      a. Low Pressure Air Test.
      b. Infiltration Test.


   4. Notify Engineer 72 hours in advance of test and have witness test.

D. Soil Compaction Testing: In accordance with Section 31 23 17.

E. When tests indicate Work does not meet specified requirements, remove work, replace, and retest.

3.7 PROTECTION OF FINISHED WORK
A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
   1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
   2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION
SECTION 33 42 13
PIPE CULVERTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe culverts.
2. Joints and accessories.
4. Slope protection at pipe end.

B. Related Sections:
1. Section 31 23 17 - Trenching: Excavating and backfilling for culvert piping.
2. Section 31 37 00 – Riprap: Erosion protection at culvert ends.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO M36 – Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
2. AASHTO M190 – Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.
3. AASHTO M196 – Corrugated Aluminum Pipe for Sewers and Drains.
4. AASHTO M294 - Specification for Corrugated Polyethylene Pipe, 305- to 915-mm (12- to 36-In.) Diameter.
5. AASHTO M294 - Corrugated Polyethylene Pipe

B. ASTM International:
2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.

C. SCDOT Standard Specifications:

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit data on pipe, fittings and accessories.

C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents:
   1. Accurately record actual locations of pipe runs, connections, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

C. Operation and Maintenance Data: Procedures for submittals.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Reinforced Concrete Pipe (RCP): ASTM C76, bell and spigot or tongue and groove ends.
   1. Pipe Class: Class III with Wall Type B, unless otherwise shown on Drawings.
   2. Fittings: Reinforced concrete.

B. Reinforced Non-Circular Concrete Pipe:
   1. Reinforced Concrete Arch Pipe: ASTM C506, Class A-III.
   2. Reinforced Horizontal Elliptical Concrete Pipe: ASTM C507, Class HE-II.
   3. Reinforced Vertical Elliptical Pipe: ASTM C507, Class VE-III.

C. HDPE Corrugated Polyethylene Pipe: AASHTO M294, Type S or Type D.
   1. Fittings: PVC conforming to pipe specifications.

D. Corrugated Metal Pipe (CMP):
   1. Steel Pipe: ASSHTO M36, Gage 16 for 6” through 48”, Gage 14 for 54”, Gage 12 for 60”.
   2. Fittings: Corrugated Steel or Aluminum to match pipe.
   3. Joints: Corrugated coupling bands, galvanized steel or aluminum to match pipe, minimum 10 inches wide; connected with two neoprene "O" ring gaskets per and two galvanized steel bolts.

E. Bituminous Coated CMP: AASHTO M 190, Coated inside and out with 0.050 inch thick bituminous coating.

2.2 BEDDING AND COVER MATERIALS

A. General: Conform to Section 31 23 17 for bedding and backfill around and on top of pipe.

B. Bedding for Rigid Pipe (RCP): Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SP, SP-SM or SP-SC.
C. Bedding for Flexible Pipe (HDPE and CMP): Clean course aggregate Gradation No. 57 conforming to Division 700 of the SCDOT Standard Specifications.

D. Cover and Fill: Conform to Section 31 23 17.

### 2.3 ACCESSORIES

A. Geotextile Fabric: Non-woven, non-biodegradable conforming to Division 800 of the SCDOT Standard Specifications for Type 1 Engineering Fabric.

B. Concrete: Class A Concrete conforming to Division 700 of the SCDOT Standard Specifications.
   1. Compressive strength of 3,000 psi at 28 days.
   2. Air entrained.
   3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
   4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
   5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

#### 3.2 PREPARATION

A. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

#### 3.3 EXCAVATION AND BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17.

B. Excavate to lines and grades shown on Drawings or required to accommodate installation of encasement.

C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

D. Provide sheeting and shoring in accordance with Section 31 23 17.

E. Place bedding material at trench bottom, level continuous layer not exceeding 8-inch compacted depth; compact to 95 percent per Section 31 23 17.

F. Maintain optimum moisture content of bedding material to attain required compaction density.

#### 3.4 INSTALLATION – PIPE
A. Install in accordance with manufactures instructions and as indicated on Drawings.

B. Install plastic pipe, fittings, and accessories in accordance with ASTM D2321.

C. Seal joints watertight.

D. Begin at downstream end and progress upstream.

E. Keep pipe and fittings clean until work is completed and accepted by Engineer.

F. Lay bell and spigot pipe with bells upstream.

G. Repair surface damage to pipe with protective coating with two coats of compatible bituminous paint coating.

H. Install cover at sides and over top of pipe

3.5 PIPE ENDS
A. Place fill at pipe ends to match embankment slopes, concrete aprons, adjacent construction, end sections, or end walls as indicated on Drawings.

3.6 ERECTION TOLERANCES
A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Lay pipe to alignment and slope gradients noted on Drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet.

C. Maximum Variation from Intended Elevation of Culvert Invert: 1/2 inch.

D. Maximum Offset of Pipe From Indicated Alignment: 1 inch.

E. Maximum Variation in Profile of Structure from Intended Position: 1 percent.

3.7 FIELD QUALITY CONTROL
A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Request inspection prior to and immediately after placing bedding.

C. Soil Compaction Testing: In accordance with Section 31 23 17.

D. When tests indicate Work does not meet specified requirements, remove work, replace, and retest.

3.8 PROTECTION OF INSTALLED CONSTRUCTION
A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.
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<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td>Double Chain Link Swing Gate</td>
</tr>
<tr>
<td>WS-8</td>
<td>Areas Required for Concrete Blocking for Tees &amp; Bends etc.</td>
</tr>
</tbody>
</table>
NOTES:
1. ALL CASTINGS TO BE FREE FROM SAND HOLES; NO PLUGGING WILL BE ALLOWED.
2. CAST WITH THE USE OF ALUMINUM PATTERNS.
3. CASTING TO BE PAINTED WHILE HOT WITH COAL TAR.
4. SLIGHT DRAFT ALLOWED ON STRAIGHT FACES.
5. COVERS SHALL HAVE TWO – 1” DIAMETER HOLES. WATERTIGHT COVERS SHALL BE SOLID WITH RUBBER GASKET SEAL AND LIFTING BARS.
6. STANDARD LETTERS UNLESS OTHERWISE SPECIFIED.
7. APPROXIMATE WEIGHT
   OF FRAME – 190 LBS.
   APPROXIMATE WEIGHT
   OF COVER – 120 LBS.
   APPROXIMATE WEIGHT
   OF TOTAL – 310 LBS.
8. COVERS SHALL BE USF669 RING AND KL COVER OR EQUAL. WATERTIGHT COVERS SHALL BE USF710 RING AND DPSSG COVER OR EQUAL.
9. WHEN THE MANHOLE IS EXPOSED TO ROAD TRAFFIC, THE TOP OF THE FRAME IS TO BE FLUSH WITH THE GROUND. AT THE OTHER LOCATIONS IT SHALL BE 9” ABOVE THE GROUND.
10. RIMS AND COVERS TO BE GRAY CAST IRON COMPLYING TO ASTM A48, CLASS 30 IRON.
11. MANHOLES COVERS SHALL BE HEAVY DUTY AND RATED FOR H-20 TRAFFIC LOADS.
NOTES:
1. 6" MIN. CONCRETE SLAB TO BE POURED TO GROUND CUT.
2. INVERTS TO IN & OUT PIPES TO BE BUILT AFTER MANHOLE HAS BEEN SET.
3. MANHOLE TO BE Leveled & assembled so as to evenly distribute wall bearing load.
4. 6" MIN. EXTENSION BEYOND EXTERIOR WALL OF MANHOLE.
5. PRE CAST MANHOLE JOINTS TO BE SEALED WITH "O" RING JOINT-ASTM C-443 OR WITH APPROVED BUTYL RUBBER SEALANT.
6. CONCRETE SLAB SHALL EXTEND A MIN. OF 3" ABOVE BOTTOM OF FIRST MANHOLE SECTION.
7. ALL LIFT HOLES TO BE SEALED WITH TAPERED NEOPRENE PLUGS OR OTHER APPROVED EQUAL LIFT HOLES TO BE SEALED FROM OUTSIDE.
8. PROVIDE REINFORCED CONCRETE FOOTING WHEN MANHOLE IS GREATER THAN 12" OR ON POOR SOIL BASE.
9. MANHOLE MUST MEET AASHTO M199
10. MANHOLE SHALL BE PRE CAST CONCRETE WITH CONCENTRIC CONE SECTIONS COMPLYING TO ASTM C-478.

NOTE:
PRE CAST MANHOLE MAY BE CONSTRUCTED TO A MAXIMUM DEPTH OF 14" USING 4' PRE CAST MANHOLE SECTIONS. IF MANHOLE DEPTH EXCEEDS 14", USE 5 MANHOLE SECTIONS AS SHOWN.

4" THICK 95% PROCTOR COMPACTED 57 WASHED STONE TO BE 6" CONCRETE W/OUTSIDE DROP.

HOLE TO BE CUT IN MANHOLE AS NEEDED
CAST IN PLACE RUBBER SLEEVE REQUIRED

LEVELING BLOCKS
6" MIN. SEE NOTE #1

USE BRICK OR BLOCK TO LEVEL MANHOLE AT 3 OR 4 POINTS AROUND BOTTOM OF MANHOLE

FOR STANDARD DETAIL OF FRAME & COVER SEE SHEET WS-1
SEE NOTE

LAYERING LENGTH VARIES
8" TO 48" IN 8 INCREMENTS

STANDARD FOOTING AS SHOWN AT LEFT TO BE USED.
VENT ELEVATION  
2’ ABOVE 100 YR FLOOD ELEV.

RIM ELEVATION
CITY OF LANCASTER STANDARD WATERTIGHT FRAME & COVER
ANCHOR FRAME TO MANHOLE WITH FOUR 3/4” BOLTS

NOTES
1. MANHOLE FRAME AND COVER AND VENT INSTALLATION TO BE SEALED WITH COAL TAR.
2. ALL VENT OUTLETS ARE TO BE POINTED DOWNSTREAM.
3. STEEL VENT PIPE SHALL BE 3” Ø SCHEDULE 40 (7.58 LBS/LF) AS SPECIFIED IN ASTM A–139, LATEST REVISION.
4. INSIDE OF VENT PIPE SHALL HAVE A 3/32 INCH COAL TAR LINING ACCORDING TO AWWA 203, LATEST REVISION.
5. OUTSIDE OF VENT PIPE SHALL BE SAND BLASTED TO COMMERCIAL STANDARDS AND HAVE ONE COAT OF ZINC CHROMATE PRIMER APPLIED ACCORDING TO FEDERAL SPECIFICATIONS TT–86A, LATEST REVISION. VENT PIPE SHALL THEN RECEIVE TWO EVENLY APPLIED COATS OF RUST INHIBITING ENAMEL PAINT, EITHER KOPPERS ‘GLAMORTEX’ NO. 501 ENAMEL (OLIVE GREEN), SOUTHERN COATINGS ‘RUSTALOY’ NO. 0537 ENAMEL (GARDEN GREEN), OR APPROVED EQUAL.
6. 2 GALVANIZED STRAPS MAY BE USED IN LIEU OF CONCRETE FOOTING FOR VENT.
7. ALL SEALED MANHOLE DETAILS SHALL BE VENTED TO 2’ ABOVE THE FLOOD ELEVATION.
8. A THREADED COUPLING MAY BE USED IN THE TOP 18” TO AID IN ALIGNING THE VENT DOWNSTREAM.

SEE CITY OF LANCASTER STANDARD MANHOLE DETAILS

3" DIA SEAMLESS STEEL PIPE ASSY

24" DIA

12" MIN.

VARS
CONCENTRIC CONE

STANDARD PRECAST CONCRETE MANHOLE, SEE DETAIL SS-3

M.J. TEE

DUCTILE IRON PIPE

DROP PIPE TO BE SAME SIZE AS INFLUENT MAIN

90° BEND

UNDISTURBED MATERIAL

AGGREGATE BED NO. 57 STONE

DIP DROP PIPE SHALL BE ENCASED IN CONCRETE AS ShOWN OR SHALL BE STRAPPED TO MANHOLE WITH STAINLESS STEEL STRAPS ON 4" MAX SPACING WITH STAINLESS STEEL ANCHOR BOLTS AND ENCASED IN #57 STONE.

SDR 21 PVC
STD. SEWER PIPE

2'-6" MIN.

VARIIES

DEPTH VARIES

6'-8"

4'-0"

DAM-1/2 PIPE DIA. MAXIMUM

PROVIDE D.I.P. TO UNDISTURBED MATERIAL (9" MINIMUM)
SLOPE AWAY FROM RIM

4' DIA. MANHOLE

1" SHUT OFF VALVE

QUICK DISCONNECT COUPLING

SEWAGE AIR RELEASE VALVE CRISPIN MODEL SL-20AB OR EQUAL

2" SHUT OFF VALVE

2 - 6" DIA. DRAIN HOLES IN MANHOLE BASE

D.I.P. FORCE MAIN

6' BACKFLUSH HOSE

1" BLOW-OFF

2" TAP IN FLANGE

FLANGED TEE

TRANSITION COUPLING (IF REQ'D.)

COMPACTED NO. 57 STONE

20' MIN

NOTES

1. INSTALL FORCE MAIN AT DEPTH TO SUIT MANHOLE.

2. VERIFY MANHOLE DEPTH REQUIRED WITH VALVE MANUFACTURER.

3. FORCE MAIN PIPE & FITTINGS SHALL BE D.I.P. WITHIN MANHOLE.
CLASS B
COMPACTED GRANULAR BEDDING
LOAD FACTOR 1.9

CLASS C
SHAPED BOTTOM
LOAD FACTOR 1.5
STANDARD BEDDING DETAIL FOR PVC

CLASS B
COMPACTED GRANULAR BEDDING
LOAD FACTOR 1.9
NOTES:
1. WHEN A SADDLE IS USED, THE HOLE SHALL BE INSTALLED BY CORING.
2. THE FULL LENGTH OF THE SERVICE DITCH SHALL BE COMPACTED IN 6" LAYERS WITH MECHANICAL TAMPER. GUARD STAKE REQUIRED AT CLEAN OUT LOCATION UNTIL LANDSCAPING IS COMPLETED.
STANDARD DETAIL

SANITARY SEWER
LATERAL CONNECTION
TO EXISTING MANHOLE

DEPTH VARIES

PROPERTY LINE

4" SCREENED CLEAN OUT
PVC PLUG

FINISHED Grade 2

4" PVC
ASTM C 3034,
SDR35 OR
4" CI SOIL PIPE

1/4" PER FT. MIN.

PLUG UNTIL HOUSE SERVICE CONNECTION

18"

COMBINATION LONG TURN AND 1/8" BEND

Curb

4' CONCRETE

PAVED

8" 6"

STANDARD PIPE CAST CONCRETE
MANHOLE, SEE DETAIL WS-3

PROPERTY OWNER'S
RESPONSIBILITY
FROM M.H. TO STRUCTURE

STANDARD DETAIL
CITY OF LANCASTER
LANCASTER COUNTY, S.C.

FILE No. SS-9

DATE: JANUARY 2008
DRAWN BY: WKD
SCALE: NONE
RESIDENTIAL PUMPING STATION

STANDARD DETAIL

48" DIA. BASIN

1-1/4 PVC DISCH. FLANGE

PVC BALL VALVE W/1/2" GALV. PIPE HARALLE EXTENSION

1-1/4" PVC SUPPORT FLANGE

RAIL SUPPORT FLANGE

RAIL SUPPORT YOKE

UPPER HOLDDOWN GUIDE

1" GUIDE RAILS

GALVANIZED LIFTING CHAIN

LOWER HOLDDOWN GUIDE

PUMP GUIDE AND LIFTING PLATE

INLET HUB--AS REQ'D. FIELD MOUNTED

HIGH WATER ALARM

PUMP GUIDE AND LIFTING PLATE

PUMP OFF GRINDER PUMP

BASIN DEPTH

1-1/4 PVC DISCHARGE PIPE

PUMP DISCHARGE PIPING W/CHECK VALVE AND SEALING FLANGE

CONCRETE FILLET

DISCHARGE AND RAIL SUPPORT

VOLUMES FOR RESIDENTIAL PUMPING STATIONS

<table>
<thead>
<tr>
<th>H (FT)</th>
<th>VOLUME (GAL.)</th>
<th># BEDROOMS</th>
</tr>
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<tbody>
<tr>
<td>2.55</td>
<td>240</td>
<td>1 OR 2</td>
</tr>
<tr>
<td>3.83</td>
<td>360</td>
<td>3</td>
</tr>
<tr>
<td>5.11</td>
<td>480</td>
<td>4</td>
</tr>
</tbody>
</table>
NEW VALVE VAULT BOX OF PRECAST CONCRETE

HALLIDAY A3648 OR OWNER APPROVED EQUIVALENT ACCESS DOOR ASSEMBLY

FLG. ELBOW FOR EMERGENCY PUMP CONNECTION

THREE PIECE ADJUSTABLE VALVE BOX W/CONCRETE COLLAR

FLG. TEE

M.J. TEE

FORCE MAIN

3'-0"

MINIMUM COVER

4" DRAIN BACK TO WET-WELL

FITTING SUPPORT MIN 3 REQUIRED

MIN 4" STONE

2 BITUMINOUS COATED TIE-RODS BACK TO VAULT

CONCRETE BLOCKING

DISCHARGE ELEV =

3'-0"

PRECAST VALVE VAULT SECTION C-C

NOT TO SCALE
NOTES:

1. BACKFILL TO 95% OF MAXIMUM DENSITY WHERE EXCAVATIONS CUT THROUGH PAVEMENTS, CURBS, DRIVEWAYS AND SIDEWALKS, AND UNDER OR ADJACENT TO STRUCTURES.

2. STONE IS REQUIRED TO 6” BELOW PIPE WHEN ENCOUNTERING ROCK OR WET CONDITIONS. STONE TO RANGE IN SIZE FROM 1/2” TO 1-1/2”.

4. HAND CARVE BOTTOM AND SHAPE FOR LOWER QUADRANT OF PIPE. EXCAVATE ADDITIONALLY FOR BELLS.

5. INVERT OF PROPOSED TRENCH LINE SHALL BE AT A MAXIMUM 1:1 SLOPE AS PROJECTED FROM EDGE OF EXISTING PAVEMENT.

7. PROVIDE MINIMUM 36” COVER OVER PIPE, OR DEEPER AS REQUIRED TO MAINTAIN A MINIMUM OF 36” BELOW ELEVATION OF EDGE OF EXISTING PAVEMENT.

8. PVC PIPE SHALL INCLUDE COPPER TRACER WIRE, SEE TYPICAL DETAIL.
NOTE: SEE STANDARD SEWER LINE TRENCH DETAIL FOR PIPE BEDDING BEYOND COUPLING.
NOTES:

1. MEASUREMENT FOR THE STATION SHALL ALWAYS BE MADE FROM THE CLOSEST DOWNSTREAM MANHOLE.

2. ALL MEASUREMENTS ARE TAKEN FROM THE MANHOLE COVER CENTER.

3. ALL MEASUREMENTS SHALL BE MADE ON A HORIZONTAL PLANE, (AT GROUND LEVEL).

4. DEFINITIONS:

   R.U. = RUN UP — THE HORIZONTAL MEASUREMENT OF THE ACTUAL LATERAL PIPE

   HT. = HEIGHT — THE DISTANCE MEASUREMENT AT 90° FROM THE MAIN LINE TO THE PROPERTY LINE

   D = DEPTH — DEPTH OF LATERAL AT PROPERTY LINE (NOTE: NORMALLY BETWEEN 24” AND 40”)
STANDARD DETAIL

STANDARD MANHOLE STEP

DATE: JANUARY 2008
DRAWN BY: WKD
SCALE: NONE

CITY OF LANCASTER
LANCASTER COUNTY, S.C.

FILE NO. SS-16
NOTES:


2. TWO PIPE CLAMPS REQUIRED FOR PIPE O.D.'S 15” AND LARGER.
Cored hole with neoprene boot

90° SCH 80 PVC discharge elbow

See note below

Existing manhole

Existing bench

Distance "D" from discharge elbow to existing bench exceeds
2'-0". Provide additional pipe and 90° elbow, grout to bench.

D.I.P.

Force main

12" Min.

12" Min.

12" Min. cover

See plans

See note

FORCE MAIN—1.5" THRU 3" Ø

CONNECTION TO EXISTING MANHOLE

STANDARD DETAIL

CITY OF LANCASTER
LANCASTER COUNTY, S.C.

DATE: JANUARY 2008
DRAWN BY: WKD
SCALE: NONE

FILE NO. SS-18A
OVERHANG
CURB LINE

STALL WIDTH
STALL ANGLE
TOP OF STALL WIDTH

STALL DEPTH
DRIVEWAY WIDTH
STALL DEPTH

MODULE DIMENSION

OVERLAP

TRAFFIC LANE

STANDARD DETAIL
CITY OF LANCASTER
LANCASTER COUNTY, S.C.

DATE: JANUARY 2008
DRAWN BY: WKD
SCALE: NONE

PARKING LOT DEFINITIONS

FILE NO. SITE-1
<table>
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<tr>
<th>n</th>
<th>s</th>
<th>a</th>
<th>c</th>
<th>u</th>
<th>s'</th>
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<tr>
<td>90°</td>
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<td>9'-0&quot;</td>
<td>64'-0&quot;</td>
<td>20'-0&quot;</td>
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<tr>
<td>60°</td>
<td>21'-10&quot;</td>
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<td>10'-5&quot;</td>
<td>61'-8&quot;</td>
<td>19'-7&quot;</td>
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<tr>
<td>45°</td>
<td>20'-6&quot;</td>
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<td>12'-10&quot;</td>
<td>54'-0&quot;</td>
<td>17'-3 1/2&quot;</td>
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<table>
<thead>
<tr>
<th>n</th>
<th>u'</th>
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<td>57'-2&quot;</td>
</tr>
<tr>
<td>45°</td>
<td>47'-7&quot;</td>
</tr>
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</table>
NOTE: ALLOW 3'–9"
FOR REAR OVERHANG

NOTE:
24' WIDE AISLES
REQUIRED FOR
2-WAY TRAFFIC

61'–8” MODULE

21'–10”
18'–0”
19'–7”
54'–0” TO Q. OVERLAP

1'–9”

6” RAISED CURB LINE

6” HIGH PARKING BARRIERS WHERE
REQUIRED BY CITY ENGINEER

BITUMINOUS SURFACING OVER
CRUSHED STONE BASE

PAINTED PARKING LINES

60°

19'–0”

10’–5”

1'–9”

10’–0”

6” RAISED CURB

STREET CURB

16’–0”

STREET

ENTRANCE

VARIABLE

3'–0” MIN.

R/W

EXIT

R

PARKING PLAN – 60° PARKING
ONE-WAY MOVEMENT

STANDARD DETAIL

CITY OF LANCASTER
LANCASTER COUNTY, S.C.

FILE NO. SITE–4

DATE: JANUARY 2003
DRAWN BY: WKD
SCALE: NONE
NOTE:
ALLOW 3'-3" FOR REAR OVERHANG

NOTE:
24' WIDE AISLES REQUIRED FOR TWO-WAY TRAFFIC

STANDARD DETAIL
CITY OF LANCASTER
LANCASTER COUNTY, S.C.

PARKING PLAN - 45° ANGLE
ONE-WAY MOVEMENT

FILE NO. SITE-5
NOTE:
1. MATERIAL: GRAY CAST IRON, ASTM CLASS A48-60CL-30
2. CODE NO. CH-BN-2001, TYPE "C" (DEWEY BROS., INC.; GOLDSBORO, NC)
3. CODE NO. CH-S-6 (SUMPTER MACHINERY CO., INC.; SUMPTER, SC)
4. USE DIRECTIONAL GRATES WHERE INDICATED
POROUS BED OF STONE 12" X 12" X 4'-0"
FOR SUB GRADE DRAIN W/FILTER FABRIC
(MIRAFI 140N) OR EQUAL, OVERLAP 1 FT. AT TOP

TOP OF CURB

12"

OPENING IN WALL
APPROX. 4"

ASPHALT

3000 PSI CONCRETE

15" OR 18"
DIAMETER

Either brick masonry, Class "A" concrete, or pre cast concrete may be used to construct catch basins.

Concrete walls are to be 6" thick & the floor 6" of 3000 PSI concrete.

Brick walls are to be 8" thick & the floor 6" of 3000 PSI concrete.
Steps required where depth exceeds 4'-0".

NOTE:
*24" R.C.P. AND UP USE PIPE DIAMETER PLUS 10"
Either brick masonry, Class "A" concrete, or pre-cast concrete may be used to construct catch basins. Concrete walls are to be 6" thick & the floor 6" of 3000 PSI concrete. Brick walls are to be 8" thick & the floor 6" of 3000 PSI concrete. Steps required where depth exceeds 4'-0".

*NOTE:
24" R.C.P. AND UP
USE PIPE DIAMETER
PLUS 10"
NOTES:
1. CLASS "B" CONCRETE TO BE USED THROUGHOUT.
2. OPTIONAL CONSTRUCTION – MONOLITHIC POUR, 2" KEYWAY, OR 4 BAR DOWELS AT 12" CENTER, AS DIRECTED BY ENGINEER.
3. FORMS ARE TO BE USED FOR THE CONSTRUCTION OF THE BOTTOM SLAB.
4. A STONE DRAIN CONSISTING OF 1 CUBIC FOOT OF NO. 78M STONE CONTAINED IN A BAG OF POROUS FABRIC SHALL BE PLACED AT EACH WEEP HOLE.
5. ALL DROP INLETS OVER 3'-6" IN DEPTH TO BE PROVIDED WITH STEPS 1'-2" ON CENTERS.
**NOTES:**

1. ALL DROP INLETS OVER 3'-6" IN DEPTH TO BE PROVIDED WITH STEPS 1'-2" ON CENTERS.

2. CLASS "B" CONCRETE TO BE USED.

3. ALL MORTAR JOINTS ARE TO BE 1/2" ± 1/8".

4. FORMS ARE TO BE USED FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

5. BRICK MASONRY DROP INLET NOT TO BE USED IN LOCATIONS SUBJECT TO TRAFFIC.

6. JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICK.

7. FOR 8"-0" IN HEIGHT OR LESS USE 8" WALL OVER 8"-0" IN HEIGHT USE 12" WALL TO 6'-0" FROM TOP OF WALL AND 8" WALL FOR THE REMAINING 6'-0".

---

**DIMENSIONS AND QUANTITIES FOR DROP INLET**

<table>
<thead>
<tr>
<th>PIPE</th>
<th>SPAN</th>
<th>WIDTH</th>
<th>HEIGHT</th>
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<tr>
<td>12&quot;</td>
<td>3'-0&quot;</td>
<td>2'-0&quot;</td>
<td>2'-8&quot;</td>
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<td></td>
<td>3'-0&quot;</td>
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</tr>
<tr>
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<td>4'-0&quot;</td>
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</tr>
<tr>
<td>30&quot;</td>
<td>3'-0&quot;</td>
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<td>4'-3&quot;</td>
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</tbody>
</table>
R.C. PIPE (OR OTHER APPROVED PIPE)
STANDARD FLARED END SECTION

PLAN

SIDE VIEW

END VIEW

NOTE:
TO BE USED ONLY FOR PIPES 36" OR LESS IN DIAMETER
PLAN

NOTE:
SEE FILE NO. SD-15 AND 16
FOR DIMENSIONS
SEE SD-9 FOR FRONT ELEV. VIEW

TYPICAL SECTION A-A

NOTE:
FILL EVERY CAVITY COMPLETELY
WITH 3000 PSI CONCRETE.

CONCRETE SHALL NOT FALL
MORE THAN THE HEIGHT OF 5
LAYERS OF BLOCK.

DUR-A-WALLS TO BE
PLACED EVERY COURSE.
PLACE 4-#5 AROUND PIPE IN BOTH FACES TO PROTECT AGAINST DIAGONAL TENSION

2" WEEP HOLES USED WITH 15"-42" PIPE WILL BE PLACED 6" INSIDE WING; 48"-96" WILL BE PLACED 8" INSIDE WING

FRONT VIEW

SIDE VIEW

NOTE: SEE FILE NO. SD-15 AND 16 FOR DIMENSIONS. SEE SD-12 FOR TOP VIEW

STANDARD DETAIL

REINFORCED CONCRETE HEADWALL WITH WING WALLS

CITY OF LANCASTER LANCASTER COUNTY, S.C.

FILE NO. SD-11
NOTE: FOR WEEP HOLES FOR 15° & 18° PIPE USE D/2

use 1-1/2” BEVEL ON FRONT CORNER

PLAN

MAIN RE-BARS BACK FACE
TEMPERATURE RE-BARS FRONT FACE

2” ON 8” WALL
3” ON 12” WALL

15”

3”

40xBAR DIA.

NOTE: SEE FILE NO. SD-15 AND 16 FOR DIMENSIONS
SEE SD-11 FOR FRONT ELEV. VIEW

SECTION A–A

#4 Ø 12” O.C. BOTH FACES HORIZONTAL & VERTICAL
**STANDARD DETAIL**

**WINGS FOR 48" RCP AND UNDER (WITHOUT REINFORCING STEEL)**

**CITY OF LANCASTER**
**LANCASTER COUNTY, S.C.**

**COMMON CLAY HARD OR CONC. BRICK**

**DIA. PIPE**

**NOTE:** ADD THESE DIMENSIONS TO OVERALL DIMENSIONS ON FILE NO. SD-15 AND 16 FOR BRICK HEADWALLS

<table>
<thead>
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<th>COMMON DIM.</th>
<th>D</th>
<th>L</th>
<th>M</th>
<th>N</th>
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<td>2&quot;</td>
<td></td>
</tr>
<tr>
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<td>3-4&quot;</td>
<td>2-0&quot;</td>
<td>2-1/2&quot;</td>
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<td>30&quot;</td>
<td>3-9&quot;</td>
<td>2-4&quot;</td>
<td>2-3/4&quot;</td>
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</tr>
<tr>
<td>36&quot;</td>
<td>4-3&quot;</td>
<td>2-4&quot;</td>
<td>3&quot;</td>
<td></td>
</tr>
<tr>
<td>42&quot;</td>
<td>4-11&quot;</td>
<td>2-8&quot;</td>
<td>3-1/2&quot;</td>
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</tr>
<tr>
<td>48&quot;</td>
<td>5-7&quot;</td>
<td>3-0&quot;</td>
<td>4&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**2" WEEP HOLES USED WITH 15"-42" PIPE WILL BE PLACED 6" INSIDE WING; 48"-96" WILL BE PLACED 8" INSIDE WNG**

**NOTE:** SEE SD-14 FOR TOPELEV. VIEW
STANDARD DETAIL

BRICK HEADWALL WITH WING WALLS
FOR UP TO 48" DIAMETER R.C.P.
(WITHOUT REINFORCING STEEL)

DATE: JANUARY 2008
DRAWN BY: WKD
SCALE: NONE

CITY OF LANCASTER
LANCASTER COUNTY, S.C.

FILE NO. SD-14
<table>
<thead>
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<th>Size</th>
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<th>36&quot;</th>
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<td>Shell Thickness</td>
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<td>4 1/2&quot;</td>
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</tbody>
</table>

**STANDARD DETAIL**

**DIMENSIONS FOR A SINGLE PIPE HEADWALL WITH WING WALLS**

**CITY OF LANCASTER**

**LANCASTER COUNTY, S.C.**

**DATE:** JANUARY 2008

**DRAWN BY:** WKD

**SCALE:** NONE

**FILE NO.:** SD-15
### SINGLE PIPE HEADWALL

<table>
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<tr>
<th>PIPE SIZE</th>
<th>WALL REINFORCEMENT</th>
<th>SLAB REINFORCEMENT</th>
<th>TEMP REINF IN FRONT FACE OF WALLS OR COMPRESSION STEEL</th>
<th>CUBIC YARDS OF CONCRETE</th>
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<tbody>
<tr>
<td>15&quot;</td>
<td>#3 @ 12&quot; O.C.</td>
<td>#3 @ 12&quot; O.C.</td>
<td>6-6 x 10-10 WIRE MESH REINF.</td>
<td>1.61</td>
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<tr>
<td>18&quot;</td>
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### DOUBLE PIPE HEADWALL

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<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>L</th>
<th>CUBIC YARDS OF CONCRETE</th>
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<td>8'-6&quot;</td>
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<td>25'-9&quot;</td>
<td>13'-8&quot;</td>
<td>15'-3&quot;</td>
<td>8.52</td>
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</tbody>
</table>

**NOTE:**
1. All dimensions for a double pipe H.W. are same as single pipe H.W. except as shown above.
2. The distance between pipes in a double pipe H.W. is 2 ft.
NOTES:
1. THE CONTRACTOR SHALL MAINTAIN ALL SILT FENCING BY REMOVING AND DISPOSING OF SILT ACCUMULATIONS. FILTER FABRIC SHALL BE REPLACED WHEN IT HAS DETERIORATED TO SUCH EXTENT THAT IT REDUCES THE EFFECTIVENESS OF THE SILT FENCE.

2. FILTER FABRIC SHALL HAVE A MINIMUM TENSILE STRENGTH (8% 20% MAX. ELONGATION) OF 30lbs/LIN. IN., WIRE FABRIC REQUIRED.

3. IF EXTRA STRENGTH FABRIC IS UTILIZED (MIN. TENSILE STRENGTH = 50 lbs/LIN. IN. @ MAX. 20% ELONGATION), WIRE FABRIC IS OPTIONAL, MAXIMUM POST SPACING = 6 FEET.

4. POSTS SHALL BE 4" DIA. PINE, 2" DIA. OAK OR 1.33 lb/LF STEEL.
NOTE:
CONTRACTOR TO DETERMINE THE SIZE OF TRENCH AND QUANTITY OF STONE FOR DIFFERENT DRAIN FIELDS, WITH FINAL APPROVAL OF THE ENGINEER.
NOTES:
CITY MAY REQUIRE GREATER DEPTHS OF STONE BASE AND SURFACE PAVING AS REQUIRED FOR INDUSTRIAL PARK.
* NOTE: CONTRACTOR MAY ALSO USE 2" IN 12".
CONCRETE SIDEWALK

TYPICAL PLAN

LOCATION OF JOINTS

NOTE:
WHEN FRONT EDGE OF WALK IS POURED ADJACENT TO CURB OR BACK OF WALK IS POURED ADJACENT TO A BUILDING OR EXISTING CONCRETE, A 1/2" EXPANSION JOINT SHALL BE PLACED BETWEEN NEW WALK AND EXISTING STRUCTURES. WHERE A DRIVEWAY CROSSES A WALK, THE SIDEWALK SHALL HAVE A DEPTH OF 6" WITH 1/2" EXPANSION JOINT EACH SIDE OF WALK.
REMOVE ALL EXISTING CURB AND GUTTER SECTIONS BETWEEN THESE EXISTING CONSTRUCTION JOINTS

WIDTH OF DRIVEWAY ENTRANCE
SEE GENERAL NOTES

CONCRETE APRON REQUIRED TO TANGENT OF DRIVEWAY RADIUS

PLAN

1/2" EXPANSION JOINT MATERIAL

4" CONC. SIDEWALK

10' RADIUS MIN.

FACE OF CURB

FOR CURB AND GUTTER DETAIL SEE CITY STANDARD

SECTION A-A
NOTE:
GRADES SHOWN ABOVE ARE MAXIMUM ALLOWABLE GRADES.
1. LOCATION OF WHEELCHAIR RAMP:

1. In accordance with the ratified House Bill 1296, all street curbs in North Carolina being constructed or reconstructed for maintenance procedures, traffic operations, repairs, correction of utilities or altered for any reason after September 1, 1973 shall provide wheelchair ramps for the physically handicapped at all intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

2. Wheelchair ramps should be located as indicated in detail drawings, however existing light poles, fire hydrants, drop inlets, etc. may affect placement.

II. CONSTRUCTION NOTES:

1. No slope shall exceed 1"=1' (12:1) on the ramp or sidewalk.

2. In no case shall the width of wheelchair ramps be less than 40" (3'-4''). Widths may exceed 40" if necessary.

3. Use Class "A" concrete with the surface having a rough, nonskid type finish.

4. A 1/2" expansion joint will be required where the concrete wheelchair ramp joins any rigid pavement or structure.

5. Construction methods shall conform with those of the governing body which has jurisdiction of the particular street.

III. ADDITIONAL NOTES:

NOTE 1. The inside pedestrian crosswalk lines shall be established by bisecting the intersection radii where marked. (See Note 7)

NOTE 2. The wheelchair ramp shall be located so that the beginning of the wheelchair ramp will be two feet from the inside pedestrian crosswalk line.

NOTE 3. The width of the pedestrian crosswalk shall be 10 feet unless a greater width is required to accommodate the pedestrian traffic.

NOTE 4. Type "B" wheelchair ramps shall be used only when the grassed distance between the curb and sidewalk exceeds 5'-4''.

NOTE 5. Stop bars shall be used where it is important to indicate the point behind the vehicle is required to stop in compliance with a traffic signal, stop sign, or other legal requirement.

NOTE 6. Parking shall be eliminated a minimum of 20 feet back of pedestrian crosswalk.

LOCATION OF WHEELCHAIR RAMPS WHEN EXISTING CURB & GUTTER AND SIDEWALK IS BEYOND END OF PROPOSED CONSTRUCTION

NOTE: USE THE METHOD SHOWN ABOVE WHEN OBSTRUCTIONS WHICH ARE NOT TO BE REMOVED ARE ENCOUNTERED ON EITHER SIDE OF WHEELCHAIR RAMPS.

STANDARD DETAIL
EXAMPLES OF SPECIAL SITUATIONS FOR WHEELCHAIR RAMPS AND DEPRESSED CURBS
### Section X-X

#### Bends & Tees

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>90° Bend A</th>
<th>90° Bend B</th>
<th>45° Bend A</th>
<th>45° Bend B</th>
<th>22-1/2° Bend A</th>
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<th>11-1/4° Bend A</th>
<th>11-1/4° Bend B</th>
<th>Tee A</th>
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2000 PSF Soil (Sand & Gravel with Clay)

### Notes:

1. Based on 200 PSI Static Pressure Plus AWWA Water Hammer Allowance.
2. All Bearing Surfaces to be Carried to Undisturbed Ground.
3. Thrust Blocks to be Used at All Lines Operating Under Pressure.
4. Keep All Piping Joints Clear of Concrete Thrust Blocks.
PLAN VIEW FOR WATER LINE OVER SEWER LINE W/LESS THAN 18" CLEARANCE

PLAN VIEW FOR WATER LINE UNDER SEWER LINE

\[ a = \text{LESS THAN 18" BOTH WATER AND SEWER LINE SHALL BE WATER MAIN STANDARDS (JOINT) FERROUS METAL PIPE (DIP), FOR 10" EACH SIDE OF CROSSING} \]

\[ a = \text{OVER 18" SDR 21 PVC SHALL APPLY} \]

NOTE: SEE STANDARD SPECIFICATIONS SECTION 2.12
TOTAL WIDTH OF PAVEMENT
TO BE REMOVED & REPLACED

BITUMINOUS SURFACE

CRUSHED AGGREGATE
BASE COURSE

COMPACTED
SUB-BASE

6" MIN.

STREET WIDTH  MINIMUM REPLACE
  CABC  1-2
ASPHALT ROADWAY  8"  2"
ASPHALT DRIVEWAY  6"  2"
CONCRETE DRIVEWAY  6" CONCRETE ON SUBGRADE
CONCRETE SIDEWALK  4" CONCRETE ON SUBGRADE
STONE ROADWAY  6" STONE ON SUBGRADE
STONE DRIVEWAY  4" STONE ON SUBGRADE

NOTES:
1. ALL BACKFILL LOCATED WITHIN THE VEHICULAR LOAD ZONE IS TO BE PLACED IN LIFTS NOT TO EXCEED 6" AND COMPACTED TO 95% OF STANDARD PROCTOR TEST (ASTM D698).
2. ALL BACKFILL OUTSIDE THE VEHICULAR LOAD ZONE BUT LOCATED IN THE RIGHT OF WAY IS TO BE COMPACTED TO 95% OF STANDARD PROCTOR TEST (ASTM D698).
3. THE LACK OF PROPER COMPACTION EQUIPMENT OR THE USE OF IMPROPER COMPACTION METHODS SHALL BE CAUSE FOR THE IMMEDIATE SHUTDOWN OF THE WORK BY THE ENGINEER.
NOTES:

1. STEEL ENCASEMENT PIPE SHALL CONFORM TO ASTM A-139 WITH WALL THICKNESS AND GRADE AS DEFINED IN THE SPECIFICATIONS. MINIMUM ALLOWABLE YIELD STRENGTH IS 35,000 PSI.

2. CARRIER PIPE SHALL BE ADEQUATELY SUPPORTED THE ENTIRE LENGTH WITHIN THE CASING BY USING "SPIDER" STEEL SUPPORTS AT A MAXIMUM OF 9 FOOT CENTERS (ONE AT EACH JOINT AND ONE INTERMEDIATE). OTHER METHODS MUST MEET APPROVAL OF THE TOWN OF DUNCAN.
Casing Section A-A

NOTE: ENTIRE SPIDER ASSEMBLY TO BE BITUMINOUS-COATED AFTER FABRICATION.
<table>
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<tr>
<th>SIZE AND DEGREE</th>
<th>STATIC POUNDS</th>
<th>THRUST IN 4000 LBS/FT2</th>
<th>FAIRLY DRY 4000 LBS/FT2</th>
<th>SOFT CLAY 2000 LBS/FT2</th>
<th>GRAVEL, COARSE SAND 1600 LBS/FT2</th>
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Reaction bearing areas are in square feet measured in a vertical plane in the trench side at an angle of 90° to the thrust vector.

Use 6” – 90° bend valve for hydrants for additional safety factor.

(2 - 5/8" Ø rod is adequate for 6" f.h. leg)
NOTES:

1. BACKFILL TO 95% OF MAXIMUM DENSITY WHERE EXCAVATIONS CUT THROUGH PAVEMENTS, CURBS, DRIVEWAYS AND SIDEWALKS, AND UNDER OR ADJACENT TO STRUCTURES.

2. STONE TO BE SIZE 1/2" TO 1-1/2", WELL TAMPERED.

3. STONE IS REQUIRED TO 6" BELOW PIPE WHERE WET CONDITIONS OR ROCK IS ENCOUNTERED, ONLY AS DIRECTED.

4. HAND SHAPE TRENCH BOTTOM FOR LOWER QUADRANT OF PIPE AND BELLS.

5. PROVIDE MINIMUM 3'-0" COVER OVER PIPE.
CAST IRON LID

PRECAST VALVE BOX PROTECTOR WITH REINFORCING BARS 27" DIAMETER

FINISH GRADE

VALVE BOX SHALL BE SOUTHERN METER VALVE BOX 562-S OR EQUAL

BRICK

BRICK

GATE VALVE W/ 2"x2" OPERATING NUT

WATER MAIN

COMPACTED EARTH

THRUST BLOCK

3' MIN. COVER
1.) PRE CAST MANHOLE, SEE STANDARD DETAIL SS–3.
2.) AIR RELEASE VALVE W/ VACUUM CHECK UNIT.
3.) GATE VALVE.
4.) CORPORATION STOP (i.e. MUELLER H–15008).
5.) IPS THREAD RED BRASS PIPE AND FITTINGS.
6.) TRASH HOOD.
7.) PIPE CAP.
8.) GROUT, 1/8"/1'-0" MIN. SLOPE TO DRAIN

NOTE:
=1" FOR 12" WATER LINE AND SMALLER.
=2" ALL WATER LINES LARGER THAN 12"

1" A.R.V. shall be Model p–10 with vacuum check by Crispin or approved equal.
2" A.R.V. shall be Model P–20 with vacuum check by Crispin or approved equal.
"E-Z SETTER" METER BOX BY MUELLER
CATALOG NO. 330-RS-18-20-F-S-A-N
WITH TR HOLE AND PLUG, AND DUAL
CHECK VALVE BACKFLOW PREVENTER
SET BOX TO GRADE

1" Ø TYP K
SOFT COPPER
SERVICE PIPE

MUELLER, CORPORATION
STOP, H-15008
3/4" AND 1"

45°
WATER MAIN

UNDISTURBED SOIL

1" PIPE TO CUSTOMER

18"

STREET R/W OR
PROPERTY LINE

FINISH GRADE

REMOVABLE COVER
READING LID

METER W/
LOCKABLE VALVE

FLOW

COMMON BRICK

ELEVATION

NOTES:
1. DIP, CLASS 52, CEMENT MORTAR LINED
   COMPLYING WITH ANSI/AWWA 151/A21.5
2. PUSH ON JOINTS WITH RUBBER GASKET
   AND LUBRICANT COMPLYING WITH
   ANSI/AWWA C111/A21.11
3. MECHANICAL JOINT DUCTILE IRON FITTING
   COMPLYING WITH ANSI/AWWA C110/A21.5
"E-Z SETTER" METER BOX BY MUELLER
Catalog No. 203-RS-18-24-F-S-A-N
with TR hole and plug, and dual
check valve backflow preventer
set box to grade

3/4" Typ K
soft copper pipe

Flow

Meter w/
lockable valve

Removable cover

Reading lid

Finish grade

18"

Common brick

Undisturbed soil

Elevation

45°

Corporation stop

PVC main

Ford saddle

6" PVC = No. 590-603
8" PVC = No. 590-803

Notes:
1. Dip, Class 52, cement mortar lined
   complying with ANSI/AWWA 151/A21.5
2. Push on joints with rubber gasket
   and lubricant complying with
   ANSI/AWWA C111/A21.11
3. Mechanical joint ductile iron fitting
   complying with ANSI/AWWA C110/A21.5

3/4" x 5/8", water tap and
meter details

Mueller, corporation
stop, H-15008
3/4" and 1"

Water main
STANDARD DETAIL

STANDARD STREET X-SECTION SHOWING WATER TAP DEPTH

CITY OF LANCASTER LANCASTER COUNTY, S.C.

FILE NO. WL-7
NOTE:

1. TOWN TO SIZE METER AND APPROVE R.P.Z./BFP DEVICE.
2. CONTRACTOR SHALL SUBMIT PLANS, PURCHASE METER FROM COUNTY AND INSTALL ALL FACILITIES. FOR 2" OR LARGER SERVICES, CONTRACTOR WILL PERFORM TAPS ONLY.
PIPE AND FITTINGS DEPEND ON SERVICE SIZE

PIT DEPTH = 3'-4"±

2" AND BELOW WET TAP BY PUBLIC WORKS DEPARTMENT LARGER THAN 2" BY CONTRACTOR W/ 48 HRS. NOTICE TO TOWN

WATER MAIN

PIF WALL IS 8" BLOCK FILLED WITH CONCRETE OR REINFORCED CONCRETE IF TRAFFIC BEARING; SET ON 6" CONCRETE SLAB

THRUST ANCHORS

4" FLOOR DRAIN TO DITCH OR CATCH BASIN

2" OR 4" DOMESTIC SUPPLY

MINIMUM 18" CLEARANCE TOP, BOTTOM & EACH SIDE

BILCO DOOR (ALUM.) – SIZE TO EXPOSE ENTIRE PIT

A  PIPE TO BE COPPER OR DUCTILE IRON

C  OS&Y VALVE

D  REDUCER

E  METER – SIZED AND APPROVED BY TOWN

F  DOUBLE CHECK VALVE – APPROVED BY TOWN

H  CL51 – SLIP JOINT DUCTILE IRON

I  5 PIPE DIAMETERS OF STRAIGHT PIPE ON BOTH SIDES OF METER; I.E., FOR 2" METER I=10", etc.

FOR METERS 2" AND BELOW, WORK TO BE PERFORMED BY CITY OF LANCASTER. FOR METERS 3" AND ABOVE, METERS PURCHASED BY CONTRACTOR WITH APPROVAL BY THE CITY OF LANCASTER.
PIPE AND FITTINGS DEPEND ON SERVICE SIZE
3' – 4' ± DEEP

SEE WS-30, FOR PIPE AND FITTING SCHEDULE

2" AND BELOW WET TAP
BY PUBLIC WORKS
DEPARTMENT
LARGER THAN 2" BY
CONTRACTOR W/
48 HRS. NOTICE TO
TOWN

WATER MAIN

THRUST ANCHORS

BYPASS SIZE IS ONE SIZE
SMALLER THAN SUPPLY SIZE

A, B, C, D, E, F, I

1 1/2", 2" OR 4"
DOMESTIC SUPPLY

BILCO DOOR (ALUM.) – SIZE
TO EXPOSE ENTIRE PIT

11/2", 2" OR 4"
DOMESTIC SUPPLY

PIT WALL IS 8" BLOCK
FILLED WITH CONCRETE OR
REINFORCED CONCRETE
IF TRAFFIC BEARING;
SET ON 6" CONCRETE
SLAB

4" FLOOR DRAIN TO
DITCH OR CATCH BASIN

1/2", 2" OR 4"
DOMESTIC SUPPLY

FOR METERS 2" AND BELOW, WORK TO
BE PERFORMED BY THE CITY OF
LANCASTER. FOR METERS 3" AND ABOVE,
METERS PURCHASED BY CONTRACTOR
WITH APPROVAL BY THE CITY OF
LANCASTER.

A PIPE TO BE COPPER OR DUCTILE IRON
B TEE
C OS&Y VALVE
D REDUCER
E METER – Sized and approved by town
F DOUBLE CHECK VALVE OR RPZ – APPROVED BY TOWN
G CL51 – SUP JOINT DUCTILE IRON
H 5 PIPE DIAMETERS OF STRAIGHT PIPE ON BOTH
SIDES OF METER; I.E., FOR 1-1/2" METER J=7.5", etc.
2" AND BELOW WET TAP
BY PUBLIC WORKS
DEPARTMENT
LARGER THAN 2" BY
CONTRACTOR W/
48 HRS. NOTICE TO
TOWN

SEE WS-30, FOR PIPE AND FITTING SCHEDULE

PIPE AND FITTINGS DEPEND ON SERVICE SIZE

3'-4'+ DEEP

PIT WALL IS 8" BLOCK
FILLED WITH CONCRETE OR
REINFORCED CONCRETE
IF TRAFFIC BEARING;
SET ON 6" CONCRETE
SLAB

WATER MAIN

THRAST
BLOCKING

90' BEND

TEE

THRAST
ANCHORS

THRAST
BLOCKING

2" OR 4"

DOMESTIC SUPPLY

2" OR 4"

DOMESTIC SUPPLY

4" FLOOR DRAIN TO
DITCH OR CATCH BASIN

BILCO DOOR (ALUM.) - SIZE
TO EXPOSE ENTIRE PIT

A PIPE TO BE COPPER OR DUCTILE IRON
C OS&Y VALVE
D REDUCER
E METER - SIZED AND APPROVED BY TOWN
F DOUBLE CHECK VALVE OR RPZ - APPROVED BY TOWN
H CL51 DIP - SLIP JOINT DUCTILE IRON
I DIP - FLANGED JOINTS
J 5 PIPE DIAMETERS OF STRAIGHT PIPE ON BOTH SIDES
OF METER; IE, FOR 1-1/2" METER J = 7.5", etc.
STANDARD DETAIL
FOR 2" AND 4" LINES

2" AND BELOW WET TAP
BY PUBLIC WORKS
DEPARTMENT
LARGER THAN 2" BY
CONTRACTOR W/ 48 HRS. NOTICE TO TOWN

PIPE AND FITTINGS DEPEND ON SERVICE SIZE

3' - 4'± DEEP

PIT WALL IS 8" BLOCK FILLED WITH CONCRETE OR REINFORCED CONCRETE IF TRAFFIC BEARING;
SET ON 6" CONCRETE SLAB

WATER MAIN

THRUST BLOCKING

90° BEND

BYPASS

TEE

BYPASS

2" OR 4:
DOMESTIC SUPPLY

4" FLOOR DRAIN TO DITCH OR CATCH BASIN

THRUST ANCHORS

THRUST BLOCKING

A PIPE TO BE COPPER OR DUCTILE IRON
B TEE
C OS&Y VALVE
D REDUCER
E METER - SIZED AND APPROVED BY TOWN
F DOUBLE CHECK VALVE OR RPZ APPROVED BY TOWN
H CL51 DIP - SLIP JOINT
I DIP - FLANGED JOINTS
J 5 PIPE DIAMETERS OF STRAIGHT PIPE ON BOTH SIDES OF METER; I.E., FOR 2" METER J=10", etc.

FOR METERS 2" AND BELOW, WORK TO BE PERFORMED BY THE CITY OF LANCASTER. FOR METERS 3" AND ABOVE, METERS PURCHASED BY CONTRACTOR WITH APPROVAL BY THE CITY OF LANCASTER.
FOR METERS 2" AND BELOW, WORK TO BE PERFORMED BY THE CITY OF LANCASTER. FOR METERS 3" AND ABOVE, METERS PURCHASED BY CONTRACTOR WITH APPROVAL BY THE CITY OF LANCASTER.

A PIPE TO BE COPPER OR DUCTILE IRON
B TEE
C OS&Y VALVE
D REDUCER
E METER - SIZED AND APPROVED BY TOWN
F DOUBLE CHECK VALVE OR RPZ - APPROVED BY TOWN

H CL51 DIP - SLIP JOINT
I DIP - FLANGED JOINTS
J 5 PIPE DIAMETERS OF STRAIGHT PIPE ON BOTH SIDES OF METER; I.E., FOR 2" METER J=10", etc.
2" AND BELOW WET TAP BY PUBLIC WORKS DEPARTMENT LARGER THAN 2" BY CONTRACTOR W/ 48 HRS. NOTICE TO TOWN

PIECE AND FITTINGS DEPEND ON SERVICE SIZE

3' - 4' DEEP

PIT WALL IS 8" BLOCK FILLED WITH CONCRETE OR REINFORCED CONCRETE IF TRAFFIC BEARING; SET ON 6" CONCRETE SLAB

WATER MAIN

THRUST BLOCKING

90° BEND

THRUST BLOCKING

90° BEND

THRUST BLOCKING

THRUST ANCHORS

H

4" FLOOR DRAIN TO DITCH OR CATCH BASIN

BILCO DOOR (ALUM.) - SIZE TO EXPOSE ENTIRE PIT

A  PIPE TO BE COPPER OR DUCTILE IRON (THIS IS A FLANGED REDUCER)
B  TEE
C  OS&Y VALVE
D  REDUCER
E  METER - SIZED AND APPROVED BY TOWN
F  DOUBLE CHECK VALVE OR RP2 - APPROVED BY TOWN

H  CL51 DIP - SLIP JOINT
I  DIP - FLANGED JOINTS OR COPPER
K  5 PIPE DIAMETERS OF STRAIGHT PIPE ON BOTH SIDES OF METER, I.E., FOR 2" METER J=10", etc.

FOR METERS 2" AND BELOW, WORK TO BE PERFORMED BY THE CITY OF LANCASTER. FOR METERS 3" AND ABOVE, METERS PURCHASED BY CONTRACTOR WITH APPROVAL BY THE CITY OF LANCASTER.